triSYCL implementation of OpenCL SYCL

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Contents

Chapter 1

Main Page

This is the main OpenCL SYCL C++ header file to experiment with the OpenCL CL provisional specification.For more information about OpenCL SYCL: http://www.khronos.org/sycl/

For more information on this project and to access to the source of this file, look at https://github.↩com/triSYCL/triSYCL

The Doxygen version of the implementation itself is in http://Xilinx.github.io/triSYCL/↩Doxygen/triSYCL/html and http://Xilinx.github.io/triSYCL/Doxygen/triSYCL/tri↩SYCL-implementation-refman.pdf

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Chapter 2

Todo List

File address_space.hpp

Add the alias ..._ptr<T> = ...<T *>

Namespace cl::sycl::access

This values should be normalized to allow separate compilation with different implementations?

Class cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >

Implement it for images according so section 3.3.4.5

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::accessor (buffer< DataType, Dimensions, Allocator > &target_buffer, handler &command_group_handler)

Add template allocator type in all the accessor constructors in the specification or just use a more opaque Buffer type?

fix specification where access mode should be target instead

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::begin () const

Add these functions to the specification

The fact that the lambda capture make a const copy of the accessor is not yet elegantly managed... The issue is that begin()/end() dispatch is made according to the accessor constness and not from the array member constness...

try to solve it by using some enable_if on array constness?

The issue is that the end may not be known if it is implemented by a raw OpenCL cl_mem... So only provide on the device the iterators related to the start? Actually the accessor needs to know a part of the shape to have the multidimentional addressing. So this only require a size_t more...

Factor out these in a template helper

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::dimensionality

in the specification: store the dimension for user request

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::get_count () const

Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::get_pointer () const

Should it be named data() instead?

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::get_range () const

Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::get_size () const

It is incompatible with buffer get_size() in the spec

Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator* ()

Add in the specification

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator* () const

Add in the specification?

Add the concept of 0-dim buffer and accessor for scalar and use an implicit conversion to value_type reference to access the value with the accessor?

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[] (nd_item< dimensionality > index)

Add in the specification because used by HPC-GPU slide 22

Member cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[] (nd_item< dimensionality > index) const

Add in the specification because used by HPC-GPU slide 22

Class cl::sycl::buffer< T, Dimensions, Allocator >

There is a naming inconsistency in the specification between buffer and accessor on T versus datatype

Finish allocator implementation

Think about the need of an allocator when constructing a buffer from other buffers

Update the specification to have a non-const allocator for const buffer? Or do we rely on rebind_alloc<T>. But does this work with astate-full allocator?

Add constructors from arrays so that in C++17 the range and type can be infered from the constructor

Add constructors from array_ref

Member cl::sycl::buffer< T, Dimensions, Allocator >::buffer (buffer< T, Dimensions, Allocator > &b, const id< Dimensions > &base_index, const range< Dimensions > &sub_range, Allocator allocator={})

To be implemented

Update the specification to replace index by id

Member cl::sycl::buffer< T, Dimensions, Allocator >::buffer (cl_mem mem_object, queue from_queue, event available_event={}, Allocator allocator={})

To be implemented

Improve the specification to allow CLHPP objects too

Member cl::sycl::buffer< T, Dimensions, Allocator >::buffer (InputIterator start_iterator, InputIterator end_iterator, Allocator allocator={})

Implement the copy back at buffer destruction

Generalize this for n-D and provide column-major and row-major initialization

a reason to have this nD is that set_final_data(weak_ptr_class<T> & finalData) is actually doing this linearization anyway

Allow read-only buffer construction too

update the specification to deal with forward iterators instead and rewrite back only when it is non const and output iterator at least

Allow initialization from ranges and collections à la STL

Member cl::sycl::buffer< T, Dimensions, Allocator >::buffer (const T *host_data, const range< Dimensions > &r, Allocator allocator={})

Actually this is redundant.

Member cl::sycl::buffer< T, Dimensions, Allocator >::buffer (shared_ptr_class< T > &host_data, const range< Dimensions > &buffer_range, cl::sycl::mutex_class &m, Allocator allocator={})

update the specification to replace the pointer by a reference and provide the constructor with and without a mutex

Member cl::sycl::buffer< T, Dimensions, Allocator >::buffer (shared_ptr_class< T > host_data, const range< Dimensions > &buffer_range, Allocator allocator={})

add this mutex-less constructor to the specification

Member cl::sycl::buffer< T, Dimensions, Allocator >::get_access (handler &command_group_handler)

Do we need for an accessor to increase the reference count of a buffer object? It does make more sense for a host-side accessor.

Implement the modes and targets

Member cl::sycl::buffer< T, Dimensions, Allocator >::get_access ()

Implement the modes

More elegant solution

Member cl::sycl::buffer< T, Dimensions, Allocator >::get_range () const

rename to the equivalent from array_ref proposals? Such as size() in http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2016/p0009r2.html

Member cl::sycl::buffer< T, Dimensions, Allocator >::get_size () const

rename to something else. In http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2015/p0122r0.pdf it is named bytes() for example

Member cl::sycl::buffer< T, Dimensions, Allocator >::is_read_only () const

Add to specification

Member cl::sycl::buffer< T, Dimensions, Allocator >::set_final_data (shared_ptr_class< T > finalData)

Update the API to take finalData by value instead of by reference. This way we can have an implicit conversion possible at the API call from a shared_ptr<>, avoiding an explicit weak_ptr<> creation

figure out how set_final_data() interact with the other way to write back some data or with some data sharing with the host that can not be undone

Member cl::sycl::buffer< T, Dimensions, Allocator >::use_count () const

Add to the specification, useful for validation

Class cl::sycl::context

The implementation is quite minimal for now.

Member cl::sycl::context::get_devices () const

To be implemented

Member cl::sycl::context::get_info () const

To be implemented

Member cl::sycl::context::get_platform ()

To be implemented

Class cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >

Use the access::mode

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::accessor (const range< Dimensions > &allocation_size, handler &command_group_handler)

fix the specification to rename target that shadows template param

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::begin () const

Add these functions to the specification

The fact that the lambda capture make a const copy of the accessor is not yet elegantly managed... The issue is that begin()/end() dispatch is made according to the accessor constness and not from the array member constness...

try to solve it by using some enable_if on array constness?

The issue is that the end may not be known if it is implemented by a raw OpenCL cl_mem... So only provide on the device the iterators related to the start? Actually the accessor needs to know a part of the shape to have the multidimentional addressing. So this only require a size_t more...

Factor out these in a template helper

Do we need this in detail::accessor too or only in accessor?

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::dimensionality

in the specification: store the dimension for user request

Use another name, such as from C++17 committee discussions.

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::get_count () const

Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::get_range () const

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Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::is_read_access () const

Strangely, it is not really constexpr because it is not a static method...

to move in the access::mode enum class and add to the specification ?

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::is_write_access () const

Strangely, it is not really constexpr because it is not a static method...

to move in the access::mode enum class and add to the specification ?

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::iterator

Add iterators to accessors in the specification

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator* ()

Add in the specification

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator* () const

Add in the specification?

Add the concept of 0-dim buffer and accessor for scalar and use an implicit conversion to value_type reference to access the value with the accessor?

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[] (nd_item< dimensionality > index)

Add in the specification because used by HPC-GPU slide 22

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[] (nd_item< dimensionality > index) const

Add in the specification because used by HPC-GPU slide 22

Member cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::value_type

in the specification: store the types for user request as STL or C++AMP

Class cl::sycl::detail::accessor< T, Dimensions, Mode, Target >

Use the access::mode

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::accessor (std::shared_ptr< detail::buffer< T, Dimensions >> target_buffer)

fix the specification to rename target that shadows template parm

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::accessor (std::shared_ptr< detail::buffer< T, Dimensions >> target_buffer, handler &command_group_handler)

fix the specification to rename target that shadows template parm

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::begin () const

Add these functions to the specification

The fact that the lambda capture make a const copy of the accessor is not yet elegantly managed... The issue is that begin()/end() dispatch is made according to the accessor constness and not from the array member constness...

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Factor out these in a template helper

Do we need this in detail::accessor too or only in accessor?

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::dimensionality

in the specification: store the dimension for user request

Use another name, such as from C++17 committee discussions.

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_count () const

Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_pointer ()

Implement the various pointer address spaces

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_range () const

Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_size () const

Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::is_read_access () const

Strangely, it is not really constexpr because it is not a static method...

to move in the access::mode enum class and add to the specification ?

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::is_write_access () const

Strangely, it is not really constexpr because it is not a static method...

to move in the access::mode enum class and add to the specification ?

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::iterator

Add iterators to accessors in the specification

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator* ()

Add in the specification

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator* () const

Add in the specification?

Add the concept of 0-dim buffer and accessor for scalar and use an implicit conversion to value_type reference to access the value with the accessor?

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (nd_item< dimensionality > index)

Add in the specification because used by HPC-GPU slide 22

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (nd_item< dimensionality > index) const

Add in the specification because used by HPC-GPU slide 22

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::register_accessor ()

Double-check with the C++ committee on this issue.

Member cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::value_type

in the specification: store the types for user request as STL or C++AMP

Member cl::sycl::detail::address_space_array< T, AS >::address_space_array (std::initializer_list< std::remove_extent_t< T >> list)

Extend to more than 1 dimension

Class cl::sycl::detail::address_space_base< T, AS >

Verify/improve to deal with const/volatile?

Member cl::sycl::detail::address_space_base< T, AS >::opencl_type

Add to the specification

Member cl::sycl::detail::address_space_base< T, AS >::type

Add to the specification

Class cl::sycl::detail::address_space_fundamental< T, AS >

Verify/improve to deal with const/volatile?

Class cl::sycl::detail::address_space_object< T, AS >

Verify/improve to deal with const/volatile?

what about T having some final methods?

Member cl::sycl::detail::address_space_object< T, AS >::opencl_type

Add to the specification

Member cl::sycl::detail::address_space_variable< T, AS >::opencl_type

Add to the specification

Member cl::sycl::detail::buffer< T, Dimensions >::alloc

Implement user-provided allocator

Member cl::sycl::detail::buffer< T, Dimensions >::buffer (const T *host_data, const range< Dimensions > &r)

Clarify the semantics in the spec. What happens if the host change the host_data after buffer creation?

Member cl::sycl::detail::buffer< T, Dimensions >::call_update_buffer_state (cl::sycl::context ctx, access::mode mode, size_t size, DataType *data, std::enable_if_t<!std::is_const< BaseType > ::value > *=0)

Use `if constexpr` when it is available with C++17

Member cl::sycl::detail::buffer< T, Dimensions >::get_destructor_future ()

Make the function private again

Member cl::sycl::detail::buffer< T, Dimensions >::get_size () const

rename to something else. In http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2015/p0122r0.pdf it is named bytes() for example

Member cl::sycl::detail::buffer< T, Dimensions >::~buffer ()

To implement and deal with reference counting buffer(buffer<T, Dimensions> b, index<Dimensions> base_index, range<Dimensions> sub_range)

Allow CLHPP objects too?

Member cl::sycl::detail::buffer_add_to_task (BufferDetail buf, handler *command_group_handler, bool is_write_mode)

To remove with some refactoring

Member cl::sycl::detail::buffer_base::buffer_base ()

Use lazy allocation for the context tracking set

Member cl::sycl::detail::context::get_devices () const =0

virtual cannot be templated template <info::context Param> typename info::param_traits<info::context, Param>::type get_info() const = 0;

Member cl::sycl::detail::device::has_extension (const string_class &extension) const =0

virtual cannot be templated template <typename t>=""> virtual T get_info(info::device param) const = 0;

Member cl::sycl::detail::host_context::get_devices () const override

To be implemented

Class cl::sycl::detail::host_device

The implementation is quite minimal for now. :-)

Member cl::sycl::detail::host_device::get_platform () const override

To be implemented

Member cl::sycl::detail::host_device::has_extension (const string_class &extension) const override

To be implemented

Member cl::sycl::detail::host_platform::has_extension (const string_class &extension) const override

To be implemented

Member cl::sycl::detail::opencl_context::get_devices () const override

To be implemented

Member cl::sycl::detail::opencl_context::get_platform () const override

To be implemented

Member cl::sycl::detail::opencl_device::has_extension (const string_class &extension) const override

To be implemented

Member cl::sycl::detail::opencl_kernel::get () const override

Improve the spec to deprecate C OpenCL host API and move to C++ instead to avoid this ugly ownership management

Test error and throw. Externalize this feature in Boost.Compute?

Member cl::sycl::detail::opencl_kernel::single_task (std::shared_ptr< detail::task > task, std::shared_ptr< detail::queue > q) override

Remove either task or q

Member cl::sycl::detail::opencl_queue::instance (const cl::sycl::device &d)

Check with SYCL committee what is the expected behaviour here about the context. Is this a new context everytime, or always the same for a given device?

Member cl::sycl::detail::parallel_for (nd_range< Dimensions > r, ParallelForFunctor f)

Add an OpenMP implementation

Deal with incomplete work-groups

Implement with parallel_for_workgroup()/parallel_for_workitem()

Member cl::sycl::detail::parallel_for_workitem (const group< Dimensions > &g, ParallelForFunctor f)

Better type the functor

Member cl::sycl::detail::pipe< T >::write (const T &value, bool blocking=false)

provide a && version

Member cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::pipe_accessor (const std::shared_ptr< detail::pipe< T >> &p, handler &command_group_handler)

Use pipe_exception instead

Member cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::write (const value_type &value) const

provide a && version

Member cl::sycl::detail::pipe_reservation< PipeAccessor >::assume_validity ()

Throw exception instead

Member cl::sycl::detail::pipe_reservation< PipeAccessor >::commit ()

Add to the specification that for simplicity a reservation can be commited several times but only the first one is taken into account

Member cl::sycl::detail::queue::~queue ()

Update according spec since queue destruction is non blocking

Member cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::operator< (const Parent &other) const

Add this to the spec

Member cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::dimensionality

add this Boost::multi_array or STL concept to the specification?

Member cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >::small_array_123 (BasicType e)

Add to the specification of the range, id...

Member cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >::small_array_123 (BasicType e)

Add to the specification of the range, id...

Member cl::sycl::detail::task::buffers_in_use

Use a set to check that some buffers are not used many times at least on writing

Member cl::sycl::detail::task::get_kernel ()

Specify this error in the spec

Member cl::sycl::detail::task::schedule (std::function< void(void)> f)

This is an issue if there is an exception in the kernel

Member cl::sycl::device::device (const device_selector &ds)

Make it non-explicit in the specification?

Member cl::sycl::device::get_info (info::device param) const

Member cl::sycl::device::get_info () const

Member cl::sycl::device::type () const

Present in Boost.Compute, to be added to the specification

Member cl::sycl::device_selector::select_device () const

Remove this from specification

Class cl::sycl::device_type_selector

To be added to the specification

Class cl::sycl::device_typename_selector< DeviceType >

To be added to the specification

Member cl::sycl::error_handler::default_handler

add this concept to the specification?

Member cl::sycl::error_handler::report_error (exception &error)=0

Add "virtual void" to the specification

Class cl::sycl::exception_list

Do we need to define it in SYCL or can we rely on plain C++17 one?

Member cl::sycl::exception_ptr

Do we need this instead of reusing directly the one from C++11?

Member cl::sycl::group< Dimensions >::dimensionality

add this Boost::multi_array or STL concept to the specification?

Member cl::sycl::group< Dimensions >::get_group_range () const

Fix this comment and the specification

Member cl::sycl::group< Dimensions >::get_local_range () const

Add to the specification

Member cl::sycl::group< Dimensions >::get_local_range (int dimension) const

Add to the specification

Member cl::sycl::group< Dimensions >::get_nd_range () const

Also provide this access to the current nd_range

Member cl::sycl::group< Dimensions >::get_offset (int dimension) const

Add to the specification

Member cl::sycl::group< Dimensions >::get_offset () const

Add to the specification

Member cl::sycl::group< Dimensions >::group (const id< Dimensions > &i, const nd_range< Dimensions > &ndr)

This should be private somehow, but it is used by the validation infrastructure

Member cl::sycl::group< Dimensions >::group (const nd_range< Dimensions > &ndr)

This should be private since it is only used by the triSYCL implementation

Member cl::sycl::group< Dimensions >::group ()=default

Make most of them protected, reserved to implementation

Member cl::sycl::group< Dimensions >::operator[] (int dimension)

In this implementation it is not const because the group<> is written in the parallel_for iterators. To fix according to the specification

Member cl::sycl::group< Dimensions >::parallel_for_work_item (std::function< void(nd_item< dimensionality >)> f) const

Add this method in the specification

Member cl::sycl::group< Dimensions >::parallel_for_work_item (std::function< void(item< dimensionality >)> f) const

Add this method in the specification

Member cl::sycl::handler::set_arg (int arg_index, accessor< DataType, Dimensions, Mode, Target > &&acc_obj)

Update the specification to use a ref && to the accessor instead?

It is not that clean to have set_arg() associated to a command handler. Rethink the specification?

It seems more logical to have these methods on kernel instead

Member cl::sycl::handler::set_args (Ts &&... args)

Update the specification to add this function according to https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15978 proposal

Member cl::sycl::handler::single_task (kernel sycl_kernel)

Add in the spec a version taking a kernel and a functor, to have host fall-back

Class cl::sycl::image< Dimensions >

implement image

Member cl::sycl::info::context

Should be unsigned int to be consistent with others?

Member cl::sycl::info::device

Should be unsigned int?

Member cl::sycl::info::device_type

To be moved in the specification from platform to device

Add opencl to the specification

there is no accelerator_selector and custom_accelerator

Member cl::sycl::info::queue

unsigned int?

To be implemented

To be implemented

Member cl::sycl::item< Dimensions >::dimensionality

add this Boost::multi_array or STL concept to the specification?

Member cl::sycl::item< Dimensions >::item ()=default

Make most of them protected, reserved to implementation

Member cl::sycl::item< Dimensions >::set (id< Dimensions > Index)

Move to private and add friends

Class cl::sycl::kernel

To be implemented

Check specification

Member cl::sycl::make_multi (multi_ptr< T, AS > pointer)

Implement the case with a plain pointer

Member cl::sycl::map_allocator

: implement and clarify the specification. It looks like it is not really an allocator according the current spec

Member cl::sycl::nd_item< Dimensions >::dimensionality

add this Boost::multi_array or STL concept to the specification?

Member cl::sycl::nd_item< Dimensions >::get_item () const

Add to the specification

Member cl::sycl::nd_item< Dimensions >::nd_item (id< Dimensions > global_index, nd_range< Dimensions > ndr)

This is for validation purpose. Hide this to the programmer somehow

Member cl::sycl::nd_item< Dimensions >::nd_item (nd_range< Dimensions > ndr)

This is for the triSYCL implementation which is expected to call set_global() and set_local() later. This should be hidden to the user.

Member cl::sycl::nd_item< Dimensions >::nd_item ()=default

Make most of them protected, reserved to implementation

Class cl::sycl::nd_range< Dimensions >

add copy constructors in the specification

Member cl::sycl::nd_range< Dimensions >::dimensionality

add this Boost::multi_array or STL concept to the specification?

Member cl::sycl::nd_range< Dimensions >::get_offset () const

get_offset() is lacking in the specification

Class cl::sycl::non_cl_error

Add to the specification

Clean implementation

Exceptions are named error in C++

Member cl::sycl::parallel_for_work_item (const group< Dimensions > &g, ParallelForFunctor f)

To be implemented

Deprecate this function in the specification to use instead the group method

Member cl::sycl::pipe_reservation< PipeAccessor >::pipe_reservation (detail::pipe_reservation< accessor_detail > &&pr)

Make it private and add required friends

Class cl::sycl::platform

triSYCL Implementation

Member cl::sycl::platform::get () const

Define a SYCL exception for this

Member cl::sycl::platform::get_info (info::platform param) const

Add to the specification

Class cl::sycl::queue

The implementation is quite minimal for now. :-)

All the queue methods should return a queue& instead of void to it is possible to chain opoerations

Member cl::sycl::queue::queue (const boost::compute::command_queue &q, async_handler ah=nullptr)

Deal with handler

Member cl::sycl::queue::queue ()

Check with the specification if it is the host queue or the one related to the default device selector.

Member cl::sycl::queue::submit (std::function< void(handler &)> cgf)

Add in the spec an implicit conversion of handler_event to queue& so it is possible to chain operations on the queue

Update the spec to replace std::function by a templated type to avoid memory allocation

Class cl::sycl::range< Dimensions >

use std::size_t Dimensions instead of int Dimensions in the specification?

add to the specification this default parameter value?

add to the specification some way to specify an offset?

Member cl::sycl::range< Dimensions >::get_count () const

Give back size() its real meaning in the specification

add this method to the specification

Namespace cl::sycl::trisycl

Refactor when updating to latest specification

Class cl::sycl::vec< DataType, NumElements >

add [] operator

add iterators on elements, with begin() and end()

having vec<> sub-classing array<> instead would solve the previous issues

move the implementation elsewhere

simplify the helpers by removing some template types since there are now inside the vec<> class.

rename in the specification element_type to value_type

Module execution

The implementation is quite minimal for now. :-)

Class handler_event

To be implemented

To be implemented

Member TRISYCL_ParallelForKernel_RANGE (N)

Add in the spec a version taking a kernel and a functor, to have host fall-back

Think to a cleaner solution

Think to a cleaner solution

Remove either task or q

Chapter 3

Module Index

3.1 Modules

Here is a list of all modules:

Chapter 4

Namespace Index

4.1 Namespace List

Here is a list of all namespaces with brief descriptions:

Chapter 5

Hierarchical Index

5.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 6

Class Index

6.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 7

File Index

7.1 File List

Here is a list of all files with brief descriptions:

Chapter 8

Module Documentation

8.1 Data access and storage in SYCL

Namespaces

- cl::sycl::access

  Describe the type of access by kernels.

Classes

- class cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >

  The local accessor specialization abstracts the way local memory is allocated to a kernel to be shared between work-items of the same work-group. More...
- class cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >

  The accessor abstracts the way buffer or pipe data are accessed inside a kernel in a multidimensional variable length array way. More...
- class cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >

  The pipe accessor abstracts the way pipe data are accessed inside a kernel. More...
- class cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >

  The pipe accessor abstracts the way pipe data are accessed inside a kernel. More...
- class cl::sycl::detail::accessor< T, Dimensions, Mode, Target >

  The buffer accessor abstracts the way buffer data are accessed inside a kernel in a multidimensional variable length array way. More...
- class cl::sycl::detail::buffer< T, Dimensions >

  A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on. More...
- struct cl::sycl::detail::buffer_base

  Factorize some template independent buffer aspects in a base class. More...
- class cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >

  A helper class to wait for the final buffer destruction if the conditions for blocking are met. More...
- class cl::sycl::buffer< T, Dimensions, Allocator >

  A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on. More...
- struct cl::sycl::image< Dimensions >
- struct cl::sycl::detail::reserve_id< T >

  A private description of a reservation station. More...

- class cl::sycl::detail::pipe< T >

  Implement a pipe object. More...
- class cl::sycl::detail::pipe_accessor< T, AccessMode, Target >

  The accessor abstracts the way pipe data are accessed inside a kernel. More...
- class cl::sycl::pipe< T >

  A SYCL pipe. More...
- class cl::sycl::detail::pipe_reservation< PipeAccessor >

  The implementation of the pipe reservation station. More...
- struct cl::sycl::pipe_reservation< PipeAccessor >

  The pipe reservation station allows to reserve an array-like view inside the pipe for ordered race-free access from various work-items for example. More...
- class cl::sycl::static_pipe< T, Capacity >

  A SYCL static-scoped pipe equivalent to an OpenCL program-scoped pipe. More...

Typedefs

- template<typename T >
  using cl::sycl::buffer_allocator = std::allocator< T >

  The allocator objects give the programmer some control on how the memory is allocated inside SYCL.
- template<typename T >
  using cl::sycl::image_allocator = std::allocator< T >

  The allocator used for the `image` inside SYCL.
- template<typename T >
  using cl::sycl::map_allocator = std::allocator< T >

  The allocator used to map the memory at the same place.

Functions

- template<typename Accessor >
  static auto & cl::sycl::get_pipe_detail (Accessor &a)

  Top-level function to break circular dependencies on the the types to get the pipe implementation.
- template<typename BufferDetail >
  static std::shared_ptr< detail::task > cl::sycl::detail::buffer_add_to_task (BufferDetail buf, handler *command_group_handler, bool is_write_mode)

  Proxy function to avoid some circular type recursion.
- static std::shared_ptr< detail::task > cl::sycl::detail::add_buffer_to_task (handler *command_group_handler, std::shared_ptr< detail::buffer_base > b, bool is_write_mode)
- template<typename T , int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>>
  auto cl::sycl::detail::waiter (detail::buffer< T, Dimensions > *b)

  Helper function to create a new buffer_waiter.

8.1.1 Detailed Description

8.1.2 Class Documentation

8.1.2.1 class cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >

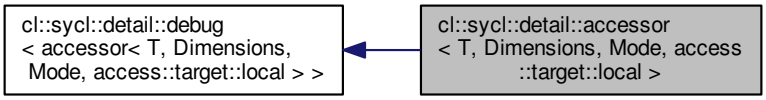
template<typename T, int Dimensions, access::mode Mode>
class cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >

The local accessor specialization abstracts the way local memory is allocated to a kernel to be shared between work-items of the same work-group.

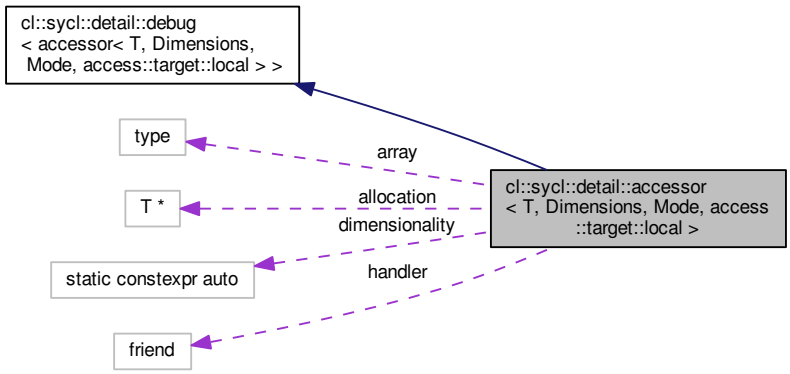
Todo Use the access::mode

Definition at line 54 of file local_accessor.hpp.

Inheritance diagram for cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >:



Collaboration diagram for cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >:



Public Types

- using value_type = T
- using element = T
- using reference = typename array_type::reference
- using const_reference = typename array_type::const_reference
- using iterator = typename array_type::iterator

  Inherit the iterator types from the implementation.
- using const_iterator = typename array_type::const_iterator
- using reverse_iterator = typename array_type::reverse_iterator
- using const_reverse_iterator = typename array_type::const_reverse_iterator

Public Member Functions

- accessor (const range< Dimensions > &allocation_size, handler &command_group_handler)

  Construct a device accessor from an existing buffer.
- ~accessor ()
- auto get_range () const

  Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.
- auto get_count () const

  Returns the total number of elements behind the accessor.
- auto get_size () const

  Returns the size of the underlying buffer storage in bytes.
- reference operator[ ] (std::size_t index)

  Use the accessor with integers à la [][][].
- reference operator[ ] (std::size_t index) const

  Use the accessor with integers à la [][][].
- auto & operator[ ] (id< dimensionality > index)

  To use the accessor with [id<>].
- auto & operator[ ] (id< dimensionality > index) const

  To use the accessor with [id<>].
- auto & operator[ ] (item< dimensionality > index)

  To use an accessor with [item<>].
- auto & operator[ ] (item< dimensionality > index) const

  To use an accessor with [item<>].
- auto & operator[ ] (nd_item< dimensionality > index)

  To use an accessor with an [nd_item<>].
- auto & operator[ ] (nd_item< dimensionality > index) const

  To use an accessor with an [nd_item<>].
- reference operator* ()

  Get the first element of the accessor.
- reference operator* () const

  Get the first element of the accessor.
- constexpr bool is_read_access () const

  Test if the accessor has a read access right.
- constexpr bool is_write_access () const

  Test if the accessor has a write access right.
- iterator begin () const

  Forward all the iterator functions to the implementation.
- iterator end () const
- const_iterator cbegin () const
- const_iterator cend () const
- reverse_iterator rbegin () const
- reverse_iterator rend () const
- const_reverse_iterator crbegin () const
- const_reverse_iterator crend () const

Static Public Attributes

- static constexpr auto dimensionality = Dimensions

Private Types

- using array_type = boost::multi_array_ref< T, Dimensions >

  The implementation is a multi_array_ref wrapper.
- using writable_array_type = typename std::remove_const< array_type >::type

Private Member Functions

- auto allocate_accessor (const range< Dimensions > &r)

  Allocate uninitialized buffer memory.
- void deallocate_accessor ()

  Deallocate accessor memory.

Private Attributes

- writable_array_type array

  The way the buffer is really accessed.
- T * allocation = nullptr

  The allocation on the host for the local accessor.
- friend handler

8.1.2.1.1 Member Typedef Documentation

8.1.2.1.1.1 array_type

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::array_type =
boost::multi_array_ref<T, Dimensions>  [private]
```

The implementation is a multi_array_ref wrapper.

Definition at line 61 of file local_accessor.hpp.

8.1.2.1.1.2 const_iterator

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::const_iterator
= typename array_type::const_iterator
```

Definition at line 104 of file local_accessor.hpp.

8.1.2.1.1.3 const_reference

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::const_reference
= typename array_type::const_reference
```

Definition at line 97 of file local_accessor.hpp.

8.1.2.1.1.4 const_reverse_iterator

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::const_reverse↩
_iterator = typename array_type::const_reverse_iterator
```

Definition at line 107 of file local_accessor.hpp.

8.1.2.1.1.5 element

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::element = T
```

Definition at line 95 of file local_accessor.hpp.

8.1.2.1.1.6 iterator

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::iterator =
typename array_type::iterator
```

Inherit the iterator types from the implementation.

Todo Add iterators to accessors in the specification

Definition at line 103 of file local_accessor.hpp.

8.1.2.1.1.7 reference

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::reference =
typename array_type::reference
```

Definition at line 96 of file local_accessor.hpp.

8.1.2.1.1.8 reverse_iterator

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::reverse_↩
iterator = typename array_type::reverse_iterator
```

Definition at line 105 of file local_accessor.hpp.

8.1.2.1.1.9 value_type

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::value_type = T
```

Todo in the specification: store the types for user request as STL or C++AMP

Definition at line 94 of file local_accessor.hpp.

8.1.2.1.1.10 writable_array_type

```
template<typename T , int Dimensions, access::mode Mode>
using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::writable_↩
array_type = typename std::remove_const<array_type>::type  [private]
```

Definition at line 66 of file local_accessor.hpp.

8.1.2.1.2 Constructor & Destructor Documentation

8.1.2.1.2.1 accessor()

```
template<typename T , int Dimensions, access::mode Mode>
cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::accessor (
            const range< Dimensions > & allocation_size,
            handler & command_group_handler )  [inline]
```

Construct a device accessor from an existing buffer.

Todo fix the specification to rename target that shadows template param

Definition at line 115 of file local_accessor.hpp.

```
00116                                       :
00117     array { allocate_accessor(allocation_size) } {}
```

8.1.2.1.2.2 ~accessor()

```
template<typename T , int Dimensions, access::mode Mode>
cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::~accessor ( )  [inline]
```

Definition at line 121 of file local_accessor.hpp.

```
00121               {
00122     deallocate_accessor();
00123   }
```

8.1.2.1.3 Member Function Documentation

8.1.2.1.3.1 allocate_accessor()

```
template<typename T , int Dimensions, access::mode Mode>
auto cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::allocate_↩
accessor (
             const range< Dimensions > & r )  [inline], [private]
```

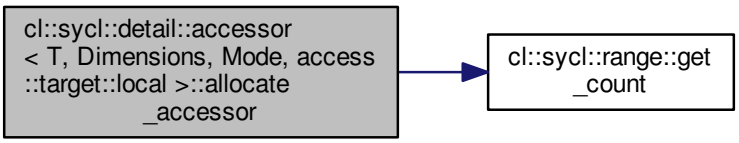
Allocate uninitialized buffer memory.

Definition at line 364 of file local_accessor.hpp.

References cl::sycl::range< Dimensions >::get_count().

```
00364                                                 {
00365     auto count = r.get_count();
00366     // Allocate uninitialized memory
00367     allocation = std::allocator<value_type>{}.allocate(count);
00368     return boost::multi_array_ref<value_type, Dimensions> { allocation, r };
00369   }
```

Here is the call graph for this function:



8.1.2.1.3.2 begin()

```
template<typename T , int Dimensions, access::mode Mode>
iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::begin ( )
const  [inline]
```

Forward all the iterator functions to the implementation.

Todo Add these functions to the specification

Todo The fact that the lambda capture make a const copy of the accessor is not yet elegantly managed... The issue is that begin()/end() dispatch is made according to the accessor constness and not from the array member constness...

Todo try to solve it by using some enable_if on array constness?

Todo The issue is that the end may not be known if it is implemented by a raw OpenCL cl_mem... So only provide on the device the iterators related to the start? Actually the accessor needs to know a part of the shape to have the multidimentional addressing. So this only require a size_t more...

Todo Factor out these in a template helper

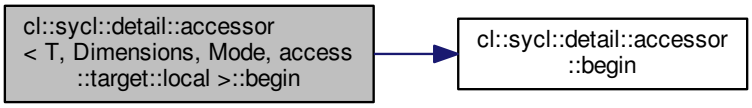
Todo Do we need this in detail::accessor too or only in accessor?

Definition at line 315 of file local_accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array, and cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::begin().

```
00315                          {
00316     return const_cast<writable_array_type &>(array).
      begin();
00317   }
```

Here is the call graph for this function:



8.1.2.1.3.3 cbegin()

```
template<typename T , int Dimensions, access::mode Mode>
const_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >↩
::cbegin ( ) const  [inline]
```

Definition at line 332 of file local_accessor.hpp.

```
00332 { return array.begin(); }
```

8.1.2.1.3.4 cend()

```
template<typename T , int Dimensions, access::mode Mode>
const_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::cend
( ) const  [inline]
```

Definition at line 335 of file local_accessor.hpp.

```
00335 { return array.end(); }
```

8.1.2.1.3.5 crbegin()

```
template<typename T , int Dimensions, access::mode Mode>
const_reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local
>::crbegin ( ) const  [inline]
```

Definition at line 356 of file local_accessor.hpp.

```
00356 { return array.rbegin(); }
```

8.1.2.1.3.6 crend()

```
template<typename T , int Dimensions, access::mode Mode>
const_reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local
>::crend ( ) const  [inline]
```

Definition at line 359 of file local_accessor.hpp.

```
00359 { return array.rend(); }
```

8.1.2.1.3.7 deallocate_accessor()

```
template<typename T , int Dimensions, access::mode Mode>
void cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::deallocate_↩
accessor ( )  [inline], [private]
```

Deallocate accessor memory.

Definition at line 373 of file local_accessor.hpp.

```
00373                                {
00374     std::allocator<value_type>{}.deallocate(allocation, array.num_elements());
00375   }
```

8.1.2.1.3.8 end()

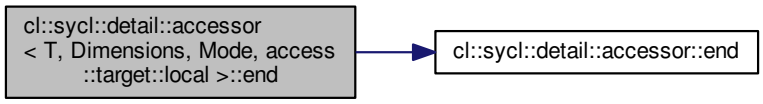
```
template<typename T , int Dimensions, access::mode Mode>
iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::end ( )
const  [inline]
```

Definition at line 321 of file local_accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array, and cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::end().

```
00321                           {
00322     return const_cast<writable_array_type &>(array).end();
00323   }
```

Here is the call graph for this function:



8.1.2.1.3.9 get_count()

```
template<typename T , int Dimensions, access::mode Mode>
auto cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::get_count ( )
const  [inline]
```

Returns the total number of elements behind the accessor.

Equal to get_range()[0] * ... * get_range()[Dimensions-1].

Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https↩://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 156 of file local_accessor.hpp.

```
00156                           {
00157     return array.num_elements();
00158   }
```

8.1.2.1.3.10 get_range()

```
template<typename T , int Dimensions, access::mode Mode>
auto cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::get_range ( )
const  [inline]
```

Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.

Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 134 of file local_accessor.hpp.

```
00134                           {
00135     /* Interpret the shape which is a pointer to the first element as an
00136        array of Dimensions elements so that the range<Dimensions>
00137        constructor is happy with this collection
00138
00139        \todo Add also a constructor in range<> to accept a const
00140        std::size_t *?
00141     */
00142     return range<Dimensions> {
00143       *(const std::size_t (*)[Dimensions])(array.shape())
00144         };
00145   }
```

8.1.2.1.3.11 get_size()

```
template<typename T , int Dimensions, access::mode Mode>
auto cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::get_size ( )
const  [inline]
```

Returns the size of the underlying buffer storage in bytes.

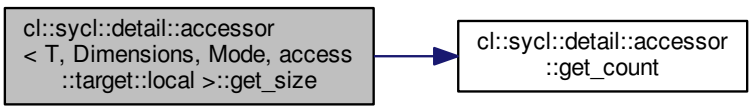
Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 167 of file local_accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_count().

```
00167                           {
00168     return get_count()*sizeof(value_type);
00169   }
```

Here is the call graph for this function:



8.1.2.1.3.12 is_read_access()

```
template<typename T , int Dimensions, access::mode Mode>
constexpr bool cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::is_↩
read_access ( ) const  [inline]
```

Test if the accessor has a read access right.

Todo Strangely, it is not really constexpr because it is not a static method...

Todo to move in the access::mode enum class and add to the specification ?

Definition at line 267 of file local_accessor.hpp.

References cl::sycl::access::discard_read_write, cl::sycl::access::read, and cl::sycl::access::read_write.

```
00267                                       {
00268     return Mode == access::mode::read
00269       || Mode == access::mode::read_write
00270       || Mode == access::mode::discard_read_write;
00271   }
```

8.1.2.1.3.13 is_write_access()

```
template<typename T , int Dimensions, access::mode Mode>
constexpr bool cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::is_↩
write_access ( ) const  [inline]
```

Test if the accessor has a write access right.

Todo Strangely, it is not really constexpr because it is not a static method...

Todo to move in the access::mode enum class and add to the specification ?

Definition at line 282 of file local_accessor.hpp.

References cl::sycl::access::discard_read_write, cl::sycl::access::discard_write, cl::sycl::access::read_write, and cl::sycl::access::write.

```
00282                                       {
00283     return Mode == access::mode::write
00284       || Mode == access::mode::read_write
00285       || Mode == access::mode::discard_write
00286       || Mode == access::mode::discard_read_write;
00287   }
```

8.1.2.1.3.14 operator*() [1/2]

```
template<typename T , int Dimensions, access::mode Mode>
reference cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator*
( )  [inline]
```

Get the first element of the accessor.

Useful with an accessor on a scalar for example.

Todo Add in the specification

Definition at line 239 of file local_accessor.hpp.

```
00239                         {
00240     return *array.data();
00241   }
```

8.1.2.1.3.15 operator*() [2/2]

```
template<typename T , int Dimensions, access::mode Mode>
reference cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator*
( ) const  [inline]
```

Get the first element of the accessor.

Useful with an accessor on a scalar for example.

Todo Add in the specification?

Todo Add the concept of 0-dim buffer and accessor for scalar and use an implicit conversion to value_type reference to access the value with the accessor?

Definition at line 254 of file local_accessor.hpp.

```
00254                               {
00255     return *array.data();
00256   }
```

8.1.2.1.3.16 operator[]() [1/8]

```
template<typename T , int Dimensions, access::mode Mode>
reference cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[]
(
             std::size_t index )  [inline]
```

Use the accessor with integers à la [][][].

Use array_view_type::reference instead of auto& because it does not work in some dimensions.

Definition at line 177 of file local_accessor.hpp.

```
00177                                       {
00178     return array[index];
00179   }
```

8.1.2.1.3.17 operator[]() [2/8]

```
template<typename T , int Dimensions, access::mode Mode>
reference cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[]
(
             std::size_t index ) const  [inline]
```

Use the accessor with integers à la [][][].

Use array_view_type::reference instead of auto& because it does not work in some dimensions.

Definition at line 187 of file local_accessor.hpp.

```
00187                                          {
00188     return array[index];
00189   }
```

8.1.2.1.3.18 operator[]() [3/8]

```
template<typename T , int Dimensions, access::mode Mode>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[] (
             id< dimensionality > index )  [inline]
```

To use the accessor with [id<>].

Definition at line 193 of file local_accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array.

```
00193                                          {
00194     return array(index);
00195   }
```

8.1.2.1.3.19 operator[]() [4/8]

```
template<typename T , int Dimensions, access::mode Mode>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[] (
             id< dimensionality > index ) const  [inline]
```

To use the accessor with [id<>].

Definition at line 199 of file local_accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array.

```
00199                                                {
00200     return array(index);
00201   }
```

8.1.2.1.3.20 operator[]() [5/8]

```
template<typename T , int Dimensions, access::mode Mode>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[] (
            item< dimensionality > index )  [inline]
```

To use an accessor with [item<>].

Definition at line 205 of file local_accessor.hpp.

```
00205                                                {
00206     return (*this)[index.get()];
00207   }
```

8.1.2.1.3.21 operator[]() [6/8]

```
template<typename T , int Dimensions, access::mode Mode>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[] (
            item< dimensionality > index ) const  [inline]
```

To use an accessor with [item<>].

Definition at line 211 of file local_accessor.hpp.

```
00211                                                      {
00212     return (*this)[index.get()];
00213   }
```

8.1.2.1.3.22 operator[]() [7/8]

```
template<typename T , int Dimensions, access::mode Mode>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[] (
            nd_item< dimensionality > index )  [inline]
```

To use an accessor with an [nd_item<>].

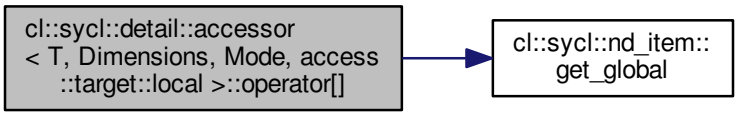
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 220 of file local_accessor.hpp.

References cl::sycl::nd_item< Dimensions >::get_global().

```
00220                                                   {
00221     return (*this)[index.get_global()];
00222   }
```

Here is the call graph for this function:



8.1.2.1.3.23 operator[]() [8/8]

```
template<typename T , int Dimensions, access::mode Mode>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[] (
             nd_item< dimensionality > index ) const  [inline]
```

To use an accessor with an [nd_item<>].

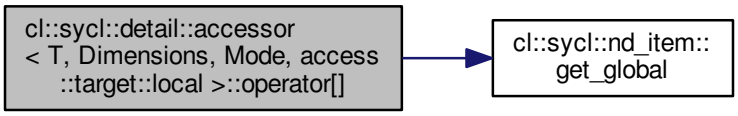
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 228 of file local_accessor.hpp.

References cl::sycl::nd_item< Dimensions >::get_global().

```
00228                                                                    {
00229     return (*this)[index.get_global()];
00230   }
```

Here is the call graph for this function:



8.1.2.1.3.24 rbegin()

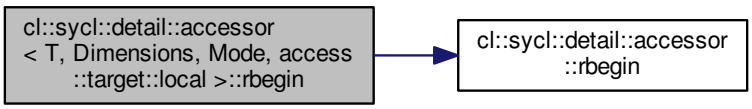
```
template<typename T , int Dimensions, access::mode Mode>
reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >↩
::rbegin ( ) const  [inline]
```

Definition at line 339 of file local_accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array, and cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::rbegin().

```
00339                                    {
00340     return const_cast<writable_array_type &>(array).
      rbegin();
00341   }
```

Here is the call graph for this function:



8.1.2.1.3.25 rend()

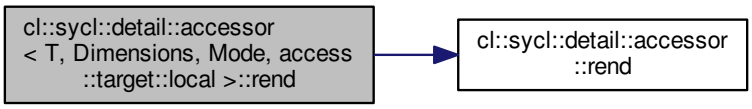
```
template<typename T , int Dimensions, access::mode Mode>
reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >↩
::rend ( ) const  [inline]
```

Definition at line 345 of file local_accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array, and cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::rend().

```
00345                                {
00346     return const_cast<writable_array_type &>(array).rend();
00347   }
```

Here is the call graph for this function:



8.1.2.1.4 Member Data Documentation

8.1.2.1.4.1 allocation

```
template<typename T , int Dimensions, access::mode Mode>
T* cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::allocation =
nullptr  [mutable], [private]
```

The allocation on the host for the local accessor.

Note that this is uninitialized memory, as stated in SYCL specification.

Definition at line 82 of file local_accessor.hpp.

8.1.2.1.4.2 array

```
template<typename T , int Dimensions, access::mode Mode>
writable_array_type cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >↩
::array  [mutable], [private]
```

The way the buffer is really accessed.

Use a mutable member because the accessor needs to be captured by value in the lambda which is then read-only. This is to avoid the user to use mutable lambda or have a lot of const_cast as previously done in this implementation

Definition at line 75 of file local_accessor.hpp.

8.1.2.1.4.3 dimensionality

```
template<typename T , int Dimensions, access::mode Mode>
constexpr auto cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >↩
::dimensionality = Dimensions  [static]
```

Todo in the specification: store the dimension for user request

Todo Use another name, such as from C++17 committee discussions.

Definition at line 90 of file local_accessor.hpp.

8.1.2.1.4.4 handler

```
template<typename T , int Dimensions, access::mode Mode>
friend cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::handler
[private]
```

Definition at line 379 of file local_accessor.hpp.

8.1.2.2 class cl::sycl::accessor

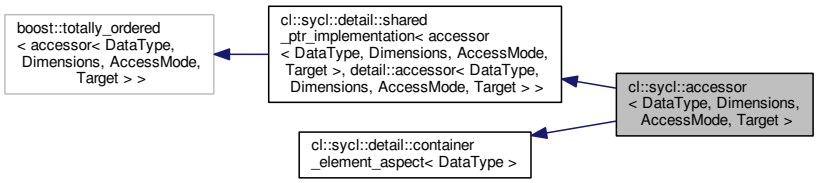
template<typename DataType, int Dimensions, access::mode AccessMode, access::target Target = access::target::global_↩ buffer>
class cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >

The accessor abstracts the way buffer or pipe data are accessed inside a kernel in a multidimensional variable length array way.

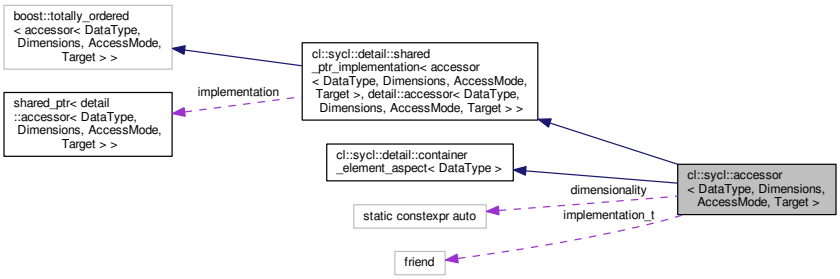
Todo Implement it for images according so section 3.3.4.5

Definition at line 47 of file accessor.hpp.

Inheritance diagram for cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >:



Collaboration diagram for cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >:



Public Member Functions

- template<typename Allocator >
  accessor (buffer< DataType, Dimensions, Allocator > &target_buffer, handler &command_group_handler)

  Construct a buffer accessor from a buffer using a command group handler object from the command group scope.
- template<typename Allocator >
  accessor (buffer< DataType, Dimensions, Allocator > &target_buffer)

  Construct a buffer accessor from a buffer.
- template<typename Allocator >
  accessor (buffer< DataType, Dimensions, Allocator > &target_buffer, handler &command_group_handler, const range< Dimensions > &offset, const range< Dimensions > &range)

  Construct a buffer accessor from a buffer given a specific range for access permissions and an offset that provides the starting point for the access range using a command group handler object from the command group scope.
- accessor (const range< Dimensions > &allocation_size, handler &command_group_handler)

  Construct an accessor of dimension Dimensions with elements of type DataType using the passed range to specify the size in each dimension.
- auto get_range () const

  Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.
- auto get_count () const

  Returns the total number of elements behind the accessor.
- auto get_size () const

  Returns the size of the underlying buffer storage in bytes.
- accessor_detail::reference operator[ ] (std::size_t index)

  Use the accessor with integers à la [][][].
- accessor_detail::reference operator[ ] (std::size_t index) const

  Use the accessor with integers à la [][][].
- auto & operator[ ] (id< dimensionality > index)

  To use the accessor with [id<>].
- auto & operator[ ] (id< dimensionality > index) const

  To use the accessor with [id<>].
- auto & operator[ ] (item< dimensionality > index)

  To use an accessor with [item<>].
- auto & operator[ ] (item< dimensionality > index) const

  To use an accessor with [item<>].
- auto & operator[ ] (nd_item< dimensionality > index)

  To use an accessor with an [nd_item<>].

- auto & operator[ ] (nd_item< dimensionality > index) const

  To use an accessor with an [nd_item<>].
- accessor_detail::reference operator* ()

  Get the first element of the accessor.
- accessor_detail::reference operator* () const

  Get the first element of the accessor.
- auto get_pointer () const

  Get the pointer to the start of the data.
- accessor_detail::iterator begin () const

  Forward all the iterator functions to the implementation.
- accessor_detail::iterator end () const
- accessor_detail::const_iterator cbegin () const
- accessor_detail::const_iterator cend () const
- accessor_detail::reverse_iterator rbegin () const
- accessor_detail::reverse_iterator rend () const
- accessor_detail::const_reverse_iterator crbegin () const
- accessor_detail::const_reverse_iterator crend () const

Static Public Attributes

- static constexpr auto dimensionality = Dimensions

Private Types

- using accessor_detail = typename detail::accessor< DataType, Dimensions, AccessMode, Target >
- using implementation_t = typename accessor::shared_ptr_implementation

Private Attributes

- friend implementation_t

Additional Inherited Members

8.1.2.2.1 Member Typedef Documentation

8.1.2.2.1.1 accessor_detail

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
using cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::accessor_detail = typename
detail::accessor<DataType, Dimensions, AccessMode, Target>  [private]
```

Definition at line 68 of file accessor.hpp.

8.1.2.2.1.2 implementation_t

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
using cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::implementation_t =
typename accessor::shared_ptr_implementation  [private]
```

Definition at line 71 of file accessor.hpp.

8.1.2.2.2 Constructor & Destructor Documentation

8.1.2.2.2.1 accessor() [1/4]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
template<typename Allocator >
cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::accessor (
            buffer< DataType, Dimensions, Allocator > & target_buffer,
            handler & command_group_handler )  [inline]
```

Construct a buffer accessor from a buffer using a command group handler object from the command group scope.

Constructor only available for global_buffer or constant_buffer target.

access_target defines the form of access being obtained.

Todo Add template allocator type in all the accessor constructors in the specification or just use a more opaque Buffer type?

Todo fix specification where access mode should be target instead

Definition at line 97 of file accessor.hpp.

References cl::sycl::access::constant_buffer, cl::sycl::access::global_buffer, cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation, and cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00098                                         : implementation_t {
00099     new detail::accessor<DataType, Dimensions, AccessMode, Target> {
00100       target_buffer.implementation->implementation, command_group_handler }
00101   } {
00102     static_assert(Target == access::target::global_buffer
00103                   || Target == access::target::constant_buffer,
00104                   "access target should be global_buffer or constant_buffer "
00105                   "when a handler is used");
00106     // Now the implementation is created, register it
00107     implementation->register_accessor();
00108   }
```

8.1.2.2.2 accessor() [2/4]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
template<typename Allocator >
cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::accessor (
            buffer< DataType, Dimensions, Allocator > & target_buffer )  [inline]
```

Construct a buffer accessor from a buffer.

Constructor only available for host_buffer target.

access_target defines the form of access being obtained.

Definition at line 118 of file accessor.hpp.

References cl::sycl::access::host_buffer, and cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00119     : implementation_t {
00120     new detail::accessor<DataType, Dimensions, AccessMode, Target> {
00121       target_buffer.implementation->implementation }
00122   } {
00123     static_assert(Target == access::target::host_buffer,
00124                   "without a handler, access target should be host_buffer");
00125   }
```

8.1.2.2.3 accessor() [3/4]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
template<typename Allocator >
cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::accessor (
            buffer< DataType, Dimensions, Allocator > & target_buffer,
            handler & command_group_handler,
            const range< Dimensions > & offset,
            const range< Dimensions > & range )  [inline]
```

Construct a buffer accessor from a buffer given a specific range for access permissions and an offset that provides the starting point for the access range using a command group handler object from the command group scope.

This accessor limits the processing of the buffer to the [offset, offset+range[for every dimension. Any other parts of the buffer will be unaffected.

Constructor only available for access modes global_buffer, and constant_buffer (see Table "Buffer accessor constructors"). access_target defines the form of access being obtained.

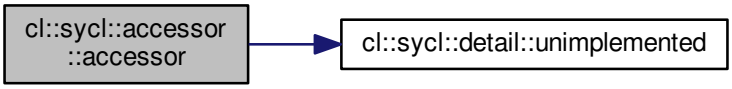
This accessor is recommended for discard-write and discard read write access modes, when the unaffected parts of the processing should be retained.

Definition at line 146 of file accessor.hpp.

References cl::sycl::detail::unimplemented().

```
00149                                       {
00150     detail::unimplemented();
00151   }
```

Here is the call graph for this function:



8.1.2.2.4 accessor() [4/4]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::accessor (
            const range< Dimensions > & allocation_size,
            handler & command_group_handler )  [inline]
```

Construct an accessor of dimension Dimensions with elements of type DataType using the passed range to specify the size in each dimension.

It needs as a parameter a command group handler object from the command group scope. Constructor only available if AccessMode is local, see Table 3.25.

Definition at line 162 of file accessor.hpp.

References cl::sycl::access::local.

```
00164     : implementation_t { new detail::accessor<DataType,
00165                                               Dimensions,
00166                                               AccessMode,
00167                                               access::target::local> {
00168       allocation_size, command_group_handler
00169         }
00170   }
00171   {
00172     static_assert(Target == access::target::local,
00173                   "This accessor constructor requires "
00174                   "access target be local");
00175   }
```

8.1.2.2.3 Member Function Documentation

8.1.2.2.3.1 begin()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::iterator cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >↩
::begin ( ) const  [inline]
```

Forward all the iterator functions to the implementation.

Todo Add these functions to the specification

Todo The fact that the lambda capture make a const copy of the accessor is not yet elegantly managed... The issue is that begin()/end() dispatch is made according to the accessor constness and not from the array member constness...

Todo try to solve it by using some enable_if on array constness?

Todo The issue is that the end may not be known if it is implemented by a raw OpenCL cl_mem... So only provide on the device the iterators related to the start? Actually the accessor needs to know a part of the shape to have the multidimentional addressing. So this only require a size_t more...

Todo Factor out these in a template helper

Definition at line 343 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00343                                                {
00344     return implementation->begin();
00345   }
```

8.1.2.2.3.2 cbegin()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::const_iterator cl::sycl::accessor< DataType, Dimensions, AccessMode, Target
>::cbegin ( ) const  [inline]
```

Definition at line 360 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00360                                                      {
00361     return implementation->cbegin();
00362   }
```

8.1.2.2.3.3 cend()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::const_iterator cl::sycl::accessor< DataType, Dimensions, AccessMode, Target
>::cend ( ) const  [inline]
```

Definition at line 365 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00365                                                    {
00366     return implementation->cend();
00367   }
```

8.1.2.2.3.4 crbegin()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::const_reverse_iterator cl::sycl::accessor< DataType, Dimensions, AccessMode,
Target >::crbegin ( ) const  [inline]
```

Definition at line 386 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00386                                                      {
00387     return implementation->rbegin();
00388   }
```

8.1.2.2.3.5 crend()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::const_reverse_iterator cl::sycl::accessor< DataType, Dimensions, AccessMode,
Target >::crend ( ) const  [inline]
```

Definition at line 391 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00391                                                    {
00392     return implementation->rend();
00393   }
```

8.1.2.2.3.6 end()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::iterator cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::end
( ) const  [inline]
```

Definition at line 349 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00349                                                {
00350     return implementation->end();
00351   }
```

8.1.2.2.3.7 get_count()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::get_count ( ) const
[inline]
```

Returns the total number of elements behind the accessor.

Equal to get_range()[0] * ... * get_range()[Dimensions-1].

Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 206 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00206                          {
00207     return implementation->get_count();
00208   }
```

8.1.2.2.3.8 get_pointer()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::get_pointer ( ) const
[inline]
```

Get the pointer to the start of the data.

Todo Should it be named data() instead?

Definition at line 315 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00315                          {
00316     return implementation->get_pointer();
00317   }
```

8.1.2.2.3.9 get_range()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::get_range ( ) const
[inline]
```

Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.

Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 186 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00186                           {
00187     /* Interpret the shape which is a pointer to the first element as an
00188        array of Dimensions elements so that the range<Dimensions>
00189        constructor is happy with this collection
00190
00191        \todo Add also a constructor in range<> to accept a const
00192        std::size_t *?
00193     */
00194     return implementation->get_range();
00195   }
```

8.1.2.2.3.10 get_size()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::get_size ( ) const  [inline]
```

Returns the size of the underlying buffer storage in bytes.

Todo It is incompatible with buffer get_size() in the spec

Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 219 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00219                           {
00220     return implementation->get_size();
00221   }
```

8.1.2.2.3.11 operator*() [1/2]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::reference cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >↩
::operator* ( )  [inline]
```

Get the first element of the accessor.

Useful with an accessor on a scalar for example.

Todo Add in the specification

Definition at line 291 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00291                                          {
00292     return **implementation;
00293   }
```

8.1.2.2.3.12 operator*() [2/2]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::reference cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >↩
::operator* ( ) const  [inline]
```

Get the first element of the accessor.

Useful with an accessor on a scalar for example.

Todo Add in the specification?

Todo Add the concept of 0-dim buffer and accessor for scalar and use an implicit conversion to value_type reference to access the value with the accessor?

Definition at line 306 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00306                                                {
00307     return **implementation;
00308   }
```

8.1.2.2.3.13 operator[]() [1/8]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::reference cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >↩
::operator[] (
            std::size_t index )  [inline]
```

Use the accessor with integers à la [][][].

Use array_view_type::reference instead of auto& because it does not work in some dimensions.

Definition at line 229 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00229                                                                    {
00230     return (*implementation)[index];
00231   }
```

8.1.2.2.3.14 operator[]() [2/8]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::reference cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >↩
::operator[] (
            std::size_t index ) const  [inline]
```

Use the accessor with integers à la [][][].

Use array_view_type::reference instead of auto& because it does not work in some dimensions.

Definition at line 239 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00239                                                                          {
00240     return (*implementation)[index];
00241   }
```

8.1.2.2.3.15 operator[]() [3/8]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto& cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[] (
            id< dimensionality > index )  [inline]
```

To use the accessor with [id<>].

Definition at line 245 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00245                                                {
00246     return (*implementation)[index];
00247   }
```

8.1.2.2.3.16 operator[]() [4/8]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto& cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[] (
            id< dimensionality > index ) const  [inline]
```

To use the accessor with [id<>].

Definition at line 251 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00251                                                {
00252     return (*implementation)[index];
00253   }
```

8.1.2.2.3.17 operator[]() [5/8]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto& cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[] (
            item< dimensionality > index )  [inline]
```

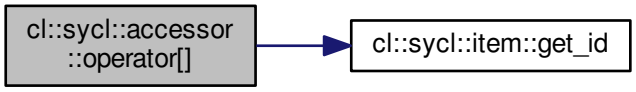
To use an accessor with [item<>].

Definition at line 257 of file accessor.hpp.

References cl::sycl::item< Dimensions >::get_id().

```
00257                                               {
00258     return (*this)[index.get_id()];
00259   }
```

Here is the call graph for this function:



8.1.2.2.3.18 operator[]() [6/8]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto& cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[] (
            item< dimensionality > index ) const  [inline]
```

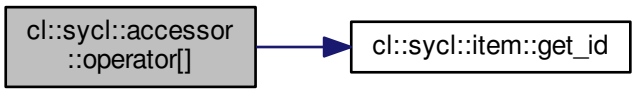
To use an accessor with [item<>].

Definition at line 263 of file accessor.hpp.

References cl::sycl::item< Dimensions >::get_id().

```
00263                                                    {
00264     return (*this)[index.get_id()];
00265   }
```

Here is the call graph for this function:



8.1.2.2.3.19 operator[]() [7/8]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto& cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[] (
            nd_item< dimensionality > index )  [inline]
```

To use an accessor with an [nd_item<>].

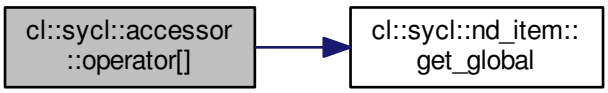
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 272 of file accessor.hpp.

References cl::sycl::nd_item< Dimensions >::get_global().

```
00272                                                    {
00273     return (*this)[index.get_global()];
00274   }
```

Here is the call graph for this function:



8.1.2.2.3.20 operator[]() [8/8]

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
auto& cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[] (
            nd_item< dimensionality > index ) const  [inline]
```

To use an accessor with an [nd_item<>].

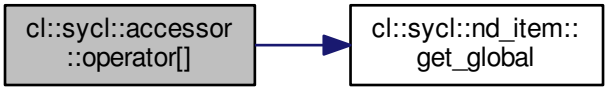
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 280 of file accessor.hpp.

References cl::sycl::nd_item< Dimensions >::get_global().

```
00280                                                                    {
00281     return (*this)[index.get_global()];
00282   }
```

Here is the call graph for this function:



8.1.2.2.3.21 rbegin()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::reverse_iterator cl::sycl::accessor< DataType, Dimensions, AccessMode, Target
>::rbegin ( ) const  [inline]
```

Definition at line 370 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00370                                                                    {
00371     return implementation->rbegin();
00372   };
```

8.1.2.2.3.22 rend()

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
accessor_detail::reverse_iterator cl::sycl::accessor< DataType, Dimensions, AccessMode, Target
>::rend ( ) const  [inline]
```

Definition at line 375 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< accessor< DataType, Dimensions, AccessMode, Target >, detail::accessor< DataType, Dimensions, AccessMode, Target > >::implementation.

```
00375                                                    {
00376     return implementation->rend();
00377   }
```

8.1.2.2.4 Member Data Documentation

8.1.2.2.4.1 dimensionality

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
constexpr auto cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::dimensionality
= Dimensions  [static]
```

Todo in the specification: store the dimension for user request

Definition at line 61 of file accessor.hpp.

8.1.2.2.4.2 implementation_t

```
template<typename DataType , int Dimensions, access::mode AccessMode, access::target Target =
access::target::global_buffer>
friend cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::implementation_t  [private]
```

Definition at line 74 of file accessor.hpp.

8.1.2.3 class cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >

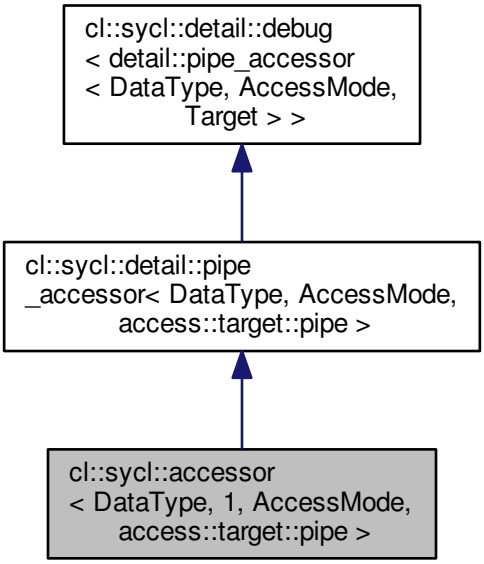
template<typename DataType, access::mode AccessMode>
class cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >

The pipe accessor abstracts the way pipe data are accessed inside a kernel.

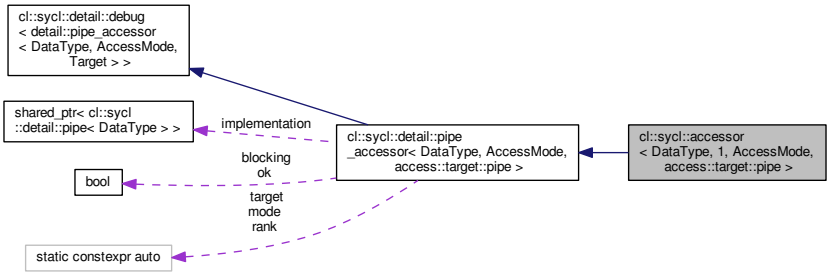
A specialization for an non-blocking pipe

Definition at line 405 of file accessor.hpp.

Inheritance diagram for cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >:



Collaboration diagram for cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >:



Public Types

- using accessor_detail = detail::pipe_accessor< DataType, AccessMode, access::target::pipe >

Public Member Functions

- accessor (pipe< DataType > &p, handler &command_group_handler)

  Construct a pipe accessor from a pipe using a command group handler object from the command group scope.
- pipe_reservation< accessor > reserve (std::size_t size) const

  Make a reservation inside the pipe.
- auto & get_pipe_detail ()

  Get the underlying pipe implementation.

Additional Inherited Members

8.1.2.3.1 Member Typedef Documentation

8.1.2.3.1.1 accessor_detail

```
template<typename DataType , access::mode AccessMode>
using cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >::accessor_detail =
detail::pipe_accessor<DataType, AccessMode, access::target::pipe>
```

Definition at line 410 of file accessor.hpp.

8.1.2.3.2 Constructor & Destructor Documentation

8.1.2.3.2.1 accessor()

```
template<typename DataType , access::mode AccessMode>
cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >::accessor (
            pipe< DataType > & p,
            handler & command_group_handler )  [inline]
```

Construct a pipe accessor from a pipe using a command group handler object from the command group scope.

access_target defines the form of access being obtained.

Definition at line 419 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< pipe< T >, detail::pipe< T > >::implementation.

```
00420     : accessor_detail { p.implementation, command_group_handler } { }
```

8.1.2.3.3 Member Function Documentation

8.1.2.3.3.1 get_pipe_detail()

```
template<typename DataType , access::mode AccessMode>
auto& cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >::get_pipe_detail ( )
[inline]
```

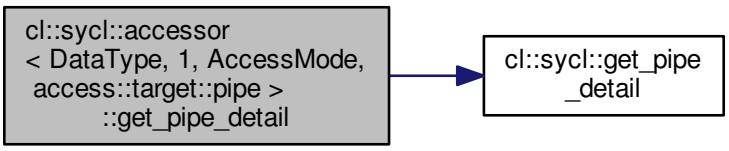
Get the underlying pipe implementation.

Definition at line 429 of file accessor.hpp.

References cl::sycl::get_pipe_detail().

```
00429                           {
00430     return accessor_detail::get_pipe_detail();
00431   }
```

Here is the call graph for this function:



8.1.2.3.3.2 reserve()

```
template<typename DataType , access::mode AccessMode>
pipe_reservation<accessor> cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe
>::reserve (
             std::size_t size ) const  [inline]
```

Make a reservation inside the pipe.

Definition at line 423 of file accessor.hpp.

```
00423                                                 {
00424     return accessor_detail::reserve(size);
00425   }
```

8.1.2.4 class cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >

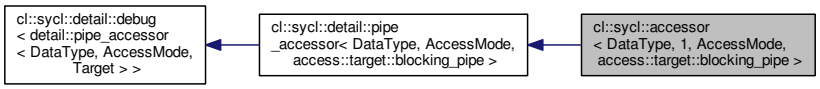
template<typename DataType, access::mode AccessMode>
class cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >

The pipe accessor abstracts the way pipe data are accessed inside a kernel.

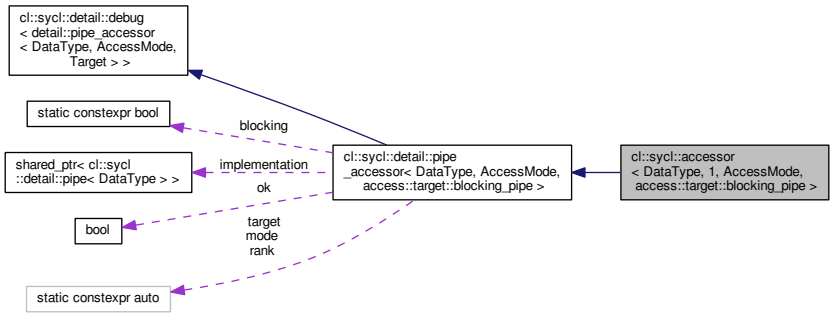
A specialization for a blocking pipe

Definition at line 443 of file accessor.hpp.

Inheritance diagram for cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >:



Collaboration diagram for cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >:



Public Types

- using accessor_detail = detail::pipe_accessor< DataType, AccessMode, access::target::blocking_pipe >

Public Member Functions

- accessor (pipe< DataType > &p, handler &command_group_handler)

  Construct a pipe accessor from a pipe using a command group handler object from the command group scope.
- pipe_reservation< accessor > reserve (std::size_t size) const

  Make a reservation inside the pipe.
- auto & get_pipe_detail ()

  Get the underlying pipe implementation.

Additional Inherited Members

8.1.2.4.1 Member Typedef Documentation

8.1.2.4.1.1 accessor_detail

```
template<typename DataType , access::mode AccessMode>
using cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >::accessor↩
_detail = detail::pipe_accessor<DataType, AccessMode, access::target::blocking_pipe>
```

Definition at line 448 of file accessor.hpp.

8.1.2.4.2 Constructor & Destructor Documentation

8.1.2.4.2.1 accessor()

```
template<typename DataType , access::mode AccessMode>
cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >::accessor (
            pipe< DataType > & p,
            handler & command_group_handler )  [inline]
```

Construct a pipe accessor from a pipe using a command group handler object from the command group scope.

access_target defines the form of access being obtained.

Definition at line 457 of file accessor.hpp.

References cl::sycl::detail::shared_ptr_implementation< pipe< T >, detail::pipe< T > >::implementation.

```
00458     : accessor_detail { p.implementation, command_group_handler } { }
```

8.1.2.4.3 Member Function Documentation

8.1.2.4.3.1 get_pipe_detail()

```
template<typename DataType , access::mode AccessMode>
auto& cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >::get_pipe↩
_detail ( )  [inline]
```

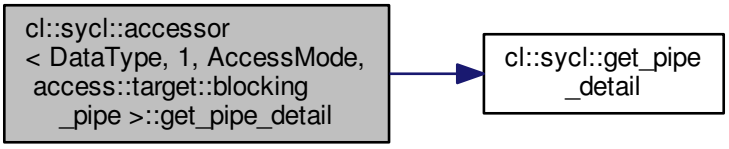
Get the underlying pipe implementation.

Definition at line 468 of file accessor.hpp.

References cl::sycl::get_pipe_detail().

```
00468                           {
00469     return accessor_detail::get_pipe_detail();
00470   }
```

Here is the call graph for this function:



8.1.2.4.3.2 reserve()

```
template<typename DataType , access::mode AccessMode>
pipe_reservation<accessor> cl::sycl::accessor< DataType, 1, AccessMode, access::target↩
::blocking_pipe >::reserve (
             std::size_t size ) const  [inline]
```

Make a reservation inside the pipe.

Definition at line 462 of file accessor.hpp.

```
00462                                                 {
00463     return accessor_detail::reserve(size);
00464   }
```

8.1.2.5 class cl::sycl::detail::accessor

template<typename T, int Dimensions, access::mode Mode, access::target Target>
class cl::sycl::detail::accessor< T, Dimensions, Mode, Target >

The buffer accessor abstracts the way buffer data are accessed inside a kernel in a multidimensional variable length array way.

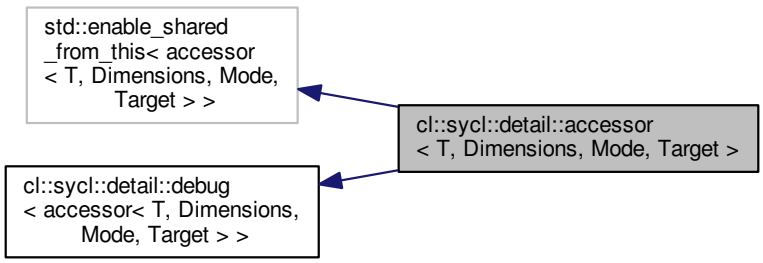
This implementation relies on boost::multi_array to provide this nice syntax and behaviour.

Right now the aim of this class is just to access to the buffer in a read-write mode, even if capturing the multi_↩ array_ref from a lambda make it const (since in examples we have lambda with [=] without mutable lambda).

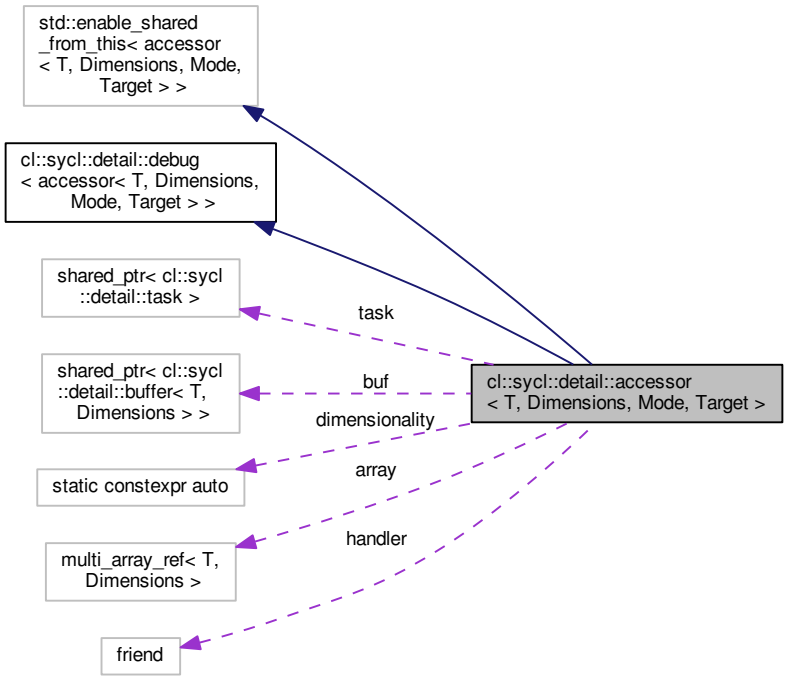
Todo Use the access::mode

Definition at line 39 of file local_accessor.hpp.

Inheritance diagram for cl::sycl::detail::accessor< T, Dimensions, Mode, Target >:



Collaboration diagram for cl::sycl::detail::accessor< T, Dimensions, Mode, Target >:



Public Types

- using value_type = T
- using element = T
- using reference = typename array_view_type::reference
- using const_reference = typename array_view_type::const_reference
- using iterator = typename array_view_type::iterator

  Inherit the iterator types from the implementation.
- using const_iterator = typename array_view_type::const_iterator
- using reverse_iterator = typename array_view_type::reverse_iterator
- using const_reverse_iterator = typename array_view_type::const_reverse_iterator

Public Member Functions

- accessor (std::shared_ptr< detail::buffer< T, Dimensions >> target_buffer)

  Construct a host accessor from an existing buffer.
- accessor (std::shared_ptr< detail::buffer< T, Dimensions >> target_buffer, handler &command_group_↩ handler)

  Construct a device accessor from an existing buffer.
- void register_accessor ()

  Register the accessor once a `std::shared_ptr` is created on it.
- auto get_range () const

  Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.

- auto get_count () const

  Returns the total number of elements behind the accessor.
- auto get_size () const

  Returns the size of the underlying buffer storage in bytes.
- reference operator[ ] (std::size_t index)

  Use the accessor with integers à la [][][].
- reference operator[ ] (std::size_t index) const

  Use the accessor with integers à la [][][].
- auto & operator[ ] (id< dimensionality > index)

  To use the accessor with [id<>].
- auto & operator[ ] (id< dimensionality > index) const

  To use the accessor with [id<>].
- auto & operator[ ] (item< dimensionality > index)

  To use an accessor with [item<>].
- auto & operator[ ] (item< dimensionality > index) const

  To use an accessor with [item<>].
- auto & operator[ ] (nd_item< dimensionality > index)

  To use an accessor with an [nd_item<>].
- auto & operator[ ] (nd_item< dimensionality > index) const

  To use an accessor with an [nd_item<>].
- reference operator* ()

  Get the first element of the accessor.
- reference operator* () const

  Get the first element of the accessor.
- detail::buffer< T, Dimensions > & get_buffer ()

  Get the buffer used to create the accessor.
- constexpr bool is_read_access () const

  Test if the accessor has a read access right.
- constexpr bool is_write_access () const

  Test if the accessor has a write access right.
- auto get_pointer ()

  Return the pointer to the data.
- iterator begin () const

  Forward all the iterator functions to the implementation.
- iterator end () const
- const_iterator cbegin () const
- const_iterator cend () const
- reverse_iterator rbegin () const
- reverse_iterator rend () const
- const_reverse_iterator crbegin () const
- const_reverse_iterator crend () const

Static Public Attributes

- static constexpr auto dimensionality = Dimensions

Private Types

- using array_view_type = boost::multi_array_ref< T, Dimensions >

  The implementation is a multi_array_ref wrapper.
- using writable_array_view_type = typename std::remove_const< array_view_type >::type

Private Member Functions

- auto get_cl_buffer () const

  Get the boost::compute::buffer or throw if unset.
- void copy_in_cl_buffer ()

  Lazily associate a CL buffer to the SYCL buffer and copy data in it if required, updates the state of the data in the buffer across contexts.
- void copy_back_cl_buffer ()

  Does nothing.

Private Attributes

- std::shared_ptr< detail::buffer< T, Dimensions > > buf

  Keep a reference to the accessed buffer.
- array_view_type array

  The way the buffer is really accessed.
- std::shared_ptr< detail::task > task

  The task where the accessor is used in.
- friend handler

8.1.2.5.1 Member Typedef Documentation

8.1.2.5.1.1 array_view_type

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array_view_type = boost↩
::multi_array_ref<T, Dimensions>  [private]
```

The implementation is a multi_array_ref wrapper.

Definition at line 73 of file accessor.hpp.

8.1.2.5.1.2 const_iterator

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::const_iterator = typename
array_view_type::const_iterator
```

Definition at line 111 of file accessor.hpp.

8.1.2.5.1.3 const_reference

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::const_reference = typename
array_view_type::const_reference
```

Definition at line 104 of file accessor.hpp.

8.1.2.5.1.4 const_reverse_iterator

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::const_reverse_iterator =
typename array_view_type::const_reverse_iterator
```

Definition at line 114 of file accessor.hpp.

8.1.2.5.1.5 element

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::element = T
```

Definition at line 102 of file accessor.hpp.

8.1.2.5.1.6 iterator

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::iterator = typename array_↩
view_type::iterator
```

Inherit the iterator types from the implementation.

Todo Add iterators to accessors in the specification

Definition at line 110 of file accessor.hpp.

8.1.2.5.1.7 reference

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::reference = typename array_↩
view_type::reference
```

Definition at line 103 of file accessor.hpp.

8.1.2.5.1.8 reverse_iterator

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::reverse_iterator = typename
array_view_type::reverse_iterator
```

Definition at line 112 of file accessor.hpp.

8.1.2.5.1.9 value_type

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::value_type = T
```

Todo in the specification: store the types for user request as STL or C++AMP

Definition at line 101 of file accessor.hpp.

8.1.2.5.1.10 writable_array_view_type

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
using cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::writable_array_view_type =
typename std::remove_const<array_view_type>::type  [private]
```

Definition at line 77 of file accessor.hpp.

8.1.2.5.2 Constructor & Destructor Documentation

8.1.2.5.2.1 accessor() [1/2]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::accessor (
            std::shared_ptr< detail::buffer< T, Dimensions >> target_buffer )  [inline]
```

Construct a host accessor from an existing buffer.

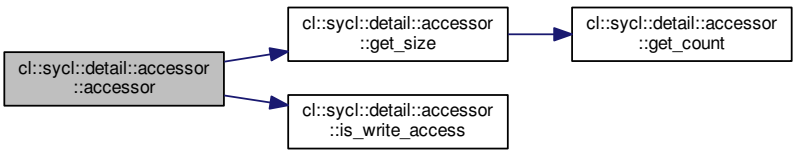
Todo fix the specification to rename target that shadows template parm

Definition at line 122 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_size(), cl::sycl::access::host_buffer, cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::is_write_access(), and TRISYCL_DUMP_T.

```
00122                                                                          :
00123     buf { target_buffer }, array { target_buffer->access } {
00124     target_buffer->template track_access_mode<Mode>();
00125     TRISYCL_DUMP_T("Create a host accessor write = " <<
      is_write_access());
00126     static_assert(Target == access::target::host_buffer,
00127                   "without a handler, access target should be host_buffer");
00128     /* The host needs to wait for all the producers of the buffer to
00129        have finished */
00130     buf->wait();
00131
00132 #ifdef TRISYCL_OPENCL
00133     /* For the host context, we are obligated to update the buffer state
00134        during the accessors creation, otherwise we have no way of knowing
00135        if a buffer was modified on the host. This is only true because
00136        host accessors are blocking
00137      */
00138     cl::sycl::context ctx;
00139     buf->update_buffer_state(ctx, Mode, get_size(), array.data());
00140 #endif
00141   }
```

Here is the call graph for this function:



8.1.2.5.2.2 accessor() [2/2]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::accessor (
             std::shared_ptr< detail::buffer< T, Dimensions >> target_buffer,
             handler & command_group_handler )  [inline]
```

Construct a device accessor from an existing buffer.

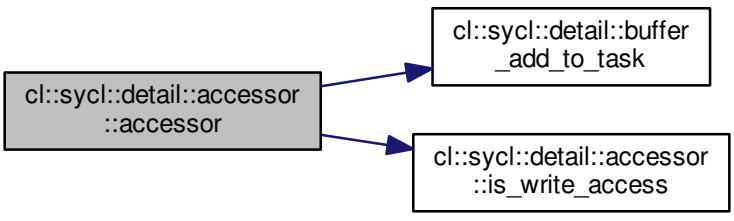
Todo fix the specification to rename target that shadows template parm

Definition at line 149 of file accessor.hpp.

References cl::sycl::detail::buffer_add_to_task(), cl::sycl::access::constant_buffer, cl::sycl::access::global_buffer, cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::is_write_access(), and TRISYCL_DUMP_T.

```
00150                                        :
00151     buf { target_buffer }, array { target_buffer->access } {
00152     target_buffer->template track_access_mode<Mode>();
00153     TRISYCL_DUMP_T("Create a kernel accessor write = " <<
      is_write_access());
00154     static_assert(Target == access::target::global_buffer
00155                   || Target == access::target::constant_buffer,
00156                   "access target should be global_buffer or constant_buffer "
00157                   "when a handler is used");
00158     // Register the buffer to the task dependencies
00159     task = buffer_add_to_task(buf, &command_group_handler,
      is_write_access());
00160   }
```

Here is the call graph for this function:



8.1.2.5.3 Member Function Documentation

8.1.2.5.3.1 begin()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
iterator cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::begin ( ) const  [inline]
```

Forward all the iterator functions to the implementation.

Todo Add these functions to the specification

Todo The fact that the lambda capture make a const copy of the accessor is not yet elegantly managed... The issue is that begin()/end() dispatch is made according to the accessor constness and not from the array member constness...

Todo try to solve it by using some enable_if on array constness?

Todo The issue is that the end may not be known if it is implemented by a raw OpenCL cl_mem... So only provide on the device the iterators related to the start? Actually the accessor needs to know a part of the shape to have the multidimentional addressing. So this only require a size_t more...

Todo Factor out these in a template helper

Todo Do we need this in detail::accessor too or only in accessor?

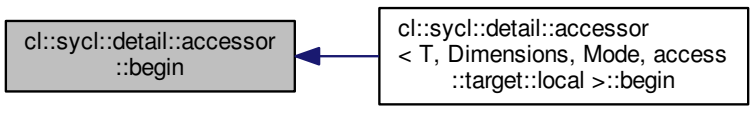
Definition at line 400 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::begin().

```
00400                           {
00401     return const_cast<writable_array_view_type &>(array).
      begin();
00402   }
```

Here is the caller graph for this function:



8.1.2.5.3.2 cbegin()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
const_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::cbegin ( ) const
[inline]
```

Definition at line 417 of file accessor.hpp.

```
00417 { return array.begin(); }
```

8.1.2.5.3.3 cend()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
const_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::cend ( ) const
[inline]
```

Definition at line 420 of file accessor.hpp.

```
00420 { return array.end(); }
```

8.1.2.5.3.4 copy_back_cl_buffer()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
void cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::copy_back_cl_buffer ( )  [inline],
[private]
```

Does nothing.

Definition at line 473 of file accessor.hpp.

```
00473                                {
00474     /* The copy back is handled by the host accessor and the buffer destructor.
00475        We don't need to systematically transfer the data after the
00476        kernel execution
00477
00478        \todo Figure out what to do with this function
00479     */
00480   }
```

8.1.2.5.3.5 copy_in_cl_buffer()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
void cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::copy_in_cl_buffer ( )  [inline],
[private]
```

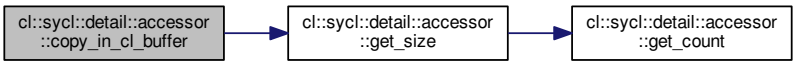
Lazily associate a CL buffer to the SYCL buffer and copy data in it if required, updates the state of the data in the buffer across contexts.

Definition at line 463 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_size().

```
00463                             {
00464     /* Create the OpenCL buffer and copy in it the data from the host if
00465        the buffer doesn't already exists or if the data is not up to date
00466     */
00467     auto ctx = task->get_queue()->get_context();
00468     buf->update_buffer_state(ctx, Mode, get_size(), array.data());
00469   }
```

Here is the call graph for this function:



8.1.2.5.3.6 crbegin()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
const_reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::crbegin ( )
const  [inline]
```

Definition at line 441 of file accessor.hpp.

```
00441 { return array.rbegin(); }
```

8.1.2.5.3.7 crend()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
const_reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::crend ( )
const  [inline]
```

Definition at line 444 of file accessor.hpp.

```
00444 { return array.rend(); }
```

8.1.2.5.3.8 end()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
iterator cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::end ( ) const  [inline]
```

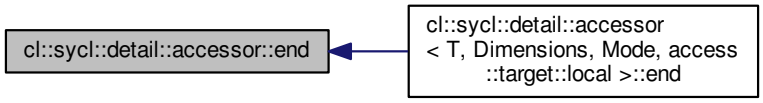
Definition at line 406 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::end().

```
00406                         {
00407     return const_cast<writable_array_view_type &>(array).
      end();
00408   }
```

Here is the caller graph for this function:



8.1.2.5.3.9 get_buffer()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
detail::buffer<T, Dimensions>& cl::sycl::detail::accessor< T, Dimensions, Mode, Target >↩
::get_buffer ( )  [inline]
```

Get the buffer used to create the accessor.

Definition at line 329 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::buf.

```
00329                                         {
00330     return *buf;
00331   }
```

8.1.2.5.3.10 get_cl_buffer()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_cl_buffer ( ) const  [inline],
[private]
```

Get the boost::compute::buffer or throw if unset.

Definition at line 453 of file accessor.hpp.

```
00453                                {
00454     // This throws if not set
00455     auto ctx = task->get_queue()->get_context();
00456     return buf->get_cl_buffer(ctx);
00457   }
```

8.1.2.5.3.11 get_count()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_count ( ) const  [inline]
```

Returns the total number of elements behind the accessor.

Equal to get_range()[0] * ... * get_range()[Dimensions-1].

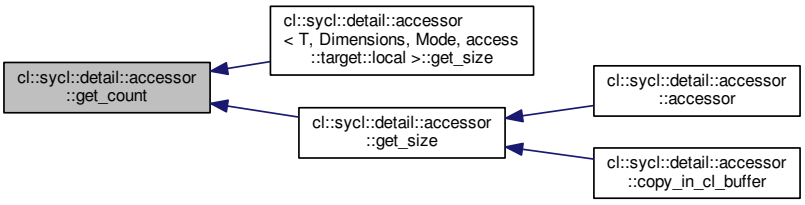
Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 225 of file accessor.hpp.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::get_size(), and cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_size().

```
00225                            {
00226     return array.num_elements();
00227   }
```

Here is the caller graph for this function:



8.1.2.5.3.12 get_pointer()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_pointer ( )  [inline]
```

Return the pointer to the data.

Todo Implement the various pointer address spaces

Definition at line 370 of file accessor.hpp.

```
00370                {
00371     return array.data();
00372   }
```

8.1.2.5.3.13 get_range()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_range ( ) const  [inline]
```

Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.

Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 203 of file accessor.hpp.

```
00203                         {
00204     /* Interpret the shape which is a pointer to the first element as an
00205        array of Dimensions elements so that the range<Dimensions>
00206        constructor is happy with this collection
00207
00208        \todo Add also a constructor in range<> to accept a const
00209        std::size_t *?
00210     */
00211     return range<Dimensions> {
00212       *(const std::size_t (*)[Dimensions])(array.shape())
00213         };
00214   }
```

8.1.2.5.3.14 get_size()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_size ( ) const  [inline]
```

Returns the size of the underlying buffer storage in bytes.

Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

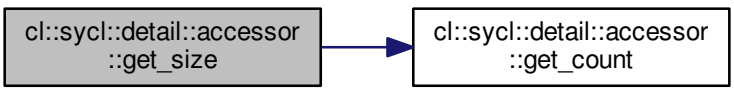
Definition at line 236 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_count().

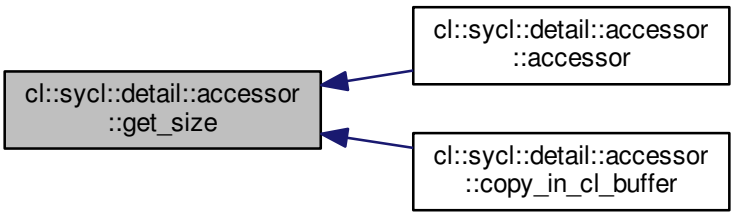
Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::accessor(), and cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::copy_in_cl_buffer().

```
00236                         {
00237     return get_count()*sizeof(value_type);
00238   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.1.2.5.3.15 is_read_access()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
constexpr bool cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::is_read_access ( )
const  [inline]
```

Test if the accessor has a read access right.

Todo Strangely, it is not really constexpr because it is not a static method...

Todo to move in the access::mode enum class and add to the specification ?

Definition at line 342 of file accessor.hpp.

References cl::sycl::access::discard_read_write, cl::sycl::access::read, and cl::sycl::access::read_write.

```
00342                                       {
00343     return Mode == access::mode::read
00344       || Mode == access::mode::read_write
00345       || Mode == access::mode::discard_read_write;
00346   }
```

8.1.2.5.3.16 is_write_access()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
constexpr bool cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::is_write_access ( )
const  [inline]
```

Test if the accessor has a write access right.

Todo Strangely, it is not really constexpr because it is not a static method...

Todo to move in the access::mode enum class and add to the specification ?

Definition at line 357 of file accessor.hpp.

References cl::sycl::access::discard_read_write, cl::sycl::access::discard_write, cl::sycl::access::read_write, and cl::sycl::access::write.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::accessor().

```
00357                                       {
00358     return Mode == access::mode::write
00359       || Mode == access::mode::read_write
00360       || Mode == access::mode::discard_write
00361       || Mode == access::mode::discard_read_write;
00362   }
```

Here is the caller graph for this function:

8.1.2.5.3.17 operator*() [1/2]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
reference cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator* ( )  [inline]
```

Get the first element of the accessor.

Useful with an accessor on a scalar for example.

Todo Add in the specification

Definition at line 308 of file accessor.hpp.

```
00308                         {
00309     return *array.data();
00310   }
```

8.1.2.5.3.18 operator*() [2/2]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
reference cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator* ( ) const  [inline]
```

Get the first element of the accessor.

Useful with an accessor on a scalar for example.

Todo Add in the specification?

Todo Add the concept of 0-dim buffer and accessor for scalar and use an implicit conversion to value_type reference to access the value with the accessor?

Definition at line 323 of file accessor.hpp.

```
00323                               {
00324     return *array.data();
00325   }
```

8.1.2.5.3.19 operator[]() [1/8]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
reference cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (
            std::size_t index )  [inline]
```

Use the accessor with integers à la [][][].

Use array_view_type::reference instead of auto& because it does not work in some dimensions.

Definition at line 246 of file accessor.hpp.

```
00246                                       {
00247     return array[index];
00248   }
```

8.1.2.5.3.20 operator[]() [2/8]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
reference cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (
            std::size_t index ) const  [inline]
```

Use the accessor with integers à la [][][].

Use array_view_type::reference instead of auto& because it does not work in some dimensions.

Definition at line 256 of file accessor.hpp.

```
00256                                                {
00257     return array[index];
00258   }
```

8.1.2.5.3.21 operator[]() [3/8]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (
            id< dimensionality > index )  [inline]
```

To use the accessor with [id<>].

Definition at line 262 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array.

```
00262                                                {
00263     return array(index);
00264   }
```

8.1.2.5.3.22 operator[]() [4/8]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (
            id< dimensionality > index ) const  [inline]
```

To use the accessor with [id<>].

Definition at line 268 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array.

```
00268                                                      {
00269     return array(index);
00270   }
```

8.1.2.5.3.23 operator[]() [5/8]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (
            item< dimensionality > index )  [inline]
```

To use an accessor with [item<>].

Definition at line 274 of file accessor.hpp.

```
00274                                                {
00275     return (*this)[index.get()];
00276   }
```

8.1.2.5.3.24 operator[]() [6/8]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (
            item< dimensionality > index ) const  [inline]
```

To use an accessor with [item<>].

Definition at line 280 of file accessor.hpp.

```
00280                                                      {
00281     return (*this)[index.get()];
00282   }
```

8.1.2.5.3.25 operator[]() [7/8]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (
            nd_item< dimensionality > index )  [inline]
```

To use an accessor with an [nd_item<>].

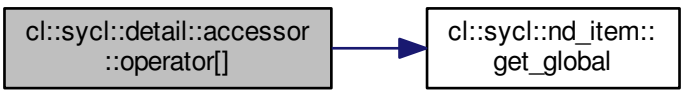
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 289 of file accessor.hpp.

References cl::sycl::nd_item< Dimensions >::get_global().

```
00289                                                    {
00290     return (*this)[index.get_global()];
00291   }
```

Here is the call graph for this function:



8.1.2.5.3.26 operator[]() [8/8]

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
auto& cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[] (
            nd_item< dimensionality > index ) const  [inline]
```

To use an accessor with an [nd_item<>].

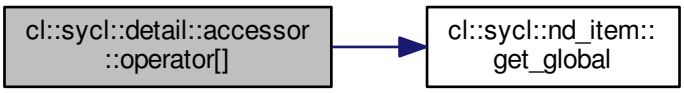
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 297 of file accessor.hpp.

References cl::sycl::nd_item< Dimensions >::get_global().

```
00297                                                                {
00298     return (*this)[index.get_global()];
00299   }
```

Here is the call graph for this function:



8.1.2.5.3.27 rbegin()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::rbegin ( ) const
[inline]
```

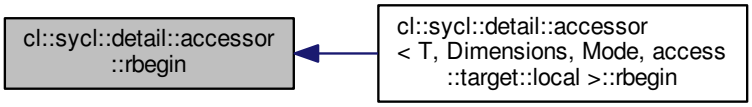
Definition at line 424 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::rbegin().

```
00424                                    {
00425     return const_cast<writable_array_view_type &>(array).
      rbegin();
00426   }
```

Here is the caller graph for this function:



8.1.2.5.3.28 register_accessor()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
void cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::register_accessor ( )  [inline]
```

Register the accessor once a `std::shared_ptr` is created on it.

This is to be called from outside once the object is created. It has been tried directly inside the contructor, but calling `shared_from_this()` from the constructor dead-lock with libstdc++6

Todo Double-check with the C++ committee on this issue.

Definition at line 172 of file accessor.hpp.

```
00172                             {
00173 #ifdef TRISYCL_OPENCL
00174     if (!task->get_queue()->is_host()) {
00175       // To keep alive this accessor in the following lambdas
00176       auto acc = this->shared_from_this();
00177       /* Before running the kernel, make sure the cl_mem behind this
00178          accessor is up-to-date on the device if needed and pass it to
00179          the kernel */
00180       task->add_prelude([=] {
00181           acc->copy_in_cl_buffer();
00182         });
00183       // After running the kernel, deal with some copy-back if needed
00184       task->add_postlude([=] {
00185           /* Even if this function does nothing, it is required to
00186              have the capture of acc to keep the accessor alive across
00187              the kernel execution up to the execution postlude */
00188           acc->copy_back_cl_buffer();
00189         });
00190     }
00191 #endif
00192   }
```

8.1.2.5.3.29 rend()

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::rend ( ) const
[inline]
```

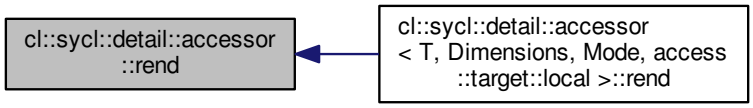
Definition at line 430 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::rend().

```
00430                                   {
00431     return const_cast<writable_array_view_type &>(array).
      rend();
00432   }
```

Here is the caller graph for this function:



8.1.2.5.4 Member Data Documentation

8.1.2.5.4.1 array

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
array_view_type cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::array  [mutable],
[private]
```

The way the buffer is really accessed.

Use a mutable member because the accessor needs to be captured by value in the lambda which is then read-only. This is to avoid the user to use mutable lambda or have a lot of const_cast as previously done in this implementation

Definition at line 86 of file accessor.hpp.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::begin(), cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::begin(), cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::end(), cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::end(), cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[ ](), cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[ ](), cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::rbegin(), cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::rbegin(), cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::rend(), and cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::rend().

8.1.2.5.4.2 buf

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
std::shared_ptr<detail::buffer<T, Dimensions> > cl::sycl::detail::accessor< T, Dimensions,
Mode, Target >::buf  [private]
```

Keep a reference to the accessed buffer.

Beware that it owns the buffer, which means that the accessor has to be destroyed to release the buffer and potentially unblock a kernel at the end of its execution

Definition at line 70 of file accessor.hpp.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_buffer().

8.1.2.5.4.3 dimensionality

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
constexpr auto cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::dimensionality =
Dimensions  [static]
```

Todo in the specification: store the dimension for user request

Todo Use another name, such as from C++17 committee discussions.

Definition at line 97 of file accessor.hpp.

8.1.2.5.4.4 handler

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
friend cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::handler  [private]
```

Definition at line 449 of file accessor.hpp.

8.1.2.5.4.5 task

```
template<typename T , int Dimensions, access::mode Mode, access::target Target>
std::shared_ptr<detail::task> cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::task
[private]
```

The task where the accessor is used in.

Definition at line 89 of file accessor.hpp.

8.1.2.6 class cl::sycl::detail::buffer

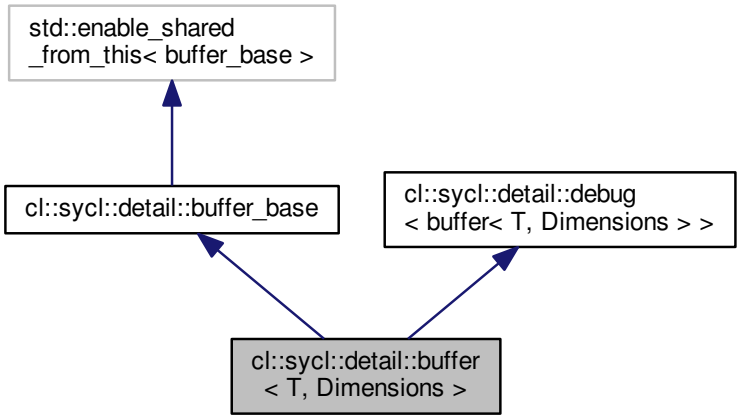
template< typename T, int Dimensions = 1 >
class cl::sycl::detail::buffer< T, Dimensions >

A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on.

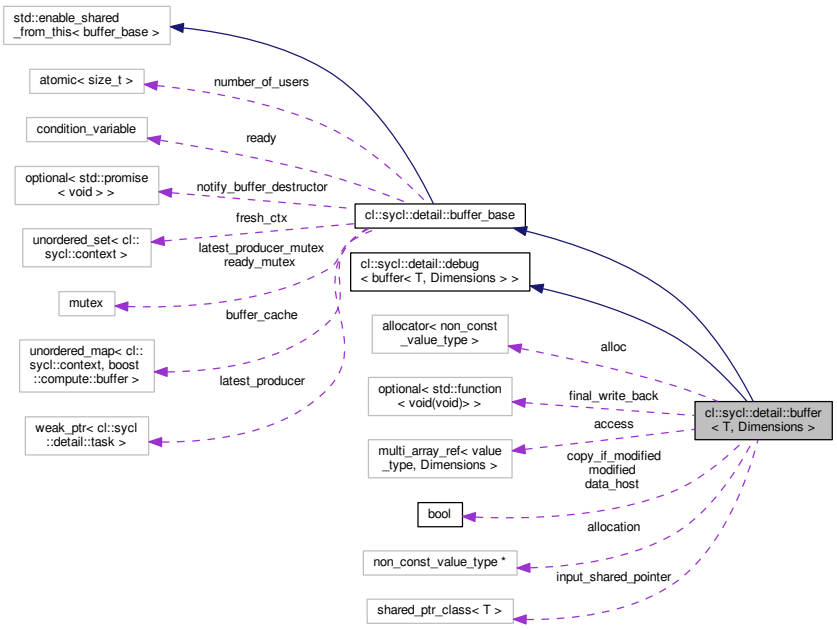
In the case we initialize it from a pointer, for now we just wrap the data with boost::multi_array_ref to provide the VLA semantics without any storage.

Definition at line 32 of file accessor.hpp.

Inheritance diagram for cl::sycl::detail::buffer< T, Dimensions >:



Collaboration diagram for cl::sycl::detail::buffer< T, Dimensions >:



Public Types

- using element = T
- using value_type = T
- using non_const_value_type = std::remove_const_t< value_type >

Public Member Functions

- buffer (const range< Dimensions > &r)

  Create a new read-write buffer of size.
- buffer (T *host_data, const range< Dimensions > &r)

  Create a new read-write buffer from.
- template<typename Dependent = T, typename = std::enable_if_t<!std::is_const<Dependent>::value>>
  buffer (const T *host_data, const range< Dimensions > &r)

  Create a new read-only buffer from.
- buffer (shared_ptr_class< T > &host_data, const range< Dimensions > &r)

  Create a new buffer with associated memory, using the data in host_data.
- template<typename Iterator >
  buffer (Iterator start_iterator, Iterator end_iterator)

  Create a new allocated 1D buffer from the given elements.
- ~buffer ()

  Create a new sub-buffer without allocation to have separate accessors later.
- void mark_as_written ()

  Enforce the buffer to be considered as being modified.
- template<access::mode Mode, access::target Target = access::target::host_buffer>
  void track_access_mode ()

  This method is to be called whenever an accessor is created.

- auto get_range () const

  Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.
- auto get_count () const

  Returns the total number of elements in the buffer.
- auto get_size () const

  Returns the size of the buffer storage in bytes.
- void set_final_data (std::weak_ptr< T > &&final_data)

  Set the weak pointer as destination for write-back on buffer destruction.
- void set_final_data (std::shared_ptr< T > &&final_data)

  Provide destination for write-back on buffer destruction as a shared pointer.
- void set_final_data (std::nullptr_t)

  Disable write-back on buffer destruction as an iterator.
- template<typename Iterator >
  void set_final_data (Iterator final_data)

  Provide destination for write-back on buffer destruction as an iterator.
- boost::optional< std::future< void > > get_destructor_future ()

  Get a `future` to wait from inside the `cl::sycl::buffer` in case there is something to copy back to the host.

Private Member Functions

- auto allocate_buffer (const range< Dimensions > &r)

  Allocate uninitialized buffer memory.
- void deallocate_buffer ()

  Deallocate buffer memory if required.
- template<typename BaseType = T, typename DataType >
  void call_update_buffer_state (cl::sycl::context ctx, access::mode mode, size_t size, DataType *data, std::enable_if_t<!std::is_const< BaseType > ::value > *=0)

  Function pair to work around the fact that T might be a `const` type.
- template<typename BaseType = T, typename DataType >
  void call_update_buffer_state (cl::sycl::context ctx, access::mode mode, size_t size, DataType *data, std::enable_if_t< std::is_const< BaseType > ::value > *=0)

  Version of `call_update_buffer_state` that does nothing.

Private Attributes

- std::allocator< non_const_value_type > alloc

  The allocator to be used when some memory is needed.
- boost::multi_array_ref< value_type, Dimensions > access

  This is the multi-dimensional interface to the data that may point to either allocation in the case of storage managed by SYCL itself or to some other memory location in the case of host memory or storage<> abstraction use.
- non_const_value_type * allocation = nullptr

  If some allocation is requested on the host for the buffer memory, this is where the memory is attached to.
- boost::optional< std::function< void(void)> > final_write_back
- shared_ptr_class< T > input_shared_pointer
- bool data_host = false
- bool copy_if_modified = false
- bool modified = false

Friends

- template<typename U , int D, access::mode Mode, access::target Target>
  class detail::accessor

Additional Inherited Members

8.1.2.6.1 Member Typedef Documentation

8.1.2.6.1.1 element

```
template<typename T, int Dimensions = 1>
using cl::sycl::detail::buffer< T, Dimensions >::element = T
```

Definition at line 49 of file buffer.hpp.

8.1.2.6.1.2 non_const_value_type

```
template<typename T, int Dimensions = 1>
using cl::sycl::detail::buffer< T, Dimensions >::non_const_value_type = std::remove_const_↩
t<value_type>
```

Definition at line 53 of file buffer.hpp.

8.1.2.6.1.3 value_type

```
template<typename T, int Dimensions = 1>
using cl::sycl::detail::buffer< T, Dimensions >::value_type = T
```

Definition at line 50 of file buffer.hpp.

8.1.2.6.2 Constructor & Destructor Documentation

8.1.2.6.2.1 buffer() [1/5]

```
template<typename T, int Dimensions = 1>
cl::sycl::detail::buffer< T, Dimensions >::buffer (
            const range< Dimensions > & r )  [inline]
```

Create a new read-write buffer of size.

Parameters

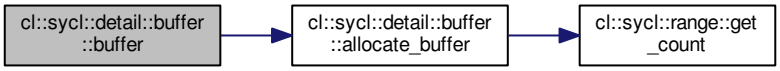
r	

Definition at line 107 of file buffer.hpp.

References cl::sycl::detail::buffer< T, Dimensions >::allocate_buffer().

```
00107 : access { allocate_buffer(r) } {}
```

Here is the call graph for this function:



8.1.2.6.2.2 buffer() [2/5]

```
template<typename T, int Dimensions = 1>
cl::sycl::detail::buffer< T, Dimensions >::buffer (
             T * host_data,
             const range< Dimensions > & r )  [inline]
```

Create a new read-write buffer from.

Parameters

host_data	of size
r	without further allocation

Definition at line 112 of file buffer.hpp.

```
00112                                                  :
00113     access { host_data, r },
00114     data_host { true }
00115   {}
```

8.1.2.6.2.3 buffer() [3/5]

```
template<typename T, int Dimensions = 1>
template<typename Dependent = T, typename = std::enable_if_t<!std::is_const<Dependent>↩
::value>>
cl::sycl::detail::buffer< T, Dimensions >::buffer (
             const T * host_data,
             const range< Dimensions > & r )  [inline]
```

Create a new read-only buffer from.

Parameters

host_data	of size
r	without further allocation

If the buffer is non const, use a copy-on-write mechanism with internal writable memory.

Todo Clarify the semantics in the spec. What happens if the host change the host_data after buffer creation?

Only enable this constructor if the value type is not constant, because if it is constant, the buffer is constant too.

Definition at line 132 of file buffer.hpp.

```
00132                                                          :
00133     /* The buffer is read-only, even if the internal multidimensional
00134        wrapper is not. If a write accessor is requested, there should
00135        be a copy on write. So this pointer should not be written and
00136        this const_cast should be acceptable. */
00137     access { const_cast<T *>(host_data), r },
00138     data_host { true },
00139     /* Set copy_if_modified to true, so that if an accessor with write
00140        access is created, data are copied before to be modified. */
00141     copy_if_modified { true }
00142   {}
```

8.1.2.6.2.4 buffer() [4/5]

```
template<typename T, int Dimensions = 1>
cl::sycl::detail::buffer< T, Dimensions >::buffer (
             shared_ptr_class< T > & host_data,
             const range< Dimensions > & r )  [inline]
```

Create a new buffer with associated memory, using the data in host_data.

The ownership of the host_data is shared between the runtime and the user. In order to enable both the user application and the SYCL runtime to use the same pointer, a cl::sycl::mutex_class is used.

Definition at line 153 of file buffer.hpp.

```
00153                                                                  :
00154     access { host_data.get(), r },
00155     input_shared_pointer { host_data },
00156     data_host { true }
00157   {}
```

8.1.2.6.2.5 buffer() [5/5]

```
template<typename T, int Dimensions = 1>
template<typename Iterator >
cl::sycl::detail::buffer< T, Dimensions >::buffer (
            Iterator start_iterator,
            Iterator end_iterator )  [inline]
```

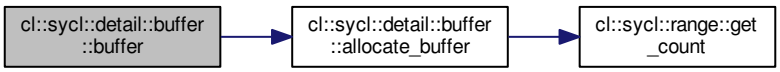
Create a new allocated 1D buffer from the given elements.

Definition at line 162 of file buffer.hpp.

References cl::sycl::detail::buffer< T, Dimensions >::allocate_buffer().

```
00162                                                       :
00163     access { allocate_buffer(std::distance(start_iterator, end_iterator)) }
00164     {
00165       /* Then assign allocation since this is the only multi_array
00166          method with this iterator interface */
00167       access.assign(start_iterator, end_iterator);
00168     }
```

Here is the call graph for this function:



8.1.2.6.2.6 ~buffer()

```
template<typename T, int Dimensions = 1>
cl::sycl::detail::buffer< T, Dimensions >::~buffer ( )  [inline]
```

Create a new sub-buffer without allocation to have separate accessors later.

Todo To implement and deal with reference counting buffer(buffer<T, Dimensions> b, index<Dimensions> base↩
_index, range<Dimensions> sub_range)

Todo Allow CLHPP objects too?

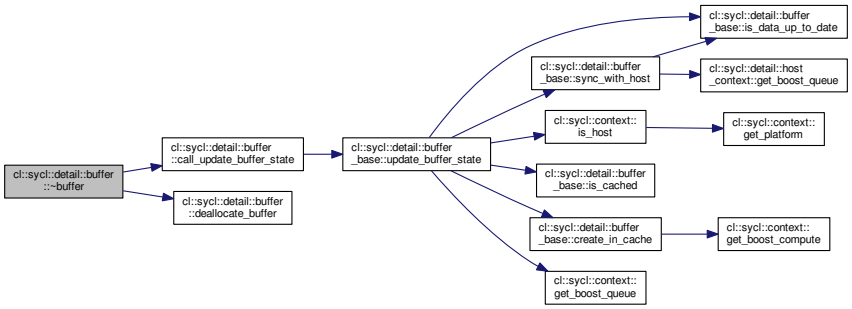
The buffer content may be copied back on destruction to some final location

Definition at line 191 of file buffer.hpp.

References cl::sycl::detail::buffer< T, Dimensions >::call_update_buffer_state(), cl::sycl::detail::buffer< T, Dimensions >::deallocate_buffer(), and cl::sycl::access::read.

```
00191           {
00192 #ifdef TRISYCL_OPENCL
00193     /* We ensure that the host has the most up-to-date version of the data
00194        before the buffer is destroyed. This is necessary because we do not
00195        systematically transfer the data back from a device with
00196        \c copy_back_cl_buffer any more.
00197        \todo Optimize for the case the buffer is not based on host memory
00198     */
00199     cl::sycl::context ctx;
00200     auto size = access.num_elements() * sizeof(value_type);
00201     call_update_buffer_state(ctx, access::mode::read, size,
      access.data());
00202
00203 #endif
00204     if (modified && final_write_back)
00205       (*final_write_back)();
00206     // Allocate explicitly allocated memory if required
00207     deallocate_buffer();
00208   }
```

Here is the call graph for this function:



8.1.2.6.3 Member Function Documentation

8.1.2.6.3.1 allocate_buffer()

```
template<typename T, int Dimensions = 1>
auto cl::sycl::detail::buffer< T, Dimensions >::allocate_buffer (
            const range< Dimensions > & r )  [inline], [private]
```

Allocate uninitialized buffer memory.

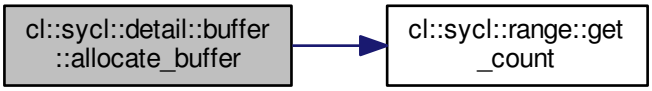
Definition at line 343 of file buffer.hpp.

References cl::sycl::detail::buffer< T, Dimensions >::allocation, and cl::sycl::range< Dimensions >::get_count().

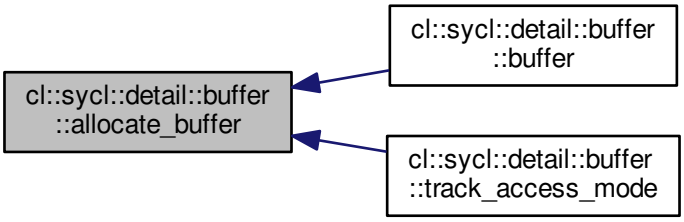
Referenced by cl::sycl::detail::buffer< T, Dimensions >::buffer(), and cl::sycl::detail::buffer< T, Dimensions >::track_access_mode().

```
00343                                                {
00344     auto count = r.get_count();
00345     // Allocate uninitialized memory
00346     allocation = alloc.allocate(count);
00347     return boost::multi_array_ref<value_type, Dimensions> { allocation, r };
00348   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.1.2.6.3.2 call_update_buffer_state() [1/2]

```
template<typename T, int Dimensions = 1>
template<typename BaseType = T, typename DataType >
void cl::sycl::detail::buffer< T, Dimensions >::call_update_buffer_state (
             cl::sycl::context ctx,
             access::mode mode,
             size_t size,
             DataType * data,
             std::enable_if_t<!std::is_const< BaseType > ::value > *  = 0 )  [inline], [private]
```

Function pair to work around the fact that T might be a `const` type.

We call update_buffer_state only if T is not `const`, we have to use `enable_if` otherwise the compiler will try to cast `const void*` to `void*` if we create a buffer with a `const` type

Todo Use `if constexpr` when it is available with C++17

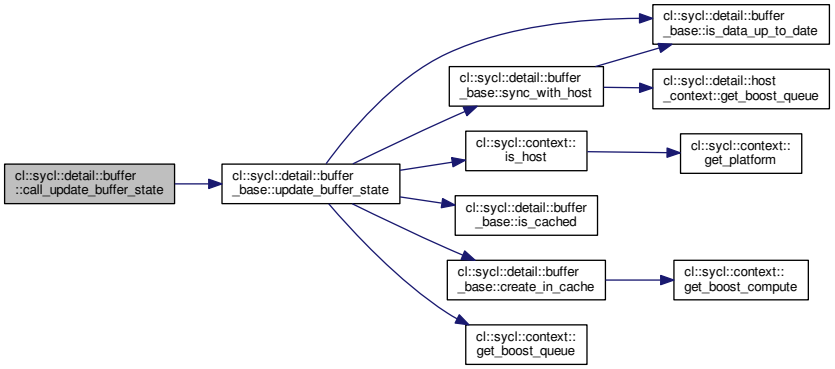
Definition at line 366 of file buffer.hpp.

References cl::sycl::detail::buffer_base::update_buffer_state().

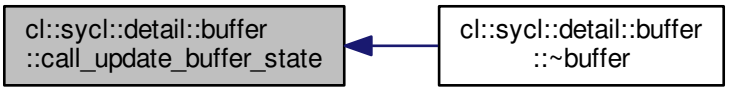
Referenced by cl::sycl::detail::buffer< T, Dimensions >::~buffer().

```
00369                                                {
00370     update_buffer_state(ctx, mode, size, data);
00371   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.1.2.6.3.3 call_update_buffer_state() [2/2]

```
template<typename T, int Dimensions = 1>
template<typename BaseType = T, typename DataType >
void cl::sycl::detail::buffer< T, Dimensions >::call_update_buffer_state (
             cl::sycl::context ctx,
             access::mode mode,
             size_t size,
             DataType * data,
             std::enable_if_t< std::is_const< BaseType > ::value > *  = 0 )  [inline], [private]
```

Version of `call_update_buffer_state` that does nothing.

It is called if the type of the data in the buffer is `const`

Definition at line 378 of file buffer.hpp.

```
00381                                        { }
```

8.1.2.6.3.4 deallocate_buffer()

```
template<typename T, int Dimensions = 1>
void cl::sycl::detail::buffer< T, Dimensions >::deallocate_buffer ( )  [inline], [private]
```

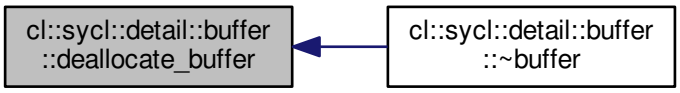
Deallocate buffer memory if required.

Definition at line 352 of file buffer.hpp.

Referenced by cl::sycl::detail::buffer< T, Dimensions >::~buffer().

```
00352                             {
00353     if (allocation)
00354       alloc.deallocate(allocation, access.num_elements());
00355   }
```

Here is the caller graph for this function:



8.1.2.6.3.5 get_count()

```
template<typename T, int Dimensions = 1>
auto cl::sycl::detail::buffer< T, Dimensions >::get_count ( ) const  [inline]
```

Returns the total number of elements in the buffer.

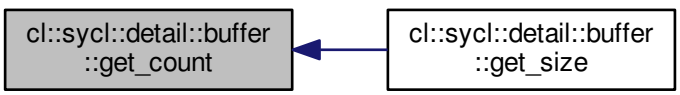
Equal to get_range()[0] * ... * get_range()[Dimensions-1].

Definition at line 280 of file buffer.hpp.

Referenced by cl::sycl::detail::buffer< T, Dimensions >::get_size().

```
00280                           {
00281     return access.num_elements();
00282   }
```

Here is the caller graph for this function:



8.1.2.6.3.6 get_destructor_future()

```
template<typename T, int Dimensions = 1>
boost::optional<std::future<void> > cl::sycl::detail::buffer< T, Dimensions >::get_destructor↩
_future ( )  [inline]
```

Get a `future` to wait from inside the `cl::sycl::buffer` in case there is something to copy back to the host.

Returns

A `future` in the `optional` if there is something to wait for, otherwise an empty `optional`

Todo Make the function private again

Definition at line 393 of file buffer.hpp.

References cl::sycl::detail::buffer_base::notify_buffer_destructor.

```
00393                                                       {
00394     /* If there is only 1 shared_ptr user of the buffer, this is the
00395        caller of this function, the \c buffer_waiter, so there is no
00396        need to get a \ future otherwise there will be a dead-lock if
00397        there is only 1 thread waiting for itself.
00398
00399        Since \c use_count() is applied to a \c shared_ptr just created
00400        for this purpose, it actually increase locally the count by 1,
00401        so check for 1 + 1 use count instead...
00402     */
00403     // If the buffer's destruction triggers a write-back, wait
00404     if ((shared_from_this().use_count() > 2) &&
00405         modified && (final_write_back || data_host)) {
00406       // Create a promise to wait for
00407       notify_buffer_destructor = std::promise<void> {};
00408       // And return the future to wait for it
00409       return notify_buffer_destructor->get_future();
00410     }
00411     return boost::none;
00412   }
```

8.1.2.6.3.7 get_range()

```
template<typename T, int Dimensions = 1>
auto cl::sycl::detail::buffer< T, Dimensions >::get_range ( ) const  [inline]
```

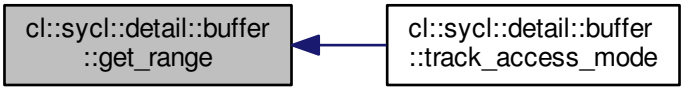
Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.

Definition at line 262 of file buffer.hpp.

Referenced by cl::sycl::detail::buffer< T, Dimensions >::track_access_mode().

```
00262                          {
00263     /* Interpret the shape which is a pointer to the first element as an
00264        array of Dimensions elements so that the range<Dimensions>
00265        constructor is happy with this collection
00266
00267        \todo Add also a constructor in range<> to accept a const
00268        std::size_t *?
00269     */
00270     return range<Dimensions> {
00271       *(const std::size_t (*)[Dimensions])(access.shape())
00272         };
00273   }
```

Here is the caller graph for this function:



8.1.2.6.3.8 get_size()

```
template<typename T, int Dimensions = 1>
auto cl::sycl::detail::buffer< T, Dimensions >::get_size ( ) const  [inline]
```

Returns the size of the buffer storage in bytes.

Todo rename to something else. In http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2015/p0122r0.pdf it is named bytes() for example

Definition at line 291 of file buffer.hpp.

References cl::sycl::detail::buffer< T, Dimensions >::get_count().

```
00291                          {
00292     return get_count()*sizeof(value_type);
00293   }
```

Here is the call graph for this function:

8.1.2.6.3.9 mark_as_written()

```
template<typename T, int Dimensions = 1>
void cl::sycl::detail::buffer< T, Dimensions >::mark_as_written ( )  [inline]
```

Enforce the buffer to be considered as being modified.

Same as creating an accessor with write access.

Definition at line 214 of file buffer.hpp.

References cl::sycl::access::host_buffer.

```
00214                           {
00215     modified = true;
00216   }
```

8.1.2.6.3.10 set_final_data() [1/4]

```
template<typename T, int Dimensions = 1>
void cl::sycl::detail::buffer< T, Dimensions >::set_final_data (
             std::weak_ptr< T > && final_data )  [inline]
```

Set the weak pointer as destination for write-back on buffer destruction.

Definition at line 299 of file buffer.hpp.

```
00299                                                  {
00300     final_write_back = [=] {
00301       if (auto sptr = final_data.lock()) {
00302         std::copy_n(access.data(), access.num_elements(), sptr.get());
00303       }
00304     };
00305   }
```

8.1.2.6.3.11 set_final_data() [2/4]

```
template<typename T, int Dimensions = 1>
void cl::sycl::detail::buffer< T, Dimensions >::set_final_data (
             std::shared_ptr< T > && final_data )  [inline]
```

Provide destination for write-back on buffer destruction as a shared pointer.

Definition at line 311 of file buffer.hpp.

```
00311                                                    {
00312     final_write_back = [=] {
00313       std::copy_n(access.data(), access.num_elements(), final_data.get());
00314     };
00315   }
```

8.1.2.6.3.12 set_final_data() [3/4]

```
template<typename T, int Dimensions = 1>
void cl::sycl::detail::buffer< T, Dimensions >::set_final_data (
             std::nullptr_t  )  [inline]
```

Disable write-back on buffer destruction as an iterator.

Definition at line 320 of file buffer.hpp.

```
00320                                    {
00321     final_write_back = boost::none;
00322   }
```

8.1.2.6.3.13 set_final_data() [4/4]

```
template<typename T, int Dimensions = 1>
template<typename Iterator >
void cl::sycl::detail::buffer< T, Dimensions >::set_final_data (
             Iterator final_data )  [inline]
```

Provide destination for write-back on buffer destruction as an iterator.

Definition at line 329 of file buffer.hpp.

```
00329                                             {
00330   /*   using type_ = typename iterator_value_type<Iterator>::value_type;
00331     static_assert(std::is_same<type_, T>::value, "buffer type mismatch");
00332     static_assert(!(std::is_const<type_>::value),
00333                   "const iterator is not allowed");*/
00334     final_write_back = [=] {
00335       std::copy_n(access.data(), access.num_elements(), final_data);
00336     };
00337   }
```

8.1.2.6.3.14 track_access_mode()

```
template<typename T, int Dimensions = 1>
template<access::mode Mode, access::target Target = access::target::host_buffer>
void cl::sycl::detail::buffer< T, Dimensions >::track_access_mode ( )  [inline]
```

This method is to be called whenever an accessor is created.

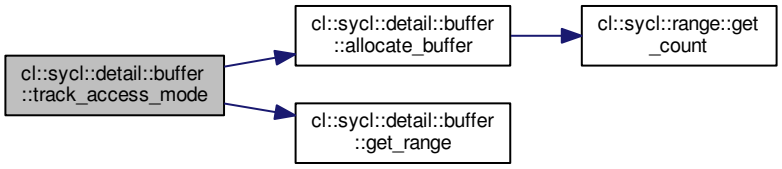
Its current purpose is to track if an accessor with write access is created and acting accordingly.

Definition at line 226 of file buffer.hpp.

References cl::sycl::detail::buffer< T, Dimensions >::access, cl::sycl::detail::buffer< T, Dimensions >::allocate↩
_buffer(), cl::sycl::access::atomic, cl::sycl::access::discard_read_write, cl::sycl::access::discard_write, cl::sycl↩
::detail::buffer< T, Dimensions >::get_range(), cl::sycl::access::read_write, and cl::sycl::access::write.

```
00226                           {
00227     // test if write access is required
00228     if (   Mode == access::mode::write
00229         || Mode == access::mode::read_write
00230         || Mode == access::mode::discard_write
00231         || Mode == access::mode::discard_read_write
00232         || Mode == access::mode::atomic
00233        ) {
00234       modified = true;
00235       if (copy_if_modified) {
00236         // Implement the allocate & copy-on-write optimization
00237         copy_if_modified = false;
00238         data_host = false;
00239         // Since \c allocate_buffer() changes \c access, keep a copy first
00240         auto current_access = access;
00241         /* The range is actually computed from \c access itself, so
00242            save it */
00243         auto current_range = get_range();
00244         allocate_buffer(current_range);
00245         /* Then move everything to the new place
00246
00247            \todo Use std::uninitialized_move instead, when we switch
00248            to full C++17
00249         */
00250         std::copy(current_access.begin(),
00251                   current_access.end(),
00252                   access.begin());
00253       }
00254     }
00255   }
```

Here is the call graph for this function:



8.1.2.6.4 Friends And Related Function Documentation

8.1.2.6.4.1 detail::accessor

```
template<typename T, int Dimensions = 1>
template<typename U , int D, access::mode Mode, access::target Target>
friend class detail::accessor  [friend]
```

Definition at line 63 of file buffer.hpp.

8.1.2.6.5 Member Data Documentation

8.1.2.6.5.1 access

```
template<typename T, int Dimensions = 1>
boost::multi_array_ref<value_type, Dimensions> cl::sycl::detail::buffer< T, Dimensions >↩
::access  [private]
```

This is the multi-dimensional interface to the data that may point to either allocation in the case of storage managed by SYCL itself or to some other memory location in the case of host memory or storage<> abstraction use.

Definition at line 76 of file buffer.hpp.

Referenced by cl::sycl::detail::buffer< T, Dimensions >::track_access_mode().

8.1.2.6.5.2 alloc

```
template<typename T, int Dimensions = 1>
std::allocator<non_const_value_type> cl::sycl::detail::buffer< T, Dimensions >::alloc  [private]
```

The allocator to be used when some memory is needed.

Todo Implement user-provided allocator

Definition at line 69 of file buffer.hpp.

8.1.2.6.5.3 allocation

```
template<typename T, int Dimensions = 1>
non_const_value_type* cl::sycl::detail::buffer< T, Dimensions >::allocation = nullptr  [private]
```

If some allocation is requested on the host for the buffer memory, this is where the memory is attached to.

Note that this is uninitialized memory, as stated in SYCL specification.

Definition at line 84 of file buffer.hpp.

Referenced by cl::sycl::detail::buffer< T, Dimensions >::allocate_buffer().

8.1.2.6.5.4 copy_if_modified

```
template<typename T, int Dimensions = 1>
bool cl::sycl::detail::buffer< T, Dimensions >::copy_if_modified = false  [private]
```

Definition at line 99 of file buffer.hpp.

8.1.2.6.5.5 data_host

```
template<typename T, int Dimensions = 1>
bool cl::sycl::detail::buffer< T, Dimensions >::data_host = false  [private]
```

Definition at line 96 of file buffer.hpp.

8.1.2.6.5.6 final_write_back

```
template<typename T, int Dimensions = 1>
boost::optional<std::function<void(void)> > cl::sycl::detail::buffer< T, Dimensions >↩
::final_write_back  [private]
```

Definition at line 89 of file buffer.hpp.

8.1.2.6.5.7 input_shared_pointer

```
template<typename T, int Dimensions = 1>
shared_ptr_class<T> cl::sycl::detail::buffer< T, Dimensions >::input_shared_pointer  [private]
```

Definition at line 92 of file buffer.hpp.

8.1.2.6.5.8 modified

```
template<typename T, int Dimensions = 1>
bool cl::sycl::detail::buffer< T, Dimensions >::modified = false  [private]
```

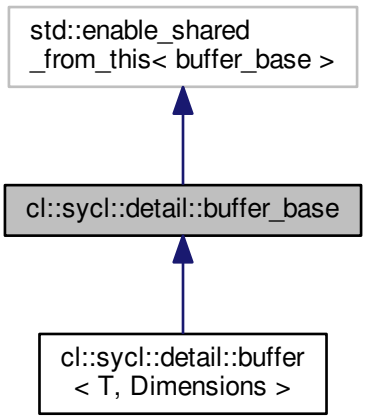
Definition at line 102 of file buffer.hpp.

8.1.2.7 struct cl::sycl::detail::buffer_base

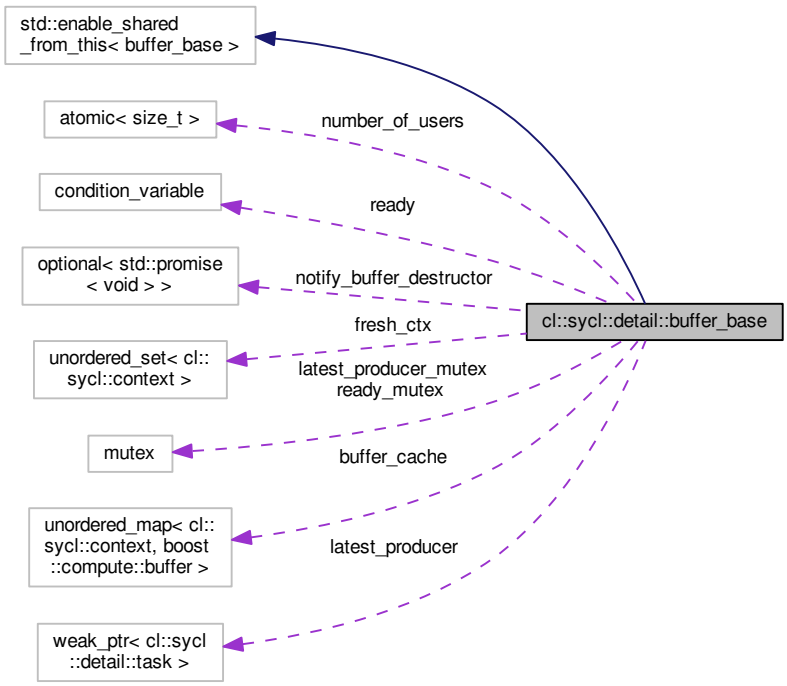
Factorize some template independent buffer aspects in a base class.

Definition at line 49 of file buffer_base.hpp.

Inheritance diagram for cl::sycl::detail::buffer_base:



Collaboration diagram for cl::sycl::detail::buffer_base:



Public Member Functions

- buffer_base ()

  Create a buffer base and marks the host context as the context that holds the most recent version of the data.
- ~buffer_base ()

  The destructor wait for not being used anymore.
- void wait ()

  Wait for this buffer to be ready, which is no longer in use.
- void use ()

  Mark this buffer in use by a task.
- void release ()

  A task has released the buffer.
- std::shared_ptr< detail::task > get_latest_producer ()

  Return the latest producer for the buffer.
- std::shared_ptr< detail::task > set_latest_producer (std::weak_ptr< detail::task > newer_latest_producer)

  Return the latest producer for the buffer and set another future producer.
- std::shared_ptr< detail::task > add_to_task (handler *command_group_handler, bool is_write_mode)

  Add a buffer to the task running the command group.
- bool is_data_up_to_date (const cl::sycl::context &ctx)

  Check if the data of this buffer is up-to-date in a certain context.
- bool is_cached (const cl::sycl::context &ctx)

  Check if the buffer is already cached for a certain context.
- void create_in_cache (const cl::sycl::context &ctx, size_t size, cl_mem_flags flags, void *data)

Create a `boost::compute::buffer` for this `cl::sycl::buffer` in the cache and associate it with a given context.

- void sync_with_host (std::size_t size, void *data)

  Transfer the most up-to-date version of the data to the host if the host version is not already up-to-date.
- void update_buffer_state (const cl::sycl::context &target_ctx, access::mode mode, std::size_t size, void *data)

  When a transfer is requested this function is called, it will update the state of the buffer according to the context in which the accessor is created and the access mode.
- boost::compute::buffer get_cl_buffer (const cl::sycl::context &context)

  Returns the cl_buffer for a given context.

Public Attributes

- std::atomic< size_t > number_of_users
- std::weak_ptr< detail::task > latest_producer

  Track the latest task to produce this buffer.
- std::mutex latest_producer_mutex

  To protect the access to latest_producer.
- std::condition_variable ready

  To signal when this buffer ready.
- std::mutex ready_mutex

  To protect the access to the condition variable.
- boost::optional< std::promise< void > > notify_buffer_destructor

  If the SYCL user buffer destructor is blocking, use this to block until this buffer implementation is destroyed.
- std::unordered_set< cl::sycl::context > fresh_ctx

  To track contexts in which the data is up-to-date.
- std::unordered_map< cl::sycl::context, boost::compute::buffer > buffer_cache

  Buffer-side cache that keeps the `boost::compute::buffer` (and the underlying `cl_buffer`) so that if the buffer already exists inside the same context it is not recreated.

8.1.2.7.1 Constructor & Destructor Documentation

8.1.2.7.1.1 buffer_base()

```
cl::sycl::detail::buffer_base::buffer_base ( )  [inline]
```

Create a buffer base and marks the host context as the context that holds the most recent version of the data.

Todo Use lazy allocation for the context tracking set

Definition at line 86 of file buffer_base.hpp.

```
00086                 : number_of_users { 0 },
00087                   fresh_ctx { cl::sycl::context {} } {}
```

8.1.2.7.1.2 ~buffer_base()

```
cl::sycl::detail::buffer_base::~buffer_base ( )  [inline]
```

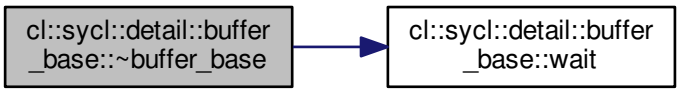
The destructor wait for not being used anymore.

Definition at line 91 of file buffer_base.hpp.

References wait().

```
00091                  {
00092     wait();
00093     // If there is the last SYCL user buffer waiting, notify it
00094     if (notify_buffer_destructor)
00095       notify_buffer_destructor->set_value();
00096   }
```

Here is the call graph for this function:



8.1.2.7.2 Member Function Documentation

8.1.2.7.2.1 add_to_task()

```
std::shared_ptr<detail::task> cl::sycl::detail::buffer_base::add_to_task (
            handler * command_group_handler,
            bool is_write_mode )  [inline]
```

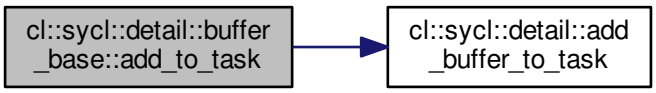
Add a buffer to the task running the command group.

Definition at line 148 of file buffer_base.hpp.

References cl::sycl::detail::add_buffer_to_task().

```
00148                                                                    {
00149     return add_buffer_to_task(command_group_handler,
00150                               shared_from_this(),
00151                               is_write_mode);
00152   }
```

Here is the call graph for this function:



8.1.2.7.2.2 create_in_cache()

```
void cl::sycl::detail::buffer_base::create_in_cache (
            const cl::sycl::context & ctx,
            size_t size,
            cl_mem_flags flags,
            void * data )  [inline]
```

Create a `boost::compute::buffer` for this `cl::sycl::buffer` in the cache and associate it with a given context.

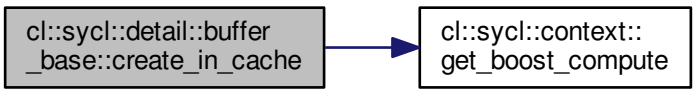
Definition at line 171 of file buffer_base.hpp.

References cl::sycl::context::get_boost_compute().

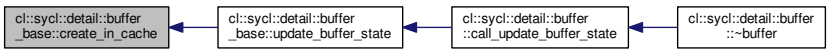
Referenced by update_buffer_state().

```
00172                                                       {
00173     buffer_cache[ctx] = boost::compute::buffer
00174       { ctx.get_boost_compute(),
00175         size,
00176         flags,
00177         data
00178       };
00179   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.1.2.7.2.3 get_cl_buffer()

```
boost::compute::buffer cl::sycl::detail::buffer_base::get_cl_buffer (
            const cl::sycl::context & context )  [inline]
```

Returns the cl_buffer for a given context.

Definition at line 307 of file buffer_base.hpp.

```
00307                                                                {
00308     return buffer_cache[context];
00309   }
```

8.1.2.7.2.4 get_latest_producer()

```
std::shared_ptr<detail::task> cl::sycl::detail::buffer_base::get_latest_producer ( )  [inline]
```

Return the latest producer for the buffer.

Definition at line 125 of file buffer_base.hpp.

```
00125                                                 {
00126     std::lock_guard<std::mutex> lg { latest_producer_mutex };
00127     // Return the valid shared_ptr to the task, if any
00128     return latest_producer.lock();
00129   }
```

8.1.2.7.2.5 is_cached()

```
bool cl::sycl::detail::buffer_base::is_cached (
            const cl::sycl::context & ctx )  [inline]
```

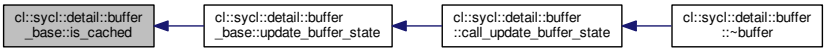
Check if the buffer is already cached for a certain context.

Definition at line 163 of file buffer_base.hpp.

Referenced by update_buffer_state().

```
00163                                          {
00164     return buffer_cache.count(ctx);
00165   }
```

Here is the caller graph for this function:



8.1.2.7.2.6 is_data_up_to_date()

```
bool cl::sycl::detail::buffer_base::is_data_up_to_date (
            const cl::sycl::context & ctx )  [inline]
```

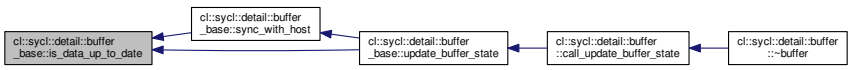
Check if the data of this buffer is up-to-date in a certain context.

Definition at line 157 of file buffer_base.hpp.

Referenced by sync_with_host(), and update_buffer_state().

```
00157                                                 {
00158     return fresh_ctx.count(ctx);
00159   }
```

Here is the caller graph for this function:



8.1.2.7.2.7 release()

```
void cl::sycl::detail::buffer_base::release ( )  [inline]
```

A task has released the buffer.

Definition at line 117 of file buffer_base.hpp.

```
00117                 {
00118     if (--number_of_users == 0)
00119       // Notify the host consumers or the buffer destructor that it is ready
00120       ready.notify_all();
00121   }
```

8.1.2.7.2.8 set_latest_producer()

```
std::shared_ptr<detail::task> cl::sycl::detail::buffer_base::set_latest_producer (
            std::weak_ptr< detail::task > newer_latest_producer )  [inline]
```

Return the latest producer for the buffer and set another future producer.

Definition at line 136 of file buffer_base.hpp.

```
00136                                                                 {
00137     std::lock_guard<std::mutex> lg { latest_producer_mutex };
00138     using std::swap;
00139
00140     swap(newer_latest_producer, latest_producer);
00141     // Return the valid shared_ptr to the previous producing task, if any
00142     return newer_latest_producer.lock();
00143   }
```

8.1.2.7.2.9 sync_with_host()

```
void cl::sycl::detail::buffer_base::sync_with_host (
            std::size_t size,
            void * data )  [inline]
```

Transfer the most up-to-date version of the data to the host if the host version is not already up-to-date.

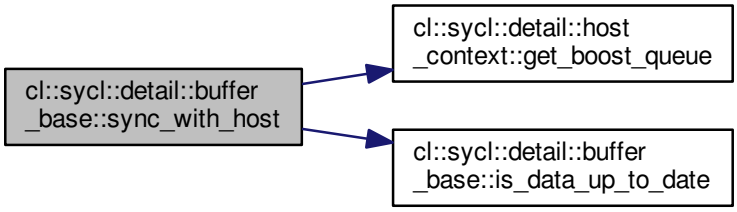
Definition at line 185 of file buffer_base.hpp.

References cl::sycl::detail::host_context::get_boost_queue(), and is_data_up_to_date().

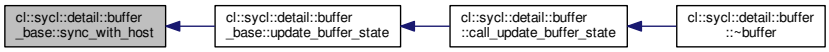
Referenced by update_buffer_state().

```
00185                                                 {
00186     cl::sycl::context host_context;
00187     if (!is_data_up_to_date(host_context) && !fresh_ctx.empty()) {
00188       /* We know that the context(s) in \c fresh_ctx hold the most recent
00189          version of the buffer
00190       */
00191       auto fresh_context = *(fresh_ctx.begin());
00192       auto fresh_q = fresh_context.get_boost_queue();
00193       fresh_q.enqueue_read_buffer(buffer_cache[fresh_context], 0, size, data);
00194       fresh_ctx.insert(host_context);
00195     }
00196   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.1.2.7.2.10 update_buffer_state()

```
void cl::sycl::detail::buffer_base::update_buffer_state (
              const cl::sycl::context & target_ctx,
              access::mode mode,
              std::size_t size,
              void * data )  [inline]
```

When a transfer is requested this function is called, it will update the state of the buffer according to the context in which the accessor is created and the access mode.

Definition at line 203 of file buffer_base.hpp.

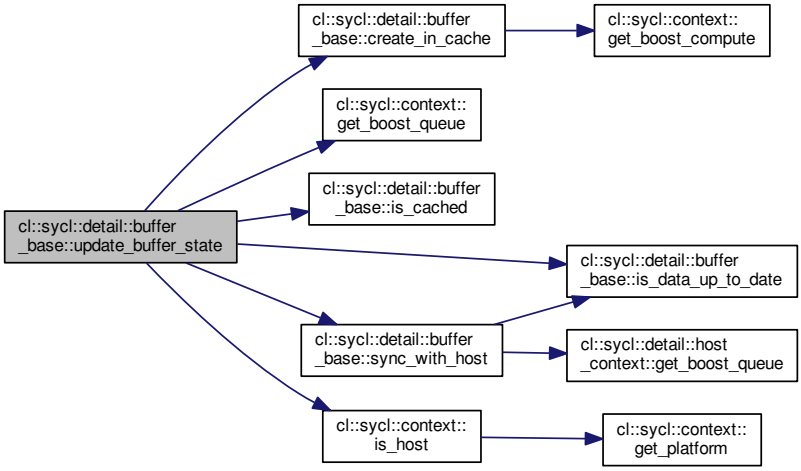
References cl::sycl::access::atomic, create_in_cache(), cl::sycl::access::discard_read_write, cl::sycl::access::discard_write, cl::sycl::context::get_boost_queue(), is_cached(), is_data_up_to_date(), cl::sycl::context::is_host(), cl::sycl::access::read, cl::sycl::access::read_write, sync_with_host(), and cl::sycl::access::write.

Referenced by cl::sycl::detail::buffer< T, Dimensions >::call_update_buffer_state().

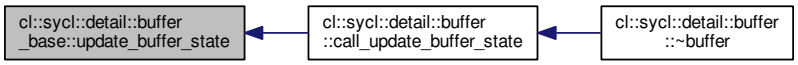
```
00204                                                                    {
00205     /* The \c cl_buffer we put in the cache might get accessed again in the
00206        future, this means that we have to always to create it in read/write
00207        mode to be able to write to it if it is accessed through a
00208        write accessor in the future
00209      */
00210     auto constexpr flag = CL_MEM_READ_WRITE;
00211
00212     /* The buffer is accessed in read mode, we want to transfer the data only if
00213        necessary. We start a transfer if the data on the target context is not
00214        up to date and then update the fresh context set.
00215      */
00216     if (mode == access::mode::read) {
```

```
00217
00218       if (is_data_up_to_date(target_ctx))
00219         // If read mode and the data is up-to-date there is nothing to do
00220         return;
00221
00222       // The data is not up-to-date, we need a transfer
00223       // We also want to be sure that the host holds the most recent data
00224       sync_with_host(size, data);
00225
00226       if (!target_ctx.is_host()) {
00227         // If the target context is a device context
00228         if (!is_cached(target_ctx)) {
00229           /* If not cached, we create the buffer and copy the data
00230              at the same time
00231           */
00232           create_in_cache(target_ctx, size,
00233                           (flag | CL_MEM_COPY_HOST_PTR), data);
00234           fresh_ctx.insert(target_ctx);
00235           return;
00236         }
00237
00238         /* Else we transfer the data to the existing buffer associated
00239            with the target context buffer
00240         */
00241         auto q = target_ctx.get_boost_queue();
00242         q.enqueue_write_buffer(buffer_cache[target_ctx], 0, size, data);
00243         fresh_ctx.insert(target_ctx);
00244       }
00245       return;
00246     }
00247
00248     /* The buffer might be written to, this means that we have to consider
00249        every version of the data obsolete except in the target context
00250
00251        We go through the same process as in read mode but in addition
00252        we empty the fresh context set and just add the target context
00253
00254        If the data is up to date on the target we just have to update
00255        the context set and nothing else
00256     */
00257     if (!is_data_up_to_date(target_ctx)) {
00258
00259       if (   mode == access::mode::read_write
00260           || mode == access::mode::write
00261           || mode == access::mode::atomic) {
00262         // If the data is not up-to-date in the target context
00263         // We want to host to be up-to-date
00264         sync_with_host(size, data);
00265
00266         if (!target_ctx.is_host()) {
00267           // If the target context is a device context
00268           if (!is_cached(target_ctx)) {
00269             create_in_cache(target_ctx, size,
00270                             (flag | CL_MEM_COPY_HOST_PTR), data);
00271           }
00272           else {
00273             // We update the buffer associated with the target context
00274             auto q = target_ctx.get_boost_queue();
00275             q.enqueue_write_buffer(buffer_cache[target_ctx], 0, size, data);
00276           }
00277         }
00278       }
00279
00280       /* When in discard mode we don't need to transfer any data, we just create
00281          the \c cl_buffer if it doesn't exist in the cache
00282       */
00283       if (   mode == access::mode::discard_write
00284           || mode == access::mode::discard_read_write) {
00285         /* We only need to create the buffer if it doesn't exist
00286            but without copying any data because of the discard mode
00287         */
00288         if (!target_ctx.is_host() && !is_cached(target_ctx)) {
00289           // If the context doesn't exist we create it.
00290           /* We don't want to transfer any data so we don't
00291              add \c CL_MEM_COPY_HOST_PTR
00292           */
00293           create_in_cache(target_ctx, size, flag, 0);
00294         }
00295       }
00296     }
00297     /* Here we are sure that we are in some kind of write mode,
00298        we indicate that all contexts except the target context
00299        are not up-to-date anymore
00300     */
00301     fresh_ctx.clear();
00302     fresh_ctx.insert(target_ctx);
00303   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.1.2.7.2.11 use()

```
void cl::sycl::detail::buffer_base::use ( )  [inline]
```

Mark this buffer in use by a task.

Definition at line 110 of file buffer_base.hpp.

References number_of_users.

```
00110             {
00111     // Increment the use count
00112     ++number_of_users;
00113   }
```

8.1.2.7.2.12 wait()

```
void cl::sycl::detail::buffer_base::wait ( )  [inline]
```

Wait for this buffer to be ready, which is no longer in use.

Definition at line 100 of file buffer_base.hpp.

Referenced by ~buffer_base().

```
00100               {
00101     std::unique_lock<std::mutex> ul { ready_mutex };
00102     ready.wait(ul, [&] {
00103         // When there is no producer for this buffer, we are ready to use it
00104         return number_of_users == 0;
00105       });
00106   }
```

Here is the caller graph for this function:

8.1.2.7.3 Member Data Documentation

8.1.2.7.3.1 buffer_cache

```
std::unordered_map<cl::sycl::context, boost::compute::buffer> cl::sycl::detail::buffer_base↩
::buffer_cache
```

Buffer-side cache that keeps the `boost::compute::buffer` (and the underlying `cl_buffer`) so that if the buffer already exists inside the same context it is not recreated.

Definition at line 79 of file buffer_base.hpp.

8.1.2.7.3.2 fresh_ctx

```
std::unordered_set<cl::sycl::context> cl::sycl::detail::buffer_base::fresh_ctx
```

To track contexts in which the data is up-to-date.

Definition at line 72 of file buffer_base.hpp.

8.1.2.7.3.3 latest_producer

```
std::weak_ptr<detail::task> cl::sycl::detail::buffer_base::latest_producer
```

Track the latest task to produce this buffer.

Definition at line 55 of file buffer_base.hpp.

8.1.2.7.3.4 latest_producer_mutex

```
std::mutex cl::sycl::detail::buffer_base::latest_producer_mutex
```

To protect the access to latest_producer.

Definition at line 57 of file buffer_base.hpp.

8.1.2.7.3.5 notify_buffer_destructor

```
boost::optional<std::promise<void> > cl::sycl::detail::buffer_base::notify_buffer_destructor
```

If the SYCL user buffer destructor is blocking, use this to block until this buffer implementation is destroyed.

Use a void promise since there is no value to send, only waiting

Definition at line 69 of file buffer_base.hpp.

Referenced by cl::sycl::detail::buffer< T, Dimensions >::get_destructor_future().

8.1.2.7.3.6 number_of_users

```
std::atomic<size_t> cl::sycl::detail::buffer_base::number_of_users
```

Definition at line 52 of file buffer_base.hpp.

Referenced by use().

8.1.2.7.3.7 ready

```
std::condition_variable cl::sycl::detail::buffer_base::ready
```

To signal when this buffer ready.

Definition at line 60 of file buffer_base.hpp.

8.1.2.7.3.8 ready_mutex

`std::mutex cl::sycl::detail::buffer_base::ready_mutex`

To protect the access to the condition variable.

Definition at line 62 of file buffer_base.hpp.

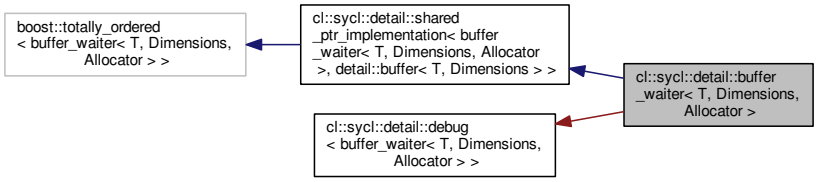
8.1.2.8 class cl::sycl::detail::buffer_waiter

template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>>
class cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >

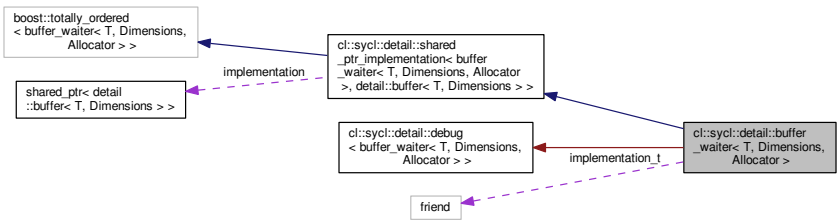
A helper class to wait for the final buffer destruction if the conditions for blocking are met.

Definition at line 33 of file buffer_waiter.hpp.

Inheritance diagram for cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >:



Collaboration diagram for cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >:



Public Member Functions

- buffer_waiter (detail::buffer< T, Dimensions > *b)

  Create a new buffer_waiter on top of a detail::buffer.
- ~buffer_waiter ()

  The buffer_waiter destructor waits for any data to be written back to the host, if any.

Private Types

- using implementation_t = typename buffer_waiter::shared_ptr_implementation

Private Attributes

- friend implementation_t

Additional Inherited Members

8.1.2.8.1 Member Typedef Documentation

8.1.2.8.1.1 implementation_t

```
template<typename T , int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
using cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >::implementation_t = typename
buffer_waiter::shared_ptr_implementation  [private]
```

Definition at line 41 of file buffer_waiter.hpp.

8.1.2.8.2 Constructor & Destructor Documentation

8.1.2.8.2.1 buffer_waiter()

```
template<typename T , int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >::buffer_waiter (
            detail::buffer< T, Dimensions > * b )  [inline]
```

Create a new buffer_waiter on top of a detail::buffer.

Definition at line 52 of file buffer_waiter.hpp.

```
00052 : implementation_t { b } {}
```

8.1.2.8.2.2 ~buffer_waiter()

```
template<typename T , int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >::~buffer_waiter ( )  [inline]
```

The buffer_waiter destructor waits for any data to be written back to the host, if any.

Definition at line 58 of file buffer_waiter.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer_waiter< T, Dimensions, Allocator >, detail::buffer< T, Dimensions > >::implementation, and TRISYCL_DUMP_T.

```
00058                   {
00059     /* Get a future from the implementation if we have to wait for its
00060        destruction */
00061     auto f = implementation->get_destructor_future();
00062     if (f) {
00063       /* No longer carry for the implementation buffer which is free to
00064          live its life up to its destruction */
00065       implementation.reset();
00066       TRISYCL_DUMP_T("~buffer_waiter() is waiting");
00067       // Then wait for its end in some other thread
00068       f->wait();
00069       TRISYCL_DUMP_T("~buffer_waiter() is done");
00070     }
00071   }
```

8.1.2.8.3 Member Data Documentation

8.1.2.8.3.1 implementation_t

```
template<typename T , int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
friend cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >::implementation_t  [private]
```

Definition at line 44 of file buffer_waiter.hpp.

8.1.2.9 class cl::sycl::buffer

template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>>
class cl::sycl::buffer< T, Dimensions, Allocator >

A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on.

Todo There is a naming inconsistency in the specification between buffer and accessor on T versus datatype

Todo Finish allocator implementation

Todo Think about the need of an allocator when constructing a buffer from other buffers

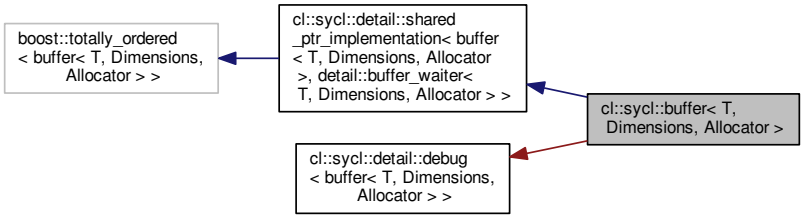
Todo Update the specification to have a non-const allocator for const buffer? Or do we rely on rebind_alloc<T>. But does this work with astate-full allocator?

Todo Add constructors from arrays so that in C++17 the range and type can be infered from the constructor

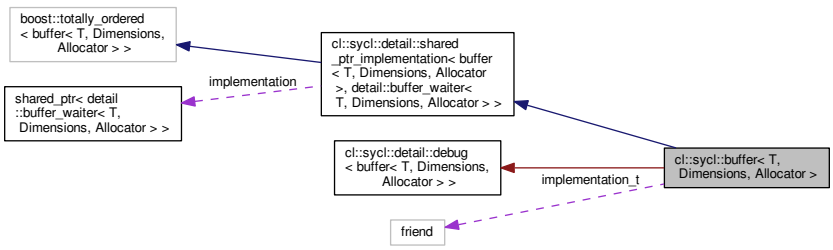
Todo Add constructors from array_ref

Definition at line 29 of file accessor.hpp.

Inheritance diagram for cl::sycl::buffer< T, Dimensions, Allocator >:



Collaboration diagram for cl::sycl::buffer< T, Dimensions, Allocator >:



Public Types

- using value_type = T

  The STL-like types.
- using reference = value_type &
- using const_reference = const value_type &
- using allocator_type = Allocator

Public Member Functions

- buffer ()=default

  Use default constructors so that we can create a new buffer copy from another one, with either a l-value or an r-value (for std::move() for example).
- buffer (const range< Dimensions > &r, Allocator allocator={})

  Create a new buffer of the given size with storage managed by the SYCL runtime.
- template<typename Dependent = T, typename = std::enable_if_t<!std::is_const<Dependent>::value>>
  buffer (const T *host_data, const range< Dimensions > &r, Allocator allocator={})

  Create a new buffer with associated host memory.
- buffer (T *host_data, const range< Dimensions > &r, Allocator allocator={})

  Create a new buffer with associated host memory.
- buffer (shared_ptr_class< T > &host_data, const range< Dimensions > &buffer_range, cl::sycl::mutex_class &m, Allocator allocator={})

  Create a new buffer with associated memory, using the data in host_data.
- buffer (shared_ptr_class< T > host_data, const range< Dimensions > &buffer_range, Allocator allocator={})

  Create a new buffer with associated memory, using the data in host_data.
- template<typename InputIterator , typename ValueType = typename std::iterator_traits<InputIterator>::value_type>
  buffer (InputIterator start_iterator, InputIterator end_iterator, Allocator allocator={})

  Create a new allocated 1D buffer initialized from the given elements ranging from first up to one before last.
- buffer (buffer< T, Dimensions, Allocator > &b, const id< Dimensions > &base_index, const range< Dimensions > &sub_range, Allocator allocator={})

  Create a new sub-buffer without allocation to have separate accessors later.
- buffer (cl_mem mem_object, queue from_queue, event available_event={}, Allocator allocator={})

  Create a buffer from an existing OpenCL memory object associated with a context after waiting for an event signaling the availability of the OpenCL data.
- template<access::mode Mode, access::target Target = access::target::global_buffer>
  accessor< T, Dimensions, Mode, Target > get_access (handler &command_group_handler)

  Get an accessor to the buffer with the required mode.
- void mark_as_written ()

  Force the buffer to behave like if we had created an accessor in write mode.
- template<access::mode Mode, access::target Target = access::target::host_buffer>
  accessor< T, Dimensions, Mode, Target > get_access ()

  Get a host accessor to the buffer with the required mode.
- auto get_range () const

  Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.
- auto get_count () const

  Returns the total number of elements in the buffer.
- size_t get_size () const

  Returns the size of the buffer storage in bytes.
- auto use_count () const

  Returns the number of buffers that are shared/referenced.
- bool constexpr is_read_only () const

  Ask for read-only status of the buffer.
- void set_final_data (shared_ptr_class< T > finalData)

  Set destination of buffer data on destruction.
- void set_final_data (weak_ptr_class< T > finalData)

  Set destination of buffer data on destruction.
- void set_final_data (std::nullptr_t)

  Disable write-back on buffer destruction.
- bool is_cached (cl::sycl::context &ctx)

Check if the buffer is already cached in a certain context.

- bool is_data_up_to_date (cl::sycl::context &ctx)

  Check if the data stored in the buffer is up-to-date in a certain context.

- template<typename Iterator >
  void set_final_data (Iterator &&finalData)

  Set destination of buffer data on destruction.

Private Types

- using implementation_t = typename buffer::shared_ptr_implementation

Private Attributes

- friend implementation_t

Additional Inherited Members

8.1.2.9.1 Member Typedef Documentation

8.1.2.9.1.1 allocator_type

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
using cl::sycl::buffer< T, Dimensions, Allocator >::allocator_type = Allocator
```

Definition at line 75 of file buffer.hpp.

8.1.2.9.1.2 const_reference

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
using cl::sycl::buffer< T, Dimensions, Allocator >::const_reference = const value_type&
```

Definition at line 74 of file buffer.hpp.

8.1.2.9.1.3 implementation_t

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
using cl::sycl::buffer< T, Dimensions, Allocator >::implementation_t = typename buffer::shared↩
_ptr_implementation  [private]
```

Definition at line 80 of file buffer.hpp.

8.1.2.9.1.4 reference

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
using cl::sycl::buffer< T, Dimensions, Allocator >::reference = value_type&
```

Definition at line 73 of file buffer.hpp.

8.1.2.9.1.5 value_type

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
using cl::sycl::buffer< T, Dimensions, Allocator >::value_type = T
```

The STL-like types.

Definition at line 72 of file buffer.hpp.

8.1.2.9.2 Constructor & Destructor Documentation

8.1.2.9.2.1 buffer() [1/9]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
cl::sycl::buffer< T, Dimensions, Allocator >::buffer ( )  [default]
```

Use default constructors so that we can create a new buffer copy from another one, with either a l-value or an r-value (for std::move() for example).

Since we just copy the shared_ptr<> from the shared_ptr_implementation above, this is where/how the sharing magic is happening with reference counting in this case.

8.1.2.9.2.2 buffer() [2/9]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
cl::sycl::buffer< T, Dimensions, Allocator >::buffer (
            const range< Dimensions > & r,
            Allocator allocator = {} )  [inline]
```

Create a new buffer of the given size with storage managed by the SYCL runtime.

The default behavior is to use the default host buffer allocator, in order to allow for host accesses. If the type of the buffer, has the const qualifier, then the default allocator will remove the qualifier to allow host access to the data.

Parameters

in	*r*	defines the size
in	*allocator*	is to be used by the SYCL runtime

Definition at line 113 of file buffer.hpp.

```
00113                                                                {})
00114     : implementation_t { detail::waiter<T, Dimensions, Allocator>(
00115                          new detail::buffer<T, Dimensions> { r }) }
00116       {}
```

8.1.2.9.2.3 buffer() [3/9]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
template<typename Dependent = T, typename = std::enable_if_t<!std::is_const<Dependent>↩
::value>>
cl::sycl::buffer< T, Dimensions, Allocator >::buffer (
             const T * host_data,
             const range< Dimensions > & r,
             Allocator allocator = {} )  [inline]
```

Create a new buffer with associated host memory.

Parameters

in	*host_data*	points to the storage and values used by the buffer
in	*r*	defines the size
in	*allocator*	is to be used by the SYCL runtime, of type `cl::sycl::buffer_allocator<T>` by default

The host address is

```
const T*
```

, so the host memory is read-only.

However, the typename T is not const so the device accesses can be both read and write accesses. Since, the host_data is const, this buffer is only initialized with this memory and there is no write after its destruction, unless there is another final data address given after construction of the buffer.

Only enable this constructor if it is not the same as the one with

```
const T *host_data
```

, which is when `T` is already a constant type.

Todo Actually this is redundant.

Definition at line 146 of file buffer.hpp.

References cl::sycl::detail::waiter().

```
00148                                {})
00149     : implementation_t { detail::waiter(new detail::buffer<T, Dimensions>
00150                          { host_data, r }) }
00151   {}
```

Here is the call graph for this function:

8.1.2.9.2.4 buffer() [4/9]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
cl::sycl::buffer< T, Dimensions, Allocator >::buffer (
             T * host_data,
             const range< Dimensions > & r,
             Allocator allocator = {} )  [inline]
```

Create a new buffer with associated host memory.

Parameters

in,out	*host_data*	points to the storage and values used by the buffer
in	*r*	defines the size
in	*allocator*	is to be used by the SYCL runtime, of type cl::sycl::buffer_allocator<T> by default

The memory is owned by the runtime during the lifetime of the object. Data is copied back to the host unless the user overrides the behavior using the set_final_data method. host_data points to the storage and values used by the buffer and range<Dimensions> defines the size.

Definition at line 170 of file buffer.hpp.

References cl::sycl::detail::waiter().

```
00172                                {})
00173     : implementation_t { detail::waiter(new detail::buffer<T, Dimensions>
00174                          { host_data, r }) }
00175   {}
```

Here is the call graph for this function:

8.1.2.9.2.5 buffer() [5/9]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
cl::sycl::buffer< T, Dimensions, Allocator >::buffer (
            shared_ptr_class< T > & host_data,
            const range< Dimensions > & buffer_range,
            cl::sycl::mutex_class & m,
            Allocator allocator = {} )  [inline]
```

Create a new buffer with associated memory, using the data in host_data.

Parameters

in,out	*host_data*	points to the storage and values used by the buffer
in	*r*	defines the size
in	*allocator*	is to be used by the SYCL runtime, of type cl::sycl::buffer_allocator<T> by default

The ownership of the host_data is shared between the runtime and the user. In order to enable both the user application and the SYCL runtime to use the same pointer, a cl::sycl::mutex_class is used. The mutex m is locked by the runtime whenever the data is in use and unlocked otherwise. Data is synchronized with host_data, when the mutex is unlocked by the runtime.

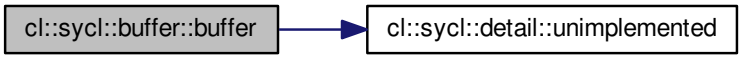
Todo update the specification to replace the pointer by a reference and provide the constructor with and without a mutex

Definition at line 199 of file buffer.hpp.

References cl::sycl::detail::unimplemented().

```
00202                                {}) {
00203     detail::unimplemented();
00204   }
```

Here is the call graph for this function:



8.1.2.9.2.6 buffer() [6/9]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
cl::sycl::buffer< T, Dimensions, Allocator >::buffer (
            shared_ptr_class< T > host_data,
            const range< Dimensions > & buffer_range,
            Allocator allocator = {} )  [inline]
```

Create a new buffer with associated memory, using the data in host_data.

Parameters

in,out	*host_data*	points to the storage and values used by the buffer
in	*r*	defines the size
in,out	*m*	is the mutex used to protect the data access
in	*allocator*	is to be used by the SYCL runtime, of type cl::sycl::buffer_allocator<T> by default

The ownership of the host_data is shared between the runtime and the user. In order to enable both the user application and the SYCL runtime to use the same pointer, a cl::sycl::mutex_class is used.

Todo add this mutex-less constructor to the specification

Definition at line 227 of file buffer.hpp.

References cl::sycl::detail::waiter().

```
00229                                {})
00230     : implementation_t { detail::waiter(new detail::buffer<T, Dimensions>
00231                          { host_data, buffer_range }) }
00232   {}
```

Here is the call graph for this function:

8.1.2.9.2.7 buffer() [7/9]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
template<typename InputIterator , typename ValueType = typename std::iterator_traits<Input↩
Iterator>::value_type>
cl::sycl::buffer< T, Dimensions, Allocator >::buffer (
            InputIterator start_iterator,
            InputIterator end_iterator,
            Allocator allocator = {} )  [inline]
```

Create a new allocated 1D buffer initialized from the given elements ranging from first up to one before last.

The data is copied to an intermediate memory position by the runtime. Data is written back to the same iterator set if the iterator is not a const iterator.

Parameters

in,out	*start_iterator*	points to the first element to copy
in	*end_iterator*	points to just after the last element to copy
in	*allocator*	is to be used by the SYCL runtime, of type cl::sycl::buffer_allocator<T> by default

Todo Implement the copy back at buffer destruction

Todo Generalize this for n-D and provide column-major and row-major initialization

Todo a reason to have this nD is that set_final_data(weak_ptr_class<T> & finalData) is actually doing this linearization anyway

Todo Allow read-only buffer construction too

Todo update the specification to deal with forward iterators instead and rewrite back only when it is non const and output iterator at least

Todo Allow initialization from ranges and collections à la STL

Definition at line 272 of file buffer.hpp.

References cl::sycl::detail::waiter().

```
00274                                {}) :
00275     implementation_t { detail::waiter(new detail::buffer<T, Dimensions>
00276                        { start_iterator, end_iterator }) }
00277   {}
```

Here is the call graph for this function:

8.1.2.9.2.8 buffer() [8/9]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
cl::sycl::buffer< T, Dimensions, Allocator >::buffer (
            buffer< T, Dimensions, Allocator > & b,
            const id< Dimensions > & base_index,
            const range< Dimensions > & sub_range,
            Allocator allocator = {} )  [inline]
```

Create a new sub-buffer without allocation to have separate accessors later.

Parameters

in,out	*b*	is the buffer with the real data
in	*base_index*	specifies the origin of the sub-buffer inside the buffer b
in	*sub_range*	specifies the size of the sub-buffer

Todo To be implemented

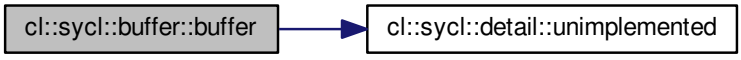
Todo Update the specification to replace index by id

Definition at line 294 of file buffer.hpp.

References cl::sycl::detail::unimplemented().

```
00297                                {}) { detail::unimplemented(); }
```

Here is the call graph for this function:



8.1.2.9.2.9 buffer() [9/9]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
cl::sycl::buffer< T, Dimensions, Allocator >::buffer (
            cl_mem mem_object,
            queue from_queue,
            event available_event = {},
            Allocator allocator = {} )  [inline]
```

Create a buffer from an existing OpenCL memory object associated with a context after waiting for an event signaling the availability of the OpenCL data.

Parameters

in,out	*mem_object*	is the OpenCL memory object to use
in,out	*from_queue*	is the queue associated to the memory object
in	*available_event*	specifies the event to wait for if non null

Note that a buffer created from a cl_mem object will only have one underlying cl_mem for the lifetime of the buffer and use on an incompatible queue constitues an error.

Todo To be implemented

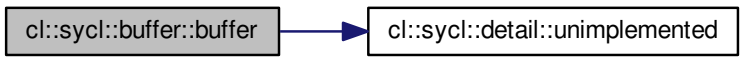
Todo Improve the specification to allow CLHPP objects too

Definition at line 321 of file buffer.hpp.

References cl::sycl::access::global_buffer, and cl::sycl::detail::unimplemented().

```
00323                                 {},
00324           Allocator allocator = {}) { detail::unimplemented();  }
```

Here is the call graph for this function:



8.1.2.9.3 Member Function Documentation

8.1.2.9.3.1 get_access() [1/2]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
template<access::mode Mode, access::target Target = access::target::global_buffer>
accessor<T, Dimensions, Mode, Target> cl::sycl::buffer< T, Dimensions, Allocator >::get_↩
access (
            handler & command_group_handler )  [inline]
```

Get an accessor to the buffer with the required mode.

Parameters

	Mode	is the requested access mode
	Target	is the type of object to be accessed
in	*command_group_handler*	is the command group handler in which the kernel is to be executed

Todo Do we need for an accessor to increase the reference count of a buffer object? It does make more sense for a host-side accessor.

Todo Implement the modes and targets

Definition at line 347 of file buffer.hpp.

References cl::sycl::access::constant_buffer, cl::sycl::access::global_buffer, and cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00347                                                {
00348     static_assert(Target == access::target::global_buffer
00349                   || Target == access::target::constant_buffer,
00350                   "get_access(handler) can only deal with access::global_buffer"
00351                   " or access::constant_buffer (for host_buffer accessor"
00352                   " do not use a command group handler");
00353     implementation->implementation->template track_access_mode<Mode, Target>();
00354     return { *this, command_group_handler };
00355   }
```

8.1.2.9.3.2 get_access() [2/2]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>>
template<access::mode Mode, access::target Target = access::target::host_buffer>
accessor<T, Dimensions, Mode, Target> cl::sycl::buffer< T, Dimensions, Allocator >::get_access ( )  [inline]
```

Get a host accessor to the buffer with the required mode.

Parameters

Mode	is the requested access mode

Todo Implement the modes

Todo More elegant solution

Definition at line 377 of file buffer.hpp.

References cl::sycl::access::host_buffer, and cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00377                {
00378     static_assert(Target == access::target::host_buffer,
00379                   "get_access() without a command group handler is only"
00380                   " for host_buffer accessor");
00381     implementation->implementation->template track_access_mode<Mode, Target>();
00382     return { *this };
00383   }
```

8.1.2.9.3.3 get_count()

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
auto cl::sycl::buffer< T, Dimensions, Allocator >::get_count ( ) const  [inline]
```

Returns the total number of elements in the buffer.

Equal to get_range()[0] * ... * get_range()[Dimensions-1].

Definition at line 407 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00407                         {
00408     return implementation->implementation->get_count();
00409   }
```

8.1.2.9.3.4 get_range()

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
auto cl::sycl::buffer< T, Dimensions, Allocator >::get_range ( ) const  [inline]
```

Return a range object representing the size of the buffer in terms of number of elements in each dimension as passed to the constructor.

Todo rename to the equivalent from array_ref proposals? Such as size() in http://www.open-std.↩ org/jtc1/sc22/wg21/docs/papers/2016/p0009r2.html

Definition at line 394 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00394                         {
00395     /* Interpret the shape which is a pointer to the first element as an
00396        array of Dimensions elements so that the range<Dimensions>
00397        constructor is happy with this collection
00398     */
00399     return implementation->implementation->get_range();
00400   }
```

8.1.2.9.3.5 get_size()

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
size_t cl::sycl::buffer< T, Dimensions, Allocator >::get_size ( ) const  [inline]
```

Returns the size of the buffer storage in bytes.

Equal to get_count()∗sizeof(T).

Todo rename to something else. In http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2015/p0122r0.pdf it is named bytes() for example

Definition at line 420 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00420                           {
00421     return implementation->implementation->get_size();
00422   }
```

8.1.2.9.3.6 is_cached()

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
bool cl::sycl::buffer< T, Dimensions, Allocator >::is_cached (
             cl::sycl::context & ctx )  [inline]
```

Check if the buffer is already cached in a certain context.

Definition at line 501 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00501                                     {
00502     return implementation->implementation->is_cached(ctx);
00503   }
```

8.1.2.9.3.7 is_data_up_to_date()

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
bool cl::sycl::buffer< T, Dimensions, Allocator >::is_data_up_to_date (
             cl::sycl::context & ctx )  [inline]
```

Check if the data stored in the buffer is up-to-date in a certain context.

Definition at line 508 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00508                                              {
00509     return implementation->implementation->is_data_up_to_date(ctx);
00510   }
```

8.1.2.9.3.8 is_read_only()

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
bool constexpr cl::sycl::buffer< T, Dimensions, Allocator >::is_read_only ( ) const  [inline]
```

Ask for read-only status of the buffer.

Todo Add to specification

Definition at line 447 of file buffer.hpp.

```
00447                                     {
00448     return std::is_const<T>::value;
00449   }
```

8.1.2.9.3.9 mark_as_written()

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
void cl::sycl::buffer< T, Dimensions, Allocator >::mark_as_written ( )  [inline]
```

Force the buffer to behave like if we had created an accessor in write mode.

Definition at line 361 of file buffer.hpp.

References cl::sycl::access::host_buffer, and cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00361                           {
00362     return implementation->implementation->mark_as_written();
00363   }
```

8.1.2.9.3.10 set_final_data() [1/4]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
void cl::sycl::buffer< T, Dimensions, Allocator >::set_final_data (
             shared_ptr_class< T > finalData )  [inline]
```

Set destination of buffer data on destruction.

The finalData points to the host memory to which, the outcome of all the buffer processing is going to be copied to.

This is the final pointer, which is going to be accessible after the destruction of the buffer and in the case where this is a valid pointer, the data are going to be copied to this host address.

finalData is different from the original host address, if the buffer was created associated with one. This is mainly to be used when a shared_ptr is given in the constructor and the output data will reside in a different location from the initialization data.

It is defined as a weak_ptr referring to a shared_ptr that is not associated with the cl::sycl::buffer, and so the cl↩ ::sycl::buffer will have no ownership of finalData.

Todo Update the API to take finalData by value instead of by reference. This way we can have an implicit conversion possible at the API call from a shared_ptr<>, avoiding an explicit weak_ptr<> creation

Todo figure out how set_final_data() interact with the other way to write back some data or with some data sharing with the host that can not be undone

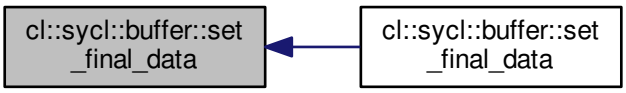
Definition at line 479 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

Referenced by cl::sycl::buffer< T, Dimensions, Allocator >::set_final_data().

```
00479                                                  {
00480     implementation->implementation->set_final_data(std::move(finalData));
00481   }
```

Here is the caller graph for this function:



8.1.2.9.3.11 set_final_data() [2/4]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
void cl::sycl::buffer< T, Dimensions, Allocator >::set_final_data (
             weak_ptr_class< T > finalData )  [inline]
```

Set destination of buffer data on destruction.

Definition at line 486 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00486                                                  {
00487     implementation->implementation->set_final_data(std::move(finalData));
00488   }
```

8.1.2.9.3.12 set_final_data() [3/4]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
void cl::sycl::buffer< T, Dimensions, Allocator >::set_final_data (
             std::nullptr_t  )  [inline]
```

Disable write-back on buffer destruction.

Definition at line 493 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00493                                     {
00494     implementation->implementation->set_final_data(nullptr);
00495   }
```

8.1.2.9.3.13 set_final_data() [4/4]

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
template<typename Iterator >
void cl::sycl::buffer< T, Dimensions, Allocator >::set_final_data (
             Iterator && finalData )  [inline]
```

Set destination of buffer data on destruction.

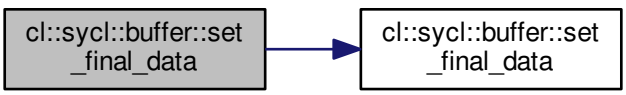
WARNING: the user has to ensure that the object refered to by the iterator will be alive after buffer destruction, otherwise the behaviour is undefined.

Definition at line 520 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation, and cl::sycl::buffer< T, Dimensions, Allocator >::set_final_data().

```
00520                                           {
00521     implementation->implementation->
00522       set_final_data(std::forward<Iterator>(finalData));
00523   }
```

Here is the call graph for this function:



8.1.2.9.3.14 use_count()

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
auto cl::sycl::buffer< T, Dimensions, Allocator >::use_count ( ) const  [inline]
```

Returns the number of buffers that are shared/referenced.

For example

```
cl::sycl::buffer<int> b { 1000 };
// Here b.use_count() should return 1
cl::sycl::buffer<int> c { b };
// Here b.use_count() and b.use_count() should return 2
```

Todo Add to the specification, useful for validation

Definition at line 437 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::implementation.

```
00437                           {
00438     // Rely on the shared_ptr<> use_count()
00439     return implementation.use_count();
00440   }
```

8.1.2.9.4 Member Data Documentation

8.1.2.9.4.1 implementation_t

```
template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
friend cl::sycl::buffer< T, Dimensions, Allocator >::implementation_t  [private]
```

Definition at line 83 of file buffer.hpp.

8.1.2.10 struct cl::sycl::image

template<int Dimensions>
struct cl::sycl::image< Dimensions >

Todo implement image

Definition at line 23 of file image.hpp.

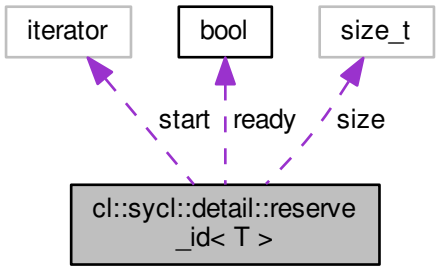
8.1.2.11 struct cl::sycl::detail::reserve_id

template<typename T>
struct cl::sycl::detail::reserve_id< T >

A private description of a reservation station.

Definition at line 40 of file pipe.hpp.

Collaboration diagram for cl::sycl::detail::reserve_id< T >:



Public Member Functions

- reserve_id (typename boost::circular_buffer< T >::iterator start, std::size_t size)
  Track a reservation not committed yet.

Public Attributes

- boost::circular_buffer< T >::iterator start
  Start of the reservation in the pipe storage.
- std::size_t size
  Number of elements in the reservation.
- bool ready = false

8.1.2.11.1 Constructor & Destructor Documentation

8.1.2.11.1.1 reserve_id()

```
template<typename T >
cl::sycl::detail::reserve_id< T >::reserve_id (
            typename boost::circular_buffer< T >::iterator start,
            std::size_t size )  [inline]
```

Track a reservation not committed yet.

Parameters

in	*start*	point to the start of the reservation in the pipe storage
in	*size*	is the number of elements in the reservation

Definition at line 58 of file pipe.hpp.

```
00059                               : start { start }, size { size } {}
```

8.1.2.11.2 Member Data Documentation

8.1.2.11.2.1 ready

```
template<typename T >
bool cl::sycl::detail::reserve_id< T >::ready = false
```

Definition at line 49 of file pipe.hpp.

8.1.2.11.2.2 size

```
template<typename T >
std::size_t cl::sycl::detail::reserve_id< T >::size
```

Number of elements in the reservation.

Definition at line 45 of file pipe.hpp.

Referenced by cl::sycl::detail::pipe< value_type >::empty(), cl::sycl::detail::pipe< value_type >::reserve_read(), cl::sycl::detail::pipe< value_type >::reserve_write(), and cl::sycl::detail::pipe< value_type >::size_with_lock().

8.1.2.11.2.3 start

```
template<typename T >
boost::circular_buffer<T>::iterator cl::sycl::detail::reserve_id< T >::start
```

Start of the reservation in the pipe storage.

Definition at line 42 of file pipe.hpp.

8.1.2.12 class cl::sycl::detail::pipe

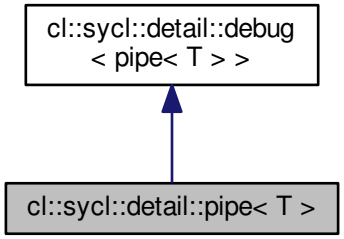
template<typename T>
class cl::sycl::detail::pipe< T >

Implement a pipe object.

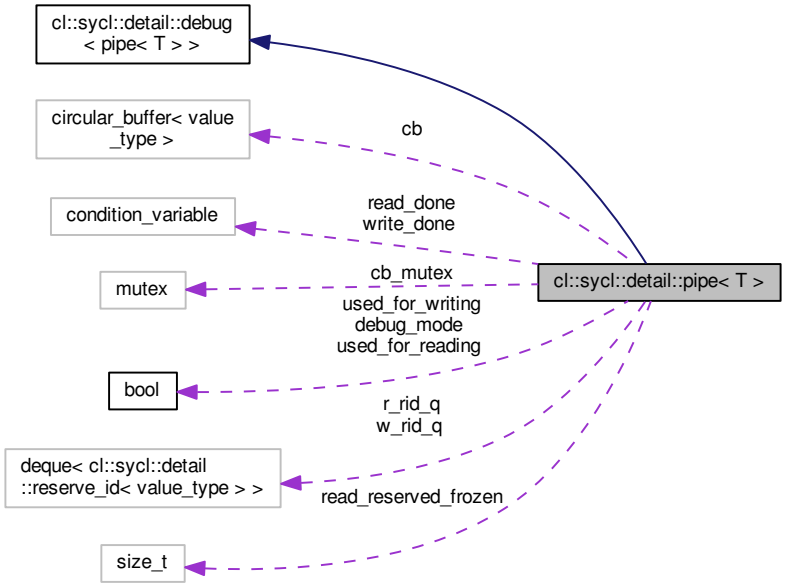
Use some mutable members so that the pipe object can be changed even when the accessors are captured in a lambda.

Definition at line 70 of file pipe.hpp.

Inheritance diagram for cl::sycl::detail::pipe< T >:



Collaboration diagram for cl::sycl::detail::pipe< T >:



Public Types

- using value_type = T
- using implementation_t = boost::circular_buffer< value_type >

  Implement the pipe with a circular buffer.
- using rid_iterator = typename decltype(w_rid_q)::iterator

Public Member Functions

- pipe (std::size_t capacity)

  Create a pipe as a circular buffer of the required capacity.
- std::size_t capacity () const

  Return the maximum number of elements that can fit in the pipe.
- std::size_t size_with_lock () const

  The size() method used outside needs to lock the datastructure.
- bool empty_with_lock () const

  The empty() method used outside needs to lock the datastructure.
- bool full_with_lock () const
- bool write (const T &value, bool blocking=false)

  Try to write a value to the pipe.
- bool read (T &value, bool blocking=false)

  Try to read a value from the pipe.
- std::size_t reserved_for_reading () const

  Compute the amount of elements blocked by read reservations, not yet committed.
- std::size_t reserved_for_writing () const

  Compute the amount of elements blocked by write reservations, not yet committed.
- bool reserve_read (std::size_t s, rid_iterator &rid, bool blocking=false)

  Reserve some part of the pipe for reading.
- bool reserve_write (std::size_t s, rid_iterator &rid, bool blocking=false)

  Reserve some part of the pipe for writing.
- void move_read_reservation_forward ()

  Process the read reservations that are ready to be released in the reservation queue.
- void move_write_reservation_forward ()

  Process the write reservations that are ready to be released in the reservation queue.

Public Attributes

- bool used_for_reading = false

  True when the pipe is currently used for reading.
- bool used_for_writing = false

  True when the pipe is currently used for writing.

Private Member Functions

- std::size_t size () const

  Get the current number of elements in the pipe that can be read.
- bool empty () const

  Test if the pipe is empty.
- bool full () const

  Test if the pipe is full.

Private Attributes

- boost::circular_buffer< value_type > cb

  The circular buffer to store the elements.
- std::mutex cb_mutex

  To protect the access to the circular buffer.
- std::deque< reserve_id< value_type > > w_rid_q

  The queue of pending write reservations.
- std::deque< reserve_id< value_type > > r_rid_q

  The queue of pending read reservations.
- std::size_t read_reserved_frozen

  Track the number of frozen elements related to read reservations.
- std::condition_variable read_done

  To signal that a read has been successful.
- std::condition_variable write_done

  To signal that a write has been successful.
- bool debug_mode = false

  To control the debug mode, disabled by default.

8.1.2.12.1 Member Typedef Documentation

8.1.2.12.1.1 implementation_t

```
template<typename T>
using cl::sycl::detail::pipe< T >::implementation_t = boost::circular_buffer<value_type>
```

Implement the pipe with a circular buffer.

Definition at line 77 of file pipe.hpp.

8.1.2.12.1.2 rid_iterator

```
template<typename T>
using cl::sycl::detail::pipe< T >::rid_iterator = typename decltype(w_rid_q)::iterator
```

Definition at line 95 of file pipe.hpp.

8.1.2.12.1.3 value_type

```
template<typename T>
using cl::sycl::detail::pipe< T >::value_type = T
```

Definition at line 74 of file pipe.hpp.

8.1.2.12.2 Constructor & Destructor Documentation

8.1.2.12.2.1 pipe()

```
template<typename T>
cl::sycl::detail::pipe< T >::pipe (
             std::size_t capacity )  [inline]
```

Create a pipe as a circular buffer of the required capacity.

Definition at line 126 of file pipe.hpp.

```
00126 : cb { capacity }, read_reserved_frozen { 0 } { }
```

8.1.2.12.3 Member Function Documentation

8.1.2.12.3.1 capacity()

```
template<typename T>
std::size_t cl::sycl::detail::pipe< T >::capacity ( ) const  [inline]
```

Return the maximum number of elements that can fit in the pipe.

Definition at line 131 of file pipe.hpp.

```
00131                              {
00132     // No lock required since it is fixed and set at construction time
00133     return cb.capacity();
00134   }
```

8.1.2.12.3.2 empty()

```
template<typename T>
bool cl::sycl::detail::pipe< T >::empty ( ) const  [inline], [private]
```

Test if the pipe is empty.

This is obviously a volatile value which is constrained by restricted relativity.

Note that on some devices it may be costly to implement on the write side (for example on FPGA).

Definition at line 166 of file pipe.hpp.

```
00166                       {
00167     TRISYCL_DUMP_T("empty() cb.size() = " << cb.size()
00168                    << " size() = " << size());
00169     // It is empty when the size is zero, taking into account reservations
00170     return size() ==  0;
00171   }
```

8.1.2.12.3.3 empty_with_lock()

```
template<typename T>
bool cl::sycl::detail::pipe< T >::empty_with_lock ( ) const  [inline]
```

The empty() method used outside needs to lock the datastructure.

Definition at line 197 of file pipe.hpp.

```
00197                                {
00198     std::lock_guard<std::mutex> lg { cb_mutex };
00199     return empty();
00200   }
```

8.1.2.12.3.4 full()

```
template<typename T>
bool cl::sycl::detail::pipe< T >::full ( ) const  [inline], [private]
```

Test if the pipe is full.

This is obviously a volatile value which is constrained by restricted relativity.

Note that on some devices it may be costly to implement on the read side (for example on FPGA).

Definition at line 182 of file pipe.hpp.

```
00182                     {
00183     return cb.full();
00184   }
```

8.1.2.12.3.5 full_with_lock()

```
template<typename T>
bool cl::sycl::detail::pipe< T >::full_with_lock ( ) const  [inline]
```

Definition at line 204 of file pipe.hpp.

```
00204                               {
00205     std::lock_guard<std::mutex> lg { cb_mutex };
00206     return full();
00207   }
```

8.1.2.12.3.6 move_read_reservation_forward()

```
template<typename T>
void cl::sycl::detail::pipe< T >::move_read_reservation_forward ( )  [inline]
```

Process the read reservations that are ready to be released in the reservation queue.

Definition at line 425 of file pipe.hpp.

Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::commit().

```
00425                                       {
00426     // Lock the pipe to avoid nuisance
00427     std::lock_guard<std::mutex> lg { cb_mutex };
00428
00429     for (;;) {
00430       if (r_rid_q.empty())
00431         // No pending reservation, so nothing to do
00432         break;
00433       if (!r_rid_q.front().ready)
00434         /* If the first reservation is not ready to be released, stop
00435            because it is blocking all the following in the queue
00436            anyway */
00437         break;
00438       // Remove the reservation to be released from the queue
00439       r_rid_q.pop_front();
00440       std::size_t n_to_pop;
00441       if (r_rid_q.empty())
00442         // If it was the last one, remove all the reservation
00443         n_to_pop = read_reserved_frozen;
00444       else
00445         // Else remove everything up to the next reservation
00446         n_to_pop =  r_rid_q.front().start - cb.begin();
00447       // No longer take into account these reserved slots
00448       read_reserved_frozen -= n_to_pop;
00449       // Release the elements from the FIFO
00450       while (n_to_pop--)
00451         cb.pop_front();
00452       // Notify the clients waiting for some room to write in the pipe
00453       read_done.notify_all();
00454       /* ...and process the next reservation to see if it is ready to
00455          be released too */
00456     }
00457   }
```

Here is the caller graph for this function:

8.1.2.12.3.7 move_write_reservation_forward()

```
template<typename T>
void cl::sycl::detail::pipe< T >::move_write_reservation_forward ( )  [inline]
```

Process the write reservations that are ready to be released in the reservation queue.

Definition at line 463 of file pipe.hpp.

Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::commit().

```
00463                                       {
00464     // Lock the pipe to avoid nuisance
00465     std::lock_guard<std::mutex> lg { cb_mutex };
00466
00467     for (;;) {
00468       if (w_rid_q.empty())
00469         // No pending reservation, so nothing to do
00470         break;
00471       // Get the first reservation
00472       const auto &rid = w_rid_q.front();
00473       if (!rid.ready)
00474         /* If the reservation is not ready to be released, stop
00475            because it is blocking all the following in the queue
00476            anyway */
00477         break;
00478       // Remove the reservation to be released from the queue
00479       w_rid_q.pop_front();
00480       // Notify the clients waiting to read something from the pipe
00481       write_done.notify_all();
00482       /* ...and process the next reservation to see if it is ready to
00483          be released too */
00484     }
00485   }
```

Here is the caller graph for this function:

8.1.2.12.3.8 read()

```
template<typename T>
bool cl::sycl::detail::pipe< T >::read (
             T & value,
             bool blocking = false )  [inline]
```

Try to read a value from the pipe.

Parameters

out	*value*	is the reference to where to store what is read
in	*blocking*	specify if the call wait for the operation to succeed

Returns

true on success

If there is a pending reservation, read the next element to be read and update the number of reserved elements

Definition at line 258 of file pipe.hpp.

```
00258                                       {
00259     // Lock the pipe to avoid being disturbed
```

```
00260     std::unique_lock<std::mutex> ul { cb_mutex };
00261     TRISYCL_DUMP_T("Read pipe empty = " << empty());
00262
00263     if (blocking)
00264       /* If in blocking mode, wait for the not empty condition, that
00265          may be changed when a write is done */
00266       write_done.wait(ul, [&] { return !empty(); });
00267     else if (empty())
00268       return false;
00269
00270     TRISYCL_DUMP_T("Read pipe front = " << cb.front()
00271                    << " back = " << cb.back()
00272                    << " reserved_for_reading() = " << reserved_for_reading());
00273     if (read_reserved_frozen)
00274       /** If there is a pending reservation, read the next element to
00275           be read and update the number of reserved elements */
00276       value = cb.begin()[read_reserved_frozen++];
00277     else {
00278       /* There is no pending read reservation, so pop the read value
00279          from the pipe */
00280       value = cb.front();
00281       cb.pop_front();
00282     }
00283
00284     TRISYCL_DUMP_T("Read pipe value = " << value);
00285     // Notify the clients waiting for some room to write in the pipe
00286     read_done.notify_all();
00287     return true;
00288   }
```

8.1.2.12.3.9 reserve_read()

```
template<typename T>
bool cl::sycl::detail::pipe< T >::reserve_read (
             std::size_t s,
             rid_iterator & rid,
             bool blocking = false )  [inline]
```

Reserve some part of the pipe for reading.

Parameters

in	*s*	is the number of element to reserve
out	*rid*	is an iterator to a description of the reservation that has been done if successful
in	*blocking*	specify if the call wait for the operation to succeed

Returns

true if the reservation was successful

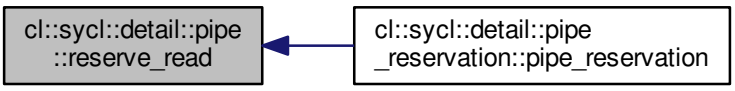
Definition at line 335 of file pipe.hpp.

Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation().

```
00337                                          {
00338     // Lock the pipe to avoid being disturbed
00339     std::unique_lock<std::mutex> ul { cb_mutex };
00340
00341     TRISYCL_DUMP_T("Before read reservation cb.size() = " << cb.size()
00342                    << " size() = " << size());
00343     if (s == 0)
00344       // Empty reservation requested, so nothing to do
00345       return false;
00346
```

```
00347     if (blocking)
00348       /* If in blocking mode, wait for enough elements to read in the
00349          pipe for the reservation. This condition can change when a
00350          write is done */
00351       write_done.wait(ul, [&] { return s <= size(); });
00352     else if (s > size())
00353       // Not enough elements to read in the pipe for the reservation
00354       return false;
00355
00356     // Compute the location of the first element of the reservation
00357     auto first = cb.begin() + read_reserved_frozen;
00358     // Increment the number of frozen elements
00359     read_reserved_frozen += s;
00360     /* Add a description of the reservation at the end of the
00361        reservation queue */
00362     r_rid_q.emplace_back(first, s);
00363     // Return the iterator to the last reservation descriptor
00364     rid = r_rid_q.end() - 1;
00365     TRISYCL_DUMP_T("After reservation cb.size() = " << cb.size()
00366                    << " size() = " << size());
00367     return true;
00368   }
```

Here is the caller graph for this function:



8.1.2.12.3.10 reserve_write()

```
template<typename T>
bool cl::sycl::detail::pipe< T >::reserve_write (
              std::size_t s,
              rid_iterator & rid,
              bool blocking = false )  [inline]
```

Reserve some part of the pipe for writing.

Parameters

in	*s*	is the number of element to reserve
out	*rid*	is an iterator to a description of the reservation that has been done if successful
in	*blocking*	specify if the call wait for the operation to succeed

Returns

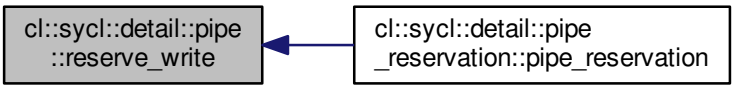
true if the reservation was successful

Definition at line 383 of file pipe.hpp.

Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation().

```
00385                                           {
00386     // Lock the pipe to avoid being disturbed
00387     std::unique_lock<std::mutex> ul { cb_mutex };
00388
00389     TRISYCL_DUMP_T("Before write reservation cb.size() = " << cb.size()
00390                    << " size() = " << size());
00391     if (s == 0)
00392       // Empty reservation requested, so nothing to do
00393       return false;
00394
00395     if (blocking)
00396       /* If in blocking mode, wait for enough room in the pipe, that
00397          may be changed when a read is done. Do not use a difference
00398          here because it is only about unsigned values */
00399       read_done.wait(ul, [&] { return cb.size() + s <= capacity(); });
00400     else if (cb.size() + s > capacity())
00401       // Not enough room in the pipe for the reservation
00402       return false;
00403
00404     /* If there is enough room in the pipe, just create default values
00405          in it to do the reservation */
00406     for (std::size_t i = 0; i != s; ++i)
00407       cb.push_back();
00408     /* Compute the location of the first element a posteriori since it
00409          may not exist a priori if cb was empty before */
00410     auto first = cb.end() - s;
00411     /* Add a description of the reservation at the end of the
00412        reservation queue */
00413     w_rid_q.emplace_back(first, s);
00414     // Return the iterator to the last reservation descriptor
00415     rid = w_rid_q.end() - 1;
00416     TRISYCL_DUMP_T("After reservation cb.size() = " << cb.size()
00417                    << " size() = " << size());
00418     return true;
00419   }
```

Here is the caller graph for this function:



8.1.2.12.3.11 reserved_for_reading()

```
template<typename T>
std::size_t cl::sycl::detail::pipe< T >::reserved_for_reading ( ) const  [inline]
```

Compute the amount of elements blocked by read reservations, not yet committed.

This includes some normal reads to pipes between/after un-committed reservations

This function assumes that the data structure is locked

Definition at line 299 of file pipe.hpp.

```
00299                                       {
00300     return read_reserved_frozen;
00301   }
```

8.1.2.12.3.12 reserved_for_writing()

```
template<typename T>
std::size_t cl::sycl::detail::pipe< T >::reserved_for_writing ( ) const  [inline]
```

Compute the amount of elements blocked by write reservations, not yet committed.

This includes some normal writes to pipes between/after un-committed reservations

This function assumes that the data structure is locked

Definition at line 312 of file pipe.hpp.

```
00312                                          {
00313     if (w_rid_q.empty())
00314       // No on-going reservation
00315       return 0;
00316     else
00317       /* The reserved size is from the first element of the first
00318          on-going reservation up to the end of the pipe content */
00319       return cb.end() - w_rid_q.front().start;
00320   }
```

8.1.2.12.3.13 size()

```
template<typename T>
std::size_t cl::sycl::detail::pipe< T >::size ( ) const  [inline], [private]
```

Get the current number of elements in the pipe that can be read.

This is obviously a volatile value which is constrained by the theory of restricted relativity.

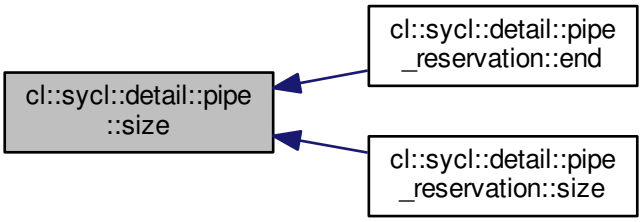
Note that on some devices it may be costly to implement (for example on FPGA).

Definition at line 146 of file pipe.hpp.

Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::end(), and cl::sycl::detail::pipe_reservation< PipeAccessor >::size().

```
00146                           {
00147     TRISYCL_DUMP_T("size() cb.size() = " << cb.size()
00148                    << " cb.end() = " << (void *)&*cb.end()
00149                    << " reserved_for_reading() = " << reserved_for_reading()
00150                    << " reserved_for_writing() = " << reserved_for_writing());
00151     /* The actual number of available elements depends from the
00152        elements blocked by some reservations.
00153        This prevents a consumer to read into reserved area. */
00154     return cb.size() - reserved_for_reading() -
      reserved_for_writing();
00155   }
```

Here is the caller graph for this function:



8.1.2.12.3.14 size_with_lock()

```
template<typename T>
std::size_t cl::sycl::detail::pipe< T >::size_with_lock ( ) const  [inline]
```

The size() method used outside needs to lock the datastructure.

Definition at line 190 of file pipe.hpp.

```
00190                                   {
00191     std::lock_guard<std::mutex> lg { cb_mutex };
00192     return size();
00193   }
```

8.1.2.12.3.15 write()

```
template<typename T>
bool cl::sycl::detail::pipe< T >::write (
            const T & value,
            bool blocking = false )  [inline]
```

Try to write a value to the pipe.

Parameters

in	*value*	is what we want to write
in	*blocking*	specify if the call wait for the operation to succeed

Returns

true on success

Todo provide a && version

Definition at line 221 of file pipe.hpp.

```
00221                                                 {
00222     // Lock the pipe to avoid being disturbed
00223     std::unique_lock<std::mutex> ul { cb_mutex };
00224     TRISYCL_DUMP_T("Write pipe full = " << full()
00225                    << " value = " << value);
00226
00227     if (blocking)
00228       /* If in blocking mode, wait for the not full condition, that
00229          may be changed when a read is done */
00230       read_done.wait(ul, [&] { return !full(); });
00231     else if (full())
00232       return false;
00233
00234     cb.push_back(value);
00235     TRISYCL_DUMP_T("Write pipe front = " << cb.front()
00236                    << " back = " << cb.back()
00237                    << " cb.begin() = " << (void *)&*cb.begin()
00238                    << " cb.size() = " << cb.size()
00239                    << " cb.end() = " << (void *)&*cb.end()
00240                    << " reserved_for_reading() = " << reserved_for_reading()
00241                    << " reserved_for_writing() = " << reserved_for_writing());
00242     // Notify the clients waiting to read something from the pipe
00243     write_done.notify_all();
00244     return true;
00245   }
```

8.1.2.12.4 Member Data Documentation

8.1.2.12.4.1 cb

```
template<typename T>
boost::circular_buffer<value_type> cl::sycl::detail::pipe< T >::cb  [private]
```

The circular buffer to store the elements.

Definition at line 82 of file pipe.hpp.

8.1.2.12.4.2 cb_mutex

```
template<typename T>
std::mutex cl::sycl::detail::pipe< T >::cb_mutex  [mutable], [private]
```

To protect the access to the circular buffer.

In case the object is capture in a lambda per copy, make it mutable.

Definition at line 88 of file pipe.hpp.

8.1.2.12.4.3 debug_mode

```
template<typename T>
bool cl::sycl::detail::pipe< T >::debug_mode = false  [private]
```

To control the debug mode, disabled by default.

Definition at line 115 of file pipe.hpp.

8.1.2.12.4.4 r_rid_q

```
template<typename T>
std::deque<reserve_id<value_type> > cl::sycl::detail::pipe< T >::r_rid_q  [private]
```

The queue of pending read reservations.

Definition at line 103 of file pipe.hpp.

8.1.2.12.4.5 read_done

```
template<typename T>
std::condition_variable cl::sycl::detail::pipe< T >::read_done  [private]
```

To signal that a read has been successful.

Definition at line 109 of file pipe.hpp.

8.1.2.12.4.6 read_reserved_frozen

```
template<typename T>
std::size_t cl::sycl::detail::pipe< T >::read_reserved_frozen  [private]
```

Track the number of frozen elements related to read reservations.

Definition at line 106 of file pipe.hpp.

8.1.2.12.4.7 used_for_reading

```
template<typename T>
bool cl::sycl::detail::pipe< T >::used_for_reading = false
```

True when the pipe is currently used for reading.

Definition at line 120 of file pipe.hpp.

8.1.2.12.4.8 used_for_writing

```
template<typename T>
bool cl::sycl::detail::pipe< T >::used_for_writing = false
```

True when the pipe is currently used for writing.

Definition at line 123 of file pipe.hpp.

8.1.2.12.4.9 w_rid_q

```
template<typename T>
std::deque<reserve_id<value_type> > cl::sycl::detail::pipe< T >::w_rid_q  [private]
```

The queue of pending write reservations.

Definition at line 91 of file pipe.hpp.

8.1.2.12.4.10 write_done

```
template<typename T>
std::condition_variable cl::sycl::detail::pipe< T >::write_done  [private]
```

To signal that a write has been successful.

Definition at line 112 of file pipe.hpp.

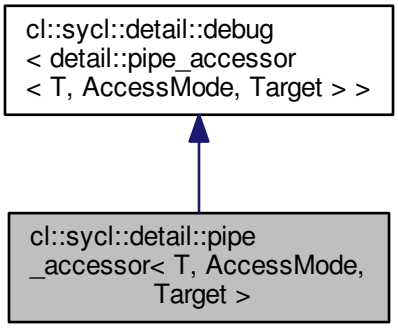
8.1.2.13 class cl::sycl::detail::pipe_accessor

template<typename T, access::mode AccessMode, access::target Target>
class cl::sycl::detail::pipe_accessor< T, AccessMode, Target >

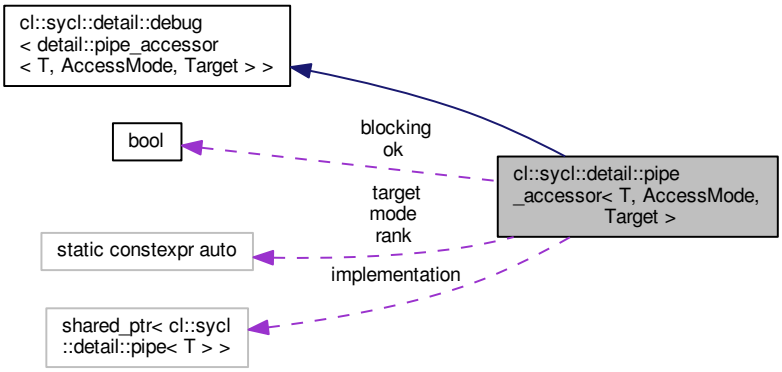
The accessor abstracts the way pipe data are accessed inside a kernel.

Definition at line 44 of file pipe_accessor.hpp.

Inheritance diagram for cl::sycl::detail::pipe_accessor< T, AccessMode, Target >:



Collaboration diagram for cl::sycl::detail::pipe_accessor< T, AccessMode, Target >:



Public Types

- using value_type = T

  The STL-like types.
- using reference = value_type &
- using const_reference = const value_type &

Public Member Functions

- pipe_accessor (const std::shared_ptr< detail::pipe< T >> &p, handler &command_group_handler)

  Construct a pipe accessor from an existing pipe.
- pipe_accessor ()=default
- std::size_t capacity () const

  Return the maximum number of elements that can fit in the pipe.
- std::size_t size () const

  Get the current number of elements in the pipe.
- bool empty () const

  Test if the pipe is empty.
- bool full () const

  Test if the pipe is full.
- operator bool () const

  In an explicit bool context, the accessor gives the success status of the last access.
- const pipe_accessor & write (const value_type &value) const

  Try to write a value to the pipe.
- const pipe_accessor & operator<< (const value_type &value) const

  Some syntactic sugar to use.
- const pipe_accessor & read (value_type &value) const

  Try to read a value from the pipe.
- value_type read () const

  Read a value from a blocking pipe.
- const pipe_accessor & operator>> (value_type &value) const

  Some syntactic sugar to use.
- detail::pipe_reservation< pipe_accessor > reserve (std::size_t size) const
- void set_debug (bool enable) const

  Set debug mode.
- auto & get_pipe_detail ()
- ~pipe_accessor ()

Static Public Attributes

- static constexpr auto rank = 1
- static constexpr auto mode = AccessMode
- static constexpr auto target = Target
- static constexpr bool blocking

Private Attributes

- std::shared_ptr< detail::pipe< T > > implementation

  The real pipe implementation behind the hood.
- bool ok = false

  Store the success status of last pipe operation.

8.1.2.13.1 Member Typedef Documentation

8.1.2.13.1.1 const_reference

```
template<typename T, access::mode AccessMode, access::target Target>
using cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::const_reference = const value_type&
```

Definition at line 59 of file pipe_accessor.hpp.

8.1.2.13.1.2 reference

```
template<typename T, access::mode AccessMode, access::target Target>
using cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::reference = value_type&
```

Definition at line 58 of file pipe_accessor.hpp.

8.1.2.13.1.3 value_type

```
template<typename T, access::mode AccessMode, access::target Target>
using cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::value_type = T
```

The STL-like types.

Definition at line 57 of file pipe_accessor.hpp.

8.1.2.13.2 Constructor & Destructor Documentation

8.1.2.13.2.1 pipe_accessor() [1/2]

```
template<typename T, access::mode AccessMode, access::target Target>
cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::pipe_accessor (
            const std::shared_ptr< detail::pipe< T >> & p,
            handler & command_group_handler ) [inline]
```

Construct a pipe accessor from an existing pipe.

Todo Use pipe_exception instead

Definition at line 83 of file pipe_accessor.hpp.

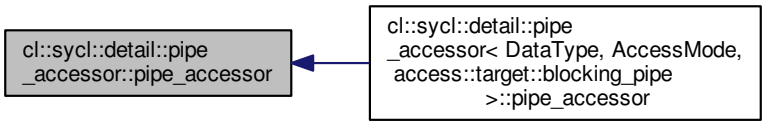
```
00084                                                :
00085     implementation { p } {
00086     //    TRISYCL_DUMP_T("Create a kernel pipe accessor write = "
00087     //                   << is_write_access());
00088     // Verify that the pipe is not already used in the requested mode
00089     if (mode == access::mode::write)
00090       if (implementation->used_for_writing)
00091         /// \todo Use pipe_exception instead
00092         throw std::logic_error { "The pipe is already used for writing." };
00093       else
00094         implementation->used_for_writing = true;
00095     else
00096       if (implementation->used_for_reading)
00097         throw std::logic_error { "The pipe is already used for reading." };
00098       else
00099         implementation->used_for_reading = true;
00100   }
```

8.1.2.13.2.2 pipe_accessor() [2/2]

```
template<typename T, access::mode AccessMode, access::target Target>
cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::pipe_accessor ( )  [default]
```

Referenced by cl::sycl::detail::pipe_accessor< DataType, AccessMode, access::target::blocking_pipe >::pipe_↩ accessor().

Here is the caller graph for this function:



8.1.2.13.2.3 ~pipe_accessor()

```
template<typename T, access::mode AccessMode, access::target Target>
cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::~pipe_accessor ( )  [inline]
```

Free the pipe for a future usage for the current mode

Definition at line 272 of file pipe_accessor.hpp.

```
00272                   {
00273     /// Free the pipe for a future usage for the current mode
00274     if (mode == access::mode::write)
00275       implementation->used_for_writing = false;
00276     else
00277       implementation->used_for_reading = false;
00278   }
```

8.1.2.13.3 Member Function Documentation

8.1.2.13.3.1 capacity()

```
template<typename T, access::mode AccessMode, access::target Target>
std::size_t cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::capacity ( ) const
[inline]
```

Return the maximum number of elements that can fit in the pipe.

Definition at line 107 of file pipe_accessor.hpp.

```
00107                           {
00108     return implementation->capacity();
00109   }
```

8.1.2.13.3.2 empty()

```
template<typename T, access::mode AccessMode, access::target Target>
bool cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::empty ( ) const  [inline]
```

Test if the pipe is empty.

This is obviously a volatile value which is constrained by restricted relativity.

Note that on some devices it may be costly to implement on the write side (for example on FPGA).

Definition at line 132 of file pipe_accessor.hpp.

```
00132                       {
00133     return implementation->empty_with_lock();
00134   }
```

8.1.2.13.3.3 full()

```
template<typename T, access::mode AccessMode, access::target Target>
bool cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::full ( ) const  [inline]
```

Test if the pipe is full.

This is obviously a volatile value which is constrained by restricted relativity.

Note that on some devices it may be costly to implement on the read side (for example on FPGA).

Definition at line 145 of file pipe_accessor.hpp.

```
00145                       {
00146     return implementation->full_with_lock();
00147   }
```

8.1.2.13.3.4 get_pipe_detail()

```
template<typename T, access::mode AccessMode, access::target Target>
auto& cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::get_pipe_detail ( )  [inline]
```

Definition at line 267 of file pipe_accessor.hpp.

```
00267                           {
00268     return implementation;
00269   }
```

8.1.2.13.3.5 operator bool()

```
template<typename T, access::mode AccessMode, access::target Target>
cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::operator bool ( ) const  [inline],
[explicit]
```

In an explicit bool context, the accessor gives the success status of the last access.

It is not impacted by reservation success.

The explicitness is related to avoid

```
 some_pipe <<
some_value
```

to be interpreted as

```
 some_bool <<
some_value
```

when the type of

```
some_value
```

is not the same type as the pipe type.

Returns

true on success of the previous read or write operation

Definition at line 162 of file pipe_accessor.hpp.

```
00162                                  {
00163     return ok;
00164   }
```

8.1.2.13.3.6 operator<<()

```
template<typename T, access::mode AccessMode, access::target Target>
const pipe_accessor& cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::operator<< (
             const value_type & value ) const  [inline]
```

Some syntactic sugar to use.

```
a << v
```

instead of

```
a.write(v)
```

Definition at line 192 of file pipe_accessor.hpp.

```
00192                                                                  {
00193     static_assert(mode == access::mode::write,
00194                   "'<<' operator on a pipe accessor is only possible"
00195                   " with write access mode");
00196     // Return a reference to *this so we can apply a sequence of >>
00197     return write(value);
00198   }
```

8.1.2.13.3.7 operator>>()

```
template<typename T, access::mode AccessMode, access::target Target>
const pipe_accessor& cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::operator>> (
            value_type & value ) const  [inline]
```

Some syntactic sugar to use.

```
a >> v
```

instead of

```
a.read(v)
```

Definition at line 247 of file pipe_accessor.hpp.

```
00247                                                          {
00248     static_assert(mode == access::mode::read,
00249                   "'>>' operator on a pipe accessor is only possible"
00250                   " with read access mode");
00251     // Return a reference to *this so we can apply a sequence of >>
00252     return read(value);
00253   }
```

8.1.2.13.3.8 read() [1/2]

```
template<typename T, access::mode AccessMode, access::target Target>
const pipe_accessor& cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::read (
            value_type & value ) const  [inline]
```

Try to read a value from the pipe.

Parameters

out	*value*	is the reference to where to store what is read

Returns

`this`
so we can apply a sequence of read for example (but do not do this on a non blocking pipe...)

This function is const so it can work when the accessor is passed by copy in the [=] kernel lambda, which is not mutable by default

Definition at line 213 of file pipe_accessor.hpp.

```
00213                                                  {
00214     static_assert(mode == access::mode::read,
00215                   "'.read(value_type &value)' method on a pipe accessor"
00216                   " is only possible with read access mode");
00217     ok = implementation->read(value, blocking);
00218     // Return a reference to *this so we can apply a sequence of read
00219     return *this;
00220   }
```

8.1.2.13.3.9 read() [2/2]

```
template<typename T, access::mode AccessMode, access::target Target>
value_type cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::read ( ) const  [inline]
```

Read a value from a blocking pipe.

Returns

the read value directly, since it cannot fail on blocking pipe

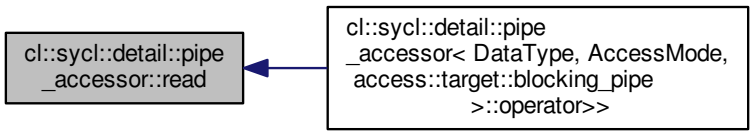
This function is const so it can work when the accessor is passed by copy in the [=] kernel lambda, which is not mutable by default

Definition at line 232 of file pipe_accessor.hpp.

Referenced by cl::sycl::detail::pipe_accessor< DataType, AccessMode, access::target::blocking_pipe >::operator>>().

```
00232                           {
00233     static_assert(mode == access::mode::read,
00234                   "'.read()' method on a pipe accessor is only possible"
00235                   " with read access mode");
00236     static_assert(blocking,
00237                   "'.read()' method on a pipe accessor is only possible"
00238                   " with a blocking pipe");
00239     value_type value;
00240     implementation->read(value, blocking);
00241     return value;
00242   }
```

Here is the caller graph for this function:



8.1.2.13.3.10 reserve()

```
template<typename T, access::mode AccessMode, access::target Target>
detail::pipe_reservation<pipe_accessor> cl::sycl::detail::pipe_accessor< T, AccessMode, Target
>::reserve (
             std::size_t size ) const  [inline]
```

Definition at line 256 of file pipe_accessor.hpp.

```
00256                                                                    {
00257     return { *implementation, size };
00258   }
```

8.1.2.13.3.11 set_debug()

```
template<typename T, access::mode AccessMode, access::target Target>
void cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::set_debug (
            bool enable ) const  [inline]
```

Set debug mode.

Definition at line 262 of file pipe_accessor.hpp.

```
00262                                    {
00263     implementation->debug_mode = enable;
00264   }
```

8.1.2.13.3.12 size()

```
template<typename T, access::mode AccessMode, access::target Target>
std::size_t cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::size ( ) const  [inline]
```

Get the current number of elements in the pipe.

This is obviously a volatile value which is constrained by restricted relativity.

Note that on some devices it may be costly to implement (for example on FPGA).

Definition at line 119 of file pipe_accessor.hpp.

```
00119                           {
00120     return implementation->size_with_lock();
00121   }
```

8.1.2.13.3.13 write()

```
template<typename T, access::mode AccessMode, access::target Target>
const pipe_accessor& cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::write (
            const value_type & value ) const  [inline]
```

Try to write a value to the pipe.

Parameters

in	*value*	is what we want to write

Returns

this so we can apply a sequence of write for example (but do not do this on a non blocking pipe...)

Todo provide a && version

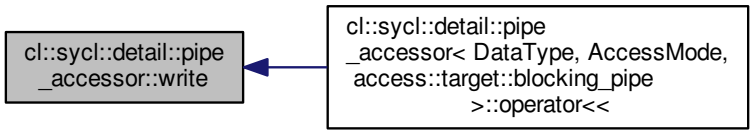
This function is const so it can work when the accessor is passed by copy in the [=] kernel lambda, which is not mutable by default

Definition at line 180 of file pipe_accessor.hpp.

Referenced by cl::sycl::detail::pipe_accessor< DataType, AccessMode, access::target::blocking_pipe >::operator<<().

```
00180                                                                {
00181     static_assert(mode == access::mode::write,
00182                   "'.write(const value_type &value)' method on a pipe accessor"
00183                   " is only possible with write access mode");
00184     ok = implementation->write(value, blocking);
00185     // Return a reference to *this so we can apply a sequence of write
00186     return *this;
00187   }
```

Here is the caller graph for this function:



8.1.2.13.4 Member Data Documentation

8.1.2.13.4.1 blocking

```
template<typename T, access::mode AccessMode, access::target Target>
constexpr bool cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::blocking  [static]
```

Initial value:

```
=
    (target == cl::sycl::access::target::blocking_pipe)
```

Definition at line 53 of file pipe_accessor.hpp.

8.1.2.13.4.2 implementation

```
template<typename T, access::mode AccessMode, access::target Target>
std::shared_ptr<detail::pipe<T> > cl::sycl::detail::pipe_accessor< T, AccessMode, Target >
::implementation  [private]
```

The real pipe implementation behind the hood.

Definition at line 64 of file pipe_accessor.hpp.

Referenced by cl::sycl::detail::pipe_accessor< DataType, AccessMode, access::target::blocking_pipe >::get_pipe_detail(), and cl::sycl::detail::pipe_accessor< DataType, AccessMode, access::target::blocking_pipe >::reserve().

8.1.2.13.4.3 mode

```
template<typename T, access::mode AccessMode, access::target Target>
constexpr auto cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::mode = AccessMode
[static]
```

Definition at line 50 of file pipe_accessor.hpp.

8.1.2.13.4.4 ok

```
template<typename T, access::mode AccessMode, access::target Target>
bool cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::ok = false  [mutable], [private]
```

Store the success status of last pipe operation.

It is not impacted by reservation success.

It does exist even if the pipe accessor is not evaluated in a boolean context for, but a use-def analysis can optimise it out in that case and not use some storage

Use a mutable state here so that it can work with a [=] lambda capture without having to declare the whole lambda as mutable

Definition at line 77 of file pipe_accessor.hpp.

Referenced by cl::sycl::detail::pipe_accessor< DataType, AccessMode, access::target::blocking_pipe >::operator bool().

8.1.2.13.4.5 rank

```
template<typename T, access::mode AccessMode, access::target Target>
constexpr auto cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::rank = 1  [static]
```

Definition at line 49 of file pipe_accessor.hpp.

8.1.2.13.4.6 target

```
template<typename T, access::mode AccessMode, access::target Target>
constexpr auto cl::sycl::detail::pipe_accessor< T, AccessMode, Target >::target = Target
[static]
```

Definition at line 51 of file pipe_accessor.hpp.

8.1.2.14 class cl::sycl::pipe

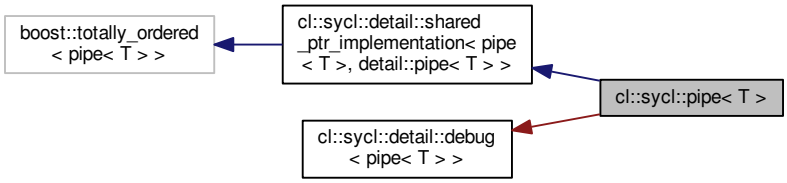
template<typename T>
class cl::sycl::pipe< T >

A SYCL pipe.

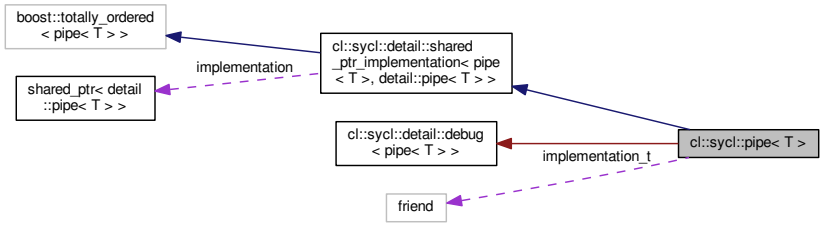
Implement a FIFO-style object that can be used through accessors to send some objects T from the input to the output

Definition at line 31 of file accessor.hpp.

Inheritance diagram for cl::sycl::pipe< T >:



Collaboration diagram for cl::sycl::pipe< T >:



Public Types

- using value_type = T

  The STL-like types.

Public Member Functions

- pipe (std::size_t capacity)

  Construct a pipe able to store up to capacity T objects.
- template<access::mode Mode, access::target Target = access::target::pipe>
  accessor< value_type, 1, Mode, Target > get_access (handler &command_group_handler)

  Get an accessor to the pipe with the required mode.
- std::size_t capacity () const

  Return the maximum number of elements that can fit in the pipe.

Private Types

- using implementation_t = typename pipe::shared_ptr_implementation

Private Attributes

- friend implementation_t

Additional Inherited Members

8.1.2.14.1 Member Typedef Documentation

8.1.2.14.1.1 implementation_t

```
template<typename T>
using cl::sycl::pipe< T >::implementation_t = typename pipe::shared_ptr_implementation  [private]
```

Definition at line 40 of file pipe.hpp.

8.1.2.14.1.2 value_type

```
template<typename T>
using cl::sycl::pipe< T >::value_type = T
```

The STL-like types.

Definition at line 53 of file pipe.hpp.

8.1.2.14.2 Constructor & Destructor Documentation

8.1.2.14.2.1 pipe()

```
template<typename T>
cl::sycl::pipe< T >::pipe (
            std::size_t capacity )  [inline]
```

Construct a pipe able to store up to capacity T objects.

Definition at line 57 of file pipe.hpp.

References cl::sycl::access::pipe.

```
00058     : implementation_t { new detail::pipe<T> { capacity } } { }
```

8.1.2.14.3 Member Function Documentation

8.1.2.14.3.1 capacity()

```
template<typename T>
std::size_t cl::sycl::pipe< T >::capacity ( ) const  [inline]
```

Return the maximum number of elements that can fit in the pipe.

Definition at line 83 of file pipe.hpp.

References cl::sycl::detail::shared_ptr_implementation< pipe< T >, detail::pipe< T > >::implementation.

```
00083                               {
00084     return implementation->capacity();
00085     }
```

8.1.2.14.3.2 get_access()

```
template<typename T>
template<access::mode Mode, access::target Target = access::target::pipe>
accessor<value_type, 1, Mode, Target> cl::sycl::pipe< T >::get_access (
            handler & command_group_handler )  [inline]
```

Get an accessor to the pipe with the required mode.

Parameters

	Mode	is the requested access mode
	Target	is the type of pipe access required
in	*command_group_handler*	is the command group handler in which the kernel is to be executed

Definition at line 73 of file pipe.hpp.

References cl::sycl::access::blocking_pipe, cl::sycl::detail::shared_ptr_implementation< pipe< T >, detail::pipe< T > >::implementation, and cl::sycl::access::pipe.

```
00073                                           {
00074     static_assert(Target == access::target::pipe
00075                   || Target == access::target::blocking_pipe,
00076                   "get_access(handler) with pipes can only deal with "
00077                   "access::pipe or access::blocking_pipe");
00078     return { implementation, command_group_handler };
00079   }
```

8.1.2.14.4 Member Data Documentation

8.1.2.14.4.1 implementation_t

```
template<typename T>
friend cl::sycl::pipe< T >::implementation_t  [private]
```

Definition at line 43 of file pipe.hpp.

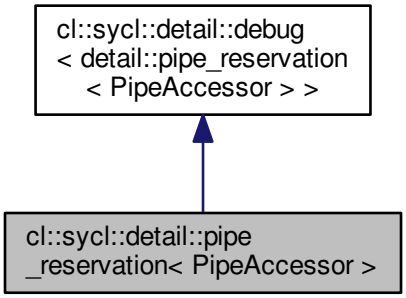
8.1.2.15 class cl::sycl::detail::pipe_reservation

template<typename PipeAccessor>
class cl::sycl::detail::pipe_reservation< PipeAccessor >

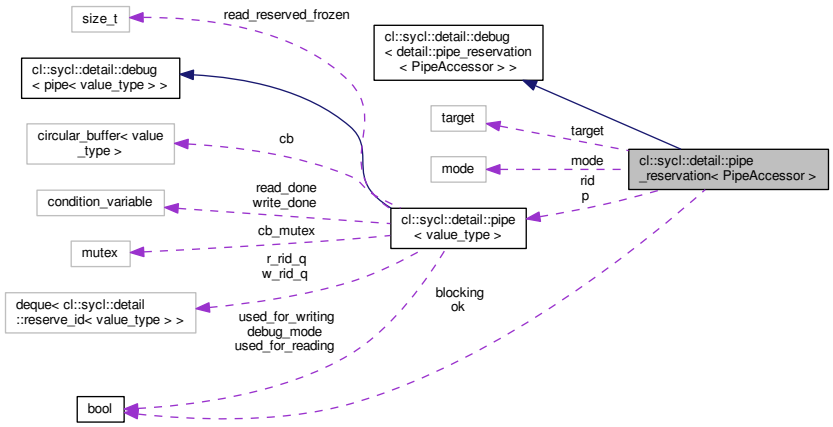
The implementation of the pipe reservation station.

Definition at line 33 of file pipe_reservation.hpp.

Inheritance diagram for cl::sycl::detail::pipe_reservation< PipeAccessor >:



Collaboration diagram for cl::sycl::detail::pipe_reservation< PipeAccessor >:



Public Types

- using iterator = typename detail::pipe< value_type >::implementation_t::iterator
- using const_iterator = typename detail::pipe< value_type >::implementation_t::const_iterator

Public Member Functions

- void assume_validity ()

  Test that the reservation is in a usable state.
- pipe_reservation (detail::pipe< value_type > &p, std::size_t s)

  Create a pipe reservation station that reserves the pipe itself.
- pipe_reservation (const pipe_reservation &)=delete

  No copy constructor with some spurious commit in the destructor of the original object.
- pipe_reservation (pipe_reservation &&orig)

  Only a move constructor is required to move it into the shared_ptr.
- pipe_reservation ()=default

  Keep the default constructors too.
- operator bool ()

  Test if the reservation succeeded and thus if the reservation can be committed.
- iterator begin ()

  Start of the reservation area.
- iterator end ()

  Past the end of the reservation area.
- std::size_t size ()

  Get the number of elements in the reservation station.
- reference operator[ ] (std::size_t index)

  Access to an element of the reservation.
- void commit ()

  Commit the reservation station.
- ~pipe_reservation ()

  An implicit commit is made in the destructor.

Public Attributes

- bool ok = false

  True if the reservation was successful and still uncommitted.
- detail::pipe< value_type >::rid_iterator rid

  Point into the reservation buffer. Only valid if ok is true.
- detail::pipe< value_type > & p

  Keep a reference on the pipe to access to the data and methods.

Static Public Attributes

- static constexpr access::mode mode = accessor_type::mode
- static constexpr access::target target = accessor_type::target

Private Types

- using accessor_type = PipeAccessor
- using value_type = typename accessor_type::value_type
- using reference = typename accessor_type::reference

Static Private Attributes

- static constexpr bool blocking

8.1.2.15.1 Member Typedef Documentation

8.1.2.15.1.1 accessor_type

```
template<typename PipeAccessor>
using cl::sycl::detail::pipe_reservation< PipeAccessor >::accessor_type = PipeAccessor  [private]
```

Definition at line 35 of file pipe_reservation.hpp.

8.1.2.15.1.2 const_iterator

```
template<typename PipeAccessor>
using cl::sycl::detail::pipe_reservation< PipeAccessor >::const_iterator = typename detail↩
::pipe<value_type>::implementation_t::const_iterator
```

Definition at line 46 of file pipe_reservation.hpp.

8.1.2.15.1.3 iterator

```
template<typename PipeAccessor>
using cl::sycl::detail::pipe_reservation< PipeAccessor >::iterator = typename detail::pipe<value↩
_type>::implementation_t::iterator
```

Definition at line 44 of file pipe_reservation.hpp.

8.1.2.15.1.4 reference

```
template<typename PipeAccessor>
using cl::sycl::detail::pipe_reservation< PipeAccessor >::reference = typename accessor_type↩
::reference  [private]
```

Definition at line 39 of file pipe_reservation.hpp.

8.1.2.15.1.5 value_type

```
template<typename PipeAccessor>
using cl::sycl::detail::pipe_reservation< PipeAccessor >::value_type = typename accessor_↩
type::value_type  [private]
```

Definition at line 38 of file pipe_reservation.hpp.

8.1.2.15.2 Constructor & Destructor Documentation

8.1.2.15.2.1 pipe_reservation() [1/4]

```
template<typename PipeAccessor>
cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation (
            detail::pipe< value_type > & p,
            std::size_t s )  [inline]
```

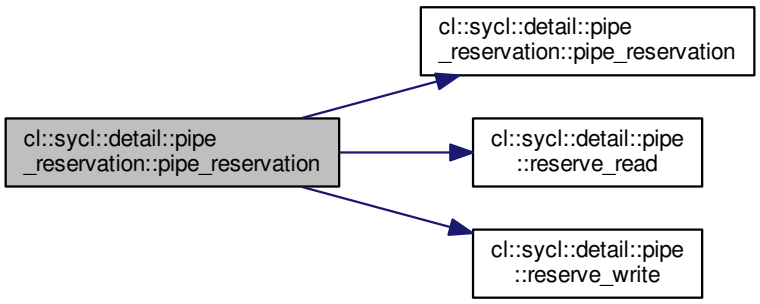
Create a pipe reservation station that reserves the pipe itself.

Definition at line 78 of file pipe_reservation.hpp.

References cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation(), cl::sycl::access::read, cl::sycl::detail::pipe< T >::reserve_read(), cl::sycl::detail::pipe< T >::reserve_write(), and cl::sycl::access::write.

```
00078                                                          : p { p } {
00079     static_assert(mode == access::mode::write
00080                   || mode == access::mode::read,
00081                   "A pipe can only be accesed in read or write mode,"
00082                   " exclusively");
00083
00084     /* Since this test is constexpr and dependent of a template
00085        parameter, it should be equivalent to a specialization of the
00086        method but in a clearer way */
00087     if (mode == access::mode::write)
00088       ok = p.reserve_write(s, rid, blocking);
00089     else
00090       ok = p.reserve_read(s, rid, blocking);
00091   }
```

Here is the call graph for this function:



8.1.2.15.2.2 pipe_reservation() [2/4]

```
template<typename PipeAccessor>
cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation (
            const pipe_reservation< PipeAccessor > &  )  [delete]
```

No copy constructor with some spurious commit in the destructor of the original object.

8.1.2.15.2.3 pipe_reservation() [3/4]

```
template<typename PipeAccessor>
cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation (
            pipe_reservation< PipeAccessor > && orig )  [inline]
```

Only a move constructor is required to move it into the shared_ptr.

Definition at line 101 of file pipe_reservation.hpp.

References cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation().

```
00101                                          :
00102     ok {orig.ok },
00103     rid {orig.rid },
00104     p { orig.p } {
00105       /* Even when an object is moved, the destructor of the old
00106          object is eventually called, so leave the old object in a
00107          destructable state but without any commit capability */
00108       orig.ok = false;
00109     }
```

Here is the call graph for this function:

8.1.2.15.2.4 pipe_reservation() [4/4]

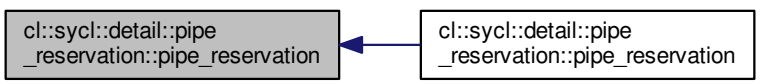
```
template<typename PipeAccessor>
cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation ( )  [default]
```

Keep the default constructors too.

Otherwise there is no move semantics and the copy is made by creating a new reservation and destructing the old one with a spurious commit in the meantime...

Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation().

Here is the caller graph for this function:



8.1.2.15.2.5 ~pipe_reservation()

```
template<typename PipeAccessor>
cl::sycl::detail::pipe_reservation< PipeAccessor >::~pipe_reservation ( )  [inline]
```

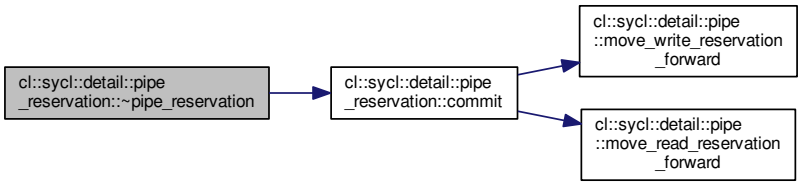
An implicit commit is made in the destructor.

Definition at line 185 of file pipe_reservation.hpp.

References cl::sycl::detail::pipe_reservation< PipeAccessor >::commit().

```
00185                       {
00186     commit();
00187   }
```

Here is the call graph for this function:



8.1.2.15.3 Member Function Documentation

8.1.2.15.3.1 assume_validity()

```
template<typename PipeAccessor>
void cl::sycl::detail::pipe_reservation< PipeAccessor >::assume_validity ( )  [inline]
```

Test that the reservation is in a usable state.

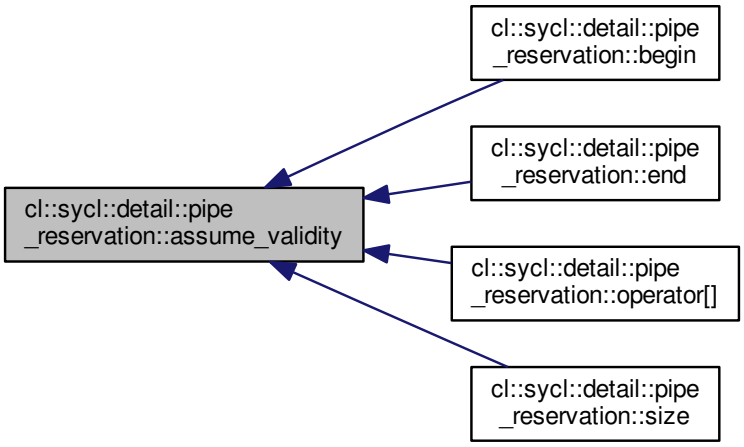
Todo Throw exception instead

Definition at line 71 of file pipe_reservation.hpp.

Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::begin(), cl::sycl::detail::pipe_reservation< PipeAccessor >::end(), cl::sycl::detail::pipe_reservation< PipeAccessor >::operator[](), and cl::sycl::detail::pipe_reservation< PipeAccessor >::size().

```
00071                           {
00072     assert(ok);
00073   }
```

Here is the caller graph for this function:



8.1.2.15.3.2 begin()

```
template<typename PipeAccessor>
iterator cl::sycl::detail::pipe_reservation< PipeAccessor >::begin ( )  [inline]
```

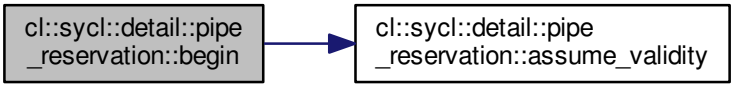
Start of the reservation area.

Definition at line 134 of file pipe_reservation.hpp.

References cl::sycl::detail::pipe_reservation< PipeAccessor >::assume_validity().

```
00134                   {
00135     assume_validity();
00136     return rid->start;
00137   }
```

Here is the call graph for this function:



8.1.2.15.3.3 commit()

```
template<typename PipeAccessor>
void cl::sycl::detail::pipe_reservation< PipeAccessor >::commit ( )  [inline]
```

Commit the reservation station.

Todo Add to the specification that for simplicity a reservation can be commited several times but only the first one is taken into account

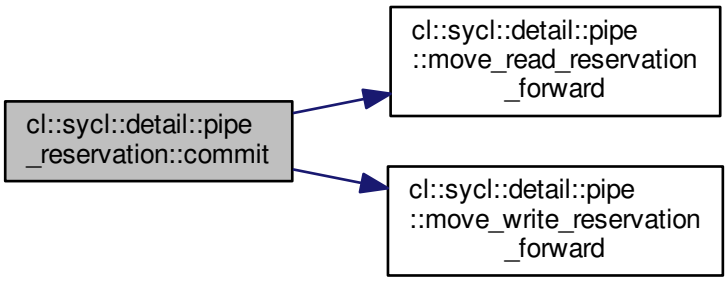
Definition at line 170 of file pipe_reservation.hpp.

References cl::sycl::detail::pipe< T >::move_read_reservation_forward(), cl::sycl::detail::pipe< T >::move_write_reservation_forward(), TRISYCL_DUMP_T, and cl::sycl::access::write.

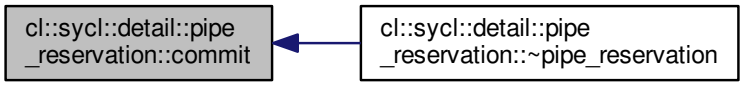
Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::~pipe_reservation().

```
00170                 {
00171     if (ok) {
00172       // If the reservation is in a committable state, commit
00173       TRISYCL_DUMP_T("Commit");
00174       rid->ready = true;
00175       if (mode == access::mode::write)
00176         p.move_write_reservation_forward();
00177       else
00178         p.move_read_reservation_forward();
00179       ok = false;
00180     }
00181   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.1.2.15.3.4 end()

```
template<typename PipeAccessor>
iterator cl::sycl::detail::pipe_reservation< PipeAccessor >::end ( )  [inline]
```

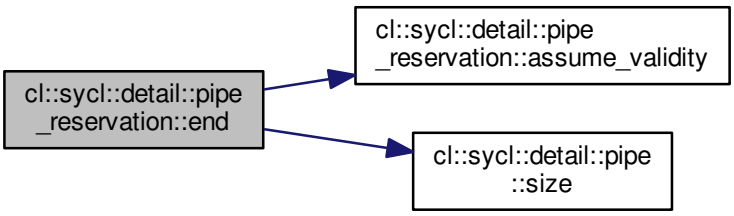
Past the end of the reservation area.

Definition at line 141 of file pipe_reservation.hpp.

References cl::sycl::detail::pipe_reservation< PipeAccessor >::assume_validity(), and cl::sycl::detail::pipe< T >::size().

```
00141                 {
00142     assume_validity();
00143     return rid->start + rid->size;
00144   }
```

Here is the call graph for this function:



8.1.2.15.3.5 operator bool()

```
template<typename PipeAccessor>
cl::sycl::detail::pipe_reservation< PipeAccessor >::operator bool ( )  [inline]
```

Test if the reservation succeeded and thus if the reservation can be committed.

Note that it is up to the user to ensure that all the reservation elements have been initialized correctly in the case of a write for example

Definition at line 128 of file pipe_reservation.hpp.

References cl::sycl::detail::pipe_reservation< PipeAccessor >::ok.

```
00128                 {
00129     return ok;
00130   }
```

8.1.2.15.3.6 operator[]()

```
template<typename PipeAccessor>
reference cl::sycl::detail::pipe_reservation< PipeAccessor >::operator[] (
            std::size_t index )  [inline]
```

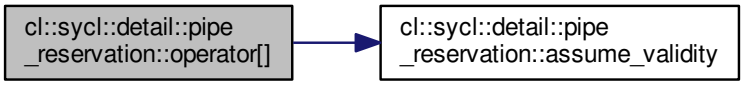
Access to an element of the reservation.

Definition at line 155 of file pipe_reservation.hpp.

References cl::sycl::detail::pipe_reservation< PipeAccessor >::assume_validity(), and TRISYCL_DUMP_T.

```
00155                                       {
00156     assume_validity();
00157     TRISYCL_DUMP_T("[] index = " << index
00158                    << " Reservation write address = " << &(rid->start[index]));
00159
00160     return rid->start[index];
00161   }
```

Here is the call graph for this function:



8.1.2.15.3.7 size()

```
template<typename PipeAccessor>
std::size_t cl::sycl::detail::pipe_reservation< PipeAccessor >::size ( )  [inline]
```

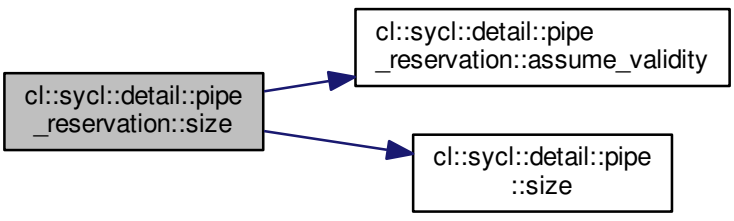
Get the number of elements in the reservation station.

Definition at line 148 of file pipe_reservation.hpp.

References cl::sycl::detail::pipe_reservation< PipeAccessor >::assume_validity(), and cl::sycl::detail::pipe< T >::size().

```
00148                   {
00149     assume_validity();
00150     return rid->size;
00151   }
```

Here is the call graph for this function:



8.1.2.15.4 Member Data Documentation

8.1.2.15.4.1 blocking

```
template<typename PipeAccessor>
constexpr bool cl::sycl::detail::pipe_reservation< PipeAccessor >::blocking  [static], [private]
```

Initial value:

```
=
    (accessor_type::target ==
      cl::sycl::access::target::blocking_pipe)
```

Definition at line 36 of file pipe_reservation.hpp.

8.1.2.15.4.2 mode

```
template<typename PipeAccessor>
constexpr access::mode cl::sycl::detail::pipe_reservation< PipeAccessor >::mode = accessor_↩
type::mode  [static]
```

Definition at line 49 of file pipe_reservation.hpp.

8.1.2.15.4.3 ok

```
template<typename PipeAccessor>
bool cl::sycl::detail::pipe_reservation< PipeAccessor >::ok = false
```

True if the reservation was successful and still uncommitted.

B default a pipe_reservation is not reserved and cannot be committed

Definition at line 55 of file pipe_reservation.hpp.

Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::operator bool().

8.1.2.15.4.4 p

```
template<typename PipeAccessor>
detail::pipe<value_type>& cl::sycl::detail::pipe_reservation< PipeAccessor >::p
```

Keep a reference on the pipe to access to the data and methods.

Note that with inlining and CSE it should not use more register when compiler optimization is in use.

Definition at line 64 of file pipe_reservation.hpp.

8.1.2.15.4.5 rid

```
template<typename PipeAccessor>
detail::pipe<value_type>::rid_iterator cl::sycl::detail::pipe_reservation< PipeAccessor >↩
::rid
```

Point into the reservation buffer. Only valid if ok is true.

Definition at line 58 of file pipe_reservation.hpp.

8.1.2.15.4.6 target

```
template<typename PipeAccessor>
constexpr access::target cl::sycl::detail::pipe_reservation< PipeAccessor >::target = accessor↩
_type::target  [static]
```

Definition at line 50 of file pipe_reservation.hpp.

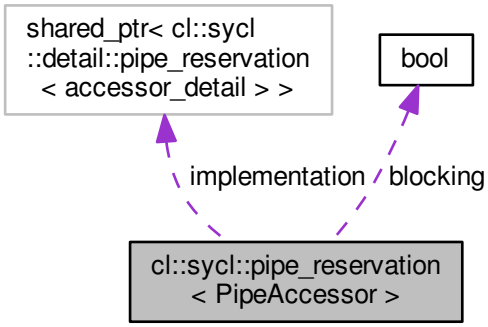
8.1.2.16 struct cl::sycl::pipe_reservation

template<typename PipeAccessor>
struct cl::sycl::pipe_reservation< PipeAccessor >

The pipe reservation station allows to reserve an array-like view inside the pipe for ordered race-free access from various work-items for example.

Definition at line 30 of file pipe_reservation.hpp.

Collaboration diagram for cl::sycl::pipe_reservation< PipeAccessor >:



Public Types

- using accessor_type = PipeAccessor
- using accessor_detail = typename accessor_type::accessor_detail
- using value_type = typename accessor_type::value_type

  The STL-like types.
- using reference = value_type &
- using const_reference = const value_type &
- using pointer = value_type *
- using const_pointer = const value_type *
- using size_type = std::size_t
- using difference_type = ptrdiff_t
- using iterator = typename detail::pipe_reservation< accessor_detail >::iterator
- using const_iterator = typename detail::pipe_reservation< accessor_detail >::const_iterator
- using reverse_iterator = std::reverse_iterator< iterator >
- using const_reverse_iterator = std::reverse_iterator< const_iterator >

Public Member Functions

- pipe_reservation ()=default

  Use default constructors so that we can create a new buffer copy from another one, with either a l-value or a r-value (for std::move() for example).
- pipe_reservation (accessor_type &accessor, std::size_t s)

  Create a pipe_reservation for an accessor and a number of elements.
- pipe_reservation (detail::pipe_reservation< accessor_detail > &&pr)

  Create a pipe_reservation from the implementation detail.
- operator bool () const

  Test if the pipe_reservation has been correctly allocated.
- std::size_t size () const

  Get the number of reserved element(s)
- reference operator[ ] (std::size_t index) const

  Access to a given element of the reservation.
- void commit () const

  Force a commit operation.
- iterator begin () const

  Get an iterator on the first element of the reservation station.
- iterator end () const

  Get an iterator past the end of the reservation station.
- const_iterator cbegin () const

  Build a constant iterator on the first element of the reservation station.
- const_iterator cend () const

  Build a constant iterator past the end of the reservation station.
- reverse_iterator rbegin () const

  Get a reverse iterator on the last element of the reservation station.
- reverse_iterator rend () const

  Get a reverse iterator on the first element past the end of the reservation station.
- const_reverse_iterator crbegin () const

  Get a constant reverse iterator on the last element of the reservation station.
- const_reverse_iterator crend () const

  Get a constant reverse iterator on the first element past the end of the reservation station.

Public Attributes

- std::shared_ptr< detail::pipe_reservation< accessor_detail > > implementation

  Point to the underlying implementation that can be shared in the SYCL model with a handler semantics.

Static Public Attributes

- static constexpr bool blocking

8.1.2.16.1 Member Typedef Documentation

8.1.2.16.1.1 accessor_detail

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::accessor_detail = typename accessor_type↩
::accessor_detail
```

Definition at line 34 of file pipe_reservation.hpp.

8.1.2.16.1.2 accessor_type

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::accessor_type = PipeAccessor
```

Definition at line 31 of file pipe_reservation.hpp.

8.1.2.16.1.3 const_iterator

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::const_iterator = typename detail::pipe_↩
reservation<accessor_detail>::const_iterator
```

Definition at line 46 of file pipe_reservation.hpp.

8.1.2.16.1.4 const_pointer

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::const_pointer = const value_type*
```

Definition at line 40 of file pipe_reservation.hpp.

8.1.2.16.1.5 const_reference

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::const_reference = const value_type&
```

Definition at line 38 of file pipe_reservation.hpp.

8.1.2.16.1.6 const_reverse_iterator

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::const_reverse_iterator = std::reverse_↩
iterator<const_iterator>
```

Definition at line 48 of file pipe_reservation.hpp.

8.1.2.16.1.7 difference_type

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::difference_type = ptrdiff_t
```

Definition at line 42 of file pipe_reservation.hpp.

8.1.2.16.1.8 iterator

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::iterator = typename detail::pipe_reservation<accessor↩
_detail>::iterator
```

Definition at line 44 of file pipe_reservation.hpp.

8.1.2.16.1.9 pointer

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::pointer = value_type*
```

Definition at line 39 of file pipe_reservation.hpp.

8.1.2.16.1.10 reference

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::reference = value_type&
```

Definition at line 37 of file pipe_reservation.hpp.

8.1.2.16.1.11 reverse_iterator

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::reverse_iterator = std::reverse_iterator<iterator>
```

Definition at line 47 of file pipe_reservation.hpp.

8.1.2.16.1.12 size_type

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::size_type = std::size_t
```

Definition at line 41 of file pipe_reservation.hpp.

8.1.2.16.1.13 value_type

```
template<typename PipeAccessor >
using cl::sycl::pipe_reservation< PipeAccessor >::value_type = typename accessor_type::value↩
_type
```

The STL-like types.

Definition at line 36 of file pipe_reservation.hpp.

8.1.2.16.2 Constructor & Destructor Documentation

8.1.2.16.2.1 pipe_reservation() [1/3]

```
template<typename PipeAccessor >
cl::sycl::pipe_reservation< PipeAccessor >::pipe_reservation ( )  [default]
```

Use default constructors so that we can create a new buffer copy from another one, with either a l-value or a r-value (for std::move() for example).

Since we just copy the shared_ptr<> above, this is where/how the sharing magic is happening with reference counting in this case.

8.1.2.16.2.2 pipe_reservation() [2/3]

```
template<typename PipeAccessor >
cl::sycl::pipe_reservation< PipeAccessor >::pipe_reservation (
             accessor_type & accessor,
             std::size_t s )  [inline]
```

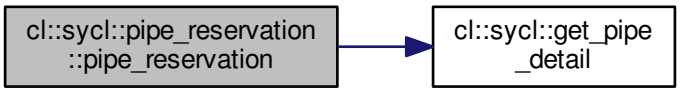
Create a pipe_reservation for an accessor and a number of elements.

Definition at line 66 of file pipe_reservation.hpp.

References cl::sycl::get_pipe_detail().

```
00067     : implementation {
00068     new detail::pipe_reservation<accessor_detail> {
00069       get_pipe_detail(accessor), s }
00070   } {}
```

Here is the call graph for this function:



8.1.2.16.2.3 pipe_reservation() [3/3]

```
template<typename PipeAccessor >
cl::sycl::pipe_reservation< PipeAccessor >::pipe_reservation (
             detail::pipe_reservation< accessor_detail > && pr )  [inline]
```

Create a pipe_reservation from the implementation detail.

This is an internal constructor to allow reserve() on the implementation to lift a full-fledged object through accessor↩
::reserve().

Todo Make it private and add required friends

Definition at line 81 of file pipe_reservation.hpp.

```
00082     : implementation {
00083     new detail::pipe_reservation<accessor_detail> { std::move(pr) } }
00084   {}
```

8.1.2.16.3 Member Function Documentation

8.1.2.16.3.1 begin()

```
template<typename PipeAccessor >
iterator cl::sycl::pipe_reservation< PipeAccessor >::begin ( ) const  [inline]
```

Get an iterator on the first element of the reservation station.

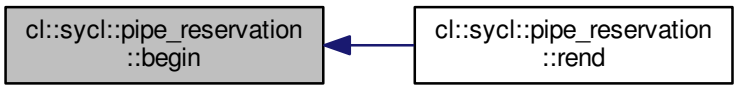
Definition at line 119 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::implementation.

Referenced by cl::sycl::pipe_reservation< PipeAccessor >::rend().

```
00119                           {
00120     return implementation->begin();
00121   }
```

Here is the caller graph for this function:



8.1.2.16.3.2 cbegin()

```
template<typename PipeAccessor >
const_iterator cl::sycl::pipe_reservation< PipeAccessor >::cbegin ( ) const  [inline]
```

Build a constant iterator on the first element of the reservation station.

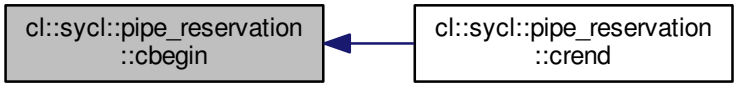
Definition at line 131 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::implementation.

Referenced by cl::sycl::pipe_reservation< PipeAccessor >::crend().

```
00131                                 {
00132     return implementation->begin();
00133   }
```

Here is the caller graph for this function:



8.1.2.16.3.3 cend()

```
template<typename PipeAccessor >
const_iterator cl::sycl::pipe_reservation< PipeAccessor >::cend ( ) const  [inline]
```

Build a constant iterator past the end of the reservation station.

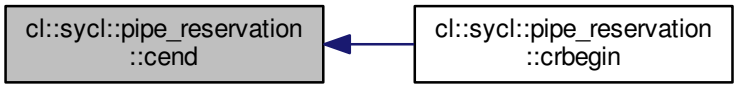
Definition at line 137 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::implementation.

Referenced by cl::sycl::pipe_reservation< PipeAccessor >::crbegin().

```
00137                                {
00138     return implementation->end();
00139   }
```

Here is the caller graph for this function:



8.1.2.16.3.4 commit()

```
template<typename PipeAccessor >
void cl::sycl::pipe_reservation< PipeAccessor >::commit ( ) const  [inline]
```

Force a commit operation.

Normally the commit is implicitly done in the destructor, but sometime it is useful to do it earlier.

Definition at line 113 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::implementation.

```
00113                         {
00114     return implementation->commit();
00115   }
```

8.1.2.16.3.5 crbegin()

```
template<typename PipeAccessor >
const_reverse_iterator cl::sycl::pipe_reservation< PipeAccessor >::crbegin ( ) const  [inline]
```

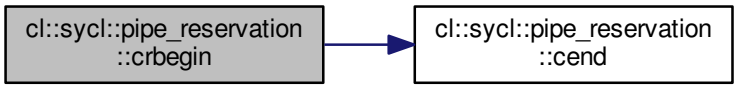
Get a constant reverse iterator on the last element of the reservation station.

Definition at line 157 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::cend().

```
00157                                          {
00158     return std::make_reverse_iterator(cend());
00159   }
```

Here is the call graph for this function:



8.1.2.16.3.6 crend()

```
template<typename PipeAccessor >
const_reverse_iterator cl::sycl::pipe_reservation< PipeAccessor >::crend ( ) const  [inline]
```

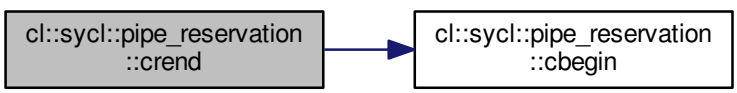
Get a constant reverse iterator on the first element past the end of the reservation station.

Definition at line 164 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::cbegin().

```
00164                                          {
00165     return std::make_reverse_iterator(cbegin());
00166   }
```

Here is the call graph for this function:



8.1.2.16.3.7 end()

```
template<typename PipeAccessor >
iterator cl::sycl::pipe_reservation< PipeAccessor >::end ( ) const  [inline]
```

Get an iterator past the end of the reservation station.

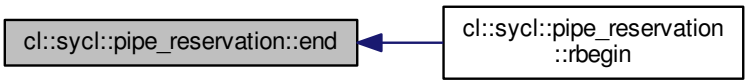
Definition at line 125 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::implementation.

Referenced by cl::sycl::pipe_reservation< PipeAccessor >::rbegin().

```
00125                         {
00126     return implementation->end();
00127   }
```

Here is the caller graph for this function:



8.1.2.16.3.8 operator bool()

```
template<typename PipeAccessor >
cl::sycl::pipe_reservation< PipeAccessor >::operator bool ( ) const  [inline]
```

Test if the pipe_reservation has been correctly allocated.

Returns

true if the pipe_reservation can be used and committed

Definition at line 91 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::implementation.

```
00091                          {
00092     return *implementation;
00093   }
```

8.1.2.16.3.9 operator[]()

```
template<typename PipeAccessor >
reference cl::sycl::pipe_reservation< PipeAccessor >::operator[] (
            std::size_t index ) const  [inline]
```

Access to a given element of the reservation.

Definition at line 103 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::implementation.

```
00103                                           {
00104     return (*implementation)[index];
00105   }
```

8.1.2.16.3.10 rbegin()

```
template<typename PipeAccessor >
reverse_iterator cl::sycl::pipe_reservation< PipeAccessor >::rbegin ( ) const  [inline]
```

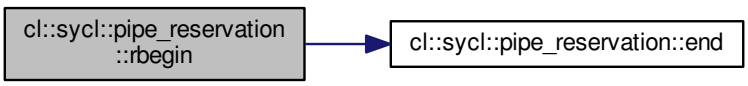
Get a reverse iterator on the last element of the reservation station.

Definition at line 143 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::end().

```
00143                                   {
00144     return std::make_reverse_iterator(end());
00145   }
```

Here is the call graph for this function:



8.1.2.16.3.11 rend()

```
template<typename PipeAccessor >
reverse_iterator cl::sycl::pipe_reservation< PipeAccessor >::rend ( ) const  [inline]
```

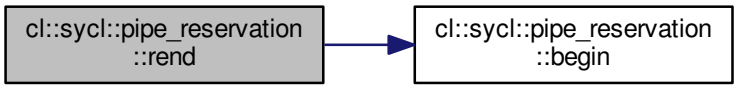
Get a reverse iterator on the first element past the end of the reservation station.

Definition at line 150 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::begin().

```
00150                                {
00151     return std::make_reverse_iterator(begin());
00152   }
```

Here is the call graph for this function:



8.1.2.16.3.12 size()

```
template<typename PipeAccessor >
std::size_t cl::sycl::pipe_reservation< PipeAccessor >::size ( ) const  [inline]
```

Get the number of reserved element(s)

Definition at line 97 of file pipe_reservation.hpp.

References cl::sycl::pipe_reservation< PipeAccessor >::implementation.

```
00097                           {
00098     return implementation->size();
00099   }
```

8.1.2.16.4 Member Data Documentation

8.1.2.16.4.1 blocking

```
template<typename PipeAccessor >
constexpr bool cl::sycl::pipe_reservation< PipeAccessor >::blocking  [static]
```

Initial value:

```
=
    (accessor_type::target ==
      cl::sycl::access::target::blocking_pipe)
```

Definition at line 32 of file pipe_reservation.hpp.

8.1.2.16.4.2 implementation

```
template<typename PipeAccessor >
std::shared_ptr<detail::pipe_reservation<accessor_detail> > cl::sycl::pipe_reservation<
PipeAccessor >::implementation
```

Point to the underlying implementation that can be shared in the SYCL model with a handler semantics.

Definition at line 53 of file pipe_reservation.hpp.

Referenced by cl::sycl::pipe_reservation< PipeAccessor >::begin(), cl::sycl::pipe_reservation< PipeAccessor >::cbegin(), cl::sycl::pipe_reservation< PipeAccessor >::cend(), cl::sycl::pipe_reservation< PipeAccessor >::commit(), cl::sycl::pipe_reservation< PipeAccessor >::end(), cl::sycl::pipe_reservation< PipeAccessor >::operator bool(), cl::sycl::pipe_reservation< PipeAccessor >::operator[](), and cl::sycl::pipe_reservation< PipeAccessor >::size().

8.1.2.17 class cl::sycl::static_pipe

template<typename T, std::size_t Capacity>
class cl::sycl::static_pipe< T, Capacity >

A SYCL static-scoped pipe equivalent to an OpenCL program-scoped pipe.

Implement a FIFO-style object that can be used through accessors to send some objects T from the input to the output.

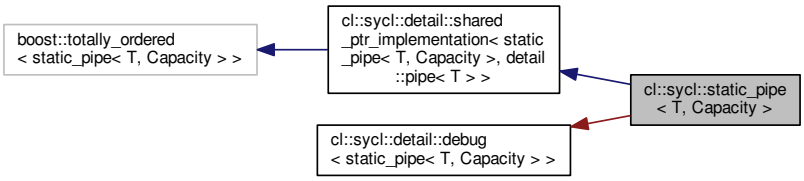
Compared to a normal pipe, a static_pipe takes a constexpr size and is expected to be declared in a compile-unit static context so the compiler can generate everything at compile time.

This is useful to generate a fixed and optimized hardware implementation on FPGA for example, where the interconnection graph can be also inferred at compile time.

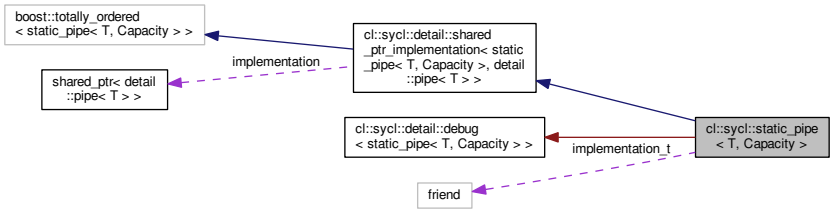
It is not directly mapped to the OpenCL program-scoped pipe because in SYCL there is not this concept of separated program. But the SYCL device compiler is expected to generate some OpenCL program(s) with program-scoped pipes when a SYCL static-scoped pipe is used. These details are implementation defined.

Definition at line 50 of file static_pipe.hpp.

Inheritance diagram for cl::sycl::static_pipe< T, Capacity >:



Collaboration diagram for cl::sycl::static_pipe< T, Capacity >:



Public Types

- using value_type = T

  The STL-like types.

Public Member Functions

- static_pipe ()

  Construct a static-scoped pipe able to store up to Capacity T objects.
- template<access::mode Mode, access::target Target = access::target::pipe>
  accessor< value_type, 1, Mode, Target > get_access (handler &command_group_handler)

  Get an accessor to the pipe with the required mode.
- std::size_t constexpr capacity () const

  Return the maximum number of elements that can fit in the pipe.

Private Types

- using implementation_t = typename static_pipe::shared_ptr_implementation

Private Attributes

- friend implementation_t

Additional Inherited Members

8.1.2.17.1 Member Typedef Documentation

8.1.2.17.1.1 implementation_t

```
template<typename T , std::size_t Capacity>
using cl::sycl::static_pipe< T, Capacity >::implementation_t = typename static_pipe::shared_↩
ptr_implementation  [private]
```

Definition at line 58 of file static_pipe.hpp.

8.1.2.17.1.2 value_type

```
template<typename T , std::size_t Capacity>
using cl::sycl::static_pipe< T, Capacity >::value_type = T
```

The STL-like types.

Definition at line 69 of file static_pipe.hpp.

8.1.2.17.2 Constructor & Destructor Documentation

8.1.2.17.2.1 static_pipe()

```
template<typename T , std::size_t Capacity>
cl::sycl::static_pipe< T, Capacity >::static_pipe ( )  [inline]
```

Construct a static-scoped pipe able to store up to Capacity T objects.

Definition at line 73 of file static_pipe.hpp.

References cl::sycl::access::pipe.

```
00074     : implementation_t { new detail::pipe<T> { Capacity } } { }
```

8.1.2.17.3 Member Function Documentation

8.1.2.17.3.1 capacity()

```
template<typename T , std::size_t Capacity>
std::size_t constexpr cl::sycl::static_pipe< T, Capacity >::capacity ( ) const  [inline]
```

Return the maximum number of elements that can fit in the pipe.

This is a constexpr since the capacity is in the type.

Definition at line 102 of file static_pipe.hpp.

```
00102                                       {
00103     return Capacity;
00104     }
```

8.1.2.17.3.2 get_access()

```
template<typename T , std::size_t Capacity>
template<access::mode Mode, access::target Target = access::target::pipe>
accessor<value_type, 1, Mode, Target> cl::sycl::static_pipe< T, Capacity >::get_access (
             handler & command_group_handler )  [inline]
```

Get an accessor to the pipe with the required mode.

Parameters

	Mode	is the requested access mode
	Target	is the type of pipe access required
in	*command_group_handler*	is the command group handler in which the kernel is to be executed

Definition at line 89 of file static_pipe.hpp.

References cl::sycl::access::blocking_pipe, cl::sycl::detail::shared_ptr_implementation< static_pipe< T, Capacity >, detail::pipe< T > >::implementation, and cl::sycl::access::pipe.

```
00089                                                {
00090     static_assert(Target == access::target::pipe
00091                   || Target == access::target::blocking_pipe,
00092                   "get_access(handler) with pipes can only deal with "
00093                   "access::pipe or access::blocking_pipe");
00094     return { implementation, command_group_handler };
00095   }
```

8.1.2.17.4 Member Data Documentation

8.1.2.17.4.1 implementation_t

```
template<typename T , std::size_t Capacity>
friend cl::sycl::static_pipe< T, Capacity >::implementation_t  [private]
```

Definition at line 64 of file static_pipe.hpp.

8.1.3 Typedef Documentation

8.1.3.1 buffer_allocator

```
template<typename T >
using cl::sycl::buffer_allocator = typedef std::allocator<T>
```

```
#include <include/CL/sycl/allocator.hpp>
```

The allocator objects give the programmer some control on how the memory is allocated inside SYCL.

The default buffer allocator used by the runtime, when no allocator is defined by the user.

The allocator used for the `buffer` inside SYCL

Just use the default allocator for now.

Reuse the C++ default allocator.

Definition at line 30 of file allocator.hpp.

8.1.3.2 image_allocator

```
template<typename T >
using cl::sycl::image_allocator = typedef std::allocator<T>
```

`#include <include/CL/sycl/allocator.hpp>`

The allocator used for the `image` inside SYCL.

Just use the default allocator for now.

Definition at line 38 of file allocator.hpp.

8.1.3.3 map_allocator

```
template<typename T >
using cl::sycl::map_allocator = typedef std::allocator<T>
```

`#include <include/CL/sycl/allocator.hpp>`

The allocator used to map the memory at the same place.

Just use the default allocator for now.

Todo : implement and clarify the specification. It looks like it is not really an allocator according the current spec

Definition at line 49 of file allocator.hpp.

8.1.4 Function Documentation

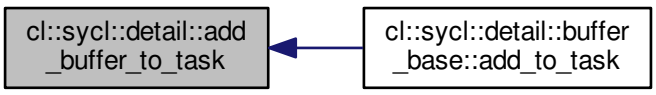
8.1.4.1 add_buffer_to_task()

```
static std::shared_ptr<detail::task> cl::sycl::detail::add_buffer_to_task (
            handler * command_group_handler,
            std::shared_ptr< detail::buffer_base > b,
            bool is_write_mode )  [inline], [static]
```

`#include <include/CL/sycl/buffer/detail/buffer_base.hpp>`

Referenced by cl::sycl::detail::buffer_base::add_to_task().

Here is the caller graph for this function:



8.1.4.2 buffer_add_to_task()

```
template<typename BufferDetail >
static std::shared_ptr<detail::task> cl::sycl::detail::buffer_add_to_task (
             BufferDetail buf,
             handler * command_group_handler,
             bool is_write_mode )  [static]
```

`#include <include/CL/sycl/buffer/detail/buffer.hpp>`

Proxy function to avoid some circular type recursion.

Returns

a shared_ptr<task>

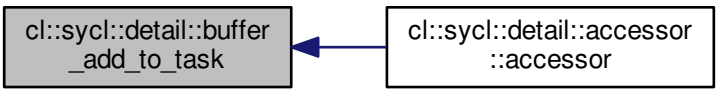
Todo To remove with some refactoring

Definition at line 436 of file buffer.hpp.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::accessor().

```
00438                                       {
00439     return buf->add_to_task(command_group_handler, is_write_mode);
00440   }
```

Here is the caller graph for this function:



8.1.4.3 get_pipe_detail()

```
template<typename Accessor >
static auto& cl::sycl::get_pipe_detail (
             Accessor & a )  [inline], [static]
```

`#include <include/CL/sycl/accessor.hpp>`

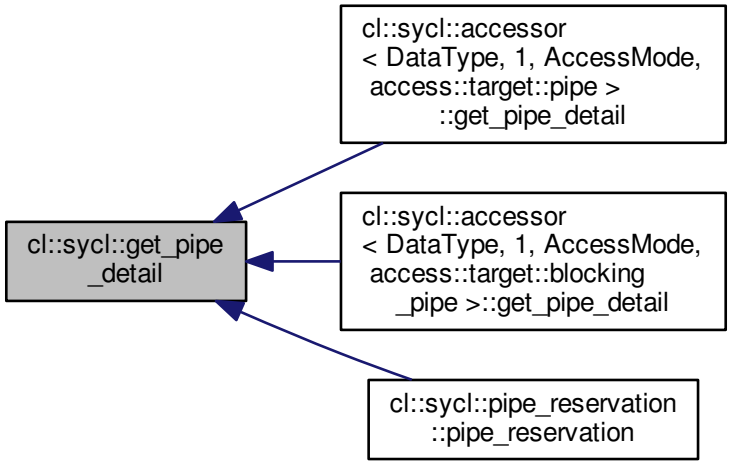
Top-level function to break circular dependencies on the the types to get the pipe implementation.

Definition at line 478 of file accessor.hpp.

Referenced by cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >::get_pipe_detail(), cl::sycl↩
::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >::get_pipe_detail(), and cl::sycl::pipe_↩
reservation< PipeAccessor >::pipe_reservation().

```
00478                                                 {
00479   return a.get_pipe_detail();
00480   }
```

Here is the caller graph for this function:



8.1.4.4 waiter()

```
template<typename T , int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_↩
const_t<T>>>
auto cl::sycl::detail::waiter (
            detail::buffer< T, Dimensions > * b )  [inline]
```

`#include <include/CL/sycl/buffer/detail/buffer_waiter.hpp>`

Helper function to create a new buffer_waiter.

Definition at line 79 of file buffer_waiter.hpp.

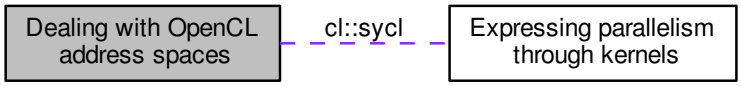
Referenced by cl::sycl::buffer< T, Dimensions, Allocator >::buffer().

```
00079                                                 {
00080   return new buffer_waiter<T, Dimensions, Allocator> { b };
00081 }
```

Here is the caller graph for this function:

8.2 Dealing with OpenCL address spaces

Collaboration diagram for Dealing with OpenCL address spaces:



Namespaces

- cl::sycl

Classes

- struct cl::sycl::detail::ocl_type< T, AS >

  Generate a type with some real OpenCL 2 attribute if we are on an OpenCL device. More...
- struct cl::sycl::detail::ocl_type< T, constant_address_space >

  Add an attribute for __constant address space. More...
- struct cl::sycl::detail::ocl_type< T, generic_address_space >

  Add an attribute for __generic address space. More...
- struct cl::sycl::detail::ocl_type< T, global_address_space >

  Add an attribute for __global address space. More...
- struct cl::sycl::detail::ocl_type< T, local_address_space >

  Add an attribute for __local address space. More...
- struct cl::sycl::detail::ocl_type< T, private_address_space >

  Add an attribute for __private address space. More...
- struct cl::sycl::detail::address_space_array< T, AS >

  Implementation of an array variable with an OpenCL address space. More...
- struct cl::sycl::detail::address_space_fundamental< T, AS >

  Implementation of a fundamental type with an OpenCL address space. More...
- struct cl::sycl::detail::address_space_object< T, AS >

  Implementation of an object type with an OpenCL address space. More...
- struct cl::sycl::detail::address_space_ptr< T, AS >

  Implementation for an OpenCL address space pointer. More...
- struct cl::sycl::detail::address_space_base< T, AS >

  Implementation of the base infrastructure to wrap something in an OpenCL address space. More...
- struct cl::sycl::detail::address_space_variable< T, AS >

  Implementation of a variable with an OpenCL address space. More...

Typedefs

- template<typename T , address_space AS>
  using cl::sycl::detail::addr_space = typename std::conditional< std::is_pointer< T >::value, address_space_ptr< T, AS >, typename std::conditional< std::is_class< T >::value, address_space_object< T, AS >, typename std::conditional< std::is_array< T >::value, address_space_array< T, AS >, address_space_fundamental< T, AS > >::type >::type >::type

  Dispatch the address space implementation according to the requested type.
- template<typename T >
  using cl::sycl::constant = detail::addr_space< T, constant_address_space >

  Declare a variable to be in the OpenCL constant address space.
- template<typename T >
  using cl::sycl::constant_ptr = constant< T * >

  Declare a variable to be in the OpenCL constant address space.
- template<typename T >
  using cl::sycl::generic = detail::addr_space< T, generic_address_space >

  Declare a variable to be in the OpenCL 2 generic address space.
- template<typename T >
  using cl::sycl::global = detail::addr_space< T, global_address_space >

  Declare a variable to be in the OpenCL global address space.
- template<typename T >
  using cl::sycl::global_ptr = global< T * >

  Declare a variable to be in the OpenCL global address space.
- template<typename T >
  using cl::sycl::local = detail::addr_space< T, local_address_space >

  Declare a variable to be in the OpenCL local address space.
- template<typename T >
  using cl::sycl::local_ptr = local< T * >

  Declare a variable to be in the OpenCL local address space.
- template<typename T >
  using cl::sycl::priv = detail::addr_space< T, private_address_space >

  Declare a variable to be in the OpenCL private address space.
- template<typename T >
  using cl::sycl::private_ptr = priv< T * >

  Declare a variable to be in the OpenCL private address space.
- template<typename Pointer , address_space AS>
  using cl::sycl::multi_ptr = detail::address_space_ptr< Pointer, AS >

  A pointer that can be statically associated to any address-space.

Enumerations

- enum cl::sycl::address_space {
  cl::sycl::constant_address_space, cl::sycl::generic_address_space, cl::sycl::global_address_space, cl::sycl::local_address_space,
  cl::sycl::private_address_space }

  Enumerate the different OpenCL 2 address spaces.

Functions

- template<typename T , address_space AS>
  multi_ptr< T, AS > cl::sycl::make_multi (multi_ptr< T, AS > pointer)

  Construct a cl::sycl::multi_ptr<> with the right type.

8.2.1 Detailed Description

8.2.2 Class Documentation

8.2.2.1 struct cl::sycl::detail::ocl_type

template<typename T, address_space AS>
struct cl::sycl::detail::ocl_type< T, AS >

Generate a type with some real OpenCL 2 attribute if we are on an OpenCL device.

In the general case, do not add any OpenCL address space qualifier

Definition at line 27 of file address_space.hpp.

Public Types

- using type = T

8.2.2.1.1 Member Typedef Documentation

8.2.2.1.1.1 type

```
template<typename T, address_space AS>
using cl::sycl::detail::ocl_type< T, AS >::type = T
```

Definition at line 28 of file address_space.hpp.

8.2.2.2 struct cl::sycl::detail::ocl_type< T, constant_address_space >

template<typename T>
struct cl::sycl::detail::ocl_type< T, constant_address_space >

Add an attribute for __constant address space.

Definition at line 33 of file address_space.hpp.

Public Types

- using type = T

8.2.2.2.1 Member Typedef Documentation

8.2.2.2.1.1 type

```
template<typename T >
using cl::sycl::detail::ocl_type< T, constant_address_space >::type = T
```

Definition at line 40 of file address_space.hpp.

8.2.2.3 struct cl::sycl::detail::ocl_type< T, generic_address_space >

template<typename T>
struct cl::sycl::detail::ocl_type< T, generic_address_space >

Add an attribute for __generic address space.

Definition at line 45 of file address_space.hpp.

Public Types

- using type = T

8.2.2.3.1 Member Typedef Documentation

8.2.2.3.1.1 type

```
template<typename T >
using cl::sycl::detail::ocl_type< T, generic_address_space >::type = T
```

Definition at line 52 of file address_space.hpp.

8.2.2.4 struct cl::sycl::detail::ocl_type< T, global_address_space >

template<typename T>
struct cl::sycl::detail::ocl_type< T, global_address_space >

Add an attribute for __global address space.

Definition at line 57 of file address_space.hpp.

Public Types

- using type = T

8.2.2.4.1 Member Typedef Documentation

8.2.2.4.1.1 type

```
template<typename T >
using cl::sycl::detail::ocl_type< T, global_address_space >::type = T
```

Definition at line 64 of file address_space.hpp.

8.2.2.5 struct cl::sycl::detail::ocl_type< T, local_address_space >

template<typename T>
struct cl::sycl::detail::ocl_type< T, local_address_space >

Add an attribute for __local address space.

Definition at line 69 of file address_space.hpp.

Public Types

- using type = T

8.2.2.5.1 Member Typedef Documentation

8.2.2.5.1.1 type

```
template<typename T >
using cl::sycl::detail::ocl_type< T, local_address_space >::type = T
```

Definition at line 76 of file address_space.hpp.

8.2.2.6 struct cl::sycl::detail::ocl_type< T, private_address_space >

template<typename T>
struct cl::sycl::detail::ocl_type< T, private_address_space >

Add an attribute for __private address space.

Definition at line 81 of file address_space.hpp.

Public Types

- using type = T

8.2.2.6.1 Member Typedef Documentation

8.2.2.6.1.1 type

```
template<typename T >
using cl::sycl::detail::ocl_type< T, private_address_space >::type = T
```

Definition at line 88 of file address_space.hpp.

8.2.2.7 struct cl::sycl::detail::address_space_array

template<typename T, address_space AS>
struct cl::sycl::detail::address_space_array< T, AS >

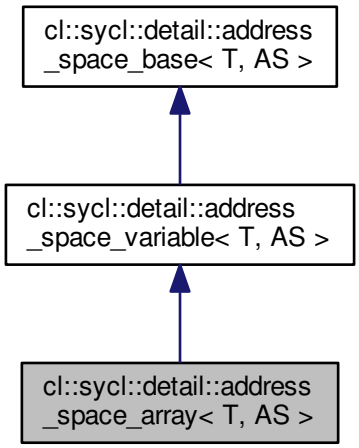
Implementation of an array variable with an OpenCL address space.

Parameters

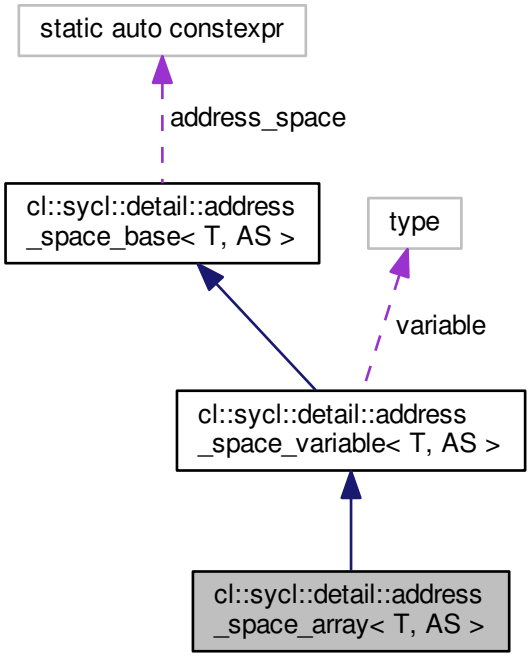
T	is the type of the basic object to be created
AS	is the address space to place the object into

Definition at line 95 of file address_space.hpp.

Inheritance diagram for cl::sycl::detail::address_space_array< T, AS >:



Collaboration diagram for cl::sycl::detail::address_space_array< T, AS >:



Public Types

- using super = address_space_variable< T, AS >

  Keep track of the base class as a short-cut.

Public Member Functions

- address_space_array (const T &array)

  Allow to create an address space array from an array.
- address_space_array (std::initializer_list< std::remove_extent_t< T >> list)

  Allow to create an address space array from an initializer list.

Additional Inherited Members

8.2.2.7.1 Member Typedef Documentation

8.2.2.7.1.1 super

```
template<typename T , address_space AS>
using cl::sycl::detail::address_space_array< T, AS >::super = address_space_variable<T, AS>
```

Keep track of the base class as a short-cut.

Definition at line 311 of file address_space.hpp.

8.2.2.7.2 Constructor & Destructor Documentation

8.2.2.7.2.1 address_space_array() [1/2]

```
template<typename T , address_space AS>
cl::sycl::detail::address_space_array< T, AS >::address_space_array (
            const T & array )  [inline]
```

Allow to create an address space array from an array.

Definition at line 319 of file address_space.hpp.

```
00319                                    {
00320     std::copy(std::begin(array), std::end(array), std::begin(super::variable));
00321   };
```

8.2.2.7.2.2 address_space_array() [2/2]

```
template<typename T , address_space AS>
cl::sycl::detail::address_space_array< T, AS >::address_space_array (
            std::initializer_list< std::remove_extent_t< T >> list )  [inline]
```

Allow to create an address space array from an initializer list.

Todo Extend to more than 1 dimension

Definition at line 328 of file address_space.hpp.

```
00328                                                                    {
00329     std::copy(std::begin(list), std::end(list), std::begin(super::variable));
00330   };
```

8.2.2.8 struct cl::sycl::detail::address_space_fundamental

template<typename T, address_space AS>
struct cl::sycl::detail::address_space_fundamental< T, AS >

Implementation of a fundamental type with an OpenCL address space.

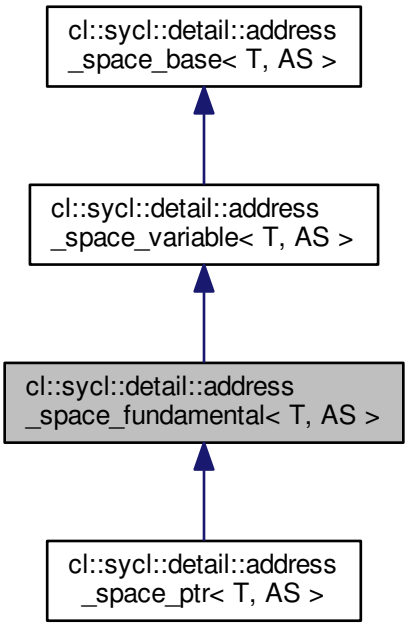
Parameters

T	is the type of the basic object to be created
AS	is the address space to place the object into

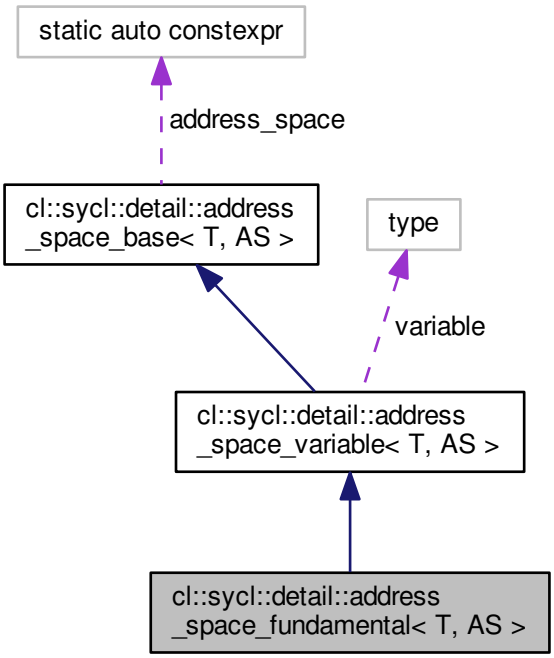
Todo Verify/improve to deal with const/volatile?

Definition at line 98 of file address_space.hpp.

Inheritance diagram for cl::sycl::detail::address_space_fundamental< T, AS >:



Collaboration diagram for cl::sycl::detail::address_space_fundamental< T, AS >:



Public Types

- using super = address_space_variable< T, AS >

  Keep track of the base class as a short-cut.

Public Member Functions

- address_space_fundamental ()=default

  Also request for the default constructors that have been disabled by the declaration of another constructor.

- template<typename SomeType , cl::sycl::address_space SomeAS>
  address_space_fundamental (address_space_fundamental< SomeType, SomeAS > &v)

  Allow for example assignment of a global<float> to a priv<double> for example.

Additional Inherited Members

8.2.2.8.1 Member Typedef Documentation

8.2.2.8.1.1 super

```
template<typename T, address_space AS>
using cl::sycl::detail::address_space_fundamental< T, AS >::super = address_space_variable<T,
AS>
```

Keep track of the base class as a short-cut.

Definition at line 219 of file address_space.hpp.

8.2.2.8.2 Constructor & Destructor Documentation

8.2.2.8.2.1 address_space_fundamental() [1/2]

```
template<typename T, address_space AS>
cl::sycl::detail::address_space_fundamental< T, AS >::address_space_fundamental ( )  [default]
```

Also request for the default constructors that have been disabled by the declaration of another constructor.

This ensures for example that we can write

```
generic<float *> q;
```

without initialization.

8.2.2.8.2.2 address_space_fundamental() [2/2]

```
template<typename T, address_space AS>
template<typename SomeType , cl::sycl::address_space SomeAS>
cl::sycl::detail::address_space_fundamental< T, AS >::address_space_fundamental (
             address_space_fundamental< SomeType, SomeAS > & v )  [inline]
```

Allow for example assignment of a global<float> to a priv<double> for example.

Since it needs 2 implicit conversions, it does not work with the conversion operators already define, so add 1 more explicit conversion here so that the remaining implicit conversion can be found by the compiler.

Strangely

```
template <typename SomeType, address_space SomeAS>
address_space_base(addr_space<SomeType, SomeAS>& v)
: variable(SomeType(v)) { }
```

cannot be used here because SomeType cannot be inferred. So use address_space_base<> instead

Need to think further about it...

Definition at line 257 of file address_space.hpp.

```
00258   {
00259     /* Strangely I cannot have it working in the initializer instead, for
00260        some cases */
00261     super::variable = SomeType(v);
00262   }
```

8.2.2.9 struct cl::sycl::detail::address_space_object

template<typename T, address_space AS>
struct cl::sycl::detail::address_space_object< T, AS >

Implementation of an object type with an OpenCL address space.

Parameters

T	is the type of the basic object to be created
AS	is the address space to place the object into

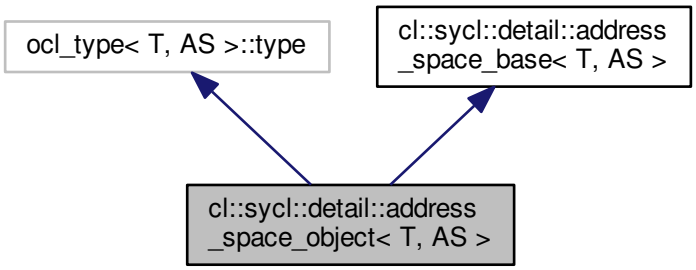
The class implementation is just inheriting of T so that all methods and non-member operators on T work also on address_space_object<T>

Todo Verify/improve to deal with const/volatile?

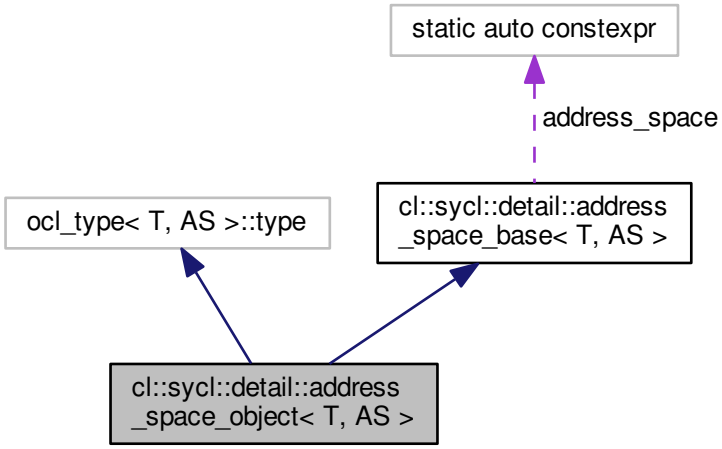
Todo what about T having some final methods?

Definition at line 101 of file address_space.hpp.

Inheritance diagram for cl::sycl::detail::address_space_object< T, AS >:



Collaboration diagram for cl::sycl::detail::address_space_object< T, AS >:



Public Types

- using opencl_type = typename ocl_type< T, AS >::type

  Store the base type of the object with OpenCL address space modifier.

Public Member Functions

- address_space_object (T &&v)

  Allow to create an address space version of an object or to convert one.
- operator opencl_type & ()

  Conversion operator to allow a address_space_object<T> to be used as a T so that all the methods of a T and the built-in operators for T can be used on a address_space_object<T> too.

Additional Inherited Members

8.2.2.9.1 Member Typedef Documentation

8.2.2.9.1.1 opencl_type

```
template<typename T , address_space AS>
using cl::sycl::detail::address_space_object< T, AS >::opencl_type = typename ocl_type<T,
AS>::type
```

Store the base type of the object with OpenCL address space modifier.

Todo Add to the specification

Definition at line 356 of file address_space.hpp.

8.2.2.9.2 Constructor & Destructor Documentation

8.2.2.9.2.1 address_space_object()

```
template<typename T , address_space AS>
cl::sycl::detail::address_space_object< T, AS >::address_space_object (
            T && v )  [inline]
```

Allow to create an address space version of an object or to convert one.

Definition at line 367 of file address_space.hpp.

```
00367 : opencl_type(v) { }
```

8.2.2.9.3 Member Function Documentation

8.2.2.9.3.1 operator opencl_type &()

```
template<typename T , address_space AS>
cl::sycl::detail::address_space_object< T, AS >::operator opencl_type & ( )  [inline]
```

Conversion operator to allow a address_space_object<T> to be used as a T so that all the methods of a T and the built-in operators for T can be used on a address_space_object<T> too.

Use opencl_type so that if we take the address of it, the address space is kept.

Definition at line 375 of file address_space.hpp.

```
00375 { return *this; }
```

8.2.2.10 struct cl::sycl::detail::address_space_ptr

template<typename T, address_space AS>
struct cl::sycl::detail::address_space_ptr< T, AS >

Implementation for an OpenCL address space pointer.

Parameters

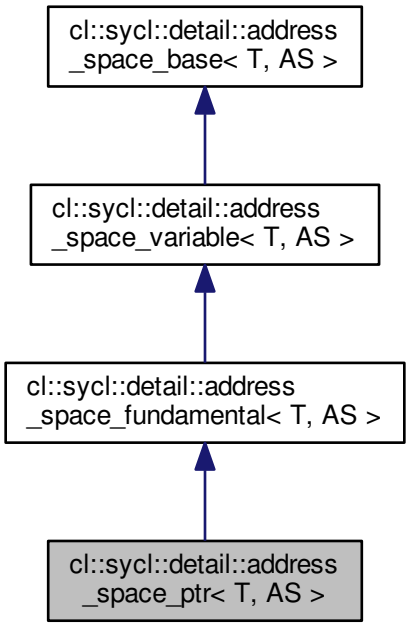
T	is the pointer type

Note that if *T* is not a pointer type, it is an error.

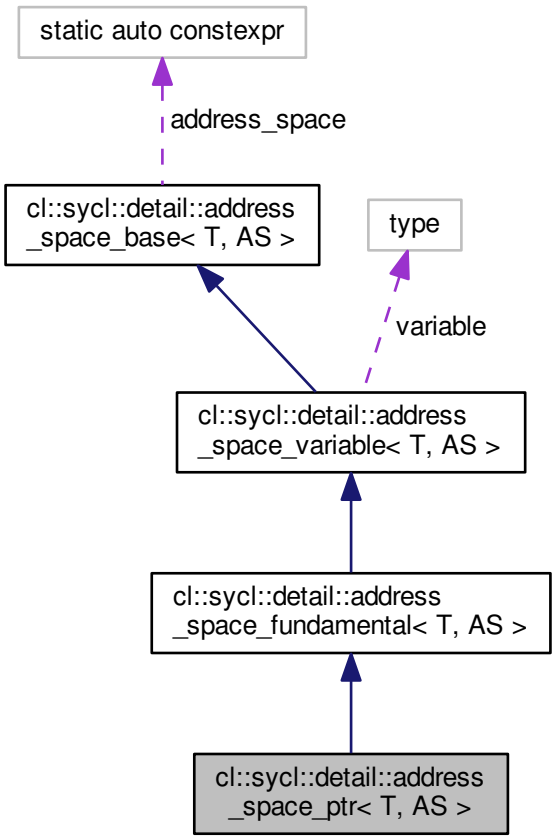
All the address space pointers inherit from it, which makes trivial the implementation of cl::sycl::multi_ptr<T, AS>

Definition at line 104 of file address_space.hpp.

Inheritance diagram for cl::sycl::detail::address_space_ptr< T, AS >:



Collaboration diagram for cl::sycl::detail::address_space_ptr< T, AS >:



Public Types

- using super = address_space_fundamental< T, AS >

  Keep track of the base class as a short-cut.
- using pointer_t = typename super::address_space_fundamental::type
- using reference_t = typename std::remove_pointer_t< pointer_t > &

Public Member Functions

- address_space_ptr (address_space_fundamental< typename std::pointer_traits< T >::element_type, AS > *p)

  Allow initialization of a pointer type from the address of an element with the same type and address space.

Additional Inherited Members

8.2.2.10.1 Member Typedef Documentation

8.2.2.10.1.1 pointer_t

```
template<typename T, address_space AS>
using cl::sycl::detail::address_space_ptr< T, AS >::pointer_t = typename super::address_↩
space_fundamental::type
```

Definition at line 288 of file address_space.hpp.

8.2.2.10.1.2 reference_t

```
template<typename T, address_space AS>
using cl::sycl::detail::address_space_ptr< T, AS >::reference_t = typename std::remove_↩
pointer_t<pointer_t>&
```

Definition at line 289 of file address_space.hpp.

8.2.2.10.1.3 super

```
template<typename T, address_space AS>
using cl::sycl::detail::address_space_ptr< T, AS >::super = address_space_fundamental<T, AS>
```

Keep track of the base class as a short-cut.

Definition at line 283 of file address_space.hpp.

8.2.2.10.2 Constructor & Destructor Documentation

8.2.2.10.2.1 address_space_ptr()

```
template<typename T, address_space AS>
cl::sycl::detail::address_space_ptr< T, AS >::address_space_ptr (
            address_space_fundamental< typename std::pointer_traits< T >::element_type, AS >
* p )  [inline]
```

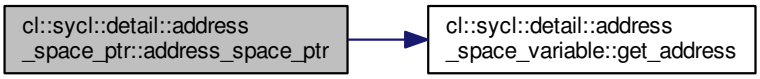
Allow initialization of a pointer type from the address of an element with the same type and address space.

Definition at line 294 of file address_space.hpp.

References cl::sycl::detail::address_space_variable< T, AS >::get_address().

```
00295     : address_space_fundamental<T, AS> { p->get_address() } {}
```

Here is the call graph for this function:



8.2.2.11 struct cl::sycl::detail::address_space_base

template<typename T, address_space AS>
struct cl::sycl::detail::address_space_base< T, AS >

Implementation of the base infrastructure to wrap something in an OpenCL address space.

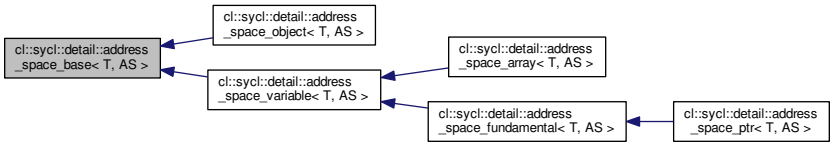
Parameters

T	is the type of the basic stuff to be created
AS	is the address space to place the object into

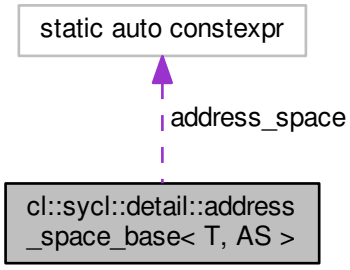
Todo Verify/improve to deal with const/volatile?

Definition at line 135 of file address_space.hpp.

Inheritance diagram for cl::sycl::detail::address_space_base< T, AS >:



Collaboration diagram for cl::sycl::detail::address_space_base< T, AS >:



Public Types

- using type = T

  Store the base type of the object.
- using opencl_type = typename ocl_type< T, AS >::type

  Store the base type of the object with OpenCL address space modifier.

Static Public Attributes

- static auto constexpr address_space = AS

  Set the address_space identifier that can be queried to know the pointer type.

8.2.2.11.1 Member Typedef Documentation

8.2.2.11.1.1 opencl_type

```
template<typename T , address_space AS>
using cl::sycl::detail::address_space_base< T, AS >::opencl_type = typename ocl_type<T, AS>↩
::type
```

Store the base type of the object with OpenCL address space modifier.

Todo Add to the specification

Definition at line 146 of file address_space.hpp.

8.2.2.11.1.2 type

```
template<typename T , address_space AS>
using cl::sycl::detail::address_space_base< T, AS >::type = T
```

Store the base type of the object.

Todo Add to the specification

Definition at line 140 of file address_space.hpp.

8.2.2.11.2 Member Data Documentation

8.2.2.11.2.1 address_space

```
template<typename T , address_space AS>
auto constexpr cl::sycl::detail::address_space_base< T, AS >::address_space = AS  [static]
```

Set the address_space identifier that can be queried to know the pointer type.

Definition at line 150 of file address_space.hpp.

8.2.2.12 struct cl::sycl::detail::address_space_variable

template<typename T, address_space AS>
struct cl::sycl::detail::address_space_variable< T, AS >

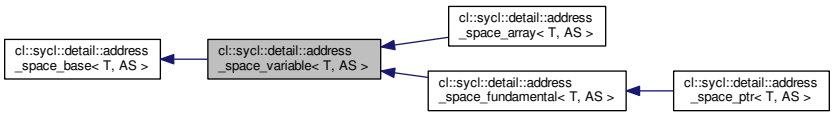
Implementation of a variable with an OpenCL address space.

Parameters

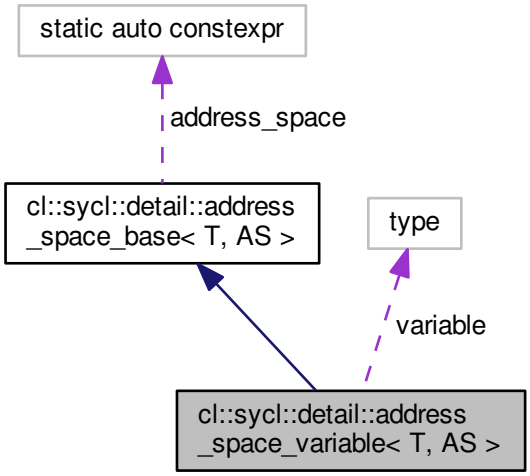
T	is the type of the basic object to be created
AS	is the address space to place the object into

Definition at line 162 of file address_space.hpp.

Inheritance diagram for cl::sycl::detail::address_space_variable< T, AS >:



Collaboration diagram for cl::sycl::detail::address_space_variable< T, AS >:



Public Types

- using opencl_type = typename ocl_type< T, AS >::type

  Store the base type of the object with OpenCL address space modifier.

- using super = address_space_base< T, AS >

  Keep track of the base class as a short-cut.

Public Member Functions

- address_space_variable (const T &v)

  Allow to create an address space version of an object or to convert one to be used by the classes inheriting by this one because it is not possible to directly initialize a base class member in C++.
- address_space_variable ()=default

  Put back the default constructors canceled by the previous definition.
- operator opencl_type & ()

  Conversion operator to allow a address_space_object<T> to be used as a T so that all the methods of a T and the built-in operators for T can be used on a address_space_object<T> too.
- opencl_type * get_address ()

  Return the address of the value to implement pointers.

Protected Attributes

- opencl_type variable

Additional Inherited Members

8.2.2.12.1 Member Typedef Documentation

8.2.2.12.1.1 opencl_type

```
template<typename T , address_space AS>
using cl::sycl::detail::address_space_variable< T, AS >::opencl_type = typename ocl_type<T,
AS>::type
```

Store the base type of the object with OpenCL address space modifier.

Todo Add to the specification

Definition at line 167 of file address_space.hpp.

8.2.2.12.1.2 super

```
template<typename T , address_space AS>
using cl::sycl::detail::address_space_variable< T, AS >::super = address_space_base<T, AS>
```

Keep track of the base class as a short-cut.

Definition at line 170 of file address_space.hpp.

8.2.2.12.2 Constructor & Destructor Documentation

8.2.2.12.2.1 address_space_variable() [1/2]

```
template<typename T , address_space AS>
cl::sycl::detail::address_space_variable< T, AS >::address_space_variable (
            const T & v )  [inline]
```

Allow to create an address space version of an object or to convert one to be used by the classes inheriting by this one because it is not possible to directly initialize a base class member in C++.

Definition at line 186 of file address_space.hpp.

```
00186 : variable(v) { }
```

8.2.2.12.2.2 address_space_variable() [2/2]

```
template<typename T , address_space AS>
cl::sycl::detail::address_space_variable< T, AS >::address_space_variable ( )  [default]
```

Put back the default constructors canceled by the previous definition.

8.2.2.12.3 Member Function Documentation

8.2.2.12.3.1 get_address()

```
template<typename T , address_space AS>
opencl_type* cl::sycl::detail::address_space_variable< T, AS >::get_address ( )  [inline]
```

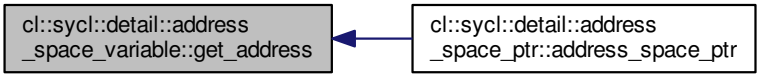
Return the address of the value to implement pointers.

Definition at line 203 of file address_space.hpp.

Referenced by cl::sycl::detail::address_space_ptr< T, AS >::address_space_ptr().

```
00203 { return &variable; }
```

Here is the caller graph for this function:



8.2.2.12.3.2 operator opencl_type &()

```
template<typename T , address_space AS>
cl::sycl::detail::address_space_variable< T, AS >::operator opencl_type & ( )  [inline]
```

Conversion operator to allow a address_space_object<T> to be used as a T so that all the methods of a T and the built-in operators for T can be used on a address_space_object<T> too.

Use opencl_type so that if we take the address of it, the address space is kept.

Definition at line 200 of file address_space.hpp.

```
00200 { return variable; }
```

8.2.2.12.4 Member Data Documentation

8.2.2.12.4.1 variable

```
template<typename T , address_space AS>
opencl_type cl::sycl::detail::address_space_variable< T, AS >::variable  [protected]
```

Definition at line 179 of file address_space.hpp.

8.2.3 Typedef Documentation

8.2.3.1 addr_space

```
template<typename T , address_space AS>
using cl::sycl::detail::addr_space = typedef typename std::conditional<std::is_pointer<T>↩
::value, address_space_ptr<T, AS>, typename std::conditional<std::is_class<T>::value, address↩
_space_object<T, AS>, typename std::conditional<std::is_array<T>::value, address_space_↩
array<T, AS>, address_space_fundamental<T, AS> >::type>::type>::type
```

```
#include <include/CL/sycl/address_space/detail/address_space.hpp>
```

Dispatch the address space implementation according to the requested type.

Parameters

T	is the type of the object to be created
AS	is the address space to place the object into or to point to in the case of a pointer type

Definition at line 122 of file address_space.hpp.

8.2.3.2 constant

```
template<typename T >
using cl::sycl::constant = typedef detail::addr_space<T, constant_address_space>
```

```
#include <include/CL/sycl/address_space.hpp>
```

Declare a variable to be in the OpenCL constant address space.

Parameters

T	is the type of the object

Definition at line 55 of file address_space.hpp.

8.2.3.3 constant_ptr

```
template<typename T >
using cl::sycl::constant_ptr = typedef constant<T*>
```

```
#include <include/CL/sycl/address_space.hpp>
```

Declare a variable to be in the OpenCL constant address space.

Parameters

T	is the type of the object

Definition at line 63 of file address_space.hpp.

8.2.3.4 generic

```
template<typename T >
using cl::sycl::generic = typedef detail::addr_space<T, generic_address_space>
```

```
#include <include/CL/sycl/address_space.hpp>
```

Declare a variable to be in the OpenCL 2 generic address space.

Parameters

T	is the type of the object

Definition at line 71 of file address_space.hpp.

8.2.3.5 global

```
template<typename T >
using cl::sycl::global = typedef detail::addr_space<T, global_address_space>
```

`#include <include/CL/sycl/address_space.hpp>`

Declare a variable to be in the OpenCL global address space.

Parameters

T	is the type of the object

Definition at line 79 of file address_space.hpp.

8.2.3.6 global_ptr

```
template<typename T >
using cl::sycl::global_ptr = typedef global<T*>
```

`#include <include/CL/sycl/address_space.hpp>`

Declare a variable to be in the OpenCL global address space.

Parameters

T	is the type of the object

Definition at line 88 of file address_space.hpp.

8.2.3.7 local

```
template<typename T >
using cl::sycl::local = typedef detail::addr_space<T, local_address_space>
```

`#include <include/CL/sycl/address_space.hpp>`

Declare a variable to be in the OpenCL local address space.

Parameters

T	is the type of the object

Definition at line 96 of file address_space.hpp.

8.2.3.8 local_ptr

```
template<typename T >
using cl::sycl::local_ptr = typedef local<T*>
```

```
#include <include/CL/sycl/address_space.hpp>
```

Declare a variable to be in the OpenCL local address space.

Parameters

T	is the type of the object

Definition at line 104 of file address_space.hpp.

8.2.3.9 multi_ptr

```
template<typename Pointer , address_space AS>
using cl::sycl::multi_ptr = typedef detail::address_space_ptr<Pointer, AS>
```

```
#include <include/CL/sycl/address_space.hpp>
```

A pointer that can be statically associated to any address-space.

Parameters

Pointer	is the pointer type
AS	is the address space to point to

Note that if *Pointer* is not a pointer type, it is an error.

Definition at line 132 of file address_space.hpp.

8.2.3.10 priv

```
template<typename T >
using cl::sycl::priv = typedef detail::addr_space<T, private_address_space>
```

```
#include <include/CL/sycl/address_space.hpp>
```

Declare a variable to be in the OpenCL private address space.

Parameters

T	is the type of the object

Definition at line 112 of file address_space.hpp.

8.2.3.11 private_ptr

```
template<typename T >
using cl::sycl::private_ptr = typedef priv<T*>
```

```
#include <include/CL/sycl/address_space.hpp>
```

Declare a variable to be in the OpenCL private address space.

Parameters

T	is the type of the object

Definition at line 120 of file address_space.hpp.

8.2.4 Enumeration Type Documentation

8.2.4.1 address_space

```
enum cl::sycl::address_space
```

```
#include <include/CL/sycl/address_space.hpp>
```

Enumerate the different OpenCL 2 address spaces.

Enumerator

constant_address_space	
generic_address_space	
global_address_space	
local_address_space	
private_address_space	

Definition at line 27 of file address_space.hpp.

```
00027                   {
00028   constant_address_space,
00029   generic_address_space,
00030   global_address_space,
00031   local_address_space,
00032   private_address_space,
00033 };
```

8.2.5 Function Documentation

8.2.5.1 make_multi()

```
template<typename T , address_space AS>
multi_ptr<T, AS> cl::sycl::make_multi (
             multi_ptr< T, AS > pointer )
```

```
#include <include/CL/sycl/address_space.hpp>
```

Construct a cl::sycl::multi_ptr<> with the right type.

Parameters

pointer	is the address with its address space to point to

Todo Implement the case with a plain pointer

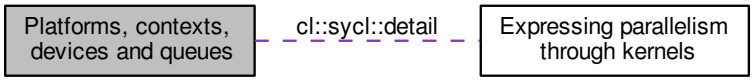
Definition at line 142 of file address_space.hpp.

```
00142                                                    {
00143   return pointer;
00144 }
```

8.3 Platforms, contexts, devices and queues

SYCL host context.

Collaboration diagram for Platforms, contexts, devices and queues:



Namespaces

- cl::sycl::detail
- cl::sycl::info

Classes

- class cl::sycl::detail::context
- class cl::sycl::detail::host_context
- class cl::sycl::context

  SYCL context. More...
- class cl::sycl::detail::device

  An abstract class representing various models of SYCL devices. More...
- class cl::sycl::device

  SYCL device. More...
- class cl::sycl::device_type_selector

  A device selector by device_type. More...
- class cl::sycl::device_typename_selector< DeviceType >

  Select a device by template device_type parameter. More...
- class cl::sycl::device_selector

  The SYCL heuristics to select a device. More...
- class cl::sycl::handler

  Command group handler class. More...
- class cl::sycl::detail::kernel

  Abstract SYCL kernel. More...
- class cl::sycl::kernel

  SYCL kernel. More...
- class cl::sycl::detail::host_platform

  SYCL host platform. More...
- class cl::sycl::detail::opencl_platform

  SYCL OpenCL platform. More...
- class cl::sycl::detail::platform

  An abstract class representing various models of SYCL platforms. More...
- class cl::sycl::platform

  Abstract the OpenCL platform. More...
- class cl::sycl::queue

  SYCL queue, similar to the OpenCL queue concept. More...

Typedefs

- using cl::sycl::default_selector = device_typename_selector< info::device_type::defaults >

  Devices selected by heuristics of the system.
- using cl::sycl::gpu_selector = device_typename_selector< info::device_type::gpu >

  Select devices according to device type info::device::device_type::gpu from all the available OpenCL devices.
- using cl::sycl::cpu_selector = device_typename_selector< info::device_type::cpu >

  Select devices according to device type info::device::device_type::cpu from all the available devices and heuristics.
- using cl::sycl::host_selector = device_typename_selector< info::device_type::host >

  Selects the SYCL host CPU device that does not require an OpenCL runtime.
- using cl::sycl::info::gl_context_interop = bool
- using cl::sycl::info::device_fp_config = unsigned int
- using cl::sycl::info::device_exec_capabilities = unsigned int
- using cl::sycl::info::device_queue_properties = unsigned int

Enumerations

- enum cl::sycl::info::context : int { cl::sycl::info::context::reference_count, cl::sycl::info::context::num_devices, cl::sycl::info::context::devices, cl::sycl::info::context::gl_interop }

  Context information descriptors.
- enum cl::sycl::info::device_type : unsigned int { cl::sycl::info::device_type::cpu, cl::sycl::info::device_type::gpu, cl::sycl::info::device_type::accelerator, cl::sycl::info::device_type::custom, cl::sycl::info::device_type::defaults, cl::sycl::info::device_type::host, cl::sycl::info::device_type::opencl, cl::sycl::info::device_type::all }

  Type of devices.
- enum cl::sycl::info::device : int { cl::sycl::info::device::device_type, cl::sycl::info::device::vendor_id, cl::sycl::info::device::max_compute_units, cl::sycl::info::device::max_work_item_dimensions, cl::sycl::info::device::max_work_item_sizes, cl::sycl::info::device::max_work_group_size, cl::sycl::info::device::preferred_vector_width_char, cl::sycl::info::device::preferred_vector_width_short, cl::sycl::info::device::preferred_vector_width_int, cl::sycl::info::device::preferred_vector_width_long_long, cl::sycl::info::device::preferred_vector_width_float, cl::sycl::info::device::preferred_vector_width_double, cl::sycl::info::device::preferred_vector_width_half, cl::sycl::info::device::native_vector_witdth_char, cl::sycl::info::device::native_vector_witdth_short, cl::sycl::info::device::native_vector_witdth_int, cl::sycl::info::device::native_vector_witdth_long_long, cl::sycl::info::device::native_vector_witdth_float, cl::sycl::info::device::native_vector_witdth_double, cl::sycl::info::device::native_vector_witdth_half, cl::sycl::info::device::max_clock_frequency, cl::sycl::info::device::address_bits, cl::sycl::info::device::max_mem_alloc_size, cl::sycl::info::device::image_support, cl::sycl::info::device::max_read_image_args, cl::sycl::info::device::max_write_image_args, cl::sycl::info::device::image2d_max_height, cl::sycl::info::device::image2d_max_width, cl::sycl::info::device::image3d_max_height, cl::sycl::info::device::image3d_max_widht, cl::sycl::info::device::image3d_mas_depth, cl::sycl::info::device::image_max_buffer_size, cl::sycl::info::device::image_max_array_size, cl::sycl::info::device::max_samplers, cl::sycl::info::device::max_parameter_size, cl::sycl::info::device::mem_base_addr_align, cl::sycl::info::device::single_fp_config, cl::sycl::info::device::double_fp_config, cl::sycl::info::device::global_mem_cache_type, cl::sycl::info::device::global_mem_cache_line_size, cl::sycl::info::device::global_mem_cache_size, cl::sycl::info::device::global_mem_size, cl::sycl::info::device::max_constant_buffer_size, cl::sycl::info::device::max_constant_args, cl::sycl::info::device::local_mem_type, cl::sycl::info::device::local_mem_size, cl::sycl::info::device::error_correction_support, cl::sycl::info::device::host_unified_memory, cl::sycl::info::device::profiling_timer_resolution, cl::sycl::info::device::endian_little, cl::sycl::info::device::is_available, cl::sycl::info::device::is_compiler_available, cl::sycl::info::device::is_linker_available, cl::sycl::info::device::execution_capabilities, cl::sycl::info::device::queue_properties, cl::sycl::info::device::built_in_kernels,

cl::sycl::info::device::platform, cl::sycl::info::device::name, cl::sycl::info::device::vendor, cl::sycl::info::device::driver_version, cl::sycl::info::device::profile, cl::sycl::info::device::device_version, cl::sycl::info::device::opencl_version, cl::sycl::info::device::extensions, cl::sycl::info::device::printf_buffer_size, cl::sycl::info::device::preferred_interop_user_sync, cl::sycl::info::device::parent_device, cl::sycl::info::device::partition_max_sub_devices, cl::sycl::info::device::partition_properties, cl::sycl::info::device::partition_affinity_domain, cl::sycl::info::device::partition_type, cl::sycl::info::device::reference_count }

Device information descriptors.

- enum cl::sycl::info::device_partition_property : int { cl::sycl::info::device_partition_property::unsupported, cl::sycl::info::device_partition_property::partition_equally, cl::sycl::info::device_partition_property::partition_by_counts, cl::sycl::info::device_partition_property::partition_by_affinity_domain, cl::sycl::info::device_partition_property::partition_affinity_domain_next_partitionable }
- enum cl::sycl::info::device_affinity_domain : int { cl::sycl::info::device_affinity_domain::unsupported, cl::sycl::info::device_affinity_domain::numa, cl::sycl::info::device_affinity_domain::L4_cache, cl::sycl::info::device_affinity_domain::L3_cache, cl::sycl::info::device_affinity_domain::L2_cache, cl::sycl::info::device_affinity_domain::next_partitionable }
- enum cl::sycl::info::device_partition_type : int { cl::sycl::info::device_partition_type::no_partition, cl::sycl::info::device_partition_type::numa, cl::sycl::info::device_partition_type::L4_cache, cl::sycl::info::device_partition_type::L3_cache, cl::sycl::info::device_partition_type::L2_cache, cl::sycl::info::device_partition_type::L1_cache }
- enum cl::sycl::info::local_mem_type : int { cl::sycl::info::local_mem_type::none, cl::sycl::info::local_mem_type::local, cl::sycl::info::local_mem_type::global }
- enum cl::sycl::info::fp_config : int { cl::sycl::info::fp_config::denorm, cl::sycl::info::fp_config::inf_nan, cl::sycl::info::fp_config::round_to_nearest, cl::sycl::info::fp_config::round_to_zero, cl::sycl::info::fp_config::round_to_inf, cl::sycl::info::fp_config::fma, cl::sycl::info::fp_config::correctly_rounded_divide_sqrt, cl::sycl::info::fp_config::soft_float }
- enum cl::sycl::info::global_mem_cache_type : int { cl::sycl::info::global_mem_cache_type::none, cl::sycl::info::global_mem_cache_type::read_only, cl::sycl::info::global_mem_cache_type::write_only }
- enum cl::sycl::info::device_execution_capabilities : unsigned int { cl::sycl::info::device_execution_capabilities::exec_kernel, cl::sycl::info::device_execution_capabilities::exec_native_kernel }
- enum cl::sycl::info::platform : unsigned int { cl::sycl::info::platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_PROFILE), cl::sycl::info::platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_VERSION), cl::sycl::info::platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_NAME), cl::sycl::info::platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_VENDOR), cl::sycl::info::platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_EXTENSIONS) }

Platform information descriptors.

Functions

- template<>
  auto cl::sycl::device::get_info< info::device::max_work_group_size > () const
- template<>
  auto cl::sycl::device::get_info< info::device::max_compute_units > () const
- template<>
  auto cl::sycl::device::get_info< info::device::device_type > () const
- template<>
  auto cl::sycl::device::get_info< info::device::local_mem_size > () const
- template<>
  auto cl::sycl::device::get_info< info::device::max_mem_alloc_size > () const
- template<>
  auto cl::sycl::device::get_info< info::device::vendor > () const

- template<>
  auto cl::sycl::device::get_info< info::device::name > () const
- template<>
  auto cl::sycl::device::get_info< info::device::profile > () const
- static vector_class< device > cl::sycl::device::get_devices (info::device_type device_type=info::device_↩
  type::all) TRISYCL_WEAK_ATTRIB_SUFFIX

  Return a list of all available devices.
- vector_class< cl::sycl::device > cl::sycl::detail::host_platform::get_devices (info::device_type device_type) const override

  Get all the available devices for the host platform.
- vector_class< cl::sycl::device > cl::sycl::detail::opencl_platform::get_devices (info::device_type device_type) const override

  Get all the available devices for this OpenCL platform.

Variables

- TRISYCL_WEAK_ATTRIB_PREFIX detail::cache< cl_context, detail::opencl_context > opencl_context↩
  ::cache cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX

8.3.1 Detailed Description

SYCL host context.

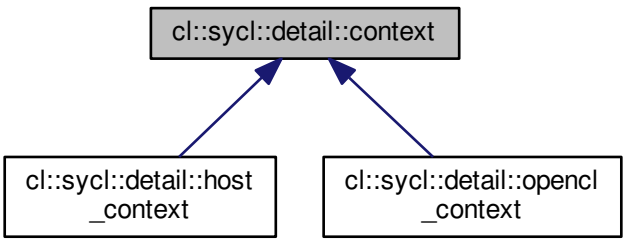
Todo The implementation is quite minimal for now. :-)

8.3.2 Class Documentation

8.3.2.1 class cl::sycl::detail::context

Definition at line 24 of file context.hpp.

Inheritance diagram for cl::sycl::detail::context:



Public Member Functions

- virtual cl_context get () const =0

  Return the underlying `cl_context` of the `cl::sycl::context`.
- virtual boost::compute::context & get_boost_compute ()=0

  Return the underlying `boost::compute::context` of the `cl::sycl::context`.
- virtual boost::compute::command_queue & get_boost_queue ()=0

  Return the underlying `boost::compute::command_queue` associated with the context.
- virtual bool is_host () const =0

  Returns true is the context is a SYCL host context.
- virtual cl::sycl::platform get_platform () const =0

  Returns the SYCL platform that the context is initialized for.
- virtual vector_class< cl::sycl::device > get_devices () const =0

  Returns the set of devices that are part of this context.
- virtual ~context ()

  Virtual to call the real destructor.

8.3.2.1.1 Constructor & Destructor Documentation

8.3.2.1.1.1 ~context()

```
virtual cl::sycl::detail::context::~context ( )  [inline], [virtual]
```

Virtual to call the real destructor.

Definition at line 58 of file context.hpp.

```
00058 {}
```

8.3.2.1.2 Member Function Documentation

8.3.2.1.2.1 get()

```
virtual cl_context cl::sycl::detail::context::get ( ) const  [pure virtual]
```

Return the underlying `cl_context` of the `cl::sycl::context`.

Implemented in cl::sycl::detail::opencl_context, and cl::sycl::detail::host_context.

8.3.2.1.2.2 get_boost_compute()

```
virtual boost::compute::context& cl::sycl::detail::context::get_boost_compute ( )  [pure virtual]
```

Return the underlying `boost::compute::context` of the `cl::sycl::context`.

Implemented in cl::sycl::detail::opencl_context, and cl::sycl::detail::host_context.

8.3.2.1.2.3 get_boost_queue()

```
virtual boost::compute::command_queue& cl::sycl::detail::context::get_boost_queue ( )  [pure
virtual]
```

Return the underlying `boost::compute::command_queue` associated with the context.

Implemented in cl::sycl::detail::opencl_context, and cl::sycl::detail::host_context.

8.3.2.1.2.4 get_devices()

```
virtual vector_class<cl::sycl::device> cl::sycl::detail::context::get_devices ( ) const  [pure
virtual]
```

Returns the set of devices that are part of this context.

Todo virtual cannot be templated template <info::context Param> typename info::param_traits<info::context, Param>::type get_info() const = 0;

Implemented in cl::sycl::detail::host_context, and cl::sycl::detail::opencl_context.

8.3.2.1.2.5 get_platform()

```
virtual cl::sycl::platform cl::sycl::detail::context::get_platform ( ) const  [pure virtual]
```

Returns the SYCL platform that the context is initialized for.

Implemented in cl::sycl::detail::opencl_context, and cl::sycl::detail::host_context.

8.3.2.1.2.6 is_host()

```
virtual bool cl::sycl::detail::context::is_host ( ) const  [pure virtual]
```

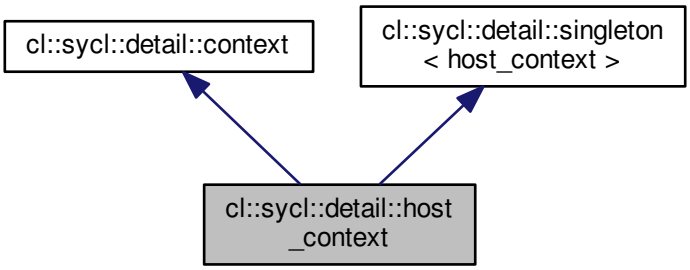
Returns true is the context is a SYCL host context.

Implemented in cl::sycl::detail::host_context, and cl::sycl::detail::opencl_context.

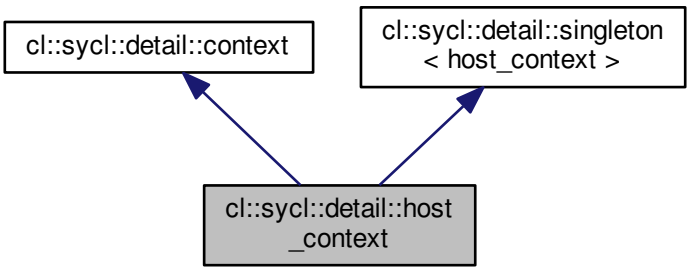
8.3.2.2 class cl::sycl::detail::host_context

Definition at line 32 of file host_context.hpp.

Inheritance diagram for cl::sycl::detail::host_context:



Collaboration diagram for cl::sycl::detail::host_context:



Public Member Functions

- cl_context get () const override

  Return the underlying `cl_context` of the `cl::sycl::context`.
- boost::compute::context & get_boost_compute () override

  Return the SYCL platform that the context is initialized for.
- boost::compute::command_queue & get_boost_queue () override

  Return the internal OpenCL queue that is associated to the host context.
- bool is_host () const override

  Return true since the context is a SYCL host context.
- cl::sycl::platform get_platform () const override

  Return the platform of the context.
- vector_class< cl::sycl::device > get_devices () const override

  Returns the set of devices that are part of this context.

Additional Inherited Members

8.3.2.2.1 Member Function Documentation

8.3.2.2.1.1 get()

```
cl_context cl::sycl::detail::host_context::get ( ) const  [inline], [override], [virtual]
```

Return the underlying `cl_context` of the `cl::sycl::context`.

This throws an error since there is no OpenCL context associated to the host device.

Implements cl::sycl::detail::context.

Definition at line 43 of file host_context.hpp.

```
00043                                {
00044     throw non_cl_error("The host context has no OpenCL context");
00045   }
```

8.3.2.2.1.2 get_boost_compute()

```
boost::compute::context& cl::sycl::detail::host_context::get_boost_compute ( )  [inline],
[override], [virtual]
```

Return the SYCL platform that the context is initialized for.

This throws an error since there is no `boost::compute` context associated to the host device.

Implements cl::sycl::detail::context.

Definition at line 53 of file host_context.hpp.

```
00053                                                {
00054     throw non_cl_error("The host context has no OpenCL context");
00055   }
```

8.3.2.2.1.3 get_boost_queue()

```
boost::compute::command_queue& cl::sycl::detail::host_context::get_boost_queue ( )  [inline],
[override], [virtual]
```

Return the internal OpenCL queue that is associated to the host context.

This throws an error since there is no `boost::compute::command_queue` associated to the host context.

Implements cl::sycl::detail::context.

Definition at line 64 of file host_context.hpp.

Referenced by cl::sycl::detail::buffer_base::sync_with_host().

```
00064                                                 {
00065     throw non_cl_error("The host context cannot have an OpenCL queue");
00066   }
```

Here is the caller graph for this function:

8.3.2.2.1.4 get_devices()

```
vector_class<cl::sycl::device> cl::sycl::detail::host_context::get_devices ( ) const  [inline],
[override], [virtual]
```

Returns the set of devices that are part of this context.

It should only return the host device itself.

Todo To be implemented

Implements cl::sycl::detail::context.

Definition at line 107 of file host_context.hpp.

```
00107                                 {
00108     // Return just the host device
00109     return { {} };
00110   }
```

8.3.2.2.1.5 get_platform()

```
cl::sycl::platform cl::sycl::detail::host_context::get_platform ( ) const  [inline], [override],
[virtual]
```

Return the platform of the context.

Return synchronous errors via the SYCL exception class.

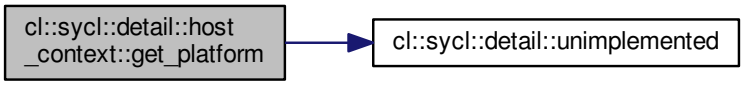
Implements cl::sycl::detail::context.

Definition at line 80 of file host_context.hpp.

References cl::sycl::detail::unimplemented().

```
00080                                                {
00081     // Return the host platform
00082     return {};
00083   }
```

Here is the call graph for this function:



8.3.2.2.1.6 is_host()

```
bool cl::sycl::detail::host_context::is_host ( ) const  [inline], [override], [virtual]
```

Return true since the context is a SYCL host context.

Implements cl::sycl::detail::context.

Definition at line 71 of file host_context.hpp.

```
00071                                {
00072     return true;
00073   }
```

8.3.2.3 class cl::sycl::context

SYCL context.

The context class encapsulates an OpenCL context, which is implicitly created and the lifetime of the context instance defines the lifetime of the underlying OpenCL context instance.

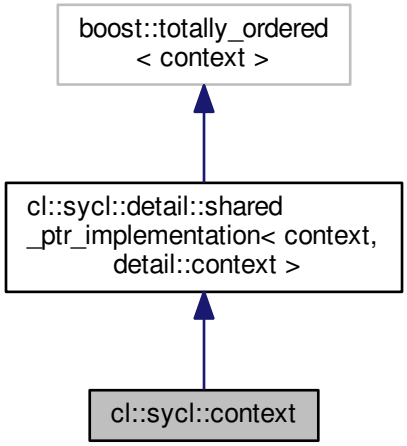
On destruction clReleaseContext is called.

The default context is the SYCL host context containing only the SYCL host device.

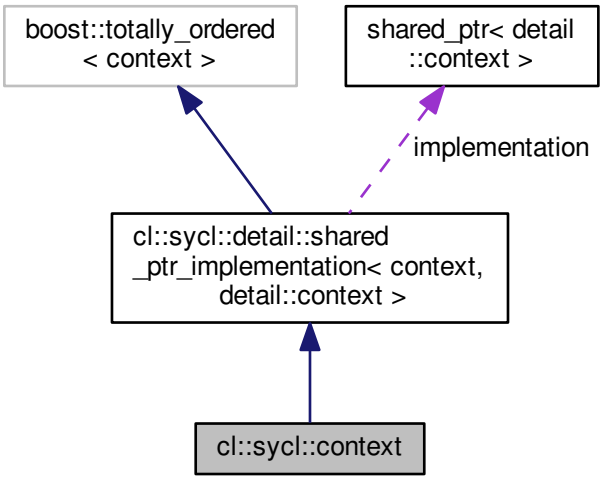
Todo The implementation is quite minimal for now.

Definition at line 48 of file context.hpp.

Inheritance diagram for cl::sycl::context:



Collaboration diagram for cl::sycl::context:



Public Member Functions

- context (async_handler asyncHandler)

  Constructs a context object for SYCL host using an async_handler for handling asynchronous errors.
- context (cl_context clContext, async_handler asyncHandler=nullptr)

  Make a SYCL context from an OpenCL context.
- context (const boost::compute::context &c, async_handler asyncHandler=nullptr)

  Build a SYCL context from a Boost.Compute context.
- context (const device_selector &deviceSelector, info::gl_context_interop interopFlag, async_handler async↩ Handler=nullptr)

  Constructs a context object using a device_selector object.
- context (const device &dev, info::gl_context_interop interopFlag, async_handler asyncHandler=nullptr)

  Constructs a context object using a device object.
- context (const platform &plt, info::gl_context_interop interopFlag, async_handler asyncHandler=nullptr)

  Constructs a context object using a platform object.
- context (const vector_class< device > &deviceList, info::gl_context_interop interopFlag, async_handler asyncHandler=nullptr)
- context ()

  Default constructor that chooses the context according the heuristics of the default selector.
- cl_context get () const

  Return the underlying `cl_context` object, after retaining the `cl_context`.
- boost::compute::context & get_boost_compute () const

  Return the underlying `boost::compute::context` of the `cl::sycl::context`.
- boost::compute::command_queue & get_boost_queue () const

  Return the internal queue that is associated to the context and used by triSYCL to move data between some different contests for example.
- bool is_host () const

  Specifies whether the context is in SYCL Host Execution Mode.

- platform get_platform ()

  Returns the SYCL platform that the context is initialized for.
- vector_class< device > get_devices () const

  Returns the set of devices that are part of this context.
- template<info::context Param>
  info::param_traits< info::context, Param >::type get_info () const

  Queries OpenCL information for the under-lying cl context.

Private Types

- using implementation_t = detail::shared_ptr_implementation< context, detail::context >

Additional Inherited Members

8.3.2.3.1 Member Typedef Documentation

8.3.2.3.1.1 implementation_t

```
using cl::sycl::context::implementation_t = detail::shared_ptr_implementation<context, detail↩
::context>  [private]
```

Definition at line 56 of file context.hpp.

8.3.2.3.2 Constructor & Destructor Documentation

8.3.2.3.2.1 context() [1/8]

```
cl::sycl::context::context (
            async_handler asyncHandler )  [inline], [explicit]
```

Constructs a context object for SYCL host using an async_handler for handling asynchronous errors.

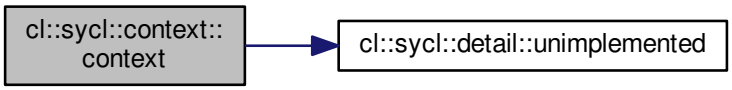
Note that the default case asyncHandler = nullptr is handled by the default constructor.

Definition at line 69 of file context.hpp.

References cl::sycl::detail::unimplemented().

```
00069                                                {
00070     detail::unimplemented();
00071   }
```

Here is the call graph for this function:



8.3.2.3.2.2 context() [2/8]

```
cl::sycl::context::context (
            cl_context clContext,
            async_handler asyncHandler = nullptr )  [inline]
```

Make a SYCL context from an OpenCL context.

The constructor executes a retain on the `cl_context`.

Return synchronous errors via the SYCL exception class and asynchronous errors are handled via the `async_handler`, if provided.

Definition at line 83 of file context.hpp.

```
00084     : context { boost::compute::context { clContext }, asyncHandler } {}
```

8.3.2.3.2.3 context() [3/8]

```
cl::sycl::context::context (
            const boost::compute::context & c,
            async_handler asyncHandler = nullptr )  [inline]
```

Build a SYCL context from a Boost.Compute context.

Definition at line 88 of file context.hpp.

References cl::sycl::detail::opencl_context::instance().

```
00090     : implementation_t { detail::opencl_context::instance(c
      ) } {}
```

Here is the call graph for this function:

8.3.2.3.2.4 context() [4/8]

```
cl::sycl::context::context (
            const device_selector & deviceSelector,
            info::gl_context_interop interopFlag,
            async_handler asyncHandler = nullptr )  [inline]
```

Constructs a context object using a device_selector object.

The context is constructed with a single device retrieved from the device_selector object provided.

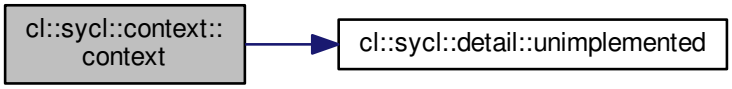
Return synchronous errors via the SYCL exception class and asynchronous errors are handled via the async_↩ handler, if provided.

Definition at line 101 of file context.hpp.

References cl::sycl::detail::unimplemented().

```
00103                                                {
00104     detail::unimplemented();
00105   }
```

Here is the call graph for this function:



8.3.2.3.2.5 context() [5/8]

```
cl::sycl::context::context (
            const device & dev,
            info::gl_context_interop interopFlag,
            async_handler asyncHandler = nullptr )  [inline]
```

Constructs a context object using a device object.

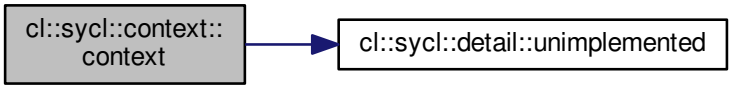
Return synchronous errors via the SYCL exception class and asynchronous errors are handled via the async_↩ handler, if provided.

Definition at line 113 of file context.hpp.

References cl::sycl::detail::unimplemented().

```
00115                                                {
00116     detail::unimplemented();
00117   }
```

Here is the call graph for this function:



8.3.2.3.2.6 context() [6/8]

```
cl::sycl::context::context (
            const platform & plt,
            info::gl_context_interop interopFlag,
            async_handler asyncHandler = nullptr )  [inline]
```

Constructs a context object using a platform object.

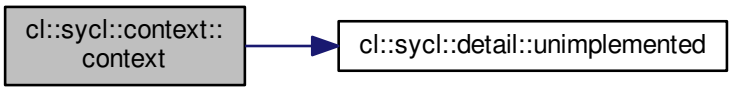
Return synchronous errors via the SYCL exception class and asynchronous errors are handled via the async_↩ handler, if provided.

Definition at line 125 of file context.hpp.

References cl::sycl::detail::unimplemented().

```
00127                                                {
00128     detail::unimplemented();
00129   }
```

Here is the call graph for this function:



8.3.2.3.2.7 context() [7/8]

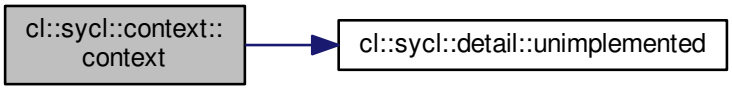
```
cl::sycl::context::context (
            const vector_class< device > & deviceList,
            info::gl_context_interop interopFlag,
            async_handler asyncHandler = nullptr )  [inline]
```

Definition at line 140 of file context.hpp.

References cl::sycl::detail::unimplemented().

```
00142                                                {
00143     detail::unimplemented();
00144   }
```

Here is the call graph for this function:



8.3.2.3.2.8 context() [8/8]

```
cl::sycl::context::context ( )  [inline]
```

Default constructor that chooses the context according the heuristics of the default selector.

Return synchronous errors via the SYCL exception class.

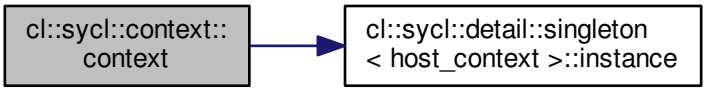
Get the default constructors back.

Definition at line 153 of file context.hpp.

References cl::sycl::detail::singleton< host_context >::instance().

```
00153 : implementation_t { detail::host_context::instance() } {}
```

Here is the call graph for this function:



8.3.2.3.3 Member Function Documentation

8.3.2.3.3.1 get()

```
cl_context cl::sycl::context::get ( ) const  [inline]
```

Return the underlying `cl_context` object, after retaining the `cl_context`.

Retains a reference to the returned `cl_context` object.

Caller should release it when finished.

Definition at line 164 of file context.hpp.

References cl::sycl::detail::shared_ptr_implementation< context, detail::context >::implementation.

```
00164                           {
00165     return implementation->get();
00166   }
```

8.3.2.3.3.2 get_boost_compute()

```
boost::compute::context& cl::sycl::context::get_boost_compute ( ) const  [inline]
```

Return the underlying `boost::compute::context` of the `cl::sycl::context`.

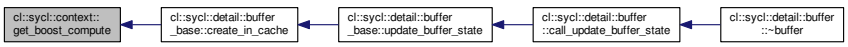
Definition at line 171 of file context.hpp.

References cl::sycl::detail::shared_ptr_implementation< context, detail::context >::implementation.

Referenced by cl::sycl::detail::buffer_base::create_in_cache().

```
00171                                                {
00172     return implementation->get_boost_compute();
00173   }
```

Here is the caller graph for this function:



8.3.2.3.3.3 get_boost_queue()

```
boost::compute::command_queue& cl::sycl::context::get_boost_queue ( ) const  [inline]
```

Return the internal queue that is associated to the context and used by triSYCL to move data between some different contests for example.

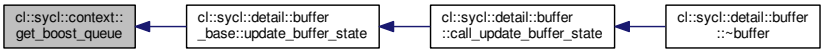
Definition at line 179 of file context.hpp.

References cl::sycl::detail::shared_ptr_implementation< context, detail::context >::implementation.

Referenced by cl::sycl::detail::buffer_base::update_buffer_state().

```
00179                                                    {
00180     return implementation->get_boost_queue();
00181   }
```

Here is the caller graph for this function:



8.3.2.3.3.4 get_devices()

```
vector_class<device> cl::sycl::context::get_devices ( ) const  [inline]
```

Returns the set of devices that are part of this context.

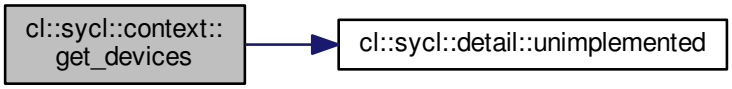
Todo To be implemented

Definition at line 202 of file context.hpp.

References cl::sycl::detail::unimplemented().

```
00202                                          {
00203     detail::unimplemented();
00204     return {};
00205   }
```

Here is the call graph for this function:



8.3.2.3.3.5 get_info()

```
template<info::context Param>
info::param_traits<info::context, Param>::type cl::sycl::context::get_info ( ) const  [inline]
```

Queries OpenCL information for the under-lying cl context.

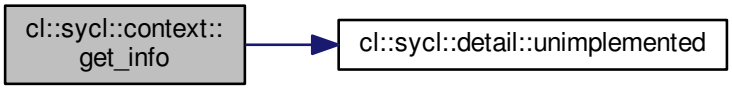
Todo To be implemented

Definition at line 213 of file context.hpp.

References cl::sycl::detail::unimplemented().

```
00213                                                                    {
00214     detail::unimplemented();
00215     return {};
00216   }
```

Here is the call graph for this function:



8.3.2.3.3.6 get_platform()

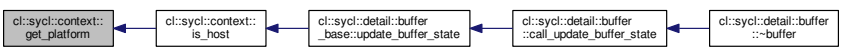
```
platform cl::sycl::context::get_platform ( )
```

Returns the SYCL platform that the context is initialized for.

Todo To be implemented

Referenced by is_host().

Here is the caller graph for this function:



8.3.2.3.3.7 is_host()

```
bool cl::sycl::context::is_host ( ) const  [inline]
```

Specifies whether the context is in SYCL Host Execution Mode.

Definition at line 186 of file context.hpp.

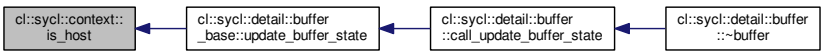
References get_platform(), and cl::sycl::detail::shared_ptr_implementation< context, detail::context >::implementation.

Referenced by cl::sycl::detail::buffer_base::update_buffer_state().

```
00186                         {
00187     return implementation->is_host();
00188   }
```

Here is the call graph for this function:

Here is the caller graph for this function:

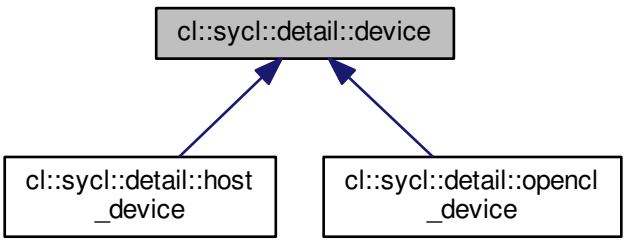


8.3.2.4 class cl::sycl::detail::device

An abstract class representing various models of SYCL devices.

Definition at line 25 of file device.hpp.

Inheritance diagram for cl::sycl::detail::device:



Public Member Functions

- virtual cl_device_id get () const =0

  Return the cl_device_id of the underlying OpenCL platform.
- virtual boost::compute::device & get_boost_compute ()=0

  Return the underlying Boost.Compute device, if any.
- virtual bool is_host () const =0

  Return true if the device is a SYCL host device.
- virtual bool is_cpu () const =0

  Return true if the device is an OpenCL CPU device.
- virtual bool is_gpu () const =0

  Return true if the device is an OpenCL GPU device.
- virtual bool is_accelerator () const =0

  Return true if the device is an OpenCL accelerator device.
- virtual cl::sycl::platform get_platform () const =0

  Return the platform of device.
- virtual bool has_extension (const string_class &extension) const =0

  Query the device for OpenCL info::device info.
- virtual ~device ()

8.3.2.4.1 Constructor & Destructor Documentation

8.3.2.4.1.1 ~device()

```
virtual cl::sycl::detail::device::~device ( )  [inline], [virtual]
```

Definition at line 70 of file device.hpp.

```
00070 {}
```

8.3.2.4.2 Member Function Documentation

8.3.2.4.2.1 get()

```
virtual cl_device_id cl::sycl::detail::device::get ( ) const  [pure virtual]
```

Return the cl_device_id of the underlying OpenCL platform.

Implemented in cl::sycl::detail::opencl_device, and cl::sycl::detail::host_device.

8.3.2.4.2.2 get_boost_compute()

```
virtual boost::compute::device& cl::sycl::detail::device::get_boost_compute ( )  [pure virtual]
```

Return the underlying Boost.Compute device, if any.

Implemented in cl::sycl::detail::host_device, and cl::sycl::detail::opencl_device.

8.3.2.4.2.3 get_platform()

```
virtual cl::sycl::platform cl::sycl::detail::device::get_platform ( ) const  [pure virtual]
```

Return the platform of device.

Implemented in cl::sycl::detail::host_device, and cl::sycl::detail::opencl_device.

8.3.2.4.2.4 has_extension()

```
virtual bool cl::sycl::detail::device::has_extension (
            const string_class & extension ) const  [pure virtual]
```

Query the device for OpenCL info::device info.

Todo virtual cannot be templated template <typename t>=""> virtual T get_info(info::device param) const = 0;

Specify whether a specific extension is supported on the device.

Implemented in cl::sycl::detail::host_device, and cl::sycl::detail::opencl_device.

8.3.2.4.2.5 is_accelerator()

```
virtual bool cl::sycl::detail::device::is_accelerator ( ) const  [pure virtual]
```

Return true if the device is an OpenCL accelerator device.

Implemented in cl::sycl::detail::host_device, and cl::sycl::detail::opencl_device.

8.3.2.4.2.6 is_cpu()

```
virtual bool cl::sycl::detail::device::is_cpu ( ) const  [pure virtual]
```

Return true if the device is an OpenCL CPU device.

Implemented in cl::sycl::detail::host_device, and cl::sycl::detail::opencl_device.

8.3.2.4.2.7 is_gpu()

```
virtual bool cl::sycl::detail::device::is_gpu ( ) const  [pure virtual]
```

Return true if the device is an OpenCL GPU device.

Implemented in cl::sycl::detail::host_device, and cl::sycl::detail::opencl_device.

8.3.2.4.2.8 is_host()

```
virtual bool cl::sycl::detail::device::is_host ( ) const  [pure virtual]
```

Return true if the device is a SYCL host device.

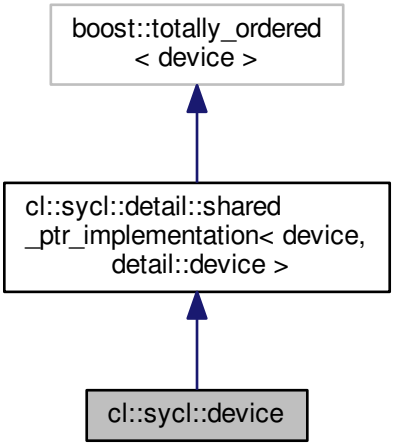
Implemented in cl::sycl::detail::host_device, and cl::sycl::detail::opencl_device.

8.3.2.5 class cl::sycl::device

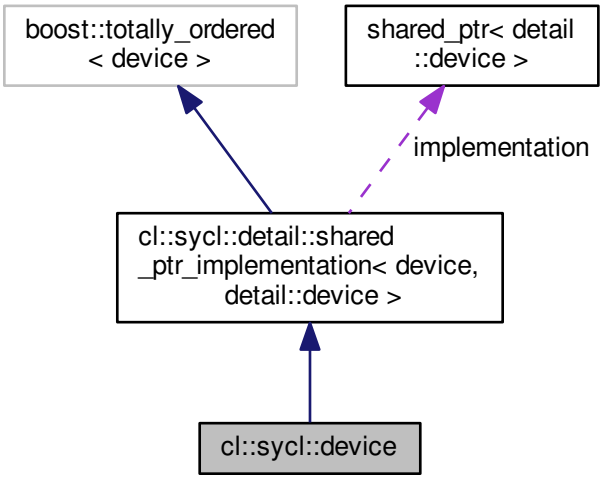
SYCL device.

Definition at line 41 of file device.hpp.

Inheritance diagram for cl::sycl::device:



Collaboration diagram for cl::sycl::device:



Public Member Functions

- device ()
  The default constructor uses the SYCL host device.
- device (cl_device_id device_id)
  Construct a device class instance using cl_device_id of the OpenCL device.
- device (const boost::compute::device &d)
  Construct a device class instance using a boost::compute::device.
- device (const device_selector &ds)
  Construct a device class instance using the device selector provided.
- cl_device_id get () const
  Return the cl_device_id of the underlying OpenCL platform.
- boost::compute::device get_boost_compute () const
  Return the underlying Boost.Compute device if it is an OpenCL device.
- bool is_host () const
  Return true if the device is the SYCL host device.
- bool is_cpu () const
  Return true if the device is an OpenCL CPU device.
- bool is_gpu () const
  Return true if the device is an OpenCL GPU device.
- bool is_accelerator () const
  Return true if the device is an OpenCL accelerator device.
- info::device_type type () const
  Return the device_type of a device.
- platform get_platform () const
  Return the platform of device.
- template<typename T >
  T get_info (info::device param) const

Query the device for OpenCL info::device info.

- template<info::device Param>
  auto get_info () const

  Query the device for OpenCL info::device info.
- bool has_extension (const string_class &extension) const

  Test if a specific extension is supported on the device.

Static Public Member Functions

- static vector_class< device > get_devices (info::device_type device_type=info::device_type::all) TRISYCL_WEAK_ATTRIB_SUFFIX

  Return a list of all available devices.

Private Types

- using implementation_t = detail::shared_ptr_implementation< device, detail::device >

Additional Inherited Members

8.3.2.5.1 Member Typedef Documentation

8.3.2.5.1.1 implementation_t

```
using cl::sycl::device::implementation_t = detail::shared_ptr_implementation<device, detail::device>  [private]
```

Definition at line 48 of file device.hpp.

8.3.2.5.2 Constructor & Destructor Documentation

8.3.2.5.2.1 device() [1/4]

```
cl::sycl::device::device ( )  [inline]
```

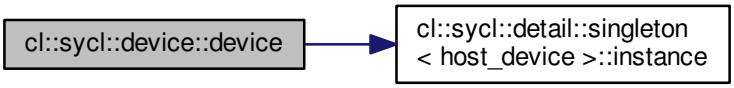
The default constructor uses the SYCL host device.

Definition at line 56 of file device.hpp.

References cl::sycl::detail::singleton< host_device >::instance().

```
00056 : implementation_t { detail::host_device::instance() } {}
```

Here is the call graph for this function:



8.3.2.5.2.2 device() [2/4]

```
cl::sycl::device::device (
              cl_device_id device_id )  [inline]
```

Construct a device class instance using cl_device_id of the OpenCL device.

Return synchronous errors via the SYCL exception class.

Retain a reference to the OpenCL device and if this device was an OpenCL subdevice the device should be released by the caller when it is no longer needed.

Definition at line 69 of file device.hpp.

```
00070     : device { boost::compute::device { device_id } } {}
```

8.3.2.5.2.3 device() [3/4]

```
cl::sycl::device::device (
              const boost::compute::device & d )  [inline]
```

Construct a device class instance using a boost::compute::device.

This is a triSYCL extension for boost::compute interoperation.

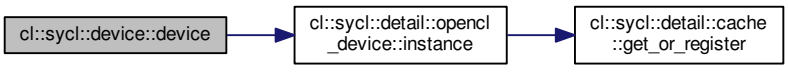
Return synchronous errors via the SYCL exception class.

Definition at line 79 of file device.hpp.

References cl::sycl::detail::opencl_device::instance().

```
00080     : implementation_t { detail::opencl_device::instance(d)
      } {}
```

Here is the call graph for this function:



8.3.2.5.2.4 device() [4/4]

```
cl::sycl::device::device (
            const device_selector & ds )  [inline], [explicit]
```

Construct a device class instance using the device selector provided.

Return errors via C++ exception class.

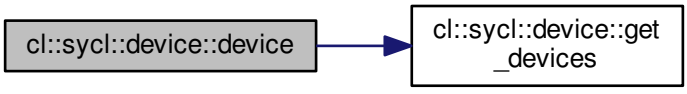
Todo Make it non-explicit in the specification?

Definition at line 91 of file device.hpp.

References get_devices(), and cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

```
00091                                           {
00092     auto devices = device::get_devices();
00093     if (devices.empty())
00094       // \todo Put a SYCL exception
00095       throw std::domain_error("No device at all! Internal error...");
00096
00097     /* Find the device with the best score according to the given
00098        device_selector */
00099     auto max = std::max_element(devices.cbegin(), devices.cend(),
00100                                 [&] (const device &d1, const device &d2) {
00101                                   return ds(d1) < ds(d2);
00102                                 });
00103     if (ds(*max) < 0)
00104       // \todo Put a SYCL exception
00105       throw std::domain_error("No device selected because no positive "
00106                               "device_selector score found");
00107
00108     // Create the current device as a shared copy of the selected one
00109     implementation = max->implementation;
00110   }
```

Here is the call graph for this function:



8.3.2.5.3 Member Function Documentation

8.3.2.5.3.1 get()

```
cl_device_id cl::sycl::device::get ( ) const  [inline]
```

Return the cl_device_id of the underlying OpenCL platform.

Return synchronous errors via the SYCL exception class.

Retain a reference to the returned cl_device_id object. Caller should release it when finished.

In the case where this is the SYCL host device it will throw an exception.

Definition at line 124 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

```
00124                            {
00125     return implementation->get();
00126   }
```

8.3.2.5.3.2 get_boost_compute()

```
boost::compute::device cl::sycl::device::get_boost_compute ( ) const  [inline]
```

Return the underlying Boost.Compute device if it is an OpenCL device.

This is a triSYCL extension

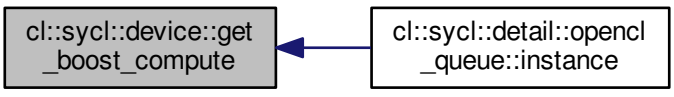
Definition at line 134 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

Referenced by cl::sycl::detail::opencl_queue::instance().

```
00134                                          {
00135     return implementation->get_boost_compute();
00136   }
```

Here is the caller graph for this function:



8.3.2.5.3.3 get_info() [1/2]

```
template<typename T >
T cl::sycl::device::get_info (
             info::device param ) const  [inline]
```

Query the device for OpenCL info::device info.

Return synchronous errors via the SYCL exception class.

Todo

Definition at line 211 of file device.hpp.

References get_info().

```
00211                                    {
00212     //return implementation->get_info<Param>(param);
00213   }
```

Here is the call graph for this function:

8.3.2.5.3.4 get_info() [2/2]

```
template<info::device Param>
auto cl::sycl::device::get_info ( ) const  [inline]
```

Query the device for OpenCL info::device info.

Return synchronous errors via the SYCL exception class.

Todo

Referenced by get_info().

Here is the caller graph for this function:

8.3.2.5.3.5 get_platform()

```
platform cl::sycl::device::get_platform ( ) const  [inline]
```

Return the platform of device.

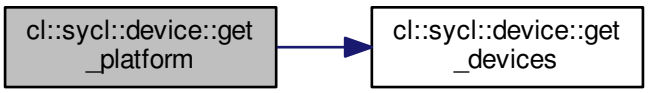
Return synchronous errors via the SYCL exception class.

Definition at line 188 of file device.hpp.

References cl::sycl::info::all, get_devices(), cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation, and TRISYCL_WEAK_ATTRIB_SUFFIX.

```
00188                                {
00189     return implementation->get_platform();
00190   }
```

Here is the call graph for this function:



8.3.2.5.3.6 has_extension()

```
bool cl::sycl::device::has_extension (
             const string_class & extension ) const  [inline]
```

Test if a specific extension is supported on the device.

Definition at line 233 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

```
00233                                                    {
00234     return implementation->has_extension(extension);
00235   }
```

8.3.2.5.3.7 is_accelerator()

```
bool cl::sycl::device::is_accelerator ( ) const  [inline]
```

Return true if the device is an OpenCL accelerator device.

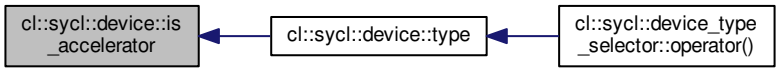
Definition at line 159 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

Referenced by type().

```
00159                                {
00160     return implementation->is_accelerator();
00161   }
```

Here is the caller graph for this function:



8.3.2.5.3.8 is_cpu()

```
bool cl::sycl::device::is_cpu ( ) const  [inline]
```

Return true if the device is an OpenCL CPU device.

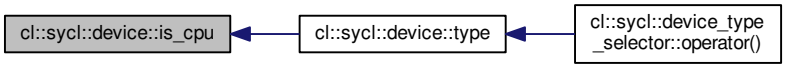
Definition at line 147 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

Referenced by type().

```
00147                        {
00148     return implementation->is_cpu();
00149   }
```

Here is the caller graph for this function:



8.3.2.5.3.9 is_gpu()

```
bool cl::sycl::device::is_gpu ( ) const  [inline]
```

Return true if the device is an OpenCL GPU device.

Definition at line 153 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

Referenced by type().

```
00153                         {
00154     return implementation->is_gpu();
00155   }
```

Here is the caller graph for this function:

8.3.2.5.3.10 is_host()

```
bool cl::sycl::device::is_host ( ) const  [inline]
```

Return true if the device is the SYCL host device.

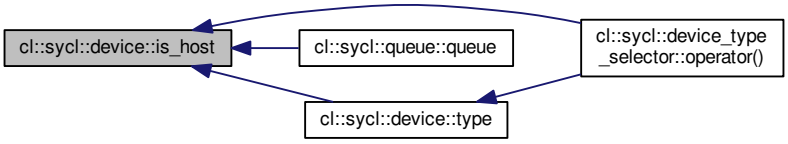
Definition at line 141 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

Referenced by cl::sycl::device_type_selector::operator()(), cl::sycl::queue::queue(), and type().

```
00141                         {
00142     return implementation->is_host();
00143   }
```

Here is the caller graph for this function:



8.3.2.5.3.11 type()

```
info::device_type cl::sycl::device::type ( ) const  [inline]
```

Return the device_type of a device.

Todo Present in Boost.Compute, to be added to the specification

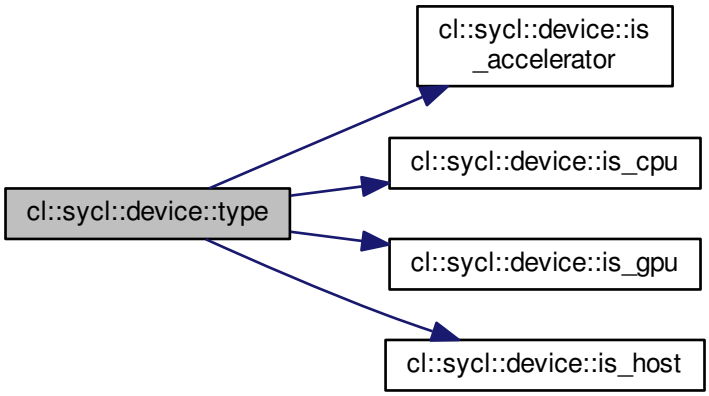
Definition at line 169 of file device.hpp.

References cl::sycl::info::accelerator, cl::sycl::info::cpu, cl::sycl::info::gpu, cl::sycl::info::host, is_accelerator(), is_cpu(), is_gpu(), and is_host().

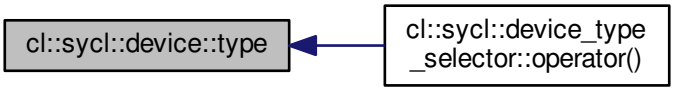
Referenced by cl::sycl::device_type_selector::operator()().

```
00169                                {
00170     if (is_host())
00171       return info::device_type::host;
00172     else if (is_cpu())
00173       return info::device_type::cpu;
00174     else if (is_gpu())
00175       return info::device_type::gpu;
00176     else if (is_accelerator())
00177       return info::device_type::accelerator;
00178     else
00179       // \todo Put a SYCL exception
00180       throw std::domain_error("Unknown cl::sycl::info::device_type");
00181   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



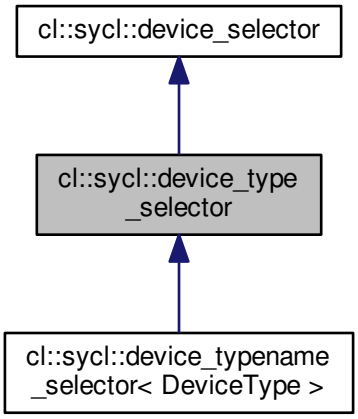
8.3.2.6 class cl::sycl::device_type_selector

A device selector by device_type.

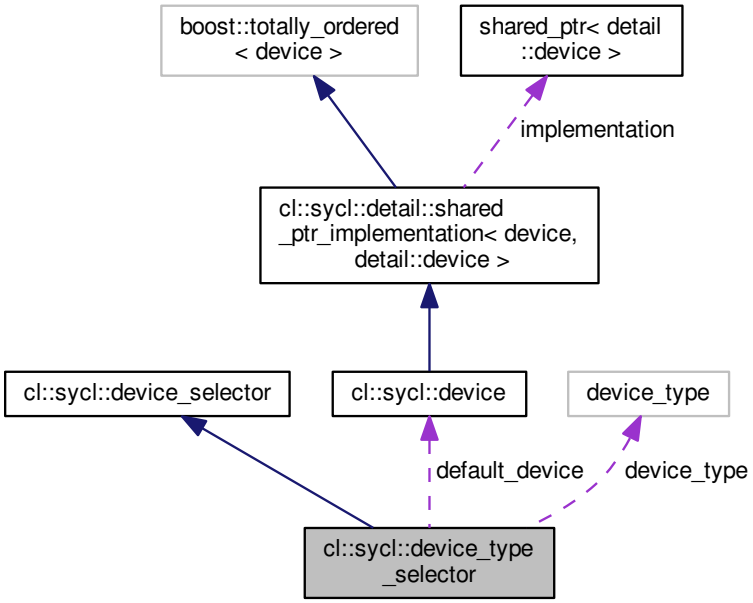
Todo To be added to the specification

Definition at line 32 of file device_selector_tail.hpp.

Inheritance diagram for cl::sycl::device_type_selector:



Collaboration diagram for cl::sycl::device_type_selector:



Public Member Functions

- device_type_selector (info::device_type device_type)
- int operator() (const device &dev) const override

  This pure virtual operator allows the customization of device selection.

Private Attributes

- info::device_type device_type

  The device_type to select.
- device default_device

  Cache the default device to select with the default device selector.

8.3.2.6.1 Constructor & Destructor Documentation

8.3.2.6.1.1 device_type_selector()

```
cl::sycl::device_type_selector::device_type_selector (
              info::device_type device_type )  [inline]
```

Definition at line 48 of file device_selector_tail.hpp.

References cl::sycl::info::defaults.

```
00049     : device_type { device_type } {
00050     // The default device selection heuristic
00051 #ifdef TRISYCL_OPENCL
00052     if (device_type == info::device_type::defaults) {
00053       // Ask Boost.Compute for the default OpenCL device
00054       try {
00055         default_device = boost::compute::system::default_device();
00056       }
00057       catch (...) {
00058         /* If there is no OpenCL device, just keep the
00059            default-constructed device, which is the host device */
00060       }
00061     }
00062 #endif
00063   }
```

8.3.2.6.2 Member Function Documentation

8.3.2.6.2.1 operator()()

```
int cl::sycl::device_type_selector::operator() (
            const device & dev ) const  [inline], [override], [virtual]
```

This pure virtual operator allows the customization of device selection.

It defines the behavior of the device_selector functor called by the SYCL runtime on device selection. It returns a "score" for each device in the system and the highest rated device will be used by the SYCL runtime.

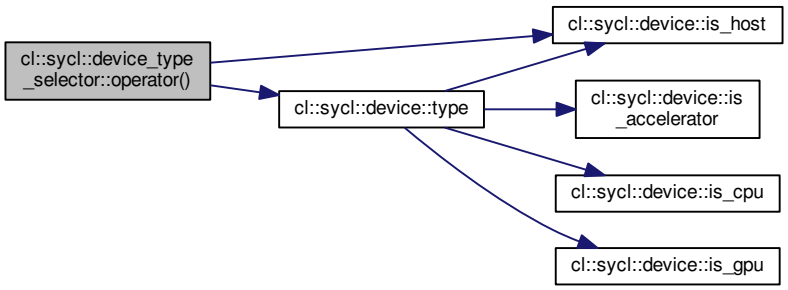
Implements cl::sycl::device_selector.

Definition at line 67 of file device_selector_tail.hpp.

References cl::sycl::info::all, cl::sycl::info::defaults, cl::sycl::device::is_host(), cl::sycl::info::opencl, and cl::sycl::device::type().

```
00067                                                {
00068     if (device_type == info::device_type::all)
00069       // All devices fit all
00070       return 1;
00071
00072     if (device_type == info::device_type::defaults)
00073       // Only select the default device
00074       return dev == default_device ? 1 : -1;
00075
00076     if (device_type == info::device_type::opencl)
00077       // For now, any non host device is an OpenCL device
00078       return dev.is_host() ? -1 : 1;
00079
00080     return dev.type() == device_type ? 1 : -1;
00081   }
```

Here is the call graph for this function:



8.3.2.6.3 Member Data Documentation

8.3.2.6.3.1 default_device

```
device cl::sycl::device_type_selector::default_device  [private]
```

Cache the default device to select with the default device selector.

This is the host device at construction time and remains as is if there is no openCL device

Definition at line 44 of file device_selector_tail.hpp.

8.3.2.6.3.2 device_type

```
info::device_type cl::sycl::device_type_selector::device_type  [private]
```

The device_type to select.

Definition at line 37 of file device_selector_tail.hpp.

8.3.2.7 class cl::sycl::device_typename_selector

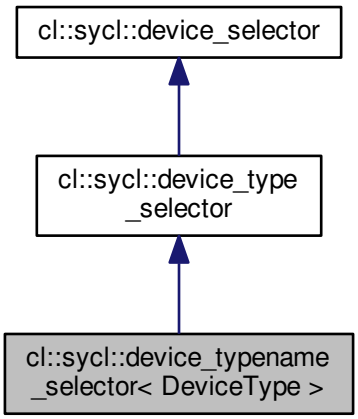
template<info::device_type DeviceType>
class cl::sycl::device_typename_selector< DeviceType >

Select a device by template device_type parameter.

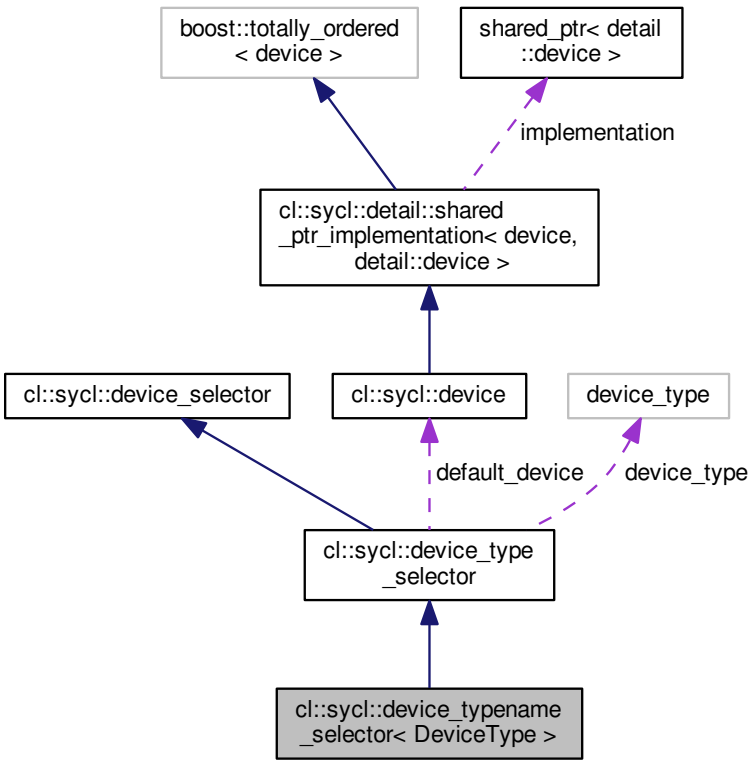
Todo To be added to the specification

Definition at line 91 of file device_selector_tail.hpp.

Inheritance diagram for cl::sycl::device_typename_selector< DeviceType >:



Collaboration diagram for cl::sycl::device_typename_selector< DeviceType >:



Public Member Functions

- device_typename_selector ()

8.3.2.7.1 Constructor & Destructor Documentation

8.3.2.7.1.1 device_typename_selector()

```
template<info::device_type DeviceType>
cl::sycl::device_typename_selector< DeviceType >::device_typename_selector ( )  [inline]
```

Definition at line 95 of file device_selector_tail.hpp.

```
00095 : device_type_selector { DeviceType } {}
```

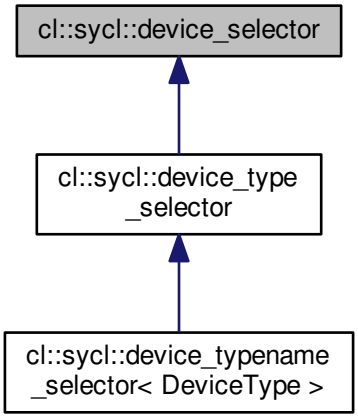
8.3.2.8 class cl::sycl::device_selector

The SYCL heuristics to select a device.

The device with the highest score is selected

Definition at line 26 of file device_selector.hpp.

Inheritance diagram for cl::sycl::device_selector:



Public Member Functions

- void select_device () const

  Returns a selected device using the functor operator defined in sub-classes operator()(const device &dev)
- virtual int operator() (const device &dev) const =0

  This pure virtual operator allows the customization of device selection.
- virtual ~device_selector ()

  Virtual destructor so the final destructor can be called if any.

8.3.2.8.1 Constructor & Destructor Documentation

8.3.2.8.1.1 ~device_selector()

```
virtual cl::sycl::device_selector::~device_selector ( )  [inline], [virtual]
```

Virtual destructor so the final destructor can be called if any.

Definition at line 52 of file device_selector.hpp.

```
00052 {}
```

8.3.2.8.2 Member Function Documentation

8.3.2.8.2.1 operator()()

```
virtual int cl::sycl::device_selector::operator() (
            const device & dev ) const  [pure virtual]
```

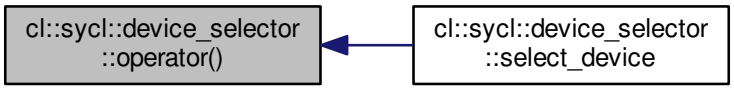
This pure virtual operator allows the customization of device selection.

It defines the behavior of the device_selector functor called by the SYCL runtime on device selection. It returns a "score" for each device in the system and the highest rated device will be used by the SYCL runtime.

Implemented in cl::sycl::device_type_selector.

Referenced by select_device().

Here is the caller graph for this function:



8.3.2.8.2.2 select_device()

```
void cl::sycl::device_selector::select_device ( ) const  [inline]
```

Returns a selected device using the functor operator defined in sub-classes operator()(const device &dev)

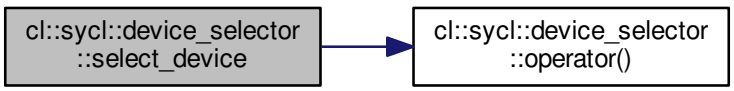
Todo Remove this from specification

Definition at line 35 of file device_selector.hpp.

References operator()().

```
00035                                {
00036     //    return {};
00037   }
```

Here is the call graph for this function:



8.3.2.9 class cl::sycl::handler

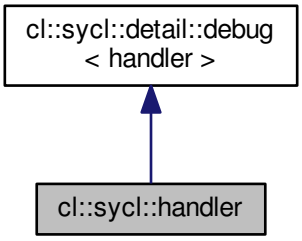
Command group handler class.

A command group handler object can only be constructed by the SYCL runtime.

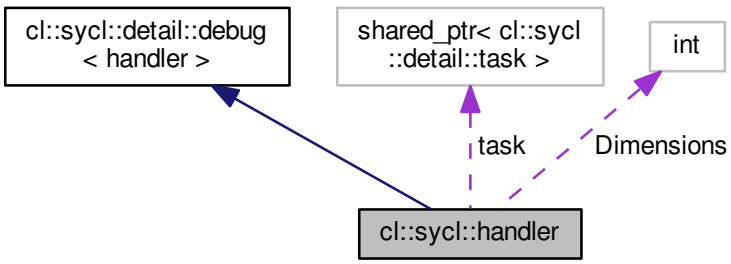
All of the accessors defined in the command group scope take as a parameter an instance of the command group handler and all the kernel invocation functions are methods of this class.

Definition at line 44 of file handler.hpp.

Inheritance diagram for cl::sycl::handler:



Collaboration diagram for cl::sycl::handler:



Public Member Functions

- handler (const std::shared_ptr< detail::queue > &q)
- template<typename DataType , int Dimensions, access::mode Mode, access::target Target = access::target::global_buffer>
  void set_arg (int arg_index, accessor< DataType, Dimensions, Mode, Target > &&acc_obj)

  Set accessor kernel arg for an OpenCL kernel which is used through the SYCL/OpenCL interop interface.
- template<typename T , typename = std::enable_if_t<is_wrapper<T>::value>>
  void set_arg (int arg_index, T &&scalar_value)

Set kernel args for an OpenCL kernel which is used through the SYCL/OpenCL interoperability interface with a wrapper type.

- template<typename T >
  std::enable_if_t<!is_wrapper< T >::value > set_arg (int arg_index, T &&scalar_value)

  Set kernel args for an OpenCL kernel which is used through the SYCL/OpenCL interoperability interface without a wrapper type.
- template<typename... Ts>
  void set_args (Ts &&... args)

  Set all kernel args for an OpenCL kernel which is used through the SYCL/OpenCL interop interface.
- template<typename KernelName = std::nullptr_t>
  void single_task (std::function< void(void)> F)

  Kernel invocation method of a kernel defined as a lambda or functor.
- TRISYCL_parallel_for_functor_GLOBAL (1) TRISYCL_parallel_for_functor_GLOBAL(2) TRISYCL_parallel_for_functor_GLOBAL(3) TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(1) TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(2) TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(3) template< typename KernelName

  Kernel invocation method of a kernel defined as a lambda or functor, for the specified range and offset and given an id or item for indexing in the indexing space defined by range.
- int ParallelForFunctor void parallel_for (nd_range< Dimensions > r, ParallelForFunctor f)
- template<typename KernelName = std::nullptr_t, int Dimensions = 1, typename ParallelForFunctor >
  void parallel_for_work_group (nd_range< Dimensions > r, ParallelForFunctor f)

  Hierarchical kernel invocation method of a kernel defined as a lambda encoding the body of each work-group to launch.
- template<typename KernelName = std::nullptr_t, int Dimensions = 1, typename ParallelForFunctor >
  void parallel_for_work_group (range< Dimensions > r1, range< Dimensions > r2, ParallelForFunctor f)

  Hierarchical kernel invocation method of a kernel defined as a lambda encoding the body of each work-group to launch.
- void single_task (kernel sycl_kernel)

  Kernel invocation method of a kernel defined as pointer to a kernel object, described in detail in 3.5.3.

Public Attributes

- std::shared_ptr< detail::task > task

  Attach the task and accessors to it.
- int Dimensions

Private Member Functions

- template<std::size_t... Is, typename... Ts>
  void dispatch_set_arg (std::index_sequence< Is... >, Ts &&... args)

  Helper to individually call set_arg() for each argument.

8.3.2.9.1 Constructor & Destructor Documentation

8.3.2.9.1.1 handler()

```
cl::sycl::handler::handler (
            const std::shared_ptr< detail::queue > & q )  [inline]
```

Definition at line 62 of file handler.hpp.

References Dimensions, and cl::sycl::access::global_buffer.

```
00062                                                {
00063     // Create a new task for this command_group
00064     task = std::make_shared<detail::task>(q);
00065   }
```

8.3.2.9.2 Member Function Documentation

8.3.2.9.2.1 dispatch_set_arg()

```
template<std::size_t...  Is, typename...  Ts>
void cl::sycl::handler::dispatch_set_arg (
             std::index_sequence< Is...  > ,
             Ts &&...  args )  [inline], [private]
```

Helper to individually call set_arg() for each argument.

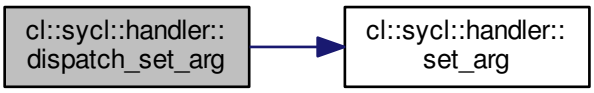
Definition at line 133 of file handler.hpp.

References set_arg().

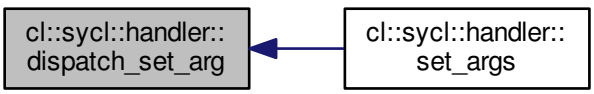
Referenced by set_args().

```
00133                                                                    {
00134     // Use an intermediate tuple to ease individual argument access
00135     auto &&t = std::make_tuple(std::forward<Ts>(args)...);
00136     // Dispatch individual set_arg() for each argument
00137     auto just_to_evaluate = {
00138       0 /*< At least 1 element to deal with empty set_args() */,
00139       ( set_arg(Is, std::forward<Ts>(std::get<Is>(t))), 0)...
00140     };
00141     // Remove the warning about unused variable
00142     static_cast<void>(just_to_evaluate);
00143   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.3.2.9.2.2 parallel_for()

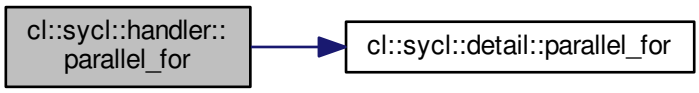
```
int ParallelForFunctor void cl::sycl::handler::parallel_for (
            nd_range< Dimensions > r,
            ParallelForFunctor f )  [inline]
```

Definition at line 285 of file handler.hpp.

References cl::sycl::detail::parallel_for().

```
00285                                                                {
00286     task->schedule(detail::trace_kernel<KernelName>([=] {
00287           detail::parallel_for(r, f);
00288         }));
00289   }
```

Here is the call graph for this function:



8.3.2.9.2.3 parallel_for_work_group() [1/2]

```
template<typename KernelName = std::nullptr_t, int Dimensions = 1, typename ParallelForFunctor
>
void cl::sycl::handler::parallel_for_work_group (
            nd_range< Dimensions > r,
            ParallelForFunctor f )  [inline]
```

Hierarchical kernel invocation method of a kernel defined as a lambda encoding the body of each work-group to launch.

May contain multiple kernel built-in parallel_for_work_item functions representing the execution on each work-item.

Launch num_work_groups work-groups of runtime-defined size. Described in detail in 3.5.3.

Parameters

r	defines the iteration space with the work-group layout and offset
Dimensions	dimensionality of the iteration space
f	is the kernel functor to execute
ParallelForFunctor	is the kernel functor type
KernelName	is a class type that defines the name to be used for the underlying kernel

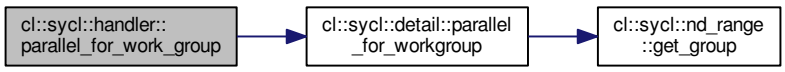
Definition at line 316 of file handler.hpp.

References cl::sycl::detail::parallel_for_workgroup().

Referenced by parallel_for_work_group().

```
00317                                                 {
00318     task->schedule(detail::trace_kernel<KernelName>([=] {
00319           detail::parallel_for_workgroup(r, f); }));
00320   }
```

Here is the call graph for this function:



Here is the caller graph for this function:

8.3.2.9.2.4 parallel_for_work_group() [2/2]

```
template<typename KernelName = std::nullptr_t, int Dimensions = 1, typename ParallelForFunctor
>
void cl::sycl::handler::parallel_for_work_group (
             range< Dimensions > r1,
             range< Dimensions > r2,
             ParallelForFunctor f )  [inline]
```

Hierarchical kernel invocation method of a kernel defined as a lambda encoding the body of each work-group to launch.

May contain multiple kernel built-in parallel_for_work_item functions representing the execution on each work-item.

Launch num_work_groups work-groups of runtime-defined size. Described in detail in 3.5.3.

Parameters

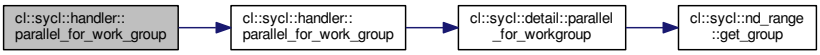
r	defines the iteration space with the work-group layout and offset
Dimensions	dimensionality of the iteration space
f	is the kernel functor to execute
ParallelForFunctor	is the kernel functor type
KernelName	is a class type that defines the name to be used for the underlying kernel

Definition at line 347 of file handler.hpp.

References parallel_for_work_group().

```
00348                                                    {
00349     parallel_for_work_group(nd_range<Dimensions> { r1, r2 }, f);
00350   }
```

Here is the call graph for this function:



8.3.2.9.2.5 set_arg() [1/3]

```
template<typename DataType , int Dimensions, access::mode Mode, access::target Target = access↩
::target::global_buffer>
void cl::sycl::handler::set_arg (
            int arg_index,
            accessor< DataType, Dimensions, Mode, Target > && acc_obj )  [inline]
```

Set accessor kernel arg for an OpenCL kernel which is used through the SYCL/OpenCL interop interface.

The index value specifies which parameter of the OpenCL kernel is being set and the accessor object, which OpenCL buffer or image is going to be given as kernel argument.

Todo Update the specification to use a ref && to the accessor instead?

Todo It is not that clean to have set_arg() associated to a command handler. Rethink the specification?

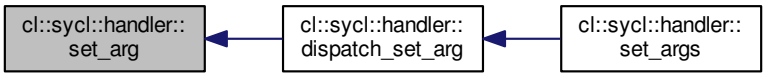
Todo It seems more logical to have these methods on kernel instead

Definition at line 87 of file handler.hpp.

Referenced by dispatch_set_arg().

```
00088                                                                    {
00089     /* Think about setting the kernel argument before actually calling
00090        the kernel.
00091
00092        Explicitly capture task by copy instead of having this captured
00093        by reference and task by reference by side effect */
00094     task->add_prelude([=, task = task] {
00095         task->get_kernel().get_boost_compute()
00096           .set_arg(arg_index, acc_obj.implementation->get_cl_buffer());
00097       });
00098   }
```

Here is the caller graph for this function:



8.3.2.9.2.6 set_arg() [2/3]

```
template<typename T , typename = std::enable_if_t<is_wrapper<T>::value>>
void cl::sycl::handler::set_arg (
             int arg_index,
             T && scalar_value )  [inline]
```

Set kernel args for an OpenCL kernel which is used through the SYCL/OpenCL interoperability interface with a wrapper type.

Definition at line 105 of file handler.hpp.

```
00105                                                {
00106     /* Explicitly capture task by copy instead of having this captured
00107        by reference and task by reference by side effect */
00108     task->add_prelude([=, task = task] {
00109         task->get_kernel().get_boost_compute()
00110           .set_arg(arg_index, scalar_value.unwrap());
00111       });
00112   }
```

8.3.2.9.2.7 set_arg() [3/3]

```
template<typename T >
std::enable_if_t<!is_wrapper<T>::value> cl::sycl::handler::set_arg (
             int arg_index,
             T && scalar_value )  [inline]
```

Set kernel args for an OpenCL kernel which is used through the SYCL/OpenCL interoperability interface without a wrapper type.

Definition at line 120 of file handler.hpp.

```
00120                                          {
00121     /* Explicitly capture task by copy instead of having this captured
00122        by reference and task by reference by side effect */
00123     task->add_prelude([=, task = task] {
00124         task->get_kernel().get_boost_compute()
00125           .set_arg(arg_index, scalar_value);
00126       });
00127   }
```

8.3.2.9.2.8 set_args()

```
template<typename...  Ts>
void cl::sycl::handler::set_args (
             Ts &&...  args )  [inline]
```

Set all kernel args for an OpenCL kernel which is used through the SYCL/OpenCL interop interface.

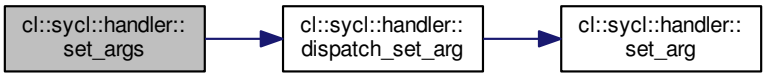
Todo Update the specification to add this function according to https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15978 proposal

Definition at line 154 of file handler.hpp.

References dispatch_set_arg().

```
00154                                {
00155     /* Construct a set of increasing argument index to be able to call
00156        the real set_arg */
00157     dispatch_set_arg(std::index_sequence_for<Ts...>{},
00158                      std::forward<Ts>(args)...);
00159   }
```

Here is the call graph for this function:



8.3.2.9.2.9 single_task() [1/2]

```
template<typename KernelName = std::nullptr_t>
void cl::sycl::handler::single_task (
             std::function< void(void)> F )  [inline]
```

Kernel invocation method of a kernel defined as a lambda or functor.

If it is a lambda function or the functor type is globally visible there is no need for the developer to provide a kernel name type (typename KernelName) for it, as described in 3.5.3

SYCL single_task launches a computation without parallelism at launch time.

Parameters

F	specify the kernel to be launched as a single_task
KernelName	is a class type that defines the name to be used for the underlying kernel

Definition at line 177 of file handler.hpp.

```
00177                                                {
00178     task->schedule(detail::trace_kernel<KernelName>(F));
00179   }
```

8.3.2.9.2.10 single_task() [2/2]

```
void cl::sycl::handler::single_task (
             kernel sycl_kernel )  [inline]
```

Kernel invocation method of a kernel defined as pointer to a kernel object, described in detail in 3.5.3.

Todo Add in the spec a version taking a kernel and a functor, to have host fall-back

Definition at line 359 of file handler.hpp.

References cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::implementation.

```
00359                                       {
00360     /* For now just use the usual host task system to schedule          \
00361        manually the OpenCL kernels instead of using OpenCL event-based  \
00362        scheduling                                                       \
00363                                                                         \
00364        \todo Move the tracing inside the kernel implementation          \
00365                                                                         \
00366        \todo Simplify this 2 step ugly interface                        \
00367     */                                                                  \
00368     task->set_kernel(sycl_kernel.implementation);                       \
00369     task->schedule(detail::trace_kernel<kernel>([=, t = task] {         \
00370           sycl_kernel.implementation->single_task(t, t->get_queue());  \
00371         }));                                                            \
00372   }
```

8.3.2.9.2.11 TRISYCL_parallel_for_functor_GLOBAL()

```
cl::sycl::handler::TRISYCL_parallel_for_functor_GLOBAL (
             1  )
```

Kernel invocation method of a kernel defined as a lambda or functor, for the specified range and offset and given an id or item for indexing in the indexing space defined by range.

If it is a lambda function or the if the functor type is globally visible there is no need for the developer to provide a kernel name type (typename KernelName) for it, as described in detail in 3.5.3

Parameters

global_size	is the global size of the range<>
offset	is the offset to be add to the id<> during iteration
f	is the kernel functor to execute
ParallelForFunctor	is the kernel functor type
KernelName	is a class type that defines the name to be used for the underlying kernel

Unfortunately, to have implicit conversion to work on the range, the function can not be templated, so instantiate it for all the dimensionsKernel invocation method of a kernel defined as a lambda or functor, for the specified nd_range and given an nd_item for indexing in the indexing space defined by the nd_range

If it is a lambda function or the if the functor type is globally visible there is no need for the developer to provide a kernel name type (typename KernelName) for it, as described in detail in 3.5.3

Parameters

r	defines the iteration space with the work-group layout and offset
Dimensions	dimensionality of the iteration space
f	is the kernel functor to execute
ParallelForFunctor	is the kernel functor type
KernelName	is a class type that defines the name to be used for the underlying kernel

8.3.2.9.3 Member Data Documentation

8.3.2.9.3.1 Dimensions

```
int cl::sycl::handler::Dimensions
```

Definition at line 283 of file handler.hpp.

Referenced by handler().

8.3.2.9.3.2 task

```
std::shared_ptr<detail::task> cl::sycl::handler::task
```

Attach the task and accessors to it.

Definition at line 50 of file handler.hpp.

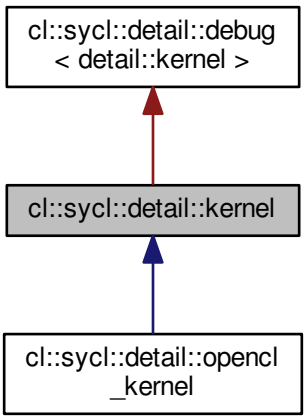
Referenced by cl::sycl::detail::add_buffer_to_task().

8.3.2.10 class cl::sycl::detail::kernel

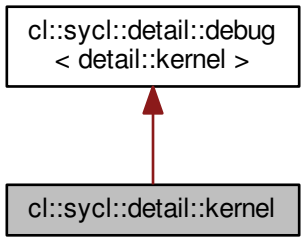
Abstract SYCL kernel.

Definition at line 31 of file kernel.hpp.

Inheritance diagram for cl::sycl::detail::kernel:



Collaboration diagram for cl::sycl::detail::kernel:



Public Member Functions

- virtual cl_kernel get () const =0

  Return the OpenCL kernel object for this kernel.
- virtual boost::compute::kernel get_boost_compute () const =0

  Return the Boost.Compute OpenCL kernel object for this kernel.
- virtual void single_task (std::shared_ptr< detail::task > task, std::shared_ptr< detail::queue > q)=0

  Launch a single task of the kernel.
- TRISYCL_ParallelForKernel_RANGE (1) TRISYCL_ParallelForKernel_RANGE(2) TRISYCL_ParallelFor↩ Kernel_RANGE(3) virtual ~kernel()

  Return the context that this kernel is defined for.

8.3.2.10.1 Member Function Documentation

8.3.2.10.1.1 get()

```
virtual cl_kernel cl::sycl::detail::kernel::get ( ) const  [pure virtual]
```

Return the OpenCL kernel object for this kernel.

Retains a reference to the returned cl_kernel object. Caller should release it when finished.

Implemented in cl::sycl::detail::opencl_kernel.

8.3.2.10.1.2 get_boost_compute()

```
virtual boost::compute::kernel cl::sycl::detail::kernel::get_boost_compute ( ) const  [pure
virtual]
```

Return the Boost.Compute OpenCL kernel object for this kernel.

This is an extension.

Implemented in cl::sycl::detail::opencl_kernel.

8.3.2.10.1.3 single_task()

```
virtual void cl::sycl::detail::kernel::single_task (
            std::shared_ptr< detail::task > task,
            std::shared_ptr< detail::queue > q )  [pure virtual]
```

Launch a single task of the kernel.

Implemented in cl::sycl::detail::opencl_kernel.

8.3.2.10.1.4 TRISYCL_ParallelForKernel_RANGE()

```
cl::sycl::detail::kernel::TRISYCL_ParallelForKernel_RANGE (
            1  )  [inline]
```

Return the context that this kernel is defined for.

Return the program that this kernel is part of

Definition at line 67 of file kernel.hpp.

```
00080                   {}
```

8.3.2.11 class cl::sycl::kernel

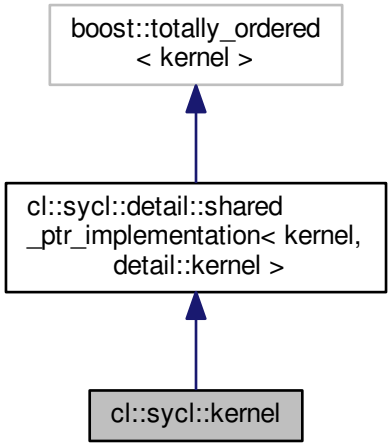
SYCL kernel.

Todo To be implemented

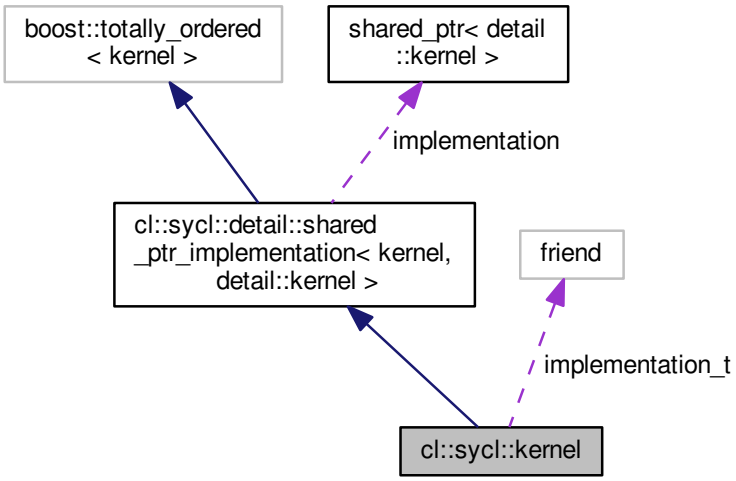
Todo Check specification

Definition at line 38 of file kernel.hpp.

Inheritance diagram for cl::sycl::kernel:



Collaboration diagram for cl::sycl::kernel:



Public Member Functions

- kernel ()=delete

  The default object is not valid because there is no program or.
- kernel (cl_kernel k)

  Constructor for SYCL kernel class given an OpenCL kernel object with set arguments, valid for enqueuing.
- kernel (const boost::compute::kernel &k)

  Construct a kernel class instance using a boost::compute::kernel.
- cl_kernel get () const

  Return the OpenCL kernel object for this kernel.

Private Types

- using implementation_t = typename kernel::shared_ptr_implementation

Private Attributes

- friend implementation_t

Friends

- class handler

Additional Inherited Members

8.3.2.11.1 Member Typedef Documentation

8.3.2.11.1.1 implementation_t

```
using cl::sycl::kernel::implementation_t = typename kernel::shared_ptr_implementation  [private]
```

Definition at line 44 of file kernel.hpp.

8.3.2.11.2 Constructor & Destructor Documentation

8.3.2.11.2.1 kernel() [1/3]

```
cl::sycl::kernel::kernel ( )  [delete]
```

The default object is not valid because there is no program or.

```
cl_kernel
```

associated with it

8.3.2.11.2.2 kernel() [2/3]

```
cl::sycl::kernel::kernel (
             cl_kernel k )  [inline]
```

Constructor for SYCL kernel class given an OpenCL kernel object with set arguments, valid for enqueuing.

Retains a reference to the `cl_kernel` object. The Caller should release the passed cl_kernel object when it is no longer needed.

Definition at line 69 of file kernel.hpp.

```
00069 : kernel { boost::compute::kernel { k } } {}
```

8.3.2.11.2.3 kernel() [3/3]

```
cl::sycl::kernel::kernel (
             const boost::compute::kernel & k )  [inline]
```

Construct a kernel class instance using a boost::compute::kernel.

This is a triSYCL extension for boost::compute interoperation.

Return synchronous errors via the SYCL exception class.

Definition at line 78 of file kernel.hpp.

References cl::sycl::detail::opencl_kernel::instance().

```
00079     : implementation_t { detail::opencl_kernel::instance(k)
      } {}
```

Here is the call graph for this function:

8.3.2.11.3 Member Function Documentation

8.3.2.11.3.1 get()

```
cl_kernel cl::sycl::kernel::get ( ) const  [inline]
```

Return the OpenCL kernel object for this kernel.

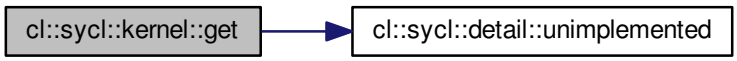
Retains a reference to the returned cl_kernel object. Caller should release it when finished.

Definition at line 87 of file kernel.hpp.

References cl::sycl::detail::shared_ptr_implementation< kernel, detail::kernel >::implementation, and cl::sycl::detail::unimplemented().

```
00087                         {
00088     return implementation->get();
00089   }
```

Here is the call graph for this function:



8.3.2.11.4 Friends And Related Function Documentation

8.3.2.11.4.1 handler

```
friend class handler  [friend]
```

Definition at line 47 of file kernel.hpp.

8.3.2.11.5 Member Data Documentation

8.3.2.11.5.1 implementation_t

```
friend cl::sycl::kernel::implementation_t  [private]
```

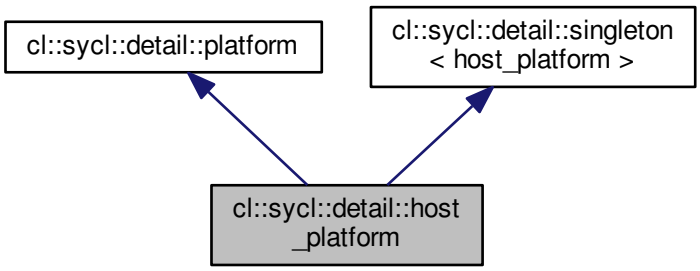
Definition at line 50 of file kernel.hpp.

8.3.2.12 class cl::sycl::detail::host_platform

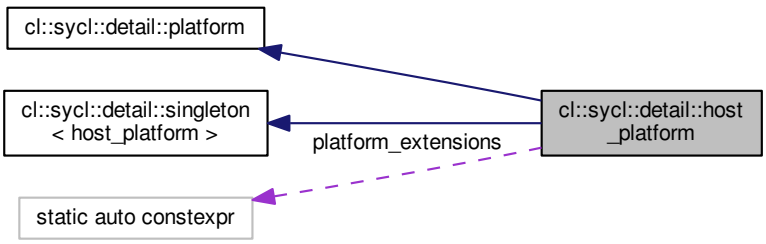
SYCL host platform.

Definition at line 31 of file host_platform.hpp.

Inheritance diagram for cl::sycl::detail::host_platform:



Collaboration diagram for cl::sycl::detail::host_platform:



Public Member Functions

- cl_platform_id get () const override

  Return the cl_platform_id of the underlying OpenCL platform.
- boost::compute::platform & get_boost_compute () const override

  Return the underlying Boost.Compute platform.
- bool is_host () const override

  Return true since this platform is the SYCL host platform.
- string_class get_info_string (info::platform param) const override

  Returning the information parameters for the host platform implementation.
- bool has_extension (const string_class &extension) const override

  Specify whether a specific extension is supported on the platform.
- vector_class< cl::sycl::device > get_devices (info::device_type device_type) const override

  Get all the available devices for the host platform.

Static Private Attributes

- static auto constexpr platform_extensions = "Xilinx_blocking_pipes"

Additional Inherited Members

8.3.2.12.1 Member Function Documentation

8.3.2.12.1.1 get()

```
cl_platform_id cl::sycl::detail::host_platform::get ( ) const  [inline], [override], [virtual]
```

Return the cl_platform_id of the underlying OpenCL platform.

This throws an error since there is no OpenCL platform associated to the host platform.

Implements cl::sycl::detail::platform.

Definition at line 45 of file host_platform.hpp.

```
00045                                       {
00046     throw non_cl_error("The host platform has no OpenCL platform");
00047   }
```

8.3.2.12.1.2 get_boost_compute()

```
boost::compute::platform& cl::sycl::detail::host_platform::get_boost_compute ( ) const  [inline],
[override], [virtual]
```

Return the underlying Boost.Compute platform.

This throws an error since there is no Boost Compute platform associated to the host platform.

Implements cl::sycl::detail::platform.

Definition at line 55 of file host_platform.hpp.

```
00055                                                       {
00056     throw
00057       non_cl_error("The host device has no underlying Boost Compute platform");
00058   }
```

8.3.2.12.1.3 get_info_string()

```
string_class cl::sycl::detail::host_platform::get_info_string (
             info::platform param ) const  [inline], [override], [virtual]
```

Returning the information parameters for the host platform implementation.

Implements cl::sycl::detail::platform.

Definition at line 71 of file host_platform.hpp.

References cl::sycl::info::extensions, cl::sycl::info::name, platform_extensions, cl::sycl::info::profile, and cl::sycl::info::vendor.

```
00071                                                                  {
00072     switch (param) {
00073     case info::platform::profile:
00074       /* Well... Is the host platform really a full profile whereas it
00075          is not really OpenCL? */
00076       return "FULL_PROFILE";
00077
00078     case info::platform::version:
00079       // \todo I guess it should include the software version too...
00080       return "2.2";
00081
00082     case info::platform::name:
00083       return "triSYCL host platform";
00084
00085     case info::platform::vendor:
00086       return "triSYCL Open Source project";
00087
00088     case info::platform::extensions:
00089       return platform_extensions;
00090
00091     default:
00092       // \todo Define some SYCL exception type for this type of errors
00093       throw std::invalid_argument {
00094         "Unknown parameter value for SYCL platform information" };
00095     }
00096   }
```

8.3.2.12.1.4 has_extension()

```
bool cl::sycl::detail::host_platform::has_extension (
             const string_class & extension ) const  [inline], [override], [virtual]
```

Specify whether a specific extension is supported on the platform.

Todo To be implemented

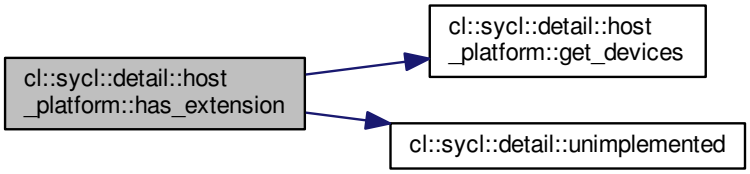
Implements cl::sycl::detail::platform.

Definition at line 103 of file host_platform.hpp.

References get_devices(), and cl::sycl::detail::unimplemented().

```
00103                                                                  {
00104     detail::unimplemented();
00105     return {};
00106   }
```

Here is the call graph for this function:



8.3.2.12.1.5 is_host()

```
bool cl::sycl::detail::host_platform::is_host ( ) const  [inline], [override], [virtual]
```

Return true since this platform is the SYCL host platform.

Implements cl::sycl::detail::platform.

Definition at line 63 of file host_platform.hpp.

```
00063                                {
00064     return true;
00065   }
```

8.3.2.12.2 Member Data Documentation

8.3.2.12.2.1 platform_extensions

```
auto constexpr cl::sycl::detail::host_platform::platform_extensions = "Xilinx_blocking_pipes"
[static], [private]
```

Definition at line 35 of file host_platform.hpp.

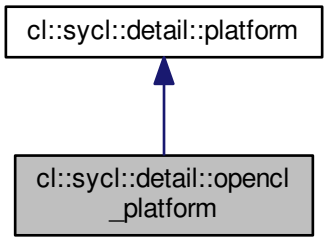
Referenced by get_info_string().

8.3.2.13 class cl::sycl::detail::opencl_platform

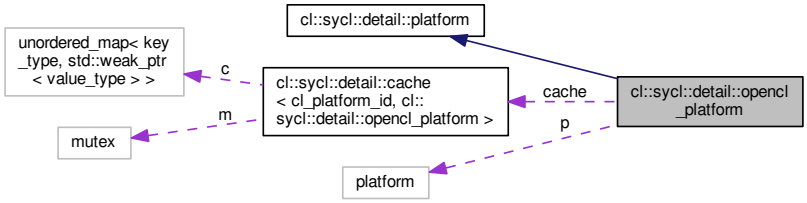
SYCL OpenCL platform.

Definition at line 36 of file opencl_platform.hpp.

Inheritance diagram for cl::sycl::detail::opencl_platform:



Collaboration diagram for cl::sycl::detail::opencl_platform:



Public Member Functions

- cl_platform_id get () const override

  Return the cl_platform_id of the underlying OpenCL platform.
- const boost::compute::platform & get_boost_compute () const override

  Return the underlying Boost.Compute platform.
- bool is_host () const override

  Return false since an OpenCL platform is not the SYCL host platform.
- string_class get_info_string (info::platform param) const override

  Returning the information string parameters for the OpenCL platform.
- bool has_extension (const string_class &extension) const override

  Specify whether a specific extension is supported on the platform.
- vector_class< cl::sycl::device > get_devices (info::device_type device_type) const override

  Get all the available devices for this OpenCL platform.
- ~opencl_platform () override

  Unregister from the cache on destruction.

Static Public Member Functions

- static std::shared_ptr< opencl_platform > instance (const boost::compute::platform &p)

Private Member Functions

- opencl_platform (const boost::compute::platform &p)

  Only the instance factory can built it.

Private Attributes

- boost::compute::platform p

  Use the Boost Compute abstraction of the OpenCL platform.

Static Private Attributes

- static detail::cache< cl_platform_id, detail::opencl_platform > cache

  A cache to always return the same live platform for a given OpenCL platform.

8.3.2.13.1 Constructor & Destructor Documentation

8.3.2.13.1.1 opencl_platform()

```
cl::sycl::detail::opencl_platform::opencl_platform (
              const boost::compute::platform & p )  [inline], [private]
```

Only the instance factory can built it.

Definition at line 105 of file opencl_platform.hpp.

```
00105 : p { p } {}
```

8.3.2.13.1.2 ~opencl_platform()

```
cl::sycl::detail::opencl_platform::~opencl_platform ( )  [inline], [override]
```

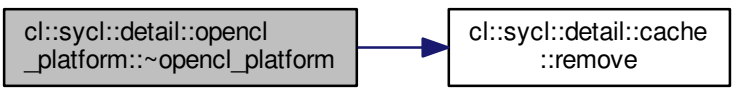
Unregister from the cache on destruction.

Definition at line 110 of file opencl_platform.hpp.

References cache, cl::sycl::detail::cache< Key, Value >::remove(), TRISYCL_WEAK_ATTRIB_PREFIX, and cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX.

```
00110                                {
00111     cache.remove(p.id());
00112   }
```

Here is the call graph for this function:



8.3.2.13.2 Member Function Documentation

8.3.2.13.2.1 get()

```
cl_platform_id cl::sycl::detail::opencl_platform::get ( ) const  [inline], [override], [virtual]
```

Return the cl_platform_id of the underlying OpenCL platform.

Implements cl::sycl::detail::platform.

Definition at line 51 of file opencl_platform.hpp.

```
00051                                       {
00052     return p.id();
00053   }
```

8.3.2.13.2.2 get_boost_compute()

```
const boost::compute::platform& cl::sycl::detail::opencl_platform::get_boost_compute ( ) const
[inline], [override], [virtual]
```

Return the underlying Boost.Compute platform.

Implements cl::sycl::detail::platform.

Definition at line 57 of file opencl_platform.hpp.

References p.

Referenced by get_devices().

```
00057                                                       {
00058     return p;
00059   }
```

Here is the caller graph for this function:

8.3.2.13.2.3 get_info_string()

```
string_class cl::sycl::detail::opencl_platform::get_info_string (
            info::platform param ) const  [inline], [override], [virtual]
```

Returning the information string parameters for the OpenCL platform.

Implements cl::sycl::detail::platform.

Definition at line 69 of file opencl_platform.hpp.

```
00069                                                                  {
00070     /* Use the fact that the triSYCL info values are the same as the
00071        OpenCL ones used in Boost.Compute to just cast the enum class
00072        to the int value */
00073     return p.get_info<std::string>(static_cast<cl_platform_info>(param));
00074   }
```

8.3.2.13.2.4 has_extension()

```
bool cl::sycl::detail::opencl_platform::has_extension (
            const string_class & extension ) const  [inline], [override], [virtual]
```

Specify whether a specific extension is supported on the platform.

Implements cl::sycl::detail::platform.

Definition at line 78 of file opencl_platform.hpp.

```
00078                                                                  {
00079     return p.supports_extension(extension);
00080   }
```

8.3.2.13.2.5 instance()

```
static std::shared_ptr<opencl_platform> cl::sycl::detail::opencl_platform::instance (
            const boost::compute::platform & p )  [inline], [static]
```

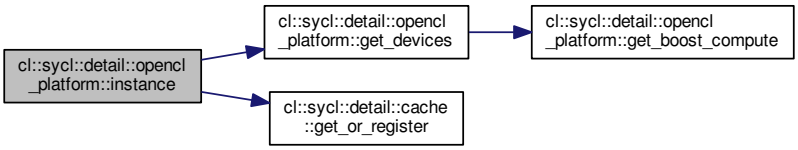
Definition at line 85 of file opencl_platform.hpp.

References get_devices(), and cl::sycl::detail::cache< Key, Value >::get_or_register().

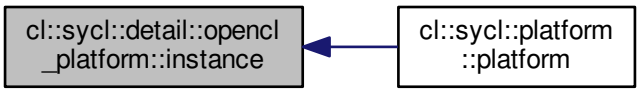
Referenced by cl::sycl::platform::platform().

```
00085                                          {
00086     return cache.get_or_register(p.id(),
00087                                  [&] { return new opencl_platform {
      p }; });
00088   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.3.2.13.2.6 is_host()

```
bool cl::sycl::detail::opencl_platform::is_host ( ) const  [inline], [override], [virtual]
```

Return false since an OpenCL platform is not the SYCL host platform.

Implements cl::sycl::detail::platform.

Definition at line 63 of file opencl_platform.hpp.

```
00063                                {
00064     return false;
00065   }
```

8.3.2.13.3 Member Data Documentation

8.3.2.13.3.1 cache

```
detail::cache<cl_platform_id, detail::opencl_platform> cl::sycl::detail::opencl_platform↩
::cache  [static], [private]
```

A cache to always return the same live platform for a given OpenCL platform.

C++11 guaranties the static construction is thread-safe

Definition at line 46 of file opencl_platform.hpp.

Referenced by ~opencl_platform().

8.3.2.13.3.2 p

```
boost::compute::platform cl::sycl::detail::opencl_platform::p  [private]
```

Use the Boost Compute abstraction of the OpenCL platform.

Definition at line 39 of file opencl_platform.hpp.

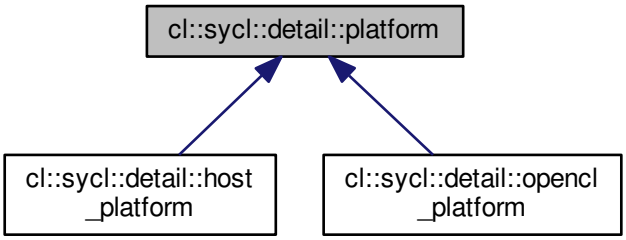
Referenced by get_boost_compute().

8.3.2.14 class cl::sycl::detail::platform

An abstract class representing various models of SYCL platforms.

Definition at line 28 of file platform.hpp.

Inheritance diagram for cl::sycl::detail::platform:



Public Member Functions

- virtual cl_platform_id get () const =0

  Return the cl_platform_id of the underlying OpenCL platform.
- virtual const boost::compute::platform & get_boost_compute () const =0

  Return the underlying Boost.Compute platform, if any.
- virtual bool is_host () const =0

  Return true if the platform is a SYCL host platform.
- virtual string_class get_info_string (info::platform param) const =0

  Query the platform for OpenCL string info::platform info.
- virtual bool has_extension (const string_class &extension) const =0

  Specify whether a specific extension is supported on the platform.
- virtual vector_class< device > get_devices (info::device_type device_type) const =0

  Get all the available devices for this platform.
- virtual ~platform ()

8.3.2.14.1 Constructor & Destructor Documentation

8.3.2.14.1.1 ~platform()

```
virtual cl::sycl::detail::platform::~platform ( )  [inline], [virtual]
```

Definition at line 65 of file platform.hpp.

```
00065 {}
```

8.3.2.14.2 Member Function Documentation

8.3.2.14.2.1 get()

```
virtual cl_platform_id cl::sycl::detail::platform::get ( ) const  [pure virtual]
```

Return the cl_platform_id of the underlying OpenCL platform.

Implemented in cl::sycl::detail::opencl_platform, and cl::sycl::detail::host_platform.

8.3.2.14.2.2 get_boost_compute()

```
virtual const boost::compute::platform& cl::sycl::detail::platform::get_boost_compute ( )
const  [pure virtual]
```

Return the underlying Boost.Compute platform, if any.

Implemented in cl::sycl::detail::opencl_platform, and cl::sycl::detail::host_platform.

8.3.2.14.2.3 get_devices()

```
virtual vector_class<device> cl::sycl::detail::platform::get_devices (
            info::device_type device_type ) const  [pure virtual]
```

Get all the available devices for this platform.

Parameters

in	*device_type*	is the device type to filter the selection or `info::device_type::all` by default to return all the devices

Returns

the device list

Implemented in cl::sycl::detail::host_platform, and cl::sycl::detail::opencl_platform.

8.3.2.14.2.4 get_info_string()

```
virtual string_class cl::sycl::detail::platform::get_info_string (
            info::platform param ) const  [pure virtual]
```

Query the platform for OpenCL string info::platform info.

Implemented in cl::sycl::detail::host_platform, and cl::sycl::detail::opencl_platform.

8.3.2.14.2.5 has_extension()

```
virtual bool cl::sycl::detail::platform::has_extension (
            const string_class & extension ) const  [pure virtual]
```

Specify whether a specific extension is supported on the platform.

Implemented in cl::sycl::detail::host_platform, and cl::sycl::detail::opencl_platform.

8.3.2.14.2.6 is_host()

```
virtual bool cl::sycl::detail::platform::is_host ( ) const  [pure virtual]
```

Return true if the platform is a SYCL host platform.

Implemented in cl::sycl::detail::host_platform, and cl::sycl::detail::opencl_platform.

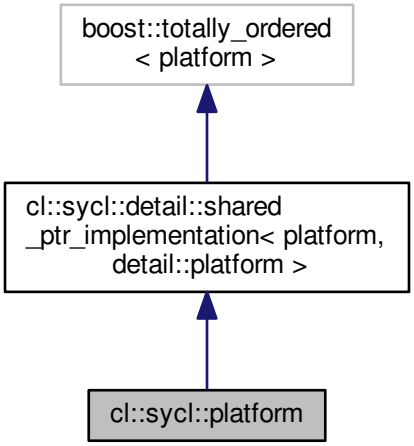
8.3.2.15 class cl::sycl::platform

Abstract the OpenCL platform.

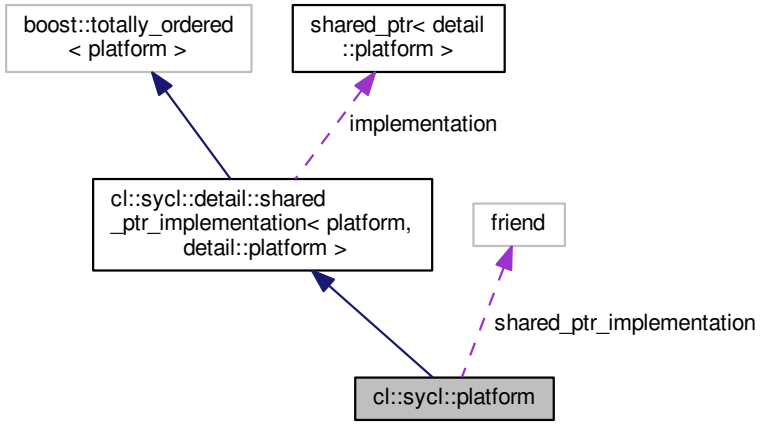
Todo triSYCL Implementation

Definition at line 42 of file platform.hpp.

Inheritance diagram for cl::sycl::platform:



Collaboration diagram for cl::sycl::platform:



Public Member Functions

- platform ()

  Default constructor for platform which is the host platform.
- platform (cl_platform_id platform_id)

  Construct a platform class instance using cl_platform_id of the OpenCL device.
- platform (const boost::compute::platform &p)

  Construct a platform class instance using a boost::compute::platform.
- platform (const device_selector &dev_selector)

  Construct a platform object from the device selected by a device selector of the user's choice.
- cl_platform_id get () const

  Returns the cl_platform_id of the underlying OpenCL platform.
- const boost::compute::platform get_boost_compute () const

  Return the underlying Boost.Compute platform if it is an OpenCL platform.
- template<typename ReturnT >
  ReturnT get_info (info::platform param) const

  Get the OpenCL information about the requested parameter.
- template<info::platform Param>
  info::param_traits< info::platform, Param >::type get_info () const

  Get the OpenCL information about the requested template parameter.
- bool has_extension (const string_class &extension) const

  Test if an extension is available on the platform.
- bool is_host () const

  Test if this platform is a host platform.
- vector_class< device > get_devices (info::device_type device_type=info::device_type::all) const

  Get all the available devices for this platform.

Static Public Member Functions

- static vector_class< platform > get_platforms ()

  Get the list of all the platforms available to the application.

Private Attributes

- friend shared_ptr_implementation

Additional Inherited Members

8.3.2.15.1 Constructor & Destructor Documentation

8.3.2.15.1.1 platform() [1/4]

```
cl::sycl::platform::platform ( )  [inline]
```

Default constructor for platform which is the host platform.

Returns errors via the SYCL exception class.

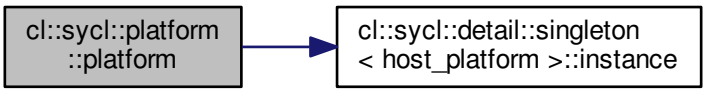
Definition at line 59 of file platform.hpp.

References cl::sycl::detail::singleton< host_platform >::instance().

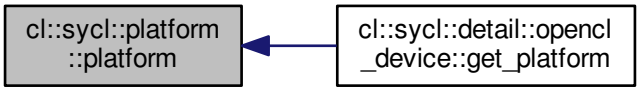
Referenced by cl::sycl::detail::opencl_device::get_platform().

```
00059             :
00060     shared_ptr_implementation {
      detail::host_platform::instance() } {}
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.3.2.15.1.2 platform() [2/4]

```
cl::sycl::platform::platform (
              cl_platform_id platform_id )  [inline]
```

Construct a platform class instance using cl_platform_id of the OpenCL device.

Return synchronous errors via the SYCL exception class.

Retain a reference to the OpenCL platform.

Definition at line 71 of file platform.hpp.

```
00072     : platform { boost::compute::platform { platform_id } } {}
```

8.3.2.15.1.3 platform() [3/4]

```
cl::sycl::platform::platform (
              const boost::compute::platform & p )  [inline]
```

Construct a platform class instance using a boost::compute::platform.

This is a triSYCL extension for boost::compute interoperation.

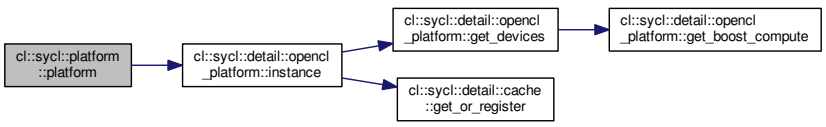
Return synchronous errors via the SYCL exception class.

Definition at line 81 of file platform.hpp.

References cl::sycl::detail::opencl_platform::instance().

```
00082     : shared_ptr_implementation {
      detail::opencl_platform::instance(p) } {}
```

Here is the call graph for this function:



8.3.2.15.1.4 platform() [4/4]

```
cl::sycl::platform::platform (
            const device_selector & dev_selector )  [inline], [explicit]
```

Construct a platform object from the device selected by a device selector of the user's choice.

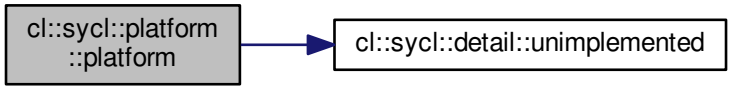
Returns errors via the SYCL exception class.

Definition at line 91 of file platform.hpp.

References cl::sycl::detail::unimplemented().

```
00091                                                 {
00092     detail::unimplemented();
00093   }
```

Here is the call graph for this function:



8.3.2.15.2 Member Function Documentation

8.3.2.15.2.1 get()

```
cl_platform_id cl::sycl::platform::get ( ) const  [inline]
```

Returns the cl_platform_id of the underlying OpenCL platform.

If the platform is not a valid OpenCL platform, for example if it is the SYCL host, an exception is thrown

Todo Define a SYCL exception for this

Definition at line 104 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00104                                {
00105     return implementation->get();
00106   }
```

8.3.2.15.2.2 get_boost_compute()

```
const boost::compute::platform cl::sycl::platform::get_boost_compute ( ) const  [inline]
```

Return the underlying Boost.Compute platform if it is an OpenCL platform.

This is a triSYCL extension

Definition at line 114 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00114                                                    {
00115     return implementation->get_boost_compute();
00116   }
```

8.3.2.15.2.3 get_devices()

```
vector_class<device> cl::sycl::platform::get_devices (
             info::device_type device_type = info::device_type::all ) const  [inline]
```

Get all the available devices for this platform.

Parameters

in	*device_type*	is the device type to filter the selection or `info::device_type::all` by default to return all the devices

Returns

the device list

Definition at line 180 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00180                                                                    {
00181     return implementation->get_devices(device_type);
00182   }
```

8.3.2.15.2.4 get_info() [1/2]

```
template<typename ReturnT >
ReturnT cl::sycl::platform::get_info (
             info::platform param ) const  [inline]
```

Get the OpenCL information about the requested parameter.

Todo Add to the specification

Definition at line 140 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00140                                          {
00141     // Only strings are needed here
00142     return implementation->get_info_string(param);
00143   }
```

8.3.2.15.2.5 get_info() [2/2]

```
template<info::platform Param>
info::param_traits<info::platform, Param>::type cl::sycl::platform::get_info ( ) const  [inline]
```

Get the OpenCL information about the requested template parameter.

Definition at line 149 of file platform.hpp.

```
00149                   {
00150     /* Forward to the implementation without using template parameter
00151        but with a parameter instead, since it is incompatible with
00152        virtual function and because fortunately only strings are
00153        needed here */
00154     return get_info<typename info::param_traits<info::platform,
00155                                                 Param>::type>(Param);
00156   }
```

8.3.2.15.2.6 get_platforms()

```
static vector_class<platform> cl::sycl::platform::get_platforms ( )  [inline], [static]
```

Get the list of all the platforms available to the application.

Definition at line 121 of file platform.hpp.

```
00121                                                {
00122     // Start with the default platform
00123     vector_class<platform> platforms { {} };
00124
00125 #ifdef TRISYCL_OPENCL
00126     // Then add all the OpenCL platforms
00127     for (const auto &d : boost::compute::system::platforms())
00128       platforms.emplace_back(d);
00129 #endif
00130
00131     return platforms;
00132   }
```

8.3.2.15.2.7 has_extension()

```
bool cl::sycl::platform::has_extension (
             const string_class & extension ) const  [inline]
```

Test if an extension is available on the platform.

Definition at line 160 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00160                                                          {
00161     return implementation->has_extension(extension);
00162   }
```

8.3.2.15.2.8 is_host()

```
bool cl::sycl::platform::is_host ( ) const  [inline]
```

Test if this platform is a host platform.

Definition at line 166 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00166                       {
00167     return implementation->is_host();
00168   }
```

8.3.2.15.3 Member Data Documentation

8.3.2.15.3.1 shared_ptr_implementation

```
friend cl::sycl::platform::shared_ptr_implementation  [private]
```

Definition at line 48 of file platform.hpp.

8.3.2.16 class cl::sycl::queue

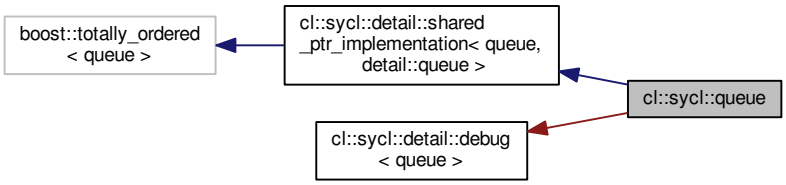
SYCL queue, similar to the OpenCL queue concept.

Todo The implementation is quite minimal for now. :-)

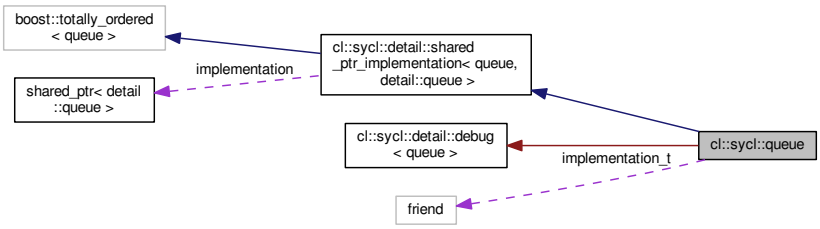
Todo All the queue methods should return a queue& instead of void to it is possible to chain opoerations

Definition at line 80 of file queue.hpp.

Inheritance diagram for cl::sycl::queue:



Collaboration diagram for cl::sycl::queue:



Public Member Functions

- queue ()

  Default constructor for platform which is the host platform.
- queue (async_handler asyncHandler)

  This constructor creates a SYCL queue from an OpenCL queue.
- queue (const device_selector &deviceSelector, async_handler asyncHandler=nullptr)

  Creates a queue for the device provided by the device selector.
- queue (const device &d, async_handler asyncHandler=nullptr)

  A queue is created for a SYCL device.
- queue (const context &syclContext, const device_selector &deviceSelector, async_handler async↩ Handler=nullptr)

  This constructor chooses a device based on the provided device_selector, which needs to be in the given context.

- queue (const context &syclContext, const device &syclDevice, async_handler asyncHandler=nullptr)

  Creates a command queue using clCreateCommandQueue from a context and a device.
- queue (const context &syclContext, const device &syclDevice, info::queue_profiling profilingFlag, async_handler asyncHandler=nullptr)

  Creates a command queue using clCreateCommandQueue from a context and a device.
- queue (const cl_command_queue &q, async_handler ah=nullptr)

  This constructor creates a SYCL queue from an OpenCL queue.
- queue (const boost::compute::command_queue &q, async_handler ah=nullptr)

  Construct a queue instance using a boost::compute::command_queue.
- cl_command_queue get () const

  Return the underlying OpenCL command queue after doing a retain.
- boost::compute::command_queue get_boost_compute () const

  Return the underlying Boost.Compute command queue if it is an OpenCL queue.
- context get_context () const

  Return the SYCL queue's context.
- device get_device () const

  Return the SYCL device the queue is associated with.
- bool is_host () const

  Return whether the queue is executing on a SYCL host device.
- void wait ()

  Performs a blocking wait for the completion all enqueued tasks in the queue.
- void wait_and_throw ()

  Perform a blocking wait for the completion all enqueued tasks in the queue.
- void throw_asynchronous ()

  Checks to see if any asynchronous errors have been produced by the queue and if so reports them by passing them to the async_handler passed to the queue on construction.
- template<info::queue param>
  info::param_traits< info::queue, param >::type get_info () const

  Queries the platform for cl_command_queue info.
- handler_event submit (std::function< void(handler &)> cgf)

  Submit a command group functor to the queue, in order to be scheduled for execution on the device.
- handler_event submit (std::function< void(handler &)> cgf, queue &secondaryQueue)

  Submit a command group functor to the queue, in order to be scheduled for execution on the device.

Private Types

- using implementation_t = typename queue::shared_ptr_implementation

Private Attributes

- friend implementation_t

Additional Inherited Members

8.3.2.16.1 Member Typedef Documentation

8.3.2.16.1.1 implementation_t

```
using cl::sycl::queue::implementation_t = typename queue::shared_ptr_implementation  [private]
```

Definition at line 87 of file queue.hpp.

8.3.2.16.2 Constructor & Destructor Documentation

8.3.2.16.2.1 queue() [1/9]

```
cl::sycl::queue::queue ( )  [inline]
```

Default constructor for platform which is the host platform.

Returns errors via the SYCL exception class.

Todo Check with the specification if it is the host queue or the one related to the default device selector.

Definition at line 107 of file queue.hpp.

```
00107 : implementation_t { new detail::host_queue } {}
```

8.3.2.16.2.2 queue() [2/9]

```
cl::sycl::queue::queue (
              async_handler asyncHandler )  [inline], [explicit]
```

This constructor creates a SYCL queue from an OpenCL queue.

At construction it does a retain on the queue memory object.

Retain a reference to the cl_command_queue object. Caller should release the passed cl_command_queue object when it is no longer needed.

Return synchronous errors regarding the creation of the queue and report asynchronous errors via the async_↩ handler callback function in conjunction with the synchronization and throw methods.

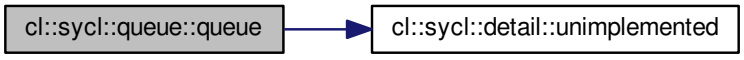
Note that the default case asyncHandler = nullptr is handled by the default constructor.

Definition at line 126 of file queue.hpp.

References cl::sycl::detail::unimplemented().

```
00126                                             : queue { } {
00127     detail::unimplemented();
00128   }
```

Here is the call graph for this function:



8.3.2.16.2.3 queue() [3/9]

```
cl::sycl::queue::queue (
              const device_selector & deviceSelector,
              async_handler asyncHandler = nullptr )  [inline]
```

Creates a queue for the device provided by the device selector.

If no device is selected, an error is reported.

Return synchronous errors regarding the creation of the queue and report asynchronous errors via the `async_handler` callback function if and only if there is an `async_handler` provided.

Definition at line 139 of file queue.hpp.

```
00142     : queue { device { deviceSelector }, asyncHandler} { }
```

8.3.2.16.2.4 queue() [4/9]

```
cl::sycl::queue::queue (
              const device & d,
              async_handler asyncHandler = nullptr )  [inline]
```

A queue is created for a SYCL device.

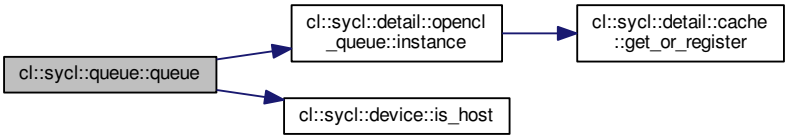
Return asynchronous errors via the `async_handler` callback function.

Definition at line 150 of file queue.hpp.

References cl::sycl::detail::opencl_queue::instance(), and cl::sycl::device::is_host().

```
00151                                             : implementation_t {
00152 #ifdef TRISYCL_OPENCL
00153     d.is_host()
00154       ? std::shared_ptr<detail::queue>{ new detail::host_queue }
00155       : detail::opencl_queue::instance(d)
00156 #else
00157     new detail::host_queue
00158 #endif
00159
00160   } { }
```

Here is the call graph for this function:



8.3.2.16.2.5 queue() [5/9]

```
cl::sycl::queue::queue (
            const context & syclContext,
            const device_selector & deviceSelector,
            async_handler asyncHandler = nullptr )  [inline]
```

This constructor chooses a device based on the provided device_selector, which needs to be in the given context.

If no device is selected, an error is reported.

Return synchronous errors regarding the creation of the queue.

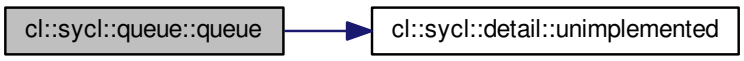
If and only if there is an asyncHandler provided, it reports asynchronous errors via the async_handler callback function in conjunction with the synchronization and throw methods.

Definition at line 174 of file queue.hpp.

References cl::sycl::detail::unimplemented().

```
00176                                             : queue { } {
00177     detail::unimplemented();
00178   }
```

Here is the call graph for this function:



8.3.2.16.2.6 queue() [6/9]

```
cl::sycl::queue::queue (
            const context & syclContext,
            const device & syclDevice,
            async_handler asyncHandler = nullptr )  [inline]
```

Creates a command queue using clCreateCommandQueue from a context and a device.

Return synchronous errors regarding the creation of the queue.

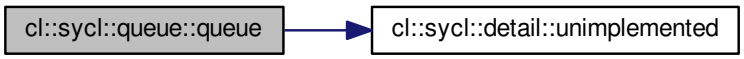
If and only if there is an asyncHandler provided, it reports asynchronous errors via the async_handler callback function in conjunction with the synchronization and throw methods.

Definition at line 190 of file queue.hpp.

References cl::sycl::detail::unimplemented().

```
00192                                                 : queue { } {
00193     detail::unimplemented();
00194   }
```

Here is the call graph for this function:



8.3.2.16.2.7 queue() [7/9]

```
cl::sycl::queue::queue (
              const context & syclContext,
              const device & syclDevice,
              info::queue_profiling profilingFlag,
              async_handler asyncHandler = nullptr )  [inline]
```

Creates a command queue using clCreateCommandQueue from a context and a device.

It enables profiling on the queue if the profilingFlag is set to true.

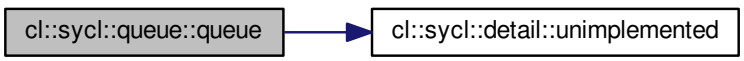
Return synchronous errors regarding the creation of the queue. If and only if there is an asyncHandler provided, it reports asynchronous errors via the async_handler callback function in conjunction with the synchronization and throw methods.

Definition at line 208 of file queue.hpp.

References cl::sycl::detail::unimplemented().

```
00211                                                 : queue { } {
00212     detail::unimplemented();
00213   }
```

Here is the call graph for this function:



8.3.2.16.2.8 queue() [8/9]

```
cl::sycl::queue::queue (
              const cl_command_queue & q,
              async_handler ah = nullptr )  [inline]
```

This constructor creates a SYCL queue from an OpenCL queue.

At construction it does a retain on the queue memory object.

Return synchronous errors regarding the creation of the queue. If and only if there is an async_handler provided, it reports asynchronous errors via the async_handler callback function in conjunction with the synchronization and throw methods.

Definition at line 226 of file queue.hpp.

```
00227     : queue { boost::compute::command_queue { q }, ah } {}
```

8.3.2.16.2.9 queue() [9/9]

```
cl::sycl::queue::queue (
              const boost::compute::command_queue & q,
              async_handler ah = nullptr )  [inline]
```

Construct a queue instance using a boost::compute::command_queue.

This is a triSYCL extension for boost::compute interoperation.

Return synchronous errors via the SYCL exception class.

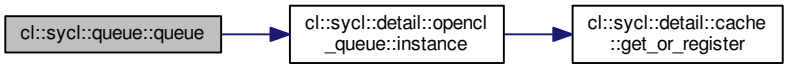
Todo Deal with handler

Definition at line 238 of file queue.hpp.

References cl::sycl::detail::opencl_queue::instance().

```
00239     : implementation_t { detail::opencl_queue::instance(q) }
      {}
```

Here is the call graph for this function:



8.3.2.16.3 Member Function Documentation

8.3.2.16.3.1 get()

```
cl_command_queue cl::sycl::queue::get ( ) const  [inline]
```

Return the underlying OpenCL command queue after doing a retain.

This memory object is expected to be released by the developer.

Retain a reference to the returned cl_command_queue object.

Caller should release it when finished.

If the queue is a SYCL host queue then an exception is thrown.

Definition at line 254 of file queue.hpp.

```
00254                                {
00255     return implementation->get();
00256   }
```

8.3.2.16.3.2 get_boost_compute()

```
boost::compute::command_queue cl::sycl::queue::get_boost_compute ( ) const  [inline]
```

Return the underlying Boost.Compute command queue if it is an OpenCL queue.

This is a triSYCL extension

Definition at line 264 of file queue.hpp.

```
00264                                                    {
00265     return implementation->get_boost_compute();
00266   }
```

8.3.2.16.3.3 get_context()

```
context cl::sycl::queue::get_context ( ) const  [inline]
```

Return the SYCL queue's context.

Report errors using SYCL exception classes.

Definition at line 274 of file queue.hpp.

```
00274                                {
00275     return implementation->get_context();
00276   }
```

8.3.2.16.3.4 get_device()

```
device cl::sycl::queue::get_device ( ) const  [inline]
```

Return the SYCL device the queue is associated with.

Report errors using SYCL exception classes.

Definition at line 283 of file queue.hpp.

```
00283                             {
00284     return implementation->get_device();
00285   }
```

8.3.2.16.3.5 get_info()

```
template<info::queue param>
info::param_traits<info::queue, param>::type cl::sycl::queue::get_info ( ) const  [inline]
```

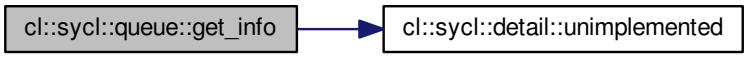
Queries the platform for cl_command_queue info.

Definition at line 335 of file queue.hpp.

References cl::sycl::detail::unimplemented().

```
00335                                                                 {
00336     detail::unimplemented();
00337     return {};
00338   }
```

Here is the call graph for this function:



8.3.2.16.3.6 is_host()

```
bool cl::sycl::queue::is_host ( ) const  [inline]
```

Return whether the queue is executing on a SYCL host device.

Definition at line 289 of file queue.hpp.

```
00289                         {
00290     return implementation->is_host();
00291   }
```

8.3.2.16.3.7 submit() [1/2]

```
handler_event cl::sycl::queue::submit (
              std::function< void(handler &)> cgf )  [inline]
```

Submit a command group functor to the queue, in order to be scheduled for execution on the device.

Use an explicit functor parameter taking a handler& so we can use "auto" in submit() lambda parameter.

Todo Add in the spec an implicit conversion of handler_event to queue& so it is possible to chain operations on the queue

Todo Update the spec to replace std::function by a templated type to avoid memory allocation

Definition at line 353 of file queue.hpp.

```
00353                                                       {
00354     handler command_group_handler { implementation };
00355     cgf(command_group_handler);
00356     return {};
00357   }
```

8.3.2.16.3.8 submit() [2/2]

```
handler_event cl::sycl::queue::submit (
              std::function< void(handler &)> cgf,
              queue & secondaryQueue )  [inline]
```

Submit a command group functor to the queue, in order to be scheduled for execution on the device.

On kernel error, this command group functor, then it is scheduled for execution on the secondary queue.

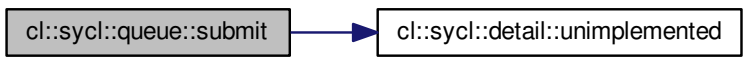
Return a command group functor event, which is corresponds to the queue the command group functor is being enqueued on.

Definition at line 369 of file queue.hpp.

References cl::sycl::detail::unimplemented().

```
00369                                                                                 {
00370     detail::unimplemented();
00371     // Since it is not implemented, always submit on the main queue
00372     return submit(cgf);
00373   }
```

Here is the call graph for this function:



8.3.2.16.3.9 throw_asynchronous()

```
void cl::sycl::queue::throw_asynchronous ( )  [inline]
```

Checks to see if any asynchronous errors have been produced by the queue and if so reports them by passing them to the async_handler passed to the queue on construction.

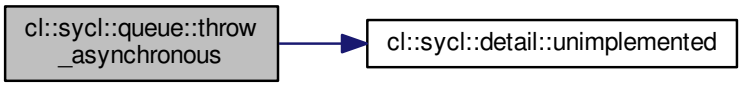
If no async_handler was provided then asynchronous exceptions will be lost.

Definition at line 328 of file queue.hpp.

References cl::sycl::detail::unimplemented().

```
00328                             {
00329     detail::unimplemented();
00330   }
```

Here is the call graph for this function:



8.3.2.16.3.10 wait()

```
void cl::sycl::queue::wait ( )  [inline]
```

Performs a blocking wait for the completion all enqueued tasks in the queue.

Synchronous errors will be reported through SYCL exceptions.

Definition at line 299 of file queue.hpp.

```
00299               {
00300     implementation->wait_for_kernel_execution();
00301   }
```

8.3.2.16.3.11 wait_and_throw()

```
void cl::sycl::queue::wait_and_throw ( )  [inline]
```

Perform a blocking wait for the completion all enqueued tasks in the queue.

Synchronous errors will be reported via SYCL exceptions.

Asynchronous errors will be passed to the async_handler passed to the queue on construction.

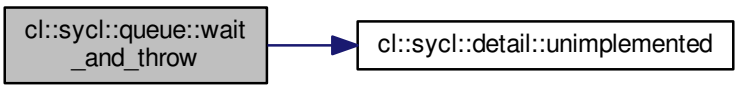
If no async_handler was provided then asynchronous exceptions will be lost.

Definition at line 314 of file queue.hpp.

References cl::sycl::detail::unimplemented().

```
00314                         {
00315     // \todo Implement the throw part of wait_and_throw
00316     wait();
00317     detail::unimplemented();
00318   }
```

Here is the call graph for this function:



8.3.2.16.4 Member Data Documentation

8.3.2.16.4.1 implementation_t

```
friend cl::sycl::queue::implementation_t  [private]
```

Definition at line 93 of file queue.hpp.

8.3.3 Typedef Documentation

8.3.3.1 cpu_selector

```
using cl::sycl::cpu_selector = typedef device_typename_selector<info::device_type::cpu>
```

```
#include <include/CL/sycl/device_selector/detail/device_selector_tail.hpp>
```

Select devices according to device type info::device::device_type::cpu from all the available devices and heuristics.

If no OpenCL CPU device is found the selector fails.

Definition at line 133 of file device_selector_tail.hpp.

8.3.3.2 default_selector

```
using cl::sycl::default_selector = typedef device_typename_selector<info::device_type::defaults>
```

```
#include <include/CL/sycl/device_selector/detail/device_selector_tail.hpp>
```

Devices selected by heuristics of the system.

If no OpenCL device is found then it defaults to the SYCL host device.

To influence the default device selection, use the Boost.Compute environment variables:

- BOOST_COMPUTE_DEFAULT_DEVICE
- BOOST_COMPUTE_DEFAULT_DEVICE_TYPE
- BOOST_COMPUTE_DEFAULT_PLATFORM
- BOOST_COMPUTE_DEFAULT_VENDOR

Definition at line 115 of file device_selector_tail.hpp.

8.3.3.3 device_exec_capabilities

```
using cl::sycl::info::device_exec_capabilities = typedef unsigned int
```

```
#include <include/CL/sycl/info/device.hpp>
```

Definition at line 183 of file device.hpp.

8.3.3.4 device_fp_config

```
using cl::sycl::info::device_fp_config = typedef unsigned int
```

```
#include <include/CL/sycl/info/device.hpp>
```

Definition at line 182 of file device.hpp.

8.3.3.5 device_queue_properties

```
using cl::sycl::info::device_queue_properties = typedef unsigned int
```

```
#include <include/CL/sycl/info/device.hpp>
```

Definition at line 184 of file device.hpp.

8.3.3.6 gl_context_interop

```
using cl::sycl::info::gl_context_interop = typedef bool
```

```
#include <include/CL/sycl/info/context.hpp>
```

Definition at line 22 of file context.hpp.

8.3.3.7 gpu_selector

```
using cl::sycl::gpu_selector = typedef device_typename_selector<info::device_type::gpu>
```

```
#include <include/CL/sycl/device_selector/detail/device_selector_tail.hpp>
```

Select devices according to device type info::device::device_type::gpu from all the available OpenCL devices.

If no OpenCL GPU device is found the selector fails.

Select the best GPU, if any.

Definition at line 125 of file device_selector_tail.hpp.

8.3.3.8 host_selector

```
using cl::sycl::host_selector = typedef device_typename_selector<info::device_type::host>
```

```
#include <include/CL/sycl/device_selector/detail/device_selector_tail.hpp>
```

Selects the SYCL host CPU device that does not require an OpenCL runtime.

Definition at line 139 of file device_selector_tail.hpp.

8.3.4 Enumeration Type Documentation

8.3.4.1 context

enum cl::sycl::info::context : int [strong]

#include <include/CL/sycl/info/context.hpp>

Context information descriptors.

Todo Should be unsigned int to be consistent with others?

Enumerator

reference_count	
num_devices	
devices	
gl_interop	

Definition at line 28 of file context.hpp.

```
00028                   : int {
00029   reference_count,
00030   num_devices,
00031   devices,
00032   gl_interop
00033 };
```

8.3.4.2 device

enum cl::sycl::info::device : int [strong]

#include <include/CL/sycl/info/device.hpp>

Device information descriptors.

From specs/latex/headers/deviceInfo.h in the specification

Todo Should be unsigned int?

Enumerator

device_type	
vendor_id	
max_compute_units	

Enumerator

max_work_item_dimensions	
max_work_item_sizes	
max_work_group_size	
preferred_vector_width_char	
preferred_vector_width_short	
preferred_vector_width_int	
preferred_vector_width_long_long	
preferred_vector_width_float	
preferred_vector_width_double	
preferred_vector_width_half	
native_vector_witdth_char	
native_vector_witdth_short	
native_vector_witdth_int	
native_vector_witdth_long_long	
native_vector_witdth_float	
native_vector_witdth_double	
native_vector_witdth_half	
max_clock_frequency	
address_bits	
max_mem_alloc_size	
image_support	
max_read_image_args	
max_write_image_args	
image2d_max_height	
image2d_max_width	
image3d_max_height	
image3d_max_widht	
image3d_mas_depth	
image_max_buffer_size	
image_max_array_size	
max_samplers	
max_parameter_size	
mem_base_addr_align	
single_fp_config	
double_fp_config	
global_mem_cache_type	
global_mem_cache_line_size	
global_mem_cache_size	
global_mem_size	
max_constant_buffer_size	
max_constant_args	
local_mem_type	
local_mem_size	
error_correction_support	
host_unified_memory	
profiling_timer_resolution	
endian_little	

Enumerator

is_available	
is_compiler_available	
is_linker_available	
execution_capabilities	
queue_properties	
built_in_kernels	
platform	
name	
vendor	
driver_version	
profile	
device_version	
opencl_version	
extensions	
printf_buffer_size	
preferred_interop_user_sync	
parent_device	
partition_max_sub_devices	
partition_properties	
partition_affinity_domain	
partition_type	
reference_count	

Definition at line 52 of file device.hpp.

```
00052                  : int {
00053   device_type,
00054   vendor_id,
00055   max_compute_units,
00056   max_work_item_dimensions,
00057   max_work_item_sizes,
00058   max_work_group_size,
00059   preferred_vector_width_char,
00060   preferred_vector_width_short,
00061   preferred_vector_width_int,
00062   preferred_vector_width_long_long,
00063   preferred_vector_width_float,
00064   preferred_vector_width_double,
00065   preferred_vector_width_half,
00066   native_vector_witdth_char,
00067   native_vector_witdth_short,
00068   native_vector_witdth_int,
00069   native_vector_witdth_long_long,
00070   native_vector_witdth_float,
00071   native_vector_witdth_double,
00072   native_vector_witdth_half,
00073   max_clock_frequency,
00074   address_bits,
00075   max_mem_alloc_size,
00076   image_support,
00077   max_read_image_args,
00078   max_write_image_args,
00079   image2d_max_height,
00080   image2d_max_width,
00081   image3d_max_height,
00082   image3d_max_widht,
00083   image3d_mas_depth,
00084   image_max_buffer_size,
00085   image_max_array_size,
00086   max_samplers,
00087   max_parameter_size,
00088   mem_base_addr_align,
00089   single_fp_config,
00090   double_fp_config,
```

```
00091   global_mem_cache_type,
00092   global_mem_cache_line_size,
00093   global_mem_cache_size,
00094   global_mem_size,
00095   max_constant_buffer_size,
00096   max_constant_args,
00097   local_mem_type,
00098   local_mem_size,
00099   error_correction_support,
00100   host_unified_memory,
00101   profiling_timer_resolution,
00102   endian_little,
00103   is_available,
00104   is_compiler_available,
00105   is_linker_available,
00106   execution_capabilities,
00107   queue_properties,
00108   built_in_kernels,
00109   platform,
00110   name,
00111   vendor,
00112   driver_version,
00113   profile,
00114   device_version,
00115   opencl_version,
00116   extensions,
00117   printf_buffer_size,
00118   preferred_interop_user_sync,
00119   parent_device,
00120   partition_max_sub_devices,
00121   partition_properties,
00122   partition_affinity_domain,
00123   partition_type,
00124   reference_count
00125 };
```

8.3.4.3 device_affinity_domain

`enum cl::sycl::info::device_affinity_domain : int [strong]`

`#include <include/CL/sycl/info/device.hpp>`

Enumerator

unsupported	
numa	
L4_cache	
L3_cache	
L2_cache	
next_partitionable	

Definition at line 135 of file device.hpp.

```
00135                                   : int {
00136   unsupported,
00137   numa,
00138   L4_cache,
00139   L3_cache,
00140   L2_cache,
00141   next_partitionable
00142 };
```

8.3.4.4 device_execution_capabilities

```
enum cl::sycl::info::device_execution_capabilities :  unsigned int  [strong]
```

```
#include <include/CL/sycl/info/device.hpp>
```

Enumerator

exec_kernel	
exec_native_kernel	

Definition at line 176 of file device.hpp.

```
00176                                          : unsigned int {
00177   exec_kernel,
00178   exec_native_kernel
00179 };
```

8.3.4.5 device_partition_property

```
enum cl::sycl::info::device_partition_property :  int  [strong]
```

```
#include <include/CL/sycl/info/device.hpp>
```

Enumerator

unsupported	
partition_equally	
partition_by_counts	
partition_by_affinity_domain	
partition_affinity_domain_next_partitionable	

Definition at line 127 of file device.hpp.

```
00127                                       : int {
00128   unsupported,
00129   partition_equally,
00130   partition_by_counts,
00131   partition_by_affinity_domain,
00132   partition_affinity_domain_next_partitionable
00133 };
```

8.3.4.6 device_partition_type

```
enum cl::sycl::info::device_partition_type :  int  [strong]
```

```
#include <include/CL/sycl/info/device.hpp>
```

Enumerator

no_partition	
numa	
L4_cache	
L3_cache	
L2_cache	
L1_cache	

Definition at line 144 of file device.hpp.

```
00144                                   : int {
00145   no_partition,
00146   numa,
00147   L4_cache,
00148   L3_cache,
00149   L2_cache,
00150   L1_cache
00151 };
```

8.3.4.7 device_type

```
enum cl::sycl::info::device_type :  unsigned int  [strong]
```

```
#include <include/CL/sycl/info/device.hpp>
```

Type of devices.

To be used either to define a device type or to select more broadly a kind of device

Todo To be moved in the specification from platform to device

Todo Add opencl to the specification

Todo there is no accelerator_selector and custom_accelerator

Enumerator

cpu	
gpu	
accelerator	
custom	
defaults	
host	
opencl	
all	

Definition at line 34 of file device.hpp.

```
00034                         : unsigned int {
00035   cpu,
00036   gpu,
00037   accelerator,
00038   custom,
00039   defaults,
00040   host,
00041   opencl,
00042   all
00043 };
```

8.3.4.8 fp_config

```
enum cl::sycl::info::fp_config :  int  [strong]
```

```
#include <include/CL/sycl/info/device.hpp>
```

Enumerator

denorm	
inf_nan	
round_to_nearest	
round_to_zero	
round_to_inf	
fma	
correctly_rounded_divide_sqrt	
soft_float	

Definition at line 159 of file device.hpp.

```
00159                       : int {
00160   denorm,
00161   inf_nan,
00162   round_to_nearest,
00163   round_to_zero,
00164   round_to_inf,
00165   fma,
00166   correctly_rounded_divide_sqrt,
00167   soft_float
00168 };
```

8.3.4.9 global_mem_cache_type

```
enum cl::sycl::info::global_mem_cache_type :  int  [strong]
```

```
#include <include/CL/sycl/info/device.hpp>
```

Enumerator

none	
read_only	
write_only	

Definition at line 170 of file device.hpp.

```
00170                                    : int {
00171   none,
00172   read_only,
00173   write_only
00174 };
```

8.3.4.10 local_mem_type

```
enum cl::sycl::info::local_mem_type :  int  [strong]
```

```
#include <include/CL/sycl/info/device.hpp>
```

Enumerator

none	
local	
global	

Definition at line 153 of file device.hpp.

```
00153                              : int {
00154   none,
00155   local,
00156   global
00157 };
```

8.3.4.11 platform

```
enum cl::sycl::info::platform :  unsigned int  [strong]
```

```
#include <include/CL/sycl/info/platform.hpp>
```

Platform information descriptors.

A SYCL platform can be queried for all of the following information using the get_info function.

In this implementation, the values are mapped to OpenCL values to avoid further remapping later when OpenCL is used

Enumerator

TRISYCL_SKIP_OPENCL	Returns the profile name (as a string_class) supported by the implementation. Can be either FULL PROFILE or EMBEDDED PROFILE.
TRISYCL_SKIP_OPENCL	Returns the OpenCL software driver version string in the form major number.minor number (as a string_class)
TRISYCL_SKIP_OPENCL	Returns the name of the platform (as a string_class)
TRISYCL_SKIP_OPENCL	Returns the string provided by the platform vendor (as a string_class)
TRISYCL_SKIP_OPENCL	Returns a space-separated list of extension names supported by the platform (as a string_class)

Definition at line 31 of file platform.hpp.

```
00031                     : unsigned int {
00032   /** Returns the profile name (as a string_class) supported by the
00033       implementation.
00034
00035       Can be either FULL PROFILE or EMBEDDED PROFILE.
00036   */
00037   profile TRISYCL_SKIP_OPENCL(= CL_PLATFORM_PROFILE),
00038
00039   /** Returns the OpenCL software driver version string in the form major
00040       number.minor number (as a string_class)
00041   */
00042   version TRISYCL_SKIP_OPENCL(= CL_PLATFORM_VERSION),
00043
00044   /** Returns the name of the platform (as a string_class)
00045   */
00046   name TRISYCL_SKIP_OPENCL(= CL_PLATFORM_NAME),
00047
00048   /** Returns the string provided by the platform vendor (as a string_class)
00049   */
00050   vendor TRISYCL_SKIP_OPENCL(= CL_PLATFORM_VENDOR),
00051
00052   /** Returns a space-separated list of extension names supported by the
00053       platform (as a string_class)
00054   */
00055   extensions TRISYCL_SKIP_OPENCL(= CL_PLATFORM_EXTENSIONS),
00056
00057 #if CL_SYCL_LANGUAGE_VERSION >= 220 && defined(CL_VERSION_2_1)
00058   /** Returns the resolution of the host timer in nanoseconds as used by
00059       clGetDeviceAndHostTimer
00060   */
00061   host_timer_resolution
00062     TRISYCL_SKIP_OPENCL(= CL_PLATFORM_HOST_TIMER_RESOLUTION)
00063 #endif
00064 };
```

8.3.5 Function Documentation

8.3.5.1 device::get_info< info::device::device_type >()

```
template<>
auto cl::sycl::device::get_info< info::device::device_type > ( ) const  [inline]
```

```
#include <include/CL/sycl/device.hpp>
```

Definition at line 270 of file device.hpp.

References cl::sycl::info::cpu.

```
00270                                                    {
00271   return info::device_type::cpu;
00272 }
```

8.3.5.2 device::get_info< info::device::local_mem_size >()

```
template<>
auto cl::sycl::device::get_info< info::device::local_mem_size > ( ) const  [inline]
```

```
#include <include/CL/sycl/device.hpp>
```

Definition at line 275 of file device.hpp.

```
00275                                                                 {
00276   return size_t { 32000 };
00277 }
```

8.3.5.3 device::get_info< info::device::max_compute_units >()

```
template<>
auto cl::sycl::device::get_info< info::device::max_compute_units > ( ) const  [inline]
```

```
#include <include/CL/sycl/device.hpp>
```

Definition at line 265 of file device.hpp.

```
00265                                                                 {
00266   return size_t { 8 };
00267 }
```

8.3.5.4 device::get_info< info::device::max_mem_alloc_size >()

```
template<>
auto cl::sycl::device::get_info< info::device::max_mem_alloc_size > ( ) const  [inline]
```

```
#include <include/CL/sycl/device.hpp>
```

Definition at line 280 of file device.hpp.

```
00280                                                                 {
00281   return size_t { 32000 };
00282 }
```

8.3.5.5 device::get_info< info::device::max_work_group_size >()

```
template<>
auto cl::sycl::device::get_info< info::device::max_work_group_size > ( ) const  [inline]
```

#include <include/CL/sycl/device.hpp>

Definition at line 260 of file device.hpp.

```
00260                                                                {
00261   return size_t { 8 };
00262 }
```

8.3.5.6 device::get_info< info::device::name >()

```
template<>
auto cl::sycl::device::get_info< info::device::name > ( ) const  [inline]
```

#include <include/CL/sycl/device.hpp>

Definition at line 290 of file device.hpp.

```
00290                                                  {
00291   return string_class {};
00292 }
```

8.3.5.7 device::get_info< info::device::profile >()

```
template<>
auto cl::sycl::device::get_info< info::device::profile > ( ) const  [inline]
```

#include <include/CL/sycl/device.hpp>

Definition at line 295 of file device.hpp.

```
00295                                                    {
00296   return string_class { "FULL_PROFILE" };
00297 }
```

8.3.5.8 device::get_info< info::device::vendor >()

```
template<>
auto cl::sycl::device::get_info< info::device::vendor > ( ) const  [inline]
```

`#include <include/CL/sycl/device.hpp>`

Definition at line 285 of file device.hpp.

```
00285                                                    {
00286   return string_class {};
00287 }
```

8.3.5.9 get_devices() [1/3]

```
vector_class< cl::sycl::device > cl::sycl::detail::opencl_platform::get_devices (
            info::device_type device_type ) const  [inline], [override], [virtual]
```

`#include <include/CL/sycl/platform/detail/opencl_platform.hpp>`

Get all the available devices for this OpenCL platform.

Returns a vector class containing all SYCL devices associated with this OpenCL platform.

Parameters

in	*device_type*	is the device type to filter the selection or `info::device_type::all` by default to return all the devices

Returns

the device list

Implements cl::sycl::detail::platform.

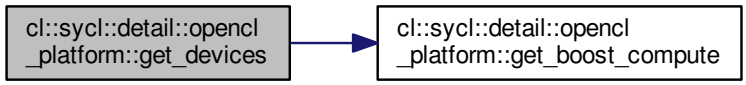
Definition at line 32 of file opencl_platform_tail.hpp.

References cl::sycl::detail::opencl_platform::get_boost_compute().

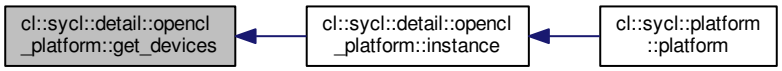
Referenced by cl::sycl::detail::opencl_platform::instance().

```
00032                                                                                {
00033   vector_class<cl::sycl::device> devices;
00034     device_type_selector ds { device_type };
00035   // Add the desired OpenCL devices
00036   for (const auto &d : get_boost_compute().devices()) {
00037     // Get the SYCL device from the Boost Compute device
00038     cl::sycl::device sycl_dev { d };
00039     /* Return the devices with the good criterion according to the selector.
00040        By calling devices on the \c boost::compute::platform we know that
00041        we iterate only over the device belonging to the current platform,
00042     */
00043     if (ds(sycl_dev) > 0)
00044       devices.push_back(sycl_dev);
00045   }
00046
00047   return devices;
00048 }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.3.5.10 get_devices() [2/3]

```
vector_class< cl::sycl::device > cl::sycl::detail::host_platform::get_devices (
            info::device_type device_type ) const  [inline], [override], [virtual]
```

```
#include <include/CL/sycl/platform/detail/host_platform.hpp>
```

Get all the available devices for the host platform.

Get all the available devices for this platform.

Parameters

in	*device_type*	is the device type to filter the selection or `info::device_type::all` by default to return all the devices

Returns

the device list

If `get_devices` is called with the host platform and the right device type, returns the host_device.

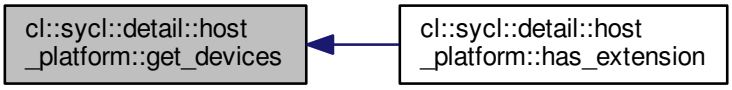
Implements cl::sycl::detail::platform.

Definition at line 31 of file host_platform_tail.hpp.

Referenced by cl::sycl::detail::host_platform::has_extension().

```
00031                                                                    {
00032   /** If \c get_devices is called with the host platform
00033       and the right device type, returns the host_device.
00034   */
00035   if (device_type_selector { device_type }(cl::sycl::device {}) > 0)
00036     // Return 1 default device, i.e. the host device
00037     return { {} };
00038   else
00039     // No matching device
00040     return {};
00041 }
```

Here is the caller graph for this function:



8.3.5.11 get_devices() [3/3]

```
vector_class< device > cl::sycl::device::get_devices (
            info::device_type device_type = info::device_type::all )  [static]
```

```
#include <include/CL/sycl/device.hpp>
```

Return a list of all available devices.

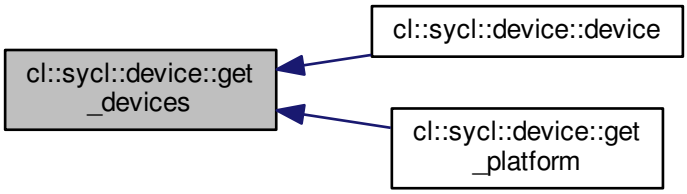
Return synchronous errors via SYCL exception classes.

Definition at line 26 of file device_tail.hpp.

Referenced by cl::sycl::device::device(), and cl::sycl::device::get_platform().

```
00026                                                {
00027   // Start with the default device
00028   vector_class<device> devices = { {} };
00029
00030 #ifdef TRISYCL_OPENCL
00031   // Then add all the OpenCL devices
00032   for (const auto &d : boost::compute::system::devices())
00033     devices.emplace_back(d);
00034 #endif
00035
00036   // The selected devices
00037   vector_class<device> sd;
00038   device_type_selector s { device_type };
00039
00040   // Return the devices with the good criterion according to the selector
00041   std::copy_if(devices.begin(), devices.end(), std::back_inserter(sd),
00042                [&](const device &e) { return s(e) >= 0; });
00043   return sd;
00044 }
```

Here is the caller graph for this function:



8.3.6 Variable Documentation

8.3.6.1 TRISYCL_WEAK_ATTRIB_SUFFIX

```
TRISYCL_WEAK_ATTRIB_PREFIX detail::cache< cl_command_queue, detail::opencl_queue > opencl_↩
queue::cache cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX
```

```
#include <include/CL/sycl/context/detail/opencl_context.hpp>
```

Definition at line 142 of file opencl_context.hpp.

Referenced by cl::sycl::detail::opencl_kernel::TRISYCL_ParallelForKernel_RANGE(), cl::sycl::detail::opencl_↩device::~opencl_device(), cl::sycl::detail::opencl_platform::~opencl_platform(), and cl::sycl::detail::opencl_↩queue::~opencl_queue().

8.4 Helpers to do array and tuple conversion

Classes

- struct cl::sycl::detail::expand_to_vector< V, Tuple, expansion >

  Allows optional expansion of a 1-element tuple to a V::dimension tuple to replicate scalar values in vector initialization. More...
- struct cl::sycl::detail::expand_to_vector< V, Tuple, true >

  Specialization in the case we ask for expansion. More...

Functions

- template<typename V , typename Tuple , size_t... Is>
  std::array< typename V::element_type, V::dimension > cl::sycl::detail::tuple_to_array_iterate (Tuple t, std::index_sequence< Is... >)

  Helper to construct an array from initializer elements provided as a tuple.
- template<typename V , typename Tuple >
  auto cl::sycl::detail::tuple_to_array (Tuple t)

  Construct an array from initializer elements provided as a tuple.
- static auto cl::sycl::detail::expand_to_vector< V, Tuple, expansion >::expand (Tuple t)
- template<typename Value , size_t... Is>
  static auto cl::sycl::detail::expand_to_vector< V, Tuple, true >::fill_tuple (Value e, std::index_sequence< Is... >)

  Construct a tuple from a value.
- static auto cl::sycl::detail::expand_to_vector< V, Tuple, true >::expand (Tuple t)

  We expand the 1-element tuple by replicating into a tuple with the size of the vector.
- template<typename V , typename Tuple >
  auto cl::sycl::detail::expand (Tuple t)

  Create the array data of V from a tuple of initializer.

8.4.1 Detailed Description

8.4.2 Class Documentation

8.4.2.1 struct cl::sycl::detail::expand_to_vector

template<typename V, typename Tuple, bool expansion = false>
struct cl::sycl::detail::expand_to_vector< V, Tuple, expansion >

Allows optional expansion of a 1-element tuple to a V::dimension tuple to replicate scalar values in vector initialization.

Definition at line 65 of file array_tuple_helpers.hpp.

Static Public Member Functions

- static auto expand (Tuple t)

8.4.2.2 struct cl::sycl::detail::expand_to_vector< V, Tuple, true >

template<typename V, typename Tuple>
struct cl::sycl::detail::expand_to_vector< V, Tuple, true >

Specialization in the case we ask for expansion.

Definition at line 77 of file array_tuple_helpers.hpp.

Static Public Member Functions

- template<typename Value , size_t... Is>
  static auto fill_tuple (Value e, std::index_sequence< Is... >)

  Construct a tuple from a value.
- static auto expand (Tuple t)

  We expand the 1-element tuple by replicating into a tuple with the size of the vector.

8.4.3 Function Documentation

8.4.3.1 expand() [1/3]

```
template<typename V , typename Tuple , bool expansion = false>
static auto cl::sycl::detail::expand_to_vector< V, Tuple, expansion >::expand (
            Tuple t )  [inline], [static]
```

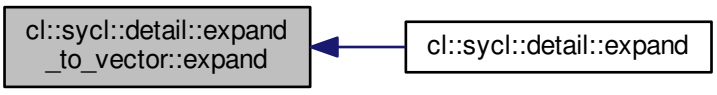
```
#include <include/CL/sycl/detail/array_tuple_helpers.hpp>
```

Definition at line 70 of file array_tuple_helpers.hpp.

Referenced by cl::sycl::detail::expand().

```
00070 { return t; }
```

Here is the caller graph for this function:



8.4.3.2 expand() [2/3]

```
template<typename V , typename Tuple >
static auto cl::sycl::detail::expand_to_vector< V, Tuple, true >::expand (
            Tuple t )  [inline], [static]
```

`#include <include/CL/sycl/detail/array_tuple_helpers.hpp>`

We expand the 1-element tuple by replicating into a tuple with the size of the vector.

Definition at line 109 of file array_tuple_helpers.hpp.

```
00109                                {
00110     return fill_tuple(std::get<0>(t),
00111                       std::make_index_sequence<V::dimension>{});
00112   }
```

8.4.3.3 expand() [3/3]

```
template<typename V , typename Tuple >
auto cl::sycl::detail::expand (
            Tuple t )
```

`#include <include/CL/sycl/detail/array_tuple_helpers.hpp>`

Create the array data of V from a tuple of initializer.

If there is only 1 initializer, this is a scalar initialization of a vector and the value is expanded to all the vector elements first.

Definition at line 123 of file array_tuple_helpers.hpp.

References cl::sycl::detail::expand_to_vector< V, Tuple, expansion >::expand().

```
00123                       {
00124   return tuple_to_array<V>(expand_to_vector<V,
00125                            decltype(t),
00126                            /* Only ask the expansion to all vector
00127                               element if there only a scalar
00128                               initializer */
00129                            std::tuple_size<Tuple>::value == 1>{}.expand(t));
00130 }
```

Here is the call graph for this function:

8.4.3.4 fill_tuple()

```
template<typename V , typename Tuple >
template<typename Value , size_t...  Is>
static auto cl::sycl::detail::expand_to_vector< V, Tuple, true >::fill_tuple (
             Value e,
             std::index_sequence< Is...  >  )  [inline], [static]
```

`#include <include/CL/sycl/detail/array_tuple_helpers.hpp>`

Construct a tuple from a value.

Parameters

value	is used to initialize each tuple element
size	is the number of elements of the tuple to be generated

The trick is to get the std::index_sequence<> that represent 0, 1,..., dimension-1 as a variadic template pack Is that we can iterate on, in this function.

Definition at line 93 of file array_tuple_helpers.hpp.

```
00093                                                          {
00094     /* The effect is like a static for-loop with Is counting from 0 to
00095        dimension-1 and thus replicating the pattern to have
00096        make_tuple( (0, e), (1, e), ... (n - 1, e) )
00097
00098        Since the "," operator is just here to throw away the Is value
00099        (which is needed for the pack expansion...), at the end this is
00100       equivalent to:
00101       make_tuple( e, e, ..., e )
00102    */
00103    return std::make_tuple(((void)Is, e)...);
00104  }
```

8.4.3.5 tuple_to_array()

```
template<typename V , typename Tuple >
auto cl::sycl::detail::tuple_to_array (
             Tuple t )
```

`#include <include/CL/sycl/detail/array_tuple_helpers.hpp>`

Construct an array from initializer elements provided as a tuple.

Definition at line 53 of file array_tuple_helpers.hpp.

```
00053                              {
00054   /* Construct an index_sequence with 0, 1, ..., (size of the tuple-1)
00055      so that tuple_to_array_iterate can statically iterate on it */
00056   return tuple_to_array_iterate<V>(t,
00057                                    std::make_index_sequence<std::tuple_size<Tuple>::value>{});
00058 }
```

8.4.3.6 tuple_to_array_iterate()

```
template<typename V , typename Tuple , size_t...  Is>
std::array<typename V::element_type, V::dimension> cl::sycl::detail::tuple_to_array_iterate (
            Tuple t,
            std::index_sequence< Is...  >  )
```

`#include <include/CL/sycl/detail/array_tuple_helpers.hpp>`

Helper to construct an array from initializer elements provided as a tuple.

The trick is to get the std::index_sequence<> that represent 0, 1,..., dimension-1 as a variadic template pack Is that we can iterate on, in this function.

Definition at line 37 of file array_tuple_helpers.hpp.

```
00037                                                                {
00038   /* The effect is like a static for-loop with Is counting from 0 to
00039      dimension-1 and thus constructing a uniform initialization { }
00040      construction from each tuple element:
00041      { std::get<0>(t), std::get<1>(t), ..., std::get<dimension-1>(t) }
00042
00043      The static cast is here to avoid the warning when there is a loss
00044      of precision, for example when initializing an int from a float.
00045   */
00046   return { { static_cast<typename V::element_type>(std::get<Is>(t))...} };
00047 }
```

8.5 Some helpers for the implementation

Classes

- struct cl::sycl::detail::container_element_aspect< T >

  A mix-in to add some container element aspects. More...
- struct cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >

  Define a multi-dimensional index, used for example to locate a work item or a buffer element. More...
- struct cl::sycl::detail::small_array_123< BasicType, FinalType, Dims >

  A small array of 1, 2 or 3 elements with the implicit constructors. More...
- struct cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >

  Use some specializations so that some function overloads can be determined according to some implicit constructors and to have an implicit conversion from/to BasicType (such as an int typically) if Dimensions = 1. More...
- struct cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >
- struct cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >

Macros

- #define TRISYCL_BOOST_OPERATOR_VECTOR_OP(op)

  Helper macro to declare a vector operation with the given side-effect operator.
- #define TRISYCL_LOGICAL_OPERATOR_VECTOR_OP(op)

Functions

- template<typename Range , typename Id >
  size_t constexpr cl::sycl::detail::linear_id (Range range, Id id, Id offset={})

  Compute a linearized array access used in the OpenCL 2 world.
- void cl::sycl::detail::unimplemented ()

  Display an "unimplemented" message.

8.5.1 Detailed Description

8.5.2 Class Documentation

8.5.2.1 struct cl::sycl::detail::container_element_aspect

template<typename T>
struct cl::sycl::detail::container_element_aspect< T >

A mix-in to add some container element aspects.

Definition at line 23 of file container_element_aspect.hpp.

Public Types

- using value_type = T
- using pointer = value_type *
- using const_pointer = const value_type *
- using reference = value_type &
- using const_reference = const value_type &

8.5.2.1.1 Member Typedef Documentation

8.5.2.1.1.1 const_pointer

```
template<typename T>
using cl::sycl::detail::container_element_aspect< T >::const_pointer = const value_type*
```

Definition at line 27 of file container_element_aspect.hpp.

8.5.2.1.1.2 const_reference

```
template<typename T>
using cl::sycl::detail::container_element_aspect< T >::const_reference = const value_type&
```

Definition at line 29 of file container_element_aspect.hpp.

8.5.2.1.1.3 pointer

```
template<typename T>
using cl::sycl::detail::container_element_aspect< T >::pointer = value_type*
```

Definition at line 26 of file container_element_aspect.hpp.

8.5.2.1.1.4 reference

```
template<typename T>
using cl::sycl::detail::container_element_aspect< T >::reference = value_type&
```

Definition at line 28 of file container_element_aspect.hpp.

8.5.2.1.1.5 value_type

```
template<typename T>
using cl::sycl::detail::container_element_aspect< T >::value_type = T
```

Definition at line 25 of file container_element_aspect.hpp.

8.5.2.2 struct cl::sycl::detail::small_array

template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor = false>
struct cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >

Define a multi-dimensional index, used for example to locate a work item or a buffer element.

Unfortunately, even if std::array is an aggregate class allowing native list initialization, it is no longer an aggregate if we derive from an aggregate. Thus we have to redeclare the constructors.

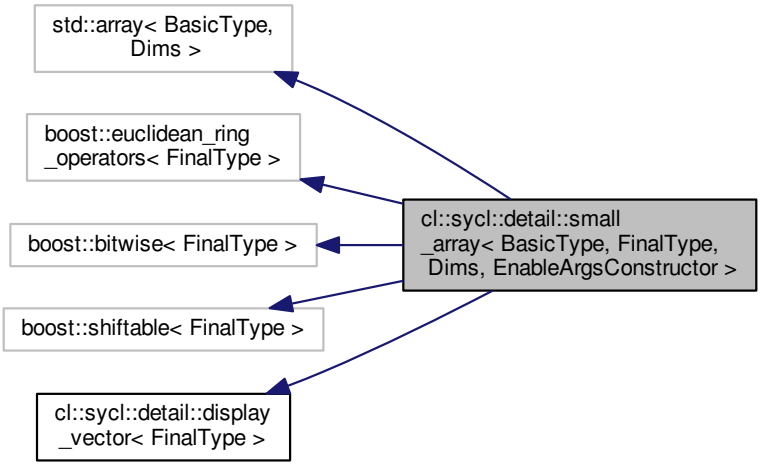
Parameters

BasicType	is the type element, such as int
Dims	is the dimension number, typically between 1 and 3
FinalType	is the final type, such as range<> or id<>, so that boost::operator can return the right type
EnableArgsConstructor	adds a constructors from Dims variadic elements when true. It is false by default.

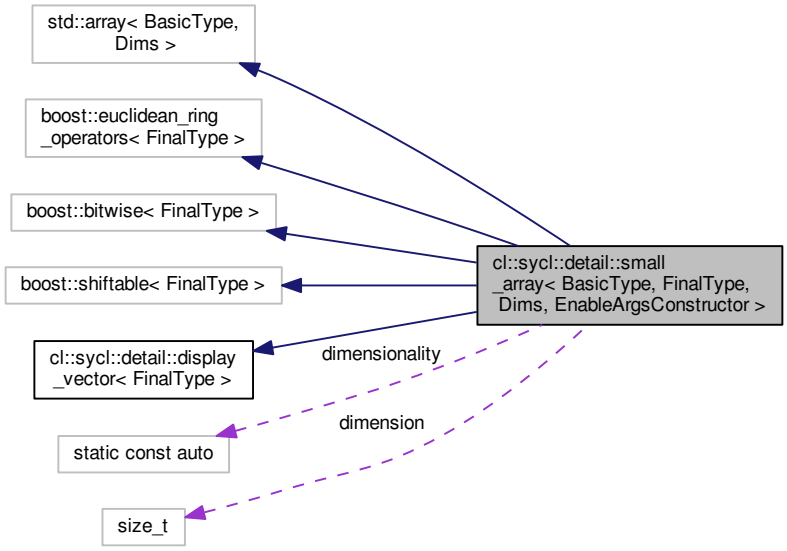
std::array<> provides the collection concept, with .size(), == and != too.

Definition at line 74 of file small_array.hpp.

Inheritance diagram for cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >:



Collaboration diagram for cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >:



Public Types

- using element_type = BasicType

Public Member Functions

- template<typename SourceType >
  small_array (const SourceType src[Dims])
  A constructor from another array.
- BasicType & x ()
  An accessor to the first variable of a small array.
- BasicType & y ()
  An accessor to the second variable of a small array.
- BasicType & z ()
  An accessor to the third variable of a small array.
- template<typename SourceBasicType , typename SourceFinalType , bool SourceEnableArgsConstructor>
  small_array (const small_array< SourceBasicType, SourceFinalType, Dims, SourceEnableArgsConstructor > &src)
  A constructor from another small_array of the same size.
- template<typename... Types, bool Depend = true, typename = typename std::enable_if_t<EnableArgsConstructor && Depend>>
  small_array (const Types &... args)
  Initialize the array from a list of elements.
- template<typename SourceBasicType >
  small_array (const std::array< SourceBasicType, Dims > &src)
  Construct a small_array from a std::array.
- small_array ()=default
  Keep the synthesized constructors.
- auto get (std::size_t index) const
  Return the element of the array.
- operator FinalType ()
  Add + like operations on the id<> and others.

Static Public Attributes

- static const auto dimensionality = Dims
- static const size_t dimension = Dims

8.5.2.2.1 Member Typedef Documentation

8.5.2.2.1.1 element_type

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
using cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >↩
::element_type = BasicType
```

Definition at line 94 of file small_array.hpp.

8.5.2.2.2 Constructor & Destructor Documentation

8.5.2.2.2.1 small_array() [1/5]

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
template<typename SourceType >
cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::small_↩
array (
            const SourceType src[Dims] )  [inline]
```

A constructor from another array.

Make it explicit to avoid spurious range<> constructions from int * for example

Definition at line 103 of file small_array.hpp.

```
00103                                         {
00104     // (*this)[0] is the first element of the underlying array
00105     std::copy_n(src, Dims, &(*this)[0]);
00106   }
```

8.5.2.2.2.2 small_array() [2/5]

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
template<typename SourceBasicType , typename SourceFinalType , bool SourceEnableArgsConstructor>
cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::small_↩
array (
            const small_array< SourceBasicType, SourceFinalType, Dims, SourceEnableArgs↩
Constructor > & src )  [inline]
```

A constructor from another small_array of the same size.

Definition at line 137 of file small_array.hpp.

```
00140                                                 {
00141     std::copy_n(&src[0], Dims, &(*this)[0]);
00142   }
```

8.5.2.2.2.3 small_array() [3/5]

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
template<typename... Types, bool Depend = true, typename = typename std::enable_if_t<Enable↩
ArgsConstructor && Depend>>
cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::small_↩
array (
            const Types &... args ) [inline]
```

Initialize the array from a list of elements.

Strangely, even when using the array constructors, the initialization of the aggregate is not available. So recreate an equivalent here.

Since there are inherited types that defines some constructors with some conflicts, make it optional here, according to EnableArgsConstructor template parameter.

Definition at line 160 of file small_array.hpp.

```
00161     : std::array<BasicType, Dims> {
00162     // Allow a loss of precision in initialization with the static_cast
00163     { static_cast<BasicType>(args)... }
00164   }
```

8.5.2.2.2.4 small_array() [4/5]

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
template<typename SourceBasicType >
cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::small_↩
array (
            const std::array< SourceBasicType, Dims > & src ) [inline]
```

Construct a small_array from a std::array.

Definition at line 174 of file small_array.hpp.

```
00175   : std::array<BasicType, Dims>(src) {}
```

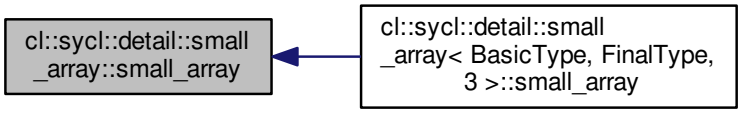
8.5.2.2.2.5 small_array() [5/5]

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::small_↩
array ( ) [default]
```

Keep the synthesized constructors.

Referenced by cl::sycl::detail::small_array< BasicType, FinalType, 3 >::small_array().

Here is the caller graph for this function:



8.5.2.2.3 Member Function Documentation

8.5.2.2.3.1 get()

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
auto cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::get (
            std::size_t index ) const  [inline]
```

Return the element of the array.

Definition at line 185 of file small_array.hpp.

```
00185                                    {
00186     return (*this)[index];
00187   }
```

8.5.2.2.3.2 operator FinalType()

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::operator
FinalType ( )  [inline]
```

Add + like operations on the id<> and others.

Add - like operations on the id<> and others Add ∗ like operations on the id<> and others Add / like operations on the id<> and others Add % like operations on the id<> and others Add << like operations on the id<> and others Add >> like operations on the id<> and others Add & like operations on the id<> and others Add ^ like operations on the id<> and others Add | like operations on the id<> and others Since the boost::operator work on the small_array, add an implicit conversion to produce the expected type

Definition at line 228 of file small_array.hpp.

```
00228                           {
00229     return *static_cast<FinalType *>(this);
00230   }
```

8.5.2.2.3.3 x()

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
BasicType& cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor
>::x ( )  [inline]
```

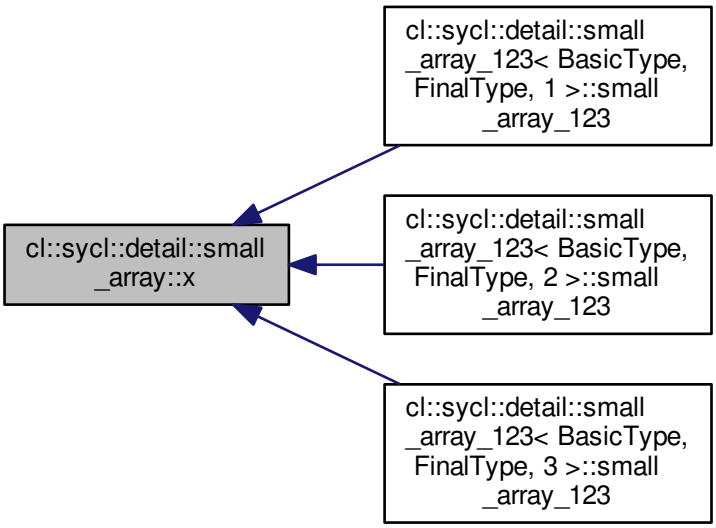
An accessor to the first variable of a small array.

Definition at line 111 of file small_array.hpp.

Referenced by cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >::small_array_123(), cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >::small_array_123(), and cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >::small_array_123().

```
00111                {
00112     static_assert(Dims >= 1, "can't access to small_array[0] if Dims < 1");
00113     return (*this)[0];
00114   }
```

Here is the caller graph for this function:



8.5.2.2.3.4 y()

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
BasicType& cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor
>::y ( )  [inline]
```

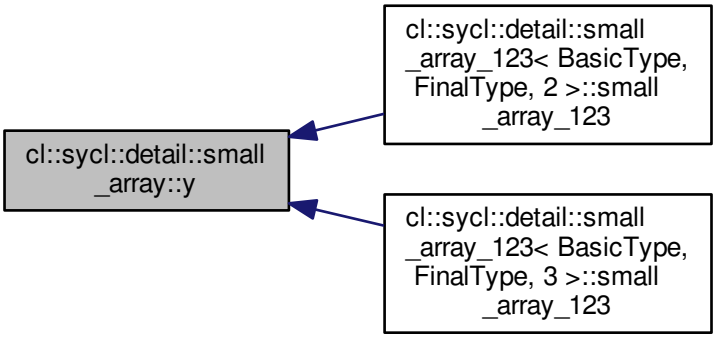
An accessor to the second variable of a small array.

Definition at line 119 of file small_array.hpp.

Referenced by cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >::small_array_123(), and cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >::small_array_123().

```
00119                 {
00120     static_assert(Dims >= 2, "can't access to small_array[1] if Dims < 2");
00121     return (*this)[1];
00122   }
```

Here is the caller graph for this function:



8.5.2.2.3.5 z()

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
BasicType& cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor
>::z ( )  [inline]
```

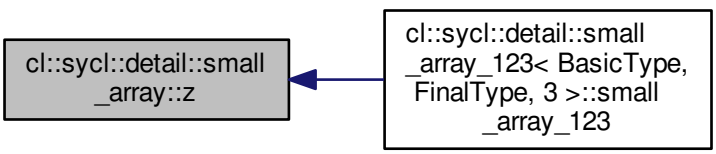
An accessor to the third variable of a small array.

Definition at line 127 of file small_array.hpp.

Referenced by cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >::small_array_123().

```
00127                 {
00128     static_assert(Dims >= 3, "can't access to small_array[2] if Dims < 3");
00129     return (*this)[2];
00130   }
```

Here is the caller graph for this function:



8.5.2.2.4 Member Data Documentation

8.5.2.2.4.1 dimension

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
const size_t cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor
>::dimension = Dims  [static]
```

Definition at line 93 of file small_array.hpp.

8.5.2.2.4.2 dimensionality

```
template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor
= false>
const auto cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor
>::dimensionality = Dims  [static]
```

Todo add this Boost::multi_array or STL concept to the specification?

Definition at line 89 of file small_array.hpp.

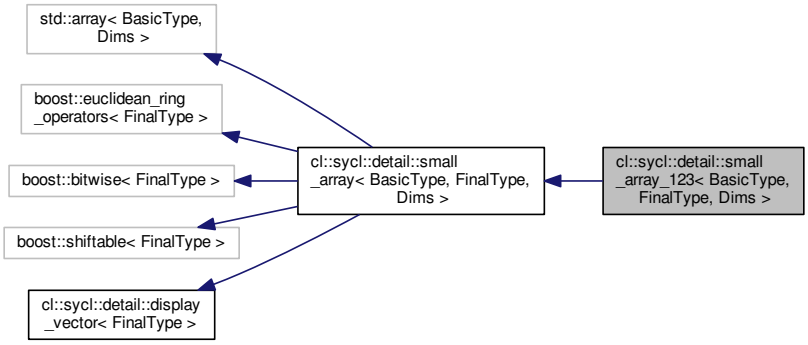
8.5.2.3 struct cl::sycl::detail::small_array_123

template<typename BasicType, typename FinalType, std::size_t Dims>
struct cl::sycl::detail::small_array_123< BasicType, FinalType, Dims >

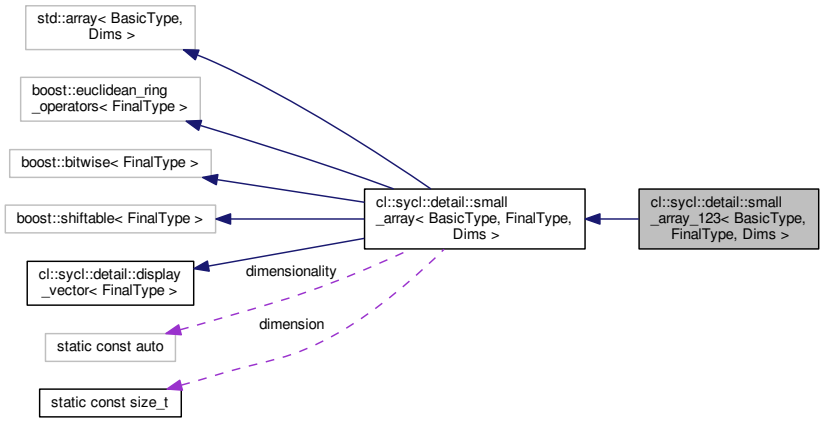
A small array of 1, 2 or 3 elements with the implicit constructors.

Definition at line 237 of file small_array.hpp.

Inheritance diagram for cl::sycl::detail::small_array_123< BasicType, FinalType, Dims >:



Collaboration diagram for cl::sycl::detail::small_array_123< BasicType, FinalType, Dims >:



Additional Inherited Members

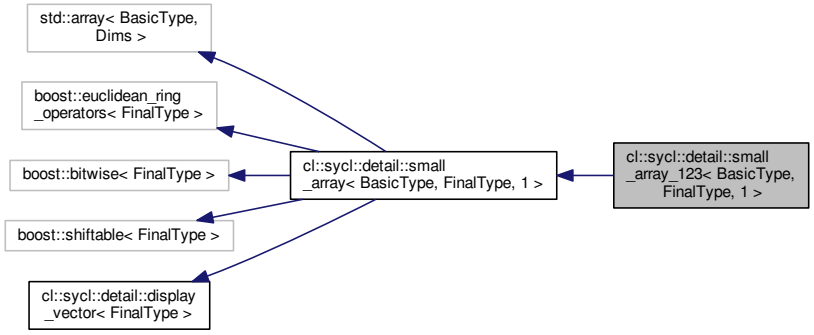
8.5.2.4 struct cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >

template<typename BasicType, typename FinalType>
struct cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >

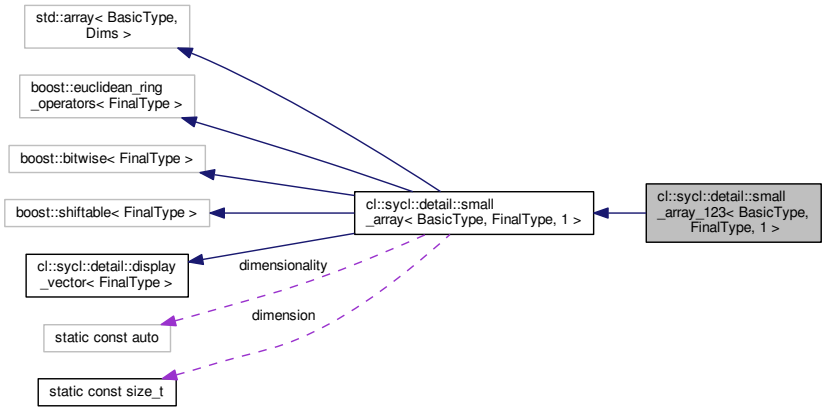
Use some specializations so that some function overloads can be determined according to some implicit constructors and to have an implicit conversion from/to BasicType (such as an int typically) if Dimensions = 1.

Definition at line 249 of file small_array.hpp.

Inheritance diagram for cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >:



Collaboration diagram for cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >:



Public Member Functions

- small_array_123 (BasicType x)

  A 1-D constructor to have implicit conversion from from 1 integer and automatic inference of the dimensionality.
- small_array_123 ()=default

  Keep other constructors.
- operator BasicType () const

  Conversion so that an for example an id<1> can basically be used like an integer.

Additional Inherited Members

8.5.2.4.1 Constructor & Destructor Documentation

8.5.2.4.1.1 small_array_123() [1/2]

```
template<typename BasicType , typename FinalType >
cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >::small_array_123 (
            BasicType x )  [inline]
```

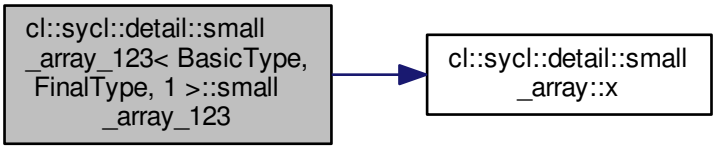
A 1-D constructor to have implicit conversion from from 1 integer and automatic inference of the dimensionality.

Definition at line 253 of file small_array.hpp.

References cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::x().

```
00253                                {
00254     (*this)[0] = x;
00255   }
```

Here is the call graph for this function:



8.5.2.4.1.2 small_array_123() [2/2]

```
template<typename BasicType , typename FinalType >
cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >::small_array_123 ( )  [default]
```

Keep other constructors.

8.5.2.4.2 Member Function Documentation

8.5.2.4.2.1 operator BasicType()

```
template<typename BasicType , typename FinalType >
cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >::operator BasicType ( ) const
[inline]
```

Conversion so that an for example an id<1> can basically be used like an integer.

Definition at line 265 of file small_array.hpp.

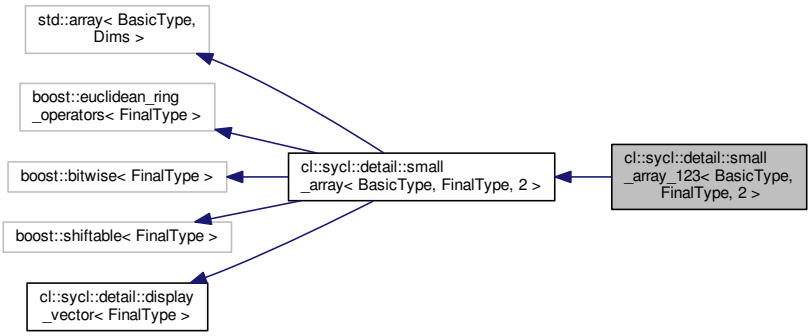
```
00265                                {
00266     return (*this)[0];
00267   }
```

8.5.2.5 struct cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >

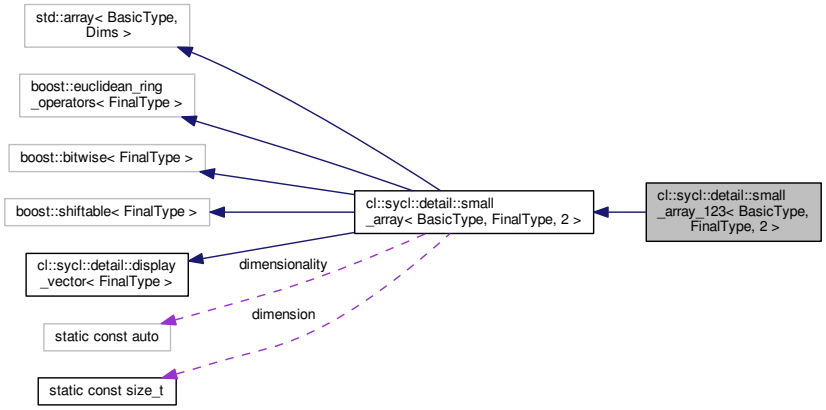
template<typename BasicType, typename FinalType>
struct cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >

Definition at line 272 of file small_array.hpp.

Inheritance diagram for cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >:



Collaboration diagram for cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >:



Public Member Functions

- small_array_123 (BasicType x, BasicType y)

  A 2-D constructor to have implicit conversion from from 2 integers and automatic inference of the dimensionality.
- small_array_123 (BasicType e)

  Broadcasting constructor initializing all the elements with the same value.
- small_array_123 ()=default

  Keep other constructors.

Additional Inherited Members

8.5.2.5.1 Constructor & Destructor Documentation

8.5.2.5.1.1 small_array_123() [1/3]

```
template<typename BasicType , typename FinalType >
cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >::small_array_123 (
            BasicType x,
            BasicType y )  [inline]
```

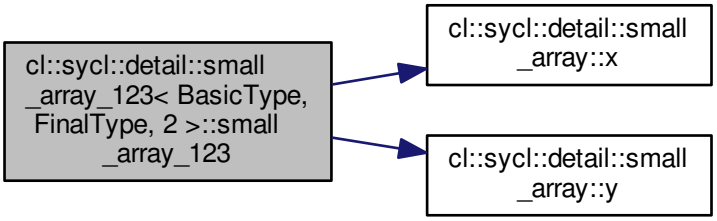
A 2-D constructor to have implicit conversion from from 2 integers and automatic inference of the dimensionality.

Definition at line 276 of file small_array.hpp.

References cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::x(), and cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::y().

```
00276                                                {
00277     (*this)[0] = x;
00278     (*this)[1] = y;
00279   }
```

Here is the call graph for this function:



8.5.2.5.1.2 small_array_123() [2/3]

```
template<typename BasicType , typename FinalType >
cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >::small_array_123 (
            BasicType e )  [inline], [explicit]
```

Broadcasting constructor initializing all the elements with the same value.

Todo Add to the specification of the range, id...

Definition at line 287 of file small_array.hpp.

```
00287 : small_array_123 { e, e } { }
```

8.5.2.5.1.3 small_array_123() [3/3]

```
template<typename BasicType , typename FinalType >
cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >::small_array_123 ( )  [default]
```

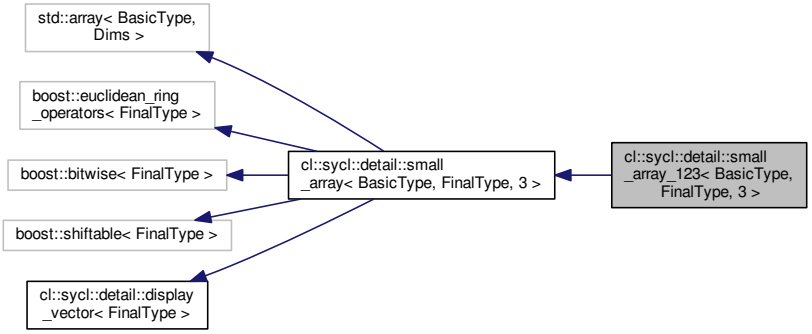
Keep other constructors.

8.5.2.6 struct cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >

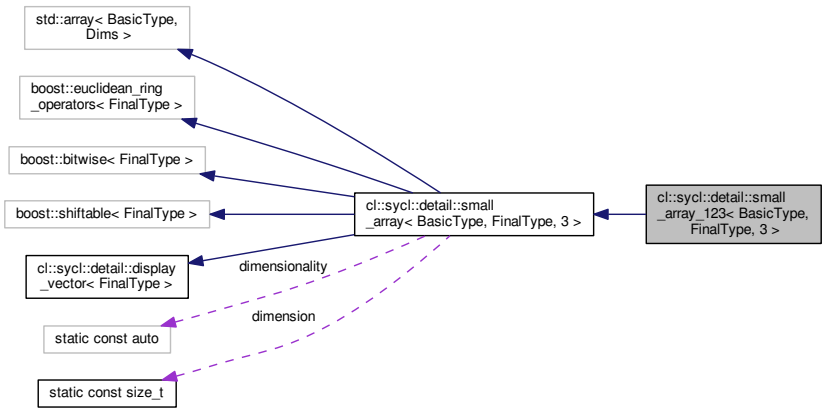
template<typename BasicType, typename FinalType>
struct cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >

Definition at line 298 of file small_array.hpp.

Inheritance diagram for cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >:



Collaboration diagram for cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >:



Public Member Functions

- small_array_123 (BasicType x, BasicType y, BasicType z)

  A 3-D constructor to have implicit conversion from from 3 integers and automatic inference of the dimensionality.
- small_array_123 (BasicType e)

  Broadcasting constructor initializing all the elements with the same value.
- small_array_123 ()=default

  Keep other constructors.

Additional Inherited Members

8.5.2.6.1 Constructor & Destructor Documentation

8.5.2.6.1.1 small_array_123() [1/3]

```
template<typename BasicType , typename FinalType >
cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >::small_array_123 (
            BasicType x,
            BasicType y,
            BasicType z )  [inline]
```

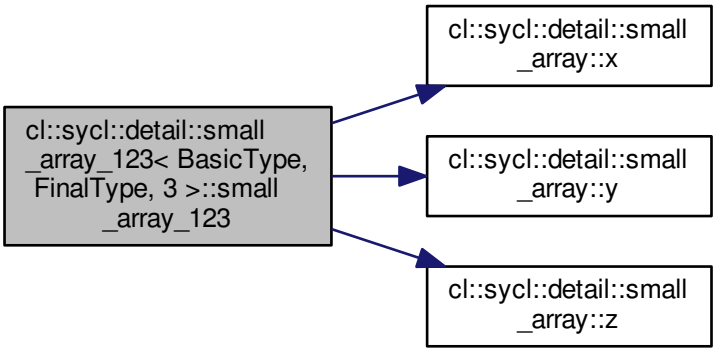
A 3-D constructor to have implicit conversion from from 3 integers and automatic inference of the dimensionality.

Definition at line 302 of file small_array.hpp.

References cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::x(), cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::y(), and cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::z().

```
00302                                                                    {
00303     (*this)[0] = x;
00304     (*this)[1] = y;
00305     (*this)[2] = z;
00306   }
```

Here is the call graph for this function:



8.5.2.6.1.2 small_array_123() [2/3]

```
template<typename BasicType , typename FinalType >
cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >::small_array_123 (
             BasicType e )  [inline], [explicit]
```

Broadcasting constructor initializing all the elements with the same value.

Todo Add to the specification of the range, id...

Definition at line 314 of file small_array.hpp.

```
00314 : small_array_123 { e, e, e } { }
```

8.5.2.6.1.3 small_array_123() [3/3]

```
template<typename BasicType , typename FinalType >
cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >::small_array_123 ( )  [default]
```

Keep other constructors.

8.5.3 Macro Definition Documentation

8.5.3.1 TRISYCL_BOOST_OPERATOR_VECTOR_OP

```
#define TRISYCL_BOOST_OPERATOR_VECTOR_OP(
             op )
```

`#include <include/CL/sycl/detail/small_array.hpp>`

Value:

```
FinalType operator op(const FinalType &rhs) {          \
    for (std::size_t i = 0; i != Dims; ++i)              \
      (*this)[i] op rhs[i];                              \
    return *this;                                        \
  }
```

Helper macro to declare a vector operation with the given side-effect operator.

Definition at line 33 of file small_array.hpp.

Referenced by cl::sycl::detail::small_array< BasicType, FinalType, 3 >::get().

8.5.3.2 TRISYCL_LOGICAL_OPERATOR_VECTOR_OP

```
#define TRISYCL_LOGICAL_OPERATOR_VECTOR_OP(
              op )
```

`#include <include/CL/sycl/detail/small_array.hpp>`

Value:

```
FinalType operator op(const FinalType &rhs) {          \
    FinalType res;                                       \
    for (std::size_t i = 0; i != Dims; ++i)              \
      res[i] = (*this)[i] op rhs[i];                     \
    return res;                                          \
  }
```

Definition at line 41 of file small_array.hpp.

Referenced by cl::sycl::detail::small_array< BasicType, FinalType, 3 >::get().

8.5.4 Function Documentation

8.5.4.1 linear_id()

```
template<typename Range , typename Id >
size_t constexpr cl::sycl::detail::linear_id (
             Range range,
             Id id,
             Id offset = {} )  [inline]
```

`#include <include/CL/sycl/detail/linear_id.hpp>`

Compute a linearized array access used in the OpenCL 2 world.

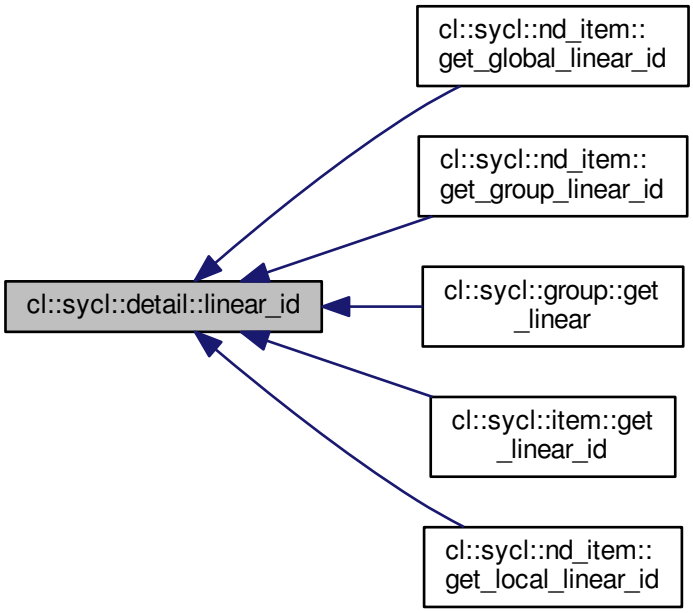
Typically for the get_global_linear_id() and get_local_linear_id() functions.

Definition at line 28 of file linear_id.hpp.

Referenced by cl::sycl::nd_item< Dimensions >::get_global_linear_id(), cl::sycl::nd_item< Dimensions >::get_group_linear_id(), cl::sycl::group< Dimensions >::get_linear(), cl::sycl::item< Dimensions >::get_linear_id(), and cl::sycl::nd_item< Dimensions >::get_local_linear_id().

```
00028                                                                    {}) {
00029   auto dims = std::distance(std::begin(range), std::end(range));
00030
00031   size_t linear_id = 0;
00032   /* A good compiler should unroll this and do partial evaluation to
00033      remove the first multiplication by 0 of this Horner evaluation and
00034      remove the 0 offset evaluation */
00035     for (int i = dims - 1; i >= 0; --i)
00036       linear_id = linear_id*range[i] + id[i] - offset[i];
00037
00038     return linear_id;
00039   }
```

Here is the caller graph for this function:



8.5.4.2 unimplemented()

```
void cl::sycl::detail::unimplemented ( )  [inline]
```

```
#include <include/CL/sycl/detail/unimplemented.hpp>
```

Display an "unimplemented" message.

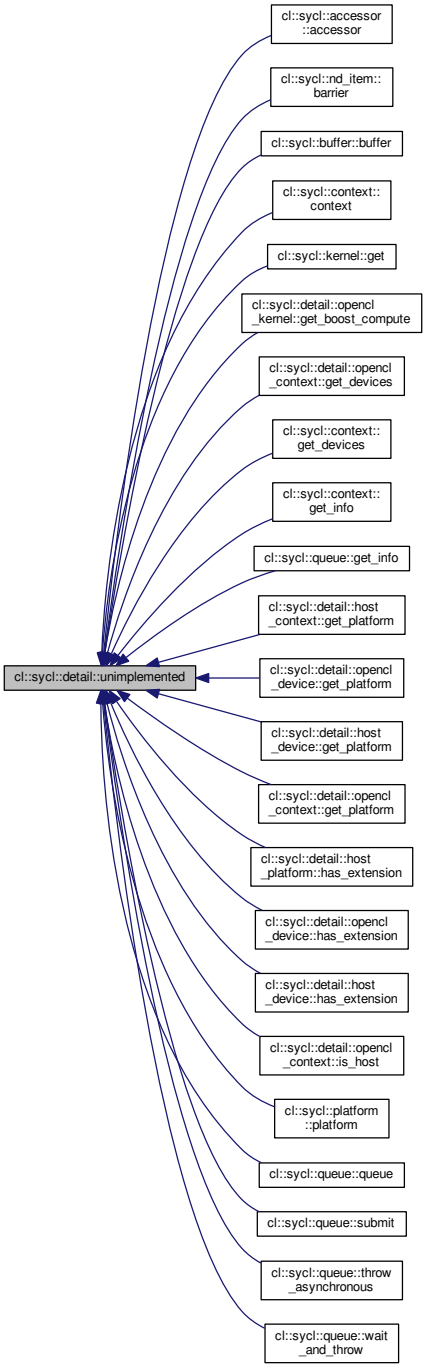
Can be changed to call assert(0) or whatever.

Definition at line 25 of file unimplemented.hpp.

Referenced by cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::accessor(), cl::sycl::nd_↩ item< Dimensions >::barrier(), cl::sycl::buffer< T, Dimensions, Allocator >::buffer(), cl::sycl::context::context(), cl::sycl::kernel::get(), cl::sycl::detail::opencl_kernel::get_boost_compute(), cl::sycl::detail::opencl_context::get_↩ devices(), cl::sycl::context::get_devices(), cl::sycl::context::get_info(), cl::sycl::queue::get_info(), cl::sycl::detail↩ ::host_context::get_platform(), cl::sycl::detail::opencl_device::get_platform(), cl::sycl::detail::host_device::get_↩ platform(), cl::sycl::detail::opencl_context::get_platform(), cl::sycl::detail::host_platform::has_extension(), cl::sycl↩ ::detail::opencl_device::has_extension(), cl::sycl::detail::host_device::has_extension(), cl::sycl::detail::opencl_↩ context::is_host(), cl::sycl::platform::platform(), cl::sycl::queue::queue(), cl::sycl::queue::submit(), cl::sycl::queue↩ ::throw_asynchronous(), and cl::sycl::queue::wait_and_throw().

```
00025                           {
00026 #ifndef NDEBUG
00027   std::cerr << "Error: using a non implemented feature!!!" << std::endl
00028             << "Please contribute to the open source implementation. :-)"
00029             << std::endl;
00030 #endif
00031 }
```

Here is the caller graph for this function:



8.6 Debugging and tracing support

Classes

- struct cl::sycl::detail::debug< T >

  Class used to trace the construction, copy-construction, move-construction and destruction of classes that inherit from it. More...
- struct cl::sycl::detail::display_vector< T >

  Class used to display a vector-like type of classes that inherit from it. More...

Functions

- template<typename KernelName , typename Functor >
  auto cl::sycl::detail::trace_kernel (const Functor &f)

  Wrap a kernel functor in some tracing messages to have start/stop information when TRISYCL_TRACE_KERNEL macro is defined.

8.6.1 Detailed Description

8.6.2 Class Documentation

8.6.2.1 struct cl::sycl::detail::debug

template<typename T>
struct cl::sycl::detail::debug< T >

Class used to trace the construction, copy-construction, move-construction and destruction of classes that inherit from it.

Parameters

T	is the real type name to be used in the debug output.

Definition at line 68 of file debug.hpp.

8.6.2.2 struct cl::sycl::detail::display_vector

template<typename T>
struct cl::sycl::detail::display_vector< T >

Class used to display a vector-like type of classes that inherit from it.

Parameters

T	is the real type name to be used in the debug output.

Calling the display() method dump the values on std::cout

Definition at line 160 of file debug.hpp.

Public Member Functions

- void display () const

  To debug and test.

8.6.2.2.1 Member Function Documentation

8.6.2.2.1.1 display()

```
template<typename T>
void cl::sycl::detail::display_vector< T >::display ( ) const  [inline]
```

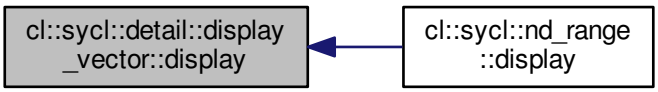
To debug and test.

Definition at line 163 of file debug.hpp.

Referenced by cl::sycl::nd_range< Dimensions >::display().

```
00163                       {
00164 #ifdef TRISYCL_DEBUG
00165     std::cout << boost::typeindex::type_id<T>().pretty_name() << ":";
00166 #endif
00167     // Get a pointer to the real object
00168     for (auto e : *static_cast<const T *>(this))
00169       std::cout << " " << e;
00170     std::cout << std::endl;
00171   }
```

Here is the caller graph for this function:



8.6.3 Function Documentation

8.6.3.1 trace_kernel()

```
template<typename KernelName , typename Functor >
auto cl::sycl::detail::trace_kernel (
             const Functor & f )
```

`#include <include/CL/sycl/detail/debug.hpp>`

Wrap a kernel functor in some tracing messages to have start/stop information when TRISYCL_TRACE_KERNEL macro is defined.

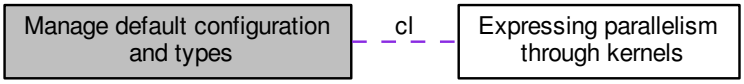
Definition at line 130 of file debug.hpp.

References TRISYCL_INTERNAL_DUMP.

```
00130                                    {
00131 #ifdef TRISYCL_TRACE_KERNEL
00132   // Inject tracing message around the kernel
00133   return [=] {
00134     /* Since the class KernelName may just be declared and not really
00135        defined, just use it through a class pointer to have
00136        typeid().name() not complaining */
00137     TRISYCL_INTERNAL_DUMP(
00138       "Kernel started "
00139       << boost::typeindex::type_id<KernelName *>().pretty_name());
00140     f();
00141     TRISYCL_INTERNAL_DUMP(
00142       "Kernel stopped "
00143       << boost::typeindex::type_id<KernelName *>().pretty_name());
00144   };
00145 #else
00146   // Identity by default
00147   return f;
00148 #endif
00149 }
```

8.7 Manage default configuration and types

Collaboration diagram for Manage default configuration and types:



Namespaces

- cl

  The vector type to be used as SYCL vector.

Macros

- #define CL_SYCL_LANGUAGE_VERSION 220

  This implement SYCL 2.2.
- #define TRISYCL_CL_LANGUAGE_VERSION 220

  This implement triSYCL 2.2.
- #define __SYCL_SINGLE_SOURCE__

  This source is compiled by a single source compiler.
- #define TRISYCL_MAKE_BOOST_CIRCULARBUFFER_THREAD_SAFE
- #define TRISYCL_SKIP_OPENCL(x) x

  Define TRISYCL_OPENCL to add OpenCL.

8.7.1 Detailed Description

8.7.2 Macro Definition Documentation

8.7.2.1 __SYCL_SINGLE_SOURCE__

```
#define __SYCL_SINGLE_SOURCE__
```

```
#include <include/CL/sycl/detail/global_config.hpp>
```

This source is compiled by a single source compiler.

Definition at line 28 of file global_config.hpp.

8.7.2.2 CL_SYCL_LANGUAGE_VERSION

```
#define CL_SYCL_LANGUAGE_VERSION 220
```

```
#include <include/CL/sycl/detail/global_config.hpp>
```

This implement SYCL 2.2.

Definition at line 19 of file global_config.hpp.

8.7.2.3 TRISYCL_CL_LANGUAGE_VERSION

```
#define TRISYCL_CL_LANGUAGE_VERSION 220
```

```
#include <include/CL/sycl/detail/global_config.hpp>
```

This implement triSYCL 2.2.

Definition at line 24 of file global_config.hpp.

8.7.2.4 TRISYCL_MAKE_BOOST_CIRCULARBUFFER_THREAD_SAFE

```
#define TRISYCL_MAKE_BOOST_CIRCULARBUFFER_THREAD_SAFE
```

```
#include <include/CL/sycl/detail/global_config.hpp>
```

Definition at line 33 of file global_config.hpp.

8.7.2.5 TRISYCL_SKIP_OPENCL

```
#define TRISYCL_SKIP_OPENCL(
              x ) x
```

```
#include <include/CL/sycl/detail/global_config.hpp>
```

Define TRISYCL_OPENCL to add OpenCL.

triSYCL can indeed work without OpenCL if only host support is needed.A macro to keep some stuff in OpenCL mode

Definition at line 51 of file global_config.hpp.

8.8 Error handling

Namespaces

- cl::sycl::trisycl

Classes

- struct cl::sycl::error_handler

  User supplied error handler to call a user-provided function when an error happens from a SYCL object that was constructed with this error handler. More...
- struct cl::sycl::exception_list

  Exception list to store several exceptions. More...
- class cl::sycl::exception

  Encapsulate a SYCL error information. More...
- class cl::sycl::cl_exception

  Returns the OpenCL error code encapsulated in the exception. More...
- struct cl::sycl::async_exception

  An error stored in an exception_list for asynchronous errors. More...
- class cl::sycl::runtime_error
- class cl::sycl::kernel_error

  Error that occurred before or while enqueuing the SYCL kernel. More...
- class cl::sycl::accessor_error

  Error regarding the cl::sycl::accessor objects defined. More...
- class cl::sycl::nd_range_error

  Error regarding the cl::sycl::nd_range specified for the SYCL kernel. More...
- class cl::sycl::event_error

  Error regarding associated cl::sycl::event objects. More...
- class cl::sycl::invalid_parameter_error

  Error regarding parameters to the SYCL kernel, it may apply to any captured parameters to the kernel lambda. More...
- class cl::sycl::device_error

  The SYCL device will trigger this exception on error. More...
- class cl::sycl::compile_program_error

  Error while compiling the SYCL kernel to a SYCL device. More...
- class cl::sycl::link_program_error

  Error while linking the SYCL kernel to a SYCL device. More...
- class cl::sycl::invalid_object_error

  Error regarding any memory objects being used inside the kernel. More...
- class cl::sycl::memory_allocation_error

  Error on memory allocation on the SYCL device for a SYCL kernel. More...
- class cl::sycl::pipe_error

  A failing pipe error will trigger this exception on error. More...
- class cl::sycl::platform_error

  The SYCL platform will trigger this exception on error. More...
- class cl::sycl::profiling_error

  The SYCL runtime will trigger this error if there is an error when profiling info is enabled. More...
- class cl::sycl::feature_not_supported

  Exception thrown when an optional feature or extension is used in a kernel but its not available on the device the SYCL kernel is being enqueued on. More...
- class cl::sycl::non_cl_error

  Exception for an OpenCL operation requested in a non OpenCL area. More...

Typedefs

- using cl::sycl::exception_ptr = std::exception_ptr

  A shared pointer to an exception as in C++ specification.
- using cl::sycl::async_handler = function_class< void, exception_list >

8.8.1 Detailed Description

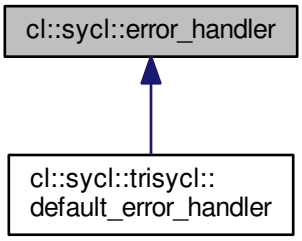
8.8.2 Class Documentation

8.8.2.1 struct cl::sycl::error_handler

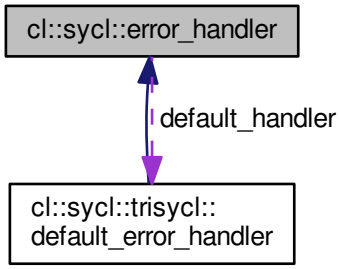
User supplied error handler to call a user-provided function when an error happens from a SYCL object that was constructed with this error handler.

Definition at line 32 of file error_handler.hpp.

Inheritance diagram for cl::sycl::error_handler:



Collaboration diagram for cl::sycl::error_handler:



Public Member Functions

- virtual void report_error (exception &error)=0

  The method to define to be called in the case of an error.
- virtual ~error_handler ()=0

Static Public Attributes

- static trisycl::default_error_handler default_handler

  Add a default_handler to be used by default.

8.8.2.1.1 Constructor & Destructor Documentation

8.8.2.1.1.1 ~error_handler()

```
virtual cl::sycl::error_handler::~error_handler ( )  [pure virtual]
```

8.8.2.1.2 Member Function Documentation

8.8.2.1.2.1 report_error()

```
virtual void cl::sycl::error_handler::report_error (
            exception & error )  [pure virtual]
```

The method to define to be called in the case of an error.

Todo Add "virtual void" to the specification

Implemented in cl::sycl::trisycl::default_error_handler.

8.8.2.1.3 Member Data Documentation

8.8.2.1.3.1 default_handler

```
trisycl::default_error_handler cl::sycl::error_handler::default_handler  [static]
```

Add a default_handler to be used by default.

Todo add this concept to the specification?

Definition at line 43 of file error_handler.hpp.

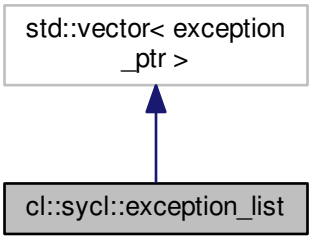
8.8.2.2 struct cl::sycl::exception_list

Exception list to store several exceptions.

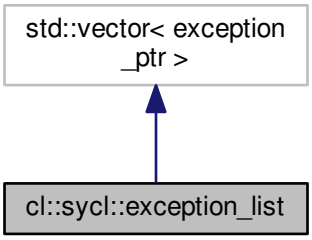
Todo Do we need to define it in SYCL or can we rely on plain C++17 one?

Definition at line 33 of file exception.hpp.

Inheritance diagram for cl::sycl::exception_list:



Collaboration diagram for cl::sycl::exception_list:

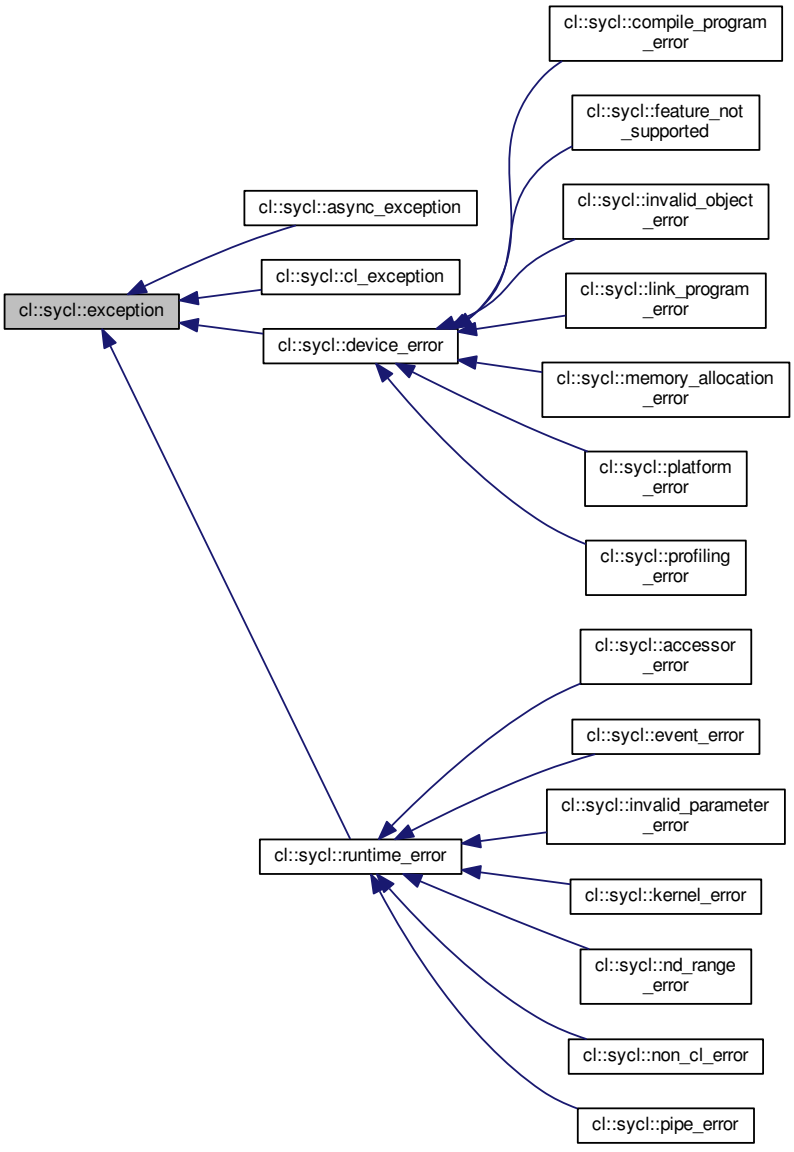


8.8.2.3 class cl::sycl::exception

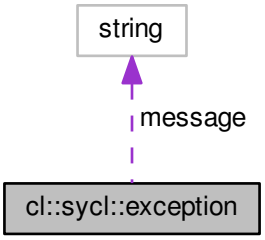
Encapsulate a SYCL error information.

Definition at line 41 of file exception.hpp.

Inheritance diagram for cl::sycl::exception:



Collaboration diagram for cl::sycl::exception:



Public Member Functions

- exception (const string_class &message)

  Construct an exception with a message for internal use.
- string_class what () const

  Returns a descriptive string for the error, if available.

Private Attributes

- string_class message

  The error message to return.

8.8.2.3.1 Constructor & Destructor Documentation

8.8.2.3.1.1 exception()

```
cl::sycl::exception::exception (
            const string_class & message )  [inline]
```

Construct an exception with a message for internal use.

Definition at line 49 of file exception.hpp.

```
00049 : message { message } {}
```

8.8.2.3.2 Member Function Documentation

8.8.2.3.2.1 what()

```
string_class cl::sycl::exception::what ( ) const  [inline]
```

Returns a descriptive string for the error, if available.

Definition at line 52 of file exception.hpp.

```
00052                             {
00053     return message;
00054   }
```

8.8.2.3.3 Member Data Documentation

8.8.2.3.3.1 message

```
string_class cl::sycl::exception::message  [private]
```

The error message to return.

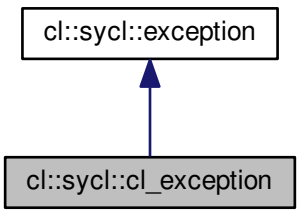
Definition at line 44 of file exception.hpp.

8.8.2.4 class cl::sycl::cl_exception

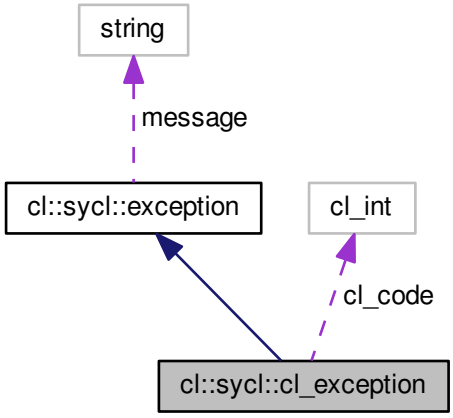
Returns the OpenCL error code encapsulated in the exception.

Definition at line 69 of file exception.hpp.

Inheritance diagram for cl::sycl::cl_exception:



Collaboration diagram for cl::sycl::cl_exception:



Public Member Functions

- cl_exception (const string_class &message, cl_int cl_code)
  Construct an exception with a message and OpenCL error code for internal use.
- cl_int get_cl_code () const

Private Attributes

- cl_int cl_code
  The OpenCL error code to return.

8.8.2.4.1 Constructor & Destructor Documentation

8.8.2.4.1.1 cl_exception()

```
cl::sycl::cl_exception::cl_exception (
            const string_class & message,
            cl_int cl_code )  [inline]
```

Construct an exception with a message and OpenCL error code for internal use.

Definition at line 80 of file exception.hpp.

```
00081     : exception { message }, cl_code { cl_code } {}
```

8.8.2.4.2 Member Function Documentation

8.8.2.4.2.1 get_cl_code()

```
cl_int cl::sycl::cl_exception::get_cl_code ( ) const  [inline]
```

Definition at line 84 of file exception.hpp.

```
00084                                {
00085     return cl_code;
00086   }
```

8.8.2.4.3 Member Data Documentation

8.8.2.4.3.1 cl_code

```
cl_int cl::sycl::cl_exception::cl_code  [private]
```

The OpenCL error code to return.

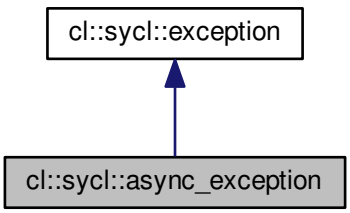
Definition at line 74 of file exception.hpp.

8.8.2.5 struct cl::sycl::async_exception

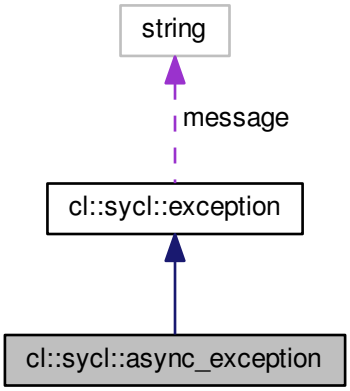
An error stored in an exception_list for asynchronous errors.

Definition at line 93 of file exception.hpp.

Inheritance diagram for cl::sycl::async_exception:



Collaboration diagram for cl::sycl::async_exception:

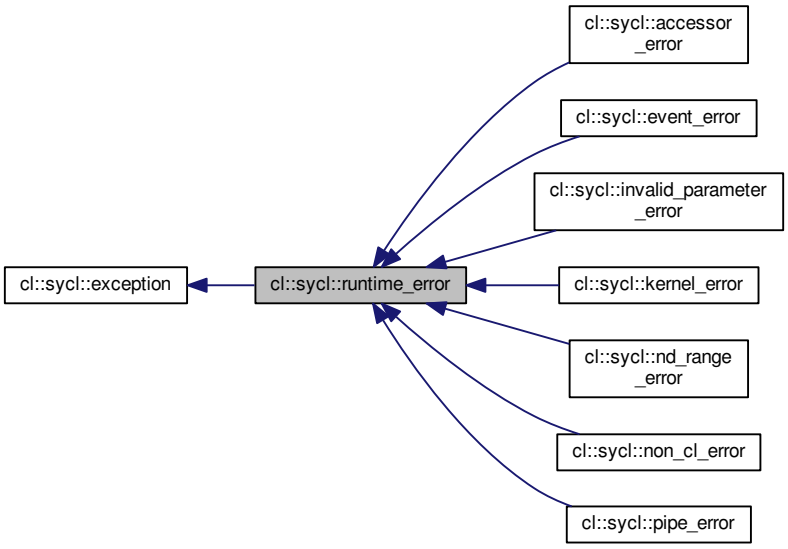


Additional Inherited Members

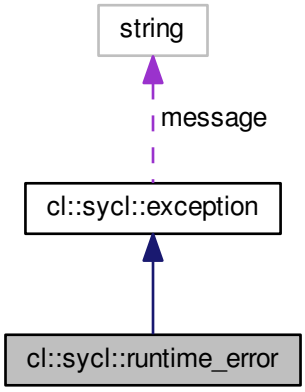
8.8.2.6 class cl::sycl::runtime_error

Definition at line 98 of file exception.hpp.

Inheritance diagram for cl::sycl::runtime_error:



Collaboration diagram for cl::sycl::runtime_error:



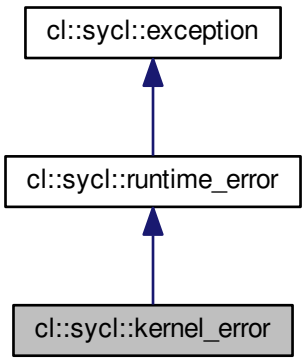
Additional Inherited Members

8.8.2.7 class cl::sycl::kernel_error

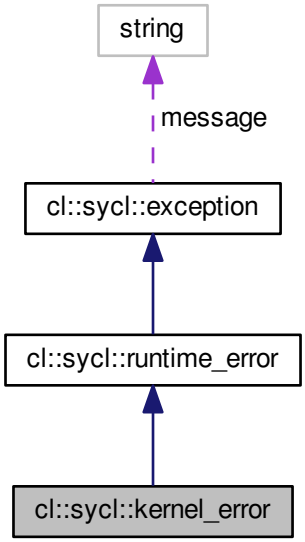
Error that occurred before or while enqueuing the SYCL kernel.

Definition at line 104 of file exception.hpp.

Inheritance diagram for cl::sycl::kernel_error:



Collaboration diagram for cl::sycl::kernel_error:



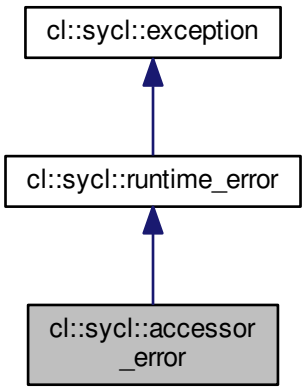
Additional Inherited Members

8.8.2.8 class cl::sycl::accessor_error

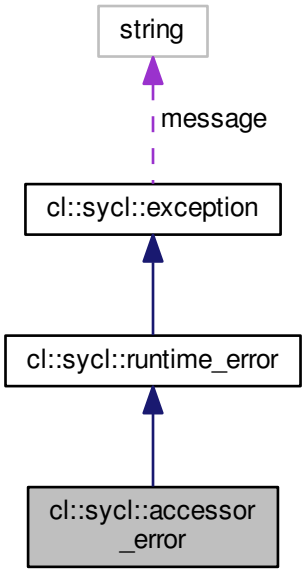
Error regarding the cl::sycl::accessor objects defined.

Definition at line 110 of file exception.hpp.

Inheritance diagram for cl::sycl::accessor_error:



Collaboration diagram for cl::sycl::accessor_error:



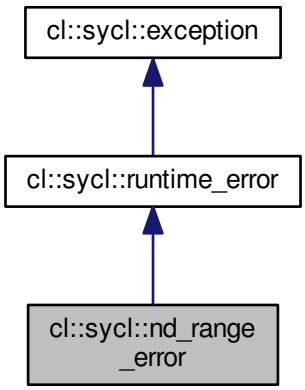
Additional Inherited Members

8.8.2.9 class cl::sycl::nd_range_error

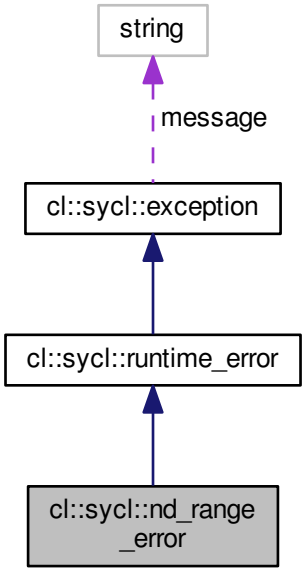
Error regarding the cl::sycl::nd_range specified for the SYCL kernel.

Definition at line 116 of file exception.hpp.

Inheritance diagram for cl::sycl::nd_range_error:



Collaboration diagram for cl::sycl::nd_range_error:



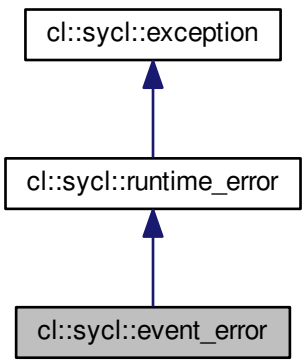
Additional Inherited Members

8.8.2.10 class cl::sycl::event_error

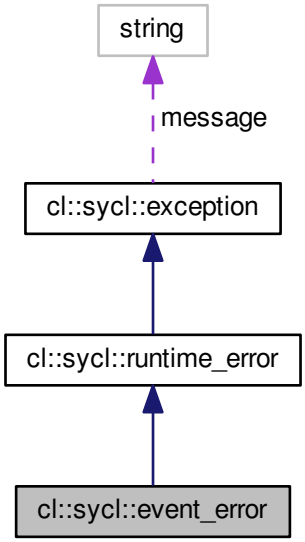
Error regarding associated cl::sycl::event objects.

Definition at line 122 of file exception.hpp.

Inheritance diagram for cl::sycl::event_error:



Collaboration diagram for cl::sycl::event_error:



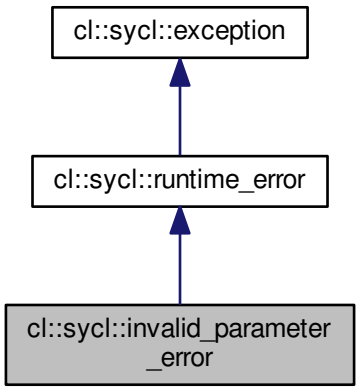
Additional Inherited Members

8.8.2.11 class cl::sycl::invalid_parameter_error

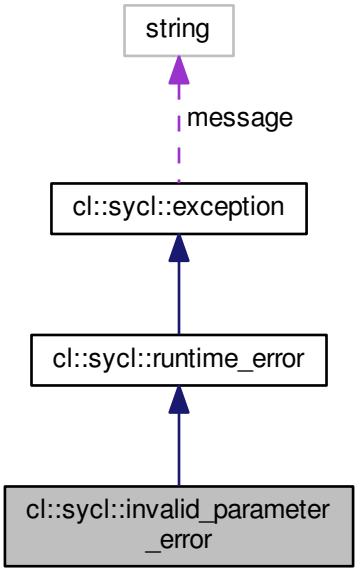
Error regarding parameters to the SYCL kernel, it may apply to any captured parameters to the kernel lambda.

Definition at line 130 of file exception.hpp.

Inheritance diagram for cl::sycl::invalid_parameter_error:



Collaboration diagram for cl::sycl::invalid_parameter_error:



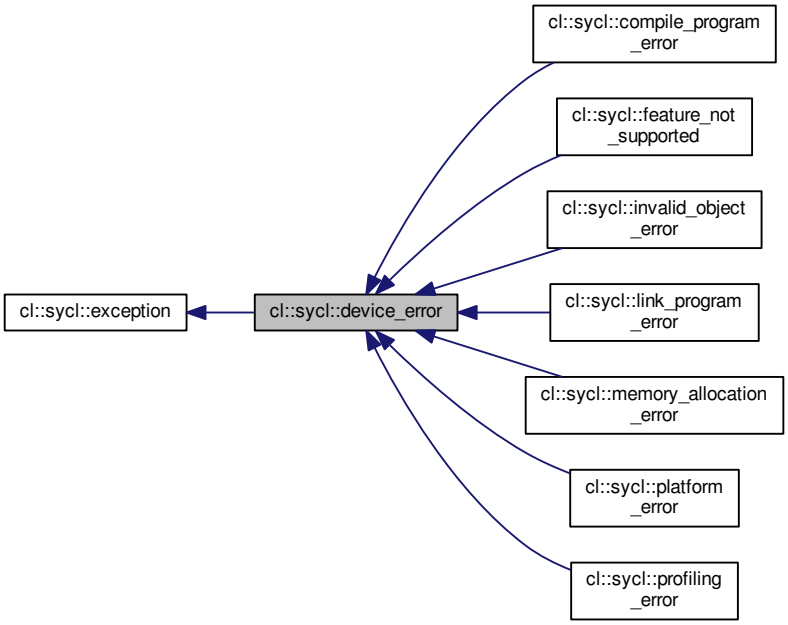
Additional Inherited Members

8.8.2.12 class cl::sycl::device_error

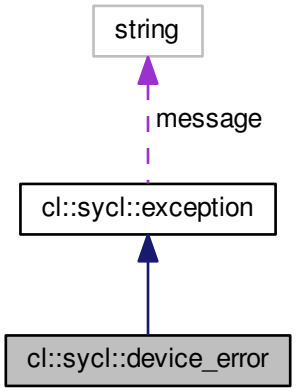
The SYCL device will trigger this exception on error.

Definition at line 136 of file exception.hpp.

Inheritance diagram for cl::sycl::device_error:



Collaboration diagram for cl::sycl::device_error:



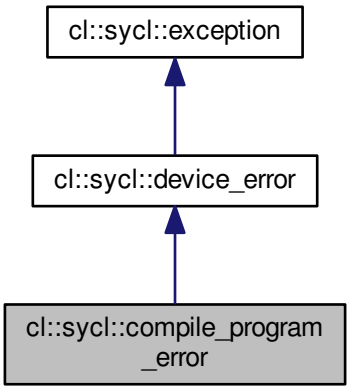
Additional Inherited Members

8.8.2.13 class cl::sycl::compile_program_error

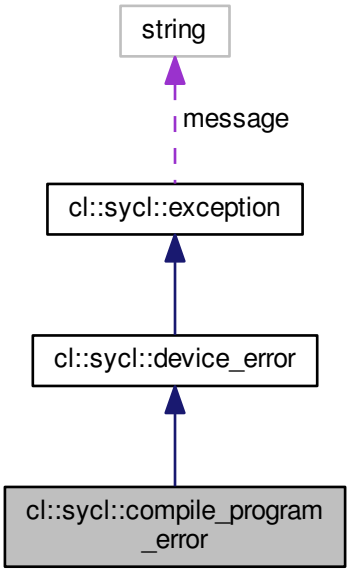
Error while compiling the SYCL kernel to a SYCL device.

Definition at line 142 of file exception.hpp.

Inheritance diagram for cl::sycl::compile_program_error:



Collaboration diagram for cl::sycl::compile_program_error:



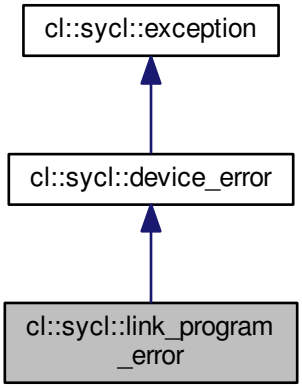
Additional Inherited Members

8.8.2.14 class cl::sycl::link_program_error

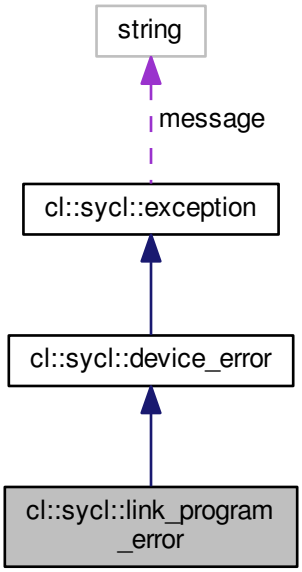
Error while linking the SYCL kernel to a SYCL device.

Definition at line 148 of file exception.hpp.

Inheritance diagram for cl::sycl::link_program_error:



Collaboration diagram for cl::sycl::link_program_error:



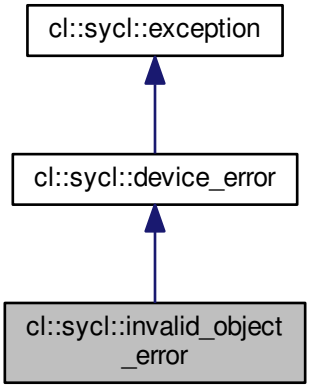
Additional Inherited Members

8.8.2.15 class cl::sycl::invalid_object_error

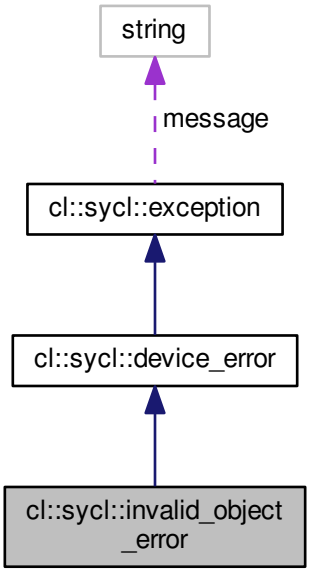
Error regarding any memory objects being used inside the kernel.

Definition at line 154 of file exception.hpp.

Inheritance diagram for cl::sycl::invalid_object_error:



Collaboration diagram for cl::sycl::invalid_object_error:



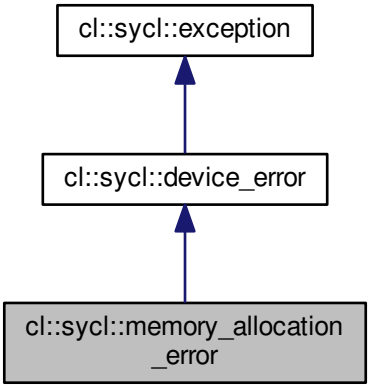
Additional Inherited Members

8.8.2.16 class cl::sycl::memory_allocation_error

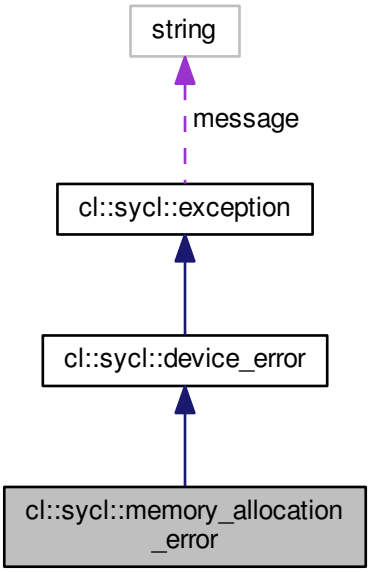
Error on memory allocation on the SYCL device for a SYCL kernel.

Definition at line 160 of file exception.hpp.

Inheritance diagram for cl::sycl::memory_allocation_error:



Collaboration diagram for cl::sycl::memory_allocation_error:



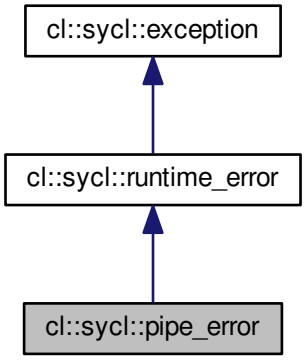
Additional Inherited Members

8.8.2.17 class cl::sycl::pipe_error

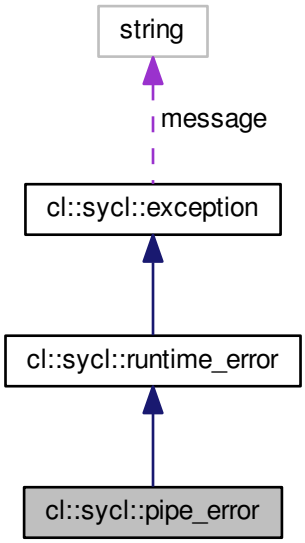
A failing pipe error will trigger this exception on error.

Definition at line 166 of file exception.hpp.

Inheritance diagram for cl::sycl::pipe_error:



Collaboration diagram for cl::sycl::pipe_error:



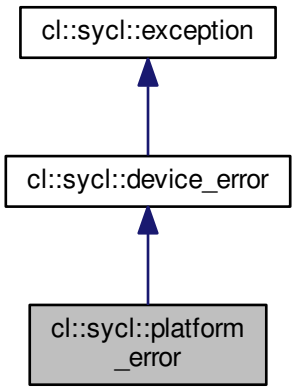
Additional Inherited Members

8.8.2.18 class cl::sycl::platform_error

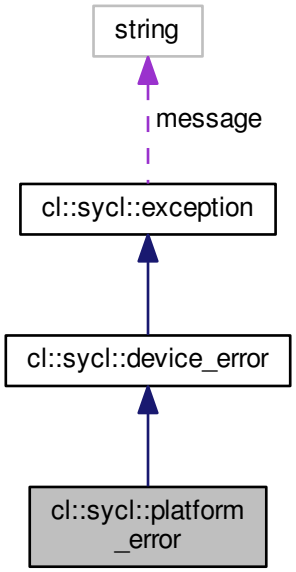
The SYCL platform will trigger this exception on error.

Definition at line 172 of file exception.hpp.

Inheritance diagram for cl::sycl::platform_error:



Collaboration diagram for cl::sycl::platform_error:



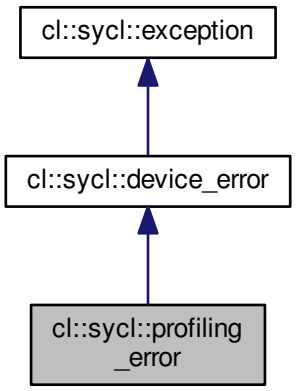
Additional Inherited Members

8.8.2.19 class cl::sycl::profiling_error

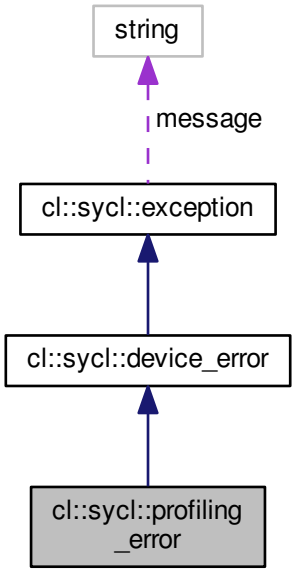
The SYCL runtime will trigger this error if there is an error when profiling info is enabled.

Definition at line 180 of file exception.hpp.

Inheritance diagram for cl::sycl::profiling_error:



Collaboration diagram for cl::sycl::profiling_error:



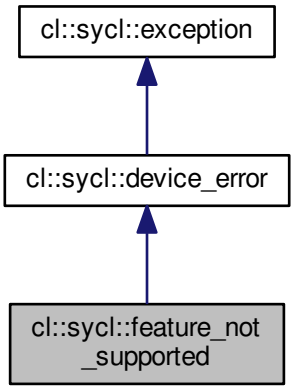
Additional Inherited Members

8.8.2.20 class cl::sycl::feature_not_supported

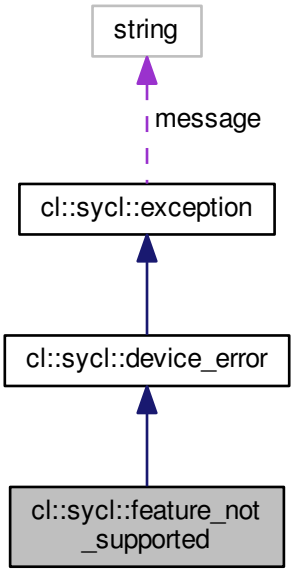
Exception thrown when an optional feature or extension is used in a kernel but its not available on the device the SYCL kernel is being enqueued on.

Definition at line 189 of file exception.hpp.

Inheritance diagram for cl::sycl::feature_not_supported:



Collaboration diagram for cl::sycl::feature_not_supported:



Additional Inherited Members

8.8.2.21 class cl::sycl::non_cl_error

Exception for an OpenCL operation requested in a non OpenCL area.

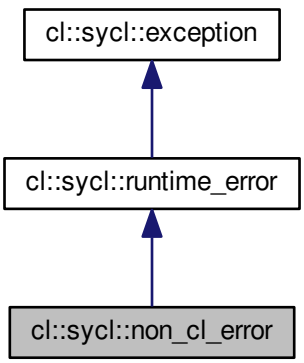
Todo Add to the specification

Todo Clean implementation

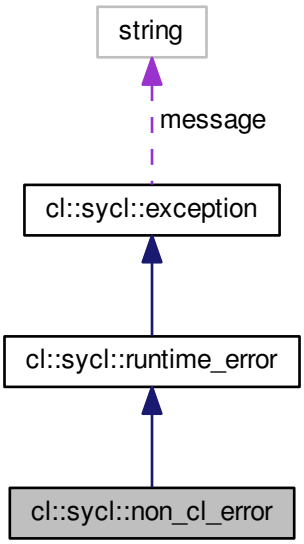
Todo Exceptions are named error in C++

Definition at line 202 of file exception.hpp.

Inheritance diagram for cl::sycl::non_cl_error:



Collaboration diagram for cl::sycl::non_cl_error:



Additional Inherited Members

8.8.3 Typedef Documentation

8.8.3.1 async_handler

```
using cl::sycl::async_handler = typedef function_class<void, exception_list>
```

```
#include <include/CL/sycl/exception.hpp>
```

Definition at line 37 of file exception.hpp.

8.8.3.2 exception_ptr

```
using cl::sycl::exception_ptr = typedef std::exception_ptr
```

```
#include <include/CL/sycl/exception.hpp>
```

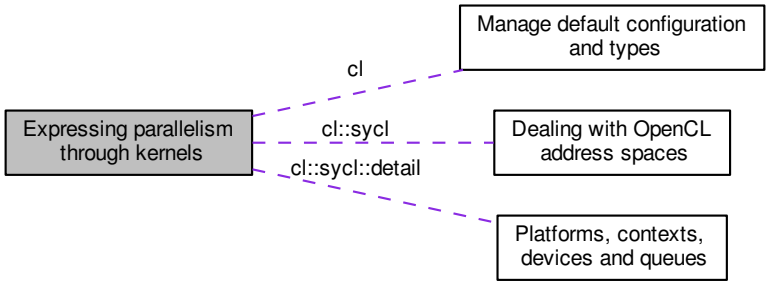
A shared pointer to an exception as in C++ specification.

Todo Do we need this instead of reusing directly the one from C++11?

Definition at line 26 of file exception.hpp.

8.9 Expressing parallelism through kernels

Collaboration diagram for Expressing parallelism through kernels:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Classes

- struct cl::sycl::group< Dimensions >

  A group index used in a parallel_for_workitem to specify a work_group. More...
- class cl::sycl::id< Dimensions >

  Define a multi-dimensional index, used for example to locate a work item. More...
- class cl::sycl::item< Dimensions >

  A SYCL item stores information on a work-item with some more context such as the definition range and offset. More...
- struct cl::sycl::nd_item< Dimensions >

  A SYCL nd_item stores information on a work-item within a work-group, with some more context such as the definition ranges. More...
- struct cl::sycl::nd_range< Dimensions >

  A ND-range, made by a global and local range, to specify work-group and work-item organization. More...
- struct cl::sycl::detail::parallel_for_iterate< level, Range, ParallelForFunctor, Id >

  A recursive multi-dimensional iterator that ends up calling f. More...
- struct cl::sycl::detail::parallel_OpenMP_for_iterate< level, Range, ParallelForFunctor, Id >

  A top-level recursive multi-dimensional iterator variant using OpenMP. More...
- struct cl::sycl::detail::parallel_for_iterate< 0, Range, ParallelForFunctor, Id >

  Stop the recursion when level reaches 0 by simply calling the kernel functor with the constructed id. More...
- class cl::sycl::range< Dimensions >

  A SYCL range defines a multi-dimensional index range that can be used to define launch parallel computation extent or buffer sizes. More...

Functions

- auto cl::sycl::make_id (id< 1 > i)

  Implement a make_id to construct an id<> of the right dimension with implicit conversion from an initializer list for example.
- auto cl::sycl::make_id (id< 2 > i)
- auto cl::sycl::make_id (id< 3 > i)
- template<typename... BasicType>
  auto cl::sycl::make_id (BasicType... Args)

  Construct an id<> from a function call with arguments, like make_id(1, 2, 3)
- template<int Dimensions = 1, typename ParallelForFunctor , typename Id >
  void cl::sycl::detail::parallel_for (range< Dimensions > r, ParallelForFunctor f, Id)

  Implementation of a data parallel computation with parallelism specified at launch time by a range<>.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for (range< Dimensions > r, ParallelForFunctor f, item< Dimensions >)

  Implementation of a data parallel computation with parallelism specified at launch time by a range<>.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for (range< Dimensions > r, ParallelForFunctor f)

  Calls the appropriate ternary parallel_for overload based on the index type of the kernel function object f.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for_global_offset (range< Dimensions > global_size, id< Dimensions > offset, ParallelForFunctor f)

  Implementation of parallel_for with a range<> and an offset.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for (nd_range< Dimensions > r, ParallelForFunctor f)

  Implement a variation of parallel_for to take into account a nd_range<>
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for_workgroup (nd_range< Dimensions > r, ParallelForFunctor f)

  Implement the loop on the work-groups.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for_workitem (const group< Dimensions > &g, ParallelForFunctor f)

  Implement the loop on the work-items inside a work-group.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::parallel_for_work_item (const group< Dimensions > &g, ParallelForFunctor f)

  SYCL parallel_for version that allows a Program object to be specified.
- auto cl::sycl::make_range (range< 1 > r)

  Implement a make_range to construct a range<> of the right dimension with implicit conversion from an initializer list for example.
- auto cl::sycl::make_range (range< 2 > r)
- auto cl::sycl::make_range (range< 3 > r)
- template<typename... BasicType>
  auto cl::sycl::make_range (BasicType... Args)

  Construct a range<> from a function call with arguments, like make_range(1, 2, 3)

8.9.1 Detailed Description

8.9.2 Class Documentation

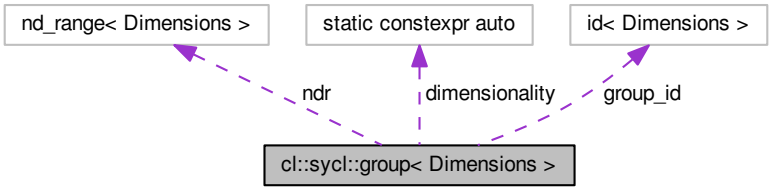
8.9.2.1 struct cl::sycl::group

template<int Dimensions>
struct cl::sycl::group< Dimensions >

A group index used in a parallel_for_workitem to specify a work_group.

Definition at line 24 of file group.hpp.

Collaboration diagram for cl::sycl::group< Dimensions >:



Public Member Functions

- group (const nd_range< Dimensions > &ndr)
  Create a group from an nd_range<> with a 0 id<>
- group (const id< Dimensions > &i, const nd_range< Dimensions > &ndr)
  Create a group from an id and a nd_range<>
- group ()=default
  To be able to copy and assign group, use default constructors too.
- id< Dimensions > get_id () const
  Return an id representing the index of the group within the nd_range for every dimension.
- size_t get_id (int dimension) const
  Return the index of the group in the given dimension.
- auto & operator[ ] (int dimension)
  Return the index of the group in the given dimension within the nd_range<>
- range< Dimensions > get_group_range () const
  Return a range<> representing the dimensions of the current group.
- size_t get_group_range (int dimension) const
  Return element dimension from the con stituent group range.
- range< Dimensions > get_global_range () const
  Get the local range for this work_group.
- size_t get_global_range (int dimension) const
  Return element dimension from the constituent global range.
- range< Dimensions > get_local_range () const
  Get the local range for this work_group.
- size_t get_local_range (int dimension) const
  Return element dimension from the constituent local range.
- id< Dimensions > get_offset () const
  Get the offset of the NDRange.
- size_t get_offset (int dimension) const
  Get the offset of the NDRange.

- nd_range< Dimensions > get_nd_range () const
- size_t get_linear () const

  Get a linearized version of the group ID.
- void parallel_for_work_item (std::function< void(nd_item< dimensionality >)> f) const

  Loop on the work-items inside a work-group.
- void parallel_for_work_item (std::function< void(item< dimensionality >)> f) const

  Loop on the work-items inside a work-group.

Static Public Attributes

- static constexpr auto dimensionality = Dimensions

Private Attributes

- id< Dimensions > group_id

  The coordinate of the group item.
- nd_range< Dimensions > ndr

  Keep a reference on the nd_range to serve potential query on it.

8.9.2.1.1 Constructor & Destructor Documentation

8.9.2.1.1.1 group() [1/3]

```
template<int Dimensions>
cl::sycl::group< Dimensions >::group (
            const nd_range< Dimensions > & ndr )  [inline]
```

Create a group from an nd_range<> with a 0 id<>

Todo This should be private since it is only used by the triSYCL implementation

Definition at line 61 of file group.hpp.

```
00061 : ndr { ndr } {}
```

8.9.2.1.1.2 group() [2/3]

```
template<int Dimensions>
cl::sycl::group< Dimensions >::group (
            const id< Dimensions > & i,
            const nd_range< Dimensions > & ndr )  [inline]
```

Create a group from an id and a nd_range<>

Todo This should be private somehow, but it is used by the validation infrastructure

Definition at line 69 of file group.hpp.

```
00069                                                                 :
00070     group_id { i }, ndr { ndr } {}
```

8.9.2.1.1.3 group() [3/3]

```
template<int Dimensions>
cl::sycl::group< Dimensions >::group ( )  [default]
```

To be able to copy and assign group, use default constructors too.

Todo Make most of them protected, reserved to implementation

8.9.2.1.2 Member Function Documentation

8.9.2.1.2.1 get_global_range() [1/2]

```
template<int Dimensions>
range<Dimensions> cl::sycl::group< Dimensions >::get_global_range ( ) const  [inline]
```

Get the local range for this work_group.

Definition at line 122 of file group.hpp.

```
00122                                          {
00123     return get_nd_range().get_global();
00124   }
```

8.9.2.1.2.2 get_global_range() [2/2]

```
template<int Dimensions>
size_t cl::sycl::group< Dimensions >::get_global_range (
             int dimension ) const  [inline]
```

Return element dimension from the constituent global range.

Definition at line 128 of file group.hpp.

```
00128                                            {
00129     return get_global_range()[dimension];
00130   }
```

8.9.2.1.2.3 get_group_range() [1/2]

```
template<int Dimensions>
range<Dimensions> cl::sycl::group< Dimensions >::get_group_range ( ) const  [inline]
```

Return a range<> representing the dimensions of the current group.

This local range may have been provided by the programmer, or chosen by the runtime.

Todo Fix this comment and the specification

Definition at line 110 of file group.hpp.

```
00110                                          {
00111     return get_nd_range().get_group();
00112   }
```

8.9.2.1.2.4 get_group_range() [2/2]

```
template<int Dimensions>
size_t cl::sycl::group< Dimensions >::get_group_range (
            int dimension ) const  [inline]
```

Return element dimension from the con stituent group range.

Definition at line 116 of file group.hpp.

```
00116                                                {
00117     return get_group_range()[dimension];
00118   }
```

8.9.2.1.2.5 get_id() [1/2]

```
template<int Dimensions>
id<Dimensions> cl::sycl::group< Dimensions >::get_id ( ) const  [inline]
```

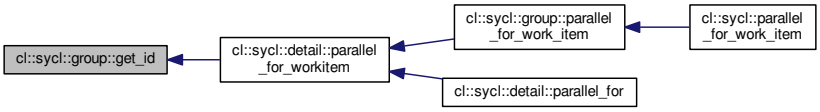
Return an id representing the index of the group within the nd_range for every dimension.

Definition at line 83 of file group.hpp.

Referenced by cl::sycl::detail::parallel_for_workitem().

```
00083 { return group_id; }
```

Here is the caller graph for this function:



8.9.2.1.2.6 get_id() [2/2]

```
template<int Dimensions>
size_t cl::sycl::group< Dimensions >::get_id (
            int dimension ) const  [inline]
```

Return the index of the group in the given dimension.

Definition at line 87 of file group.hpp.

References cl::sycl::group< Dimensions >::get_id().

Referenced by cl::sycl::group< Dimensions >::get_id().

```
00087 { return get_id()[dimension]; }
```

Here is the call graph for this function:

Here is the caller graph for this function:

8.9.2.1.2.7 get_linear()

```
template<int Dimensions>
size_t cl::sycl::group< Dimensions >::get_linear ( ) const  [inline]
```

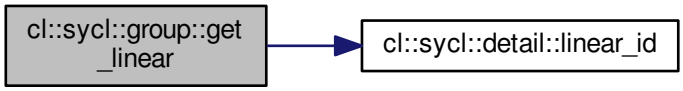
Get a linearized version of the group ID.

Definition at line 172 of file group.hpp.

References cl::sycl::detail::linear_id().

```
00172                             {
00173     return detail::linear_id(get_group_range(),
      get_id());
00174   }
```

Here is the call graph for this function:



8.9.2.1.2.8 get_local_range() [1/2]

```
template<int Dimensions>
range<Dimensions> cl::sycl::group< Dimensions >::get_local_range ( ) const  [inline]
```

Get the local range for this work_group.

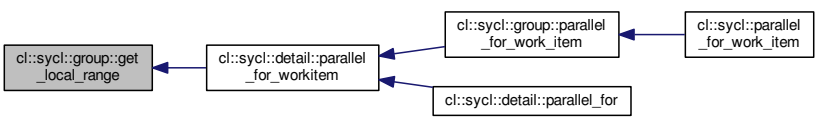
Todo Add to the specification

Definition at line 137 of file group.hpp.

Referenced by cl::sycl::detail::parallel_for_workitem().

```
00137                                          {
00138     return get_nd_range().get_local();
00139   }
```

Here is the caller graph for this function:



8.9.2.1.2.9 get_local_range() [2/2]

```
template<int Dimensions>
size_t cl::sycl::group< Dimensions >::get_local_range (
            int dimension ) const  [inline]
```

Return element dimension from the constituent local range.

Todo Add to the specification

Definition at line 146 of file group.hpp.

```
00146                                              {
00147     return get_local_range()[dimension];
00148   }
```

8.9.2.1.2.10 get_nd_range()

```
template<int Dimensions>
nd_range<Dimensions> cl::sycl::group< Dimensions >::get_nd_range ( ) const  [inline]
```

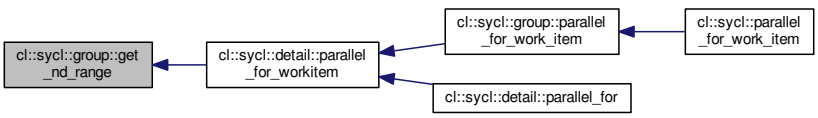
Todo Also provide this access to the current nd_range

Definition at line 166 of file group.hpp.

Referenced by cl::sycl::detail::parallel_for_workitem().

```
00166 { return ndr; }
```

Here is the caller graph for this function:



8.9.2.1.2.11 get_offset() [1/2]

```
template<int Dimensions>
id<Dimensions> cl::sycl::group< Dimensions >::get_offset ( ) const  [inline]
```

Get the offset of the NDRange.

Todo Add to the specification

Definition at line 155 of file group.hpp.

```
00155 { return get_nd_range().get_offset(); }
```

8.9.2.1.2.12 get_offset() [2/2]

```
template<int Dimensions>
size_t cl::sycl::group< Dimensions >::get_offset (
            int dimension ) const  [inline]
```

Get the offset of the NDRange.

Todo Add to the specification

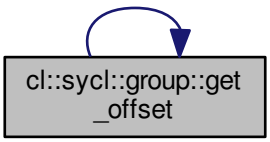
Definition at line 162 of file group.hpp.

References cl::sycl::group< Dimensions >::get_offset().

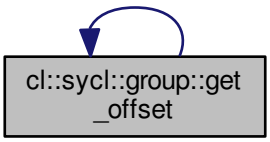
Referenced by cl::sycl::group< Dimensions >::get_offset().

```
00162 { return get_offset()[dimension]; }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.9.2.1.2.13 operator[]()

```
template<int Dimensions>
auto& cl::sycl::group< Dimensions >::operator[] (
             int dimension )  [inline]
```

Return the index of the group in the given dimension within the nd_range<>

Todo In this implementation it is not const because the group<> is written in the parallel_for iterators. To fix according to the specification

Definition at line 97 of file group.hpp.

```
00097                                  {
00098     return group_id[dimension];
00099   }
```

8.9.2.1.2.14 parallel_for_work_item() [1/2]

```
template<int Dimensions>
void cl::sycl::group< Dimensions >::parallel_for_work_item (
             std::function< void(nd_item< dimensionality >)> f ) const  [inline]
```

Loop on the work-items inside a work-group.

Todo Add this method in the specification

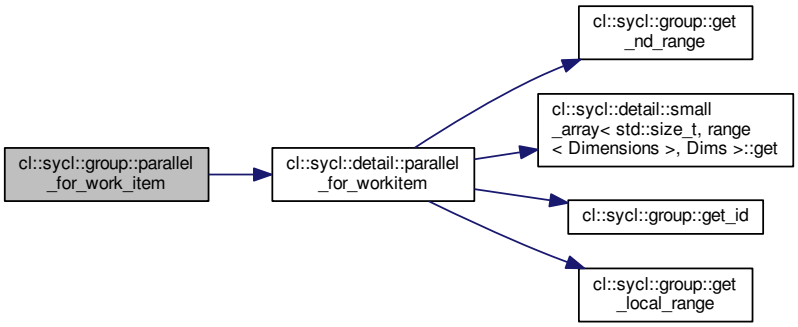
Definition at line 181 of file group.hpp.

References cl::sycl::detail::parallel_for_workitem().

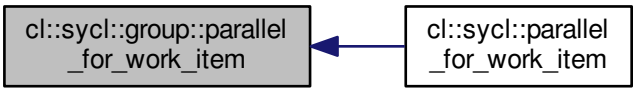
Referenced by cl::sycl::parallel_for_work_item().

```
00182           {
00183     detail::parallel_for_workitem(*this, f);
00184   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.9.2.1.2.15 parallel_for_work_item() [2/2]

```
template<int Dimensions>
void cl::sycl::group< Dimensions >::parallel_for_work_item (
            std::function< void(item< dimensionality >)> f ) const  [inline]
```

Loop on the work-items inside a work-group.

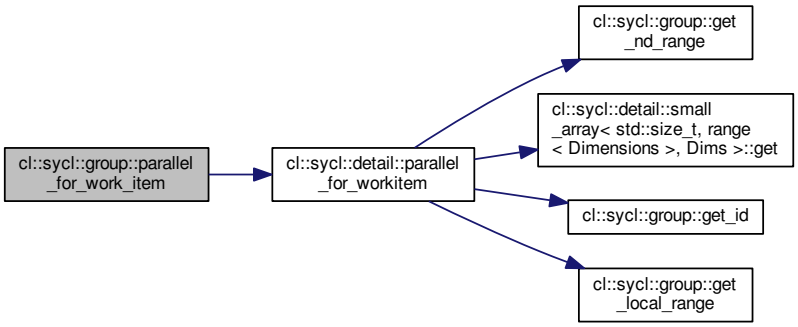
Todo Add this method in the specification

Definition at line 191 of file group.hpp.

References cl::sycl::detail::parallel_for_workitem().

```
00192           {
00193     auto item_adapter = [=] (nd_item<dimensionality> ndi) {
00194       item<dimensionality> i = ndi.get_item();
00195       f(i);
00196     };
00197     detail::parallel_for_workitem(*this, item_adapter);
00198   }
```

Here is the call graph for this function:



8.9.2.1.3 Member Data Documentation

8.9.2.1.3.1 dimensionality

```
template<int Dimensions>
constexpr auto cl::sycl::group< Dimensions >::dimensionality = Dimensions  [static]
```

Todo add this Boost::multi_array or STL concept to the specification?

Definition at line 44 of file group.hpp.

8.9.2.1.3.2 group_id

```
template<int Dimensions>
id<Dimensions> cl::sycl::group< Dimensions >::group_id  [private]
```

The coordinate of the group item.

Definition at line 49 of file group.hpp.

8.9.2.1.3.3 ndr

```
template<int Dimensions>
nd_range<Dimensions> cl::sycl::group< Dimensions >::ndr  [private]
```

Keep a reference on the nd_range to serve potential query on it.

Definition at line 52 of file group.hpp.

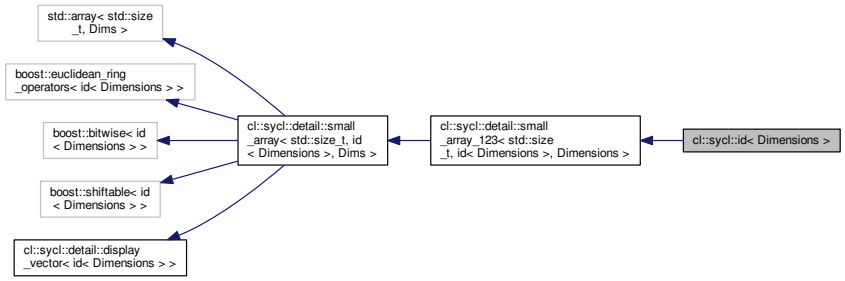
8.9.2.2 class cl::sycl::id

template<int Dimensions = 1>
class cl::sycl::id< Dimensions >

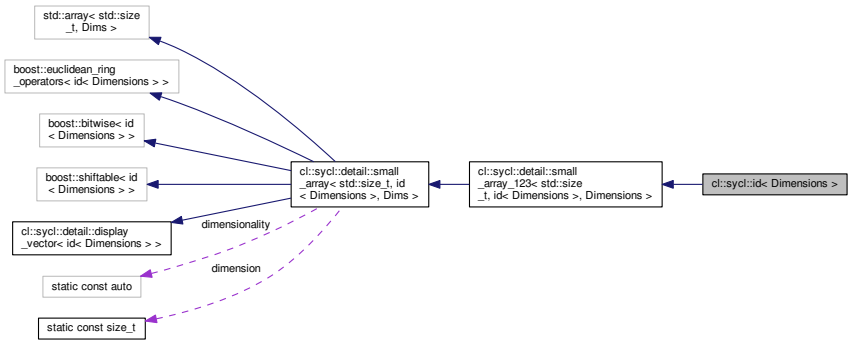
Define a multi-dimensional index, used for example to locate a work item.

Definition at line 31 of file id.hpp.

Inheritance diagram for cl::sycl::id< Dimensions >:



Collaboration diagram for cl::sycl::id< Dimensions >:



Public Member Functions

- id (const range< Dimensions > &range_size)
  Construct an id from the dimensions of a range.

Additional Inherited Members

8.9.2.2.1 Constructor & Destructor Documentation

8.9.2.2.1.1 id()

```
template<int Dimensions = 1>
cl::sycl::id< Dimensions >::id (
            const range< Dimensions > & range_size )  [inline]
```

Construct an id from the dimensions of a range.

Use the fact we have a constructor of a small_array from a another kind of small_array

Definition at line 45 of file id.hpp.

Referenced by cl::sycl::id< dimensionality >::id().

```
00049     : detail::small_array_123<std::size_t, id<Dimensions>, Dimensions>
00050       { range_size }
```

Here is the caller graph for this function:

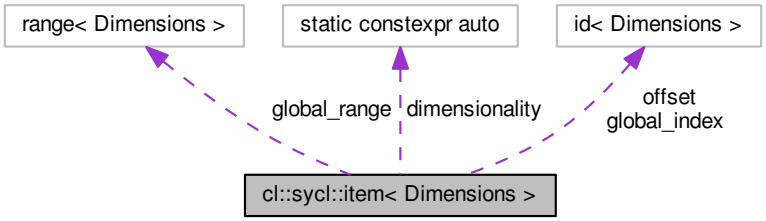
8.9.2.3 class cl::sycl::item

template<int Dimensions = 1>
class cl::sycl::item< Dimensions >

A SYCL item stores information on a work-item with some more context such as the definition range and offset.

Definition at line 21 of file id.hpp.

Collaboration diagram for cl::sycl::item< Dimensions >:



Public Member Functions

- item (range< Dimensions > global_size, id< Dimensions > global_index, id< Dimensions > offset={})
  Create an item from a local size and an optional offset.
- item ()=default
  To be able to copy and assign item, use default constructors too.
- id< Dimensions > get_id () const
  Return the constituent local or global id<> representing the work-item's position in the iteration space.
- size_t get_id (int dimension) const
  Return the requested dimension of the constituent id<> representing the work-item's position in the iteration space.

- auto & operator[ ] (int dimension)

  Return the constituent id<> l-value representing the work-item's position in the iteration space in the given dimension.
- range< Dimensions > get_range () const

  Returns a range<> representing the dimensions of the range of possible values of the item.
- id< Dimensions > get_offset () const

  Returns an id<> representing the n-dimensional offset provided to the parallel_for and that is added by the runtime to the global-ID of each work-item, if this item represents a global range.
- size_t get_linear_id () const

  Return the linearized ID in the item's range.
- void set (id< Dimensions > Index)

  For the implementation, need to set the global index.
- void display () const

  Display the value for debugging and validation purpose.

Static Public Attributes

- static constexpr auto dimensionality = Dimensions

Private Attributes

- range< Dimensions > global_range
- id< Dimensions > global_index
- id< Dimensions > offset

8.9.2.3.1 Constructor & Destructor Documentation

8.9.2.3.1.1 item() [1/2]

```
template<int Dimensions = 1>
cl::sycl::item< Dimensions >::item (
             range< Dimensions > global_size,
             id< Dimensions > global_index,
             id< Dimensions > offset = {} )  [inline]
```

Create an item from a local size and an optional offset.

This constructor is used by the triSYCL implementation and the non-regression testing.

Definition at line 50 of file item.hpp.

References cl::sycl::item< Dimensions >::item().

```
00052                                {}) :
00053     global_range { global_size },
00054     global_index { global_index },
00055     offset { offset }
00056   {}
```

Here is the call graph for this function:

8.9.2.3.1.2 item() [2/2]

```
template<int Dimensions = 1>
cl::sycl::item< Dimensions >::item ( )  [default]
```

To be able to copy and assign item, use default constructors too.

Todo Make most of them protected, reserved to implementation

Referenced by cl::sycl::item< Dimensions >::item().

Here is the caller graph for this function:

8.9.2.3.2 Member Function Documentation

8.9.2.3.2.1 display()

```
template<int Dimensions = 1>
void cl::sycl::item< Dimensions >::display ( ) const  [inline]
```

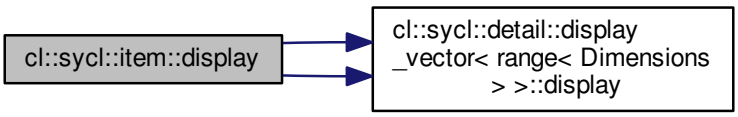
Display the value for debugging and validation purpose.

Definition at line 117 of file item.hpp.

References cl::sycl::detail::display_vector< range< Dimensions > >::display(), and cl::sycl::detail::display_vector< id< Dimensions > >::display().

```
00117                       {
00118     global_range.display();
00119     global_index.display();
00120     offset.display();
00121   }
```

Here is the call graph for this function:



8.9.2.3.2.2 get_id() [1/2]

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::item< Dimensions >::get_id ( ) const  [inline]
```

Return the constituent local or global id<> representing the work-item's position in the iteration space.

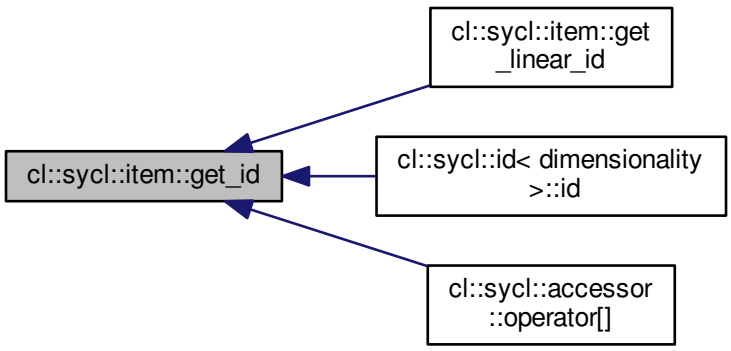
Definition at line 69 of file item.hpp.

References cl::sycl::item< Dimensions >::global_index.

Referenced by cl::sycl::item< Dimensions >::get_linear_id(), cl::sycl::id< dimensionality >::id(), and cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[]().

```
00069 { return global_index; }
```

Here is the caller graph for this function:



8.9.2.3.2.3 get_id() [2/2]

```
template<int Dimensions = 1>
size_t cl::sycl::item< Dimensions >::get_id (
            int dimension ) const  [inline]
```

Return the requested dimension of the constituent id<> representing the work-item's position in the iteration space.

Definition at line 75 of file item.hpp.

References cl::sycl::item< Dimensions >::get_id().

Referenced by cl::sycl::item< Dimensions >::get_id().

```
00075 { return get_id()[dimension]; }
```

Here is the call graph for this function:

Here is the caller graph for this function:

8.9.2.3.2.4 get_linear_id()

```
template<int Dimensions = 1>
size_t cl::sycl::item< Dimensions >::get_linear_id ( ) const  [inline]
```

Return the linearized ID in the item's range.

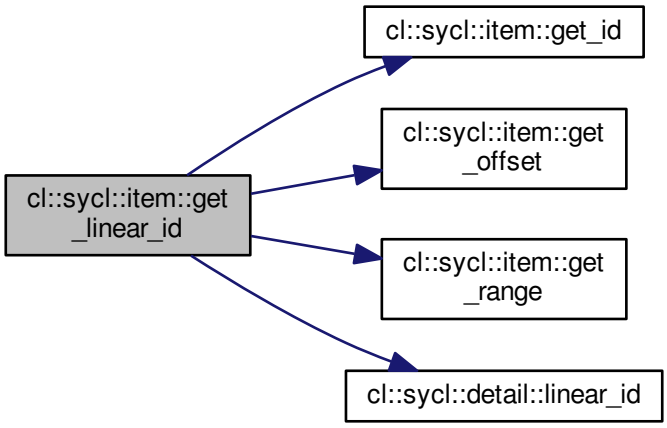
Computed as the flatted ID after the offset is subtracted.

Definition at line 104 of file item.hpp.

References cl::sycl::item< Dimensions >::get_id(), cl::sycl::item< Dimensions >::get_offset(), cl::sycl::item< Dimensions >::get_range(), and cl::sycl::detail::linear_id().

```
00104                                {
00105     return detail::linear_id(get_range(), get_id(),
      get_offset());
00106   }
```

Here is the call graph for this function:



8.9.2.3.2.5 get_offset()

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::item< Dimensions >::get_offset ( ) const  [inline]
```

Returns an id<> representing the n-dimensional offset provided to the parallel_for and that is added by the runtime to the global-ID of each work-item, if this item represents a global range.

For an item representing a local range of where no offset was passed this will always return an id of all 0 values.

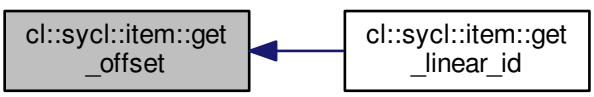
Definition at line 97 of file item.hpp.

References cl::sycl::item< Dimensions >::offset.

Referenced by cl::sycl::item< Dimensions >::get_linear_id().

```
00097 { return offset; }
```

Here is the caller graph for this function:



8.9.2.3.2.6 get_range()

```
template<int Dimensions = 1>
range<Dimensions> cl::sycl::item< Dimensions >::get_range ( ) const  [inline]
```

Returns a range<> representing the dimensions of the range of possible values of the item.

Definition at line 87 of file item.hpp.

References cl::sycl::item< Dimensions >::global_range.

Referenced by cl::sycl::item< Dimensions >::get_linear_id().

```
00087 { return global_range; }
```

Here is the caller graph for this function:

8.9.2.3.2.7 operator[]()

```
template<int Dimensions = 1>
auto& cl::sycl::item< Dimensions >::operator[] (
             int dimension )  [inline]
```

Return the constituent id<> l-value representing the work-item's position in the iteration space in the given dimension.

Definition at line 81 of file item.hpp.

```
00081 { return global_index[dimension]; }
```

8.9.2.3.2.8 set()

```
template<int Dimensions = 1>
void cl::sycl::item< Dimensions >::set (
             id< Dimensions > Index )  [inline]
```

For the implementation, need to set the global index.

Todo Move to private and add friends

Definition at line 113 of file item.hpp.

```
00113 { global_index = Index; }
```

8.9.2.3.3 Member Data Documentation

8.9.2.3.3.1 dimensionality

```
template<int Dimensions = 1>
constexpr auto cl::sycl::item< Dimensions >::dimensionality = Dimensions  [static]
```

Todo add this Boost::multi_array or STL concept to the specification?

Definition at line 35 of file item.hpp.

8.9.2.3.3.2 global_index

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::item< Dimensions >::global_index  [private]
```

Definition at line 40 of file item.hpp.

Referenced by cl::sycl::item< Dimensions >::get_id().

8.9.2.3.3.3 global_range

```
template<int Dimensions = 1>
range<Dimensions> cl::sycl::item< Dimensions >::global_range  [private]
```

Definition at line 39 of file item.hpp.

Referenced by cl::sycl::item< Dimensions >::get_range().

8.9.2.3.3.4 offset

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::item< Dimensions >::offset  [private]
```

Definition at line 41 of file item.hpp.

Referenced by cl::sycl::item< Dimensions >::get_offset().

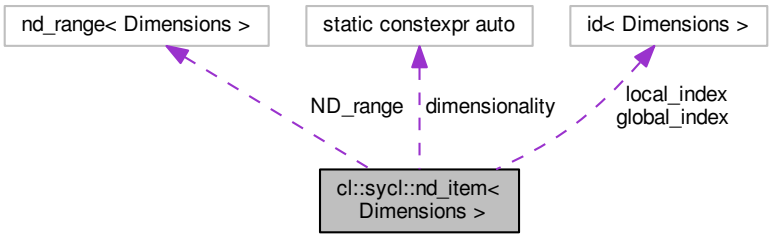
8.9.2.4 struct cl::sycl::nd_item

template<int Dimensions = 1>
struct cl::sycl::nd_item< Dimensions >

A SYCL nd_item stores information on a work-item within a work-group, with some more context such as the definition ranges.

Definition at line 33 of file nd_item.hpp.

Collaboration diagram for cl::sycl::nd_item< Dimensions >:



Public Member Functions

- nd_item (nd_range< Dimensions > ndr)

  Create an empty nd_item<> from an nd_range<>
- nd_item (id< Dimensions > global_index, nd_range< Dimensions > ndr)

  Create a full nd_item.
- nd_item ()=default

  To be able to copy and assign nd_item, use default constructors too.
- id< Dimensions > get_global () const

  Return the constituent global id representing the work-item's position in the global iteration space.
- size_t get_global (int dimension) const

  Return the constituent element of the global id representing the work-item's position in the global iteration space in the given dimension.
- size_t get_global_linear_id () const

  Return the flattened id of the current work-item after subtracting the offset.
- id< Dimensions > get_local () const

  Return the constituent local id representing the work-item's position within the current work-group.
- size_t get_local (int dimension) const

  Return the constituent element of the local id representing the work-item's position within the current work-group in the given dimension.
- size_t get_local_linear_id () const

  Return the flattened id of the current work-item within the current work-group.
- id< Dimensions > get_group () const

  Return the constituent group group representing the work-group's position within the overall nd_range.
- size_t get_group (int dimension) const

  Return the constituent element of the group id representing the work-group;s position within the overall nd_range in the given dimension.

- size_t get_group_linear_id () const

  Return the flattened id of the current work-group.
- id< Dimensions > get_num_groups () const

  Return the number of groups in the nd_range.
- size_t get_num_groups (int dimension) const

  Return the number of groups for dimension in the nd_range.
- range< Dimensions > get_global_range () const

  Return a range<> representing the dimensions of the nd_range<>
- range< Dimensions > get_local_range () const

  Return a range<> representing the dimensions of the current work-group.
- id< Dimensions > get_offset () const

  Return an id<> representing the n-dimensional offset provided to the constructor of the nd_range<> and that is added by the runtime to the global-ID of each work-item.
- nd_range< Dimensions > get_nd_range () const

  Return the nd_range<> of the current execution.
- item< Dimensions > get_item () const

  Allows projection down to an item.
- void barrier (access::fence_space flag=access::fence_space::global_and_local) const

  Execute a barrier with memory ordering on the local address space, global address space or both based on the value of flag.
- void set_local (id< Dimensions > Index)
- void set_global (id< Dimensions > Index)

Static Public Attributes

- static constexpr auto dimensionality = Dimensions

Private Attributes

- id< Dimensions > global_index
- id< Dimensions > local_index
- nd_range< Dimensions > ND_range

8.9.2.4.1 Constructor & Destructor Documentation

8.9.2.4.1.1 nd_item() [1/3]

```
template<int Dimensions = 1>
cl::sycl::nd_item< Dimensions >::nd_item (
            nd_range< Dimensions > ndr )  [inline]
```

Create an empty nd_item<> from an nd_range<>

Todo This is for the triSYCL implementation which is expected to call set_global() and set_local() later. This should be hidden to the user.

Definition at line 54 of file nd_item.hpp.

```
00054 : ND_range { ndr } {}
```

8.9.2.4.1.2 nd_item() [2/3]

```
template<int Dimensions = 1>
cl::sycl::nd_item< Dimensions >::nd_item (
            id< Dimensions > global_index,
            nd_range< Dimensions > ndr )  [inline]
```

Create a full nd_item.

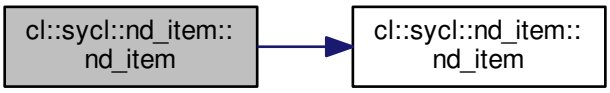
Todo This is for validation purpose. Hide this to the programmer somehow

Definition at line 62 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::nd_item().

```
00063                                  :
00064     global_index { global_index },
00065     // Compute the local index using the offset and the group size
00066     local_index
00067       { (global_index - ndr.get_offset())%id<Dimensions> { ndr.get_local() } },
00068     ND_range { ndr }
00069   {}
```

Here is the call graph for this function:



8.9.2.4.1.3 nd_item() [3/3]

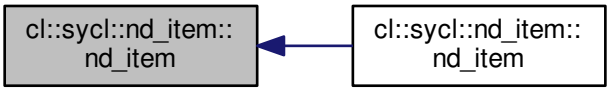
```
template<int Dimensions = 1>
cl::sycl::nd_item< Dimensions >::nd_item ( )  [default]
```

To be able to copy and assign nd_item, use default constructors too.

Todo Make most of them protected, reserved to implementation

Referenced by cl::sycl::nd_item< Dimensions >::nd_item().

Here is the caller graph for this function:



8.9.2.4.2 Member Function Documentation

8.9.2.4.2.1 barrier()

```
template<int Dimensions = 1>
void cl::sycl::nd_item< Dimensions >::barrier (
            access::fence_space flag = access::fence_space::global_and_local ) const  [inline]
```

Execute a barrier with memory ordering on the local address space, global address space or both based on the value of flag.

The current work-item will wait at the barrier until all work-items in the current work-group have reached the barrier.

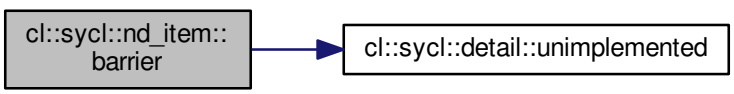
In addition, the barrier performs a fence operation ensuring that all memory accesses in the specified address space issued before the barrier complete before those issued after the barrier

Definition at line 199 of file nd_item.hpp.

References cl::sycl::detail::unimplemented().

```
00200                                                    {
00201 #if defined(_OPENMP) && !defined(TRISYCL_NO_BARRIER)
00202     /* Use OpenMP barrier in the implementation with 1 OpenMP thread per
00203        work-item of the work-group */
00204 #pragma omp barrier
00205 #else
00206     // \todo To be implemented efficiently otherwise
00207     detail::unimplemented();
00208 #endif
00209   }
```

Here is the call graph for this function:



8.9.2.4.2.2 get_global() [1/2]

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::nd_item< Dimensions >::get_global ( ) const  [inline]
```

Return the constituent global id representing the work-item's position in the global iteration space.

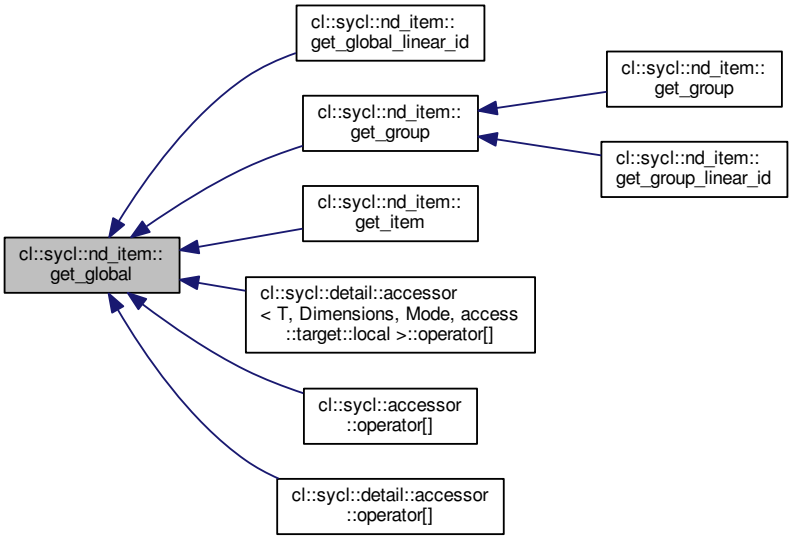
Definition at line 82 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::global_index.

Referenced by cl::sycl::nd_item< Dimensions >::get_global_linear_id(), cl::sycl::nd_item< Dimensions >::get_group(), cl::sycl::nd_item< Dimensions >::get_item(), cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[](), cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[](), and cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[]().

```
00082 { return global_index; }
```

Here is the caller graph for this function:



8.9.2.4.2.3 get_global() [2/2]

```
template<int Dimensions = 1>
size_t cl::sycl::nd_item< Dimensions >::get_global (
            int dimension ) const  [inline]
```

Return the constituent element of the global id representing the work-item's position in the global iteration space in the given dimension.

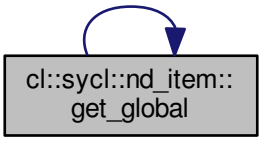
Definition at line 89 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_global().

Referenced by cl::sycl::nd_item< Dimensions >::get_global().

```
00089 { return get_global()[dimension]; }
```

Here is the call graph for this function:



Here is the caller graph for this function:

8.9.2.4.2.4 get_global_linear_id()

```
template<int Dimensions = 1>
size_t cl::sycl::nd_item< Dimensions >::get_global_linear_id ( ) const  [inline]
```

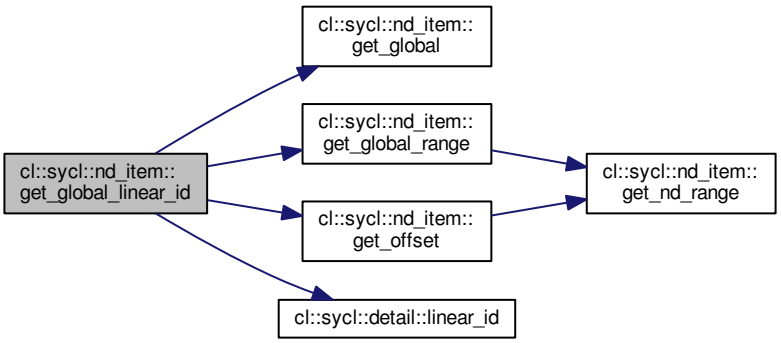
Return the flattened id of the current work-item after subtracting the offset.

Definition at line 95 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_global(), cl::sycl::nd_item< Dimensions >::get_global_range(), cl::sycl::nd_item< Dimensions >::get_offset(), and cl::sycl::detail::linear_id().

```
00095                                       {
00096     return detail::linear_id(get_global_range(),
      get_global(), get_offset());
00097   }
```

Here is the call graph for this function:



8.9.2.4.2.5 get_global_range()

```
template<int Dimensions = 1>
range<Dimensions> cl::sycl::nd_item< Dimensions >::get_global_range ( ) const  [inline]
```

Return a range<> representing the dimensions of the nd_range<>

Definition at line 158 of file nd_item.hpp.

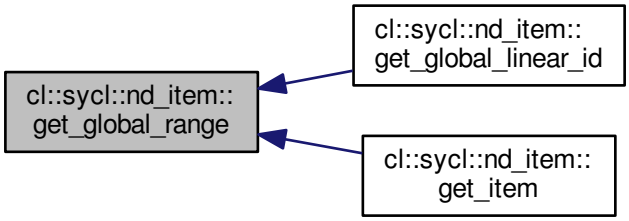
References cl::sycl::nd_item< Dimensions >::get_nd_range().

Referenced by cl::sycl::nd_item< Dimensions >::get_global_linear_id(), and cl::sycl::nd_item< Dimensions >::get_item().

```
00158                                                {
00159     return get_nd_range().get_global();
00160   }
```

Here is the call graph for this function:

Here is the caller graph for this function:



8.9.2.4.2.6 get_group() [1/2]

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::nd_item< Dimensions >::get_group ( ) const  [inline]
```

Return the constituent group group representing the work-group's position within the overall nd_range.

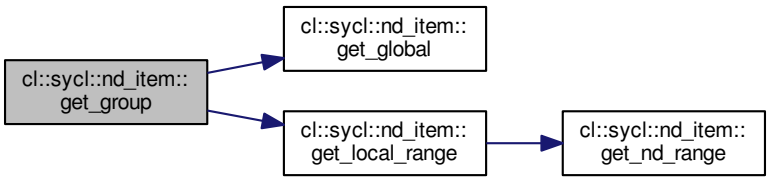
Definition at line 124 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_global(), and cl::sycl::nd_item< Dimensions >::get_local_↩ range().

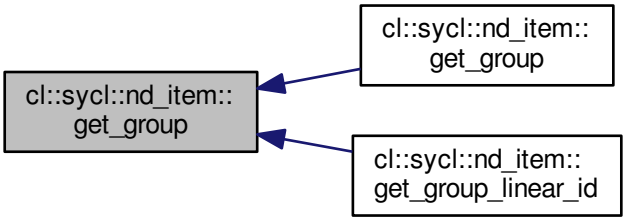
Referenced by cl::sycl::nd_item< Dimensions >::get_group(), and cl::sycl::nd_item< Dimensions >::get_group↩ _linear_id().

```
00124                                {
00125     /* Convert get_local_range() to an id<> to remove ambiguity into using
00126        implicit conversion either from range<> to id<> or the opposite */
00127     return get_global()/id<Dimensions> { get_local_range() };
00128   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.9.2.4.2.7 get_group() [2/2]

```
template<int Dimensions = 1>
size_t cl::sycl::nd_item< Dimensions >::get_group (
            int dimension ) const  [inline]
```

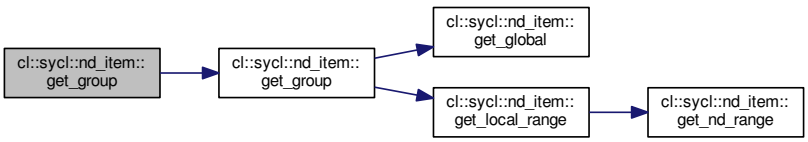
Return the constituent element of the group id representing the work-group;s position within the overall nd_range in the given dimension.

Definition at line 135 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_group().

```
00135                                       {
00136     return get_group()[dimension];
00137   }
```

Here is the call graph for this function:



8.9.2.4.2.8 get_group_linear_id()

```
template<int Dimensions = 1>
size_t cl::sycl::nd_item< Dimensions >::get_group_linear_id ( ) const  [inline]
```

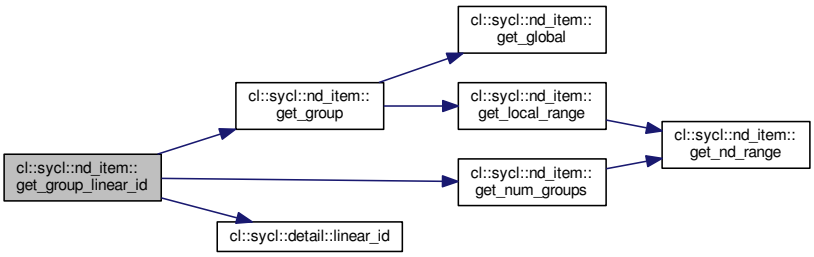
Return the flattened id of the current work-group.

Definition at line 141 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_group(), cl::sycl::nd_item< Dimensions >::get_num_groups(), and cl::sycl::detail::linear_id().

```
00141                                       {
00142     return detail::linear_id(get_num_groups(),
      get_group());
00143   }
```

Here is the call graph for this function:



8.9.2.4.2.9 get_item()

```
template<int Dimensions = 1>
item<Dimensions> cl::sycl::nd_item< Dimensions >::get_item ( ) const  [inline]
```

Allows projection down to an item.

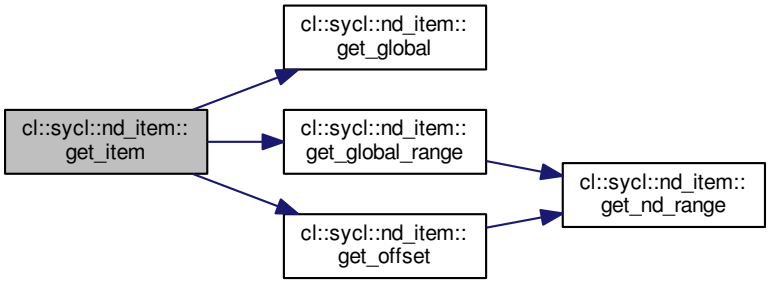
Todo Add to the specification

Definition at line 184 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_global(), cl::sycl::nd_item< Dimensions >::get_global_range(), and cl::sycl::nd_item< Dimensions >::get_offset().

```
00184                                       {
00185     return { get_global_range(), get_global(),
      get_offset() };
00186   }
```

Here is the call graph for this function:



8.9.2.4.2.10 get_local() [1/2]

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::nd_item< Dimensions >::get_local ( ) const  [inline]
```

Return the constituent local id representing the work-item's position within the current work-group.

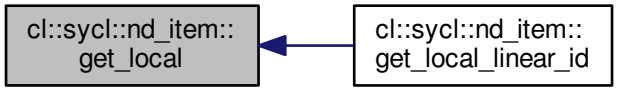
Definition at line 103 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::local_index.

Referenced by cl::sycl::nd_item< Dimensions >::get_local_linear_id().

```
00103 { return local_index; }
```

Here is the caller graph for this function:



8.9.2.4.2.11 get_local() [2/2]

```
template<int Dimensions = 1>
size_t cl::sycl::nd_item< Dimensions >::get_local (
            int dimension ) const  [inline]
```

Return the constituent element of the local id representing the work-item's position within the current work-group in the given dimension.

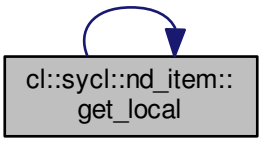
Definition at line 110 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_local().

Referenced by cl::sycl::nd_item< Dimensions >::get_local().

```
00110 { return get_local()[dimension]; }
```

Here is the call graph for this function:



Here is the caller graph for this function:

8.9.2.4.2.12 get_local_linear_id()

```
template<int Dimensions = 1>
size_t cl::sycl::nd_item< Dimensions >::get_local_linear_id ( ) const  [inline]
```

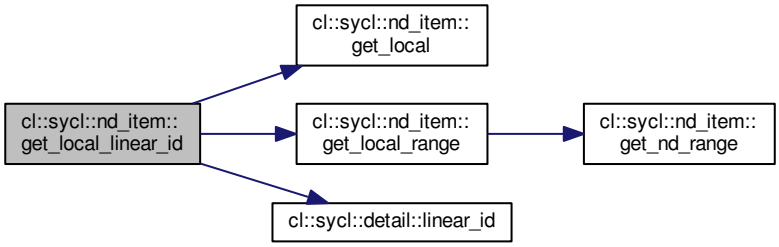
Return the flattened id of the current work-item within the current work-group.

Definition at line 116 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_local(), cl::sycl::nd_item< Dimensions >::get_local_range(), and cl::sycl::detail::linear_id().

```
00116                                       {
00117     return detail::linear_id(get_local_range(),
      get_local());
00118   }
```

Here is the call graph for this function:



8.9.2.4.2.13 get_local_range()

```
template<int Dimensions = 1>
range<Dimensions> cl::sycl::nd_item< Dimensions >::get_local_range ( ) const  [inline]
```

Return a range<> representing the dimensions of the current work-group.

Definition at line 164 of file nd_item.hpp.

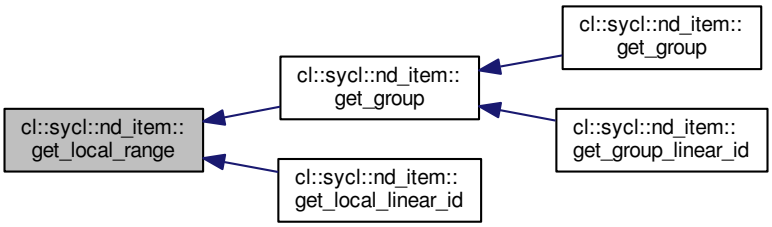
References cl::sycl::nd_item< Dimensions >::get_nd_range().

Referenced by cl::sycl::nd_item< Dimensions >::get_group(), and cl::sycl::nd_item< Dimensions >::get_local_↩ linear_id().

```
00164                                       {
00165     return get_nd_range().get_local();
00166   }
```

Here is the call graph for this function:

Here is the caller graph for this function:



8.9.2.4.2.14 get_nd_range()

```
template<int Dimensions = 1>
nd_range<Dimensions> cl::sycl::nd_item< Dimensions >::get_nd_range ( ) const  [inline]
```

Return the nd_range<> of the current execution.

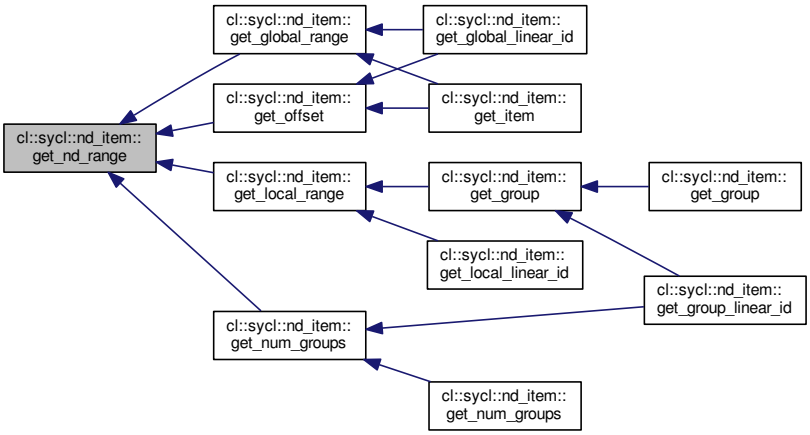
Definition at line 177 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::ND_range.

Referenced by cl::sycl::nd_item< Dimensions >::get_global_range(), cl::sycl::nd_item< Dimensions >::get_local↩
_range(), cl::sycl::nd_item< Dimensions >::get_num_groups(), and cl::sycl::nd_item< Dimensions >::get_offset().

```
00177 { return ND_range; }
```

Here is the caller graph for this function:



8.9.2.4.2.15 get_num_groups() [1/2]

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::nd_item< Dimensions >::get_num_groups ( ) const  [inline]
```

Return the number of groups in the nd_range.

Definition at line 147 of file nd_item.hpp.

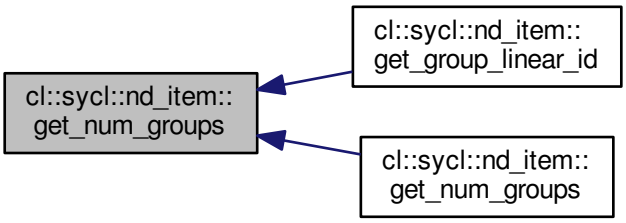
References cl::sycl::nd_item< Dimensions >::get_nd_range().

Referenced by cl::sycl::nd_item< Dimensions >::get_group_linear_id(), and cl::sycl::nd_item< Dimensions >::get_num_groups().

```
00147                                        {
00148     return get_nd_range().get_group();
00149   }
```

Here is the call graph for this function:

Here is the caller graph for this function:



8.9.2.4.2.16 get_num_groups() [2/2]

```
template<int Dimensions = 1>
size_t cl::sycl::nd_item< Dimensions >::get_num_groups (
            int dimension ) const  [inline]
```

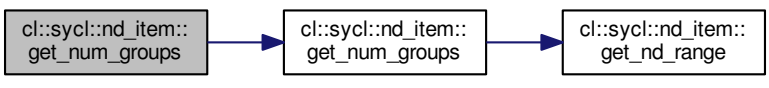
Return the number of groups for dimension in the nd_range.

Definition at line 152 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_num_groups().

```
00152                                          {
00153     return get_num_groups()[dimension];
00154   }
```

Here is the call graph for this function:



8.9.2.4.2.17 get_offset()

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::nd_item< Dimensions >::get_offset ( ) const  [inline]
```

Return an id<> representing the n-dimensional offset provided to the constructor of the nd_range<> and that is added by the runtime to the global-ID of each work-item.

Definition at line 173 of file nd_item.hpp.

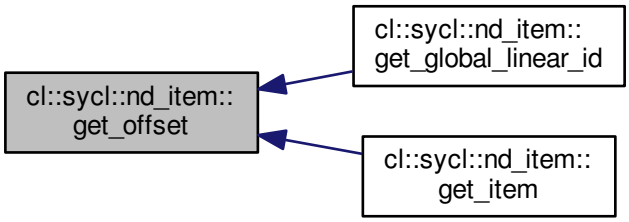
References cl::sycl::nd_item< Dimensions >::get_nd_range().

Referenced by cl::sycl::nd_item< Dimensions >::get_global_linear_id(), and cl::sycl::nd_item< Dimensions >::get_item().

```
00173 { return get_nd_range().get_offset(); }
```

Here is the call graph for this function:

Here is the caller graph for this function:



8.9.2.4.2.18 set_global()

```
template<int Dimensions = 1>
void cl::sycl::nd_item< Dimensions >::set_global (
             id< Dimensions > Index )  [inline]
```

Definition at line 217 of file nd_item.hpp.

```
00217 { global_index = Index; }
```

8.9.2.4.2.19 set_local()

```
template<int Dimensions = 1>
void cl::sycl::nd_item< Dimensions >::set_local (
            id< Dimensions > Index )  [inline]
```

Definition at line 213 of file nd_item.hpp.

```
00213 { local_index = Index; }
```

8.9.2.4.3 Member Data Documentation

8.9.2.4.3.1 dimensionality

```
template<int Dimensions = 1>
constexpr auto cl::sycl::nd_item< Dimensions >::dimensionality = Dimensions  [static]
```

Todo add this Boost::multi_array or STL concept to the specification?

Definition at line 36 of file nd_item.hpp.

8.9.2.4.3.2 global_index

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::nd_item< Dimensions >::global_index  [private]
```

Definition at line 40 of file nd_item.hpp.

Referenced by cl::sycl::nd_item< Dimensions >::get_global().

8.9.2.4.3.3 local_index

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::nd_item< Dimensions >::local_index  [private]
```

Definition at line 43 of file nd_item.hpp.

Referenced by cl::sycl::nd_item< Dimensions >::get_local().

8.9.2.4.3.4 ND_range

```
template<int Dimensions = 1>
nd_range<Dimensions> cl::sycl::nd_item< Dimensions >::ND_range  [private]
```

Definition at line 44 of file nd_item.hpp.

Referenced by cl::sycl::nd_item< Dimensions >::get_nd_range().

8.9.2.5 struct cl::sycl::nd_range

template<int Dimensions = 1>
struct cl::sycl::nd_range< Dimensions >

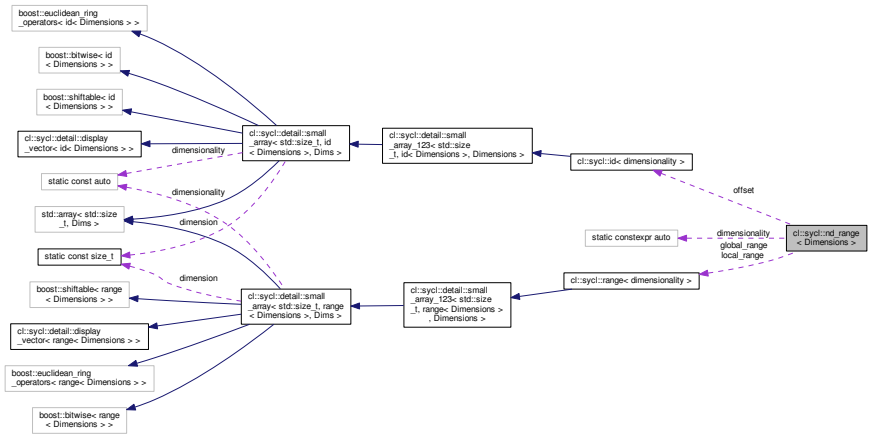
A ND-range, made by a global and local range, to specify work-group and work-item organization.

The local offset is used to translate the iteration space origin if needed.

Todo add copy constructors in the specification

Definition at line 33 of file nd_range.hpp.

Collaboration diagram for cl::sycl::nd_range< Dimensions >:



Public Member Functions

- nd_range (range< Dimensions > global_size, range< Dimensions > local_size, id< Dimensions > offset={})

  Construct a ND-range with all the details available in OpenCL.
- range< Dimensions > get_global () const

  Get the global iteration space range.
- range< Dimensions > get_local () const

  Get the local part of the iteration space range.
- auto get_group () const

  Get the range of work-groups needed to run this ND-range.
- id< Dimensions > get_offset () const
- void display () const

  Display the value for debugging and validation purpose.

Static Public Attributes

- static constexpr auto dimensionality = Dimensions

Private Attributes

- range< dimensionality > global_range
- range< dimensionality > local_range
- id< dimensionality > offset

8.9.2.5.1 Constructor & Destructor Documentation

8.9.2.5.1.1 nd_range()

```
template<int Dimensions = 1>
cl::sycl::nd_range< Dimensions >::nd_range (
             range< Dimensions > global_size,
             range< Dimensions > local_size,
             id< Dimensions > offset = {} )  [inline]
```

Construct a ND-range with all the details available in OpenCL.

By default use a zero offset, that is iterations start at 0

Definition at line 50 of file nd_range.hpp.

```
00052                                    {}) :
00053     global_range { global_size }, local_range { local_size },
      offset { offset }
00054   { }
```

8.9.2.5.2 Member Function Documentation

8.9.2.5.2.1 display()

```
template<int Dimensions = 1>
void cl::sycl::nd_range< Dimensions >::display ( ) const  [inline]
```

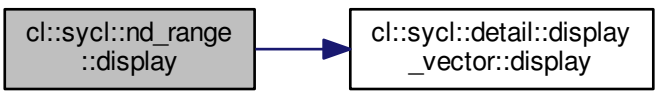
Display the value for debugging and validation purpose.

Definition at line 80 of file nd_range.hpp.

References cl::sycl::detail::display_vector< T >::display().

```
00080                        {
00081     global_range.display();
00082     local_range.display();
00083     offset.display();
00084   }
```

Here is the call graph for this function:



8.9.2.5.2.2 get_global()

```
template<int Dimensions = 1>
range<Dimensions> cl::sycl::nd_range< Dimensions >::get_global ( ) const  [inline]
```

Get the global iteration space range.

Definition at line 58 of file nd_range.hpp.

References cl::sycl::nd_range< Dimensions >::global_range.

```
00058 { return global_range; }
```

8.9.2.5.2.3 get_group()

```
template<int Dimensions = 1>
auto cl::sycl::nd_range< Dimensions >::get_group ( ) const  [inline]
```

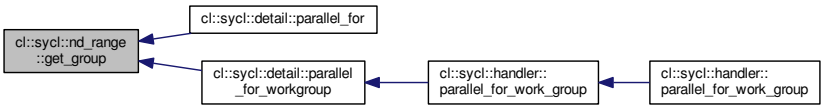
Get the range of work-groups needed to run this ND-range.

Definition at line 66 of file nd_range.hpp.

Referenced by cl::sycl::detail::parallel_for(), and cl::sycl::detail::parallel_for_workgroup().

```
00066                          {
00067     /* This is basically global_range/local_range, round up to the
00068        next integer, in case the global range is not a multiple of the
00069        local range. Note this is a motivating example to build a range
00070        from a scalar with a broadcasting constructor. */
00071     return (global_range + local_range - range<Dimensions>{ 1 })/
      local_range;
00072   }
```

Here is the caller graph for this function:



8.9.2.5.2.4 get_local()

```
template<int Dimensions = 1>
range<Dimensions> cl::sycl::nd_range< Dimensions >::get_local ( ) const  [inline]
```

Get the local part of the iteration space range.

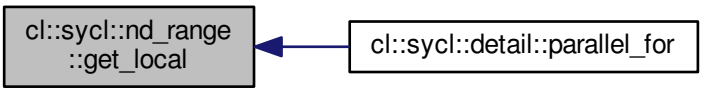
Definition at line 62 of file nd_range.hpp.

References cl::sycl::nd_range< Dimensions >::local_range.

Referenced by cl::sycl::detail::parallel_for().

```
00062 { return local_range; }
```

Here is the caller graph for this function:



8.9.2.5.2.5 get_offset()

```
template<int Dimensions = 1>
id<Dimensions> cl::sycl::nd_range< Dimensions >::get_offset ( ) const  [inline]
```

Todo get_offset() is lacking in the specification

Definition at line 76 of file nd_range.hpp.

References cl::sycl::nd_range< Dimensions >::offset.

```
00076 { return offset; }
```

8.9.2.5.3 Member Data Documentation

8.9.2.5.3.1 dimensionality

```
template<int Dimensions = 1>
constexpr auto cl::sycl::nd_range< Dimensions >::dimensionality = Dimensions  [static]
```

Todo add this Boost::multi_array or STL concept to the specification?

Definition at line 36 of file nd_range.hpp.

8.9.2.5.3.2 global_range

```
template<int Dimensions = 1>
range<dimensionality> cl::sycl::nd_range< Dimensions >::global_range  [private]
```

Definition at line 40 of file nd_range.hpp.

Referenced by cl::sycl::nd_range< Dimensions >::get_global().

8.9.2.5.3.3 local_range

```
template<int Dimensions = 1>
range<dimensionality> cl::sycl::nd_range< Dimensions >::local_range  [private]
```

Definition at line 41 of file nd_range.hpp.

Referenced by cl::sycl::nd_range< Dimensions >::get_local().

8.9.2.5.3.4 offset

```
template<int Dimensions = 1>
id<dimensionality> cl::sycl::nd_range< Dimensions >::offset  [private]
```

Definition at line 42 of file nd_range.hpp.

Referenced by cl::sycl::nd_range< Dimensions >::get_offset().

8.9.2.6 struct cl::sycl::detail::parallel_for_iterate

template<std::size_t level, typename Range, typename ParallelForFunctor, typename Id>
struct cl::sycl::detail::parallel_for_iterate< level, Range, ParallelForFunctor, Id >

A recursive multi-dimensional iterator that ends up calling f.

The iteration order may be changed later.

Since partial specialization of function template is not possible in C++14, use a class template instead with everything in the constructor.

Definition at line 50 of file parallelism.hpp.

Public Member Functions

- parallel_for_iterate (Range r, ParallelForFunctor &f, Id &index)

8.9.2.6.1 Constructor & Destructor Documentation

8.9.2.6.1.1 parallel_for_iterate()

```
template<std::size_t level, typename Range , typename ParallelForFunctor , typename Id >
cl::sycl::detail::parallel_for_iterate< level, Range, ParallelForFunctor, Id >::parallel_for↩
_iterate (
             Range r,
             ParallelForFunctor & f,
             Id & index )  [inline]
```

Definition at line 51 of file parallelism.hpp.

```
00051                                                                    {
00052     for (boost::multi_array_types::index _sycl_index = 0,
00053            _sycl_end = r[Range::dimensionality - level];
00054          _sycl_index < _sycl_end;
00055          _sycl_index++) {
00056       // Set the current value of the index for this dimension
00057       index[Range::dimensionality - level] = _sycl_index;
00058       // Iterate further on lower dimensions
00059       parallel_for_iterate<level - 1,
00060                            Range,
00061                            ParallelForFunctor,
00062                            Id> { r, f, index };
00063     }
00064   }
```

8.9.2.7 struct cl::sycl::detail::parallel_OpenMP_for_iterate

template<std::size_t level, typename Range, typename ParallelForFunctor, typename Id>
struct cl::sycl::detail::parallel_OpenMP_for_iterate< level, Range, ParallelForFunctor, Id >

A top-level recursive multi-dimensional iterator variant using OpenMP.

Only the top-level loop uses OpenMP and goes on with the normal recursive multi-dimensional.

Definition at line 77 of file parallelism.hpp.

Public Member Functions

- parallel_OpenMP_for_iterate (Range r, ParallelForFunctor &f)

8.9.2.7.1 Constructor & Destructor Documentation

8.9.2.7.1.1 parallel_OpenMP_for_iterate()

```
template<std::size_t level, typename Range , typename ParallelForFunctor , typename Id >
cl::sycl::detail::parallel_OpenMP_for_iterate< level, Range, ParallelForFunctor, Id >::parallel↩
_OpenMP_for_iterate (
             Range r,
             ParallelForFunctor & f )  [inline]
```

Definition at line 78 of file parallelism.hpp.

```
00078                                                                {
00079     // Create the OpenMP threads before the for-loop to avoid creating an
00080     // index in each iteration
00081 #pragma omp parallel
00082     {
00083       // Allocate an OpenMP thread-local index
00084       Id index;
00085       // Make a simple loop end condition for OpenMP
00086       boost::multi_array_types::index _sycl_end =
00087         r[Range::dimensionality - level];
00088       /* Distribute the iterations on the OpenMP threads. Some OpenMP
00089          "collapse" could be useful for small iteration space, but it
00090          would need some template specialization to have real contiguous
00091          loop nests */
00092 #pragma omp for
00093       for (boost::multi_array_types::index _sycl_index = 0;
00094            _sycl_index < _sycl_end;
00095            _sycl_index++) {
00096         // Set the current value of the index for this dimension
00097         index[Range::dimensionality - level] = _sycl_index;
00098         // Iterate further on lower dimensions
00099         parallel_for_iterate<level - 1,
00100                              Range,
00101                              ParallelForFunctor,
00102                              Id> { r, f, index };
00103       }
00104     }
00105   }
```

8.9.2.8 struct cl::sycl::detail::parallel_for_iterate< 0, Range, ParallelForFunctor, Id >

template<typename Range, typename ParallelForFunctor, typename Id>
struct cl::sycl::detail::parallel_for_iterate< 0, Range, ParallelForFunctor, Id >

Stop the recursion when level reaches 0 by simply calling the kernel functor with the constructed id.

Definition at line 112 of file parallelism.hpp.

Public Member Functions

- parallel_for_iterate (Range r, ParallelForFunctor &f, Id &index)

8.9.2.8.1 Constructor & Destructor Documentation

8.9.2.8.1.1 parallel_for_iterate()

```
template<typename Range , typename ParallelForFunctor , typename Id >
cl::sycl::detail::parallel_for_iterate< 0, Range, ParallelForFunctor, Id >::parallel_for_↩
iterate (
            Range r,
            ParallelForFunctor & f,
            Id & index )  [inline]
```

Definition at line 113 of file parallelism.hpp.

```
00113                                                                    {
00114     f(index);
00115   }
```

8.9.2.9 class cl::sycl::range

template<int Dimensions = 1>
class cl::sycl::range< Dimensions >

A SYCL range defines a multi-dimensional index range that can be used to define launch parallel computation extent or buffer sizes.

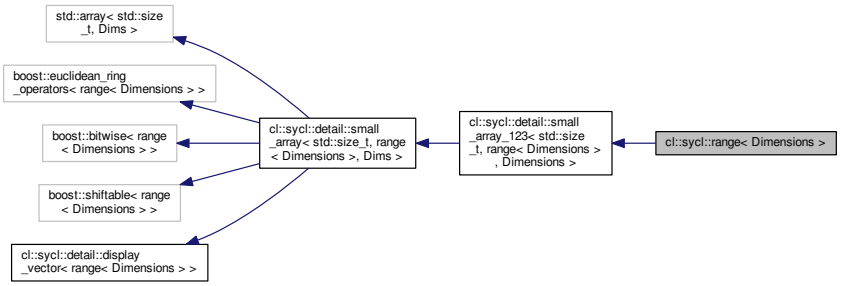
Todo use std::size_t Dimensions instead of int Dimensions in the specification?

Todo add to the specification this default parameter value?

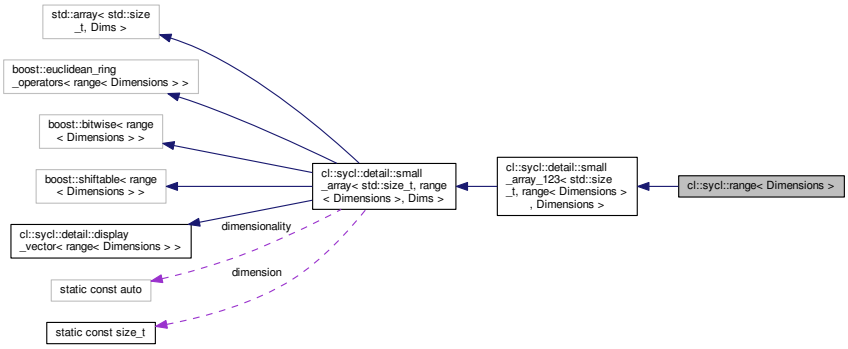
Todo add to the specification some way to specify an offset?

Definition at line 34 of file range.hpp.

Inheritance diagram for cl::sycl::range< Dimensions >:



Collaboration diagram for cl::sycl::range< Dimensions >:



Public Member Functions

- size_t get_count () const

  Return the number of elements in the range.

Additional Inherited Members

8.9.2.9.1 Member Function Documentation

8.9.2.9.1.1 get_count()

```
template<int Dimensions = 1>
size_t cl::sycl::range< Dimensions >::get_count ( ) const  [inline]
```

Return the number of elements in the range.

Todo Give back size() its real meaning in the specification

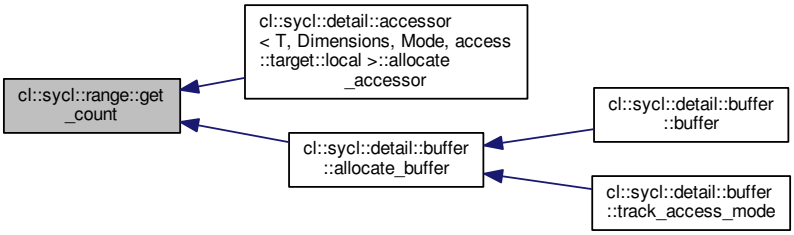
Todo add this method to the specification

Definition at line 53 of file range.hpp.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::allocate_accessor(), and cl::sycl::detail::buffer< T, Dimensions >::allocate_buffer().

```
00053                           {
00054     // Return the product of the sizes in each dimension
00055     return std::accumulate(this->cbegin(),
00056                            this->cend(),
00057                            1,
00058                            std::multiplies<size_t> {});
00059   }
```

Here is the caller graph for this function:



8.9.3 Function Documentation

8.9.3.1 make_id() [1/4]

```
auto cl::sycl::make_id (
            id< 1 > i )  [inline]
```

```
#include <include/CL/sycl/id.hpp>
```

Implement a make_id to construct an id<> of the right dimension with implicit conversion from an initializer list for example.

Cannot use a template on the number of dimensions because the implicit conversion would not be tried.

Definition at line 71 of file id.hpp.

```
00071 { return i; }
```

8.9.3.2 make_id() [2/4]

```
auto cl::sycl::make_id (
            id< 2 > i )  [inline]
```

```
#include <include/CL/sycl/id.hpp>
```

Definition at line 72 of file id.hpp.

```
00072 { return i; }
```

8.9.3.3 make_id() [3/4]

```
auto cl::sycl::make_id (
            id< 3 > i )  [inline]
```

`#include <include/CL/sycl/id.hpp>`

Definition at line 73 of file id.hpp.

```
00073 { return i; }
```

8.9.3.4 make_id() [4/4]

```
template<typename...  BasicType>
auto cl::sycl::make_id (
            BasicType...  Args )
```

`#include <include/CL/sycl/id.hpp>`

Construct an id<> from a function call with arguments, like make_id(1, 2, 3)

Definition at line 79 of file id.hpp.

```
00079                                {
00080   // Call constructor directly to allow narrowing
00081   return id<sizeof...(Args)>(Args...);
00082 }
```

8.9.3.5 make_range() [1/4]

```
auto cl::sycl::make_range (
            range< 1 > r )  [inline]
```

`#include <include/CL/sycl/range.hpp>`

Implement a make_range to construct a range<> of the right dimension with implicit conversion from an initializer list for example.

Cannot use a template on the number of dimensions because the implicit conversion would not be tried.

Definition at line 69 of file range.hpp.

```
00069 { return r; }
```

8.9.3.6 make_range() [2/4]

```
auto cl::sycl::make_range (
             range< 2 > r )  [inline]
```

```
#include <include/CL/sycl/range.hpp>
```

Definition at line 70 of file range.hpp.

```
00070 { return r; }
```

8.9.3.7 make_range() [3/4]

```
auto cl::sycl::make_range (
             range< 3 > r )  [inline]
```

```
#include <include/CL/sycl/range.hpp>
```

Definition at line 71 of file range.hpp.

```
00071 { return r; }
```

8.9.3.8 make_range() [4/4]

```
template<typename...  BasicType>
auto cl::sycl::make_range (
             BasicType...  Args )
```

```
#include <include/CL/sycl/range.hpp>
```

Construct a range<> from a function call with arguments, like make_range(1, 2, 3)

Definition at line 78 of file range.hpp.

```
00078                                    {
00079   // Call constructor directly to allow narrowing
00080   return range<sizeof...(Args)>(Args...);
00081 }
```

8.9.3.9 parallel_for() [1/4]

```
template<int Dimensions = 1, typename ParallelForFunctor , typename Id >
void cl::sycl::detail::parallel_for (
             range< Dimensions > r,
             ParallelForFunctor f,
             Id  )
```

`#include <include/CL/sycl/parallelism/detail/parallelism.hpp>`

Implementation of a data parallel computation with parallelism specified at launch time by a range<>.

Kernel index is id or int.

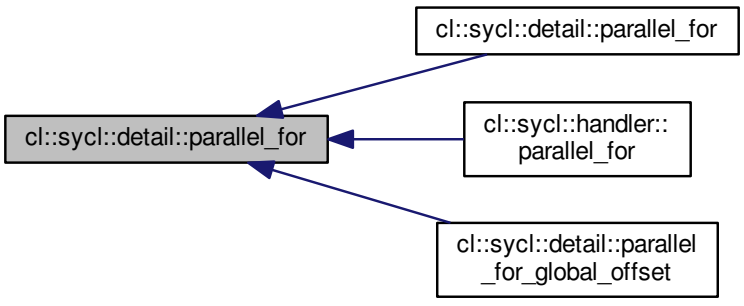
This implementation use OpenMP 3 if compiled with the right flag.

Definition at line 125 of file parallelism.hpp.

Referenced by cl::sycl::detail::parallel_for(), cl::sycl::handler::parallel_for(), and cl::sycl::detail::parallel_for_global↩ _offset().

```
00127                     {
00128 #ifdef _OPENMP
00129   // Use OpenMP for the top loop level
00130   parallel_OpenMP_for_iterate<Dimensions,
00131                               range<Dimensions>,
00132                               ParallelForFunctor,
00133                               id<Dimensions>> { r, f };
00134 #else
00135   // In a sequential execution there is only one index processed at a time
00136   id<Dimensions> index;
00137   parallel_for_iterate<Dimensions,
00138                        range<Dimensions>,
00139                        ParallelForFunctor,
00140                        id<Dimensions>> { r, f, index };
00141 #endif
00142 }
```

Here is the caller graph for this function:



8.9.3.10 parallel_for() [2/4]

```
template<int Dimensions = 1, typename ParallelForFunctor >
void cl::sycl::detail::parallel_for (
             range< Dimensions > r,
             ParallelForFunctor f,
             item< Dimensions >  )
```

`#include <include/CL/sycl/parallelism/detail/parallelism.hpp>`

Implementation of a data parallel computation with parallelism specified at launch time by a range<>.

Kernel index is item.

This implementation use OpenMP 3 if compiled with the right flag.

Definition at line 151 of file parallelism.hpp.

```
00153                                    {
00154   auto reconstruct_item = [&] (id<Dimensions> l) {
00155     // Reconstruct the global item
00156     item<Dimensions> index { r, l };
00157     // Call the user kernel with the item<> instead of the id<>
00158     f(index);
00159   };
00160 #ifdef _OPENMP
00161   // Use OpenMP for the top loop level
00162   parallel_OpenMP_for_iterate<Dimensions,
00163                               range<Dimensions>,
00164                               decltype(reconstruct_item),
00165                               id<Dimensions>> { r, reconstruct_item };
00166 #else
00167   // In a sequential execution there is only one index processed at a time
00168   id<Dimensions> index;
00169   parallel_for_iterate<Dimensions,
00170                        range<Dimensions>,
00171                        decltype(reconstruct_item),
00172                        id<Dimensions>> { r, reconstruct_item, index };
00173 #endif
00174 }
```

8.9.3.11 parallel_for() [3/4]

```
template<int Dimensions = 1, typename ParallelForFunctor >
void cl::sycl::detail::parallel_for (
             range< Dimensions > r,
             ParallelForFunctor f )
```

`#include <include/CL/sycl/parallelism/detail/parallelism.hpp>`

Calls the appropriate ternary parallel_for overload based on the index type of the kernel function object f.

Definition at line 182 of file parallelism.hpp.

References cl::sycl::detail::parallel_for().

```
00182                                                          {
00183   using mf_t  = decltype(std::mem_fn(&ParallelForFunctor::operator()));
00184   using arg_t = typename mf_t::second_argument_type;
00185   parallel_for(r,f,arg_t{});
00186 }
```

Here is the call graph for this function:

8.9.3.12 parallel_for() [4/4]

```
template<int Dimensions = 1, typename ParallelForFunctor >
void cl::sycl::detail::parallel_for (
             nd_range< Dimensions > r,
             ParallelForFunctor f )
```

`#include <include/CL/sycl/parallelism/detail/parallelism.hpp>`

Implement a variation of parallel_for to take into account a nd_range<>

Todo Add an OpenMP implementation

Todo Deal with incomplete work-groups

Todo Implement with parallel_for_workgroup()/parallel_for_workitem()

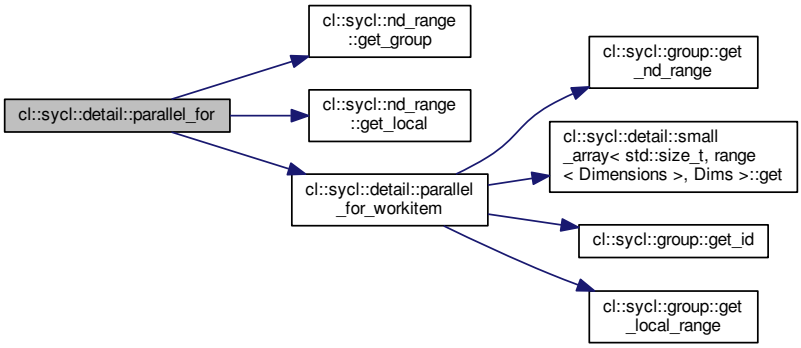
Definition at line 217 of file parallelism.hpp.

References cl::sycl::nd_range< Dimensions >::get_group(), cl::sycl::nd_range< Dimensions >::get_local(), and cl::sycl::detail::parallel_for_workitem().

```
00218                                       {
00219   // To iterate on the work-group
00220   id<Dimensions> group;
00221   range<Dimensions> group_range = r.get_group();
00222
00223 #ifdef _OPENMP
00224
00225   auto iterate_in_work_group = [&] (id<Dimensions> g) {
00226     //group.display();
00227
00228     // Then iterate on the local work-groups
00229     cl::sycl::group<Dimensions> wg {g, r};
00230     parallel_for_workitem<Dimensions,
00231                           decltype(f)>(wg, f);
00232   };
00233
00234 #else
00235
00236   // In a sequential execution there is only one index processed at a time
00237   nd_item<Dimensions> index { r };
00238
00239   // To iterate on the local work-item
00240   id<Dimensions> local;
00241   range<Dimensions> local_range = r.get_local();
00242
```

```
00243   // Reconstruct the nd_item from its group and local id
00244   auto reconstruct_item = [&] (id<Dimensions> l) {
00245     //local.display();
00246     // Reconstruct the global nd_item
00247     index.set_local(local);
00248     // Upgrade local_range to an id<> so that we can * with the group (an id<>)
00249     index.set_global(local + id<Dimensions>(local_range)*group);
00250     // Call the user kernel at last
00251     f(index);
00252   };
00253
00254   /* To recycle the parallel_for on range<>, wrap the ParallelForFunctor f
00255      into another functor that iterates inside the work-group and then
00256      calls f */
00257   auto iterate_in_work_group = [&] (id<Dimensions> g) {
00258     //group.display();
00259     // Then iterate on the local work-groups
00260     parallel_for_iterate<Dimensions,
00261                          range<Dimensions>,
00262                          decltype(reconstruct_item),
00263                          id<Dimensions>> { local_range,
00264                                            reconstruct_item,
00265                                            local };
00266   };
00267
00268 #endif
00269
00270   // First iterate on all the work-groups
00271   parallel_for_iterate<Dimensions,
00272                        range<Dimensions>,
00273                        decltype(iterate_in_work_group),
00274                        id<Dimensions>> { group_range,
00275                                          iterate_in_work_group,
00276                                          group };
00277 }
```

Here is the call graph for this function:



8.9.3.13 parallel_for_global_offset()

```
template<int Dimensions = 1, typename ParallelForFunctor >
void cl::sycl::detail::parallel_for_global_offset (
            range< Dimensions > global_size,
            id< Dimensions > offset,
            ParallelForFunctor f )
```

```
#include <include/CL/sycl/parallelism/detail/parallelism.hpp>
```

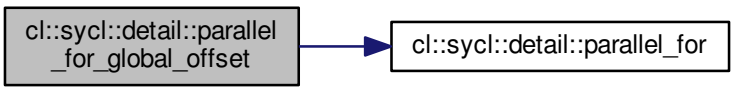
Implementation of parallel_for with a range<> and an offset.

Definition at line 191 of file parallelism.hpp.

References cl::sycl::detail::parallel_for().

```
00193                                                    {
00194   // Reconstruct the item from its id<> and its offset
00195   auto reconstruct_item = [&] (id<Dimensions> l) {
00196     // Reconstruct the global item
00197     item<Dimensions> index { global_size, l + offset, offset };
00198     // Call the user kernel with the item<> instead of the id<>
00199     f(index);
00200   };
00201
00202   // First iterate on all the work-groups
00203   parallel_for(global_size, reconstruct_item);
00204 }
```

Here is the call graph for this function:



8.9.3.14 parallel_for_work_item()

```
template<int Dimensions = 1, typename ParallelForFunctor >
void cl::sycl::parallel_for_work_item (
             const group< Dimensions > & g,
             ParallelForFunctor f )
```

```
#include <include/CL/sycl/parallelism.hpp>
```

SYCL parallel_for version that allows a Program object to be specified.

Todo To be implemented

Loop on the work-items inside a work-group

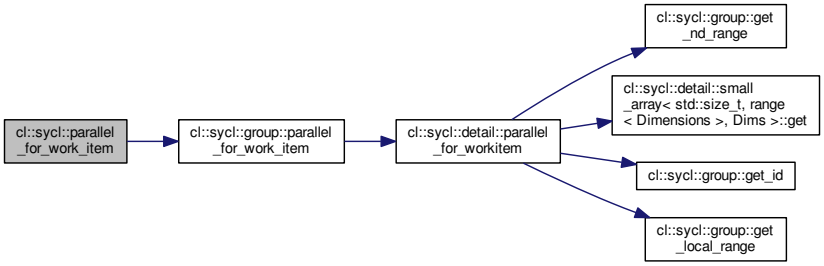
Todo Deprecate this function in the specification to use instead the group method

Definition at line 39 of file parallelism.hpp.

References cl::sycl::group< Dimensions >::parallel_for_work_item().

```
00040                                                 {
00041     g.parallel_for_work_item(f);
00042   }
```

Here is the call graph for this function:



8.9.3.15 parallel_for_workgroup()

```
template<int Dimensions = 1, typename ParallelForFunctor >
void cl::sycl::detail::parallel_for_workgroup (
             nd_range< Dimensions > r,
             ParallelForFunctor f )
```

```
#include <include/CL/sycl/parallelism/detail/parallelism.hpp>
```

Implement the loop on the work-groups.

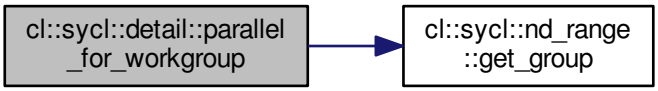
Definition at line 282 of file parallelism.hpp.

References cl::sycl::nd_range< Dimensions >::get_group().

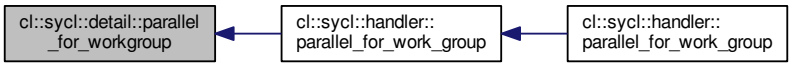
Referenced by cl::sycl::handler::parallel_for_work_group().

```
00283                                                 {
00284   // In a sequential execution there is only one index processed at a time
00285   group<Dimensions> g { r };
00286
00287   // First iterate on all the work-groups
00288   parallel_for_iterate<Dimensions,
00289                        range<Dimensions>,
00290                        ParallelForFunctor,
00291                        group<Dimensions>> {
00292     r.get_group(),
00293     f,
00294     g };
00295 }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.9.3.16 parallel_for_workitem()

```
template<int Dimensions = 1, typename ParallelForFunctor >
void cl::sycl::detail::parallel_for_workitem (
             const group< Dimensions > & g,
             ParallelForFunctor f )
```

```
#include <include/CL/sycl/group.hpp>
```

Implement the loop on the work-items inside a work-group.

Todo Better type the functor

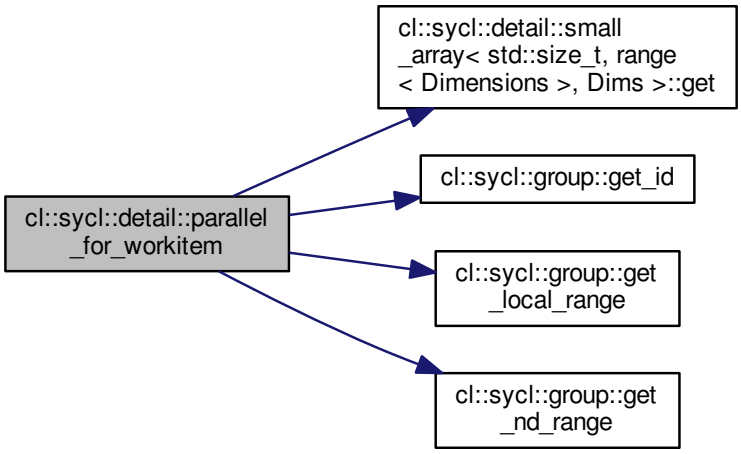
Definition at line 303 of file parallelism.hpp.

References cl::sycl::detail::small_array< std::size_t, range< Dimensions >, Dims >::get(), cl::sycl::group< Dimensions >::get_id(), cl::sycl::group< Dimensions >::get_local_range(), and cl::sycl::group< Dimensions >::get_nd↩_range().

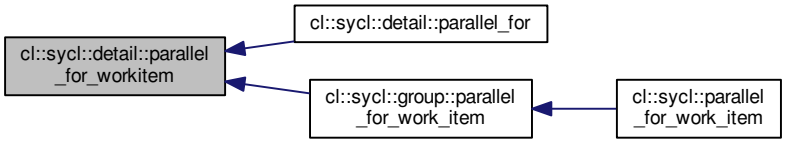
Referenced by cl::sycl::detail::parallel_for(), and cl::sycl::group< Dimensions >::parallel_for_work_item().

```
00304                                                   {
00305 #if defined(_OPENMP) && (!defined(TRISYCL_NO_BARRIER) && !defined(_MSC_VER))
00306   /* To implement barriers With OpenMP, one thread is created for each
00307      work-item in the group and thus an OpenMP barrier has the same effect
00308      of an OpenCL barrier executed by the work-items in a workgroup
00309
00310      The issue is that the parallel_for_workitem() execution is slow even
00311      when nd_item::barrier() is not used
00312
00313      \todo Simplify by just using omp parallel for collapse
00314   */
00315
00316   range<Dimensions> l_r = g.get_nd_range().get_local();
00317   auto tot = l_r.get(0);
00318   for (int i = 1; i < (int) Dimensions; ++i){
00319     tot *= l_r.get(i);
00320   }
00321 #pragma omp parallel num_threads(tot)
00322   {
00323     nd_item<Dimensions> index { g.get_nd_range() };
00324     id<Dimensions> local; // to initialize correctly
00325 #pragma omp for nowait
00326     for (std::size_t th_id = 0; th_id < tot; ++th_id) {
00327       if (Dimensions == 1) {
00328         local[0] = th_id;
00329       } else if (Dimensions == 2) {
00330         local[0] = th_id / l_r.get(1);
00331         local[1] = th_id % l_r.get(1);
00332       } else if (Dimensions == 3) {
00333         local[0] = th_id / (l_r.get(1)*l_r.get(2));
00334         local[1] = (th_id / l_r.get(2)) % l_r.get(1);
00335         local[2] = th_id % l_r.get(2);
00336       }
00337       index.set_local(local);
00338       index.set_global(local + id<Dimensions>(l_r)*g.get_id());
00339       f(index);
00340     }
00341   }
00342 #else
00343   // In a sequential execution there is only one index processed at a time
00344   nd_item<Dimensions> index { g.get_nd_range() };
00345   // To iterate on the local work-item
00346   id<Dimensions> local;
00347
00348   // Reconstruct the nd_item from its group and local id
00349   auto reconstruct_item = [&] (id<Dimensions> l) {
00350     //local.display();
00351     //l.display();
00352     // Reconstruct the global nd_item
00353     index.set_local(local);
00354     // \todo Some strength reduction here
00355     index.set_global(local + id<Dimensions>(g.get_local_range())*g.get_id());
00356     // Call the user kernel at last
00357     f(index);
00358   };
00359
00360   // Then iterate on all the work-items of the work-group
00361   parallel_for_iterate<Dimensions,
00362                        range<Dimensions>,
00363                        decltype(reconstruct_item),
00364                        id<Dimensions>> {
00365     g.get_local_range(),
00366     reconstruct_item,
00367     local };
00368 #endif
00369 }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.10 Vector types in SYCL

Classes

- class cl::sycl::vec< DataType, NumElements >

  Small OpenCL vector class. More...

Macros

- #define TRISYCL_DEFINE_VEC_TYPE_SIZE(type, size, actual_type) using type##size = vec<actual_type, size>;

  A macro to define type alias, such as for type=uchar, size=4 and actual_type=unsigned char, uchar4 is equivalent to vec<unsigned char, 4>
- #define TRISYCL_DEFINE_VEC_TYPE(type, actual_type)

  Declare the vector types of a type for all the sizes.

8.10.1 Detailed Description

8.10.2 Class Documentation

8.10.2.1 class cl::sycl::vec

template<typename DataType, size_t NumElements>
class cl::sycl::vec< DataType, NumElements >

Small OpenCL vector class.

Todo add [] operator

Todo add iterators on elements, with begin() and end()

Todo having vec<> sub-classing array<> instead would solve the previous issues

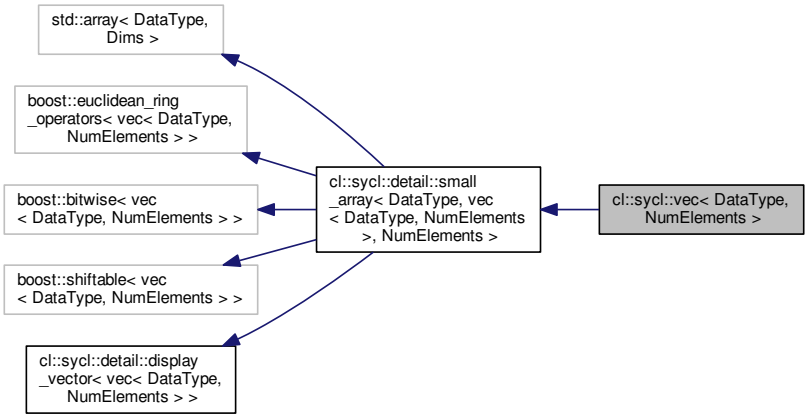
Todo move the implementation elsewhere

Todo simplify the helpers by removing some template types since there are now inside the vec<> class.

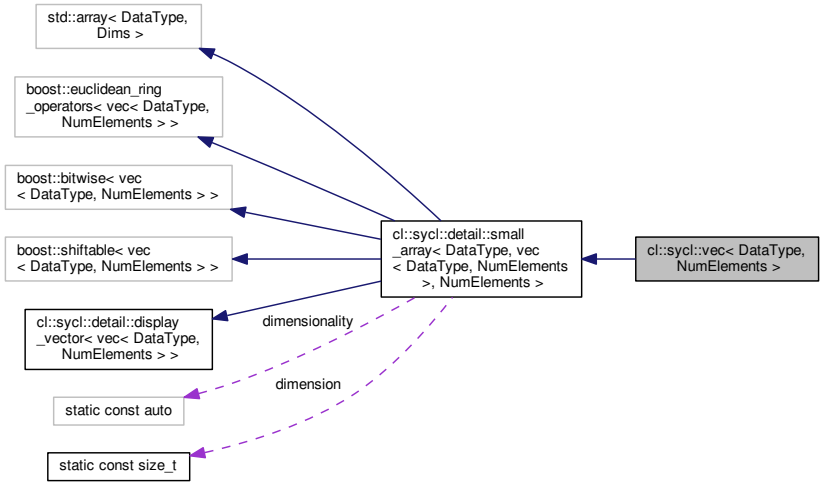
Todo rename in the specification element_type to value_type

Definition at line 42 of file vec.hpp.

Inheritance diagram for cl::sycl::vec< DataType, NumElements >:



Collaboration diagram for cl::sycl::vec< DataType, NumElements >:



Public Member Functions

- template<typename... Types>
  vec (const Types... args)

  Construct a vec from anything from a scalar (to initialize all the elements with this value) up to an aggregate of scalar and vector types (in this case the total number of elements must match the size of the vector)
- vec ()=default

  Use classical constructors too.

Private Types

- using basic_type = typename detail::small_array< DataType, vec< DataType, NumElements >, Num↩ Elements >

Static Private Member Functions

- template<typename V , typename Element , size_t s>
  static auto flatten (const vec< Element, s > i)

  Flattening helper that does not change scalar values but flatten a vec<T, n> v into a tuple<T, T,..., T>{ v[0], v[1],..., v[n-1] }.
- template<typename V , typename Type >
  static auto flatten (const Type i)

  If we do not have a vector, just forward it as a tuple up to the final initialization.
- template<typename V , typename... Types>
  static auto flatten_to_tuple (const Types... i)

  Take some initializer values and apply flattening on each value.

Additional Inherited Members

8.10.2.1.1 Member Typedef Documentation

8.10.2.1.1.1 basic_type

```
template<typename DataType, size_t NumElements>
using cl::sycl::vec< DataType, NumElements >::basic_type = typename detail::small_array<Data↩
Type, vec<DataType, NumElements>, NumElements>  [private]
```

Definition at line 47 of file vec.hpp.

8.10.2.1.2 Constructor & Destructor Documentation

8.10.2.1.2.1 vec() [1/2]

```
template<typename DataType, size_t NumElements>
template<typename...  Types>
cl::sycl::vec< DataType, NumElements >::vec (
             const Types...  args )  [inline]
```

Construct a vec from anything from a scalar (to initialize all the elements with this value) up to an aggregate of scalar and vector types (in this case the total number of elements must match the size of the vector)

Definition at line 57 of file vec.hpp.

References cl::sycl::vec< DataType, NumElements >::vec().

```
00058     : basic_type { detail::expand<vec>(flatten_to_tuple<vec>(args...)) } { }
```

Here is the call graph for this function:

8.10.2.1.2.2 vec() [2/2]

```
template<typename DataType, size_t NumElements>
cl::sycl::vec< DataType, NumElements >::vec ( )  [default]
```

Use classical constructors too.

Referenced by cl::sycl::vec< DataType, NumElements >::vec().

Here is the caller graph for this function:

8.10.2.1.3 Member Function Documentation

8.10.2.1.3.1 flatten() [1/2]

```
template<typename DataType, size_t NumElements>
template<typename V , typename Element , size_t s>
static auto cl::sycl::vec< DataType, NumElements >::flatten (
             const vec< Element, s > i )  [inline], [static], [private]
```

Flattening helper that does not change scalar values but flatten a vec<T, n> v into a tuple<T, T,..., T>{ v[0], v[1],..., v[n-1] }.

If we have a vector, just forward its array content since an array has also a tuple interface :-) (23.3.2.9 Tuple interface to class template array [array.tuple])

Definition at line 78 of file vec.hpp.

```
00078                                                {
00079     static_assert(s <= V::dimension,
00080                   "The element i will not fit in the vector");
00081     return static_cast<std::array<Element, s>>(i);
00082   }
```

8.10.2.1.3.2 flatten() [2/2]

```
template<typename DataType, size_t NumElements>
template<typename V , typename Type >
static auto cl::sycl::vec< DataType, NumElements >::flatten (
             const Type i )  [inline], [static], [private]
```

If we do not have a vector, just forward it as a tuple up to the final initialization.

Returns

typically tuple<double>{ 2.4 } from 2.4 input for example

Definition at line 91 of file vec.hpp.

```
00091                                    {
00092     return std::make_tuple(i);
00093   }
```

8.10.2.1.3.3 flatten_to_tuple()

```
template<typename DataType, size_t NumElements>
template<typename V , typename...  Types>
static auto cl::sycl::vec< DataType, NumElements >::flatten_to_tuple (
             const Types...  i )  [inline], [static], [private]
```

Take some initializer values and apply flattening on each value.

Returns

a tuple of scalar initializer values

Definition at line 101 of file vec.hpp.

```
00101                                              {
00102     // Concatenate the tuples returned by each flattening
00103     return std::tuple_cat(flatten<V>(i)...);
00104   }
```

8.10.3 Macro Definition Documentation

8.10.3.1 TRISYCL_DEFINE_VEC_TYPE

```
#define TRISYCL_DEFINE_VEC_TYPE(
              type,
              actual_type )
```

```
#include <include/CL/sycl/vec.hpp>
```

Value:

```
TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 1, actual_type)          \
  TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 2, actual_type)          \
  TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 3, actual_type)          \
  TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 4, actual_type)          \
  TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 8, actual_type)          \
  TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 16, actual_type)
```

Declare the vector types of a type for all the sizes.

Definition at line 163 of file vec.hpp.

8.10.3.2 TRISYCL_DEFINE_VEC_TYPE_SIZE

```
#define TRISYCL_DEFINE_VEC_TYPE_SIZE(
              type,
              size,
              actual_type ) using type##size = vec<actual_type, size>;
```

```
#include <include/CL/sycl/vec.hpp>
```

A macro to define type alias, such as for type=uchar, size=4 and actual_type=unsigned char, uchar4 is equivalent to vec<unsigned char, 4>

Definition at line 159 of file vec.hpp.

Chapter 9

Namespace Documentation

9.1 cl Namespace Reference

The vector type to be used as SYCL vector.

Namespaces

- sycl

9.1.1 Detailed Description

The vector type to be used as SYCL vector.

The hash type to be used as SYCL hash.

The weak pointer type to be used as SYCL weak pointer.

The shared pointer type to be used as SYCL shared pointer.

The unique pointer type to be used as SYCL unique pointer.

The mutex type to be used as SYCL mutex.

The functional type to be used as SYCL function.

The string type to be used as SYCL string.

9.2 cl::sycl Namespace Reference

Namespaces

- access
  Describe the type of access by kernels.
- detail
- info
- trisycl

Classes

- class accessor

  The accessor abstracts the way buffer or pipe data are accessed inside a kernel in a multidimensional variable length array way. More...
- class accessor< DataType, 1, AccessMode, access::target::blocking_pipe >

  The pipe accessor abstracts the way pipe data are accessed inside a kernel. More...
- class accessor< DataType, 1, AccessMode, access::target::pipe >

  The pipe accessor abstracts the way pipe data are accessed inside a kernel. More...
- class accessor_error

  Error regarding the cl::sycl::accessor objects defined. More...
- struct async_exception

  An error stored in an exception_list for asynchronous errors. More...
- class buffer

  A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on. More...
- class cl_exception

  Returns the OpenCL error code encapsulated in the exception. More...
- class compile_program_error

  Error while compiling the SYCL kernel to a SYCL device. More...
- class context

  SYCL context. More...
- class device

  SYCL device. More...
- class device_error

  The SYCL device will trigger this exception on error. More...
- class device_selector

  The SYCL heuristics to select a device. More...
- class device_type_selector

  A device selector by device_type. More...
- class device_typename_selector

  Select a device by template device_type parameter. More...
- struct error_handler

  User supplied error handler to call a user-provided function when an error happens from a SYCL object that was constructed with this error handler. More...
- class event
- class event_error

  Error regarding associated cl::sycl::event objects. More...
- class exception

  Encapsulate a SYCL error information. More...
- struct exception_list

  Exception list to store several exceptions. More...
- class feature_not_supported

  Exception thrown when an optional feature or extension is used in a kernel but its not available on the device the SYCL kernel is being enqueued on. More...
- struct group

  A group index used in a parallel_for_workitem to specify a work_group. More...
- class handler

  Command group handler class. More...
- class id

  Define a multi-dimensional index, used for example to locate a work item. More...
- struct image

- class invalid_object_error

  Error regarding any memory objects being used inside the kernel. More...
- class invalid_parameter_error

  Error regarding parameters to the SYCL kernel, it may apply to any captured parameters to the kernel lambda. More...
- struct is_wrapper
- class item

  A SYCL item stores information on a work-item with some more context such as the definition range and offset. More...
- class kernel

  SYCL kernel. More...
- class kernel_error

  Error that occurred before or while enqueuing the SYCL kernel. More...
- class link_program_error

  Error while linking the SYCL kernel to a SYCL device. More...
- class memory_allocation_error

  Error on memory allocation on the SYCL device for a SYCL kernel. More...
- struct nd_item

  A SYCL nd_item stores information on a work-item within a work-group, with some more context such as the definition ranges. More...
- struct nd_range

  A ND-range, made by a global and local range, to specify work-group and work-item organization. More...
- class nd_range_error

  Error regarding the cl::sycl::nd_range specified for the SYCL kernel. More...
- class non_cl_error

  Exception for an OpenCL operation requested in a non OpenCL area. More...
- class pipe

  A SYCL pipe. More...
- class pipe_error

  A failing pipe error will trigger this exception on error. More...
- struct pipe_reservation

  The pipe reservation station allows to reserve an array-like view inside the pipe for ordered race-free access from various work-items for example. More...
- class platform

  Abstract the OpenCL platform. More...
- class platform_error

  The SYCL platform will trigger this exception on error. More...
- class profiling_error

  The SYCL runtime will trigger this error if there is an error when profiling info is enabled. More...
- class queue

  SYCL queue, similar to the OpenCL queue concept. More...
- class range

  A SYCL range defines a multi-dimensional index range that can be used to define launch parallel computation extent or buffer sizes. More...
- class runtime_error
- class static_pipe

  A SYCL static-scoped pipe equivalent to an OpenCL program-scoped pipe. More...
- class vec

  Small OpenCL vector class. More...

Typedefs

- template<typename T >
  using constant = detail::addr_space< T, constant_address_space >

  Declare a variable to be in the OpenCL constant address space.
- template<typename T >
  using constant_ptr = constant< T * >

  Declare a variable to be in the OpenCL constant address space.
- template<typename T >
  using generic = detail::addr_space< T, generic_address_space >

  Declare a variable to be in the OpenCL 2 generic address space.
- template<typename T >
  using global = detail::addr_space< T, global_address_space >

  Declare a variable to be in the OpenCL global address space.
- template<typename T >
  using global_ptr = global< T * >

  Declare a variable to be in the OpenCL global address space.
- template<typename T >
  using local = detail::addr_space< T, local_address_space >

  Declare a variable to be in the OpenCL local address space.
- template<typename T >
  using local_ptr = local< T * >

  Declare a variable to be in the OpenCL local address space.
- template<typename T >
  using priv = detail::addr_space< T, private_address_space >

  Declare a variable to be in the OpenCL private address space.
- template<typename T >
  using private_ptr = priv< T * >

  Declare a variable to be in the OpenCL private address space.
- template<typename Pointer , address_space AS>
  using multi_ptr = detail::address_space_ptr< Pointer, AS >

  A pointer that can be statically associated to any address-space.
- template<typename T >
  using buffer_allocator = std::allocator< T >

  The allocator objects give the programmer some control on how the memory is allocated inside SYCL.
- template<typename T >
  using image_allocator = std::allocator< T >

  The allocator used for the `image` inside SYCL.
- template<typename T >
  using map_allocator = std::allocator< T >

  The allocator used to map the memory at the same place.
- template<class T , class Alloc = std::allocator<T>>
  using vector_class = std::vector< T, Alloc >
- using string_class = std::string
- template<class R , class... ArgTypes>
  using function_class = std::function< R(ArgTypes...)>
- using mutex_class = std::mutex
- template<class T , class D = std::default_delete<T>>
  using unique_ptr_class = std::unique_ptr< T[ ], D >
- template<class T >
  using shared_ptr_class = std::shared_ptr< T >
- template<class T >
  using weak_ptr_class = std::weak_ptr< T >

- template<class T >
  using hash_class = std::hash< T >
- using default_selector = device_typename_selector< info::device_type::defaults >

  Devices selected by heuristics of the system.
- using gpu_selector = device_typename_selector< info::device_type::gpu >

  Select devices according to device type info::device::device_type::gpu from all the available OpenCL devices.
- using cpu_selector = device_typename_selector< info::device_type::cpu >

  Select devices according to device type info::device::device_type::cpu from all the available devices and heuristics.
- using host_selector = device_typename_selector< info::device_type::host >

  Selects the SYCL host CPU device that does not require an OpenCL runtime.
- using exception_ptr = std::exception_ptr

  A shared pointer to an exception as in C++ specification.
- using async_handler = function_class< void, exception_list >

Enumerations

- enum address_space {
  constant_address_space, generic_address_space, global_address_space, local_address_space,
  private_address_space }

  Enumerate the different OpenCL 2 address spaces.

Functions

- template<typename Accessor >
  static auto & get_pipe_detail (Accessor &a)

  Top-level function to break circular dependencies on the the types to get the pipe implementation.
- template<typename T , address_space AS>
  multi_ptr< T, AS > make_multi (multi_ptr< T, AS > pointer)

  Construct a cl::sycl::multi_ptr<> with the right type.
- template<>
  auto device::get_info< info::device::max_work_group_size > () const
- template<>
  auto device::get_info< info::device::max_compute_units > () const
- template<>
  auto device::get_info< info::device::device_type > () const
- template<>
  auto device::get_info< info::device::local_mem_size > () const
- template<>
  auto device::get_info< info::device::max_mem_alloc_size > () const
- template<>
  auto device::get_info< info::device::vendor > () const
- template<>
  auto device::get_info< info::device::name > () const
- template<>
  auto device::get_info< info::device::profile > () const
- auto make_id (id< 1 > i)

  Implement a make_id to construct an id<> of the right dimension with implicit conversion from an initializer list for example.
- auto make_id (id< 2 > i)
- auto make_id (id< 3 > i)
- template<typename... BasicType>
  auto make_id (BasicType... Args)

Construct an id<> from a function call with arguments, like make_id(1, 2, 3)

- TRISYCL_MATH_WRAP (abs) TRISYCL_MATH_WRAP(atan) TRISYCL_MATH_WRAP2s(fmax) TRISYCL_MATH_WRAP2s(fmin) TRISYCL_MATH_WRAP2s(frexp) template< typename T > T max(T x
- template<typename T >
  T min (T x, T y, T z)
- TRISYCL_MATH_WRAP2s (modf) TRISYCL_MATH_WRAP3s(remquo) TRISYCL_MATH_WRAP2(rotate)
  namespace native
- template<int Dimensions = 1, typename ParallelForFunctor >
  void parallel_for_work_item (const group< Dimensions > &g, ParallelForFunctor f)

  SYCL parallel_for version that allows a Program object to be specified.
- auto make_range (range< 1 > r)

  Implement a make_range to construct a range<> of the right dimension with implicit conversion from an initializer list for example.
- auto make_range (range< 2 > r)
- auto make_range (range< 3 > r)
- template<typename... BasicType>
  auto make_range (BasicType... Args)

  Construct a range<> from a function call with arguments, like make_range(1, 2, 3)

Variables

- T y
- T T z

9.2.1 Typedef Documentation

9.2.1.1 function_class

```
template<class R , class...  ArgTypes>
using cl::sycl::function_class = typedef std::function<R(ArgTypes...)>
```

Definition at line 55 of file default_classes.hpp.

9.2.1.2 hash_class

```
template<class T >
using cl::sycl::hash_class = typedef std::hash<T>
```

Definition at line 129 of file default_classes.hpp.

9.2.1.3 mutex_class

```
using cl::sycl::mutex_class = typedef std::mutex
```

Definition at line 69 of file default_classes.hpp.

9.2.1.4 shared_ptr_class

```
template<class T >
using cl::sycl::shared_ptr_class = typedef std::shared_ptr<T>
```

Definition at line 99 of file default_classes.hpp.

9.2.1.5 string_class

```
using cl::sycl::string_class = typedef std::string
```

Definition at line 40 of file default_classes.hpp.

9.2.1.6 unique_ptr_class

```
template<class T , class D = std::default_delete<T>>
using cl::sycl::unique_ptr_class = typedef std::unique_ptr<T[], D>
```

Definition at line 84 of file default_classes.hpp.

9.2.1.7 vector_class

```
template<class T , class Alloc = std::allocator<T>>
using cl::sycl::vector_class = typedef std::vector<T, Alloc>
```

Definition at line 26 of file default_classes.hpp.

9.2.1.8 weak_ptr_class

```
template<class T >
using cl::sycl::weak_ptr_class = typedef std::weak_ptr<T>
```

Definition at line 114 of file default_classes.hpp.

9.2.2 Function Documentation

9.2.2.1 min()

```
template<typename T >
T cl::sycl::min (
              T x,
              T y,
              T z )
```

Definition at line 120 of file math.hpp.

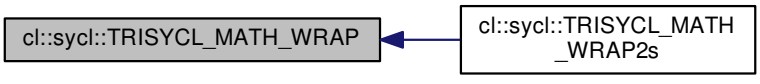
```
00120                       {
00121   return std::min(x, std::min(y, z));
00122 }
```

9.2.2.2 TRISYCL_MATH_WRAP()

```
cl::sycl::TRISYCL_MATH_WRAP (
              abs  )
```

Referenced by TRISYCL_MATH_WRAP2s().

Here is the caller graph for this function:



9.2.2.3 TRISYCL_MATH_WRAP2s()

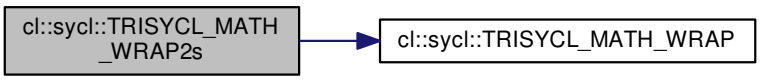
```
cl::sycl::TRISYCL_MATH_WRAP2s (
              modf  )
```

Definition at line 128 of file math.hpp.

References TRISYCL_MATH_WRAP().

```
00166                 {
00167 TRISYCL_MATH_WRAP(cos)
00168 //*TRISYCL_MATH_WRAP2(divide)
00169 TRISYCL_MATH_WRAP(exp)
00170 TRISYCL_MATH_WRAP(exp2)
00171 //*TRISYCL_MATH_WRAP(exp10)
00172 TRISYCL_MATH_WRAP(log)
00173 TRISYCL_MATH_WRAP(log2)
00174 TRISYCL_MATH_WRAP(log10)
00175 //*TRISYCL_MATH_WRAP(powr)
00176 //*TRISYCL_MATH_WRAP(recip)
00177 //*TRISYCL_MATH_WRAP(rsqrt)
00178 TRISYCL_MATH_WRAP(sin)
00179 TRISYCL_MATH_WRAP(sqrt)
00180 TRISYCL_MATH_WRAP(tan)
00181 }
```

Here is the call graph for this function:



9.2.3 Variable Documentation

9.2.3.1 y

```
T cl::sycl::y
```

Definition at line 109 of file math.hpp.

9.2.3.2 z

```
T T cl::sycl::z
```

Initial value:

```
{
  return std::max(x, std::max(y, z))
```

Definition at line 109 of file math.hpp.

9.3 cl::sycl::access Namespace Reference

Describe the type of access by kernels.

Enumerations

- enum mode {
  mode::read = 42, mode::write, mode::read_write, mode::discard_write,
  mode::discard_read_write, mode::atomic }

  This describes the type of the access mode to be used via accessor.
- enum target {
  target::global_buffer = 2014, target::constant_buffer, target::local, target::image,
  target::host_buffer, target::host_image, target::image_array, target::pipe,
  target::blocking_pipe }

  The target enumeration describes the type of object to be accessed via the accessor.
- enum fence_space : char { fence_space::local_space, fence_space::global_space, fence_space::global_↩
  and_local }

  Precise the address space a barrier needs to act on.

9.3.1 Detailed Description

Describe the type of access by kernels.

Todo This values should be normalized to allow separate compilation with different implementations?

9.3.2 Enumeration Type Documentation

9.3.2.1 fence_space

```
enum cl::sycl::access::fence_space : char [strong]
```

Precise the address space a barrier needs to act on.

Enumerator

local_space	
global_space	
global_and_local	

Definition at line 63 of file access.hpp.

```
00063                         : char {
00064     local_space,
00065     global_space,
00066     global_and_local
00067   };
```

9.3.2.2 mode

```
enum cl::sycl::access::mode  [strong]
```

This describes the type of the access mode to be used via accessor.

Enumerator

read	Read-only access. Insist on the fact that read_write != read + write
write	Write-only access, but previous content *not* discarded.
read_write	Read and write access.
discard_write	Write-only access and previous content discarded.
discard_read_write	Read and write access and previous content discarded.
atomic	Atomic access.

Definition at line 33 of file access.hpp.

```
00033                   {
00034     read = 42, /**< Read-only access. Insist on the fact that
00035                     read_write != read + write */
00036     write, ///< Write-only access, but previous content *not* discarded
00037     read_write, ///< Read and write access
00038     discard_write, ///< Write-only access and previous content discarded
00039     discard_read_write, /**< Read and write access and previous
00040                            content discarded*/
00041     atomic ///< Atomic access
00042   };
```

9.3.2.3 target

```
enum cl::sycl::access::target  [strong]
```

The target enumeration describes the type of object to be accessed via the accessor.

Enumerator

global_buffer	
constant_buffer	
local	
image	
host_buffer	
host_image	
image_array	
pipe	
blocking_pipe	

Definition at line 48 of file access.hpp.

```
00048                   {
00049     global_buffer = 2014, //< Just pick a random number...
00050     constant_buffer,
00051     local,
00052     image,
00053     host_buffer,
00054     host_image,
00055     image_array,
00056     pipe,
00057     blocking_pipe
00058   };
```

9.4 cl::sycl::detail Namespace Reference

Classes

- class accessor

  The buffer accessor abstracts the way buffer data are accessed inside a kernel in a multidimensional variable length array way. More...
- class accessor< T, Dimensions, Mode, access::target::local >

  The local accessor specialization abstracts the way local memory is allocated to a kernel to be shared between work-items of the same work-group. More...
- struct address_space_array

  Implementation of an array variable with an OpenCL address space. More...
- struct address_space_base

  Implementation of the base infrastructure to wrap something in an OpenCL address space. More...
- struct address_space_fundamental

  Implementation of a fundamental type with an OpenCL address space. More...
- struct address_space_object

  Implementation of an object type with an OpenCL address space. More...
- struct address_space_ptr

  Implementation for an OpenCL address space pointer. More...
- struct address_space_variable

  Implementation of a variable with an OpenCL address space. More...
- class buffer

  A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on. More...
- struct buffer_base

  Factorize some template independent buffer aspects in a base class. More...
- class buffer_waiter

  A helper class to wait for the final buffer destruction if the conditions for blocking are met. More...
- class cache

  A simple thread safe cache mechanism to cache std::shared_ptr of values indexed by keys.
- struct container_element_aspect

  A mix-in to add some container element aspects. More...
- class context
- struct debug

  Class used to trace the construction, copy-construction, move-construction and destruction of classes that inherit from it. More...
- class device

  An abstract class representing various models of SYCL devices. More...
- struct display_vector

  Class used to display a vector-like type of classes that inherit from it. More...
- struct expand_to_vector

Allows optional expansion of a 1-element tuple to a V::dimension tuple to replicate scalar values in vector initialization. More...

- struct expand_to_vector< V, Tuple, true >

  Specialization in the case we ask for expansion. More...
- class host_context
- class host_device

  SYCL host device.
- class host_platform

  SYCL host platform. More...
- class host_queue

  Some implementation details about the SYCL queue.
- class kernel

  Abstract SYCL kernel. More...
- struct ocl_type

  Generate a type with some real OpenCL 2 attribute if we are on an OpenCL device. More...
- struct ocl_type< T, constant_address_space >

  Add an attribute for __constant address space. More...
- struct ocl_type< T, generic_address_space >

  Add an attribute for __generic address space. More...
- struct ocl_type< T, global_address_space >

  Add an attribute for __global address space. More...
- struct ocl_type< T, local_address_space >

  Add an attribute for __local address space. More...
- struct ocl_type< T, private_address_space >

  Add an attribute for __private address space. More...
- class opencl_context

  SYCL OpenCL context.
- class opencl_device

  SYCL OpenCL device.
- class opencl_kernel

  An abstraction of the OpenCL kernel.
- class opencl_platform

  SYCL OpenCL platform. More...
- class opencl_queue

  Some implementation details about the SYCL queue.
- struct parallel_for_iterate

  A recursive multi-dimensional iterator that ends up calling f. More...
- struct parallel_for_iterate< 0, Range, ParallelForFunctor, Id >

  Stop the recursion when level reaches 0 by simply calling the kernel functor with the constructed id. More...
- struct parallel_OpenMP_for_iterate

  A top-level recursive multi-dimensional iterator variant using OpenMP. More...
- class pipe

  Implement a pipe object. More...
- class pipe_accessor

  The accessor abstracts the way pipe data are accessed inside a kernel. More...
- class pipe_reservation

  The implementation of the pipe reservation station. More...
- class platform

  An abstract class representing various models of SYCL platforms. More...
- struct queue

  Some implementation details about the SYCL queue.

- struct reserve_id

  A private description of a reservation station. More...
- struct shared_ptr_implementation

  Provide an implementation as shared_ptr with total ordering and hashing to be used with algorithms and in (un)ordered containers.
- struct singleton

  Provide a singleton factory.
- struct small_array

  Define a multi-dimensional index, used for example to locate a work item or a buffer element. More...
- struct small_array_123

  A small array of 1, 2 or 3 elements with the implicit constructors. More...
- struct small_array_123< BasicType, FinalType, 1 >

  Use some specializations so that some function overloads can be determined according to some implicit constructors and to have an implicit conversion from/to BasicType (such as an int typically) if Dimensions = 1. More...
- struct small_array_123< BasicType, FinalType, 2 >
- struct small_array_123< BasicType, FinalType, 3 >
- struct task

  The abstraction to represent SYCL tasks executing inside command_group.

Typedefs

- template<typename T , address_space AS>
  using addr_space = typename std::conditional< std::is_pointer< T >::value, address_space_ptr< T, AS >, typename std::conditional< std::is_class< T >::value, address_space_object< T, AS >, typename std::conditional< std::is_array< T >::value, address_space_array< T, AS >, address_space_fundamental< T, AS > >::type >::type >::type

  Dispatch the address space implementation according to the requested type.

Functions

- template<typename BufferDetail >
  static std::shared_ptr< detail::task > buffer_add_to_task (BufferDetail buf, handler *command_group_handler, bool is_write_mode)

  Proxy function to avoid some circular type recursion.
- static std::shared_ptr< detail::task > add_buffer_to_task (handler *command_group_handler, std::shared_ptr< detail::buffer_base > b, bool is_write_mode)
- template<typename T , int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>>
  auto waiter (detail::buffer< T, Dimensions > *b)

  Helper function to create a new buffer_waiter.
- template<typename V , typename Tuple , size_t... Is>
  std::array< typename V::element_type, V::dimension > tuple_to_array_iterate (Tuple t, std::index_sequence< Is... >)

  Helper to construct an array from initializer elements provided as a tuple.
- template<typename V , typename Tuple >
  auto tuple_to_array (Tuple t)

  Construct an array from initializer elements provided as a tuple.
- template<typename V , typename Tuple >
  auto expand (Tuple t)

  Create the array data of V from a tuple of initializer.
- template<typename KernelName , typename Functor >
  auto trace_kernel (const Functor &f)

Wrap a kernel functor in some tracing messages to have start/stop information when TRISYCL_TRACE_KERNEL macro is defined.

- template<typename Range , typename Id >
  size_t constexpr linear_id (Range range, Id id, Id offset={})

  Compute a linearized array access used in the OpenCL 2 world.
- void unimplemented ()

  Display an "unimplemented" message.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void parallel_for_workitem (const group< Dimensions > &g, ParallelForFunctor f)

  Implement the loop on the work-items inside a work-group.
- static std::shared_ptr< detail::task > add_buffer_to_task (handler *command_group_handler, std::shared_ptr< detail::buffer_base > b, bool is_write_mode)

  Register a buffer as used by a task.
- template<int Dimensions = 1, typename ParallelForFunctor , typename Id >
  void parallel_for (range< Dimensions > r, ParallelForFunctor f, Id)

  Implementation of a data parallel computation with parallelism specified at launch time by a range<>.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void parallel_for (range< Dimensions > r, ParallelForFunctor f, item< Dimensions >)

  Implementation of a data parallel computation with parallelism specified at launch time by a range<>.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void parallel_for (range< Dimensions > r, ParallelForFunctor f)

  Calls the appropriate ternary parallel_for overload based on the index type of the kernel function object f.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void parallel_for_global_offset (range< Dimensions > global_size, id< Dimensions > offset, ParallelForFunctor f)

  Implementation of parallel_for with a range<> and an offset.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void parallel_for (nd_range< Dimensions > r, ParallelForFunctor f)

  Implement a variation of parallel_for to take into account a nd_range<>
- template<int Dimensions = 1, typename ParallelForFunctor >
  void parallel_for_workgroup (nd_range< Dimensions > r, ParallelForFunctor f)

  Implement the loop on the work-groups.

Variables

- TRISYCL_WEAK_ATTRIB_PREFIX detail::cache< cl_context, detail::opencl_context > opencl_context::cache TRISYCL_WEAK_ATTRIB_SUFFIX

9.4.1 Function Documentation

9.4.1.1 add_buffer_to_task()

```
static std::shared_ptr<detail::task> cl::sycl::detail::add_buffer_to_task (
            handler * command_group_handler,
            std::shared_ptr< detail::buffer_base > b,
            bool is_write_mode )  [static]
```

Register a buffer as used by a task.

This is a proxy function to avoid complicated type recursion.

Definition at line 438 of file handler.hpp.

References cl::sycl::handler::task.

```
00440                                     {
00441   command_group_handler->task->add_buffer(b, is_write_mode);
00442   return command_group_handler->task;
00443 }
```

9.5 cl::sycl::info Namespace Reference

Classes

- struct param_traits

  Implement a meta-function from (T, value) to T' to express the return type value of an OpenCL function of kind (T, value)

Typedefs

- using gl_context_interop = bool
- using device_fp_config = unsigned int
- using device_exec_capabilities = unsigned int
- using device_queue_properties = unsigned int
- using queue_profiling = bool

Enumerations

- enum context : int { context::reference_count, context::num_devices, context::devices, context::gl_interop }

  Context information descriptors.
- enum device_type : unsigned int {
  device_type::cpu, device_type::gpu, device_type::accelerator, device_type::custom,
  device_type::defaults, device_type::host, device_type::opencl, device_type::all }

  Type of devices.
- enum device : int {
  device::device_type, device::vendor_id, device::max_compute_units, device::max_work_item_dimensions,
  device::max_work_item_sizes, device::max_work_group_size, device::preferred_vector_width_char,
  device::preferred_vector_width_short,
  device::preferred_vector_width_int, device::preferred_vector_width_long_long, device::preferred_vector_↩
  width_float, device::preferred_vector_width_double,
  device::preferred_vector_width_half, device::native_vector_witdth_char, device::native_vector_witdth_short,
  device::native_vector_witdth_int,
  device::native_vector_witdth_long_long, device::native_vector_witdth_float, device::native_vector_witdth_↩
  double, device::native_vector_witdth_half,
  device::max_clock_frequency, device::address_bits, device::max_mem_alloc_size, device::image_support,
  device::max_read_image_args, device::max_write_image_args, device::image2d_max_height, device↩
  ::image2d_max_width,
  device::image3d_max_height, device::image3d_max_widht, device::image3d_mas_depth, device::image_↩
  max_buffer_size,
  device::image_max_array_size, device::max_samplers, device::max_parameter_size, device::mem_base↩
  _addr_align,
  device::single_fp_config, device::double_fp_config, device::global_mem_cache_type, device::global_mem↩
  _cache_line_size,
  device::global_mem_cache_size, device::global_mem_size, device::max_constant_buffer_size, device↩
  ::max_constant_args,
  device::local_mem_type, device::local_mem_size, device::error_correction_support, device::host_unified_↩
  memory,
  device::profiling_timer_resolution, device::endian_little, device::is_available, device::is_compiler_available,

device::is_linker_available, device::execution_capabilities, device::queue_properties, device::built_in_↩ kernels,
device::platform, device::name, device::vendor, device::driver_version,
device::profile, device::device_version, device::opencl_version, device::extensions,
device::printf_buffer_size, device::preferred_interop_user_sync, device::parent_device, device::partition_↩ max_sub_devices,
device::partition_properties, device::partition_affinity_domain, device::partition_type, device::reference_↩ count }

Device information descriptors.

- enum device_partition_property : int {
device_partition_property::unsupported, device_partition_property::partition_equally, device_partition_↩ property::partition_by_counts, device_partition_property::partition_by_affinity_domain,
device_partition_property::partition_affinity_domain_next_partitionable }
- enum device_affinity_domain : int {
device_affinity_domain::unsupported, device_affinity_domain::numa, device_affinity_domain::L4_cache,
device_affinity_domain::L3_cache,
device_affinity_domain::L2_cache, device_affinity_domain::next_partitionable }
- enum device_partition_type : int {
device_partition_type::no_partition, device_partition_type::numa, device_partition_type::L4_cache, device↩ _partition_type::L3_cache,
device_partition_type::L2_cache, device_partition_type::L1_cache }
- enum local_mem_type : int { local_mem_type::none, local_mem_type::local, local_mem_type::global }
- enum fp_config : int {
fp_config::denorm, fp_config::inf_nan, fp_config::round_to_nearest, fp_config::round_to_zero,
fp_config::round_to_inf, fp_config::fma, fp_config::correctly_rounded_divide_sqrt, fp_config::soft_float }
- enum global_mem_cache_type : int { global_mem_cache_type::none, global_mem_cache_type::read_only,
global_mem_cache_type::write_only }
- enum device_execution_capabilities : unsigned int { device_execution_capabilities::exec_kernel, device_↩ execution_capabilities::exec_native_kernel }
- enum platform : unsigned int {
platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_PROFILE), platform::TRISYCL_SKIP_OPEN↩ CL =(= CL_PLATFORM_VERSION), platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_NAME),
platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_VENDOR),
platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_EXTENSIONS) }

Platform information descriptors.

- enum queue : int { queue::context, queue::device, queue::reference_count, queue::properties }

Queue information descriptors.

9.5.1 Typedef Documentation

9.5.1.1 queue_profiling

```
using cl::sycl::info::queue_profiling = typedef bool
```

Definition at line 46 of file queue.hpp.

9.5.2 Enumeration Type Documentation

9.5.2.1 queue

```
enum cl::sycl::info::queue :  int  [strong]
```

Queue information descriptors.

From specification C.4

Todo unsigned int?

Todo To be implemented

Enumerator

context	
device	
reference_count	
properties	

Definition at line 56 of file queue.hpp.

```
00056                 : int {
00057   context,
00058   device,
00059   reference_count,
00060   properties
00061 };
```

9.6 cl::sycl::trisycl Namespace Reference

Classes

- struct default_error_handler

9.6.1 Detailed Description

Todo Refactor when updating to latest specification

9.7 std Namespace Reference

Classes

- struct hash< cl::sycl::buffer< T, Dimensions, Allocator > >
- struct hash< cl::sycl::context >
- struct hash< cl::sycl::device >
- struct hash< cl::sycl::kernel >
- struct hash< cl::sycl::platform >
- struct hash< cl::sycl::queue >

Chapter 10

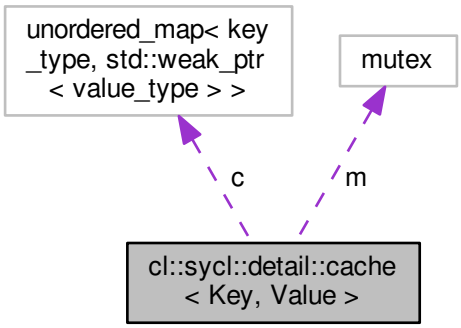
Class Documentation

10.1 cl::sycl::detail::cache< Key, Value > Class Template Reference

A simple thread safe cache mechanism to cache std::shared_ptr of values indexed by keys.

`#include <cache.hpp>`

Collaboration diagram for cl::sycl::detail::cache< Key, Value >:



Public Types

- using key_type = Key

  The type of the keys used to indexed the cache.
- using value_type = Value

  The base type of the values stored in the cache.

Public Member Functions

- template<typename Functor >
  std::shared_ptr< value_type > get_or_register (const key_type &k, Functor &&create_element)

  Get a value stored in the cache if present or insert by calling a generator function.
- void remove (const key_type &k)

  Remove an entry from the cache.

Private Attributes

- std::unordered_map< key_type, std::weak_ptr< value_type > > c

  The caching storage.
- std::mutex m

  To make the cache thread-safe.

10.1.1 Detailed Description

template<typename Key, typename Value>
class cl::sycl::detail::cache< Key, Value >

A simple thread safe cache mechanism to cache std::shared_ptr of values indexed by keys.

Since internally only std::weak_ptr are stored, this does not prevent object deletion but it is up to the programmer not to use this cache to retrieve deleted objects.

Definition at line 29 of file cache.hpp.

10.1.2 Member Typedef Documentation

10.1.2.1 key_type

```
template<typename Key, typename Value>
using cl::sycl::detail::cache< Key, Value >::key_type = Key
```

The type of the keys used to indexed the cache.

Definition at line 34 of file cache.hpp.

10.1.2.2 value_type

```
template<typename Key, typename Value>
using cl::sycl::detail::cache< Key, Value >::value_type = Value
```

The base type of the values stored in the cache.

Definition at line 37 of file cache.hpp.

10.1.3 Member Function Documentation

10.1.3.1 get_or_register()

```
template<typename Key, typename Value>
template<typename Functor >
std::shared_ptr<value_type> cl::sycl::detail::cache< Key, Value >::get_or_register (
            const key_type & k,
            Functor && create_element )  [inline]
```

Get a value stored in the cache if present or insert by calling a generator function.

Parameters

in	*k*	is the key used to retrieve the value
in	*create_element*	is the function to be called if the key is not found in the cache to generate a value which is inserted for the key. This function has to produce a value convertible to a shared_ptr

Returns

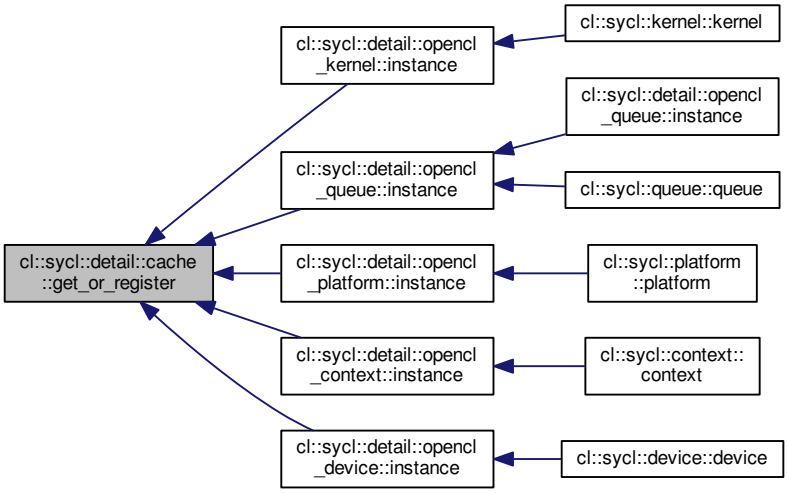
a shared_ptr to the value retrieved or inserted

Definition at line 62 of file cache.hpp.

Referenced by cl::sycl::detail::opencl_kernel::instance(), cl::sycl::detail::opencl_queue::instance(), cl::sycl::detail::opencl_platform::instance(), cl::sycl::detail::opencl_context::instance(), and cl::sycl::detail::opencl_device::instance().

```
00063                                                                                {
00064     std::lock_guard<std::mutex> lg { m };
00065
00066     auto i = c.find(k);
00067     if (i != c.end())
00068       if (auto observe = i->second.lock())
00069         // Returns \c shared_ptr only if target object is still alive
00070         return observe;
00071
00072     // Otherwise create and insert a new element
00073     std::shared_ptr<value_type> e { create_element() };
00074     c.insert({ k, e });
00075     return e;
00076   }
```

Here is the caller graph for this function:



10.1.3.2 remove()

```
template<typename Key, typename Value>
void cl::sycl::detail::cache< Key, Value >::remove (
             const key_type & k )  [inline]
```

Remove an entry from the cache.

Parameters

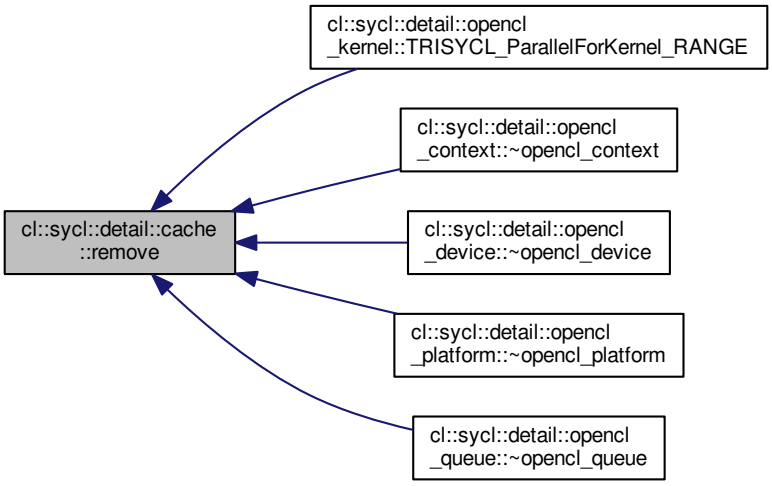
in	*k*	is the key associated to the value to remove from the cache

Definition at line 84 of file cache.hpp.

Referenced by cl::sycl::detail::opencl_kernel::TRISYCL_ParallelForKernel_RANGE(), cl::sycl::detail::opencl_↩ context::~opencl_context(), cl::sycl::detail::opencl_device::~opencl_device(), cl::sycl::detail::opencl_platform↩ ::~opencl_platform(), and cl::sycl::detail::opencl_queue::~opencl_queue().

```
00084                                {
00085     std::lock_guard<std::mutex> lg { m };
00086     c.erase(k);
00087   }
```

Here is the caller graph for this function:



10.1.4 Member Data Documentation

10.1.4.1 c

```
template<typename Key, typename Value>
std::unordered_map<key_type, std::weak_ptr<value_type> > cl::sycl::detail::cache< Key, Value
>::c  [private]
```

The caching storage.

Definition at line 42 of file cache.hpp.

10.1.4.2 m

```
template<typename Key, typename Value>
std::mutex cl::sycl::detail::cache< Key, Value >::m  [private]
```

To make the cache thread-safe.

Definition at line 45 of file cache.hpp.

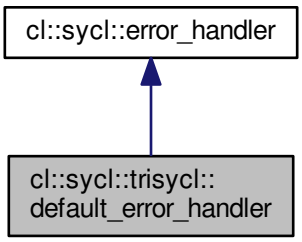
The documentation for this class was generated from the following file:

- include/CL/sycl/detail/cache.hpp

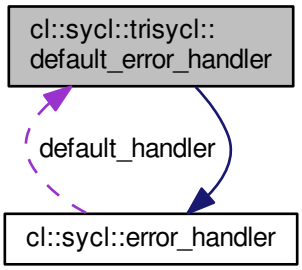
10.2 cl::sycl::trisycl::default_error_handler Struct Reference

`#include <error_handler.hpp>`

Inheritance diagram for cl::sycl::trisycl::default_error_handler:



Collaboration diagram for cl::sycl::trisycl::default_error_handler:



Public Member Functions

- void report_error (exception &) override

  The method to define to be called in the case of an error.

Additional Inherited Members

10.2.1 Detailed Description

Definition at line 52 of file error_handler.hpp.

10.2.2 Member Function Documentation

10.2.2.1 report_error()

```
void cl::sycl::trisycl::default_error_handler::report_error (
             exception & error )  [inline], [override], [virtual]
```

The method to define to be called in the case of an error.

Todo Add "virtual void" to the specification

Implements cl::sycl::error_handler.

Definition at line 54 of file error_handler.hpp.

```
00054                                          {
00055     }
```

The documentation for this struct was generated from the following file:

- include/CL/sycl/error_handler.hpp

10.3 cl::sycl::event Class Reference

```
#include <event.hpp>
```

Public Member Functions

- event ()=default

10.3.1 Detailed Description

Definition at line 14 of file event.hpp.

10.3.2 Constructor & Destructor Documentation

10.3.2.1 event()

```
cl::sycl::event::event ( )  [default]
```

The documentation for this class was generated from the following file:

- include/CL/sycl/event.hpp

10.4 handler_event Class Reference

Handler event.

```
#include <handler_event.hpp>
```

10.4.1 Detailed Description

Handler event.

Todo To be implemented

Todo To be implemented

Definition at line 19 of file handler_event.hpp.

The documentation for this class was generated from the following file:

- include/CL/sycl/handler_event.hpp

10.5 std::hash< cl::sycl::buffer< T, Dimensions, Allocator > > Struct Template Reference

```
#include <buffer.hpp>
```

Public Member Functions

- auto operator() (const cl::sycl::buffer< T, Dimensions, Allocator > &b) const

10.5.1 Detailed Description

template<typename T, int Dimensions, typename Allocator>
struct std::hash< cl::sycl::buffer< T, Dimensions, Allocator > >

Definition at line 542 of file buffer.hpp.

10.5.2 Member Function Documentation

10.5.2.1 operator()()

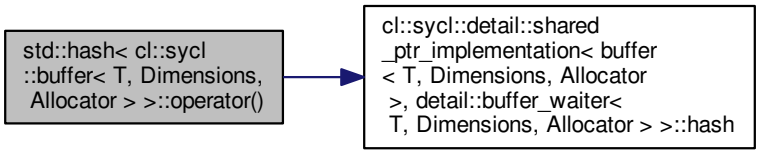
```
template<typename T , int Dimensions, typename Allocator >
auto std::hash< cl::sycl::buffer< T, Dimensions, Allocator > >::operator() (
            const cl::sycl::buffer< T, Dimensions, Allocator > & b ) const  [inline]
```

Definition at line 544 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::hash().

```
00544                                                                        {
00545     // Forward the hashing to the implementation
00546     return b.hash();
00547   }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

- include/CL/sycl/buffer.hpp

10.6 std::hash< cl::sycl::context > Struct Template Reference

```
#include <context.hpp>
```

Public Member Functions

- auto operator() (const cl::sycl::context &c) const

10.6.1 Detailed Description

template<>
struct std::hash< cl::sycl::context >

Definition at line 227 of file context.hpp.

10.6.2 Member Function Documentation

10.6.2.1 operator()()

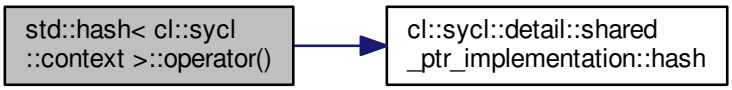
```
auto std::hash< cl::sycl::context >::operator() (
            const cl::sycl::context & c ) const  [inline]
```

Definition at line 228 of file context.hpp.

References cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash().

```
00228                                                {
00229     return c.hash();
00230     }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

- include/CL/sycl/context.hpp

10.7 std::hash< cl::sycl::device > Struct Template Reference

```
#include <device.hpp>
```

Public Member Functions

- auto operator() (const cl::sycl::device &d) const

10.7.1 Detailed Description

template<>
struct std::hash< cl::sycl::device >

Definition at line 312 of file device.hpp.

10.7.2 Member Function Documentation

10.7.2.1 operator()()

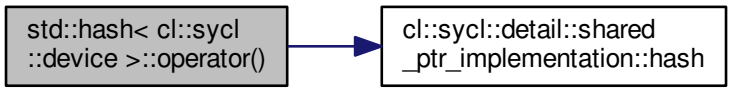
```
auto std::hash< cl::sycl::device >::operator() (
            const cl::sycl::device & d ) const  [inline]
```

Definition at line 314 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash().

```
00314                                                {
00315     // Forward the hashing to the implementation
00316     return d.hash();
00317   }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

- include/CL/sycl/device.hpp

10.8 std::hash< cl::sycl::kernel > Struct Template Reference

```
#include <kernel.hpp>
```

Public Member Functions

- auto operator() (const cl::sycl::kernel &k) const

10.8.1 Detailed Description

template<>
struct std::hash< cl::sycl::kernel >

Definition at line 125 of file kernel.hpp.

10.8.2 Member Function Documentation

10.8.2.1 operator()()

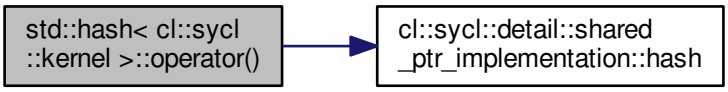
```
auto std::hash< cl::sycl::kernel >::operator() (
            const cl::sycl::kernel & k ) const  [inline]
```

Definition at line 127 of file kernel.hpp.

References cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash().

```
00127                                                {
00128     // Forward the hashing to the implementation
00129     return k.hash();
00130   }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

- include/CL/sycl/kernel.hpp

10.9 std::hash< cl::sycl::platform > Struct Template Reference

```
#include <platform.hpp>
```

Public Member Functions

- auto operator() (const cl::sycl::platform &p) const

10.9.1 Detailed Description

template<>
struct std::hash< cl::sycl::platform >

Definition at line 199 of file platform.hpp.

10.9.2 Member Function Documentation

10.9.2.1 operator()()

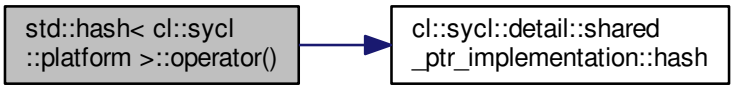
```
auto std::hash< cl::sycl::platform >::operator() (
            const cl::sycl::platform & p ) const  [inline]
```

Definition at line 201 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash().

```
00201                                                {
00202     // Forward the hashing to the implementation
00203     return p.hash();
00204   }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

- include/CL/sycl/platform.hpp

10.10 std::hash< cl::sycl::queue > Struct Template Reference

```
#include <queue.hpp>
```

Public Member Functions

- auto operator() (const cl::sycl::queue &q) const

10.10.1 Detailed Description

template<>
struct std::hash< cl::sycl::queue >

Definition at line 389 of file queue.hpp.

10.10.2 Member Function Documentation

10.10.2.1 operator()()

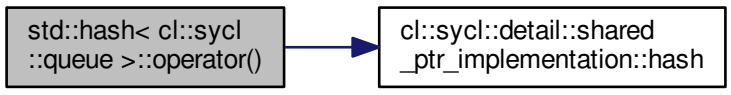
```
auto std::hash< cl::sycl::queue >::operator() (
            const cl::sycl::queue & q ) const  [inline]
```

Definition at line 391 of file queue.hpp.

References cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash().

```
00391                                                {
00392     // Forward the hashing to the implementation
00393     return q.hash();
00394   }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

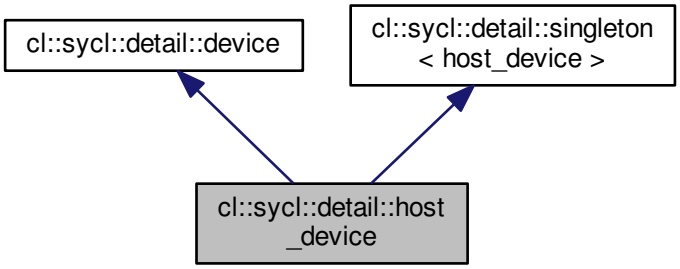
- include/CL/sycl/queue.hpp

10.11 cl::sycl::detail::host_device Class Reference

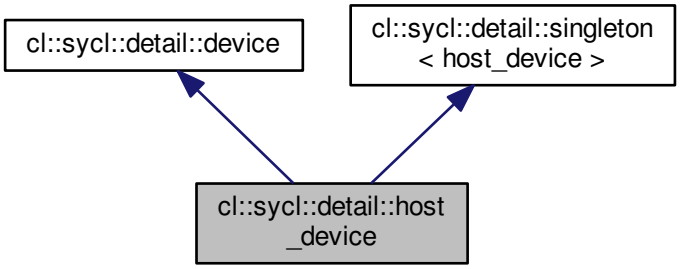
SYCL host device.

`#include <host_device.hpp>`

Inheritance diagram for cl::sycl::detail::host_device:



Collaboration diagram for cl::sycl::detail::host_device:



Public Member Functions

- cl_device_id get () const override

  Return the cl_device_id of the underlying OpenCL platform.
- boost::compute::device & get_boost_compute () override

  Return the underlying Boost.Compute device.
- bool is_host () const override

  Return true since the device is a SYCL host device.
- bool is_cpu () const override

  Return false since the host device is not an OpenCL CPU device.

- bool is_gpu () const override

  Return false since the host device is not an OpenCL GPU device.
- bool is_accelerator () const override

  Return false since the host device is not an OpenCL accelerator device.
- cl::sycl::platform get_platform () const override

  Return the platform of device.
- bool has_extension (const string_class &extension) const override

  Specify whether a specific extension is supported on the device.

Additional Inherited Members

10.11.1 Detailed Description

SYCL host device.

Todo The implementation is quite minimal for now. :-)

Definition at line 31 of file host_device.hpp.

10.11.2 Member Function Documentation

10.11.2.1 get()

```
cl_device_id cl::sycl::detail::host_device::get ( ) const  [inline], [override], [virtual]
```

Return the cl_device_id of the underlying OpenCL platform.

This throws an error since there is no OpenCL device associated to the host device.

Implements cl::sycl::detail::device.

Definition at line 42 of file host_device.hpp.

```
00042                                {
00043     throw non_cl_error("The host device has no OpenCL device");
00044   }
```

10.11.2.2 get_boost_compute()

```
boost::compute::device& cl::sycl::detail::host_device::get_boost_compute ( )  [inline], [override],
[virtual]
```

Return the underlying Boost.Compute device.

This throws an error since there is no OpenCL device associated to the host device.

Implements cl::sycl::detail::device.

Definition at line 52 of file host_device.hpp.

```
00052                                                {
00053     throw non_cl_error("The host device has no underlying OpenCL device");
00054   }
```

10.11.2.3 get_platform()

```
cl::sycl::platform cl::sycl::detail::host_device::get_platform ( ) const  [inline], [override],
[virtual]
```

Return the platform of device.

Return synchronous errors via the SYCL exception class.

Todo To be implemented

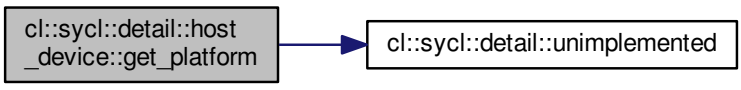
Implements cl::sycl::detail::device.

Definition at line 88 of file host_device.hpp.

References cl::sycl::detail::unimplemented().

```
00088                                              {
00089     detail::unimplemented();
00090     return {};
00091   }
```

Here is the call graph for this function:



10.11.2.4 has_extension()

```
bool cl::sycl::detail::host_device::has_extension (
            const string_class & extension ) const  [inline], [override], [virtual]
```

Specify whether a specific extension is supported on the device.

Todo To be implemented

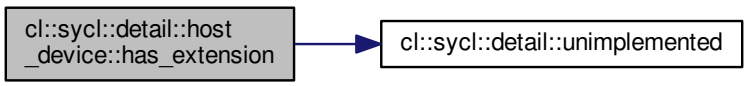
Implements cl::sycl::detail::device.

Definition at line 112 of file host_device.hpp.

References cl::sycl::detail::unimplemented().

```
00112                                                                    {
00113     detail::unimplemented();
00114     return {};
00115   }
```

Here is the call graph for this function:



10.11.2.5 is_accelerator()

```
bool cl::sycl::detail::host_device::is_accelerator ( ) const  [inline], [override], [virtual]
```

Return false since the host device is not an OpenCL accelerator device.

Implements cl::sycl::detail::device.

Definition at line 77 of file host_device.hpp.

```
00077                                    {
00078     return false;
00079   }
```

10.11.2.6 is_cpu()

```
bool cl::sycl::detail::host_device::is_cpu ( ) const  [inline], [override], [virtual]
```

Return false since the host device is not an OpenCL CPU device.

Implements cl::sycl::detail::device.

Definition at line 65 of file host_device.hpp.

```
00065                                {
00066     return false;
00067   }
```

10.11.2.7 is_gpu()

```
bool cl::sycl::detail::host_device::is_gpu ( ) const  [inline], [override], [virtual]
```

Return false since the host device is not an OpenCL GPU device.

Implements cl::sycl::detail::device.

Definition at line 71 of file host_device.hpp.

```
00071                                {
00072     return false;
00073   }
```

10.11.2.8 is_host()

```
bool cl::sycl::detail::host_device::is_host ( ) const  [inline], [override], [virtual]
```

Return true since the device is a SYCL host device.

Implements cl::sycl::detail::device.

Definition at line 59 of file host_device.hpp.

```
00059                                 {
00060     return true;
00061   }
```

The documentation for this class was generated from the following file:

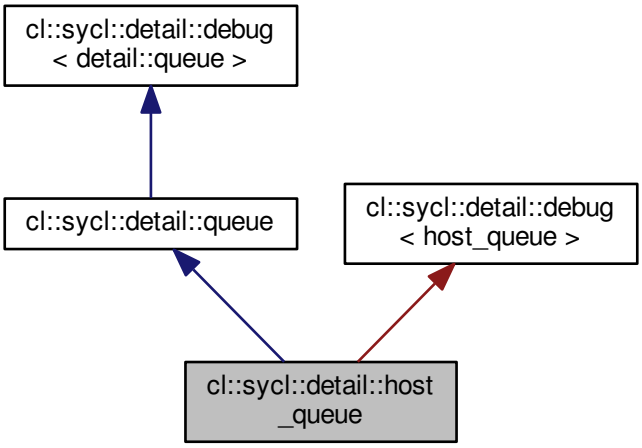
- include/CL/sycl/device/detail/host_device.hpp

10.12 cl::sycl::detail::host_queue Class Reference

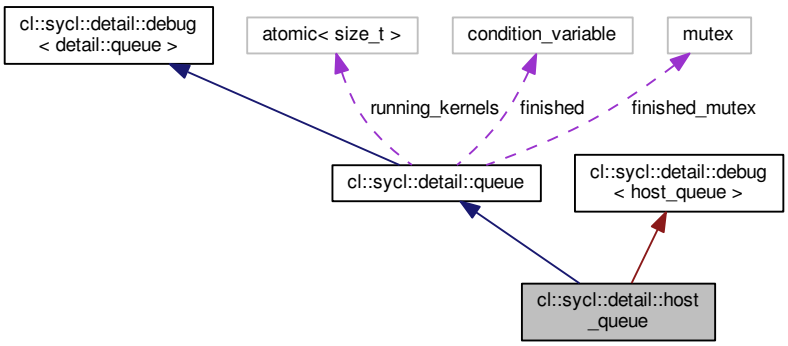
Some implementation details about the SYCL queue.

`#include <host_queue.hpp>`

Inheritance diagram for cl::sycl::detail::host_queue:



Collaboration diagram for cl::sycl::detail::host_queue:



Private Member Functions

- cl_command_queue get () const override

  Return the cl_command_queue of the underlying OpenCL queue.
- boost::compute::command_queue & get_boost_compute () override

Return the underlying Boost.Compute command queue.

- cl::sycl::context get_context () const override

  Return the SYCL host queue's host context.

- cl::sycl::device get_device () const override

  Return the SYCL host device the host queue is associated with.

- bool is_host () const override

  Claim proudly that the queue is executing on the SYCL host device.

Additional Inherited Members

10.12.1 Detailed Description

Some implementation details about the SYCL queue.

Note that a host queue is not a singleton, compared to host device or host platform, for example.

Definition at line 30 of file host_queue.hpp.

10.12.2 Member Function Documentation

10.12.2.1 get()

```
cl_command_queue cl::sycl::detail::host_queue::get ( ) const  [inline], [override], [private],
[virtual]
```

Return the cl_command_queue of the underlying OpenCL queue.

This throws an error since there is no OpenCL queue associated to the host queue.

Implements cl::sycl::detail::queue.

Definition at line 39 of file host_queue.hpp.

```
00039                                    {
00040     throw non_cl_error("The host queue has no OpenCL command queue");
00041   }
```

10.12.2.2 get_boost_compute()

```
boost::compute::command_queue& cl::sycl::detail::host_queue::get_boost_compute ( )  [inline],
[override], [private], [virtual]
```

Return the underlying Boost.Compute command queue.

This throws an error since there is no OpenCL queue associated to the host queue.

Implements cl::sycl::detail::queue.

Definition at line 49 of file host_queue.hpp.

```
00049                                                       {
00050     throw non_cl_error("The host queue has no OpenCL command queue");
00051   }
```

10.12.2.3 get_context()

```
cl::sycl::context cl::sycl::detail::host_queue::get_context ( ) const  [inline], [override],
[private], [virtual]
```

Return the SYCL host queue's host context.

Implements cl::sycl::detail::queue.

Definition at line 56 of file host_queue.hpp.

```
00056                                           {
00057     // Return the default context which is the host context
00058     return {};
00059   }
```

10.12.2.4 get_device()

```
cl::sycl::device cl::sycl::detail::host_queue::get_device ( ) const  [inline], [override],
[private], [virtual]
```

Return the SYCL host device the host queue is associated with.

Implements cl::sycl::detail::queue.

Definition at line 63 of file host_queue.hpp.

```
00063                                         {
00064     // Return the default device which is the host device
00065     return {};
00066   }
```

10.12.2.5 is_host()

```
bool cl::sycl::detail::host_queue::is_host ( ) const  [inline], [override], [private], [virtual]
```

Claim proudly that the queue is executing on the SYCL host device.

Implements cl::sycl::detail::queue.

Definition at line 70 of file host_queue.hpp.

```
00070                                {
00071     return true;
00072   }
```

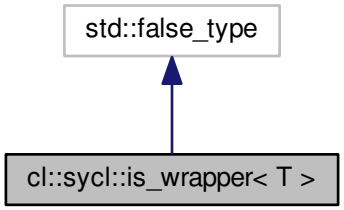
The documentation for this class was generated from the following file:

- include/CL/sycl/queue/detail/host_queue.hpp

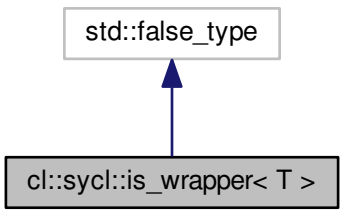
10.13 cl::sycl::is_wrapper< T > Struct Template Reference

```
#include <opencl_types.hpp>
```

Inheritance diagram for cl::sycl::is_wrapper< T >:



Collaboration diagram for cl::sycl::is_wrapper< T >:



10.13.1 Detailed Description

template<class T>
struct cl::sycl::is_wrapper< T >

Definition at line 81 of file opencl_types.hpp.

The documentation for this struct was generated from the following file:

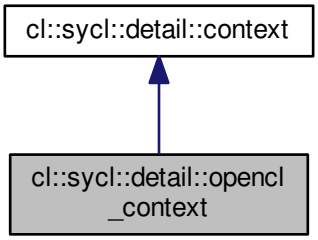
- include/CL/sycl/opencl_types.hpp

10.14 cl::sycl::detail::opencl_context Class Reference

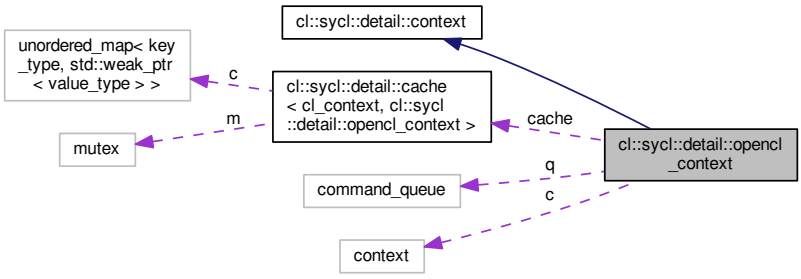
SYCL OpenCL context.

`#include <opencl_context.hpp>`

Inheritance diagram for cl::sycl::detail::opencl_context:



Collaboration diagram for cl::sycl::detail::opencl_context:



Public Member Functions

- cl_context get () const override

  Return the underlying `cl_context` of the `cl::sycl::context`.
- boost::compute::context & get_boost_compute () override

  Return the underlying `boost::compute::context` of the `cl::sycl::context`.
- boost::compute::command_queue & get_boost_queue () override

  Return the queue that is associated to the context.
- bool is_host () const override

  Return false because the context is not a SYCL host context.
- cl::sycl::platform get_platform () const override

  Return the platform of the context.
- vector_class< cl::sycl::device > get_devices () const override

  Returns the set of devices that are part of this context.
- ~opencl_context () override

  Unregister from the cache on destruction.

Static Public Member Functions

- static std::shared_ptr< opencl_context > instance (const boost::compute::context &c)

  Get a singleton instance of the `opencl_context`.

Private Member Functions

- opencl_context (const boost::compute::context &c)

  Only the instance factory can build it.

Private Attributes

- boost::compute::context c

  User the Boost Compute abstraction of the OpenCL context.
- boost::compute::command_queue q

  A boost `command_queue` associated to an OpenCL context for when we need to transfer data but no queue is given (eg.

Static Private Attributes

- static detail::cache< cl_context, detail::opencl_context > cache

  A cache to always return the same alive context for a given OpenCL context.

10.14.1 Detailed Description

SYCL OpenCL context.

Definition at line 30 of file opencl_context.hpp.

10.14.2 Constructor & Destructor Documentation

10.14.2.1 opencl_context()

```
cl::sycl::detail::opencl_context::opencl_context (
            const boost::compute::context & c )  [inline], [private]
```

Only the instance factory can build it.

Definition at line 122 of file opencl_context.hpp.

References c.

```
00122                                                :
00123     c { c },
00124     q { boost::compute::command_queue { c, c.get_device() } } {}
```

10.14.2.2 ~opencl_context()

```
cl::sycl::detail::opencl_context::~opencl_context ( )  [inline], [override]
```

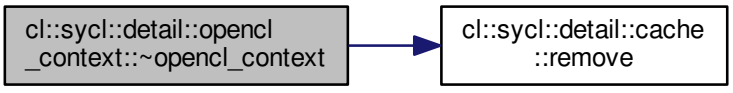
Unregister from the cache on destruction.

Definition at line 129 of file opencl_context.hpp.

References cache, cl::sycl::detail::cache< Key, Value >::remove(), and TRISYCL_WEAK_ATTRIB_PREFIX.

```
00129                               {
00130     cache.remove(c.get());
00131   }
```

Here is the call graph for this function:



10.14.3 Member Function Documentation

10.14.3.1 get()

`cl_context cl::sycl::detail::opencl_context::get ( ) const [inline], [override], [virtual]`

Return the underlying `cl_context` of the `cl::sycl::context`.

Implements cl::sycl::detail::context.

Definition at line 51 of file opencl_context.hpp.

```
00051                                  {
00052     return c.get();
00053   }
```

10.14.3.2 get_boost_compute()

`boost::compute::context& cl::sycl::detail::opencl_context::get_boost_compute ( ) [inline], [override], [virtual]`

Return the underlying `boost::compute::context` of the `cl::sycl::context`.

Implements cl::sycl::detail::context.

Definition at line 59 of file opencl_context.hpp.

References c.

```
00059                                                 {
00060     return c;
00061   }
```

10.14.3.3 get_boost_queue()

`boost::compute::command_queue& cl::sycl::detail::opencl_context::get_boost_queue ( ) [inline], [override], [virtual]`

Return the queue that is associated to the context.

Implements cl::sycl::detail::context.

Definition at line 65 of file opencl_context.hpp.

References q.

```
00065                                                   {
00066     return q;
00067   }
```

10.14.3.4 get_devices()

```
vector_class<cl::sycl::device> cl::sycl::detail::opencl_context::get_devices ( ) const  [inline],
[override], [virtual]
```

Returns the set of devices that are part of this context.

Todo To be implemented

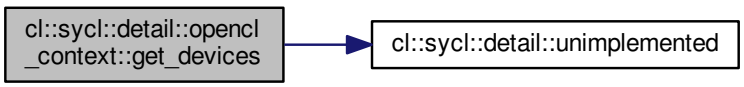
Implements cl::sycl::detail::context.

Definition at line 106 of file opencl_context.hpp.

References cl::sycl::detail::unimplemented().

```
00106                                                    {
00107     detail::unimplemented();
00108     return {};
00109   }
```

Here is the call graph for this function:



10.14.3.5 get_platform()

```
cl::sycl::platform cl::sycl::detail::opencl_context::get_platform ( ) const  [inline], [override],
[virtual]
```

Return the platform of the context.

Return synchronous errors via the SYCL exception class.

Todo To be implemented

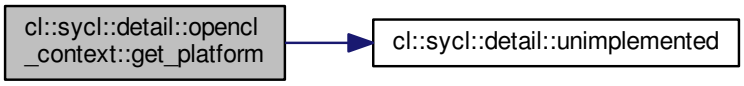
Implements cl::sycl::detail::context.

Definition at line 96 of file opencl_context.hpp.

References cl::sycl::detail::unimplemented().

```
00096                                                {
00097     detail::unimplemented();
00098     return {};
00099   }
```

Here is the call graph for this function:



10.14.3.6 instance()

```
static std::shared_ptr<opencl_context> cl::sycl::detail::opencl_context::instance (
            const boost::compute::context & c )  [inline], [static]
```

Get a singleton instance of the opencl_context.

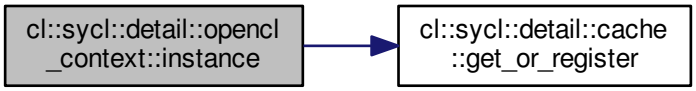
Definition at line 113 of file opencl_context.hpp.

References cl::sycl::detail::cache< Key, Value >::get_or_register().

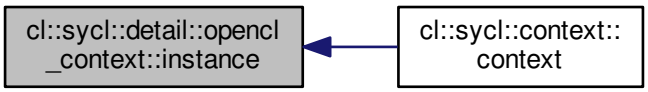
Referenced by cl::sycl::context::context().

```
00113                                          {
00114     return cache.get_or_register(c.get(),
00115                                  [&] { return new opencl_context {
      c }; });
00116   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



10.14.3.7 is_host()

```
bool cl::sycl::detail::opencl_context::is_host ( ) const  [inline], [override], [virtual]
```

Return false because the context is not a SYCL host context.

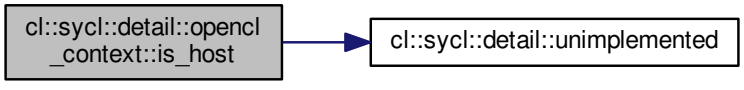
Implements cl::sycl::detail::context.

Definition at line 71 of file opencl_context.hpp.

References cl::sycl::detail::unimplemented().

```
00071                                {
00072     return false;
00073   }
```

Here is the call graph for this function:



10.14.4 Member Data Documentation

10.14.4.1 c

```
boost::compute::context cl::sycl::detail::opencl_context::c  [private]
```

User the Boost Compute abstraction of the OpenCL context.

Definition at line 33 of file opencl_context.hpp.

Referenced by get_boost_compute(), and opencl_context().

10.14.4.2 cache

```
detail::cache<cl_context, detail::opencl_context> cl::sycl::detail::opencl_context::cache
[static], [private]
```

A cache to always return the same alive context for a given OpenCL context.

C++11 guaranties the static construction is thread-safe

Definition at line 46 of file opencl_context.hpp.

Referenced by ~opencl_context().

10.14.4.3 q

```
boost::compute::command_queue cl::sycl::detail::opencl_context::q  [private]
```

A boost `command_queue` associated to an OpenCL context for when we need to transfer data but no queue is given (eg.

When an buffer accessor is created)

Definition at line 39 of file opencl_context.hpp.

Referenced by get_boost_queue().

The documentation for this class was generated from the following file:

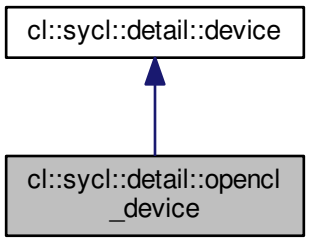
- include/CL/sycl/context/detail/opencl_context.hpp

10.15 cl::sycl::detail::opencl_device Class Reference

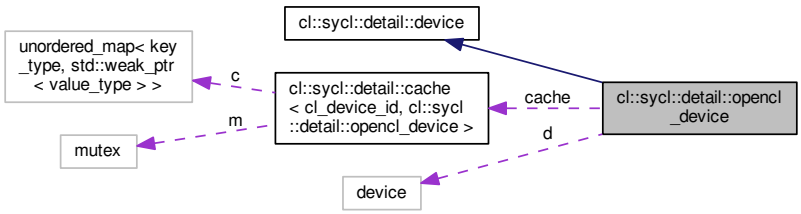
SYCL OpenCL device.

`#include <opencl_device.hpp>`

Inheritance diagram for cl::sycl::detail::opencl_device:



Collaboration diagram for cl::sycl::detail::opencl_device:



Public Member Functions

- cl_device_id get () const override

  Return the cl_device_id of the underlying OpenCL device.
- boost::compute::device & get_boost_compute () override

  Return the underlying Boost.Compute device.
- bool is_host () const override

  Return false since an OpenCL device is not the SYCL host device.
- bool is_cpu () const override

  Test if the OpenCL is a CPU device.
- bool is_gpu () const override

  Test if the OpenCL is a GPU device.
- bool is_accelerator () const override

  Test if the OpenCL is an accelerator device.
- cl::sycl::platform get_platform () const override

Return the platform of device.

- bool has_extension (const string_class &extension) const override

  Specify whether a specific extension is supported on the device.

- ~opencl_device () override

  Unregister from the cache on destruction.

Static Public Member Functions

- static std::shared_ptr< opencl_device > instance (const boost::compute::device &d)

Private Member Functions

- opencl_device (const boost::compute::device &d)

  Only the instance factory can build it.

Private Attributes

- boost::compute::device d

  Use the Boost Compute abstraction of the OpenCL device.

Static Private Attributes

- static detail::cache< cl_device_id, detail::opencl_device > cache

  A cache to always return the same alive device for a given OpenCL device.

10.15.1 Detailed Description

SYCL OpenCL device.

Definition at line 30 of file opencl_device.hpp.

10.15.2 Constructor & Destructor Documentation

10.15.2.1 opencl_device()

```
cl::sycl::detail::opencl_device::opencl_device (
            const boost::compute::device & d )  [inline], [private]
```

Only the instance factory can build it.

Definition at line 126 of file opencl_device.hpp.

```
00126 : d { d } {}
```

10.15.2.2 ~opencl_device()

```
cl::sycl::detail::opencl_device::~opencl_device ( )  [inline], [override]
```

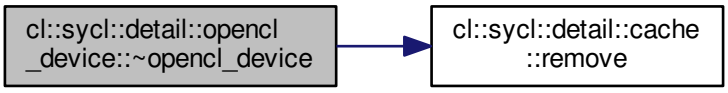
Unregister from the cache on destruction.

Definition at line 131 of file opencl_device.hpp.

References cache, cl::sycl::detail::cache< Key, Value >::remove(), TRISYCL_WEAK_ATTRIB_PREFIX, and cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX.

```
00131                             {
00132     cache.remove(d.id());
00133   }
```

Here is the call graph for this function:



10.15.3 Member Function Documentation

10.15.3.1 get()

```
cl_device_id cl::sycl::detail::opencl_device::get ( ) const  [inline], [override], [virtual]
```

Return the cl_device_id of the underlying OpenCL device.

Implements cl::sycl::detail::device.

Definition at line 45 of file opencl_device.hpp.

```
00045                                 {
00046     return d.id();
00047   }
```

10.15.3.2 get_boost_compute()

```
boost::compute::device& cl::sycl::detail::opencl_device::get_boost_compute ( )  [inline],
[override], [virtual]
```

Return the underlying Boost.Compute device.

Implements cl::sycl::detail::device.

Definition at line 51 of file opencl_device.hpp.

References d.

```
00051                                                 {
00052     return d;
00053   }
```

10.15.3.3 get_platform()

```
cl::sycl::platform cl::sycl::detail::opencl_device::get_platform ( ) const  [inline], [override],
[virtual]
```

Return the platform of device.

Return synchronous errors via the SYCL exception class.

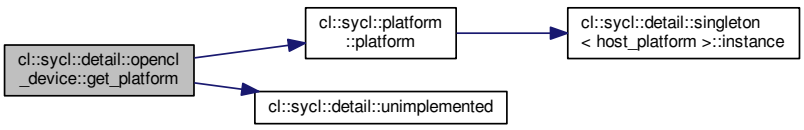
Implements cl::sycl::detail::device.

Definition at line 87 of file opencl_device.hpp.

References cl::sycl::platform::platform(), and cl::sycl::detail::unimplemented().

```
00087                                                 {
00088     return d.platform();
00089   }
```

Here is the call graph for this function:



10.15.3.4 has_extension()

```
bool cl::sycl::detail::opencl_device::has_extension (
            const string_class & extension ) const  [inline], [override], [virtual]
```

Specify whether a specific extension is supported on the device.

Todo To be implemented

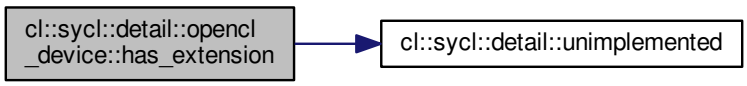
Implements cl::sycl::detail::device.

Definition at line 110 of file opencl_device.hpp.

References cl::sycl::detail::unimplemented().

```
00110                                                                    {
00111     detail::unimplemented();
00112     return {};
00113   }
```

Here is the call graph for this function:



10.15.3.5 instance()

```
static std::shared_ptr<opencl_device> cl::sycl::detail::opencl_device::instance (
            const boost::compute::device & d )  [inline], [static]
```

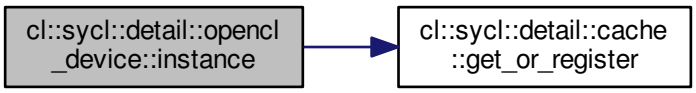
Definition at line 118 of file opencl_device.hpp.

References cl::sycl::detail::cache< Key, Value >::get_or_register().

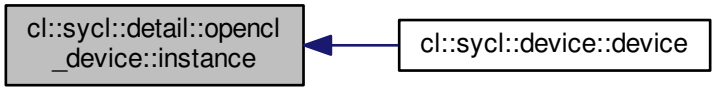
Referenced by cl::sycl::device::device().

```
00118                                       {
00119     return cache.get_or_register(d.id(),
00120                                  [&] { return new opencl_device { d }; });
00121   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



10.15.3.6 is_accelerator()

```
bool cl::sycl::detail::opencl_device::is_accelerator ( ) const  [inline], [override], [virtual]
```

Test if the OpenCL is an accelerator device.

Implements cl::sycl::detail::device.

Definition at line 77 of file opencl_device.hpp.

```
00077                                       {
00078     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00079     return d.type() & boost::compute::device::accelerator;
00080   }
```

10.15.3.7 is_cpu()

```
bool cl::sycl::detail::opencl_device::is_cpu ( ) const  [inline], [override], [virtual]
```

Test if the OpenCL is a CPU device.

Implements cl::sycl::detail::device.

Definition at line 63 of file opencl_device.hpp.

```
00063                                 {
00064     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00065     return d.type() & boost::compute::device::cpu;
00066   }
```

10.15.3.8 is_gpu()

```
bool cl::sycl::detail::opencl_device::is_gpu ( ) const  [inline], [override], [virtual]
```

Test if the OpenCL is a GPU device.

Implements cl::sycl::detail::device.

Definition at line 70 of file opencl_device.hpp.

```
00070                                {
00071     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00072     return d.type() & boost::compute::device::gpu;
00073   }
```

10.15.3.9 is_host()

```
bool cl::sycl::detail::opencl_device::is_host ( ) const  [inline], [override], [virtual]
```

Return false since an OpenCL device is not the SYCL host device.

Implements cl::sycl::detail::device.

Definition at line 57 of file opencl_device.hpp.

```
00057                                {
00058     return false;
00059   }
```

10.15.4 Member Data Documentation

10.15.4.1 cache

```
detail::cache<cl_device_id, detail::opencl_device> cl::sycl::detail::opencl_device::cache
[static], [private]
```

A cache to always return the same alive device for a given OpenCL device.

C++11 guaranties the static construction is thread-safe

Definition at line 40 of file opencl_device.hpp.

Referenced by ~opencl_device().

10.15.4.2 d

```
boost::compute::device cl::sycl::detail::opencl_device::d  [private]
```

Use the Boost Compute abstraction of the OpenCL device.

Definition at line 33 of file opencl_device.hpp.

Referenced by get_boost_compute().

The documentation for this class was generated from the following file:

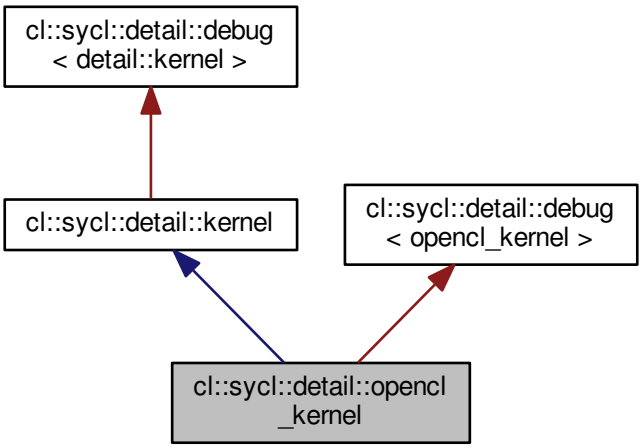
- include/CL/sycl/device/detail/opencl_device.hpp

10.16 cl::sycl::detail::opencl_kernel Class Reference

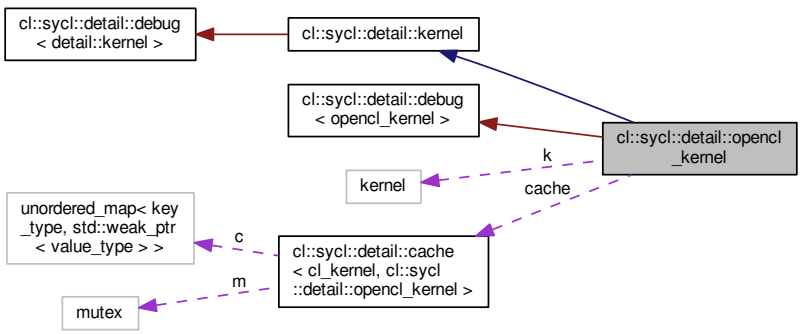
An abstraction of the OpenCL kernel.

```
#include <opencl_kernel.hpp>
```

Inheritance diagram for cl::sycl::detail::opencl_kernel:



Collaboration diagram for cl::sycl::detail::opencl_kernel:



Public Member Functions

- cl_kernel get () const override

  Return the underlying OpenCL object.
- boost::compute::kernel get_boost_compute () const override

  Return the Boost.Compute OpenCL kernel object for this kernel.
- void single_task (std::shared_ptr< detail::task > task, std::shared_ptr< detail::queue > q) override

  Launch a single task of the OpenCL kernel.
- TRISYCL_ParallelForKernel_RANGE (1) TRISYCL_ParallelForKernel_RANGE(2) TRISYCL_ParallelFor↩ Kernel_RANGE(3) ~opencl_kernel() override

  Unregister from the cache on destruction.

Static Public Member Functions

- static std::shared_ptr< opencl_kernel > instance (const boost::compute::kernel &k)

Private Member Functions

- opencl_kernel (const boost::compute::kernel &k)

Private Attributes

- boost::compute::kernel k

  Use the Boost Compute abstraction of the OpenCL kernel.

Static Private Attributes

- static detail::cache< cl_kernel, detail::opencl_kernel > cache

  A cache to always return the same alive kernel for a given OpenCL kernel.

10.16.1 Detailed Description

An abstraction of the OpenCL kernel.

Definition at line 29 of file opencl_kernel.hpp.

10.16.2 Constructor & Destructor Documentation

10.16.2.1 opencl_kernel()

```
cl::sycl::detail::opencl_kernel::opencl_kernel (
            const boost::compute::kernel & k )  [inline], [private]
```

Definition at line 42 of file opencl_kernel.hpp.

```
00042 : k { k } {}
```

10.16.3 Member Function Documentation

10.16.3.1 get()

```
cl_kernel cl::sycl::detail::opencl_kernel::get ( ) const  [inline], [override], [virtual]
```

Return the underlying OpenCL object.

Todo Improve the spec to deprecate C OpenCL host API and move to C++ instead to avoid this ugly ownership management

Todo Test error and throw. Externalize this feature in Boost.Compute?

Implements cl::sycl::detail::kernel.

Definition at line 58 of file opencl_kernel.hpp.

```
00058                                {
00059     /// \todo Test error and throw. Externalize this feature in Boost.Compute?
00060     clRetainKernel(k);
00061     return k.get();
00062   }
```

10.16.3.2 get_boost_compute()

```
boost::compute::kernel cl::sycl::detail::opencl_kernel::get_boost_compute ( ) const  [inline],
[override], [virtual]
```

Return the Boost.Compute OpenCL kernel object for this kernel.

This is an extension.

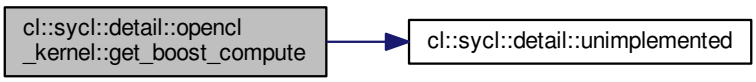
Implements cl::sycl::detail::kernel.

Definition at line 69 of file opencl_kernel.hpp.

References k, and cl::sycl::detail::unimplemented().

```
00069                                                 {
00070     return k;
00071   }
```

Here is the call graph for this function:



10.16.3.3 instance()

```
static std::shared_ptr<opencl_kernel> cl::sycl::detail::opencl_kernel::instance (
            const boost::compute::kernel & k )  [inline], [static]
```

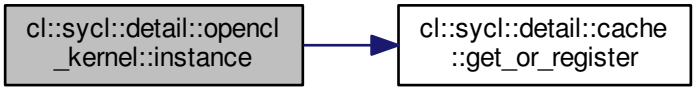
Definition at line 48 of file opencl_kernel.hpp.

References cl::sycl::detail::cache< Key, Value >::get_or_register().

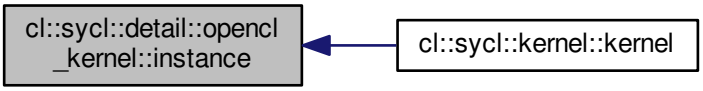
Referenced by cl::sycl::kernel::kernel().

```
00048                                       {
00049     return cache.get_or_register(k.get(),
00050                                  [&] { return new opencl_kernel { k }; });
00051   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



10.16.3.4 single_task()

```
void cl::sycl::detail::opencl_kernel::single_task (
             std::shared_ptr< detail::task > task,
             std::shared_ptr< detail::queue > q )  [inline], [override], [virtual]
```

Launch a single task of the OpenCL kernel.

Todo Remove either task or q

Implements cl::sycl::detail::kernel.

Definition at line 91 of file opencl_kernel.hpp.

```
00092                                                    {
00093     q->get_boost_compute().enqueue_task(k);
00094     /* For now use a crude synchronization mechanism to map directly a
00095        host task to an accelerator task */
00096     q->get_boost_compute().finish();
00097   }
```

10.16.3.5 TRISYCL_ParallelForKernel_RANGE()

```
cl::sycl::detail::opencl_kernel::TRISYCL_ParallelForKernel_RANGE (
            1  )  [inline], [override]
```

Unregister from the cache on destruction.

Definition at line 126 of file opencl_kernel.hpp.

References cache, cl::sycl::detail::cache< Key, Value >::remove(), TRISYCL_WEAK_ATTRIB_PREFIX, and cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX.

```
00133                             {
00134     cache.remove(k.get());
00135   }
```

Here is the call graph for this function:

10.16.4 Member Data Documentation

10.16.4.1 cache

```
detail::cache<cl_kernel, detail::opencl_kernel> cl::sycl::detail::opencl_kernel::cache  [static],
[private]
```

A cache to always return the same alive kernel for a given OpenCL kernel.

C++11 guaranties the static construction is thread-safe

Definition at line 40 of file opencl_kernel.hpp.

Referenced by TRISYCL_ParallelForKernel_RANGE().

10.16.4.2 k

```
boost::compute::kernel cl::sycl::detail::opencl_kernel::k  [private]
```

Use the Boost Compute abstraction of the OpenCL kernel.

Definition at line 33 of file opencl_kernel.hpp.

Referenced by get_boost_compute().

The documentation for this class was generated from the following file:

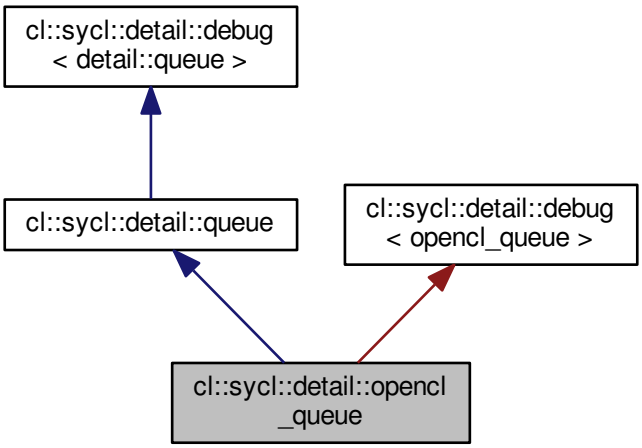
- include/CL/sycl/kernel/detail/opencl_kernel.hpp

10.17 cl::sycl::detail::opencl_queue Class Reference

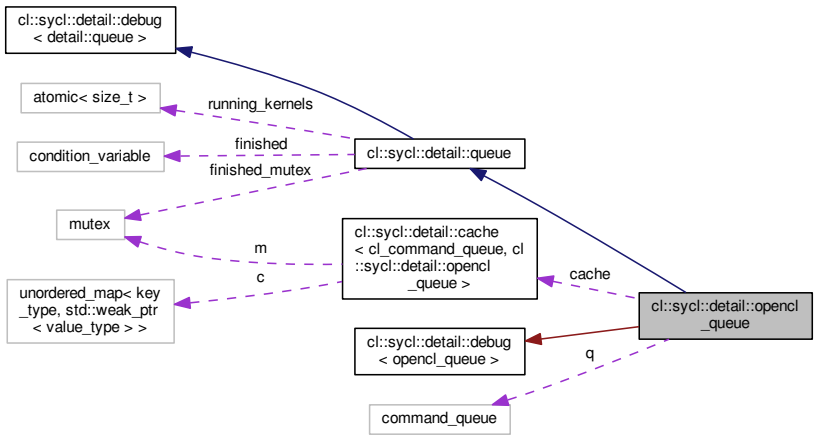
Some implementation details about the SYCL queue.

```
#include <opencl_queue.hpp>
```

Inheritance diagram for cl::sycl::detail::opencl_queue:



Collaboration diagram for cl::sycl::detail::opencl_queue:



Public Member Functions

- ~opencl_queue () override

  Unregister from the cache on destruction.

Static Public Member Functions

- static std::shared_ptr< opencl_queue > instance (const boost::compute::command_queue &q)

  Get a singleton instance of the opencl_queue.
- static std::shared_ptr< detail::queue > instance (const cl::sycl::device &d)

  Create a new queue associated to this device.

Private Member Functions

- cl_command_queue get () const override

  Return the cl_command_queue of the underlying OpenCL queue.
- boost::compute::command_queue & get_boost_compute () override

  Return the underlying Boost.Compute command queue.
- cl::sycl::context get_context () const override

  Return the SYCL context associated to the queue.
- cl::sycl::device get_device () const override

  Return the SYCL device associated to the queue.
- bool is_host () const override

  Claim proudly that an OpenCL queue cannot be the SYCL host queue.
- opencl_queue (const boost::compute::command_queue &q)

  Only the instance factory can built it.

Private Attributes

- boost::compute::command_queue q

  Use the Boost Compute abstraction of the OpenCL command queue.

Static Private Attributes

- static detail::cache< cl_command_queue, detail::opencl_queue > cache

  A cache to always return the same alive queue for a given OpenCL command queue.

Additional Inherited Members

10.17.1 Detailed Description

Some implementation details about the SYCL queue.

Definition at line 23 of file opencl_queue.hpp.

10.17.2 Constructor & Destructor Documentation

10.17.2.1 opencl_queue()

```
cl::sycl::detail::opencl_queue::opencl_queue (
            const boost::compute::command_queue & q )  [inline], [private]
```

Only the instance factory can built it.

Definition at line 67 of file opencl_queue.hpp.

```
00067 : q { q } {}
```

10.17.2.2 ~opencl_queue()

```
cl::sycl::detail::opencl_queue::~opencl_queue ( )  [inline], [override]
```

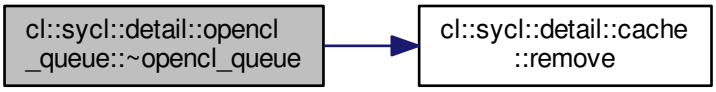
Unregister from the cache on destruction.

Definition at line 96 of file opencl_queue.hpp.

References cache, cl::sycl::detail::cache< Key, Value >::remove(), TRISYCL_WEAK_ATTRIB_PREFIX, and cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX.

```
00096                             {
00097     cache.remove(q.get());
00098   }
```

Here is the call graph for this function:



10.17.3 Member Function Documentation

10.17.3.1 get()

```
cl_command_queue cl::sycl::detail::opencl_queue::get ( ) const  [inline], [override], [private],
[virtual]
```

Return the cl_command_queue of the underlying OpenCL queue.

Implements cl::sycl::detail::queue.

Definition at line 36 of file opencl_queue.hpp.

```
00036                                          {
00037     return q.get();
00038   }
```

10.17.3.2 get_boost_compute()

```
boost::compute::command_queue& cl::sycl::detail::opencl_queue::get_boost_compute ( )  [inline],
[override], [private], [virtual]
```

Return the underlying Boost.Compute command queue.

Implements cl::sycl::detail::queue.

Definition at line 42 of file opencl_queue.hpp.

References q.

```
00042                                                        {
00043     return q;
00044   }
```

10.17.3.3 get_context()

```
cl::sycl::context cl::sycl::detail::opencl_queue::get_context ( ) const  [inline], [override],
[private], [virtual]
```

Return the SYCL context associated to the queue.

Implements cl::sycl::detail::queue.

Definition at line 48 of file opencl_queue.hpp.

```
00048                                             {
00049     return q.get_context();
00050   }
```

10.17.3.4 get_device()

```
cl::sycl::device cl::sycl::detail::opencl_queue::get_device ( ) const  [inline], [override],
[private], [virtual]
```

Return the SYCL device associated to the queue.

Implements cl::sycl::detail::queue.

Definition at line 54 of file opencl_queue.hpp.

```
00054                                           {
00055     return q.get_device();
00056   }
```

10.17.3.5 instance() [1/2]

```
static std::shared_ptr<opencl_queue> cl::sycl::detail::opencl_queue::instance (
            const boost::compute::command_queue & q )  [inline], [static]
```

Get a singleton instance of the opencl_queue.

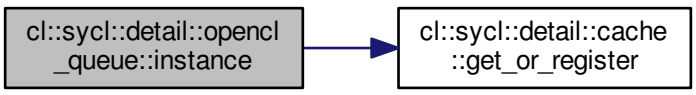
Definition at line 73 of file opencl_queue.hpp.

References cl::sycl::detail::cache< Key, Value >::get_or_register().

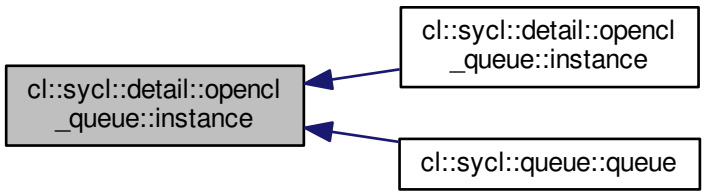
Referenced by instance(), and cl::sycl::queue::queue().

```
00073                                                 {
00074     return cache.get_or_register(q.get(),
00075                                  [&] { return new opencl_queue { q }; });
00076   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



10.17.3.6 instance() [2/2]

```
static std::shared_ptr<detail::queue> cl::sycl::detail::opencl_queue::instance (
            const cl::sycl::device & d )  [inline], [static]
```

Create a new queue associated to this device.

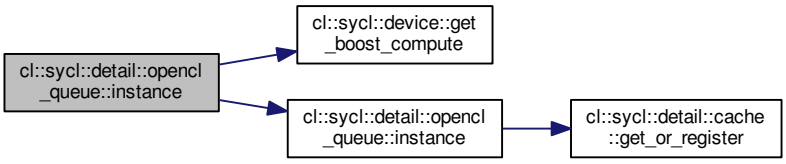
Todo Check with SYCL committee what is the expected behaviour here about the context. Is this a new context everytime, or always the same for a given device?

Definition at line 86 of file opencl_queue.hpp.

References cl::sycl::device::get_boost_compute(), and instance().

```
00086                                    {
00087     return instance (boost::compute::command_queue {
00088         // For now, create a new context every time
00089         boost::compute::context { d.get_boost_compute() },
00090         d.get_boost_compute()
00091           });
00092   }
```

Here is the call graph for this function:



10.17.3.7 is_host()

```
bool cl::sycl::detail::opencl_queue::is_host ( ) const  [inline], [override], [private], [virtual]
```

Claim proudly that an OpenCL queue cannot be the SYCL host queue.

Implements cl::sycl::detail::queue.

Definition at line 60 of file opencl_queue.hpp.

```
00060                                   {
00061     return false;
00062   }
```

10.17.4 Member Data Documentation

10.17.4.1 cache

`detail::cache<cl_command_queue, detail::opencl_queue> cl::sycl::detail::opencl_queue::cache [static], [private]`

A cache to always return the same alive queue for a given OpenCL command queue.

C++11 guaranties the static construction is thread-safe

Definition at line 33 of file opencl_queue.hpp.

Referenced by ~opencl_queue().

10.17.4.2 q

`boost::compute::command_queue cl::sycl::detail::opencl_queue::q [private]`

Use the Boost Compute abstraction of the OpenCL command queue.

Definition at line 26 of file opencl_queue.hpp.

Referenced by get_boost_compute().

The documentation for this class was generated from the following file:

- include/CL/sycl/queue/detail/opencl_queue.hpp

10.18 cl::sycl::info::param_traits< T, Param > Struct Template Reference

Implement a meta-function from (T, value) to T' to express the return type value of an OpenCL function of kind (T, value)

`#include <param_traits.hpp>`

10.18.1 Detailed Description

template<typename T, T Param>
struct cl::sycl::info::param_traits< T, Param >

Implement a meta-function from (T, value) to T' to express the return type value of an OpenCL function of kind (T, value)

Definition at line 20 of file param_traits.hpp.

The documentation for this struct was generated from the following file:

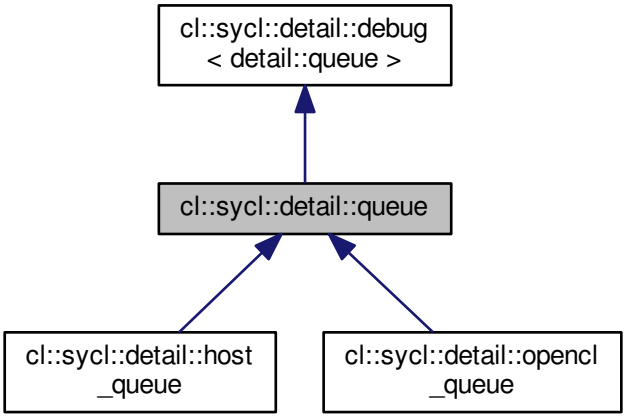
- include/CL/sycl/info/param_traits.hpp

10.19 cl::sycl::detail::queue Struct Reference

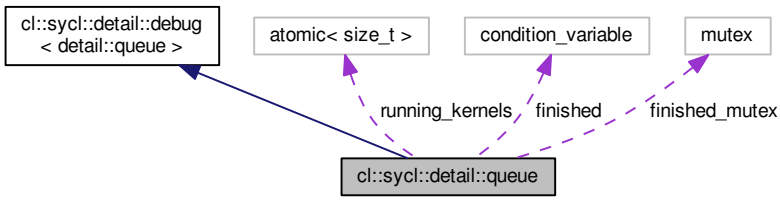
Some implementation details about the SYCL queue.

`#include <queue.hpp>`

Inheritance diagram for cl::sycl::detail::queue:



Collaboration diagram for cl::sycl::detail::queue:



Public Member Functions

- queue ()

  Initialize the queue with 0 running kernel.
- void wait_for_kernel_execution ()

  Wait for all kernel completion.
- void kernel_start ()

  Signal that a new kernel started on this queue.
- void kernel_end ()

  Signal that a new kernel finished on this queue.

- virtual cl_command_queue get () const =0

  Return the underlying OpenCL command queue after doing a retain.
- virtual boost::compute::command_queue & get_boost_compute ()=0

  Return the underlying Boost.Compute command queue.
- virtual cl::sycl::context get_context () const =0

  Return the SYCL queue's context.
- virtual cl::sycl::device get_device () const =0

  Return the SYCL device the queue is associated with.
- virtual bool is_host () const =0

  Return whether the queue is executing on a SYCL host device.
- virtual ~queue ()

  Wait for all kernel completion before the queue destruction.

Public Attributes

- std::atomic< size_t > running_kernels

  Track the number of kernels still running to wait for their completion.
- std::condition_variable finished

  To signal when all the kernels have completed.
- std::mutex finished_mutex

  To protect the access to the condition variable.

10.19.1 Detailed Description

Some implementation details about the SYCL queue.

Definition at line 30 of file queue.hpp.

10.19.2 Constructor & Destructor Documentation

10.19.2.1 queue()

```
cl::sycl::detail::queue::queue ( )  [inline]
```

Initialize the queue with 0 running kernel.

Definition at line 41 of file queue.hpp.

```
00041           {
00042     running_kernels = 0;
00043   }
```

10.19.2.2 ~queue()

```
virtual cl::sycl::detail::queue::~queue ( )  [inline], [virtual]
```

Wait for all kernel completion before the queue destruction.

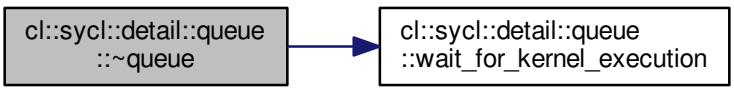
Todo Update according spec since queue destruction is non blocking

Definition at line 119 of file queue.hpp.

References wait_for_kernel_execution().

```
00119                   {
00120     wait_for_kernel_execution();
00121   }
```

Here is the call graph for this function:



10.19.3 Member Function Documentation

10.19.3.1 get()

```
virtual cl_command_queue cl::sycl::detail::queue::get ( ) const  [pure virtual]
```

Return the underlying OpenCL command queue after doing a retain.

This memory object is expected to be released by the developer.

Retain a reference to the returned cl_command_queue object.

Caller should release it when finished.

If the queue is a SYCL host queue then an exception is thrown.

Implemented in cl::sycl::detail::host_queue, and cl::sycl::detail::opencl_queue.

10.19.3.2 get_boost_compute()

```
virtual boost::compute::command_queue& cl::sycl::detail::queue::get_boost_compute ( )  [pure
virtual]
```

Return the underlying Boost.Compute command queue.

Implemented in cl::sycl::detail::host_queue, and cl::sycl::detail::opencl_queue.

Referenced by kernel_end().

Here is the caller graph for this function:

10.19.3.3 get_context()

```
virtual cl::sycl::context cl::sycl::detail::queue::get_context ( ) const  [pure virtual]
```

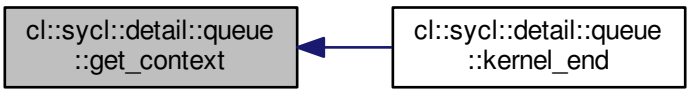
Return the SYCL queue's context.

Report errors using SYCL exception classes.

Implemented in cl::sycl::detail::host_queue, and cl::sycl::detail::opencl_queue.

Referenced by kernel_end().

Here is the caller graph for this function:



10.19.3.4 get_device()

```
virtual cl::sycl::device cl::sycl::detail::queue::get_device ( ) const  [pure virtual]
```

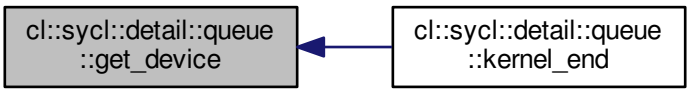
Return the SYCL device the queue is associated with.

Report errors using SYCL exception classes.

Implemented in cl::sycl::detail::host_queue, and cl::sycl::detail::opencl_queue.

Referenced by kernel_end().

Here is the caller graph for this function:



10.19.3.5 is_host()

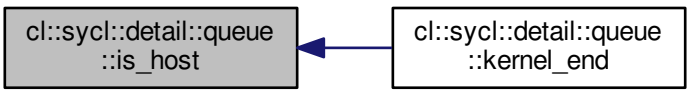
```
virtual bool cl::sycl::detail::queue::is_host ( ) const  [pure virtual]
```

Return whether the queue is executing on a SYCL host device.

Implemented in cl::sycl::detail::host_queue, and cl::sycl::detail::opencl_queue.

Referenced by kernel_end().

Here is the caller graph for this function:



10.19.3.6 kernel_end()

```
void cl::sycl::detail::queue::kernel_end ( )  [inline]
```

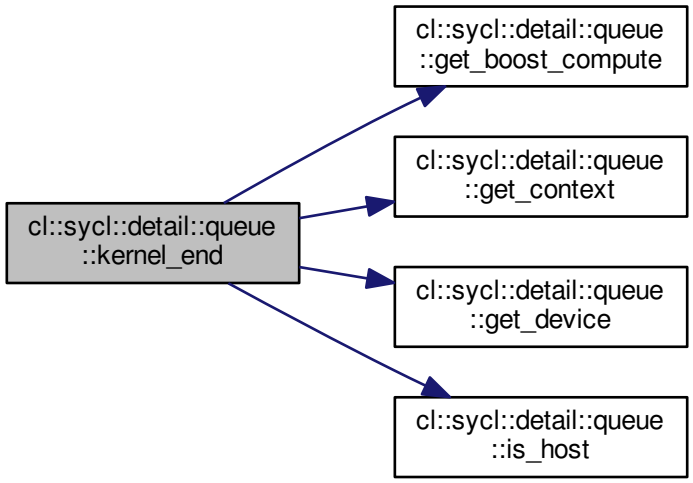
Signal that a new kernel finished on this queue.

Definition at line 66 of file queue.hpp.

References get_boost_compute(), get_context(), get_device(), is_host(), and TRISYCL_DUMP_T.

```
00066                     {
00067     TRISYCL_DUMP_T("A kernel of the queue ended");
00068     if (--running_kernels == 0) {
00069       /* It was the last kernel running, so signal the queue just in
00070          case it was working for it for completion
00071
00072          In some cases several threads might want to wait for the
00073          same queue, because of this \c notify_one is not be enough
00074          and a \c notify_all is needed
00075       */
00076       finished.notify_all();
00077     }
00078   }
```

Here is the call graph for this function:



10.19.3.7 kernel_start()

```
void cl::sycl::detail::queue::kernel_start ( )  [inline]
```

Signal that a new kernel started on this queue.

Definition at line 58 of file queue.hpp.

References running_kernels, and TRISYCL_DUMP_T.

```
00058                     {
00059     TRISYCL_DUMP_T("A kernel has been added to the queue");
00060     // One more kernel
00061     ++running_kernels;
00062   }
```

10.19.3.8 wait_for_kernel_execution()

```
void cl::sycl::detail::queue::wait_for_kernel_execution ( )  [inline]
```

Wait for all kernel completion.

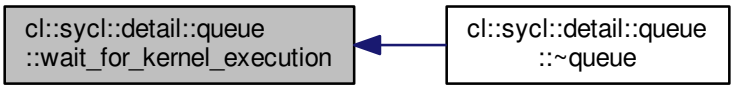
Definition at line 47 of file queue.hpp.

References TRISYCL_DUMP_T.

Referenced by ~queue().

```
00047                                    {
00048     TRISYCL_DUMP_T("Queue waiting for kernel completion");
00049     std::unique_lock<std::mutex> ul { finished_mutex };
00050     finished.wait(ul, [&] {
00051         // When there is no kernel running in this queue, we are ready to go
00052         return running_kernels == 0;
00053       });
00054   }
```

Here is the caller graph for this function:



10.19.4 Member Data Documentation

10.19.4.1 finished

```
std::condition_variable cl::sycl::detail::queue::finished
```

To signal when all the kernels have completed.

Definition at line 35 of file queue.hpp.

10.19.4.2 finished_mutex

```
std::mutex cl::sycl::detail::queue::finished_mutex
```

To protect the access to the condition variable.

Definition at line 37 of file queue.hpp.

10.19.4.3 running_kernels

```
std::atomic<size_t> cl::sycl::detail::queue::running_kernels
```

Track the number of kernels still running to wait for their completion.

Definition at line 32 of file queue.hpp.

Referenced by kernel_start().

The documentation for this struct was generated from the following file:

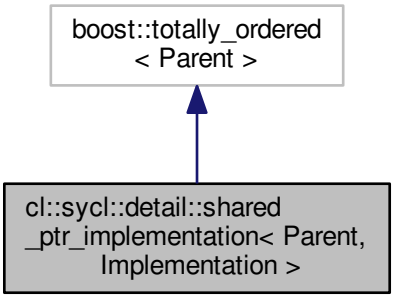
- include/CL/sycl/queue/detail/queue.hpp

10.20 cl::sycl::detail::shared_ptr_implementation< Parent, Implementation > Struct Template Reference

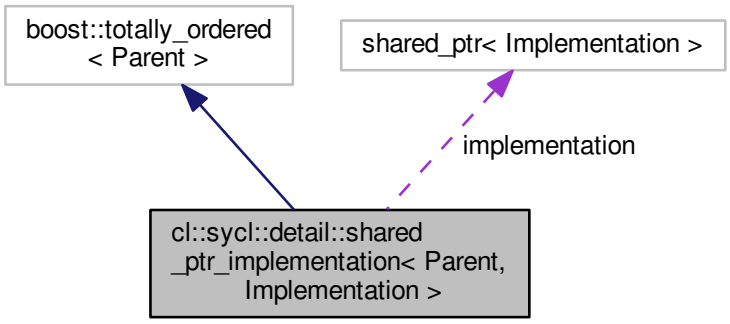
Provide an implementation as shared_ptr with total ordering and hashing to be used with algorithms and in (un)ordered containers.

```
#include <shared_ptr_implementation.hpp>
```

Inheritance diagram for cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >:



Collaboration diagram for cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >:



Public Member Functions

- shared_ptr_implementation (std::shared_ptr< Implementation > i)
  The implementation directly as a shared pointer.
- shared_ptr_implementation (Implementation *i)
  The implementation takes the ownership from a raw pointer.
- shared_ptr_implementation ()=default
  Keep all other constructors to have usual shared_ptr behaviour.
- bool operator== (const Parent &other) const
  Equality operator.
- bool operator< (const Parent &other) const
  Inferior operator.
- auto hash () const
  Forward the hashing for unordered containers to the implementation.

Public Attributes

- std::shared_ptr< Implementation > implementation
  The implementation forward everything to this... implementation.

10.20.1 Detailed Description

template<typename Parent, typename Implementation>
struct cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >

Provide an implementation as shared_ptr with total ordering and hashing to be used with algorithms and in (un)ordered containers.

To be used, a Parent class wanting an Implementation needs to inherit from.

The implementation ends up in a member really named "implementation".

```
public detail::shared_ptr_implementation<Parent, Implementation>
```

and also inject in std namespace a specialization for

```
hash<Parent>
```

Definition at line 40 of file shared_ptr_implementation.hpp.

10.20.2 Constructor & Destructor Documentation

10.20.2.1 shared_ptr_implementation() [1/3]

```
template<typename Parent, typename Implementation>
cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::shared_ptr_implementation
(
            std::shared_ptr< Implementation > i )  [inline]
```

The implementation directly as a shared pointer.

Definition at line 46 of file shared_ptr_implementation.hpp.

```
00047     : implementation { i } {}
```

10.20.2.2 shared_ptr_implementation() [2/3]

```
template<typename Parent, typename Implementation>
cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::shared_ptr_implementation
(
            Implementation * i )  [inline]
```

The implementation takes the ownership from a raw pointer.

Definition at line 51 of file shared_ptr_implementation.hpp.

```
00051 : implementation { i } {}
```

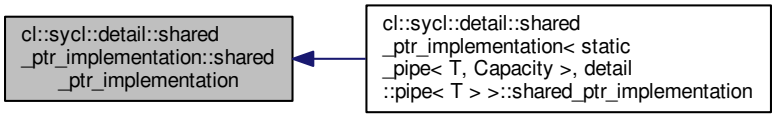
10.20.2.3 shared_ptr_implementation() [3/3]

```
template<typename Parent, typename Implementation>
cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::shared_ptr_implementation
( )  [default]
```

Keep all other constructors to have usual shared_ptr behaviour.

Referenced by cl::sycl::detail::shared_ptr_implementation< static_pipe< T, Capacity >, detail::pipe< T > >::shared_ptr_implementation().

Here is the caller graph for this function:



10.20.3 Member Function Documentation

10.20.3.1 hash()

```
template<typename Parent, typename Implementation>
auto cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash ( ) const
[inline]
```

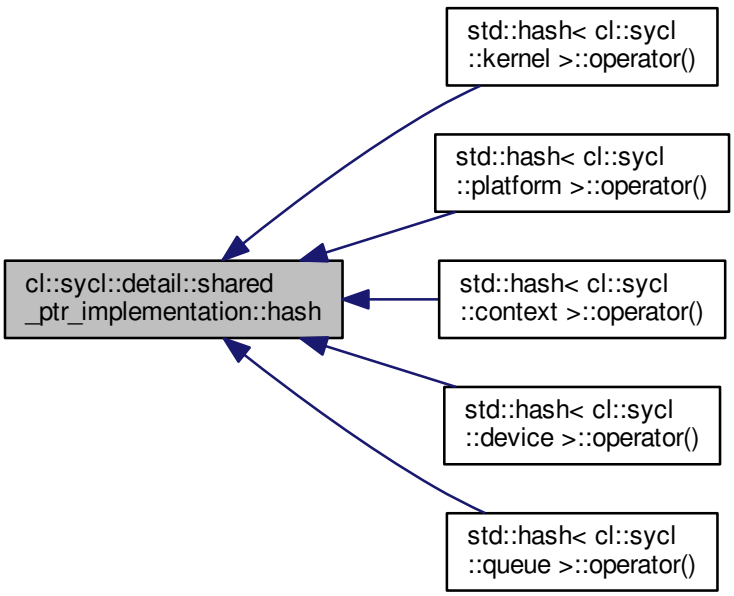
Forward the hashing for unordered containers to the implementation.

Definition at line 83 of file shared_ptr_implementation.hpp.

Referenced by std::hash< cl::sycl::kernel >::operator()(), std::hash< cl::sycl::platform >::operator()(), std::hash< cl::sycl::context >::operator()(), std::hash< cl::sycl::device >::operator()(), and std::hash< cl::sycl::queue >::operator()().

```
00083                     {
00084     return std::hash<decltype(implementation)>{}(implementation);
00085   }
```

Here is the caller graph for this function:



10.20.3.2 operator<()

```
template<typename Parent, typename Implementation>
bool cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::operator< (
            const Parent & other ) const  [inline]
```

Inferior operator.

This is generalized by boost::less_than_comparable from boost::totally_ordered to implement the equality comparable concept

Todo Add this to the spec

Definition at line 77 of file shared_ptr_implementation.hpp.

```
00077                                           {
00078     return implementation < other.implementation;
00079   }
```

10.20.3.3 operator==()

```
template<typename Parent, typename Implementation>
bool cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::operator== (
            const Parent & other ) const  [inline]
```

Equality operator.

This is generalized by boost::equality_comparable from boost::totally_ordered to implement the equality comparable concept

Definition at line 64 of file shared_ptr_implementation.hpp.

```
00064                                           {
00065     return implementation == other.implementation;
00066   }
```

10.20.4 Member Data Documentation

10.20.4.1 implementation

```
template<typename Parent, typename Implementation>
std::shared_ptr<Implementation> cl::sycl::detail::shared_ptr_implementation< Parent, Implementation
>::implementation
```

The implementation forward everything to this... implementation.

Definition at line 43 of file shared_ptr_implementation.hpp.

Referenced by cl::sycl::detail::shared_ptr_implementation< static_pipe< T, Capacity >, detail::pipe< T > >↩ ::hash(), and cl::sycl::handler::single_task().

The documentation for this struct was generated from the following file:

- include/CL/sycl/detail/shared_ptr_implementation.hpp

10.21 cl::sycl::detail::singleton< T > Struct Template Reference

Provide a singleton factory.

`#include <singleton.hpp>`

Static Public Member Functions

- static std::shared_ptr< T > instance ()
  Get a singleton instance of T.

10.21.1 Detailed Description

template<typename T>
struct cl::sycl::detail::singleton< T >

Provide a singleton factory.

Definition at line 25 of file singleton.hpp.

10.21.2 Member Function Documentation

10.21.2.1 instance()

```
template<typename T>
static std::shared_ptr<T> cl::sycl::detail::singleton< T >::instance ( )  [inline], [static]
```

Get a singleton instance of T.

Use a null_deleter since the singleton should not be deleted, as allocated in the static area

Definition at line 28 of file singleton.hpp.

```
00028                                    {
00029     // C++11 guaranties the static construction is thread-safe
00030     static T single;
00031     /** Use a null_deleter since the singleton should not be deleted,
00032         as allocated in the static area */
00033     static std::shared_ptr<T> sps { &single,
00034                                     boost::null_deleter {} };
00035
00036     return sps;
00037   }
```

The documentation for this struct was generated from the following file:

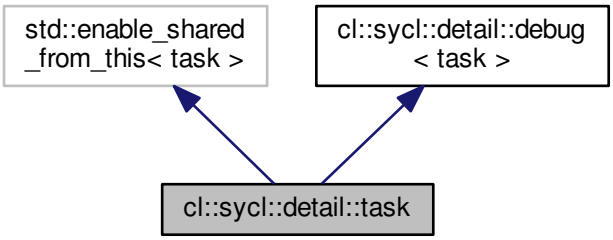
- include/CL/sycl/detail/singleton.hpp

10.22 cl::sycl::detail::task Struct Reference

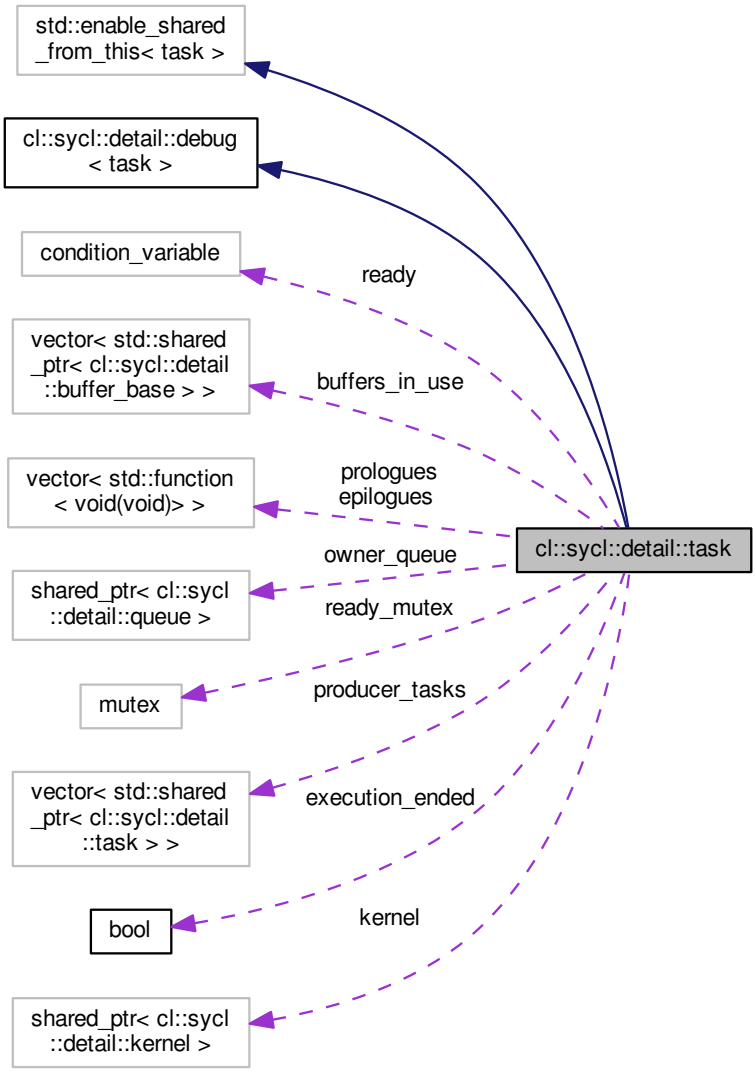
The abstraction to represent SYCL tasks executing inside command_group.

```
#include <task.hpp>
```

Inheritance diagram for cl::sycl::detail::task:



Collaboration diagram for cl::sycl::detail::task:



Public Member Functions

- task (const std::shared_ptr< detail::queue > &q)

  Create a task from a submitting queue.
- void schedule (std::function< void(void)> f)

  Add a new task to the task graph and schedule for execution.
- void wait_for_producers ()

  Wait for the required producer tasks to be ready.
- void release_buffers ()

  Release the buffers that have been used by this task.
- void notify_consumers ()

  Notify the waiting tasks that we are done.

- void wait ()

  Wait for this task to be ready.
- void add_buffer (std::shared_ptr< detail::buffer_base > &buf, bool is_write_mode)

  Register a buffer to this task.
- void prelude ()

  Execute the prologues.
- void postlude ()

  Execute the epilogues.
- void add_prelude (const std::function< void(void)> &f)

  Add a function to the prelude to run before kernel execution.
- void add_postlude (const std::function< void(void)> &f)

  Add a function to the postlude to run after kernel execution.
- auto get_queue ()

  Get the queue behind the task to run a kernel on.
- void set_kernel (const std::shared_ptr< cl::sycl::detail::kernel > &k)

  Set the kernel running this task if any.
- cl::sycl::detail::kernel & get_kernel ()

  Get the kernel running if any.

Public Attributes

- std::vector< std::shared_ptr< detail::buffer_base > > buffers_in_use

  List of the buffers used by this task.
- std::vector< std::shared_ptr< detail::task > > producer_tasks

  The tasks producing the buffers used by this task.
- std::vector< std::function< void(void)> > prologues

  Keep track of any prologue to be executed before the kernel.
- std::vector< std::function< void(void)> > epilogues

  Keep track of any epilogue to be executed after the kernel.
- bool execution_ended = false

  Store if the execution ended, to be notified by task_ready.
- std::condition_variable ready

  To signal when this task is ready.
- std::mutex ready_mutex

  To protect the access to the condition variable.
- std::shared_ptr< detail::queue > owner_queue

  Keep track of the queue used to submission to notify kernel completion or to run OpenCL kernels on.
- std::shared_ptr< cl::sycl::detail::kernel > kernel

10.22.1 Detailed Description

The abstraction to represent SYCL tasks executing inside command_group.

"enable_shared_from_this" allows to access the shared_ptr behind the scene.

Definition at line 34 of file task.hpp.

10.22.2 Constructor & Destructor Documentation

10.22.2.1 task()

```
cl::sycl::detail::task::task (
            const std::shared_ptr< detail::queue > & q )  [inline]
```

Create a task from a submitting queue.

Definition at line 70 of file task.hpp.

```
00071     : owner_queue { q } {}
```

10.22.3 Member Function Documentation

10.22.3.1 add_buffer()

```
void cl::sycl::detail::task::add_buffer (
            std::shared_ptr< detail::buffer_base > & buf,
            bool is_write_mode )  [inline]
```

Register a buffer to this task.

This is how the dependency graph is incrementally built.

Definition at line 170 of file task.hpp.

References TRISYCL_DUMP_T.

```
00171                                     {
00172     TRISYCL_DUMP_T("Add buffer " << buf << " in task " << this);
00173     /* Keep track of the use of the buffer to notify its release at
00174        the end of the execution */
00175     buffers_in_use.push_back(buf);
00176     // To be sure the buffer does not disappear before the kernel can run
00177     buf->use();
00178
00179     std::shared_ptr<detail::task> latest_producer;
00180     if (is_write_mode) {
00181       /* Set this task as the latest producer of the buffer so that
00182          another kernel may wait on this task */
00183       latest_producer = buf->set_latest_producer(shared_from_this());
00184     }
00185     else
00186       latest_producer = buf->get_latest_producer();
00187
00188     /* If the buffer is to be produced by a task, add the task in the
00189        producer list to wait on it before running the task core
00190
00191        If a buffer is accessed first in write mode and then in read mode,
00192        the task will add itself as a producer and will wait for itself
00193        when calling \c wait_for_producers, we avoid this by checking that
00194        \c latest_producer is not \c this
00195     */
00196     if (latest_producer && latest_producer != shared_from_this())
00197       producer_tasks.push_back(latest_producer);
00198   }
```

10.22.3.2 add_postlude()

```
void cl::sycl::detail::task::add_postlude (
            const std::function< void(void)> & f )  [inline]
```

Add a function to the postlude to run after kernel execution.

Definition at line 228 of file task.hpp.

```
00228                                                {
00229     epilogues.push_back(f);
00230   }
```

10.22.3.3 add_prelude()

```
void cl::sycl::detail::task::add_prelude (
            const std::function< void(void)> & f )  [inline]
```

Add a function to the prelude to run before kernel execution.

Definition at line 222 of file task.hpp.

```
00222                                               {
00223     prologues.push_back(f);
00224   }
```

10.22.3.4 get_kernel()

```
cl::sycl::detail::kernel& cl::sycl::detail::task::get_kernel ( )  [inline]
```

Get the kernel running if any.

Todo Specify this error in the spec

Definition at line 249 of file task.hpp.

References kernel.

```
00249                                  {
00250     if (!kernel)
00251       throw non_cl_error("Cannot use an OpenCL kernel in this context");
00252     return *kernel;
00253   }
```

10.22.3.5 get_queue()

```
auto cl::sycl::detail::task::get_queue ( )  [inline]
```

Get the queue behind the task to run a kernel on.

Definition at line 234 of file task.hpp.

References owner_queue.

```
00234                     {
00235     return owner_queue;
00236   }
```

10.22.3.6 notify_consumers()

```
void cl::sycl::detail::task::notify_consumers ( )  [inline]
```

Notify the waiting tasks that we are done.

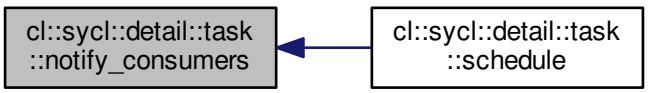
Definition at line 143 of file task.hpp.

References TRISYCL_DUMP_T.

Referenced by schedule().

```
00143                           {
00144     TRISYCL_DUMP_T("Notify all the task waiting for this task " << this);
00145     {
00146       std::unique_lock<std::mutex> ul { ready_mutex };
00147       execution_ended = true;
00148     }
00149     /* \todo Verify that the memory model with the notify does not
00150        require some fence or atomic */
00151     ready.notify_all();
00152   }
```

Here is the caller graph for this function:



10.22.3.7 postlude()

```
void cl::sycl::detail::task::postlude ( )  [inline]
```

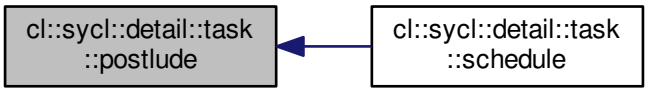
Execute the epilogues.

Definition at line 212 of file task.hpp.

Referenced by schedule().

```
00212                 {
00213     for (const auto &p : epilogues)
00214       p();
00215     /* Free the functors that may own an accessor owning a buffer
00216        preventing the command group to complete */
00217     epilogues.clear();
00218   }
```

Here is the caller graph for this function:



10.22.3.8 prelude()

```
void cl::sycl::detail::task::prelude ( )  [inline]
```

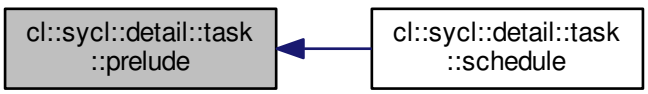
Execute the prologues.

Definition at line 202 of file task.hpp.

Referenced by schedule().

```
00202                 {
00203     for (const auto &p : prologues)
00204       p();
00205     /* Free the functors that may own an accessor owning a buffer
00206        preventing the command group to complete */
00207     prologues.clear();
00208   }
```

Here is the caller graph for this function:



10.22.3.9 release_buffers()

```
void cl::sycl::detail::task::release_buffers ( )  [inline]
```

Release the buffers that have been used by this task.

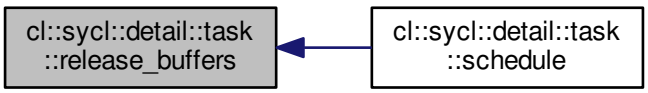
Definition at line 134 of file task.hpp.

References TRISYCL_DUMP_T.

Referenced by schedule().

```
00134                          {
00135     TRISYCL_DUMP_T("Task " << this << " releases the written buffers");
00136     for (auto b: buffers_in_use)
00137       b->release();
00138     buffers_in_use.clear();
00139   }
```

Here is the caller graph for this function:



10.22.3.10 schedule()

```
void cl::sycl::detail::task::schedule (
             std::function< void(void)> f )  [inline]
```

Add a new task to the task graph and schedule for execution.

Detach the thread since it will synchronize by its own means

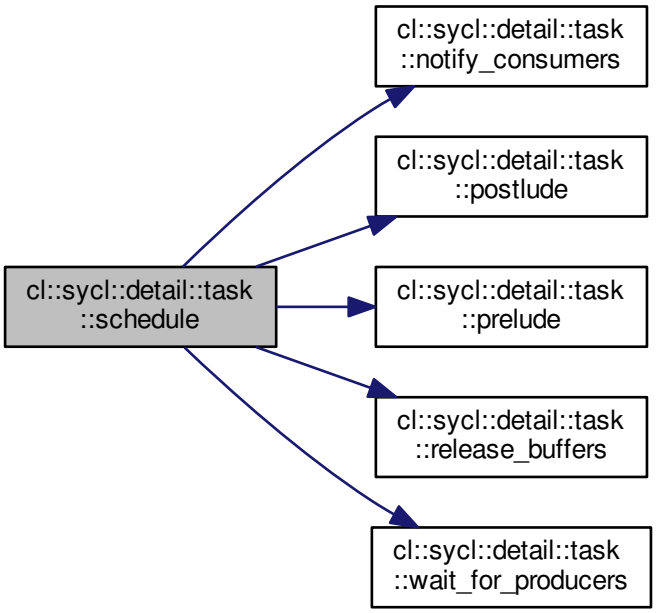
Todo This is an issue if there is an exception in the kernel

Definition at line 75 of file task.hpp.

References notify_consumers(), postlude(), prelude(), release_buffers(), TRISYCL_DUMP_T, and wait_for_↩ producers().

```
00075                                           {
00076     /* To keep a copy of the task shared_ptr after the end of the
00077        command group, capture it by copy in the following lambda. This
00078        should be easier in C++17 with move semantics on capture
00079     */
00080     auto task = shared_from_this();
00081     auto execution = [=] {
00082       // Wait for the required tasks to be ready
00083       task->wait_for_producers();
00084       task->prelude();
00085       TRISYCL_DUMP_T("Execute the kernel");
00086       // Execute the kernel
00087       f();
00088       task->postlude();
00089       // Release the buffers that have been written by this task
00090       task->release_buffers();
00091       // Notify the waiting tasks that we are done
00092       task->notify_consumers();
00093       // Notify the queue we are done
00094       owner_queue->kernel_end();
00095       TRISYCL_DUMP_T("Task thread exit");
00096     };
00097     /* Notify the queue that there is a kernel submitted to the
00098        queue. Do not do it in the task contructor so that we can deal
00099        with command group without kernel and if we put it inside the
00100        thread, the queue may have finished before the thread is
00101        scheduled */
00102     owner_queue->kernel_start();
00103     /* \todo it may be implementable with packaged_task that would
00104        deal with exceptions in kernels
00105     */
00106 #ifndef TRISYCL_NO_ASYNC
00107     /* If in asynchronous execution mode, execute the functor in a new
00108        thread */
00109     std::thread thread(execution);
00110     TRISYCL_DUMP_T("Task thread started");
00111     /** Detach the thread since it will synchronize by its own means
00112
00113         \todo This is an issue if there is an exception in the kernel
00114     */
00115     thread.detach();
00116 #else
00117     // Just a synchronous execution otherwise
00118     execution();
00119 #endif
00120   }
```

Here is the call graph for this function:



10.22.3.11 set_kernel()

```
void cl::sycl::detail::task::set_kernel (
            const std::shared_ptr< cl::sycl::detail::kernel > & k )  [inline]
```

Set the kernel running this task if any.

Definition at line 240 of file task.hpp.

```
00240                                                                {
00241     kernel = k;
00242   }
```

10.22.3.12 wait()

```
void cl::sycl::detail::task::wait ( )  [inline]
```

Wait for this task to be ready.

This is to be called from another thread

Definition at line 159 of file task.hpp.

References execution_ended, and TRISYCL_DUMP_T.

```
00159               {
00160     TRISYCL_DUMP_T("The task wait for task " << this << " to end");
00161     std::unique_lock<std::mutex> ul { ready_mutex };
00162     ready.wait(ul, [&] { return execution_ended; });
00163   }
```

10.22.3.13 wait_for_producers()

```
void cl::sycl::detail::task::wait_for_producers ( )  [inline]
```

Wait for the required producer tasks to be ready.

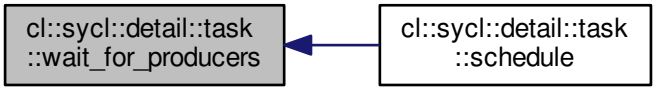
Definition at line 124 of file task.hpp.

References TRISYCL_DUMP_T.

Referenced by schedule().

```
00124                           {
00125     TRISYCL_DUMP_T("Task " << this << " waits for the producer tasks");
00126     for (auto &t : producer_tasks)
00127       t->wait();
00128     // We can let the producers rest in peace
00129     producer_tasks.clear();
00130   }
```

Here is the caller graph for this function:



10.22.4 Member Data Documentation

10.22.4.1 buffers_in_use

```
std::vector<std::shared_ptr<detail::buffer_base> > cl::sycl::detail::task::buffers_in_use
```

List of the buffers used by this task.

Todo Use a set to check that some buffers are not used many times at least on writing

Definition at line 42 of file task.hpp.

10.22.4.2 epilogues

```
std::vector<std::function<void(void)> > cl::sycl::detail::task::epilogues
```

Keep track of any epilogue to be executed after the kernel.

Definition at line 51 of file task.hpp.

10.22.4.3 execution_ended

```
bool cl::sycl::detail::task::execution_ended = false
```

Store if the execution ended, to be notified by task_ready.

Definition at line 54 of file task.hpp.

Referenced by wait().

10.22.4.4 kernel

```
std::shared_ptr<cl::sycl::detail::kernel> cl::sycl::detail::task::kernel
```

Definition at line 66 of file task.hpp.

Referenced by get_kernel().

10.22.4.5 owner_queue

```
std::shared_ptr<detail::queue> cl::sycl::detail::task::owner_queue
```

Keep track of the queue used to submission to notify kernel completion or to run OpenCL kernels on.

Definition at line 64 of file task.hpp.

Referenced by get_queue().

10.22.4.6 producer_tasks

```
std::vector<std::shared_ptr<detail::task> > cl::sycl::detail::task::producer_tasks
```

The tasks producing the buffers used by this task.

Definition at line 45 of file task.hpp.

10.22.4.7 prologues

```
std::vector<std::function<void(void)> > cl::sycl::detail::task::prologues
```

Keep track of any prologue to be executed before the kernel.

Definition at line 48 of file task.hpp.

10.22.4.8 ready

```
std::condition_variable cl::sycl::detail::task::ready
```

To signal when this task is ready.

Definition at line 57 of file task.hpp.

10.22.4.9 ready_mutex

```
std::mutex cl::sycl::detail::task::ready_mutex
```

To protect the access to the condition variable.

Definition at line 60 of file task.hpp.

The documentation for this struct was generated from the following file:

- include/CL/sycl/command_group/detail/task.hpp

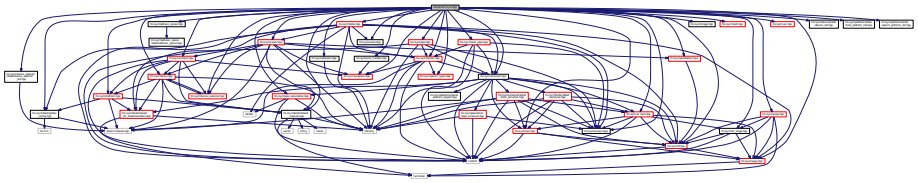
Chapter 11

File Documentation

11.1 include/CL/sycl.hpp File Reference

```
#include "CL/sycl/detail/global_config.hpp"
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/access.hpp"
#include "CL/sycl/accessor.hpp"
#include "CL/sycl/allocator.hpp"
#include "CL/sycl/address_space.hpp"
#include "CL/sycl/buffer.hpp"
#include "CL/sycl/context.hpp"
#include "CL/sycl/device.hpp"
#include "CL/sycl/device_selector.hpp"
#include "CL/sycl/error_handler.hpp"
#include "CL/sycl/event.hpp"
#include "CL/sycl/exception.hpp"
#include "CL/sycl/group.hpp"
#include "CL/sycl/handler.hpp"
#include "CL/sycl/id.hpp"
#include "CL/sycl/image.hpp"
#include "CL/sycl/item.hpp"
#include "CL/sycl/math.hpp"
#include "CL/sycl/nd_item.hpp"
#include "CL/sycl/nd_range.hpp"
#include "CL/sycl/opencl_types.hpp"
#include "CL/sycl/parallelism.hpp"
#include "CL/sycl/pipe.hpp"
#include "CL/sycl/pipe_reservation.hpp"
#include "CL/sycl/platform.hpp"
#include "CL/sycl/queue.hpp"
#include "CL/sycl/range.hpp"
#include "CL/sycl/static_pipe.hpp"
#include "CL/sycl/vec.hpp"
#include "CL/sycl/device_selector/detail/device_selector_tail.hpp"
#include "CL/sycl/device/detail/device_tail.hpp"
#include "CL/sycl/platform/detail/host_platform_tail.hpp"
#include "CL/sycl/platform/detail/opencl_platform_tail.hpp"
```

Include dependency graph for sycl.hpp:



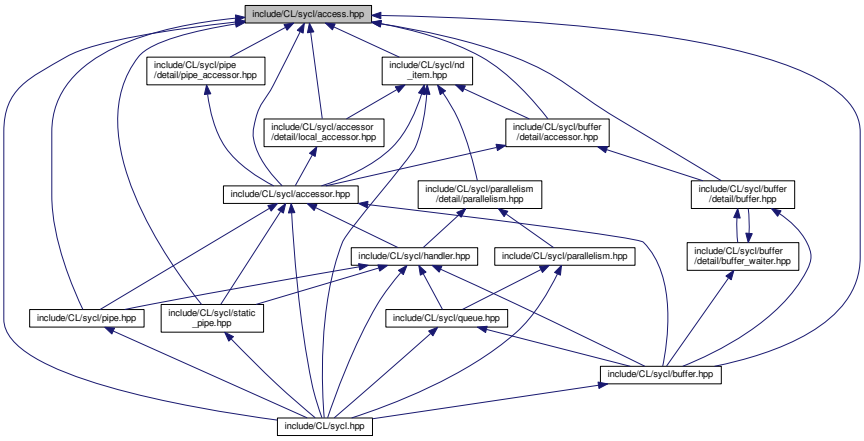
11.2 sycl.hpp

```
00001 /** \file
00002
00003     \mainpage
00004
00005     This is the main OpenCL SYCL C++ header file to experiment with
00006     the OpenCL CL provisional specification.
00007
00008     For more information about OpenCL SYCL:
00009     http://www.khronos.org/sycl/
00010
00011     For more information on this project and to access to the source of
00012     this file, look at https://github.com/triSYCL/triSYCL
00013
00014     The Doxygen version of the implementation itself is in
00015     http://Xilinx.github.io/triSYCL/Doxygen/triSYCL/html and
00016     http://Xilinx.github.io/triSYCL/Doxygen/triSYCL/triSYCL-implementation-refman.pdf
00017
00018
00019     Ronan at keryell dot FR
00020
00021     Copyright 2014--2015 Advanced Micro Devices, Inc.
00022
00023     Copyright 2015--2017 Xilinx, Inc.
00024
00025     This file is distributed under the University of Illinois Open Source
00026     License. See LICENSE.TXT for details.
00027 */
00028
00029
00030 /** Some global triSYCL configuration */
00031 #include "CL/sycl/detail/global_config.hpp"
00032 #include "CL/sycl/detail/default_classes.hpp"
00033
00034
00035 /* All the SYCL components, one per file */
00036 #include "CL/sycl/access.hpp"
00037 #include "CL/sycl/accessor.hpp"
00038 #include "CL/sycl/allocator.hpp"
00039 #include "CL/sycl/address_space.hpp"
00040 #include "CL/sycl/buffer.hpp"
00041 #include "CL/sycl/context.hpp"
00042 #include "CL/sycl/device.hpp"
00043 #include "CL/sycl/device_selector.hpp"
00044 #include "CL/sycl/error_handler.hpp"
00045 #include "CL/sycl/event.hpp"
00046 #include "CL/sycl/exception.hpp"
00047 #include "CL/sycl/group.hpp"
00048 #include "CL/sycl/handler.hpp"
00049 #include "CL/sycl/id.hpp"
00050 #include "CL/sycl/image.hpp"
00051 #include "CL/sycl/item.hpp"
00052 #include "CL/sycl/math.hpp"
00053 #include "CL/sycl/nd_item.hpp"
00054 #include "CL/sycl/nd_range.hpp"
00055 #include "CL/sycl/opencl_types.hpp"
00056 #include "CL/sycl/parallelism.hpp"
00057 #include "CL/sycl/pipe.hpp"
00058 #include "CL/sycl/pipe_reservation.hpp"
00059 #include "CL/sycl/platform.hpp"
00060 #include "CL/sycl/queue.hpp"
00061 #include "CL/sycl/range.hpp"
00062 #include "CL/sycl/static_pipe.hpp"
00063 #include "CL/sycl/vec.hpp"
00064
00065 // Some includes at the end to break some dependencies
```

```
00066 #include "CL/sycl/device_selector/detail/device_selector_tail.hpp
      "
00067 #include "CL/sycl/device/detail/device_tail.hpp"
00068 #include "CL/sycl/platform/detail/host_platform_tail.hpp"
00069 #ifdef TRISYCL_OPENCL
00070 #include "CL/sycl/platform/detail/opencl_platform_tail.hpp"
00071 #endif
00072
00073 /*
00074     # Some Emacs stuff:
00075     ### Local Variables:
00076     ### ispell-local-dictionary: "american"
00077     ### eval: (flyspell-prog-mode)
00078     ### End:
00079 */
```

11.3 include/CL/sycl/access.hpp File Reference

This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::access

  Describe the type of access by kernels.

Enumerations

- enum cl::sycl::access::mode { cl::sycl::access::mode::read = 42, cl::sycl::access::mode::write, cl::sycl::access::mode::read_write, cl::sycl::access::mode::discard_write, cl::sycl::access::mode::discard_read_write, cl::sycl::access::mode::atomic }

  This describes the type of the access mode to be used via accessor.
- enum cl::sycl::access::target { cl::sycl::access::target::global_buffer = 2014, cl::sycl::access::target::constant_buffer, cl::sycl::access::target::local, cl::sycl::access::target::image, cl::sycl::access::target::host_buffer, cl::sycl::access::target::host_image, cl::sycl::access::target::image_array, cl::sycl::access::target::pipe, cl::sycl::access::target::blocking_pipe }

The target enumeration describes the type of object to be accessed via the accessor.

- enum cl::sycl::access::fence_space : char { cl::sycl::access::fence_space::local_space, cl::sycl::access::fence_space::global_space, cl::sycl::access::fence_space::global_and_local }

  Precise the address space a barrier needs to act on.

11.4 access.hpp

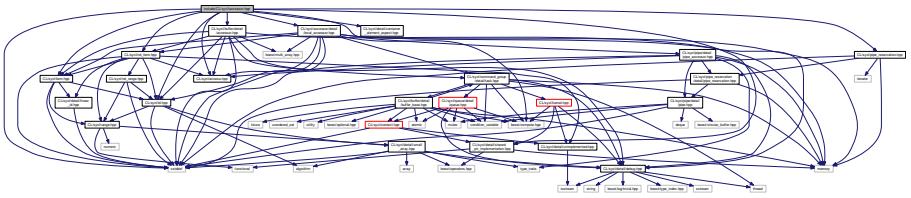
```
00001 #ifndef TRISYCL_SYCL_ACCESS_HPP
00002 #define TRISYCL_SYCL_ACCESS_HPP
00003
00004 /** \file The OpenCL SYCL access naming space
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 // SYCL dwells in the cl::sycl namespace
00013 namespace cl {
00014 namespace sycl {
00015
00016 /** \addtogroup data Data access and storage in SYCL
00017
00018     @{
00019 */
00020
00021 /** Describe the type of access by kernels.
00022
00023     \todo This values should be normalized to allow separate compilation
00024     with different implementations?
00025 */
00026 namespace access {
00027   /* By using "enum mode" here instead of "enum struct mode", we have for
00028      example "write" appearing both as cl::sycl::access::mode::write and
00029      cl::sycl::access::write, instead of only the last one. This seems
00030      more conform to the specification. */
00031
00032   /// This describes the type of the access mode to be used via accessor
00033   enum class mode {
00034     read = 42, /**< Read-only access. Insist on the fact that
00035                   read_write != read + write */
00036     write, ///< Write-only access, but previous content *not* discarded
00037     read_write, ///< Read and write access
00038     discard_write, ///< Write-only access and previous content discarded
00039     discard_read_write, /**< Read and write access and previous
00040                            content discarded*/
00041     atomic ///< Atomic access
00042   };
00043
00044
00045   /** The target enumeration describes the type of object to be accessed
00046       via the accessor
00047   */
00048   enum class target {
00049     global_buffer = 2014, //< Just pick a random number...
00050     constant_buffer,
00051     local,
00052     image,
00053     host_buffer,
00054     host_image,
00055     image_array,
00056     pipe,
00057     blocking_pipe
00058   };
00059
00060
00061   /** Precise the address space a barrier needs to act on
00062   */
00063   enum class fence_space : char {
00064     local_space,
00065     global_space,
00066     global_and_local
00067   };
00068
00069 }
00070
00071 /// @} End the data Doxygen group
00072
00073 }
```

```
00074 }
00075
00076 /*
00077     # Some Emacs stuff:
00078     ### Local Variables:
00079     ### ispell-local-dictionary: "american"
00080     ### eval: (flyspell-prog-mode)
00081     ### End:
00082 */
00083
00084 #endif // TRISYCL_SYCL_ACCESS_HPP
```

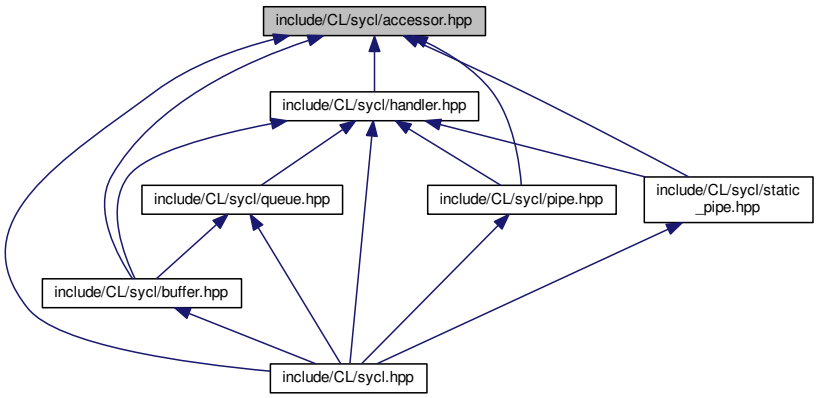
11.5 include/CL/sycl/accessor.hpp File Reference

```
#include <cstddef>
#include "CL/sycl/access.hpp"
#include "CL/sycl/accessor/detail/local_accessor.hpp"
#include "CL/sycl/buffer/detail/accessor.hpp"
#include "CL/sycl/detail/container_element_aspect.hpp"
#include "CL/sycl/detail/shared_ptr_implementation.hpp"
#include "CL/sycl/id.hpp"
#include "CL/sycl/item.hpp"
#include "CL/sycl/nd_item.hpp"
#include "CL/sycl/pipe_reservation.hpp"
#include "CL/sycl/pipe/detail/pipe_accessor.hpp"
```

Include dependency graph for accessor.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::buffer< T, Dimensions, Allocator >

  A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on. More...
- class cl::sycl::pipe< T >

  A SYCL pipe. More...
- class cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >

  The accessor abstracts the way buffer or pipe data are accessed inside a kernel in a multidimensional variable length array way. More...
- class cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >

  The pipe accessor abstracts the way pipe data are accessed inside a kernel. More...
- class cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >

  The pipe accessor abstracts the way pipe data are accessed inside a kernel. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Functions

- template<typename Accessor >
  static auto & cl::sycl::get_pipe_detail (Accessor &a)

  Top-level function to break circular dependencies on the the types to get the pipe implementation.

11.6 accessor.hpp

```
00001 #ifndef TRISYCL_SYCL_ACCESSOR_HPP
00002 #define TRISYCL_SYCL_ACCESSOR_HPP
00003
00004 /** \file The OpenCL SYCL accessor<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013
00014 #include "CL/sycl/access.hpp"
00015 #include "CL/sycl/accessor/detail/local_accessor.hpp"
00016 #include "CL/sycl/buffer/detail/accessor.hpp"
00017 #include "CL/sycl/detail/container_element_aspect.hpp"
00018 #include "CL/sycl/detail/shared_ptr_implementation.hpp"
00019 #include "CL/sycl/id.hpp"
00020 #include "CL/sycl/item.hpp"
00021 #include "CL/sycl/nd_item.hpp"
00022 #include "CL/sycl/pipe_reservation.hpp"
00023 #include "CL/sycl/pipe/detail/pipe_accessor.hpp"
00024
00025 namespace cl {
00026 namespace sycl {
00027
00028 template <typename T, int Dimensions, typename Allocator>
00029 class buffer;
00030 template <typename T>
00031 class pipe;
00032 class handler;
00033
```

```
00034 /** \addtogroup data Data access and storage in SYCL
00035     @{
00036 */
00037
00038 /** The accessor abstracts the way buffer or pipe data are accessed
00039     inside a kernel in a multidimensional variable length array way.
00040
00041     \todo Implement it for images according so section 3.3.4.5
00042 */
00043 template <typename DataType,
00044           int Dimensions,
00045           access::mode AccessMode,
00046           access::target Target = access::target::global_buffer>
00047 class accessor :
00048     public detail::shared_ptr_implementation<accessor<DataType,
00049                                                       Dimensions,
00050                                                       AccessMode,
00051                                                       Target>,
00052                                              detail::accessor<DataType,
00053                                                               Dimensions,
00054                                                               AccessMode,
00055                                                               Target>>,
00056     public detail::container_element_aspect<DataType> {
00057
00058  public:
00059
00060   /// \todo in the specification: store the dimension for user request
00061   static constexpr auto dimensionality = Dimensions;
00062
00063  private:
00064
00065   using accessor_detail = typename detail::accessor<DataType,
00066                                                     Dimensions,
00067                                                     AccessMode,
00068                                                     Target>;
00069
00070   // The type encapsulating the implementation
00071   using implementation_t = typename
      accessor::shared_ptr_implementation;
00072
00073   // Allows the comparison operation to access the implementation
00074   friend implementation_t;
00075
00076  public:
00077
00078   // Make the implementation member directly accessible in this class
00079   using implementation_t::implementation;
00080
00081   /** Construct a buffer accessor from a buffer using a command group
00082       handler object from the command group scope
00083
00084       Constructor only available for global_buffer or constant_buffer
00085       target.
00086
00087       access_target defines the form of access being obtained.
00088
00089       \todo Add template allocator type in all the accessor
00090       constructors in the specification or just use a more opaque
00091       Buffer type?
00092
00093       \todo fix specification where access mode should be target
00094       instead
00095   */
00096   template <typename Allocator>
00097   accessor(buffer<DataType, Dimensions, Allocator> &
      target_buffer,
00098            handler &command_group_handler) : implementation_t {
00099     new detail::accessor<DataType, Dimensions, AccessMode, Target>
      {
00100       target_buffer.implementation->implementation, command_group_handler }
00101   } {
00102     static_assert(Target == access::target::global_buffer
00103                   || Target == access::target::constant_buffer,
00104                   "access target should be global_buffer or constant_buffer "
00105                   "when a handler is used");
00106     // Now the implementation is created, register it
00107     implementation->register_accessor();
00108   }
00109
00110
00111   /** Construct a buffer accessor from a buffer
00112
00113       Constructor only available for host_buffer target.
00114
00115       access_target defines the form of access being obtained.
00116   */
00117   template <typename Allocator>
```

```
00118   accessor(buffer<DataType, Dimensions, Allocator> &
      target_buffer)
00119     : implementation_t {
00120     new detail::accessor<DataType, Dimensions, AccessMode, Target>
       {
00121       target_buffer.implementation->implementation }
00122    } {
00123     static_assert(Target == access::target::host_buffer,
00124                   "without a handler, access target should be host_buffer");
00125   }
00126
00127
00128   /** Construct a buffer accessor from a buffer given a specific range for
00129       access permissions and an offset that provides the starting point
00130       for the access range using a command group handler object from the
00131       command group scope
00132
00133       This accessor limits the processing of the buffer to the [offset,
00134       offset+range[ for every dimension. Any other parts of the buffer
00135       will be unaffected.
00136
00137       Constructor only available for access modes global_buffer, and
00138       constant_buffer (see Table "Buffer accessor constructors").
00139       access_target defines the form of access being obtained.
00140
00141       This accessor is recommended for discard-write and discard read
00142       write access modes, when the unaffected parts of the processing
00143       should be retained.
00144   */
00145   template <typename Allocator>
00146   accessor(buffer<DataType, Dimensions, Allocator> &
      target_buffer,
00147            handler &command_group_handler,
00148            const range<Dimensions> &offset,
00149            const range<Dimensions> &range) {
00150     detail::unimplemented();
00151   }
00152
00153
00154   /** Construct an accessor of dimension Dimensions with elements of type
00155       DataType using the passed range to specify the size in each
00156       dimension
00157
00158       It needs as a parameter a command group handler object from the
00159       command group scope. Constructor only available if AccessMode is
00160       local, see Table 3.25.
00161   */
00162   accessor(const range<Dimensions> &allocation_size,
00163            handler &command_group_handler)
00164     : implementation_t { new detail::accessor<DataType,
00165                                               Dimensions,
00166                                               AccessMode,
00167                                               access::target::local> {
00168       allocation_size, command_group_handler
00169         }
00170   }
00171   {
00172     static_assert(Target == access::target::local,
00173                   "This accessor constructor requires "
00174                   "access target be local");
00175   }
00176
00177
00178   /** Return a range object representing the size of the buffer in
00179       terms of number of elements in each dimension as passed to the
00180       constructor
00181
00182       \todo Move on
00183       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00184       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00185   */
00186   auto get_range() const {
00187     /* Interpret the shape which is a pointer to the first element as an
00188        array of Dimensions elements so that the range<Dimensions>
00189        constructor is happy with this collection
00190
00191        \todo Add also a constructor in range<> to accept a const
00192        std::size_t *?
00193     */
00194     return implementation->get_range();
00195   }
00196
00197
00198   /** Returns the total number of elements behind the accessor
00199
00200       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
00201
```

```
00202       \todo Move on
00203       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00204       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00205   */
00206   auto get_count() const {
00207     return implementation->get_count();
00208   }
00209
00210
00211   /** Returns the size of the underlying buffer storage in bytes
00212
00213       \todo It is incompatible with buffer get_size() in the spec
00214
00215       \todo Move on
00216       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00217       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00218   */
00219   auto get_size() const {
00220     return implementation->get_size();
00221   }
00222
00223
00224   /** Use the accessor with integers à la [][][]
00225
00226       Use array_view_type::reference instead of auto& because it does not
00227       work in some dimensions.
00228    */
00229   typename accessor_detail::reference operator[](std::size_t index) {
00230     return (*implementation)[index];
00231   }
00232
00233
00234   /** Use the accessor with integers à la [][][]
00235
00236       Use array_view_type::reference instead of auto& because it does not
00237       work in some dimensions.
00238    */
00239   typename accessor_detail::reference operator[](std::size_t index) const {
00240     return (*implementation)[index];
00241   }
00242
00243
00244   /// To use the accessor with [id<>]
00245   auto &operator[](id<dimensionality> index) {
00246     return (*implementation)[index];
00247   }
00248
00249
00250   /// To use the accessor with [id<>]
00251   auto &operator[](id<dimensionality> index) const {
00252     return (*implementation)[index];
00253   }
00254
00255
00256   /// To use an accessor with [item<>]
00257   auto &operator[](item<dimensionality> index) {
00258     return (*this)[index.get_id()];
00259   }
00260
00261
00262   /// To use an accessor with [item<>]
00263   auto &operator[](item<dimensionality> index) const {
00264     return (*this)[index.get_id()];
00265   }
00266
00267
00268   /** To use an accessor with an [nd_item<>]
00269
00270       \todo Add in the specification because used by HPC-GPU slide 22
00271   */
00272   auto &operator[](nd_item<dimensionality> index) {
00273     return (*this)[index.get_global()];
00274   }
00275
00276   /** To use an accessor with an [nd_item<>]
00277
00278       \todo Add in the specification because used by HPC-GPU slide 22
00279   */
00280   auto &operator[](nd_item<dimensionality> index) const {
00281     return (*this)[index.get_global()];
00282   }
00283
00284
00285     /** Get the first element of the accessor
00286
00287       Useful with an accessor on a scalar for example.
00288
```

```
00289       \todo Add in the specification
00290   */
00291   typename accessor_detail::reference operator*() {
00292     return **implementation;
00293   }
00294
00295
00296   /** Get the first element of the accessor
00297
00298       Useful with an accessor on a scalar for example.
00299
00300       \todo Add in the specification?
00301
00302       \todo Add the concept of 0-dim buffer and accessor for scalar
00303       and use an implicit conversion to value_type reference to access
00304       the value with the accessor?
00305   */
00306   typename accessor_detail::reference operator*() const {
00307     return **implementation;
00308   }
00309
00310
00311   /** Get the pointer to the start of the data
00312
00313       \todo Should it be named data() instead? */
00314   auto
00315   get_pointer() const {
00316     return implementation->get_pointer();
00317   }
00318
00319
00320   /** Forward all the iterator functions to the implementation
00321
00322       \todo Add these functions to the specification
00323
00324       \todo The fact that the lambda capture make a const copy of the
00325       accessor is not yet elegantly managed... The issue is that
00326       begin()/end() dispatch is made according to the accessor
00327       constness and not from the array member constness...
00328
00329       \todo try to solve it by using some enable_if on array
00330       constness?
00331
00332       \todo The issue is that the end may not be known if it is
00333       implemented by a raw OpenCL cl_mem... So only provide on the
00334       device the iterators related to the start? Actually the accessor
00335       needs to know a part of the shape to have the multidimentional
00336       addressing. So this only require a size_t more...
00337
00338       \todo Factor out these in a template helper
00339   */
00340
00341
00342   // iterator begin() { return array.begin(); }
00343   typename accessor_detail::iterator begin() const {
00344     return implementation->begin();
00345   }
00346
00347
00348   // iterator end() { return array.end(); }
00349   typename accessor_detail::iterator end() const {
00350     return implementation->end();
00351   }
00352
00353
00354   // const_iterator begin() const { return implementation->begin(); }
00355
00356
00357   // const_iterator end() const { return implementation->end(); }
00358
00359
00360   typename accessor_detail::const_iterator cbegin() const {
00361     return implementation->cbegin();
00362   }
00363
00364
00365   typename accessor_detail::const_iterator cend() const {
00366     return implementation->cend();
00367   }
00368
00369
00370   typename accessor_detail::reverse_iterator rbegin() const {
00371     return implementation->rbegin();
00372   };
00373
00374
00375   typename accessor_detail::reverse_iterator rend() const {
```

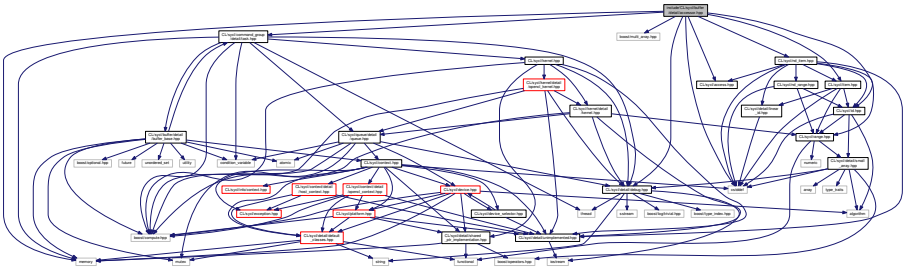
```
00376     return implementation->rend();
00377   }
00378
00379
00380   // const_reverse_iterator rbegin() const { return array.rbegin(); }
00381
00382
00383   // const_reverse_iterator rend() const { return array.rend(); }
00384
00385
00386   typename accessor_detail::const_reverse_iterator crbegin() const {
00387     return implementation->rbegin();
00388   }
00389
00390
00391   typename accessor_detail::const_reverse_iterator crend() const {
00392     return implementation->rend();
00393   }
00394
00395 };
00396
00397
00398 /** The pipe accessor abstracts the way pipe data are accessed inside
00399     a kernel
00400
00401     A specialization for an non-blocking pipe
00402 */
00403 template <typename DataType,
00404           access::mode AccessMode>
00405 class accessor<DataType, 1, AccessMode, access::target::pipe> :
00406     public detail::pipe_accessor<DataType, AccessMode, access::target::pipe> {
00407 public:
00408
00409   using accessor_detail =
00410     detail::pipe_accessor<DataType, AccessMode, access::target::pipe>
    ;
00411   // Inherit of the constructors to have accessor constructor from detail
00412   using accessor_detail::accessor_detail;
00413
00414   /** Construct a pipe accessor from a pipe using a command group
00415       handler object from the command group scope
00416
00417       access_target defines the form of access being obtained.
00418   */
00419   accessor(pipe<DataType> &p, handler &command_group_handler)
00420     : accessor_detail { p.implementation, command_group_handler } { }
00421
00422   /// Make a reservation inside the pipe
00423   pipe_reservation<accessor> reserve(std::size_t size) const {
00424     return accessor_detail::reserve(size);
00425   }
00426
00427
00428   /// Get the underlying pipe implementation
00429   auto &get_pipe_detail() {
00430     return accessor_detail::get_pipe_detail();
00431   }
00432
00433 };
00434
00435
00436 /** The pipe accessor abstracts the way pipe data are accessed inside
00437     a kernel
00438
00439     A specialization for a blocking pipe
00440 */
00441 template <typename DataType,
00442           access::mode AccessMode>
00443 class accessor<DataType, 1, AccessMode, access::target::blocking_pipe> :
00444     public detail::pipe_accessor<DataType, AccessMode, access::target::blocking_pipe>
     {
00445 public:
00446
00447   using accessor_detail =
00448     detail::pipe_accessor<DataType, AccessMode, access::target::blocking_pipe>
    ;
00449   // Inherit of the constructors to have accessor constructor from detail
00450   using accessor_detail::accessor_detail;
00451
00452   /** Construct a pipe accessor from a pipe using a command group
00453       handler object from the command group scope
00454
00455       access_target defines the form of access being obtained.
00456   */
00457   accessor(pipe<DataType> &p, handler &command_group_handler)
00458     : accessor_detail { p.implementation, command_group_handler } { }
00459
```

```
00460
00461   /// Make a reservation inside the pipe
00462   pipe_reservation<accessor> reserve(std::size_t size) const {
00463     return accessor_detail::reserve(size);
00464   }
00465
00466
00467   /// Get the underlying pipe implementation
00468   auto &get_pipe_detail() {
00469     return accessor_detail::get_pipe_detail();
00470   }
00471
00472 };
00473
00474
00475 /** Top-level function to break circular dependencies on the the types
00476     to get the pipe implementation */
00477 template <typename Accessor>
00478 static inline auto &get_pipe_detail(Accessor &a) {
00479   return a.get_pipe_detail();
00480   }
00481
00482 /// @} End the data Doxygen group
00483
00484 }
00485 }
00486
00487 /*
00488     # Some Emacs stuff:
00489     ### Local Variables:
00490     ### ispell-local-dictionary: "american"
00491     ### eval: (flyspell-prog-mode)
00492     ### End:
00493 */
00494
00495 #endif // TRISYCL_SYCL_ACCESSOR_HPP
```

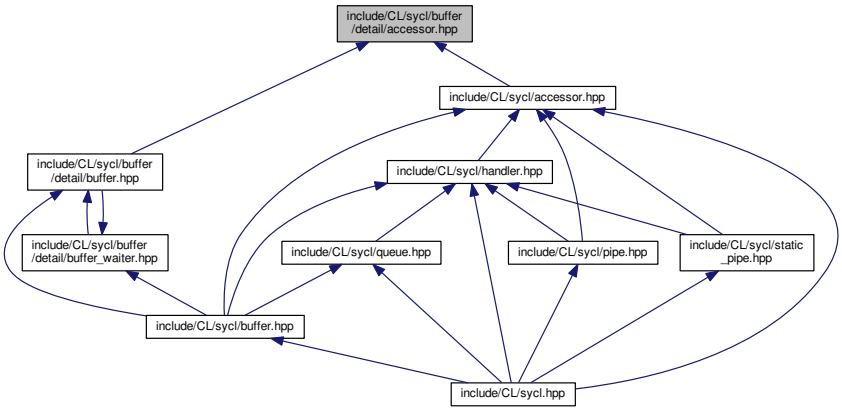
11.7 include/CL/sycl/buffer/detail/accessor.hpp File Reference

```
#include <cstddef>
#include <memory>
#include <boost/multi_array.hpp>
#include "CL/sycl/access.hpp"
#include "CL/sycl/command_group/detail/task.hpp"
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/id.hpp"
#include "CL/sycl/item.hpp"
#include "CL/sycl/nd_item.hpp"
```

Include dependency graph for accessor.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::buffer< T, Dimensions >

  A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on. More...
- class cl::sycl::detail::accessor< T, Dimensions, Mode, Target >

  The buffer accessor abstracts the way buffer data are accessed inside a kernel in a multidimensional variable length array way. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.8 accessor.hpp

```
00001 #ifndef TRISYCL_SYCL_ACCESSOR_DETAIL_ACCESSOR_HPP
00002 #define TRISYCL_SYCL_ACCESSOR_DETAIL_ACCESSOR_HPP
00003
00004 /** \file The OpenCL SYCL buffer accessor<> detail behind the scene
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <memory>
00014
00015 #include <boost/multi_array.hpp>
00016
00017 #include "CL/sycl/access.hpp"
00018 #include "CL/sycl/command_group/detail/task.hpp"
00019 #include "CL/sycl/detail/debug.hpp"
00020 #include "CL/sycl/id.hpp"
00021 #include "CL/sycl/item.hpp"
00022 #include "CL/sycl/nd_item.hpp"
```

```
00023
00024 namespace cl {
00025 namespace sycl {
00026
00027 class handler;
00028
00029 namespace detail {
00030
00031 // Forward declaration of detail::buffer for use in accessor
00032 template <typename T, int Dimensions> class buffer;
00033
00034 /** \addtogroup data Data access and storage in SYCL
00035     @{
00036 */
00037
00038 /** The buffer accessor abstracts the way buffer data are accessed
00039     inside a kernel in a multidimensional variable length array way.
00040
00041     This implementation relies on boost::multi_array to provide this
00042     nice syntax and behaviour.
00043
00044     Right now the aim of this class is just to access to the buffer in
00045     a read-write mode, even if capturing the multi_array_ref from a
00046     lambda make it const (since in examples we have lambda with [=]
00047     without mutable lambda).
00048
00049     \todo Use the access::mode
00050 */
00051 template <typename T,
00052           int Dimensions,
00053           access::mode Mode,
00054           access::target Target /* = access::global_buffer */>
00055 class accessor :
00056     public std::enable_shared_from_this<accessor<T,
00057                                                  Dimensions,
00058                                                  Mode,
00059                                                  Target>>,
00060     public detail::debug<accessor<T,
00061                                   Dimensions,
00062                                   Mode,
00063                                   Target>> {
00064   /** Keep a reference to the accessed buffer
00065
00066       Beware that it owns the buffer, which means that the accessor
00067       has to be destroyed to release the buffer and potentially
00068       unblock a kernel at the end of its execution
00069   */
00070   std::shared_ptr<detail::buffer<T, Dimensions>> buf;
00071
00072   /// The implementation is a multi_array_ref wrapper
00073   using array_view_type = boost::multi_array_ref<T, Dimensions>;
00074
00075   // The same type but writable
00076   using writable_array_view_type =
00077     typename std::remove_const<array_view_type>::type;
00078
00079   /** The way the buffer is really accessed
00080
00081       Use a mutable member because the accessor needs to be captured
00082       by value in the lambda which is then read-only. This is to avoid
00083       the user to use mutable lambda or have a lot of const_cast as
00084       previously done in this implementation
00085    */
00086   mutable array_view_type array;
00087
00088   /// The task where the accessor is used in
00089   std::shared_ptr<detail::task> task;
00090
00091 public:
00092
00093   /** \todo in the specification: store the dimension for user request
00094
00095       \todo Use another name, such as from C++17 committee discussions.
00096    */
00097   static constexpr auto dimensionality = Dimensions;
00098
00099   /** \todo in the specification: store the types for user request as STL
00100       or C++AMP */
00101   using value_type = T;
00102   using element = T;
00103   using reference = typename array_view_type::reference;
00104   using const_reference = typename array_view_type::const_reference;
00105
00106   /** Inherit the iterator types from the implementation
00107
00108       \todo Add iterators to accessors in the specification
00109   */
```

```
00110   using iterator = typename array_view_type::iterator;
00111   using const_iterator = typename array_view_type::const_iterator;
00112   using reverse_iterator = typename array_view_type::reverse_iterator;
00113   using const_reverse_iterator =
00114     typename array_view_type::const_reverse_iterator;
00115
00116
00117   /** Construct a host accessor from an existing buffer
00118
00119       \todo fix the specification to rename target that shadows
00120       template parm
00121   */
00122   accessor(std::shared_ptr<detail::buffer<T, Dimensions>>
      target_buffer) :
00123     buf { target_buffer }, array { target_buffer->access } {
00124     target_buffer->template track_access_mode<Mode>();
00125     TRISYCL_DUMP_T("Create a host accessor write = " <<
      is_write_access());
00126     static_assert(Target == access::target::host_buffer,
00127                   "without a handler, access target should be host_buffer");
00128     /* The host needs to wait for all the producers of the buffer to
00129        have finished */
00130     buf->wait();
00131
00132 #ifdef TRISYCL_OPENCL
00133     /* For the host context, we are obligated to update the buffer state
00134        during the accessors creation, otherwise we have no way of knowing
00135        if a buffer was modified on the host. This is only true because
00136        host accessors are blocking
00137      */
00138     cl::sycl::context ctx;
00139     buf->update_buffer_state(ctx, Mode, get_size(), array.data());
00140 #endif
00141   }
00142
00143
00144   /** Construct a device accessor from an existing buffer
00145
00146       \todo fix the specification to rename target that shadows
00147       template parm
00148   */
00149   accessor(std::shared_ptr<detail::buffer<T, Dimensions>>
      target_buffer,
00150            handler &command_group_handler) :
00151     buf { target_buffer }, array { target_buffer->access } {
00152     target_buffer->template track_access_mode<Mode>();
00153     TRISYCL_DUMP_T("Create a kernel accessor write = " <<
      is_write_access());
00154     static_assert(Target == access::target::global_buffer
00155                   || Target == access::target::constant_buffer,
00156                   "access target should be global_buffer or constant_buffer "
00157                   "when a handler is used");
00158     // Register the buffer to the task dependencies
00159     task = buffer_add_to_task(buf, &command_group_handler,
      is_write_access());
00160   }
00161
00162
00163   /** Register the accessor once a \c std::shared_ptr is created on it
00164
00165       This is to be called from outside once the object is created. It
00166       has been tried directly inside the contructor, but calling \c
00167       shared_from_this() from the constructor dead-lock with
00168       libstdc++6
00169
00170       \todo Double-check with the C++ committee on this issue.
00171   */
00172   void register_accessor() {
00173 #ifdef TRISYCL_OPENCL
00174     if (!task->get_queue()->is_host()) {
00175       // To keep alive this accessor in the following lambdas
00176       auto acc = this->shared_from_this();
00177       /* Before running the kernel, make sure the cl_mem behind this
00178          accessor is up-to-date on the device if needed and pass it to
00179          the kernel */
00180       task->add_prelude([=] {
00181           acc->copy_in_cl_buffer();
00182         });
00183       // After running the kernel, deal with some copy-back if needed
00184       task->add_postlude([=] {
00185           /* Even if this function does nothing, it is required to
00186              have the capture of acc to keep the accessor alive across
00187              the kernel execution up to the execution postlude */
00188           acc->copy_back_cl_buffer();
00189         });
00190     }
00191 #endif
```

```
00192   }
00193
00194
00195   /** Return a range object representing the size of the buffer in
00196       terms of number of elements in each dimension as passed to the
00197       constructor
00198
00199       \todo Move on
00200       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00201       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00202   */
00203   auto get_range() const {
00204     /* Interpret the shape which is a pointer to the first element as an
00205        array of Dimensions elements so that the range<Dimensions>
00206        constructor is happy with this collection
00207
00208        \todo Add also a constructor in range<> to accept a const
00209        std::size_t *?
00210     */
00211     return range<Dimensions> {
00212       *(const std::size_t (*)[Dimensions])(array.shape())
00213         };
00214   }
00215
00216
00217   /** Returns the total number of elements behind the accessor
00218
00219       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
00220
00221       \todo Move on
00222       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00223       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00224   */
00225   auto get_count() const {
00226     return array.num_elements();
00227   }
00228
00229
00230   /** Returns the size of the underlying buffer storage in bytes
00231
00232       \todo Move on
00233       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00234       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00235   */
00236   auto get_size() const {
00237     return get_count()*sizeof(value_type);
00238   }
00239
00240
00241   /** Use the accessor with integers à la [][][]
00242
00243       Use array_view_type::reference instead of auto& because it does not
00244       work in some dimensions.
00245    */
00246   reference operator[](std::size_t index) {
00247     return array[index];
00248   }
00249
00250
00251   /** Use the accessor with integers à la [][][]
00252
00253       Use array_view_type::reference instead of auto& because it does not
00254       work in some dimensions.
00255    */
00256   reference operator[](std::size_t index) const {
00257     return array[index];
00258   }
00259
00260
00261   /// To use the accessor with [id<>]
00262   auto &operator[](id<dimensionality> index) {
00263     return array(index);
00264   }
00265
00266
00267   /// To use the accessor with [id<>]
00268   auto &operator[](id<dimensionality> index) const {
00269     return array(index);
00270   }
00271
00272
00273   /// To use an accessor with [item<>]
00274   auto &operator[](item<dimensionality> index) {
00275     return (*this)[index.get()];
00276   }
00277
00278
```

```
00279   /// To use an accessor with [item<>]
00280   auto &operator[](item<dimensionality> index) const {
00281     return (*this)[index.get()];
00282   }
00283
00284
00285   /** To use an accessor with an [nd_item<>]
00286
00287       \todo Add in the specification because used by HPC-GPU slide 22
00288   */
00289   auto &operator[](nd_item<dimensionality> index) {
00290     return (*this)[index.get_global()];
00291   }
00292
00293   /** To use an accessor with an [nd_item<>]
00294
00295       \todo Add in the specification because used by HPC-GPU slide 22
00296   */
00297   auto &operator[](nd_item<dimensionality> index) const {
00298     return (*this)[index.get_global()];
00299   }
00300
00301
00302   /** Get the first element of the accessor
00303
00304       Useful with an accessor on a scalar for example.
00305
00306       \todo Add in the specification
00307   */
00308   reference operator*() {
00309     return *array.data();
00310   }
00311
00312
00313   /** Get the first element of the accessor
00314
00315       Useful with an accessor on a scalar for example.
00316
00317       \todo Add in the specification?
00318
00319       \todo Add the concept of 0-dim buffer and accessor for scalar
00320       and use an implicit conversion to value_type reference to access
00321       the value with the accessor?
00322   */
00323   reference operator*() const {
00324     return *array.data();
00325   }
00326
00327
00328   /// Get the buffer used to create the accessor
00329   detail::buffer<T, Dimensions> &get_buffer() {
00330     return *buf;
00331   }
00332
00333
00334   /** Test if the accessor has a read access right
00335
00336       \todo Strangely, it is not really constexpr because it is not a
00337       static method...
00338
00339       \todo to move in the access::mode enum class and add to the
00340       specification ?
00341   */
00342   constexpr bool is_read_access() const {
00343     return Mode == access::mode::read
00344       || Mode == access::mode::read_write
00345       || Mode == access::mode::discard_read_write;
00346   }
00347
00348
00349   /** Test if the accessor has a write access right
00350
00351       \todo Strangely, it is not really constexpr because it is not a
00352       static method...
00353
00354       \todo to move in the access::mode enum class and add to the
00355       specification ?
00356   */
00357   constexpr bool is_write_access() const {
00358     return Mode == access::mode::write
00359       || Mode == access::mode::read_write
00360       || Mode == access::mode::discard_write
00361       || Mode == access::mode::discard_read_write;
00362   }
00363
00364
00365   /** Return the pointer to the data
```

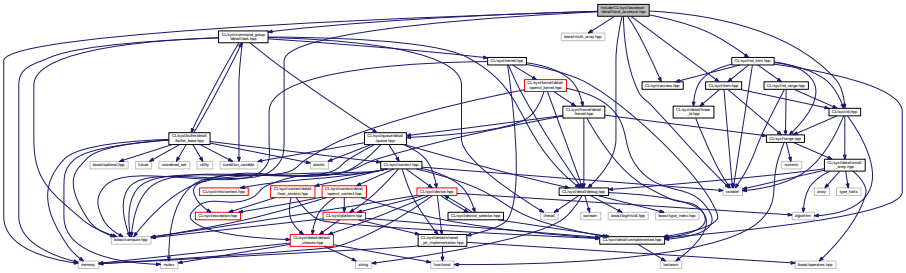
```
00366
00367       \todo Implement the various pointer address spaces
00368   */
00369   auto
00370   get_pointer() {
00371     return array.data();
00372   }
00373
00374
00375   /** Forward all the iterator functions to the implementation
00376
00377       \todo Add these functions to the specification
00378
00379       \todo The fact that the lambda capture make a const copy of the
00380       accessor is not yet elegantly managed... The issue is that
00381       begin()/end() dispatch is made according to the accessor
00382       constness and not from the array member constness...
00383
00384       \todo try to solve it by using some enable_if on array
00385       constness?
00386
00387       \todo The issue is that the end may not be known if it is
00388       implemented by a raw OpenCL cl_mem... So only provide on the
00389       device the iterators related to the start? Actually the accessor
00390       needs to know a part of the shape to have the multidimentional
00391       addressing. So this only require a size_t more...
00392
00393       \todo Factor out these in a template helper
00394
00395       \todo Do we need this in detail::accessor too or only in accessor?
00396   */
00397
00398
00399   // iterator begin() { return array.begin(); }
00400   iterator begin() const {
00401     return const_cast<writable_array_view_type &>(array).
      begin();
00402   }
00403
00404
00405   // iterator end() { return array.end(); }
00406   iterator end() const {
00407     return const_cast<writable_array_view_type &>(array).
      end();
00408   }
00409
00410
00411   // const_iterator begin() const { return array.begin(); }
00412
00413
00414   // const_iterator end() const { return array.end(); }
00415
00416
00417   const_iterator cbegin() const { return array.begin(); }
00418
00419
00420   const_iterator cend() const { return array.end(); }
00421
00422
00423   // reverse_iterator rbegin() { return array.rbegin(); }
00424   reverse_iterator rbegin() const {
00425     return const_cast<writable_array_view_type &>(array).
      rbegin();
00426   }
00427
00428
00429   // reverse_iterator rend() { return array.rend(); }
00430   reverse_iterator rend() const {
00431     return const_cast<writable_array_view_type &>(array).
      rend();
00432   }
00433
00434
00435   // const_reverse_iterator rbegin() const { return array.rbegin(); }
00436
00437
00438   // const_reverse_iterator rend() const { return array.rend(); }
00439
00440
00441   const_reverse_iterator crbegin() const { return array.rbegin(); }
00442
00443
00444   const_reverse_iterator crend() const { return array.rend(); }
00445
00446 private:
00447
00448   // The following function are used from handler
```

```
00449   friend handler;
00450
00451 #ifdef TRISYCL_OPENCL
00452   /// Get the boost::compute::buffer or throw if unset
00453   auto get_cl_buffer() const {
00454     // This throws if not set
00455     auto ctx = task->get_queue()->get_context();
00456     return buf->get_cl_buffer(ctx);
00457   }
00458
00459
00460   /** Lazily associate a CL buffer to the SYCL buffer and copy data in it
00461       if required, updates the state of the data in the buffer across contexts
00462   */
00463   void copy_in_cl_buffer() {
00464     /* Create the OpenCL buffer and copy in it the data from the host if
00465        the buffer doesn't already exists or if the data is not up to date
00466     */
00467     auto ctx = task->get_queue()->get_context();
00468     buf->update_buffer_state(ctx, Mode, get_size(), array.data());
00469   }
00470
00471
00472   /// Does nothing
00473   void copy_back_cl_buffer() {
00474     /* The copy back is handled by the host accessor and the buffer destructor.
00475        We don't need to systematically transfer the data after the
00476        kernel execution
00477
00478        \todo Figure out what to do with this function
00479     */
00480   }
00481 #endif
00482
00483 };
00484
00485 /// @} End the data Doxygen group
00486
00487 }
00488 }
00489 }
00490
00491 /*
00492     # Some Emacs stuff:
00493     ### Local Variables:
00494     ### ispell-local-dictionary: "american"
00495     ### eval: (flyspell-prog-mode)
00496     ### End:
00497 */
00498
00499 #endif // TRISYCL_SYCL_ACCESSOR_DETAIL_ACCESSOR_HPP
```

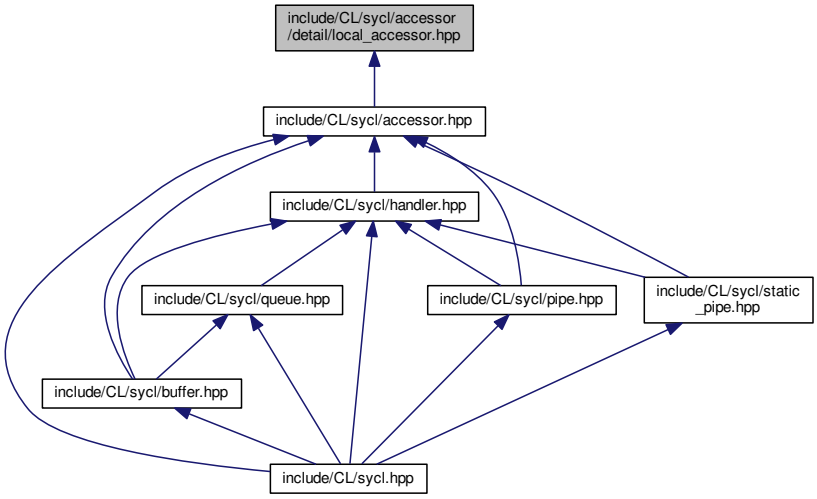
11.9 include/CL/sycl/accessor/detail/local_accessor.hpp File Reference

```
#include <cstddef>
#include <memory>
#include <boost/compute.hpp>
#include <boost/multi_array.hpp>
#include "CL/sycl/access.hpp"
#include "CL/sycl/command_group/detail/task.hpp"
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/id.hpp"
#include "CL/sycl/item.hpp"
#include "CL/sycl/nd_item.hpp"
```

Include dependency graph for local_accessor.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::accessor< T, Dimensions, Mode, Target >

  The buffer accessor abstracts the way buffer data are accessed inside a kernel in a multidimensional variable length array way. More...
- class cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >

  The local accessor specialization abstracts the way local memory is allocated to a kernel to be shared between work-items of the same work-group. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.10 local_accessor.hpp

```
00001 #ifndef TRISYCL_SYCL_ACCESSOR_DETAIL_LOCAL_ACCESSOR_HPP
00002 #define TRISYCL_SYCL_ACCESSOR_DETAIL_LOCAL_ACCESSOR_HPP
00003
00004 /** \file The OpenCL SYCL local accessor<> detail behind the scene
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <memory>
00014
00015 #ifdef TRISYCL_OPENCL
00016 #include <boost/compute.hpp>
00017 #endif
00018 #include <boost/multi_array.hpp>
00019
00020 #include "CL/sycl/access.hpp"
00021 #include "CL/sycl/command_group/detail/task.hpp"
00022 #include "CL/sycl/detail/debug.hpp"
00023 #include "CL/sycl/id.hpp"
00024 #include "CL/sycl/item.hpp"
00025 #include "CL/sycl/nd_item.hpp"
00026
00027 namespace cl {
00028 namespace sycl {
00029
00030 class handler;
00031
00032 namespace detail {
00033
00034 // Forward declaration of detail::accessor to declare the specialization
00035 template <typename T,
00036           int Dimensions,
00037           access::mode Mode,
00038           access::target Target>
00039 class accessor;
00040
00041 /** \addtogroup data Data access and storage in SYCL
00042     @{
00043 */
00044
00045 /** The local accessor specialization abstracts the way local memory
00046     is allocated to a kernel to be shared between work-items of the
00047     same work-group.
00048
00049     \todo Use the access::mode
00050 */
00051 template <typename T,
00052           int Dimensions,
00053           access::mode Mode>
00054 class accessor<T, Dimensions, Mode, access::target::local> :
00055     public detail::debug<accessor<T,
00056                                   Dimensions,
00057                                   Mode,
00058                                   access::target::local>> {
00059
00060   /// The implementation is a multi_array_ref wrapper
00061   using array_type = boost::multi_array_ref<T, Dimensions>;
00062
00063   // The same type but writable
00064   // \todo Only if T is non const actually
00065   using writable_array_type =
00066     typename std::remove_const<array_type>::type;
00067
00068   /** The way the buffer is really accessed
00069
00070       Use a mutable member because the accessor needs to be captured
00071       by value in the lambda which is then read-only. This is to avoid
00072       the user to use mutable lambda or have a lot of const_cast as
00073       previously done in this implementation
00074    */
00075   mutable writable_array_type array;
00076
00077   /** The allocation on the host for the local accessor
00078
00079       Note that this is uninitialized memory, as stated in SYCL
00080       specification.
00081   */
00082   mutable T *allocation = nullptr;
00083
00084 public:
```

```
00085
00086   /** \todo in the specification: store the dimension for user request
00087
00088       \todo Use another name, such as from C++17 committee discussions.
00089    */
00090   static constexpr auto dimensionality = Dimensions;
00091
00092   /** \todo in the specification: store the types for user request as STL
00093       or C++AMP */
00094   using value_type = T;
00095   using element = T;
00096   using reference = typename array_type::reference;
00097   using const_reference = typename array_type::const_reference;
00098
00099   /** Inherit the iterator types from the implementation
00100
00101       \todo Add iterators to accessors in the specification
00102   */
00103   using iterator = typename array_type::iterator;
00104   using const_iterator = typename array_type::const_iterator;
00105   using reverse_iterator = typename array_type::reverse_iterator;
00106   using const_reverse_iterator =
00107     typename array_type::const_reverse_iterator;
00108
00109
00110   /** Construct a device accessor from an existing buffer
00111
00112       \todo fix the specification to rename target that shadows
00113       template param
00114   */
00115   accessor(const range<Dimensions> &allocation_size,
00116            handler &command_group_handler) :
00117     array { allocate_accessor(allocation_size) } {}
00118
00119
00120   // Deallocate the memory
00121   ~accessor() {
00122     deallocate_accessor();
00123   }
00124
00125
00126   /** Return a range object representing the size of the buffer in
00127       terms of number of elements in each dimension as passed to the
00128       constructor
00129
00130       \todo Move on
00131       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00132       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00133   */
00134   auto get_range() const {
00135     /* Interpret the shape which is a pointer to the first element as an
00136        array of Dimensions elements so that the range<Dimensions>
00137        constructor is happy with this collection
00138
00139        \todo Add also a constructor in range<> to accept a const
00140        std::size_t *?
00141     */
00142     return range<Dimensions> {
00143       *(const std::size_t (*)[Dimensions])(array.shape())
00144         };
00145   }
00146
00147
00148   /** Returns the total number of elements behind the accessor
00149
00150       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
00151
00152       \todo Move on
00153       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00154       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00155   */
00156   auto get_count() const {
00157     return array.num_elements();
00158   }
00159
00160
00161   /** Returns the size of the underlying buffer storage in bytes
00162
00163       \todo Move on
00164       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00165       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00166   */
00167   auto get_size() const {
00168     return get_count()*sizeof(value_type);
00169   }
00170
00171
```

```
00172   /** Use the accessor with integers à la [][][]
00173
00174       Use array_view_type::reference instead of auto& because it does not
00175       work in some dimensions.
00176    */
00177   reference operator[](std::size_t index) {
00178     return array[index];
00179   }
00180
00181
00182   /** Use the accessor with integers à la [][][]
00183
00184       Use array_view_type::reference instead of auto& because it does not
00185       work in some dimensions.
00186    */
00187   reference operator[](std::size_t index) const {
00188     return array[index];
00189   }
00190
00191
00192   /// To use the accessor with [id<>]
00193   auto &operator[](id<dimensionality> index) {
00194     return array(index);
00195   }
00196
00197
00198   /// To use the accessor with [id<>]
00199   auto &operator[](id<dimensionality> index) const {
00200     return array(index);
00201   }
00202
00203
00204   /// To use an accessor with [item<>]
00205   auto &operator[](item<dimensionality> index) {
00206     return (*this)[index.get()];
00207   }
00208
00209
00210   /// To use an accessor with [item<>]
00211   auto &operator[](item<dimensionality> index) const {
00212     return (*this)[index.get()];
00213   }
00214
00215
00216   /** To use an accessor with an [nd_item<>]
00217
00218       \todo Add in the specification because used by HPC-GPU slide 22
00219   */
00220   auto &operator[](nd_item<dimensionality> index) {
00221     return (*this)[index.get_global()];
00222   }
00223
00224   /** To use an accessor with an [nd_item<>]
00225
00226       \todo Add in the specification because used by HPC-GPU slide 22
00227   */
00228   auto &operator[](nd_item<dimensionality> index) const {
00229     return (*this)[index.get_global()];
00230   }
00231
00232
00233   /** Get the first element of the accessor
00234
00235       Useful with an accessor on a scalar for example.
00236
00237       \todo Add in the specification
00238   */
00239   reference operator*() {
00240     return *array.data();
00241   }
00242
00243
00244   /** Get the first element of the accessor
00245
00246       Useful with an accessor on a scalar for example.
00247
00248       \todo Add in the specification?
00249
00250       \todo Add the concept of 0-dim buffer and accessor for scalar
00251       and use an implicit conversion to value_type reference to access
00252       the value with the accessor?
00253   */
00254   reference operator*() const {
00255     return *array.data();
00256   }
00257
00258
```

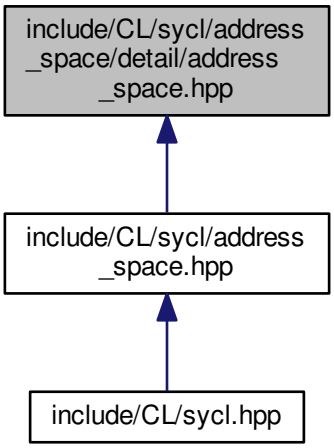
```
00259   /** Test if the accessor has a read access right
00260
00261       \todo Strangely, it is not really constexpr because it is not a
00262       static method...
00263
00264       \todo to move in the access::mode enum class and add to the
00265       specification ?
00266   */
00267   constexpr bool is_read_access() const {
00268     return Mode == access::mode::read
00269       || Mode == access::mode::read_write
00270       || Mode == access::mode::discard_read_write;
00271   }
00272
00273
00274   /** Test if the accessor has a write access right
00275
00276       \todo Strangely, it is not really constexpr because it is not a
00277       static method...
00278
00279       \todo to move in the access::mode enum class and add to the
00280       specification ?
00281   */
00282   constexpr bool is_write_access() const {
00283     return Mode == access::mode::write
00284       || Mode == access::mode::read_write
00285       || Mode == access::mode::discard_write
00286       || Mode == access::mode::discard_read_write;
00287   }
00288
00289
00290   /** Forward all the iterator functions to the implementation
00291
00292       \todo Add these functions to the specification
00293
00294       \todo The fact that the lambda capture make a const copy of the
00295       accessor is not yet elegantly managed... The issue is that
00296       begin()/end() dispatch is made according to the accessor
00297       constness and not from the array member constness...
00298
00299       \todo try to solve it by using some enable_if on array
00300       constness?
00301
00302       \todo The issue is that the end may not be known if it is
00303       implemented by a raw OpenCL cl_mem... So only provide on the
00304       device the iterators related to the start? Actually the accessor
00305       needs to know a part of the shape to have the multidimentional
00306       addressing. So this only require a size_t more...
00307
00308       \todo Factor out these in a template helper
00309
00310       \todo Do we need this in detail::accessor too or only in accessor?
00311   */
00312
00313
00314   // iterator begin() { return array.begin(); }
00315   iterator begin() const {
00316     return const_cast<writable_array_type &>(array).
      begin();
00317   }
00318
00319
00320   // iterator end() { return array.end(); }
00321   iterator end() const {
00322     return const_cast<writable_array_type &>(array).end();
00323   }
00324
00325
00326   // const_iterator begin() const { return array.begin(); }
00327
00328
00329   // const_iterator end() const { return array.end(); }
00330
00331
00332   const_iterator cbegin() const { return array.begin(); }
00333
00334
00335   const_iterator cend() const { return array.end(); }
00336
00337
00338   // reverse_iterator rbegin() { return array.rbegin(); }
00339   reverse_iterator rbegin() const {
00340     return const_cast<writable_array_type &>(array).
      rbegin();
00341   }
00342
00343
```

```
00344   // reverse_iterator rend() { return array.rend(); }
00345   reverse_iterator rend() const {
00346     return const_cast<writable_array_type &>(array).rend();
00347   }
00348
00349
00350   // const_reverse_iterator rbegin() const { return array.rbegin(); }
00351
00352
00353   // const_reverse_iterator rend() const { return array.rend(); }
00354
00355
00356   const_reverse_iterator crbegin() const { return array.rbegin(); }
00357
00358
00359   const_reverse_iterator crend() const { return array.rend(); }
00360
00361 private:
00362
00363   /// Allocate uninitialized buffer memory
00364   auto allocate_accessor(const range<Dimensions> &r) {
00365     auto count = r.get_count();
00366     // Allocate uninitialized memory
00367     allocation = std::allocator<value_type>{}.allocate(count);
00368     return boost::multi_array_ref<value_type, Dimensions> { allocation, r };
00369   }
00370
00371
00372   /// Deallocate accessor memory
00373   void deallocate_accessor() {
00374     std::allocator<value_type>{}.deallocate(allocation, array.num_elements());
00375   }
00376
00377
00378   // The following function are used from handler
00379   friend handler;
00380
00381
00382 };
00383
00384 /// @} End the data Doxygen group
00385
00386 }
00387 }
00388 }
00389
00390 /*
00391     # Some Emacs stuff:
00392     ### Local Variables:
00393     ### ispell-local-dictionary: "american"
00394     ### eval: (flyspell-prog-mode)
00395     ### End:
00396 */
00397
00398 #endif // TRISYCL_SYCL_ACCESSOR_DETAIL_LOCAL_ACCESSOR_HPP
```

11.11 include/CL/sycl/address_space/detail/address_space.hpp File Reference

Implement OpenCL address spaces in SYCL with C++-style.

This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::ocl_type< T, AS >

  Generate a type with some real OpenCL 2 attribute if we are on an OpenCL device. More...
- struct cl::sycl::detail::ocl_type< T, constant_address_space >

  Add an attribute for __constant address space. More...
- struct cl::sycl::detail::ocl_type< T, generic_address_space >

  Add an attribute for __generic address space. More...
- struct cl::sycl::detail::ocl_type< T, global_address_space >

  Add an attribute for __global address space. More...
- struct cl::sycl::detail::ocl_type< T, local_address_space >

  Add an attribute for __local address space. More...
- struct cl::sycl::detail::ocl_type< T, private_address_space >

  Add an attribute for __private address space. More...
- struct cl::sycl::detail::address_space_array< T, AS >

  Implementation of an array variable with an OpenCL address space. More...
- struct cl::sycl::detail::address_space_fundamental< T, AS >

  Implementation of a fundamental type with an OpenCL address space. More...
- struct cl::sycl::detail::address_space_object< T, AS >

  Implementation of an object type with an OpenCL address space. More...
- struct cl::sycl::detail::address_space_ptr< T, AS >

  Implementation for an OpenCL address space pointer. More...
- struct cl::sycl::detail::address_space_base< T, AS >

  Implementation of the base infrastructure to wrap something in an OpenCL address space. More...
- struct cl::sycl::detail::address_space_variable< T, AS >

  Implementation of a variable with an OpenCL address space. More...
- struct cl::sycl::detail::address_space_fundamental< T, AS >

  Implementation of a fundamental type with an OpenCL address space. More...

- struct cl::sycl::detail::address_space_ptr< T, AS >

  Implementation for an OpenCL address space pointer. More...
- struct cl::sycl::detail::address_space_array< T, AS >

  Implementation of an array variable with an OpenCL address space. More...
- struct cl::sycl::detail::address_space_object< T, AS >

  Implementation of an object type with an OpenCL address space. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Typedefs

- template<typename T , address_space AS>
  using cl::sycl::detail::addr_space = typename std::conditional< std::is_pointer< T >::value, address_space_ptr< T, AS >, typename std::conditional< std::is_class< T >::value, address_space_object< T, AS >, typename std::conditional< std::is_array< T >::value, address_space_array< T, AS >, address_space_fundamental< T, AS > >::type >::type >::type

  Dispatch the address space implementation according to the requested type.

11.11.1 Detailed Description

Implement OpenCL address spaces in SYCL with C++-style.

Ronan at Keryell point FR

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Definition in file address_space.hpp.

11.12 address_space.hpp

```
00001 #ifndef TRISYCL_SYCL_ADDRESS_SPACES_DETAIL_ADDRESS_SPACES_HPP
00002 #define TRISYCL_SYCL_ADDRESS_SPACES_DETAIL_ADDRESS_SPACES_HPP
00003
00004 /** \file
00005
00006     Implement OpenCL address spaces in SYCL with C++-style.
00007
00008     Ronan at Keryell point FR
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 namespace cl {
00015 namespace sycl {
00016 namespace detail {
00017
00018 /** \addtogroup address_spaces
00019     @{
00020 */
00021
00022 /** Generate a type with some real OpenCL 2 attribute if we are on an
```

```
00023     OpenCL device
00024
00025     In the general case, do not add any OpenCL address space qualifier */
00026 template <typename T, address_space AS>
00027 struct ocl_type { // NOTE: renamed from opencl_type because of MSVC bug
00028   using type = T;
00029 };
00030
00031 /// Add an attribute for __constant address space
00032 template <typename T>
00033 struct ocl_type<T, constant_address_space> {
00034   using type = T
00035 #ifdef __SYCL_DEVICE_ONLY__
00036     /* Put the address space qualifier after the type so that we can
00037        construct pointer type with qualifier */
00038     __constant
00039 #endif
00040     ;
00041 };
00042
00043 /// Add an attribute for __generic address space
00044 template <typename T>
00045 struct ocl_type<T, generic_address_space> {
00046   using type = T
00047 #ifdef __SYCL_DEVICE_ONLY__
00048     /* Put the address space qualifier after the type so that we can
00049        construct pointer type with qualifier */
00050     __generic
00051 #endif
00052     ;
00053 };
00054
00055 /// Add an attribute for __global address space
00056 template <typename T>
00057 struct ocl_type<T, global_address_space> {
00058   using type = T
00059 #ifdef __SYCL_DEVICE_ONLY__
00060     /* Put the address space qualifier after the type so that we can
00061        construct pointer type with qualifier */
00062     __global
00063 #endif
00064     ;
00065 };
00066
00067 /// Add an attribute for __local address space
00068 template <typename T>
00069 struct ocl_type<T, local_address_space> {
00070   using type = T
00071 #ifdef __SYCL_DEVICE_ONLY__
00072     /* Put the address space qualifier after the type so that we can
00073        construct pointer type with qualifier */
00074     __local
00075 #endif
00076     ;
00077 };
00078
00079 /// Add an attribute for __private address space
00080 template <typename T>
00081 struct ocl_type<T, private_address_space> {
00082   using type = T
00083 #ifdef __SYCL_DEVICE_ONLY__
00084     /* Put the address space qualifier after the type so that we can
00085        construct pointer type with qualifier */
00086     __private
00087 #endif
00088     ;
00089 };
00090
00091
00092 /* Forward declare some classes to allow some recursion in conversion
00093    operators */
00094 template <typename SomeType, address_space SomeAS>
00095 struct address_space_array;
00096
00097 template <typename SomeType, address_space SomeAS>
00098 struct address_space_fundamental;
00099
00100 template <typename SomeType, address_space SomeAS>
00101 struct address_space_object;
00102
00103 template <typename SomeType, address_space SomeAS>
00104 struct address_space_ptr;
00105
00106 /** Dispatch the address space implementation according to the requested type
00107
00108     \param T is the type of the object to be created
00109
```

```
00110     \param AS is the address space to place the object into or to point to
00111     in the case of a pointer type
00112 */
00113 template <typename T, address_space AS>
00114 using addr_space =
00115   typename std::conditional<std::is_pointer<T>::value,
00116                             address_space_ptr<T, AS>,
00117   typename std::conditional<std::is_class<T>::value,
00118                             address_space_object<T, AS>,
00119   typename std::conditional<std::is_array<T>::value,
00120                             address_space_array<T, AS>,
00121                             address_space_fundamental<T, AS>
00122   >::type>::type>::type;
00123
00124
00125 /** Implementation of the base infrastructure to wrap something in an
00126     OpenCL address space
00127
00128     \param T is the type of the basic stuff to be created
00129
00130     \param AS is the address space to place the object into
00131
00132     \todo Verify/improve to deal with const/volatile?
00133 */
00134 template <typename T, address_space AS>
00135 struct address_space_base {
00136   /** Store the base type of the object
00137
00138       \todo Add to the specification
00139   */
00140   using type = T;
00141
00142   /** Store the base type of the object with OpenCL address space modifier
00143
00144       \todo Add to the specification
00145   */
00146   using opencl_type = typename ocl_type<T, AS>::type;
00147
00148   /** Set the address_space identifier that can be queried to know the
00149       pointer type */
00150   static auto constexpr address_space = AS;
00151
00152 };
00153
00154
00155 /** Implementation of a variable with an OpenCL address space
00156
00157     \param T is the type of the basic object to be created
00158
00159     \param AS is the address space to place the object into
00160 */
00161 template <typename T, address_space AS>
00162 struct address_space_variable : public address_space_base<T, AS> {
00163   /** Store the base type of the object with OpenCL address space modifier
00164
00165       \todo Add to the specification
00166   */
00167   using opencl_type = typename ocl_type<T, AS>::type;
00168
00169   /// Keep track of the base class as a short-cut
00170   using super = address_space_base<T, AS>;
00171
00172 protected:
00173
00174   /* C++11 helps a lot to be able to have the same constructors as the
00175      parent class here
00176
00177      \todo Add this to the list of required C++11 features needed for SYCL
00178   */
00179   opencl_type variable;
00180
00181 public:
00182
00183   /** Allow to create an address space version of an object or to convert
00184       one to be used by the classes inheriting by this one because it is
00185       not possible to directly initialize a base class member in C++ */
00186   address_space_variable(const T & v) : variable(v) { }
00187
00188
00189   /// Put back the default constructors canceled by the previous definition
00190   address_space_variable() = default;
00191
00192
00193   /** Conversion operator to allow a address_space_object<T> to be used
00194       as a T so that all the methods of a T and the built-in operators for
00195       T can be used on a address_space_object<T> too.
00196
```

```
00197       Use opencl_type so that if we take the address of it, the address
00198       space is kept.
00199   */
00200   operator opencl_type & () { return variable; }
00201
00202   /// Return the address of the value to implement pointers
00203   opencl_type * get_address() { return &variable; }
00204
00205 };
00206
00207
00208 /** Implementation of a fundamental type with an OpenCL address space
00209
00210     \param T is the type of the basic object to be created
00211
00212     \param AS is the address space to place the object into
00213
00214     \todo Verify/improve to deal with const/volatile?
00215 */
00216 template <typename T, address_space AS>
00217 struct address_space_fundamental : public
      address_space_variable<T, AS> {
00218   /// Keep track of the base class as a short-cut
00219   using super = address_space_variable<T, AS>;
00220
00221   /// Inherit from base class constructors
00222   using super::address_space_variable;
00223
00224
00225   /** Also request for the default constructors that have been disabled by
00226       the declaration of another constructor
00227
00228       This ensures for example that we can write
00229       \code
00230         generic<float *> q;
00231       \endcode
00232       without initialization.
00233   */
00234   address_space_fundamental() = default;
00235
00236
00237   /** Allow for example assignment of a global<float> to a priv<double>
00238       for example
00239
00240      Since it needs 2 implicit conversions, it does not work with the
00241      conversion operators already define, so add 1 more explicit
00242      conversion here so that the remaining implicit conversion can be
00243      found by the compiler.
00244
00245      Strangely
00246      \code
00247      template <typename SomeType, address_space SomeAS>
00248      address_space_base(addr_space<SomeType, SomeAS>& v)
00249      : variable(SomeType(v)) { }
00250      \endcode
00251      cannot be used here because SomeType cannot be inferred. So use
00252      address_space_base<> instead
00253
00254      Need to think further about it...
00255   */
00256   template <typename SomeType, cl::sycl::address_space SomeAS>
00257   address_space_fundamental(
      address_space_fundamental<SomeType, SomeAS>& v)
00258   {
00259     /* Strangely I cannot have it working in the initializer instead, for
00260        some cases */
00261     super::variable = SomeType(v);
00262   }
00263
00264 };
00265
00266
00267 /** Implementation for an OpenCL address space pointer
00268
00269     \param T is the pointer type
00270
00271     Note that if \a T is not a pointer type, it is an error.
00272
00273     All the address space pointers inherit from it, which makes trivial
00274     the implementation of cl::sycl::multi_ptr<T, AS>
00275 */
00276 template <typename T, address_space AS>
00277 struct address_space_ptr : public address_space_fundamental<T, AS
      > {
00278   // Verify that \a T is really a pointer
00279   static_assert(std::is_pointer<T>::value,
00280                 "T must be a pointer type");
```

```
00281
00282   /// Keep track of the base class as a short-cut
00283   using super = address_space_fundamental<T, AS>;
00284
00285   /// Inherit from base class constructors
00286   using super::address_space_fundamental;
00287
00288   using pointer_t = typename super::address_space_fundamental::type
      ;
00289   using reference_t = typename std::remove_pointer_t<pointer_t>&;
00290
00291   /** Allow initialization of a pointer type from the address of an
00292       element with the same type and address space
00293   */
00294   address_space_ptr(address_space_fundamental<typename
      std::pointer_traits<T>::element_type, AS> *p)
00295     : address_space_fundamental<T, AS> { p->get_address() } {}
00296
00297   /// Put back the default constructors canceled by the previous definition
00298   address_space_ptr() = default;
00299 };
00300
00301
00302 /** Implementation of an array variable with an OpenCL address space
00303
00304     \param T is the type of the basic object to be created
00305
00306     \param AS is the address space to place the object into
00307 */
00308 template <typename T, address_space AS>
00309 struct address_space_array : public address_space_variable<T, AS>
      {
00310   /// Keep track of the base class as a short-cut
00311   using super = address_space_variable<T, AS>;
00312
00313   /// Inherit from base class constructors
00314   using super::address_space_variable;
00315
00316
00317   /** Allow to create an address space array from an array
00318    */
00319   address_space_array(const T &array) {
00320     std::copy(std::begin(array), std::end(array), std::begin(super::variable));
00321   };
00322
00323
00324   /** Allow to create an address space array from an initializer list
00325
00326       \todo Extend to more than 1 dimension
00327   */
00328   address_space_array(std::initializer_list<std::remove_extent_t<T>> list) {
00329     std::copy(std::begin(list), std::end(list), std::begin(super::variable));
00330   };
00331
00332 };
00333
00334
00335 /** Implementation of an object type with an OpenCL address space
00336
00337     \param T is the type of the basic object to be created
00338
00339     \param AS is the address space to place the object into
00340
00341     The class implementation is just inheriting of T so that all methods
00342     and non-member operators on T work also on address_space_object<T>
00343
00344     \todo Verify/improve to deal with const/volatile?
00345
00346     \todo what about T having some final methods?
00347 */
00348 template <typename T, address_space AS>
00349 //struct address_space_object : public opencl_type<T, AS>::type,
00350 struct address_space_object : public ocl_type<T, AS>::type,
00351                               public address_space_base<T, AS> {
00352   /** Store the base type of the object with OpenCL address space modifier
00353
00354       \todo Add to the specification
00355   */
00356   using opencl_type = typename ocl_type<T, AS>::type;
00357
00358   /* C++11 helps a lot to be able to have the same constructors as the
00359      parent class here but with an OpenCL address space
00360
00361      \todo Add this to the list of required C++11 features needed for SYCL
00362   */
00363   using opencl_type::opencl_type;
00364
```

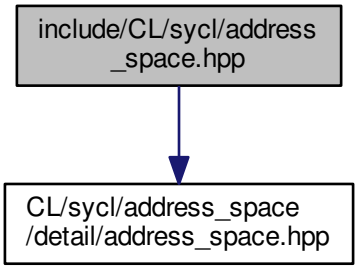
```
00365   /** Allow to create an address space version of an object or to
00366       convert one */
00367   address_space_object(T && v) : opencl_type(v) { }
00368
00369   /** Conversion operator to allow a address_space_object<T> to be used
00370       as a T so that all the methods of a T and the built-in operators for
00371       T can be used on a address_space_object<T> too.
00372
00373       Use opencl_type so that if we take the address of it, the address
00374       space is kept. */
00375   operator opencl_type & () { return *this; }
00376
00377 };
00378
00379 /// @} End the address_spaces Doxygen group
00380
00381 }
00382 }
00383 }
00384
00385 /*
00386     # Some Emacs stuff:
00387     ### Local Variables:
00388     ### ispell-local-dictionary: "american"
00389     ### eval: (flyspell-prog-mode)
00390     ### End:
00391 */
00392
00393 #endif // TRISYCL_SYCL_ADDRESS_SPACES_DETAIL_ADDRESS_SPACES_HPP
```

11.13 include/CL/sycl/address_space.hpp File Reference

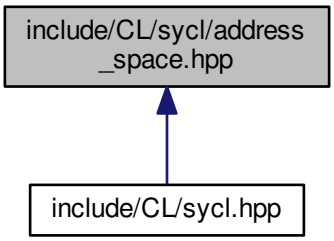
Implement OpenCL address spaces in SYCL with C++-style.

```
#include "CL/sycl/address_space/detail/address_space.hpp"
```

Include dependency graph for address_space.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Typedefs

- template<typename T >
  using cl::sycl::constant = detail::addr_space< T, constant_address_space >

  Declare a variable to be in the OpenCL constant address space.
- template<typename T >
  using cl::sycl::constant_ptr = constant< T * >

  Declare a variable to be in the OpenCL constant address space.
- template<typename T >
  using cl::sycl::generic = detail::addr_space< T, generic_address_space >

  Declare a variable to be in the OpenCL 2 generic address space.
- template<typename T >
  using cl::sycl::global = detail::addr_space< T, global_address_space >

  Declare a variable to be in the OpenCL global address space.
- template<typename T >
  using cl::sycl::global_ptr = global< T * >

  Declare a variable to be in the OpenCL global address space.
- template<typename T >
  using cl::sycl::local = detail::addr_space< T, local_address_space >

  Declare a variable to be in the OpenCL local address space.
- template<typename T >
  using cl::sycl::local_ptr = local< T * >

  Declare a variable to be in the OpenCL local address space.
- template<typename T >
  using cl::sycl::priv = detail::addr_space< T, private_address_space >

  Declare a variable to be in the OpenCL private address space.
- template<typename T >
  using cl::sycl::private_ptr = priv< T * >

  Declare a variable to be in the OpenCL private address space.
- template<typename Pointer , address_space AS>
  using cl::sycl::multi_ptr = detail::address_space_ptr< Pointer, AS >

  A pointer that can be statically associated to any address-space.

Enumerations

- enum cl::sycl::address_space {
  cl::sycl::constant_address_space, cl::sycl::generic_address_space, cl::sycl::global_address_space, cl::sycl::local_address_space,
  cl::sycl::private_address_space }

  Enumerate the different OpenCL 2 address spaces.

Functions

- template<typename T , address_space AS>
  multi_ptr< T, AS > cl::sycl::make_multi (multi_ptr< T, AS > pointer)

  Construct a cl::sycl::multi_ptr<> with the right type.

11.13.1 Detailed Description

Implement OpenCL address spaces in SYCL with C++-style.

Note that in SYCL 1.2, only pointer types should be specified but in this implementation we generalize the concept to any type.

Todo Add the alias ..._ptr<T> = ...<T *>

Ronan at Keryell point FR

Definition in file address_space.hpp.

11.14 address_space.hpp

```
00001 #ifndef TRISYCL_SYCL_ADDRESS_SPACE_HPP
00002 #define TRISYCL_SYCL_ADDRESS_SPACE_HPP
00003
00004 /** \file
00005
00006     Implement OpenCL address spaces in SYCL with C++-style.
00007
00008     Note that in SYCL 1.2, only pointer types should be specified but
00009     in this implementation we generalize the concept to any type.
00010
00011     \todo Add the alias ..._ptr<T> = ...<T *>
00012
00013     Ronan at Keryell point FR
00014
00015     This file is distributed under the University of Illinois Open Source
00016     License. See LICENSE.TXT for details.
00017 */
00018
00019 namespace cl {
00020 namespace sycl {
00021
00022 /** \addtogroup address_spaces Dealing with OpenCL address spaces
00023     @{
00024 */
00025
00026 /** Enumerate the different OpenCL 2 address spaces */
00027 enum address_space {
00028   constant_address_space,
00029   generic_address_space,
00030   global_address_space,
```

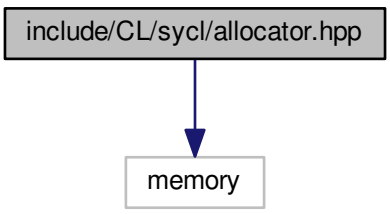
```
00031   local_address_space,
00032   private_address_space,
00033 };
00034
00035 }
00036 }
00037 /// @} End the address_spaces Doxygen group
00038
00039
00040 #include "CL/sycl/address_space/detail/address_space.hpp"
00041
00042
00043 namespace cl {
00044 namespace sycl {
00045
00046 /** \addtogroup address_spaces
00047     @{
00048 */
00049
00050 /** Declare a variable to be in the OpenCL constant address space
00051
00052     \param T is the type of the object
00053 */
00054 template <typename T>
00055 using constant = detail::addr_space<T, constant_address_space>
    ;
00056
00057
00058 /** Declare a variable to be in the OpenCL constant address space
00059
00060     \param T is the type of the object
00061 */
00062 template <typename T>
00063 using constant_ptr = constant<T*>;
00064
00065
00066 /** Declare a variable to be in the OpenCL 2 generic address space
00067
00068     \param T is the type of the object
00069 */
00070 template <typename T>
00071 using generic = detail::addr_space<T, generic_address_space>;
00072
00073
00074 /** Declare a variable to be in the OpenCL global address space
00075
00076     \param T is the type of the object
00077 */
00078 template <typename T>
00079 using global = detail::addr_space<T, global_address_space>
    ;
00080
00081
00082 /** Declare a variable to be in the OpenCL global address space
00083
00084     \param T is the type of the object
00085 */
00086
00087 template <typename T>
00088 using global_ptr = global<T*>;
00089
00090
00091 /** Declare a variable to be in the OpenCL local address space
00092
00093     \param T is the type of the object
00094 */
00095 template <typename T>
00096 using local = detail::addr_space<T, local_address_space>;
00097
00098
00099 /** Declare a variable to be in the OpenCL local address space
00100
00101     \param T is the type of the object
00102 */
00103 template <typename T>
00104 using local_ptr = local<T*>;
00105
00106
00107 /** Declare a variable to be in the OpenCL private address space
00108
00109     \param T is the type of the object
00110 */
00111 template <typename T>
00112 using priv = detail::addr_space<T, private_address_space>;
00113
00114
00115 /** Declare a variable to be in the OpenCL private address space
```

```
00116
00117     \param T is the type of the object
00118 */
00119 template <typename T>
00120 using private_ptr = priv<T*>;
00121
00122
00123 /** A pointer that can be statically associated to any address-space
00124
00125     \param Pointer is the pointer type
00126
00127     \param AS is the address space to point to
00128
00129     Note that if \a Pointer is not a pointer type, it is an error.
00130 */
00131 template <typename Pointer, address_space AS>
00132 using multi_ptr = detail::address_space_ptr<Pointer, AS>;
00133
00134
00135 /** Construct a cl::sycl::multi_ptr<> with the right type
00136
00137     \param pointer is the address with its address space to point to
00138
00139     \todo Implement the case with a plain pointer
00140 */
00141 template <typename T, address_space AS>
00142 multi_ptr<T, AS> make_multi(multi_ptr<T, AS> pointer) {
00143   return pointer;
00144 }
00145
00146 }
00147 }
00148 /// @} End the parallelism Doxygen group
00149
00150 /*
00151     # Some Emacs stuff:
00152     ### Local Variables:
00153     ### ispell-local-dictionary: "american"
00154     ### eval: (flyspell-prog-mode)
00155     ### End:
00156 */
00157
00158 #endif // TRISYCL_SYCL_ADDRESS_SPACE_HPP
```

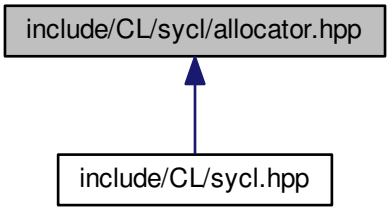
11.15 include/CL/sycl/allocator.hpp File Reference

`#include <memory>`

Include dependency graph for allocator.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Typedefs

- template<typename T >
  using cl::sycl::buffer_allocator = std::allocator< T >

  The allocator objects give the programmer some control on how the memory is allocated inside SYCL.
- template<typename T >
  using cl::sycl::image_allocator = std::allocator< T >

  The allocator used for the `image` inside SYCL.
- template<typename T >
  using cl::sycl::map_allocator = std::allocator< T >

  The allocator used to map the memory at the same place.

11.16 allocator.hpp

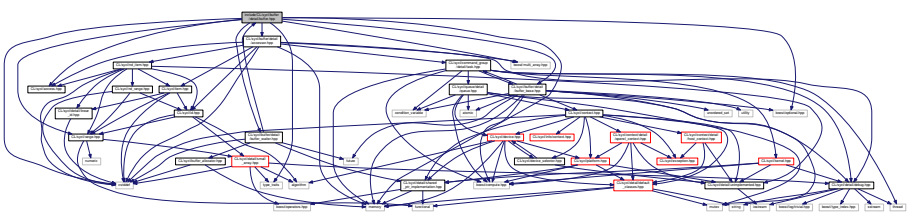
```
00001 #ifndef TRISYCL_SYCL_ALLOCATOR_HPP
00002 #define TRISYCL_SYCL_ALLOCATOR_HPP
00003
00004 /** \file The OpenCL SYCL allocator
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <memory>
00013
00014 namespace cl {
00015 namespace sycl {
00016
00017 /** \addtogroup data Data access and storage in SYCL
00018     @{
00019 */
00020
00021 /** The allocator objects give the programmer some control on how the
00022     memory is allocated inside SYCL
```

```
00023 */
00024
00025 /** The allocator used for the \c buffer inside SYCL
00026
00027     Just use the default allocator for now.
00028 */
00029 template <typename T>
00030 using buffer_allocator = std::allocator<T>;
00031
00032
00033 /** The allocator used for the \c image inside SYCL
00034
00035     Just use the default allocator for now.
00036 */
00037 template <typename T>
00038 using image_allocator = std::allocator<T>;
00039
00040
00041 /** The allocator used to map the memory at the same place
00042
00043     Just use the default allocator for now.
00044
00045     \todo : implement and clarify the specification. It looks like it
00046     is not really an allocator according the current spec
00047 */
00048 template <typename T>
00049 using map_allocator = std::allocator<T>;
00050
00051
00052 /// @} End the data Doxygen group
00053
00054 }
00055 }
00056
00057 /*
00058     # Some Emacs stuff:
00059     ### Local Variables:
00060     ### ispell-local-dictionary: "american"
00061     ### eval: (flyspell-prog-mode)
00062     ### End:
00063 */
00064
00065 #endif // TRISYCL_SYCL_ALLOCATOR_HPP
```

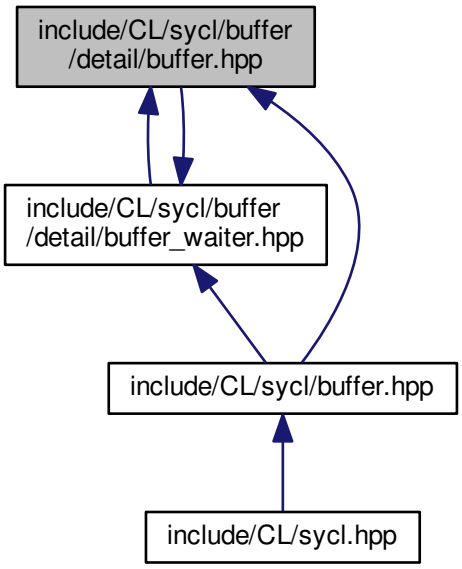
11.17 include/CL/sycl/buffer/detail/buffer.hpp File Reference

```
#include <cstddef>
#include <memory>
#include <type_traits>
#include <boost/multi_array.hpp>
#include <boost/optional.hpp>
#include "CL/sycl/access.hpp"
#include "CL/sycl/buffer/detail/accessor.hpp"
#include "CL/sycl/buffer/detail/buffer_base.hpp"
#include "CL/sycl/buffer/detail/buffer_waiter.hpp"
#include "CL/sycl/range.hpp"
```

Include dependency graph for buffer.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::buffer< T, Dimensions >

  A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Functions

- template<typename BufferDetail >
  static std::shared_ptr< detail::task > cl::sycl::detail::buffer_add_to_task (BufferDetail buf, handler *command_group_handler, bool is_write_mode)

  Proxy function to avoid some circular type recursion.

11.18 buffer.hpp

```
00001 #ifndef TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_HPP
00002 #define TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_HPP
00003
00004 /** \file The OpenCL SYCL buffer<> detail implementation
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <memory>
00014 #include <type_traits>
00015
00016 #include <boost/multi_array.hpp>
00017 // \todo Use C++17 optional when it is mainstream
00018 #include <boost/optional.hpp>
00019
00020 #include "CL/sycl/access.hpp"
00021 #include "CL/sycl/buffer/detail/accessor.hpp"
00022 #include "CL/sycl/buffer/detail/buffer_base.hpp"
00023 #include "CL/sycl/buffer/detail/buffer_waiter.hpp"
00024 #include "CL/sycl/range.hpp"
00025
00026 namespace cl {
00027 namespace sycl {
00028 namespace detail {
00029
00030
00031 /** \addtogroup data Data access and storage in SYCL
00032     @{
00033 */
00034
00035 /** A SYCL buffer is a multidimensional variable length array (à la C99
00036     VLA or even Fortran before) that is used to store data to work on.
00037
00038     In the case we initialize it from a pointer, for now we just wrap the
00039     data with boost::multi_array_ref to provide the VLA semantics without
00040     any storage.
00041 */
00042 template <typename T,
00043           int Dimensions = 1>
00044 class buffer : public detail::buffer_base,
00045                public detail::debug<buffer<T, Dimensions>> {
00046 public:
00047
00048   // Extension to SYCL: provide pieces of STL container interface
00049   using element = T;
00050   using value_type = T;
00051   /* Even if the buffer is read-only use a non-const type so at
00052      least the current implementation can copy the data too */
00053   using non_const_value_type = std::remove_const_t<value_type>;
00054
00055 private:
00056
00057   // \todo Replace U and D somehow by T and Dimensions
00058   // To allow allocation access
00059   template <typename U,
00060             int D,
00061             access::mode Mode,
00062             access::target Target /* = access::global_buffer */>
00063     friend class detail::accessor;
00064
00065   /** The allocator to be used when some memory is needed
00066
00067       \todo Implement user-provided allocator
00068   */
00069   std::allocator<non_const_value_type> alloc;
00070
00071   /** This is the multi-dimensional interface to the data that may point
00072       to either allocation in the case of storage managed by SYCL itself
00073       or to some other memory location in the case of host memory or
00074       storage<> abstraction use
00075   */
00076   boost::multi_array_ref<value_type, Dimensions> access;
00077
00078   /** If some allocation is requested on the host for the buffer
00079       memory, this is where the memory is attached to.
00080
00081       Note that this is uninitialized memory, as stated in SYCL
00082       specification.
00083   */
00084   non_const_value_type *allocation = nullptr;
```

```
00085
00086   /* How to copy back data on buffer destruction, can be modified with
00087      set_final_data( ... )
00088    */
00089   boost::optional<std::function<void(void)>> final_write_back;
00090
00091   // Keep the shared pointer used to create the buffer
00092   shared_ptr_class<T> input_shared_pointer;
00093
00094
00095   // Track if the buffer memory is provided as host memory
00096   bool data_host = false;
00097
00098   // Track if data should be copied if a modification occurs
00099   bool copy_if_modified = false;
00100
00101   // Track if data have been modified
00102   bool modified = false;
00103
00104 public:
00105
00106   /// Create a new read-write buffer of size \param r
00107   buffer(const range<Dimensions> &r) : access {
      allocate_buffer(r) } {}
00108
00109
00110   /** Create a new read-write buffer from \param host_data of size
00111       \param r without further allocation */
00112   buffer(T *host_data, const range<Dimensions> &r) :
00113     access { host_data, r },
00114     data_host { true }
00115   {}
00116
00117
00118   /** Create a new read-only buffer from \param host_data of size \param r
00119       without further allocation
00120
00121       If the buffer is non const, use a copy-on-write mechanism with
00122       internal writable memory.
00123
00124       \todo Clarify the semantics in the spec. What happens if the
00125       host change the host_data after buffer creation?
00126
00127       Only enable this constructor if the value type is not constant,
00128       because if it is constant, the buffer is constant too.
00129   */
00130   template <typename Dependent = T,
00131             typename = std::enable_if_t<!std::is_const<Dependent>::value>>
00132   buffer(const T *host_data, const range<Dimensions> &r) :
00133     /* The buffer is read-only, even if the internal multidimensional
00134        wrapper is not. If a write accessor is requested, there should
00135        be a copy on write. So this pointer should not be written and
00136        this const_cast should be acceptable. */
00137     access { const_cast<T *>(host_data), r },
00138     data_host { true },
00139     /* Set copy_if_modified to true, so that if an accessor with write
00140        access is created, data are copied before to be modified. */
00141     copy_if_modified { true }
00142   {}
00143
00144
00145   /** Create a new buffer with associated memory, using the data in
00146       host_data
00147
00148       The ownership of the host_data is shared between the runtime and the
00149       user. In order to enable both the user application and the SYCL
00150       runtime to use the same pointer, a cl::sycl::mutex_class is
00151       used.
00152   */
00153   buffer(shared_ptr_class<T> &host_data, const
      range<Dimensions> &r) :
00154     access { host_data.get(), r },
00155     input_shared_pointer { host_data },
00156     data_host { true }
00157   {}
00158
00159
00160   /// Create a new allocated 1D buffer from the given elements
00161   template <typename Iterator>
00162   buffer(Iterator start_iterator, Iterator end_iterator) :
00163     access { allocate_buffer(std::distance(start_iterator, end_iterator)) }
00164     {
00165       /* Then assign allocation since this is the only multi_array
00166          method with this iterator interface */
00167       access.assign(start_iterator, end_iterator);
00168     }
00169
```

```
00170
00171   /** Create a new sub-buffer without allocation to have separate
00172       accessors later
00173
00174       \todo To implement and deal with reference counting
00175   buffer(buffer<T, Dimensions> b,
00176          index<Dimensions> base_index,
00177          range<Dimensions> sub_range)
00178   */
00179
00180   /// \todo Allow CLHPP objects too?
00181   ///
00182   /*
00183   buffer(cl_mem mem_object,
00184          queue from_queue,
00185          event available_event)
00186   */
00187
00188
00189   /** The buffer content may be copied back on destruction to some
00190       final location */
00191   ~buffer() {
00192 #ifdef TRISYCL_OPENCL
00193     /* We ensure that the host has the most up-to-date version of the data
00194        before the buffer is destroyed. This is necessary because we do not
00195        systematically transfer the data back from a device with
00196        \c copy_back_cl_buffer any more.
00197        \todo Optimize for the case the buffer is not based on host memory
00198     */
00199     cl::sycl::context ctx;
00200     auto size = access.num_elements() * sizeof(value_type);
00201     call_update_buffer_state(ctx, access::mode::read, size,
      access.data());
00202
00203 #endif
00204     if (modified && final_write_back)
00205       (*final_write_back)();
00206     // Allocate explicitly allocated memory if required
00207     deallocate_buffer();
00208   }
00209
00210
00211   /** Enforce the buffer to be considered as being modified.
00212       Same as creating an accessor with write access.
00213    */
00214   void mark_as_written() {
00215     modified = true;
00216   }
00217
00218
00219   /** This method is to be called whenever an accessor is created
00220
00221       Its current purpose is to track if an accessor with write access
00222       is created and acting accordingly.
00223    */
00224   template <access::mode Mode,
00225             access::target Target = access::target::host_buffer>
00226   void track_access_mode() {
00227     // test if write access is required
00228     if (   Mode == access::mode::write
00229         || Mode == access::mode::read_write
00230         || Mode == access::mode::discard_write
00231         || Mode == access::mode::discard_read_write
00232         || Mode == access::mode::atomic
00233        ) {
00234       modified = true;
00235       if (copy_if_modified) {
00236         // Implement the allocate & copy-on-write optimization
00237         copy_if_modified = false;
00238         data_host = false;
00239         // Since \c allocate_buffer() changes \c access, keep a copy first
00240         auto current_access = access;
00241         /* The range is actually computed from \c access itself, so
00242            save it */
00243         auto current_range = get_range();
00244         allocate_buffer(current_range);
00245         /* Then move everything to the new place
00246
00247            \todo Use std::uninitialized_move instead, when we switch
00248            to full C++17
00249         */
00250         std::copy(current_access.begin(),
00251                   current_access.end(),
00252                   access.begin());
00253       }
00254     }
00255   }
```

```
00256
00257
00258   /** Return a range object representing the size of the buffer in
00259       terms of number of elements in each dimension as passed to the
00260       constructor
00261    */
00262   auto get_range() const {
00263     /* Interpret the shape which is a pointer to the first element as an
00264        array of Dimensions elements so that the range<Dimensions>
00265        constructor is happy with this collection
00266
00267        \todo Add also a constructor in range<> to accept a const
00268        std::size_t *?
00269     */
00270     return range<Dimensions> {
00271       *(const std::size_t (*)[Dimensions])(access.shape())
00272         };
00273   }
00274
00275
00276   /** Returns the total number of elements in the buffer
00277
00278       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
00279   */
00280   auto get_count() const {
00281     return access.num_elements();
00282   }
00283
00284
00285   /** Returns the size of the buffer storage in bytes
00286
00287       \todo rename to something else. In
00288       http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2015/p0122r0.pdf
00289       it is named bytes() for example
00290   */
00291   auto get_size() const {
00292     return get_count()*sizeof(value_type);
00293   }
00294
00295
00296   /** Set the weak pointer as destination for write-back on buffer
00297       destruction
00298   */
00299   void set_final_data(std::weak_ptr<T> && final_data) {
00300     final_write_back = [=] {
00301       if (auto sptr = final_data.lock()) {
00302         std::copy_n(access.data(), access.num_elements(), sptr.get());
00303       }
00304     };
00305   }
00306
00307
00308   /** Provide destination for write-back on buffer destruction as a
00309       shared pointer.
00310    */
00311   void set_final_data(std::shared_ptr<T> && final_data) {
00312     final_write_back = [=] {
00313       std::copy_n(access.data(), access.num_elements(), final_data.get());
00314     };
00315   }
00316
00317
00318   /** Disable write-back on buffer destruction as an iterator.
00319   */
00320   void set_final_data(std::nullptr_t) {
00321     final_write_back = boost::none;
00322   }
00323
00324
00325   /** Provide destination for write-back on buffer destruction as an
00326       iterator
00327   */
00328   template <typename Iterator>
00329   void set_final_data(Iterator final_data) {
00330 /*    using type_ = typename iterator_value_type<Iterator>::value_type;
00331     static_assert(std::is_same<type_, T>::value, "buffer type mismatch");
00332     static_assert(!(std::is_const<type_>::value),
00333                   "const iterator is not allowed");*/
00334     final_write_back = [=] {
00335       std::copy_n(access.data(), access.num_elements(), final_data);
00336     };
00337   }
00338
00339
00340 private:
00341
00342   /// Allocate uninitialized buffer memory
```

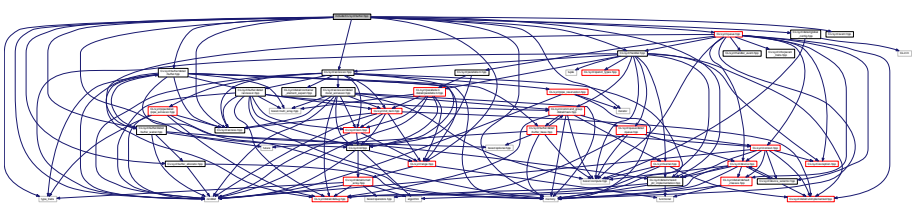
```
00343   auto allocate_buffer(const range<Dimensions> &r) {
00344     auto count = r.get_count();
00345     // Allocate uninitialized memory
00346     allocation = alloc.allocate(count);
00347     return boost::multi_array_ref<value_type, Dimensions> { allocation, r };
00348   }
00349
00350
00351   /// Deallocate buffer memory if required
00352   void deallocate_buffer() {
00353     if (allocation)
00354       alloc.deallocate(allocation, access.num_elements());
00355   }
00356
00357
00358   /** Function pair to work around the fact that T might be a \c const type.
00359       We call update_buffer_state only if T is not \c const, we have to
00360       use \c enable_if otherwise the compiler will try to cast \c const
00361       \c void* to \c void* if we create a buffer with a \c const type
00362
00363       \todo Use \c if \c constexpr when it is available with C++17
00364   */
00365   template <typename BaseType = T, typename DataType>
00366   void call_update_buffer_state(cl::sycl::context ctx,
      access::mode mode,
00367                                 size_t size, DataType* data,
00368                                 std::enable_if_t<!std::is_const<BaseType>
00369                                 ::value>* = 0) {
00370     update_buffer_state(ctx, mode, size, data);
00371   }
00372
00373
00374   /** Version of \c call_update_buffer_state that does nothing. It is called if
00375       the type of the data in the buffer is \c const
00376    */
00377   template <typename BaseType = T, typename DataType>
00378   void call_update_buffer_state(cl::sycl::context ctx,
      access::mode mode,
00379                                 size_t size, DataType* data,
00380                                 std::enable_if_t<std::is_const<BaseType>
00381                                 ::value>* = 0) { }
00382
00383
00384 public:
00385
00386   /** Get a \c future to wait from inside the \c cl::sycl::buffer in
00387       case there is something to copy back to the host
00388
00389       \return A \c future in the \c optional if there is something to
00390       wait for, otherwise an empty \c optional
00391       \todo Make the function private again
00392   */
00393   boost::optional<std::future<void>> get_destructor_future() {
00394     /* If there is only 1 shared_ptr user of the buffer, this is the
00395        caller of this function, the \c buffer_waiter, so there is no
00396        need to get a \ future otherwise there will be a dead-lock if
00397        there is only 1 thread waiting for itself.
00398
00399        Since \c use_count() is applied to a \c shared_ptr just created
00400        for this purpose, it actually increase locally the count by 1,
00401        so check for 1 + 1 use count instead...
00402     */
00403     // If the buffer's destruction triggers a write-back, wait
00404     if ((shared_from_this().use_count() > 2) &&
00405         modified && (final_write_back || data_host)) {
00406       // Create a promise to wait for
00407       notify_buffer_destructor = std::promise<void> {};
00408       // And return the future to wait for it
00409       return notify_buffer_destructor->get_future();
00410     }
00411     return boost::none;
00412   }
00413
00414 private:
00415
00416   // Allow buffer_waiter destructor to access get_destructor_future()
00417   // friend detail::buffer_waiter<T, Dimensions>::~buffer_waiter();
00418   /* \todo Work around to Clang bug
00419      https://llvm.org/bugs/show_bug.cgi?id=28873 cannot use destructor
00420      here */
00421   /* \todo solve the fact that get_destructor_future is not accessible
00422      when private and buffer_waiter uses a custom allocator */
00423   friend detail::buffer_waiter<T, Dimensions>;
00424
00425 };
00426
00427
```

```
00428 /** Proxy function to avoid some circular type recursion
00429
00430     \return a shared_ptr<task>
00431
00432     \todo To remove with some refactoring
00433 */
00434 template <typename BufferDetail>
00435 static std::shared_ptr<detail::task>
00436 buffer_add_to_task(BufferDetail buf,
00437                    handler *command_group_handler,
00438                    bool is_write_mode) {
00439     return buf->add_to_task(command_group_handler, is_write_mode);
00440   }
00441
00442 /// @} End the data Doxygen group
00443
00444 }
00445 }
00446 }
00447
00448 /*
00449     # Some Emacs stuff:
00450     ### Local Variables:
00451     ### ispell-local-dictionary: "american"
00452     ### eval: (flyspell-prog-mode)
00453     ### End:
00454 */
00455
00456 #endif // TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_HPP
```

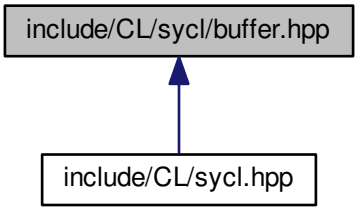
11.19 include/CL/sycl/buffer.hpp File Reference

```
#include <cstddef>
#include <iterator>
#include <memory>
#include <type_traits>
#include "CL/sycl/access.hpp"
#include "CL/sycl/accessor.hpp"
#include "CL/sycl/buffer/detail/buffer.hpp"
#include "CL/sycl/buffer/detail/buffer_waiter.hpp"
#include "CL/sycl/buffer_allocator.hpp"
#include "CL/sycl/detail/global_config.hpp"
#include "CL/sycl/detail/shared_ptr_implementation.hpp"
#include "CL/sycl/event.hpp"
#include "CL/sycl/handler.hpp"
#include "CL/sycl/id.hpp"
#include "CL/sycl/queue.hpp"
#include "CL/sycl/range.hpp"
```

Include dependency graph for buffer.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::buffer< T, Dimensions, Allocator >

  A SYCL buffer is a multidimensional variable length array (à la C99 VLA or even Fortran before) that is used to store data to work on. More...
- struct std::hash< cl::sycl::buffer< T, Dimensions, Allocator > >

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- std

11.20 buffer.hpp

```
00001 #ifndef TRISYCL_SYCL_BUFFER_HPP
00002 #define TRISYCL_SYCL_BUFFER_HPP
00003
00004 /** \file The OpenCL SYCL buffer<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <iterator>
00014 #include <memory>
00015 #include <type_traits>
00016
00017 #include "CL/sycl/access.hpp"
00018 #include "CL/sycl/accessor.hpp"
00019 #include "CL/sycl/buffer/detail/buffer.hpp"
00020 #include "CL/sycl/buffer/detail/buffer_waiter.hpp"
00021 #include "CL/sycl/buffer_allocator.hpp"
00022 #include "CL/sycl/detail/global_config.hpp"
00023 #include "CL/sycl/detail/shared_ptr_implementation.hpp"
00024 #include "CL/sycl/event.hpp"
00025 #include "CL/sycl/handler.hpp"
00026 #include "CL/sycl/id.hpp"
00027 #include "CL/sycl/queue.hpp"
00028 #include "CL/sycl/range.hpp"
00029
```

```
00030 namespace cl {
00031 namespace sycl {
00032
00033 /** \addtogroup data Data access and storage in SYCL
00034     @{
00035 */
00036
00037 /** A SYCL buffer is a multidimensional variable length array (à la C99
00038     VLA or even Fortran before) that is used to store data to work on.
00039
00040     \todo There is a naming inconsistency in the specification between
00041     buffer and accessor on T versus datatype
00042
00043     \todo Finish allocator implementation
00044
00045     \todo Think about the need of an allocator when constructing a buffer
00046     from other buffers
00047
00048     \todo Update the specification to have a non-const allocator for
00049     const buffer? Or do we rely on rebind_alloc<T>. But does this work
00050     with astate-full allocator?
00051
00052     \todo Add constructors from arrays so that in C++17 the range and
00053     type can be infered from the constructor
00054
00055     \todo Add constructors from array_ref
00056 */
00057 template <typename T,
00058           int Dimensions = 1,
00059           /* Even a buffer of const T may need to allocate memory, so
00060              need an allocator of non const T */
00061           typename Allocator = buffer_allocator<std::remove_const_t<T>>>
00062 class buffer
00063   /* Use the underlying buffer waiter implementation that can be
00064      shared in the SYCL model */
00065   : public detail::shared_ptr_implementation<
00066                          buffer<T, Dimensions, Allocator>,
00067                          detail::buffer_waiter<T, Dimensions, Allocator>>,
00068     detail::debug<buffer<T, Dimensions, Allocator>> {
00069 public:
00070
00071   /// The STL-like types
00072   using value_type = T;
00073   using reference = value_type&;
00074   using const_reference = const value_type&;
00075   using allocator_type = Allocator;
00076
00077 private:
00078
00079   // The type encapsulating the implementation
00080   using implementation_t = typename
      buffer::shared_ptr_implementation;
00081
00082   // Allows the comparison operation to access the implementation
00083   friend implementation_t;
00084
00085 public:
00086
00087   // Make the implementation member directly accessible in this class
00088   using implementation_t::implementation;
00089
00090   /** Use default constructors so that we can create a new buffer copy
00091       from another one, with either a l-value or an r-value (for
00092       std::move() for example).
00093
00094       Since we just copy the shared_ptr<> from the
00095       shared_ptr_implementation above, this is where/how the sharing
00096       magic is happening with reference counting in this case.
00097   */
00098   buffer() = default;
00099
00100
00101   /** Create a new buffer of the given size with
00102       storage managed by the SYCL runtime
00103
00104       The default behavior is to use the default host buffer
00105       allocator, in order to allow for host accesses. If the type of
00106       the buffer, has the const qualifier, then the default allocator
00107       will remove the qualifier to allow host access to the data.
00108
00109       \param[in] r defines the size
00110
00111       \param[in] allocator is to be used by the SYCL runtime
00112   */
00113   buffer(const range<Dimensions> &r, Allocator allocator = {})
00114     : implementation_t { detail::waiter<T, Dimensions, Allocator>(
00115                          new detail::buffer<T, Dimensions> { r }) }
```

```
00116       {}
00117
00118
00119   /** Create a new buffer with associated host memory
00120
00121       \param[in] host_data points to the storage and values used by
00122       the buffer
00123
00124       \param[in] r defines the size
00125
00126       \param[in] allocator is to be used by the SYCL runtime, of type
00127       \c cl::sycl::buffer_allocator<T> by default
00128
00129       The host address is \code const T* \endcode, so the host memory
00130       is read-only.
00131
00132       However, the typename T is not const so the device accesses can
00133       be both read and write accesses. Since, the host_data is const,
00134       this buffer is only initialized with this memory and there is
00135       no write after its destruction, unless there is another final
00136       data address given after construction of the buffer.
00137
00138       Only enable this constructor if it is not the same as the one
00139       with \code const T *host_data \endcode, which is when \c T is
00140       already a constant type.
00141
00142       \todo Actually this is redundant.
00143   */
00144   template <typename Dependent = T,
00145             typename = std::enable_if_t<!std::is_const<Dependent>::value>>
00146   buffer(const T *host_data,
00147          const range<Dimensions> &r,
00148          Allocator allocator = {})
00149     : implementation_t { detail::waiter(new
      detail::buffer<T, Dimensions>
00150                          { host_data, r }) }
00151   {}
00152
00153
00154   /** Create a new buffer with associated host memory
00155
00156       \param[inout] host_data points to the storage and values used by
00157       the buffer
00158
00159       \param[in] r defines the size
00160
00161       \param[in] allocator is to be used by the SYCL runtime, of type
00162       cl::sycl::buffer_allocator<T> by default
00163
00164       The memory is owned by the runtime during the lifetime of the
00165       object.  Data is copied back to the host unless the user
00166       overrides the behavior using the set_final_data method. host_data
00167       points to the storage and values used by the buffer and
00168       range<Dimensions> defines the size.
00169   */
00170   buffer(T *host_data,
00171          const range<Dimensions> &r,
00172          Allocator allocator = {})
00173     : implementation_t { detail::waiter(new
      detail::buffer<T, Dimensions>
00174                          { host_data, r }) }
00175   {}
00176
00177
00178   /** Create a new buffer with associated memory, using the data in
00179       host_data
00180
00181       \param[inout] host_data points to the storage and values used by
00182       the buffer
00183
00184       \param[in] r defines the size
00185
00186       \param[in] allocator is to be used by the SYCL runtime, of type
00187       cl::sycl::buffer_allocator<T> by default
00188
00189       The ownership of the host_data is shared between the runtime and the
00190       user. In order to enable both the user application and the SYCL
00191       runtime to use the same pointer, a cl::sycl::mutex_class is
00192       used. The mutex m is locked by the runtime whenever the data is in
00193       use and unlocked otherwise. Data is synchronized with host_data, when
00194       the mutex is unlocked by the runtime.
00195
00196       \todo update the specification to replace the pointer by a
00197       reference and provide the constructor with and without a mutex
00198   */
00199   buffer(shared_ptr_class<T> &host_data,
00200          const range<Dimensions> &buffer_range,
```

```
00201         cl::sycl::mutex_class &m,
00202         Allocator allocator = {}) {
00203     detail::unimplemented();
00204   }
00205
00206
00207   /** Create a new buffer with associated memory, using the data in
00208       host_data
00209
00210       \param[inout] host_data points to the storage and values used by
00211       the buffer
00212
00213       \param[in] r defines the size
00214
00215       \param[inout] m is the mutex used to protect the data access
00216
00217       \param[in] allocator is to be used by the SYCL runtime, of type
00218       cl::sycl::buffer_allocator<T> by default
00219
00220       The ownership of the host_data is shared between the runtime and the
00221       user. In order to enable both the user application and the SYCL
00222       runtime to use the same pointer, a cl::sycl::mutex_class is
00223       used.
00224
00225       \todo add this mutex-less constructor to the specification
00226   */
00227   buffer(shared_ptr_class<T> host_data,
00228         const range<Dimensions> &buffer_range,
00229         Allocator allocator = {})
00230     : implementation_t { detail::waiter(new
      detail::buffer<T, Dimensions>
00231                         { host_data, buffer_range }) }
00232   {}
00233
00234
00235   /** Create a new allocated 1D buffer initialized from the given
00236       elements ranging from first up to one before last
00237
00238       The data is copied to an intermediate memory position by the
00239       runtime. Data is written back to the same iterator set if the
00240       iterator is not a const iterator.
00241
00242       \param[inout] start_iterator points to the first element to copy
00243
00244       \param[in] end_iterator points to just after the last element to copy
00245
00246       \param[in] allocator is to be used by the SYCL runtime, of type
00247       cl::sycl::buffer_allocator<T> by default
00248
00249       \todo Implement the copy back at buffer destruction
00250
00251       \todo Generalize this for n-D and provide column-major and row-major
00252       initialization
00253
00254       \todo a reason to have this nD is that
00255             set_final_data(weak_ptr_class<T> & finalData) is actually
00256             doing this linearization anyway
00257
00258       \todo Allow read-only buffer construction too
00259
00260       \todo update the specification to deal with forward iterators
00261       instead and rewrite back only when it is non const and output
00262       iterator at least
00263
00264       \todo Allow initialization from ranges and collections à la STL
00265   */
00266   template <typename InputIterator,
00267             /* To force some iterator concept checking to avoid GCC 4.9
00268                diving into this when initializing from ({ int, int })
00269                which is a range<> and and not an iterator... */
00270             typename ValueType =
00271             typename std::iterator_traits<InputIterator>::value_type>
00272   buffer(InputIterator start_iterator,
00273          InputIterator end_iterator,
00274          Allocator allocator = {}) :
00275     implementation_t { detail::waiter(new
      detail::buffer<T, Dimensions>
00276                         { start_iterator, end_iterator }) }
00277   {}
00278
00279
00280   /** Create a new sub-buffer without allocation to have separate
00281       accessors later
00282
00283       \param[inout] b is the buffer with the real data
00284
00285       \param[in] base_index specifies the origin of the sub-buffer inside the
```

```
00286       buffer b
00287
00288       \param[in] sub_range specifies the size of the sub-buffer
00289
00290       \todo To be implemented
00291
00292       \todo Update the specification to replace index by id
00293   */
00294   buffer(buffer<T, Dimensions, Allocator> &b,
00295          const id<Dimensions> &base_index,
00296          const range<Dimensions> &sub_range,
00297          Allocator allocator = {}) { detail::unimplemented(); }
00298
00299
00300 #ifdef TRISYCL_OPENCL
00301   /** Create a buffer from an existing OpenCL memory object associated
00302       with a context after waiting for an event signaling the
00303       availability of the OpenCL data
00304
00305       \param[inout] mem_object is the OpenCL memory object to use
00306
00307       \param[inout] from_queue is the queue associated to the memory
00308       object
00309
00310       \param[in] available_event specifies the event to wait for if
00311       non null
00312
00313       Note that a buffer created from a cl_mem object will only have
00314       one underlying cl_mem for the lifetime of the buffer and use on
00315       an incompatible queue constitues an error.
00316
00317       \todo To be implemented
00318
00319       \todo Improve the specification to allow CLHPP objects too
00320   */
00321   buffer(cl_mem mem_object,
00322          queue from_queue,
00323          event available_event = {},
00324          Allocator allocator = {}) { detail::unimplemented();  }
00325 #endif
00326
00327
00328   // Use BOOST_DISABLE_ASSERTS at some time to disable range checking
00329
00330   /** Get an accessor to the buffer with the required mode
00331
00332       \param Mode is the requested access mode
00333
00334       \param Target is the type of object to be accessed
00335
00336       \param[in] command_group_handler is the command group handler in
00337       which the kernel is to be executed
00338
00339       \todo Do we need for an accessor to increase the reference count of
00340       a buffer object? It does make more sense for a host-side accessor.
00341
00342       \todo Implement the modes and targets
00343   */
00344   template <access::mode Mode,
00345             access::target Target = access::target::global_buffer
    >
00346   accessor<T, Dimensions, Mode, Target>
00347   get_access(handler &command_group_handler) {
00348     static_assert(Target == access::target::global_buffer
00349                   || Target == access::target::constant_buffer,
00350                   "get_access(handler) can only deal with access::global_buffer"
00351                   " or access::constant_buffer (for host_buffer accessor"
00352                   " do not use a command group handler");
00353     implementation->implementation->template track_access_mode<Mode, Target>();
00354     return { *this, command_group_handler };
00355   }
00356
00357
00358   /** Force the buffer to behave like if we had created
00359       an accessor in write mode.
00360    */
00361   void mark_as_written() {
00362     return implementation->implementation->mark_as_written();
00363   }
00364
00365
00366   /** Get a host accessor to the buffer with the required mode
00367
00368       \param Mode is the requested access mode
00369
00370       \todo Implement the modes
00371
```

```
00372       \todo More elegant solution
00373   */
00374   template <access::mode Mode,
00375             access::target Target = access::target::host_buffer>
00376   accessor<T, Dimensions, Mode, Target>
00377   get_access() {
00378     static_assert(Target == access::target::host_buffer,
00379                   "get_access() without a command group handler is only"
00380                   " for host_buffer accessor");
00381     implementation->implementation->template track_access_mode<Mode, Target>();
00382     return { *this };
00383   }
00384
00385
00386   /** Return a range object representing the size of the buffer in
00387       terms of number of elements in each dimension as passed to the
00388       constructor
00389
00390       \todo rename to the equivalent from array_ref proposals? Such
00391       as size() in
00392       http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2016/p0009r2.html
00393   */
00394   auto get_range() const {
00395     /* Interpret the shape which is a pointer to the first element as an
00396        array of Dimensions elements so that the range<Dimensions>
00397        constructor is happy with this collection
00398     */
00399     return implementation->implementation->get_range();
00400   }
00401
00402
00403   /** Returns the total number of elements in the buffer
00404
00405       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
00406   */
00407   auto get_count() const {
00408     return implementation->implementation->get_count();
00409   }
00410
00411
00412   /** Returns the size of the buffer storage in bytes
00413
00414       Equal to get_count()*sizeof(T).
00415
00416       \todo rename to something else. In
00417       http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2015/p0122r0.pdf
00418       it is named bytes() for example
00419   */
00420   size_t get_size() const {
00421     return implementation->implementation->get_size();
00422   }
00423
00424
00425   /** Returns the number of buffers that are shared/referenced
00426
00427       For example
00428       \code
00429       cl::sycl::buffer<int> b { 1000 };
00430       // Here b.use_count() should return 1
00431       cl::sycl::buffer<int> c { b };
00432       // Here b.use_count() and b.use_count() should return 2
00433       \endcode
00434
00435       \todo Add to the specification, useful for validation
00436   */
00437   auto use_count() const {
00438     // Rely on the shared_ptr<> use_count()
00439     return implementation.use_count();
00440   }
00441
00442
00443   /** Ask for read-only status of the buffer
00444
00445       \todo Add to specification
00446   */
00447   bool constexpr is_read_only() const {
00448     return std::is_const<T>::value;
00449   }
00450
00451
00452   /** Set destination of buffer data on destruction
00453
00454       The finalData points to the host memory to which, the outcome of all
00455       the buffer processing is going to be copied to.
00456
00457       This is the final pointer, which is going to be accessible after the
00458       destruction of the buffer and in the case where this is a valid
```

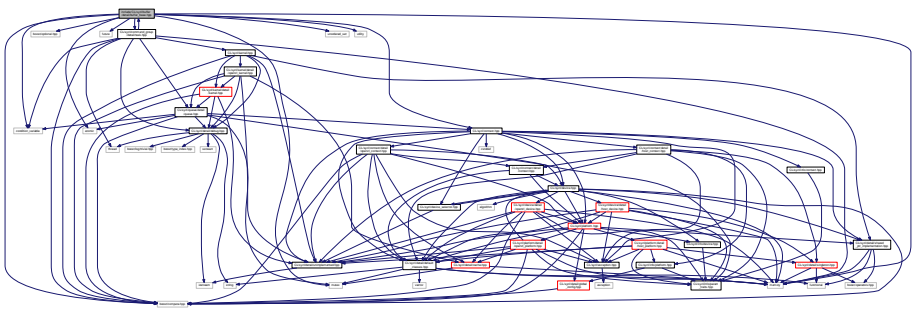
```
00459       pointer, the data are going to be copied to this host address.
00460
00461       finalData is different from the original host address, if the buffer
00462       was created associated with one. This is mainly to be used when a
00463       shared_ptr is given in the constructor and the output data will
00464       reside in a different location from the initialization data.
00465
00466       It is defined as a weak_ptr referring to a shared_ptr that is not
00467       associated with the cl::sycl::buffer, and so the cl::sycl::buffer
00468       will have no ownership of finalData.
00469
00470       \todo Update the API to take finalData by value instead of by
00471             reference.  This way we can have an implicit conversion
00472             possible at the API call from a shared_ptr<>, avoiding an
00473             explicit weak_ptr<> creation
00474
00475       \todo figure out how set_final_data() interact with the other
00476       way to write back some data or with some data sharing with the
00477       host that can not be undone
00478   */
00479   void set_final_data(shared_ptr_class<T> finalData) {
00480     implementation->implementation->set_final_data(std::move(finalData));
00481   }
00482
00483
00484   /** Set destination of buffer data on destruction.
00485    */
00486   void set_final_data(weak_ptr_class<T> finalData) {
00487     implementation->implementation->set_final_data(std::move(finalData));
00488   }
00489
00490
00491   /** Disable write-back on buffer destruction.
00492    */
00493   void set_final_data(std::nullptr_t) {
00494     implementation->implementation->set_final_data(nullptr);
00495   }
00496
00497
00498 #ifdef TRISYCL_OPENCL
00499   /** Check if the buffer is already cached in a certain context
00500    */
00501   bool is_cached(cl::sycl::context& ctx) {
00502     return implementation->implementation->is_cached(ctx);
00503   }
00504
00505
00506   /** Check if the data stored in the buffer is up-to-date in a certain context
00507    */
00508   bool is_data_up_to_date(cl::sycl::context& ctx) {
00509     return implementation->implementation->is_data_up_to_date(ctx);
00510   }
00511 #endif
00512
00513   /** Set destination of buffer data on destruction.
00514
00515       WARNING: the user has to ensure that the object refered to by the
00516       iterator will be alive after buffer destruction, otherwise the behaviour
00517       is undefined.
00518    */
00519   template<typename Iterator>
00520   void set_final_data(Iterator&& finalData) {
00521     implementation->implementation->
00522       set_final_data(std::forward<Iterator>(finalData));
00523   }
00524
00525 };
00526
00527 /// @} End the data Doxygen group
00528
00529 }
00530 }
00531
00532 /* Inject a custom specialization of std::hash to have the buffer
00533    usable into an unordered associative container
00534
00535    \todo Add this to the spec
00536 */
00537 namespace std {
00538
00539 template <typename T,
00540           int Dimensions,
00541           typename Allocator>
00542 struct hash<cl::sycl::buffer<T, Dimensions, Allocator>> {
00543
00544   auto operator()(const cl::sycl::buffer<T, Dimensions, Allocator>
       &b) const {
```

```
00545     // Forward the hashing to the implementation
00546     return b.hash();
00547   }
00548
00549 };
00550
00551 }
00552
00553 /*
00554     # Some Emacs stuff:
00555     ### Local Variables:
00556     ### ispell-local-dictionary: "american"
00557     ### eval: (flyspell-prog-mode)
00558     ### End:
00559 */
00560
00561 #endif // TRISYCL_SYCL_BUFFER_HPP
```

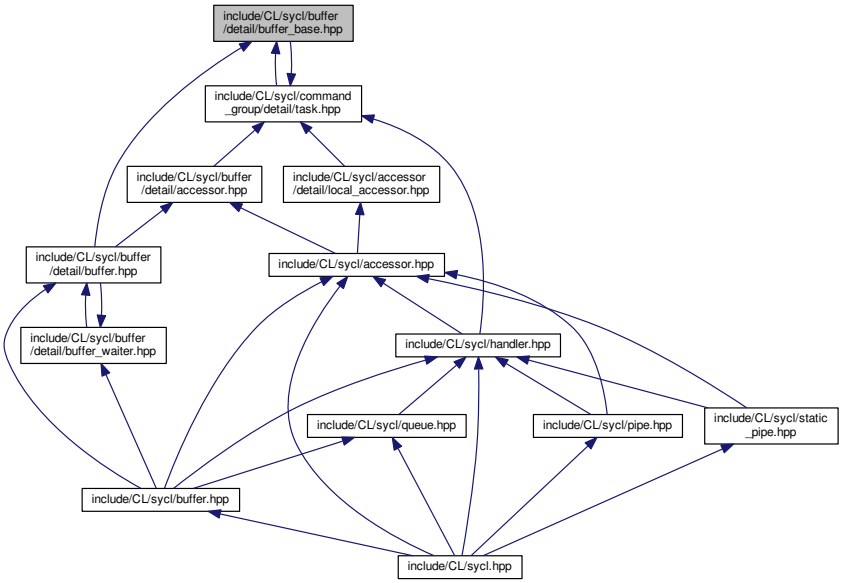
11.21 include/CL/sycl/buffer/detail/buffer_base.hpp File Reference

```
#include <atomic>
#include <boost/compute.hpp>
#include <boost/optional.hpp>
#include <condition_variable>
#include <future>
#include <memory>
#include <mutex>
#include <unordered_set>
#include <utility>
#include "CL/sycl/command_group/detail/task.hpp"
#include "CL/sycl/context.hpp"
```

Include dependency graph for buffer_base.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::buffer_base

  Factorize some template independent buffer aspects in a base class. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Functions

- static std::shared_ptr< detail::task > cl::sycl::detail::add_buffer_to_task (handler *command_group_handler, std::shared_ptr< detail::buffer_base > b, bool is_write_mode)

11.22 buffer_base.hpp

```
00001 #ifndef TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_BASE_HPP
00002 #define TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_BASE_HPP
00003
00004 /** \file The buffer_base behind the buffers, independent of the data
00005     type
00006
00007     Ronan at Keryell point FR
00008
00009     This file is distributed under the University of Illinois Open Source
00010     License. See LICENSE.TXT for details.
00011 */
```

```
00012
00013 #include <atomic>
00014 #ifdef TRISYCL_OPENCL
00015 #include <boost/compute.hpp>
00016 #endif
00017 // \todo Use C++17 optional when it is mainstream
00018 #include <boost/optional.hpp>
00019 #include <condition_variable>
00020 #include <future>
00021 #include <memory>
00022 #include <mutex>
00023 #include <unordered_set>
00024 #include <utility>
00025
00026 #include "CL/sycl/command_group/detail/task.hpp"
00027 #include "CL/sycl/context.hpp"
00028
00029 namespace cl {
00030 namespace sycl {
00031
00032 class handler;
00033
00034 namespace detail {
00035
00036 /** \addtogroup data Data access and storage in SYCL
00037     @{
00038 */
00039
00040 struct task;
00041 struct buffer_base;
00042 inline static std::shared_ptr<detail::task>
00043 add_buffer_to_task(handler *command_group_handler,
00044                    std::shared_ptr<detail::buffer_base> b,
00045                    bool is_write_mode);
00046
00047 /** Factorize some template independent buffer aspects in a base class
00048  */
00049 struct buffer_base : public std::enable_shared_from_this<buffer_base> {
00050
00051   //// Keep track of the number of kernel accessors using this buffer
00052   std::atomic<size_t> number_of_users;
00053
00054   /// Track the latest task to produce this buffer
00055   std::weak_ptr<detail::task> latest_producer;
00056   /// To protect the access to latest_producer
00057   std::mutex latest_producer_mutex;
00058
00059   /// To signal when this buffer ready
00060   std::condition_variable ready;
00061   /// To protect the access to the condition variable
00062   std::mutex ready_mutex;
00063
00064   /** If the SYCL user buffer destructor is blocking, use this to
00065       block until this buffer implementation is destroyed.
00066
00067       Use a void promise since there is no value to send, only
00068       waiting */
00069   boost::optional<std::promise<void>> notify_buffer_destructor;
00070
00071   /// To track contexts in which the data is up-to-date
00072   std::unordered_set<cl::sycl::context> fresh_ctx;
00073
00074 #ifdef TRISYCL_OPENCL
00075   /** Buffer-side cache that keeps the \c boost::compute::buffer (and the
00076       underlying \c cl_buffer ) so that if the buffer already exists inside
00077       the same context it is not recreated.
00078    */
00079   std::unordered_map<cl::sycl::context, boost::compute::buffer> buffer_cache;
00080 #endif
00081
00082   /** Create a buffer base and marks the host context as the context that
00083       holds the most recent version of the data
00084       \todo Use lazy allocation for the context tracking set
00085    */
00086   buffer_base() : number_of_users { 0 },
00087                   fresh_ctx { cl::sycl::context {} } {}
00088
00089
00090   /// The destructor wait for not being used anymore
00091   ~buffer_base() {
00092     wait();
00093     // If there is the last SYCL user buffer waiting, notify it
00094     if (notify_buffer_destructor)
00095       notify_buffer_destructor->set_value();
00096   }
00097
00098
```

```
00099   /// Wait for this buffer to be ready, which is no longer in use
00100   void wait() {
00101     std::unique_lock<std::mutex> ul { ready_mutex };
00102     ready.wait(ul, [&] {
00103         // When there is no producer for this buffer, we are ready to use it
00104         return number_of_users == 0;
00105       });
00106   }
00107
00108
00109   /// Mark this buffer in use by a task
00110   void use() {
00111     // Increment the use count
00112     ++number_of_users;
00113   }
00114
00115
00116   /// A task has released the buffer
00117   void release() {
00118     if (--number_of_users == 0)
00119       // Notify the host consumers or the buffer destructor that it is ready
00120       ready.notify_all();
00121   }
00122
00123
00124   /// Return the latest producer for the buffer
00125   std::shared_ptr<detail::task> get_latest_producer() {
00126     std::lock_guard<std::mutex> lg { latest_producer_mutex };
00127     // Return the valid shared_ptr to the task, if any
00128     return latest_producer.lock();
00129   }
00130
00131
00132   /** Return the latest producer for the buffer and set another
00133       future producer
00134   */
00135   std::shared_ptr<detail::task>
00136   set_latest_producer(std::weak_ptr<detail::task> newer_latest_producer) {
00137     std::lock_guard<std::mutex> lg { latest_producer_mutex };
00138     using std::swap;
00139
00140     swap(newer_latest_producer, latest_producer);
00141     // Return the valid shared_ptr to the previous producing task, if any
00142     return newer_latest_producer.lock();
00143   }
00144
00145
00146   /// Add a buffer to the task running the command group
00147   std::shared_ptr<detail::task>
00148   add_to_task(handler *command_group_handler, bool is_write_mode) {
00149     return add_buffer_to_task(command_group_handler,
00150                               shared_from_this(),
00151                               is_write_mode);
00152   }
00153
00154
00155 #ifdef TRISYCL_OPENCL
00156   /// Check if the data of this buffer is up-to-date in a certain context
00157   bool is_data_up_to_date(const cl::sycl::context& ctx) {
00158     return fresh_ctx.count(ctx);
00159   }
00160
00161
00162   /// Check if the buffer is already cached for a certain context
00163   bool is_cached(const cl::sycl::context& ctx) {
00164     return buffer_cache.count(ctx);
00165   }
00166
00167
00168   /** Create a \c boost::compute::buffer for this \c cl::sycl::buffer in the
00169       cache and associate it with a given context
00170   */
00171   void create_in_cache(const cl::sycl::context& ctx, size_t size,
00172                        cl_mem_flags flags, void* data) {
00173     buffer_cache[ctx] = boost::compute::buffer
00174       { ctx.get_boost_compute(),
00175         size,
00176         flags,
00177         data
00178       };
00179   }
00180
00181
00182   /** Transfer the most up-to-date version of the data to the host
00183       if the host version is not already up-to-date
00184   */
00185   void sync_with_host(std::size_t size, void* data) {
```

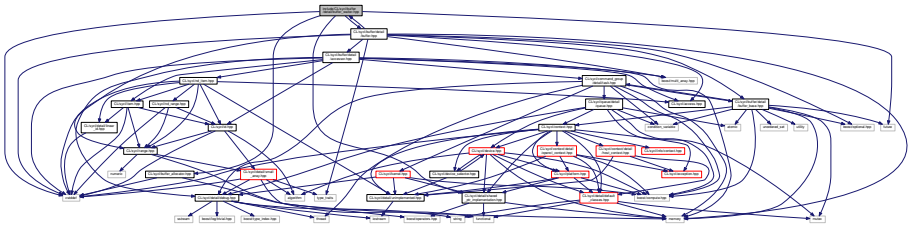
```
00186     cl::sycl::context host_context;
00187     if (!is_data_up_to_date(host_context) && !fresh_ctx.empty()) {
00188       /* We know that the context(s) in \c fresh_ctx hold the most recent
00189          version of the buffer
00190       */
00191       auto fresh_context = *(fresh_ctx.begin());
00192       auto fresh_q = fresh_context.get_boost_queue();
00193       fresh_q.enqueue_read_buffer(buffer_cache[fresh_context], 0, size, data);
00194       fresh_ctx.insert(host_context);
00195     }
00196   }
00197
00198
00199   /** When a transfer is requested this function is called, it will
00200       update the state of the buffer according to the context in which
00201       the accessor is created and the access mode
00202   */
00203   void update_buffer_state(const cl::sycl::context& target_ctx,
00204                            access::mode mode, std::size_t size, void* data) {
00205     /* The \c cl_buffer we put in the cache might get accessed again in the
00206        future, this means that we have to always to create it in read/write
00207        mode to be able to write to it if it is accessed through a
00208        write accessor in the future
00209     */
00210     auto constexpr flag = CL_MEM_READ_WRITE;
00211
00212     /* The buffer is accessed in read mode, we want to transfer the data only if
00213        necessary. We start a transfer if the data on the target context is not
00214        up to date and then update the fresh context set.
00215     */
00216     if (mode == access::mode::read) {
00217
00218       if (is_data_up_to_date(target_ctx))
00219         // If read mode and the data is up-to-date there is nothing to do
00220         return;
00221
00222       // The data is not up-to-date, we need a transfer
00223       // We also want to be sure that the host holds the most recent data
00224       sync_with_host(size, data);
00225
00226       if (!target_ctx.is_host()) {
00227         // If the target context is a device context
00228         if (!is_cached(target_ctx)) {
00229           /* If not cached, we create the buffer and copy the data
00230              at the same time
00231           */
00232           create_in_cache(target_ctx, size,
00233                           (flag | CL_MEM_COPY_HOST_PTR), data);
00234           fresh_ctx.insert(target_ctx);
00235           return;
00236         }
00237
00238         /* Else we transfer the data to the existing buffer associated
00239            with the target context buffer
00240         */
00241         auto q = target_ctx.get_boost_queue();
00242         q.enqueue_write_buffer(buffer_cache[target_ctx], 0, size, data);
00243         fresh_ctx.insert(target_ctx);
00244       }
00245       return;
00246     }
00247
00248     /* The buffer might be written to, this means that we have to consider
00249        every version of the data obsolete except in the target context
00250
00251        We go through the same process as in read mode but in addition
00252        we empty the fresh context set and just add the target context
00253
00254        If the data is up to date on the target we just have to update
00255        the context set and nothing else
00256     */
00257     if (!is_data_up_to_date(target_ctx)) {
00258
00259       if (   mode == access::mode::read_write
00260           || mode == access::mode::write
00261           || mode == access::mode::atomic) {
00262         // If the data is not up-to-date in the target context
00263         // We want to host to be up-to-date
00264         sync_with_host(size, data);
00265
00266         if (!target_ctx.is_host()) {
00267           // If the target context is a device context
00268           if (!is_cached(target_ctx)) {
00269             create_in_cache(target_ctx, size,
00270                             (flag | CL_MEM_COPY_HOST_PTR), data);
00271           }
00272           else {
```

```
00273             // We update the buffer associated with the target context
00274             auto q = target_ctx.get_boost_queue();
00275             q.enqueue_write_buffer(buffer_cache[target_ctx], 0, size, data);
00276           }
00277         }
00278       }
00279
00280       /* When in discard mode we don't need to transfer any data, we just create
00281          the \c cl_buffer if it doesn't exist in the cache
00282       */
00283       if (   mode == access::mode::discard_write
00284           || mode == access::mode::discard_read_write) {
00285         /* We only need to create the buffer if it doesn't exist
00286            but without copying any data because of the discard mode
00287         */
00288         if (!target_ctx.is_host() && !is_cached(target_ctx)) {
00289           // If the context doesn't exist we create it.
00290           /* We don't want to transfer any data so we don't
00291              add \c CL_MEM_COPY_HOST_PTR
00292           */
00293           create_in_cache(target_ctx, size, flag, 0);
00294         }
00295       }
00296     }
00297     /* Here we are sure that we are in some kind of write mode,
00298        we indicate that all contexts except the target context
00299        are not up-to-date anymore
00300     */
00301     fresh_ctx.clear();
00302     fresh_ctx.insert(target_ctx);
00303   }
00304
00305
00306   /// Returns the cl_buffer for a given context.
00307   boost::compute::buffer get_cl_buffer(const cl::sycl::context&
      context) {
00308     return buffer_cache[context];
00309   }
00310
00311 #endif
00312
00313 };
00314
00315 /// @} End the data Doxygen group
00316
00317 }
00318 }
00319 }
00320
00321 /*
00322     # Some Emacs stuff:
00323     ### Local Variables:
00324     ### ispell-local-dictionary: "american"
00325     ### eval: (flyspell-prog-mode)
00326     ### End:
00327 */
00328
00329 #endif // TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_BASE_HPP
```

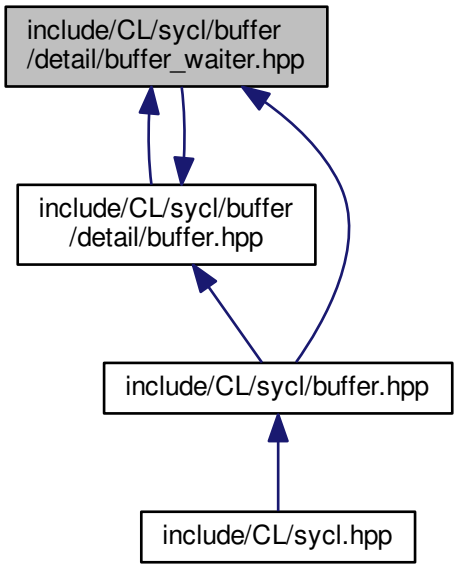
11.23 include/CL/sycl/buffer/detail/buffer_waiter.hpp File Reference

```
#include <cstddef>
#include <future>
#include "CL/sycl/buffer/detail/buffer.hpp"
#include "CL/sycl/buffer_allocator.hpp"
#include "CL/sycl/detail/shared_ptr_implementation.hpp"
```

Include dependency graph for buffer_waiter.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >

  A helper class to wait for the final buffer destruction if the conditions for blocking are met. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Functions

- template<typename T , int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>>
  auto cl::sycl::detail::waiter (detail::buffer< T, Dimensions > *b)

  Helper function to create a new buffer_waiter.

11.24 buffer_waiter.hpp

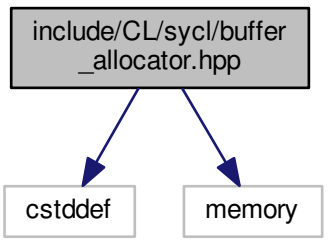
```
00001 #ifndef TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_WAITER_HPP
00002 #define TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_WAITER_HPP
00003
00004 /** \file A helper class to wait for the buffer<> detail
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <future>
00014
00015 #include "CL/sycl/buffer/detail/buffer.hpp"
00016 #include "CL/sycl/buffer_allocator.hpp"
00017 #include "CL/sycl/detail/shared_ptr_implementation.hpp"
00018
00019 namespace cl {
00020 namespace sycl {
00021 namespace detail {
00022
00023 /** \addtogroup data Data access and storage in SYCL
00024     @{
00025 */
00026
00027 /** A helper class to wait for the final buffer destruction if the
00028     conditions for blocking are met
00029 */
00030 template <typename T,
00031           int Dimensions = 1,
00032           typename Allocator = buffer_allocator<std::remove_const_t<T>>>
00033 class buffer_waiter :
00034     public detail::shared_ptr_implementation<buffer_waiter<T,
00035                                                            Dimensions,
00036                                                            Allocator>,
00037                                              detail::buffer<T, Dimensions>>,
00038     detail::debug<buffer_waiter<T, Dimensions, Allocator>> {
00039
00040   // The type encapsulating the implementation
00041   using implementation_t = typename
      buffer_waiter::shared_ptr_implementation;
00042
00043   // Allows the comparison operation to access the implementation
00044   friend implementation_t;
00045
00046 public:
00047
00048   // Make the implementation member directly accessible in this class
00049   using implementation_t::implementation;
00050
00051   /// Create a new buffer_waiter on top of a detail::buffer
00052   buffer_waiter(detail::buffer<T, Dimensions> *b) :
      implementation_t { b } {}
00053
00054
00055   /** The buffer_waiter destructor waits for any data to be written
00056       back to the host, if any
00057   */
00058   ~buffer_waiter() {
00059     /* Get a future from the implementation if we have to wait for its
00060        destruction */
00061     auto f = implementation->get_destructor_future();
00062     if (f) {
00063       /* No longer carry for the implementation buffer which is free to
00064          live its life up to its destruction */
00065       implementation.reset();
00066       TRISYCL_DUMP_T("~buffer_waiter() is waiting");
00067       // Then wait for its end in some other thread
00068       f->wait();
00069       TRISYCL_DUMP_T("~buffer_waiter() is done");
```

```
00070     }
00071   }
00072 };
00073
00074
00075 /// Helper function to create a new buffer_waiter
00076 template <typename T,
00077           int Dimensions = 1,
00078           typename Allocator = buffer_allocator<std::remove_const_t<T>
      >>
00079 inline auto waiter(detail::buffer<T, Dimensions> *b) {
00080   return new buffer_waiter<T, Dimensions, Allocator> { b };
00081 }
00082
00083 /// @} End the data Doxygen group
00084
00085 }
00086 }
00087 }
00088
00089 /*
00090     # Some Emacs stuff:
00091     ### Local Variables:
00092     ### ispell-local-dictionary: "american"
00093     ### eval: (flyspell-prog-mode)
00094     ### End:
00095 */
00096
00097 #endif // TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_WAITER_HPP
```

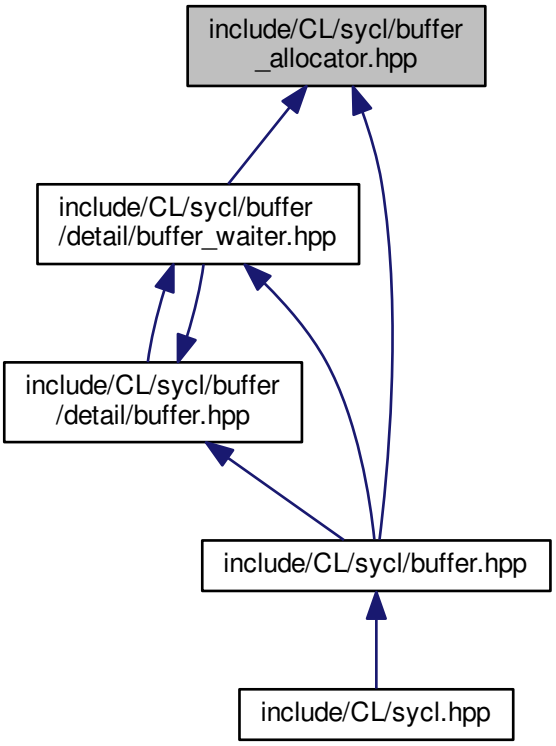
11.25 include/CL/sycl/buffer_allocator.hpp File Reference

```
#include <cstddef>
#include <memory>
```

Include dependency graph for buffer_allocator.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

11.26 buffer_allocator.hpp

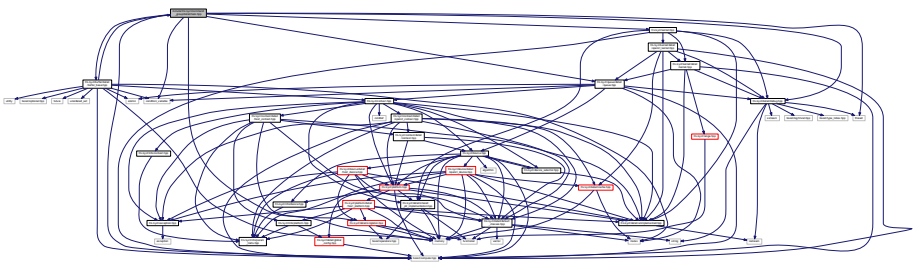
```
00001 #ifndef TRISYCL_SYCL_BUFFER_ALLOCATOR_HPP
00002 #define TRISYCL_SYCL_BUFFER_ALLOCATOR_HPP
00003
00004 /** \file The OpenCL SYCL buffer_allocator
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <memory>
00014
00015 namespace cl {
00016 namespace sycl {
00017
00018 /** \addtogroup data Data access and storage in SYCL
```

```
00019     @{
00020 */
00021
00022 /** The default buffer allocator used by the runtime, when no allocator is
00023     defined by the user
00024
00025     Reuse the C++ default allocator.
00026 */
00027 template <typename T>
00028 using buffer_allocator = std::allocator<T>;
00029
00030 /// @} End the data Doxygen group
00031
00032 }
00033 }
00034
00035 /*
00036     # Some Emacs stuff:
00037     ### Local Variables:
00038     ### ispell-local-dictionary: "american"
00039     ### eval: (flyspell-prog-mode)
00040     ### End:
00041 */
00042
00043 #endif // TRISYCL_SYCL_BUFFER_ALLOCATOR_HPP
```

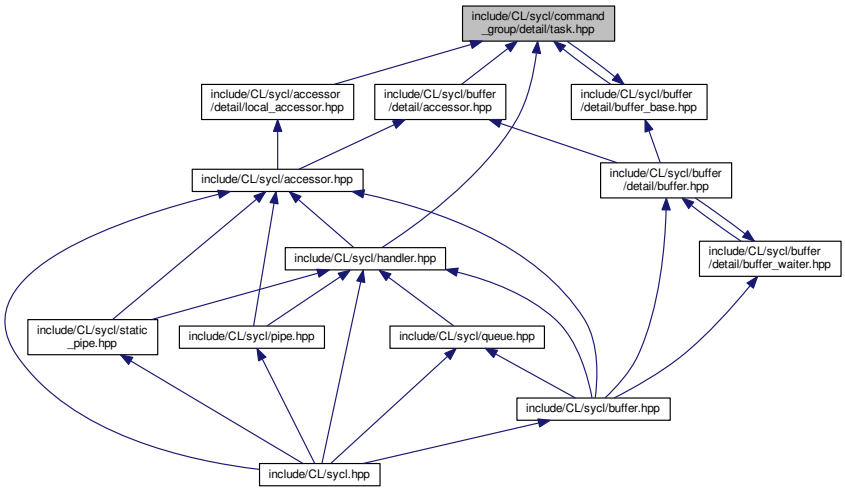
11.27 include/CL/sycl/command_group/detail/task.hpp File Reference

```
#include <condition_variable>
#include <memory>
#include <thread>
#include <boost/compute.hpp>
#include "CL/sycl/buffer/detail/buffer_base.hpp"
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/kernel.hpp"
#include "CL/sycl/queue/detail/queue.hpp"
```

Include dependency graph for task.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::task

  The abstraction to represent SYCL tasks executing inside command_group.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.28 task.hpp

```
00001 #ifndef TRISYCL_SYCL_TASK_HPP
00002 #define TRISYCL_SYCL_TASK_HPP
00003
00004 /** \file The concept of task behind the scene
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <condition_variable>
00013 #include <memory>
00014 #include <thread>
00015
00016 #ifdef TRISYCL_OPENCL
00017 #include <boost/compute.hpp>
00018 #endif
00019
00020 #include "CL/sycl/buffer/detail/buffer_base.hpp"
00021 #include "CL/sycl/detail/debug.hpp"
00022 #include "CL/sycl/kernel.hpp"
00023 #include "CL/sycl/queue/detail/queue.hpp"
00024
00025 namespace cl {
```

```
00026 namespace sycl {
00027 namespace detail {
00028
00029 /** The abstraction to represent SYCL tasks executing inside command_group
00030
00031     "enable_shared_from_this" allows to access the shared_ptr behind the
00032     scene.
00033 */
00034 struct task : public std::enable_shared_from_this<task>,
00035               public detail::debug<task> {
00036
00037   /** List of the buffers used by this task
00038
00039       \todo Use a set to check that some buffers are not used many
00040       times at least on writing
00041   */
00042   std::vector<std::shared_ptr<detail::buffer_base>> buffers_in_use;
00043
00044   /// The tasks producing the buffers used by this task
00045   std::vector<std::shared_ptr<detail::task>> producer_tasks;
00046
00047   /// Keep track of any prologue to be executed before the kernel
00048   std::vector<std::function<void(void)>> prologues;
00049
00050   /// Keep track of any epilogue to be executed after the kernel
00051   std::vector<std::function<void(void)>> epilogues;
00052
00053   /// Store if the execution ended, to be notified by task_ready
00054   bool execution_ended = false;
00055
00056   /// To signal when this task is ready
00057   std::condition_variable ready;
00058
00059   /// To protect the access to the condition variable
00060   std::mutex ready_mutex;
00061
00062   /** Keep track of the queue used to submission to notify kernel completion
00063       or to run OpenCL kernels on */
00064   std::shared_ptr<detail::queue> owner_queue;
00065
00066   std::shared_ptr<cl::sycl::detail::kernel> kernel;
00067
00068
00069   /// Create a task from a submitting queue
00070   task(const std::shared_ptr<detail::queue> &q)
00071     : owner_queue { q } {}
00072
00073
00074   /// Add a new task to the task graph and schedule for execution
00075   void schedule(std::function<void(void)> f) {
00076     /* To keep a copy of the task shared_ptr after the end of the
00077        command group, capture it by copy in the following lambda. This
00078        should be easier in C++17 with move semantics on capture
00079     */
00080     auto task = shared_from_this();
00081     auto execution = [=] {
00082       // Wait for the required tasks to be ready
00083       task->wait_for_producers();
00084       task->prelude();
00085       TRISYCL_DUMP_T("Execute the kernel");
00086       // Execute the kernel
00087       f();
00088       task->postlude();
00089       // Release the buffers that have been written by this task
00090       task->release_buffers();
00091       // Notify the waiting tasks that we are done
00092       task->notify_consumers();
00093       // Notify the queue we are done
00094       owner_queue->kernel_end();
00095       TRISYCL_DUMP_T("Task thread exit");
00096     };
00097     /* Notify the queue that there is a kernel submitted to the
00098        queue. Do not do it in the task contructor so that we can deal
00099        with command group without kernel and if we put it inside the
00100        thread, the queue may have finished before the thread is
00101        scheduled */
00102     owner_queue->kernel_start();
00103     /* \todo it may be implementable with packaged_task that would
00104        deal with exceptions in kernels
00105     */
00106 #ifndef TRISYCL_NO_ASYNC
00107     /* If in asynchronous execution mode, execute the functor in a new
00108        thread */
00109     std::thread thread(execution);
00110     TRISYCL_DUMP_T("Task thread started");
00111     /** Detach the thread since it will synchronize by its own means
00112
```

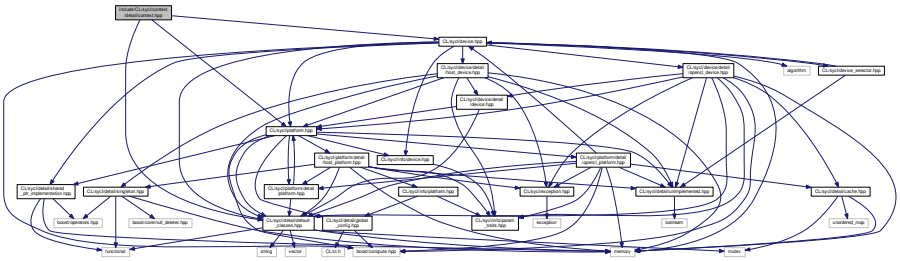
```
00113         \todo This is an issue if there is an exception in the kernel
00114     */
00115     thread.detach();
00116 #else
00117     // Just a synchronous execution otherwise
00118     execution();
00119 #endif
00120   }
00121
00122
00123   /// Wait for the required producer tasks to be ready
00124   void wait_for_producers() {
00125     TRISYCL_DUMP_T("Task " << this << " waits for the producer tasks");
00126     for (auto &t : producer_tasks)
00127       t->wait();
00128     // We can let the producers rest in peace
00129     producer_tasks.clear();
00130   }
00131
00132
00133   /// Release the buffers that have  been used by this task
00134   void release_buffers() {
00135     TRISYCL_DUMP_T("Task " << this << " releases the written buffers");
00136     for (auto b: buffers_in_use)
00137       b->release();
00138     buffers_in_use.clear();
00139   }
00140
00141
00142   /// Notify the waiting tasks that we are done
00143   void notify_consumers() {
00144     TRISYCL_DUMP_T("Notify all the task waiting for this task " << this);
00145    {
00146      std::unique_lock<std::mutex> ul { ready_mutex };
00147      execution_ended = true;
00148    }
00149     /* \todo Verify that the memory model with the notify does not
00150        require some fence or atomic */
00151     ready.notify_all();
00152   }
00153
00154
00155   /** Wait for this task to be ready
00156
00157       This is to be called from another thread
00158   */
00159   void wait() {
00160     TRISYCL_DUMP_T("The task wait for task " << this << " to end");
00161     std::unique_lock<std::mutex> ul { ready_mutex };
00162     ready.wait(ul, [&] { return execution_ended; });
00163   }
00164
00165
00166   /** Register a buffer to this task
00167
00168       This is how the dependency graph is incrementally built.
00169   */
00170   void add_buffer(std::shared_ptr<detail::buffer_base> &buf,
00171                   bool is_write_mode) {
00172     TRISYCL_DUMP_T("Add buffer " << buf << " in task " << this);
00173     /* Keep track of the use of the buffer to notify its release at
00174        the end of the execution */
00175     buffers_in_use.push_back(buf);
00176     // To be sure the buffer does not disappear before the kernel can run
00177     buf->use();
00178
00179     std::shared_ptr<detail::task> latest_producer;
00180     if (is_write_mode) {
00181       /* Set this task as the latest producer of the buffer so that
00182          another kernel may wait on this task */
00183       latest_producer = buf->set_latest_producer(shared_from_this());
00184     }
00185     else
00186       latest_producer = buf->get_latest_producer();
00187
00188     /* If the buffer is to be produced by a task, add the task in the
00189        producer list to wait on it before running the task core
00190
00191        If a buffer is accessed first in write mode and then in read mode,
00192        the task will add itself as a producer and will wait for itself
00193        when calling \c wait_for_producers, we avoid this by checking that
00194        \c latest_producer is not \c this
00195     */
00196     if (latest_producer && latest_producer != shared_from_this())
00197       producer_tasks.push_back(latest_producer);
00198   }
00199
```

```
00200
00201   /// Execute the prologues
00202   void prelude() {
00203     for (const auto &p : prologues)
00204       p();
00205     /* Free the functors that may own an accessor owning a buffer
00206        preventing the command group to complete */
00207     prologues.clear();
00208   }
00209
00210
00211   /// Execute the epilogues
00212   void postlude() {
00213     for (const auto &p : epilogues)
00214       p();
00215     /* Free the functors that may own an accessor owning a buffer
00216        preventing the command group to complete */
00217     epilogues.clear();
00218   }
00219
00220
00221   /// Add a function to the prelude to run before kernel execution
00222   void add_prelude(const std::function<void(void)> &f) {
00223     prologues.push_back(f);
00224   }
00225
00226
00227   /// Add a function to the postlude to run after kernel execution
00228   void add_postlude(const std::function<void(void)> &f) {
00229     epilogues.push_back(f);
00230   }
00231
00232
00233   /// Get the queue behind the task to run a kernel on
00234   auto get_queue() {
00235     return owner_queue;
00236   }
00237
00238
00239   /// Set the kernel running this task if any
00240   void set_kernel(const std::shared_ptr<cl::sycl::detail::kernel> &k) {
00241     kernel = k;
00242   }
00243
00244
00245   /** Get the kernel running if any
00246
00247       \todo Specify this error in the spec
00248   */
00249   cl::sycl::detail::kernel &get_kernel() {
00250     if (!kernel)
00251       throw non_cl_error("Cannot use an OpenCL kernel in this context");
00252     return *kernel;
00253   }
00254
00255 };
00256
00257 }
00258 }
00259 }
00260
00261 /*
00262     # Some Emacs stuff:
00263     ### Local Variables:
00264     ### ispell-local-dictionary: "american"
00265     ### eval: (flyspell-prog-mode)
00266     ### End:
00267 */
00268
00269 #endif // TRISYCL_SYCL_TASK_HPP
```

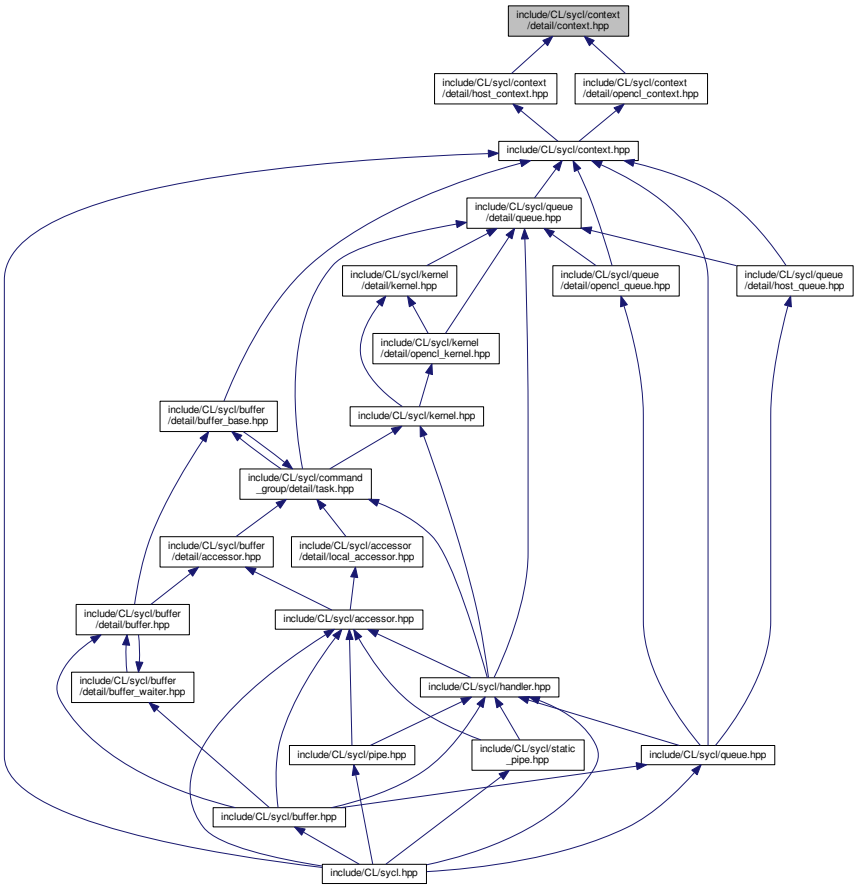
11.29 include/CL/sycl/context/detail/context.hpp File Reference

```
#include "CL/sycl/device.hpp"
#include "CL/sycl/platform.hpp"
#include "CL/sycl/detail/default_classes.hpp"
```

Include dependency graph for context.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::context

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

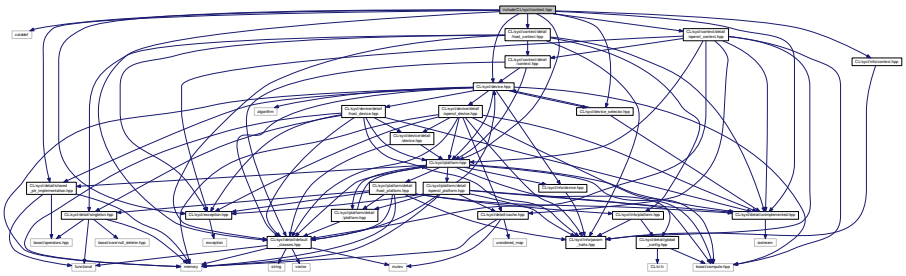
11.30 context.hpp

```
00001 #ifndef TRISYCL_SYCL_CONTEXT_DETAIL_CONTEXT_HPP
00002 #define TRISYCL_SYCL_CONTEXT_DETAIL_CONTEXT_HPP
00003
00004 /** \file The OpenCL SYCL abstract context
00005
00006     a-doumoulakis at gmail dot com (Anastasios Doumoulakis)
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/device.hpp"
00013 #include "CL/sycl/platform.hpp"
00014 #include "CL/sycl/detail/default_classes.hpp"
00015
00016 namespace cl {
00017 namespace sycl {
00018 namespace detail {
00019
00020   /** \addtogroup execution Platforms, contexts, devices and queues
00021       @{
00022   */
00023
00024 class context {
00025 public:
00026
00027 #ifdef TRISYCL_OPENCL
00028   /// Return the underlying \c cl_context of the \c cl::sycl::context
00029   virtual cl_context get() const = 0;
00030
00031   /** Return the underlying \c boost::compute::context
00032       of the \c cl::sycl::context
00033   */
00034   virtual boost::compute::context &get_boost_compute() = 0;
00035
00036   /** Return the underlying \c boost::compute::command_queue associated
00037       with the context
00038   */
00039   virtual boost::compute::command_queue &get_boost_queue() = 0;
00040 #endif
00041
00042   /// Returns true is the context is a SYCL host context
00043   virtual bool is_host() const = 0;
00044
00045   /// Returns the SYCL platform that the context is initialized for
00046   virtual cl::sycl::platform get_platform() const = 0;
00047
00048   /** \todo virtual cannot be templated
00049       template <info::context Param>
00050       typename info::param_traits<info::context, Param>::type
00051       get_info() const = 0;
00052   */
00053
00054   /// Returns the set of devices that are part of this context.
00055   virtual vector_class<cl::sycl::device>
      get_devices() const = 0;
00056
00057   /// Virtual to call the real destructor
00058   virtual ~context() {}
00059
00060 };
00061
00062 /// @} to end the execution Doxygen group
00063
00064 }
00065 }
00066 }
00067
00068 /*
00069     # Some Emacs stuff:
00070     ### Local Variables:
00071     ### ispell-local-dictionary: "american"
00072     ### eval: (flyspell-prog-mode)
00073     ### End:
00074 */
00075
00076 #endif // TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_HPP
```

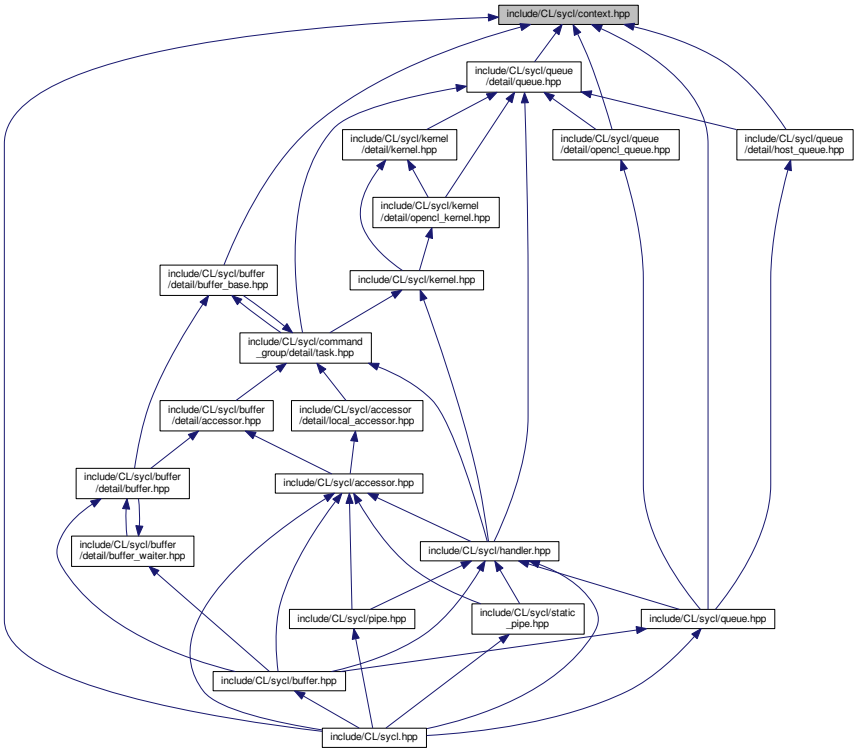
11.31 include/CL/sycl/context.hpp File Reference

```
#include <cstddef>
#include "CL/sycl/context/detail/host_context.hpp"
#include "CL/sycl/context/detail/opencl_context.hpp"
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/detail/shared_ptr_implementation.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/device.hpp"
#include "CL/sycl/device_selector.hpp"
#include "CL/sycl/exception.hpp"
#include "CL/sycl/info/context.hpp"
#include "CL/sycl/platform.hpp"
```

Include dependency graph for context.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::context

  SYCL context. More...
- struct std::hash< cl::sycl::context >

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- std

11.32 context.hpp

```
00001 #ifndef TRISYCL_SYCL_CONTEXT_HPP
00002 #define TRISYCL_SYCL_CONTEXT_HPP
00003
00004 /** \file The OpenCL SYCL context
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013
00014 #include "CL/sycl/context/detail/host_context.hpp"
00015 #ifdef TRISYCL_OPENCL
00016 #include "CL/sycl/context/detail/opencl_context.hpp"
00017 #endif
00018
00019 #include "CL/sycl/detail/default_classes.hpp"
00020 #include "CL/sycl/detail/shared_ptr_implementation.hpp"
00021 #include "CL/sycl/detail/unimplemented.hpp"
00022 #include "CL/sycl/device.hpp"
00023 #include "CL/sycl/device_selector.hpp"
00024 #include "CL/sycl/exception.hpp"
00025 #include "CL/sycl/info/context.hpp"
00026 #include "CL/sycl/platform.hpp"
00027
00028 namespace cl {
00029 namespace sycl {
00030
00031 /** \addtogroup execution Platforms, contexts, devices and queues
00032     @{
00033 */
00034
00035 /** SYCL context
00036
00037     The context class encapsulates an OpenCL context, which is implicitly
00038     created and the lifetime of the context instance defines the lifetime
00039     of the underlying OpenCL context instance.
00040
00041     On destruction clReleaseContext is called.
00042
00043     The default context is the SYCL host context containing only the SYCL
00044     host device.
00045
00046     \todo The implementation is quite minimal for now.
00047 */
00048 class context
00049
00050   /* Use the underlying context implementation that can be shared in the
00051      SYCL model */
00052   : public detail::shared_ptr_implementation<context, detail::context> {
00053
00054   // The type encapsulating the implementation
00055   using implementation_t =
00056     detail::shared_ptr_implementation<context, detail::context>
    ;
00057
```

```
00058 public:
00059
00060     // Make the implementation member directly accessible in this class
00061   using implementation_t::implementation;
00062
00063   /** Constructs a context object for SYCL host using an async_handler for
00064       handling asynchronous errors
00065
00066       Note that the default case asyncHandler = nullptr is handled by the
00067       default constructor.
00068   */
00069   explicit context(async_handler asyncHandler) {
00070     detail::unimplemented();
00071   }
00072
00073
00074 #ifdef TRISYCL_OPENCL
00075   /** Make a SYCL context from an OpenCL context
00076
00077       The constructor executes a retain on the \c cl_context.
00078
00079       Return synchronous errors via the SYCL exception class and
00080       asynchronous errors are handled via the \c async_handler, if
00081       provided.
00082   */
00083   context(cl_context clContext, async_handler asyncHandler = nullptr)
00084     : context { boost::compute::context { clContext }, asyncHandler } {}
00085
00086
00087   /// Build a SYCL context from a Boost.Compute context
00088   context(const boost::compute::context &c,
00089           async_handler asyncHandler = nullptr)
00090     : implementation_t { detail::opencl_context::instance(c
      ) } {}
00091 #endif
00092
00093   /** Constructs a context object using a device_selector object
00094
00095       The context is constructed with a single device retrieved from the
00096       device_selector object provided.
00097
00098       Return synchronous errors via the SYCL exception class and
00099       asynchronous errors are handled via the async_handler, if provided.
00100   */
00101   context(const device_selector &deviceSelector,
00102           info::gl_context_interop interopFlag,
00103           async_handler asyncHandler = nullptr) {
00104     detail::unimplemented();
00105   }
00106
00107
00108   /** Constructs a context object using a device object
00109
00110       Return synchronous errors via the SYCL exception class and
00111       asynchronous errors are handled via the async_handler, if provided.
00112   */
00113   context(const device &dev,
00114           info::gl_context_interop interopFlag,
00115           async_handler asyncHandler = nullptr) {
00116     detail::unimplemented();
00117   }
00118
00119
00120   /** Constructs a context object using a platform object
00121
00122       Return synchronous errors via the SYCL exception class and
00123       asynchronous errors are handled via the async_handler, if provided.
00124   */
00125   context(const platform &plt,
00126           info::gl_context_interop interopFlag,
00127           async_handler asyncHandler = nullptr) {
00128     detail::unimplemented();
00129   }
00130
00131
00132   /* Constructs a context object using a vector_class of device objects
00133
00134      Return synchronous errors via the SYCL exception class and
00135      asynchronous errors are handled via the async_handler, if provided.
00136
00137      \todo Update the specification to replace vector by collection
00138      concept.
00139   */
00140   context(const vector_class<device> &deviceList,
00141           info::gl_context_interop interopFlag,
00142           async_handler asyncHandler = nullptr) {
00143     detail::unimplemented();
```

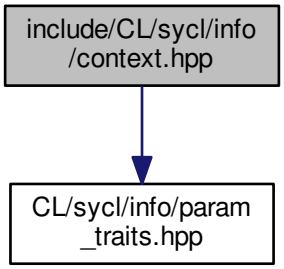
```
00144   }
00145
00146   /** Default constructor that chooses the context according the
00147       heuristics of the default selector
00148
00149       Return synchronous errors via the SYCL exception class.
00150
00151       Get the default constructors back.
00152   */
00153   context() : implementation_t {
      detail::host_context::instance() } {}
00154
00155
00156 #ifdef TRISYCL_OPENCL
00157   /** Return the underlying \c cl_context object, after retaining
00158       the \c cl_context.
00159
00160      Retains a reference to the returned \c cl_context object.
00161
00162      Caller should release it when finished.
00163   */
00164   cl_context get() const {
00165     return implementation->get();
00166   }
00167
00168   /** Return the underlying \c boost::compute::context
00169       of the \c cl::sycl::context
00170   */
00171   boost::compute::context &get_boost_compute() const {
00172     return implementation->get_boost_compute();
00173   }
00174
00175   /** Return the internal queue that is associated to the context and
00176       used by triSYCL to move data between some different contests for
00177       example
00178   */
00179   boost::compute::command_queue &get_boost_queue() const {
00180     return implementation->get_boost_queue();
00181   }
00182 #endif
00183
00184
00185   /// Specifies whether the context is in SYCL Host Execution Mode.
00186   bool is_host() const {
00187     return implementation->is_host();
00188   }
00189
00190
00191   /** Returns the SYCL platform that the context is initialized for
00192
00193       \todo To be implemented
00194   */
00195   platform get_platform();
00196
00197
00198   /** Returns the set of devices that are part of this context
00199
00200       \todo To be implemented
00201   */
00202   vector_class<device> get_devices() const {
00203     detail::unimplemented();
00204     return {};
00205   }
00206
00207
00208   /** Queries OpenCL information for the under-lying cl context
00209
00210       \todo To be implemented
00211   */
00212   template <info::context Param>
00213   typename info::param_traits<info::context, Param>::type
      get_info() const {
00214     detail::unimplemented();
00215     return {};
00216   }
00217
00218 };
00219
00220 /// @} to end the execution Doxygen group
00221
00222 }
00223 }
00224
00225 namespace std {
00226
00227   template <> struct hash<cl::sycl::context> {
00228     auto operator()(const cl::sycl::context &c) const {
```

```
00229     return c.hash();
00230     }
00231   };
00232
00233 }
00234
00235 /*
00236     # Some Emacs stuff:
00237     ### Local Variables:
00238     ### ispell-local-dictionary: "american"
00239     ### eval: (flyspell-prog-mode)
00240     ### End:
00241 */
00242
00243 #endif // TRISYCL_SYCL_CONTEXT_HPP
```

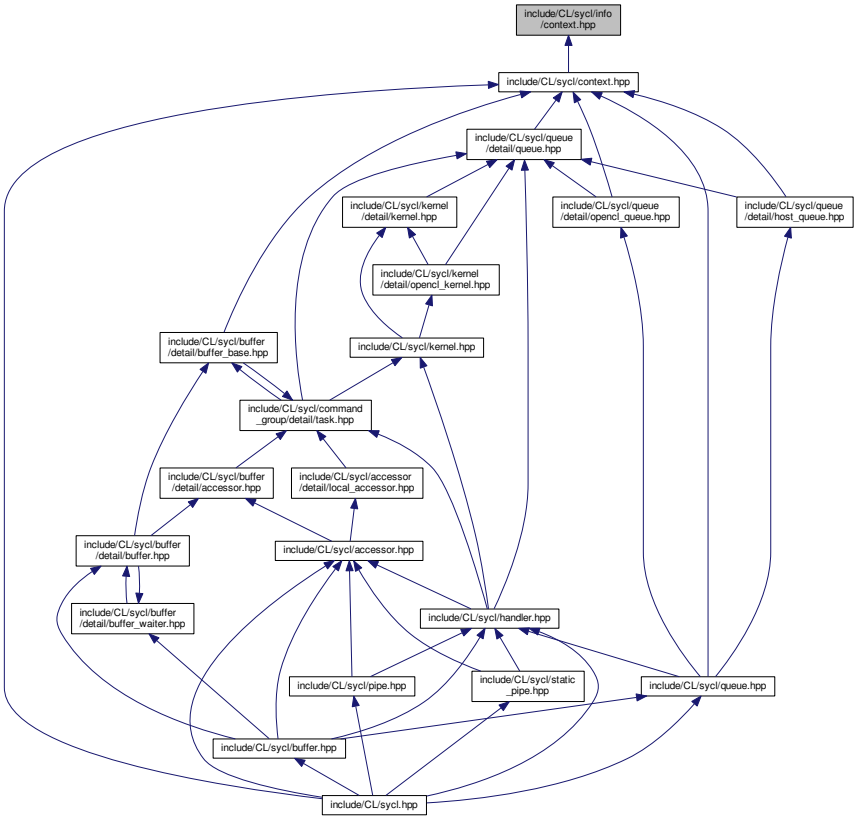
11.33 include/CL/sycl/info/context.hpp File Reference

```
#include "CL/sycl/info/param_traits.hpp"
```

Include dependency graph for context.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::info

Typedefs

- using cl::sycl::info::gl_context_interop = bool

Enumerations

- enum cl::sycl::info::context : int { cl::sycl::info::context::reference_count, cl::sycl::info::context::num_devices, cl::sycl::info::context::devices, cl::sycl::info::context::gl_interop }

  Context information descriptors.

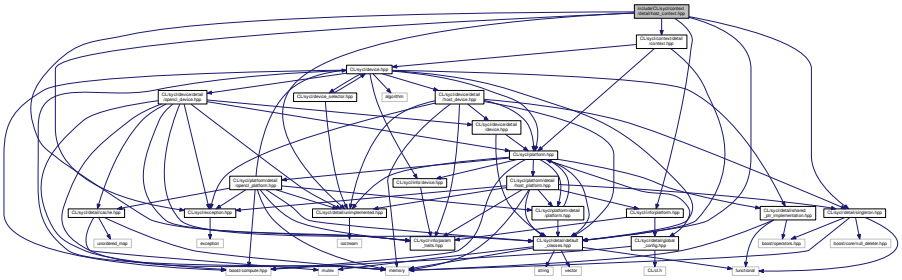
11.34 context.hpp

```
00001 #ifndef TRISYCL_SYCL_INFO_CONTEXT_HPP
00002 #define TRISYCL_SYCL_INFO_CONTEXT_HPP
00003
00004 /** \file The OpenCL SYCL context information parameters
00005
00006     Anastasi at Xilinx dot com
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/info/param_traits.hpp"
00013
00014 namespace cl {
00015 namespace sycl {
00016
00017 /** \addtogroup execution Platforms, contexts, devices and queues
00018     @{
00019 */
00020 namespace info {
00021
00022 using gl_context_interop = bool;
00023
00024 /** Context information descriptors
00025
00026     \todo Should be unsigned int to be consistent with others?
00027 */
00028 enum class context : int {
00029   reference_count,
00030   num_devices,
00031   devices,
00032   gl_interop
00033 };
00034
00035
00036 /** Query the return type for get_info() on context stuff
00037
00038     \todo To be implemented, return always void.
00039 */
00040 TRISYCL_INFO_PARAM_TRAITS_ANY_T(info::context, void)
00041
00042 }
00043 }
00044 }
00045
00046 /*
00047     # Some Emacs stuff:
00048     ### Local Variables:
00049     ### ispell-local-dictionary: "american"
00050     ### eval: (flyspell-prog-mode)
00051     ### End:
00052 */
00053
00054
00055 #endif //TRISYCL_SYCL_INFO_CONTEXT_HPP
```

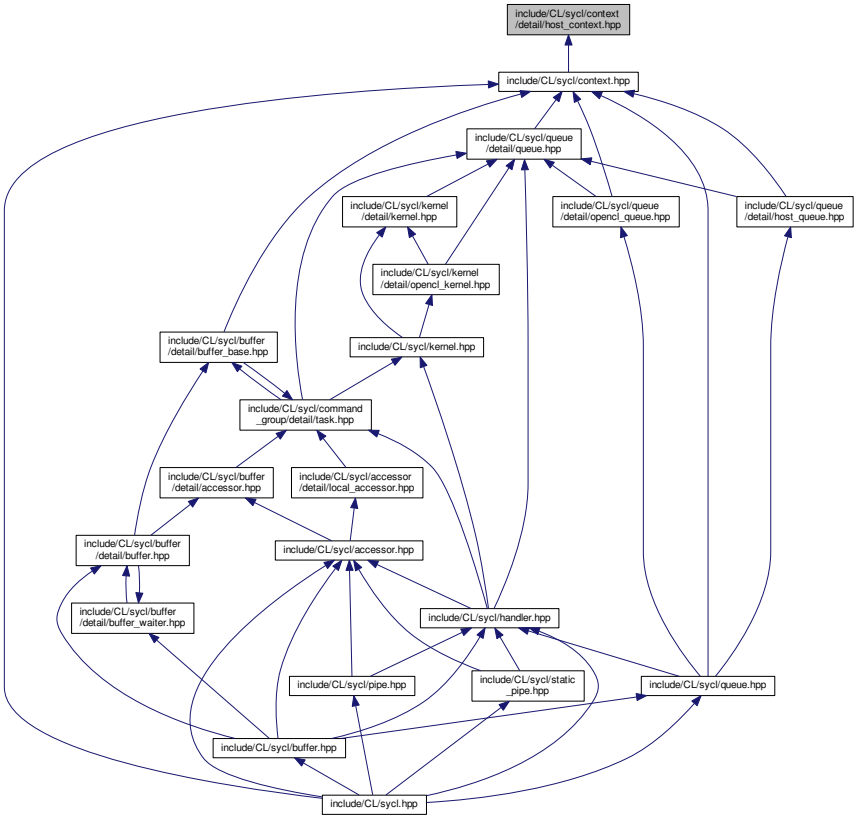
11.35 include/CL/sycl/context/detail/host_context.hpp File Reference

```
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/detail/singleton.hpp"
#include "CL/sycl/exception.hpp"
#include "CL/sycl/info/param_traits.hpp"
#include "CL/sycl/info/platform.hpp"
#include "CL/sycl/context/detail/context.hpp"
```

Include dependency graph for host_context.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::host_context

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.36 host_context.hpp

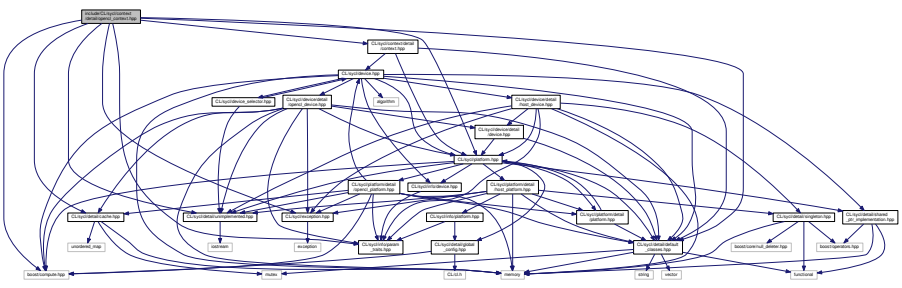
```
00001 #ifndef TRISYCL_SYCL_CONTEXT_DETAIL_HOST_CONTEXT_HPP
00002 #define TRISYCL_SYCL_CONTEXT_DETAIL_HOST_CONTEXT_HPP
00003
00004 /** \file The OpenCL SYCL host context implementation
00005
00006     a-doumoulakis at gmail dot com (Anastasios Doumoulakis)
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/detail/default_classes.hpp"
00013 #include "CL/sycl/detail/unimplemented.hpp"
00014 #include "CL/sycl/detail/singleton.hpp"
00015 #include "CL/sycl/exception.hpp"
00016 #include "CL/sycl/info/param_traits.hpp"
00017 #include "CL/sycl/info/platform.hpp"
00018 #include "CL/sycl/context/detail/context.hpp"
00019
00020 namespace cl {
00021 namespace sycl {
00022 namespace detail {
00023
00024
00025 /** \addtogroup execution Platforms, contexts, devices and queues
00026     @{
00027
00028     SYCL host context
00029
00030     \todo The implementation is quite minimal for now. :-)
00031 */
00032 class host_context : public detail::context,
00033                      public detail::singleton<host_context> {
00034
00035 public:
00036
00037 #ifdef TRISYCL_OPENCL
00038   /** Return the underlying \c cl_context of the \c cl::sycl::context
00039
00040       This throws an error since there is no OpenCL context associated
00041       to the host device.
00042   */
00043   cl_context get() const override {
00044     throw non_cl_error("The host context has no OpenCL context");
00045   }
00046
00047
00048   /** Return the SYCL platform that the context is initialized for
00049
00050       This throws an error since there is no \c boost::compute context
00051       associated to the host device.
00052   */
00053   boost::compute::context &get_boost_compute() override {
00054     throw non_cl_error("The host context has no OpenCL context");
00055   }
00056
00057
00058   /** Return the internal OpenCL queue that is associated to the host
00059       context
00060
00061       This throws an error since there is no \c
00062       boost::compute::command_queue associated to the host context.
00063   */
00064   boost::compute::command_queue &get_boost_queue() override {
00065     throw non_cl_error("The host context cannot have an OpenCL queue");
00066   }
00067 #endif
00068
00069
00070   /// Return true since the context is a SYCL host context
00071   bool is_host() const override {
00072     return true;
00073   }
00074
00075
00076   /** Return the platform of the context
00077
00078       Return synchronous errors via the SYCL exception class.
00079   */
00080   cl::sycl::platform get_platform() const override {
00081     // Return the host platform
00082     return {};
00083   }
00084
```

```
00085 #if 0
00086   /** Query the context for OpenCL \c info::context info
00087
00088       Return synchronous errors via the SYCL exception class.
00089
00090       \todo To be implemented
00091   */
00092   template <info::context Param>
00093   typename info::param_traits<info::context, Param>::type
00094   get_info() const override {
00095     detail::unimplemented();
00096     return {};
00097   }
00098 #endif
00099
00100
00101   /** Returns the set of devices that are part of this context.
00102       It should only return the host device itself.
00103
00104       \todo To be implemented
00105   */
00106   vector_class<cl::sycl::device>
00107   get_devices() const override {
00108     // Return just the host device
00109     return { {} };
00110   }
00111 };
00112
00113 /// @} to end the execution Doxygen group
00114
00115 }
00116 }
00117 }
00118 #endif // TRISYCL_SYCL_CONTEXT_DETAIL_HOST_CONTEXT_HPP
```

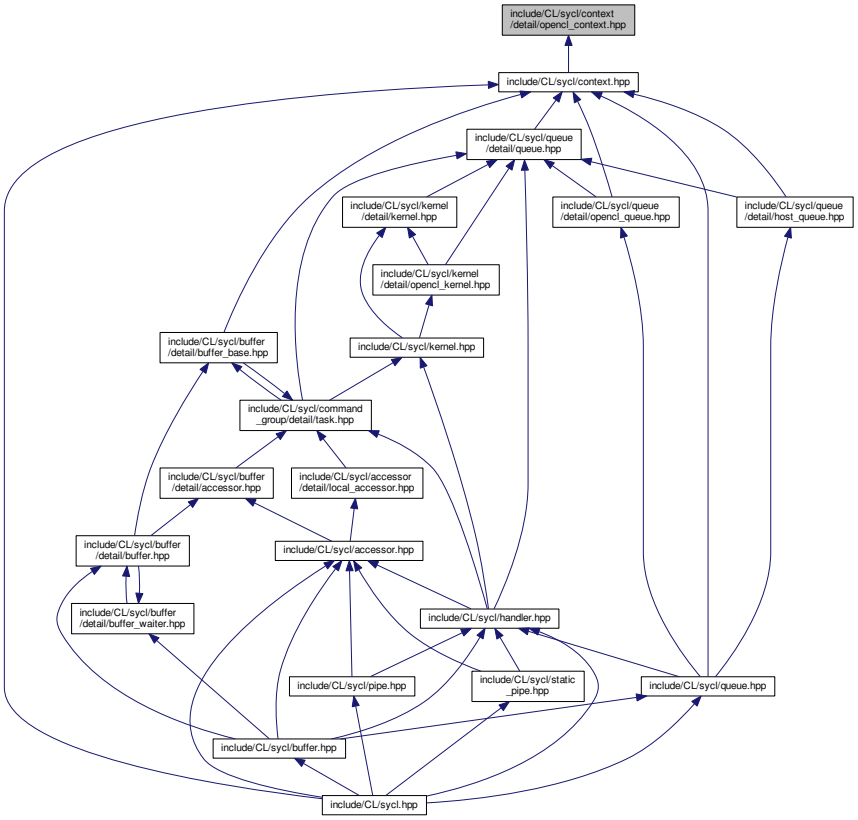
11.37 include/CL/sycl/context/detail/opencl_context.hpp File Reference

```
#include <boost/compute.hpp>
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/detail/cache.hpp"
#include "CL/sycl/context/detail/context.hpp"
#include "CL/sycl/platform.hpp"
#include "CL/sycl/info/param_traits.hpp"
#include "CL/sycl/exception.hpp"
```

Include dependency graph for opencl_context.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::opencl_context

  SYCL OpenCL context.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Variables

- TRISYCL_WEAK_ATTRIB_PREFIX detail::cache< cl_context, detail::opencl_context > opencl_context↩
  ::cache cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX

11.38 opencl_context.hpp

```
00001 #ifndef TRISYCL_SYCL_CONTEXT_DETAIL_OPENCL_CONTEXT_HPP
00002 #define TRISYCL_SYCL_CONTEXT_DETAIL_OPENCL_CONTEXT_HPP
00003
00004 /** \file The SYCL OpenCL context implementation
00005
00006     a-doumoulakis at gmail dot com (Anastasios Doumoulakis)
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012
00013 #include <boost/compute.hpp>
00014
00015 #include "CL/sycl/detail/default_classes.hpp"
00016 #include "CL/sycl/detail/unimplemented.hpp"
00017 #include "CL/sycl/detail/cache.hpp"
00018
00019 #include "CL/sycl/context/detail/context.hpp"
00020 #include "CL/sycl/platform.hpp"
00021 #include "CL/sycl/info/param_traits.hpp"
00022 #include "CL/sycl/exception.hpp"
00023
00024
00025 namespace cl {
00026 namespace sycl {
00027 namespace detail {
00028
00029 /// SYCL OpenCL context
00030 class opencl_context : public detail::context {
00031
00032   /// User the Boost Compute abstraction of the OpenCL context
00033   boost::compute::context c;
00034
00035   /** A boost \c command_queue associated to an OpenCL context for
00036       when we need to transfer data but no queue is given
00037       (eg. When an buffer accessor is created)
00038   */
00039   boost::compute::command_queue q;
00040
00041   /** A cache to always return the same alive context for a given OpenCL
00042       context
00043
00044       C++11 guaranties the static construction is thread-safe
00045   */
00046   static detail::cache<cl_context, detail::opencl_context>
      cache;
00047
00048 public:
00049
00050   /// Return the underlying \c cl_context of the \c cl::sycl::context
00051   cl_context get() const override {
00052     return c.get();
00053   }
00054
00055
00056   /** Return the underlying \c boost::compute::context
00057       of the \c cl::sycl::context
00058   */
00059   boost::compute::context &get_boost_compute() override {
00060     return c;
00061   }
00062
00063
00064   /// Return the queue that is associated to the context
00065   boost::compute::command_queue &get_boost_queue() override {
00066     return q;
00067   }
00068
00069
00070   /// Return false because the context is not a SYCL host context
00071   bool is_host() const override {
00072     return false;
00073   }
00074
00075 #if 0
00076   /** Query the context for OpenCL \c info::context info
00077
00078       Return synchronous errors via the SYCL exception class.
00079
00080       \todo To be implemented
00081   */
00082   template <info::context Param>
00083   typename info::param_traits<info::context, Param>::type
```

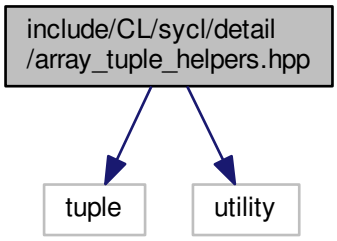
```
00084   get_info() const override{
00085     detail::unimplemented();
00086     return {};
00087   }
00088 #endif
00089
00090   /** Return the platform of the context
00091
00092       Return synchronous errors via the SYCL exception class.
00093
00094       \todo To be implemented
00095   */
00096   cl::sycl::platform get_platform() const override {
00097     detail::unimplemented();
00098     return {};
00099   }
00100
00101
00102   /** Returns the set of devices that are part of this context.
00103
00104       \todo To be implemented
00105   */
00106   vector_class<cl::sycl::device> get_devices() const override {
00107     detail::unimplemented();
00108     return {};
00109   }
00110
00111   /// Get a singleton instance of the \c opencl_context
00112   static std::shared_ptr<opencl_context>
00113   instance(const boost::compute::context &c) {
00114     return cache.get_or_register(c.get(),
00115                                  [&] { return new opencl_context { c }; });
00116   }
00117
00118
00119 private:
00120
00121   /// Only the instance factory can build it
00122   opencl_context(const boost::compute::context &c) :
00123     c { c },
00124     q { boost::compute::command_queue { c, c.get_device() } } {}
00125
00126
00127 public:
00128   /// Unregister from the cache on destruction
00129   ~opencl_context() override {
00130     cache.remove(c.get());
00131   }
00132
00133 };
00134
00135
00136 /* Allocate the cache here but since this is a pure-header library,
00137    use a weak symbol so that only one remains when SYCL headers are
00138    used in different compilation units of a program
00139 */
00140 TRISYCL_WEAK_ATTRIB_PREFIX
00141 detail::cache<cl_context, detail::opencl_context>
     opencl_context::cache
00142 TRISYCL_WEAK_ATTRIB_SUFFIX;
00143
00144 }
00145 }
00146 }
00147
00148 /*
00149     # Some Emacs stuff:
00150     ### Local Variables:
00151     ### ispell-local-dictionary: "american"
00152     ### eval: (flyspell-prog-mode)
00153     ### End:
00154 */
00155
00156 #endif //TRISYCL_SYCL_CONTEXT_DETAIL_OPENCL_CONTEXT_HPP
```

11.39 include/CL/sycl/detail/array_tuple_helpers.hpp File Reference

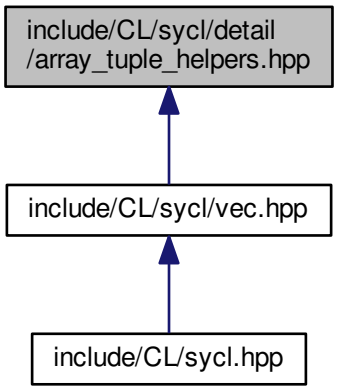
Some helpers to do array-tuple conversions.

```
#include <tuple>
#include <utility>
```

Include dependency graph for array_tuple_helpers.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::expand_to_vector< V, Tuple, expansion >

  Allows optional expansion of a 1-element tuple to a V::dimension tuple to replicate scalar values in vector initialization. More...
- struct cl::sycl::detail::expand_to_vector< V, Tuple, true >

  Specialization in the case we ask for expansion. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Functions

- template<typename V , typename Tuple , size_t... Is>
  std::array< typename V::element_type, V::dimension > cl::sycl::detail::tuple_to_array_iterate (Tuple t, std::index_sequence< Is... >)

  Helper to construct an array from initializer elements provided as a tuple.
- template<typename V , typename Tuple >
  auto cl::sycl::detail::tuple_to_array (Tuple t)

  Construct an array from initializer elements provided as a tuple.
- template<typename V , typename Tuple >
  auto cl::sycl::detail::expand (Tuple t)

  Create the array data of V from a tuple of initializer.

11.39.1 Detailed Description

Some helpers to do array-tuple conversions.

Used for example to implement cl::sycl::vec<> class.

Ronan at Keryell point FR

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Definition in file array_tuple_helpers.hpp.

11.40 array_tuple_helpers.hpp

```
00001 #ifndef TRISYCL_SYCL_DETAIL_ARRAY_TUPLE_HELPERS_HPP
00002 #define TRISYCL_SYCL_DETAIL_ARRAY_TUPLE_HELPERS_HPP
00003
00004 /** \file
00005
00006     Some helpers to do array-tuple conversions
00007
00008     Used for example to implement cl::sycl::vec<> class.
00009
00010     Ronan at Keryell point FR
00011
00012     This file is distributed under the University of Illinois Open Source
00013     License. See LICENSE.TXT for details.
00014 */
00015
00016 #include <tuple>
00017 #include <utility>
00018
00019 namespace cl {
00020 namespace sycl {
00021 namespace detail {
00022
00023 /** \addtogroup array_tuple_helpers Helpers to do array and tuple conversion
00024
00025     @{
00026 */
00027
00028 /** Helper to construct an array from initializer elements provided as a
00029     tuple
00030
00031     The trick is to get the std::index_sequence<> that represent 0,
00032     1,..., dimension-1 as a variadic template pack Is that we can
00033     iterate on, in this function.
00034 */
00035 template <typename V, typename Tuple, size_t... Is>
00036 std::array<typename V::element_type, V::dimension>
00037 tuple_to_array_iterate(Tuple t, std::index_sequence<Is...>) {
00038   /* The effect is like a static for-loop with Is counting from 0 to
00039      dimension-1 and thus constructing a uniform initialization { }
```

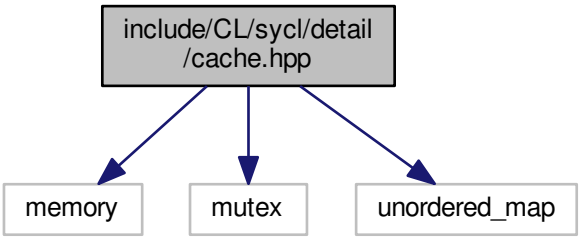
```
00040      construction from each tuple element:
00041      { std::get<0>(t), std::get<1>(t), ..., std::get<dimension-1>(t) }
00042
00043      The static cast is here to avoid the warning when there is a loss
00044      of precision, for example when initializing an int from a float.
00045   */
00046   return { { static_cast<typename V::element_type>(std::get<Is>(t))...} };
00047 }
00048
00049
00050 /** Construct an array from initializer elements provided as a tuple
00051  */
00052 template <typename V, typename Tuple>
00053 auto tuple_to_array(Tuple t) {
00054   /* Construct an index_sequence with 0, 1, ..., (size of the tuple-1)
00055      so that tuple_to_array_iterate can statically iterate on it */
00056   return tuple_to_array_iterate<V>(t,
00057                                    std::make_index_sequence<std::tuple_size<Tuple>::value>{});
00058 }
00059
00060
00061 /** Allows optional expansion of a 1-element tuple to a V::dimension
00062     tuple to replicate scalar values in vector initialization
00063 */
00064 template <typename V, typename Tuple, bool expansion = false>
00065 struct expand_to_vector {
00066   static_assert(V::dimension == std::tuple_size<Tuple>::value,
00067                 "The number of elements in initialization should match the dimension of the vector");
00068
00069   // By default, act as a pass-through and do not do any expansion
00070   static auto expand(Tuple t) { return t; }
00071
00072 };
00073
00074
00075 /** Specialization in the case we ask for expansion */
00076 template <typename V, typename Tuple>
00077 struct expand_to_vector<V, Tuple, true> {
00078   static_assert(std::tuple_size<Tuple>::value == 1,
00079                 "Since it is a vector initialization from a scalar there should be only one initializer
      value");
00080
00081
00082   /** Construct a tuple from a value
00083
00084       \param value is used to initialize each tuple element
00085
00086       \param size is the number of elements of the tuple to be generated
00087
00088       The trick is to get the std::index_sequence<> that represent 0,
00089       1,..., dimension-1 as a variadic template pack Is that we can
00090       iterate on, in this function.
00091   */
00092   template <typename Value, size_t... Is>
00093   static auto fill_tuple(Value e, std::index_sequence<Is...>) {
00094     /* The effect is like a static for-loop with Is counting from 0 to
00095        dimension-1 and thus replicating the pattern to have
00096        make_tuple( (0, e), (1, e), ... (n - 1, e) )
00097
00098        Since the "," operator is just here to throw away the Is value
00099        (which is needed for the pack expansion...), at the end this is
00100        equivalent to:
00101        make_tuple( e, e, ..., e )
00102     */
00103     return std::make_tuple(((void)Is, e)...);
00104   }
00105
00106
00107   /** We expand the 1-element tuple by replicating into a tuple with the
00108       size of the vector */
00109   static auto expand(Tuple t) {
00110     return fill_tuple(std::get<0>(t),
00111                       std::make_index_sequence<V::dimension>{});
00112   }
00113
00114 };
00115
00116
00117 /** Create the array data of V from a tuple of initializer
00118
00119     If there is only 1 initializer, this is a scalar initialization of a
00120     vector and the value is expanded to all the vector elements first.
00121 */
00122 template <typename V, typename Tuple>
00123 auto expand(Tuple t) {
00124   return tuple_to_array<V>(expand_to_vector<V,
00125                            decltype(t),
```

```
00126                           /* Only ask the expansion to all vector
00127                              element if there only a scalar
00128                              initializer */
00129                           std::tuple_size<Tuple>::value == 1>{}.expand(t));
00130 }
00131
00132 }
00133 }
00134 }
00135
00136 /*
00137     # Some Emacs stuff:
00138     ### Local Variables:
00139     ### ispell-local-dictionary: "american"
00140     ### eval: (flyspell-prog-mode)
00141     ### End:
00142 */
00143
00144 #endif // TRISYCL_SYCL_DETAIL_ARRAY_TUPLE_HELPERS_HPP
```

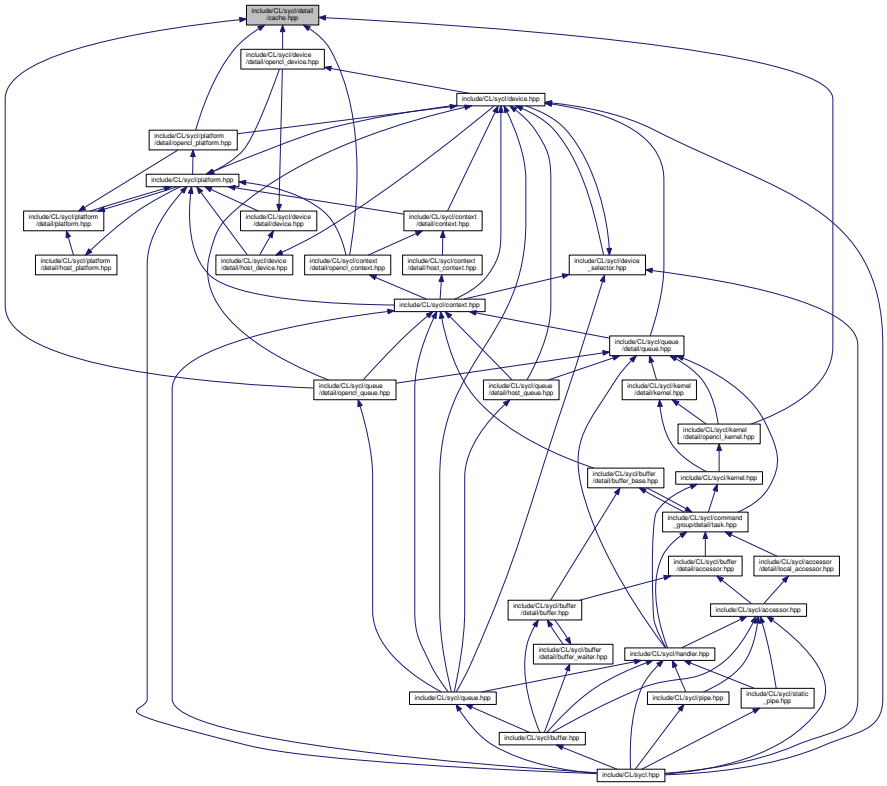
11.41 include/CL/sycl/detail/cache.hpp File Reference

```
#include <memory>
#include <mutex>
#include <unordered_map>
```

Include dependency graph for cache.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::cache< Key, Value >

  A simple thread safe cache mechanism to cache std::shared_ptr of values indexed by keys.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.42 cache.hpp

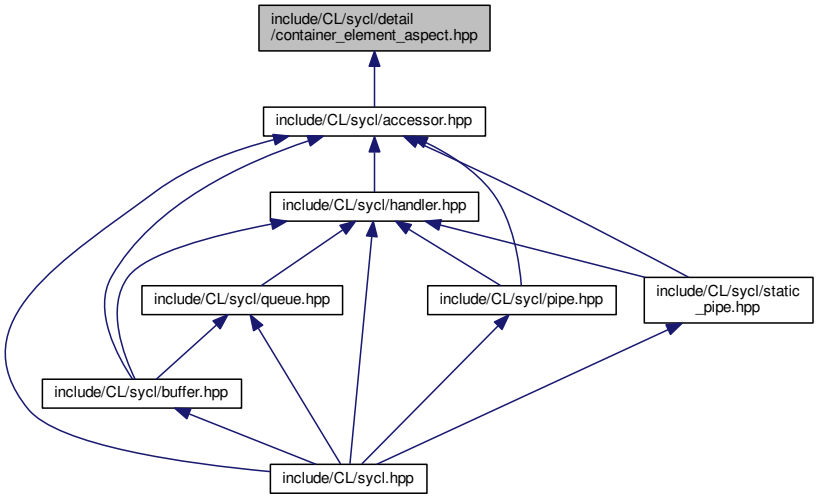
```
00001 #ifndef TRISYCL_SYCL_DETAIL_CACHE_HPP
00002 #define TRISYCL_SYCL_DETAIL_CACHE_HPP
00003
00004 /** \file A simple thread-safe cache
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <memory>
00013 #include <mutex>
```

```
00014 #include <unordered_map>
00015
00016 namespace cl {
00017 namespace sycl {
00018 namespace detail {
00019
00020
00021 /** A simple thread safe cache mechanism to cache std::shared_ptr of
00022     values indexed by keys
00023
00024     Since internally only std::weak_ptr are stored, this does not
00025     prevent object deletion but it is up to the programmer not to use
00026     this cache to retrieve deleted objects.
00027 */
00028 template <typename Key, typename Value>
00029 class cache {
00030
00031 public:
00032
00033   /// The type of the keys used to indexed the cache
00034   using key_type = Key;
00035
00036   /// The base type of the values stored in the cache
00037   using value_type = Value;
00038
00039 private:
00040
00041   /// The caching storage
00042   std::unordered_map<key_type, std::weak_ptr<value_type>> c;
00043
00044   /// To make the cache thread-safe
00045   std::mutex m;
00046
00047 public:
00048
00049   /** Get a value stored in the cache if present or insert by calling
00050       a generator function
00051
00052       \param[in] k is the key used to retrieve the value
00053
00054       \param[in] create_element is the function to be called if the
00055       key is not found in the cache to generate a value which is
00056       inserted for the key. This function has to produce a value
00057       convertible to a shared_ptr
00058
00059       \return a shared_ptr to the value retrieved or inserted
00060   */
00061   template <typename Functor>
00062   std::shared_ptr<value_type> get_or_register(const key_type &k,
00063                                               Functor &&create_element) {
00064     std::lock_guard<std::mutex> lg { m };
00065
00066     auto i = c.find(k);
00067     if (i != c.end())
00068       if (auto observe = i->second.lock())
00069         // Returns \c shared_ptr only if target object is still alive
00070         return observe;
00071
00072     // Otherwise create and insert a new element
00073     std::shared_ptr<value_type> e { create_element() };
00074     c.insert({ k, e });
00075     return e;
00076   }
00077
00078
00079   /** Remove an entry from the cache
00080
00081       \param[in] k is the key associated to the value to remove from
00082       the cache
00083   */
00084   void remove(const key_type &k) {
00085     std::lock_guard<std::mutex> lg { m };
00086     c.erase(k);
00087   }
00088
00089 };
00090
00091 }
00092 }
00093 }
00094
00095 /*
00096     # Some Emacs stuff:
00097     ### Local Variables:
00098     ### ispell-local-dictionary: "american"
00099     ### eval: (flyspell-prog-mode)
00100     ### End:
```

```
00101 */
00102
00103 #endif // TRISYCL_SYCL_DEVICE_CACHE_HPP
```

11.43 include/CL/sycl/detail/container_element_aspect.hpp File Reference

This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::container_element_aspect< T >

  A mix-in to add some container element aspects. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.44 container_element_aspect.hpp

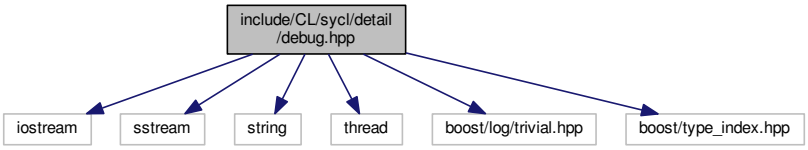
```
00001 #ifndef TRISYCL_SYCL_DETAIL_CONTAINER_ELEMENT_ASPECT_HPP
00002 #define TRISYCL_SYCL_DETAIL_CONTAINER_ELEMENT_ASPECT_HPP
00003
00004 /** \file Implement basic types à la STL related to container
00005     elements, such as value_type, reference...
00006
00007     Ronan at Keryell point FR
00008
00009     This file is distributed under the University of Illinois Open Source
00010     License. See LICENSE.TXT for details.
00011 */
```

```
00012
00013 namespace cl {
00014 namespace sycl {
00015 namespace detail {
00016
00017 /** \addtogroup helpers Some helpers for the implementation
00018     @{
00019 */
00020
00021 /// A mix-in to add some container element aspects
00022 template <typename T>
00023 struct container_element_aspect {
00024
00025   using value_type = T;
00026   using pointer = value_type*;
00027   using const_pointer = const value_type*;
00028   using reference = value_type&;
00029   using const_reference = const value_type&;
00030
00031 };
00032
00033 /// @} End the helpers Doxygen group
00034
00035 }
00036 }
00037 }
00038
00039 /*
00040     # Some Emacs stuff:
00041     ### Local Variables:
00042     ### ispell-local-dictionary: "american"
00043     ### eval: (flyspell-prog-mode)
00044     ### End:
00045 */
00046
00047 #endif // TRISYCL_SYCL_DETAIL_CONTAINER_ELEMENT_ASPECT_HPP
```

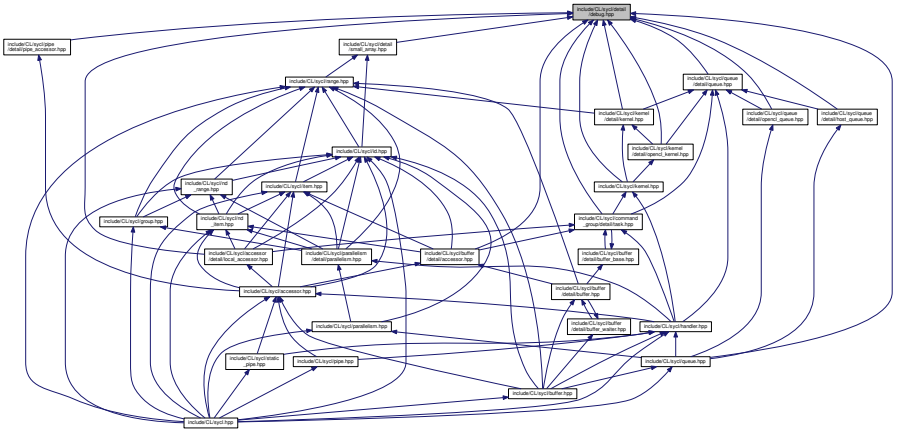
11.45 include/CL/sycl/detail/debug.hpp File Reference

```
#include <iostream>
#include <sstream>
#include <string>
#include <thread>
#include <boost/log/trivial.hpp>
#include <boost/type_index.hpp>
```

Include dependency graph for debug.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::debug< T >

  Class used to trace the construction, copy-construction, move-construction and destruction of classes that inherit from it. More...
- struct cl::sycl::detail::display_vector< T >

  Class used to display a vector-like type of classes that inherit from it. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Macros

- #define TRISYCL_INTERNAL_DUMP(expression)

  Dump a debug message in a formatted way.
- #define TRISYCL_DUMP(expression) TRISYCL_INTERNAL_DUMP(expression)
- #define TRISYCL_DUMP_T(expression)

  Same as TRISYCL_DUMP() but with thread id first.

Functions

- template<typename KernelName , typename Functor >
  auto cl::sycl::detail::trace_kernel (const Functor &f)

  Wrap a kernel functor in some tracing messages to have start/stop information when TRISYCL_TRACE_KERNEL macro is defined.

11.45.1 Macro Definition Documentation

11.45.1.1 TRISYCL_DUMP

```
#define TRISYCL_DUMP(
              expression ) TRISYCL_INTERNAL_DUMP(expression)
```

Definition at line 43 of file debug.hpp.

11.45.1.2 TRISYCL_DUMP_T

```
#define TRISYCL_DUMP_T(
              expression )
```

Value:

```
TRISYCL_DUMP("Thread " << std::hex                                    \
             << std::this_thread::get_id() << ": " << expression)
```

Same as TRISYCL_DUMP() but with thread id first.

Definition at line 46 of file debug.hpp.

Referenced by cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::accessor(), cl::sycl::detail::task::add_buffer(), cl::sycl::detail::pipe_reservation< PipeAccessor >::commit(), cl::sycl::detail::pipe< value_type >::empty(), cl::sycl::detail::queue::kernel_end(), cl::sycl::detail::queue::kernel_start(), cl::sycl::detail::task::notify_consumers(), cl::sycl::detail::pipe_reservation< PipeAccessor >::operator[](), cl::sycl::detail::pipe< value_type >::read(), cl::sycl::detail::task::release_buffers(), cl::sycl::detail::pipe< value_type >::reserve_read(), cl::sycl::detail::pipe< value_type >::reserve_write(), cl::sycl::detail::task::schedule(), cl::sycl::detail::pipe< value_type >::size(), cl::sycl::detail::task::wait(), cl::sycl::detail::queue::wait_for_kernel_execution(), cl::sycl::detail::task::wait_for_producers(), cl::sycl::detail::pipe< value_type >::write(), and cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >::~buffer_waiter().

11.45.1.3 TRISYCL_INTERNAL_DUMP

```
#define TRISYCL_INTERNAL_DUMP(
              expression )
```

Value:

```
do {       \
    std::ostringstream s;                          \
    s << expression;                               \
    BOOST_LOG_TRIVIAL(debug) << s.str();           \
  } while(0)
```

Dump a debug message in a formatted way.

Use an intermediate ostringstream because there are issues with BOOST_LOG_TRIVIAL to display C strings

Definition at line 35 of file debug.hpp.

Referenced by cl::sycl::detail::trace_kernel().

11.46 debug.hpp

```
00001 #ifndef TRISYCL_SYCL_DETAIL_DEBUG_HPP
00002 #define TRISYCL_SYCL_DETAIL_DEBUG_HPP
00003
00004 /** \file Track constructor/destructor invocations and trace kernel execution
00005
00006     Define the TRISYCL_DEBUG CPP flag to have an output.
00007
00008     To use it in some class C, make C inherit from debug<C>.
00009
00010     Ronan at Keryell point FR
00011
00012     This file is distributed under the University of Illinois Open Source
00013     License. See LICENSE.TXT for details.
00014 */
00015
00016 #include <iostream>
00017
00018 // The common debug and trace infrastructure
00019 #if defined(TRISYCL_DEBUG) || defined(TRISYCL_TRACE_KERNEL)
00020 #include <sstream>
00021 #include <string>
00022 #include <thread>
00023
00024 #include <boost/log/trivial.hpp>
00025 #include <boost/type_index.hpp>
00026
00027 // To be able to construct string literals like "blah"s
00028 using namespace std::string_literals;
00029
00030 /** Dump a debug message in a formatted way.
00031
00032     Use an intermediate ostringstream because there are issues with
00033     BOOST_LOG_TRIVIAL to display C strings
00034 */
00035 #define TRISYCL_INTERNAL_DUMP(expression) do {       \
00036     std::ostringstream s;                            \
00037     s << expression;                                 \
00038     BOOST_LOG_TRIVIAL(debug) << s.str();             \
00039   } while(0)
00040 #endif
00041
00042 #ifdef TRISYCL_DEBUG
00043 #define TRISYCL_DUMP(expression) TRISYCL_INTERNAL_DUMP(expression)
00044
00045 /// Same as TRISYCL_DUMP() but with thread id first
00046 #define TRISYCL_DUMP_T(expression)                                    \
00047   TRISYCL_DUMP("Thread " << std::hex                                  \
00048                << std::this_thread::get_id() << ": " << expression)
00049 #else
00050 #define TRISYCL_DUMP(expression) do { } while(0)
00051 #define TRISYCL_DUMP_T(expression) do { } while(0)
00052 #endif
00053
00054 namespace cl {
00055 namespace sycl {
00056 namespace detail {
00057
00058 /** \addtogroup debug_trace Debugging and tracing support
00059     @{
00060 */
00061
00062 /** Class used to trace the construction, copy-construction,
00063     move-construction and destruction of classes that inherit from it
00064
00065     \param T is the real type name to be used in the debug output.
00066 */
00067 template <typename T>
00068 struct debug {
00069   // To trace the execution of the conSTRUCTORs and deSTRUCTORs
00070 #ifdef TRISYCL_DEBUG_STRUCTORS
00071   /// Trace the construction with the compiler-dependent mangled named
00072   debug() {
00073     TRISYCL_DUMP("Constructor of "
00074                  << boost::typeindex::type_id<T>().pretty_name()
00075                  << " " << (void*) this);
00076   }
00077
00078
00079   /** Trace the copy construction with the compiler-dependent mangled
00080       named
00081
00082       Only add this constructor if T has itself the same constructor,
00083       otherwise it may prevent the synthesis of default copy
00084       constructor and assignment.
```

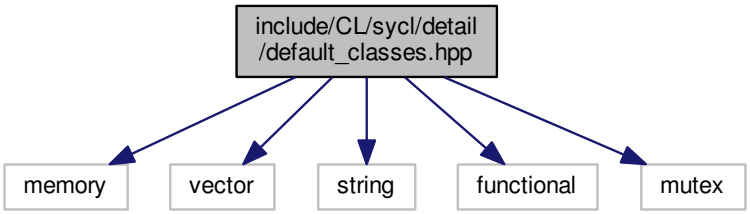
```
00085   */
00086   template <typename U = T>
00087   debug(debug const &,
00088         /* Use intermediate U type to have the type dependent for
00089            enable_if to work
00090
00091         \todo Use is_copy_constructible_v when moving to C++17 */
00092         std::enable_if_t<std::is_copy_constructible<U>::value> * = 0) {
00093     TRISYCL_DUMP("Copy of " << boost::typeindex::type_id<T>().pretty_name()
00094                  << " " << (void*) this);
00095   }
00096
00097
00098   /** Trace the move construction with the compiler-dependent mangled
00099       named
00100
00101       Only add this constructor if T has itself the same constructor,
00102       otherwise it may prevent the synthesis of default move
00103       constructor and move assignment.
00104   */
00105   template <typename U = T>
00106   debug(debug &&,
00107         /* Use intermediate U type to have the type dependent for
00108            enable_if to work
00109
00110         \todo Use is_move_constructible_v when moving to C++17 */
00111         std::enable_if_t<std::is_move_constructible<U>::value> * = 0) {
00112     TRISYCL_DUMP("Move of " << boost::typeindex::type_id<T>().pretty_name()
00113                  << " " << (void*) this);
00114   }
00115
00116
00117   /// Trace the destruction with the compiler-dependent mangled named
00118   ~debug() {
00119     TRISYCL_DUMP("~ Destructor of "
00120                  << boost::typeindex::type_id<T>().pretty_name()
00121                  << " " << (void*) this);
00122   }
00123 #endif
00124 };
00125
00126
00127 /** Wrap a kernel functor in some tracing messages to have start/stop
00128     information when TRISYCL_TRACE_KERNEL macro is defined */
00129 template <typename KernelName, typename Functor>
00130 auto trace_kernel(const Functor &f) {
00131 #ifdef TRISYCL_TRACE_KERNEL
00132   // Inject tracing message around the kernel
00133   return [=] {
00134     /* Since the class KernelName may just be declared and not really
00135        defined, just use it through a class pointer to have
00136        typeid().name() not complaining */
00137     TRISYCL_INTERNAL_DUMP(
00138       "Kernel started "
00139       << boost::typeindex::type_id<KernelName *>().pretty_name());
00140     f();
00141     TRISYCL_INTERNAL_DUMP(
00142       "Kernel stopped "
00143       << boost::typeindex::type_id<KernelName *>().pretty_name());
00144   };
00145 #else
00146   // Identity by default
00147   return f;
00148 #endif
00149 }
00150
00151
00152 /** Class used to display a vector-like type of classes that inherit from
00153     it
00154
00155     \param T is the real type name to be used in the debug output.
00156
00157     Calling the display() method dump the values on std::cout
00158 */
00159 template <typename T>
00160 struct display_vector {
00161
00162   /// To debug and test
00163   void display() const {
00164 #ifdef TRISYCL_DEBUG
00165     std::cout << boost::typeindex::type_id<T>().pretty_name() << ":";
00166 #endif
00167     // Get a pointer to the real object
00168     for (auto e : *static_cast<const T *>(this))
00169       std::cout << " " << e;
00170     std::cout << std::endl;
00171   }
```

```
00172
00173 };
00174
00175 /// @} End the debug_trace Doxygen group
00176
00177 }
00178 }
00179 }
00180
00181 /*
00182     # Some Emacs stuff:
00183     ### Local Variables:
00184     ### ispell-local-dictionary: "american"
00185     ### eval: (flyspell-prog-mode)
00186     ### End:
00187 */
00188
00189 #endif // TRISYCL_SYCL_DETAIL_DEBUG_HPP
```

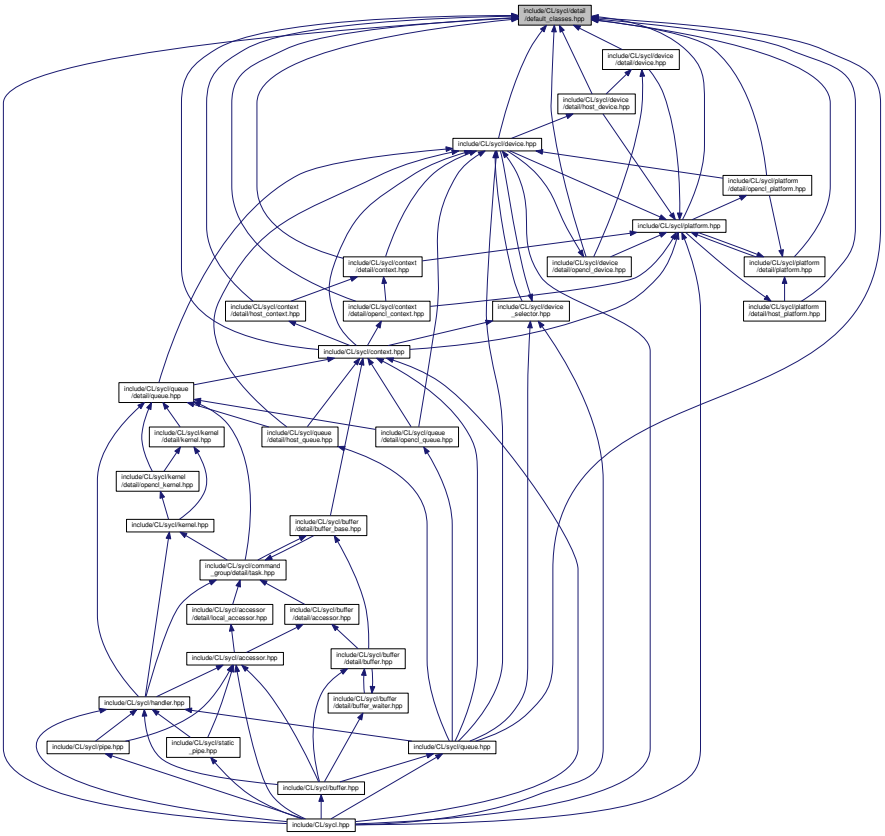
11.47 include/CL/sycl/detail/default_classes.hpp File Reference

```
#include <memory>
#include <vector>
#include <string>
#include <functional>
#include <mutex>
```

Include dependency graph for default_classes.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Typedefs

- template<class T , class Alloc = std::allocator<T>>
  using cl::sycl::vector_class = std::vector< T, Alloc >
- using cl::sycl::string_class = std::string
- template<class R , class... ArgTypes>
  using cl::sycl::function_class = std::function< R(ArgTypes...)>
- using cl::sycl::mutex_class = std::mutex
- template<class T , class D = std::default_delete<T>>
  using cl::sycl::unique_ptr_class = std::unique_ptr< T[ ], D >
- template<class T >
  using cl::sycl::shared_ptr_class = std::shared_ptr< T >
- template<class T >
  using cl::sycl::weak_ptr_class = std::weak_ptr< T >
- template<class T >
  using cl::sycl::hash_class = std::hash< T >

11.48 default_classes.hpp

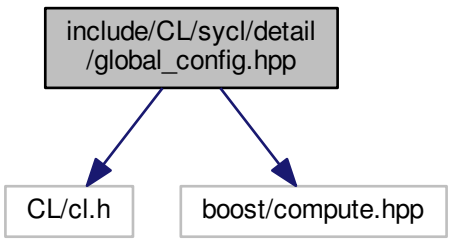
```
00001 #ifndef TRISYCL_SYCL_DETAIL_DEFAULT_CLASSES_HPP
00002 #define TRISYCL_SYCL_DETAIL_DEFAULT_CLASSES_HPP
00003
00004 /** \file The OpenCL SYCL default classes to use from the STL according to
00005     section 3.2 of SYCL 1.2 specification
00006
00007     Ronan at Keryell point FR
00008
00009     This file is distributed under the University of Illinois Open Source
00010     License. See LICENSE.TXT for details.
00011 */
00012
00013 /** \addtogroup defaults Manage default configuration and types
00014     @{
00015 */
00016
00017 #ifndef CL_SYCL_NO_STD_VECTOR
00018 /** The vector type to be used as SYCL vector
00019  */
00020 #include <memory>
00021 #include <vector>
00022 namespace cl {
00023 namespace sycl {
00024
00025 template <class T, class Alloc = std::allocator<T>>
00026 using vector_class = std::vector<T, Alloc>;
00027
00028 }
00029 }
00030 #endif
00031
00032
00033 #ifndef CL_SYCL_NO_STD_STRING
00034 /** The string type to be used as SYCL string
00035  */
00036 #include <string>
00037 namespace cl {
00038 namespace sycl {
00039
00040 using string_class = std::string;
00041
00042 }
00043 }
00044 #endif
00045
00046
00047 #ifndef CL_SYCL_NO_STD_FUNCTION
00048 /** The functional type to be used as SYCL function
00049  */
00050 #include <functional>
00051 namespace cl {
00052 namespace sycl {
00053
00054 template <class R, class... ArgTypes>
00055 using function_class = std::function<R(ArgTypes...)>;
00056
00057 }
00058 }
00059 #endif
00060
00061
00062 #ifndef CL_SYCL_NO_STD_MUTEX
00063 /** The mutex type to be used as SYCL mutex
00064  */
00065 #include <mutex>
00066 namespace cl {
00067 namespace sycl {
00068
00069 using mutex_class = std::mutex;
00070
00071 }
00072 }
00073 #endif
00074
00075
00076 #ifndef CL_SYCL_NO_STD_UNIQUE_PTR
00077 /** The unique pointer type to be used as SYCL unique pointer
00078  */
00079 #include <memory>
00080 namespace cl {
00081 namespace sycl {
00082
00083 template <class T, class D = std::default_delete<T>>
00084 using unique_ptr_class = std::unique_ptr<T[], D>;
```

```
00085
00086 }
00087 }
00088 #endif
00089
00090
00091 #ifndef CL_SYCL_NO_STD_SHARED_PTR
00092 /** The shared pointer type to be used as SYCL shared pointer
00093  */
00094 #include <memory>
00095 namespace cl {
00096 namespace sycl {
00097
00098 template <class T>
00099 using shared_ptr_class = std::shared_ptr<T>;
00100
00101 }
00102 }
00103 #endif
00104
00105
00106 #ifndef CL_SYCL_NO_STD_WEAK_PTR
00107 /** The weak pointer type to be used as SYCL weak pointer
00108  */
00109 #include <memory>
00110 namespace cl {
00111 namespace sycl {
00112
00113 template <class T>
00114 using weak_ptr_class = std::weak_ptr<T>;
00115
00116 }
00117 }
00118 #endif
00119
00120
00121 #ifndef CL_SYCL_NO_STD_HASH
00122 /** The hash type to be used as SYCL hash
00123  */
00124 #include <functional>
00125 namespace cl {
00126 namespace sycl {
00127
00128 template <class T>
00129 using hash_class = std::hash<T>;
00130
00131 }
00132 }
00133 #endif
00134
00135
00136 /// @} End the defaults Doxygen group
00137
00138 /*
00139     # Some Emacs stuff:
00140     ### Local Variables:
00141     ### ispell-local-dictionary: "american"
00142     ### eval: (flyspell-prog-mode)
00143     ### End:
00144 */
00145
00146 #endif // TRISYCL_SYCL_DETAIL_DEFAULT_CLASSES_HPP
```

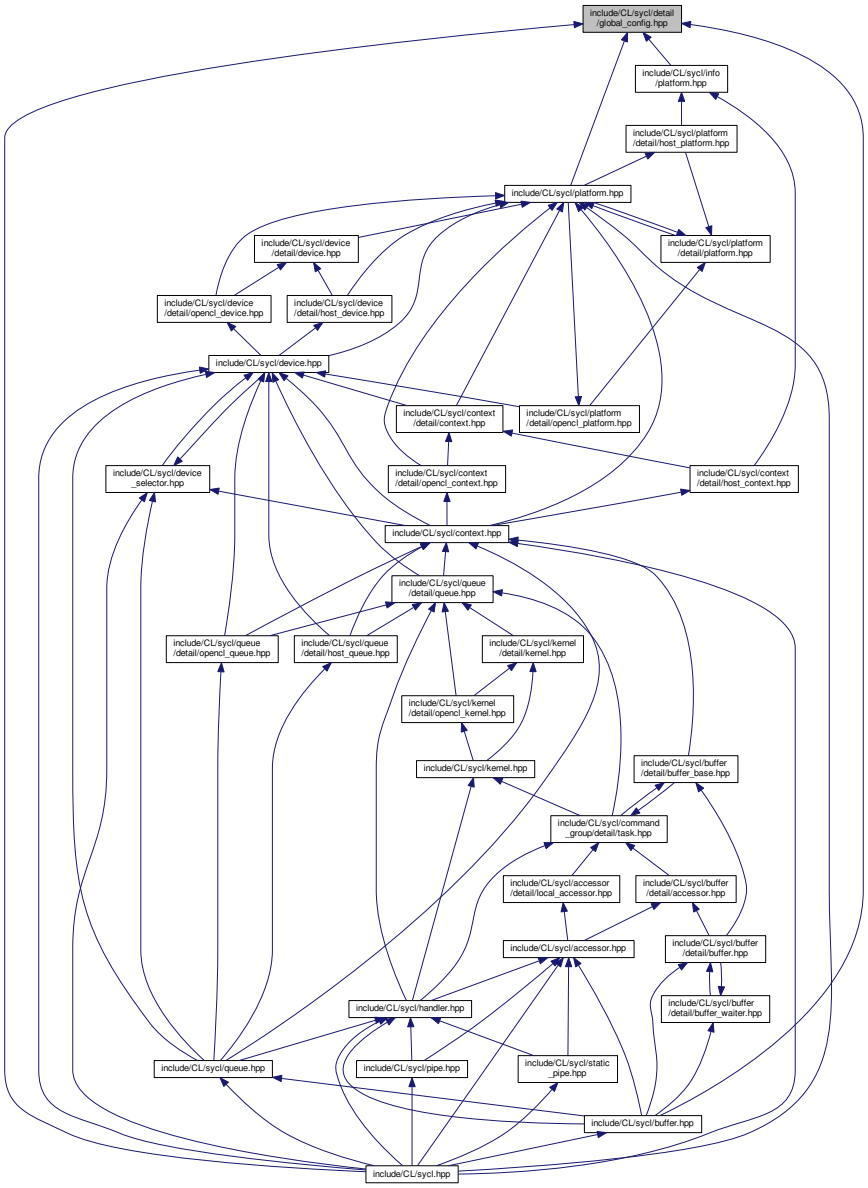
11.49 include/CL/sycl/detail/global_config.hpp File Reference

```
#include <CL/cl.h>
#include <boost/compute.hpp>
```

Include dependency graph for global_config.hpp:



This graph shows which files directly or indirectly include this file:



Macros

- #define CL_SYCL_LANGUAGE_VERSION 220

  This implement SYCL 2.2.
- #define TRISYCL_CL_LANGUAGE_VERSION 220

  This implement triSYCL 2.2.
- #define __SYCL_SINGLE_SOURCE__

  This source is compiled by a single source compiler.
- #define TRISYCL_MAKE_BOOST_CIRCULARBUFFER_THREAD_SAFE
- #define TRISYCL_SKIP_OPENCL(x) x

  Define TRISYCL_OPENCL to add OpenCL.
- #define TRISYCL_WEAK_ATTRIB_PREFIX
- #define TRISYCL_WEAK_ATTRIB_SUFFIX __attribute__((weak))

11.49.1 Macro Definition Documentation

11.49.1.1 TRISYCL_WEAK_ATTRIB_PREFIX

```
#define TRISYCL_WEAK_ATTRIB_PREFIX
```

Definition at line 65 of file global_config.hpp.

Referenced by cl::sycl::detail::opencl_kernel::TRISYCL_ParallelForKernel_RANGE(), cl::sycl::detail::opencl_context::~opencl_context(), cl::sycl::detail::opencl_device::~opencl_device(), cl::sycl::detail::opencl_platform::~opencl_platform(), and cl::sycl::detail::opencl_queue::~opencl_queue().

11.49.1.2 TRISYCL_WEAK_ATTRIB_SUFFIX

```
#define TRISYCL_WEAK_ATTRIB_SUFFIX __attribute__((weak))
```

Definition at line 66 of file global_config.hpp.

Referenced by cl::sycl::device::get_platform().

11.50 global_config.hpp

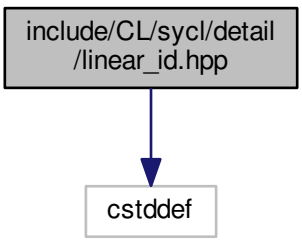
```
00001 #ifndef TRISYCL_SYCL_DETAIL_GLOBAL_CONFIG_HPP
00002 #define TRISYCL_SYCL_DETAIL_GLOBAL_CONFIG_HPP
00003
00004 /** \file The OpenCL SYCL details on the global triSYCL configuration
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 /** \addtogroup defaults Manage default configuration and types
00013     @{
00014 */
00015
00016 // The following symbols can be set to implement a different version
00017 #ifndef CL_SYCL_LANGUAGE_VERSION
00018 /// This implement SYCL 2.2
00019 #define CL_SYCL_LANGUAGE_VERSION 220
00020 #endif
00021
00022 #ifndef TRISYCL_CL_LANGUAGE_VERSION
00023 /// This implement triSYCL 2.2
00024 #define TRISYCL_CL_LANGUAGE_VERSION 220
00025 #endif
00026
00027 /// This source is compiled by a single source compiler
00028 #define __SYCL_SINGLE_SOURCE__
00029
00030
00031 /* Work-around an old Boost.CircularBuffer bug if a pre 1.62 Boost
00032    version is used */
00033 #define TRISYCL_MAKE_BOOST_CIRCULARBUFFER_THREAD_SAFE
00034
00035
00036 /** Define TRISYCL_OPENCL to add OpenCL
00037
00038     triSYCL can indeed work without OpenCL if only host support is needed.
00039 */
```

```
00040 #ifdef TRISYCL_OPENCL
00041
00042 // SYCL interoperation API with OpenCL requires some OpenCL C types:
00043 #if defined(__APPLE__)
00044 #include <OpenCL/cl.h>
00045 #else
00046 #include <CL/cl.h>
00047 #endif
00048 // But the triSYCL OpenCL implementation is actually based on Boost.Compute
00049 #include <boost/compute.hpp>
00050 /// A macro to keep some stuff in OpenCL mode
00051 #define TRISYCL_SKIP_OPENCL(x) x
00052 #else
00053 /// A macro to skip stuff when not supporting OpenCL
00054 #define TRISYCL_SKIP_OPENCL(x)
00055 #endif
00056
00057 /// @} End the defaults Doxygen group
00058
00059 // Compiler specific weak linking (until changing to C++17 inline variables/functions)
00060 #ifndef TRISYCL_WEAK_ATTRIB_PREFIX
00061 #ifdef _MSC_VER
00062 #define TRISYCL_WEAK_ATTRIB_PREFIX __declspec(selectany)
00063 #define TRISYCL_WEAK_ATTRIB_SUFFIX
00064 #else
00065 #define TRISYCL_WEAK_ATTRIB_PREFIX
00066 #define TRISYCL_WEAK_ATTRIB_SUFFIX __attribute__((weak))
00067 #endif
00068 #endif
00069
00070 // Suppress usage/leak of macros originating from Visual C++ headers
00071 #ifdef _MSC_VER
00072 #define NOMINMAX
00073 #endif
00074
00075 /*
00076     # Some Emacs stuff:
00077     ### Local Variables:
00078     ### ispell-local-dictionary: "american"
00079     ### eval: (flyspell-prog-mode)
00080     ### End:
00081 */
00082
00083 #endif // TRISYCL_SYCL_DETAIL_GLOBAL_CONFIG_HPP
```

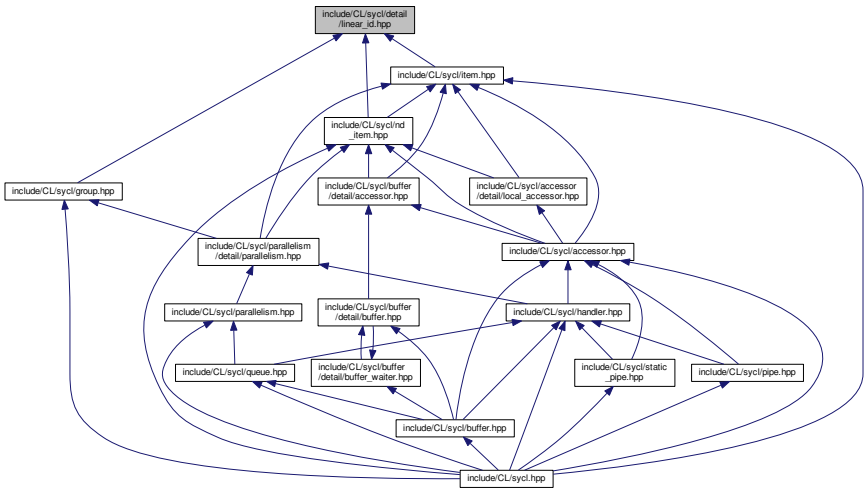
11.51 include/CL/sycl/detail/linear_id.hpp File Reference

`#include <cstddef>`

Include dependency graph for linear_id.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Functions

- template<typename Range , typename Id >
  size_t constexpr cl::sycl::detail::linear_id (Range range, Id id, Id offset={})

  Compute a linearized array access used in the OpenCL 2 world.

11.52 linear_id.hpp

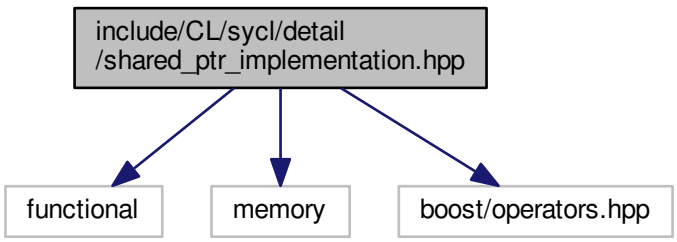
```
00001 #ifndef TRISYCL_SYCL_DETAIL_LINEAR_ID_HPP
00002 #define TRISYCL_SYCL_DETAIL_LINEAR_ID_HPP
00003
00004 /** \file Compute linearized array access
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013
00014 namespace cl {
00015 namespace sycl {
00016 namespace detail {
00017
00018 /** \addtogroup helpers Some helpers for the implementation
00019     @{
00020 */
00021
00022 /** Compute a linearized array access used in the OpenCL 2 world
00023
00024     Typically for the get_global_linear_id() and get_local_linear_id()
```

```
00025     functions.
00026 */
00027 template <typename Range, typename Id>
00028 size_t constexpr inline linear_id(Range range, Id id, Id offset = {}) {
00029   auto dims = std::distance(std::begin(range), std::end(range));
00030
00031   size_t linear_id = 0;
00032   /* A good compiler should unroll this and do partial evaluation to
00033      remove the first multiplication by 0 of this Horner evaluation and
00034      remove the 0 offset evaluation */
00035     for (int i = dims - 1; i >= 0; --i)
00036       linear_id = linear_id*range[i] + id[i] - offset[i];
00037
00038     return linear_id;
00039   }
00040
00041
00042 /// @} End the helpers Doxygen group
00043
00044 }
00045 }
00046 }
00047
00048 /*
00049     # Some Emacs stuff:
00050     ### Local Variables:
00051     ### ispell-local-dictionary: "american"
00052     ### eval: (flyspell-prog-mode)
00053     ### End:
00054 */
00055
00056 #endif // TRISYCL_SYCL_DETAIL_LINEAR_ID_HPP
```

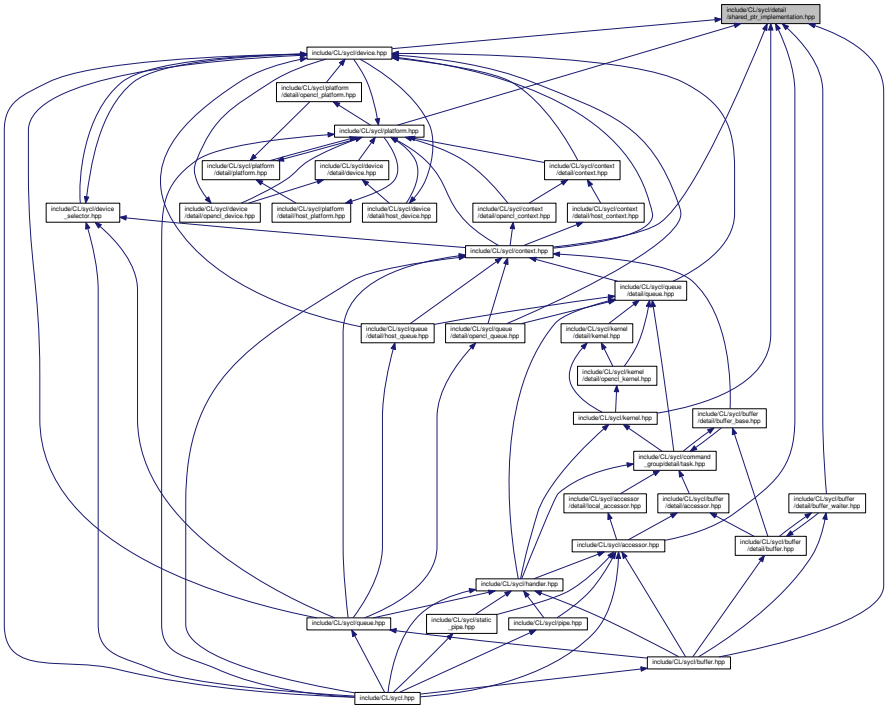
11.53 include/CL/sycl/detail/shared_ptr_implementation.hpp File Reference

```
#include <functional>
#include <memory>
#include <boost/operators.hpp>
```

Include dependency graph for shared_ptr_implementation.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >

  Provide an implementation as shared_ptr with total ordering and hashing to be used with algorithms and in (un)ordered containers.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.54 shared_ptr_implementation.hpp

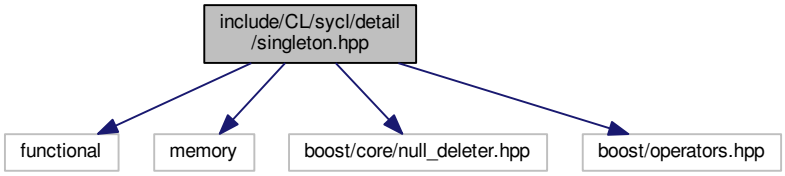
```
00001 #ifndef TRISYCL_SYCL_DETAIL_SHARED_PTR_IMPLEMENTATION_HPP
00002 #define TRISYCL_SYCL_DETAIL_SHARED_PTR_IMPLEMENTATION_HPP
00003
00004 /** \file Mix-in to add an implementation as shared_ptr with total
00005     ordering and hashing so that the class can be used with algorithms
00006     and in (un)ordered containers
00007
00008     Ronan at Keryell point FR
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 #include <functional>
00015 #include <memory>
```

```
00016
00017 #include <boost/operators.hpp>
00018
00019 namespace cl {
00020 namespace sycl {
00021 namespace detail {
00022
00023 /** Provide an implementation as shared_ptr with total ordering and
00024     hashing to be used with algorithms and in (un)ordered containers
00025
00026     To be used, a Parent class wanting an Implementation needs to
00027     inherit from.
00028
00029     The implementation ends up in a member really named
00030     "implementation".
00031
00032     \code
00033     public detail::shared_ptr_implementation<Parent, Implementation>
00034     \endcode
00035
00036     and also inject in std namespace a specialization for
00037     \code hash<Parent> \endcode
00038 */
00039 template <typename Parent, typename Implementation>
00040 struct shared_ptr_implementation : public boost::totally_ordered<Parent> {
00041
00042   /// The implementation forward everything to this... implementation
00043   std::shared_ptr<Implementation> implementation;
00044
00045   /// The implementation directly as a shared pointer
00046   shared_ptr_implementation(std::shared_ptr<Implementation> i)
00047     : implementation { i } {}
00048
00049
00050   /// The implementation takes the ownership from a raw pointer
00051   shared_ptr_implementation(Implementation *i) : implementation { i } {}
00052
00053
00054   /// Keep all other constructors to have usual shared_ptr behaviour
00055   shared_ptr_implementation() = default;
00056
00057
00058   /** Equality operator
00059
00060       This is generalized by boost::equality_comparable from
00061       boost::totally_ordered to implement the equality comparable
00062       concept
00063   */
00064   bool operator ==(const Parent &other) const {
00065     return implementation == other.implementation;
00066   }
00067
00068
00069   /** Inferior operator
00070
00071       This is generalized by boost::less_than_comparable from
00072       boost::totally_ordered to implement the equality comparable
00073       concept
00074
00075       \todo Add this to the spec
00076   */
00077   bool operator <(const Parent &other) const {
00078     return implementation < other.implementation;
00079   }
00080
00081
00082   /// Forward the hashing for unordered containers to the implementation
00083   auto hash() const {
00084     return std::hash<decltype(implementation)>{}(implementation);
00085   }
00086
00087 };
00088
00089 }
00090 }
00091 }
00092
00093 /*
00094     # Some Emacs stuff:
00095     ### Local Variables:
00096     ### ispell-local-dictionary: "american"
00097     ### eval: (flyspell-prog-mode)
00098     ### End:
00099 */
00100
00101 #endif // TRISYCL_SYCL_DETAIL_SHARED_PTR_IMPLEMENTATION_HPP
```

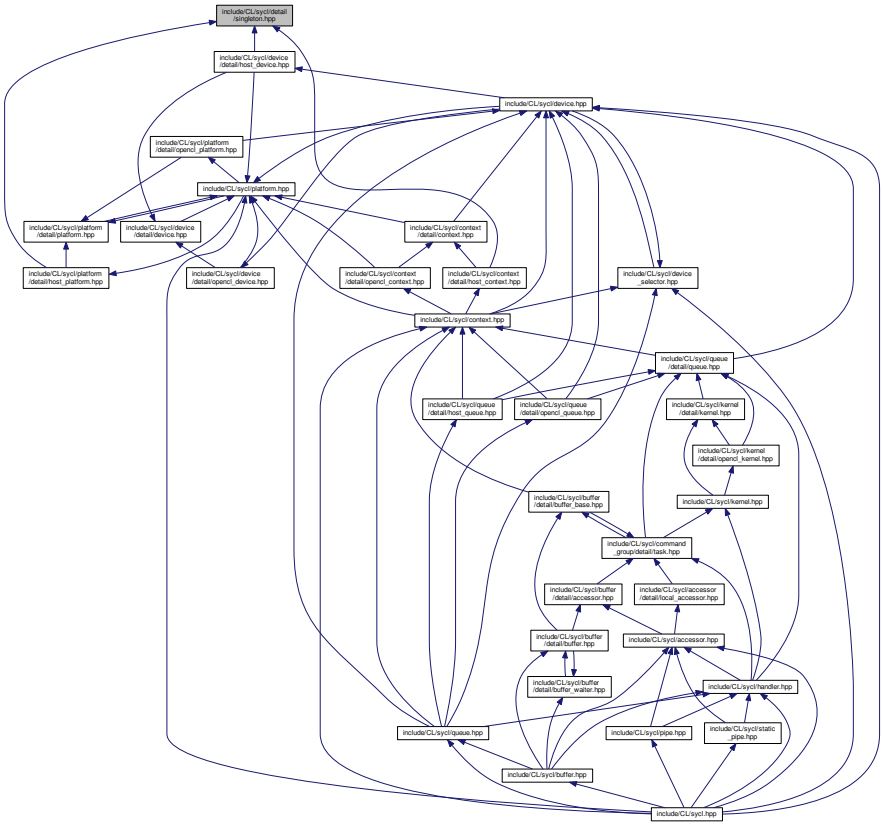
11.55 include/CL/sycl/detail/singleton.hpp File Reference

```
#include <functional>
#include <memory>
#include <boost/core/null_deleter.hpp>
#include <boost/operators.hpp>
```

Include dependency graph for singleton.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::singleton< T >

  Provide a singleton factory.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.56 singleton.hpp

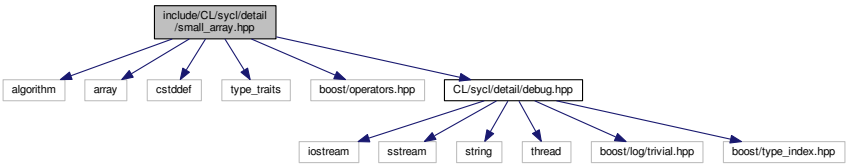
```
00001 #ifndef TRISYCL_SYCL_DETAIL_SINGLETON_HPP
00002 #define TRISYCL_SYCL_DETAIL_SINGLETON_HPP
00003
00004 /** \file Mix-in to add a singleton implementation with an instance() method
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <functional>
00013 #include <memory>
00014
00015 #include <boost/core/null_deleter.hpp>
00016 #include <boost/operators.hpp>
00017
00018
00019 namespace cl {
00020 namespace sycl {
00021 namespace detail {
00022
00023 /// Provide a singleton factory
00024 template <typename T>
00025 struct singleton {
00026
00027   /// Get a singleton instance of T
00028   static std::shared_ptr<T> instance() {
00029     // C++11 guaranties the static construction is thread-safe
00030     static T single;
00031     /** Use a null_deleter since the singleton should not be deleted,
00032         as allocated in the static area */
00033     static std::shared_ptr<T> sps { &single,
00034                                     boost::null_deleter {} };
00035
00036     return sps;
00037   }
00038
00039 };
00040
00041 }
00042 }
00043 }
00044
00045 /*
00046     # Some Emacs stuff:
00047     ### Local Variables:
00048     ### ispell-local-dictionary: "american"
00049     ### eval: (flyspell-prog-mode)
00050     ### End:
00051 */
00052
00053 #endif // TRISYCL_SYCL_DETAIL_SINGLETON_HPP
```

11.57 include/CL/sycl/detail/small_array.hpp File Reference

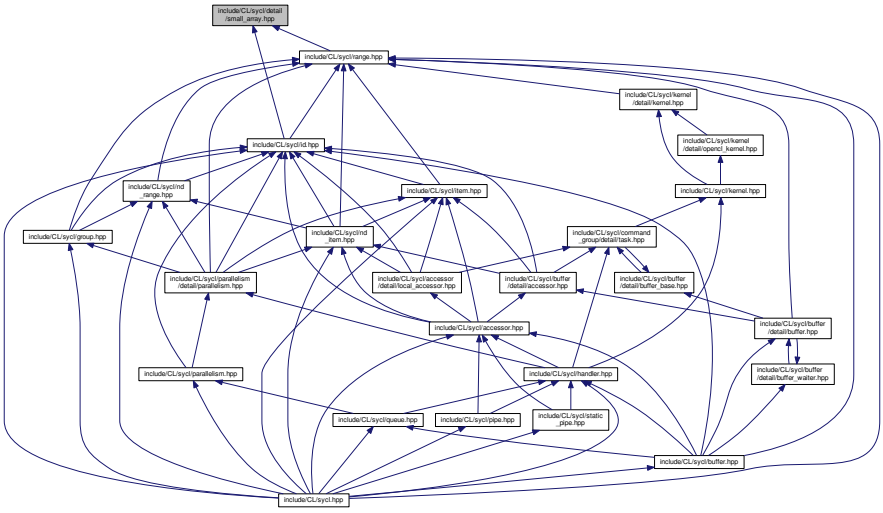
```
#include <algorithm>
#include <array>
#include <cstddef>
#include <type_traits>
#include <boost/operators.hpp>
```

```
#include "CL/sycl/detail/debug.hpp"
```

Include dependency graph for small_array.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >

  Define a multi-dimensional index, used for example to locate a work item or a buffer element. More...
- struct cl::sycl::detail::small_array_123< BasicType, FinalType, Dims >

  A small array of 1, 2 or 3 elements with the implicit constructors. More...
- struct cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >

  Use some specializations so that some function overloads can be determined according to some implicit constructors and to have an implicit conversion from/to BasicType (such as an int typically) if Dimensions = 1. More...
- struct cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >
- struct cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Macros

- #define TRISYCL_BOOST_OPERATOR_VECTOR_OP(op)

  Helper macro to declare a vector operation with the given side-effect operator.
- #define TRISYCL_LOGICAL_OPERATOR_VECTOR_OP(op)

11.58 small_array.hpp

```
00001 #ifndef TRISYCL_SYCL_DETAIL_SMALL_ARRAY_HPP
00002 #define TRISYCL_SYCL_DETAIL_SMALL_ARRAY_HPP
00003
00004 /** \file This is a small array class to build range<>, id<>, etc.
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <algorithm>
00013 #include <array>
00014 #include <cstddef>
00015 #include <type_traits>
00016
00017 #include <boost/operators.hpp>
00018
00019 #include "CL/sycl/detail/debug.hpp"
00020
00021
00022 namespace cl {
00023 namespace sycl {
00024 namespace detail {
00025
00026 /** \addtogroup helpers Some helpers for the implementation
00027     @{
00028 */
00029
00030
00031 /** Helper macro to declare a vector operation with the given side-effect
00032     operator */
00033 #define TRISYCL_BOOST_OPERATOR_VECTOR_OP(op)            \
00034   FinalType operator op(const FinalType &rhs) {         \
00035     for (std::size_t i = 0; i != Dims; ++i)             \
00036       (*this)[i] op rhs[i];                             \
00037     return *this;                                       \
00038   }
00039
00040
00041 #define TRISYCL_LOGICAL_OPERATOR_VECTOR_OP(op)          \
00042   FinalType operator op(const FinalType &rhs) {         \
00043     FinalType res;                                      \
00044     for (std::size_t i = 0; i != Dims; ++i)             \
00045       res[i] = (*this)[i] op rhs[i];                    \
00046     return res;                                         \
00047   }
00048
00049
00050 /** Define a multi-dimensional index, used for example to locate a work
00051     item or a buffer element
00052
00053     Unfortunately, even if std::array is an aggregate class allowing
00054     native list initialization, it is no longer an aggregate if we derive
00055     from an aggregate. Thus we have to redeclare the constructors.
00056
00057     \param BasicType is the type element, such as int
00058
00059     \param Dims is the dimension number, typically between 1 and 3
00060
00061     \param FinalType is the final type, such as range<> or id<>, so that
00062     boost::operator can return the right type
00063
00064     \param EnableArgsConstructor adds a constructors from Dims variadic
00065     elements when true. It is false by default.
00066
00067     std::array<> provides the collection concept, with .size(), == and !=
00068     too.
00069 */
00070 template <typename BasicType,
00071           typename FinalType,
```

```
00072           std::size_t Dims,
00073           bool EnableArgsConstructor = false>
00074 struct small_array : std::array<BasicType, Dims>,
00075   // To have all the usual arithmetic operations on this type
00076   boost::euclidean_ring_operators<FinalType>,
00077   // Bitwise operations
00078   boost::bitwise<FinalType>,
00079   // Shift operations
00080   boost::shiftable<FinalType>,
00081   // Already provided by array<> lexicographically:
00082   // boost::equality_comparable<FinalType>,
00083   // boost::less_than_comparable<FinalType>,
00084   // Add a display() method
00085   detail::display_vector<FinalType> {
00086
00087   /// \todo add this Boost::multi_array or STL concept to the
00088   /// specification?
00089   static const auto dimensionality = Dims;
00090
00091   /* Note that constexpr size() from the underlying std::array provides
00092      the same functionality */
00093   static const size_t dimension = Dims;
00094   using element_type = BasicType;
00095
00096
00097   /** A constructor from another array
00098
00099       Make it explicit to avoid spurious range<> constructions from int *
00100       for example
00101   */
00102   template <typename SourceType>
00103   small_array(const SourceType src[Dims]) {
00104     // (*this)[0] is the first element of the underlying array
00105     std::copy_n(src, Dims, &(*this)[0]);
00106   }
00107
00108
00109   /** An accessor to the first variable of a small array
00110   */
00111   BasicType& x(){
00112     static_assert(Dims >= 1, "can't access to small_array[0] if Dims < 1");
00113     return (*this)[0];
00114   }
00115
00116
00117   /** An accessor to the second variable of a small array
00118   */
00119   BasicType& y(){
00120     static_assert(Dims >= 2, "can't access to small_array[1] if Dims < 2");
00121     return (*this)[1];
00122   }
00123
00124
00125   /** An accessor to the third variable of a small array
00126   */
00127   BasicType& z(){
00128     static_assert(Dims >= 3, "can't access to small_array[2] if Dims < 3");
00129     return (*this)[2];
00130   }
00131
00132
00133   /// A constructor from another small_array of the same size
00134   template <typename SourceBasicType,
00135             typename SourceFinalType,
00136             bool SourceEnableArgsConstructor>
00137   small_array(const small_array<SourceBasicType,
00138               SourceFinalType,
00139               Dims,
00140               SourceEnableArgsConstructor> &src) {
00141     std::copy_n(&src[0], Dims, &(*this)[0]);
00142   }
00143
00144
00145   /** Initialize the array from a list of elements
00146
00147       Strangely, even when using the array constructors, the
00148       initialization of the aggregate is not available. So recreate an
00149       equivalent here.
00150
00151       Since there are inherited types that defines some constructors with
00152       some conflicts, make it optional here, according to
00153       EnableArgsConstructor template parameter.
00154    */
00155   template <typename... Types,
00156             // Just to make enable_if depend of the template and work
00157             bool Depend = true,
00158             typename = typename std::enable_if_t<EnableArgsConstructor
```

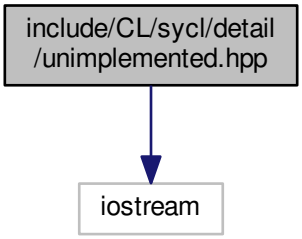
```
00159                                                 && Depend>>
00160   small_array(const Types &... args)
00161     : std::array<BasicType, Dims> {
00162     // Allow a loss of precision in initialization with the static_cast
00163     { static_cast<BasicType>(args)... }
00164   }
00165   {
00166     static_assert(sizeof...(args) == Dims,
00167                   "The number of initializing elements should match "
00168                   "the dimension");
00169   }
00170
00171
00172   /// Construct a small_array from a std::array
00173   template <typename SourceBasicType>
00174   small_array(const std::array<SourceBasicType, Dims> &src)
00175   : std::array<BasicType, Dims>(src) {}
00176
00177
00178   /// Keep other constructors from the underlying std::array
00179   using std::array<BasicType, Dims>::array;
00180
00181   /// Keep the synthesized constructors
00182   small_array() = default;
00183
00184   /// Return the element of the array
00185   auto get(std::size_t index) const {
00186     return (*this)[index];
00187   }
00188
00189   /* Implement minimal methods boost::euclidean_ring_operators needs to
00190      generate everything */
00191   /// Add + like operations on the id<> and others
00192   TRISYCL_BOOST_OPERATOR_VECTOR_OP(+=)
00193
00194   /// Add - like operations on the id<> and others
00195   TRISYCL_BOOST_OPERATOR_VECTOR_OP(-=)
00196
00197   /// Add * like operations on the id<> and others
00198   TRISYCL_BOOST_OPERATOR_VECTOR_OP(*=)
00199
00200   /// Add / like operations on the id<> and others
00201   TRISYCL_BOOST_OPERATOR_VECTOR_OP(/=)
00202
00203   /// Add % like operations on the id<> and others
00204   TRISYCL_BOOST_OPERATOR_VECTOR_OP(%=)
00205
00206   /// Add << like operations on the id<> and others
00207   TRISYCL_BOOST_OPERATOR_VECTOR_OP(<<=)
00208
00209   /// Add >> like operations on the id<> and others
00210   TRISYCL_BOOST_OPERATOR_VECTOR_OP(>>=)
00211
00212   /// Add & like operations on the id<> and others
00213   TRISYCL_BOOST_OPERATOR_VECTOR_OP(&=)
00214
00215   /// Add ^ like operations on the id<> and others
00216   TRISYCL_BOOST_OPERATOR_VECTOR_OP(^=)
00217
00218   /// Add | like operations on the id<> and others
00219   TRISYCL_BOOST_OPERATOR_VECTOR_OP(|=)
00220
00221   TRISYCL_LOGICAL_OPERATOR_VECTOR_OP(&&)
00222
00223   TRISYCL_LOGICAL_OPERATOR_VECTOR_OP(||)
00224
00225
00226   /** Since the boost::operator work on the small_array, add an implicit
00227       conversion to produce the expected type */
00228   operator FinalType () {
00229     return *static_cast<FinalType *>(this);
00230   }
00231
00232 };
00233
00234
00235 /** A small array of 1, 2 or 3 elements with the implicit constructors */
00236 template <typename BasicType, typename FinalType, std::size_t Dims>
00237 struct small_array_123 : small_array<BasicType, FinalType, Dims> {
00238   static_assert(1 <= Dims && Dims <= 3,
00239                 "Dimensions are between 1 and 3");
00240 };
00241
00242
00243 /** Use some specializations so that some function overloads can be
00244     determined according to some implicit constructors and to have an
00245     implicit conversion from/to BasicType (such as an int typically) if
```

```
00246     Dimensions = 1
00247 */
00248 template <typename BasicType, typename FinalType>
00249 struct small_array_123<BasicType, FinalType, 1>
00250   : public small_array<BasicType, FinalType, 1> {
00251   /// A 1-D constructor to have implicit conversion from from 1 integer
00252   /// and automatic inference of the dimensionality
00253   small_array_123(BasicType x) {
00254     (*this)[0] = x;
00255   }
00256
00257
00258   /// Keep other constructors
00259   small_array_123() = default;
00260
00261   using small_array<BasicType, FinalType, 1>::small_array;
00262
00263   /** Conversion so that an for example an id<1> can basically be used
00264       like an integer */
00265   operator BasicType() const {
00266     return (*this)[0];
00267   }
00268 };
00269
00270
00271 template <typename BasicType, typename FinalType>
00272 struct small_array_123<BasicType, FinalType, 2>
00273   : public small_array<BasicType, FinalType, 2> {
00274   /// A 2-D constructor to have implicit conversion from from 2 integers
00275   /// and automatic inference of the dimensionality
00276   small_array_123(BasicType x, BasicType y) {
00277     (*this)[0] = x;
00278     (*this)[1] = y;
00279   }
00280
00281
00282   /** Broadcasting constructor initializing all the elements with the
00283       same value
00284
00285       \todo Add to the specification of the range, id...
00286   */
00287   explicit small_array_123(BasicType e) : small_array_123 { e, e } { }
00288
00289
00290   /// Keep other constructors
00291   small_array_123() = default;
00292
00293   using small_array<BasicType, FinalType, 2>::small_array;
00294 };
00295
00296
00297 template <typename BasicType, typename FinalType>
00298 struct small_array_123<BasicType, FinalType, 3>
00299   : public small_array<BasicType, FinalType, 3> {
00300   /// A 3-D constructor to have implicit conversion from from 3 integers
00301   /// and automatic inference of the dimensionality
00302   small_array_123(BasicType x, BasicType y, BasicType z) {
00303     (*this)[0] = x;
00304     (*this)[1] = y;
00305     (*this)[2] = z;
00306   }
00307
00308
00309   /** Broadcasting constructor initializing all the elements with the
00310       same value
00311
00312       \todo Add to the specification of the range, id...
00313   */
00314   explicit small_array_123(BasicType e) : small_array_123 { e, e, e } { }
00315
00316
00317   /// Keep other constructors
00318   small_array_123() = default;
00319
00320   using small_array<BasicType, FinalType, 3>::small_array;
00321 };
00322
00323 /// @} End the helpers Doxygen group
00324
00325 }
00326 }
00327 }
00328
00329 /*
00330     # Some Emacs stuff:
00331     ### Local Variables:
00332     ### ispell-local-dictionary: "american"
```

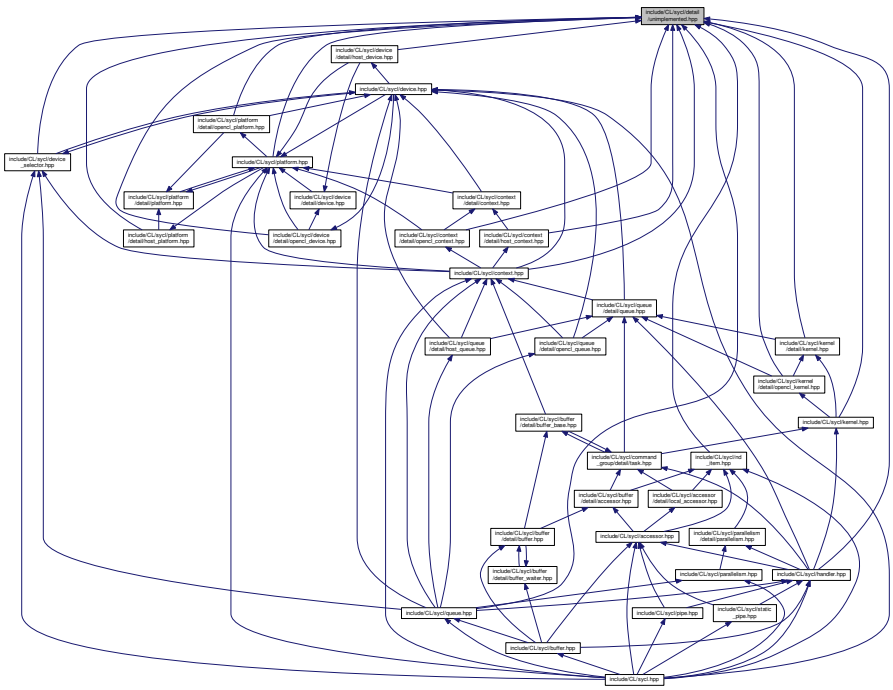
```
00333     ### eval: (flyspell-prog-mode)
00334     ### End:
00335 */
00336
00337 #endif // TRISYCL_SYCL_DETAIL_SMALL_ARRAY_HPP
```

11.59 include/CL/sycl/detail/unimplemented.hpp File Reference

`#include <iostream>`
Include dependency graph for unimplemented.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Functions

- void cl::sycl::detail::unimplemented ()

  Display an "unimplemented" message.

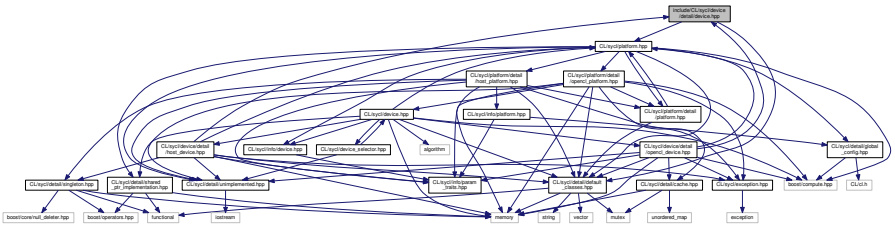
11.60 unimplemented.hpp

```
00001 #ifndef TRISYCL_SYCL_DETAIL_UNIMPLEMENTED_HPP
00002 #define TRISYCL_SYCL_DETAIL_UNIMPLEMENTED_HPP
00003
00004 /** \file Deal with unimplemented features
00005     Ronan at Keryell point FR
00006
00007     This file is distributed under the University of Illinois Open Source
00008     License. See LICENSE.TXT for details.
00009 */
00010
00011 #include <iostream>
00012
00013 namespace cl {
00014 namespace sycl {
00015 namespace detail {
00016
00017 /** \addtogroup helpers Some helpers for the implementation
00018     @{
00019 */
00020
00021 /** Display an "unimplemented" message
00022
00023     Can be changed to call assert(0) or whatever.
00024 */
00025 inline void unimplemented() {
00026 #ifndef NDEBUG
00027   std::cerr << "Error: using a non implemented feature!!!" << std::endl
00028             << "Please contribute to the open source implementation. :-)"
00029             << std::endl;
00030 #endif
00031 }
00032
00033 /// @} End the helpers Doxygen group
00034
00035 }
00036 }
00037 }
00038
00039 /*
00040     # Some Emacs stuff:
00041     ### Local Variables:
00042     ### ispell-local-dictionary: "american"
00043     ### eval: (flyspell-prog-mode)
00044     ### End:
00045 */
00046
00047 #endif // TRISYCL_SYCL_DETAIL_UNIMPLEMENTED_HPP
```

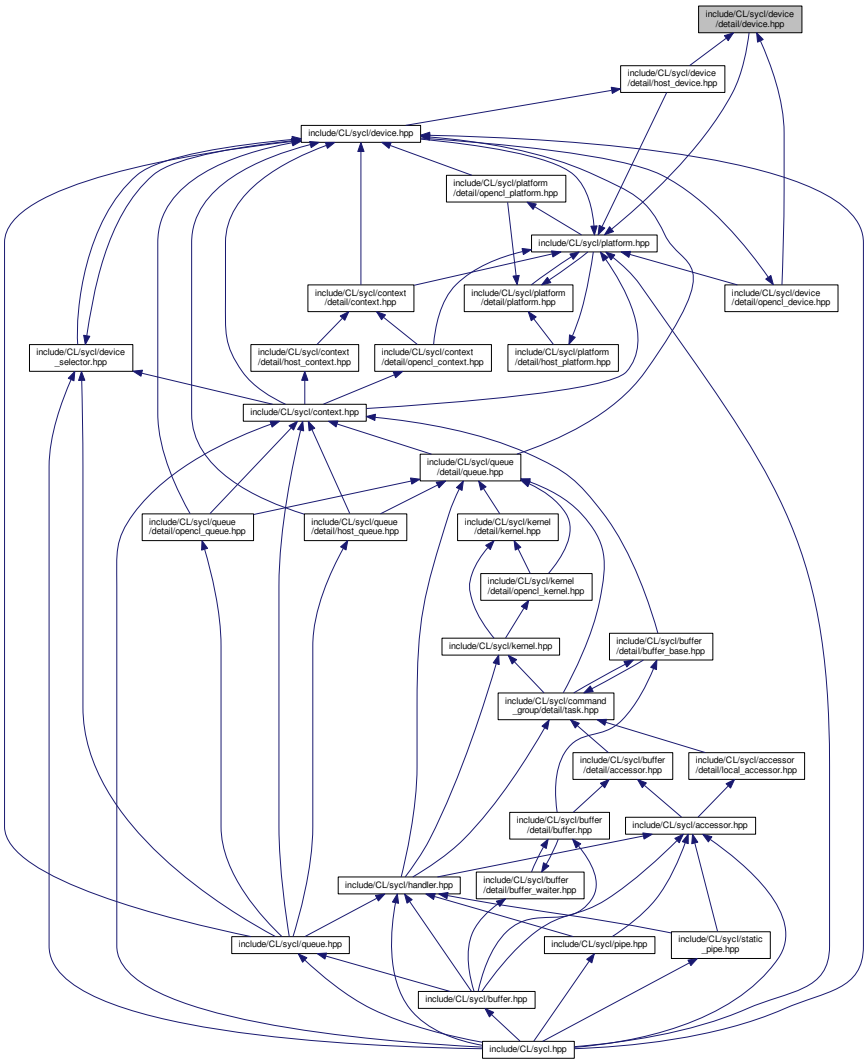
11.61 include/CL/sycl/device/detail/device.hpp File Reference

```
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/platform.hpp"
```

Include dependency graph for device.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::device

  An abstract class representing various models of SYCL devices. *More...*

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.62 device.hpp

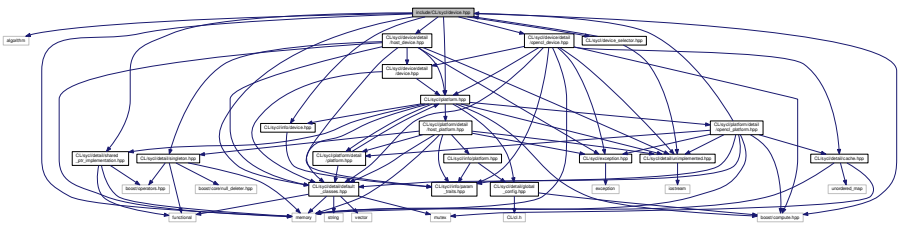
```
00001 #ifndef TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_HPP
00002 #define TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_HPP
00003
00004 /** \file The OpenCL SYCL abstract device
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/detail/default_classes.hpp"
00013
00014 #include "CL/sycl/platform.hpp"
00015
00016 namespace cl {
00017 namespace sycl {
00018 namespace detail {
00019
00020 /** \addtogroup execution Platforms, contexts, devices and queues
00021     @{
00022 */
00023
00024 /// An abstract class representing various models of SYCL devices
00025 class device {
00026
00027 public:
00028
00029 #ifdef TRISYCL_OPENCL
00030   /// Return the cl_device_id of the underlying OpenCL platform
00031   virtual cl_device_id get() const = 0;
00032
00033   /// Return the underlying Boost.Compute device, if any
00034   virtual boost::compute::device &get_boost_compute() = 0;
00035 #endif
00036
00037
00038   /// Return true if the device is a SYCL host device
00039   virtual bool is_host() const = 0;
00040
00041
00042   /// Return true if the device is an OpenCL CPU device
00043   virtual bool is_cpu() const = 0;
00044
00045
00046   /// Return true if the device is an OpenCL GPU device
00047   virtual bool is_gpu() const = 0;
00048
00049
00050   /// Return true if the device is an OpenCL accelerator device
00051   virtual bool is_accelerator() const = 0;
00052
00053
00054   /// Return the platform of device
00055   virtual cl::sycl::platform get_platform() const = 0;
00056
00057
00058   /// Query the device for OpenCL info::device info
00059   /** \todo virtual cannot be templated
00060   template <typename T>
```

```
00061   virtual T get_info(info::device param) const = 0;
00062   */
00063
00064
00065   /// Specify whether a specific extension is supported on the device.
00066   virtual bool has_extension(const string_class &extension) const = 0;
00067
00068
00069   // Virtual to call the real destructor
00070   virtual ~device() {}
00071
00072 };
00073
00074 /// @} to end the execution Doxygen group
00075
00076 }
00077 }
00078 }
00079
00080 /*
00081     # Some Emacs stuff:
00082     ### Local Variables:
00083     ### ispell-local-dictionary: "american"
00084     ### eval: (flyspell-prog-mode)
00085     ### End:
00086 */
00087
00088 #endif // TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_HPP
```

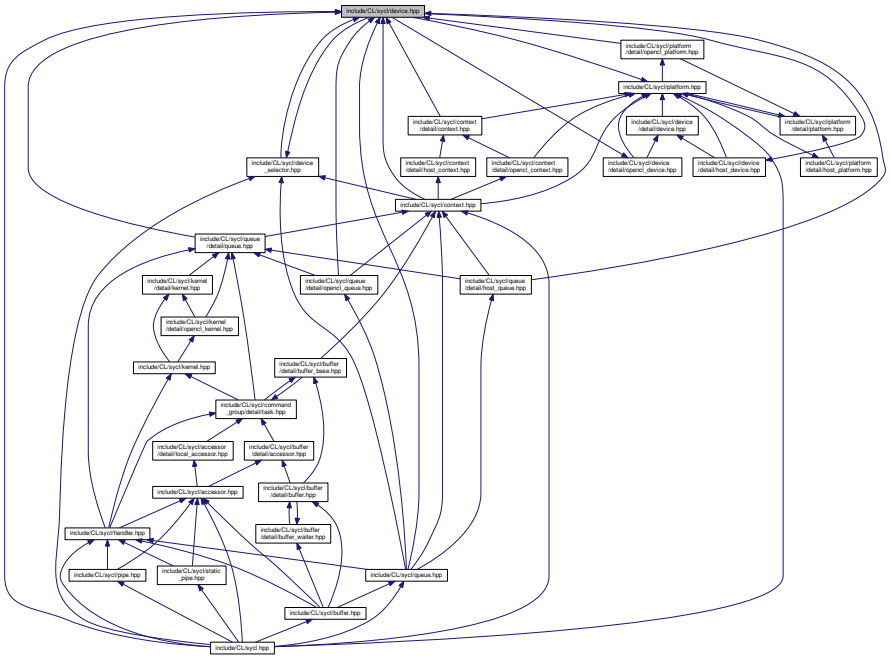
11.63 include/CL/sycl/device.hpp File Reference

```
#include <algorithm>
#include <memory>
#include <boost/compute.hpp>
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/detail/shared_ptr_implementation.hpp"
#include "CL/sycl/device/detail/host_device.hpp"
#include "CL/sycl/device/detail/opencl_device.hpp"
#include "CL/sycl/info/device.hpp"
#include "CL/sycl/device_selector.hpp"
#include "CL/sycl/platform.hpp"
```

Include dependency graph for device.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::device

  SYCL device. More...
- struct std::hash< cl::sycl::device >

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- std

Functions

- template<>
  auto cl::sycl::device::get_info< info::device::max_work_group_size > () const
- template<>
  auto cl::sycl::device::get_info< info::device::max_compute_units > () const
- template<>
  auto cl::sycl::device::get_info< info::device::device_type > () const
- template<>
  auto cl::sycl::device::get_info< info::device::local_mem_size > () const
- template<>
  auto cl::sycl::device::get_info< info::device::max_mem_alloc_size > () const
- template<>
  auto cl::sycl::device::get_info< info::device::vendor > () const
- template<>
  auto cl::sycl::device::get_info< info::device::name > () const
- template<>
  auto cl::sycl::device::get_info< info::device::profile > () const

11.64 device.hpp

```
00001 #ifndef TRISYCL_SYCL_DEVICE_HPP
00002 #define TRISYCL_SYCL_DEVICE_HPP
00003
00004 /** \file The OpenCL SYCL device
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <algorithm>
00013 #include <memory>
00014
00015 #ifdef TRISYCL_OPENCL
00016 #include <boost/compute.hpp>
00017 #endif
00018
00019 #include "CL/sycl/detail/default_classes.hpp"
00020
00021 #include "CL/sycl/detail/shared_ptr_implementation.hpp"
00022 #include "CL/sycl/device/detail/host_device.hpp"
00023 #ifdef TRISYCL_OPENCL
00024 #include "CL/sycl/device/detail/opencl_device.hpp"
00025 #endif
00026 #include "CL/sycl/info/device.hpp"
00027 #include "CL/sycl/device_selector.hpp"
00028 #include "CL/sycl/platform.hpp"
00029
00030 namespace cl {
00031 namespace sycl {
00032
00033 class device_selector;
00034 class platform;
00035
00036 /** \addtogroup execution Platforms, contexts, devices and queues
00037     @{
00038 */
00039
00040 /// SYCL device
00041 class device
00042   /* Use the underlying device implementation that can be shared in the
00043      SYCL model */
00044   : public detail::shared_ptr_implementation<device, detail::device> {
00045
00046   // The type encapsulating the implementation
00047   using implementation_t =
00048     detail::shared_ptr_implementation<device, detail::device>
      ;
00049
00050 public:
00051
00052   // Make the implementation member directly accessible in this class
00053   using implementation_t::implementation;
00054
00055   /// The default constructor uses the SYCL host device
00056   device() : implementation_t {
     detail::host_device::instance() } {}
00057
00058
00059 #ifdef TRISYCL_OPENCL
00060   /** Construct a device class instance using cl_device_id of the
00061       OpenCL device
00062
00063       Return synchronous errors via the SYCL exception class.
00064
00065       Retain a reference to the OpenCL device and if this device was
00066       an OpenCL subdevice the device should be released by the caller
00067       when it is no longer needed.
00068   */
00069   device(cl_device_id device_id)
00070     : device { boost::compute::device { device_id } } {}
00071
00072
00073   /** Construct a device class instance using a boost::compute::device
00074
00075       This is a triSYCL extension for boost::compute interoperation.
00076
00077       Return synchronous errors via the SYCL exception class.
00078   */
00079   device(const boost::compute::device &d)
00080     : implementation_t { detail::opencl_device::instance(d)
      } {}
00081 #endif
```

```
00082
00083
00084   /** Construct a device class instance using the device selector
00085       provided
00086
00087       Return errors via C++ exception class.
00088
00089       \todo Make it non-explicit in the specification?
00090   */
00091   explicit device(const device_selector &ds) {
00092     auto devices = device::get_devices();
00093     if (devices.empty())
00094       // \todo Put a SYCL exception
00095       throw std::domain_error("No device at all! Internal error...");
00096
00097     /* Find the device with the best score according to the given
00098        device_selector */
00099     auto max = std::max_element(devices.cbegin(), devices.cend(),
00100                                 [&] (const device &d1, const device &d2) {
00101                                   return ds(d1) < ds(d2);
00102                                 });
00103     if (ds(*max) < 0)
00104       // \todo Put a SYCL exception
00105       throw std::domain_error("No device selected because no positive "
00106                               "device_selector score found");
00107
00108     // Create the current device as a shared copy of the selected one
00109     implementation = max->implementation;
00110   }
00111
00112
00113 #ifdef TRISYCL_OPENCL
00114   /** Return the cl_device_id of the underlying OpenCL platform
00115
00116       Return synchronous errors via the SYCL exception class.
00117
00118       Retain a reference to the returned cl_device_id object. Caller
00119       should release it when finished.
00120
00121       In the case where this is the SYCL host device it will throw an
00122       exception.
00123   */
00124   cl_device_id get() const {
00125     return implementation->get();
00126   }
00127
00128
00129   /** Return the underlying Boost.Compute device if it is an
00130       OpenCL device
00131
00132       This is a triSYCL extension
00133   */
00134   boost::compute::device get_boost_compute() const {
00135     return implementation->get_boost_compute();
00136   }
00137 #endif
00138
00139
00140   /// Return true if the device is the SYCL host device
00141   bool is_host() const {
00142     return implementation->is_host();
00143   }
00144
00145
00146   /// Return true if the device is an OpenCL CPU device
00147   bool is_cpu() const {
00148     return implementation->is_cpu();
00149   }
00150
00151
00152   /// Return true if the device is an OpenCL GPU device
00153   bool is_gpu() const {
00154     return implementation->is_gpu();
00155   }
00156
00157
00158   /// Return true if the device is an OpenCL accelerator device
00159   bool is_accelerator() const {
00160     return implementation->is_accelerator();
00161   }
00162
00163
00164
00165   /** Return the device_type of a device
00166
00167       \todo Present in Boost.Compute, to be added to the specification
00168   */
```

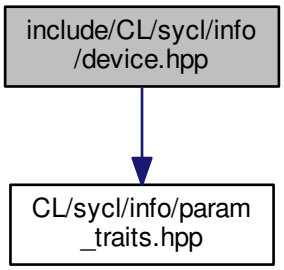
```
00169   info::device_type type() const {
00170     if (is_host())
00171       return info::device_type::host;
00172     else if (is_cpu())
00173       return info::device_type::cpu;
00174     else if (is_gpu())
00175       return info::device_type::gpu;
00176     else if (is_accelerator())
00177       return info::device_type::accelerator;
00178     else
00179       // \todo Put a SYCL exception
00180       throw std::domain_error("Unknown cl::sycl::info::device_type");
00181   }
00182
00183
00184   /** Return the platform of device
00185
00186       Return synchronous errors via the SYCL exception class.
00187   */
00188   platform get_platform() const {
00189     return implementation->get_platform();
00190   }
00191
00192
00193   /** Return a list of all available devices
00194
00195       Return synchronous errors via SYCL exception classes.
00196   */
00197 #ifdef _MSC_VER
00198   inline
00199 #endif
00200   static vector_class<device>
00201     get_devices(info::device_type device_type =
      info::device_type::all)
00202     TRISYCL_WEAK_ATTRIB_SUFFIX;
00203
00204   /** Query the device for OpenCL info::device info
00205
00206       Return synchronous errors via the SYCL exception class.
00207
00208       \todo
00209   */
00210   template <typename T>
00211   T get_info(info::device param) const {
00212     //return implementation->get_info<Param>(param);
00213   }
00214
00215
00216   /** Query the device for OpenCL info::device info
00217
00218       Return synchronous errors via the SYCL exception class.
00219
00220       \todo
00221   */
00222   template <info::device Param>
00223   inline auto get_info() const;
00224   /*{
00225     // Forward to the version where the info parameter is not a template
00226     //return get_info<typename info::param_traits_t<info::device, Param>>(Param);
00227     detail::unimplemented();
00228     return 0;
00229   }*/
00230
00231
00232   /// Test if a specific extension is supported on the device
00233   bool has_extension(const string_class &extension) const {
00234     return implementation->has_extension(extension);
00235   }
00236
00237
00238 #ifdef XYZTRISYCL_OPENCL
00239   /** Partition the device into sub devices based upon the properties
00240       provided
00241
00242       Return synchronous errors via SYCL exception classes.
00243
00244       \todo
00245   */
00246   vector_class<device>
00247   create_sub_devices(info::device_partition_type partition_type,
00248                      info::device_partition_property partition_property,
00249                      info::device_affinity_domain affinity_domain) const {
00250     return implementation->create_sub_devices(partition_type,
00251                                               partition_property,
00252                                               affinity_domain);
00253   }
00254 #endif
```

```
00255
00256 };
00257
00258
00259 template <>
00260 inline auto device::get_info<info::device::max_work_group_size>() const {
00261   return size_t { 8 };
00262 }
00263
00264 template <>
00265 inline auto device::get_info<info::device::max_compute_units>() const {
00266   return size_t { 8 };
00267 }
00268
00269 template <>
00270 inline auto device::get_info<info::device::device_type>() const {
00271   return info::device_type::cpu;
00272 }
00273
00274 template <>
00275 inline auto device::get_info<info::device::local_mem_size>() const {
00276   return size_t { 32000 };
00277 }
00278
00279 template <>
00280 inline auto device::get_info<info::device::max_mem_alloc_size>() const {
00281   return size_t { 32000 };
00282 }
00283
00284 template <>
00285 inline auto device::get_info<info::device::vendor>() const {
00286   return string_class {};
00287 }
00288
00289 template <>
00290 inline auto device::get_info<info::device::name>() const {
00291   return string_class {};
00292 }
00293
00294 template <>
00295 inline auto device::get_info<info::device::profile>() const {
00296   return string_class { "FULL_PROFILE" };
00297 }
00298
00299 /// @} to end the Doxygen group
00300
00301 }
00302 }
00303
00304
00305 /* Inject a custom specialization of std::hash to have the buffer
00306    usable into an unordered associative container
00307
00308    \todo Add this to the spec
00309 */
00310 namespace std {
00311
00312 template <> struct hash<cl::sycl::device> {
00313
00314   auto operator()(const cl::sycl::device &d) const {
00315     // Forward the hashing to the implementation
00316     return d.hash();
00317   }
00318
00319 };
00320
00321 }
00322
00323 /*
00324     # Some Emacs stuff:
00325     ### Local Variables:
00326     ### ispell-local-dictionary: "american"
00327     ### eval: (flyspell-prog-mode)
00328     ### End:
00329 */
00330
00331 #endif // TRISYCL_SYCL_DEVICE_HPP
```

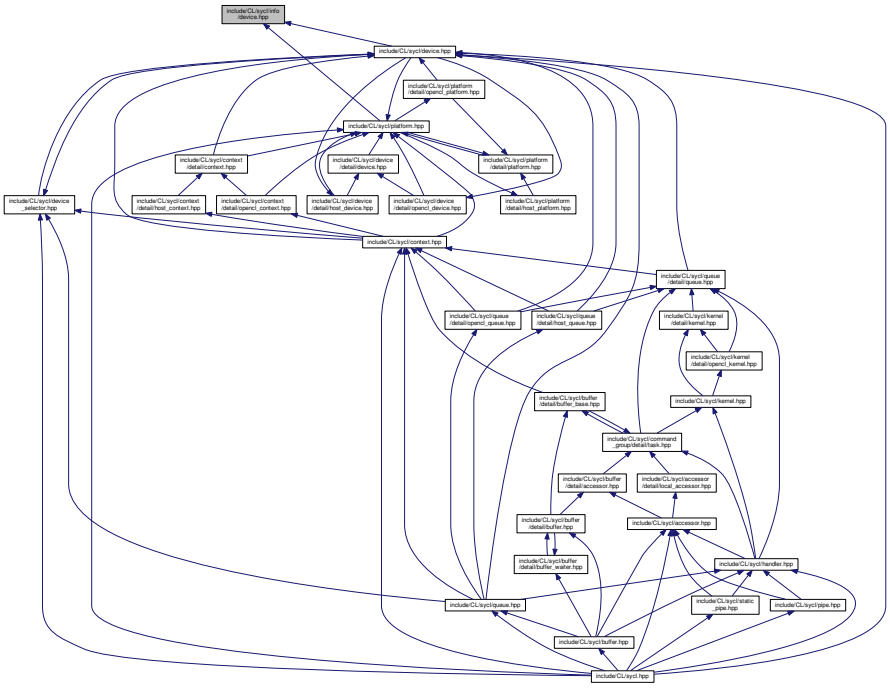
11.65 include/CL/sycl/info/device.hpp File Reference

`#include "CL/sycl/info/param_traits.hpp"`

Include dependency graph for device.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::info

Typedefs

- using cl::sycl::info::device_fp_config = unsigned int
- using cl::sycl::info::device_exec_capabilities = unsigned int
- using cl::sycl::info::device_queue_properties = unsigned int

Enumerations

- enum cl::sycl::info::device_type : unsigned int {
  cl::sycl::info::device_type::cpu, cl::sycl::info::device_type::gpu, cl::sycl::info::device_type::accelerator, cl::sycl::info::device_type::custom,
  cl::sycl::info::device_type::defaults, cl::sycl::info::device_type::host, cl::sycl::info::device_type::opencl, cl::sycl::info::device_type::all }

  Type of devices.
- enum cl::sycl::info::device : int {
  cl::sycl::info::device::device_type, cl::sycl::info::device::vendor_id, cl::sycl::info::device::max_compute_units, cl::sycl::info::device::max_work_item_dimensions,
  cl::sycl::info::device::max_work_item_sizes, cl::sycl::info::device::max_work_group_size, cl::sycl::info::device::preferred_vector_width_char, cl::sycl::info::device::preferred_vector_width_short,
  cl::sycl::info::device::preferred_vector_width_int, cl::sycl::info::device::preferred_vector_width_long_long, cl::sycl::info::device::preferred_vector_width_float, cl::sycl::info::device::preferred_vector_width_double,
  cl::sycl::info::device::preferred_vector_width_half, cl::sycl::info::device::native_vector_witdth_char, cl::sycl::info::device::native_vector_witdth_short, cl::sycl::info::device::native_vector_witdth_int,
  cl::sycl::info::device::native_vector_witdth_long_long, cl::sycl::info::device::native_vector_witdth_float, cl::sycl::info::device::native_vector_witdth_double, cl::sycl::info::device::native_vector_witdth_half,
  cl::sycl::info::device::max_clock_frequency, cl::sycl::info::device::address_bits, cl::sycl::info::device::max_mem_alloc_size, cl::sycl::info::device::image_support,
  cl::sycl::info::device::max_read_image_args, cl::sycl::info::device::max_write_image_args, cl::sycl::info::device::image2d_max_height, cl::sycl::info::device::image2d_max_width,
  cl::sycl::info::device::image3d_max_height, cl::sycl::info::device::image3d_max_widht, cl::sycl::info::device::image3d_mas_depth, cl::sycl::info::device::image_max_buffer_size,
  cl::sycl::info::device::image_max_array_size, cl::sycl::info::device::max_samplers, cl::sycl::info::device::max_parameter_size, cl::sycl::info::device::mem_base_addr_align,
  cl::sycl::info::device::single_fp_config, cl::sycl::info::device::double_fp_config, cl::sycl::info::device::global_mem_cache_type, cl::sycl::info::device::global_mem_cache_line_size,
  cl::sycl::info::device::global_mem_cache_size, cl::sycl::info::device::global_mem_size, cl::sycl::info::device::max_constant_buffer_size, cl::sycl::info::device::max_constant_args,
  cl::sycl::info::device::local_mem_type, cl::sycl::info::device::local_mem_size, cl::sycl::info::device::error_correction_support, cl::sycl::info::device::host_unified_memory,
  cl::sycl::info::device::profiling_timer_resolution, cl::sycl::info::device::endian_little, cl::sycl::info::device::is_available, cl::sycl::info::device::is_compiler_available,
  cl::sycl::info::device::is_linker_available, cl::sycl::info::device::execution_capabilities, cl::sycl::info::device::queue_properties, cl::sycl::info::device::built_in_kernels,
  cl::sycl::info::device::platform, cl::sycl::info::device::name, cl::sycl::info::device::vendor, cl::sycl::info::device::driver_version,
  cl::sycl::info::device::profile, cl::sycl::info::device::device_version, cl::sycl::info::device::opencl_version, cl::sycl::info::device::extensions,
  cl::sycl::info::device::printf_buffer_size, cl::sycl::info::device::preferred_interop_user_sync, cl::sycl::info::device::parent_device, cl::sycl::info::device::partition_max_sub_devices,
  cl::sycl::info::device::partition_properties, cl::sycl::info::device::partition_affinity_domain, cl::sycl::info::device::partition_type, cl::sycl::info::device::reference_count }

  Device information descriptors.
- enum cl::sycl::info::device_partition_property : int {
  cl::sycl::info::device_partition_property::unsupported, cl::sycl::info::device_partition_property::partition_equally, cl::sycl::info::device_partition_property::partition_by_counts, cl::sycl::info::device_partition_property::partition_by_affinity_domain,
  cl::sycl::info::device_partition_property::partition_affinity_domain_next_partitionable }
- enum cl::sycl::info::device_affinity_domain : int {
  cl::sycl::info::device_affinity_domain::unsupported, cl::sycl::info::device_affinity_domain::numa, cl::sycl::info::device_affinity_domain::L4_cache, cl::sycl::info::device_affinity_domain::L3_cache,
  cl::sycl::info::device_affinity_domain::L2_cache, cl::sycl::info::device_affinity_domain::next_partitionable }
- enum cl::sycl::info::device_partition_type : int {
  cl::sycl::info::device_partition_type::no_partition, cl::sycl::info::device_partition_type::numa, cl::sycl::info::device_partition_type::L4_cache, cl::sycl::info::device_partition_type::L3_cache,
  cl::sycl::info::device_partition_type::L2_cache, cl::sycl::info::device_partition_type::L1_cache }

- enum cl::sycl::info::local_mem_type : int { cl::sycl::info::local_mem_type::none, cl::sycl::info::local_mem_type::local, cl::sycl::info::local_mem_type::global }
- enum cl::sycl::info::fp_config : int { cl::sycl::info::fp_config::denorm, cl::sycl::info::fp_config::inf_nan, cl::sycl::info::fp_config::round_to_nearest, cl::sycl::info::fp_config::round_to_zero, cl::sycl::info::fp_config::round_to_inf, cl::sycl::info::fp_config::fma, cl::sycl::info::fp_config::correctly_rounded_divide_sqrt, cl::sycl::info::fp_config::soft_float }
- enum cl::sycl::info::global_mem_cache_type : int { cl::sycl::info::global_mem_cache_type::none, cl::sycl::info::global_mem_cache_type::read_only, cl::sycl::info::global_mem_cache_type::write_only }
- enum cl::sycl::info::device_execution_capabilities : unsigned int { cl::sycl::info::device_execution_capabilities::exec_kernel, cl::sycl::info::device_execution_capabilities::exec_native_kernel }

11.66 device.hpp

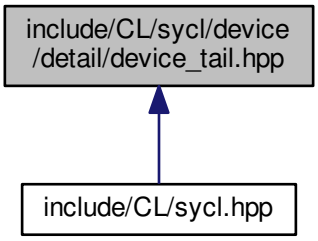
```
00001 #ifndef TRISYCL_SYCL_INFO_DEVICE_HPP
00002 #define TRISYCL_SYCL_INFO_DEVICE_HPP
00003
00004 /** \file The OpenCL SYCL device information parameters
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/info/param_traits.hpp"
00013
00014 namespace cl {
00015 namespace sycl {
00016
00017 /** \addtogroup execution Platforms, contexts, devices and queues
00018     @{
00019 */
00020
00021 namespace info {
00022
00023 /** Type of devices
00024
00025     To be used either to define a device type or to select more
00026     broadly a kind of device
00027
00028     \todo To be moved in the specification from platform to device
00029
00030     \todo Add opencl to the specification
00031
00032     \todo there is no accelerator_selector and custom_accelerator
00033 */
00034 enum class device_type : unsigned int {
00035   cpu,
00036   gpu,
00037   accelerator,
00038   custom,
00039   defaults,
00040   host,
00041   opencl,
00042   all
00043 };
00044
00045
00046 /** Device information descriptors
00047
00048     From specs/latex/headers/deviceInfo.h in the specification
00049
00050     \todo Should be unsigned int?
00051 */
00052 enum class device : int {
00053   device_type,
00054   vendor_id,
00055   max_compute_units,
00056   max_work_item_dimensions,
00057   max_work_item_sizes,
00058   max_work_group_size,
00059   preferred_vector_width_char,
00060   preferred_vector_width_short,
00061   preferred_vector_width_int,
00062   preferred_vector_width_long_long,
```

```
00063   preferred_vector_width_float,
00064   preferred_vector_width_double,
00065   preferred_vector_width_half,
00066   native_vector_witdth_char,
00067   native_vector_witdth_short,
00068   native_vector_witdth_int,
00069   native_vector_witdth_long_long,
00070   native_vector_witdth_float,
00071   native_vector_witdth_double,
00072   native_vector_witdth_half,
00073   max_clock_frequency,
00074   address_bits,
00075   max_mem_alloc_size,
00076   image_support,
00077   max_read_image_args,
00078   max_write_image_args,
00079   image2d_max_height,
00080   image2d_max_width,
00081   image3d_max_height,
00082   image3d_max_widht,
00083   image3d_mas_depth,
00084   image_max_buffer_size,
00085   image_max_array_size,
00086   max_samplers,
00087   max_parameter_size,
00088   mem_base_addr_align,
00089   single_fp_config,
00090   double_fp_config,
00091   global_mem_cache_type,
00092   global_mem_cache_line_size,
00093   global_mem_cache_size,
00094   global_mem_size,
00095   max_constant_buffer_size,
00096   max_constant_args,
00097   local_mem_type,
00098   local_mem_size,
00099   error_correction_support,
00100   host_unified_memory,
00101   profiling_timer_resolution,
00102   endian_little,
00103   is_available,
00104   is_compiler_available,
00105   is_linker_available,
00106   execution_capabilities,
00107   queue_properties,
00108   built_in_kernels,
00109   platform,
00110   name,
00111   vendor,
00112   driver_version,
00113   profile,
00114   device_version,
00115   opencl_version,
00116   extensions,
00117   printf_buffer_size,
00118   preferred_interop_user_sync,
00119   parent_device,
00120   partition_max_sub_devices,
00121   partition_properties,
00122   partition_affinity_domain,
00123   partition_type,
00124   reference_count
00125 };
00126
00127 enum class device_partition_property : int {
00128   unsupported,
00129   partition_equally,
00130   partition_by_counts,
00131   partition_by_affinity_domain,
00132   partition_affinity_domain_next_partitionable
00133 };
00134
00135 enum class device_affinity_domain : int {
00136   unsupported,
00137   numa,
00138   L4_cache,
00139   L3_cache,
00140   L2_cache,
00141   next_partitionable
00142 };
00143
00144 enum class device_partition_type : int {
00145   no_partition,
00146   numa,
00147   L4_cache,
00148   L3_cache,
00149   L2_cache,
```

```
00150   L1_cache
00151 };
00152
00153 enum class local_mem_type : int {
00154   none,
00155   local,
00156   global
00157 };
00158
00159 enum class fp_config : int {
00160   denorm,
00161   inf_nan,
00162   round_to_nearest,
00163   round_to_zero,
00164   round_to_inf,
00165   fma,
00166   correctly_rounded_divide_sqrt,
00167   soft_float
00168 };
00169
00170 enum class global_mem_cache_type : int {
00171   none,
00172   read_only,
00173   write_only
00174 };
00175
00176 enum class device_execution_capabilities : unsigned int {
00177   exec_kernel,
00178   exec_native_kernel
00179 };
00180
00181
00182 using device_fp_config = unsigned int;
00183 using device_exec_capabilities = unsigned int;
00184 using device_queue_properties = unsigned int;
00185
00186
00187 /** Query the return type for get_info() on context stuff
00188
00189     \todo To be implemented, return always void.
00190 */
00191 TRISYCL_INFO_PARAM_TRAITS_ANY_T(info::device, void)
00192
00193 }
00194 }
00195 }
00196
00197 /*
00198     # Some Emacs stuff:
00199     ### Local Variables:
00200     ### ispell-local-dictionary: "american"
00201     ### eval: (flyspell-prog-mode)
00202     ### End:
00203 */
00204
00205 #endif // TRISYCL_SYCL_INFO_DEVICE_HPP
```

11.67 include/CL/sycl/device/detail/device_tail.hpp File Reference

This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

11.68 device_tail.hpp

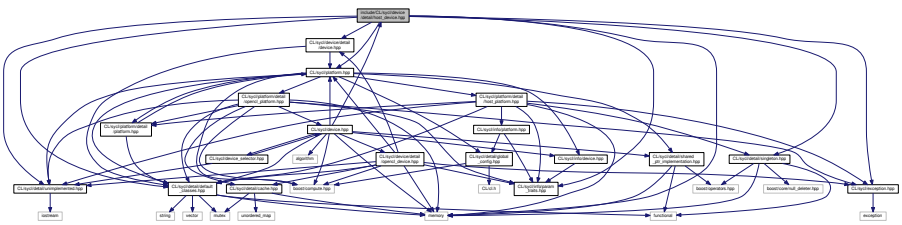
```
00001 #ifndef TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_TAIL_HPP
00002 #define TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_TAIL_HPP
00003
00004 /** \file The ending part of of OpenCL SYCL device
00005
00006     This is here to break a dependence between device and device_selector
00007
00008     Ronan at Keryell point FR
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 namespace cl {
00015 namespace sycl {
00016
00017 /** \addtogroup execution Platforms, contexts, devices and queues
00018     @{
00019 */
00020
00021 /** Return a list of all available devices
00022
00023     Return synchronous errors via SYCL exception classes.
00024 */
00025 vector_class<device>
00026 device::get_devices(info::device_type device_type) {
00027   // Start with the default device
00028   vector_class<device> devices = { {} };
00029
00030 #ifdef TRISYCL_OPENCL
00031   // Then add all the OpenCL devices
00032   for (const auto &d : boost::compute::system::devices())
00033     devices.emplace_back(d);
00034 #endif
00035
00036   // The selected devices
00037   vector_class<device> sd;
00038   device_type_selector s { device_type };
```

```
00039
00040   // Return the devices with the good criterion according to the selector
00041   std::copy_if(devices.begin(), devices.end(), std::back_inserter(sd),
00042                [&](const device &e) { return s(e) >= 0; });
00043   return sd;
00044 }
00045
00046 /// @} to end the Doxygen group
00047
00048 }
00049 }
00050
00051 /*
00052     # Some Emacs stuff:
00053     ### Local Variables:
00054     ### ispell-local-dictionary: "american"
00055     ### eval: (flyspell-prog-mode)
00056     ### End:
00057 */
00058
00059 #endif // TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_TAIL_HPP
```

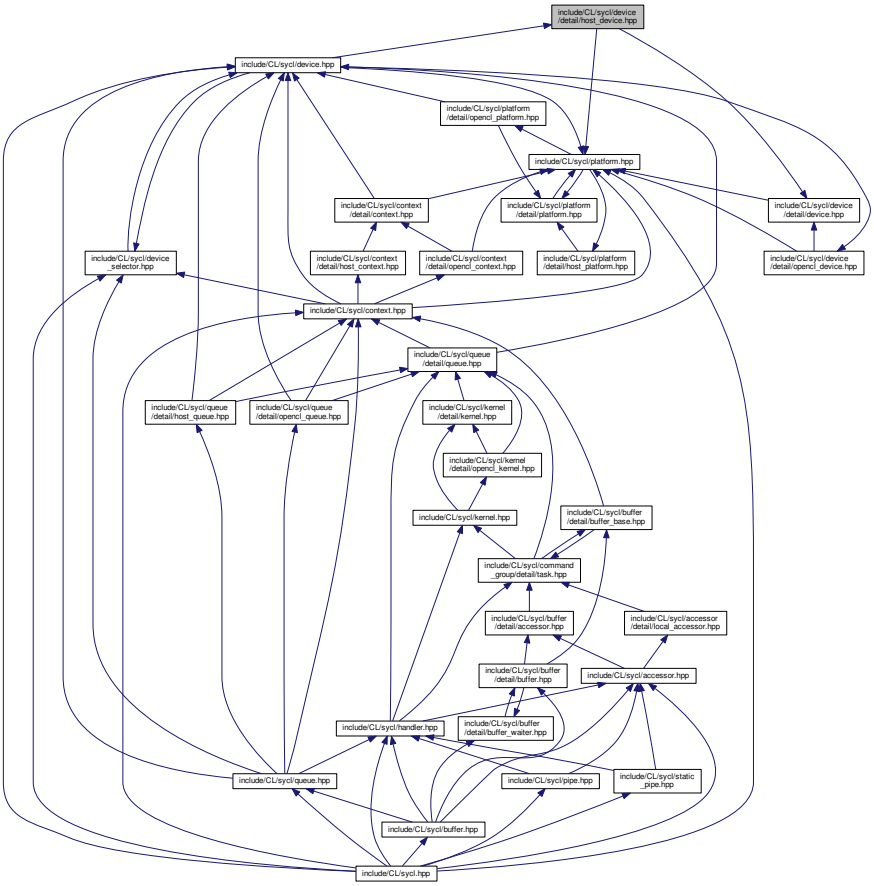
11.69 include/CL/sycl/device/detail/host_device.hpp File Reference

```
#include <memory>
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/detail/singleton.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/device/detail/device.hpp"
#include "CL/sycl/exception.hpp"
#include "CL/sycl/info/param_traits.hpp"
#include "CL/sycl/platform.hpp"
```

Include dependency graph for host_device.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::host_device

  SYCL host device.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.70 host_device.hpp

```
00001 #ifndef TRISYCL_SYCL_DEVICE_DETAIL_HOST_DEVICE_HPP
00002 #define TRISYCL_SYCL_DEVICE_DETAIL_HOST_DEVICE_HPP
00003
00004 /** \file The OpenCL SYCL host device implementation
00005
00006     Ronan at Keryell point FR
00007
```

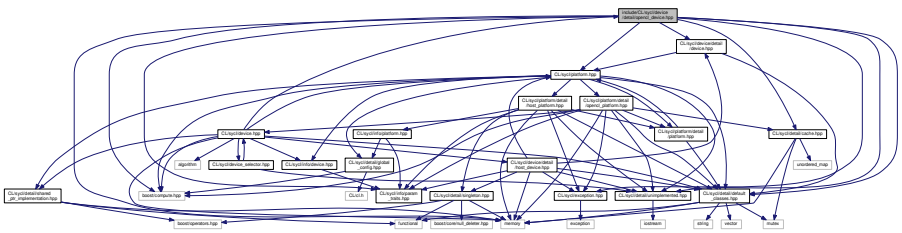
```
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <memory>
00013
00014 #include "CL/sycl/detail/default_classes.hpp"
00015
00016 #include "CL/sycl/detail/singleton.hpp"
00017 #include "CL/sycl/detail/unimplemented.hpp"
00018 #include "CL/sycl/device/detail/device.hpp"
00019 #include "CL/sycl/exception.hpp"
00020 #include "CL/sycl/info/param_traits.hpp"
00021 #include "CL/sycl/platform.hpp"
00022
00023 namespace cl {
00024 namespace sycl {
00025 namespace detail {
00026
00027 /** SYCL host device
00028
00029     \todo The implementation is quite minimal for now. :-)
00030 */
00031 class host_device : public detail::device,
00032                     public detail::singleton<host_device> {
00033
00034 public:
00035
00036 #ifdef TRISYCL_OPENCL
00037   /** Return the cl_device_id of the underlying OpenCL platform
00038
00039       This throws an error since there is no OpenCL device associated
00040       to the host device.
00041   */
00042   cl_device_id get() const override {
00043     throw non_cl_error("The host device has no OpenCL device");
00044   }
00045
00046
00047   /** Return the underlying Boost.Compute device
00048
00049       This throws an error since there is no OpenCL device associated
00050       to the host device.
00051   */
00052   boost::compute::device &get_boost_compute() override {
00053     throw non_cl_error("The host device has no underlying OpenCL device");
00054   }
00055 #endif
00056
00057
00058   /// Return true since the device is a SYCL host device
00059   bool is_host() const override {
00060     return true;
00061   }
00062
00063
00064   /// Return false since the host device is not an OpenCL CPU device
00065   bool is_cpu() const override {
00066     return false;
00067   }
00068
00069
00070   /// Return false since the host device is not an OpenCL GPU device
00071   bool is_gpu() const override {
00072     return false;
00073   }
00074
00075
00076   /// Return false since the host device is not an OpenCL accelerator device
00077   bool is_accelerator() const override {
00078     return false;
00079   }
00080
00081
00082   /** Return the platform of device
00083
00084       Return synchronous errors via the SYCL exception class.
00085
00086       \todo To be implemented
00087   */
00088   cl::sycl::platform get_platform() const override {
00089     detail::unimplemented();
00090     return {};
00091   }
00092
00093 #if 0
00094   /** Query the device for OpenCL info::device info
```

```
00095
00096       Return synchronous errors via the SYCL exception class.
00097
00098       \todo To be implemented
00099   */
00100   template <info::device Param>
00101   typename info::param_traits<info::device, Param>::type
00102   get_info() const override {
00103     detail::unimplemented();
00104     return {};
00105   }
00106 #endif
00107
00108   /** Specify whether a specific extension is supported on the device
00109
00110       \todo To be implemented
00111   */
00112   bool has_extension(const string_class &extension) const override {
00113     detail::unimplemented();
00114     return {};
00115   }
00116
00117
00118 };
00119
00120 /// @} to end the execution Doxygen group
00121
00122 }
00123 }
00124 }
00125
00126 /*
00127     # Some Emacs stuff:
00128     ### Local Variables:
00129     ### ispell-local-dictionary: "american"
00130     ### eval: (flyspell-prog-mode)
00131     ### End:
00132 */
00133
00134 #endif // TRISYCL_SYCL_DEVICE_DETAIL_HOST_DEVICE_HPP
```

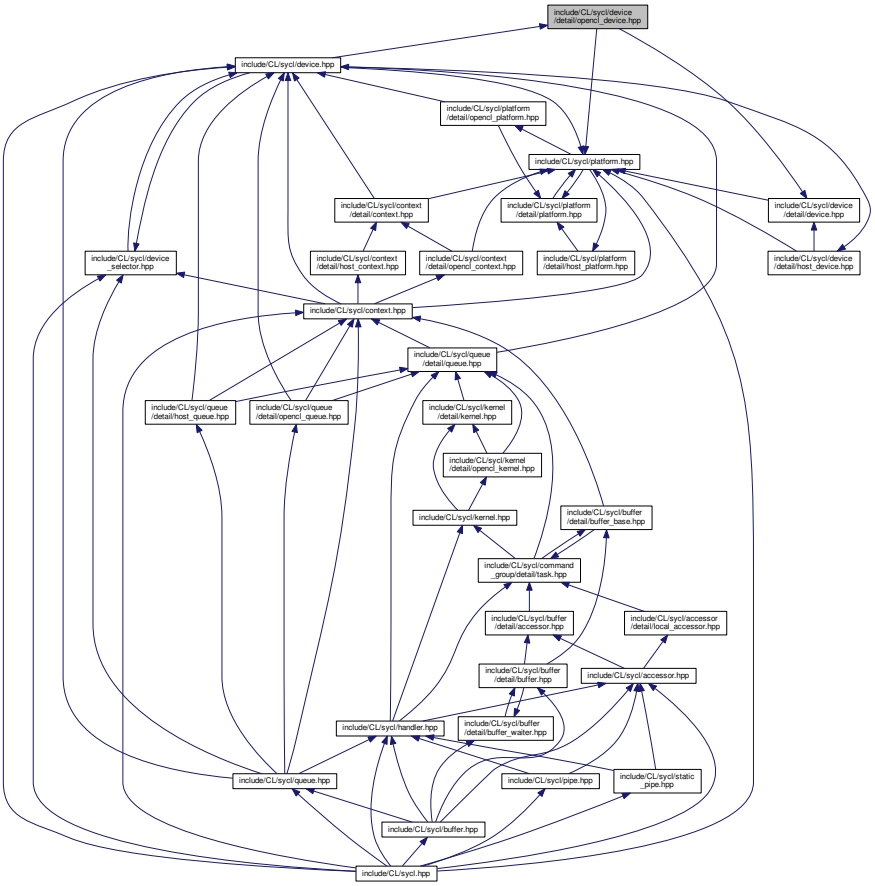
11.71 include/CL/sycl/device/detail/opencl_device.hpp File Reference

```
#include <memory>
#include <boost/compute.hpp>
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/detail/cache.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/device/detail/device.hpp"
#include "CL/sycl/exception.hpp"
#include "CL/sycl/info/param_traits.hpp"
#include "CL/sycl/platform.hpp"
```

Include dependency graph for opencl_device.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::opencl_device

  SYCL OpenCL device.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.72 opencl_device.hpp

```
00001 #ifndef TRISYCL_SYCL_DEVICE_DETAIL_OPENCL_DEVICE_HPP
00002 #define TRISYCL_SYCL_DEVICE_DETAIL_OPENCL_DEVICE_HPP
00003
00004 /** \file The SYCL OpenCL device implementation
00005
00006     Ronan at Keryell point FR
00007
```

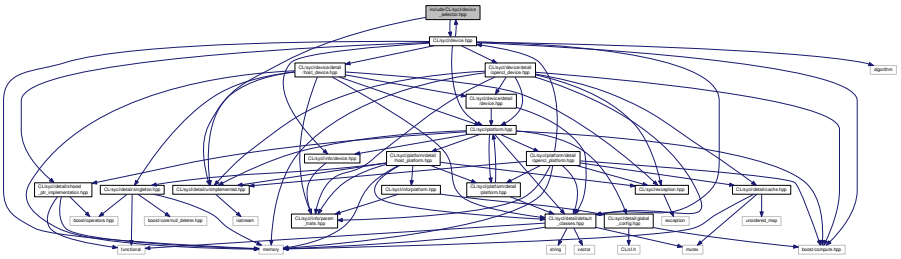
```
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <memory>
00013
00014 #include <boost/compute.hpp>
00015
00016 #include "CL/sycl/detail/default_classes.hpp"
00017
00018 #include "CL/sycl/detail/cache.hpp"
00019 #include "CL/sycl/detail/unimplemented.hpp"
00020 #include "CL/sycl/device/detail/device.hpp"
00021 #include "CL/sycl/exception.hpp"
00022 #include "CL/sycl/info/param_traits.hpp"
00023 #include "CL/sycl/platform.hpp"
00024
00025 namespace cl {
00026 namespace sycl {
00027 namespace detail {
00028
00029 /// SYCL OpenCL device
00030 class opencl_device : public detail::device {
00031
00032   /// Use the Boost Compute abstraction of the OpenCL device
00033   boost::compute::device d;
00034
00035   /** A cache to always return the same alive device for a given
00036       OpenCL device
00037
00038       C++11 guaranties the static construction is thread-safe
00039   */
00040   static detail::cache<cl_device_id, detail::opencl_device>
      cache;
00041
00042 public:
00043
00044   /// Return the cl_device_id of the underlying OpenCL device
00045   cl_device_id get() const override {
00046     return d.id();
00047   }
00048
00049
00050   /// Return the underlying Boost.Compute device
00051   boost::compute::device &get_boost_compute() override {
00052     return d;
00053   }
00054
00055
00056   /// Return false since an OpenCL device is not the SYCL host device
00057   bool is_host() const override {
00058     return false;
00059   }
00060
00061
00062   /// Test if the OpenCL is a CPU device
00063   bool is_cpu() const override {
00064     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00065     return d.type() & boost::compute::device::cpu;
00066   }
00067
00068
00069   /// Test if the OpenCL is a GPU device
00070   bool is_gpu() const override {
00071     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00072     return d.type() & boost::compute::device::gpu;
00073   }
00074
00075
00076   /// Test if the OpenCL is an accelerator device
00077   bool is_accelerator() const override {
00078     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00079     return d.type() & boost::compute::device::accelerator;
00080   }
00081
00082
00083   /** Return the platform of device
00084
00085       Return synchronous errors via the SYCL exception class.
00086   */
00087   cl::sycl::platform get_platform() const override {
00088     return d.platform();
00089   }
00090
00091 #if 0
00092   /** Query the device for OpenCL info::device info
00093
```

```
00094       Return synchronous errors via the SYCL exception class.
00095
00096       \todo To be implemented
00097   */
00098   template <info::device Param>
00099   typename info::param_traits<info::device, Param>::type
00100   get_info() const override {
00101     detail::unimplemented();
00102     return {};
00103   }
00104 #endif
00105
00106   /** Specify whether a specific extension is supported on the device.
00107
00108       \todo To be implemented
00109   */
00110   bool has_extension(const string_class &extension) const override {
00111     detail::unimplemented();
00112     return {};
00113   }
00114
00115
00116   ///// Get a singleton instance of the opencl_device
00117   static std::shared_ptr<opencl_device>
00118   instance(const boost::compute::device &d) {
00119     return cache.get_or_register(d.id(),
00120                                  [&] { return new opencl_device { d }; });
00121   }
00122
00123 private:
00124
00125   /// Only the instance factory can build it
00126   opencl_device(const boost::compute::device &d) : d { d } {}
00127
00128 public:
00129
00130   /// Unregister from the cache on destruction
00131   ~opencl_device() override {
00132     cache.remove(d.id());
00133   }
00134
00135 };
00136
00137 /* Allocate the cache here but since this is a pure-header library,
00138    use a weak symbol so that only one remains when SYCL headers are
00139    used in different compilation units of a program
00140 */
00141 TRISYCL_WEAK_ATTRIB_PREFIX
00142 detail::cache<cl_device_id, detail::opencl_device>
      opencl_device::cache
00143 TRISYCL_WEAK_ATTRIB_SUFFIX;
00144
00145 }
00146 }
00147 }
00148
00149 /*
00150     # Some Emacs stuff:
00151     ### Local Variables:
00152     ### ispell-local-dictionary: "american"
00153     ### eval: (flyspell-prog-mode)
00154     ### End:
00155 */
00156
00157 #endif // TRISYCL_SYCL_DEVICE_DETAIL_OPENCL_DEVICE_HPP
```

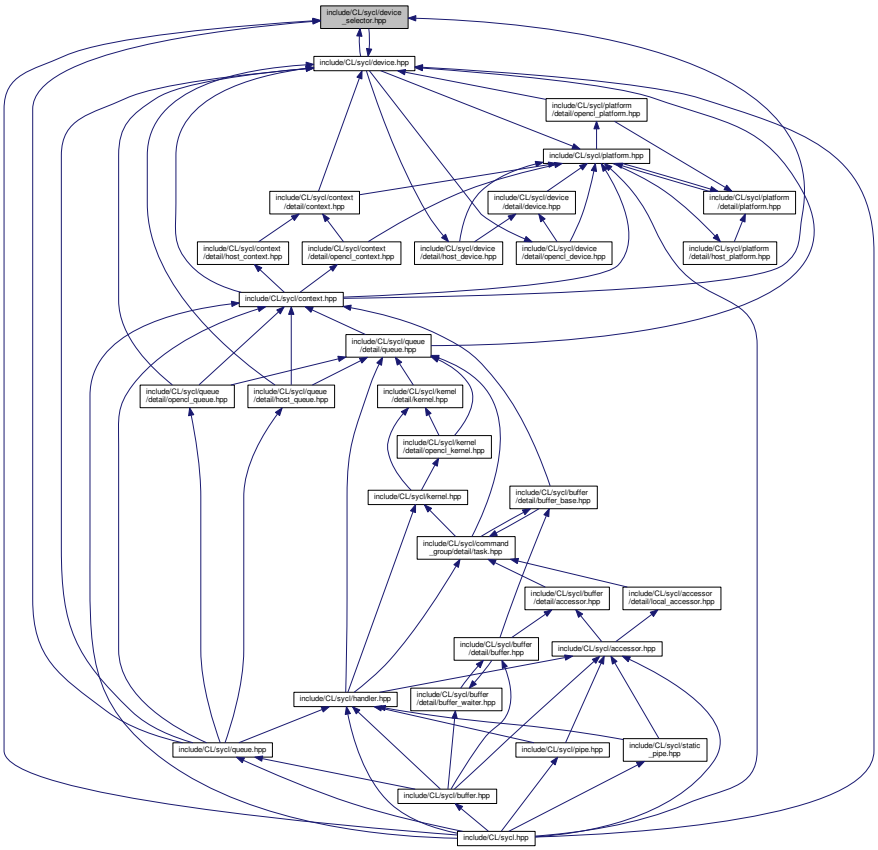
11.73 include/CL/sycl/device_selector.hpp File Reference

```
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/device.hpp"
```

Include dependency graph for device_selector.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::device_selector

  The SYCL heuristics to select a device. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

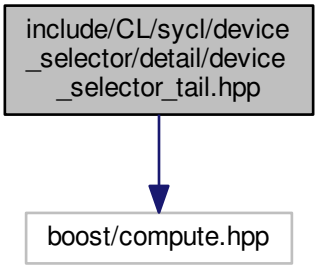
11.74 device_selector.hpp

```
00001 #ifndef TRISYCL_SYCL_DEVICE_SELECTOR_HPP
00002 #define TRISYCL_SYCL_DEVICE_SELECTOR_HPP
00003
00004 /** \file The OpenCL SYCL device_selector
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/detail/unimplemented.hpp"
00013 #include "CL/sycl/device.hpp"
00014
00015 namespace cl {
00016 namespace sycl {
00017
00018 /** \addtogroup execution Platforms, contexts, devices and queues
00019     @{
00020 */
00021
00022 /** The SYCL heuristics to select a device
00023
00024     The device with the highest score is selected
00025 */
00026 class device_selector {
00027
00028 public:
00029
00030   /** Returns a selected device using the functor operator defined in
00031       sub-classes operator()(const device &dev)
00032
00033       \todo Remove this from specification
00034   */
00035   void /* device */ select_device() const {
00036     //    return {};
00037   }
00038
00039
00040   /**  This pure virtual operator allows the customization of device
00041        selection.
00042
00043        It defines the behavior of the device_selector functor called by
00044        the SYCL runtime on device selection. It returns a "score" for each
00045        device in the system and the highest rated device will be used
00046        by the SYCL runtime.
00047   */
00048   virtual int operator()(const device &dev) const = 0;
00049
00050
00051   /// Virtual destructor so the final destructor can be called if any
00052   virtual ~device_selector() {}
00053
00054 };
00055
00056 /// @} to end the execution Doxygen group
00057
00058 }
00059 }
00060
00061 /*
00062     # Some Emacs stuff:
00063     ### Local Variables:
00064     ### ispell-local-dictionary: "american"
00065     ### eval: (flyspell-prog-mode)
00066     ### End:
00067 */
00068
00069 #endif // TRISYCL_SYCL_DEVICE_SELECTOR_HPP
```

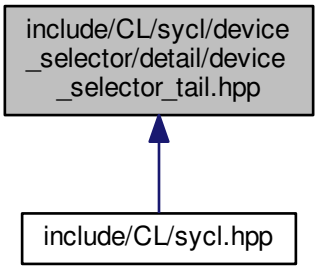
11.75 include/CL/sycl/device_selector/detail/device_selector_tail.hpp File Reference

```
#include <boost/compute.hpp>
```

Include dependency graph for device_selector_tail.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::device_type_selector

  A device selector by device_type. More...
- class cl::sycl::device_typename_selector< DeviceType >

  Select a device by template device_type parameter. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Typedefs

- using cl::sycl::default_selector = device_typename_selector< info::device_type::defaults >

  Devices selected by heuristics of the system.
- using cl::sycl::gpu_selector = device_typename_selector< info::device_type::gpu >

  Select devices according to device type info::device::device_type::gpu from all the available OpenCL devices.
- using cl::sycl::cpu_selector = device_typename_selector< info::device_type::cpu >

  Select devices according to device type info::device::device_type::cpu from all the available devices and heuristics.
- using cl::sycl::host_selector = device_typename_selector< info::device_type::host >

  Selects the SYCL host CPU device that does not require an OpenCL runtime.

11.76 device_selector_tail.hpp

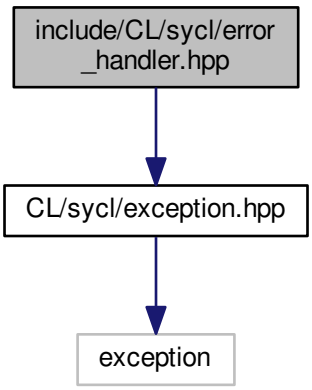
```
00001 #ifndef TRISYCL_SYCL_DEVICE_SELECTOR_DETAIL_DEVICE_SELECTOR_TAIL_HPP
00002 #define TRISYCL_SYCL_DEVICE_SELECTOR_DETAIL_DEVICE_SELECTOR_TAIL_HPP
00003
00004 /** \file The ending part of of the OpenCL SYCL device_selector
00005
00006     This is here to break a dependence between device and device_selector
00007
00008     \todo Implement lacking SYCL 2.2 selectors
00009
00010     Ronan at Keryell point FR
00011
00012     This file is distributed under the University of Illinois Open Source
00013     License. See LICENSE.TXT for details.
00014 */
00015
00016 #ifdef TRISYCL_OPENCL
00017 #include <boost/compute.hpp>
00018 #endif
00019
00020 namespace cl {
00021 namespace sycl {
00022
00023 /** \addtogroup execution Platforms, contexts, devices and queues
00024     @{
00025 */
00026
00027
00028 /** A device selector by device_type
00029
00030     \todo To be added to the specification
00031 */
00032 class device_type_selector : public device_selector {
00033
00034 private:
00035
00036   /// The device_type to select
00037   info::device_type device_type;
00038
00039   /** Cache the default device to select with the default device
00040       selector.
00041
00042       This is the host device at construction time and remains as is
00043       if there is no openCL device */
00044   device default_device;
00045
00046 public:
00047
00048   device_type_selector(info::device_type device_type)
00049     : device_type { device_type } {
00050     // The default device selection heuristic
00051 #ifdef TRISYCL_OPENCL
00052     if (device_type == info::device_type::defaults) {
00053       // Ask Boost.Compute for the default OpenCL device
00054       try {
00055         default_device = boost::compute::system::default_device();
00056       }
00057       catch (...) {
00058         /* If there is no OpenCL device, just keep the
00059            default-constructed device, which is the host device */
00060       }
00061     }
00062 #endif
```

```
00063   }
00064
00065
00066   // To select only the requested device_type
00067   int operator()(const device &dev) const override {
00068     if (device_type == info::device_type::all)
00069       // All devices fit all
00070       return 1;
00071
00072     if (device_type == info::device_type::defaults)
00073       // Only select the default device
00074       return dev == default_device ? 1 : -1;
00075
00076     if (device_type == info::device_type::opencl)
00077       // For now, any non host device is an OpenCL device
00078       return dev.is_host() ? -1 : 1;
00079
00080     return dev.type() == device_type ? 1 : -1;
00081   }
00082
00083 };
00084
00085
00086 /** Select a device by template device_type parameter
00087
00088     \todo To be added to the specification
00089 */
00090 template <info::device_type DeviceType>
00091 class device_typename_selector : public
      device_type_selector {
00092
00093 public:
00094
00095   device_typename_selector() : device_type_selector {
      DeviceType } {}
00096
00097 };
00098
00099
00100 /** Devices selected by heuristics of the system
00101
00102     If no OpenCL device is found then it defaults to the SYCL host device.
00103
00104     To influence the default device selection, use the Boost.Compute
00105     environment variables:
00106
00107     - \c BOOST_COMPUTE_DEFAULT_DEVICE
00108
00109     - \c BOOST_COMPUTE_DEFAULT_DEVICE_TYPE
00110
00111     - \c BOOST_COMPUTE_DEFAULT_PLATFORM
00112
00113     - \c BOOST_COMPUTE_DEFAULT_VENDOR
00114 */
00115 using default_selector =
      device_typename_selector<info::device_type::defaults>;
00116
00117
00118   /** Select devices according to device type info::device::device_type::gpu
00119     from all the available OpenCL devices.
00120
00121     If no OpenCL GPU device is found the selector fails.
00122
00123     Select the best GPU, if any.
00124 */
00125 using gpu_selector =
      device_typename_selector<info::device_type::gpu>;
00126
00127
00128 /** Select devices according to device type info::device::device_type::cpu
00129     from all the available devices and heuristics
00130
00131     If no OpenCL CPU device is found the selector fails.
00132 */
00133 using cpu_selector =
      device_typename_selector<info::device_type::cpu>;
00134
00135
00136 /** Selects the SYCL host CPU device that does not require an OpenCL
00137     runtime
00138 */
00139 using host_selector =
      device_typename_selector<info::device_type::host>;
00140
00141 /// @} to end the execution Doxygen group
00142
00143 }
```

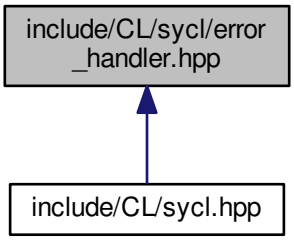
```
00144 }
00145
00146 /*
00147     # Some Emacs stuff:
00148     ### Local Variables:
00149     ### ispell-local-dictionary: "american"
00150     ### eval: (flyspell-prog-mode)
00151     ### End:
00152 */
00153
00154 #endif // TRISYCL_SYCL_DEVICE_SELECTOR_DETAIL_DEVICE_SELECTOR_TAIL_HPP
```

11.77 include/CL/sycl/error_handler.hpp File Reference

`#include "CL/sycl/exception.hpp"`
Include dependency graph for error_handler.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::error_handler

  User supplied error handler to call a user-provided function when an error happens from a SYCL object that was constructed with this error handler. More...
- struct cl::sycl::trisycl::default_error_handler

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::trisycl

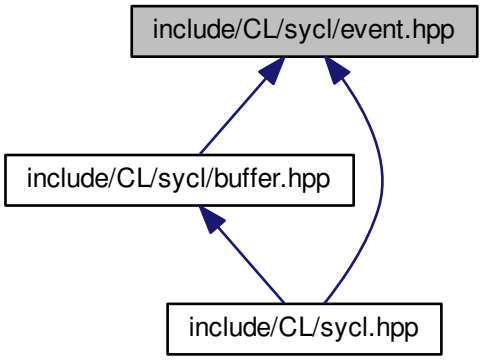
11.78 error_handler.hpp

```
00001 #ifndef TRISYCL_SYCL_ERROR_HANDLER_HPP
00002 #define TRISYCL_SYCL_ERROR_HANDLER_HPP
00003
00004 /** \file The OpenCL SYCL error_handler
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/exception.hpp"
00013
00014 namespace cl {
00015 namespace sycl {
00016
00017 /** \addtogroup error_handling Error handling
00018     @{
00019 */
00020
00021 /// \todo Refactor when updating to latest specification
00022 namespace trisycl {
00023   // Create a default error handler to be used when nothing is specified
00024   struct default_error_handler;
00025 }
00026
00027
00028 /** User supplied error handler to call a user-provided function when an
00029     error happens from a SYCL object that was constructed with this error
00030     handler
00031 */
00032 struct error_handler {
00033   /** The method to define to be called in the case of an error
00034
00035       \todo Add "virtual void" to the specification
00036   */
00037   virtual void report_error(exception &error) = 0;
00038
00039   /** Add a default_handler to be used by default
00040
00041       \todo add this concept to the specification?
00042   */
00043   static trisycl::default_error_handler
      default_handler;
00044
00045
00046   virtual ~error_handler() = 0;
00047 };
00048
00049
00050 namespace trisycl {
00051
00052   struct default_error_handler : error_handler {
00053
00054     void report_error(exception &) override {
00055     }
00056   };
```

```
00057 }
00058
00059   // \todo finish initialization
00060   //error_handler::default_handler = nullptr;
00061
00062
00063 /// @} End the error_handling Doxygen group
00064
00065 }
00066 }
00067
00068 /*
00069     # Some Emacs stuff:
00070     ### Local Variables:
00071     ### ispell-local-dictionary: "american"
00072     ### eval: (flyspell-prog-mode)
00073     ### End:
00074 */
00075
00076 #endif // TRISYCL_SYCL_ERROR_HANDLER_HPP
```

11.79 include/CL/sycl/event.hpp File Reference

This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::event

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

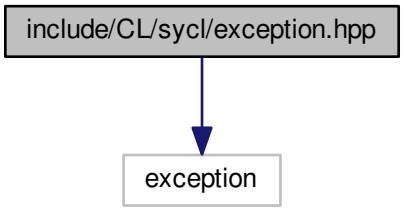
11.80 event.hpp

```
00001 #ifndef TRISYCL_SYCL_EVENT_HPP
00002 #define TRISYCL_SYCL_EVENT_HPP
00003
00004 /** \file The event class
00005
00006     Ronan at keryell dot FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011 namespace cl {
00012 namespace sycl {
00013
00014 class event {
00015
00016 public:
00017
00018   event() = default;
00019
00020
00021 /** \todo To be implemented */
00022 #if 0
00023   explicit event(cl_event clEvent);
00024
00025   event(const event & rhs);
00026
00027   cl_event get();
00028
00029   vector_class<event> get_wait_list();
00030
00031   void wait();
00032
00033   static void wait(const vector_class<event> &eventList);
00034
00035   void wait_and_throw();
00036
00037   static void wait_and_throw(const vector_class<event> &eventList);
00038
00039   template <info::event param>
00040   typename param_traits<info::event, param>::type get_info() const;
00041
00042   template <info::event_profiling param>
00043   typename param_traits<info::event_profiling,
00044                         param>::type get_profiling_info() const;
00045 #endif
00046 };
00047
00048 }
00049 }
00050
00051 /*
00052     # Some Emacs stuff:
00053     ### Local Variables:
00054     ### ispell-local-dictionary: "american"
00055     ### eval: (flyspell-prog-mode)
00056     ### End:
00057 */
00058
00059 #endif // TRISYCL_SYCL_EVENT_HPP
```

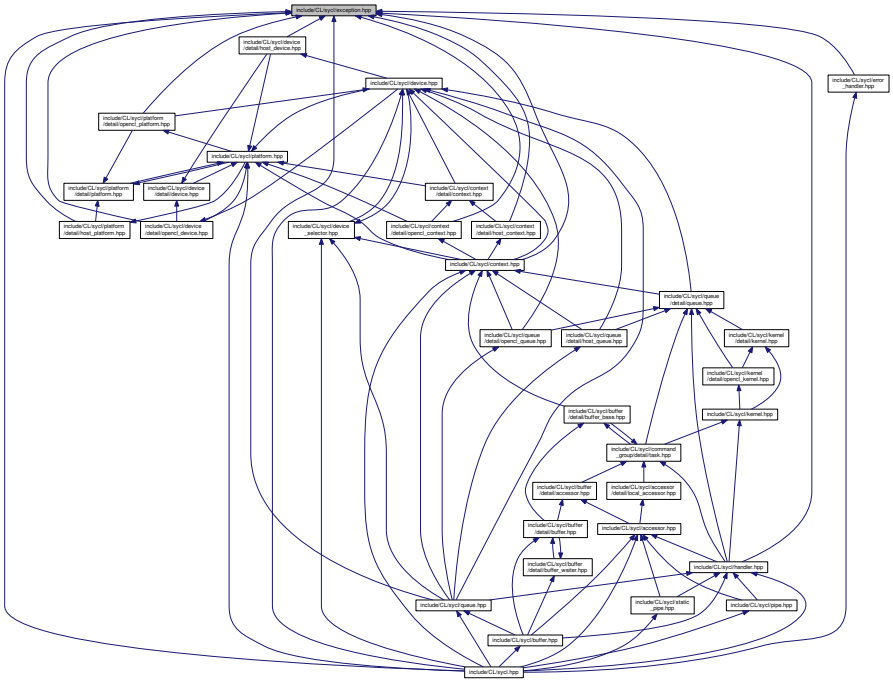
11.81 include/CL/sycl/exception.hpp File Reference

```
#include <exception>
```

Include dependency graph for exception.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::exception_list

  Exception list to store several exceptions. More...
- class cl::sycl::exception

  Encapsulate a SYCL error information. More...
- class cl::sycl::cl_exception

  Returns the OpenCL error code encapsulated in the exception. More...
- struct cl::sycl::async_exception

  An error stored in an exception_list for asynchronous errors. More...
- class cl::sycl::runtime_error

- class cl::sycl::kernel_error

  Error that occurred before or while enqueuing the SYCL kernel. More...
- class cl::sycl::accessor_error

  Error regarding the cl::sycl::accessor objects defined. More...
- class cl::sycl::nd_range_error

  Error regarding the cl::sycl::nd_range specified for the SYCL kernel. More...
- class cl::sycl::event_error

  Error regarding associated cl::sycl::event objects. More...
- class cl::sycl::invalid_parameter_error

  Error regarding parameters to the SYCL kernel, it may apply to any captured parameters to the kernel lambda. More...
- class cl::sycl::device_error

  The SYCL device will trigger this exception on error. More...
- class cl::sycl::compile_program_error

  Error while compiling the SYCL kernel to a SYCL device. More...
- class cl::sycl::link_program_error

  Error while linking the SYCL kernel to a SYCL device. More...
- class cl::sycl::invalid_object_error

  Error regarding any memory objects being used inside the kernel. More...
- class cl::sycl::memory_allocation_error

  Error on memory allocation on the SYCL device for a SYCL kernel. More...
- class cl::sycl::pipe_error

  A failing pipe error will trigger this exception on error. More...
- class cl::sycl::platform_error

  The SYCL platform will trigger this exception on error. More...
- class cl::sycl::profiling_error

  The SYCL runtime will trigger this error if there is an error when profiling info is enabled. More...
- class cl::sycl::feature_not_supported

  Exception thrown when an optional feature or extension is used in a kernel but its not available on the device the SYCL kernel is being enqueued on. More...
- class cl::sycl::non_cl_error

  Exception for an OpenCL operation requested in a non OpenCL area. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Typedefs

- using cl::sycl::exception_ptr = std::exception_ptr

  A shared pointer to an exception as in C++ specification.
- using cl::sycl::async_handler = function_class< void, exception_list >

11.82 exception.hpp

```
00001 #ifndef TRISYCL_SYCL_EXCEPTION_HPP
00002 #define TRISYCL_SYCL_EXCEPTION_HPP
00003
00004 /** \file The OpenCL SYCL exception
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <exception>
00013
00014 namespace cl {
00015 namespace sycl {
00016
00017 /** \addtogroup error_handling Error handling
00018     @{
00019 */
00020
00021
00022 /** A shared pointer to an exception as in C++ specification
00023
00024     \todo Do we need this instead of reusing directly the one from C++11?
00025 */
00026 using exception_ptr = std::exception_ptr;
00027
00028
00029 /** Exception list to store several exceptions
00030
00031     \todo Do we need to define it in SYCL or can we rely on plain C++17 one?
00032 */
00033 struct exception_list : std::vector<exception_ptr> {
00034   using std::vector<exception_ptr>::vector;
00035 };
00036
00037 using async_handler = function_class<void, exception_list>
      ;
00038
00039
00040 /// Encapsulate a SYCL error information
00041 class exception {
00042
00043   /// The error message to return
00044   string_class message;
00045
00046 public:
00047
00048   /// Construct an exception with a message for internal use
00049   exception(const string_class &message) : message { message } {}
00050
00051   /// Returns a descriptive string for the error, if available
00052   string_class what() const {
00053     return message;
00054   }
00055
00056
00057   /** Returns the context that caused the error
00058
00059       Returns nullptr if not a buffer error.
00060
00061       \todo Cannot return nullptr. Use optional? Use a specific exception type?
00062   */
00063   //context get_context()
00064
00065 };
00066
00067
00068 /// Returns the OpenCL error code encapsulated in the exception
00069 class cl_exception : public exception {
00070
00071 #ifdef TRISYCL_OPENCL
00072   /// The OpenCL error code to return
00073
00074   cl_int cl_code;
00075
00076 public:
00077
00078   /**  Construct an exception with a message and OpenCL error code for
00079        internal use */
00080   cl_exception(const string_class &message, cl_int cl_code)
00081     : exception { message }, cl_code { cl_code } {}
00082
00083   // thrown as a result of an OpenCL API error code
```

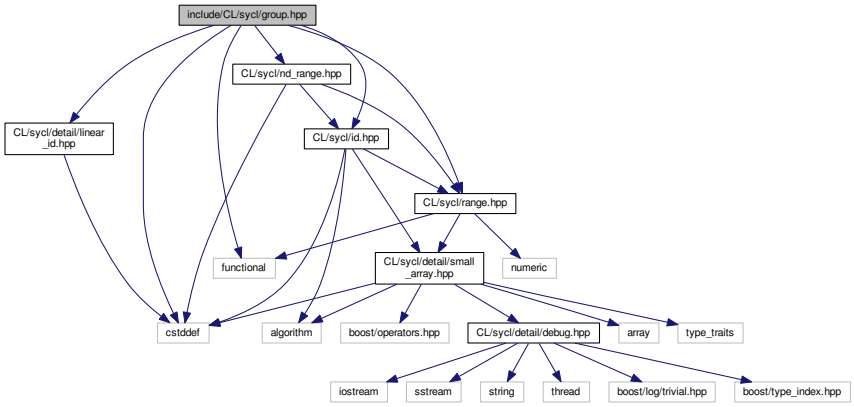
```
00084   cl_int get_cl_code() const {
00085     return cl_code;
00086   }
00087 #endif
00088
00089 };
00090
00091
00092 /// An error stored in an exception_list for asynchronous errors
00093 struct async_exception : exception {
00094   using exception::exception;
00095 };
00096
00097
00098 class runtime_error : public exception {
00099   using exception::exception;
00100 };
00101
00102
00103 /// Error that occurred before or while enqueuing the SYCL kernel
00104 class kernel_error : public runtime_error {
00105   using runtime_error::runtime_error;
00106 };
00107
00108
00109 /// Error regarding the cl::sycl::accessor objects defined
00110 class accessor_error : public runtime_error {
00111   using runtime_error::runtime_error;
00112 };
00113
00114
00115 /// Error regarding the cl::sycl::nd_range specified for the SYCL kernel
00116 class nd_range_error : public runtime_error {
00117   using runtime_error::runtime_error;
00118 };
00119
00120
00121 /// Error regarding associated cl::sycl::event objects
00122 class event_error : public runtime_error {
00123   using runtime_error::runtime_error;
00124 };
00125
00126
00127 /** Error regarding parameters to the SYCL kernel, it may apply to any
00128     captured parameters to the kernel lambda
00129 */
00130 class invalid_parameter_error : public runtime_error {
00131   using runtime_error::runtime_error;
00132 };
00133
00134
00135 /// The SYCL device will trigger this exception on error
00136 class device_error : public exception {
00137   using exception::exception;
00138 };
00139
00140
00141 /// Error while compiling the SYCL kernel to a SYCL device
00142 class compile_program_error : public device_error {
00143   using device_error::device_error;
00144 };
00145
00146
00147 /// Error while linking the SYCL kernel to a SYCL device
00148 class link_program_error : public device_error {
00149   using device_error::device_error;
00150 };
00151
00152
00153 /// Error regarding any memory objects being used inside the kernel
00154 class invalid_object_error : public device_error {
00155   using device_error::device_error;
00156 };
00157
00158
00159 /// Error on memory allocation on the SYCL device for a SYCL kernel
00160 class memory_allocation_error : public device_error {
00161   using device_error::device_error;
00162 };
00163
00164
00165 /// A failing pipe error will trigger this exception on error
00166 class pipe_error : public runtime_error {
00167   using runtime_error::runtime_error;
00168 };
00169
00170
```

```
00171 /// The SYCL platform will trigger this exception on error
00172 class platform_error : public device_error {
00173   using device_error::device_error;
00174 };
00175
00176
00177 /** The SYCL runtime will trigger this error if there is an error when
00178     profiling info is enabled
00179 */
00180 class profiling_error : public device_error {
00181   using device_error::device_error;
00182 };
00183
00184
00185 /** Exception thrown when an optional feature or extension is used in
00186     a kernel but its not available on the device the SYCL kernel is
00187     being enqueued on
00188 */
00189 class feature_not_supported : public device_error {
00190   using device_error::device_error;
00191 };
00192
00193
00194 /** Exception for an OpenCL operation requested in a non OpenCL area
00195
00196     \todo Add to the specification
00197
00198     \todo Clean implementation
00199
00200     \todo Exceptions are named error in C++
00201 */
00202 class non_cl_error : public runtime_error {
00203   using runtime_error::runtime_error;
00204 };
00205
00206
00207 /// @} End the error_handling Doxygen group
00208
00209 }
00210 }
00211
00212 /*
00213     # Some Emacs stuff:
00214     ### Local Variables:
00215     ### ispell-local-dictionary: "american"
00216     ### eval: (flyspell-prog-mode)
00217     ### End:
00218 */
00219
00220 #endif // TRISYCL_SYCL_EXCEPTION_HPP
```

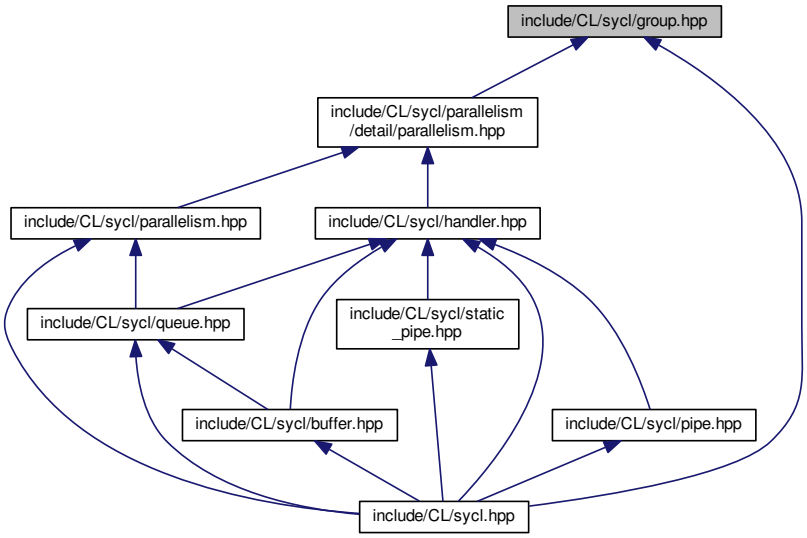
11.83 include/CL/sycl/group.hpp File Reference

```
#include <cstddef>
#include <functional>
#include "CL/sycl/detail/linear_id.hpp"
#include "CL/sycl/id.hpp"
#include "CL/sycl/nd_range.hpp"
#include "CL/sycl/range.hpp"
```

Include dependency graph for group.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::group< Dimensions >

  A group index used in a parallel_for_workitem to specify a work_group. More...
- struct cl::sycl::group< Dimensions >

  A group index used in a parallel_for_workitem to specify a work_group. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Functions

- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for_workitem (const group< Dimensions > &g, ParallelForFunctor f)

  Implement the loop on the work-items inside a work-group.

11.84 group.hpp

```
00001 #ifndef TRISYCL_SYCL_GROUP_HPP
00002 #define TRISYCL_SYCL_GROUP_HPP
00003
00004 /** \file The OpenCL SYCL nd_item<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <functional>
00014
00015 #include "CL/sycl/detail/linear_id.hpp"
00016 #include "CL/sycl/id.hpp"
00017 #include "CL/sycl/nd_range.hpp"
00018 #include "CL/sycl/range.hpp"
00019
00020 namespace cl {
00021 namespace sycl {
00022
00023 template <int Dimensions = 1>
00024 struct group;
00025
00026 namespace detail {
00027
00028 template <int Dimensions = 1, typename ParallelForFunctor>
00029 void parallel_for_workitem(const group<Dimensions> &g,
00030                            ParallelForFunctor f);
00031
00032 }
00033
00034 /** \addtogroup parallelism Expressing parallelism through kernels
00035     @{
00036 */
00037
00038 /** A group index used in a parallel_for_workitem to specify a work_group
00039  */
00040 template <int Dimensions>
00041 struct group {
00042   /// \todo add this Boost::multi_array or STL concept to the
00043   /// specification?
00044   static constexpr auto dimensionality = Dimensions;
00045
00046 private:
00047
00048   /// The coordinate of the group item
00049   id<Dimensions> group_id;
00050
00051   /// Keep a reference on the nd_range to serve potential query on it
00052   nd_range<Dimensions> ndr;
00053
00054 public:
00055
00056   /** Create a group from an nd_range<> with a 0 id<>
00057
00058       \todo This should be private since it is only used by the triSYCL
00059       implementation
00060   */
00061   group(const nd_range<Dimensions> &ndr) : ndr { ndr } {}
00062
00063
00064   /** Create a group from an id and a nd_range<>
00065
00066       \todo This should be private somehow, but it is used by the
00067       validation infrastructure
00068   */
00069   group(const id<Dimensions> &i, const nd_range<Dimensions> &ndr ) :
00070     group_id { i }, ndr { ndr } {}
00071
```

```
00072
00073   /** To be able to copy and assign group, use default constructors too
00074
00075       \todo Make most of them protected, reserved to implementation
00076   */
00077   group() = default;
00078
00079
00080   /** Return an id representing the index of the group within the nd_range
00081       for every dimension
00082   */
00083   id<Dimensions> get_id() const { return group_id; }
00084
00085
00086   /// Return the index of the group in the given dimension
00087   size_t get_id(int dimension) const { return get_id()[dimension]; }
00088
00089
00090   /** Return the index of the group in the given dimension within the
00091       nd_range<>
00092
00093       \todo In this implementation it is not const because the group<> is
00094       written in the parallel_for iterators. To fix according to the
00095       specification
00096   */
00097   auto &operator[](int dimension) {
00098     return group_id[dimension];
00099   }
00100
00101
00102   /** Return a range<> representing the dimensions of the current
00103       group
00104
00105       This local range may have been provided by the programmer, or chosen
00106       by the runtime.
00107
00108       \todo Fix this comment and the specification
00109   */
00110   range<Dimensions> get_group_range() const {
00111     return get_nd_range().get_group();
00112   }
00113
00114
00115   /// Return element dimension from the con stituent group range
00116   size_t get_group_range(int dimension) const {
00117     return get_group_range()[dimension];
00118   }
00119
00120
00121   /// Get the local range for this work_group
00122   range<Dimensions> get_global_range() const {
00123     return get_nd_range().get_global();
00124   }
00125
00126
00127   /// Return element dimension from the constituent global range
00128   size_t get_global_range(int dimension) const {
00129     return get_global_range()[dimension];
00130   }
00131
00132
00133   /** Get the local range for this work_group
00134
00135       \todo Add to the specification
00136   */
00137   range<Dimensions> get_local_range() const {
00138     return get_nd_range().get_local();
00139   }
00140
00141
00142   /** Return element dimension from the constituent local range
00143
00144       \todo Add to the specification
00145   */
00146   size_t get_local_range(int dimension) const {
00147     return get_local_range()[dimension];
00148   }
00149
00150
00151   /**  Get the offset of the NDRange
00152
00153        \todo Add to the specification
00154   */
00155   id<Dimensions> get_offset() const { return get_nd_range().get_offset(); }
00156
00157
00158   /**  Get the offset of the NDRange
```

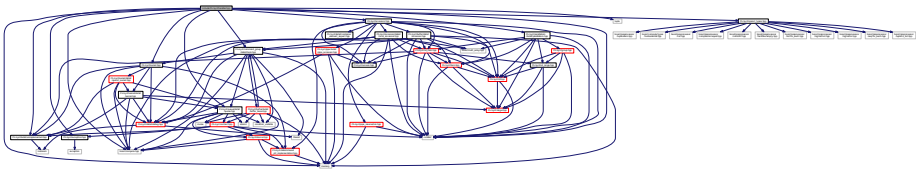
```
00159
00160         \todo Add to the specification
00161   */
00162   size_t get_offset(int dimension) const { return get_offset()[dimension]; }
00163
00164
00165   /// \todo Also provide this access to the current nd_range
00166   nd_range<Dimensions> get_nd_range() const { return ndr; }
00167
00168
00169   /** Get a linearized version of the group ID
00170
00171    */
00172   size_t get_linear() const {
00173     return detail::linear_id(get_group_range(), get_id());
00174   }
00175
00176
00177   /** Loop on the work-items inside a work-group
00178
00179       \todo Add this method in the specification
00180   */
00181   void parallel_for_work_item(std::function<void(
      nd_item<dimensionality>)> f)
00182     const {
00183     detail::parallel_for_workitem(*this, f);
00184   }
00185
00186
00187   /** Loop on the work-items inside a work-group
00188
00189       \todo Add this method in the specification
00190   */
00191   void parallel_for_work_item(std::function<void(
      item<dimensionality>)> f)
00192     const {
00193     auto item_adapter = [=] (nd_item<dimensionality> ndi) {
00194       item<dimensionality> i = ndi.get_item();
00195       f(i);
00196     };
00197     detail::parallel_for_workitem(*this, item_adapter);
00198   }
00199
00200 };
00201
00202 /// @} End the parallelism Doxygen group
00203
00204 }
00205 }
00206
00207 /*
00208     # Some Emacs stuff:
00209     ### Local Variables:
00210     ### ispell-local-dictionary: "american"
00211     ### eval: (flyspell-prog-mode)
00212     ### End:
00213 */
00214
00215 #endif // TRISYCL_SYCL_GROUP_HPP
```

11.85 include/CL/sycl/handler.hpp File Reference

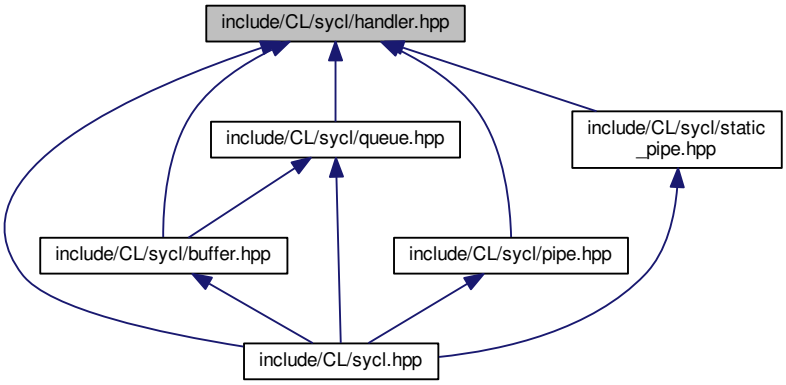
```
#include <cstddef>
#include <memory>
#include <tuple>
#include <boost/compute.hpp>
#include "CL/sycl/accessor.hpp"
#include "CL/sycl/command_group/detail/task.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/exception.hpp"
#include "CL/sycl/kernel.hpp"
#include "CL/sycl/opencl_types.hpp"
#include "CL/sycl/parallelism/detail/parallelism.hpp"
```

```
#include "CL/sycl/queue/detail/queue.hpp"
```

Include dependency graph for handler.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::handler

  Command group handler class. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Macros

- #define TRISYCL_parallel_for_functor_GLOBAL(N)

  SYCL parallel_for launches a data parallel computation with parallelism specified at launch time by a range<>
- #define TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(N)
- #define TRISYCL_ParallelForKernel_RANGE(N)

  Kernel invocation method of a kernel defined as a kernel object, for the specified range and given an id or item for indexing in the indexing space defined by range, described in detail in 5.4.

Functions

- static std::shared_ptr< detail::task > cl::sycl::detail::add_buffer_to_task (handler *command_group_handler, std::shared_ptr< detail::buffer_base > b, bool is_write_mode)

  Register a buffer as used by a task.

11.85.1 Macro Definition Documentation

11.85.1.1 TRISYCL_parallel_for_functor_GLOBAL

```
#define TRISYCL_parallel_for_functor_GLOBAL(
              N )
```

Value:

```
template <typename KernelName = std::nullptr_t,                    \
          typename ParallelForFunctor>                               \
  void parallel_for(range<N> global_size,                            \
                    ParallelForFunctor f) {                          \
    task->schedule(detail::trace_kernel<KernelName>([=] {            \
          detail::parallel_for(global_size, f);                      \
        }));                                                         \
  }
```

SYCL parallel_for launches a data parallel computation with parallelism specified at launch time by a range<>

Kernel invocation method of a kernel defined as a lambda or functor, for the specified range and given an id or item for indexing in the indexing space defined by range.

If it is a lambda function or the if the functor type is globally visible there is no need for the developer to provide a kernel name type (typename KernelName) for it, as described in detail in 3.5.3

Parameters

global_size	is the full size of the range<>
N	dimensionality of the iteration space
f	is the kernel functor to execute
KernelName	is a class type that defines the name to be used for the underlying kernel

Unfortunately, to have implicit conversion to work on the range, the function can not be templated, so instantiate it for all the Dimensions

Definition at line 206 of file handler.hpp.

11.85.1.2 TRISYCL_ParallelForFunctor_GLOBAL_OFFSET

```
#define TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(
              N )
```

Value:

```
template <typename KernelName = std::nullptr_t,          \
          typename ParallelForFunctor>                    \
  void parallel_for(range<N> global_size,                 \
                    id<N> offset,                         \
                    ParallelForFunctor f) {               \
    task->schedule(detail::trace_kernel<KernelName>([=] { \
          detail::parallel_for_global_offset(global_size, \
                                             offset,      \
                                             f);          \
        }));                                              \
  }
```

11.85.1.3 TRISYCL_ParallelForKernel_RANGE

```
#define TRISYCL_ParallelForKernel_RANGE(
              N )
```

Value:

```
void parallel_for(range<N> num_work_items,                          \
                  kernel sycl_kernel) {                             \
    /* For now just use the usual host task system to schedule      \
       manually the OpenCL kernels instead of using OpenCL event-based \
       scheduling                                                   \
                                                                    \
       \todo Move the tracing inside the kernel implementation      \
                                                                    \
       \todo Simplify this 2 step ugly interface                    \
    */                                                              \
    task->set_kernel(sycl_kernel.implementation);                   \
    /* Use an intermediate variable to capture task by copy because \
       otherwise "this" is captured by reference and havoc with task \
       just accessing the dead "this". Nasty bug to find... */      \
    task->schedule(detail::trace_kernel<kernel>([=, t = task] {     \
          sycl_kernel.implementation->parallel_for(t, t->get_queue(), \
                                                   num_work_items); })); \
  }
```

Kernel invocation method of a kernel defined as a kernel object, for the specified range and given an id or item for indexing in the indexing space defined by range, described in detail in 5.4.

Todo Add in the spec a version taking a kernel and a functor, to have host fall-back

Definition at line 383 of file handler.hpp.

11.86 handler.hpp

```
00001 #ifndef TRISYCL_SYCL_HANDLER_HPP
00002 #define TRISYCL_SYCL_HANDLER_HPP
00003
00004 /** \file The OpenCL SYCL command group handler
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <memory>
00014 #include <tuple>
00015
00016 #ifdef TRISYCL_OPENCL
```

```
00017 #include <boost/compute.hpp>
00018 #endif
00019
00020 #include "CL/sycl/accessor.hpp"
00021 #include "CL/sycl/command_group/detail/task.hpp"
00022 #include "CL/sycl/detail/unimplemented.hpp"
00023 #include "CL/sycl/exception.hpp"
00024 #include "CL/sycl/kernel.hpp"
00025 #include "CL/sycl/opencl_types.hpp"
00026 #include "CL/sycl/parallelism/detail/parallelism.hpp"
00027 #include "CL/sycl/queue/detail/queue.hpp"
00028
00029 namespace cl {
00030 namespace sycl {
00031
00032 /** \addtogroup execution Platforms, contexts, devices and queues
00033     @{
00034 */
00035
00036 /** Command group handler class
00037
00038     A command group handler object can only be constructed by the SYCL runtime.
00039
00040     All of the accessors defined in the command group scope take as a
00041     parameter an instance of the command group handler and all the kernel
00042     invocation functions are methods of this class.
00043 */
00044 class handler : public detail::debug<handler> {
00045
00046 public:
00047
00048   /** Attach the task and accessors to it.
00049    */
00050   std::shared_ptr<detail::task> task;
00051
00052
00053   /* Create a command group handler from the queue detail
00054
00055      The queue detail is used to track kernel completion.
00056
00057      Note that this is an implementation dependent constructor. Normal
00058      users cannot construct handler from scratch.
00059
00060      \todo Make this constructor private
00061   */
00062   handler(const std::shared_ptr<detail::queue> &q) {
00063     // Create a new task for this command_group
00064     task = std::make_shared<detail::task>(q);
00065   }
00066
00067
00068 #ifdef TRISYCL_OPENCL
00069   /** Set accessor kernel arg for an OpenCL kernel which is used through the
00070       SYCL/OpenCL interop interface
00071
00072       The index value specifies which parameter of the OpenCL kernel is
00073       being set and the accessor object, which OpenCL buffer or image is
00074       going to be given as kernel argument.
00075
00076       \todo Update the specification to use a ref && to the accessor instead?
00077
00078       \todo It is not that clean to have set_arg() associated to a
00079       command handler. Rethink the specification?
00080
00081       \todo It seems more logical to have these methods on kernel instead
00082   */
00083   template <typename DataType,
00084             int Dimensions,
00085             access::mode Mode,
00086             access::target Target = access::target::global_buffer
    >
00087   void set_arg(int arg_index,
00088                accessor<DataType, Dimensions, Mode, Target> &&
    acc_obj) {
00089     /* Think about setting the kernel argument before actually calling
00090        the kernel.
00091
00092        Explicitly capture task by copy instead of having this captured
00093        by reference and task by reference by side effect */
00094     task->add_prelude([=, task = task] {
00095         task->get_kernel().get_boost_compute()
00096           .set_arg(arg_index, acc_obj.implementation->get_cl_buffer());
00097       });
00098   }
00099
00100
00101   /** Set kernel args for an OpenCL kernel which is used through the
```

```
00102       SYCL/OpenCL interoperability interface with a wrapper type
00103   */
00104   template <typename T, typename = std::enable_if_t<is_wrapper<T>::value> >
00105   void set_arg(int arg_index, T && scalar_value) {
00106     /* Explicitly capture task by copy instead of having this captured
00107        by reference and task by reference by side effect */
00108     task->add_prelude([=, task = task] {
00109         task->get_kernel().get_boost_compute()
00110           .set_arg(arg_index, scalar_value.unwrap());
00111       });
00112   }
00113
00114
00115   /** Set kernel args for an OpenCL kernel which is used through the
00116       SYCL/OpenCL interoperability interface without a wrapper type
00117   */
00118   template <typename T>
00119   std::enable_if_t<!is_wrapper<T>::value>
00120   set_arg(int arg_index, T && scalar_value) {
00121     /* Explicitly capture task by copy instead of having this captured
00122        by reference and task by reference by side effect */
00123     task->add_prelude([=, task = task] {
00124         task->get_kernel().get_boost_compute()
00125           .set_arg(arg_index, scalar_value);
00126       });
00127   }
00128
00129 private:
00130
00131   /// Helper to individually call set_arg() for each argument
00132   template <std::size_t... Is, typename... Ts>
00133   void dispatch_set_arg(std::index_sequence<Is...>, Ts&&... args) {
00134     // Use an intermediate tuple to ease individual argument access
00135     auto &&t = std::make_tuple(std::forward<Ts>(args)...);
00136     // Dispatch individual set_arg() for each argument
00137     auto just_to_evaluate = {
00138       0 /*< At least 1 element to deal with empty set_args() */,
00139       ( set_arg(Is, std::forward<Ts>(std::get<Is>(t))), 0)...
00140     };
00141     // Remove the warning about unused variable
00142     static_cast<void>(just_to_evaluate);
00143   }
00144
00145 public:
00146
00147   /** Set all kernel args for an OpenCL kernel which is used through the
00148       SYCL/OpenCL interop interface
00149
00150       \todo Update the specification to add this function according to
00151       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15978 proposal
00152   */
00153   template <typename... Ts>
00154   void set_args(Ts &&... args) {
00155     /* Construct a set of increasing argument index to be able to call
00156        the real set_arg */
00157     dispatch_set_arg(std::index_sequence_for<Ts...>{},
00158                      std::forward<Ts>(args)...);
00159   }
00160 #endif
00161
00162
00163   /** Kernel invocation method of a kernel defined as a lambda or
00164       functor. If it is a lambda function or the functor type is globally
00165       visible there is no need for the developer to provide a kernel name type
00166       (typename KernelName) for it, as described in 3.5.3
00167
00168       SYCL single_task launches a computation without parallelism at
00169       launch time.
00170
00171       \param F specify the kernel to be launched as a single_task
00172
00173       \param KernelName is a class type that defines the name to be used for
00174       the underlying kernel
00175   */
00176   template <typename KernelName = std::nullptr_t>
00177   void single_task(std::function<void(void)> F) {
00178     task->schedule(detail::trace_kernel<KernelName>(F));
00179   }
00180
00181
00182   /** SYCL parallel_for launches a data parallel computation with
00183       parallelism specified at launch time by a range<>
00184
00185       Kernel invocation method of a kernel defined as a lambda or functor,
00186       for the specified range and given an id or item for indexing in the
00187       indexing space defined by range.
00188
```

```
00189       If it is a lambda function or the if the functor type is globally
00190       visible there is no need for the developer to provide a kernel name
00191       type (typename KernelName) for it, as described in detail in 3.5.3
00192
00193       \param global_size is the full size of the range<>
00194
00195       \param N dimensionality of the iteration space
00196
00197       \param f is the kernel functor to execute
00198
00199       \param KernelName is a class type that defines the name to be used
00200       for the underlying kernel
00201
00202       Unfortunately, to have implicit conversion to work on the range, the
00203       function can not be templated, so instantiate it for all the
00204       Dimensions
00205   */
00206 #define TRISYCL_parallel_for_functor_GLOBAL(N)                          \
00207   template <typename KernelName = std::nullptr_t,                       \
00208             typename ParallelForFunctor>                                \
00209   void parallel_for(range<N> global_size,                               \
00210                     ParallelForFunctor f) {                             \
00211     task->schedule(detail::trace_kernel<KernelName>([=] {               \
00212           detail::parallel_for(global_size, f);                         \
00213         }));                                                            \
00214   }
00215
00216   TRISYCL_parallel_for_functor_GLOBAL(1)
00217   TRISYCL_parallel_for_functor_GLOBAL(2)
00218   TRISYCL_parallel_for_functor_GLOBAL(3)
00219
00220
00221   /** Kernel invocation method of a kernel defined as a lambda or functor,
00222       for the specified range and offset and given an id or item for
00223       indexing in the indexing space defined by range
00224
00225       If it is a lambda function or the if the functor type is globally
00226       visible there is no need for the developer to provide a kernel name
00227       type (typename KernelName) for it, as described in detail in 3.5.3
00228
00229       \param global_size is the global size of the range<>
00230
00231       \param offset is the offset to be add to the id<> during iteration
00232
00233       \param f is the kernel functor to execute
00234
00235       \param ParallelForFunctor is the kernel functor type
00236
00237       \param KernelName is a class type that defines the name to be used for
00238       the underlying kernel
00239
00240       Unfortunately, to have implicit conversion to work on the range, the
00241       function can not be templated, so instantiate it for all the
00242       dimensions
00243   */
00244 #define TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(N)                     \
00245   template <typename KernelName = std::nullptr_t,                       \
00246             typename ParallelForFunctor>                                \
00247   void parallel_for(range<N> global_size,                               \
00248                     id<N> offset,                                       \
00249                     ParallelForFunctor f) {                             \
00250     task->schedule(detail::trace_kernel<KernelName>([=] {               \
00251           detail::parallel_for_global_offset(global_size,               \
00252                                              offset,                    \
00253                                              f);                        \
00254         }));                                                            \
00255   }
00256
00257   TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(1)
00258   TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(2)
00259   TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(3)
00260
00261
00262   /** Kernel invocation method of a kernel defined as a lambda or functor,
00263       for the specified nd_range and given an nd_item for indexing in the
00264       indexing space defined by the nd_range
00265
00266       If it is a lambda function or the if the functor type is globally
00267       visible there is no need for the developer to provide a kernel name
00268       type (typename KernelName) for it, as described in detail in 3.5.3
00269
00270       \param r defines the iteration space with the work-group layout and
00271       offset
00272
00273       \param Dimensions dimensionality of the iteration space
00274
00275       \param f is the kernel functor to execute
```

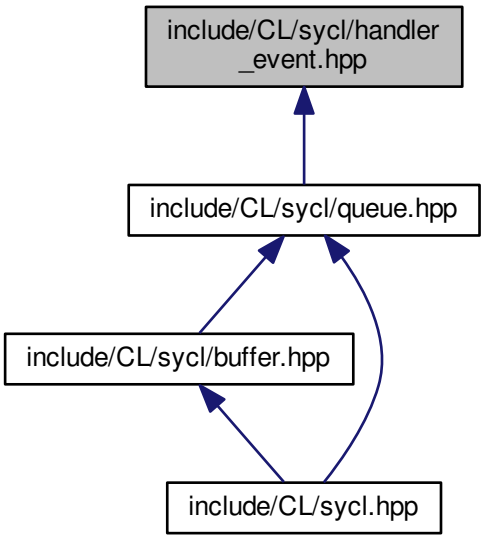
```
00276
00277       \param ParallelForFunctor is the kernel functor type
00278
00279       \param KernelName is a class type that defines the name to be used for
00280       the underlying kernel
00281   */
00282   template <typename KernelName = std::nullptr_t,
00283             int Dimensions,
00284             typename ParallelForFunctor>
00285   void parallel_for(nd_range<Dimensions> r, ParallelForFunctor f) {
00286     task->schedule(detail::trace_kernel<KernelName>([=] {
00287           detail::parallel_for(r, f);
00288         }));
00289   }
00290
00291
00292   /** Hierarchical kernel invocation method of a kernel defined as a
00293       lambda encoding the body of each work-group to launch
00294
00295       May contain multiple kernel built-in parallel_for_work_item
00296       functions representing the execution on each work-item.
00297
00298       Launch num_work_groups work-groups of runtime-defined
00299       size. Described in detail in 3.5.3.
00300
00301       \param r defines the iteration space with the work-group layout and
00302       offset
00303
00304       \param Dimensions dimensionality of the iteration space
00305
00306       \param f is the kernel functor to execute
00307
00308       \param ParallelForFunctor is the kernel functor type
00309
00310       \param KernelName is a class type that defines the name to be used for
00311       the underlying kernel
00312   */
00313   template <typename KernelName = std::nullptr_t,
00314             int Dimensions = 1,
00315             typename ParallelForFunctor>
00316   void parallel_for_work_group(nd_range<Dimensions> r,
00317                                ParallelForFunctor f) {
00318     task->schedule(detail::trace_kernel<KernelName>([=] {
00319           detail::parallel_for_workgroup(r, f); }));
00320   }
00321
00322
00323   /** Hierarchical kernel invocation method of a kernel defined as a
00324       lambda encoding the body of each work-group to launch
00325
00326       May contain multiple kernel built-in parallel_for_work_item
00327       functions representing the execution on each work-item.
00328
00329       Launch num_work_groups work-groups of runtime-defined
00330       size. Described in detail in 3.5.3.
00331
00332       \param r defines the iteration space with the work-group layout and
00333       offset
00334
00335       \param Dimensions dimensionality of the iteration space
00336
00337       \param f is the kernel functor to execute
00338
00339       \param ParallelForFunctor is the kernel functor type
00340
00341       \param KernelName is a class type that defines the name to be used for
00342       the underlying kernel
00343   */
00344   template <typename KernelName = std::nullptr_t,
00345             int Dimensions = 1,
00346             typename ParallelForFunctor>
00347   void parallel_for_work_group(range<Dimensions> r1,
      range<Dimensions> r2,
00348                                ParallelForFunctor f) {
00349     parallel_for_work_group(nd_range<Dimensions> { r1, r2 }, f);
00350   }
00351
00352
00353   /** Kernel invocation method of a kernel defined as pointer to a kernel
00354       object, described in detail in 3.5.3
00355
00356       \todo Add in the spec a version taking a kernel and a functor,
00357       to have host fall-back
00358   */
00359   void single_task(kernel sycl_kernel) {
00360     /* For now just use the usual host task system to schedule          \
00361        manually the OpenCL kernels instead of using OpenCL event-based  \
```

```
00362        scheduling                                                    \
00363                                                                      \
00364        \todo Move the tracing inside the kernel implementation       \
00365                                                                      \
00366        \todo Simplify this 2 step ugly interface                     \
00367     */                                                               \
00368     task->set_kernel(sycl_kernel.implementation);                    \
00369     task->schedule(detail::trace_kernel<kernel>([=, t = task] {      \
00370           sycl_kernel.implementation->single_task(t, t->get_queue());\
00371         }));                                                         \
00372   }
00373
00374
00375   /** Kernel invocation method of a kernel defined as a kernel object,
00376       for the specified range and given an id or item for indexing in
00377       the indexing space defined by range, described in detail in
00378       5.4.
00379
00380       \todo Add in the spec a version taking a kernel and a functor,
00381       to have host fall-back
00382   */
00383 #define TRISYCL_ParallelForKernel_RANGE(N)                           \
00384   void parallel_for(range<N> num_work_items,                         \
00385                     kernel sycl_kernel) {                            \
00386     /* For now just use the usual host task system to schedule       \
00387        manually the OpenCL kernels instead of using OpenCL event-based \
00388        scheduling                                                    \
00389                                                                     \
00390        \todo Move the tracing inside the kernel implementation       \
00391                                                                      \
00392        \todo Simplify this 2 step ugly interface                     \
00393     */                                                               \
00394     task->set_kernel(sycl_kernel.implementation);                    \
00395     /* Use an intermediate variable to capture task by copy because  \
00396        otherwise "this" is captured by reference and havoc with task \
00397        just accessing the dead "this". Nasty bug to find... */       \
00398     task->schedule(detail::trace_kernel<kernel>([=, t = task] {      \
00399           sycl_kernel.implementation->parallel_for(t, t->get_queue(),\
00400                                                    num_work_items); })); \
00401   }
00402
00403
00404   /* Do not use a template parameter since otherwise the parallel_for
00405      functor is selected instead of this one
00406
00407      \todo Clean this
00408   */
00409   TRISYCL_ParallelForKernel_RANGE(1)
00410   TRISYCL_ParallelForKernel_RANGE(2)
00411   TRISYCL_ParallelForKernel_RANGE(3)
00412 #undef TRISYCL_ParallelForKernel_RANGE
00413
00414   /** Kernel invocation method of a kernel defined as pointer to a kernel
00415       object, for the specified nd_range and given an nd_item for indexing
00416       in the indexing space defined by the nd_range, described in detail
00417       in 3.5.3
00418
00419       \todo Add in the spec a version taking a kernel and a functor,
00420       to have host fall-back
00421
00422       \todo To be implemented
00423   */
00424   template <int Dimensions = 1>
00425   void parallel_for(nd_range<Dimensions>, kernel syclKernel) {
00426     detail::unimplemented();
00427   }
00428
00429 };
00430
00431 namespace detail {
00432
00433 /** Register a buffer as used by a task
00434
00435     This is a proxy function to avoid complicated type recursion.
00436 */
00437 static std::shared_ptr<detail::task>
00438 add_buffer_to_task(handler *command_group_handler,
00439                    std::shared_ptr<detail::buffer_base> b,
00440                    bool is_write_mode) {
00441   command_group_handler->task->add_buffer(b, is_write_mode);
00442   return command_group_handler->task;
00443 }
00444
00445 }
00446
00447 /// @} End the execution Doxygen group
00448
```

```
00449 }
00450 }
00451
00452 /*
00453     # Some Emacs stuff:
00454     ### Local Variables:
00455     ### ispell-local-dictionary: "american"
00456     ### eval: (flyspell-prog-mode)
00457     ### End:
00458 */
00459
00460 #endif // TRISYCL_SYCL_HANDLER_HPP
```

11.87 include/CL/sycl/handler_event.hpp File Reference

This graph shows which files directly or indirectly include this file:



Classes

- class handler_event

  Handler event.

11.88 handler_event.hpp

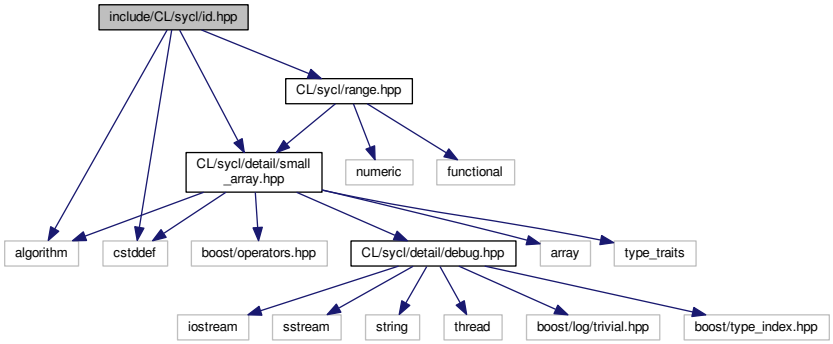
```
00001 #ifndef TRISYCL_SYCL_HANDLER_EVENT_HPP
00002 #define TRISYCL_SYCL_HANDLER_EVENT_HPP
00003
00004 /** \file The handler event
00005
00006     Implement parallel constructions to launch kernels
00007
00008     Ronan at keryell dot FR
00009
```

```
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 /** \todo To be implemented */
00015 /** Handler event
00016
00017     \todo To be implemented
00018 */
00019 class handler_event {
00020 /*
00021  public:
00022   event get_kernel() const;
00023   event get_complete() const;
00024   event get_end() const;
00025 */
00026 };
00027
00028
00029 /*
00030     # Some Emacs stuff:
00031     ### Local Variables:
00032     ### ispell-local-dictionary: "american"
00033     ### eval: (flyspell-prog-mode)
00034     ### End:
00035 */
00036
00037 #endif // TRISYCL_SYCL_HANDLER_EVENT_HPP
```

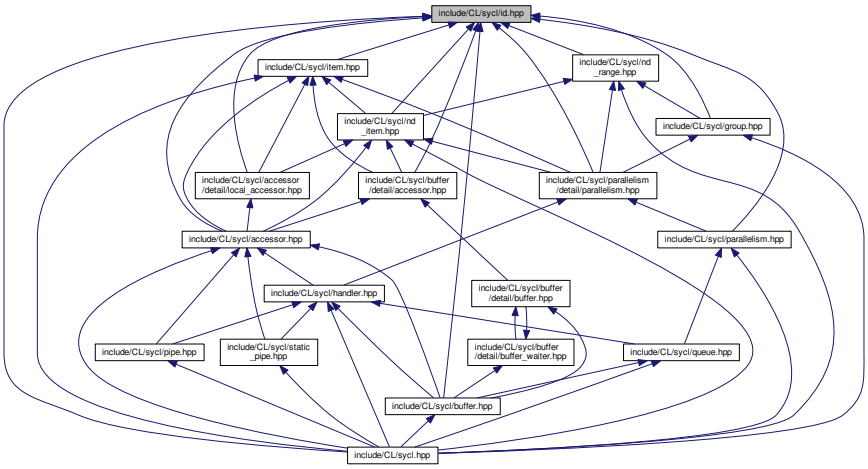
11.89 include/CL/sycl/id.hpp File Reference

```
#include <algorithm>
#include <cstddef>
#include "CL/sycl/detail/small_array.hpp"
#include "CL/sycl/range.hpp"
```

Include dependency graph for id.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::item< Dimensions >

  A SYCL item stores information on a work-item with some more context such as the definition range and offset. More...
- class cl::sycl::id< Dimensions >

  Define a multi-dimensional index, used for example to locate a work item. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Functions

- auto cl::sycl::make_id (id< 1 > i)

  Implement a make_id to construct an id<> of the right dimension with implicit conversion from an initializer list for example.
- auto cl::sycl::make_id (id< 2 > i)
- auto cl::sycl::make_id (id< 3 > i)
- template<typename... BasicType>
  auto cl::sycl::make_id (BasicType... Args)

  Construct an id<> from a function call with arguments, like make_id(1, 2, 3)

11.90 id.hpp

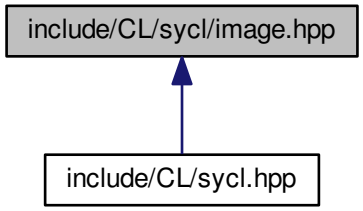
```
00001 #ifndef TRISYCL_SYCL_ID_HPP
00002 #define TRISYCL_SYCL_ID_HPP
00003
00004 /** \file The OpenCL SYCL id<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <algorithm>
00013 #include <cstddef>
00014
00015 #include "CL/sycl/detail/small_array.hpp"
00016 #include "CL/sycl/range.hpp"
00017
00018 namespace cl {
00019 namespace sycl {
00020
00021 template <int Dimensions> class item;
00022
00023 /** \addtogroup parallelism Expressing parallelism through kernels
00024     @{
00025 */
00026
00027 /** Define a multi-dimensional index, used for example to locate a work
00028     item
00029 */
00030 template <int Dimensions = 1>
00031 class id : public detail::small_array_123<
00032              std::size_t,
00033              id<Dimensions>,
00034              Dimensions > {
00035
00036 public:
00037
00038   // Inherit from all the constructors
00039   using detail::small_array_123<std::size_t,
00040                                 id<Dimensions>,
00041                                 Dimensions>::small_array_123;
00042
00043
00044   /// Construct an id from the dimensions of a range
00045   id(const range<Dimensions> &range_size)
00046     /** Use the fact we have a constructor of a small_array from a another
00047         kind of small_array
00048      */
00049     : detail::small_array_123<std::size_t, id<Dimensions>, Dimensions>
00050       { range_size }
00051   {}
00052
00053
00054   /// Construct an id from an item global_id
00055   id(const item<Dimensions> &rhs)
00056     : detail::small_array_123<std::size_t, id<Dimensions>
      , Dimensions>
00057       { rhs.get_id() }
00058   {}
00059
00060   /// Keep other constructors
00061   id() = default;
00062
00063 };
00064
00065
00066 /** Implement a make_id to construct an id<> of the right dimension with
00067     implicit conversion from an initializer list for example.
00068
00069     Cannot use a template on the number of dimensions because the implicit
00070     conversion would not be tried. */
00071 inline auto make_id(id<1> i) { return i; }
00072 inline auto make_id(id<2> i) { return i; }
00073 inline auto make_id(id<3> i) { return i; }
00074
00075
00076 /** Construct an id<> from a function call with arguments, like
00077     make_id(1, 2, 3) */
00078 template<typename... BasicType>
00079 auto make_id(BasicType... Args) {
00080   // Call constructor directly to allow narrowing
00081   return id<sizeof...(Args)>(Args...);
00082 }
00083
```

```
00084 /// @} End the parallelism Doxygen group
00085
00086 }
00087 }
00088
00089 /*
00090     # Some Emacs stuff:
00091     ### Local Variables:
00092     ### ispell-local-dictionary: "american"
00093     ### eval: (flyspell-prog-mode)
00094     ### End:
00095 */
00096
00097 #endif // TRISYCL_SYCL_ID_HPP
```

11.91 include/CL/sycl/image.hpp File Reference

OpenCL SYCL image class.

This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::image< Dimensions >

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

11.91.1 Detailed Description

OpenCL SYCL image class.

Ronan at Keryell point FR

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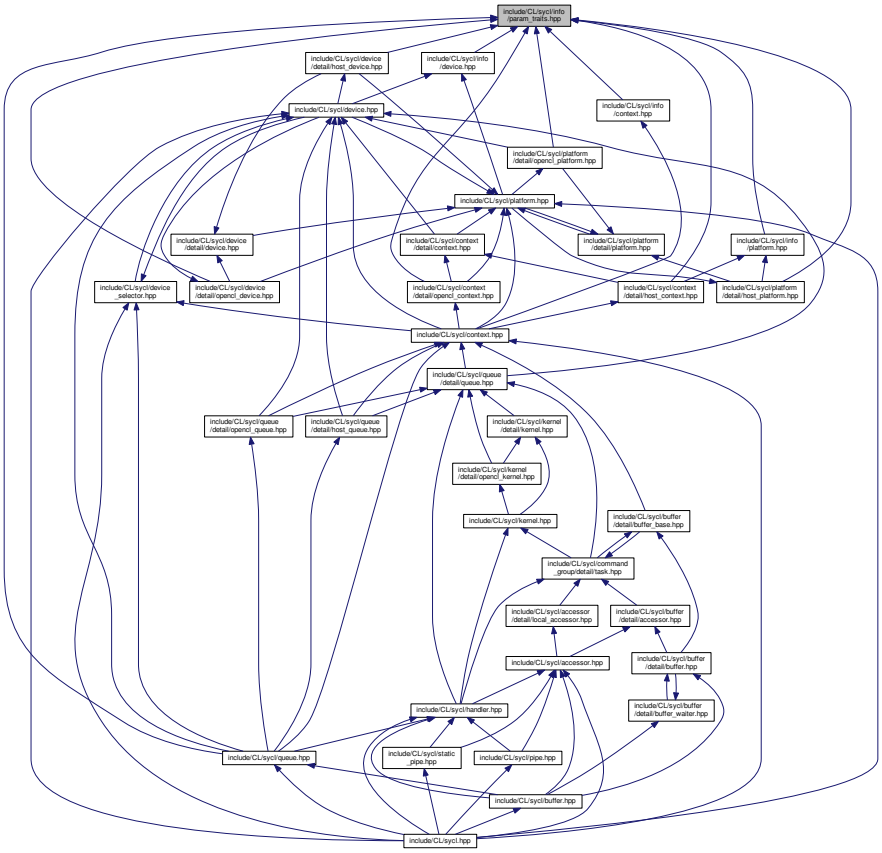
Definition in file image.hpp.

11.92 image.hpp

```
00001 #ifndef TRISYCL_SYCL_IMAGE_HPP
00002 #define TRISYCL_SYCL_IMAGE_HPP
00003
00004 /** \file
00005
00006     OpenCL SYCL image class
00007
00008     Ronan at Keryell point FR
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 namespace cl {
00015 namespace sycl {
00016
00017 /** \addtogroup data
00018
00019     @{
00020 */
00021
00022 /// \todo implement image
00023 template <int Dimensions> struct image;
00024
00025
00026 /// @} End the data Doxygen group
00027
00028
00029 }
00030 }
00031
00032 /*
00033     # Some Emacs stuff:
00034     ### Local Variables:
00035     ### ispell-local-dictionary: "american"
00036     ### eval: (flyspell-prog-mode)
00037     ### End:
00038 */
00039
00040 #endif // TRISYCL_SYCL_IMAGE_HPP
```

11.93 include/CL/sycl/info/param_traits.hpp File Reference

This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::info::param_traits< T, Param >

  Implement a meta-function from (T, value) to T' to express the return type value of an OpenCL function of kind (T, value)

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::info

Macros

- #define TRISYCL_INFO_PARAM_TRAITS_ANY_T(T, RETURN_TYPE)

  To declare a param_traits returning RETURN_TYPE for function of any T.
- #define TRISYCL_INFO_PARAM_TRAITS(VALUE, RETURN_TYPE)

  To declare a param_traits returning RETURN_TYPE for function taking a VALUE of type T.

11.93.1 Macro Definition Documentation

11.93.1.1 TRISYCL_INFO_PARAM_TRAITS

```
#define TRISYCL_INFO_PARAM_TRAITS(
              VALUE,
              RETURN_TYPE )
```

Value:

```
template <>                                                    \
  struct param_traits<decltype(VALUE), VALUE> {                  \
    using type = RETURN_TYPE;                                    \
  };
```

To declare a param_traits returning RETURN_TYPE for function taking a VALUE of type T.

Definition at line 36 of file param_traits.hpp.

11.93.1.2 TRISYCL_INFO_PARAM_TRAITS_ANY_T

```
#define TRISYCL_INFO_PARAM_TRAITS_ANY_T(
              T,
              RETURN_TYPE )
```

Value:

```
template <T Param>                                             \
  struct param_traits<T, Param> {                                \
    using type = RETURN_TYPE;                                    \
  };
```

To declare a param_traits returning RETURN_TYPE for function of any T.

Definition at line 26 of file param_traits.hpp.

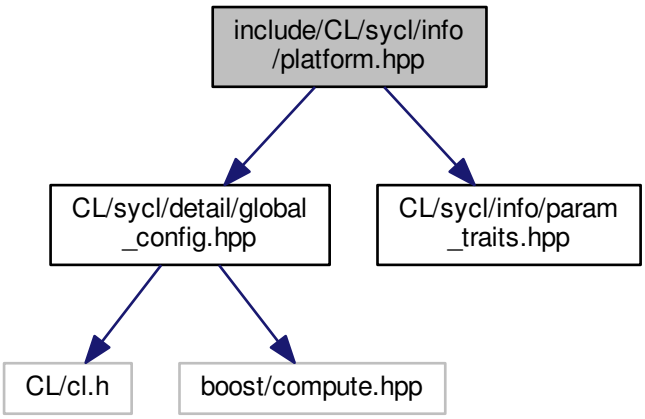
11.94 param_traits.hpp

```
00001 #ifndef TRISYCL_SYCL_INFO_PARAM_TRAITS_HPP
00002 #define TRISYCL_SYCL_INFO_PARAM_TRAITS_HPP
00003
00004 /** \file The OpenCL SYCL param_traits
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 namespace cl {
00013 namespace sycl {
00014 namespace info {
00015
00016 /** Implement a meta-function from (T, value) to T' to express the return type
00017     value of an OpenCL function of kind (T, value)
00018 */
00019 template <typename T, T Param>
00020 struct param_traits {
00021   // By default no return type
00022 };
00023
00024
00025 /// To declare a param_traits returning RETURN_TYPE for function of any T
00026 #define TRISYCL_INFO_PARAM_TRAITS_ANY_T(T, RETURN_TYPE)      \
00027   template <T Param>                                         \
00028   struct param_traits<T, Param> {                            \
00029     using type = RETURN_TYPE;                                \
00030   };
00031
00032
00033 /** To declare a param_traits returning RETURN_TYPE for function taking a
00034     VALUE of type T
00035 */
00036 #define TRISYCL_INFO_PARAM_TRAITS(VALUE, RETURN_TYPE)        \
00037   template <>                                                \
00038   struct param_traits<decltype(VALUE), VALUE> {              \
00039     using type = RETURN_TYPE;                                \
00040   };
00041
00042 }
00043 }
00044 }
00045
00046 /*
00047     # Some Emacs stuff:
00048     ### Local Variables:
00049     ### ispell-local-dictionary: "american"
00050     ### eval: (flyspell-prog-mode)
00051     ### End:
00052 */
00053
00054 #endif // TRISYCL_SYCL_INFO_PARAM_TRAITS_HPP
```

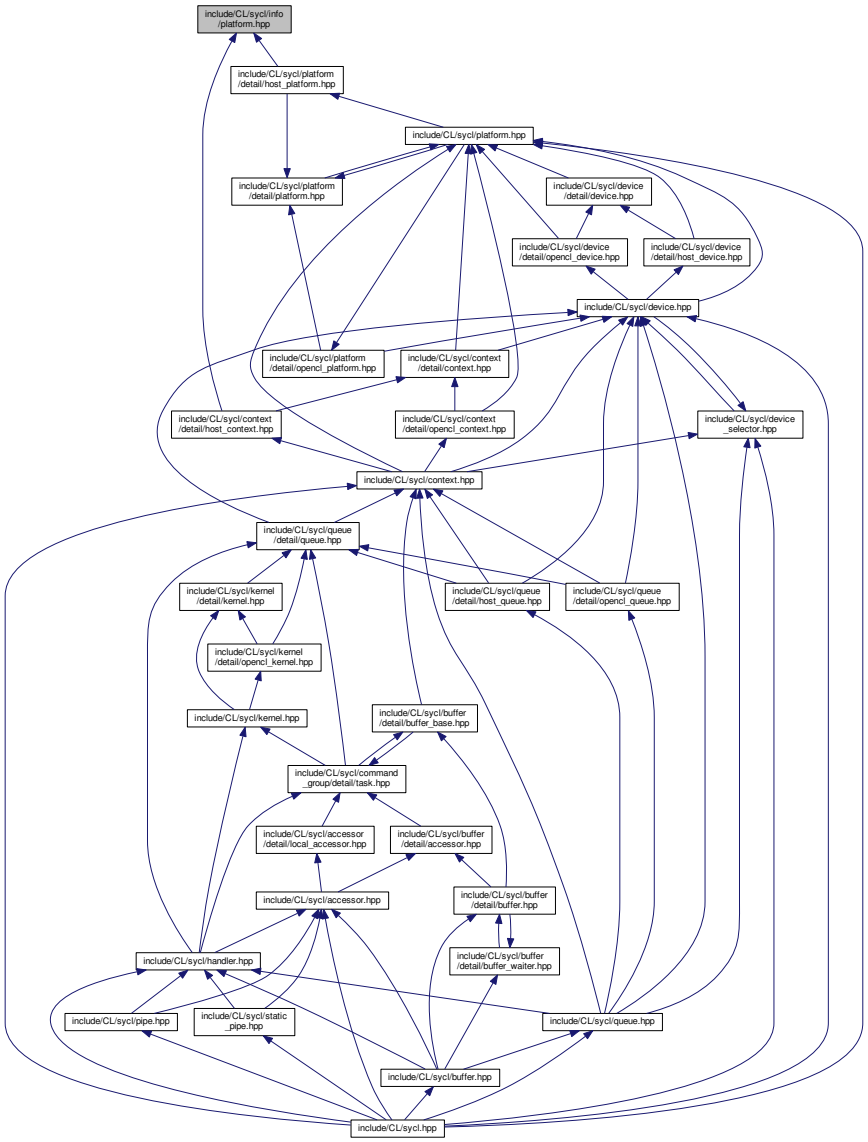
11.95 include/CL/sycl/info/platform.hpp File Reference

```
#include "CL/sycl/detail/global_config.hpp"
#include "CL/sycl/info/param_traits.hpp"
```

Include dependency graph for platform.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::info

Enumerations

- enum cl::sycl::info::platform : unsigned int { cl::sycl::info::platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_PROFILE), cl::sycl::info::platform::↩ TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_VERSION), cl::sycl::info::platform::TRISYCL_SKIP_OPE↩ NCL =(= CL_PLATFORM_NAME), cl::sycl::info::platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM↩ _VENDOR), cl::sycl::info::platform::TRISYCL_SKIP_OPENCL =(= CL_PLATFORM_EXTENSIONS) }

  Platform information descriptors.

11.96 platform.hpp

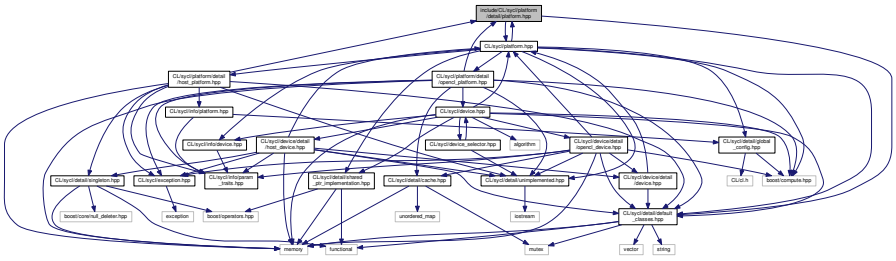
```
00001 #ifndef TRISYCL_SYCL_INFO_PLATFORM_HPP
00002 #define TRISYCL_SYCL_INFO_PLATFORM_HPP
00003
00004 /** \file The OpenCL SYCL platform information parameters
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/detail/global_config.hpp"
00013 #include "CL/sycl/info/param_traits.hpp"
00014
00015 namespace cl {
00016 namespace sycl {
00017
00018 /** \addtogroup execution Platforms, contexts, devices and queues
00019     @{
00020 */
00021 namespace info {
00022
00023 /** Platform information descriptors
00024
00025     A SYCL platform can be queried for all of the following information
00026     using the get_info function.
00027
00028     In this implementation, the values are mapped to OpenCL values to
00029     avoid further remapping later when OpenCL is used
00030 */
00031 enum class platform : unsigned int {
00032   /** Returns the profile name (as a string_class) supported by the
00033       implementation.
00034
00035       Can be either FULL PROFILE or EMBEDDED PROFILE.
00036   */
00037   profile TRISYCL_SKIP_OPENCL(= CL_PLATFORM_PROFILE),
00038
00039   /** Returns the OpenCL software driver version string in the form major
00040       number.minor number (as a string_class)
00041   */
00042   version TRISYCL_SKIP_OPENCL(= CL_PLATFORM_VERSION),
00043
00044   /** Returns the name of the platform (as a string_class)
00045   */
00046   name TRISYCL_SKIP_OPENCL(= CL_PLATFORM_NAME),
00047
00048   /** Returns the string provided by the platform vendor (as a string_class)
00049   */
00050   vendor TRISYCL_SKIP_OPENCL(= CL_PLATFORM_VENDOR),
00051
00052   /** Returns a space-separated list of extension names supported by the
00053       platform (as a string_class)
00054   */
00055   extensions TRISYCL_SKIP_OPENCL(= CL_PLATFORM_EXTENSIONS),
00056
00057 #if CL_SYCL_LANGUAGE_VERSION >= 220 && defined(CL_VERSION_2_1)
00058   /** Returns the resolution of the host timer in nanoseconds as used by
00059       clGetDeviceAndHostTimer
00060   */
00061   host_timer_resolution
00062     TRISYCL_SKIP_OPENCL(= CL_PLATFORM_HOST_TIMER_RESOLUTION)
00063 #endif
00064 };
00065
00066
00067 /** Query the return type for get_info() on platform parameter type
00068
00069     This defines the meta-function
00070     \code
00071     param_traits<info::platform x, string_class>::type == string_class
00072     \endcode
00073
00074     for all x, which means that get_info() returns always a string_class
00075     when asked about platform info.
00076 */
00077 TRISYCL_INFO_PARAM_TRAITS_ANY_T(info::platform,
      string_class)
00078
00079 #if CL_SYCL_LANGUAGE_VERSION >= 220 && defined(CL_VERSION_2_1)
00080 ///  get_info<host_timer_resolution>() return a cl_ulong
00081 #ifdef TRISYCL_OPENCL
00082 TRISYCL_INFO_PARAM_TRAITS(info::platform::host_timer_resolution, cl_ulong)
00083 #else
```

```
00084 TRISYCL_INFO_PARAM_TRAITS(info::platform::host_timer_resolution,
00085                           unsigned long int)
00086 #endif
00087 #endif
00088 }
00089 }
00090 }
00091
00092 /*
00093     # Some Emacs stuff:
00094     ### Local Variables:
00095     ### ispell-local-dictionary: "american"
00096     ### eval: (flyspell-prog-mode)
00097     ### End:
00098 */
00099
00100 #endif // TRISYCL_SYCL_INFO_PLATFORM_HPP
```

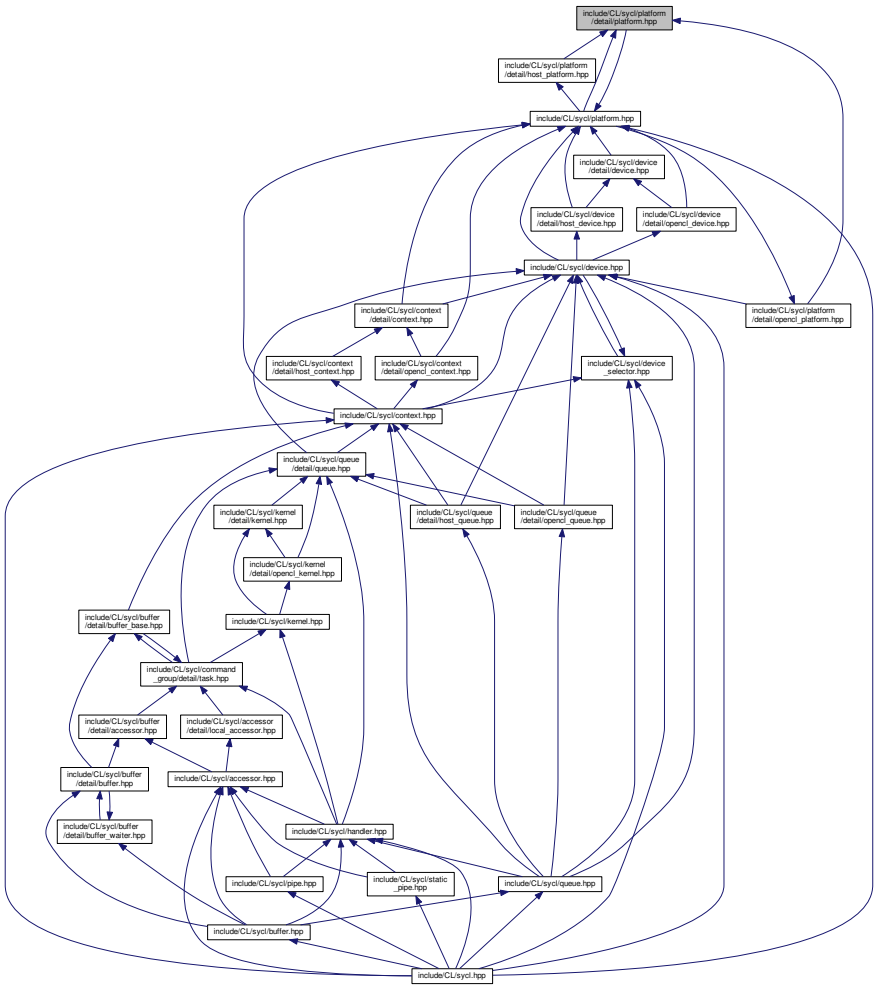
11.97 include/CL/sycl/platform/detail/platform.hpp File Reference

```
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/platform.hpp"
```

Include dependency graph for platform.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::platform

  An abstract class representing various models of SYCL platforms. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.98 platform.hpp

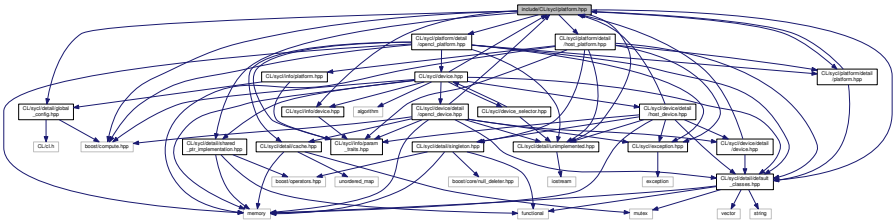
```
00001 #ifndef TRISYCL_SYCL_PLATFORM_DETAIL_PLATFORM_HPP
00002 #define TRISYCL_SYCL_PLATFORM_DETAIL_PLATFORM_HPP
00003
```

```
00004 /** \file The OpenCL SYCL abstract platform
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/detail/default_classes.hpp"
00013
00014 #include "CL/sycl/platform.hpp"
00015
00016 namespace cl {
00017 namespace sycl {
00018
00019 class device;
00020
00021 namespace detail {
00022
00023 /** \addtogroup execution Platforms, contexts, devices and queues
00024     @{
00025 */
00026
00027 /// An abstract class representing various models of SYCL platforms
00028 class platform {
00029
00030 public:
00031
00032 #ifdef TRISYCL_OPENCL
00033   /// Return the cl_platform_id of the underlying OpenCL platform
00034   virtual cl_platform_id get() const = 0;
00035
00036
00037   /// Return the underlying Boost.Compute platform, if any
00038   virtual const boost::compute::platform &
      get_boost_compute() const = 0;
00039 #endif
00040
00041
00042   /// Return true if the platform is a SYCL host platform
00043   virtual bool is_host() const = 0;
00044
00045
00046   /// Query the platform for OpenCL string info::platform info
00047   virtual string_class get_info_string(info::platform param) const
       = 0;
00048
00049
00050   /// Specify whether a specific extension is supported on the platform.
00051   virtual bool has_extension(const string_class &extension) const = 0;
00052
00053   /** Get all the available devices for this platform
00054
00055       \param[in] device_type is the device type to filter the selection
00056       or \c info::device_type::all by default to return all the
00057       devices
00058
00059       \return the device list
00060   */
00061   virtual vector_class<device>
00062   get_devices(info::device_type device_type) const = 0;
00063
00064   // Virtual to call the real destructor
00065   virtual ~platform() {}
00066
00067 };
00068
00069 /// @} to end the execution Doxygen group
00070
00071 }
00072 }
00073 }
00074
00075 /*
00076     # Some Emacs stuff:
00077     ### Local Variables:
00078     ### ispell-local-dictionary: "american"
00079     ### eval: (flyspell-prog-mode)
00080     ### End:
00081 */
00082
00083 #endif // TRISYCL_SYCL_PLATFORM_DETAIL_PLATFORM_HPP
```

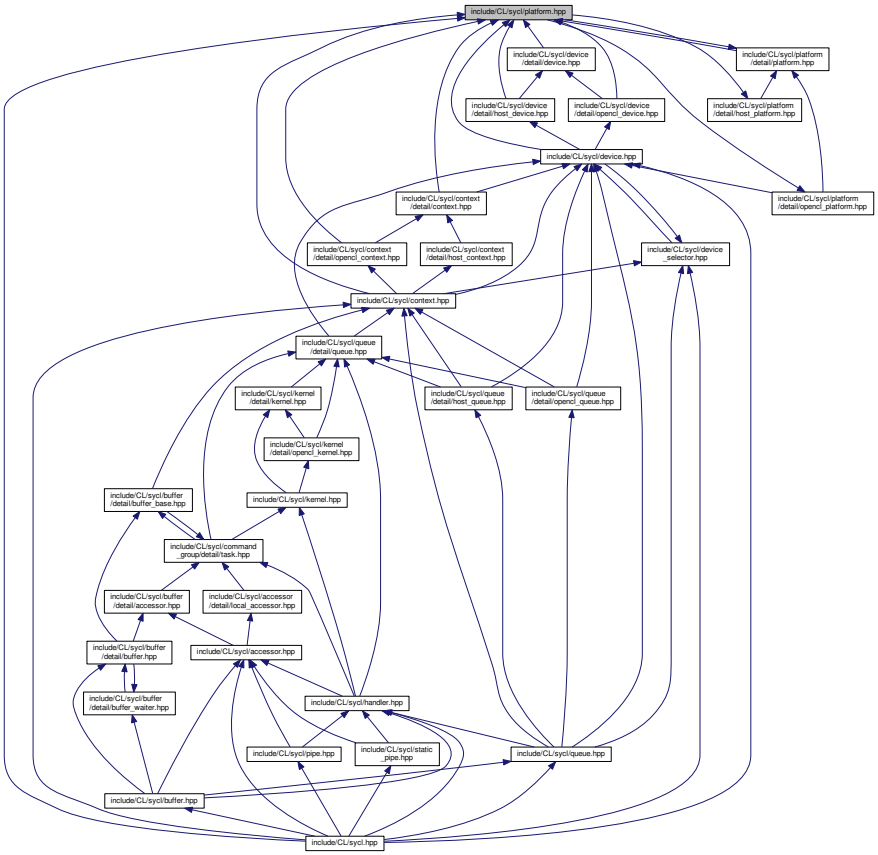
11.99 include/CL/sycl/platform.hpp File Reference

```
#include <boost/compute.hpp>
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/detail/global_config.hpp"
#include "CL/sycl/detail/shared_ptr_implementation.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/info/device.hpp"
#include "CL/sycl/platform/detail/host_platform.hpp"
#include "CL/sycl/platform/detail/opencl_platform.hpp"
#include "CL/sycl/platform/detail/platform.hpp"
```

Include dependency graph for platform.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::platform

  Abstract the OpenCL platform. More...
- struct std::hash< cl::sycl::platform >

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- std

11.100 platform.hpp

```
00001 #ifndef TRISYCL_SYCL_PLATFORM_HPP
00002 #define TRISYCL_SYCL_PLATFORM_HPP
00003
00004 /** \file The OpenCL SYCL platform
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #ifdef TRISYCL_OPENCL
00013 #include <boost/compute.hpp>
00014 #endif
00015
00016 #include "CL/sycl/detail/default_classes.hpp"
00017 #include "CL/sycl/detail/global_config.hpp"
00018
00019 #include "CL/sycl/detail/shared_ptr_implementation.hpp"
00020 #include "CL/sycl/detail/unimplemented.hpp"
00021 #include "CL/sycl/info/device.hpp"
00022 #include "CL/sycl/platform/detail/host_platform.hpp"
00023 #ifdef TRISYCL_OPENCL
00024 #include "CL/sycl/platform/detail/opencl_platform.hpp"
00025 #endif
00026 #include "CL/sycl/platform/detail/platform.hpp"
00027
00028 namespace cl {
00029 namespace sycl {
00030
00031 class device_selector;
00032 class device;
00033
00034 /** \addtogroup execution Platforms, contexts, devices and queues
00035     @{
00036 */
00037
00038 /** Abstract the OpenCL platform
00039
00040     \todo triSYCL Implementation
00041 */
00042 class platform
00043   /* Use the underlying platform implementation that can be shared in the
00044      SYCL model */
00045   : public detail::shared_ptr_implementation<platform, detail::platform> {
00046
00047   // Allows the comparison operation to access the implementation
00048   friend shared_ptr_implementation;
00049
00050 public:
00051
00052   // Make the implementation member directly accessible in this class
00053   using shared_ptr_implementation::implementation;
00054
00055   /** Default constructor for platform which is the host platform
00056
00057       Returns errors via the SYCL exception class.
00058   */
```

```
00059   platform() :
00060     shared_ptr_implementation {
      detail::host_platform::instance() } {}
00061
00062
00063 #ifdef TRISYCL_OPENCL
00064   /** Construct a platform class instance using cl_platform_id of the
00065       OpenCL device
00066
00067       Return synchronous errors via the SYCL exception class.
00068
00069       Retain a reference to the OpenCL platform.
00070   */
00071   platform(cl_platform_id platform_id)
00072     : platform { boost::compute::platform { platform_id } } {}
00073
00074
00075   /** Construct a platform class instance using a boost::compute::platform
00076
00077       This is a triSYCL extension for boost::compute interoperation.
00078
00079       Return synchronous errors via the SYCL exception class.
00080   */
00081   platform(const boost::compute::platform &p)
00082     : shared_ptr_implementation {
      detail::opencl_platform::instance(p) } {}
00083 #endif
00084
00085
00086   /**  Construct a platform object from the device selected by a device
00087        selector of the user's choice
00088
00089        Returns errors via the SYCL exception class.
00090   */
00091   explicit platform(const device_selector &dev_selector) {
00092     detail::unimplemented();
00093   }
00094
00095
00096 #ifdef TRISYCL_OPENCL
00097   /** Returns the cl_platform_id of the underlying OpenCL platform
00098
00099       If the platform is not a valid OpenCL platform, for example if it is
00100       the SYCL host, an exception is thrown
00101
00102       \todo Define a SYCL exception for this
00103   */
00104   cl_platform_id get() const {
00105     return implementation->get();
00106   }
00107
00108
00109   /** Return the underlying Boost.Compute platform if it is an
00110       OpenCL platform
00111
00112       This is a triSYCL extension
00113   */
00114   const boost::compute::platform get_boost_compute() const {
00115     return implementation->get_boost_compute();
00116   }
00117 #endif
00118
00119
00120   /// Get the list of all the platforms available to the application
00121   static vector_class<platform> get_platforms() {
00122     // Start with the default platform
00123     vector_class<platform> platforms { {} };
00124
00125 #ifdef TRISYCL_OPENCL
00126     // Then add all the OpenCL platforms
00127     for (const auto &d : boost::compute::system::platforms())
00128       platforms.emplace_back(d);
00129 #endif
00130
00131     return platforms;
00132   }
00133
00134
00135   /** Get the OpenCL information about the requested parameter
00136
00137       \todo Add to the specification
00138   */
00139   template <typename ReturnT>
00140   ReturnT get_info(info::platform param) const {
00141     // Only strings are needed here
00142     return implementation->get_info_string(param);
00143   }
```

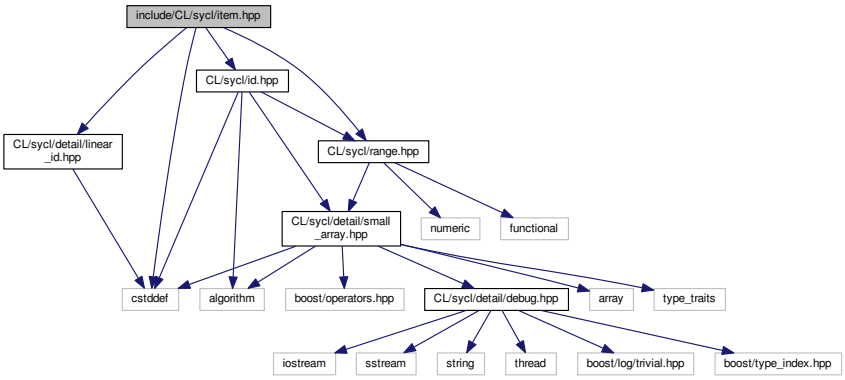
```
00144
00145
00146   /// Get the OpenCL information about the requested template parameter
00147   template <info::platform Param>
00148   typename info::param_traits<info::platform, Param>::type
00149   get_info() const {
00150     /* Forward to the implementation without using template parameter
00151        but with a parameter instead, since it is incompatible with
00152        virtual function and because fortunately only strings are
00153        needed here */
00154     return get_info<typename info::param_traits<
      info::platform,
00155                                                 Param>::type>(Param);
00156   }
00157
00158
00159   /// Test if an extension is available on the platform
00160   bool has_extension(const string_class &extension) const {
00161     return implementation->has_extension(extension);
00162   }
00163
00164
00165   /// Test if this platform is a host platform
00166   bool is_host() const {
00167     return implementation->is_host();
00168   }
00169
00170
00171   /** Get all the available devices for this platform
00172
00173       \param[in] device_type is the device type to filter the selection
00174       or \c info::device_type::all by default to return all the
00175       devices
00176
00177       \return the device list
00178   */
00179   vector_class<device>
00180   get_devices(info::device_type device_type =
      info::device_type::all) const {
00181     return implementation->get_devices(device_type);
00182   }
00183
00184 };
00185
00186 /// @} to end the execution Doxygen group
00187
00188 }
00189 }
00190
00191
00192 /* Inject a custom specialization of std::hash to have the buffer
00193    usable into an unordered associative container
00194
00195    \todo Add this to the spec
00196 */
00197 namespace std {
00198
00199 template <> struct hash<cl::sycl::platform> {
00200
00201   auto operator()(const cl::sycl::platform &p) const {
00202     // Forward the hashing to the implementation
00203     return p.hash();
00204   }
00205
00206 };
00207
00208 }
00209
00210 /*
00211     # Some Emacs stuff:
00212     ### Local Variables:
00213     ### ispell-local-dictionary: "american"
00214     ### eval: (flyspell-prog-mode)
00215     ### End:
00216 */
00217
00218 #endif // TRISYCL_SYCL_PLATFORM_HPP
```

11.101 include/CL/sycl/item.hpp File Reference

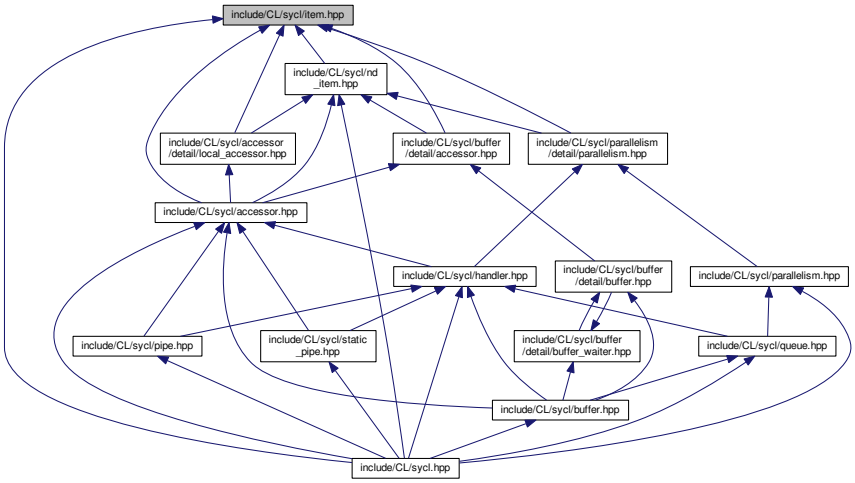
```
#include <cstddef>
#include "CL/sycl/detail/linear_id.hpp"
```

```
#include "CL/sycl/id.hpp"
#include "CL/sycl/range.hpp"
```

Include dependency graph for item.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::item< Dimensions >

  A SYCL item stores information on a work-item with some more context such as the definition range and offset. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

11.102 item.hpp

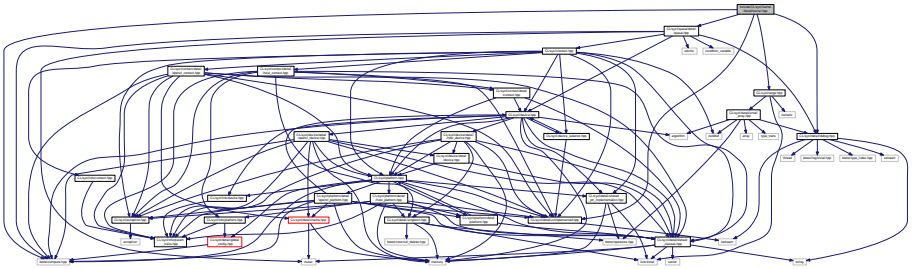
```
00001 #ifndef TRISYCL_SYCL_ITEM_HPP
00002 #define TRISYCL_SYCL_ITEM_HPP
00003
00004 /** \file The OpenCL SYCL item<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013
00014 #include "CL/sycl/detail/linear_id.hpp"
00015 #include "CL/sycl/id.hpp"
00016 #include "CL/sycl/range.hpp"
00017
00018 namespace cl {
00019 namespace sycl {
00020
00021 /** \addtogroup parallelism Expressing parallelism through kernels
00022     @{
00023 */
00024
00025 /** A SYCL item stores information on a work-item with some more context
00026     such as the definition range and offset.
00027 */
00028 template <int Dimensions = 1>
00029 class item {
00030
00031 public:
00032
00033   /// \todo add this Boost::multi_array or STL concept to the
00034   /// specification?
00035   static constexpr auto dimensionality = Dimensions;
00036
00037 private:
00038
00039   range<Dimensions> global_range;
00040   id<Dimensions> global_index;
00041   id<Dimensions> offset;
00042
00043 public:
00044
00045   /** Create an item from a local size and an optional offset
00046
00047       This constructor is used by the triSYCL implementation and the
00048       non-regression testing.
00049   */
00050   item(range<Dimensions> global_size,
00051        id<Dimensions> global_index,
00052        id<Dimensions> offset = {}) :
00053     global_range { global_size },
00054     global_index { global_index },
00055     offset { offset }
00056   {}
00057
00058
00059   /** To be able to copy and assign item, use default constructors too
00060
00061       \todo Make most of them protected, reserved to implementation
00062   */
00063   item() = default;
00064
00065
00066   /** Return the constituent local or global id<> representing the
00067       work-item's position in the iteration space
00068   */
00069   id<Dimensions> get_id() const { return global_index; }
00070
00071
00072   /** Return the requested dimension of the constituent id<> representing
00073       the work-item's position in the iteration space
00074   */
00075   size_t get_id(int dimension) const { return get_id()[dimension]; }
00076
00077
00078   /** Return the constituent id<> l-value representing the work-item's
00079       position in the iteration space in the given dimension
00080   */
00081   auto &operator[](int dimension) { return global_index[dimension]; }
00082
00083
00084   /** Returns a range<> representing the dimensions of the range of
```

```
00085       possible values of the item
00086   */
00087   range<Dimensions> get_range() const { return
      global_range; }
00088
00089
00090   /** Returns an id<> representing the n-dimensional offset provided to
00091       the parallel_for and that is added by the runtime to the global-ID
00092       of each work-item, if this item represents a global range
00093
00094       For an item representing a local range of where no offset was passed
00095       this will always return an id of all 0 values.
00096   */
00097   id<Dimensions> get_offset() const { return offset; }
00098
00099
00100   /** Return the linearized ID in the item's range
00101
00102       Computed as the flatted ID after the offset is subtracted.
00103   */
00104   size_t get_linear_id() const {
00105     return detail::linear_id(get_range(), get_id(),
      get_offset());
00106   }
00107
00108
00109   /** For the implementation, need to set the global index
00110
00111       \todo Move to private and add friends
00112   */
00113   void set(id<Dimensions> Index) { global_index = Index; }
00114
00115
00116   /// Display the value for debugging and validation purpose
00117   void display() const {
00118     global_range.display();
00119     global_index.display();
00120     offset.display();
00121   }
00122
00123 };
00124
00125 /// @} End the parallelism Doxygen group
00126
00127 }
00128 }
00129
00130 /*
00131     # Some Emacs stuff:
00132     ### Local Variables:
00133     ### ispell-local-dictionary: "american"
00134     ### eval: (flyspell-prog-mode)
00135     ### End:
00136 */
00137
00138 #endif // TRISYCL_SYCL_ITEM_HPP
```

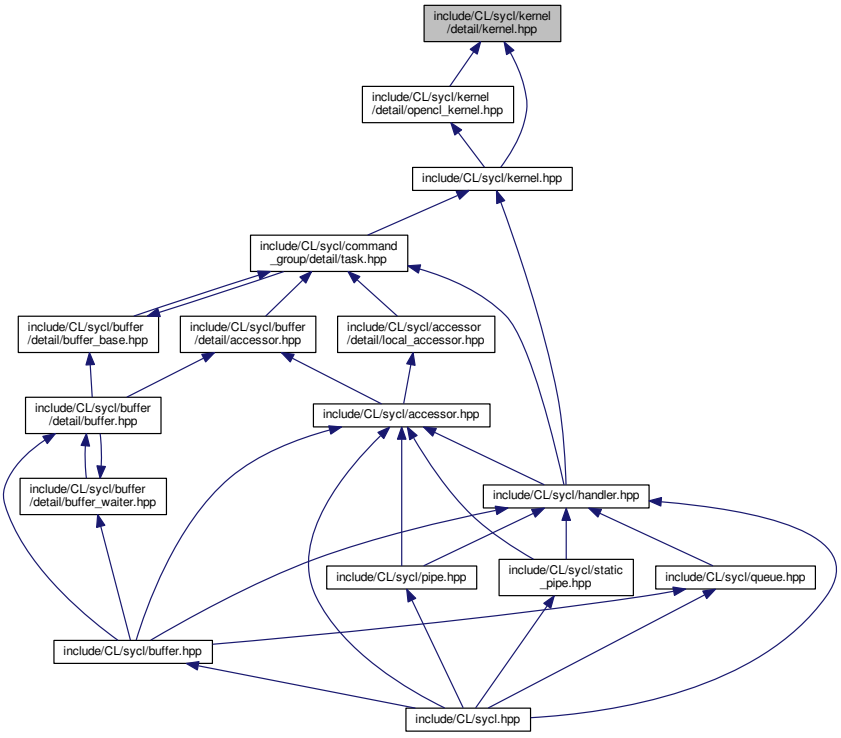
11.103 include/CL/sycl/kernel/detail/kernel.hpp File Reference

```
#include <boost/compute.hpp>
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/queue/detail/queue.hpp"
#include "CL/sycl/range.hpp"
```

Include dependency graph for kernel.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::kernel

  Abstract SYCL kernel. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Macros

- #define TRISYCL_ParallelForKernel_RANGE(N)
  Launch a kernel with a range<>

11.103.1 Macro Definition Documentation

11.103.1.1 TRISYCL_ParallelForKernel_RANGE

```
#define TRISYCL_ParallelForKernel_RANGE(
              N )
```

Value:

```
virtual void parallel_for(std::shared_ptr<detail::task> task, std::shared_ptr<detail::queue> q,
          \
                          const range<N> &num_work_items) = 0;
```

Launch a kernel with a range<>

Do not use a template since it does not work with virtual functions

Todo Think to a cleaner solution

Definition at line 63 of file kernel.hpp.

11.104 kernel.hpp

```
00001 #ifndef TRISYCL_SYCL_KERNEL_DETAIL_KERNEL_HPP
00002 #define TRISYCL_SYCL_KERNEL_DETAIL_KERNEL_HPP
00003
00004 /** \file The OpenCL SYCL kernel
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #ifdef TRISYCL_OPENCL
00013 #include <boost/compute.hpp>
00014 #endif
00015
00016 #include "CL/sycl/detail/debug.hpp"
00017 #include "CL/sycl/detail/unimplemented.hpp"
00018 //#include "CL/sycl/info/kernel.hpp"
00019 #include "CL/sycl/queue/detail/queue.hpp"
00020 #include "CL/sycl/range.hpp"
00021
00022 namespace cl {
00023 namespace sycl {
00024 namespace detail {
00025
00026 /** \addtogroup execution Platforms, contexts, devices and queues
00027     @{
00028 */
00029
00030 /// Abstract SYCL kernel
```

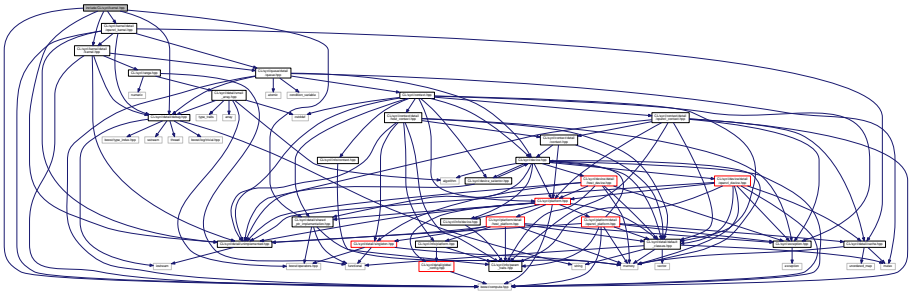
```
00031 class kernel : detail::debug<detail::kernel> {
00032
00033  public:
00034
00035 #ifdef TRISYCL_OPENCL
00036   /** Return the OpenCL kernel object for this kernel
00037
00038       Retains a reference to the returned cl_kernel object. Caller
00039       should release it when finished.
00040   */
00041   virtual cl_kernel get() const = 0;
00042
00043
00044   /** Return the Boost.Compute OpenCL kernel object for this kernel
00045
00046       This is an extension.
00047   */
00048   virtual boost::compute::kernel get_boost_compute() const = 0;
00049 #endif
00050
00051
00052   /// Launch a single task of the kernel
00053   virtual void single_task(std::shared_ptr<detail::task> task,
00054                            std::shared_ptr<detail::queue> q) = 0;
00055
00056
00057   /** Launch a kernel with a range<>
00058
00059       Do not use a template since it does not work with virtual functions
00060
00061       \todo Think to a cleaner solution
00062   */
00063 #define TRISYCL_ParallelForKernel_RANGE(N)                              \
00064   virtual void parallel_for(std::shared_ptr<detail::task> task, std::shared_ptr<detail::queue> q,     \
00065                             const range<N> &num_work_items) = 0;
00066
00067   TRISYCL_ParallelForKernel_RANGE(1)
00068   TRISYCL_ParallelForKernel_RANGE(2)
00069   TRISYCL_ParallelForKernel_RANGE(3)
00070 #undef TRISYCL_ParallelForKernel_RANGE
00071
00072
00073   /// Return the context that this kernel is defined for
00074   //virtual context get_context() const;
00075
00076   /// Return the program that this kernel is part of
00077   //virtual program get_program() const;
00078
00079   // Virtual to call the real destructor
00080   virtual ~kernel() {}
00081
00082 };
00083
00084 /// @} End the execution Doxygen group
00085
00086 }
00087 }
00088 }
00089
00090 /*
00091     # Some Emacs stuff:
00092     ### Local Variables:
00093     ### ispell-local-dictionary: "american"
00094     ### eval: (flyspell-prog-mode)
00095     ### End:
00096 */
00097
00098 #endif // TRISYCL_SYCL_DETAIL_KERNEL_KERNEL_HPP
```

11.105 include/CL/sycl/kernel.hpp File Reference

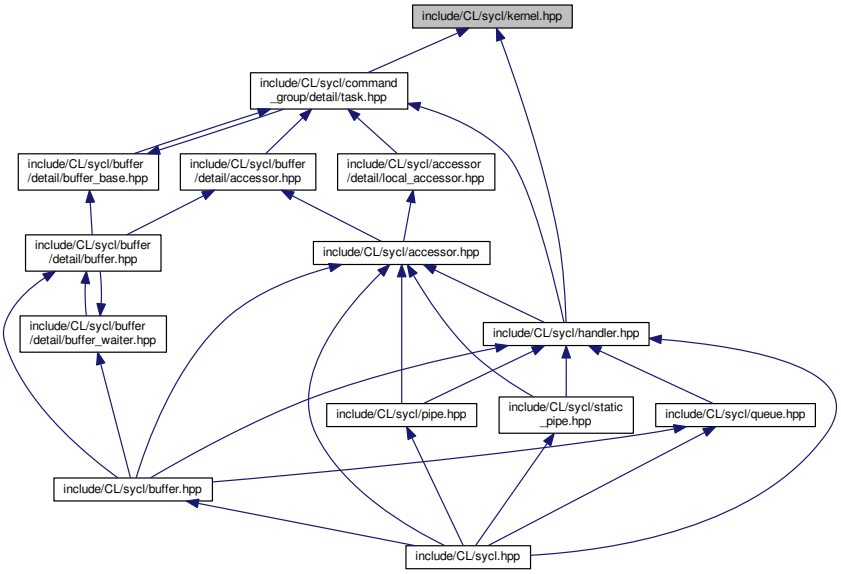
```
#include <boost/compute.hpp>
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/detail/shared_ptr_implementation.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/kernel/detail/kernel.hpp"
```

```
#include "CL/sycl/kernel/detail/opencl_kernel.hpp"
```

Include dependency graph for kernel.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::kernel

  SYCL kernel. More...
- struct std::hash< cl::sycl::kernel >

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- std

11.106 kernel.hpp

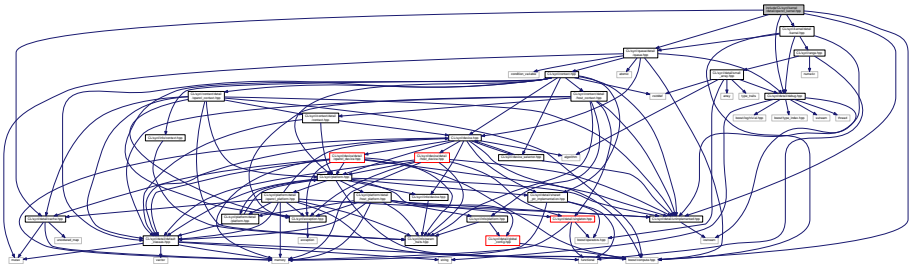
```
00001 #ifndef TRISYCL_SYCL_KERNEL_HPP
00002 #define TRISYCL_SYCL_KERNEL_HPP
00003
00004 /** \file The OpenCL SYCL kernel
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #ifdef TRISYCL_OPENCL
00013 #include <boost/compute.hpp>
00014 #endif
00015
00016 #include "CL/sycl/detail/debug.hpp"
00017 #include "CL/sycl/detail/shared_ptr_implementation.hpp"
00018 #include "CL/sycl/detail/unimplemented.hpp"
00019 //#include "CL/sycl/info/kernel.hpp"
00020 #include "CL/sycl/kernel/detail/kernel.hpp"
00021 #ifdef TRISYCL_OPENCL
00022 #include "CL/sycl/kernel/detail/opencl_kernel.hpp"
00023 #endif
00024
00025 namespace cl {
00026 namespace sycl {
00027
00028 /** \addtogroup execution Platforms, contexts, devices and queues
00029     @{
00030 */
00031
00032 /** SYCL kernel
00033
00034     \todo To be implemented
00035
00036     \todo Check specification
00037 */
00038 class kernel
00039   /* Use the underlying kernel implementation that can be shared in
00040      the SYCL model */
00041   : public detail::shared_ptr_implementation<kernel, detail::kernel> {
00042
00043   // The type encapsulating the implementation
00044   using implementation_t = typename
      kernel::shared_ptr_implementation;
00045
00046   // The handler class uses the implementation
00047   friend class handler;
00048
00049   // Allows the comparison operation to access the implementation
00050   friend implementation_t;
00051
00052  public:
00053
00054   // Make the implementation member directly accessible in this class
00055   using implementation_t::implementation;
00056
00057   /** The default object is not valid because there is no program or
00058       \code cl_kernel \endcode associated with it */
00059   kernel() = delete;
00060
00061 #ifdef TRISYCL_OPENCL
00062   /** Constructor for SYCL kernel class given an OpenCL kernel object
00063       with set arguments, valid for enqueuing
00064
00065       Retains a reference to the \p cl_kernel object. The Caller
00066       should release the passed cl_kernel object when it is no longer
00067       needed.
00068   */
00069   kernel(cl_kernel k) : kernel { boost::compute::kernel { k } } {}
00070
00071
00072   /** Construct a kernel class instance using a boost::compute::kernel
00073
00074       This is a triSYCL extension for boost::compute interoperation.
00075
00076       Return synchronous errors via the SYCL exception class.
00077   */
00078   kernel(const boost::compute::kernel &k)
00079     : implementation_t { detail::opencl_kernel::instance(k)
      } {}
00080
00081
00082   /** Return the OpenCL kernel object for this kernel
```

```
00083
00084       Retains a reference to the returned cl_kernel object. Caller
00085       should release it when finished.
00086   */
00087   cl_kernel get() const {
00088     return implementation->get();
00089   }
00090 #endif
00091
00092
00093 #if 0
00094   /// Return the context that this kernel is defined for
00095   //context get_context() const;
00096
00097   /// Return the program that this kernel is part of
00098   //program get_program() const;
00099
00100   /** Query information from the kernel object using the
00101       info::kernel_info descriptor.
00102   */
00103   template <info::kernel param>
00104   typename info::param_traits<info::kernel, param>::type
00105     get_info() const {
00106     detail::unimplemented();
00107   }
00108 #endif
00109
00110 };
00111
00112 /// @} End the execution Doxygen group
00113
00114 }
00115 }
00116
00117
00118 /* Inject a custom specialization of std::hash to have the buffer
00119    usable into an unordered associative container
00120
00121    \todo Add this to the spec
00122 */
00123 namespace std {
00124
00125 template <> struct hash<cl::sycl::kernel> {
00126
00127   auto operator()(const cl::sycl::kernel &k) const {
00128     // Forward the hashing to the implementation
00129     return k.hash();
00130   }
00131
00132 };
00133
00134 }
00135
00136 /*
00137     # Some Emacs stuff:
00138     ### Local Variables:
00139     ### ispell-local-dictionary: "american"
00140     ### eval: (flyspell-prog-mode)
00141     ### End:
00142 */
00143
00144 #endif // TRISYCL_SYCL_KERNEL_HPP
```

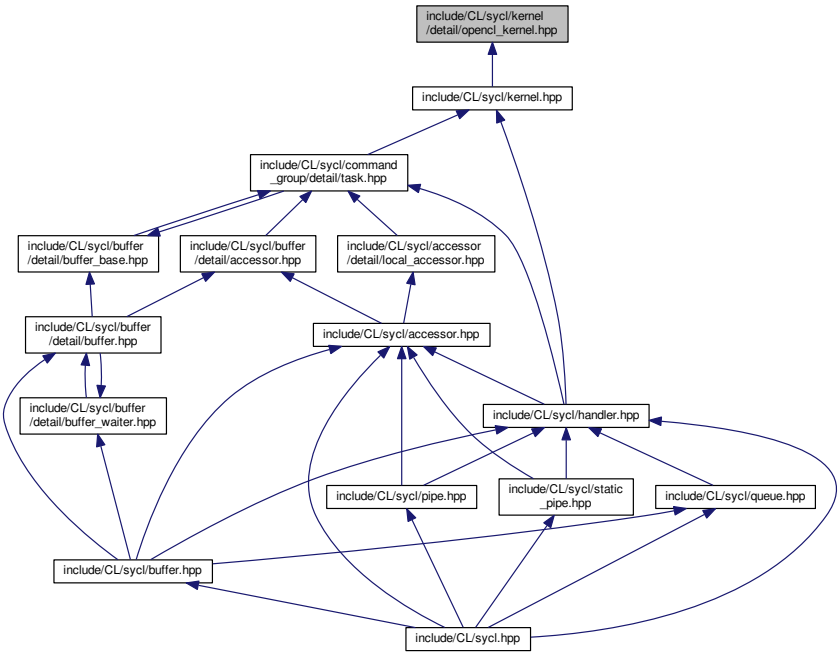
11.107 include/CL/sycl/kernel/detail/opencl_kernel.hpp File Reference

```
#include <boost/compute.hpp>
#include "CL/sycl/detail/cache.hpp"
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/kernel/detail/kernel.hpp"
#include "CL/sycl/queue/detail/queue.hpp"
```

Include dependency graph for opencl_kernel.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::opencl_kernel

  An abstraction of the OpenCL kernel.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Macros

- #define TRISYCL_ParallelForKernel_RANGE(N)

  Launch an OpenCL kernel with a range<>

11.107.1 Macro Definition Documentation

11.107.1.1 TRISYCL_ParallelForKernel_RANGE

```
#define TRISYCL_ParallelForKernel_RANGE(
              N )
```

Value:

```
void parallel_for(std::shared_ptr<detail::task> task,                \
                  std::shared_ptr<detail::queue> q,                  \
                  const range<N> &num_work_items) override {         \
    static_assert(sizeof(range<N>::value_type) == sizeof(size_t),    \
                  "num_work_items::value_type compatible with "      \
                  "Boost.Compute");                                  \
    q->get_boost_compute().enqueue_nd_range_kernel                   \
      (k,                                                            \
       static_cast<size_t>(N),                                       \
       NULL,                                                         \
       static_cast<const size_t *>(num_work_items.data()),           \
       NULL);                                                        \
    /* For now use a crude synchronization mechanism to map directly a  \
       host task to an accelerator task */                           \
    q->get_boost_compute().finish();                                 \
  };
```

Launch an OpenCL kernel with a range<>

Do not use a template since it does not work with virtual functions

Todo Think to a cleaner solution

Todo Remove either task or q

Definition at line 108 of file opencl_kernel.hpp.

11.108 opencl_kernel.hpp

```
00001 #ifndef TRISYCL_SYCL_KERNEL_DETAIL_OPENCL_KERNEL_HPP
00002 #define TRISYCL_SYCL_KERNEL_DETAIL_OPENCL_KERNEL_HPP
00003
00004 /** \file The OpenCL SYCL kernel
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #ifdef TRISYCL_OPENCL
00013 #include <boost/compute.hpp>
00014 #endif
00015
00016 #include "CL/sycl/detail/cache.hpp"
00017 #include "CL/sycl/detail/debug.hpp"
00018 #include "CL/sycl/detail/unimplemented.hpp"
00019 //#include "CL/sycl/info/kernel.hpp"
00020 #include "CL/sycl/kernel/detail/kernel.hpp"
00021 #include "CL/sycl/queue/detail/queue.hpp"
00022
00023
00024 namespace cl {
00025 namespace sycl {
00026 namespace detail {
00027
00028 /// An abstraction of the OpenCL kernel
00029 class opencl_kernel : public detail::kernel,
00030                       detail::debug<opencl_kernel> {
00031
00032   /// Use the Boost Compute abstraction of the OpenCL kernel
00033   boost::compute::kernel k;
00034
00035   /** A cache to always return the same alive kernel for a given
00036       OpenCL kernel
00037
00038       C++11 guaranties the static construction is thread-safe
00039   */
00040   static detail::cache<cl_kernel, detail::opencl_kernel>
      cache;
00041
00042   opencl_kernel(const boost::compute::kernel &k) : k { k } {}
00043
00044  public:
00045
00046   ///// Get a singleton instance of the opencl_device
00047   static std::shared_ptr<opencl_kernel>
00048   instance(const boost::compute::kernel &k) {
00049     return cache.get_or_register(k.get(),
00050                                  [&] { return new opencl_kernel { k }; });
00051   }
00052
00053   /** Return the underlying OpenCL object
00054
00055       \todo Improve the spec to deprecate C OpenCL host API and move
00056       to C++ instead to avoid this ugly ownership management
00057   */
00058   cl_kernel get() const override {
00059     /// \todo Test error and throw. Externalize this feature in Boost.Compute?
00060     clRetainKernel(k);
00061     return k.get();
00062   }
00063
00064
00065   /** Return the Boost.Compute OpenCL kernel object for this kernel
00066
00067       This is an extension.
00068   */
00069   boost::compute::kernel get_boost_compute() const override {
00070     return k;
00071   }
00072
00073
00074   //context get_context() const override
00075
00076   //program get_program() const override
00077
00078 #if 0
00079   template <info::kernel param>
00080   typename info::param_traits<info::kernel, param>::type
00081   get_info() const {
00082     detail::unimplemented();
00083   }
```

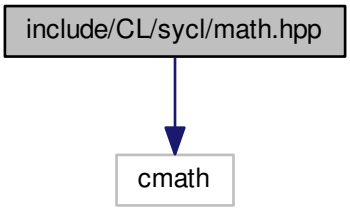
```
00084 #endif
00085
00086
00087   /** Launch a single task of the OpenCL kernel
00088
00089       \todo Remove either task or q
00090    */
00091   void single_task(std::shared_ptr<detail::task> task,
00092                    std::shared_ptr<detail::queue> q) override {
00093     q->get_boost_compute().enqueue_task(k);
00094     /* For now use a crude synchronization mechanism to map directly a
00095        host task to an accelerator task */
00096     q->get_boost_compute().finish();
00097   }
00098
00099
00100   /** Launch an OpenCL kernel with a range<>
00101
00102       Do not use a template since it does not work with virtual functions
00103
00104       \todo Think to a cleaner solution
00105
00106       \todo Remove either task or q
00107   */
00108 #define TRISYCL_ParallelForKernel_RANGE(N)                              \
00109   void parallel_for(std::shared_ptr<detail::task> task,                 \
00110                     std::shared_ptr<detail::queue> q,                   \
00111                     const range<N> &num_work_items) override {          \
00112     static_assert(sizeof(range<N>::value_type) == sizeof(size_t),       \
00113                   "num_work_items::value_type compatible with "         \
00114                   "Boost.Compute");                                     \
00115     q->get_boost_compute().enqueue_nd_range_kernel                      \
00116       (k,                                                               \
00117        static_cast<size_t>(N),                                          \
00118        NULL,                                                            \
00119        static_cast<const size_t *>(num_work_items.data()),              \
00120        NULL);                                                           \
00121     /* For now use a crude synchronization mechanism to map directly a  \
00122        host task to an accelerator task */                              \
00123     q->get_boost_compute().finish();                                    \
00124   };
00125
00126   TRISYCL_ParallelForKernel_RANGE(1)
00127   TRISYCL_ParallelForKernel_RANGE(2)
00128   TRISYCL_ParallelForKernel_RANGE(3)
00129 #undef TRISYCL_ParallelForKernel_RANGE
00130
00131
00132   /// Unregister from the cache on destruction
00133   ~opencl_kernel() override {
00134     cache.remove(k.get());
00135   }
00136
00137 };
00138
00139 /* Allocate the cache here but since this is a pure-header library,
00140    use a weak symbol so that only one remains when SYCL headers are
00141    used in different compilation units of a program
00142 */
00143 TRISYCL_WEAK_ATTRIB_PREFIX
00144 detail::cache<cl_kernel, detail::opencl_kernel>
      opencl_kernel::cache
00145 TRISYCL_WEAK_ATTRIB_SUFFIX;
00146
00147 }
00148 }
00149 }
00150
00151 /*
00152     # Some Emacs stuff:
00153     ### Local Variables:
00154     ### ispell-local-dictionary: "american"
00155     ### eval: (flyspell-prog-mode)
00156     ### End:
00157 */
00158
00159 #endif // TRISYCL_SYCL_KERNEL_DETAIL_OPENCL_KERNEL_HPP
```

11.109 include/CL/sycl/math.hpp File Reference

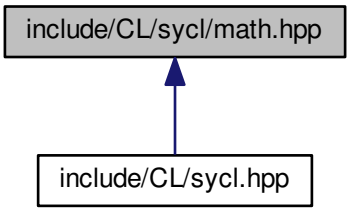
Implement a wrapper around OpenCL math operations Joan.Thibault AT ens-rennes POINT fr This file is distributed under the University of Illinois Open Source License.

```
#include <cmath>
```

Include dependency graph for math.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Macros

- #define TRISYCL_MATH_WRAP(FUN)
- #define TRISYCL_MATH_WRAP2(FUN)
- #define TRISYCL_MATH_WRAP2s(FUN)
- #define TRISYCL_MATH_WRAP3(FUN)
- #define TRISYCL_MATH_WRAP3s(FUN)
- #define TRISYCL_MATH_WRAP3ss(FUN)

Functions

- cl::sycl::TRISYCL_MATH_WRAP (abs) TRISYCL_MATH_WRAP(atan) TRISYCL_MATH_WRAP2s(fmax) TRISYCL_MATH_WRAP2s(fmin) TRISYCL_MATH_WRAP2s(frexp) template< typename T > T max(T x
- template<typename T >
  T cl::sycl::min (T x, T y, T z)
- cl::sycl::TRISYCL_MATH_WRAP2s (modf) TRISYCL_MATH_WRAP3s(remquo) TRISYCL_MATH_WRAP2(rotate) namespace native

Variables

- T cl::sycl::y
- T T cl::sycl::z

11.109.1 Detailed Description

Implement a wrapper around OpenCL math operations Joan.Thibault AT ens-rennes POINT fr This file is distributed under the University of Illinois Open Source License.

See LICENSE.TXT for details.

Definition in file math.hpp.

11.109.2 Macro Definition Documentation

11.109.2.1 TRISYCL_MATH_WRAP

```
#define TRISYCL_MATH_WRAP(
              FUN )
```

Value:

```
template<typename T>                          \
  T FUN(T x) {                                \
    return std::FUN(x);                       \
  }
```

Definition at line 25 of file math.hpp.

11.109.2.2 TRISYCL_MATH_WRAP2

```
#define TRISYCL_MATH_WRAP2(
              FUN )
```

Value:

```
template<typename T>                          \
  T FUN(T x, T y) {                                                  \
    return std::FUN(x, y);                                           \
  }
```

Definition at line 29 of file math.hpp.

11.109.2.3 TRISYCL_MATH_WRAP2s

```
#define TRISYCL_MATH_WRAP2s(
              FUN )
```

Value:

```
template<typename T, typename U>              \
  T FUN(T x, U y) {                                                  \
    return std::FUN(x, y);                                           \
  }
```

Definition at line 33 of file math.hpp.

11.109.2.4 TRISYCL_MATH_WRAP3

```
#define TRISYCL_MATH_WRAP3(
              FUN )
```

Value:

```
template<typename T>                          \
  T FUN(T x, T y, T z) {                                             \
    return std::FUN(x, y, z);                                        \
  }
```

Definition at line 37 of file math.hpp.

11.109.2.5 TRISYCL_MATH_WRAP3s

```
#define TRISYCL_MATH_WRAP3s(
              FUN )
```

Value:

```
template<typename T, typename U>              \
  T FUN(T x, T y, U z) {                                                \
    return std::FUN(x, y, z);                                           \
  }
```

Definition at line 41 of file math.hpp.

11.109.2.6 TRISYCL_MATH_WRAP3ss

```
#define TRISYCL_MATH_WRAP3ss(
              FUN )
```

Value:

```
template<typename T, typename U>             \
  T FUN(T x, U y, U z) {                                                \
    return std::FUN(x, y, z);                                           \
  }
```

Definition at line 45 of file math.hpp.

11.110 math.hpp

```
00001 #ifndef TRISYCL_SYCL_MATH_HPP
00002 #define TRISYCL_SYCL_MATH_HPP
00003
00004 /** \file
00005     Implement a wrapper around OpenCL math operations
00006     Joan.Thibault AT ens-rennes POINT fr
00007     This file is distributed under the University of Illinois Open Source
00008     License. See LICENSE.TXT for details.
00009 */
00010
00011 #include <cmath>
00012
00013 // Include order and configure insensitive treating of unwanted macros
00014 #ifdef _MSC_VER
00015   #ifdef min
00016     #undef min
00017   #endif
00018   #ifdef max
00019     #undef max
00020   #endif
00021 #endif
00022
00023 namespace cl {
00024 namespace sycl {
00025 #define TRISYCL_MATH_WRAP(FUN) template<typename T>                     \
00026   T FUN(T x) {                                                          \
00027     return std::FUN(x);                                                 \
00028   }
00029 #define TRISYCL_MATH_WRAP2(FUN) template<typename T>                    \
00030   T FUN(T x, T y) {                                                     \
00031     return std::FUN(x, y);                                              \
00032   }
```

```
00033 #define TRISYCL_MATH_WRAP2s(FUN) template<typename T, typename U>              \
00034   T FUN(T x, U y) {                                                           \
00035     return std::FUN(x, y);                                                    \
00036   }
00037 #define TRISYCL_MATH_WRAP3(FUN) template<typename T>                          \
00038   T FUN(T x, T y, T z) {                                                      \
00039     return std::FUN(x, y, z);                                                 \
00040   }
00041 #define TRISYCL_MATH_WRAP3s(FUN) template<typename T, typename U>             \
00042   T FUN(T x, T y, U z) {                                                      \
00043     return std::FUN(x, y, z);                                                 \
00044   }
00045 #define TRISYCL_MATH_WRAP3ss(FUN) template<typename T, typename U>            \
00046   T FUN(T x, U y, U z) {                                                      \
00047     return std::FUN(x, y, z);                                                 \
00048   }
00049
00050 TRISYCL_MATH_WRAP(abs)//I
00051 //*TRISYCL_MATH_WRAP2(abs_diff)//I
00052 //*TRISYCL_MATH_WRAP2(add_sat)//I
00053 TRISYCL_MATH_WRAP(acos)
00054 TRISYCL_MATH_WRAP(acosh)
00055 //*TRISYCL_MATH_WRAP(acospi)
00056 TRISYCL_MATH_WRAP(asin)
00057 TRISYCL_MATH_WRAP(asinh)
00058 //*TRISYCL_MATH_WRAP(asinpi)
00059 TRISYCL_MATH_WRAP(atan) // atan(y/x)
00060 TRISYCL_MATH_WRAP2(atan2)
00061 TRISYCL_MATH_WRAP(atanh)
00062 //*TRISYCL_MATH_WRAP(atanpi)
00063 //*TRISYCL_MATH_WRAP2(atan2pi)
00064 TRISYCL_MATH_WRAP(cbrt)
00065 TRISYCL_MATH_WRAP(ceil)
00066 //*TRISYCL_MATH_WRAP3ss(clamp)//I
00067 //geninteger clamp(geninteger, sgeninteger, sgeninteger)
00068 //*TRISYCL_MATH_WRAP(clz)
00069 TRISYCL_MATH_WRAP2(copysign)
00070 TRISYCL_MATH_WRAP(cos)
00071 TRISYCL_MATH_WRAP(cosh)
00072 //*TRISYCL_MATH_WRAP(cospi)
00073 TRISYCL_MATH_WRAP(erfc)
00074 TRISYCL_MATH_WRAP(erf)
00075 TRISYCL_MATH_WRAP(exp)
00076 TRISYCL_MATH_WRAP(exp2)
00077 //*TRISYCL_MATH_WRAP(exp10)
00078 TRISYCL_MATH_WRAP(expm1)
00079 TRISYCL_MATH_WRAP(fabs)
00080 TRISYCL_MATH_WRAP2(fdim)
00081 TRISYCL_MATH_WRAP(floor)
00082 TRISYCL_MATH_WRAP3(fma)
00083 /* genfloat fmax ( genfloat x, genfloat y)
00084  * genfloat fmax ( genfloat x, sgenfloat y)
00085  */
00086 TRISYCL_MATH_WRAP2s(fmax)
00087 TRISYCL_MATH_WRAP2s(fmin)
00088 TRISYCL_MATH_WRAP2(fmod)
00089 //*TRISYCL_MATH_WRAP2s(fract)
00090 TRISYCL_MATH_WRAP2s(frexp)
00091 //*TRISYCL_MATH_WRAP(hadd)
00092 TRISYCL_MATH_WRAP2(hypot)
00093 //log
00094 //ilogb
00095 //ldexp
00096 TRISYCL_MATH_WRAP(lgamma)
00097 //*TRISYCL_MATH_WRAP2s(lgamma_r)
00098 TRISYCL_MATH_WRAP(log)
00099 TRISYCL_MATH_WRAP(log2)
00100 TRISYCL_MATH_WRAP(log10)
00101 TRISYCL_MATH_WRAP(log1p)
00102 TRISYCL_MATH_WRAP(logb)
00103 //*TRISYCL_MATH_WRAP3(mad)
00104 //*TRISYCL_MATH_WRAP3(mad_hi)//I
00105 //*TRISYCL_MATH_WRAP3(mad_sat)
00106 //
00107 //TRISYCL_MATH_WRAP3s(max) //I
00108 template<typename T>
00109 T max(T x, T y, T z) {
00110   return std::max(x, std::max(y, z));
00111 }
00112 /* geninteger max (geninteger, geninteger)
00113  * geninteger max (geninteger, sgeninteger)
00114  */
00115
00116 //*TRISYCL_MATH_WRAP2(maxmag)
00117 //
00118 //TRISYCL_MATH_WRAP3s(min) //I
00119 template<typename T>
```

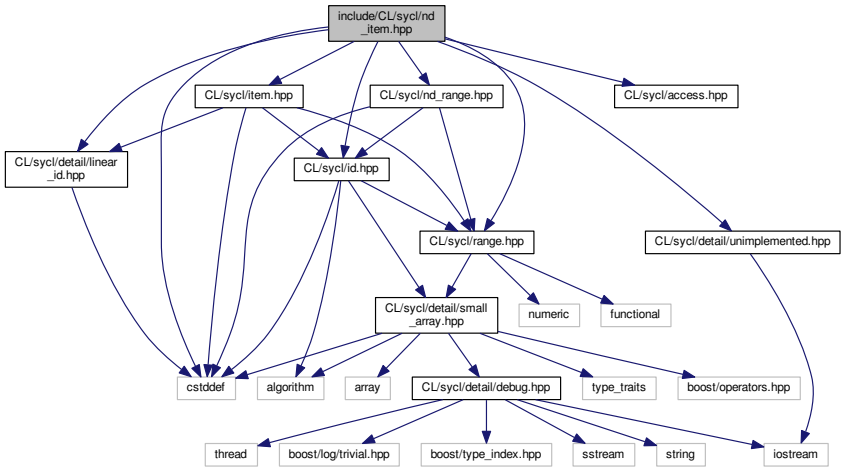
```
00120 T min(T x, T y, T z) {
00121   return std::min(x, std::min(y, z));
00122 }
00123 /* geninteger min (geninteger, geninteger)
00124  * geninteger min (geninteger, sgeninteger)
00125  */
00126
00127 //*TRISYCL_MATH_WRAP2(minmag)
00128 TRISYCL_MATH_WRAP2s(modf)
00129 //*TRISYCL_MATH_WRAP2(mul_hi)//I
00130 //nan
00131 TRISYCL_MATH_WRAP2(pow)
00132 //*TRISYCL_MATH_WRAP2s(posn)
00133 //*TRISYCL_MATH_WRAP2(powr)
00134 TRISYCL_MATH_WRAP2(remainder)
00135 TRISYCL_MATH_WRAP3s(remquo)
00136 //*TRISYCL_MATH_WRAP(rhadd)//I
00137 TRISYCL_MATH_WRAP(rint)
00138 //*TRISYCL_MATH_WRAP3s(rootn)
00139 TRISYCL_MATH_WRAP2(rotate)//I
00140 TRISYCL_MATH_WRAP(round)
00141 //*TRISYCL_MATH_WRAP(rsqrt)
00142 TRISYCL_MATH_WRAP(sin)
00143 //*TRISYCL_MATH_WRAP2s(sincos)
00144 TRISYCL_MATH_WRAP(sinh)
00145 //*TRISYCL_MATH_WRAP(sinpi)
00146 TRISYCL_MATH_WRAP(sqrt)
00147 //*TRISYCL_MATH_WRAP2(sub_sat)
00148 TRISYCL_MATH_WRAP(tan)
00149 TRISYCL_MATH_WRAP(tanh)
00150 //*TRISYCL_MATH_WRAP(tanpi)
00151 TRISYCL_MATH_WRAP(tgamma)
00152 TRISYCL_MATH_WRAP(trunc)
00153 /* Integer concatenation
00154  * shortn upsample (charn hi, ucharn lo)
00155  * ushortn upsample (ucharn hi, ucharn lo)
00156  * intn upsample (shortn hi, ushortn lo)
00157  * uintn upsample (ushortn hi, ushortn lo)
00158  * longlongn upsample(intn hi, uintn lo)
00159  * ulonglongn upsample(uintn hi, uintn l)
00160  */
00161 //*TRISYCL_MATH_WRAP(popcount)//I
00162 //*TRISYCL_MATH_WRAP3(mad24)
00163 //*TRISYCL_MATH_WRAP3(mul24)
00164
00165 //
00166 namespace native {
00167 TRISYCL_MATH_WRAP(cos)
00168 //*TRISYCL_MATH_WRAP2(divide)
00169 TRISYCL_MATH_WRAP(exp)
00170 TRISYCL_MATH_WRAP(exp2)
00171 //*TRISYCL_MATH_WRAP(exp10)
00172 TRISYCL_MATH_WRAP(log)
00173 TRISYCL_MATH_WRAP(log2)
00174 TRISYCL_MATH_WRAP(log10)
00175 //*TRISYCL_MATH_WRAP(powr)
00176 //*TRISYCL_MATH_WRAP(recip)
00177 //*TRISYCL_MATH_WRAP(rsqrt)
00178 TRISYCL_MATH_WRAP(sin)
00179 TRISYCL_MATH_WRAP(sqrt)
00180 TRISYCL_MATH_WRAP(tan)
00181 }
00182 #undef TRISYCL_MATH_WRAP
00183 #undef TRISYCL_MATH_WRAP2
00184 #undef TRISYCL_MATH_WRAP2s
00185 #undef TRISYCL_MATH_WRAP3
00186 #undef TRISYCL_MATH_WRAP3s
00187 #undef TRISYCL_MATH_WRAP3ss
00188
00189 }
00190 }
00191
00192 #endif
```

11.111 include/CL/sycl/nd_item.hpp File Reference

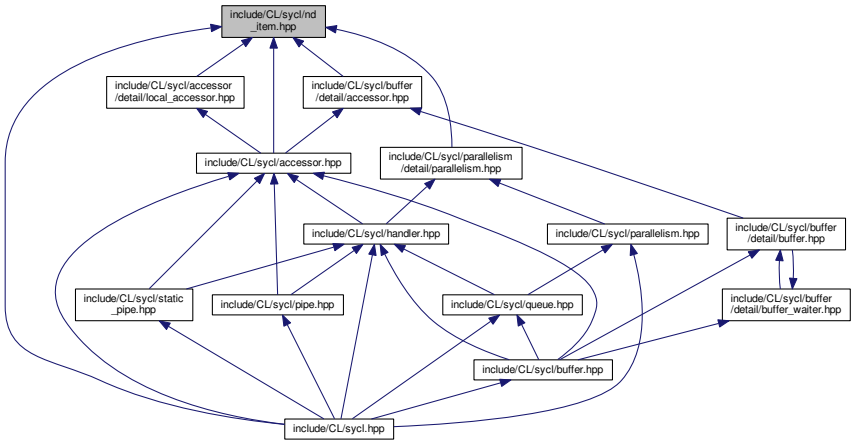
```
#include <cstddef>
#include "CL/sycl/access.hpp"
#include "CL/sycl/detail/linear_id.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
```

```
#include "CL/sycl/id.hpp"
#include "CL/sycl/item.hpp"
#include "CL/sycl/nd_range.hpp"
#include "CL/sycl/range.hpp"
```

Include dependency graph for nd_item.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::nd_item< Dimensions >

  A SYCL nd_item stores information on a work-item within a work-group, with some more context such as the definition ranges. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

11.112 nd_item.hpp

```
00001 #ifndef TRISYCL_SYCL_ND_ITEM_HPP
00002 #define TRISYCL_SYCL_ND_ITEM_HPP
00003
00004 /** \file The OpenCL SYCL nd_item<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013
00014 #include "CL/sycl/access.hpp"
00015 #include "CL/sycl/detail/linear_id.hpp"
00016 #include "CL/sycl/detail/unimplemented.hpp"
00017 #include "CL/sycl/id.hpp"
00018 #include "CL/sycl/item.hpp"
00019 #include "CL/sycl/nd_range.hpp"
00020 #include "CL/sycl/range.hpp"
00021
00022 namespace cl {
00023 namespace sycl {
00024
00025 /** \addtogroup parallelism Expressing parallelism through kernels
00026     @{
00027 */
00028
00029 /** A SYCL nd_item stores information on a work-item within a work-group,
00030     with some more context such as the definition ranges.
00031 */
00032 template <int Dimensions = 1>
00033 struct nd_item {
00034   /// \todo add this Boost::multi_array or STL concept to the
00035   /// specification?
00036   static constexpr auto dimensionality = Dimensions;
00037
00038 private:
00039
00040   id<Dimensions> global_index;
00041   /* This is a cached value since it can be computed from global_index and
00042      ND_range */
00043   id<Dimensions> local_index;
00044   nd_range<Dimensions> ND_range;
00045
00046 public:
00047
00048   /** Create an empty nd_item<> from an nd_range<>
00049
00050       \todo This is for the triSYCL implementation which is expected to
00051       call set_global() and set_local() later. This should be hidden to
00052       the user.
00053   */
00054   nd_item(nd_range<Dimensions> ndr) : ND_range { ndr } {}
00055
00056
00057   /** Create a full nd_item
00058
00059       \todo This is for validation purpose. Hide this to the programmer
00060       somehow
00061   */
00062   nd_item(id<Dimensions> global_index,
00063           nd_range<Dimensions> ndr) :
00064     global_index { global_index },
00065     // Compute the local index using the offset and the group size
00066     local_index
00067       { (global_index - ndr.get_offset())%id<Dimensions> { ndr.get_local() } },
00068     ND_range { ndr }
00069   {}
00070
00071
00072   /** To be able to copy and assign nd_item, use default constructors too
00073
00074       \todo Make most of them protected, reserved to implementation
00075   */
00076   nd_item() = default;
00077
00078
00079   /** Return the constituent global id representing the work-item's
00080       position in the global iteration space
00081   */
00082   id<Dimensions> get_global() const { return
      global_index; }
00083
```

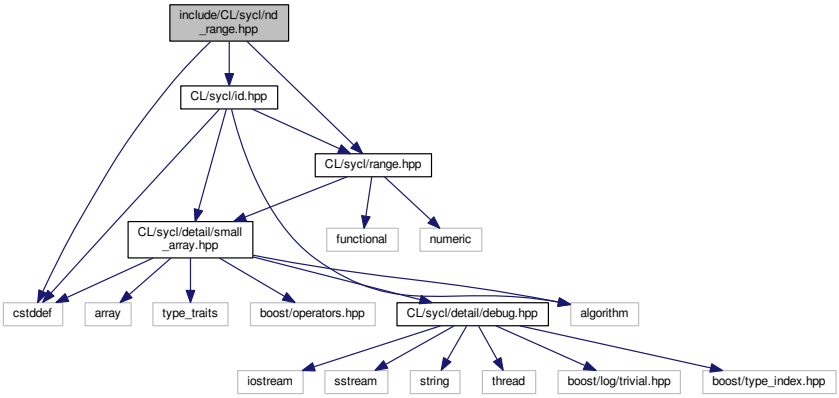
```
00084
00085   /** Return the constituent element of the global id representing the
00086       work-item's position in the global iteration space in the given
00087       dimension
00088   */
00089   size_t get_global(int dimension) const { return get_global()[dimension]; }
00090
00091
00092   /** Return the flattened id of the current work-item after subtracting
00093       the offset
00094   */
00095   size_t get_global_linear_id() const {
00096     return detail::linear_id(get_global_range(),
      get_global(), get_offset());
00097   }
00098
00099
00100   /** Return the constituent local id representing the work-item's
00101       position within the current work-group
00102   */
00103   id<Dimensions> get_local() const { return local_index; }
00104
00105
00106   /** Return the constituent element of the local id representing the
00107       work-item's position within the current work-group in the given
00108       dimension
00109   */
00110   size_t get_local(int dimension) const { return get_local()[dimension]; }
00111
00112
00113   /** Return the flattened id of the current work-item within the current
00114       work-group
00115    */
00116   size_t get_local_linear_id() const {
00117     return detail::linear_id(get_local_range(),
      get_local());
00118   }
00119
00120
00121   /** Return the constituent group group representing the work-group's
00122       position within the overall nd_range
00123   */
00124   id<Dimensions> get_group() const {
00125     /* Convert get_local_range() to an id<> to remove ambiguity into using
00126        implicit conversion either from range<> to id<> or the opposite */
00127     return get_global()/id<Dimensions> { get_local_range() };
00128   }
00129
00130
00131   /** Return the constituent element of the group id representing the
00132       work-group;s position within the overall nd_range in the given
00133       dimension.
00134   */
00135   size_t get_group(int dimension) const {
00136     return get_group()[dimension];
00137   }
00138
00139
00140   /// Return the flattened id of the current work-group
00141   size_t get_group_linear_id() const {
00142     return detail::linear_id(get_num_groups(),
      get_group());
00143   }
00144
00145
00146   /// Return the number of groups in the nd_range
00147   id<Dimensions> get_num_groups() const {
00148     return get_nd_range().get_group();
00149   }
00150
00151   /// Return the number of groups for dimension in the nd_range
00152   size_t get_num_groups(int dimension) const {
00153      return get_num_groups()[dimension];
00154   }
00155
00156
00157   /// Return a range<> representing the dimensions of the nd_range<>
00158   range<Dimensions> get_global_range() const {
00159     return get_nd_range().get_global();
00160   }
00161
00162
00163   /// Return a range<> representing the dimensions of the current work-group
00164   range<Dimensions> get_local_range() const {
00165     return get_nd_range().get_local();
00166   }
00167
```

```
00168
00169   /** Return an id<> representing the n-dimensional offset provided to the
00170       constructor of the nd_range<> and that is added by the runtime to the
00171       global-ID of each work-item
00172   */
00173   id<Dimensions> get_offset() const { return
      get_nd_range().get_offset(); }
00174
00175
00176   /// Return the nd_range<> of the current execution
00177   nd_range<Dimensions> get_nd_range() const { return
      ND_range; }
00178
00179
00180   /** Allows projection down to an item
00181
00182       \todo Add to the specification
00183   */
00184   item<Dimensions> get_item() const {
00185     return { get_global_range(), get_global(),
      get_offset() };
00186   }
00187
00188
00189   /** Execute a barrier with memory ordering on the local address space,
00190       global address space or both based on the value of flag
00191
00192       The current work-item will wait at the barrier until all work-items
00193       in the current work-group have reached the barrier.
00194
00195       In addition, the barrier performs a fence operation ensuring that all
00196       memory accesses in the specified address space issued before the
00197       barrier complete before those issued after the barrier
00198   */
00199   void barrier(access::fence_space flag =
00200                access::fence_space::global_and_local) const {
00201 #if defined(_OPENMP) && !defined(TRISYCL_NO_BARRIER)
00202     /* Use OpenMP barrier in the implementation with 1 OpenMP thread per
00203        work-item of the work-group */
00204 #pragma omp barrier
00205 #else
00206     // \todo To be implemented efficiently otherwise
00207     detail::unimplemented();
00208 #endif
00209   }
00210
00211
00212   // For the triSYCL implementation, need to set the local index
00213   void set_local(id<Dimensions> Index) { local_index = Index; }
00214
00215
00216   // For the triSYCL implementation, need to set the global index
00217   void set_global(id<Dimensions> Index) { global_index = Index; }
00218
00219 };
00220
00221 /// @} End the parallelism Doxygen group
00222
00223 }
00224 }
00225
00226 /*
00227     # Some Emacs stuff:
00228     ### Local Variables:
00229     ### ispell-local-dictionary: "american"
00230     ### eval: (flyspell-prog-mode)
00231     ### End:
00232 */
00233
00234 #endif // TRISYCL_SYCL_ND_ITEM_HPP
```

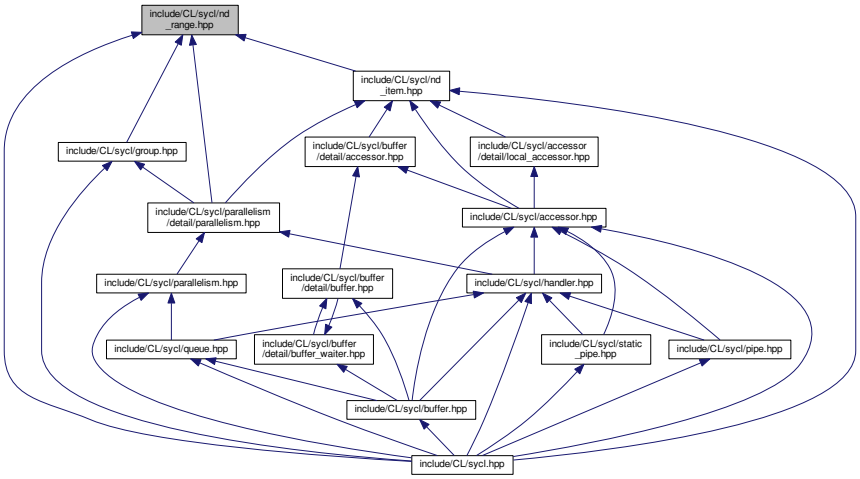
11.113 include/CL/sycl/nd_range.hpp File Reference

```
#include <cstddef>
#include "CL/sycl/id.hpp"
#include "CL/sycl/range.hpp"
```

Include dependency graph for nd_range.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::nd_range< Dimensions >

  A ND-range, made by a global and local range, to specify work-group and work-item organization. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

11.114 nd_range.hpp

```
00001 #ifndef TRISYCL_SYCL_ND_RANGE_HPP
00002 #define TRISYCL_SYCL_ND_RANGE_HPP
00003
00004 /** \file The OpenCL SYCL nd_range<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013
00014 #include "CL/sycl/id.hpp"
00015 #include "CL/sycl/range.hpp"
00016
00017 namespace cl {
00018 namespace sycl {
00019
00020 /** \addtogroup parallelism Expressing parallelism through kernels
00021     @{
00022 */
00023
00024 /** A ND-range, made by a global and local range, to specify work-group
00025     and work-item organization.
00026
00027     The local offset is used to translate the iteration space origin if
00028     needed.
00029
00030     \todo add copy constructors in the specification
00031 */
00032 template <int Dimensions = 1>
00033 struct nd_range {
00034   /// \todo add this Boost::multi_array or STL concept to the
00035   /// specification?
00036   static constexpr auto dimensionality = Dimensions;
00037
00038 private:
00039
00040   range<dimensionality> global_range;
00041   range<dimensionality> local_range;
00042   id<dimensionality> offset;
00043
00044 public:
00045
00046   /** Construct a ND-range with all the details available in OpenCL
00047
00048       By default use a zero offset, that is iterations start at 0
00049    */
00050   nd_range(range<Dimensions> global_size,
00051            range<Dimensions> local_size,
00052            id<Dimensions> offset = {}) :
00053     global_range { global_size }, local_range { local_size }, offset { offset }
00054   { }
00055
00056
00057   /// Get the global iteration space range
00058   range<Dimensions> get_global() const { return
      global_range; }
00059
00060
00061   /// Get the local part of the iteration space range
00062   range<Dimensions> get_local() const { return
      local_range; }
00063
00064
00065   /// Get the range of work-groups needed to run this ND-range
00066   auto get_group() const {
00067     /* This is basically global_range/local_range, round up to the
00068        next integer, in case the global range is not a multiple of the
00069        local range. Note this is a motivating example to build a range
00070        from a scalar with a broadcasting constructor. */
00071     return (global_range + local_range - range<Dimensions>{ 1 })/local_range;
00072   }
00073
00074
00075   /// \todo get_offset() is lacking in the specification
00076   id<Dimensions> get_offset() const { return offset; }
00077
00078
00079   /// Display the value for debugging and validation purpose
00080   void display() const {
00081     global_range.display();
00082     local_range.display();
```

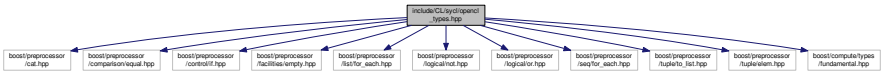
```
00083     offset.display();
00084   }
00085
00086 };
00087
00088 /// @} End the parallelism Doxygen group
00089
00090 }
00091 }
00092
00093 /*
00094     # Some Emacs stuff:
00095     ### Local Variables:
00096     ### ispell-local-dictionary: "american"
00097     ### eval: (flyspell-prog-mode)
00098     ### End:
00099 */
00100
00101 #endif // TRISYCL_SYCL_ND_RANGE_HPP
```

11.115 include/CL/sycl/opencl_types.hpp File Reference

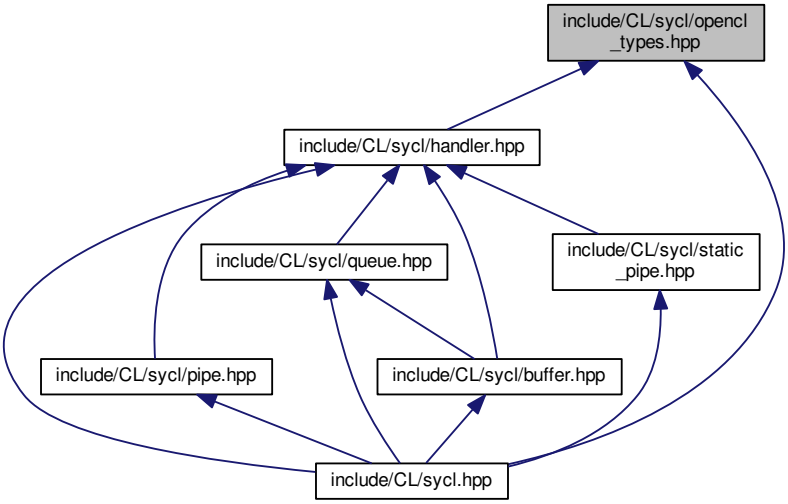
triSYCL wrapper for OpenCL types

```
#include <boost/preprocessor/cat.hpp>
#include <boost/preprocessor/comparison/equal.hpp>
#include <boost/preprocessor/control/if.hpp>
#include <boost/preprocessor/facilities/empty.hpp>
#include <boost/preprocessor/list/for_each.hpp>
#include <boost/preprocessor/logical/not.hpp>
#include <boost/preprocessor/logical/or.hpp>
#include <boost/preprocessor/seq/for_each.hpp>
#include <boost/preprocessor/tuple/to_list.hpp>
#include <boost/preprocessor/tuple/elem.hpp>
#include <boost/compute/types/fundamental.hpp>
```

Include dependency graph for opencl_types.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::is_wrapper< T >

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Macros

- #define TRISYCL_SCALAR_TYPES
- #define TRISYCL_TYPE_NAME(T) BOOST_PP_TUPLE_ELEM(3, 0, T)
- #define TRISYCL_TYPE_CL_NAME(T) BOOST_PP_TUPLE_ELEM(3, 1, T)
- #define TRISYCL_TYPE_ACTUAL_NAME(T) BOOST_PP_TUPLE_ELEM(3, 2, T)
- #define TRISYCL_SIZED_NAME(T, size)
- #define TRISYCL_IS_WRAPPER_TRAIT(type) template <> struct is_wrapper<type> : std::true_type {};
- #define TRISYCL_WRAPPER_CLASS_2(cl_type, boost_name, scalar_type)
- #define TRISYCL_WRAPPER_CLASS_3(cl_type, boost_name, scalar_type)
- #define TRISYCL_WRAPPER_CLASS_4(cl_type, boost_name, scalar_type)
- #define TRISYCL_BOOST_COMPUTE_NAME(scalar, size) TRISYCL_SIZED_NAME(boost::compute::TR↩ ISYCL_TYPE_NAME(scalar), size)
- #define TRISYCL_TYPEDEF_TYPE(cl_type, boost_name, scalar_type) using cl_type = boost_name##_;
- #define TRISYCL_H_DEFINE_TYPE(cl_type, boost_name, scalar_type, i)
- #define TRISYCL_DEFINE_TYPES(scalar, i)
- #define TRISYCL_DECLARE_CL_TYPES(r, data, scalar)

11.115.1 Detailed Description

triSYCL wrapper for OpenCL types

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Definition in file opencl_types.hpp.

11.115.2 Macro Definition Documentation

11.115.2.1 TRISYCL_BOOST_COMPUTE_NAME

```
#define TRISYCL_BOOST_COMPUTE_NAME(
              scalar,
              size ) TRISYCL_SIZED_NAME(boost::compute::TRISYCL_TYPE_NAME(scalar), size)
```

Definition at line 137 of file opencl_types.hpp.

11.115.2.2 TRISYCL_DECLARE_CL_TYPES

```
#define TRISYCL_DECLARE_CL_TYPES(
              r,
              data,
              scalar )
```

Value:

```
TRISYCL_DEFINE_TYPES(scalar, 1)                                          \
  TRISYCL_DEFINE_TYPES(scalar, 2)                                          \
  TRISYCL_DEFINE_TYPES(scalar, 3)                                          \
  TRISYCL_DEFINE_TYPES(scalar, 4)                                          \
  TRISYCL_DEFINE_TYPES(scalar, 8)                                          \
  TRISYCL_DEFINE_TYPES(scalar, 16)
```

Definition at line 168 of file opencl_types.hpp.

11.115.2.3 TRISYCL_DEFINE_TYPES

```
#define TRISYCL_DEFINE_TYPES(
              scalar,
              i )
```

Value:

```
TRISYCL_H_DEFINE_TYPE(TRISYCL_SIZED_NAME(
      TRISYCL_TYPE_CL_NAME(scalar), i),   \
                    TRISYCL_BOOST_COMPUTE_NAME(scalar, i),                \
                    TRISYCL_TYPE_ACTUAL_NAME(scalar), i)
```

Definition at line 158 of file opencl_types.hpp.

11.115.2.4 TRISYCL_H_DEFINE_TYPE

```
#define TRISYCL_H_DEFINE_TYPE(
              cl_type,
              boost_name,
              scalar_type,
              i )
```

Value:

```
BOOST_PP_IF(BOOST_PP_EQUAL(i, 1), TRISYCL_TYPEDEF_TYPE,                    \
              BOOST_PP_IF(BOOST_PP_EQUAL(i, 2), TRISYCL_WRAPPER_CLASS_2,     \
                          BOOST_PP_IF(BOOST_PP_EQUAL(i, 3),                  \
                                      TRISYCL_WRAPPER_CLASS_3,               \
                                      BOOST_PP_IF(BOOST_PP_EQUAL(i, 4),      \
                                                  TRISYCL_WRAPPER_CLASS_4,   \
                                                  TRISYCL_TYPEDEF_TYPE))))   \
  (cl_type, boost_name, scalar_type)
```

Definition at line 147 of file opencl_types.hpp.

11.115.2.5 TRISYCL_IS_WRAPPER_TRAIT

```
#define TRISYCL_IS_WRAPPER_TRAIT(
              type ) template <> struct is_wrapper<type> :  std::true_type {};
```

Definition at line 83 of file opencl_types.hpp.

11.115.2.6 TRISYCL_SCALAR_TYPES

```
#define TRISYCL_SCALAR_TYPES
```

Value:

```
BOOST_PP_TUPLE_TO_LIST(                                                    \
    10,                                                                      \
    (                                                                        \
      ( char   ,cl_char,   char),                                            \
      ( uchar  ,cl_uchar,  unsigned char),                                   \
      ( short  ,cl_short,  short int),                                       \
      ( ushort ,cl_ushort, unsigned short int),                              \
      ( int    ,cl_int,    int),                                             \
      ( uint   ,cl_uint,   unsigned int),                                    \
      ( long   ,cl_long,   long int),                                        \
      ( ulong  ,cl_ulong,  unsigned long int),                               \
      ( float  ,cl_float,  float),                                           \
      ( double ,cl_double, double)                                           \
      )                                                                      \
    )
```

Definition at line 36 of file opencl_types.hpp.

11.115.2.7 TRISYCL_SIZED_NAME

```
#define TRISYCL_SIZED_NAME(
              T,
              size )
```

Value:

```
BOOST_PP_IF(                                                    \
    BOOST_PP_EQUAL(size, 1), T,                                   \
    BOOST_PP_CAT(T, size))
```

Definition at line 59 of file opencl_types.hpp.

11.115.2.8 TRISYCL_TYPE_ACTUAL_NAME

```
#define TRISYCL_TYPE_ACTUAL_NAME(
              T ) BOOST_PP_TUPLE_ELEM(3, 2, T)
```

Definition at line 56 of file opencl_types.hpp.

11.115.2.9 TRISYCL_TYPE_CL_NAME

```
#define TRISYCL_TYPE_CL_NAME(
              T ) BOOST_PP_TUPLE_ELEM(3, 1, T)
```

Definition at line 55 of file opencl_types.hpp.

11.115.2.10 TRISYCL_TYPE_NAME

```
#define TRISYCL_TYPE_NAME(
              T ) BOOST_PP_TUPLE_ELEM(3, 0, T)
```

Definition at line 54 of file opencl_types.hpp.

11.115.2.11 TRISYCL_TYPEDEF_TYPE

```
#define TRISYCL_TYPEDEF_TYPE(
              cl_type,
              boost_name,
              scalar_type ) using cl_type = boost_name##_;
```

Definition at line 143 of file opencl_types.hpp.

11.115.2.12 TRISYCL_WRAPPER_CLASS_2

```
#define TRISYCL_WRAPPER_CLASS_2(
              cl_type,
              boost_name,
              scalar_type )
```

Value:

```
class cl_type {                                                                 \
    ::cl_type self;                                                               \
                                                                                  \
  public:                                                                         \
    cl_type () = default;                                                         \
    cl_type (::cl_type self_) : self { self_ } {}                                 \
    cl_type (scalar_type x, scalar_type y) : self { x, y } {}                     \
    auto& x() { return self.s[0]; }                                               \
    auto& y() { return self.s[1]; }                                               \
    auto& unwrap() const { return self; }};                                       \
  TRISYCL_IS_WRAPPER_TRAIT(cl_type)
```

Definition at line 91 of file opencl_types.hpp.

11.115.2.13 TRISYCL_WRAPPER_CLASS_3

```
#define TRISYCL_WRAPPER_CLASS_3(
              cl_type,
              boost_name,
              scalar_type )
```

Value:

```
class cl_type {                                                                 \
    ::cl_type self;                                                               \
                                                                                  \
  public:                                                                         \
    cl_type () = default;                                                         \
    cl_type (::cl_type self_) : self { self_ } {}                                 \
    cl_type (scalar_type x, scalar_type y, scalar_type z) :                       \
      self { x, y, z } {}                                                         \
    auto& x() { return self.s[0]; }                                               \
    auto& y() { return self.s[1]; }                                               \
    auto& z() { return self.s[2]; }                                               \
    auto& unwrap() const { return self; }};                                       \
  TRISYCL_IS_WRAPPER_TRAIT(cl_type)
```

Definition at line 104 of file opencl_types.hpp.

11.115.2.14 TRISYCL_WRAPPER_CLASS_4

```
#define TRISYCL_WRAPPER_CLASS_4(
              cl_type,
              boost_name,
              scalar_type )
```

Value:

```
class cl_type {                                                                 \
    ::cl_type self;                                                               \
                                                                                  \
  public:                                                                         \
    cl_type () = default;                                                         \
    cl_type (::cl_type self_) : self { self_ } {}                                 \
    cl_type (scalar_type x, scalar_type y, scalar_type z, scalar_type w) :        \
      self { x, y, z, w } {}                                                      \
    auto& x() { return self.s[0]; }                                               \
    auto& y() { return self.s[1]; }                                               \
    auto& z() { return self.s[2]; }                                               \
    auto& w() { return self.s[3]; }                                               \
    auto& unwrap() const { return self; }};                                       \
  TRISYCL_IS_WRAPPER_TRAIT(cl_type)
```

Definition at line 119 of file opencl_types.hpp.

11.116 opencl_types.hpp

```
00001 #ifndef TRISYCL_SYCL_OPENCL_TYPES_HPP
00002 #define TRISYCL_SYCL_OPENCL_TYPES_HPP
00003
00004 /** \file
00005     triSYCL wrapper for OpenCL types
00006
00007     Joan DOT Thibault AT ens-rennes DOT fr
00008     a.doumoulakis AT gmail DOT com
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 #include <boost/preprocessor/cat.hpp>
00015 #include <boost/preprocessor/comparison/equal.hpp>
00016 #include <boost/preprocessor/control/if.hpp>
00017 #include <boost/preprocessor/facilities/empty.hpp>
00018 #include <boost/preprocessor/list/for_each.hpp>
00019 #include <boost/preprocessor/logical/not.hpp>
00020 #include <boost/preprocessor/logical/or.hpp>
00021 #include <boost/preprocessor/seq/for_each.hpp>
00022 #include <boost/preprocessor/tuple/to_list.hpp>
00023 #include <boost/preprocessor/tuple/elem.hpp>
00024
00025 #ifdef TRISYCL_OPENCL
00026 #include <boost/compute/types/fundamental.hpp>
00027 #else
00028 #include "CL/sycl/vec.hpp"
00029 #endif
00030
00031
00032 namespace cl {
00033 namespace sycl {
00034
00035 // List of the cl_types that will be iterated upon to generate the vector types
00036 #define TRISYCL_SCALAR_TYPES                                                  \
00037   BOOST_PP_TUPLE_TO_LIST(                                                     \
00038     10,                                                                       \
00039     (                                                                         \
00040       ( char   ,cl_char,   char),                                             \
00041       ( uchar  ,cl_uchar,  unsigned char),                                    \
00042       ( short  ,cl_short,  short int),                                        \
00043       ( ushort ,cl_ushort, unsigned short int),                               \
00044       ( int    ,cl_int,    int),                                              \
00045       ( uint   ,cl_uint,   unsigned int),                                     \
00046       ( long   ,cl_long,   long int),                                         \
```

```
00047       ( ulong  ,cl_ulong,  unsigned long int),                                 \
00048       ( float  ,cl_float,  float),                                            \
00049       ( double ,cl_double, double)                                            \
00050       )                                                                       \
00051     )
00052
00053 // Accessors to get the type name, the cl_type name and the actual type
00054 #define TRISYCL_TYPE_NAME(T)         BOOST_PP_TUPLE_ELEM(3, 0, T)
00055 #define TRISYCL_TYPE_CL_NAME(T)      BOOST_PP_TUPLE_ELEM(3, 1, T)
00056 #define TRISYCL_TYPE_ACTUAL_NAME(T)  BOOST_PP_TUPLE_ELEM(3, 2, T)
00057
00058 // Return the name of the type concatenated with the size unless the size is 1
00059 #define TRISYCL_SIZED_NAME(T, size)                                           \
00060   BOOST_PP_IF(                                                                \
00061     BOOST_PP_EQUAL(size, 1), T,                                               \
00062     BOOST_PP_CAT(T, size))
00063
00064 #ifndef TRISYCL_OPENCL
00065
00066 /* If we are not using Boost Compute we just every cl_type with its \c vec
00067    equivalent
00068 */
00069 #define TRISYCL_DEFINE_TYPES(scalar, i)                                       \
00070   using TRISYCL_SIZED_NAME(TRISYCL_TYPE_CL_NAME(scalar), i) =                 \
00071     BOOST_PP_CAT(TRISYCL_TYPE_NAME(scalar), i);
00072
00073 #else
00074
00075 /* When passing the arguments to Boost Compute, we need to know if we have to
00076    unwrap our type and give Boost Compute the actual OpenCL type. To do this
00077    we define this meta-function that returns true if \c T is a wrapper type
00078    to an OpenCL type. For example \c is_wrapper<cl::sycl::int3>::value == true
00079 */
00080 template<class T>
00081 struct is_wrapper : std::false_type {};
00082
00083 #define TRISYCL_IS_WRAPPER_TRAIT(type)                                        \
00084 template <> struct is_wrapper<type> : std::true_type {};
00085
00086 /* We define 3 different wrapper classes around OpenCL types.
00087    These classes allow us to use t.x() and t.y() for vector types of size 2.
00088    And in addition we can also use t.z() and t.w() for vector types of size
00089    3 and 4 similarly to OpenCL vector types
00090 */
00091 #define TRISYCL_WRAPPER_CLASS_2(cl_type, boost_name, scalar_type)             \
00092   class cl_type {                                                             \
00093     ::cl_type self;                                                           \
00094                                                                               \
00095   public:                                                                     \
00096     cl_type () = default;                                                     \
00097     cl_type (::cl_type self_) : self { self_ } {}                             \
00098     cl_type (scalar_type x, scalar_type y) : self { x, y } {}                 \
00099     auto& x() { return self.s[0]; }                                           \
00100     auto& y() { return self.s[1]; }                                           \
00101     auto& unwrap() const { return self; }};                                   \
00102   TRISYCL_IS_WRAPPER_TRAIT(cl_type)
00103
00104 #define TRISYCL_WRAPPER_CLASS_3(cl_type, boost_name, scalar_type)             \
00105   class cl_type {                                                             \
00106     ::cl_type self;                                                           \
00107                                                                               \
00108   public:                                                                     \
00109     cl_type () = default;                                                     \
00110     cl_type (::cl_type self_) : self { self_ } {}                             \
00111     cl_type (scalar_type x, scalar_type y, scalar_type z) :                   \
00112       self { x, y, z } {}                                                     \
00113     auto& x() { return self.s[0]; }                                           \
00114     auto& y() { return self.s[1]; }                                           \
00115     auto& z() { return self.s[2]; }                                           \
00116     auto& unwrap() const { return self; }};                                   \
00117   TRISYCL_IS_WRAPPER_TRAIT(cl_type)
00118
00119 #define TRISYCL_WRAPPER_CLASS_4(cl_type, boost_name, scalar_type)             \
00120   class cl_type {                                                             \
00121     ::cl_type self;                                                           \
00122                                                                               \
00123   public:                                                                     \
00124     cl_type () = default;                                                     \
00125     cl_type (::cl_type self_) : self { self_ } {}                             \
00126     cl_type (scalar_type x, scalar_type y, scalar_type z, scalar_type w) :    \
00127       self { x, y, z, w } {}                                                  \
00128     auto& x() { return self.s[0]; }                                           \
00129     auto& y() { return self.s[1]; }                                           \
00130     auto& z() { return self.s[2]; }                                           \
00131     auto& w() { return self.s[3]; }                                           \
00132     auto& unwrap() const { return self; }};                                   \
00133   TRISYCL_IS_WRAPPER_TRAIT(cl_type)
```

```
00134
00135
00136 // Return the Boost Compute type for OpenCL vector types
00137 #define TRISYCL_BOOST_COMPUTE_NAME(scalar, size)                                \
00138   TRISYCL_SIZED_NAME(boost::compute::TRISYCL_TYPE_NAME(scalar), size)
00139
00140 /* For vector types of size above 4 and 1 we typedef the vector type with
00141    its Boost Compute equivalent
00142 */
00143 #define TRISYCL_TYPEDEF_TYPE(cl_type, boost_name, scalar_type)                   \
00144   using cl_type = boost_name##_;
00145
00146 // Helper macro to properly define each OpenCL type
00147 #define TRISYCL_H_DEFINE_TYPE(cl_type, boost_name, scalar_type, i)              \
00148   BOOST_PP_IF(BOOST_PP_EQUAL(i, 1), TRISYCL_TYPEDEF_TYPE,                       \
00149               BOOST_PP_IF(BOOST_PP_EQUAL(i, 2), TRISYCL_WRAPPER_CLASS_2,        \
00150                           BOOST_PP_IF(BOOST_PP_EQUAL(i, 3),                     \
00151                                       TRISYCL_WRAPPER_CLASS_3,                  \
00152                                       BOOST_PP_IF(BOOST_PP_EQUAL(i, 4),         \
00153                                                   TRISYCL_WRAPPER_CLASS_4,      \
00154                                                   TRISYCL_TYPEDEF_TYPE))))      \
00155   (cl_type, boost_name, scalar_type)
00156
00157 // Helper macro to properly define each OpenCL type
00158 #define TRISYCL_DEFINE_TYPES(scalar, i)                                         \
00159   TRISYCL_H_DEFINE_TYPE(TRISYCL_SIZED_NAME(TRISYCL_TYPE_CL_NAME(scalar), i),    \
00160                         TRISYCL_BOOST_COMPUTE_NAME(scalar, i),                  \
00161                         TRISYCL_TYPE_ACTUAL_NAME(scalar), i)
00162
00163 #endif
00164
00165 /* We declare vector types of sizes 1,2,3,4,8 and 16 as per
00166    the SYCL specification
00167 */
00168 #define TRISYCL_DECLARE_CL_TYPES(r, data, scalar)                               \
00169   TRISYCL_DEFINE_TYPES(scalar, 1)                                               \
00170   TRISYCL_DEFINE_TYPES(scalar, 2)                                               \
00171   TRISYCL_DEFINE_TYPES(scalar, 3)                                               \
00172   TRISYCL_DEFINE_TYPES(scalar, 4)                                               \
00173   TRISYCL_DEFINE_TYPES(scalar, 8)                                               \
00174   TRISYCL_DEFINE_TYPES(scalar, 16)
00175
00176 // Generate the vector types for all listed scalar types
00177 BOOST_PP_LIST_FOR_EACH(TRISYCL_DECLARE_CL_TYPES, _,
      TRISYCL_SCALAR_TYPES)
00178
00179 } // sycl
00180 } // cl
00181
00182
00183 // Undef macros to avoid name collision
00184 #undef TRISYCL_SCALAR_TYPES
00185 #undef TRISYCL_TYPE_NAME
00186 #undef TRISYCL_TYPE_CL_NAME
00187 #undef TRISYCL_TYPE_ACTUAL_NAME
00188 #undef TRISYCL_SIZED_NAME
00189 #undef TRISYCL_IS_WRAPPER_TRAIT
00190 #undef TRISYCL_WRAPPER_CLASS_2
00191 #undef TRISYCL_WRAPPER_CLASS_3
00192 #undef TRISYCL_WRAPPER_CLASS_4
00193 #undef TRISYCL_BOOST_COMPUTE_NAME
00194 #undef TRISYCL_TYPEDEF_TYPE
00195 #undef TRISYCL_DEFINE_TYPES
00196 #undef TRISYCL_DECLARE_CL_TYPES
00197
00198 /*
00199     # Some Emacs stuff:
00200     ### Local Variables:
00201     ### ispell-local-dictionary: "american"
00202     ### eval: (flyspell-prog-mode)
00203     ### End:
00204 */
00205
00206 #endif // TRISYCL_SYCL_OPENCL_TYPES_HPP
```

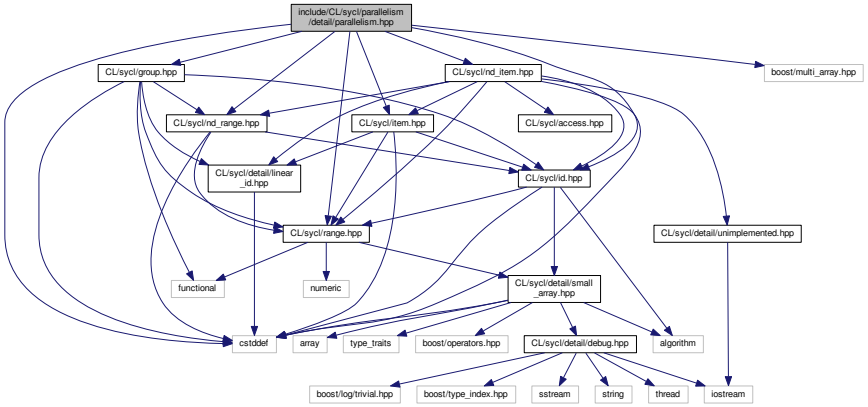
11.117 include/CL/sycl/parallelism/detail/parallelism.hpp File Reference

Implement the detail of the parallel constructions to launch kernels.

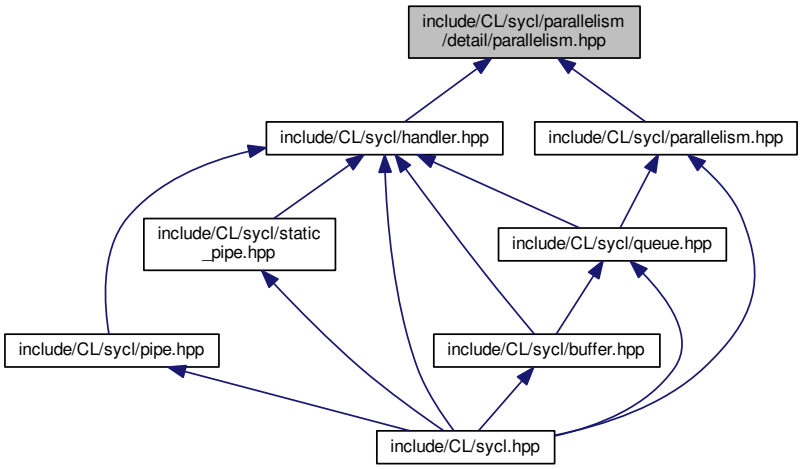
```
#include <cstddef>
#include <boost/multi_array.hpp>
```

```
#include "CL/sycl/group.hpp"
#include "CL/sycl/id.hpp"
#include "CL/sycl/item.hpp"
#include "CL/sycl/nd_item.hpp"
#include "CL/sycl/nd_range.hpp"
#include "CL/sycl/range.hpp"
```

Include dependency graph for parallelism.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::parallel_for_iterate< level, Range, ParallelForFunctor, Id >

  A recursive multi-dimensional iterator that ends up calling f. More...
- struct cl::sycl::detail::parallel_OpenMP_for_iterate< level, Range, ParallelForFunctor, Id >

  A top-level recursive multi-dimensional iterator variant using OpenMP. More...
- struct cl::sycl::detail::parallel_for_iterate< 0, Range, ParallelForFunctor, Id >

  Stop the recursion when level reaches 0 by simply calling the kernel functor with the constructed id. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

Functions

- template<int Dimensions = 1, typename ParallelForFunctor , typename Id >
  void cl::sycl::detail::parallel_for (range< Dimensions > r, ParallelForFunctor f, Id)

  Implementation of a data parallel computation with parallelism specified at launch time by a range<>.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for (range< Dimensions > r, ParallelForFunctor f, item< Dimensions >)

  Implementation of a data parallel computation with parallelism specified at launch time by a range<>.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for (range< Dimensions > r, ParallelForFunctor f)

  Calls the appropriate ternary parallel_for overload based on the index type of the kernel function object f.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for_global_offset (range< Dimensions > global_size, id< Dimensions > offset, ParallelForFunctor f)

  Implementation of parallel_for with a range<> and an offset.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for (nd_range< Dimensions > r, ParallelForFunctor f)

  Implement a variation of parallel_for to take into account a nd_range<>
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for_workgroup (nd_range< Dimensions > r, ParallelForFunctor f)

  Implement the loop on the work-groups.
- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::detail::parallel_for_workitem (const group< Dimensions > &g, ParallelForFunctor f)

  Implement the loop on the work-items inside a work-group.

11.117.1 Detailed Description

Implement the detail of the parallel constructions to launch kernels.

Ronan at keryell dot FR

Definition in file parallelism.hpp.

11.118 parallelism.hpp

```
00001 #ifndef TRISYCL_SYCL_PARALLELISM_DETAIL_PARALLELISM_HPP
00002 #define TRISYCL_SYCL_PARALLELISM_DETAIL_PARALLELISM_HPP
00003
00004 /** \file
00005
00006     Implement the detail of the parallel constructions to launch kernels
00007
00008     Ronan at keryell dot FR
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 #include <cstddef>
00015 #include <boost/multi_array.hpp>
00016
00017 #include "CL/sycl/group.hpp"
00018 #include "CL/sycl/id.hpp"
00019 #include "CL/sycl/item.hpp"
00020 #include "CL/sycl/nd_item.hpp"
00021 #include "CL/sycl/nd_range.hpp"
00022 #include "CL/sycl/range.hpp"
00023
00024 #ifdef _OPENMP
00025 #include <omp.h>
00026 #endif
00027
00028
00029 /** \addtogroup parallelism
00030     @{
00031 */
00032
00033 namespace cl {
00034 namespace sycl {
00035 namespace detail {
00036
00037
00038 /** A recursive multi-dimensional iterator that ends up calling f
00039
00040     The iteration order may be changed later.
00041
00042     Since partial specialization of function template is not possible in
00043     C++14, use a class template instead with everything in the
00044     constructor.
00045 */
00046 template <std::size_t level,
00047           typename Range,
00048           typename ParallelForFunctor,
00049           typename Id>
00050 struct parallel_for_iterate {
00051   parallel_for_iterate(Range r, ParallelForFunctor &f, Id &index) {
00052     for (boost::multi_array_types::index _sycl_index = 0,
00053            _sycl_end = r[Range::dimensionality - level];
00054          _sycl_index < _sycl_end;
00055          _sycl_index++) {
00056       // Set the current value of the index for this dimension
00057       index[Range::dimensionality - level] = _sycl_index;
00058       // Iterate further on lower dimensions
00059       parallel_for_iterate<level - 1,
00060                            Range,
00061                            ParallelForFunctor,
00062                            Id> { r, f, index };
00063     }
00064   }
00065 };
00066
00067
00068 /** A top-level recursive multi-dimensional iterator variant using OpenMP
00069
00070     Only the top-level loop uses OpenMP and goes on with the normal
00071     recursive multi-dimensional.
00072 */
00073 template <std::size_t level,
00074           typename Range,
00075           typename ParallelForFunctor,
00076           typename Id>
00077 struct parallel_OpenMP_for_iterate {
00078   parallel_OpenMP_for_iterate(Range r, ParallelForFunctor &f) {
00079     // Create the OpenMP threads before the for-loop to avoid creating an
00080     // index in each iteration
00081 #pragma omp parallel
00082     {
00083       // Allocate an OpenMP thread-local index
00084       Id index;
```

```
00085       // Make a simple loop end condition for OpenMP
00086       boost::multi_array_types::index _sycl_end =
00087         r[Range::dimensionality - level];
00088       /* Distribute the iterations on the OpenMP threads. Some OpenMP
00089          "collapse" could be useful for small iteration space, but it
00090          would need some template specialization to have real contiguous
00091          loop nests */
00092 #pragma omp for
00093       for (boost::multi_array_types::index _sycl_index = 0;
00094            _sycl_index < _sycl_end;
00095            _sycl_index++) {
00096         // Set the current value of the index for this dimension
00097         index[Range::dimensionality - level] = _sycl_index;
00098         // Iterate further on lower dimensions
00099         parallel_for_iterate<level - 1,
00100                              Range,
00101                              ParallelForFunctor,
00102                              Id> { r, f, index };
00103       }
00104     }
00105   }
00106 };
00107
00108
00109 /** Stop the recursion when level reaches 0 by simply calling the
00110     kernel functor with the constructed id */
00111 template <typename Range, typename ParallelForFunctor, typename Id>
00112 struct parallel_for_iterate<0, Range, ParallelForFunctor, Id> {
00113   parallel_for_iterate(Range r, ParallelForFunctor &f, Id &index) {
00114     f(index);
00115   }
00116 };
00117
00118
00119 /** Implementation of a data parallel computation with parallelism
00120     specified at launch time by a range<>. Kernel index is id or int.
00121
00122     This implementation use OpenMP 3 if compiled with the right flag.
00123 */
00124 template <int Dimensions = 1, typename ParallelForFunctor, typename Id>
00125 void parallel_for(range<Dimensions> r,
00126                   ParallelForFunctor f,
00127                   Id) {
00128 #ifdef _OPENMP
00129   // Use OpenMP for the top loop level
00130   parallel_OpenMP_for_iterate<Dimensions,
00131                               range<Dimensions>,
00132                               ParallelForFunctor,
00133                               id<Dimensions>> { r, f };
00134 #else
00135   // In a sequential execution there is only one index processed at a time
00136   id<Dimensions> index;
00137   parallel_for_iterate<Dimensions,
00138                        range<Dimensions>,
00139                        ParallelForFunctor,
00140                        id<Dimensions>> { r, f, index };
00141 #endif
00142 }
00143
00144
00145 /** Implementation of a data parallel computation with parallelism
00146     specified at launch time by a range<>. Kernel index is item.
00147
00148     This implementation use OpenMP 3 if compiled with the right flag.
00149 */
00150 template <int Dimensions = 1, typename ParallelForFunctor>
00151 void parallel_for(range<Dimensions> r,
00152                   ParallelForFunctor f,
00153                   item<Dimensions>) {
00154   auto reconstruct_item = [&] (id<Dimensions> l) {
00155     // Reconstruct the global item
00156     item<Dimensions> index { r, l };
00157     // Call the user kernel with the item<> instead of the id<>
00158     f(index);
00159   };
00160 #ifdef _OPENMP
00161   // Use OpenMP for the top loop level
00162   parallel_OpenMP_for_iterate<Dimensions,
00163                               range<Dimensions>,
00164                               decltype(reconstruct_item),
00165                               id<Dimensions>> { r, reconstruct_item };
00166 #else
00167   // In a sequential execution there is only one index processed at a time
00168   id<Dimensions> index;
00169   parallel_for_iterate<Dimensions,
00170                        range<Dimensions>,
00171                        decltype(reconstruct_item),
```

```
00172                       id<Dimensions>> { r, reconstruct_item, index };
00173 #endif
00174 }
00175
00176
00177 /** Calls the appropriate ternary parallel_for overload based on the
00178     index type of the kernel function object f
00179
00180 */
00181 template <int Dimensions = 1, typename ParallelForFunctor>
00182 void parallel_for(range<Dimensions> r, ParallelForFunctor f) {
00183   using mf_t  = decltype(std::mem_fn(&ParallelForFunctor::operator()));
00184   using arg_t = typename mf_t::second_argument_type;
00185   parallel_for(r,f,arg_t{});
00186 }
00187
00188
00189 /** Implementation of parallel_for with a range<> and an offset */
00190 template <int Dimensions = 1, typename ParallelForFunctor>
00191 void parallel_for_global_offset(range<Dimensions> global_size,
00192                                 id<Dimensions> offset,
00193                                 ParallelForFunctor f) {
00194   // Reconstruct the item from its id<> and its offset
00195   auto reconstruct_item = [&] (id<Dimensions> l) {
00196     // Reconstruct the global item
00197     item<Dimensions> index { global_size, l + offset, offset };
00198     // Call the user kernel with the item<> instead of the id<>
00199     f(index);
00200   };
00201
00202   // First iterate on all the work-groups
00203   parallel_for(global_size, reconstruct_item);
00204 }
00205
00206
00207 /** Implement a variation of parallel_for to take into account a
00208     nd_range<>
00209
00210     \todo Add an OpenMP implementation
00211
00212     \todo Deal with incomplete work-groups
00213
00214     \todo Implement with parallel_for_workgroup()/parallel_for_workitem()
00215 */
00216 template <int Dimensions = 1, typename ParallelForFunctor>
00217 void parallel_for(nd_range<Dimensions> r,
00218                   ParallelForFunctor f) {
00219   // To iterate on the work-group
00220   id<Dimensions> group;
00221   range<Dimensions> group_range = r.get_group();
00222
00223 #ifdef _OPENMP
00224
00225   auto iterate_in_work_group = [&] (id<Dimensions> g) {
00226     //group.display();
00227
00228     // Then iterate on the local work-groups
00229     cl::sycl::group<Dimensions> wg {g, r};
00230     parallel_for_workitem<Dimensions,
00231                           decltype(f)>(wg, f);
00232   };
00233
00234 #else
00235
00236   // In a sequential execution there is only one index processed at a time
00237   nd_item<Dimensions> index { r };
00238
00239   // To iterate on the local work-item
00240   id<Dimensions> local;
00241   range<Dimensions> local_range = r.get_local();
00242
00243   // Reconstruct the nd_item from its group and local id
00244   auto reconstruct_item = [&] (id<Dimensions> l) {
00245     //local.display();
00246     // Reconstruct the global nd_item
00247     index.set_local(local);
00248     // Upgrade local_range to an id<> so that we can * with the group (an id<>)
00249     index.set_global(local + id<Dimensions>(local_range)*group);
00250     // Call the user kernel at last
00251     f(index);
00252   };
00253
00254   /* To recycle the parallel_for on range<>, wrap the ParallelForFunctor f
00255      into another functor that iterates inside the work-group and then
00256      calls f */
00257   auto iterate_in_work_group = [&] (id<Dimensions> g) {
00258     //group.display();
```

```
00259     // Then iterate on the local work-groups
00260     parallel_for_iterate<Dimensions,
00261                          range<Dimensions>,
00262                          decltype(reconstruct_item),
00263                          id<Dimensions>> { local_range,
00264                                            reconstruct_item,
00265                                            local };
00266   };
00267
00268 #endif
00269
00270   // First iterate on all the work-groups
00271   parallel_for_iterate<Dimensions,
00272                        range<Dimensions>,
00273                        decltype(iterate_in_work_group),
00274                        id<Dimensions>> { group_range,
00275                                          iterate_in_work_group,
00276                                          group };
00277 }
00278
00279
00280 /// Implement the loop on the work-groups
00281 template <int Dimensions = 1, typename ParallelForFunctor>
00282 void parallel_for_workgroup(nd_range<Dimensions> r,
00283                             ParallelForFunctor f) {
00284   // In a sequential execution there is only one index processed at a time
00285   group<Dimensions> g { r };
00286
00287   // First iterate on all the work-groups
00288   parallel_for_iterate<Dimensions,
00289                        range<Dimensions>,
00290                        ParallelForFunctor,
00291                        group<Dimensions>> {
00292     r.get_group(),
00293     f,
00294     g };
00295 }
00296
00297
00298 /** Implement the loop on the work-items inside a work-group
00299
00300     \todo Better type the functor
00301 */
00302 template <int Dimensions, typename ParallelForFunctor>
00303 void parallel_for_workitem(const group<Dimensions> &g,
00304                            ParallelForFunctor f) {
00305 #if defined(_OPENMP) && (!defined(TRISYCL_NO_BARRIER) && !defined(_MSC_VER))
00306   /* To implement barriers With OpenMP, one thread is created for each
00307      work-item in the group and thus an OpenMP barrier has the same effect
00308      of an OpenCL barrier executed by the work-items in a workgroup
00309
00310      The issue is that the parallel_for_workitem() execution is slow even
00311      when nd_item::barrier() is not used
00312
00313      \todo Simplify by just using omp parallel for collapse
00314   */
00315
00316   range<Dimensions> l_r = g.get_nd_range().get_local();
00317   auto tot = l_r.get(0);
00318   for (int i = 1; i < (int) Dimensions; ++i){
00319     tot *= l_r.get(i);
00320   }
00321 #pragma omp parallel num_threads(tot)
00322   {
00323     nd_item<Dimensions> index { g.get_nd_range() };
00324     id<Dimensions> local; // to initialize correctly
00325 #pragma omp for nowait
00326     for (std::size_t th_id = 0; th_id < tot; ++th_id) {
00327       if (Dimensions == 1) {
00328         local[0] = th_id;
00329       } else if (Dimensions == 2) {
00330         local[0] = th_id / l_r.get(1);
00331         local[1] = th_id % l_r.get(1);
00332       } else if (Dimensions == 3) {
00333         local[0] = th_id / (l_r.get(1)*l_r.get(2));
00334         local[1] = (th_id / l_r.get(2)) % l_r.get(1);
00335         local[2] = th_id % l_r.get(2);
00336       }
00337       index.set_local(local);
00338       index.set_global(local + id<Dimensions>(l_r)*g.get_id());
00339       f(index);
00340     }
00341   }
00342 #else
00343   // In a sequential execution there is only one index processed at a time
00344   nd_item<Dimensions> index { g.get_nd_range() };
00345   // To iterate on the local work-item
```

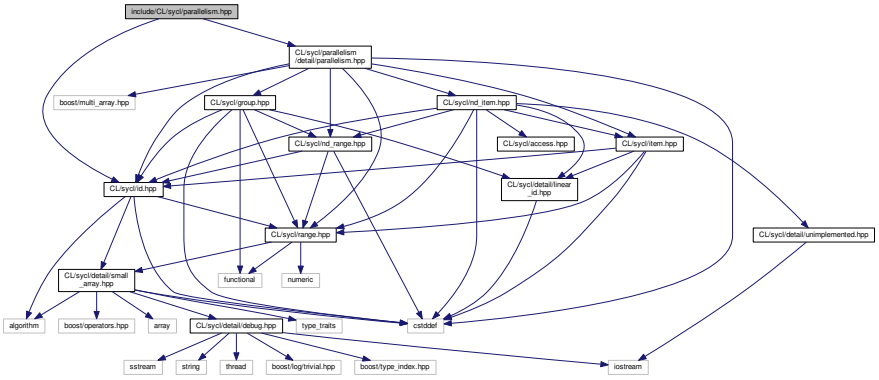
```
00346   id<Dimensions> local;
00347
00348   // Reconstruct the nd_item from its group and local id
00349   auto reconstruct_item = [&] (id<Dimensions> l) {
00350     //local.display();
00351     //l.display();
00352     // Reconstruct the global nd_item
00353     index.set_local(local);
00354     // \todo Some strength reduction here
00355     index.set_global(local + id<Dimensions>(g.get_local_range())*g.
      get_id());
00356     // Call the user kernel at last
00357     f(index);
00358   };
00359
00360   // Then iterate on all the work-items of the work-group
00361   parallel_for_iterate<Dimensions,
00362                        range<Dimensions>,
00363                        decltype(reconstruct_item),
00364                        id<Dimensions>> {
00365     g.get_local_range(),
00366     reconstruct_item,
00367     local };
00368 #endif
00369 }
00370 /// @} End the parallelism Doxygen group
00371
00372 } // namespace detail
00373 }
00374 }
00375
00376 /*
00377     # Some Emacs stuff:
00378     ### Local Variables:
00379     ### ispell-local-dictionary: "american"
00380     ### eval: (flyspell-prog-mode)
00381     ### End:
00382 */
00383
00384 #endif // TRISYCL_SYCL_PARALLELISM_DETAIL_PARALLELISM_HPP
```

11.119 include/CL/sycl/parallelism.hpp File Reference

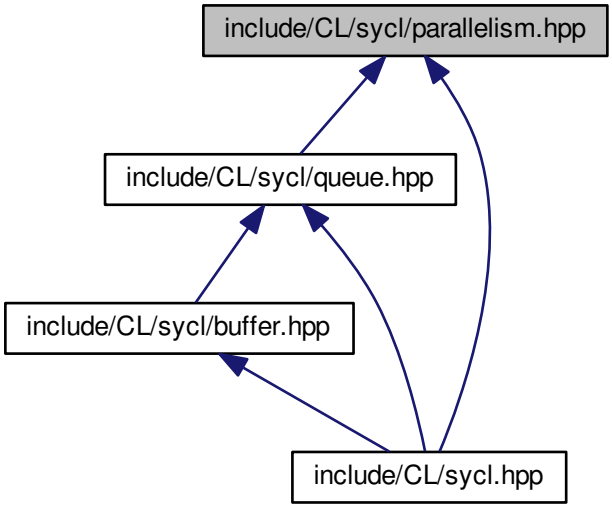
Implement parallel constructions to launch kernels.

```
#include "CL/sycl/parallelism/detail/parallelism.hpp"
#include "CL/sycl/id.hpp"
```

Include dependency graph for parallelism.hpp:



This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Functions

- template<int Dimensions = 1, typename ParallelForFunctor >
  void cl::sycl::parallel_for_work_item (const group< Dimensions > &g, ParallelForFunctor f)

  SYCL parallel_for version that allows a Program object to be specified.

11.119.1 Detailed Description

Implement parallel constructions to launch kernels.

Ronan at keryell dot FR

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Definition in file parallelism.hpp.

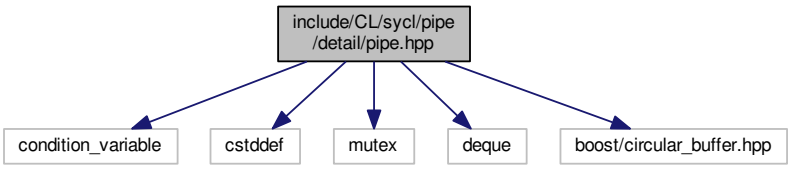
11.120 parallelism.hpp

```
00001 #ifndef TRISYCL_SYCL_PARALLELISM_HPP
00002 #define TRISYCL_SYCL_PARALLELISM_HPP
00003
00004 /** \file
00005
00006     Implement parallel constructions to launch kernels
00007
00008     Ronan at keryell dot FR
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 #include "CL/sycl/parallelism/detail/parallelism.hpp"
00015 #include "CL/sycl/id.hpp"
00016
00017 namespace cl {
00018 namespace sycl {
00019
00020 /** \addtogroup parallelism
00021     @{
00022 */
00023
00024 /// SYCL parallel_for version that allows a Program object to be specified
00025 /// \todo To be implemented
00026 /* template <typename Range, typename Program, typename ParallelForFunctor>
00027 void parallel_for(Range r, Program p, ParallelForFunctor f) {
00028   /// \todo deal with Program
00029   parallel_for(r, f);
00030 }
00031 */
00032
00033   /** Loop on the work-items inside a work-group
00034
00035       \todo Deprecate this function in the specification to use
00036       instead the group method
00037   */
00038   template <int Dimensions = 1, typename ParallelForFunctor>
00039   void parallel_for_work_item(const group<Dimensions> &g,
00040                               ParallelForFunctor f) {
00041     g.parallel_for_work_item(f);
00042   }
00043
00044
00045
00046 }
00047 }
00048
00049 /// @} End the parallelism Doxygen group
00050
00051 /*
00052     # Some Emacs stuff:
00053     ### Local Variables:
00054     ### ispell-local-dictionary: "american"
00055     ### eval: (flyspell-prog-mode)
00056     ### End:
00057 */
00058
00059 #endif // TRISYCL_SYCL_PARALLELISM_HPP
```

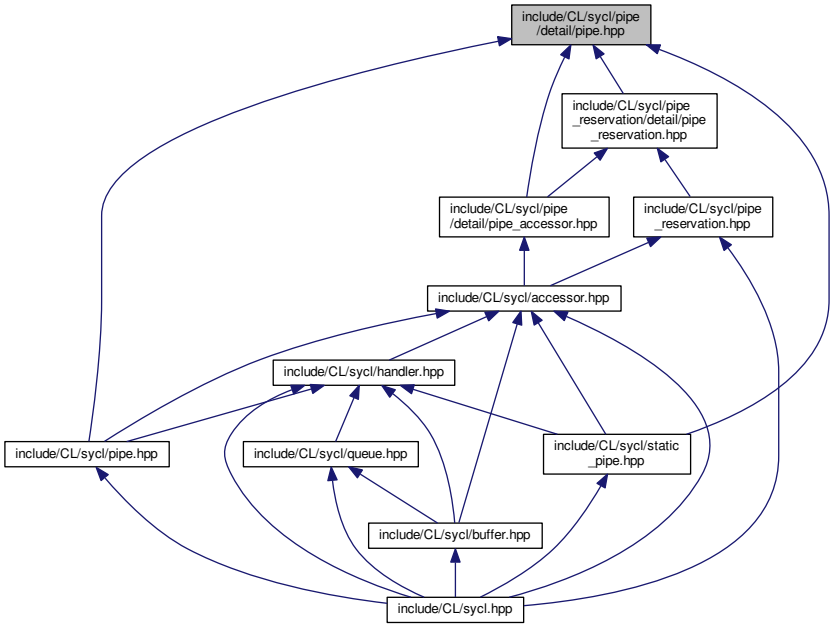
11.121 include/CL/sycl/pipe/detail/pipe.hpp File Reference

```
#include <condition_variable>
#include <cstddef>
#include <mutex>
#include <deque>
#include <boost/circular_buffer.hpp>
```

Include dependency graph for pipe.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::reserve_id< T >

  A private description of a reservation station. More...
- class cl::sycl::detail::pipe< T >

  Implement a pipe object. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.122 pipe.hpp

```
00001 #ifndef TRISYCL_SYCL_PIPE_DETAIL_PIPE_HPP
00002 #define TRISYCL_SYCL_PIPE_DETAIL_PIPE_HPP
00003
00004 /** \file The OpenCL SYCL pipe<> details
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <condition_variable>
00013 #include <cstddef>
00014 #include <mutex>
00015 #include <deque>
00016
00017 #ifdef TRISYCL_MAKE_BOOST_CIRCULARBUFFER_THREAD_SAFE
00018 /* The debug mode of boost/circular_buffer.hpp has a nasty side effect
00019    in multithread applications using several iterators at the same
00020    time even in read-only mode because the library tracks them for
00021    debugging purpose in a... non-thread safe way
00022
00023    This is described in https://svn.boost.org/trac/boost/ticket/6277
00024    and fixed with https://github.com/boostorg/circular_buffer/pull/9
00025 */
00026 #define BOOST_CB_DISABLE_DEBUG
00027 #endif
00028 #include <boost/circular_buffer.hpp>
00029
00030 namespace cl {
00031 namespace sycl {
00032 namespace detail {
00033
00034 /** \addtogroup data Data access and storage in SYCL
00035     @{
00036 */
00037
00038 /// A private description of a reservation station
00039 template <typename T>
00040 struct reserve_id {
00041   /// Start of the reservation in the pipe storage
00042   typename boost::circular_buffer<T>::iterator start;
00043
00044   /// Number of elements in the reservation
00045   std::size_t size;
00046
00047   /* True when the reservation has been committed and is ready to be
00048      released */
00049   bool ready = false;
00050
00051   /** Track a reservation not committed yet
00052
00053       \param[in] start point to the start of the reservation in the
00054       pipe storage
00055
00056       \param[in] size is the number of elements in the reservation
00057   */
00058   reserve_id(typename boost::circular_buffer<T>::iterator start,
00059              std::size_t size) : start { start }, size { size } {}
00060
00061 };
00062
00063
00064 /** Implement a pipe object
00065
00066     Use some mutable members so that the pipe object can be changed even
00067     when the accessors are captured in a lambda.
00068 */
00069 template <typename T>
00070 class pipe : public detail::debug<pipe<T>> {
00071
00072 public:
00073
00074   using value_type = T;
00075
00076   /// Implement the pipe with a circular buffer
00077   using implementation_t = boost::circular_buffer<value_type>;
00078
00079 private:
00080
00081   /// The circular buffer to store the elements
00082   boost::circular_buffer<value_type> cb;
00083
00084   /** To protect the access to the circular buffer.
```

```
00085
00086       In case the object is capture in a lambda per copy, make it
00087       mutable. */
00088   mutable std::mutex cb_mutex;
00089
00090   /// The queue of pending write reservations
00091   std::deque<reserve_id<value_type>> w_rid_q;
00092
00093 public:
00094 #ifndef _MSC_VER
00095   using rid_iterator = typename decltype(w_rid_q)::iterator;
00096 #else
00097   using rid_iterator = typename std::deque<reserve_id<value_type>>::iterator;
00098 #endif
00099
00100 private:
00101
00102   /// The queue of pending read reservations
00103   std::deque<reserve_id<value_type>> r_rid_q;
00104
00105   /// Track the number of frozen elements related to read reservations
00106   std::size_t read_reserved_frozen;
00107
00108   /// To signal that a read has been successful
00109   std::condition_variable read_done;
00110
00111   /// To signal that a write has been successful
00112   std::condition_variable write_done;
00113
00114   /// To control the debug mode, disabled by default
00115   bool debug_mode = false;
00116
00117 public:
00118
00119   /// True when the pipe is currently used for reading
00120   bool used_for_reading = false;
00121
00122   /// True when the pipe is currently used for writing
00123   bool used_for_writing = false;
00124
00125   /// Create a pipe as a circular buffer of the required capacity
00126   pipe(std::size_t capacity) : cb { capacity }, read_reserved_frozen { 0 } { }
00127
00128
00129   /** Return the maximum number of elements that can fit in the pipe
00130    */
00131   std::size_t capacity() const {
00132     // No lock required since it is fixed and set at construction time
00133     return cb.capacity();
00134   }
00135
00136 private:
00137
00138   /** Get the current number of elements in the pipe that can be read
00139
00140       This is obviously a volatile value which is constrained by the
00141       theory of restricted relativity.
00142
00143       Note that on some devices it may be costly to implement (for
00144       example on FPGA).
00145    */
00146   std::size_t size() const {
00147     TRISYCL_DUMP_T("size() cb.size() = " << cb.size()
00148                    << " cb.end() = " << (void *)&*cb.end()
00149                    << " reserved_for_reading() = " << reserved_for_reading()
00150                    << " reserved_for_writing() = " << reserved_for_writing());
00151     /* The actual number of available elements depends from the
00152        elements blocked by some reservations.
00153        This prevents a consumer to read into reserved area. */
00154     return cb.size() - reserved_for_reading() - reserved_for_writing();
00155   }
00156
00157
00158   /** Test if the pipe is empty
00159
00160       This is obviously a volatile value which is constrained by
00161       restricted relativity.
00162
00163       Note that on some devices it may be costly to implement on the
00164       write side (for example on FPGA).
00165   */
00166   bool empty() const {
00167     TRISYCL_DUMP_T("empty() cb.size() = " << cb.size()
00168                    << " size() = " << size());
00169     // It is empty when the size is zero, taking into account reservations
00170     return size() ==  0;
00171   }
```

```
00172
00173
00174   /** Test if the pipe is full
00175
00176       This is obviously a volatile value which is constrained by
00177       restricted relativity.
00178
00179       Note that on some devices it may be costly to implement on the
00180       read side (for example on FPGA).
00181   */
00182   bool full() const {
00183     return cb.full();
00184   }
00185
00186
00187 public:
00188
00189   /// The size() method used outside needs to lock the datastructure
00190   std::size_t size_with_lock() const {
00191     std::lock_guard<std::mutex> lg { cb_mutex };
00192     return size();
00193   }
00194
00195
00196   /// The empty() method used outside needs to lock the datastructure
00197   bool empty_with_lock() const {
00198     std::lock_guard<std::mutex> lg { cb_mutex };
00199     return empty();
00200   }
00201
00202
00203   // The full() method used outside needs to lock the datastructure
00204   bool full_with_lock() const {
00205     std::lock_guard<std::mutex> lg { cb_mutex };
00206     return full();
00207   }
00208
00209
00210   /** Try to write a value to the pipe
00211
00212       \param[in] value is what we want to write
00213
00214       \param[in] blocking specify if the call wait for the operation
00215       to succeed
00216
00217       \return true on success
00218
00219       \todo provide a && version
00220   */
00221   bool write(const T &value, bool blocking = false) {
00222     // Lock the pipe to avoid being disturbed
00223     std::unique_lock<std::mutex> ul { cb_mutex };
00224     TRISYCL_DUMP_T("Write pipe full = " << full()
00225                    << " value = " << value);
00226
00227     if (blocking)
00228       /* If in blocking mode, wait for the not full condition, that
00229          may be changed when a read is done */
00230       read_done.wait(ul, [&] { return !full(); });
00231     else if (full())
00232       return false;
00233
00234     cb.push_back(value);
00235     TRISYCL_DUMP_T("Write pipe front = " << cb.front()
00236                    << " back = " << cb.back()
00237                    << " cb.begin() = " << (void *)&*cb.begin()
00238                    << " cb.size() = " << cb.size()
00239                    << " cb.end() = " << (void *)&*cb.end()
00240                    << " reserved_for_reading() = " << reserved_for_reading()
00241                    << " reserved_for_writing() = " << reserved_for_writing());
00242     // Notify the clients waiting to read something from the pipe
00243     write_done.notify_all();
00244     return true;
00245   }
00246
00247
00248   /** Try to read a value from the pipe
00249
00250       \param[out] value is the reference to where to store what is
00251       read
00252
00253       \param[in] blocking specify if the call wait for the operation
00254       to succeed
00255
00256       \return true on success
00257   */
00258   bool read(T &value, bool blocking = false) {
```

```
00259     // Lock the pipe to avoid being disturbed
00260     std::unique_lock<std::mutex> ul { cb_mutex };
00261     TRISYCL_DUMP_T("Read pipe empty = " << empty());
00262
00263     if (blocking)
00264       /* If in blocking mode, wait for the not empty condition, that
00265          may be changed when a write is done */
00266       write_done.wait(ul, [&] { return !empty(); });
00267     else if (empty())
00268       return false;
00269
00270     TRISYCL_DUMP_T("Read pipe front = " << cb.front()
00271                    << " back = " << cb.back()
00272                    << " reserved_for_reading() = " << reserved_for_reading());
00273     if (read_reserved_frozen)
00274       /** If there is a pending reservation, read the next element to
00275           be read and update the number of reserved elements */
00276       value = cb.begin()[read_reserved_frozen++];
00277     else {
00278       /* There is no pending read reservation, so pop the read value
00279          from the pipe */
00280       value = cb.front();
00281       cb.pop_front();
00282     }
00283
00284     TRISYCL_DUMP_T("Read pipe value = " << value);
00285     // Notify the clients waiting for some room to write in the pipe
00286     read_done.notify_all();
00287     return true;
00288   }
00289
00290
00291   /** Compute the amount of elements blocked by read reservations, not yet
00292       committed
00293
00294       This includes some normal reads to pipes between/after
00295       un-committed reservations
00296
00297       This function assumes that the data structure is locked
00298   */
00299   std::size_t reserved_for_reading() const {
00300     return read_reserved_frozen;
00301   }
00302
00303
00304   /** Compute the amount of elements blocked by write reservations, not yet
00305       committed
00306
00307       This includes some normal writes to pipes between/after
00308       un-committed reservations
00309
00310       This function assumes that the data structure is locked
00311   */
00312   std::size_t reserved_for_writing() const {
00313     if (w_rid_q.empty())
00314       // No on-going reservation
00315       return 0;
00316     else
00317       /* The reserved size is from the first element of the first
00318          on-going reservation up to the end of the pipe content */
00319       return cb.end() - w_rid_q.front().start;
00320   }
00321
00322
00323   /** Reserve some part of the pipe for reading
00324
00325       \param[in] s is the number of element to reserve
00326
00327       \param[out] rid is an iterator to a description of the
00328       reservation that has been done if successful
00329
00330       \param[in] blocking specify if the call wait for the operation
00331       to succeed
00332
00333       \return true if the reservation was successful
00334   */
00335   bool reserve_read(std::size_t s,
00336                     rid_iterator &rid,
00337                     bool blocking = false)  {
00338     // Lock the pipe to avoid being disturbed
00339     std::unique_lock<std::mutex> ul { cb_mutex };
00340
00341     TRISYCL_DUMP_T("Before read reservation cb.size() = " << cb.size()
00342                    << " size() = " << size());
00343     if (s == 0)
00344       // Empty reservation requested, so nothing to do
00345       return false;
```

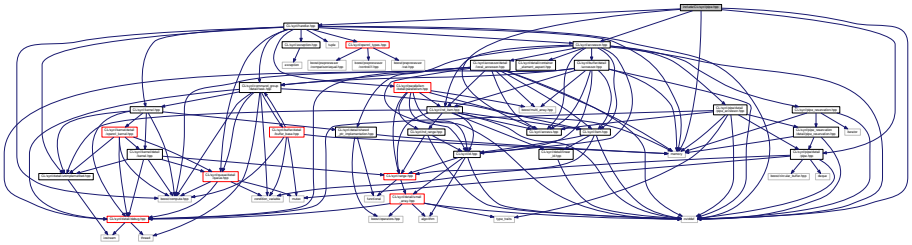
```
00346
00347     if (blocking)
00348       /* If in blocking mode, wait for enough elements to read in the
00349          pipe for the reservation. This condition can change when a
00350          write is done */
00351       write_done.wait(ul, [&] { return s <= size(); });
00352     else if (s > size())
00353       // Not enough elements to read in the pipe for the reservation
00354       return false;
00355
00356     // Compute the location of the first element of the reservation
00357     auto first = cb.begin() + read_reserved_frozen;
00358     // Increment the number of frozen elements
00359     read_reserved_frozen += s;
00360     /* Add a description of the reservation at the end of the
00361        reservation queue */
00362     r_rid_q.emplace_back(first, s);
00363     // Return the iterator to the last reservation descriptor
00364     rid = r_rid_q.end() - 1;
00365     TRISYCL_DUMP_T("After reservation cb.size() = " << cb.size()
00366                    << " size() = " << size());
00367     return true;
00368   }
00369
00370
00371   /** Reserve some part of the pipe for writing
00372
00373       \param[in] s is the number of element to reserve
00374
00375       \param[out] rid is an iterator to a description of the
00376       reservation that has been done if successful
00377
00378       \param[in] blocking specify if the call wait for the operation
00379       to succeed
00380
00381       \return true if the reservation was successful
00382   */
00383   bool reserve_write(std::size_t s,
00384                      rid_iterator &rid,
00385                      bool blocking = false)  {
00386     // Lock the pipe to avoid being disturbed
00387     std::unique_lock<std::mutex> ul { cb_mutex };
00388
00389     TRISYCL_DUMP_T("Before write reservation cb.size() = " << cb.size()
00390                    << " size() = " << size());
00391     if (s == 0)
00392       // Empty reservation requested, so nothing to do
00393       return false;
00394
00395     if (blocking)
00396       /* If in blocking mode, wait for enough room in the pipe, that
00397          may be changed when a read is done. Do not use a difference
00398          here because it is only about unsigned values */
00399       read_done.wait(ul, [&] { return cb.size() + s <= capacity(); });
00400     else if (cb.size() + s > capacity())
00401       // Not enough room in the pipe for the reservation
00402       return false;
00403
00404     /* If there is enough room in the pipe, just create default values
00405          in it to do the reservation */
00406     for (std::size_t i = 0; i != s; ++i)
00407       cb.push_back();
00408     /* Compute the location of the first element a posteriori since it
00409          may not exist a priori if cb was empty before */
00410     auto first = cb.end() - s;
00411     /* Add a description of the reservation at the end of the
00412        reservation queue */
00413     w_rid_q.emplace_back(first, s);
00414     // Return the iterator to the last reservation descriptor
00415     rid = w_rid_q.end() - 1;
00416     TRISYCL_DUMP_T("After reservation cb.size() = " << cb.size()
00417                    << " size() = " << size());
00418     return true;
00419   }
00420
00421
00422   /** Process the read reservations that are ready to be released in the
00423       reservation queue
00424   */
00425   void move_read_reservation_forward() {
00426     // Lock the pipe to avoid nuisance
00427     std::lock_guard<std::mutex> lg { cb_mutex };
00428
00429     for (;;) {
00430       if (r_rid_q.empty())
00431         // No pending reservation, so nothing to do
00432         break;
```

```
00433       if (!r_rid_q.front().ready)
00434         /* If the first reservation is not ready to be released, stop
00435            because it is blocking all the following in the queue
00436            anyway */
00437         break;
00438       // Remove the reservation to be released from the queue
00439       r_rid_q.pop_front();
00440       std::size_t n_to_pop;
00441       if (r_rid_q.empty())
00442         // If it was the last one, remove all the reservation
00443         n_to_pop = read_reserved_frozen;
00444       else
00445         // Else remove everything up to the next reservation
00446         n_to_pop =  r_rid_q.front().start - cb.begin();
00447       // No longer take into account these reserved slots
00448       read_reserved_frozen -= n_to_pop;
00449       // Release the elements from the FIFO
00450       while (n_to_pop--)
00451         cb.pop_front();
00452       // Notify the clients waiting for some room to write in the pipe
00453       read_done.notify_all();
00454       /* ...and process the next reservation to see if it is ready to
00455          be released too */
00456     }
00457   }
00458
00459
00460   /** Process the write reservations that are ready to be released in the
00461       reservation queue
00462   */
00463   void move_write_reservation_forward() {
00464     // Lock the pipe to avoid nuisance
00465     std::lock_guard<std::mutex> lg { cb_mutex };
00466
00467     for (;;) {
00468       if (w_rid_q.empty())
00469         // No pending reservation, so nothing to do
00470         break;
00471       // Get the first reservation
00472       const auto &rid = w_rid_q.front();
00473       if (!rid.ready)
00474         /* If the reservation is not ready to be released, stop
00475            because it is blocking all the following in the queue
00476            anyway */
00477         break;
00478       // Remove the reservation to be released from the queue
00479       w_rid_q.pop_front();
00480       // Notify the clients waiting to read something from the pipe
00481       write_done.notify_all();
00482       /* ...and process the next reservation to see if it is ready to
00483          be released too */
00484     }
00485   }
00486
00487 };
00488
00489 /// @} End the execution Doxygen group
00490
00491 }
00492 }
00493 }
00494
00495 /*
00496     # Some Emacs stuff:
00497     ### Local Variables:
00498     ### ispell-local-dictionary: "american"
00499     ### eval: (flyspell-prog-mode)
00500     ### End:
00501 */
00502
00503 #endif // TRISYCL_SYCL_PIPE_DETAIL_PIPE_HPP
```

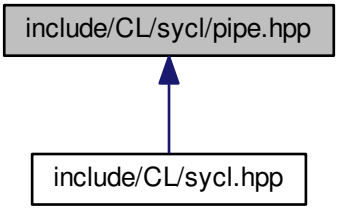
11.123 include/CL/sycl/pipe.hpp File Reference

```
#include <cstddef>
#include <memory>
#include "CL/sycl/access.hpp"
#include "CL/sycl/accessor.hpp"
#include "CL/sycl/handler.hpp"
```

`#include "CL/sycl/pipe/detail/pipe.hpp"`
Include dependency graph for pipe.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::pipe< T >
  A SYCL pipe. *More...*

Namespaces

- cl
  The vector type to be used as SYCL vector.
- cl::sycl

11.124 pipe.hpp

```
00001 #ifndef TRISYCL_SYCL_PIPE_HPP
00002 #define TRISYCL_SYCL_PIPE_HPP
00003
00004 /** \file The OpenCL SYCL pipe<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
```

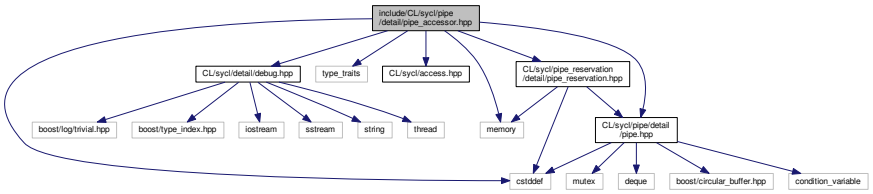
```
00013 #include <memory>
00014
00015 #include "CL/sycl/access.hpp"
00016 #include "CL/sycl/accessor.hpp"
00017 #include "CL/sycl/handler.hpp"
00018 #include "CL/sycl/pipe/detail/pipe.hpp"
00019
00020 namespace cl {
00021 namespace sycl {
00022
00023 /** \addtogroup data Data access and storage in SYCL
00024     @{
00025 */
00026
00027 /** A SYCL pipe
00028
00029     Implement a FIFO-style object that can be used through accessors
00030     to send some objects T from the input to the output
00031 */
00032 template <typename T>
00033 class pipe
00034     /* Use the underlying pipe implementation that can be shared in
00035        the SYCL model */
00036   : public detail::shared_ptr_implementation<pipe<T>, detail::pipe<T>>,
00037     detail::debug<pipe<T>> {
00038
00039   // The type encapsulating the implementation
00040   using implementation_t = typename
      pipe::shared_ptr_implementation;
00041
00042   // Allows the comparison operation to access the implementation
00043   friend implementation_t;
00044
00045 public:
00046
00047   // Make the implementation member directly accessible in this class
00048   using implementation_t::implementation;
00049
00050   /// The STL-like types
00051   /* Since a pipe element cannot be directly addressed without
00052      accessor, only define value_type here */
00053   using value_type = T;
00054
00055
00056   /// Construct a pipe able to store up to capacity T objects
00057   pipe(std::size_t capacity)
00058     : implementation_t { new detail::pipe<T> { capacity } } { }
00059
00060
00061   /** Get an accessor to the pipe with the required mode
00062
00063       \param Mode is the requested access mode
00064
00065       \param Target is the type of pipe access required
00066
00067       \param[in] command_group_handler is the command group handler in
00068       which the kernel is to be executed
00069   */
00070   template <access::mode Mode,
00071             access::target Target = access::target::pipe>
00072   accessor<value_type, 1, Mode, Target>
00073   get_access(handler &command_group_handler) {
00074     static_assert(Target == access::target::pipe
00075                   || Target == access::target::blocking_pipe,
00076                   "get_access(handler) with pipes can only deal with "
00077                   "access::pipe or access::blocking_pipe");
00078     return { implementation, command_group_handler };
00079   }
00080
00081
00082   /// Return the maximum number of elements that can fit in the pipe
00083   std::size_t capacity() const {
00084     return implementation->capacity();
00085     }
00086
00087 };
00088
00089 /// @} End the execution Doxygen group
00090
00091 }
00092 }
00093
00094 /*
00095     # Some Emacs stuff:
00096     ### Local Variables:
00097     ### ispell-local-dictionary: "american"
00098     ### eval: (flyspell-prog-mode)
```

```
00099     ### End:
00100 */
00101
00102 #endif // TRISYCL_SYCL_PIPE_HPP
```

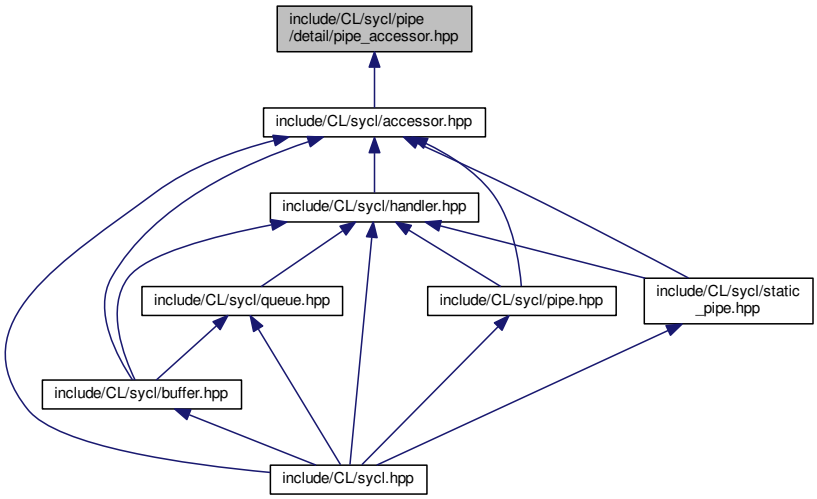
11.125 include/CL/sycl/pipe/detail/pipe_accessor.hpp File Reference

```
#include <cstddef>
#include <memory>
#include <type_traits>
#include "CL/sycl/access.hpp"
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/pipe/detail/pipe.hpp"
#include "CL/sycl/pipe_reservation/detail/pipe_reservation.hpp"
```

Include dependency graph for pipe_accessor.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::accessor< T, Dimensions, Mode, Target >

  The buffer accessor abstracts the way buffer data are accessed inside a kernel in a multidimensional variable length array way. More...
- class cl::sycl::detail::pipe_accessor< T, AccessMode, Target >

  The accessor abstracts the way pipe data are accessed inside a kernel. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.126 pipe_accessor.hpp

```
00001 #ifndef TRISYCL_SYCL_PIPE_DETAIL_PIPE_ACCESSOR_HPP
00002 #define TRISYCL_SYCL_PIPE_DETAIL_PIPE_ACCESSOR_HPP
00003
00004 /** \file The OpenCL SYCL pipe accessor<> detail behind the scene
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <memory>
00014 #include <type_traits>
00015
00016 #include "CL/sycl/access.hpp"
00017 #include "CL/sycl/detail/debug.hpp"
00018 #include "CL/sycl/pipe/detail/pipe.hpp"
00019 #include "CL/sycl/pipe_reservation/detail/pipe_reservation.hpp
      "
00020
00021 namespace cl {
00022 namespace sycl {
00023
00024 class handler;
00025
00026 namespace detail {
00027
00028 // Forward declaration of detail::accessor to declare the specialization
00029 template <typename T,
00030           int Dimensions,
00031           access::mode Mode,
00032           access::target Target>
00033 class accessor;
00034 /** \addtogroup data Data access and storage in SYCL
00035     @{
00036 */
00037
00038 /** The accessor abstracts the way pipe data are accessed inside a
00039     kernel
00040 */
00041 template <typename T,
00042           access::mode AccessMode,
00043           access::target Target>
00044 class pipe_accessor :
00045     public detail::debug<detail::pipe_accessor<T, AccessMode, Target>> {
00046
00047 public:
00048
00049   static constexpr auto rank = 1;
00050   static constexpr auto mode = AccessMode;
00051   static constexpr auto target = Target;
00052
00053   static constexpr bool blocking =
00054     (target == cl::sycl::access::target::blocking_pipe);
00055
00056   /// The STL-like types
00057   using value_type = T;
00058   using reference = value_type&;
00059   using const_reference = const value_type&;
00060
00061 private:
00062
00063   /// The real pipe implementation behind the hood
00064   std::shared_ptr<detail::pipe<T>> implementation;
00065
00066   /** Store the success status of last pipe operation
00067
00068       It is not impacted by reservation success.
00069
```

```
00070       It does exist even if the pipe accessor is not evaluated in a
00071       boolean context for, but a use-def analysis can optimise it out
00072       in that case and not use some storage
00073
00074       Use a mutable state here so that it can work with a [=] lambda
00075       capture without having to declare the whole lambda as mutable
00076   */
00077   bool mutable ok = false;
00078
00079 public:
00080
00081   /** Construct a pipe accessor from an existing pipe
00082    */
00083   pipe_accessor(const std::shared_ptr<detail::pipe<T>> &p,
00084                 handler &command_group_handler) :
00085     implementation { p } {
00086     //    TRISYCL_DUMP_T("Create a kernel pipe accessor write = "
00087     //                   << is_write_access());
00088     // Verify that the pipe is not already used in the requested mode
00089     if (mode == access::mode::write)
00090       if (implementation->used_for_writing)
00091         /// \todo Use pipe_exception instead
00092         throw std::logic_error { "The pipe is already used for writing." };
00093       else
00094         implementation->used_for_writing = true;
00095     else
00096       if (implementation->used_for_reading)
00097         throw std::logic_error { "The pipe is already used for reading." };
00098       else
00099         implementation->used_for_reading = true;
00100   }
00101
00102
00103   pipe_accessor() = default;
00104
00105
00106   /// Return the maximum number of elements that can fit in the pipe
00107   std::size_t capacity() const {
00108     return implementation->capacity();
00109   }
00110
00111   /** Get the current number of elements in the pipe
00112
00113       This is obviously a volatile value which is constrained by
00114       restricted relativity.
00115
00116       Note that on some devices it may be costly to implement (for
00117       example on FPGA).
00118    */
00119   std::size_t size() const {
00120     return implementation->size_with_lock();
00121   }
00122
00123
00124   /** Test if the pipe is empty
00125
00126       This is obviously a volatile value which is constrained by
00127       restricted relativity.
00128
00129       Note that on some devices it may be costly to implement on the
00130       write side (for example on FPGA).
00131    */
00132   bool empty() const {
00133     return implementation->empty_with_lock();
00134   }
00135
00136
00137   /** Test if the pipe is full
00138
00139       This is obviously a volatile value which is constrained by
00140       restricted relativity.
00141
00142       Note that on some devices it may be costly to implement on the
00143       read side (for example on FPGA).
00144   */
00145   bool full() const {
00146     return implementation->full_with_lock();
00147   }
00148
00149
00150   /** In an explicit bool context, the accessor gives the success
00151       status of the last access
00152
00153       It is not impacted by reservation success.
00154
00155       The explicitness is related to avoid \code some_pipe <<
00156       some_value \endcode to be interpreted as \code some_bool <<
```

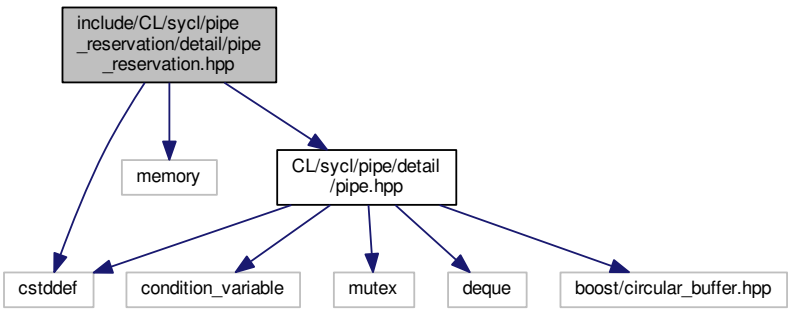
```
00157       some_value \endcode when the type of \code some_value \endcode
00158       is not the same type as the pipe type.
00159
00160       \return true on success of the previous read or write operation
00161   */
00162   explicit operator bool() const {
00163     return ok;
00164   }
00165
00166
00167   /** Try to write a value to the pipe
00168
00169       \param[in] value is what we want to write
00170
00171       \return this so we can apply a sequence of write for example
00172       (but do not do this on a non blocking pipe...)
00173
00174       \todo provide a && version
00175
00176       This function is const so it can work when the accessor is
00177       passed by copy in the [=] kernel lambda, which is not mutable by
00178       default
00179   */
00180   const pipe_accessor &write(const value_type &value) const {
00181     static_assert(mode == access::mode::write,
00182                   "'.write(const value_type &value)' method on a pipe accessor"
00183                   " is only possible with write access mode");
00184     ok = implementation->write(value, blocking);
00185     // Return a reference to *this so we can apply a sequence of write
00186     return *this;
00187   }
00188
00189
00190   /** Some syntactic sugar to use \code a << v \endcode instead of
00191       \code a.write(v) \endcode */
00192   const pipe_accessor &operator<<(const value_type &value) const {
00193     static_assert(mode == access::mode::write,
00194                   "'<<' operator on a pipe accessor is only possible"
00195                   " with write access mode");
00196     // Return a reference to *this so we can apply a sequence of >>
00197     return write(value);
00198   }
00199
00200
00201   /** Try to read a value from the pipe
00202
00203       \param[out] value is the reference to where to store what is
00204       read
00205
00206       \return \code this \endcode so we can apply a sequence of read
00207       for example (but do not do this on a non blocking pipe...)
00208
00209       This function is const so it can work when the accessor is
00210       passed by copy in the [=] kernel lambda, which is not mutable by
00211       default
00212   */
00213   const pipe_accessor &read(value_type &value) const {
00214     static_assert(mode == access::mode::read,
00215                   "'.read(value_type &value)' method on a pipe accessor"
00216                   " is only possible with read access mode");
00217     ok = implementation->read(value, blocking);
00218     // Return a reference to *this so we can apply a sequence of read
00219     return *this;
00220   }
00221
00222
00223   /** Read a value from a blocking pipe
00224
00225       \return the read value directly, since it cannot fail on
00226       blocking pipe
00227
00228       This function is const so it can work when the accessor is
00229       passed by copy in the [=] kernel lambda, which is not mutable by
00230       default
00231   */
00232   value_type read() const {
00233     static_assert(mode == access::mode::read,
00234                   "'.read()' method on a pipe accessor is only possible"
00235                   " with read access mode");
00236     static_assert(blocking,
00237                   "'.read()' method on a pipe accessor is only possible"
00238                   " with a blocking pipe");
00239     value_type value;
00240     implementation->read(value, blocking);
00241     return value;
00242   }
00243
```

```
00244
00245   /** Some syntactic sugar to use \code a >> v \endcode instead of
00246       \code a.read(v) \endcode */
00247   const pipe_accessor &operator>>(value_type &value) const {
00248     static_assert(mode == access::mode::read,
00249                   "'>>' operator on a pipe accessor is only possible"
00250                   " with read access mode");
00251     // Return a reference to *this so we can apply a sequence of >>
00252     return read(value);
00253   }
00254
00255
00256   detail::pipe_reservation<pipe_accessor>
      reserve(std::size_t size) const {
00257     return { *implementation, size };
00258   }
00259
00260
00261   /// Set debug mode
00262   void set_debug(bool enable) const {
00263     implementation->debug_mode = enable;
00264   }
00265
00266
00267   auto &get_pipe_detail() {
00268     return implementation;
00269   }
00270
00271
00272   ~pipe_accessor() {
00273     /// Free the pipe for a future usage for the current mode
00274     if (mode == access::mode::write)
00275       implementation->used_for_writing = false;
00276     else
00277       implementation->used_for_reading = false;
00278   }
00279
00280 };
00281
00282 /// @} End the data Doxygen group
00283
00284 }
00285 }
00286 }
00287
00288 /*
00289     # Some Emacs stuff:
00290     ### Local Variables:
00291     ### ispell-local-dictionary: "american"
00292     ### eval: (flyspell-prog-mode)
00293     ### End:
00294 */
00295
00296 #endif // TRISYCL_SYCL_PIPE_DETAIL_PIPE_ACCESSOR_HPP
```

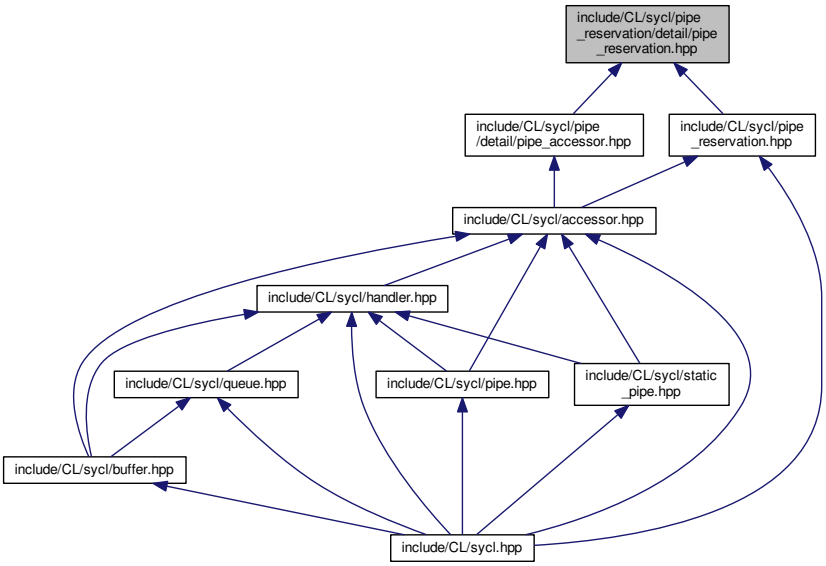
11.127 include/CL/sycl/pipe_reservation/detail/pipe_reservation.hpp File Reference

```
#include <cstddef>
#include <memory>
#include "CL/sycl/pipe/detail/pipe.hpp"
```

Include dependency graph for pipe_reservation.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::accessor< T, Dimensions, Mode, Target >

  The buffer accessor abstracts the way buffer data are accessed inside a kernel in a multidimensional variable length array way. More...
- class cl::sycl::detail::pipe_reservation< PipeAccessor >

  The implementation of the pipe reservation station. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.128 pipe_reservation.hpp

```
00001 #ifndef TRISYCL_SYCL_PIPE_RESERVATION_DETAIL_PIPE_RESERVATION_HPP
00002 #define TRISYCL_SYCL_PIPE_RESERVATION_DETAIL_PIPE_RESERVATION_HPP
00003
00004 /** \file The OpenCL SYCL pipe reservation detail behind the scene
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <memory>
00014
00015 #include "CL/sycl/pipe/detail/pipe.hpp"
00016
00017 namespace cl {
00018 namespace sycl {
00019 namespace detail {
00020
00021 template <typename T,
00022           int Dimensions,
00023           access::mode Mode,
00024           access::target Target>
00025 class accessor;
00026
00027 /** \addtogroup data Data access and storage in SYCL
00028     @{
00029 */
00030
00031 /// The implementation of the pipe reservation station
00032 template <typename PipeAccessor>
00033 class pipe_reservation :
00034     public detail::debug<detail::pipe_reservation<PipeAccessor>> {
00035   using accessor_type = PipeAccessor;
00036   static constexpr bool blocking =
00037     (accessor_type::target ==
      cl::sycl::access::target::blocking_pipe);
00038   using value_type = typename accessor_type::value_type;
00039   using reference = typename accessor_type::reference;
00040
00041 public:
00042
00043   using iterator =
00044     typename detail::pipe<value_type>::implementation_t::iterator
      ;
00045   using const_iterator =
00046     typename detail::pipe<value_type>::implementation_t::const_iterator
      ;
00047
00048   // \todo Add to the specification
00049   static constexpr access::mode mode = accessor_type::mode;
00050   static constexpr access::target target =
      accessor_type::target;
00051
00052   /**  True if the reservation was successful and still uncommitted. B
00053        default a pipe_reservation is not reserved and cannot be
00054        committed */
00055   bool ok = false;
00056
00057   /// Point into the reservation buffer. Only valid if ok is true
00058   typename detail::pipe<value_type>::rid_iterator
      rid;
00059
00060   /** Keep a reference on the pipe to access to the data and methods
00061
00062       Note that with inlining and CSE it should not use more register
00063       when compiler optimization is in use. */
00064   detail::pipe<value_type> &p;
00065
00066
00067   /** Test that the reservation is in a usable state
00068
00069       \todo Throw exception instead
00070   */
00071   void assume_validity() {
00072     assert(ok);
00073   }
00074
00075 public:
00076
00077   /// Create a pipe reservation station that reserves the pipe itself
00078   pipe_reservation(detail::pipe<value_type> &p, std::size_t s) : p
      { p } {
```

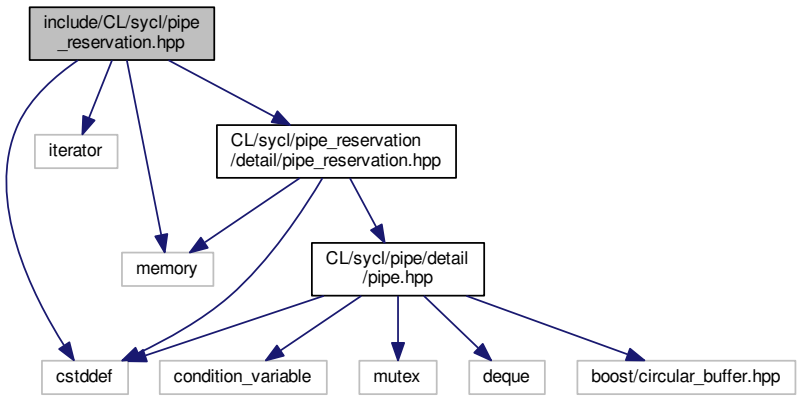
```
00079     static_assert(mode == access::mode::write
00080                   || mode == access::mode::read,
00081                   "A pipe can only be accesed in read or write mode,"
00082                   " exclusively");
00083
00084     /* Since this test is constexpr and dependent of a template
00085        parameter, it should be equivalent to a specialization of the
00086        method but in a clearer way */
00087     if (mode == access::mode::write)
00088       ok = p.reserve_write(s, rid, blocking);
00089     else
00090       ok = p.reserve_read(s, rid, blocking);
00091   }
00092
00093
00094   /** No copy constructor with some spurious commit in the destructor
00095       of the original object
00096   */
00097   pipe_reservation(const pipe_reservation &) = delete;
00098
00099
00100   /// Only a move constructor is required to move it into the shared_ptr
00101   pipe_reservation(pipe_reservation &&orig) :
00102     ok {orig.ok },
00103     rid {orig.rid },
00104     p { orig.p } {
00105       /* Even when an object is moved, the destructor of the old
00106          object is eventually called, so leave the old object in a
00107          destructable state but without any commit capability */
00108       orig.ok = false;
00109     }
00110
00111
00112   /** Keep the default constructors too
00113
00114       Otherwise there is no move semantics and the copy is made by
00115       creating a new reservation and destructing the old one with a
00116       spurious commit in the meantime...
00117   */
00118   pipe_reservation() = default;
00119
00120
00121   /** Test if the reservation succeeded and thus if the reservation
00122       can be committed
00123
00124       Note that it is up to the user to ensure that all the
00125       reservation elements have been initialized correctly in the case
00126       of a write for example
00127   */
00128   operator bool() {
00129     return ok;
00130   }
00131
00132
00133   /// Start of the reservation area
00134   iterator begin() {
00135     assume_validity();
00136     return rid->start;
00137   }
00138
00139
00140   /// Past the end of the reservation area
00141   iterator end() {
00142     assume_validity();
00143     return rid->start + rid->size;
00144   }
00145
00146
00147   /// Get the number of elements in the reservation station
00148   std::size_t size() {
00149     assume_validity();
00150     return rid->size;
00151   }
00152
00153
00154   /// Access to an element of the reservation
00155   reference operator[](std::size_t index) {
00156     assume_validity();
00157     TRISYCL_DUMP_T("[] index = " << index
00158                    << " Reservation write address = " << &(rid->start[index]));
00159
00160     return rid->start[index];
00161   }
00162
00163
00164   /** Commit the reservation station
00165
```

```
00166       \todo Add to the specification that for simplicity a reservation
00167       can be commited several times but only the first one is taken
00168       into account
00169   */
00170   void commit() {
00171     if (ok) {
00172       // If the reservation is in a committable state, commit
00173       TRISYCL_DUMP_T("Commit");
00174       rid->ready = true;
00175       if (mode == access::mode::write)
00176         p.move_write_reservation_forward();
00177       else
00178         p.move_read_reservation_forward();
00179       ok = false;
00180     }
00181   }
00182
00183
00184   /// An implicit commit is made in the destructor
00185   ~pipe_reservation() {
00186     commit();
00187   }
00188
00189 };
00190
00191 /// @} End the data Doxygen group
00192
00193 }
00194 }
00195 }
00196
00197 /*
00198     # Some Emacs stuff:
00199     ### Local Variables:
00200     ### ispell-local-dictionary: "american"
00201     ### eval: (flyspell-prog-mode)
00202     ### End:
00203 */
00204
00205 #endif // TRISYCL_SYCL_PIPE_RESERVATION_DETAIL_PIPE_RESERVATION_HPP
```

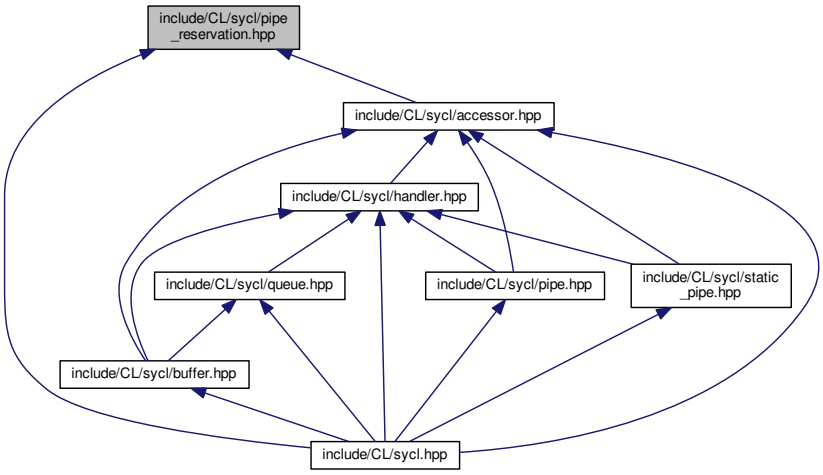
11.129 include/CL/sycl/pipe_reservation.hpp File Reference

```
#include <cstddef>
#include <iterator>
#include <memory>
#include "CL/sycl/pipe_reservation/detail/pipe_reservation.hpp"
```

Include dependency graph for pipe_reservation.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::pipe_reservation< PipeAccessor >

  The pipe reservation station allows to reserve an array-like view inside the pipe for ordered race-free access from various work-items for example. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

11.130 pipe_reservation.hpp

```
00001 #ifndef TRISYCL_SYCL_PIPE_RESERVATION_HPP
00002 #define TRISYCL_SYCL_PIPE_RESERVATION_HPP
00003
00004 /** \file The reservation station for OpenCL SYCL pipe accessor<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <cstddef>
00013 #include <iterator>
00014 #include <memory>
00015
00016 #include "CL/sycl/pipe_reservation/detail/pipe_reservation.hpp
      "
00017
00018 namespace cl {
00019 namespace sycl {
00020
00021 /** \addtogroup data Data access and storage in SYCL
00022     @{
00023 */
00024
```

```
00025 /** The pipe reservation station allows to reserve an array-like view
00026     inside the pipe for ordered race-free access from various
00027     work-items for example
00028  */
00029 template <typename PipeAccessor>
00030 struct pipe_reservation {
00031   using accessor_type = PipeAccessor;
00032   static constexpr bool blocking =
00033     (accessor_type::target ==
      cl::sycl::access::target::blocking_pipe);
00034   using accessor_detail = typename accessor_type::accessor_detail;
00035   /// The STL-like types
00036   using value_type = typename accessor_type::value_type;
00037   using reference = value_type&;
00038   using const_reference = const value_type&;
00039   using pointer = value_type*;
00040   using const_pointer = const value_type*;
00041   using size_type = std::size_t;
00042   using difference_type = ptrdiff_t;
00043   using iterator =
00044     typename detail::pipe_reservation<accessor_detail>::iterator
    ;
00045   using const_iterator =
00046     typename detail::pipe_reservation<accessor_detail>::const_iterator
    ;
00047   using reverse_iterator = std::reverse_iterator<iterator>;
00048   using const_reverse_iterator = std::reverse_iterator<const_iterator>;
00049
00050   /** Point to the underlying implementation that can be shared in the
00051       SYCL model with a handler semantics */
00052   typename std::shared_ptr<detail::pipe_reservation<accessor_detail>>
00053   implementation;
00054
00055   /** Use default constructors so that we can create a new buffer copy
00056       from another one, with either a l-value or a r-value (for
00057       std::move() for example).
00058
00059       Since we just copy the shared_ptr<> above, this is where/how the
00060       sharing magic is happening with reference counting in this case.
00061   */
00062   pipe_reservation() = default;
00063
00064
00065   /// Create a pipe_reservation for an accessor and a number of elements
00066   pipe_reservation(accessor_type &accessor, std::size_t s)
00067     : implementation {
00068     new detail::pipe_reservation<accessor_detail> {
00069       get_pipe_detail(accessor), s }
00070   } {}
00071
00072
00073   /** Create a pipe_reservation from the implementation detail
00074
00075       This is an internal constructor to allow reserve() on the
00076       implementation to lift a full-fledged object through
00077       accessor::reserve().
00078
00079       \todo Make it private and add required friends
00080    */
00081   pipe_reservation(detail::pipe_reservation<accessor_detail>
      &&pr)
00082     : implementation {
00083     new detail::pipe_reservation<accessor_detail> { std::move(pr)
    } }
00084   {}
00085
00086
00087   /** Test if the pipe_reservation has been correctly allocated
00088
00089       \return true if the pipe_reservation can be used and committed
00090   */
00091   operator bool() const {
00092     return *implementation;
00093   }
00094
00095
00096   /// Get the number of reserved element(s)
00097   std::size_t size() const {
00098     return implementation->size();
00099   }
00100
00101
00102   /// Access to a given element of the reservation
00103   reference operator[](std::size_t index) const {
00104     return (*implementation)[index];
00105   }
00106
```

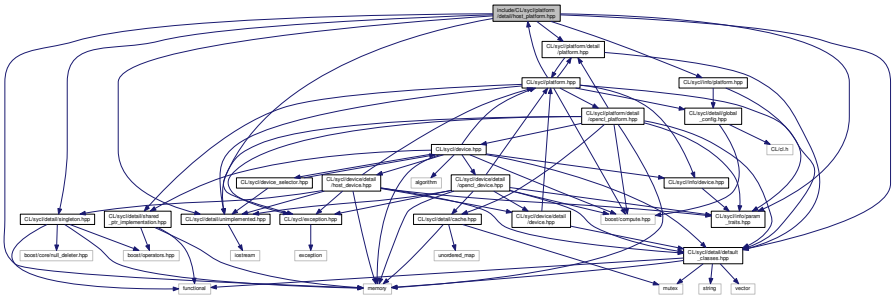
```
00107
00108   /** Force a commit operation
00109
00110       Normally the commit is implicitly done in the destructor, but
00111       sometime it is useful to do it earlier.
00112   */
00113   void commit() const {
00114     return implementation->commit();
00115   }
00116
00117
00118   /// Get an iterator on the first element of the reservation station
00119   iterator begin() const {
00120     return implementation->begin();
00121   }
00122
00123
00124   /// Get an iterator past the end of the reservation station
00125   iterator end() const {
00126     return implementation->end();
00127   }
00128
00129
00130   /// Build a constant iterator on the first element of the reservation station
00131   const_iterator cbegin() const {
00132     return implementation->begin();
00133   }
00134
00135
00136   /// Build a constant iterator past the end of the reservation station
00137   const_iterator cend() const {
00138     return implementation->end();
00139   }
00140
00141
00142   /// Get a reverse iterator on the last element of the reservation station
00143   reverse_iterator rbegin() const {
00144     return std::make_reverse_iterator(end());
00145   }
00146
00147
00148   /** Get a reverse iterator on the first element past the end of the
00149       reservation station */
00150   reverse_iterator rend() const {
00151     return std::make_reverse_iterator(begin());
00152   }
00153
00154
00155   /** Get a constant reverse iterator on the last element of the
00156       reservation station */
00157   const_reverse_iterator crbegin() const {
00158     return std::make_reverse_iterator(cend());
00159   }
00160
00161
00162   /** Get a constant reverse iterator on the first element past the
00163       end of the reservation station */
00164   const_reverse_iterator crend() const {
00165     return std::make_reverse_iterator(cbegin());
00166   }
00167
00168 };
00169
00170 /// @} End the data Doxygen group
00171
00172 }
00173 }
00174
00175 /*
00176     # Some Emacs stuff:
00177     ### Local Variables:
00178     ### ispell-local-dictionary: "american"
00179     ### eval: (flyspell-prog-mode)
00180     ### End:
00181 */
00182
00183 #endif // TRISYCL_SYCL_PIPE_RESERVATION_HPP
```

11.131 include/CL/sycl/platform/detail/host_platform.hpp File Reference

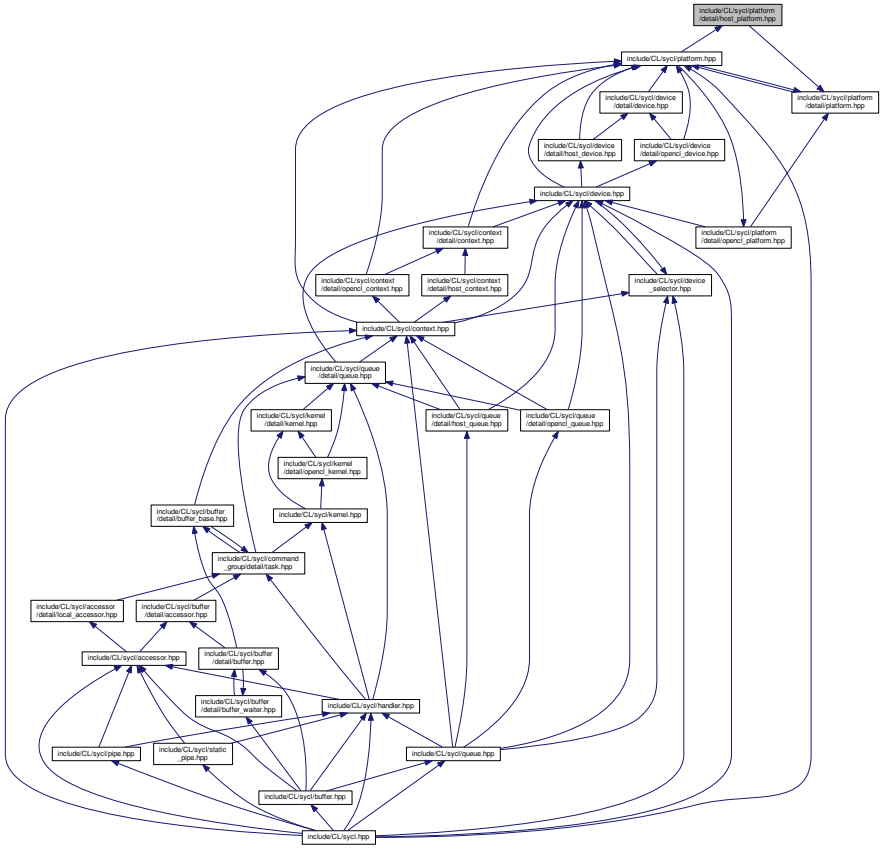
```
#include <memory>
#include "CL/sycl/detail/default_classes.hpp"
```

```
#include "CL/sycl/detail/singleton.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/exception.hpp"
#include "CL/sycl/info/param_traits.hpp"
#include "CL/sycl/info/platform.hpp"
#include "CL/sycl/platform/detail/platform.hpp"
```

Include dependency graph for host_platform.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::host_platform

  SYCL host platform. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

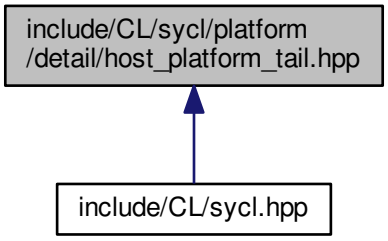
11.132 host_platform.hpp

```
00001 #ifndef TRISYCL_SYCL_PLATFORM_DETAIL_HOST_PLATFORM_HPP
00002 #define TRISYCL_SYCL_PLATFORM_DETAIL_HOST_PLATFORM_HPP
00003
00004 /** \file The OpenCL triSYCL host platform implementation
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011 #include <memory>
00012
00013 #include "CL/sycl/detail/default_classes.hpp"
00014
00015 #include "CL/sycl/detail/singleton.hpp"
00016 #include "CL/sycl/detail/unimplemented.hpp"
00017 #include "CL/sycl/exception.hpp"
00018 #include "CL/sycl/info/param_traits.hpp"
00019 #include "CL/sycl/info/platform.hpp"
00020 #include "CL/sycl/platform/detail/platform.hpp"
00021
00022 namespace cl {
00023 namespace sycl {
00024 namespace detail {
00025
00026 /** \addtogroup execution Platforms, contexts, devices and queues
00027     @{
00028 */
00029
00030 /// SYCL host platform
00031 class host_platform : public detail::platform,
00032                       public detail::singleton<host_platform> {
00033
00034 // \todo Have this compatible with has_extension
00035 auto static constexpr platform_extensions = "Xilinx_blocking_pipes";
00036
00037 public:
00038
00039 #ifdef TRISYCL_OPENCL
00040   /** Return the cl_platform_id of the underlying OpenCL platform
00041
00042       This throws an error since there is no OpenCL platform associated
00043       to the host platform.
00044   */
00045   cl_platform_id get() const override {
00046     throw non_cl_error("The host platform has no OpenCL platform");
00047   }
00048
00049
00050   /** Return the underlying Boost.Compute platform
00051
00052       This throws an error since there is no Boost Compute platform associated
00053       to the host platform.
00054    */
00055   boost::compute::platform &get_boost_compute() const override {
00056     throw
00057       non_cl_error("The host device has no underlying Boost Compute platform");
00058   }
00059 #endif
00060
00061
00062   /// Return true since this platform is the SYCL host platform
00063   bool is_host() const override {
00064     return true;
00065   }
00066
00067
00068   /** Returning the information parameters for the host platform
00069       implementation
00070   */
```

```
00071   string_class get_info_string(info::platform param) const
       override {
00072     switch (param) {
00073     case info::platform::profile:
00074       /* Well... Is the host platform really a full profile whereas it
00075          is not really OpenCL? */
00076       return "FULL_PROFILE";
00077
00078     case info::platform::version:
00079       // \todo I guess it should include the software version too...
00080       return "2.2";
00081
00082     case info::platform::name:
00083       return "triSYCL host platform";
00084
00085     case info::platform::vendor:
00086       return "triSYCL Open Source project";
00087
00088     case info::platform::extensions:
00089       return platform_extensions;
00090
00091     default:
00092       // \todo Define some SYCL exception type for this type of errors
00093       throw std::invalid_argument {
00094         "Unknown parameter value for SYCL platform information" };
00095     }
00096   }
00097
00098
00099   /** Specify whether a specific extension is supported on the platform
00100
00101       \todo To be implemented
00102   */
00103   bool has_extension(const string_class &extension) const override {
00104     detail::unimplemented();
00105     return {};
00106   }
00107
00108   /** Get all the available devices for the host platform
00109
00110       \param[in] device_type is the device type to filter the selection
00111       or \c info::device_type::all by default to return all the
00112       devices
00113
00114       \return the device list
00115   */
00116   vector_class<cl::sycl::device>
00117   get_devices(info::device_type device_type) const override;
00118
00119 };
00120
00121 /// @} to end the execution Doxygen group
00122
00123 }
00124 }
00125 }
00126
00127 /*
00128     # Some Emacs stuff:
00129     ### Local Variables:
00130     ### ispell-local-dictionary: "american"
00131     ### eval: (flyspell-prog-mode)
00132     ### End:
00133 */
00134
00135 #endif // TRISYCL_SYCL_PLATFORM_DETAIL_HOST_PLATFORM_HPP
```

11.133 include/CL/sycl/platform/detail/host_platform_tail.hpp File Reference

This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.134 host_platform_tail.hpp

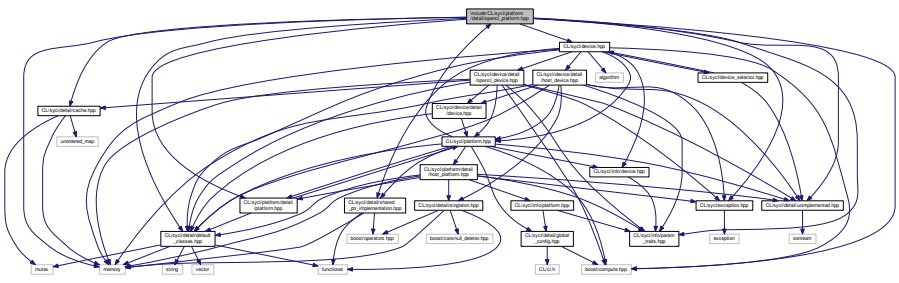
```
00001 #ifndef TRISYCL_SYCL_PLATFORM_DETAIL_HOST_PLATFORM_TAIL_HPP
00002 #define TRISYCL_SYCL_PLATFORM_DETAIL_HOST_PLATFORM_TAIL_HPP
00003
00004 /** \file The ending part of the SYCL host platform
00005
00006     This is here to break a dependency between platform and device
00007
00008     a-doumoulakis at gmail dot com
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 namespace cl {
00015 namespace sycl {
00016 namespace detail {
00017
00018 /** \addtogroup execution Platforms, contexts, devices and queues
00019     @{
00020 */
00021
00022 /** Get all the available devices for this platform
00023
00024     \param[in] device_type is the device type to filter the selection
00025     or \c info::device_type::all by default to return all the
00026     devices
00027
00028     \return the device list
00029 */
00030 vector_class<cl::sycl::device>
00031 inline host_platform::get_devices(info::device_type device_type)
       const {
00032   /** If \c get_devices is called with the host platform
00033       and the right device type, returns the host_device.
00034   */
00035   if (device_type_selector { device_type }(cl::sycl::device {}) > 0)
```

```
00036     // Return 1 default device, i.e. the host device
00037     return { {} };
00038   else
00039     // No matching device
00040     return {};
00041 }
00042
00043 /// @} to end the Doxygen group
00044
00045 }
00046 }
00047 }
00048
00049 /*
00050     # Some Emacs stuff:
00051     ### Local Variables:
00052     ### ispell-local-dictionary: "american"
00053     ### eval: (flyspell-prog-mode)
00054     ### End:
00055 */
00056
00057 #endif // TRISYCL_SYCL_PLATFORM_DETAIL_HOST_PLATFORM_TAIL_HPP
```

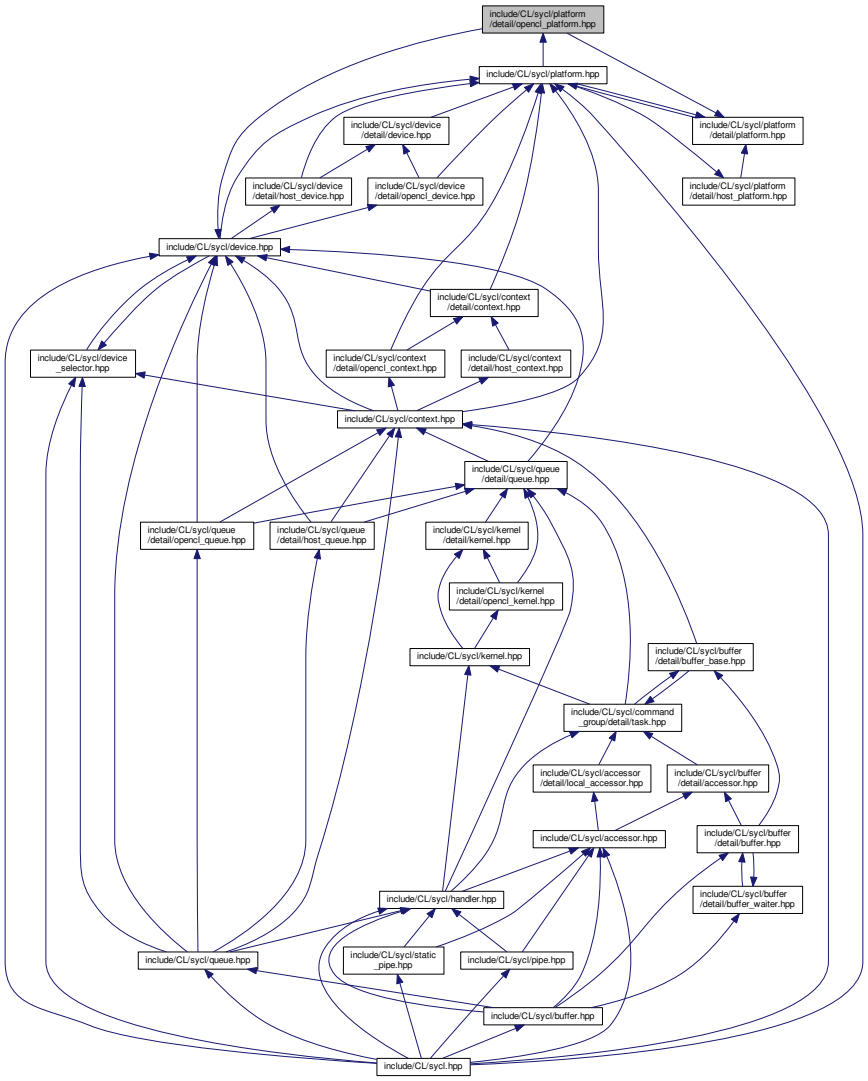
11.135 include/CL/sycl/platform/detail/opencl_platform.hpp File Reference

```
#include <memory>
#include <boost/compute.hpp>
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/detail/cache.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/device.hpp"
#include "CL/sycl/exception.hpp"
#include "CL/sycl/info/param_traits.hpp"
#include "CL/sycl/platform/detail/platform.hpp"
```

Include dependency graph for opencl_platform.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::opencl_platform

  SYCL OpenCL platform. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

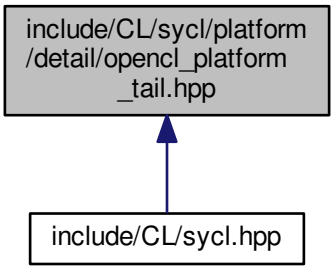
11.136 opencl_platform.hpp

```
00001 #ifndef TRISYCL_SYCL_PLATFORM_DETAIL_OPENCL_PLATFORM_HPP
00002 #define TRISYCL_SYCL_PLATFORM_DETAIL_OPENCL_PLATFORM_HPP
00003
00004 /** \file The OpenCL triSYCL OpenCL platform implementation
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011 #include <memory>
00012
00013 #include <boost/compute.hpp>
00014
00015 #include "CL/sycl/detail/default_classes.hpp"
00016
00017 #include "CL/sycl/detail/cache.hpp"
00018 #include "CL/sycl/detail/unimplemented.hpp"
00019 #include "CL/sycl/device.hpp"
00020 #include "CL/sycl/exception.hpp"
00021 #include "CL/sycl/info/param_traits.hpp"
00022 #include "CL/sycl/platform/detail/platform.hpp"
00023
00024 namespace cl {
00025 namespace sycl {
00026
00027 class device;
00028
00029 namespace detail {
00030
00031 /** \addtogroup execution Platforms, contexts, devices and queues
00032     @{
00033 */
00034
00035 /// SYCL OpenCL platform
00036 class opencl_platform : public detail::platform {
00037
00038   /// Use the Boost Compute abstraction of the OpenCL platform
00039   boost::compute::platform p;
00040
00041   /** A cache to always return the same live platform for a given OpenCL
00042       platform
00043
00044       C++11 guaranties the static construction is thread-safe
00045   */
00046   static detail::cache<cl_platform_id, detail::opencl_platform>
      cache;
00047
00048 public:
00049
00050   /// Return the cl_platform_id of the underlying OpenCL platform
00051   cl_platform_id get() const override {
00052     return p.id();
00053   }
00054
00055
00056   /// Return the underlying Boost.Compute platform
00057   const boost::compute::platform &get_boost_compute() const
      override {
00058     return p;
00059   }
00060
00061
00062   /// Return false since an OpenCL platform is not the SYCL host platform
00063   bool is_host() const override {
00064     return false;
00065   }
00066
00067
00068   /// Returning the information string parameters for the OpenCL platform
00069   string_class get_info_string(info::platform param) const
      override {
00070     /* Use the fact that the triSYCL info values are the same as the
00071        OpenCL ones used in Boost.Compute to just cast the enum class
00072        to the int value */
00073     return p.get_info<std::string>(static_cast<cl_platform_info>(param));
00074   }
00075
00076
00077   /// Specify whether a specific extension is supported on the platform
00078   bool has_extension(const string_class &extension) const override {
00079     return p.supports_extension(extension);
00080   }
00081
```

```
00082
00083   ///// Get a singleton instance of the opencl_platform
00084   static std::shared_ptr<opencl_platform>
00085   instance(const boost::compute::platform &p) {
00086     return cache.get_or_register(p.id(),
00087                                  [&] { return new opencl_platform { p }; });
00088   }
00089
00090
00091   /** Get all the available devices for this OpenCL platform
00092
00093       \param[in] device_type is the device type to filter the selection
00094       or \c info::device_type::all by default to return all the
00095       devices
00096
00097       \return the device list
00098   */
00099   vector_class<cl::sycl::device>
00100   get_devices(info::device_type device_type) const override;
00101
00102 private:
00103
00104   /// Only the instance factory can built it
00105   opencl_platform(const boost::compute::platform &p) : p { p } {}
00106
00107 public:
00108
00109   /// Unregister from the cache on destruction
00110   ~opencl_platform() override {
00111     cache.remove(p.id());
00112   }
00113
00114 };
00115
00116 /* Allocate the cache here but since this is a pure-header library,
00117    use a weak symbol so that only one remains when SYCL headers are
00118    used in different compilation units of a program
00119 */
00120 TRISYCL_WEAK_ATTRIB_PREFIX
00121 detail::cache<cl_platform_id, detail::opencl_platform>
       opencl_platform::cache
00122 TRISYCL_WEAK_ATTRIB_SUFFIX;
00123
00124 /// @} to end the execution Doxygen group
00125
00126 }
00127 }
00128 }
00129
00130 /*
00131     # Some Emacs stuff:
00132     ### Local Variables:
00133     ### ispell-local-dictionary: "american"
00134     ### eval: (flyspell-prog-mode)
00135     ### End:
00136 */
00137
00138 #endif // TRISYCL_SYCL_PLATFORM_DETAIL_HOST_PLATFORM_HPP
```

11.137 include/CL/sycl/platform/detail/opencl_platform_tail.hpp File Reference

This graph shows which files directly or indirectly include this file:



Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.138 opencl_platform_tail.hpp

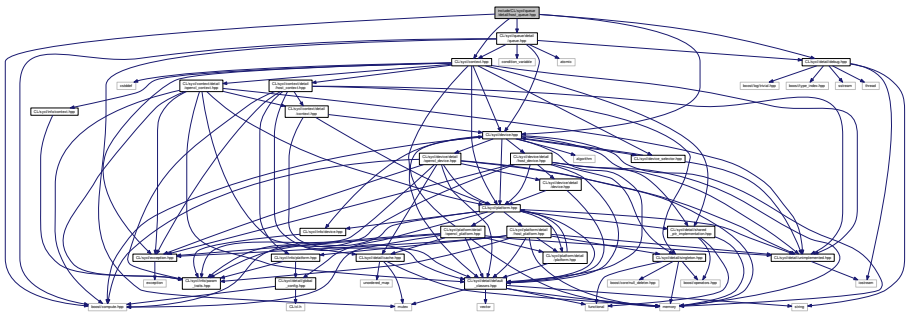
```
00001 #ifndef TRISYCL_SYCL_PLATFORM_DETAIL_OPENCL_PLATFORM_TAIL_HPP
00002 #define TRISYCL_SYCL_PLATFORM_DETAIL_OPENCL_PLATFORM_TAIL_HPP
00003
00004 /** \file The ending part of the SYCL host platform
00005
00006     This is here to break a dependency between platform and device
00007
00008     a-doumoulakis at gmail dot com
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 namespace cl {
00015 namespace sycl {
00016 namespace detail {
00017
00018 /** \addtogroup execution Platforms, contexts, devices and queues
00019     @{
00020 */
00021
00022 /** Returns a vector class containing all SYCL devices associated with
00023     this OpenCL platform
00024
00025     \param[in] device_type is the device type to filter the selection
00026     or \c info::device_type::all by default to return all the
00027     devices
00028
00029     \return the device list
00030 */
00031 vector_class<cl::sycl::device>
00032 inline opencl_platform::get_devices(
      info::device_type device_type) const {
00033   vector_class<cl::sycl::device> devices;
00034     device_type_selector ds { device_type };
```

```
00035   // Add the desired OpenCL devices
00036   for (const auto &d : get_boost_compute().devices()) {
00037     // Get the SYCL device from the Boost Compute device
00038     cl::sycl::device sycl_dev { d };
00039     /* Return the devices with the good criterion according to the selector.
00040        By calling devices on the \c boost::compute::platform we know that
00041        we iterate only over the device belonging to the current platform,
00042     */
00043     if (ds(sycl_dev) > 0)
00044       devices.push_back(sycl_dev);
00045   }
00046
00047   return devices;
00048 }
00049
00050 /// @} to end the Doxygen group
00051
00052 }
00053 }
00054 }
00055
00056 /*
00057     # Some Emacs stuff:
00058     ### Local Variables:
00059     ### ispell-local-dictionary: "american"
00060     ### eval: (flyspell-prog-mode)
00061     ### End:
00062 */
00063
00064 #endif // TRISYCL_SYCL_PLATFORM_DETAIL_OPENCL_PLATFORM_TAIL_HPP
```

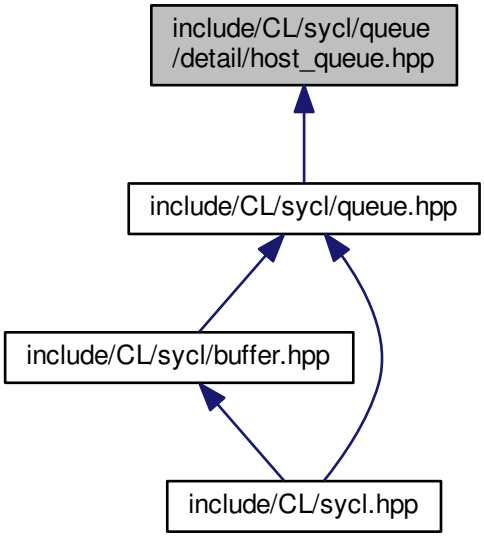
11.139 include/CL/sycl/queue/detail/host_queue.hpp File Reference

```
#include <boost/compute.hpp>
#include "CL/sycl/context.hpp"
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/device.hpp"
#include "CL/sycl/queue/detail/queue.hpp"
```

Include dependency graph for host_queue.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::host_queue

  Some implementation details about the SYCL queue.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.140 host_queue.hpp

```
00001 #ifndef TRISYCL_SYCL_QUEUE_DETAIL_HOST_QUEUE_HPP
00002 #define TRISYCL_SYCL_QUEUE_DETAIL_HOST_QUEUE_HPP
00003
00004 /** \file Some implementation details of the host queue
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #ifdef TRISYCL_OPENCL
00013 #include <boost/compute.hpp>
00014 #endif
00015
00016 #include "CL/sycl/context.hpp"
00017 #include "CL/sycl/detail/debug.hpp"
```

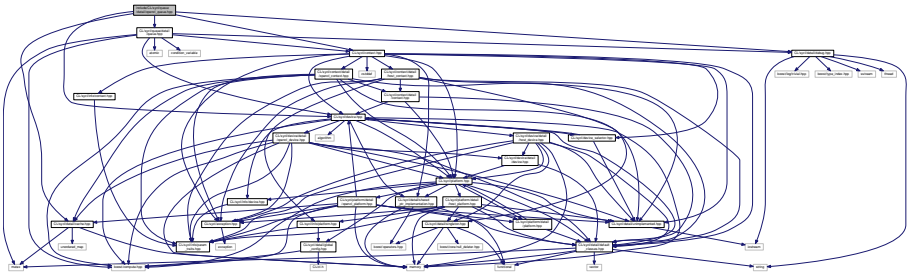
```
00018 #include "CL/sycl/device.hpp"
00019 #include "CL/sycl/queue/detail/queue.hpp"
00020
00021 namespace cl {
00022 namespace sycl {
00023 namespace detail {
00024
00025 /** Some implementation details about the SYCL queue
00026
00027     Note that a host queue is not a singleton, compared to host
00028     device or host platform, for example.
00029  */
00030 class host_queue : public detail::queue,
00031                    detail::debug<host_queue> {
00032
00033 #ifdef TRISYCL_OPENCL
00034   /** Return the cl_command_queue of the underlying OpenCL queue
00035
00036       This throws an error since there is no OpenCL queue associated
00037       to the host queue.
00038   */
00039   cl_command_queue get() const override {
00040     throw non_cl_error("The host queue has no OpenCL command queue");
00041   }
00042
00043
00044   /** Return the underlying Boost.Compute command queue
00045
00046       This throws an error since there is no OpenCL queue associated
00047       to the host queue.
00048   */
00049   boost::compute::command_queue &get_boost_compute() override {
00050     throw non_cl_error("The host queue has no OpenCL command queue");
00051   }
00052 #endif
00053
00054
00055   /// Return the SYCL host queue's host context
00056   cl::sycl::context get_context() const override {
00057     // Return the default context which is the host context
00058     return {};
00059   }
00060
00061
00062   /// Return the SYCL host device the host queue is associated with
00063   cl::sycl::device get_device() const override {
00064     // Return the default device which is the host device
00065     return {};
00066   }
00067
00068
00069   /// Claim proudly that the queue is executing on the SYCL host device
00070   bool is_host() const override {
00071     return true;
00072   }
00073
00074
00075 };
00076
00077 }
00078 }
00079 }
00080
00081 /*
00082     # Some Emacs stuff:
00083     ### Local Variables:
00084     ### ispell-local-dictionary: "american"
00085     ### eval: (flyspell-prog-mode)
00086     ### End:
00087 */
00088
00089 #endif // TRISYCL_SYCL_QUEUE_DETAIL_HOST_QUEUE_HPP
```

11.141 include/CL/sycl/queue/detail/opencl_queue.hpp File Reference

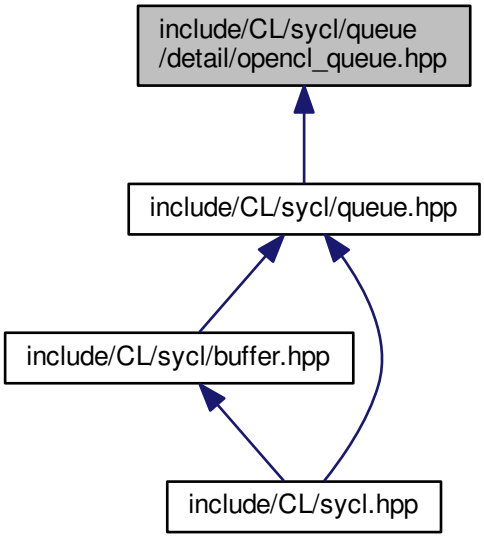
```
#include "CL/sycl/context.hpp"
#include "CL/sycl/detail/cache.hpp"
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/device.hpp"
```

```
#include "CL/sycl/queue/detail/queue.hpp"
```

Include dependency graph for opencl_queue.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::detail::opencl_queue

  Some implementation details about the SYCL queue.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.142 opencl_queue.hpp

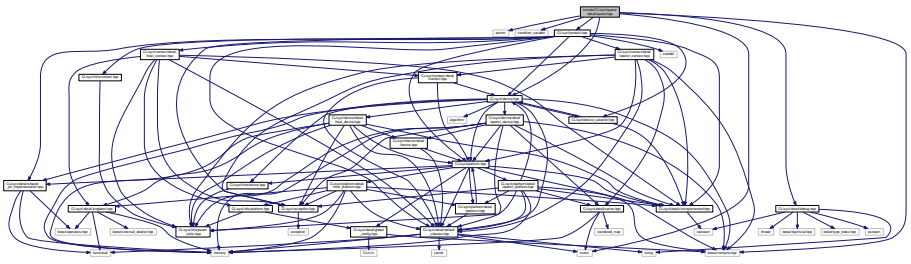
```
00001 #ifndef TRISYCL_SYCL_QUEUE_DETAIL_OPENCL_QUEUE_HPP
00002 #define TRISYCL_SYCL_QUEUE_DETAIL_OPENCL_QUEUE_HPP
00003
00004 /** \file Some implementation details of the OpenCL queue
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include "CL/sycl/context.hpp"
00013 #include "CL/sycl/detail/cache.hpp"
00014 #include "CL/sycl/detail/debug.hpp"
00015 #include "CL/sycl/device.hpp"
00016 #include "CL/sycl/queue/detail/queue.hpp"
00017
00018 namespace cl {
00019 namespace sycl {
00020 namespace detail {
00021
00022 /// Some implementation details about the SYCL queue
00023 class opencl_queue : public detail::queue,
00024                      detail::debug<opencl_queue> {
00025   /// Use the Boost Compute abstraction of the OpenCL command queue
00026   boost::compute::command_queue q;
00027
00028   /** A cache to always return the same alive queue for a given OpenCL
00029       command queue
00030
00031       C++11 guaranties the static construction is thread-safe
00032   */
00033   static detail::cache<cl_command_queue, detail::opencl_queue>
       cache;
00034
00035   /// Return the cl_command_queue of the underlying OpenCL queue
00036   cl_command_queue get() const override {
00037     return q.get();
00038   }
00039
00040
00041   /// Return the underlying Boost.Compute command queue
00042   boost::compute::command_queue &get_boost_compute() override {
00043     return q;
00044   }
00045
00046
00047   /// Return the SYCL context associated to the queue
00048   cl::sycl::context get_context() const override {
00049     return q.get_context();
00050   }
00051
00052
00053   /// Return the SYCL device associated to the queue
00054   cl::sycl::device get_device() const override {
00055     return q.get_device();
00056   }
00057
00058
00059   /// Claim proudly that an OpenCL queue cannot be the SYCL host queue
00060   bool is_host() const override {
00061     return false;
00062   }
00063
00064 private:
00065
00066   /// Only the instance factory can built it
00067   opencl_queue(const boost::compute::command_queue &q) : q { q } {}
00068
00069 public:
00070
00071   /// Get a singleton instance of the opencl_queue
00072   static std::shared_ptr<opencl_queue>
00073   instance(const boost::compute::command_queue &q) {
00074     return cache.get_or_register(q.get(),
00075                                  [&] { return new opencl_queue { q }; });
00076   }
00077
00078
00079   /** Create a new queue associated to this device
00080
00081       \todo Check with SYCL committee what is the expected behaviour
00082       here about the context. Is this a new context everytime, or
00083       always the same for a given device?
```

```
00084   */
00085   static std::shared_ptr<detail::queue>
00086   instance(const cl::sycl::device &d) {
00087     return instance (boost::compute::command_queue {
00088         // For now, create a new context every time
00089         boost::compute::context { d.get_boost_compute() },
00090         d.get_boost_compute()
00091           });
00092   }
00093
00094
00095   /// Unregister from the cache on destruction
00096   ~opencl_queue() override {
00097     cache.remove(q.get());
00098   }
00099
00100 };
00101
00102 /* Allocate the cache here but since this is a pure-header library,
00103    use a weak symbol so that only one remains when SYCL headers are
00104    used in different compilation units of a program
00105 */
00106 TRISYCL_WEAK_ATTRIB_PREFIX
00107 detail::cache<cl_command_queue, detail::opencl_queue>
      opencl_queue::cache
00108 TRISYCL_WEAK_ATTRIB_SUFFIX;
00109
00110 }
00111 }
00112 }
00113
00114 /*
00115     # Some Emacs stuff:
00116     ### Local Variables:
00117     ### ispell-local-dictionary: "american"
00118     ### eval: (flyspell-prog-mode)
00119     ### End:
00120 */
00121
00122 #endif // TRISYCL_SYCL_QUEUE_DETAIL_OPENCL_QUEUE_HPP
```

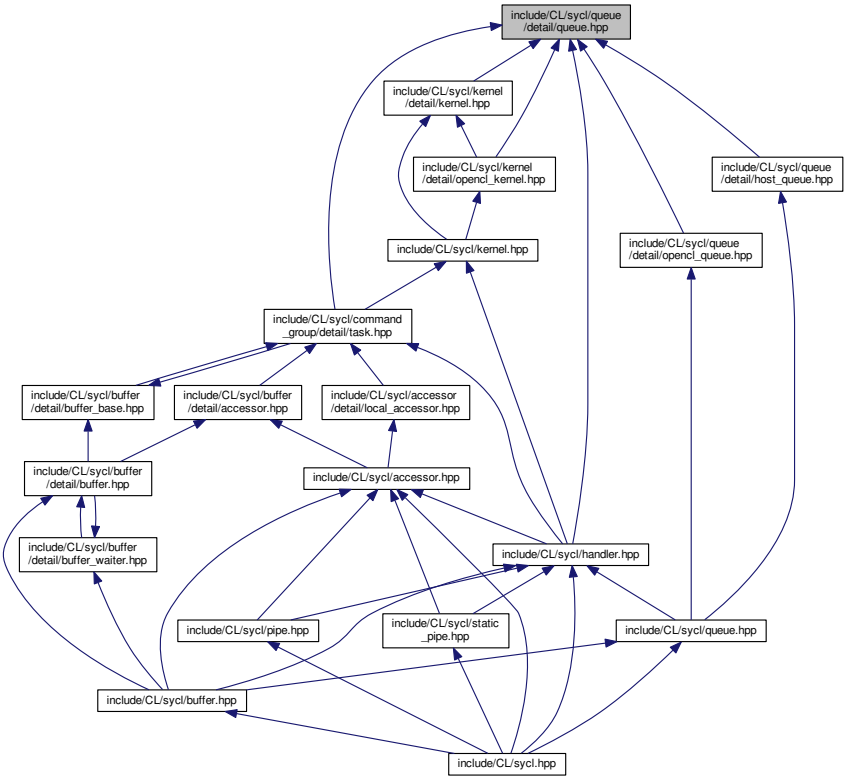
11.143 include/CL/sycl/queue/detail/queue.hpp File Reference

```
#include <atomic>
#include <condition_variable>
#include <mutex>
#include <boost/compute.hpp>
#include "CL/sycl/context.hpp"
#include "CL/sycl/device.hpp"
#include "CL/sycl/detail/debug.hpp"
```

Include dependency graph for queue.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- struct cl::sycl::detail::queue

  Some implementation details about the SYCL queue.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::detail

11.144 queue.hpp

```
00001 #ifndef TRISYCL_SYCL_QUEUE_DETAIL_QUEUE_HPP
00002 #define TRISYCL_SYCL_QUEUE_DETAIL_QUEUE_HPP
00003
00004 /** \file Some implementation details of queue.
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
```

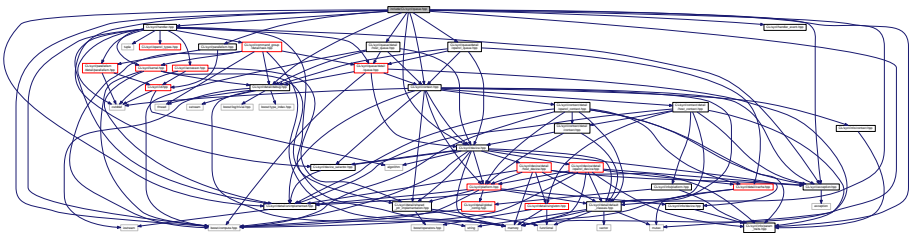
```
00012 #include <atomic>
00013 #include <condition_variable>
00014 #include <mutex>
00015
00016 #ifdef TRISYCL_OPENCL
00017 #include <boost/compute.hpp>
00018 #endif
00019
00020 #include "CL/sycl/context.hpp"
00021 #include "CL/sycl/device.hpp"
00022 #include "CL/sycl/detail/debug.hpp"
00023
00024 namespace cl {
00025 namespace sycl {
00026 namespace detail {
00027
00028 /** Some implementation details about the SYCL queue
00029  */
00030 struct queue : detail::debug<detail::queue> {
00031   /// Track the number of kernels still running to wait for their completion
00032   std::atomic<size_t> running_kernels;
00033
00034   /// To signal when all the kernels have completed
00035   std::condition_variable finished;
00036   /// To protect the access to the condition variable
00037   std::mutex finished_mutex;
00038
00039
00040   /// Initialize the queue with 0 running kernel
00041   queue() {
00042     running_kernels = 0;
00043   }
00044
00045
00046   /// Wait for all kernel completion
00047   void wait_for_kernel_execution() {
00048     TRISYCL_DUMP_T("Queue waiting for kernel completion");
00049     std::unique_lock<std::mutex> ul { finished_mutex };
00050     finished.wait(ul, [&] {
00051         // When there is no kernel running in this queue, we are ready to go
00052         return running_kernels == 0;
00053       });
00054   }
00055
00056
00057   /// Signal that a new kernel started on this queue
00058   void kernel_start() {
00059     TRISYCL_DUMP_T("A kernel has been added to the queue");
00060     // One more kernel
00061     ++running_kernels;
00062   }
00063
00064
00065   /// Signal that a new kernel finished on this queue
00066   void kernel_end() {
00067     TRISYCL_DUMP_T("A kernel of the queue ended");
00068     if (--running_kernels == 0) {
00069       /* It was the last kernel running, so signal the queue just in
00070          case it was working for it for completion
00071
00072          In some cases several threads might want to wait for the
00073          same queue, because of this \c notify_one is not be enough
00074          and a \c notify_all is needed
00075       */
00076       finished.notify_all();
00077     }
00078   }
00079
00080
00081 #ifdef TRISYCL_OPENCL
00082   /** Return the underlying OpenCL command queue after doing a retain
00083
00084       This memory object is expected to be released by the developer.
00085
00086       Retain a reference to the returned cl_command_queue object.
00087
00088       Caller should release it when finished.
00089
00090       If the queue is a SYCL host queue then an exception is thrown.
00091   */
00092   virtual cl_command_queue get() const = 0;
00093
00094   /// Return the underlying Boost.Compute command queue
00095   virtual boost::compute::command_queue &get_boost_compute() = 0;
00096 #endif
00097
00098
```

```
00099   /** Return the SYCL queue's context
00100
00101       Report errors using SYCL exception classes.
00102   */
00103   virtual cl::sycl::context get_context() const = 0;
00104
00105
00106   /** Return the SYCL device the queue is associated with
00107
00108       Report errors using SYCL exception classes.
00109   */
00110   virtual cl::sycl::device get_device() const = 0;
00111
00112
00113   /// Return whether the queue is executing on a SYCL host device
00114   virtual bool is_host() const = 0;
00115
00116
00117   /// Wait for all kernel completion before the queue destruction
00118   /// \todo Update according spec since queue destruction is non blocking
00119   virtual ~queue() {
00120     wait_for_kernel_execution();
00121   }
00122
00123 };
00124
00125 }
00126 }
00127 }
00128
00129 /*
00130     # Some Emacs stuff:
00131     ### Local Variables:
00132     ### ispell-local-dictionary: "american"
00133     ### eval: (flyspell-prog-mode)
00134     ### End:
00135 */
00136
00137 #endif // TRISYCL_SYCL_QUEUE_DETAIL_QUEUE_HPP
```

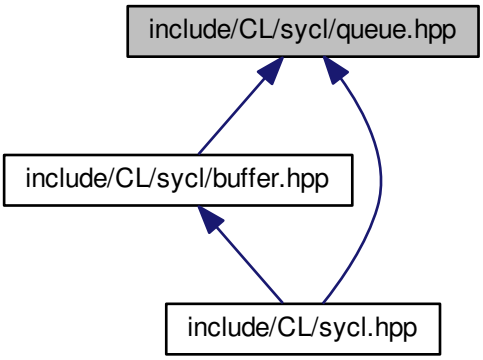
11.145 include/CL/sycl/queue.hpp File Reference

```
#include <memory>
#include <boost/compute.hpp>
#include "CL/sycl/context.hpp"
#include "CL/sycl/detail/debug.hpp"
#include "CL/sycl/detail/default_classes.hpp"
#include "CL/sycl/detail/unimplemented.hpp"
#include "CL/sycl/device.hpp"
#include "CL/sycl/device_selector.hpp"
#include "CL/sycl/exception.hpp"
#include "CL/sycl/handler.hpp"
#include "CL/sycl/handler_event.hpp"
#include "CL/sycl/info/param_traits.hpp"
#include "CL/sycl/parallelism.hpp"
#include "CL/sycl/queue/detail/host_queue.hpp"
#include "CL/sycl/queue/detail/opencl_queue.hpp"
```

Include dependency graph for queue.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::queue

  SYCL queue, similar to the OpenCL queue concept. More...
- struct std::hash< cl::sycl::queue >

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl
- cl::sycl::info
- std

Typedefs

- using cl::sycl::info::queue_profiling = bool

Enumerations

- enum cl::sycl::info::queue : int { cl::sycl::info::queue::context, cl::sycl::info::queue::device, cl::sycl::info↩ ::queue::reference_count, cl::sycl::info::queue::properties }

  Queue information descriptors.

11.146 queue.hpp

```
00001 #ifndef TRISYCL_SYCL_QUEUE_HPP
00002 #define TRISYCL_SYCL_QUEUE_HPP
00003
00004 /** \file The OpenCL SYCL queue
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <memory>
00013
00014 #ifdef TRISYCL_OPENCL
00015 #include <boost/compute.hpp>
00016 #endif
00017
00018 #include "CL/sycl/context.hpp"
00019 #include "CL/sycl/detail/debug.hpp"
00020 #include "CL/sycl/detail/default_classes.hpp"
00021 #include "CL/sycl/detail/unimplemented.hpp"
00022 #include "CL/sycl/device.hpp"
00023 #include "CL/sycl/device_selector.hpp"
00024 #include "CL/sycl/exception.hpp"
00025 #include "CL/sycl/handler.hpp"
00026 #include "CL/sycl/handler_event.hpp"
00027 #include "CL/sycl/info/param_traits.hpp"
00028 #include "CL/sycl/parallelism.hpp"
00029 #include "CL/sycl/queue/detail/host_queue.hpp"
00030 #ifdef TRISYCL_OPENCL
00031 #include "CL/sycl/queue/detail/opencl_queue.hpp"
00032 #endif
00033
00034 namespace cl {
00035 namespace sycl {
00036
00037 class context;
00038 class device_selector;
00039
00040 /** \addtogroup execution Platforms, contexts, devices and queues
00041     @{
00042 */
00043
00044 namespace info {
00045
00046 using queue_profiling = bool;
00047
00048 /** Queue information descriptors
00049
00050     From specification C.4
00051
00052     \todo unsigned int?
00053
00054     \todo To be implemented
00055 */
00056 enum class queue : int {
00057   context,
00058   device,
00059   reference_count,
00060   properties
00061 };
00062
00063 /** Dummy example for get_info() on queue::context that would return a
00064     context
00065
00066     \todo Describe all the types
00067 */
00068 TRISYCL_INFO_PARAM_TRAITS(queue::context,
      context)
00069
00070 }
00071
00072
00073 /** SYCL queue, similar to the OpenCL queue concept.
00074
00075     \todo The implementation is quite minimal for now. :-)
00076
00077     \todo All the queue methods should return a queue& instead of void
00078     to it is possible to chain opoerations
00079 */
00080 class queue
00081     /* Use the underlying queue implementation that can be shared in
00082        the SYCL model */
00083   : public detail::shared_ptr_implementation<queue, detail::queue>,
```

```
00084     detail::debug<queue> {
00085
00086   // The type encapsulating the implementation
00087   using implementation_t = typename
      queue::shared_ptr_implementation;
00088
00089   /* Allows the comparison operation to sneak in
00090
00091      Required from Clang++ 3.9 and G++ 6
00092   */
00093   friend implementation_t;
00094
00095 public:
00096
00097   // Make the implementation member directly accessible in this class
00098   using implementation_t::implementation;
00099
00100   /** Default constructor for platform which is the host platform
00101
00102       Returns errors via the SYCL exception class.
00103
00104       \todo Check with the specification if it is the host queue or
00105       the one related to the default device selector.
00106   */
00107   queue() : implementation_t { new detail::host_queue } {}
00108
00109
00110   /** This constructor creates a SYCL queue from an OpenCL queue
00111
00112       At construction it does a retain on the queue memory object.
00113
00114       Retain a reference to the cl_command_queue object. Caller should
00115       release the passed cl_command_queue object when it is no longer
00116       needed.
00117
00118       Return synchronous errors regarding the creation of the queue and
00119       report asynchronous errors via the async_handler callback function
00120       in conjunction with the synchronization and throw methods.
00121
00122       Note that the default case asyncHandler = nullptr is handled by the
00123       default constructor.
00124
00125   */
00126   explicit queue(async_handler asyncHandler) : queue { } {
00127     detail::unimplemented();
00128   }
00129
00130
00131   /** Creates a queue for the device provided by the device selector
00132
00133       If no device is selected, an error is reported.
00134
00135       Return synchronous errors regarding the creation of the queue and
00136       report asynchronous errors via the \c async_handler callback
00137       function if and only if there is an \c async_handler provided.
00138   */
00139   queue(const device_selector &deviceSelector,
00140         async_handler asyncHandler = nullptr)
00141     // Just create the queue from the selected device
00142     : queue { device { deviceSelector }, asyncHandler} { }
00143
00144
00145   /** A queue is created for a SYCL device
00146
00147       Return asynchronous errors via the \c async_handler callback
00148       function.
00149   */
00150   queue(const device &d,
00151         async_handler asyncHandler = nullptr) : implementation_t {
00152 #ifdef TRISYCL_OPENCL
00153     d.is_host()
00154       ? std::shared_ptr<detail::queue>{ new detail::host_queue }
00155       : detail::opencl_queue::instance(d)
00156 #else
00157     new detail::host_queue
00158 #endif
00159
00160   } { }
00161
00162
00163   /** This constructor chooses a device based on the provided
00164       device_selector, which needs to be in the given context.
00165
00166       If no device is selected, an error is reported.
00167
00168       Return synchronous errors regarding the creation of the queue.
00169
```

```
00170       If and only if there is an asyncHandler provided, it reports
00171       asynchronous errors via the async_handler callback function in
00172       conjunction with the synchronization and throw methods.
00173   */
00174   queue(const context &syclContext,
00175         const device_selector &deviceSelector,
00176         async_handler asyncHandler = nullptr) : queue { } {
00177     detail::unimplemented();
00178   }
00179
00180
00181   /** Creates a command queue using clCreateCommandQueue from a context
00182       and a device
00183
00184       Return synchronous errors regarding the creation of the queue.
00185
00186       If and only if there is an asyncHandler provided, it reports
00187       asynchronous errors via the async_handler callback function in
00188       conjunction with the synchronization and throw methods.
00189   */
00190   queue(const context &syclContext,
00191         const device &syclDevice,
00192         async_handler asyncHandler = nullptr) : queue { } {
00193     detail::unimplemented();
00194   }
00195
00196
00197   /** Creates a command queue using clCreateCommandQueue from a context
00198       and a device
00199
00200       It enables profiling on the queue if the profilingFlag is set to
00201       true.
00202
00203       Return synchronous errors regarding the creation of the queue. If
00204       and only if there is an asyncHandler provided, it reports
00205       asynchronous errors via the async_handler callback function in
00206       conjunction with the synchronization and throw methods.
00207   */
00208   queue(const context &syclContext,
00209         const device &syclDevice,
00210         info::queue_profiling profilingFlag,
00211         async_handler asyncHandler = nullptr) : queue { } {
00212     detail::unimplemented();
00213   }
00214
00215
00216 #ifdef TRISYCL_OPENCL
00217   /** This constructor creates a SYCL queue from an OpenCL queue
00218
00219       At construction it does a retain on the queue memory object.
00220
00221       Return synchronous errors regarding the creation of the queue. If
00222       and only if there is an async_handler provided, it reports
00223       asynchronous errors via the async_handler callback function in
00224       conjunction with the synchronization and throw methods.
00225   */
00226   queue(const cl_command_queue &q, async_handler ah = nullptr)
00227     : queue { boost::compute::command_queue { q }, ah } {}
00228
00229
00230   /** Construct a queue instance using a boost::compute::command_queue
00231
00232       This is a triSYCL extension for boost::compute interoperation.
00233
00234       Return synchronous errors via the SYCL exception class.
00235
00236       \todo Deal with handler
00237   */
00238   queue(const boost::compute::command_queue &q, async_handler ah = nullptr)
00239     : implementation_t { detail::opencl_queue::instance(q) }
      {}
00240 #endif
00241
00242
00243 #ifdef TRISYCL_OPENCL
00244   /** Return the underlying OpenCL command queue after doing a retain
00245
00246       This memory object is expected to be released by the developer.
00247
00248       Retain a reference to the returned cl_command_queue object.
00249
00250       Caller should release it when finished.
00251
00252       If the queue is a SYCL host queue then an exception is thrown.
00253   */
00254   cl_command_queue get() const {
00255     return implementation->get();
```

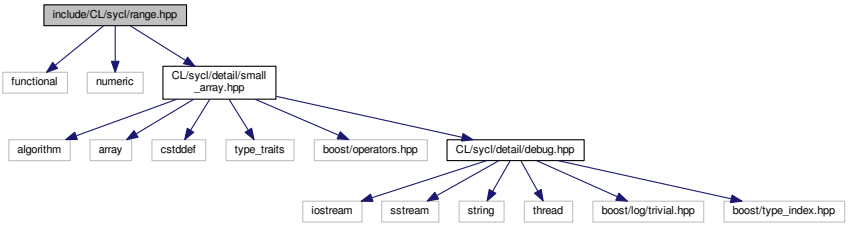
```
00256   }
00257
00258
00259   /** Return the underlying Boost.Compute command queue if it is an
00260       OpenCL queue
00261
00262       This is a triSYCL extension
00263   */
00264   boost::compute::command_queue get_boost_compute() const {
00265     return implementation->get_boost_compute();
00266   }
00267 #endif
00268
00269
00270   /** Return the SYCL queue's context
00271
00272       Report errors using SYCL exception classes.
00273   */
00274   context get_context() const {
00275     return implementation->get_context();
00276   }
00277
00278
00279   /** Return the SYCL device the queue is associated with
00280
00281       Report errors using SYCL exception classes.
00282   */
00283   device get_device() const {
00284     return implementation->get_device();
00285   }
00286
00287
00288   /// Return whether the queue is executing on a SYCL host device
00289   bool is_host() const {
00290     return implementation->is_host();
00291   }
00292
00293
00294   /** Performs a blocking wait for the completion all enqueued tasks in
00295       the queue
00296
00297       Synchronous errors will be reported through SYCL exceptions.
00298   */
00299   void wait() {
00300     implementation->wait_for_kernel_execution();
00301   }
00302
00303
00304   /** Perform a blocking wait for the completion all enqueued tasks in the queue
00305
00306       Synchronous errors will be reported via SYCL exceptions.
00307
00308       Asynchronous errors will be passed to the async_handler passed to the
00309       queue on construction.
00310
00311       If no async_handler was provided then asynchronous exceptions will
00312       be lost.
00313   */
00314   void wait_and_throw() {
00315     // \todo Implement the throw part of wait_and_throw
00316     wait();
00317     detail::unimplemented();
00318   }
00319
00320
00321   /** Checks to see if any asynchronous errors have been produced by the
00322       queue and if so reports them by passing them to the async_handler
00323       passed to the queue on construction
00324
00325       If no async_handler was provided then asynchronous exceptions will
00326       be lost.
00327   */
00328   void throw_asynchronous() {
00329     detail::unimplemented();
00330   }
00331
00332
00333   /// Queries the platform for cl_command_queue info
00334   template <info::queue param>
00335   typename info::param_traits<info::queue, param>::type
      get_info() const  {
00336     detail::unimplemented();
00337     return {};
00338   }
00339
00340
00341   /** Submit a command group functor to the queue, in order to be
```

```
00342       scheduled for execution on the device
00343
00344       Use an explicit functor parameter taking a handler& so we can use
00345       "auto" in submit() lambda parameter.
00346
00347       \todo Add in the spec an implicit conversion of handler_event to
00348       queue& so it is possible to chain operations on the queue
00349
00350       \todo Update the spec to replace std::function by a templated
00351       type to avoid memory allocation
00352   */
00353   handler_event submit(std::function<void(handler &)> cgf) {
00354     handler command_group_handler { implementation };
00355     cgf(command_group_handler);
00356     return {};
00357   }
00358
00359
00360   /** Submit a command group functor to the queue, in order to be
00361       scheduled for execution on the device
00362
00363       On kernel error, this command group functor, then it is scheduled
00364       for execution on the secondary queue.
00365
00366       Return a command group functor event, which is corresponds to the
00367       queue the command group functor is being enqueued on.
00368   */
00369   handler_event submit(std::function<void(handler &)> cgf,
      queue &secondaryQueue) {
00370     detail::unimplemented();
00371     // Since it is not implemented, always submit on the main queue
00372     return submit(cgf);
00373   }
00374
00375 };
00376
00377 /// @} to end the execution Doxygen group
00378
00379 }
00380 }
00381
00382 /* Inject a custom specialization of std::hash to have the buffer
00383    usable into an unordered associative container
00384
00385    \todo Add this to the spec
00386 */
00387 namespace std {
00388
00389 template <> struct hash<cl::sycl::queue> {
00390
00391   auto operator()(const cl::sycl::queue &q) const {
00392     // Forward the hashing to the implementation
00393     return q.hash();
00394   }
00395
00396 };
00397
00398 }
00399
00400 /*
00401     # Some Emacs stuff:
00402     ### Local Variables:
00403     ### ispell-local-dictionary: "american"
00404     ### eval: (flyspell-prog-mode)
00405     ### End:
00406 */
00407
00408 #endif // TRISYCL_SYCL_QUEUE_HPP
```

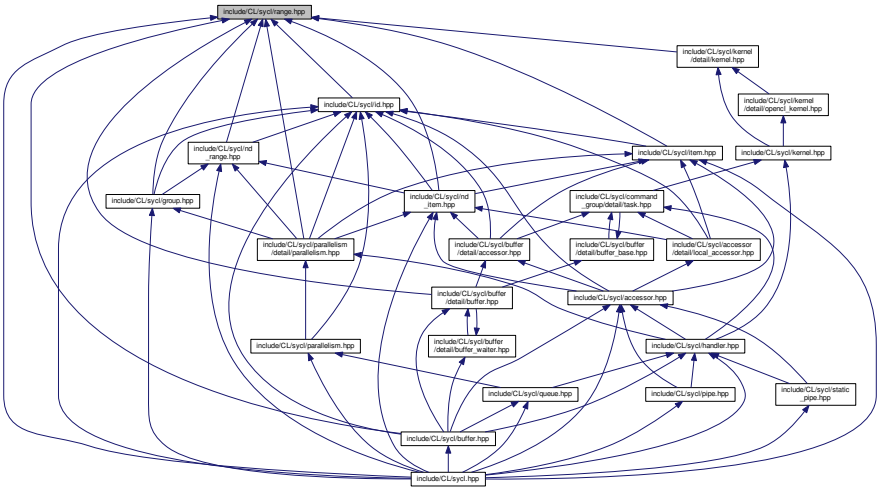
11.147 include/CL/sycl/range.hpp File Reference

```
#include <functional>
#include <numeric>
#include "CL/sycl/detail/small_array.hpp"
```

Include dependency graph for range.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::range< Dimensions >

  A SYCL range defines a multi-dimensional index range that can be used to define launch parallel computation extent or buffer sizes. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Functions

- auto cl::sycl::make_range (range< 1 > r)

  Implement a make_range to construct a range<> of the right dimension with implicit conversion from an initializer list for example.
- auto cl::sycl::make_range (range< 2 > r)
- auto cl::sycl::make_range (range< 3 > r)
- template<typename... BasicType>
  auto cl::sycl::make_range (BasicType... Args)

  Construct a range<> from a function call with arguments, like make_range(1, 2, 3)

11.148 range.hpp

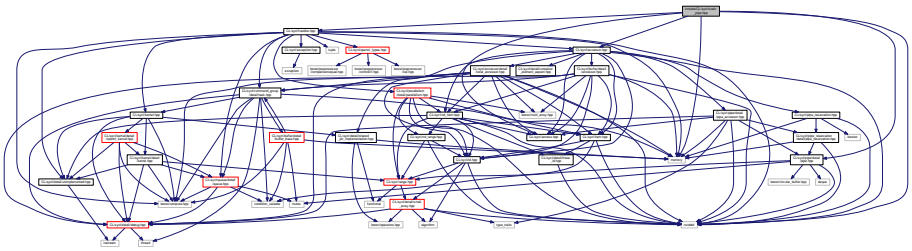
```
00001 #ifndef TRISYCL_SYCL_RANGE_HPP
00002 #define TRISYCL_SYCL_RANGE_HPP
00003
00004 /** \file The OpenCL SYCL range<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <functional>
00013 #include <numeric>
00014 #include "CL/sycl/detail/small_array.hpp"
00015
00016 namespace cl {
00017 namespace sycl {
00018
00019 /** \addtogroup parallelism Expressing parallelism through kernels
00020     @{
00021 */
00022
00023 /** A SYCL range defines a multi-dimensional index range that can be used
00024     to define launch parallel computation extent or buffer sizes.
00025
00026     \todo use std::size_t Dimensions instead of int Dimensions in the
00027         specification?
00028
00029     \todo add to the specification this default parameter value?
00030
00031     \todo add to the specification some way to specify an offset?
00032 */
00033 template <int Dimensions = 1>
00034 class range : public detail::small_array_123<
00035                 std::size_t,
00036                 range<Dimensions>,
00037                 Dimensions > {
00038
00039 public:
00040
00041   // Inherit of all the constructors
00042   using detail::small_array_123<std::size_t,
00043                                 range<Dimensions>,
00044                                 Dimensions>::small_array_123;
00045
00046
00047   /** Return the number of elements in the range
00048
00049       \todo Give back size() its real meaning in the specification
00050
00051       \todo add this method to the specification
00052   */
00053   size_t get_count() const {
00054     // Return the product of the sizes in each dimension
00055     return std::accumulate(this->cbegin(),
00056                            this->cend(),
00057                            1,
00058                            std::multiplies<size_t> {});
00059   }
00060 };
00061
00062
00063 /** Implement a make_range to construct a range<> of the right dimension
00064     with implicit conversion from an initializer list for example.
00065
00066     Cannot use a template on the number of dimensions because the implicit
00067     conversion would not be tried.
00068 */
00069 inline auto make_range(range<1> r) { return r; }
00070 inline auto make_range(range<2> r) { return r; }
00071 inline auto make_range(range<3> r) { return r; }
00072
00073
00074 /** Construct a range<> from a function call with arguments, like
00075     make_range(1, 2, 3)
00076 */
00077 template<typename... BasicType>
00078 auto make_range(BasicType... Args) {
00079   // Call constructor directly to allow narrowing
00080   return range<sizeof...(Args)>(Args...);
00081 }
00082
00083 /// @} End the parallelism Doxygen group
00084
```

```
00085 }
00086 }
00087
00088 /*
00089     # Some Emacs stuff:
00090     ### Local Variables:
00091     ### ispell-local-dictionary: "american"
00092     ### eval: (flyspell-prog-mode)
00093     ### End:
00094 */
00095
00096 #endif // TRISYCL_SYCL_RANGE_HPP
```

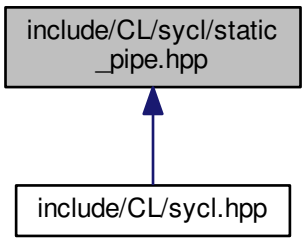
11.149 include/CL/sycl/static_pipe.hpp File Reference

```
#include <cstddef>
#include <memory>
#include "CL/sycl/access.hpp"
#include "CL/sycl/accessor.hpp"
#include "CL/sycl/handler.hpp"
#include "CL/sycl/pipe/detail/pipe.hpp"
```

Include dependency graph for static_pipe.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::static_pipe< T, Capacity >

  A SYCL static-scoped pipe equivalent to an OpenCL program-scoped pipe. More...

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

11.150 static_pipe.hpp

```
00001 #ifndef TRISYCL_SYCL_STATIC_PIPE_HPP
00002 #define TRISYCL_SYCL_STATIC_PIPE_HPP
00003
00004 /** \file The OpenCL SYCL static-scoped pipe equivalent to an OpenCL
00005     program-scoped pipe
00006
00007     Ronan at Keryell point FR
00008
00009     This file is distributed under the University of Illinois Open Source
00010     License. See LICENSE.TXT for details.
00011 */
00012
00013 #include <cstddef>
00014 #include <memory>
00015
00016 #include "CL/sycl/access.hpp"
00017 #include "CL/sycl/accessor.hpp"
00018 #include "CL/sycl/handler.hpp"
00019 #include "CL/sycl/pipe/detail/pipe.hpp"
00020
00021 namespace cl {
00022 namespace sycl {
00023
00024 /** \addtogroup data Data access and storage in SYCL
00025     @{
00026 */
00027
00028 /** A SYCL static-scoped pipe equivalent to an OpenCL program-scoped
00029     pipe
00030
00031     Implement a FIFO-style object that can be used through accessors
00032     to send some objects T from the input to the output.
00033
00034     Compared to a normal pipe, a static_pipe takes a constexpr size
00035     and is expected to be declared in a compile-unit static context so
00036     the compiler can generate everything at compile time.
00037
00038     This is useful to generate a fixed and optimized hardware
00039     implementation on FPGA for example, where the interconnection
00040     graph can be also inferred at compile time.
00041
00042     It is not directly mapped to the OpenCL program-scoped pipe
00043     because in SYCL there is not this concept of separated
00044     program. But the SYCL device compiler is expected to generate some
00045     OpenCL program(s) with program-scoped pipes when a SYCL
00046     static-scoped pipe is used. These details are implementation
00047     defined.
00048 */
00049 template <typename T, std::size_t Capacity>
00050 class static_pipe
00051     /* Use the underlying pipe implementation that can be shared in
00052        the SYCL model */
00053   : public detail::shared_ptr_implementation<static_pipe<T, Capacity>,
00054                                              detail::pipe<T>>,
00055     detail::debug<static_pipe<T, Capacity>> {
00056
00057   // The type encapsulating the implementation
00058   using implementation_t = typename
      static_pipe::shared_ptr_implementation;
00059
00060   // Make the implementation member directly accessible in this class
00061   using implementation_t::implementation;
00062
00063   // Allows the comparison operation to access the implementation
00064   friend implementation_t;
00065
00066 public:
00067
00068   /// The STL-like types
00069   using value_type = T;
00070
```

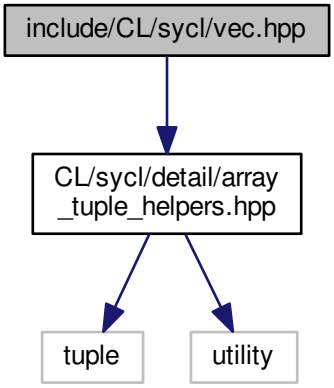
```
00071
00072   /// Construct a static-scoped pipe able to store up to Capacity T objects
00073   static_pipe()
00074     : implementation_t { new detail::pipe<T> { Capacity } } { }
00075
00076
00077   /** Get an accessor to the pipe with the required mode
00078
00079       \param Mode is the requested access mode
00080
00081       \param Target is the type of pipe access required
00082
00083       \param[in] command_group_handler is the command group handler in
00084       which the kernel is to be executed
00085   */
00086   template <access::mode Mode,
00087             access::target Target = access::target::pipe>
00088   accessor<value_type, 1, Mode, Target>
00089   get_access(handler &command_group_handler) {
00090     static_assert(Target == access::target::pipe
00091                   || Target == access::target::blocking_pipe,
00092                   "get_access(handler) with pipes can only deal with "
00093                   "access::pipe or access::blocking_pipe");
00094     return { implementation, command_group_handler };
00095   }
00096
00097
00098   /** Return the maximum number of elements that can fit in the pipe
00099
00100       This is a constexpr since the capacity is in the type.
00101   */
00102   std::size_t constexpr capacity() const {
00103     return Capacity;
00104     }
00105
00106 };
00107
00108 /// @} End the execution Doxygen group
00109
00110 }
00111 }
00112
00113 /*
00114     # Some Emacs stuff:
00115     ### Local Variables:
00116     ### ispell-local-dictionary: "american"
00117     ### eval: (flyspell-prog-mode)
00118     ### End:
00119 */
00120
00121 #endif // TRISYCL_SYCL_STATIC_PIPE_HPP
```

11.151 include/CL/sycl/vec.hpp File Reference

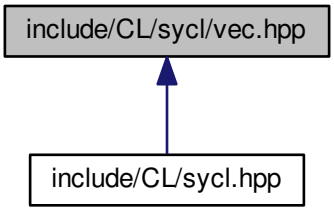
Implement the small OpenCL vector class.

```
#include "CL/sycl/detail/array_tuple_helpers.hpp"
```

Include dependency graph for vec.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::vec< DataType, NumElements >

  Small OpenCL vector class. *More...*

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

Macros

- #define TRISYCL_DEFINE_VEC_TYPE_SIZE(type, size, actual_type) using type##size = vec<actual_type, size>;

  A macro to define type alias, such as for type=uchar, size=4 and actual_type=unsigned char, uchar4 is equivalent to vec<unsigned char, 4>
- #define TRISYCL_DEFINE_VEC_TYPE(type, actual_type)

  Declare the vector types of a type for all the sizes.

11.151.1 Detailed Description

Implement the small OpenCL vector class.

Ronan at Keryell point FR

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Definition in file vec.hpp.

11.152 vec.hpp

```
00001 #ifndef TRISYCL_SYCL_VEC_HPP
00002 #define TRISYCL_SYCL_VEC_HPP
00003
00004 /** \file
00005
00006     Implement the small OpenCL vector class
00007
00008     Ronan at Keryell point FR
00009
00010     This file is distributed under the University of Illinois Open Source
00011     License. See LICENSE.TXT for details.
00012 */
00013
00014 #include "CL/sycl/detail/array_tuple_helpers.hpp"
00015
00016 namespace cl {
00017 namespace sycl {
00018
00019 /** \addtogroup vector Vector types in SYCL
00020
00021     @{
00022 */
00023
00024
00025 /** Small OpenCL vector class
00026
00027     \todo add [] operator
00028
00029     \todo add iterators on elements, with begin() and end()
00030
00031     \todo having vec<> sub-classing array<> instead would solve the
00032     previous issues
00033
00034     \todo move the implementation elsewhere
00035
00036     \todo simplify the helpers by removing some template types since there
00037     are now inside the vec<> class.
00038
00039     \todo rename in the specification element_type to value_type
00040 */
00041 template <typename DataType, size_t NumElements>
00042 class vec : public detail::small_array<DataType,
00043                                        vec<DataType, NumElements>,
00044                                        NumElements> {
00045   using basic_type = typename detail::small_array<DataType,
00046                                                   vec<DataType, NumElements>,
00047                                                   NumElements>;
00048
00049 public:
```

```
00050
00051   /** Construct a vec from anything from a scalar (to initialize all the
00052       elements with this value) up to an aggregate of scalar and vector
00053       types (in this case the total number of elements must match the size
00054       of the vector)
00055   */
00056   template <typename... Types>
00057   vec(const Types... args)
00058     : basic_type { detail::expand<vec>(flatten_to_tuple<vec>(args...)) } { }
00059
00060
00061 /// Use classical constructors too
00062   vec() = default;
00063
00064
00065   // Inherit of all the constructors
00066   using basic_type::basic_type;
00067
00068 private:
00069
00070   /** Flattening helper that does not change scalar values but flatten a
00071       vec<T, n> v into a tuple<T, T,..., T>{ v[0], v[1],..., v[n-1] }
00072
00073       If we have a vector, just forward its array content since an array
00074       has also a tuple interface :-) (23.3.2.9 Tuple interface to class
00075       template array [array.tuple])
00076   */
00077   template <typename V, typename Element, size_t s>
00078   static auto flatten(const vec<Element, s> i) {
00079     static_assert(s <= V::dimension,
00080                   "The element i will not fit in the vector");
00081     return static_cast<std::array<Element, s>>(i);
00082   }
00083
00084
00085   /** If we do not have a vector, just forward it as a tuple up to the
00086       final initialization.
00087
00088       \return typically tuple<double>{ 2.4 } from 2.4 input for example
00089   */
00090   template <typename V, typename Type>
00091   static auto flatten(const Type i) {
00092     return std::make_tuple(i);
00093   }
00094
00095
00096  /** Take some initializer values and apply flattening on each value
00097
00098       \return a tuple of scalar initializer values
00099    */
00100   template <typename V, typename... Types>
00101   static auto flatten_to_tuple(const Types... i) {
00102     // Concatenate the tuples returned by each flattening
00103     return std::tuple_cat(flatten<V>(i)...);
00104   }
00105
00106
00107   /// \todo To implement
00108 #if 0
00109   vec<dataT,
00110       numElements>
00111   operator+(const vec<dataT, numElements> &rhs) const;
00112   vec<dataT, numElements>
00113   operator-(const vec<dataT, numElements> &rhs) const;
00114   vec<dataT, numElements>
00115   operator*(const vec<dataT, numElements> &rhs) const;
00116   vec<dataT, numElements>
00117   operator/(const vec<dataT, numElements> &rhs) const;
00118   vec<dataT, numElements>
00119   operator+=(const vec<dataT, numElements> &rhs);
00120   vec<dataT, numElements>
00121   operator-=(const vec<dataT, numElements> &rhs);
00122   vec<dataT, numElements>
00123   operator*=(const vec<dataT, numElements> &rhs);
00124   vec<dataT, numElements>
00125   operator/=(const vec<dataT, numElements> &rhs);
00126   vec<dataT, numElements>
00127   operator+(const dataT &rhs) const;
00128   vec<dataT, numElements>
00129   operator-(const dataT &rhs) const;
00130   vec<dataT, numElements>
00131   operator*(const dataT &rhs) const;
00132   vec<dataT, numElements>
00133   operator/(const dataT &rhs) const;
00134   vec<dataT, numElements>
00135   operator+=(const dataT &rhs);
00136   vec<dataT, numElements>
```

```
00137   operator-=(const dataT &rhs);
00138   vec<dataT, numElements>
00139   operator*=(const dataT &rhs);
00140   vec<dataT, numElements>
00141   operator/=(const dataT &rhs);
00142   vec<dataT, numElements> &operator=(const
      vec<dataT, numElements> &rhs);
00143   vec<dataT, numElements> &operator=(const dataT &rhs);
00144   bool operator==(const vec<dataT, numElements> &rhs) const;
00145   bool operator!=(const vec<dataT, numElements> &rhs) const;
00146   // Swizzle methods (see notes)
00147   swizzled_vec<T, out_dims> swizzle<int s1, ...>();
00148 #ifdef SYCL_SIMPLE_SWIZZLES
00149   swizzled_vec<T, 4> xyzw();
00150   ...
00151 #endif // #ifdef SYCL_SIMPLE_SWIZZLES
00152 #endif
00153 };
00154
00155
00156   /** A macro to define type alias, such as for type=uchar, size=4 and
00157       actual_type=unsigned char, uchar4 is equivalent to vec<unsigned char, 4>
00158   */
00159 #define TRISYCL_DEFINE_VEC_TYPE_SIZE(type, size, actual_type) \
00160   using type##size = vec<actual_type, size>;
00161
00162   /// Declare the vector types of a type for all the sizes
00163 #define TRISYCL_DEFINE_VEC_TYPE(type, actual_type)           \
00164   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 1, actual_type)         \
00165   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 2, actual_type)         \
00166   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 3, actual_type)         \
00167   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 4, actual_type)         \
00168   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 8, actual_type)         \
00169   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 16, actual_type)
00170
00171   /// Declare all the possible vector type aliases
00172   TRISYCL_DEFINE_VEC_TYPE(char, char)
00173   TRISYCL_DEFINE_VEC_TYPE(uchar, unsigned char)
00174   TRISYCL_DEFINE_VEC_TYPE(short, short int)
00175   TRISYCL_DEFINE_VEC_TYPE(ushort, unsigned short int)
00176   TRISYCL_DEFINE_VEC_TYPE(int, int)
00177   TRISYCL_DEFINE_VEC_TYPE(uint, unsigned int)
00178   TRISYCL_DEFINE_VEC_TYPE(long, long int)
00179   TRISYCL_DEFINE_VEC_TYPE(ulong, unsigned long int)
00180   TRISYCL_DEFINE_VEC_TYPE(float, float)
00181   TRISYCL_DEFINE_VEC_TYPE(double, double)
00182
00183 /// @} End the vector Doxygen group
00184
00185
00186 }
00187 }
00188
00189 /*
00190     # Some Emacs stuff:
00191     ### Local Variables:
00192     ### ispell-local-dictionary: "american"
00193     ### eval: (flyspell-prog-mode)
00194     ### End:
00195 */
00196
00197 #endif // TRISYCL_SYCL_VEC_HPP
```

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