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* () 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* ()

Add in the specification

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 (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 (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 (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 >::buffer (unique_ptr_class< T > &&host_data, const range< Dimensions > &r, Allocator allocator={})

Update the API to add template <typename D = std::default_delete<T>> because the unique_ptr_class/std::unique_ptr have the destructor type as dependent

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 >::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 parm

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 >::get_size () 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) const

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)

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...

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, Target >::copy_back_cl_buffer ()

Move this into the buffer with queue/device-based caching

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

Move this into the buffer with queue/device-based caching

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 >::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 >::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 >::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::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;

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

Class cl::sycl::detail::host_queue

Once a triSYCL queue is no longer blocking, make this a singleton

Member cl::sycl::detail::opencl_device::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_queue::get_context () const override

Finish context

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 syclKernel)

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

To be implemented

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 ()=default

Make most of them protected, reserved to implementation

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 (id< Dimensions > global_index, nd_range< Dimensions > ndr)

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

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::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 ()

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

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

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...
- 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...
- 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.

- template<typename T , int Dimensions = 1>
  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 >

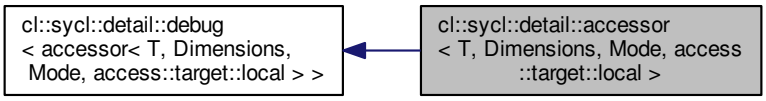
template<typename T, int Dimensions, access::mode Mode>
class cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >

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.

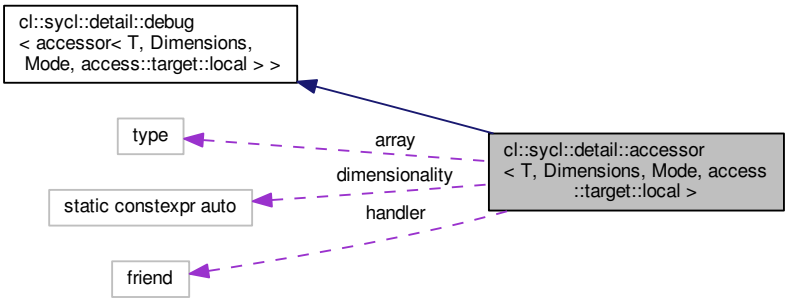
Todo Use the access::mode

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.
- 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< T, Dimensions >

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

Private Attributes

- writable_array_type array

  The way the buffer is really accessed.
- friend handler

8.1.2.1.1 Member Typedef Documentation

8.1.2.1.1.1 template<typename T , int Dimensions, access::mode Mode> using cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::array_type = boost::multi_array<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 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 97 of file local_accessor.hpp.

8.1.2.1.1.3 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 90 of file local_accessor.hpp.

8.1.2.1.1.4 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 100 of file local_accessor.hpp.

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

Definition at line 88 of file local_accessor.hpp.

8.1.2.1.1.6 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 96 of file local_accessor.hpp.

8.1.2.1.1.7 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 89 of file local_accessor.hpp.

8.1.2.1.1.8 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 98 of file local_accessor.hpp.

8.1.2.1.1.9 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 87 of file local_accessor.hpp.

8.1.2.1.1.10 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 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 parm

Definition at line 108 of file local_accessor.hpp.

```
00109                                          :
00110     array { allocation_size } {}
```

8.1.2.1.3 Member Function Documentation

8.1.2.1.3.1 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

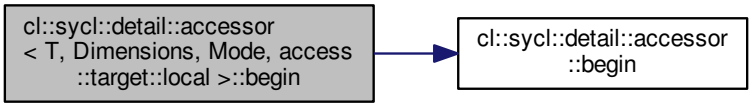
Todo Do we need this in detail::accessor too or only in accessor?

Definition at line 302 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().

```
00302                           {
00303     return const_cast<writable_array_type &>(array).
      begin();
00304   }
```

Here is the call graph for this function:



8.1.2.1.3.2 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 319 of file local_accessor.hpp.

```
00319 { return array.begin(); }
```

8.1.2.1.3.3 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 322 of file local_accessor.hpp.

```
00322 { return array.end(); }
```

8.1.2.1.3.4 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 343 of file local_accessor.hpp.

```
00343 { return array.rbegin(); }
```

8.1.2.1.3.5 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 346 of file local_accessor.hpp.

```
00346 { return array.rend(); }
```

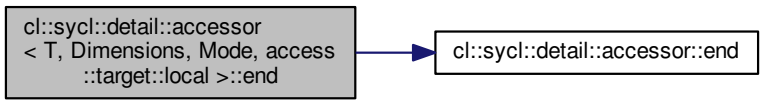
8.1.2.1.3.6 template<typename T , int Dimensions, access::mode Mode> iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::end ( ) const [inline]

Definition at line 308 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().

```
00308                         {
00309     return const_cast<writable_array_type &>(array).end();
00310   }
```

Here is the call graph for this function:



8.1.2.1.3.7 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 143 of file local_accessor.hpp.

```
00143                         {
00144     return array.num_elements();
00145   }
```

8.1.2.1.3.8 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 121 of file local_accessor.hpp.

```
00121                           {
00122     /* Interpret the shape which is a pointer to the first element as an
00123        array of Dimensions elements so that the range<Dimensions>
00124        constructor is happy with this collection
00125
00126        \todo Add also a constructor in range<> to accept a const
00127        std::size_t *?
00128     */
00129     return range<Dimensions> {
00130       *(const std::size_t (*)[Dimensions])(array.shape())
00131         };
00132   }
```

8.1.2.1.3.9 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.

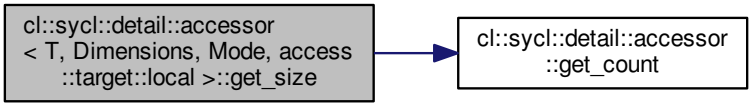
Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 154 of file local_accessor.hpp.

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

```
00154                           {
00155     return get_count()*sizeof(value_type);
00156   }
```

Here is the call graph for this function:



8.1.2.1.3.10 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 254 of file local_accessor.hpp.

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

```
00254                                       {
00255     return Mode == access::mode::read
00256       || Mode == access::mode::read_write
00257       || Mode == access::mode::discard_read_write;
00258   }
```

8.1.2.1.3.11 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 269 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.

```
00269                                       {
00270     return Mode == access::mode::write
00271       || Mode == access::mode::read_write
00272       || Mode == access::mode::discard_write
00273       || Mode == access::mode::discard_read_write;
00274   }
```

8.1.2.1.3.12 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 226 of file local_accessor.hpp.

```
00226                         {
00227     return *array.data();
00228   }
```

8.1.2.1.3.13 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 241 of file local_accessor.hpp.

```
00241                                {
00242     return *array.data();
00243   }
```

8.1.2.1.3.14 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 164 of file local_accessor.hpp.

```
00164                                        {
00165     return array[index];
00166   }
```

8.1.2.1.3.15 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 174 of file local_accessor.hpp.

```
00174                                              {
00175     return array[index];
00176   }
```

8.1.2.1.3.16 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 180 of file local_accessor.hpp.

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

```
00180                                              {
00181     return array(index);
00182   }
```

8.1.2.1.3.17 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 186 of file local_accessor.hpp.

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

```
00186                                                 {
00187     return array(index);
00188   }
```

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

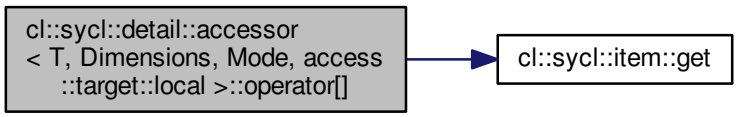
To use an accessor with [item<>].

Definition at line 192 of file local_accessor.hpp.

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

```
00192                                                 {
00193     return (*this)[index.get()];
00194   }
```

Here is the call graph for this function:



8.1.2.1.3.19 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]

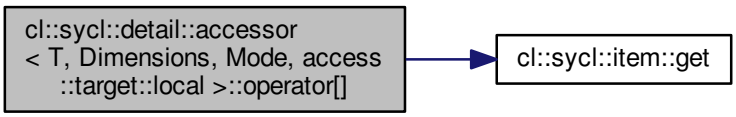
To use an accessor with [item<>].

Definition at line 198 of file local_accessor.hpp.

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

```
00198                                                 {
00199     return (*this)[index.get()];
00200   }
```

Here is the call graph for this function:



8.1.2.1.3.20 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<>].

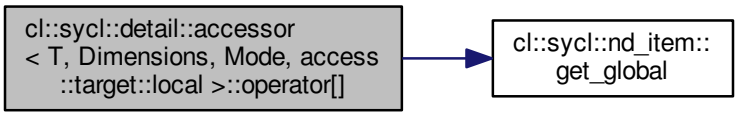
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 207 of file local_accessor.hpp.

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

```
00207                                                {
00208     return (*this)[index.get_global()];
00209   }
```

Here is the call graph for this function:



8.1.2.1.3.21 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<>].

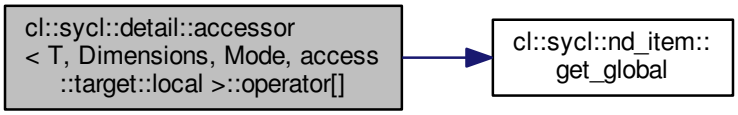
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 215 of file local_accessor.hpp.

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

```
00215                                                                {
00216     return (*this)[index.get_global()];
00217   }
```

Here is the call graph for this function:



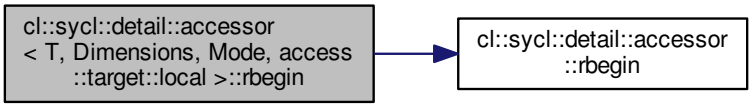
8.1.2.1.3.22 template<typename T , int Dimensions, access::mode Mode> reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::rbegin ( ) const [inline]

Definition at line 326 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().

```
00326                                    {
00327     return const_cast<writable_array_type &>(array).
    rbegin();
00328   }
```

Here is the call graph for this function:



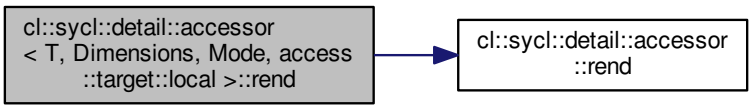
8.1.2.1.3.23 template<typename T , int Dimensions, access::mode Mode> reverse_iterator cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::rend ( ) const [inline]

Definition at line 332 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().

```
00332                                  {
00333     return const_cast<writable_array_type &>(array).rend();
00334   }
```

Here is the call graph for this function:



8.1.2.1.4 Member Data Documentation

8.1.2.1.4.1 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.

8.1.2.1.4.2 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 83 of file local_accessor.hpp.

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

Definition at line 351 of file local_accessor.hpp.

8.1.2.2 class cl::sycl::accessor

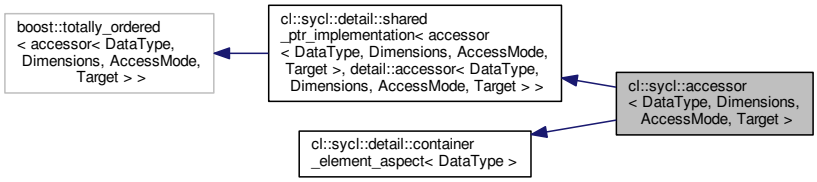
template<typename DataType, int Dimensions, access::mode AccessMode, access::target Target = access::target::global_buffer>
class cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >

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

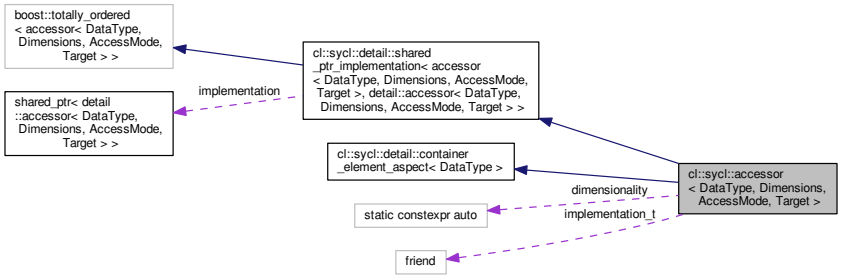
Todo Implement it for images according so section 3.3.4.5

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 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 67 of file accessor.hpp.

8.1.2.2.1.2 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 70 of file accessor.hpp.

8.1.2.2.2 Constructor & Destructor Documentation

8.1.2.2.2.1 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 96 of file accessor.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.

```
00097                                         : implementation_t {
00098     new detail::accessor<DataType, Dimensions, AccessMode, Target> {
00099       target_buffer.implementation->implementation, command_group_handler }
00100   } {
00101     static_assert(Target == access::target::global_buffer
00102                   || Target == access::target::constant_buffer,
00103                   "access target should be global_buffer or constant_buffer "
00104                   "when a handler is used");
00105   }
```

8.1.2.2.2.2 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 115 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.

```
00116     : implementation_t {
00117     new detail::accessor<DataType, Dimensions, AccessMode, Target> {
00118       target_buffer.implementation->implementation }
00119   } {
00120     static_assert(Target == access::target::host_buffer,
00121                   "without a handler, access target should be host_buffer");
00122   }
```

8.1.2.2.2.3 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.

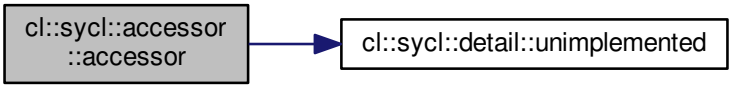
This accessor is recommended for discard-write and discard read write access modes, when the unaffected parts of the processing should be retained.

Definition at line 143 of file accessor.hpp.

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

```
00146                                       {
00147     detail::unimplemented();
00148   }
```

Here is the call graph for this function:



8.1.2.2.2.4 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 159 of file accessor.hpp.

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

```
00161     : implementation_t { new detail::accessor<DataType,
00162                                               Dimensions,
00163                                               AccessMode,
00164                                               access::target::local> {
00165       allocation_size, command_group_handler
00166         }
00167   }
00168   {
00169     static_assert(Target == access::target::local,
00170                   "This accessor constructor requires "
00171                   "access target be local");
00172   }
```

8.1.2.2.3 Member Function Documentation

8.1.2.2.3.1 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 340 of file accessor.hpp.

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

```
00340                                                {
00341     return implementation->begin();
00342   }
```

8.1.2.2.3.2 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 357 of file accessor.hpp.

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

```
00357                                                    {
00358     return implementation->cbegin();
00359   }
```

8.1.2.2.3.3 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 362 of file accessor.hpp.

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

```
00362                                                  {
00363     return implementation->cend();
00364   }
```

8.1.2.2.3.4 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 383 of file accessor.hpp.

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

```
00383                                                      {
00384     return implementation->rbegin();
00385   }
```

8.1.2.2.3.5 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 388 of file accessor.hpp.

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

```
00388                                                    {
00389     return implementation->rend();
00390   }
```

8.1.2.2.3.6 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 346 of file accessor.hpp.

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

```
00346                                                {
00347     return implementation->end();
00348   }
```

8.1.2.2.3.7 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 203 of file accessor.hpp.

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

```
00203                           {
00204     return implementation->get_count();
00205   }
```

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

Get the pointer to the start of the data.

Todo Should it be named data() instead?

Definition at line 312 of file accessor.hpp.

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

```
00312                           {
00313     return implementation->get_pointer();
00314   }
```

8.1.2.2.3.9 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 183 of file accessor.hpp.

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

```
00183                           {
00184     /* Interpret the shape which is a pointer to the first element as an
00185        array of Dimensions elements so that the range<Dimensions>
00186        constructor is happy with this collection
00187
00188        \todo Add also a constructor in range<> to accept a const
00189        std::size_t *?
00190     */
00191     return implementation->get_range();
00192   }
```

8.1.2.2.3.10 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 216 of file accessor.hpp.

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

```
00216                           {
00217     return implementation->get_size();
00218   }
```

8.1.2.2.3.11 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 288 of file accessor.hpp.

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

```
00288                                           {
00289     return **implementation;
00290   }
```

8.1.2.2.3.12 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 303 of file accessor.hpp.

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

```
00303                                                    {
00304     return **implementation;
00305   }
```

8.1.2.2.3.13 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 226 of file accessor.hpp.

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

```
00226                                                                {
00227     return (*implementation)[index];
00228   }
```

8.1.2.2.3.14 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 236 of file accessor.hpp.

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

```
00236                                                                      {
00237     return (*implementation)[index];
00238   }
```

8.1.2.2.3.15 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 242 of file accessor.hpp.

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

```
00242                                                {
00243     return (*implementation)[index];
00244   }
```

8.1.2.2.3.16 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 248 of file accessor.hpp.

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

```
00248                                                      {
00249     return (*implementation)[index];
00250   }
```

8.1.2.2.3.17 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]

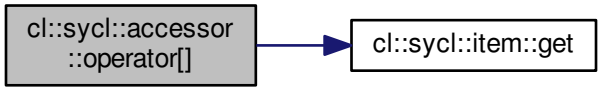
To use an accessor with [item<>].

Definition at line 254 of file accessor.hpp.

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

```
00254                                                {
00255     return (*this)[index.get()];
00256   }
```

Here is the call graph for this function:



8.1.2.2.3.18 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]

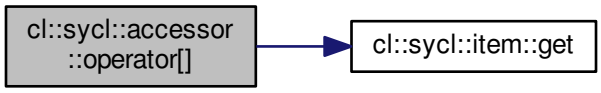
To use an accessor with [item<>].

Definition at line 260 of file accessor.hpp.

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

```
00260                                                    {
00261     return (*this)[index.get()];
00262   }
```

Here is the call graph for this function:



8.1.2.2.3.19 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<>].

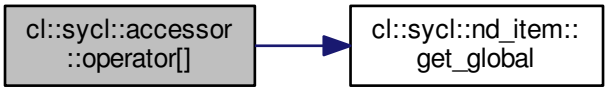
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 269 of file accessor.hpp.

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

```
00269                                                    {
00270     return (*this)[index.get_global()];
00271   }
```

Here is the call graph for this function:



8.1.2.2.3.20 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 277 of file accessor.hpp.

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

```
00277                                                                {
00278     return (*this)[index.get_global()];
00279   }
```

Here is the call graph for this function:

8.1.2.2.3.21 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 367 of file accessor.hpp.

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

```
00367                                                                 {
00368     return implementation->rbegin();
00369   };
```

8.1.2.2.3.22 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 372 of file accessor.hpp.

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

```
00372                                                                 {
00373     return implementation->rend();
00374   }
```

8.1.2.2.4 Member Data Documentation

8.1.2.2.4.1 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 60 of file accessor.hpp.

8.1.2.2.4.2 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 73 of file accessor.hpp.

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

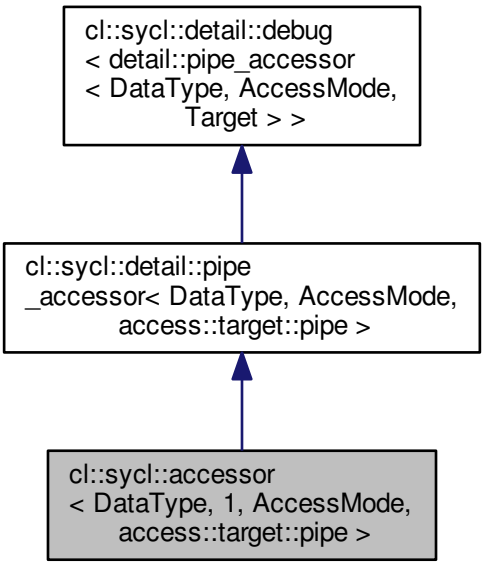
template<typename DataType, access::mode AccessMode>
class cl::sycl::accessor< DataType, 1, AccessMode, access::target::pipe >

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

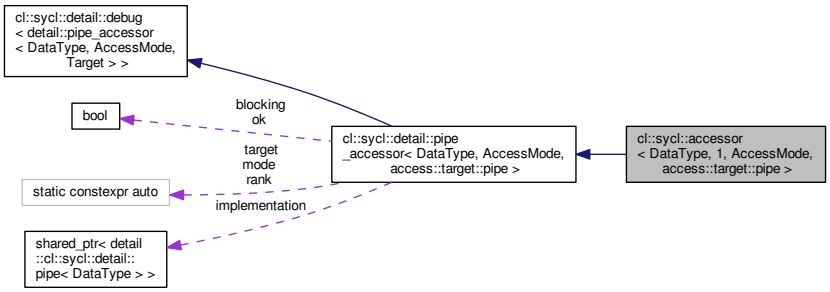
A specialization for an non-blocking pipe

Definition at line 402 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 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 407 of file accessor.hpp.

8.1.2.3.2 Constructor & Destructor Documentation

8.1.2.3.2.1 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 416 of file accessor.hpp.

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

```
00417     : accessor_detail { p.implementation, command_group_handler } { }
```

8.1.2.3.3 Member Function Documentation

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

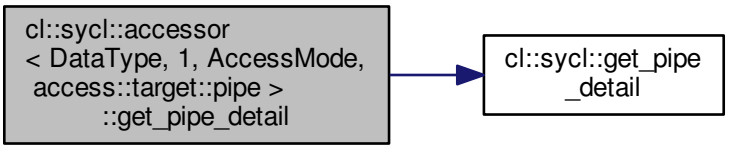
Get the underlying pipe implementation.

Definition at line 426 of file accessor.hpp.

References cl::sycl::get_pipe_detail().

```
00426                           {
00427     return accessor_detail::get_pipe_detail();
00428   }
```

Here is the call graph for this function:



8.1.2.3.3.2 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 420 of file accessor.hpp.

```
00420                                                   {
00421     return accessor_detail::reserve(size);
00422   }
```

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

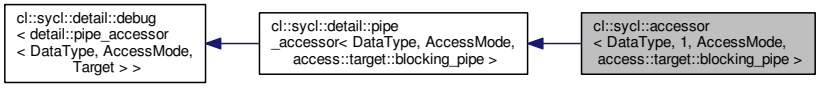
template<typename DataType, access::mode AccessMode>
class cl::sycl::accessor< DataType, 1, AccessMode, access::target::blocking_pipe >

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

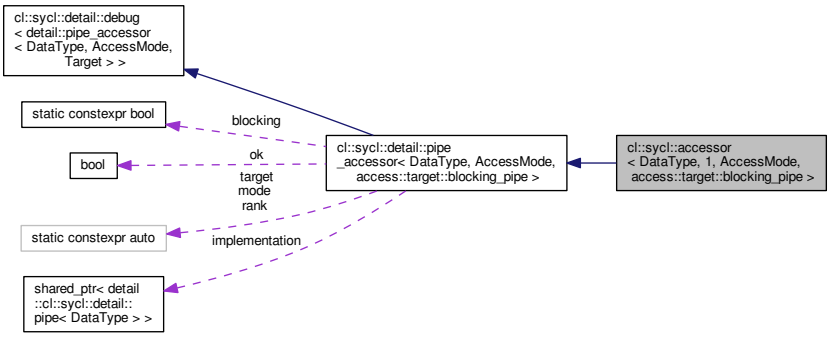
A specialization for a blocking pipe

Definition at line 440 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 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 445 of file accessor.hpp.

8.1.2.4.2 Constructor & Destructor Documentation

8.1.2.4.2.1 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 454 of file accessor.hpp.

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

```
00455     : accessor_detail { p.implementation, command_group_handler } { }
```

8.1.2.4.3 Member Function Documentation

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

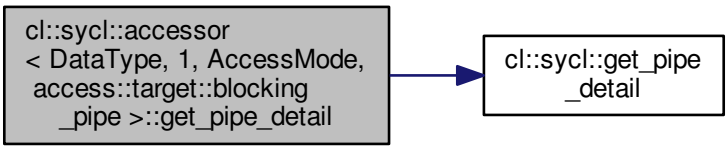
Get the underlying pipe implementation.

Definition at line 465 of file accessor.hpp.

References cl::sycl::get_pipe_detail().

```
00465                           {
00466     return accessor_detail::get_pipe_detail();
00467   }
```

Here is the call graph for this function:



8.1.2.4.3.2 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 459 of file accessor.hpp.

```
00459                                                 {
00460     return accessor_detail::reserve(size);
00461   }
```

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.

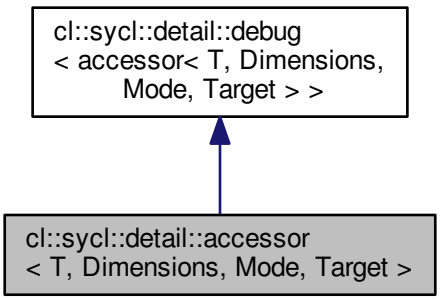
This implementation relies on boost::multi_array to provide this nice syntax and behaviour.

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).

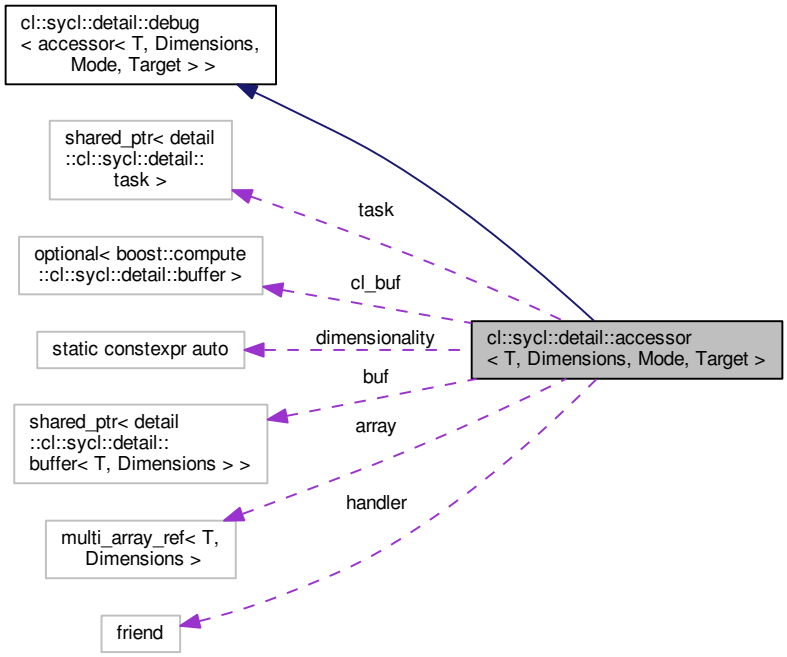
Todo Use the access::mode

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.
- 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 if required.
- void copy_back_cl_buffer ()

  Copy back the CL buffer to the SYCL if required.

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.
- boost::optional< boost::compute::buffer > cl_buf

  The OpenCL buffer used by an OpenCL accessor.
- friend handler

8.1.2.5.1 Member Typedef Documentation

8.1.2.5.1.1 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 71 of file accessor.hpp.

8.1.2.5.1.2 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 114 of file accessor.hpp.

8.1.2.5.1.3 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 107 of file accessor.hpp.

8.1.2.5.1.4 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 117 of file accessor.hpp.

8.1.2.5.1.5 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 105 of file accessor.hpp.

8.1.2.5.1.6 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 113 of file accessor.hpp.

8.1.2.5.1.7 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 106 of file accessor.hpp.

8.1.2.5.1.8 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 115 of file accessor.hpp.

8.1.2.5.1.9 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 104 of file accessor.hpp.

8.1.2.5.1.10 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 75 of file accessor.hpp.

8.1.2.5.2 Constructor & Destructor Documentation

8.1.2.5.2.1 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 125 of file accessor.hpp.

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

```
00125                                                                    :
00126     buf { target_buffer }, array { target_buffer->access } {
00127     target_buffer->template track_access_mode<Mode>();
00128     TRISYCL_DUMP_T("Create a host accessor write = " <<
      is_write_access());
00129     static_assert(Target == access::target::host_buffer,
00130                   "without a handler, access target should be host_buffer");
00131     /* The host needs to wait for all the producers of the buffer to
00132        have finished */
00133     buf->wait();
00134   }
```

Here is the call graph for this function:

8.1.2.5.2.2 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.

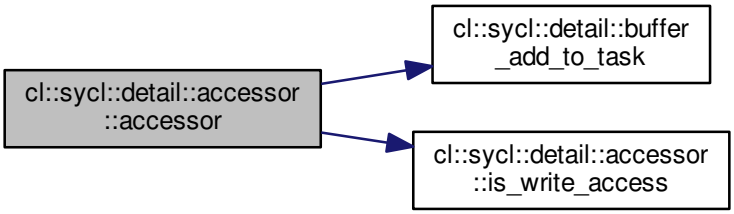
Todo fix the specification to rename target that shadows template parm

Definition at line 142 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.

```
00143                                       :
00144     buf { target_buffer }, array { target_buffer->access } {
00145     target_buffer->template track_access_mode<Mode>();
00146     TRISYCL_DUMP_T("Create a kernel accessor write = " <<
      is_write_access());
00147     static_assert(Target == access::target::global_buffer
00148                   || Target == access::target::constant_buffer,
00149                   "access target should be global_buffer or constant_buffer "
00150                   "when a handler is used");
00151     // Register the buffer to the task dependencies
00152     task = buffer_add_to_task(buf, &command_group_handler,
      is_write_access());
00153   }
```

Here is the call graph for this function:



8.1.2.5.3 Member Function Documentation

8.1.2.5.3.1 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?

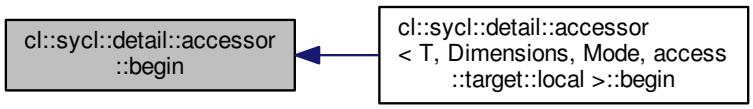
Definition at line 361 of file accessor.hpp.

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

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

```
00361                           {
00362     return const_cast<writable_array_view_type &>(array).
      begin();
00363   }
```

Here is the caller graph for this function:



8.1.2.5.3.2 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 378 of file accessor.hpp.

```
00378 { return array.begin(); }
```

8.1.2.5.3.3 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 381 of file accessor.hpp.

```
00381 { return array.end(); }
```

8.1.2.5.3.4 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]

Copy back the CL buffer to the SYCL if required.

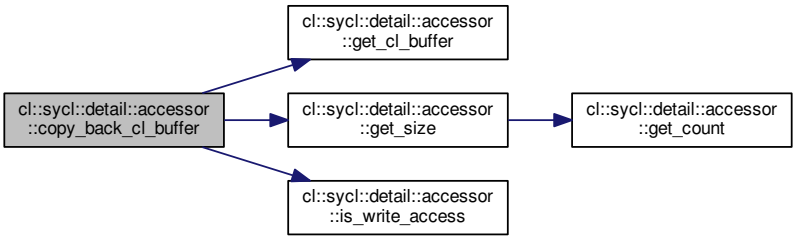
Todo Move this into the buffer with queue/device-based caching

Definition at line 447 of file accessor.hpp.

References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_cl_buffer(), cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_size(), and cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::is_write↩_access().

```
00447                                {
00448     // \todo Use if constexpr in C++17
00449     if (is_write_access())
00450       task->get_queue()->get_boost_compute()
00451         .enqueue_read_buffer(get_cl_buffer(),
00452                              0 /*< Offset */,
00453                              get_size(),
00454                              array.data());
00455   }
```

Here is the call graph for this function:



8.1.2.5.3.5 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 if required.

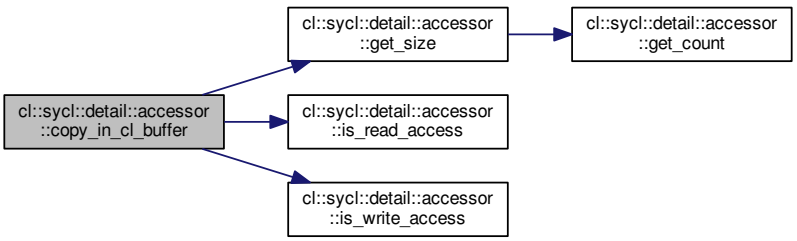
Todo Move this into the buffer with queue/device-based caching

Definition at line 425 of file accessor.hpp.

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

```
00425                               {
00426     // This should be a constexpr
00427     cl_mem_flags flags = is_read_access() && is_write_access() ?
00428       CL_MEM_READ_WRITE | CL_MEM_COPY_HOST_PTR
00429       : is_read_access() ? CL_MEM_READ_ONLY | CL_MEM_COPY_HOST_PTR
00430                          : CL_MEM_WRITE_ONLY;
00431
00432     /* Create the OpenCL buffer and copy in data from the host if in
00433        read mode */
00434     cl_buf = boost::compute::buffer {
00435       task->get_queue()->get_boost_compute().get_context(),
00436       get_size(),
00437       flags,
00438       is_read_access() ? array.data() : 0
00439     };
00440   }
```

Here is the call graph for this function:



8.1.2.5.3.6 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 402 of file accessor.hpp.

```
00402 { return array.rbegin(); }
```

8.1.2.5.3.7 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 405 of file accessor.hpp.

```
00405 { return array.rend(); }
```

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

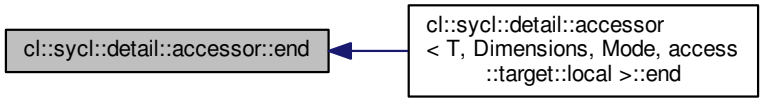
Definition at line 367 of file accessor.hpp.

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

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

```
00367                         {
00368     return const_cast<writable_array_view_type &>(array).
      end();
00369   }
```

Here is the caller graph for this function:



8.1.2.5.3.9 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 290 of file accessor.hpp.

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

```
00290                                                {
00291     return *buf;
00292   }
```

8.1.2.5.3.10 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 414 of file accessor.hpp.

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

```
00414                                {
00415     // This throws if not set
00416     return cl_buf.value();
00417   }
```

Here is the caller graph for this function:

8.1.2.5.3.11 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].

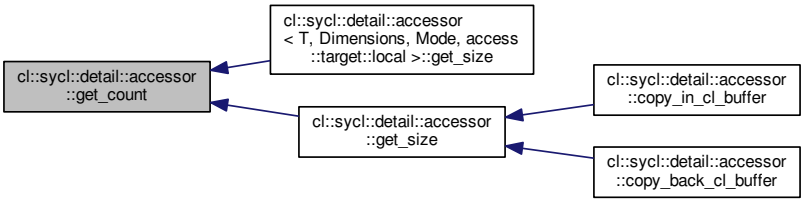
Todo Move on https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404

Definition at line 186 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().

```
00186                           {
00187     return array.num_elements();
00188   }
```

Here is the caller graph for this function:



8.1.2.5.3.12 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 331 of file accessor.hpp.

```
00331                   {
00332     return array.data();
00333   }
```

8.1.2.5.3.13 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 164 of file accessor.hpp.

```
00164                           {
00165     /* Interpret the shape which is a pointer to the first element as an
00166        array of Dimensions elements so that the range<Dimensions>
00167        constructor is happy with this collection
00168
00169        \todo Add also a constructor in range<> to accept a const
00170        std::size_t *?
00171     */
00172     return range<Dimensions> {
00173       *(const std::size_t (*)[Dimensions])(array.shape())
00174         };
00175   }
```

8.1.2.5.3.14 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 197 of file accessor.hpp.

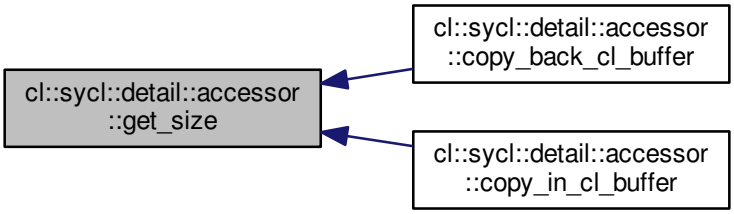
References cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::get_count().

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

```
00197                          {
00198     return get_count()*sizeof(value_type);
00199   }
```

Here is the call graph for this function:

Here is the caller graph for this function:



8.1.2.5.3.15 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 303 of file accessor.hpp.

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

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

```
00303                                       {
00304     return Mode == access::mode::read
00305       || Mode == access::mode::read_write
00306       || Mode == access::mode::discard_read_write;
00307   }
```

Here is the caller graph for this function:

8.1.2.5.3.16 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 ?

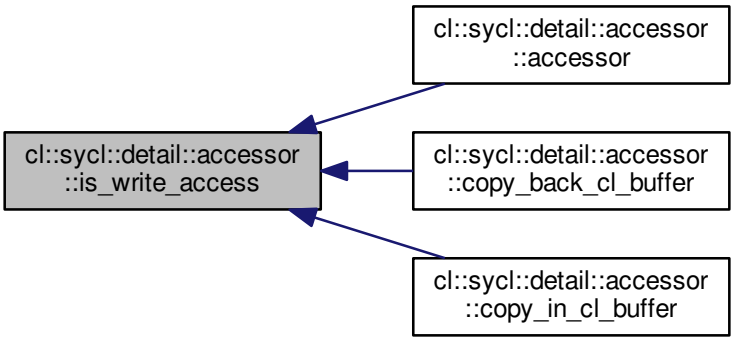
Definition at line 318 of file accessor.hpp.

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

```
00318                                       {
00319     return Mode == access::mode::write
00320       || Mode == access::mode::read_write
00321       || Mode == access::mode::discard_write
00322       || Mode == access::mode::discard_read_write;
00323   }
```

Here is the caller graph for this function:



8.1.2.5.3.17 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 269 of file accessor.hpp.

```
00269                         {
00270     return *array.data();
00271   }
```

8.1.2.5.3.18 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 284 of file accessor.hpp.

```
00284                               {
00285     return *array.data();
00286   }
```

8.1.2.5.3.19 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 207 of file accessor.hpp.

```
00207                                       {
00208     return array[index];
00209   }
```

8.1.2.5.3.20 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 217 of file accessor.hpp.

```
00217                                             {
00218     return array[index];
00219   }
```

8.1.2.5.3.21 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 223 of file accessor.hpp.

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

```
00223                                       {
00224     return array(index);
00225   }
```

8.1.2.5.3.22 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 229 of file accessor.hpp.

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

```
00229                                             {
00230     return array(index);
00231   }
```

8.1.2.5.3.23 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]

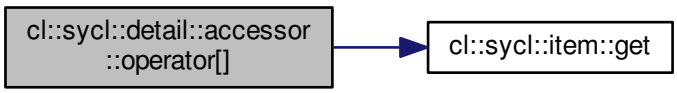
To use an accessor with [item<>].

Definition at line 235 of file accessor.hpp.

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

```
00235                                                {
00236     return (*this)[index.get()];
00237   }
```

Here is the call graph for this function:



8.1.2.5.3.24 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]

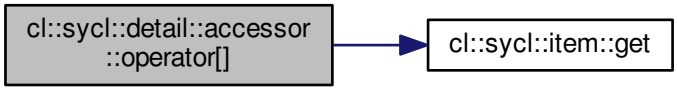
To use an accessor with [item<>].

Definition at line 241 of file accessor.hpp.

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

```
00241                                                      {
00242     return (*this)[index.get()];
00243   }
```

Here is the call graph for this function:



8.1.2.5.3.25 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<>].

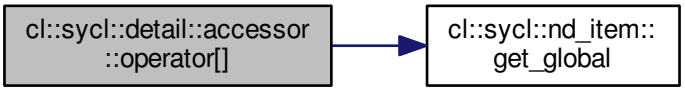
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 250 of file accessor.hpp.

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

```
00250                                                {
00251     return (*this)[index.get_global()];
00252   }
```

Here is the call graph for this function:



8.1.2.5.3.26 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<>].

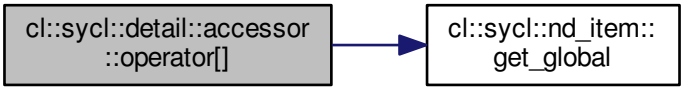
Todo Add in the specification because used by HPC-GPU slide 22

Definition at line 258 of file accessor.hpp.

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

```
00258                                                      {
00259     return (*this)[index.get_global()];
00260   }
```

Here is the call graph for this function:



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

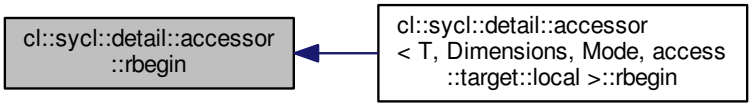
Definition at line 385 of file accessor.hpp.

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

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

```
00385                                    {
00386     return const_cast<writable_array_view_type &>(array).
      rbegin();
00387   }
```

Here is the caller graph for this function:



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

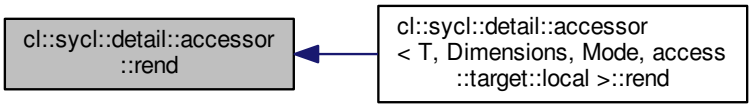
Definition at line 391 of file accessor.hpp.

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

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

```
00391                                    {
00392     return const_cast<writable_array_view_type &>(array).
      rend();
00393   }
```

Here is the caller graph for this function:



8.1.2.5.4 Member Data Documentation

8.1.2.5.4.1 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 84 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 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 68 of file accessor.hpp.

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

8.1.2.5.4.3 template<typename T , int Dimensions, access::mode Mode, access::target Target> boost::optional<boost::compute::buffer> cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::cl_buf [private]

The OpenCL buffer used by an OpenCL accessor.

Definition at line 91 of file accessor.hpp.

8.1.2.5.4.4 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 100 of file accessor.hpp.

8.1.2.5.4.5 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 410 of file accessor.hpp.

8.1.2.5.4.6 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 87 of file accessor.hpp.

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

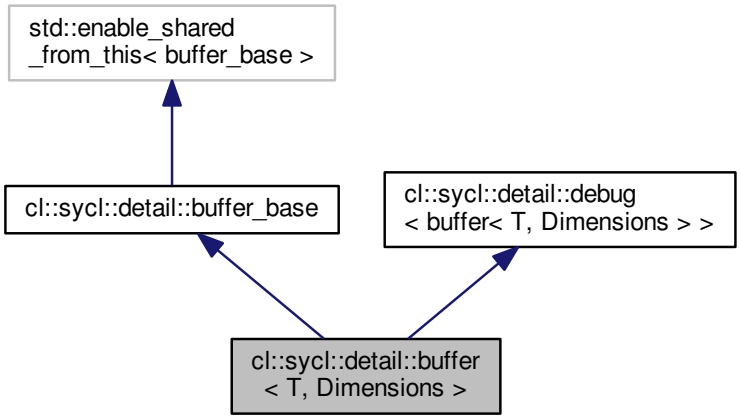
template<typename T, int Dimensions = 1>
class cl::sycl::detail::buffer< T, Dimensions >

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.

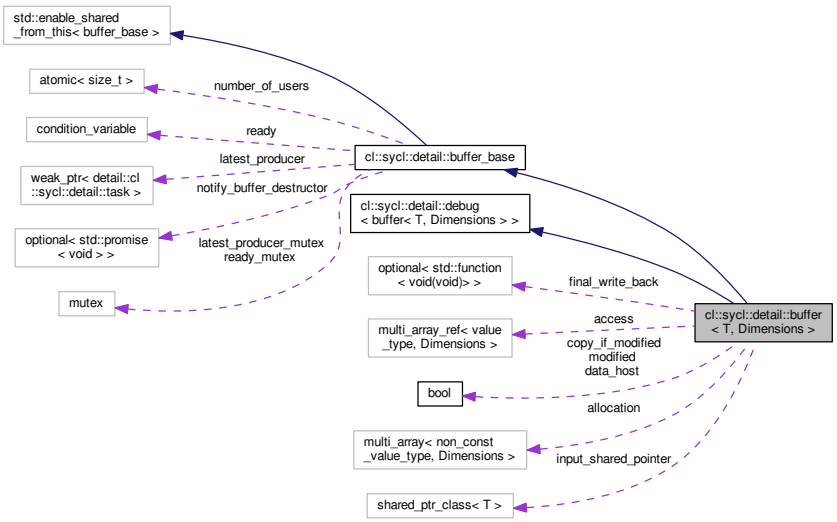
In the case we initialize it from a pointer, for now we just wrap the data with boost::multi_array_ref to provide the VLA semantics without any storage.

Definition at line 35 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 Deleter >
  buffer (unique_ptr_class< T, Deleter > &&host_data, const range< Dimensions > &r)

  Create a new buffer with associated memory, using the data owned in a unique pointer.
- 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 acessor 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.

Private Member Functions

- 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 Attributes

- boost::multi_array< non_const_value_type, Dimensions > allocation

  If some allocation is requested, it is managed by this multi_array to ease initialization from data.
- 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.
- 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 template<typename T, int Dimensions = 1> using cl::sycl::detail::buffer< T, Dimensions >::element = T

Definition at line 47 of file buffer.hpp.

8.1.2.6.1.2 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 51 of file buffer.hpp.

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

Definition at line 48 of file buffer.hpp.

8.1.2.6.2 Constructor & Destructor Documentation

8.1.2.6.2.1 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 96 of file buffer.hpp.

```
00096                                     : allocation { r },
00097                                       access { allocation }
00098                                       {}
```

8.1.2.6.2.2 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 103 of file buffer.hpp.

```
00103                                                 :
00104     access { host_data, r },
00105     data_host { true }
00106   {}
```

8.1.2.6.2.3 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 123 of file buffer.hpp.

```
00123                                                    :
00124     /* The buffer is read-only, even if the internal multidimensional
00125        wrapper is not. If a write accessor is requested, there should
00126        be a copy on write. So this pointer should not be written and
00127        this const_cast should be acceptable. */
00128     access { const_cast<T *>(host_data), r },
00129     data_host { true },
00130     /* Set copy_if_modified to true, so that if an accessor with write
00131        access is created, data are copied before to be modified. */
00132     copy_if_modified { true }
00133   {}
```

8.1.2.6.2.4 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 144 of file buffer.hpp.

```
00144                                                                :
00145     access { host_data.get(), r },
00146     input_shared_pointer { host_data },
00147     data_host { true }
00148   {}
```

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

Create a new buffer with associated memory, using the data owned in a unique pointer.

SYCL's runtime has full ownership of the host_data.

Definition at line 157 of file buffer.hpp.

```
00158                                     :
00159     access { host_data.get(), r },
00160       /* Use the fact that there is an implicit constructor of a \c
00161          std::shared_ptr from a \c std::unique_ptr to avoid storing
00162          the unique pointer. Doing so would need to implement
00163          ourselves some type erasure on the \c Deleter to avoid it
00164          leaking out of the \c buffer type and \c accessor type.
00165
00166          It still works as expected since, if we own a shared pointer,
00167          the \c Deleter is correctly handled and if we own it and its
00168          use-count is 1, we are the only owner and we can skip the
00169          copy-back later.
00170        */
00171     input_shared_pointer { std::move(host_data) },
00172     data_host { true }
00173   {}
```

8.1.2.6.2.6 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 178 of file buffer.hpp.

```
00178                                                     :
00179     // The size of a multi_array is set at creation time
00180     allocation { boost::extents[std::distance(start_iterator, end_iterator)] },
00181     access { allocation }
00182     // If iterators are const ones, then we do not write back
00183     {
00184       /* Then assign allocation since this is the only multi_array
00185          method with this iterator interface */
00186       allocation.assign(start_iterator, end_iterator);
00187     }
```

8.1.2.6.2.7 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 210 of file buffer.hpp.

```
00210             {
00211     if (modified && final_write_back)
00212       (*final_write_back)();
00213   }
```

8.1.2.6.3 Member Function Documentation

8.1.2.6.3.1 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.

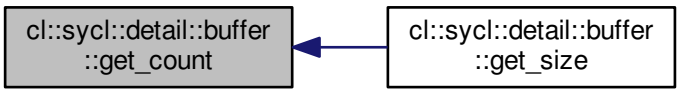
Equal to get_range()[0] * ... * get_range()[Dimensions-1].

Definition at line 274 of file buffer.hpp.

Referenced by cl::sycl::detail::buffer< T, Dimensions >::get_size().

```
00274                         {
00275     return access.num_elements();
00276   }
```

Here is the caller graph for this function:



8.1.2.6.3.2 template<typename T, int Dimensions = 1> boost::optional<std::future<void> > cl::sycl::detail::buffer< T, Dimensions >::get_destructor_future ( ) [inline], [private]

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`

Definition at line 339 of file buffer.hpp.

References cl::sycl::detail::buffer_base::notify_buffer_destructor.

```
00339                                                    {
00340     /* If there is only 1 shared_ptr user of the buffer, this is the
00341        caller of this function, the \c buffer_waiter, so there is no
00342        need to get a \ future otherwise there will be a dead-lock if
00343        there is only 1 thread waiting for itself.
00344
00345        Since \c use_count() is applied to a \c shared_ptr just created
00346        for this purpose, it actually increase locally the count by 1,
00347        so check for 1 + 1 use count instead...
00348     */
00349     // If the buffer's destruction triggers a write-back, wait
00350     if ((shared_from_this().use_count() > 2) &&
00351         modified && (final_write_back || data_host)) {
00352       // Create a promise to wait for
00353       notify_buffer_destructor = std::promise<void> {};
00354       // And return the future to wait for it
00355       return notify_buffer_destructor->get_future();
00356     }
00357     return boost::none;
00358   }
```

8.1.2.6.3.3 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 256 of file buffer.hpp.

```
00256                          {
00257     /* Interpret the shape which is a pointer to the first element as an
00258        array of Dimensions elements so that the range<Dimensions>
00259        constructor is happy with this collection
00260
00261        \todo Add also a constructor in range<> to accept a const
00262        std::size_t *?
00263     */
00264     return range<Dimensions> {
00265       *(const std::size_t (*)[Dimensions])(access.shape())
00266         };
00267   }
```

8.1.2.6.3.4 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.

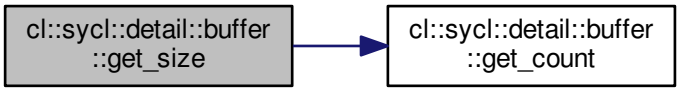
Todo rename to something else. In http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2015/p0122r0.pdf it is named bytes() for example

Definition at line 285 of file buffer.hpp.

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

```
00285                           {
00286     return get_count()*sizeof(value_type);
00287   }
```

Here is the call graph for this function:



8.1.2.6.3.5 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 219 of file buffer.hpp.

References cl::sycl::access::host_buffer.

```
00219                           {
00220     modified = true;
00221   }
```

8.1.2.6.3.6 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 292 of file buffer.hpp.

```
00292                                                   {
00293     final_write_back = [=] {
00294       if (auto sptr = final_data.lock()) {
00295         std::copy_n(access.data(), access.num_elements(), sptr.get());
00296       }
00297     };
00298   }
```

8.1.2.6.3.7 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 304 of file buffer.hpp.

```
00304                                                          {
00305     final_write_back = [=] {
00306       std::copy_n(access.data(), access.num_elements(), final_data.get());
00307     };
00308   }
```

8.1.2.6.3.8 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 313 of file buffer.hpp.

```
00313                                    {
00314     final_write_back = boost::none;
00315   }
```

8.1.2.6.3.9 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 321 of file buffer.hpp.

```
00321                                             {
00322 /*   using type_ = typename iterator_value_type<Iterator>::value_type;
00323     static_assert(std::is_same<type_, T>::value, "buffer type mismatch");
00324     static_assert(!(std::is_const<type_>::value), "const iterator is not allowed");*/
00325     final_write_back = [=] {
00326       std::copy_n(access.data(), access.num_elements(), final_data);
00327     };
00328   }
```

8.1.2.6.3.10 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 acessor is created.

Its current purpose is to track if an accessor with write access is created and acting acordingly.

Definition at line 233 of file buffer.hpp.

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

```
00233                                {
00234     // test if write access is required
00235     if (   Mode == access::mode::write
00236         || Mode == access::mode::read_write
00237         || Mode == access::mode::discard_write
00238         || Mode == access::mode::discard_read_write
00239         || Mode == access::mode::atomic
00240        ) {
00241       modified = true;
00242       if (copy_if_modified) {
00243         copy_if_modified = false;
00244         data_host = false;
00245         allocation = boost::multi_array<T, Dimensions> { access };
00246         access = boost::multi_array_ref<T, Dimensions> { allocation };
00247       }
00248     }
00249   }
```

8.1.2.6.4 Friends And Related Function Documentation

8.1.2.6.4.1 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 65 of file buffer.hpp.

8.1.2.6.5 Member Data Documentation

8.1.2.6.5.1 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 73 of file buffer.hpp.

8.1.2.6.5.2 template<typename T, int Dimensions = 1> boost::multi_array<non_const_value_type, Dimensions> cl::sycl::detail::buffer< T, Dimensions >::allocation [private]

If some allocation is requested, it is managed by this multi_array to ease initialization from data.

Definition at line 57 of file buffer.hpp.

8.1.2.6.5.3 template<typename T, int Dimensions = 1> bool cl::sycl::detail::buffer< T, Dimensions >::copy_if_modified = false [private]

Definition at line 88 of file buffer.hpp.

8.1.2.6.5.4 template<typename T, int Dimensions = 1> bool cl::sycl::detail::buffer< T, Dimensions >::data_host = false [private]

Definition at line 85 of file buffer.hpp.

8.1.2.6.5.5 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 78 of file buffer.hpp.

8.1.2.6.5.6 template<typename T, int Dimensions = 1> shared_ptr_class<T> cl::sycl::detail::buffer< T, Dimensions >::input_shared_pointer [private]

Definition at line 81 of file buffer.hpp.

8.1.2.6.5.7 template<typename T, int Dimensions = 1> bool cl::sycl::detail::buffer< T, Dimensions >::modified = false [private]

Definition at line 91 of file buffer.hpp.

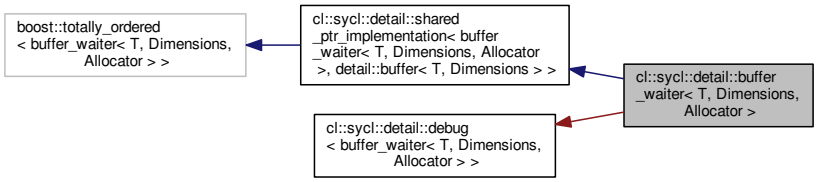
8.1.2.7 class cl::sycl::detail::buffer_waiter

template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>>
class cl::sycl::detail::buffer_waiter< T, Dimensions, Allocator >

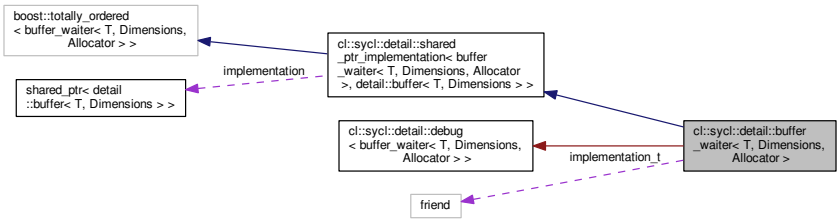
A helper class to wait for the final buffer destruction if the conditions for blocking are met.

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

8.1.2.7.1 Member Typedef Documentation

8.1.2.7.1.1 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.

8.1.2.7.2 Constructor & Destructor Documentation

8.1.2.7.2.1 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 } {}
```

8.1.2.7.2.2 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   }
```

8.1.2.7.3 Member Data Documentation

8.1.2.7.3.1 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.

8.1.2.8 struct cl::sycl::image

template<int Dimensions>
struct cl::sycl::image< Dimensions >

Todo implement image

Definition at line 23 of file image.hpp.

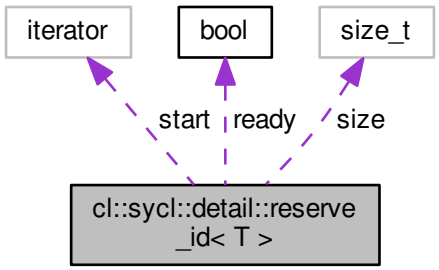
8.1.2.9 struct cl::sycl::detail::reserve_id

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

8.1.2.9.1 Constructor & Destructor Documentation

8.1.2.9.1.1 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 } {}
```

8.1.2.9.2 Member Data Documentation

8.1.2.9.2.1 template<typename T > bool cl::sycl::detail::reserve_id< T >::ready = false

Definition at line 49 of file pipe.hpp.

8.1.2.9.2.2 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().

8.1.2.9.2.3 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.

8.1.2.10 class cl::sycl::detail::pipe

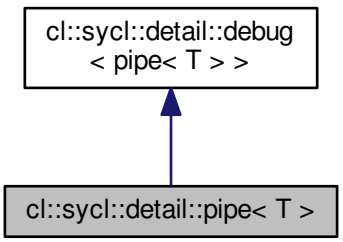
template<typename T>
class cl::sycl::detail::pipe< T >

Implement a pipe object.

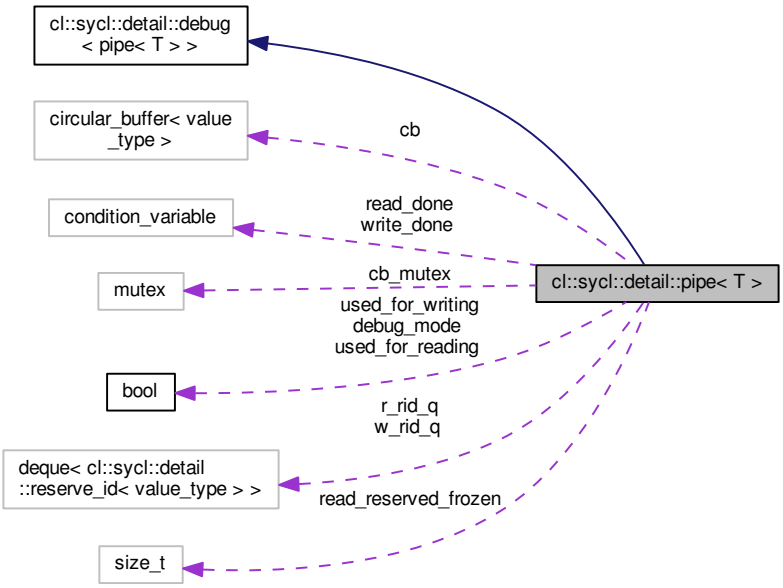
Use some mutable members so that the pipe object can be changed even when the accessors are captured in a lambda.

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.

8.1.2.10.1 Member Typedef Documentation

8.1.2.10.1.1 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.

8.1.2.10.1.2 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.

8.1.2.10.1.3 template<typename T> using cl::sycl::detail::pipe< T >::value_type = T

Definition at line 74 of file pipe.hpp.

8.1.2.10.2 Constructor & Destructor Documentation

8.1.2.10.2.1 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 } { }
```

8.1.2.10.3 Member Function Documentation

8.1.2.10.3.1 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   }
```

8.1.2.10.3.2 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   }
```

8.1.2.10.3.3 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   }
```

8.1.2.10.3.4 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   }
```

8.1.2.10.3.5 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   }
```

8.1.2.10.3.6 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:

8.1.2.10.3.7 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:

8.1.2.10.3.8 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   }
```

8.1.2.10.3.9 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

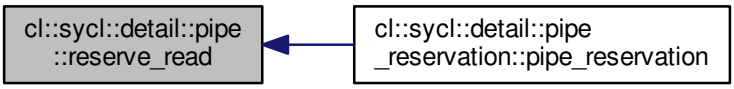
Definition at line 335 of file pipe.hpp.

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:



8.1.2.10.3.10 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

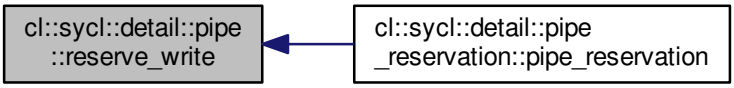
Definition at line 383 of file pipe.hpp.

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:



8.1.2.10.3.11 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   }
```

8.1.2.10.3.12 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   }
```

8.1.2.10.3.13 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.

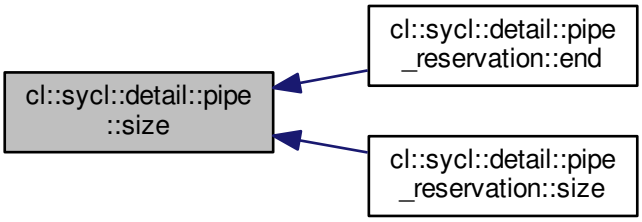
Note that on some devices it may be costly to implement (for example on FPGA).

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:



8.1.2.10.3.14 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   }
```

8.1.2.10.3.15 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   }
```

8.1.2.10.4 Member Data Documentation

8.1.2.10.4.1 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.

8.1.2.10.4.2 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.

8.1.2.10.4.3 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.

8.1.2.10.4.4 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.

8.1.2.10.4.5 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.

8.1.2.10.4.6 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.

8.1.2.10.4.7 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.

8.1.2.10.4.8 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.

8.1.2.10.4.9 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.

8.1.2.10.4.10 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.

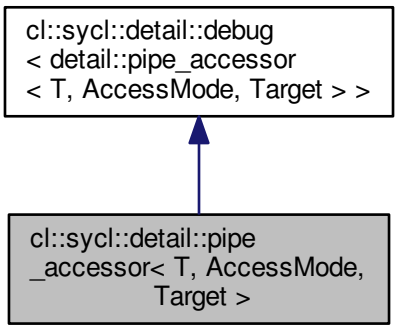
8.1.2.11 class cl::sycl::detail::pipe_accessor

template<typename T, access::mode AccessMode, access::target Target>
class cl::sycl::detail::pipe_accessor< T, AccessMode, Target >

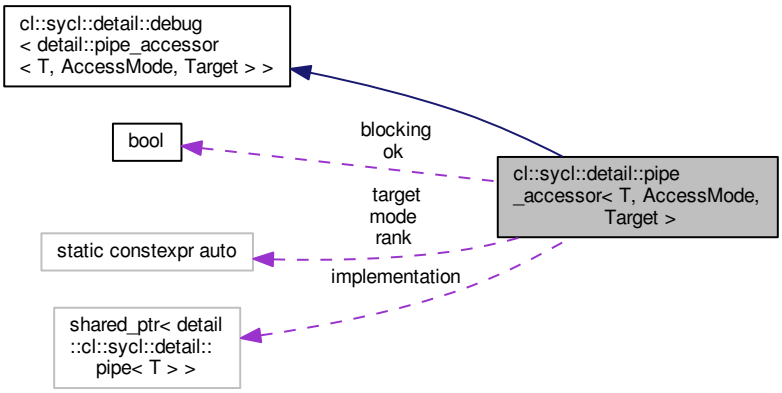
The accessor abstracts the way pipe data are accessed inside a kernel.

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.

8.1.2.11.1 Member Typedef Documentation

8.1.2.11.1.1 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.

8.1.2.11.1.2 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.

8.1.2.11.1.3 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.

8.1.2.11.2 Constructor & Destructor Documentation

8.1.2.11.2.1 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

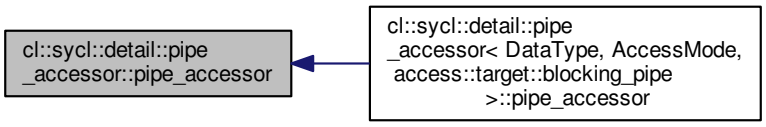
Definition at line 83 of file pipe_accessor.hpp.

```
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   }
```

8.1.2.11.2.2 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:



8.1.2.11.2.3 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   }
```

8.1.2.11.3 Member Function Documentation

8.1.2.11.3.1 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   }
```

8.1.2.11.3.2 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   }
```

8.1.2.11.3.3 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   }
```

8.1.2.11.3.4 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   }
```

8.1.2.11.3.5 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   }
```

8.1.2.11.3.6 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   }
```

8.1.2.11.3.7 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   }
```

8.1.2.11.3.8 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   }
```

8.1.2.11.3.9 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

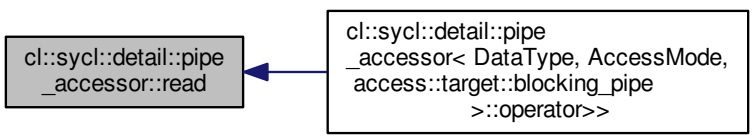
This function is const so it can work when the accessor is passed by copy in the [=] kernel lambda, which is not mutable by default

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:



8.1.2.11.3.10 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   }
```

8.1.2.11.3.11 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   }
```

8.1.2.11.3.12 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   }
```

8.1.2.11.3.13 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

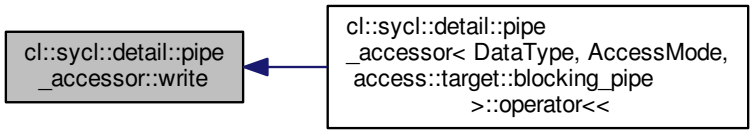
This function is const so it can work when the accessor is passed by copy in the [=] kernel lambda, which is not mutable by default

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:



8.1.2.11.4 Member Data Documentation

8.1.2.11.4.1 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.

8.1.2.11.4.2 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().

8.1.2.11.4.3 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.

8.1.2.11.4.4 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().

8.1.2.11.4.5 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.

8.1.2.11.4.6 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.

8.1.2.12 class cl::sycl::pipe

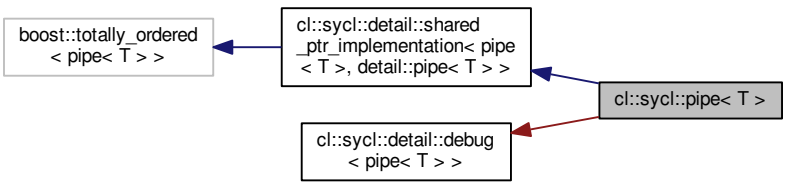
template<typename T>
class cl::sycl::pipe< T >

A SYCL pipe.

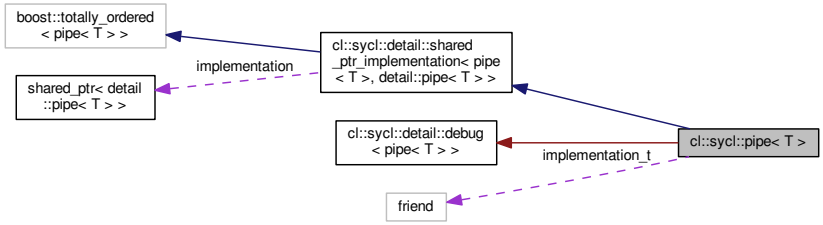
Implement a FIFO-style object that can be used through accessors to send some objects T from the input to the output

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

8.1.2.12.1 Member Typedef Documentation

8.1.2.12.1.1 template<typename T> using cl::sycl::pipe< T >::implementation_t = typename pipe::shared_ptr_implementation [private]

Definition at line 40 of file pipe.hpp.

8.1.2.12.1.2 template<typename T> using cl::sycl::pipe< T >::value_type = T

The STL-like types.

Definition at line 53 of file pipe.hpp.

8.1.2.12.2 Constructor & Destructor Documentation

8.1.2.12.2.1 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 } } { }
```

8.1.2.12.3 Member Function Documentation

8.1.2.12.3.1 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     }
```

8.1.2.12.3.2 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   }
```

8.1.2.12.4 Member Data Documentation

8.1.2.12.4.1 template<typename T> friend cl::sycl::pipe< T >::implementation_t [private]

Definition at line 43 of file pipe.hpp.

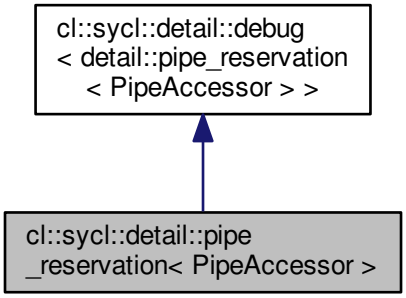
8.1.2.13 class cl::sycl::detail::pipe_reservation

template<typename PipeAccessor>
class cl::sycl::detail::pipe_reservation< PipeAccessor >

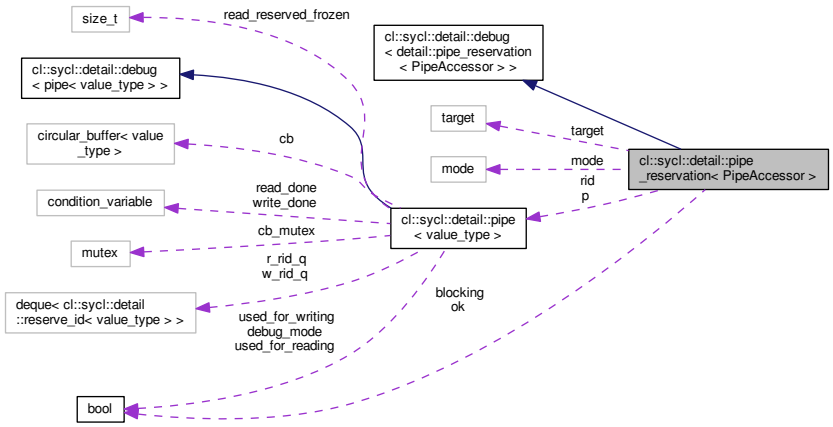
The implementation of the pipe reservation station.

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

8.1.2.13.1 Member Typedef Documentation

8.1.2.13.1.1 template<typename PipeAccessor> using cl::sycl::detail::pipe_reservation< PipeAccessor >::accessor_type = PipeAccessor [private]

Definition at line 35 of file pipe_reservation.hpp.

8.1.2.13.1.2 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.

8.1.2.13.1.3 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.

8.1.2.13.1.4 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.

8.1.2.13.1.5 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.

8.1.2.13.2 Constructor & Destructor Documentation

8.1.2.13.2.1 template<typename PipeAccessor> cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation (detail::pipe< value_type > & *p*, std::size_t *s*) [inline]

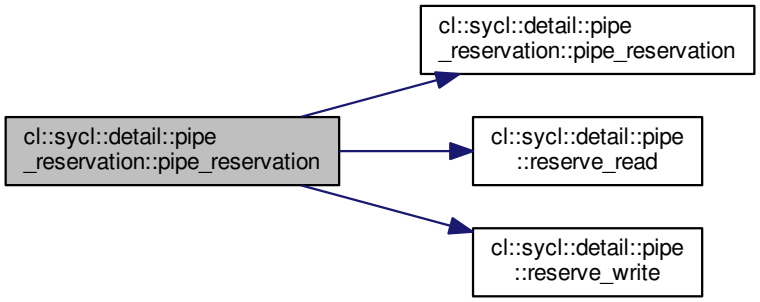
Create a pipe reservation station that reserves the pipe itself.

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:



8.1.2.13.2.2 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.

8.1.2.13.2.3 template<typename PipeAccessor> cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation (pipe_reservation< PipeAccessor > && *orig*) [inline]

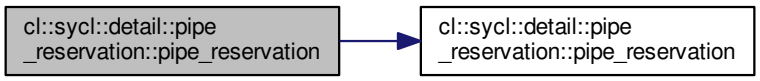
Only a move constructor is required to move it into the shared_ptr.

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:



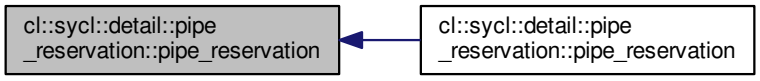
8.1.2.13.2.4 template<typename PipeAccessor> cl::sycl::detail::pipe_reservation< PipeAccessor >::pipe_reservation ( ) [default]

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:



8.1.2.13.2.5 template<typename PipeAccessor> cl::sycl::detail::pipe_reservation< PipeAccessor >::~pipe_reservation ( ) [inline]

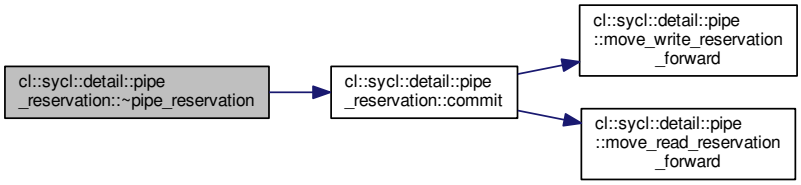
An implicit commit is made in the destructor.

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:



8.1.2.13.3 Member Function Documentation

8.1.2.13.3.1 template<typename PipeAccessor> void cl::sycl::detail::pipe_reservation< PipeAccessor >::assume_validity ( ) [inline]

Test that the reservation is in a usable state.

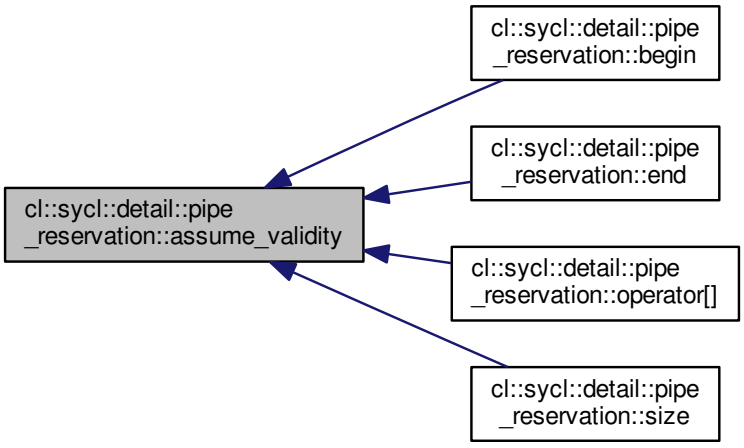
Todo Throw exception instead

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:



8.1.2.13.3.2 template<typename PipeAccessor> iterator cl::sycl::detail::pipe_reservation< PipeAccessor >::begin ( ) [inline]

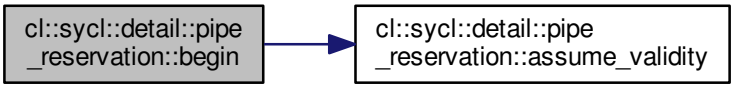
Start of the reservation area.

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:



8.1.2.13.3.3 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

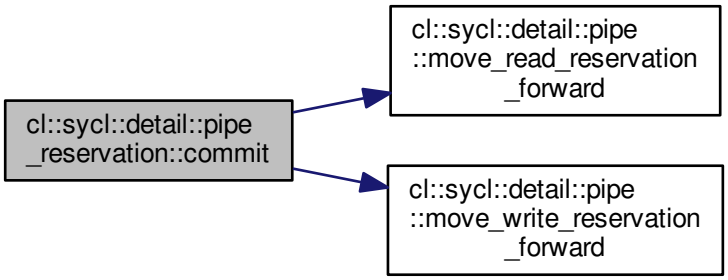
Definition at line 170 of file pipe_reservation.hpp.

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.

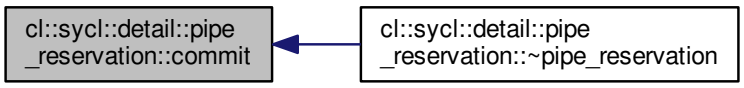
Referenced by cl::sycl::detail::pipe_reservation< PipeAccessor >::~pipe_reservation().

```
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:



8.1.2.13.3.4 template<typename PipeAccessor> iterator cl::sycl::detail::pipe_reservation< PipeAccessor >::end ( ) [inline]

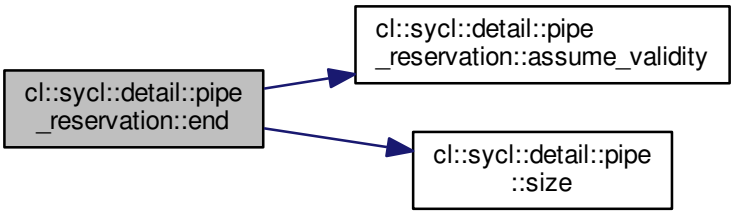
Past the end of the reservation area.

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:



8.1.2.13.3.5 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   }
```

8.1.2.13.3.6 template<typename PipeAccessor> reference cl::sycl::detail::pipe_reservation< PipeAccessor >::operator[] (std::size_t *index*) [inline]

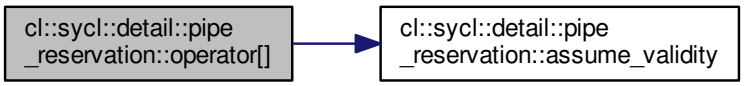
Access to an element of the reservation.

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:



8.1.2.13.3.7 template<typename PipeAccessor> std::size_t cl::sycl::detail::pipe_reservation< PipeAccessor >::size ( ) [inline]

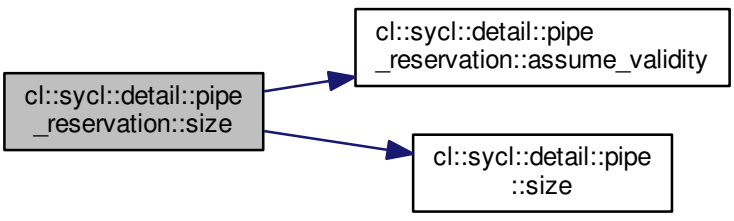
Get the number of elements in the reservation station.

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:



8.1.2.13.4 Member Data Documentation

8.1.2.13.4.1 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.

8.1.2.13.4.2 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.

8.1.2.13.4.3 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().

8.1.2.13.4.4 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.

8.1.2.13.4.5 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.

8.1.2.13.4.6 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.

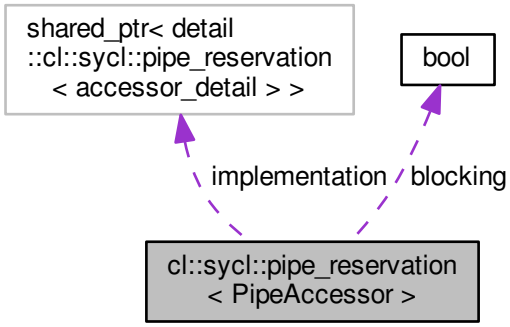
8.1.2.14 struct cl::sycl::pipe_reservation

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

8.1.2.14.1 Member Typedef Documentation

8.1.2.14.1.1 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.

8.1.2.14.1.2 template<typename PipeAccessor > using cl::sycl::pipe_reservation< PipeAccessor >::accessor_type = PipeAccessor

Definition at line 31 of file pipe_reservation.hpp.

8.1.2.14.1.3 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.

8.1.2.14.1.4 template<typename PipeAccessor > using cl::sycl::pipe_reservation< PipeAccessor >::const_pointer = const value_type*

Definition at line 40 of file pipe_reservation.hpp.

8.1.2.14.1.5 template<typename PipeAccessor > using cl::sycl::pipe_reservation< PipeAccessor >::const_reference = const value_type&

Definition at line 38 of file pipe_reservation.hpp.

8.1.2.14.1.6 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.

8.1.2.14.1.7 template<typename PipeAccessor > using cl::sycl::pipe_reservation< PipeAccessor >::difference_type = ptrdiff_t

Definition at line 42 of file pipe_reservation.hpp.

8.1.2.14.1.8 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.

8.1.2.14.1.9 template<typename PipeAccessor > using cl::sycl::pipe_reservation< PipeAccessor >::pointer = value_type*

Definition at line 39 of file pipe_reservation.hpp.

8.1.2.14.1.10 template<typename PipeAccessor > using cl::sycl::pipe_reservation< PipeAccessor >::reference = value_type&

Definition at line 37 of file pipe_reservation.hpp.

8.1.2.14.1.11 template<typename PipeAccessor > using cl::sycl::pipe_reservation< PipeAccessor >::reverse_iterator = std::reverse_iterator<iterator>

Definition at line 47 of file pipe_reservation.hpp.

8.1.2.14.1.12 template<typename PipeAccessor > using cl::sycl::pipe_reservation< PipeAccessor >::size_type = std::size_t

Definition at line 41 of file pipe_reservation.hpp.

8.1.2.14.1.13 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.

8.1.2.14.2 Constructor & Destructor Documentation

8.1.2.14.2.1 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.

8.1.2.14.2.2 template<typename PipeAccessor > cl::sycl::pipe_reservation< PipeAccessor >::pipe_reservation (accessor_type & *accessor,* std::size_t *s*) [inline]

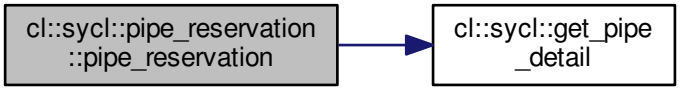
Create a pipe_reservation for an accessor and a number of elements.

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:



8.1.2.14.2.3 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   {}
```

8.1.2.14.3 Member Function Documentation

8.1.2.14.3.1 template<typename PipeAccessor > iterator cl::sycl::pipe_reservation< PipeAccessor >::begin ( ) const [inline]

Get an iterator on the first element of the reservation station.

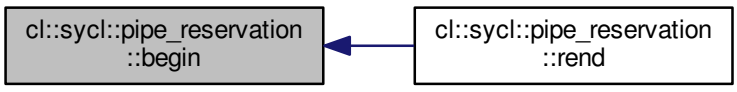
Definition at line 119 of file pipe_reservation.hpp.

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:



8.1.2.14.3.2 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.

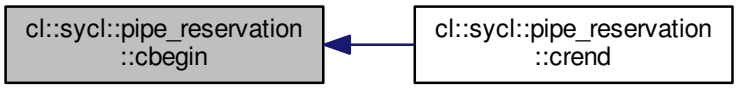
Definition at line 131 of file pipe_reservation.hpp.

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:



8.1.2.14.3.3 template<typename PipeAccessor > const_iterator cl::sycl::pipe_reservation< PipeAccessor >::cend ( ) const [inline]

Build a constant iterator past the end of the reservation station.

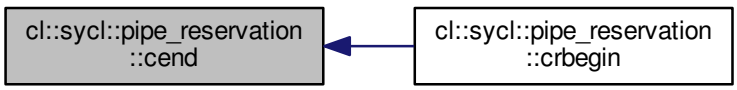
Definition at line 137 of file pipe_reservation.hpp.

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:



8.1.2.14.3.4 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   }
```

8.1.2.14.3.5 template<typename PipeAccessor > const_reverse_iterator cl::sycl::pipe_reservation< PipeAccessor >::crbegin ( ) const [inline]

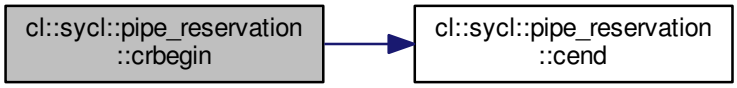
Get a constant reverse iterator on the last element of the reservation station.

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:



8.1.2.14.3.6 template<typename PipeAccessor > const_reverse_iterator cl::sycl::pipe_reservation< PipeAccessor >::crend ( ) const [inline]

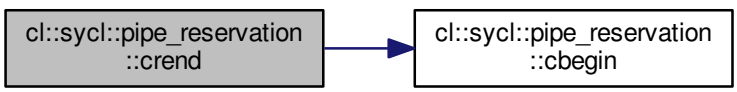
Get a constant reverse iterator on the first element past the end of the reservation station.

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:



8.1.2.14.3.7 template<typename PipeAccessor > iterator cl::sycl::pipe_reservation< PipeAccessor >::end ( ) const [inline]

Get an iterator past the end of the reservation station.

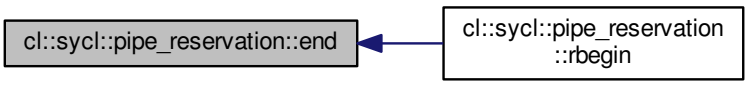
Definition at line 125 of file pipe_reservation.hpp.

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:



8.1.2.14.3.8 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   }
```

8.1.2.14.3.9 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   }
```

8.1.2.14.3.10 template<typename PipeAccessor > reverse_iterator cl::sycl::pipe_reservation< PipeAccessor >::rbegin ( ) const [inline]

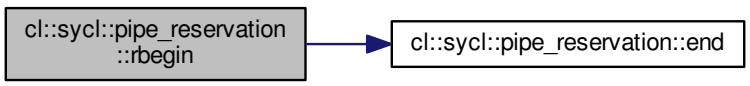
Get a reverse iterator on the last element of the reservation station.

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:



8.1.2.14.3.11 template<typename PipeAccessor > reverse_iterator cl::sycl::pipe_reservation< PipeAccessor >::rend ( ) const [inline]

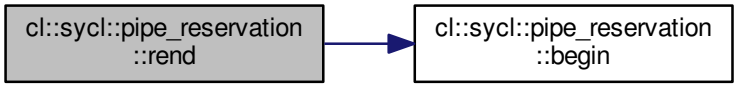
Get a reverse iterator on the first element past the end of the reservation station.

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:



8.1.2.14.3.12 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   }
```

8.1.2.14.4 Member Data Documentation

8.1.2.14.4.1 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.

8.1.2.14.4.2 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().

8.1.2.15 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.

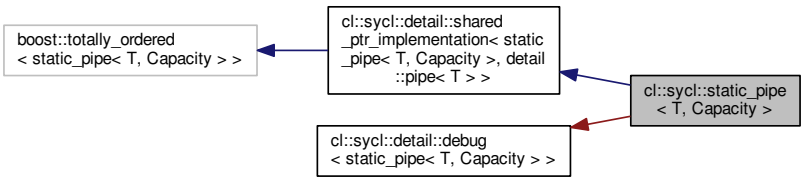
Compared to a normal pipe, a static_pipe takes a constexpr size and is expected to be declared in a compile-unit static context so the compiler can generate everything at compile time.

This is useful to generate a fixed and optimized hardware implementation on FPGA for example, where the inter-connection graph can be also inferred at compile time.

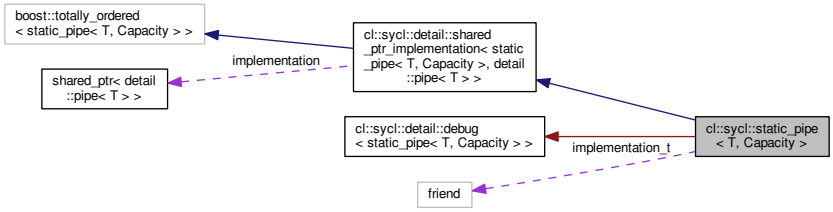
It is not directly mapped to the OpenCL program-scoped pipe because in SYCL there is not this concept of separated program. But the SYCL device compiler is expected to generate some OpenCL program(s) with program-scoped pipes when a SYCL static-scoped pipe is used. These details are implementation defined.

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

8.1.2.15.1 Member Typedef Documentation

8.1.2.15.1.1 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.

8.1.2.15.1.2 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.

8.1.2.15.2 Constructor & Destructor Documentation

8.1.2.15.2.1 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 } } { }
```

8.1.2.15.3 Member Function Documentation

8.1.2.15.3.1 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     }
```

8.1.2.15.3.2 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   }
```

8.1.2.15.4 Member Data Documentation

8.1.2.15.4.1 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 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 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 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 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>

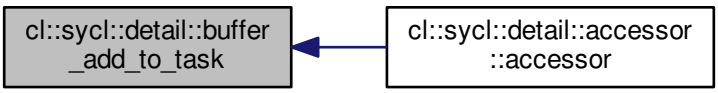
Todo To remove with some refactoring

Definition at line 379 of file buffer.hpp.

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

```
00381                                       {
00382     return buf->add_to_task(command_group_handler, is_write_mode);
00383   }
```

Here is the caller graph for this function:



8.1.4.2 template<typename Accessor > static auto& cl::sycl::get_pipe_detail (Accessor & *a*) [inline], [static]

`#include <include/CL/sycl/accessor.hpp>`

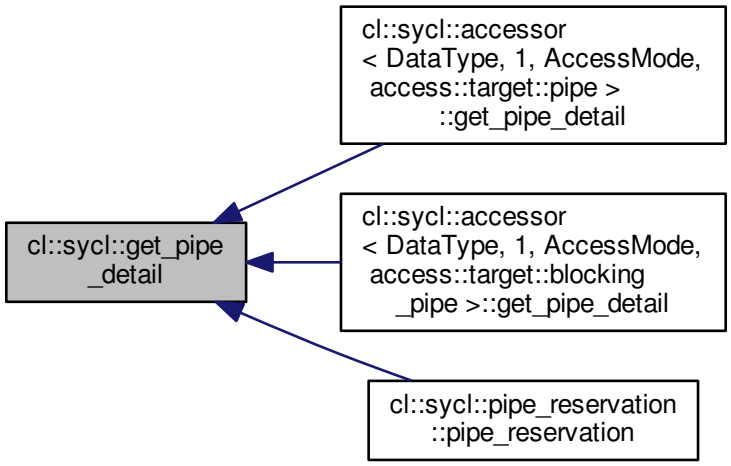
Top-level function to break circular dependencies on the the types to get the pipe implementation.

Definition at line 475 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().

```
00475                                                {
00476   return a.get_pipe_detail();
00477   }
```

Here is the caller graph for this function:



8.1.4.3 template<typename T , int Dimensions = 1> 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 78 of file buffer_waiter.hpp.

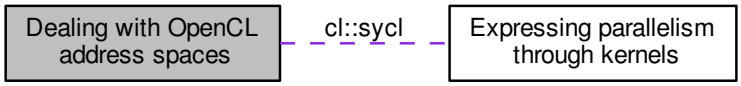
Referenced by cl::sycl::buffer< T, Dimensions, Allocator >::buffer().

```
00078                                                    {
00079   return new buffer_waiter<T, Dimensions> { b };
00080 }
```

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 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 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 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 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 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 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 >

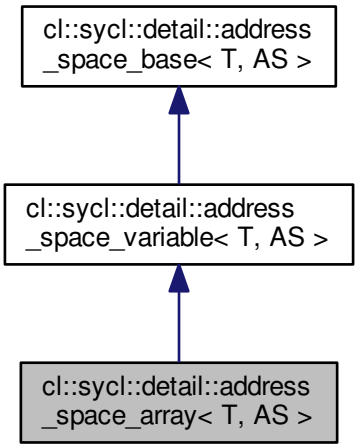
Implementation of an array variable with an OpenCL address space.

Parameters

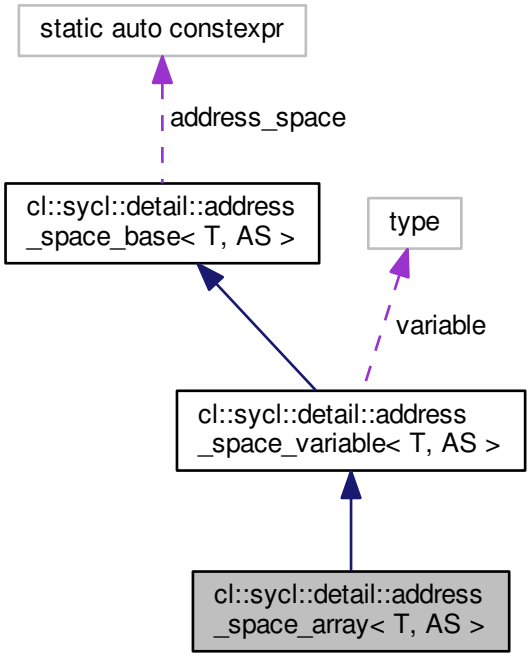
T	is the type of the basic object to be created
AS	is the address space to place the object into

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 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 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 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.

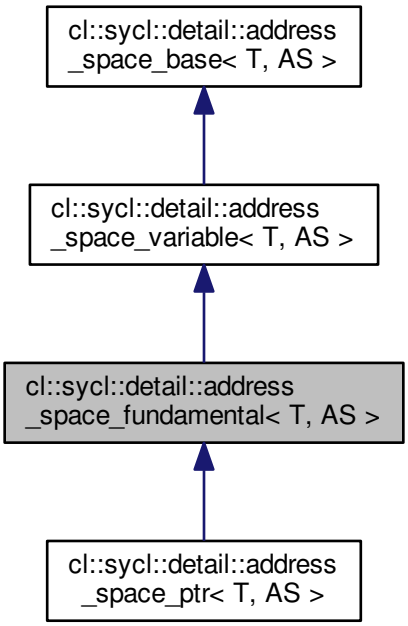
Parameters

T	is the type of the basic object to be created
AS	is the address space to place the object into

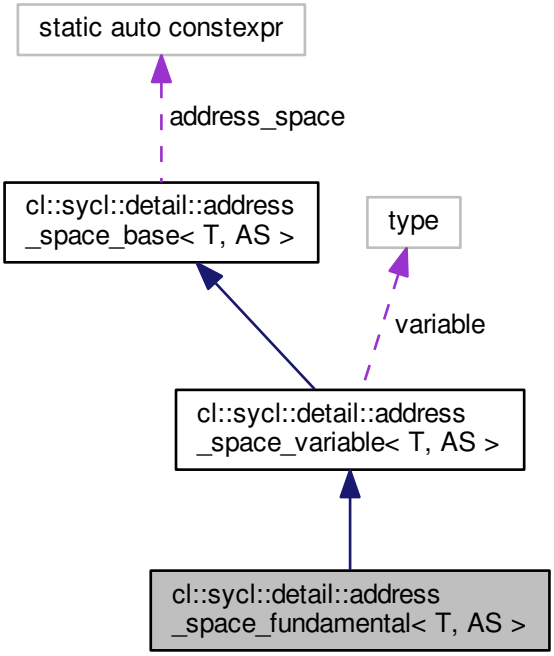
Todo Verify/improve to deal with const/volatile?

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 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 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 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

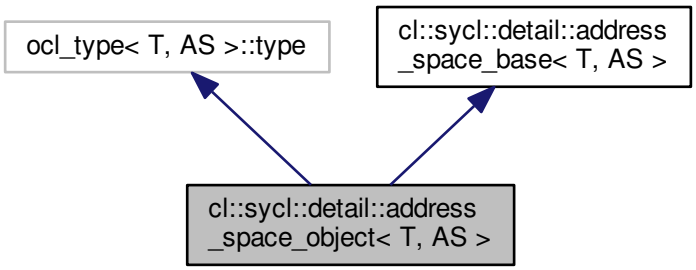
The class implementation is just inheriting of T so that all methods and non-member operators on T work also on address_space_object<T>

Todo Verify/improve to deal with const/volatile?

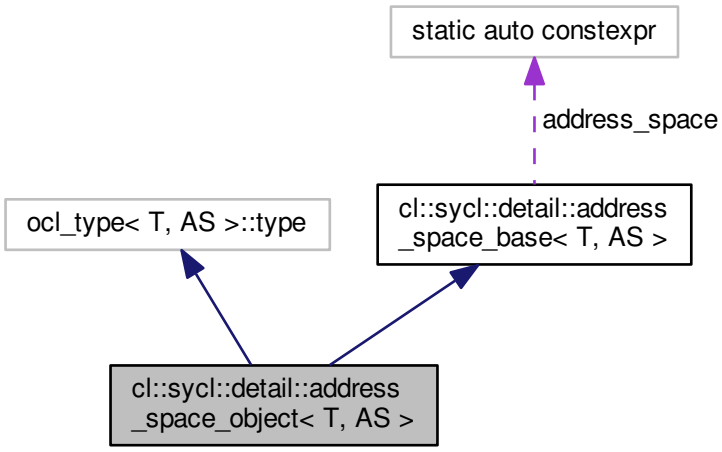
Todo what about T having some final methods?

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 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 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 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

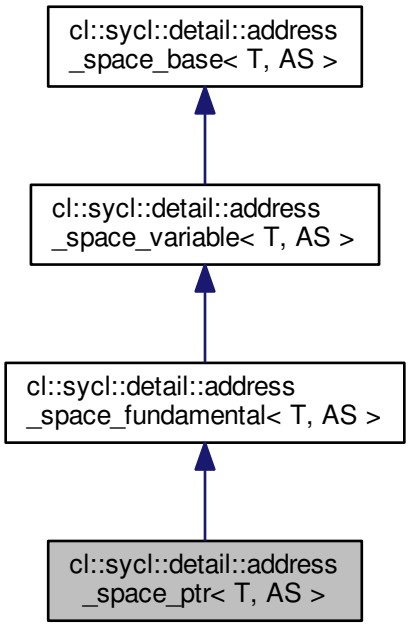
T	is the pointer type

Note that if *T* is not a pointer type, it is an error.

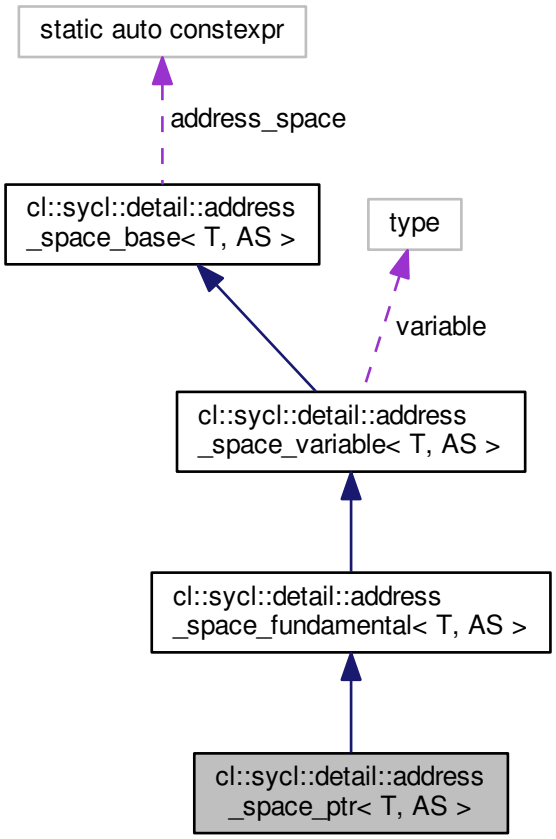
All the address space pointers inherit from it, which makes trivial the implementation of cl::sycl::multi_ptr<T, AS>

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 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 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 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 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]

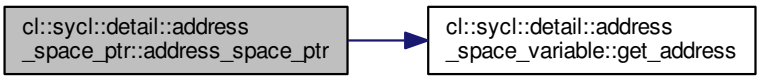
Allow initialization of a pointer type from the address of an element with the same type and address space.

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.

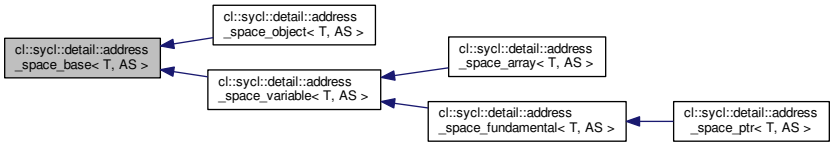
Parameters

T	is the type of the basic stuff to be created
AS	is the address space to place the object into

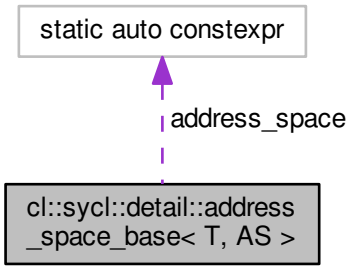
Todo Verify/improve to deal with const/volatile?

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 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 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 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 >

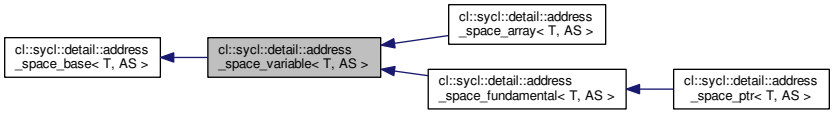
Implementation of a variable with an OpenCL address space.

Parameters

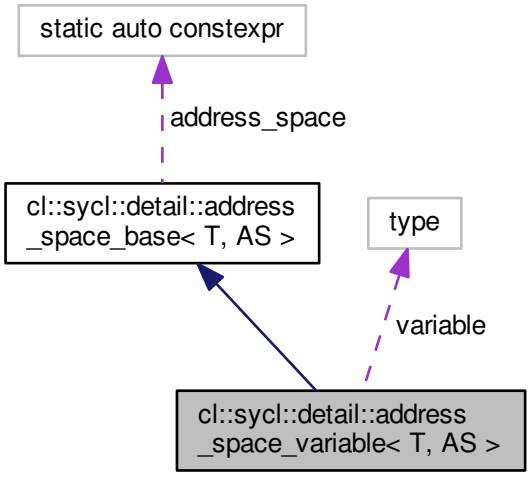
T	is the type of the basic object to be created
AS	is the address space to place the object into

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 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 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 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 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 template<typename T , address_space AS> opencl_type* cl::sycl::detail::address_space_variable< T, AS >::get_address ( ) [inline]

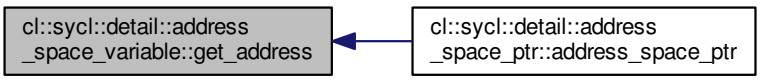
Return the address of the value to implement pointers.

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 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 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 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 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 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 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 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 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 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 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 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 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 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 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 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

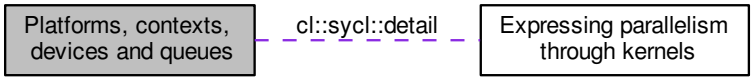
Todo Implement the case with a plain pointer

Definition at line 142 of file address_space.hpp.

```
00142                                                   {
00143   return pointer;
00144 }
```

8.3 Platforms, contexts, devices and queues

Collaboration diagram for Platforms, contexts, devices and queues:



Namespaces

- cl::sycl::info
- cl::sycl::detail

Classes

- 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::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 }
- 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::vendor > () 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.

Variables

- TRISYCL_WEAK_ATTRIB_PREFIX detail::cache< cl_device_id, detail::opencl_device > opencl_device::cache cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX

8.3.1 Detailed Description

8.3.2 Class Documentation

8.3.2.1 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 67 of file context.hpp.

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)
- context (const device_selector &deviceSelector, info::gl_context_interop interopFlag, async_handler asyncHandler=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

  Default constructor that chooses the context according the heuristics of the default selector.
- cl_context get () const
- 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.

8.3.2.1.1 Constructor & Destructor Documentation

8.3.2.1.1.1 cl::sycl::context::context (async_handler *asyncHandler*) [inline],[explicit]

Constructs a context object for SYCL host using an async_handler for handling asynchronous errors.

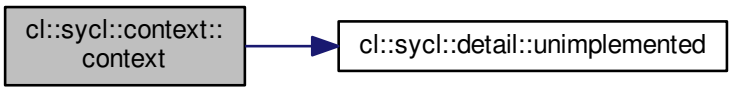
Note that the default case asyncHandler = nullptr is handled by the default constructor.

Definition at line 77 of file context.hpp.

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

```
00077                                                {
00078     detail::unimplemented();
00079   }
```

Here is the call graph for this function:



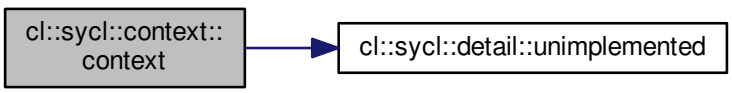
8.3.2.1.1.2 cl::sycl::context::context (cl_context *clContext,* async_handler *asyncHandler* = nullptr) [inline]

Definition at line 91 of file context.hpp.

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

```
00091                                                                {
00092     detail::unimplemented();
00093   }
```

Here is the call graph for this function:



8.3.2.1.1.3 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.

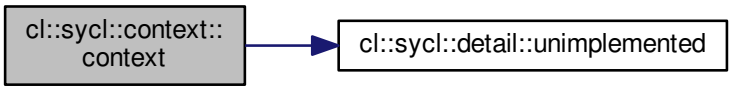
Return synchronous errors via the SYCL exception class and asynchronous errors are handled via the async_↩ handler, if provided.

Definition at line 104 of file context.hpp.

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

```
00106                                                {
00107     detail::unimplemented();
00108   }
```

Here is the call graph for this function:



8.3.2.1.1.4 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.

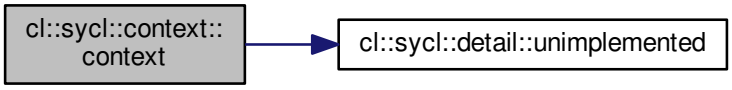
Return synchronous errors via the SYCL exception class and asynchronous errors are handled via the async_↩ handler, if provided.

Definition at line 116 of file context.hpp.

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

```
00118                                                {
00119     detail::unimplemented();
00120   }
```

Here is the call graph for this function:



8.3.2.1.1.5 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.

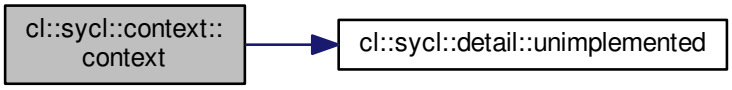
Return synchronous errors via the SYCL exception class and asynchronous errors are handled via the async_↩ handler, if provided.

Definition at line 128 of file context.hpp.

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

```
00130                                                {
00131     detail::unimplemented();
00132   }
```

Here is the call graph for this function:



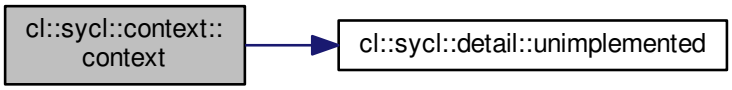
8.3.2.1.1.6 cl::sycl::context::context (const vector_class< device > & *deviceList*, info::gl_context_interop *interopFlag*, async_handler *asyncHandler* = nullptr) [inline]

Definition at line 143 of file context.hpp.

References cl::sycl::info::context, and cl::sycl::detail::unimplemented().

```
00145                                                {
00146     detail::unimplemented();
00147   }
```

Here is the call graph for this function:



8.3.2.1.1.7 cl::sycl::context::context ( ) [default]

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.

8.3.2.1.2 Member Function Documentation

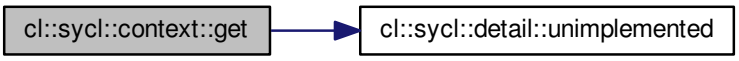
8.3.2.1.2.1 cl_context cl::sycl::context::get ( ) const [inline]

Definition at line 166 of file context.hpp.

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

```
00166                           {
00167     detail::unimplemented();
00168     return {};
00169   }
```

Here is the call graph for this function:



8.3.2.1.2.2 vector_class<device> cl::sycl::context::get_devices ( ) const [inline]

Returns the set of devices that are part of this context.

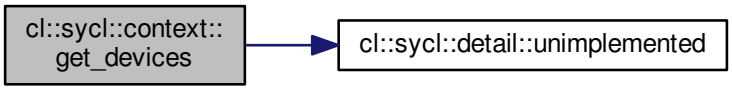
Todo To be implemented

Definition at line 190 of file context.hpp.

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

```
00190                                           {
00191     detail::unimplemented();
00192     return {};
00193   }
```

Here is the call graph for this function:



8.3.2.1.2.3 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.

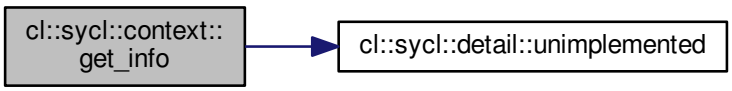
Todo To be implemented

Definition at line 201 of file context.hpp.

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

```
00201                                                                    {
00202     detail::unimplemented();
00203     return {};
00204   }
```

Here is the call graph for this function:



8.3.2.1.2.4 platform cl::sycl::context::get_platform ( )

Returns the SYCL platform that the context is initialized for.

Todo To be implemented

8.3.2.1.2.5 bool cl::sycl::context::is_host ( ) const [inline]

Specifies whether the context is in SYCL Host Execution Mode.

Definition at line 174 of file context.hpp.

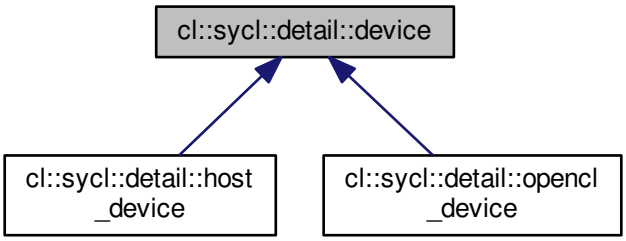
```
00174                       {
00175     return true;
00176   }
```

8.3.2.2 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 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 ()

8.3.2.2.1 Constructor & Destructor Documentation

8.3.2.2.1.1 virtual cl::sycl::detail::device::~device ( ) [inline], [virtual]

Definition at line 67 of file device.hpp.

```
00067 {}
```

8.3.2.2.2 Member Function Documentation

8.3.2.2.2.1 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.

8.3.2.2.2.2 virtual cl::sycl::platform cl::sycl::detail::device::get_platform ( ) const [pure virtual]

Return the platform of device.

Implemented in cl::sycl::detail::opencl_device, and cl::sycl::detail::host_device.

8.3.2.2.2.3 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::opencl_device, and cl::sycl::detail::host_device.

8.3.2.2.2.4 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::opencl_device, and cl::sycl::detail::host_device.

8.3.2.2.2.5 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::opencl_device, and cl::sycl::detail::host_device.

8.3.2.2.2.6 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::opencl_device, and cl::sycl::detail::host_device.

8.3.2.2.2.7 virtual bool cl::sycl::detail::device::is_host ( ) const [pure virtual]

Return true if the device is a SYCL host device.

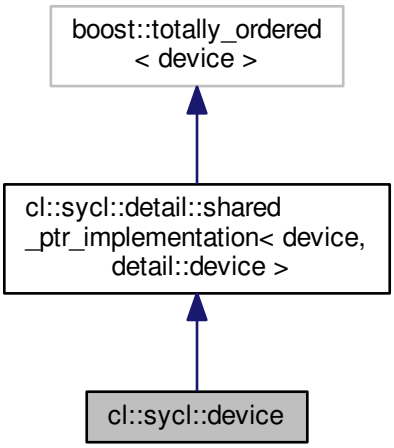
Implemented in cl::sycl::detail::opencl_device, and cl::sycl::detail::host_device.

8.3.2.3 class cl::sycl::device

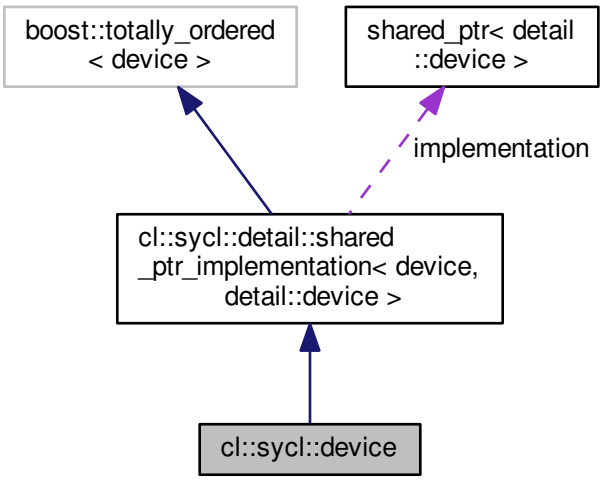
SYCL device.

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.
- 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

8.3.2.3.1 Member Typedef Documentation

8.3.2.3.1.1 using cl::sycl::device::implementation_t = detail::shared_ptr_implementation<device, detail::device> [private]

Definition at line 48 of file device.hpp.

8.3.2.3.2 Constructor & Destructor Documentation

8.3.2.3.2.1 cl::sycl::device::device ( ) [inline]

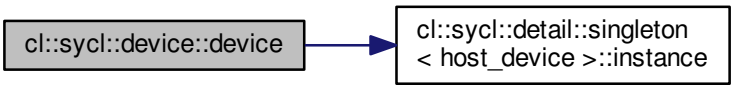
The default constructor uses the SYCL host device.

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:



8.3.2.3.2.2 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 } } {}
```

8.3.2.3.2.3 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:

8.3.2.3.2.4 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.

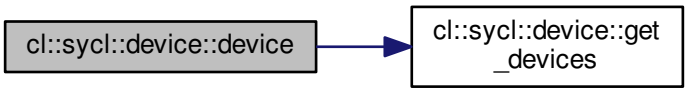
Todo Make it non-explicit in the specification?

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:



8.3.2.3.3 Member Function Documentation

8.3.2.3.3.1 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   }
```

8.3.2.3.3.2 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 201 of file device.hpp.

References get_info().

```
00201                                     {
00202     //return implementation->get_info<Param>(param);
00203   }
```

Here is the call graph for this function:

8.3.2.3.3.3 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:

8.3.2.3.3.4 platform cl::sycl::device::get_platform ( ) const [inline]

Return the platform of device.

Return synchronous errors via the SYCL exception class.

Definition at line 178 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.

```
00178                                {
00179     return implementation->get_platform();
00180   }
```

Here is the call graph for this function:

8.3.2.3.3.5 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 223 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

```
00223                                                        {
00224     return implementation->has_extension(extension);
00225   }
```

8.3.2.3.3.6 bool cl::sycl::device::is_accelerator ( ) const [inline]

Return true if the device is an OpenCL accelerator device.

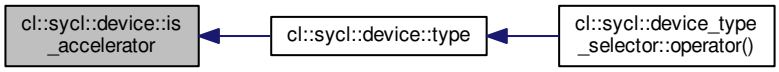
Definition at line 149 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

Referenced by type().

```
00149                                {
00150     return implementation->is_accelerator();
00151   }
```

Here is the caller graph for this function:



8.3.2.3.3.7 bool cl::sycl::device::is_cpu ( ) const [inline]

Return true if the device is an OpenCL CPU device.

Definition at line 137 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

Referenced by type().

```
00137                       {
00138     return implementation->is_cpu();
00139   }
```

Here is the caller graph for this function:

8.3.2.3.3.8 bool cl::sycl::device::is_gpu ( ) const [inline]

Return true if the device is an OpenCL GPU device.

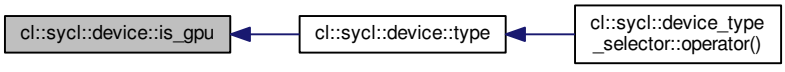
Definition at line 143 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

Referenced by type().

```
00143                       {
00144     return implementation->is_gpu();
00145   }
```

Here is the caller graph for this function:



8.3.2.3.3.9 bool cl::sycl::device::is_host ( ) const [inline]

Return true if the device is the SYCL host device.

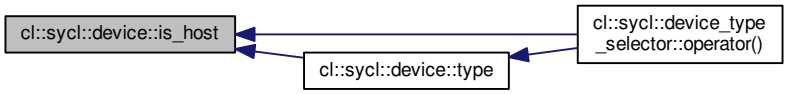
Definition at line 131 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< device, detail::device >::implementation.

Referenced by cl::sycl::device_type_selector::operator()(), and type().

```
00131                         {
00132     return implementation->is_host();
00133   }
```

Here is the caller graph for this function:



8.3.2.3.3.10 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

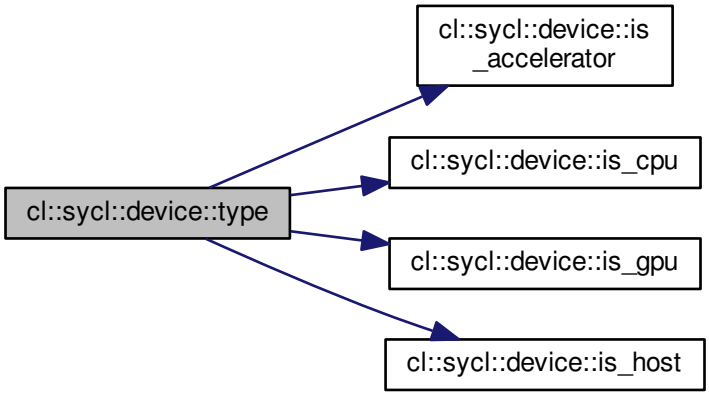
Definition at line 159 of file device.hpp.

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()().

```
00159                               {
00160     if (is_host())
00161       return info::device_type::host;
00162     else if (is_cpu())
00163       return info::device_type::cpu;
00164     else if (is_gpu())
00165       return info::device_type::gpu;
00166     else if (is_accelerator())
00167       return info::device_type::accelerator;
00168     else
00169       // \todo Put a SYCL exception
00170       throw std::domain_error("Unknown cl::sycl::info::device_type");
00171   }
```

Here is the call graph for this function:



Here is the caller graph for this function:

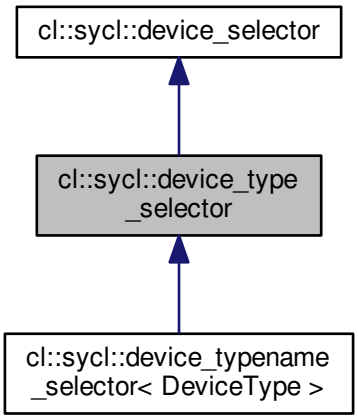
8.3.2.4 class cl::sycl::device_type_selector

A device selector by device_type.

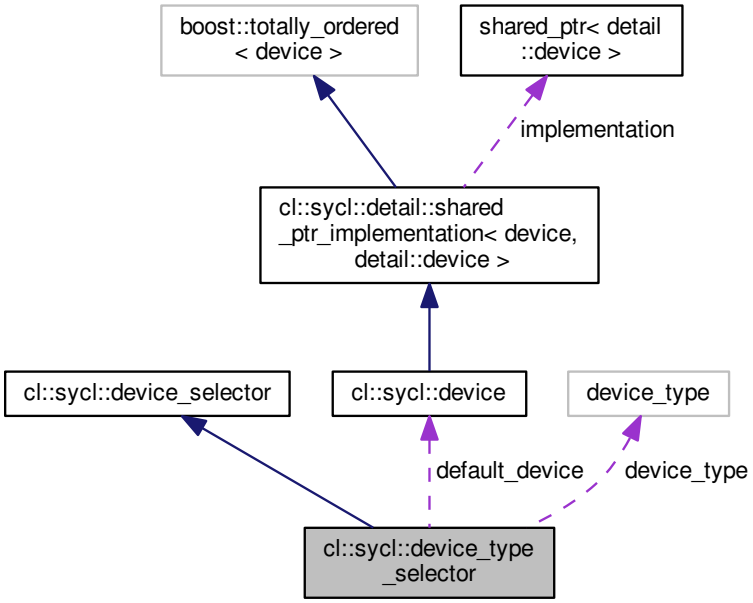
Todo To be added to the specification

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.

8.3.2.4.1 Constructor & Destructor Documentation

8.3.2.4.1.1 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   }
```

8.3.2.4.2 Member Function Documentation

8.3.2.4.2.1 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.

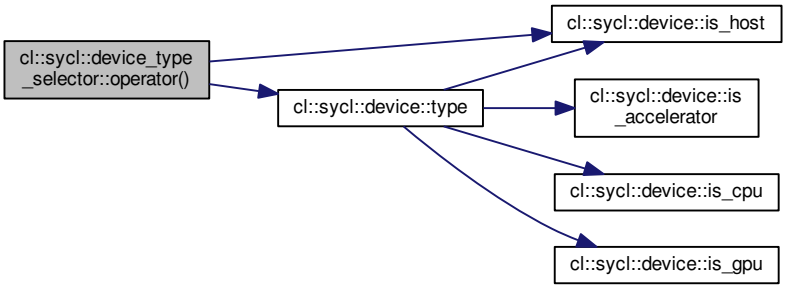
Implements cl::sycl::device_selector.

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:



8.3.2.4.3 Member Data Documentation

8.3.2.4.3.1 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.

8.3.2.4.3.2 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.

8.3.2.5 class cl::sycl::device_typename_selector

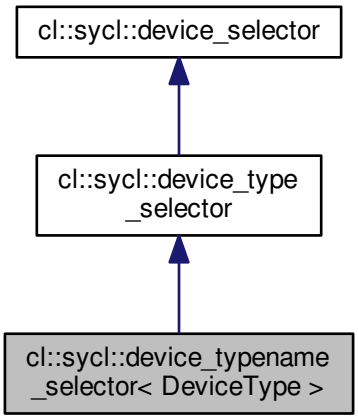
template<info::device_type DeviceType>
class cl::sycl::device_typename_selector< DeviceType >

Select a device by template device_type parameter.

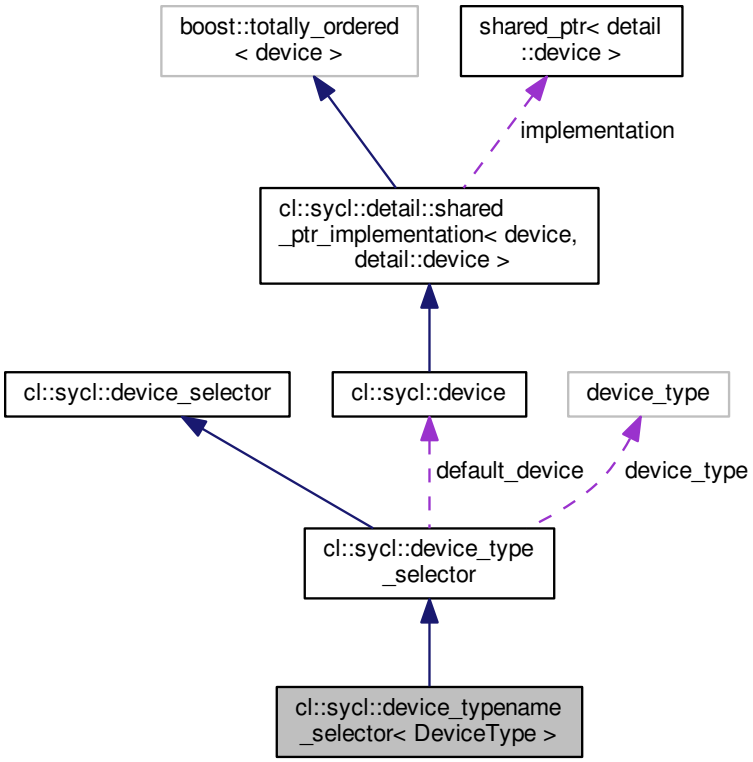
Todo To be added to the specification

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 ()

8.3.2.5.1 Constructor & Destructor Documentation

8.3.2.5.1.1 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 } {}
```

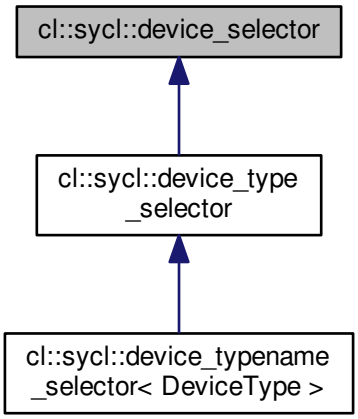
8.3.2.6 class cl::sycl::device_selector

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.

8.3.2.6.1 Constructor & Destructor Documentation

8.3.2.6.1.1 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 {}
```

8.3.2.6.2 Member Function Documentation

8.3.2.6.2.1 virtual int cl::sycl::device_selector::operator() (const device & *dev*) const [pure virtual]

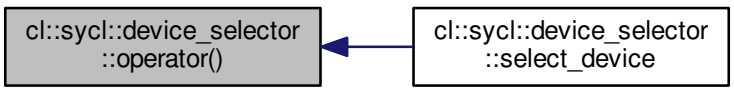
This pure virtual operator allows the customization of device selection.

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:



8.3.2.6.2.2 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)

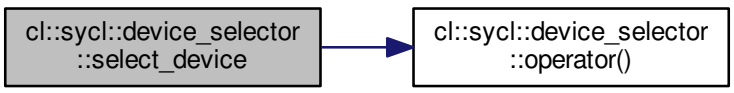
Todo Remove this from specification

Definition at line 35 of file device_selector.hpp.

References operator()().

```
00035                                {
00036     //    return {};
00037   }
```

Here is the call graph for this function:



8.3.2.7 class cl::sycl::handler

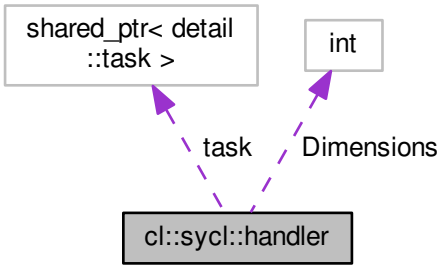
Command group handler class.

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 43 of file handler.hpp.

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 >
  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.
- 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 syclKernel)

  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.

8.3.2.7.1 Constructor & Destructor Documentation

8.3.2.7.1.1 cl::sycl::handler::handler (const std::shared_ptr< detail::queue > & *q*) [inline]

Definition at line 61 of file handler.hpp.

References Dimensions, and cl::sycl::access::global_buffer.

```
00061                                                {
00062     // Create a new task for this command_group
00063     task = std::make_shared<detail::task>(q);
00064   }
```

8.3.2.7.2 Member Function Documentation

8.3.2.7.2.1 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 125 of file handler.hpp.

References set_arg().

Referenced by set_args().

```
00125                                                                {
00126     // Use an intermediate tuple to ease individual argument access
00127     auto &&t = std::make_tuple(std::forward<Ts>(args)...);
00128     // Dispatch individual set_arg() for each argument
00129     auto just_to_evaluate = {
00130       0 /*< At least 1 element to deal with empty set_args() */,
00131       ( set_arg(Is, std::forward<Ts>(std::get<Is>(t))), 0)...
00132     };
00133     // Remove the warning about unused variable
00134     static_cast<void>(just_to_evaluate);
00135   }
```

Here is the call graph for this function:

Here is the caller graph for this function:

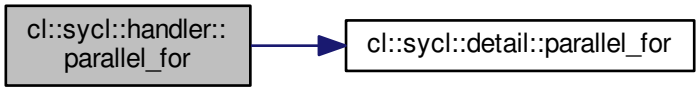
8.3.2.7.2.2 int ParallelForFunctor void cl::sycl::handler::parallel_for (nd_range< Dimensions > *r*, ParallelForFunctor *f*) [inline]

Definition at line 277 of file handler.hpp.

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

```
00277                                                                    {
00278     task->schedule(detail::trace_kernel<KernelName>([=] {
00279           detail::parallel_for(r, f);
00280         }));
00281   }
```

Here is the call graph for this function:



8.3.2.7.2.3 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

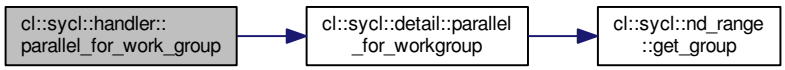
Definition at line 308 of file handler.hpp.

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

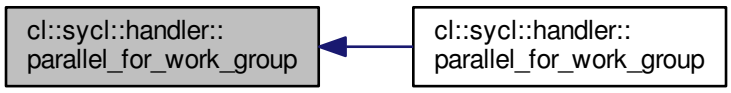
Referenced by parallel_for_work_group().

```
00309                                                    {
00310     task->schedule(detail::trace_kernel<KernelName>([=] {
00311           detail::parallel_for_workgroup(r, f); }));
00312   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.3.2.7.2.4 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

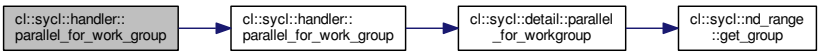
r	defines the iteration space with the work-group layout and offset
Dimensions	dimensionality of the iteration space
f	is the kernel functor to execute
ParallelForFunctor	is the kernel functor type
KernelName	is a class type that defines the name to be used for the underlying kernel

Definition at line 339 of file handler.hpp.

References parallel_for_work_group().

```
00340                                                    {
00341     parallel_for_work_group(nd_range<Dimensions> { r1, r2 }, f);
00342   }
```

Here is the call graph for this function:



8.3.2.7.2.5 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?

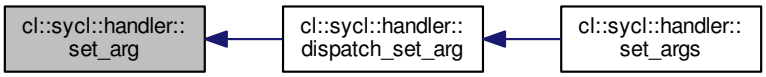
Todo It seems more logical to have these methods on kernel instead

Definition at line 86 of file handler.hpp.

Referenced by dispatch_set_arg().

```
00087                                                                    {
00088     /* Before running the kernel, make sure the cl_mem behind this
00089        accessor is up-to-date on the device if needed and pass it to
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         acc_obj.implementation->copy_in_cl_buffer();
00096         task->get_kernel().get_boost_compute()
00097           .set_arg(arg_index, acc_obj.implementation->get_cl_buffer());
00098       });
00099     /* After running the kernel, make sure the cl_mem behind this
00100        accessor is up-to-date on the host if needed */
00101     task->add_postlude([=] {
00102         acc_obj.implementation->copy_back_cl_buffer();
00103       });
00104   }
```

Here is the caller graph for this function:



8.3.2.7.2.6 template<typename T > 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.

Definition at line 111 of file handler.hpp.

```
00111                                                {
00112     /* Explicitly capture task by copy instead of having this captured
00113        by reference and task by reference by side effect */
00114     task->add_prelude([=, task = task] {
00115         task->get_kernel().get_boost_compute()
00116           .set_arg(arg_index, scalar_value);
00117       });
00118   }
```

8.3.2.7.2.7 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.

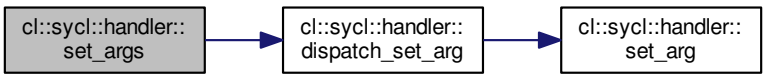
Todo Update the specification to add this function according to https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15978 proposal

Definition at line 146 of file handler.hpp.

References dispatch_set_arg().

```
00146                                {
00147     /* Construct a set of increasing argument index to be able to call
00148        the real set_arg */
00149     dispatch_set_arg(std::index_sequence_for<Ts...>{},
00150                      std::forward<Ts>(args)...);
00151   }
```

Here is the call graph for this function:



8.3.2.7.2.8 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 169 of file handler.hpp.

```
00169                                                {
00170     task->schedule(detail::trace_kernel<KernelName>(F));
00171   }
```

8.3.2.7.2.9 void cl::sycl::handler::single_task (kernel *syclKernel*) [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

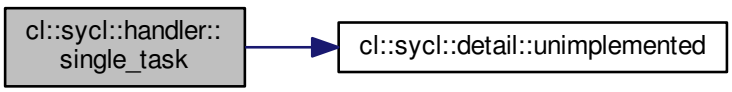
Todo To be implemented

Definition at line 353 of file handler.hpp.

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

```
00353                                       {
00354     detail::unimplemented();
00355   }
```

Here is the call graph for this function:



8.3.2.7.2.10 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

8.3.2.7.3 Member Data Documentation

8.3.2.7.3.1 int cl::sycl::handler::Dimensions

Definition at line 275 of file handler.hpp.

Referenced by handler().

8.3.2.7.3.2 std::shared_ptr<detail::task> cl::sycl::handler::task

Attach the task and accessors to it.

Definition at line 49 of file handler.hpp.

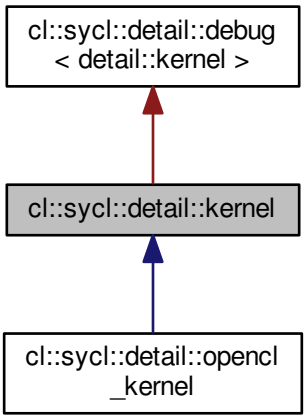
Referenced by cl::sycl::detail::add_buffer_to_task().

8.3.2.8 class cl::sycl::detail::kernel

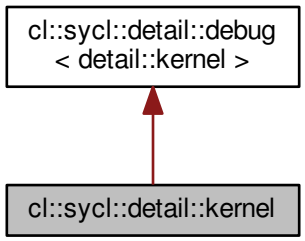
Abstract SYCL kernel.

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.

- TRISYCL_ParallelForKernel_RANGE (1) TRISYCL_ParallelForKernel_RANGE(2) TRISYCL_ParallelFor↩ Kernel_RANGE(3) virtual ∼kernel()

  Return the context that this kernel is defined for.

8.3.2.8.1 Member Function Documentation

8.3.2.8.1.1 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.

8.3.2.8.1.2 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.

8.3.2.8.1.3 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 62 of file kernel.hpp.

```
00075                     {}
```

8.3.2.9 class cl::sycl::kernel

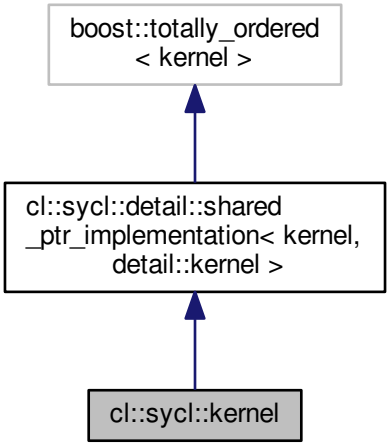
SYCL kernel.

Todo To be implemented

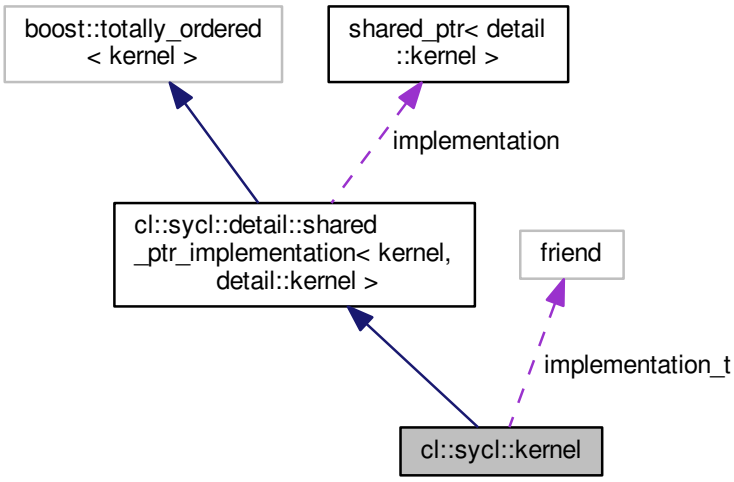
Todo Check specification

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

8.3.2.9.1 Member Typedef Documentation

8.3.2.9.1.1 using cl::sycl::kernel::implementation_t = typename kernel::shared_ptr_implementation [private]

Definition at line 44 of file kernel.hpp.

8.3.2.9.2 Constructor & Destructor Documentation

8.3.2.9.2.1 cl::sycl::kernel::kernel ( ) [delete]

The default object is not valid because there is no program or.

```
cl_kernel
```

associated with it

8.3.2.9.2.2 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 } } {}
```

8.3.2.9.2.3 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:

8.3.2.9.3 Member Function Documentation

8.3.2.9.3.1 cl_kernel cl::sycl::kernel::get ( ) const [inline]

Return the OpenCL kernel object for this kernel.

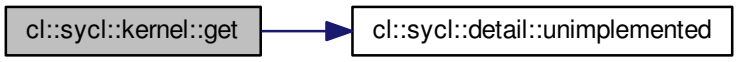
Retains a reference to the returned cl_kernel object. Caller should release it when finished.

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:



8.3.2.9.4 Friends And Related Function Documentation

8.3.2.9.4.1 friend class handler [friend]

Definition at line 47 of file kernel.hpp.

8.3.2.9.5 Member Data Documentation

8.3.2.9.5.1 friend cl::sycl::kernel::implementation_t [private]

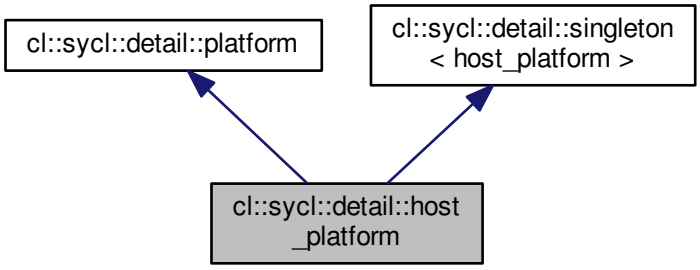
Definition at line 50 of file kernel.hpp.

8.3.2.10 class cl::sycl::detail::host_platform

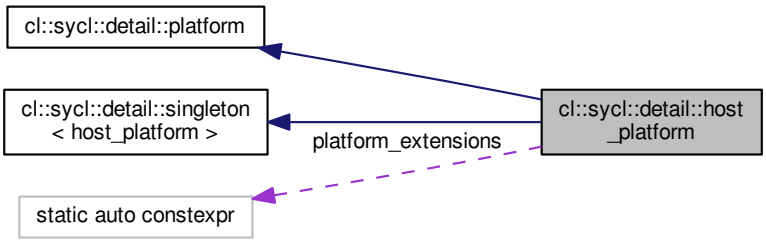
SYCL host platform.

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.
- 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.

Static Private Attributes

- static auto constexpr platform_extensions = "Xilinx_blocking_pipes"

Additional Inherited Members

8.3.2.10.1 Member Function Documentation

8.3.2.10.1.1 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   }
```

8.3.2.10.1.2 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 79 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.

```
00079                                                                     {
00080     switch (param) {
00081     case info::platform::profile:
00082       /* Well... Is the host platform really a full profile whereas it
00083          is not really OpenCL? */
00084       return "FULL_PROFILE";
00085
00086     case info::platform::version:
00087       // \todo I guess it should include the software version too...
00088       return "2.2";
00089
00090     case info::platform::name:
00091       return "triSYCL host platform";
00092
00093     case info::platform::vendor:
00094       return "triSYCL Open Source project";
00095
00096     case info::platform::extensions:
00097       return platform_extensions;
00098
00099     default:
00100       // \todo Define some SYCL exception type for this type of errors
00101       throw std::invalid_argument {
00102         "Unknown parameter value for SYCL platform information" };
00103     }
00104   }
```

8.3.2.10.1.3 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

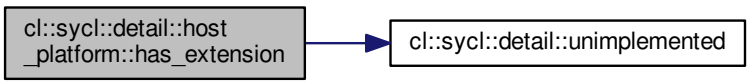
Implements cl::sycl::detail::platform.

Definition at line 111 of file host_platform.hpp.

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

```
00111                                                                    {
00112     detail::unimplemented();
00113     return {};
00114   }
```

Here is the call graph for this function:



8.3.2.10.1.4 bool cl::sycl::detail::host_platform::is_host ( ) const [inline], [override], [virtual]

Return true since this platform is the SYCL host platform.

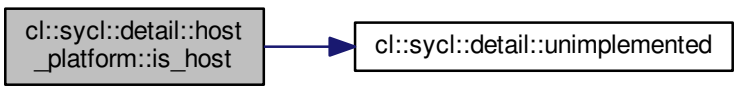
Implements cl::sycl::detail::platform.

Definition at line 52 of file host_platform.hpp.

References cl::sycl::info::all, and cl::sycl::detail::unimplemented().

```
00052                                {
00053     return true;
00054   }
```

Here is the call graph for this function:



8.3.2.10.2 Member Data Documentation

8.3.2.10.2.1 auto constexpr cl::sycl::detail::host_platform::platform_extensions = "Xilinx_blocking_pipes" [static], [private]

Definition at line 35 of file host_platform.hpp.

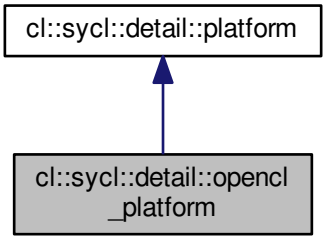
Referenced by get_info_string().

8.3.2.11 class cl::sycl::detail::opencl_platform

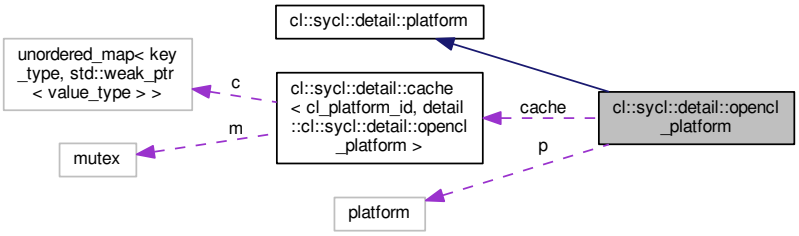
SYCL OpenCL platform.

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.
- 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.
- ~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.

8.3.2.11.1 Constructor & Destructor Documentation

8.3.2.11.1.1 cl::sycl::detail::opencl_platform::opencl_platform (const boost::compute::platform & *p*) [inline], [private]

Only the instance factory can built it.

Definition at line 106 of file opencl_platform.hpp.

```
00106 : p { p } {}
```

8.3.2.11.1.2 cl::sycl::detail::opencl_platform::~opencl_platform ( ) [inline], [override]

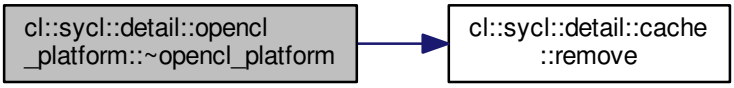
Unregister from the cache on destruction.

Definition at line 111 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.

```
00111                                {
00112     cache.remove(p.id());
00113   }
```

Here is the call graph for this function:



8.3.2.11.2 Member Function Documentation

8.3.2.11.2.1 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   }
```

8.3.2.11.2.2 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 82 of file opencl_platform.hpp.

```
00082                                                              {
00083     /* Use the fact that the triSYCL info values are the same as the
00084        OpenCL ones used in Boost.Compute to just cast the enum class
00085        to the int value */
00086     return p.get_info<std::string>(static_cast<cl_platform_info>(param));
00087   }
```

8.3.2.11.2.3 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 91 of file opencl_platform.hpp.

```
00091                                                                    {
00092     return p.supports_extension(extension);
00093   }
```

8.3.2.11.2.4 static std::shared_ptr<opencl_platform> cl::sycl::detail::opencl_platform::instance (const boost::compute::platform & *p*) [inline], [static]

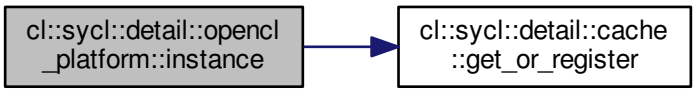
Definition at line 98 of file opencl_platform.hpp.

References cl::sycl::detail::cache< Key, Value >::get_or_register().

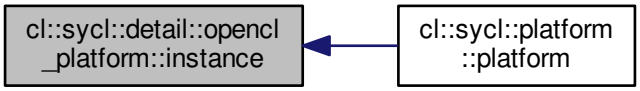
Referenced by cl::sycl::platform::platform().

```
00098                                          {
00099     return cache.get_or_register(p.id(),
00100                                  [&] { return new opencl_platform {
      p }; });
00101   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.3.2.11.2.5 bool cl::sycl::detail::opencl_platform::is_host ( ) const [inline],[override],[virtual]

Return false since an OpenCL platform is not the SYCL host platform.

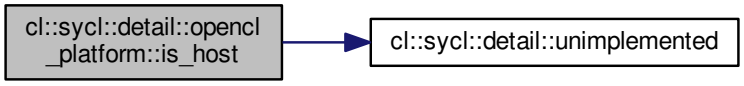
Implements cl::sycl::detail::platform.

Definition at line 57 of file opencl_platform.hpp.

References cl::sycl::info::all, and cl::sycl::detail::unimplemented().

```
00057                                {
00058     return false;
00059   }
```

Here is the call graph for this function:



8.3.2.11.3 Member Data Documentation

8.3.2.11.3.1 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().

8.3.2.11.3.2 boost::compute::platform cl::sycl::detail::opencl_platform::p [private]

Use the Boost Compute abstraction of the OpenCL platform.

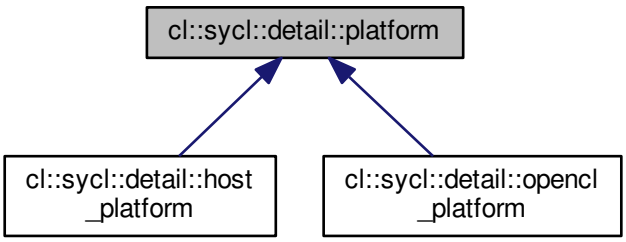
Definition at line 39 of file opencl_platform.hpp.

8.3.2.12 class cl::sycl::detail::platform

An abstract class representing various models of SYCL platforms.

Definition at line 25 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 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 ~platform ()

8.3.2.12.1 Constructor & Destructor Documentation

8.3.2.12.1.1 virtual cl::sycl::detail::platform::~platform ( ) [inline], [virtual]

Definition at line 48 of file platform.hpp.

```
00048 {}
```

8.3.2.12.2 Member Function Documentation

8.3.2.12.2.1 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.

8.3.2.12.2.2 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::opencl_platform, and cl::sycl::detail::host_platform.

8.3.2.12.2.3 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.

8.3.2.12.2.4 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::opencl_platform, and cl::sycl::detail::host_platform.

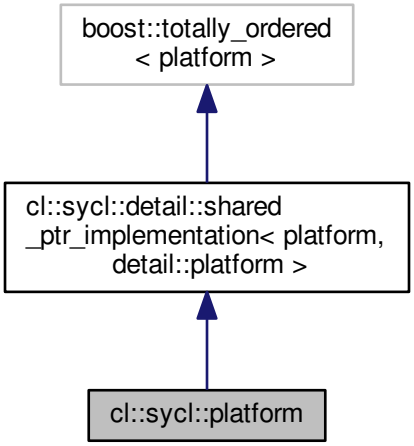
8.3.2.13 class cl::sycl::platform

Abstract the OpenCL platform.

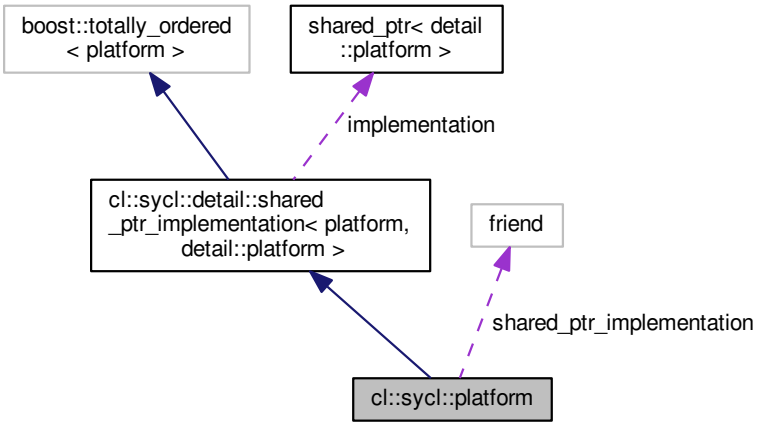
Todo triSYCL Implementation

Definition at line 43 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.
- 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.

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

8.3.2.13.1 Constructor & Destructor Documentation

8.3.2.13.1.1 cl::sycl::platform::platform ( ) [inline]

Default constructor for platform which is the host platform.

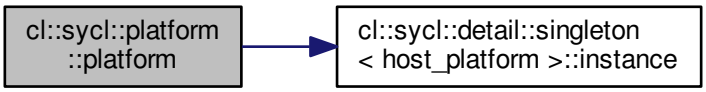
Returns errors via the SYCL exception class.

Definition at line 60 of file platform.hpp.

References cl::sycl::detail::singleton< host_platform >::instance().

```
00060             :
00061     shared_ptr_implementation {
      detail::host_platform::instance() } {}
```

Here is the call graph for this function:



8.3.2.13.1.2 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 72 of file platform.hpp.

```
00073     : platform { boost::compute::platform { platform_id } } {}
```

8.3.2.13.1.3 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.

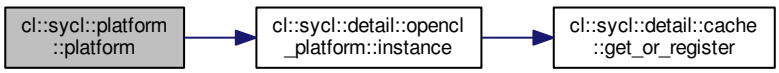
Return synchronous errors via the SYCL exception class.

Definition at line 82 of file platform.hpp.

References cl::sycl::detail::opencl_platform::instance().

```
00083     : shared_ptr_implementation {
      detail::opencl_platform::instance(p) } {}
```

Here is the call graph for this function:



8.3.2.13.1.4 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.

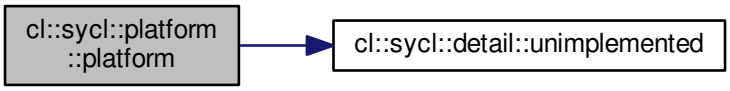
Returns errors via the SYCL exception class.

Definition at line 92 of file platform.hpp.

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

```
00092                                                 {
00093     detail::unimplemented();
00094   }
```

Here is the call graph for this function:



8.3.2.13.2 Member Function Documentation

8.3.2.13.2.1 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 105 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00105                              {
00106     return implementation->get();
00107   }
```

8.3.2.13.2.2 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 146 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00146                                           {
00147     // Only strings are needed here
00148     return implementation->get_info_string(param);
00149   }
```

8.3.2.13.2.3 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 155 of file platform.hpp.

```
00155                     {
00156     /* Forward to the implementation without using template parameter
00157        but with a parameter instead, since it is incompatible with
00158        virtual function and because fortunately only strings are
00159        needed here */
00160     return get_info<typename info::param_traits<info::platform,
00161                                                 Param>::type>(Param);
00162   }
```

8.3.2.13.2.4 static vector_class<platform> cl::sycl::platform::get_platforms ( ) [inline], [static]

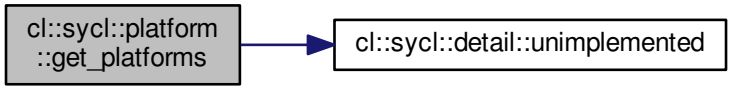
Get the list of all the platforms available to the application.

Definition at line 112 of file platform.hpp.

References cl::sycl::info::all, and cl::sycl::detail::unimplemented().

```
00112                                                {
00113     // Start with the default platform
00114     vector_class<platform> platforms { {} };
00115
00116 #ifdef TRISYCL_OPENCL
00117     // Then add all the OpenCL platforms
00118     for (const auto &d : boost::compute::system::platforms())
00119       platforms.emplace_back(d);
00120 #endif
00121
00122     return platforms;
00123   }
```

Here is the call graph for this function:



8.3.2.13.2.5 bool cl::sycl::platform::has_extension (const string_class & *extension*) const [inline]

Test if an extension is available on the platform.

Definition at line 166 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00166                                                          {
00167     return implementation->has_extension(extension);
00168   }
```

8.3.2.13.2.6 bool cl::sycl::platform::is_host ( ) const [inline]

Test if this platform is a host platform.

Definition at line 172 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< platform, detail::platform >::implementation.

```
00172                         {
00173     return implementation->is_host();
00174   }
```

8.3.2.13.3 Member Data Documentation

8.3.2.13.3.1 friend cl::sycl::platform::shared_ptr_implementation [private]

Definition at line 49 of file platform.hpp.

8.3.2.14 class cl::sycl::queue

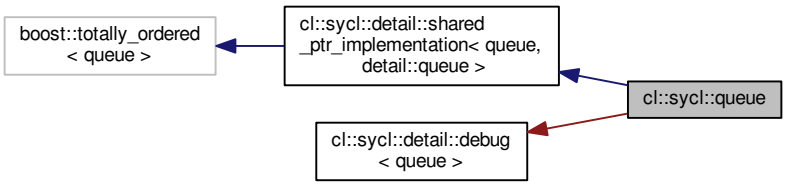
SYCL queue, similar to the OpenCL queue concept.

Todo The implementation is quite minimal for now. :-)

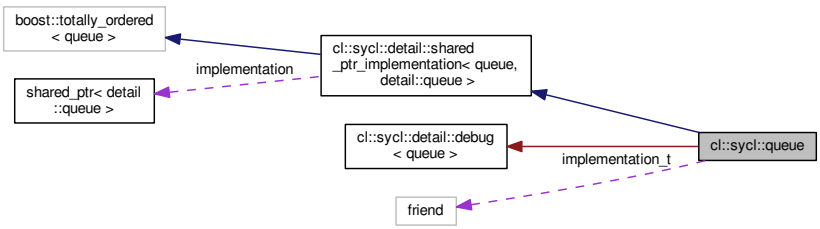
Todo All the queue methods should return a queue& instead of void to it is possible to chain opoerations

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 &syclDevice, async_handler asyncHandler=nullptr)

  A queue is created for syclDevice.
- queue (const context &syclContext, const device_selector &deviceSelector, async_handler asyncHandler=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.
- 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

8.3.2.14.1 Member Typedef Documentation

8.3.2.14.1.1 using cl::sycl::queue::implementation_t = typename queue::shared_ptr_implementation [private]

Definition at line 87 of file queue.hpp.

8.3.2.14.2 Constructor & Destructor Documentation

8.3.2.14.2.1 cl::sycl::queue::queue ( ) [inline]

Default constructor for platform which is the host platform.

Returns errors via the SYCL exception class.

Definition at line 104 of file queue.hpp.

```
00104 : implementation_t { new detail::host_queue } {}
```

8.3.2.14.2.2 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.

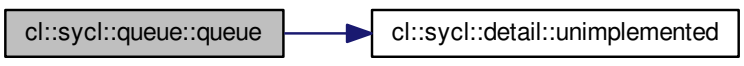
Note that the default case asyncHandler = nullptr is handled by the default constructor.

Definition at line 123 of file queue.hpp.

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

```
00123                                                : queue { } {
00124     detail::unimplemented();
00125   }
```

Here is the call graph for this function:



8.3.2.14.2.3 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.

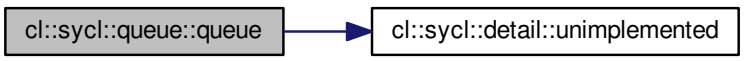
Return synchronous errors regarding the creation of the queue and report asynchronous errors via the async_↩ handler callback function if and only if there is an async_handler provided.

Definition at line 136 of file queue.hpp.

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

```
00137                                                : queue { } {
00138     detail::unimplemented();
00139   }
```

Here is the call graph for this function:



8.3.2.14.2.4 cl::sycl::queue::queue (const device & *syclDevice,* async_handler *asyncHandler* = nullptr) [inline]

A queue is created for syclDevice.

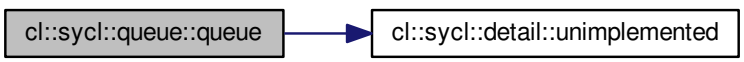
Return asynchronous errors via the async_handler callback function.

Definition at line 146 of file queue.hpp.

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

```
00147                                                : queue { } {
00148     detail::unimplemented();
00149   };
```

Here is the call graph for this function:



8.3.2.14.2.5 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.

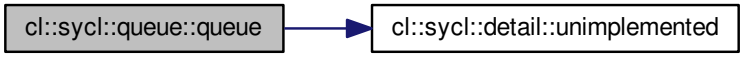
If and only if there is an asyncHandler provided, it reports asynchronous errors via the async_handler callback function in conjunction with the synchronization and throw methods.

Definition at line 163 of file queue.hpp.

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

```
00165                                                : queue { } {
00166     detail::unimplemented();
00167   }
```

Here is the call graph for this function:



8.3.2.14.2.6 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.

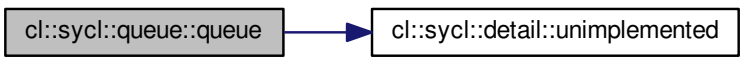
If and only if there is an asyncHandler provided, it reports asynchronous errors via the async_handler callback function in conjunction with the synchronization and throw methods.

Definition at line 179 of file queue.hpp.

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

```
00181                                                : queue { } {
00182     detail::unimplemented();
00183   }
```

Here is the call graph for this function:



8.3.2.14.2.7 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.

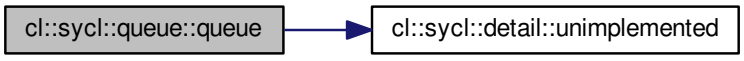
Return synchronous errors regarding the creation of the queue. If and only if there is an asyncHandler provided, it reports asynchronous errors via the async_handler callback function in conjunction with the synchronization and throw methods.

Definition at line 197 of file queue.hpp.

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

```
00200                                                : queue { } {
00201     detail::unimplemented();
00202   }
```

Here is the call graph for this function:



8.3.2.14.2.8 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 215 of file queue.hpp.

```
00216     : queue { boost::compute::command_queue { q }, ah } {}
```

8.3.2.14.2.9 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.

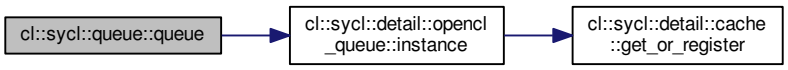
Todo Deal with handler

Definition at line 227 of file queue.hpp.

References cl::sycl::detail::opencl_queue::instance().

```
00228     : implementation_t { detail::opencl_queue::instance(q) }
      {}
```

Here is the call graph for this function:



8.3.2.14.3 Member Function Documentation

8.3.2.14.3.1 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 243 of file queue.hpp.

```
00243                                {
00244     return implementation->get();
00245   }
```

8.3.2.14.3.2 context cl::sycl::queue::get_context ( ) const [inline]

Return the SYCL queue's context.

Report errors using SYCL exception classes.

Definition at line 253 of file queue.hpp.

```
00253                                {
00254     return implementation->get_context();
00255   }
```

8.3.2.14.3.3 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 262 of file queue.hpp.

```
00262                               {
00263     return implementation->get_device();
00264   }
```

8.3.2.14.3.4 template<info::queue param> info::param_traits<info::queue, param>::type cl::sycl::queue::get_info ( ) const [inline]

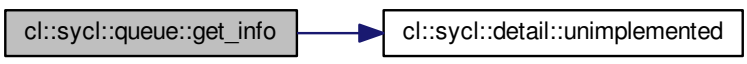
Queries the platform for cl_command_queue info.

Definition at line 312 of file queue.hpp.

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

```
00312                                                                    {
00313     detail::unimplemented();
00314     return {};
00315   }
```

Here is the call graph for this function:



8.3.2.14.3.5 bool cl::sycl::queue::is_host ( ) const [inline]

Return whether the queue is executing on a SYCL host device.

Definition at line 268 of file queue.hpp.

```
00268                         {
00269     return implementation->is_host();
00270   }
```

8.3.2.14.3.6 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 330 of file queue.hpp.

```
00330                                                       {
00331     handler command_group_handler { implementation };
00332     cgf(command_group_handler);
00333     return {};
00334   }
```

8.3.2.14.3.7 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.

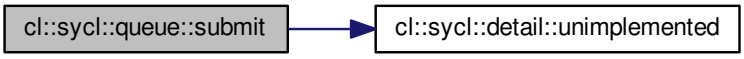
Return a command group functor event, which is corresponds to the queue the command group functor is being enqueued on.

Definition at line 346 of file queue.hpp.

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

```
00346                                                                                 {
00347     detail::unimplemented();
00348     // Since it is not implemented, always submit on the main queue
00349     return submit(cgf);
00350   }
```

Here is the call graph for this function:



8.3.2.14.3.8 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.

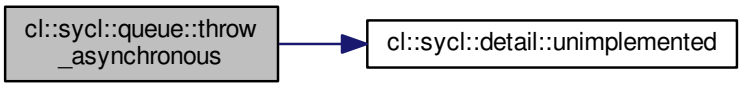
If no async_handler was provided then asynchronous exceptions will be lost.

Definition at line 305 of file queue.hpp.

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

```
00305                             {
00306     detail::unimplemented();
00307   }
```

Here is the call graph for this function:



8.3.2.14.3.9 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 278 of file queue.hpp.

```
00278               {
00279     implementation->wait_for_kernel_execution();
00280   }
```

8.3.2.14.3.10 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.

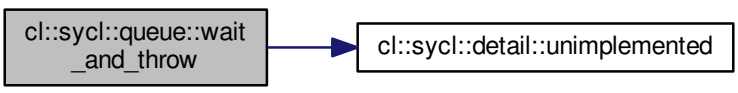
If no async_handler was provided then asynchronous exceptions will be lost.

Definition at line 293 of file queue.hpp.

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

```
00293                           {
00294     detail::unimplemented();
00295   }
```

Here is the call graph for this function:



8.3.2.14.4 Member Data Documentation

8.3.2.14.4.1 friend cl::sycl::queue::implementation_t [private]

Definition at line 93 of file queue.hpp.

8.3.3 Typedef Documentation

8.3.3.1 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 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 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 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 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 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.

8.3.3.7 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 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

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
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 };
```

8.3.4.2 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 };
```

8.3.4.3 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 };
```

8.3.4.4 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 };
```

8.3.4.5 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 };
```

8.3.4.6 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 };
```

8.3.4.7 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 };
```

8.3.4.8 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 };
```

8.3.4.9 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 };
```

8.3.4.10 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 template<> auto cl::sycl::device::get_info< info::device::device_type > ( ) const [inline]

`#include <include/CL/sycl/device.hpp>`

Definition at line 261 of file device.hpp.

References cl::sycl::info::cpu.

```
00261                                                          {
00262   return info::device_type::cpu;
00263 }
```

8.3.5.2 template<> auto cl::sycl::device::get_info< info::device::local_mem_size > ( ) const [inline]

`#include <include/CL/sycl/device.hpp>`

Definition at line 266 of file device.hpp.

```
00266                                                              {
00267   return size_t { 32000 };
00268 }
```

8.3.5.3 template<> auto cl::sycl::device::get_info< info::device::max_compute_units > ( ) const [inline]

```
#include <include/CL/sycl/device.hpp>
```

Definition at line 256 of file device.hpp.

```
00256                                                                {
00257   return size_t { 56 };
00258 }
```

8.3.5.4 template<> auto cl::sycl::device::get_info< info::device::max_work_group_size > ( ) const [inline]

```
#include <include/CL/sycl/device.hpp>
```

Definition at line 250 of file device.hpp.

```
00250                                                                  {
00251   return size_t { 63 };
00252 }
```

8.3.5.5 template<> auto cl::sycl::device::get_info< info::device::vendor > ( ) const [inline]

```
#include <include/CL/sycl/device.hpp>
```

Definition at line 271 of file device.hpp.

```
00271                                                          {
00272   return string_class {};
00273 }
```

8.3.5.6 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.

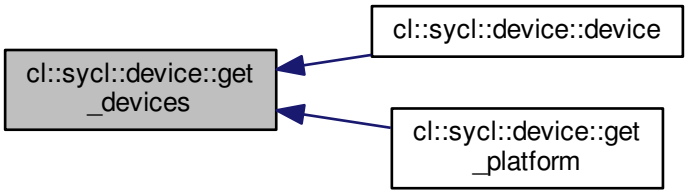
Return synchronous errors via SYCL exception classes.

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_PREFIX detail::cache< cl_command_queue, detail::opencl_queue > opencl_queue::cache cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX

```
#include <include/CL/sycl/device/detail/opencl_device.hpp>
```

Definition at line 140 of file opencl_device.hpp.

Referenced by cl::sycl::detail::opencl_kernel::TRISYCL_ParallelForKernel_RANGE(), 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 template<typename V , typename Tuple , bool expansion = false> static auto cl::sycl::detail::expand_to_vector< V, Tuple, expansion >::expand (Tuple *t*) [inline], [static]

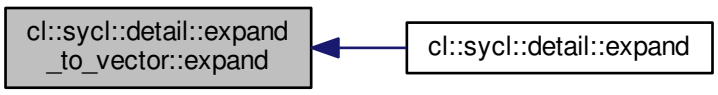
#include <include/CL/sycl/detail/array_tuple_helpers.hpp>

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 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 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.

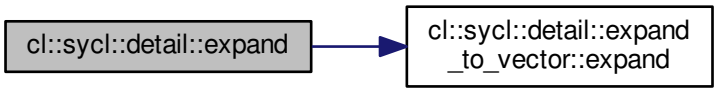
If there is only 1 initializer, this is a scalar initialization of a vector and the value is expanded to all the vector elements first.

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 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 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 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.

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 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 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 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 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 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.

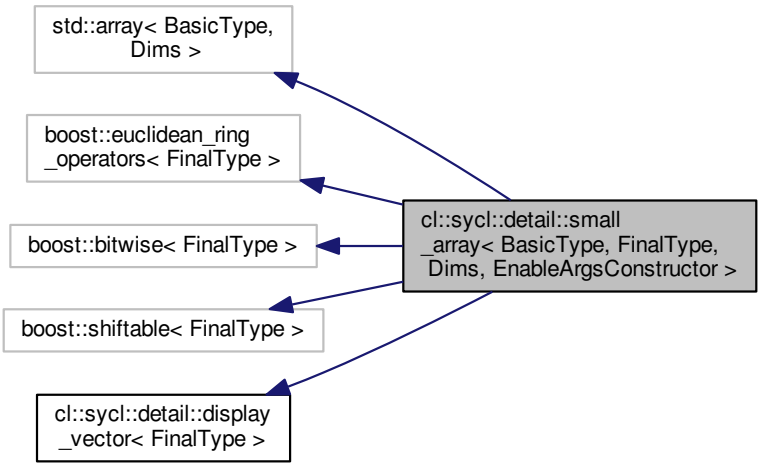
Parameters

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.

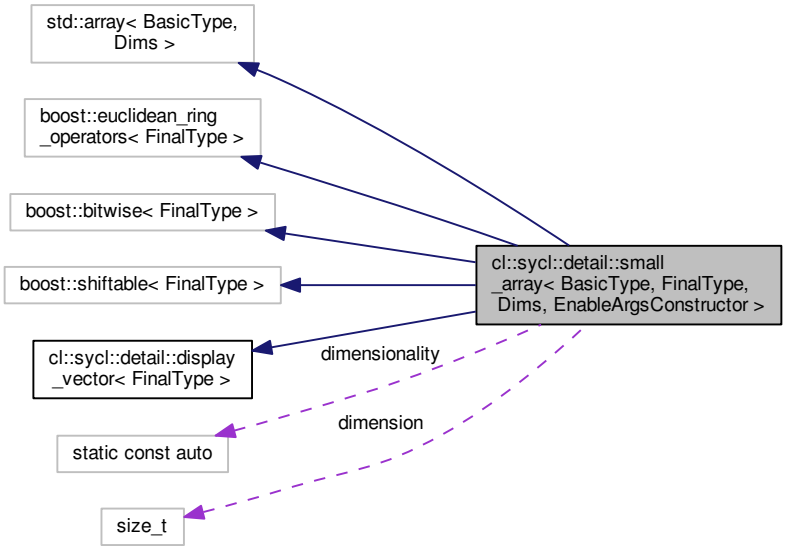
std::array<> provides the collection concept, with .size(), == and != too.

Definition at line 65 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 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 85 of file small_array.hpp.

8.5.2.2.2 Constructor & Destructor Documentation

8.5.2.2.2.1 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 94 of file small_array.hpp.

```
00094                                        {
00095     // (*this)[0] is the first element of the underlying array
00096     std::copy_n(src, Dims, &(*this)[0]);
00097   }
```

8.5.2.2.2.2 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, SourceEnableArgsConstructor > & *src*) [inline]

A constructor from another small_array of the same size.

Definition at line 128 of file small_array.hpp.

```
00131                                                 {
00132     std::copy_n(&src[0], Dims, &(*this)[0]);
00133   }
```

8.5.2.2.2.3 template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor = false> template<typename... Types, bool Depend = true, typename = typename std::enable_if_t<EnableArgsConstructor && 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 151 of file small_array.hpp.

```
00152     : std::array<BasicType, Dims> {
00153     // Allow a loss of precision in initialization with the static_cast
00154     { static_cast<BasicType>(args)... }
00155   }
```

8.5.2.2.2.4 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 165 of file small_array.hpp.

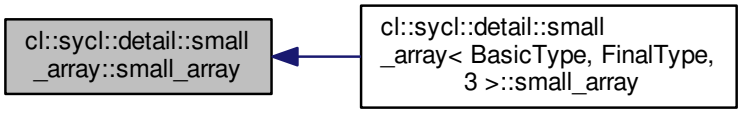
```
00166   : std::array<BasicType, Dims>(src) {}
```

8.5.2.2.2.5 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 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 176 of file small_array.hpp.

```
00176                                    {
00177     return (*this)[index];
00178   }
```

8.5.2.2.3.2 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 215 of file small_array.hpp.

```
00215                           {
00216     return *static_cast<FinalType *>(this);
00217   }
```

8.5.2.2.3.3 template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor = false> BasicType& cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::x ( ) [inline]

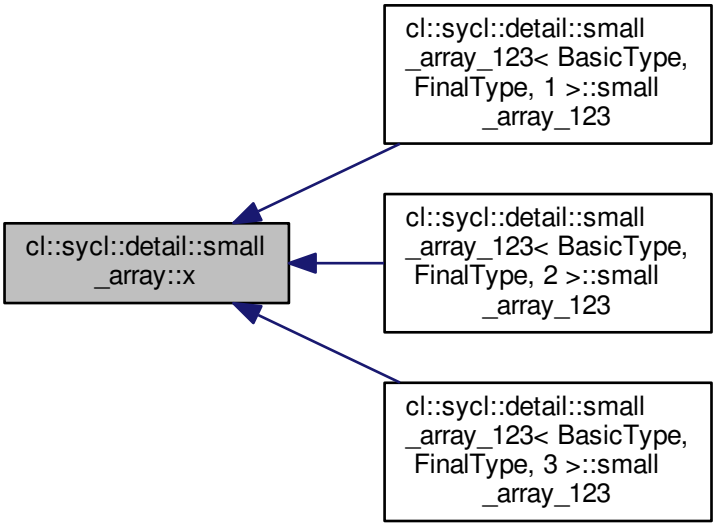
An accessor to the first variable of a small array.

Definition at line 102 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().

```
00102                   {
00103     static_assert(Dims >= 1, "can't access to small_array[0] if Dims < 1");
00104     return (*this)[0];
00105   }
```

Here is the caller graph for this function:



8.5.2.2.3.4 template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor = false> BasicType& cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::y ( ) [inline]

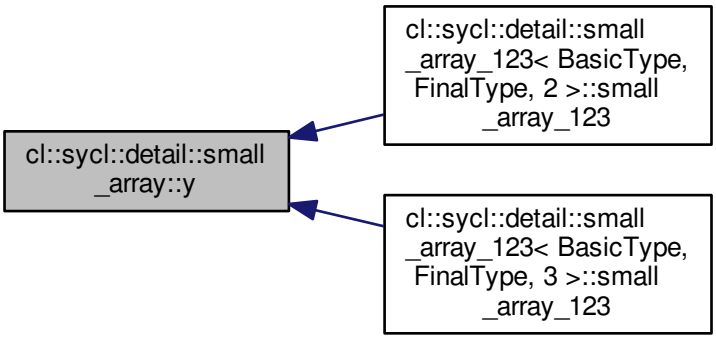
An accessor to the second variable of a small array.

Definition at line 110 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().

```
00110                {
00111     static_assert(Dims >= 2, "can't access to small_array[1] if Dims < 2");
00112     return (*this)[1];
00113   }
```

Here is the caller graph for this function:



8.5.2.2.3.5 template<typename BasicType, typename FinalType, std::size_t Dims, bool EnableArgsConstructor = false> BasicType& cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::z ( ) [inline]

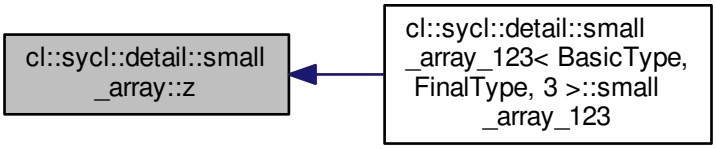
An accessor to the third variable of a small array.

Definition at line 118 of file small_array.hpp.

Referenced by cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >::small_array_123().

```
00118                 {
00119     static_assert(Dims >= 3, "can't access to small_array[2] if Dims < 3");
00120     return (*this)[2];
00121   }
```

Here is the caller graph for this function:



8.5.2.2.4 Member Data Documentation

8.5.2.2.4.1 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 84 of file small_array.hpp.

8.5.2.2.4.2 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 80 of file small_array.hpp.

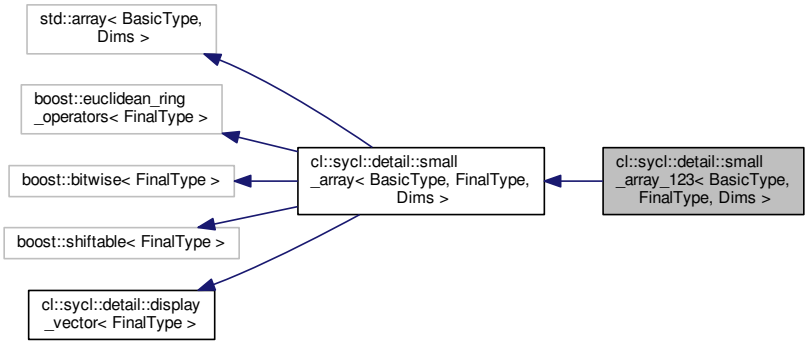
8.5.2.3 struct cl::sycl::detail::small_array_123

template<typename BasicType, typename FinalType, std::size_t Dims>
struct cl::sycl::detail::small_array_123< BasicType, FinalType, Dims >

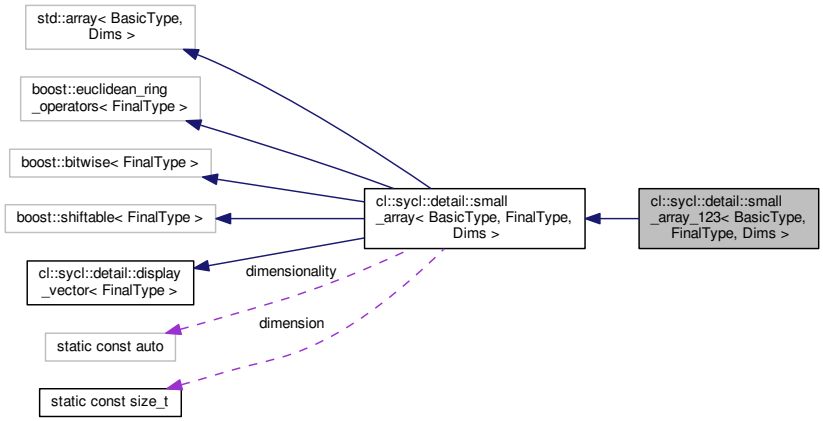
A small array of 1, 2 or 3 elements with the implicit constructors.

Definition at line 224 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

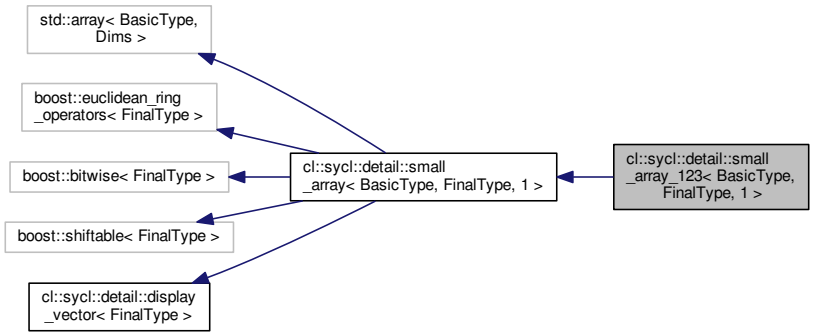
8.5.2.4 struct cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >

template<typename BasicType, typename FinalType>
struct cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >

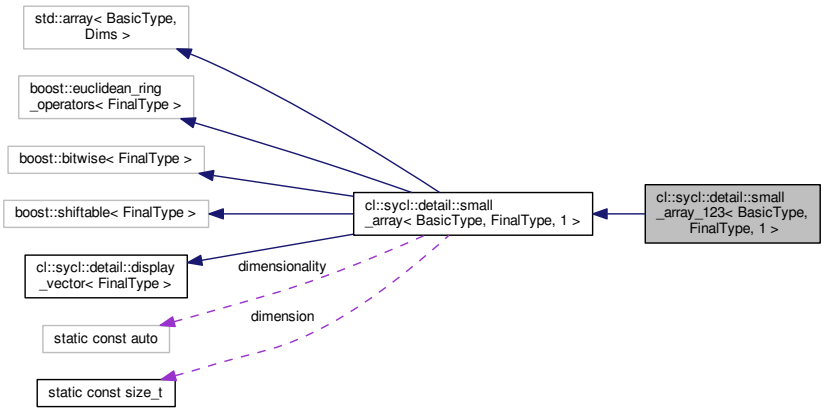
Use some specializations so that some function overloads can be determined according to some implicit constructors and to have an implicit conversion from/to BasicType (such as an int typically) if Dimensions = 1.

Definition at line 236 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 template<typename BasicType , typename FinalType > cl::sycl::detail::small_array_123< BasicType, FinalType, 1 >::small_array_123 (BasicType *x*) [inline]

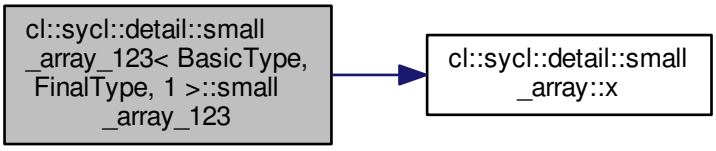
A 1-D constructor to have implicit conversion from from 1 integer and automatic inference of the dimensionality.

Definition at line 240 of file small_array.hpp.

References cl::sycl::detail::small_array< BasicType, FinalType, Dims, EnableArgsConstructor >::x().

```
00240                                 {
00241     (*this)[0] = x;
00242   }
```

Here is the call graph for this function:



8.5.2.4.1.2 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 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 252 of file small_array.hpp.

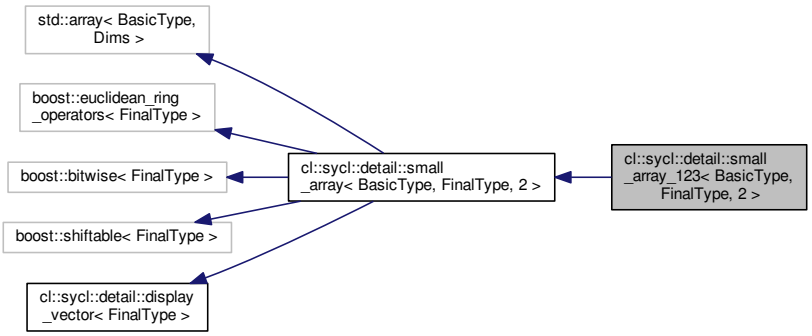
```
00252                                 {
00253     return (*this)[0];
00254   }
```

8.5.2.5 struct cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >

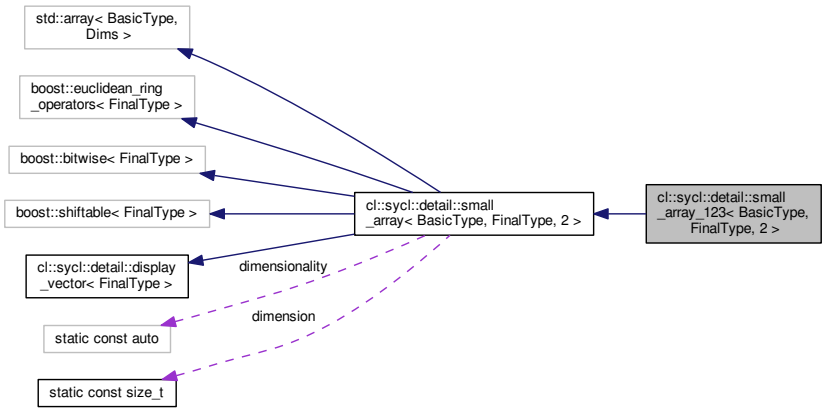
template<typename BasicType, typename FinalType>
struct cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >

Definition at line 259 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 template<typename BasicType , typename FinalType > cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >::small_array_123 (BasicType *x*, BasicType *y*) [inline]

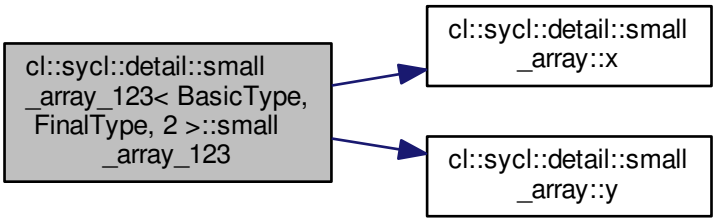
A 2-D constructor to have implicit conversion from from 2 integers and automatic inference of the dimensionality.

Definition at line 263 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().

```
00263                                                {
00264     (*this)[0] = x;
00265     (*this)[1] = y;
00266   }
```

Here is the call graph for this function:



8.5.2.5.1.2 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 274 of file small_array.hpp.

```
00274 : small_array_123 { e, e } { }
```

8.5.2.5.1.3 template<typename BasicType , typename FinalType > cl::sycl::detail::small_array_123< BasicType, FinalType, 2 >::small_array_123 ( ) [default]

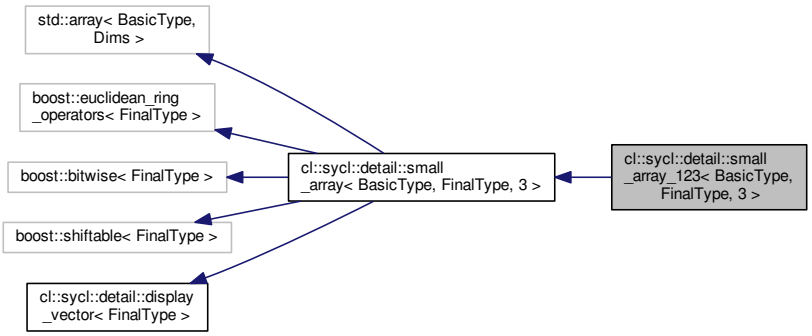
Keep other constructors.

8.5.2.6 struct cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >

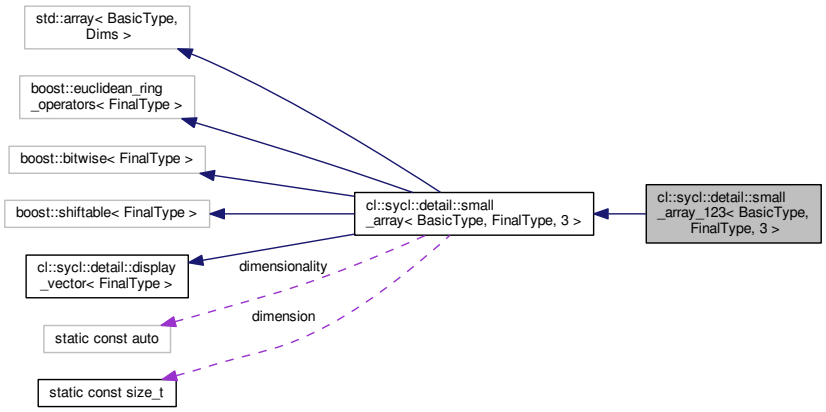
template<typename BasicType, typename FinalType>
struct cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >

Definition at line 285 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 template<typename BasicType , typename FinalType > cl::sycl::detail::small_array_123< BasicType, FinalType, 3 >::small_array_123 (BasicType *x*, BasicType *y*, BasicType *z*) [inline]

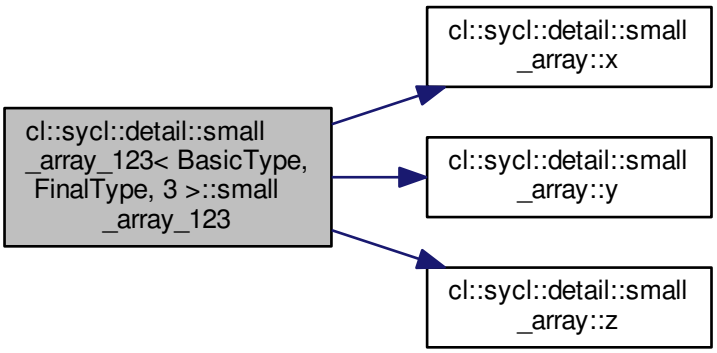
A 3-D constructor to have implicit conversion from from 3 integers and automatic inference of the dimensionality.

Definition at line 289 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().

```
00289                                                                  {
00290     (*this)[0] = x;
00291     (*this)[1] = y;
00292     (*this)[2] = z;
00293   }
```

Here is the call graph for this function:



8.5.2.6.1.2 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 301 of file small_array.hpp.

```
00301 : small_array_123 { e, e, e } { }
```

8.5.2.6.1.3 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 #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().

8.5.4 Function Documentation

8.5.4.1 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.

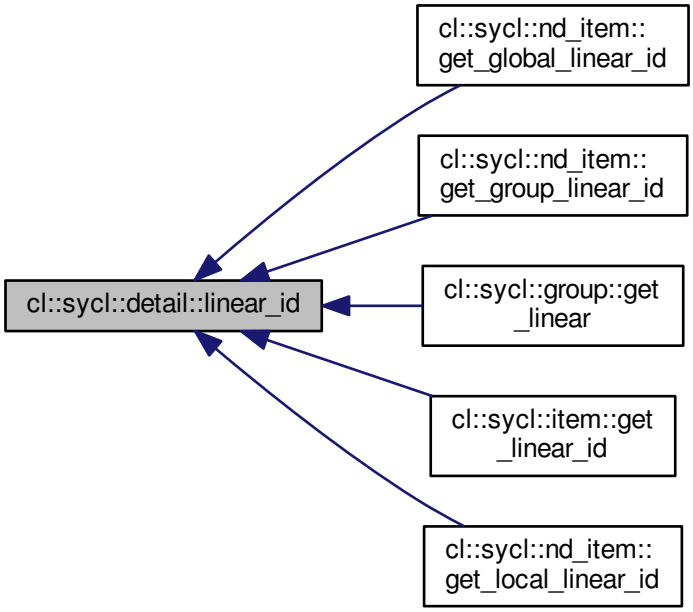
Typically for the get_global_linear_id() and get_local_linear_id() functions.

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 void cl::sycl::detail::unimplemented ( ) [inline]

`#include <include/CL/sycl/detail/unimplemented.hpp>`

Display an "unimplemented" message.

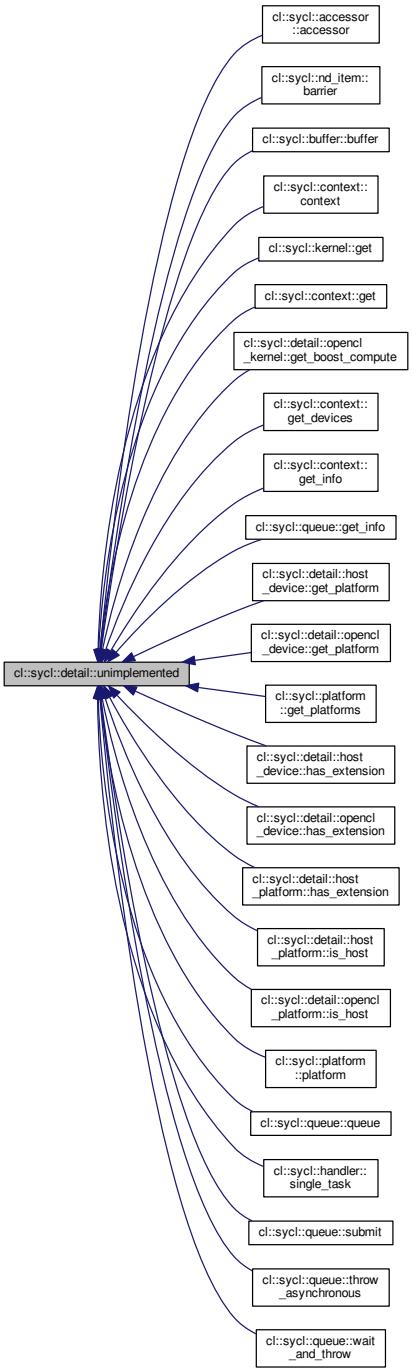
Can be changed to call assert(0) or whatever.

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::context::get(), cl::sycl::detail::opencl_kernel::get_boost_compute(), cl::sycl::context::get_devices(), cl::sycl::context::get_info(), cl::sycl::queue::get_info(), cl::sycl::detail::host_device::get_platform(), cl::sycl::detail::opencl_device::get_platform(), cl::sycl::platform::get_platforms(), cl::sycl::detail::host_device::has_extension(), cl::sycl::detail::opencl_device::has_extension(), cl::sycl::detail::host_platform::has_extension(), cl::sycl::detail::host_platform::is_host(), cl::sycl::detail::opencl_platform::is_host(), cl::sycl::platform::platform(), cl::sycl::queue::queue(), cl::sycl::handler::single_task(), cl::sycl::queue::submit(), cl::sycl::queue::throw_asynchronous(), and cl::sycl::queue::wait_and_throw().

```
00025                                {
00026   std::cerr << "Error: using a non implemented feature!!!" << std::endl
00027             << "Please contribute to the open source implementation. :-)"
00028             << std::endl;
00029 }
```

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 template<typename T> void cl::sycl::detail::display_vector< T >::display ( ) const [inline]

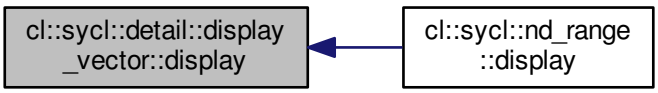
To debug and test.

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 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.

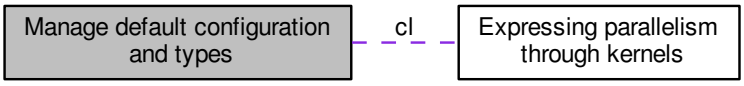
Definition at line 130 of file debug.hpp.

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 #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 #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 #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 #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 #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

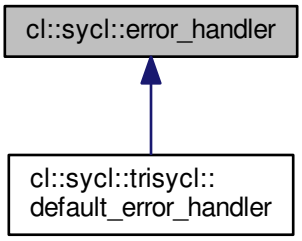
8.8.2 Class Documentation

8.8.2.1 struct cl::sycl::error_handler

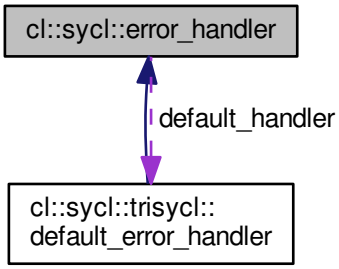
User supplied error handler to call a user-provided function when an error happens from a SYCL object that was constructed with this error handler.

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.

Static Public Attributes

- static trisycl::default_error_handler default_handler

  Add a default_handler to be used by default.

8.8.2.1.1 Member Function Documentation

8.8.2.1.1.1 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.

8.8.2.1.2 Member Data Documentation

8.8.2.1.2.1 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.

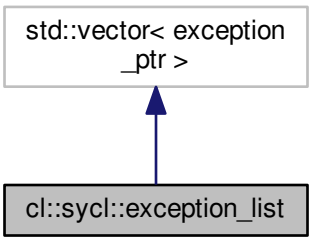
8.8.2.2 struct cl::sycl::exception_list

Exception list to store several exceptions.

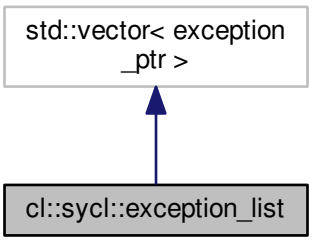
Todo Do we need to define it in SYCL or can we rely on plain C++17 one?

Definition at line 33 of file exception.hpp.

Inheritance diagram for cl::sycl::exception_list:



Collaboration diagram for cl::sycl::exception_list:

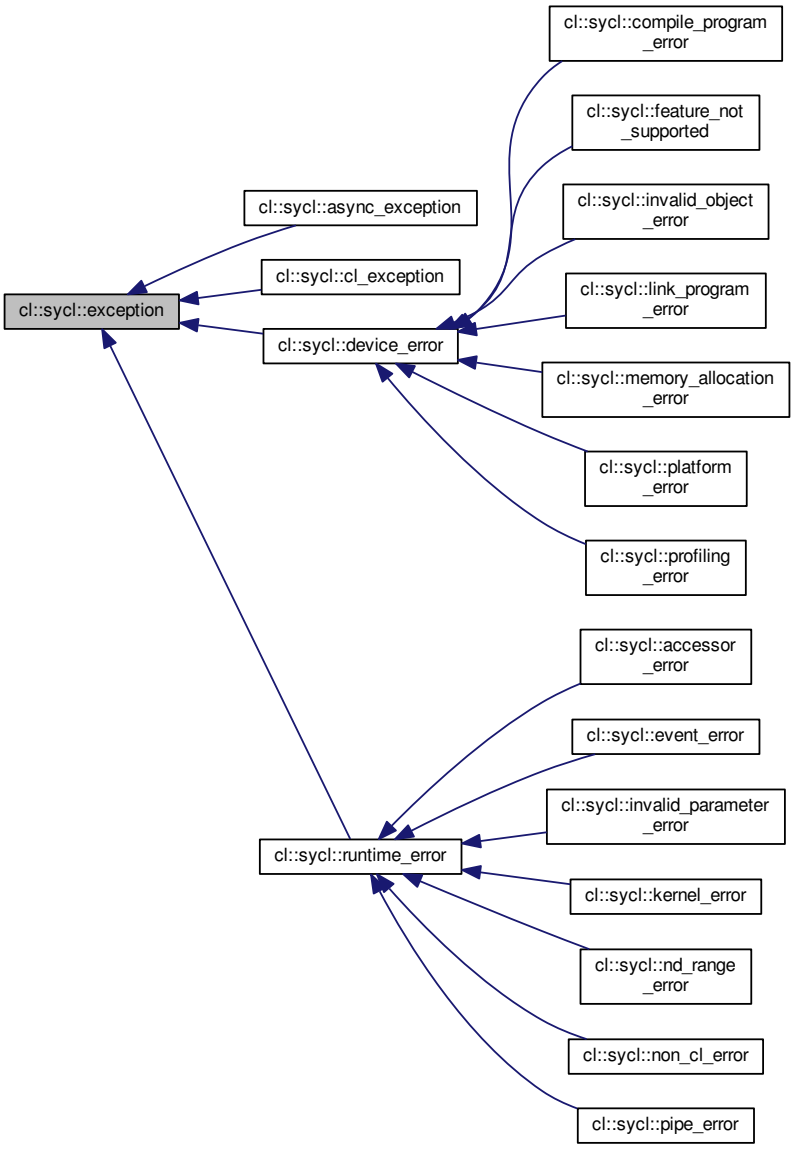


8.8.2.3 class cl::sycl::exception

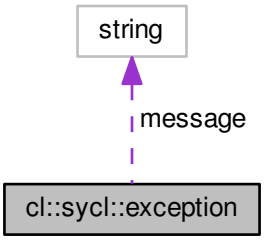
Encapsulate a SYCL error information.

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 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 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 string_class cl::sycl::exception::message [private]

The error message to return.

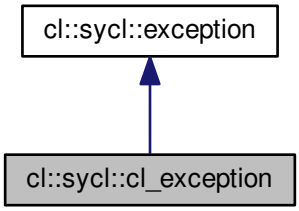
Definition at line 44 of file exception.hpp.

8.8.2.4 class cl::sycl::cl_exception

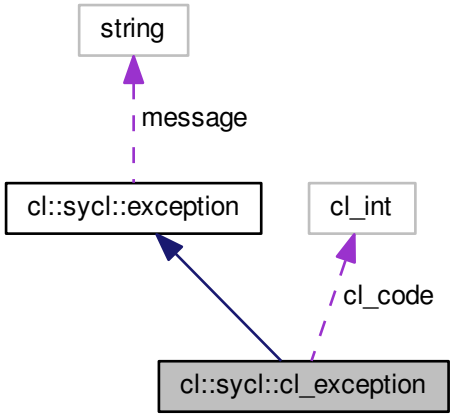
Returns the OpenCL error code encapsulated in the exception.

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::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 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_int cl::sycl::cl_exception::cl_code [private]

The OpenCL error code to return.

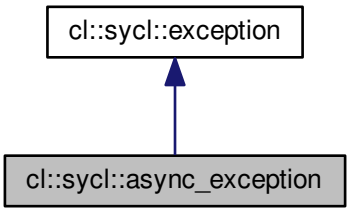
Definition at line 74 of file exception.hpp.

8.8.2.5 struct cl::sycl::async_exception

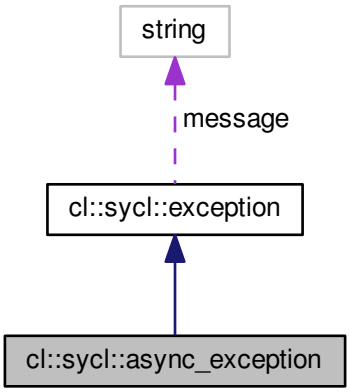
An error stored in an exception_list for asynchronous errors.

Definition at line 93 of file exception.hpp.

Inheritance diagram for cl::sycl::async_exception:



Collaboration diagram for cl::sycl::async_exception:

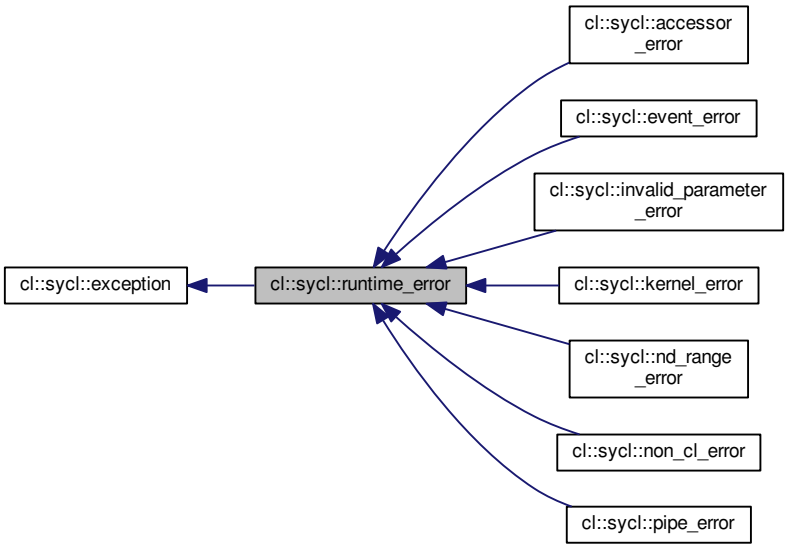


Additional Inherited Members

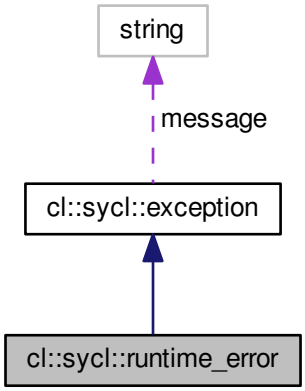
8.8.2.6 class cl::sycl::runtime_error

Definition at line 98 of file exception.hpp.

Inheritance diagram for cl::sycl::runtime_error:



Collaboration diagram for cl::sycl::runtime_error:



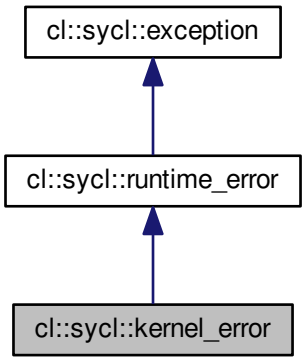
Additional Inherited Members

8.8.2.7 class cl::sycl::kernel_error

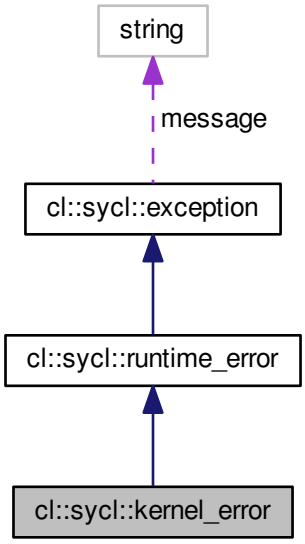
Error that occurred before or while enqueuing the SYCL kernel.

Definition at line 104 of file exception.hpp.

Inheritance diagram for cl::sycl::kernel_error:



Collaboration diagram for cl::sycl::kernel_error:



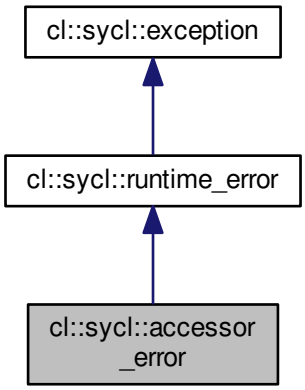
Additional Inherited Members

8.8.2.8 class cl::sycl::accessor_error

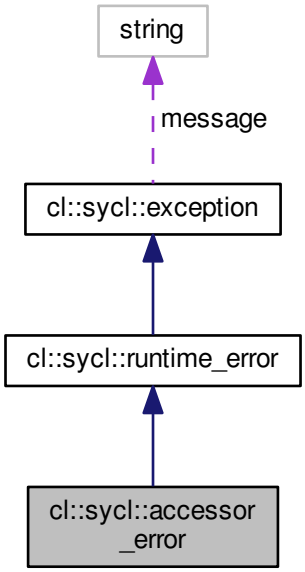
Error regarding the cl::sycl::accessor objects defined.

Definition at line 110 of file exception.hpp.

Inheritance diagram for cl::sycl::accessor_error:



Collaboration diagram for cl::sycl::accessor_error:



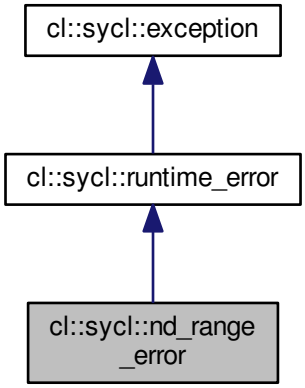
Additional Inherited Members

8.8.2.9 class cl::sycl::nd_range_error

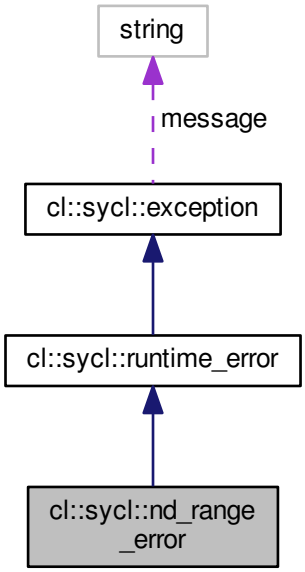
Error regarding the cl::sycl::nd_range specified for the SYCL kernel.

Definition at line 116 of file exception.hpp.

Inheritance diagram for cl::sycl::nd_range_error:



Collaboration diagram for cl::sycl::nd_range_error:



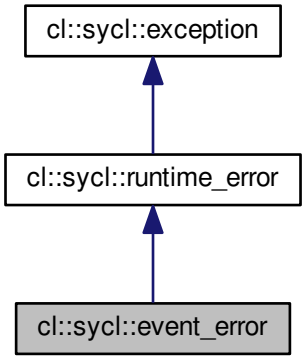
Additional Inherited Members

8.8.2.10 class cl::sycl::event_error

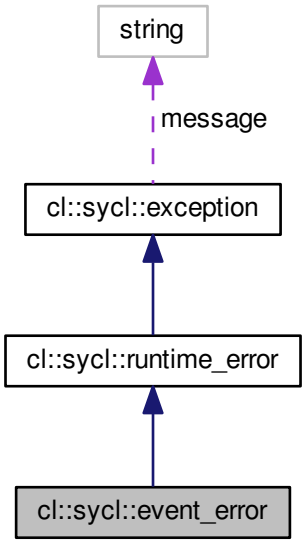
Error regarding associated cl::sycl::event objects.

Definition at line 122 of file exception.hpp.

Inheritance diagram for cl::sycl::event_error:



Collaboration diagram for cl::sycl::event_error:



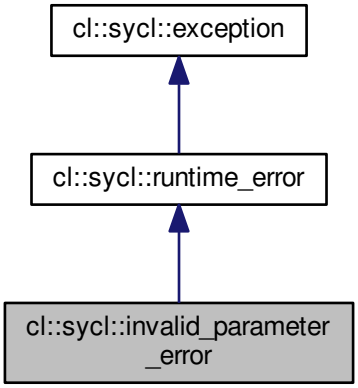
Additional Inherited Members

8.8.2.11 class cl::sycl::invalid_parameter_error

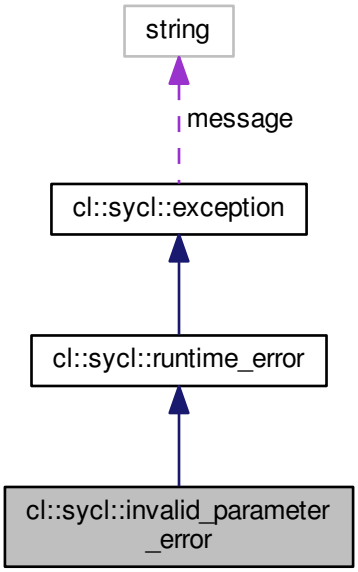
Error regarding parameters to the SYCL kernel, it may apply to any captured parameters to the kernel lambda.

Definition at line 130 of file exception.hpp.

Inheritance diagram for cl::sycl::invalid_parameter_error:



Collaboration diagram for cl::sycl::invalid_parameter_error:



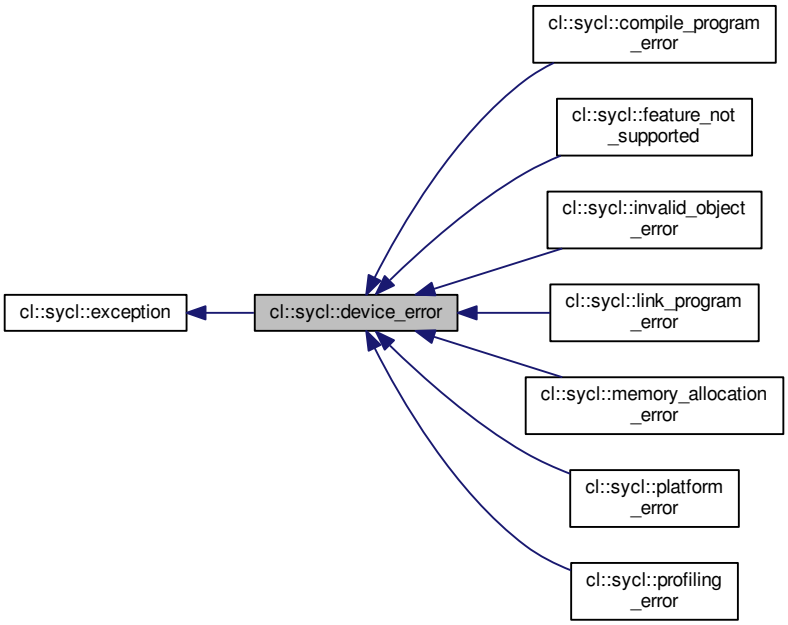
Additional Inherited Members

8.8.2.12 class cl::sycl::device_error

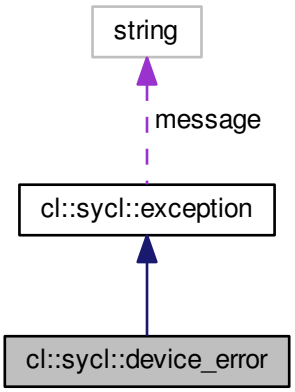
The SYCL device will trigger this exception on error.

Definition at line 136 of file exception.hpp.

Inheritance diagram for cl::sycl::device_error:



Collaboration diagram for cl::sycl::device_error:



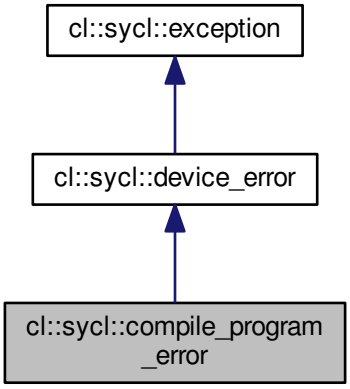
Additional Inherited Members

8.8.2.13 class cl::sycl::compile_program_error

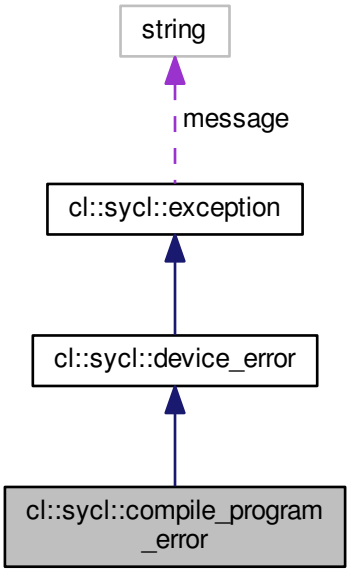
Error while compiling the SYCL kernel to a SYCL device.

Definition at line 142 of file exception.hpp.

Inheritance diagram for cl::sycl::compile_program_error:



Collaboration diagram for cl::sycl::compile_program_error:



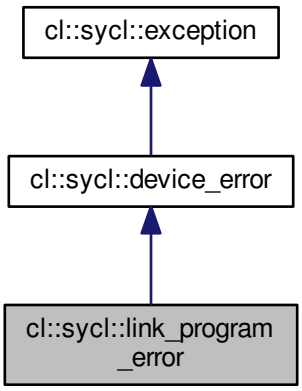
Additional Inherited Members

8.8.2.14 class cl::sycl::link_program_error

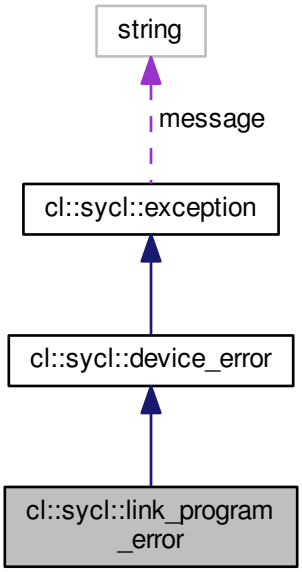
Error while linking the SYCL kernel to a SYCL device.

Definition at line 148 of file exception.hpp.

Inheritance diagram for cl::sycl::link_program_error:



Collaboration diagram for cl::sycl::link_program_error:



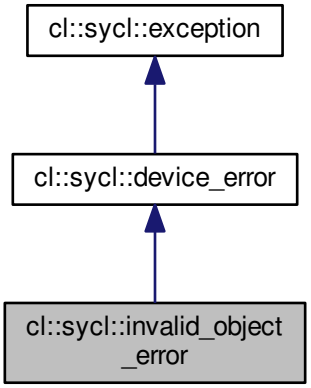
Additional Inherited Members

8.8.2.15 class cl::sycl::invalid_object_error

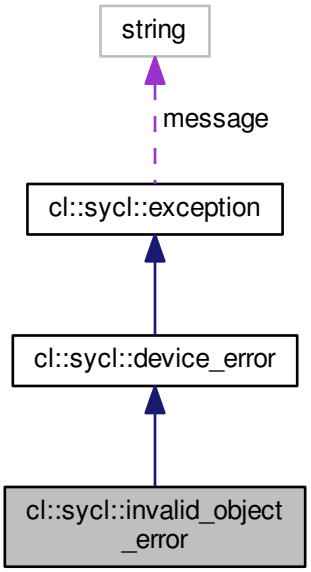
Error regarding any memory objects being used inside the kernel.

Definition at line 154 of file exception.hpp.

Inheritance diagram for cl::sycl::invalid_object_error:



Collaboration diagram for cl::sycl::invalid_object_error:



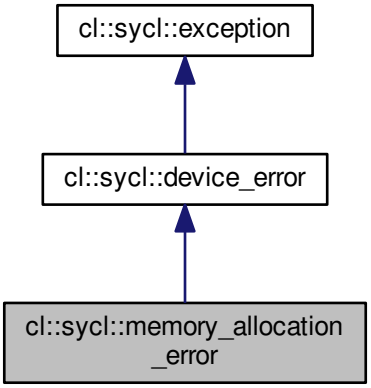
Additional Inherited Members

8.8.2.16 class cl::sycl::memory_allocation_error

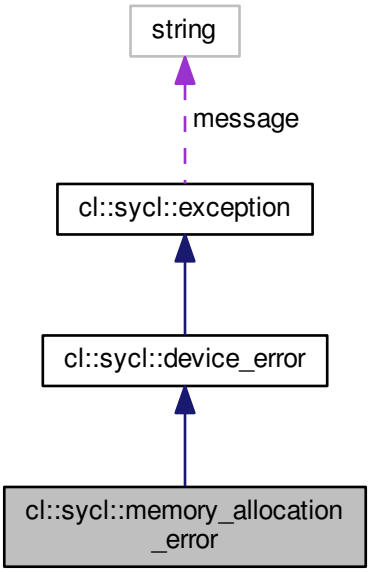
Error on memory allocation on the SYCL device for a SYCL kernel.

Definition at line 160 of file exception.hpp.

Inheritance diagram for cl::sycl::memory_allocation_error:



Collaboration diagram for cl::sycl::memory_allocation_error:



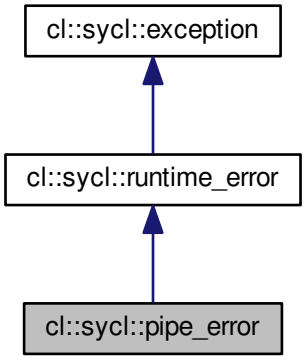
Additional Inherited Members

8.8.2.17 class cl::sycl::pipe_error

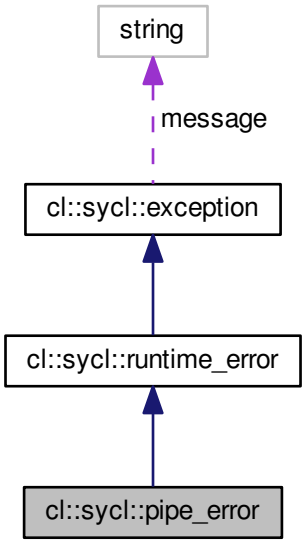
A failing pipe error will trigger this exception on error.

Definition at line 166 of file exception.hpp.

Inheritance diagram for cl::sycl::pipe_error:



Collaboration diagram for cl::sycl::pipe_error:



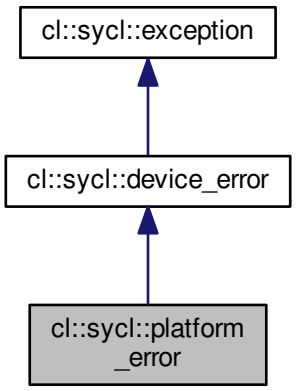
Additional Inherited Members

8.8.2.18 class cl::sycl::platform_error

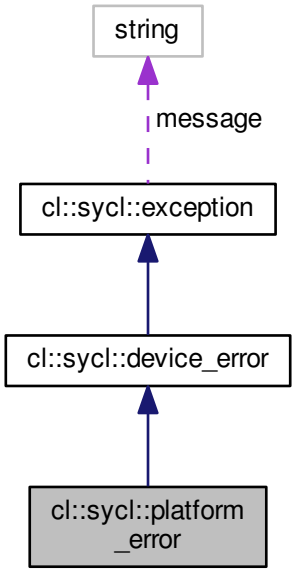
The SYCL platform will trigger this exception on error.

Definition at line 172 of file exception.hpp.

Inheritance diagram for cl::sycl::platform_error:



Collaboration diagram for cl::sycl::platform_error:



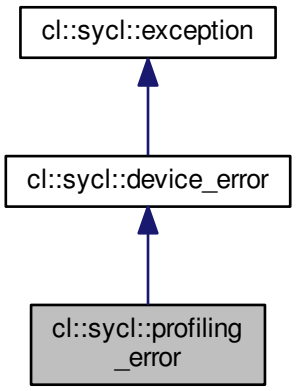
Additional Inherited Members

8.8.2.19 class cl::sycl::profiling_error

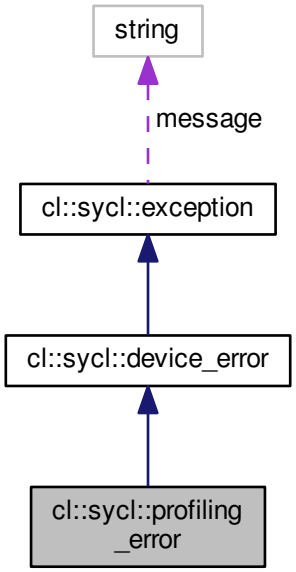
The SYCL runtime will trigger this error if there is an error when profiling info is enabled.

Definition at line 180 of file exception.hpp.

Inheritance diagram for cl::sycl::profiling_error:



Collaboration diagram for cl::sycl::profiling_error:



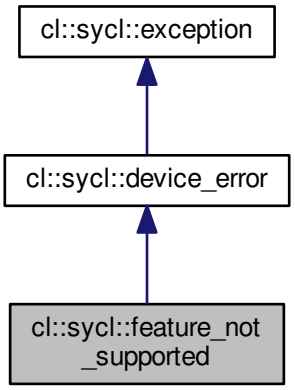
Additional Inherited Members

8.8.2.20 class cl::sycl::feature_not_supported

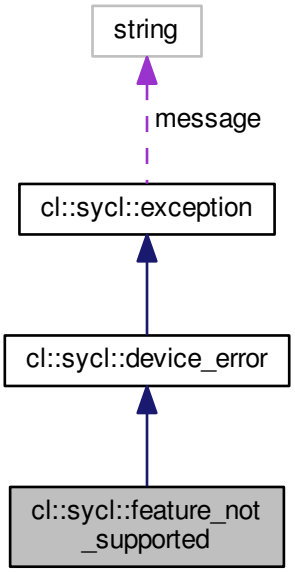
Exception thrown when an optional feature or extension is used in a kernel but its not available on the device the SYCL kernel is being enqueued on.

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.

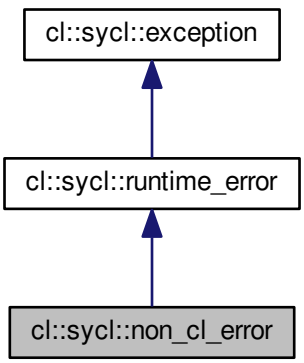
Todo Add to the specification

Todo Clean implementation

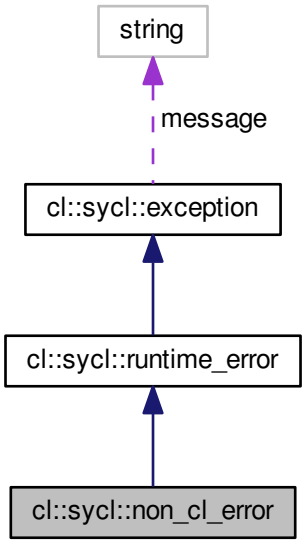
Todo Exceptions are named error in C++

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 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 using cl::sycl::exception_ptr = typedef std::exception_ptr

```
#include <include/CL/sycl/exception.hpp>
```

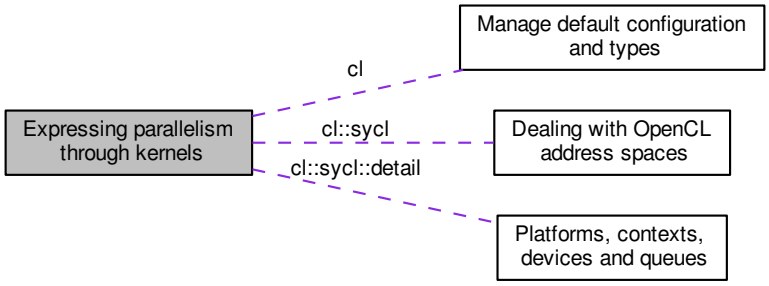
A shared pointer to an exception as in C++ specification.

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

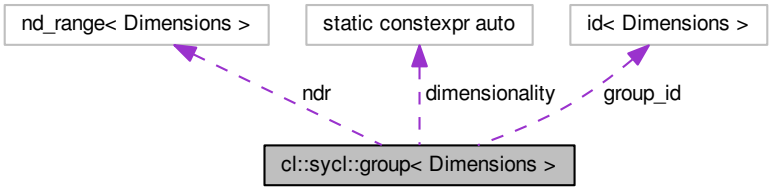
8.9.2.1 struct cl::sycl::group

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 () const
  Return an id representing the index of the group within the nd_range for every dimension.
- size_t get (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 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 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 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 template<int Dimensions> id<Dimensions> cl::sycl::group< Dimensions >::get ( ) const [inline]

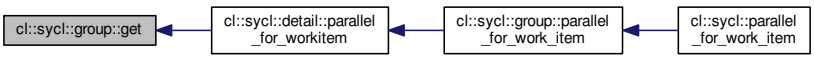
Return an id representing the index of the group within the nd_range for every dimension.

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:



8.9.2.1.2.2 template<int Dimensions> size_t cl::sycl::group< Dimensions >::get (int *dimension*) const [inline]

Return the index of the group in the given dimension.

Definition at line 87 of file group.hpp.

```
00087 { return get()[dimension]; }
```

8.9.2.1.2.3 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   }
```

8.9.2.1.2.4 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   }
```

8.9.2.1.2.5 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   }
```

8.9.2.1.2.6 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   }
```

8.9.2.1.2.7 template<int Dimensions> size_t cl::sycl::group< Dimensions >::get_linear ( ) const [inline]

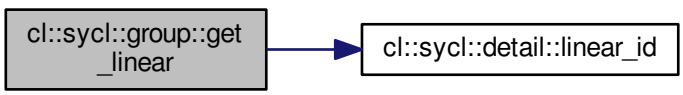
Get a linearized version of the group ID.

Definition at line 172 of file group.hpp.

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

```
00172                              {
00173     return detail::linear_id(get_group_range(), get());
00174   }
```

Here is the call graph for this function:



8.9.2.1.2.8 template<int Dimensions> range<Dimensions> cl::sycl::group< Dimensions >::get_local_range ( ) const [inline]

Get the local range for this work_group.

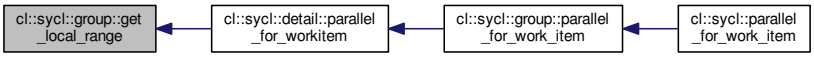
Todo Add to the specification

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 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 template<int Dimensions> nd_range<Dimensions> cl::sycl::group< Dimensions >::get_nd_range ( ) const [inline]

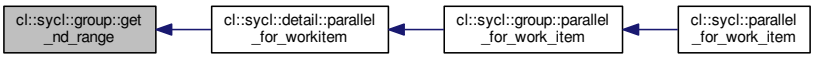
Todo Also provide this access to the current nd_range

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 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 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

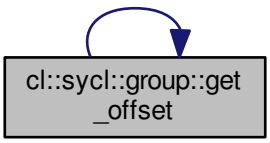
Definition at line 162 of file group.hpp.

References cl::sycl::group< Dimensions >::get_offset().

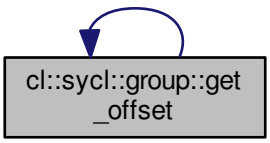
Referenced by cl::sycl::group< Dimensions >::get_offset().

```
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 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 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

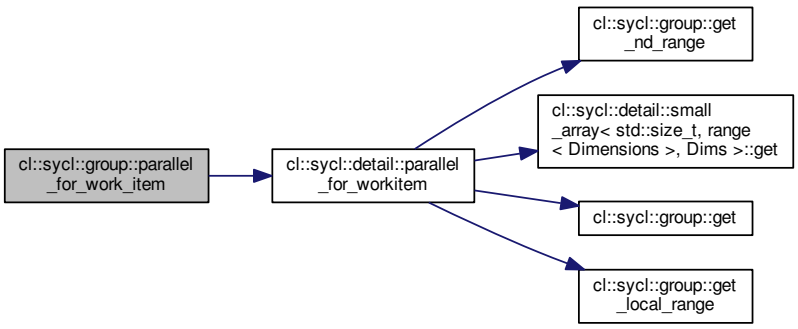
Definition at line 181 of file group.hpp.

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

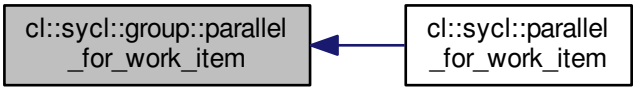
Referenced by cl::sycl::parallel_for_work_item().

```
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 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.

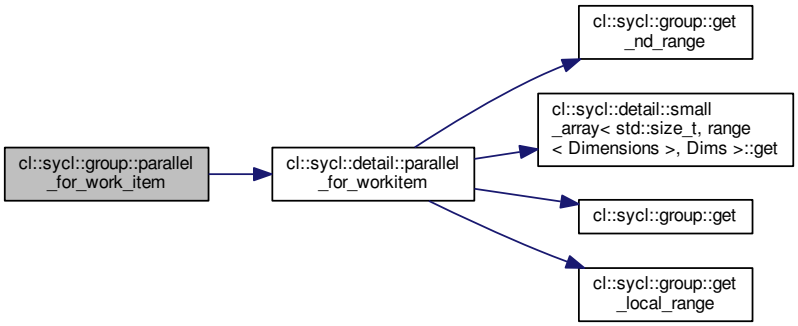
Todo Add this method in the specification

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 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 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 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.

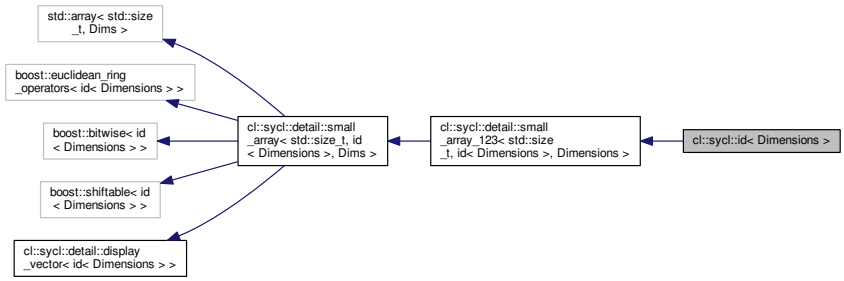
8.9.2.2 class cl::sycl::id

template<int Dimensions = 1>
class cl::sycl::id< Dimensions >

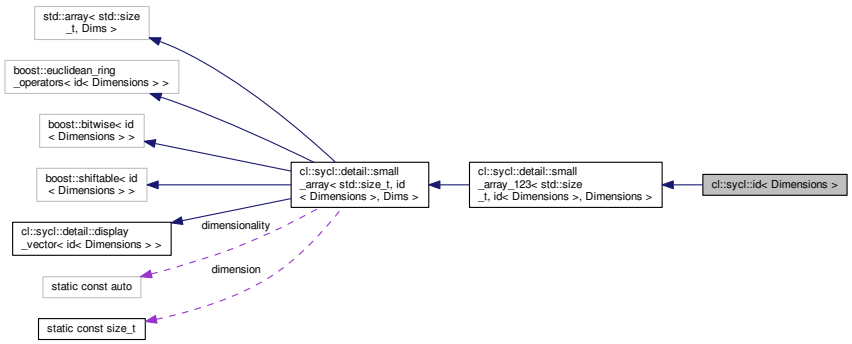
Define a multi-dimensional index, used for example to locate a work item.

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 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:

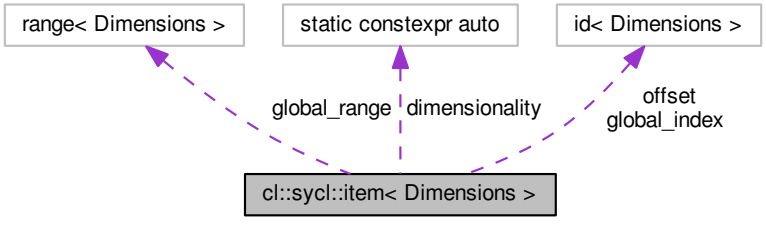
8.9.2.3 class cl::sycl::item

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 () const

  Return the constituent local or global id<> representing the work-item's position in the iteration space.
- size_t get (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 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 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 template<int Dimensions = 1> void cl::sycl::item< Dimensions >::display ( ) const [inline]

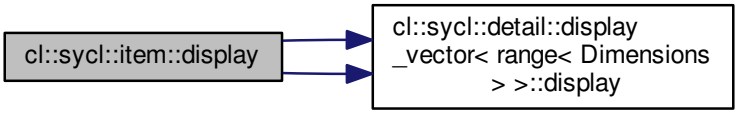
Display the value for debugging and validation purpose.

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 template<int Dimensions = 1> id<Dimensions> cl::sycl::item< Dimensions >::get ( ) const [inline]

Return the constituent local or global id<> representing the work-item's position in the iteration space.

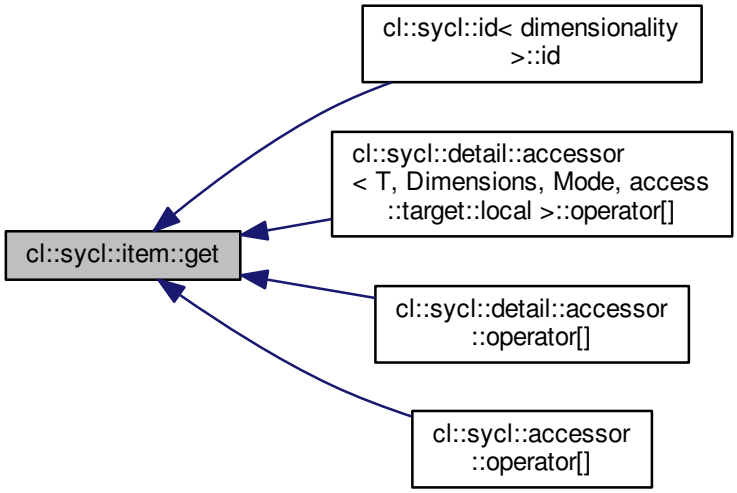
Definition at line 69 of file item.hpp.

References cl::sycl::item< Dimensions >::global_index.

Referenced by cl::sycl::id< dimensionality >::id(), cl::sycl::detail::accessor< T, Dimensions, Mode, access::target::local >::operator[](), cl::sycl::detail::accessor< T, Dimensions, Mode, Target >::operator[](), 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 template<int Dimensions = 1> size_t cl::sycl::item< Dimensions >::get (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.

```
00075 { return get()[dimension]; }
```

8.9.2.3.2.4 template<int Dimensions = 1> size_t cl::sycl::item< Dimensions >::get_linear_id ( ) const [inline]

Return the linearized ID in the item's range.

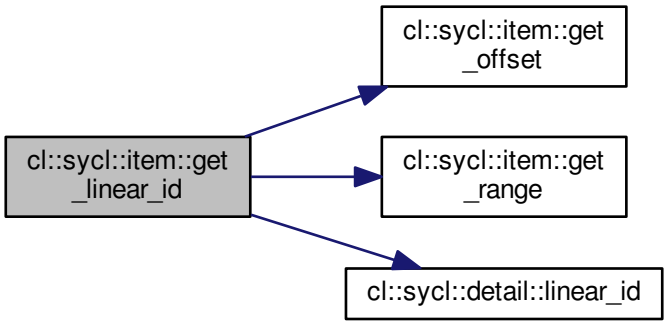
Computed as the flatted ID after the offset is subtracted.

Definition at line 104 of file item.hpp.

References cl::sycl::item< Dimensions >::get_offset(), cl::sycl::item< Dimensions >::get_range(), and cl::sycl::detail::linear_id().

```
00104                                {
00105     return detail::linear_id(get_range(), get(),
      get_offset());
00106   }
```

Here is the call graph for this function:



8.9.2.3.2.5 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.

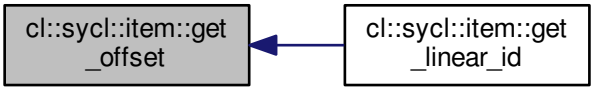
Definition at line 97 of file item.hpp.

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 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 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 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 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 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().

8.9.2.3.3.3 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 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().

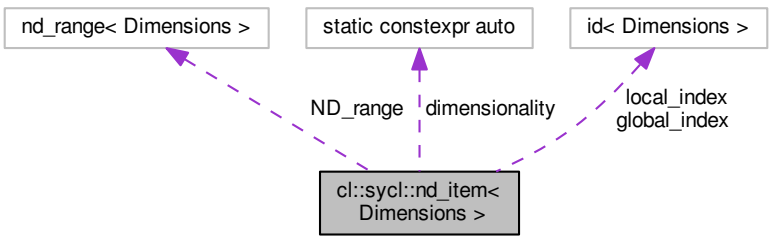
8.9.2.4 struct cl::sycl::nd_item

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 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 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.

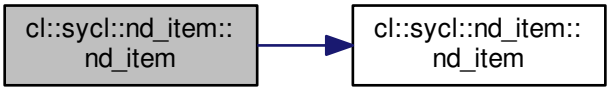
Todo This is for validation purpose. Hide this to the programmer somehow

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:



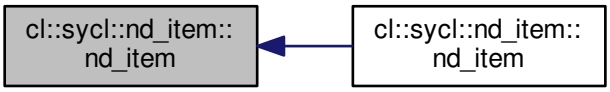
8.9.2.4.1.3 template<int Dimensions = 1> cl::sycl::nd_item< Dimensions >::nd_item ( ) [default]

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 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.

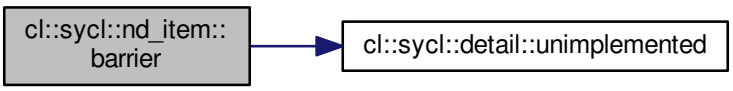
In addition, the barrier performs a fence operation ensuring that all memory accesses in the specified address space issued before the barrier complete before those issued after the barrier

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 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.

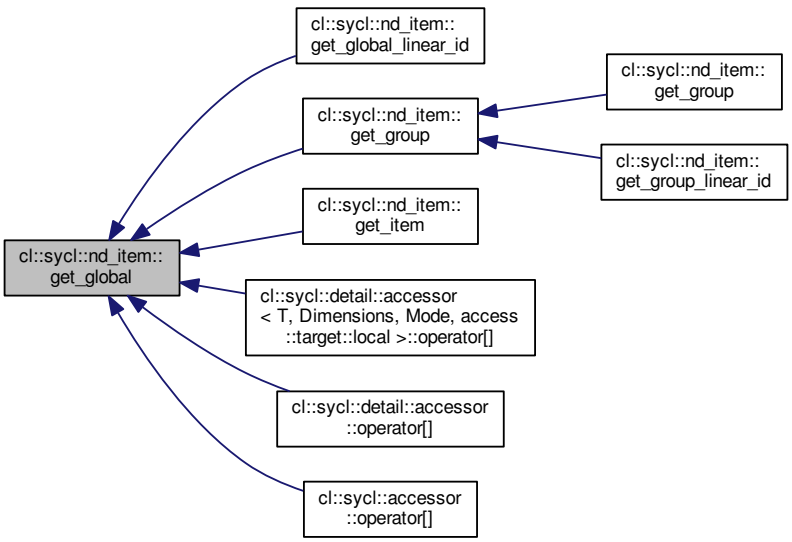
Definition at line 82 of file nd_item.hpp.

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::detail::accessor< T, Dimensions, Mode, Target >::operator[](), and cl::sycl::accessor< DataType, Dimensions, AccessMode, Target >::operator[]().

```
00082 { return global_index; }
```

Here is the caller graph for this function:



8.9.2.4.2.3 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.

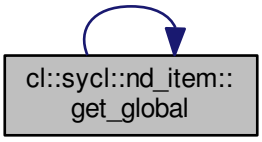
Definition at line 89 of file nd_item.hpp.

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 template<int Dimensions = 1> size_t cl::sycl::nd_item< Dimensions >::get_global_linear_id ( ) const [inline]

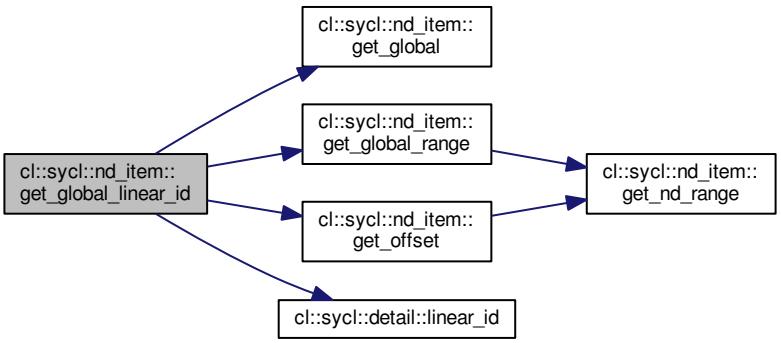
Return the flattened id of the current work-item after subtracting the offset.

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 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.

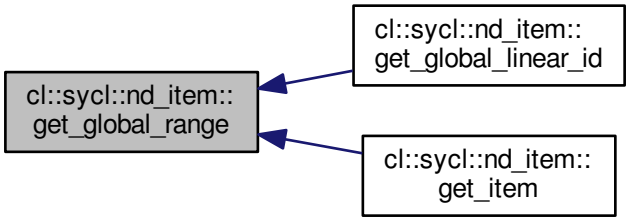
References cl::sycl::nd_item< Dimensions >::get_nd_range().

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 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.

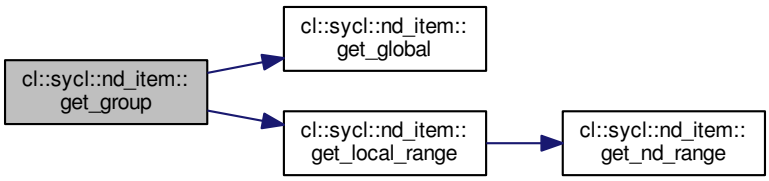
Definition at line 124 of file nd_item.hpp.

References cl::sycl::nd_item< Dimensions >::get_global(), and cl::sycl::nd_item< Dimensions >::get_local_↩ range().

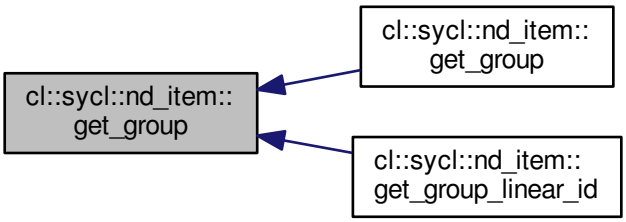
Referenced by cl::sycl::nd_item< Dimensions >::get_group(), and cl::sycl::nd_item< Dimensions >::get_group↩ _linear_id().

```
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 template<int Dimensions = 1> size_t cl::sycl::nd_item< Dimensions >::get_group (int *dimension*) const [inline]

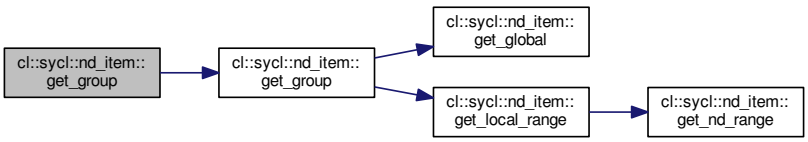
Return the constituent element of the group id representing the work-group;s position within the overall nd_range in the given dimension.

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 template<int Dimensions = 1> size_t cl::sycl::nd_item< Dimensions >::get_group_linear_id ( ) const [inline]

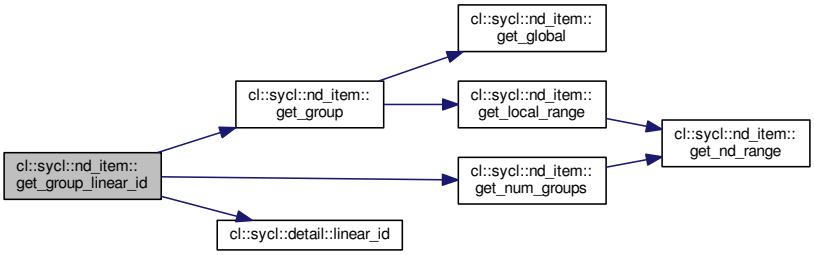
Return the flattened id of the current work-group.

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 template<int Dimensions = 1> item<Dimensions> cl::sycl::nd_item< Dimensions >::get_item ( ) const [inline]

Allows projection down to an item.

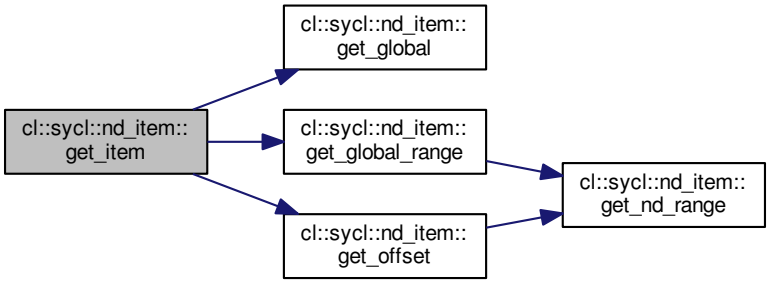
Todo Add to the specification

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 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.

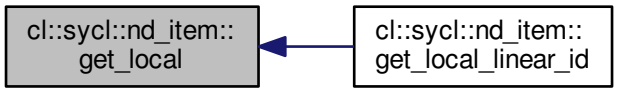
Definition at line 103 of file nd_item.hpp.

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 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.

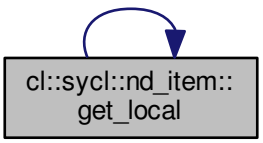
Definition at line 110 of file nd_item.hpp.

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 template<int Dimensions = 1> size_t cl::sycl::nd_item< Dimensions >::get_local_linear_id ( ) const [inline]

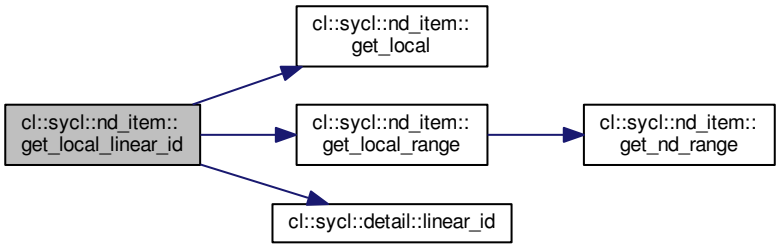
Return the flattened id of the current work-item within the current work-group.

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 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.

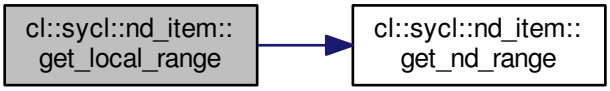
Definition at line 164 of file nd_item.hpp.

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

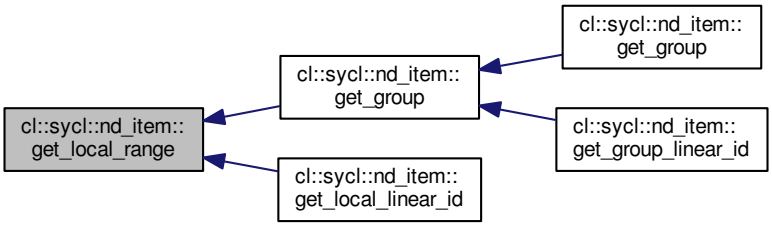
Referenced by cl::sycl::nd_item< Dimensions >::get_group(), and cl::sycl::nd_item< Dimensions >::get_local_↩ linear_id().

```
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 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.

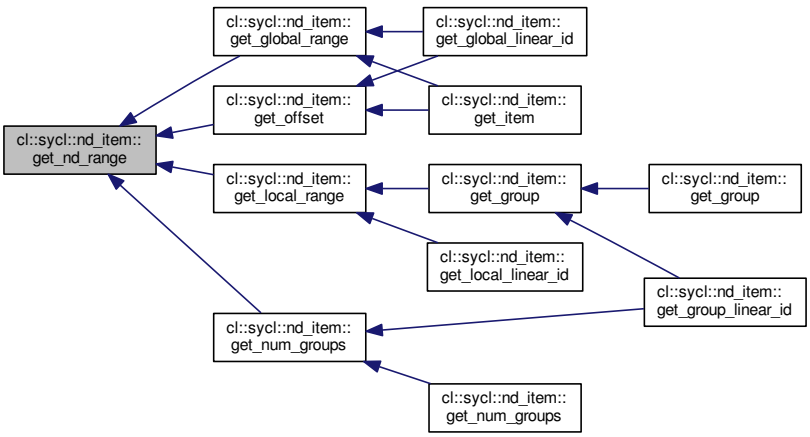
Definition at line 177 of file nd_item.hpp.

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 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.

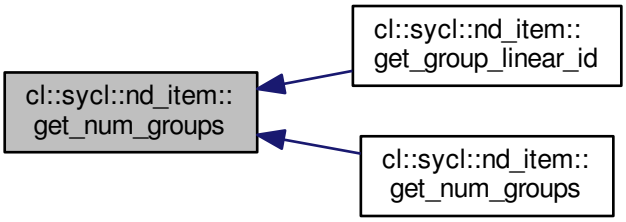
References cl::sycl::nd_item< Dimensions >::get_nd_range().

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 template<int Dimensions = 1> size_t cl::sycl::nd_item< Dimensions >::get_num_groups (int *dimension*) const [inline]

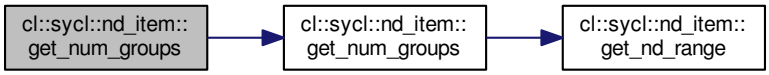
Return the number of groups for dimension in the nd_range.

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 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.

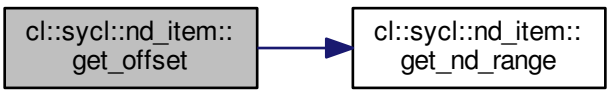
Definition at line 173 of file nd_item.hpp.

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

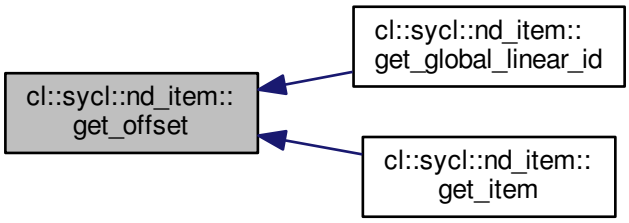
Referenced by cl::sycl::nd_item< Dimensions >::get_global_linear_id(), and cl::sycl::nd_item< Dimensions >::get_item().

```
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 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 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 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 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 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 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 >

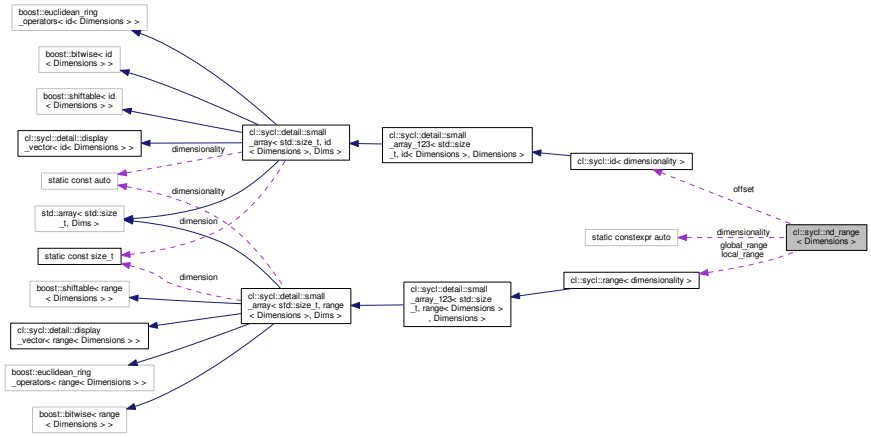
A ND-range, made by a global and local range, to specify work-group and work-item organization.

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 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 template<int Dimensions = 1> void cl::sycl::nd_range< Dimensions >::display ( ) const [inline]

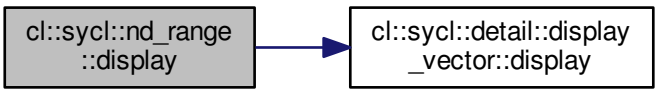
Display the value for debugging and validation purpose.

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 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 template<int Dimensions = 1> auto cl::sycl::nd_range< Dimensions >::get_group ( ) const [inline]

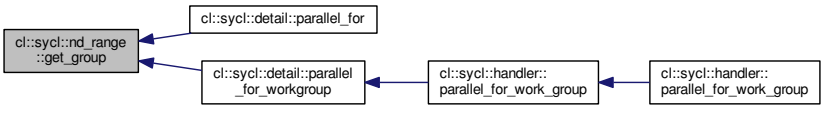
Get the range of work-groups needed to run this ND-range.

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 eange 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 template<int Dimensions = 1> range<Dimensions> cl::sycl::nd_range< Dimensions >::get_local ( ) const [inline]

Get the local part of the iteration space range.

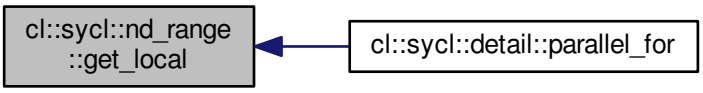
Definition at line 62 of file nd_range.hpp.

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 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 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 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 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 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 47 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 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 48 of file parallelism.hpp.

```
00048                                                                    {
00049     for (boost::multi_array_types::index _sycl_index = 0,
00050            _sycl_end = r[Range::dimensionality - level];
00051          _sycl_index < _sycl_end;
00052          _sycl_index++) {
00053       // Set the current value of the index for this dimension
00054       index[Range::dimensionality - level] = _sycl_index;
00055       // Iterate further on lower dimensions
00056       parallel_for_iterate<level - 1,
00057                            Range,
00058                            ParallelForFunctor,
00059                            Id> { r, f, index };
00060     }
00061   }
```

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 74 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 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 75 of file parallelism.hpp.

```
00075                                                                {
00076     // Create the OpenMP threads before the for-loop to avoid creating an
00077     // index in each iteration
00078 #pragma omp parallel
00079     {
00080       // Allocate an OpenMP thread-local index
00081       Id index;
00082       // Make a simple loop end condition for OpenMP
00083       boost::multi_array_types::index _sycl_end =
00084         r[Range::dimensionality - level];
00085       /* Distribute the iterations on the OpenMP threads. Some OpenMP
00086          "collapse" could be useful for small iteration space, but it
00087          would need some template specialization to have real contiguous
00088          loop nests */
00089 #pragma omp for
00090       for (boost::multi_array_types::index _sycl_index = 0;
00091            _sycl_index < _sycl_end;
00092            _sycl_index++) {
00093         // Set the current value of the index for this dimension
00094         index[Range::dimensionality - level] = _sycl_index;
00095         // Iterate further on lower dimensions
00096         parallel_for_iterate<level - 1,
00097                              Range,
00098                              ParallelForFunctor,
00099                              Id> { r, f, index };
00100       }
00101     }
00102   }
```

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 109 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 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 110 of file parallelism.hpp.

```
00110                                                                    {
00111     f(index);
00112   }
```

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.

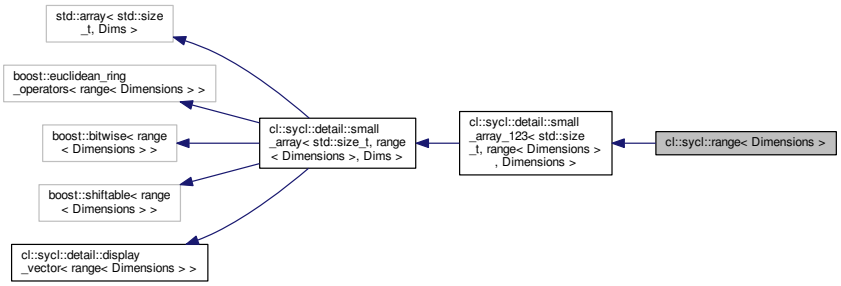
Todo use std::size_t Dimensions instead of int Dimensions in the specification?

Todo add to the specification this default parameter value?

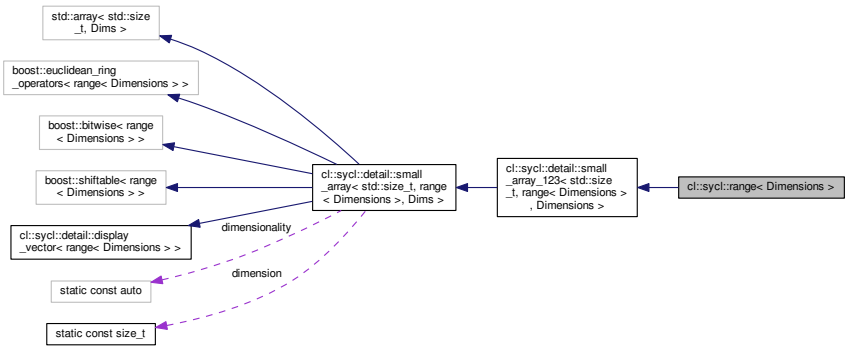
Todo add to the specification some way to specify an offset?

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 ()

  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 template<int Dimensions = 1> size_t cl::sycl::range< Dimensions >::get_count ( ) [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.

```
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   }
```

8.9.3 Function Documentation

8.9.3.1 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 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 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 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 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 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 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 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 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.

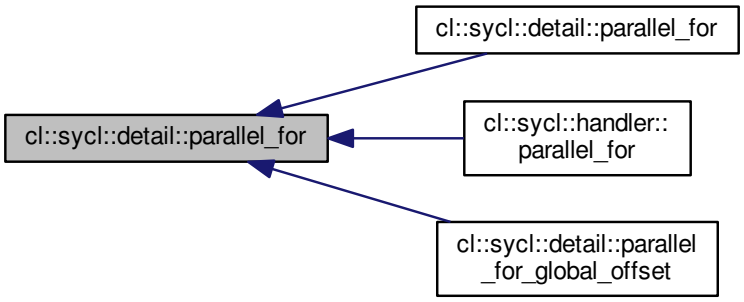
This implementation use OpenMP 3 if compiled with the right flag.

Definition at line 122 of file parallelism.hpp.

Referenced by cl::sycl::detail::parallel_for(), cl::sycl::handler::parallel_for(), and cl::sycl::detail::parallel_for_global↩_offset().

```
00124                       {
00125 #ifdef _OPENMP
00126   // Use OpenMP for the top loop level
00127   parallel_OpenMP_for_iterate<Dimensions,
00128                               range<Dimensions>,
00129                               ParallelForFunctor,
00130                               id<Dimensions>> { r, f };
00131 #else
00132   // In a sequential execution there is only one index processed at a time
00133   id<Dimensions> index;
00134   parallel_for_iterate<Dimensions,
00135                        range<Dimensions>,
00136                        ParallelForFunctor,
00137                        id<Dimensions>> { r, f, index };
00138 #endif
00139 }
```

Here is the caller graph for this function:



8.9.3.10 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 148 of file parallelism.hpp.

```
00150                                 {
00151   auto reconstruct_item = [&] (id<Dimensions> l) {
00152     // Reconstruct the global item
00153     item<Dimensions> index { r, l };
00154     // Call the user kernel with the item<> instead of the id<>
00155     f(index);
00156   };
00157 #ifdef _OPENMP
00158   // Use OpenMP for the top loop level
00159   parallel_OpenMP_for_iterate<Dimensions,
00160                               range<Dimensions>,
00161                               decltype(reconstruct_item),
00162                               id<Dimensions>> { r, reconstruct_item };
00163 #else
00164   // In a sequential execution there is only one index processed at a time
00165   id<Dimensions> index;
00166   parallel_for_iterate<Dimensions,
00167                        range<Dimensions>,
00168                        decltype(reconstruct_item),
00169                        id<Dimensions>> { r, reconstruct_item, index };
00170 #endif
00171 }
```

8.9.3.11 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 179 of file parallelism.hpp.

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

```
00179                                                                {
00180   using mf_t  = decltype(std::mem_fn(&ParallelForFunctor::operator()));
00181   using arg_t = typename mf_t::second_argument_type;
00182   parallel_for(r,f,arg_t{});
00183 }
```

Here is the call graph for this function:

8.9.3.12 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

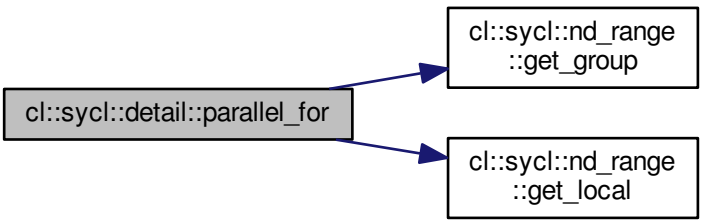
Todo Implement with parallel_for_workgroup()/parallel_for_workitem()

Definition at line 214 of file parallelism.hpp.

References cl::sycl::nd_range< Dimensions >::get_group(), and cl::sycl::nd_range< Dimensions >::get_local().

```
00215                                       {
00216   // In a sequential execution there is only one index processed at a time
00217   nd_item<Dimensions> index { r };
00218   // To iterate on the work-group
00219   id<Dimensions> group;
00220   range<Dimensions> group_range = r.get_group();
00221   // To iterate on the local work-item
00222   id<Dimensions> local;
00223
00224   range<Dimensions> local_range = r.get_local();
00225
00226   // Reconstruct the nd_item from its group and local id
00227   auto reconstruct_item = [&] (id<Dimensions> l) {
00228     //local.display();
00229     // Reconstruct the global nd_item
00230     index.set_local(local);
00231     // Upgrade local_range to an id<> so that we can * with the group (an id<>)
00232     index.set_global(local + id<Dimensions>(local_range)*group);
00233     // Call the user kernel at last
00234     f(index);
00235   };
00236
00237   /* To recycle the parallel_for on range<>, wrap the ParallelForFunctor f
00238      into another functor that iterates inside the work-group and then
00239      calls f */
00240   auto iterate_in_work_group = [&] (id<Dimensions> g) {
00241     //group.display();
00242     // Then iterate on the local work-groups
00243     parallel_for_iterate<Dimensions,
00244                          range<Dimensions>,
00245                          decltype(reconstruct_item),
00246                          id<Dimensions>> { local_range,
00247                                            reconstruct_item,
00248                                            local };
00249   };
00250
00251   // First iterate on all the work-groups
00252   parallel_for_iterate<Dimensions,
00253                        range<Dimensions>,
00254                        decltype(iterate_in_work_group),
00255                        id<Dimensions>> { group_range,
00256                                          iterate_in_work_group,
00257       group };
00258 }
```

Here is the call graph for this function:



8.9.3.13 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>`

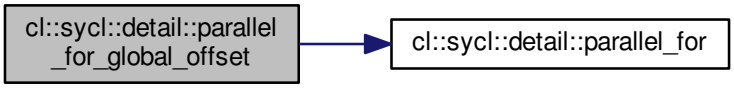
Implementation of parallel_for with a range<> and an offset.

Definition at line 188 of file parallelism.hpp.

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

```
00190                                                   {
00191   // Reconstruct the item from its id<> and its offset
00192   auto reconstruct_item = [&] (id<Dimensions> l) {
00193     // Reconstruct the global item
00194     item<Dimensions> index { global_size, l + offset, offset };
00195     // Call the user kernel with the item<> instead of the id<>
00196     f(index);
00197   };
00198
00199   // First iterate on all the work-groups
00200   parallel_for(global_size, reconstruct_item);
00201 }
```

Here is the call graph for this function:



8.9.3.14 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

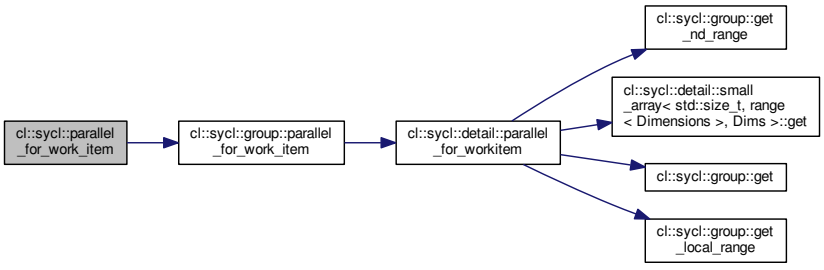
Todo Deprecate this function in the specification to use instead the group method

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 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.

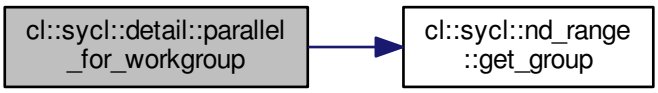
Definition at line 263 of file parallelism.hpp.

References cl::sycl::nd_range< Dimensions >::get_group().

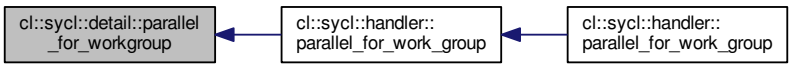
Referenced by cl::sycl::handler::parallel_for_work_group().

```
00264                                                 {
00265   // In a sequential execution there is only one index processed at a time
00266   group<Dimensions> g { r };
00267
00268   // First iterate on all the work-groups
00269   parallel_for_iterate<Dimensions,
00270                        range<Dimensions>,
00271                        ParallelForFunctor,
00272                        group<Dimensions>> {
00273     r.get_group(),
00274     f,
00275     g };
00276 }
```

Here is the call graph for this function:



Here is the caller graph for this function:



8.9.3.16 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 284 of file parallelism.hpp.

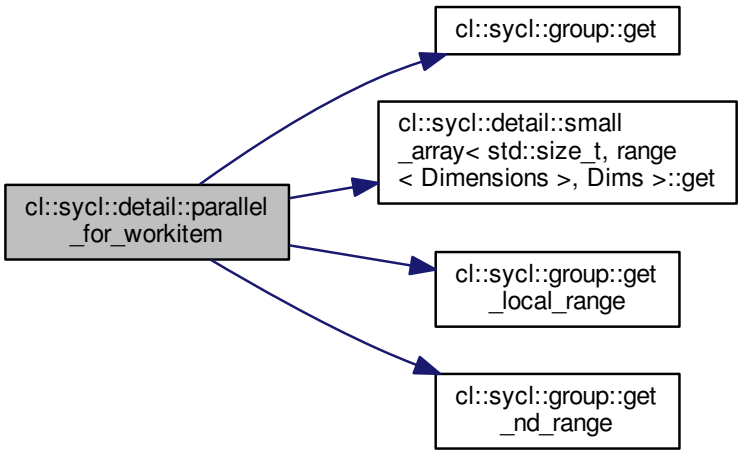
References cl::sycl::group< Dimensions >::get(), cl::sycl::detail::small_array< std::size_t, range< Dimensions >, Dims >::get(), cl::sycl::group< Dimensions >::get_local_range(), and cl::sycl::group< Dimensions >::get_nd_range().

Referenced by cl::sycl::group< Dimensions >::parallel_for_work_item().

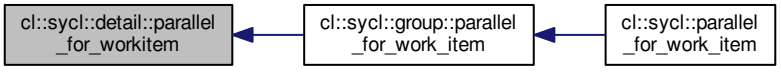
```
00285                                                    {
00286 #if defined(_OPENMP) && (!defined(TRISYCL_NO_BARRIER) && !defined(_MSC_VER))
00287   /* To implement barriers With OpenMP, one thread is created for each
00288      work-item in the group and thus an OpenMP barrier has the same effect
00289      of an OpenCL barrier executed by the work-items in a workgroup
00290
00291      The issue is that the parallel_for_workitem() execution is slow even
00292      when nd_item::barrier() is not used
00293   */
00294
00295
00296   // Is the above comment true anymore ?
00297   // Maybe the following will be enough
00298   // #ifdef _OPENMP
00299
00300   // With OMP, one task is created for each work-item in the group
00301
00302   range<Dimensions> l_r = g.get_nd_range().get_local();
00303   std::size_t tot = l_r.get(0);
00304   for (int i = 1; i < (int) Dimensions; ++i){
00305     tot *= l_r.get(i);
00306   }
00307 #pragma omp parallel
00308   {
00309 #pragma omp single nowait
00310     {
00311       for (int th_id = 0; th_id < tot; ++th_id) {
00312 #pragma omp task firstprivate(th_id)
00313         {
00314           nd_item<Dimensions> index { g.get_nd_range() };
00315           id<Dimensions> local; // to initialize correctly
00316
00317           if (Dimensions ==1) {
00318             local[0] = th_id;
00319           } else if (Dimensions == 2) {
00320             local[0] = th_id / l_r.get(1);
00321             local[1] = th_id - local[0]*l_r.get(1);
00322           } else if (Dimensions == 3) {
00323             int tmp = l_r.get(1)*l_r.get(2);
00324             local[0] = th_id / tmp;
00325             local[1] = (th_id - local[0]*tmp) / l_r.get(1);
00326             local[2] = th_id - local[0]*tmp - local[1]*l_r.get(1);
00327           }
00328           index.set_local(local);
00329           index.set_global(local + id<Dimensions>(l_r)*g.get());
00330           f(index);
00331         }
00332       }
00333     }
00334   }
00335 #else
00336   // In a sequential execution there is only one index processed at a time
00337   nd_item<Dimensions> index { g.get_nd_range() };
00338   // To iterate on the local work-item
00339   id<Dimensions> local;
00340
00341   // Reconstruct the nd_item from its group and local id
00342   auto reconstruct_item = [&] (id<Dimensions> l) {
```

```
00343     //local.display();
00344     //l.display();
00345     // Reconstruct the global nd_item
00346     index.set_local(local);
00347     // \todo Some strength reduction here
00348     index.set_global(local + id<Dimensions>(g.get_local_range())*g.get());
00349     // Call the user kernel at last
00350     f(index);
00351   };
00352
00353   // Then iterate on all the work-items of the work-group
00354   parallel_for_iterate<Dimensions,
00355                        range<Dimensions>,
00356                        decltype(reconstruct_item),
00357                        id<Dimensions>> {
00358     g.get_local_range(),
00359     reconstruct_item,
00360     local };
00361 #endif
00362 }
```

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 real_type=unsigned char, uchar4 is equivalent to vec<float, 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

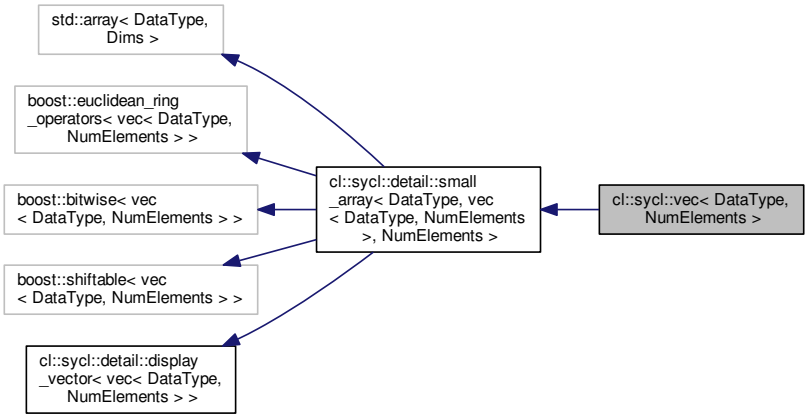
Todo move the implementation elsewhere

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

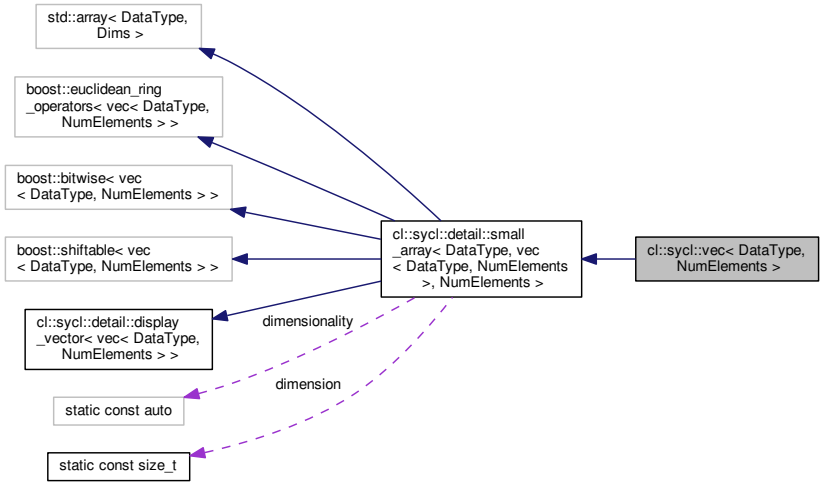
Todo rename in the specification element_type to value_type

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 template<typename DataType, size_t NumElements> using cl::sycl::vec< DataType, NumElements >::basic_type = typename detail::small_array<DataType, 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 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 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 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 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 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 #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 162 of file vec.hpp.

8.10.3.2 #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 real_type=unsigned char, uchar4 is equivalent to vec<float, 4>

Definition at line 158 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 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

  <T, Dimensions, Mode, Target>up data Data access and storage in SYCL
- class cl_exception

  Returns the OpenCL error code encapsulated in the exception. More...
- class cl_float3

  Wrapper of Boost::compute's cl_float3.
- 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...
- 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 >
- 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::vendor > () 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) TRISY↩
  CL_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 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 using cl::sycl::mutex_class = typedef std::mutex

Definition at line 69 of file default_classes.hpp.

9.2.1.3 template<class T > using cl::sycl::shared_ptr_class = typedef std::shared_ptr<T>

Definition at line 99 of file default_classes.hpp.

9.2.1.4 using cl::sycl::string_class = typedef std::string

Definition at line 40 of file default_classes.hpp.

9.2.1.5 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.

9.2.1.6 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.

9.2.1.7 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 template<typename T > T cl::sycl::min (T *x*, T *y*, T *z*)

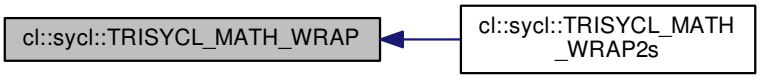
Definition at line 120 of file math.hpp.

```
00120                       {
00121   return std::min(x, std::min(y, z));
00122 }
```

9.2.2.2 cl::sycl::TRISYCL_MATH_WRAP (abs)

Referenced by TRISYCL_MATH_WRAP2s().

Here is the caller graph for this function:



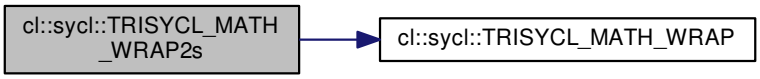
9.2.2.3 cl::sycl::TRISYCL_MATH_WRAP2s (modf)

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 T cl::sycl::y

Definition at line 109 of file math.hpp.

9.2.3.2 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 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 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 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.
- 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...
- 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_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_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>
  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

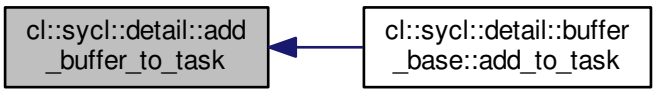
- TRISYCL_WEAK_ATTRIB_PREFIX detail::cache< cl_device_id, detail::opencl_device > opencl_device::cache TRISYCL_WEAK_ATTRIB_SUFFIX

9.4.1 Function Documentation

9.4.1.1 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]

Referenced by cl::sycl::detail::buffer_base::add_to_task().

Here is the caller graph for this function:



9.4.1.2 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 420 of file handler.hpp.

References cl::sycl::handler::task.

```
00422                                       {
00423   command_group_handler->task->add_buffer(b, is_write_mode);
00424   return command_group_handler->task;
00425 }
```

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_OPENCL =(= 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 using cl::sycl::info::gl_context_interop = typedef bool

Definition at line 31 of file context.hpp.

9.5.1.2 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 enum cl::sycl::info::context : int [strong]

Context information descriptors.

Todo Should be unsigned int to be consistent with others?

Enumerator

reference_count

num_devices

devices

gl_interop

Definition at line 37 of file context.hpp.

```
00037                   : int {
00038   reference_count,
00039   num_devices,
00040   devices,
00041   gl_interop
00042 };
```

9.5.2.2 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::device >
- struct hash< cl::sycl::kernel >
- struct hash< cl::sycl::platform >
- struct hash< cl::sycl::queue >

Chapter 10

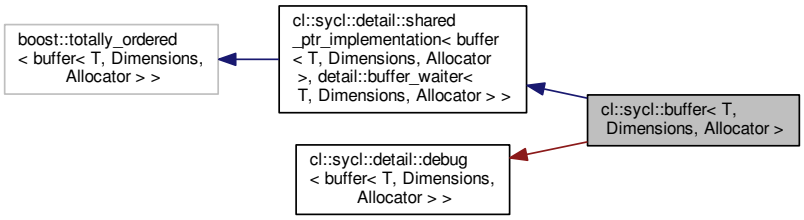
Class Documentation

10.1 cl::sycl::buffer< T, Dimensions, Allocator > Class Template Reference

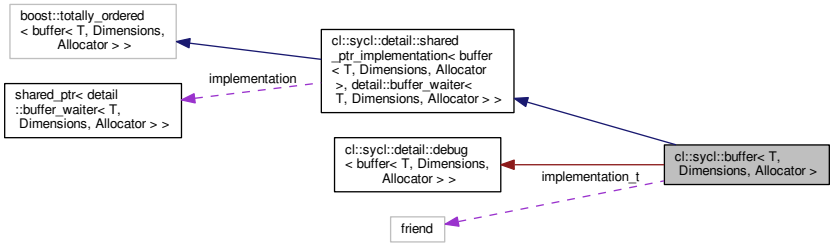
<T, Dimensions, Mode, Target>up data Data access and storage in SYCL

`#include <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.
- buffer (unique_ptr_class< T > &&host_data, const range< Dimensions > &r, Allocator allocator={})

  Create a new buffer which is initialized by 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.
- 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

10.1.1 Detailed Description

template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>>
class cl::sycl::buffer< T, Dimensions, Allocator >

<T, Dimensions, Mode, Target>up data Data access and storage in SYCL

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.

10.1.2 Member Typedef Documentation

10.1.2.1 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.

10.1.2.2 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.

10.1.2.3 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.

10.1.2.4 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.

10.1.2.5 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.

10.1.3 Constructor & Destructor Documentation

10.1.3.1 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.

10.1.3.2 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.

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

```
00113                                                                {})
00114     : implementation_t { detail::waiter(new detail::buffer<T, Dimensions>
00115                          { r }) }
00116       {}
```

Here is the call graph for this function:

10.1.3.3 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:

10.1.3.4 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:

10.1.3.5 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.

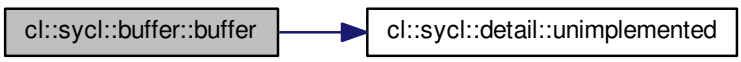
Todo update the specification to replace the pointer by a reference and provide the constructor with and without a mutex

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:



10.1.3.6 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:

10.1.3.7 template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>> cl::sycl::buffer< T, Dimensions, Allocator >::buffer (unique_ptr_class< T > && *host_data,* const range< Dimensions > & *r,* Allocator *allocator* = {}) [inline]

Create a new buffer which is initialized by host_data.

Parameters

in	*host_data*	points to the storage and values used to initialize 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 SYCL runtime receives full ownership of the host_data unique_ptr and there in effect there is no synchronization with the application code using host_data.

Todo Update the API to add template <typename D = std::default_delete<T>> because the unique_ptr_↩ class/std::unique_ptr have the destructor type as dependent

Definition at line 254 of file buffer.hpp.

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

```
00256                                {})
00257     : implementation_t { detail::waiter(new detail::buffer<T, Dimensions>
00258                          { std::move(host_data), r }) }
00259   {}
```

Here is the call graph for this function:

10.1.3.8 template<typename T, int Dimensions = 1, typename Allocator = buffer_allocator<std::remove_const_t<T>>> template<typename InputIterator , typename ValueType = typename std::iterator_traits<InputIterator>::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 299 of file buffer.hpp.

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

```
00301                                {}) :
00302     implementation_t { detail::waiter(new detail::buffer<T, Dimensions>
00303                         { start_iterator, end_iterator }) }
00304   {}
```

Here is the call graph for this function:

10.1.3.9 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

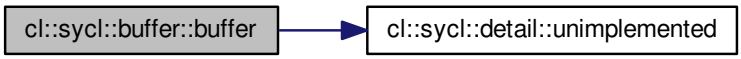
Todo Update the specification to replace index by id

Definition at line 321 of file buffer.hpp.

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

```
00324                                {}) { detail::unimplemented(); }
```

Here is the call graph for this function:



10.1.3.10 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

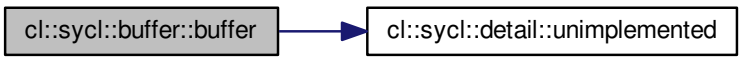
Todo Improve the specification to allow CLHPP objects too

Definition at line 348 of file buffer.hpp.

References cl::sycl::access::global_buffer, and cl::sycl::detail::unimplemented().

```
00350                                {},
00351          Allocator allocator = {}) { detail::unimplemented();  }
```

Here is the call graph for this function:



10.1.4 Member Function Documentation

10.1.4.1 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 374 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.

```
00374                                                {
00375     static_assert(Target == access::target::global_buffer
00376                   || Target == access::target::constant_buffer,
00377                   "get_access(handler) can only deal with access::global_buffer"
00378                   " or access::constant_buffer (for host_buffer accessor"
00379                   " do not use a command group handler");
00380     implementation->implementation->template track_access_mode<Mode, Target>();
00381     return { *this, command_group_handler };
00382   }
```

10.1.4.2 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 404 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.

```
00404                {
00405     static_assert(Target == access::target::host_buffer,
00406                   "get_access() without a command group handler is only"
00407                   " for host_buffer accessor");
00408     implementation->implementation->template track_access_mode<Mode, Target>();
00409     return { *this };
00410   }
```

10.1.4.3 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 434 of file buffer.hpp.

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

```
00434                          {
00435     return implementation->implementation->get_count();
00436   }
```

10.1.4.4 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 421 of file buffer.hpp.

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

```
00421                          {
00422     /* Interpret the shape which is a pointer to the first element as an
00423        array of Dimensions elements so that the range<Dimensions>
00424        constructor is happy with this collection
00425     */
00426     return implementation->implementation->get_range();
00427   }
```

10.1.4.5 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 447 of file buffer.hpp.

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

```
00447                            {
00448     return implementation->implementation->get_size();
00449   }
```

10.1.4.6 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 474 of file buffer.hpp.

```
00474                                      {
00475     return std::is_const<T>::value;
00476   }
```

10.1.4.7 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 388 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.

```
00388                           {
00389     return implementation->implementation->mark_as_written();
00390   }
```

10.1.4.8 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

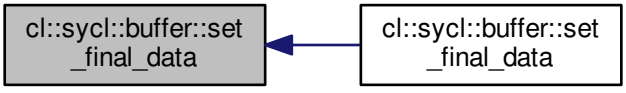
Definition at line 506 of file buffer.hpp.

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().

```
00506                                                  {
00507     implementation->implementation->set_final_data(std::move(finalData));
00508   }
```

Here is the caller graph for this function:



10.1.4.9 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 513 of file buffer.hpp.

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

```
00513                                                 {
00514     implementation->implementation->set_final_data(std::move(finalData));
00515   }
```

10.1.4.10 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 520 of file buffer.hpp.

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

```
00520                                       {
00521     implementation->implementation->set_final_data(nullptr);
00522   }
```

10.1.4.11 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 532 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().

```
00532                                           {
00533     implementation->implementation->
00534       set_final_data(std::forward<Iterator>(finalData));
00535   }
```

Here is the call graph for this function:

10.1.4.12 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 464 of file buffer.hpp.

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

```
00464                          {
00465     // Rely on the shared_ptr<> use_count()
00466     return implementation.use_count();
00467   }
```

10.1.5 Member Data Documentation

10.1.5.1 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.

The documentation for this class was generated from the following files:

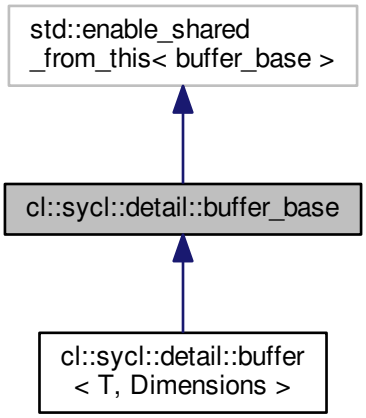
- include/CL/sycl/accessor.hpp
- include/CL/sycl/buffer.hpp

10.2 cl::sycl::detail::buffer_base Struct Reference

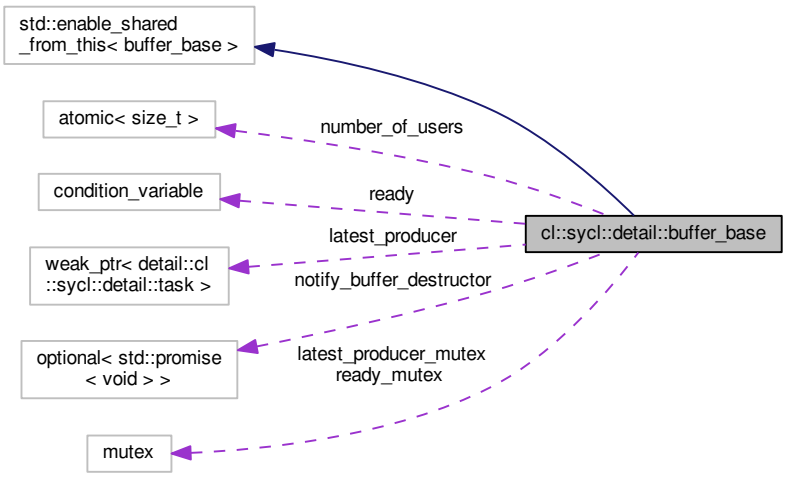
Factorize some template independent buffer aspects in a base class.

```
#include <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.
- ~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.

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.

10.2.1 Detailed Description

Factorize some template independent buffer aspects in a base class.

Definition at line 41 of file buffer_base.hpp.

10.2.2 Constructor & Destructor Documentation

10.2.2.1 cl::sycl::detail::buffer_base::buffer_base ( ) [inline]

Create a buffer base.

Definition at line 65 of file buffer_base.hpp.

```
00065 : number_of_users { 0 } {}
```

10.2.2.2 cl::sycl::detail::buffer_base::~buffer_base ( ) [inline]

The destructor wait for not being used anymore.

Definition at line 69 of file buffer_base.hpp.

References wait().

```
00069                 {
00070     wait();
00071     // If there is the last SYCL user buffer waiting, notify it
00072     if (notify_buffer_destructor)
00073       notify_buffer_destructor->set_value();
00074   }
```

Here is the call graph for this function:

10.2.3 Member Function Documentation

10.2.3.1 std::shared_ptr<detail::task> cl::sycl::detail::buffer_base::add_to_task (handler * *command_group_handler*, bool *is_write_mode*) [inline]

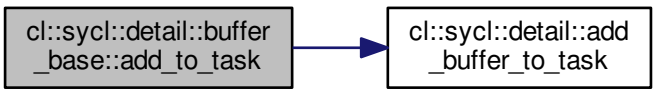
Add a buffer to the task running the command group.

Definition at line 126 of file buffer_base.hpp.

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

```
00126                                                                 {
00127     return add_buffer_to_task(command_group_handler,
00128                               shared_from_this(),
00129                               is_write_mode);
00130   }
```

Here is the call graph for this function:



10.2.3.2 std::shared_ptr<detail::task> cl::sycl::detail::buffer_base::get_latest_producer ( ) [inline]

Return the latest producer for the buffer.

Definition at line 103 of file buffer_base.hpp.

```
00103                                                 {
00104     std::lock_guard<std::mutex> lg { latest_producer_mutex };
00105     // Return the valid shared_ptr to the task, if any
00106     return latest_producer.lock();
00107   }
```

10.2.3.3 void cl::sycl::detail::buffer_base::release ( ) [inline]

A task has released the buffer.

Definition at line 95 of file buffer_base.hpp.

```
00095                 {
00096     if (--number_of_users == 0)
00097       // Notify the host consumers or the buffer destructor that it is ready
00098       ready.notify_all();
00099   }
```

10.2.3.4 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 114 of file buffer_base.hpp.

```
00114                                                                       {
00115     std::lock_guard<std::mutex> lg { latest_producer_mutex };
00116     using std::swap;
00117
00118     swap(newer_latest_producer, latest_producer);
00119     // Return the valid shared_ptr to the previous producing task, if any
00120     return newer_latest_producer.lock();
00121   }
```

10.2.3.5 void cl::sycl::detail::buffer_base::use ( ) [inline]

Mark this buffer in use by a task.

Definition at line 88 of file buffer_base.hpp.

References number_of_users.

```
00088             {
00089     // Increment the use count
00090     ++number_of_users;
00091   }
```

10.2.3.6 void cl::sycl::detail::buffer_base::wait ( ) [inline]

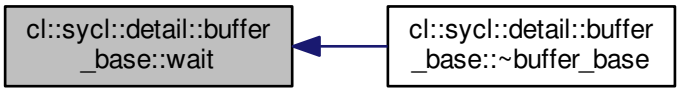
Wait for this buffer to be ready, which is no longer in use.

Definition at line 78 of file buffer_base.hpp.

Referenced by ~buffer_base().

```
00078               {
00079     std::unique_lock<std::mutex> ul { ready_mutex };
00080     ready.wait(ul, [&] {
00081         // When there is no producer for this buffer, we are ready to use it
00082         return number_of_users == 0;
00083       });
00084   }
```

Here is the caller graph for this function:



10.2.4 Member Data Documentation

10.2.4.1 std::weak_ptr<detail::task> cl::sycl::detail::buffer_base::latest_producer

Track the latest task to produce this buffer.

Definition at line 47 of file buffer_base.hpp.

10.2.4.2 std::mutex cl::sycl::detail::buffer_base::latest_producer_mutex

To protect the access to latest_producer.

Definition at line 49 of file buffer_base.hpp.

10.2.4.3 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 61 of file buffer_base.hpp.

Referenced by cl::sycl::detail::buffer< T, Dimensions >::get_destructor_future().

10.2.4.4 std::atomic<size_t> cl::sycl::detail::buffer_base::number_of_users

Definition at line 44 of file buffer_base.hpp.

Referenced by use().

10.2.4.5 std::condition_variable cl::sycl::detail::buffer_base::ready

To signal when this buffer ready.

Definition at line 52 of file buffer_base.hpp.

10.2.4.6 std::mutex cl::sycl::detail::buffer_base::ready_mutex

To protect the access to the condition variable.

Definition at line 54 of file buffer_base.hpp.

The documentation for this struct was generated from the following file:

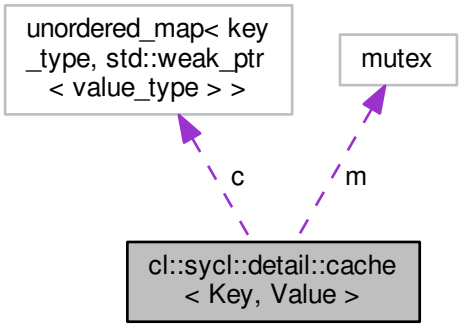
- include/CL/sycl/buffer/detail/buffer_base.hpp

10.3 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.

10.3.1 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.

10.3.2 Member Typedef Documentation

10.3.2.1 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.

10.3.2.2 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.

10.3.3 Member Function Documentation

10.3.3.1 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

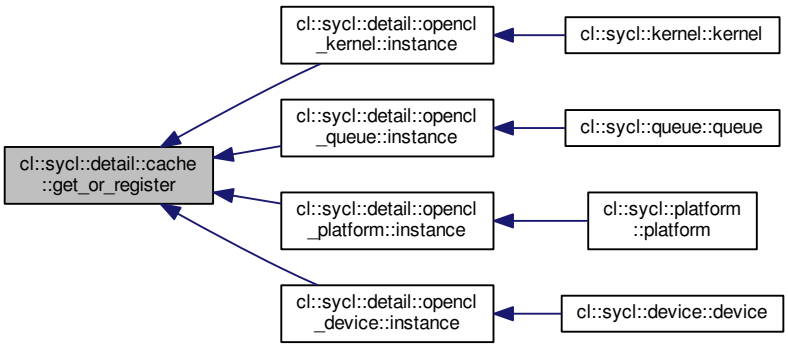
a shared_ptr to the value retrieved or inserted

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(), 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       // Return the found element
00069       return std::shared_ptr<value_type>{ i->second };
00070
00071     // Otherwise create and insert a new element
00072     std::shared_ptr<value_type> e { create_element() };
00073     c.insert({ k, e });
00074     return e;
00075   }
```

Here is the caller graph for this function:



10.3.3.2 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

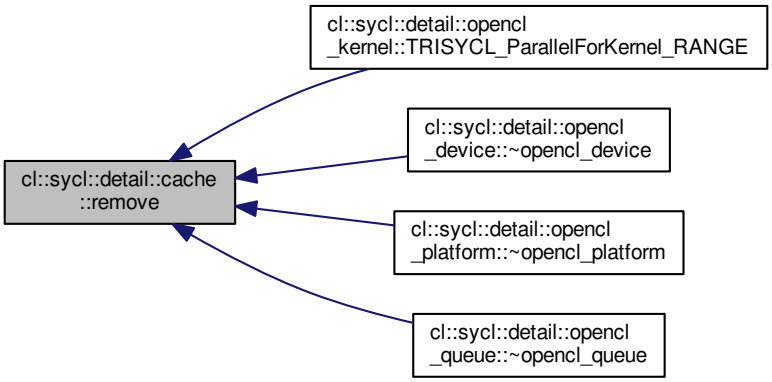
in	*k*	is the key associated to the value to remove from the cache

Definition at line 83 of file cache.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().

```
00083                                {
00084     std::lock_guard<std::mutex> lg { m };
00085     c.erase(k);
00086   }
```

Here is the caller graph for this function:



10.3.4 Member Data Documentation

10.3.4.1 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.

10.3.4.2 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:

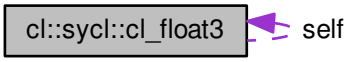
- include/CL/sycl/detail/cache.hpp

10.4 cl::sycl::cl_float3 Class Reference

Wrapper of Boost::compute's cl_float3.

`#include <opencl_type.hpp>`

Collaboration diagram for cl::sycl::cl_float3:



Public Member Functions

- cl_float3 ()=default
- cl_float3 (::cl_float3 self_)
- cl_float3 (float x, float y, float z)
- auto & x ()
- auto & y ()
- auto & z ()

Private Attributes

- ::cl_float3 self

10.4.1 Detailed Description

Wrapper of Boost::compute's cl_float3.

Definition at line 18 of file opencl_type.hpp.

10.4.2 Constructor & Destructor Documentation

10.4.2.1 cl::sycl::cl_float3::cl_float3 ( ) [default]

10.4.2.2 cl::sycl::cl_float3::cl_float3 (::cl_float3 *self_*) [inline]

Definition at line 27 of file opencl_type.hpp.

```
00027                               : self { self_ }
00028   {}
```

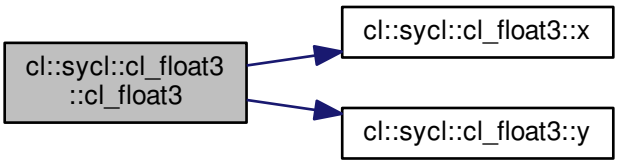
10.4.2.3 cl::sycl::cl_float3::cl_float3 (float *x*, float *y*, float *z*) [inline]

Definition at line 31 of file opencl_type.hpp.

References x(), and y().

```
00031                                       : self { x, y, z }
00032   {}
```

Here is the call graph for this function:



10.4.3 Member Function Documentation

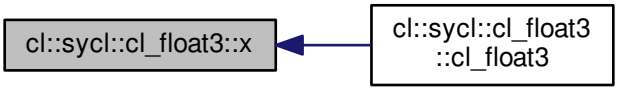
10.4.3.1 auto& cl::sycl::cl_float3::x ( ) [inline]

Definition at line 37 of file opencl_type.hpp.

Referenced by cl_float3().

```
00037             {
00038     return self.s[0];
00039   }
```

Here is the caller graph for this function:



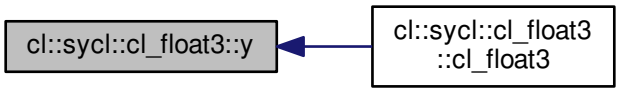
10.4.3.2 auto& cl::sycl::cl_float3::y ( ) [inline]

Definition at line 44 of file opencl_type.hpp.

Referenced by cl_float3().

```
00044             {
00045     return self.s[1];
00046   }
```

Here is the caller graph for this function:



10.4.3.3 auto& cl::sycl::cl_float3::z ( ) [inline]

Definition at line 51 of file opencl_type.hpp.

```
00051             {
00052     return self.s[2];
00053   }
```

10.4.4 Member Data Documentation

10.4.4.1 ::cl_float3 cl::sycl::cl_float3::self [private]

Definition at line 20 of file opencl_type.hpp.

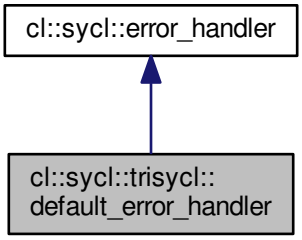
The documentation for this class was generated from the following file:

- include/CL/sycl/opencl_type.hpp

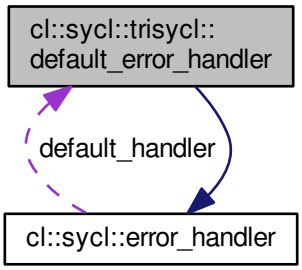
10.5 cl::sycl::trisycl::default_error_handler Struct Reference

`#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

10.5.1 Detailed Description

Definition at line 49 of file error_handler.hpp.

10.5.2 Member Function Documentation

10.5.2.1 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 51 of file error_handler.hpp.

```
00051                                          {
00052     }
```

The documentation for this struct was generated from the following file:

- include/CL/sycl/error_handler.hpp

10.6 cl::sycl::event Class Reference

`#include <event.hpp>`

Public Member Functions

- event ()=default

10.6.1 Detailed Description

Definition at line 14 of file event.hpp.

10.6.2 Constructor & Destructor Documentation

10.6.2.1 cl::sycl::event::event ( ) [default]

The documentation for this class was generated from the following file:

- include/CL/sycl/event.hpp

10.7 handler_event Class Reference

Handler event.

`#include <handler_event.hpp>`

10.7.1 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

10.8 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

10.8.1 Detailed Description

template<typename T, int Dimensions, typename Allocator>
struct std::hash< cl::sycl::buffer< T, Dimensions, Allocator > >

Definition at line 554 of file buffer.hpp.

10.8.2 Member Function Documentation

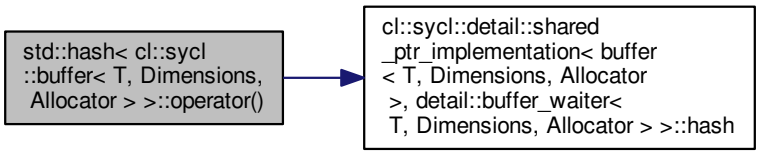
10.8.2.1 template<typename T , int Dimensions, typename Allocator > auto std::hash< cl::sycl::buffer< T, Dimensions, Allocator > >::operator() (const cl::sycl::buffer< T, Dimensions, Allocator > & *b*) const [inline]

Definition at line 556 of file buffer.hpp.

References cl::sycl::detail::shared_ptr_implementation< buffer< T, Dimensions, Allocator >, detail::buffer_waiter< T, Dimensions, Allocator > >::hash().

```
00556                                                                    {
00557     // Forward the hashing to the implementation
00558     return b.hash();
00559   }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

- include/CL/sycl/buffer.hpp

10.9 std::hash< cl::sycl::device > Struct Template Reference

`#include <device.hpp>`

Public Member Functions

- auto operator() (const cl::sycl::device &d) const

10.9.1 Detailed Description

template<>
struct std::hash< cl::sycl::device >

Definition at line 288 of file device.hpp.

10.9.2 Member Function Documentation

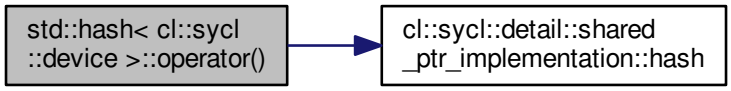
10.9.2.1 auto std::hash< cl::sycl::device >::operator() (const cl::sycl::device & *d*) const [inline]

Definition at line 290 of file device.hpp.

References cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash().

```
00290                                          {
00291     // Forward the hashing to the implementation
00292     return d.hash();
00293   }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

- include/CL/sycl/device.hpp

10.10 std::hash< cl::sycl::kernel > Struct Template Reference

`#include <kernel.hpp>`

Public Member Functions

- auto operator() (const cl::sycl::kernel &k) const

10.10.1 Detailed Description

template<>
struct std::hash< cl::sycl::kernel >

Definition at line 125 of file kernel.hpp.

10.10.2 Member Function Documentation

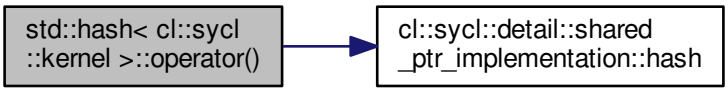
10.10.2.1 auto std::hash< cl::sycl::kernel >::operator() (const cl::sycl::kernel & *k*) const [inline]

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

10.11 std::hash< cl::sycl::platform > Struct Template Reference

`#include <platform.hpp>`

Public Member Functions

- auto operator() (const cl::sycl::platform &p) const

10.11.1 Detailed Description

template<>
struct std::hash< cl::sycl::platform >

Definition at line 191 of file platform.hpp.

10.11.2 Member Function Documentation

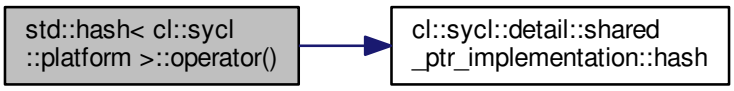
10.11.2.1 auto std::hash< cl::sycl::platform >::operator() (const cl::sycl::platform & *p*) const [inline]

Definition at line 193 of file platform.hpp.

References cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash().

```
00193                                                {
00194     // Forward the hashing to the implementation
00195     return p.hash();
00196   }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

- include/CL/sycl/platform.hpp

10.12 std::hash< cl::sycl::queue > Struct Template Reference

`#include <queue.hpp>`

Public Member Functions

- auto operator() (const cl::sycl::queue &q) const

10.12.1 Detailed Description

template<>
struct std::hash< cl::sycl::queue >

Definition at line 366 of file queue.hpp.

10.12.2 Member Function Documentation

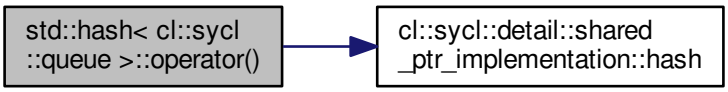
10.12.2.1 auto std::hash< cl::sycl::queue >::operator() (const cl::sycl::queue & *q*) const [inline]

Definition at line 368 of file queue.hpp.

References cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash().

```
00368                                          {
00369     // Forward the hashing to the implementation
00370     return q.hash();
00371   }
```

Here is the call graph for this function:



The documentation for this struct was generated from the following file:

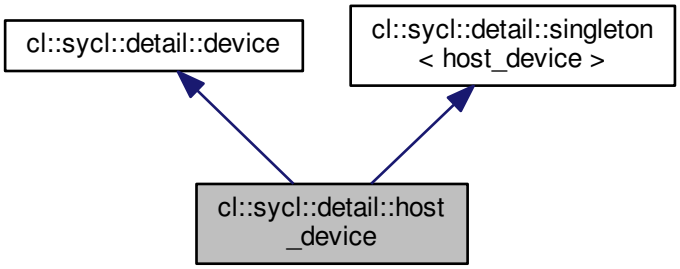
- include/CL/sycl/queue.hpp

10.13 cl::sycl::detail::host_device Class Reference

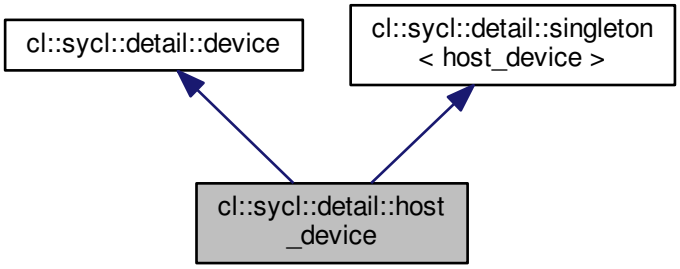
SYCL host device.

```
#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.
- 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

10.13.1 Detailed Description

SYCL host device.

Todo The implementation is quite minimal for now. :-)

Definition at line 31 of file host_device.hpp.

10.13.2 Member Function Documentation

10.13.2.1 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   }
```

10.13.2.2 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

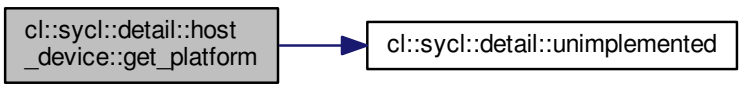
Implements cl::sycl::detail::device.

Definition at line 78 of file host_device.hpp.

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

```
00078                                              {
00079     detail::unimplemented();
00080     return {};
00081   }
```

Here is the call graph for this function:



10.13.2.3 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

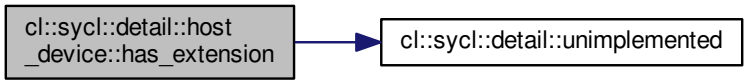
Implements cl::sycl::detail::device.

Definition at line 102 of file host_device.hpp.

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

```
00102                                                                  {
00103     detail::unimplemented();
00104     return {};
00105   }
```

Here is the call graph for this function:



10.13.2.4 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 67 of file host_device.hpp.

```
00067                                      {
00068     return false;
00069   }
```

10.13.2.5 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 55 of file host_device.hpp.

```
00055                                {
00056     return false;
00057   }
```

10.13.2.6 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 61 of file host_device.hpp.

```
00061                                {
00062     return false;
00063   }
```

10.13.2.7 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 49 of file host_device.hpp.

```
00049                                {
00050     return true;
00051   }
```

The documentation for this class was generated from the following file:

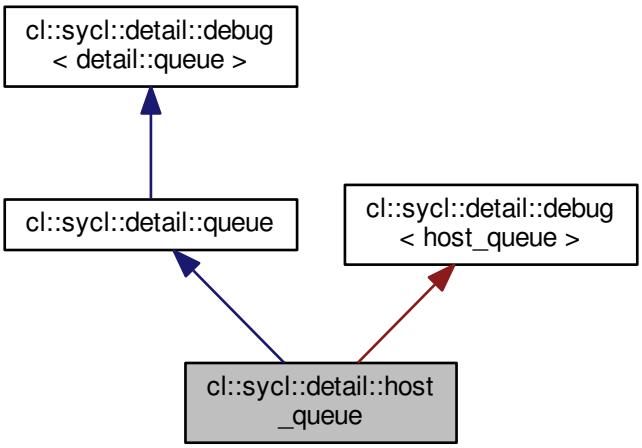
- include/CL/sycl/device/detail/host_device.hpp

10.14 cl::sycl::detail::host_queue Class Reference

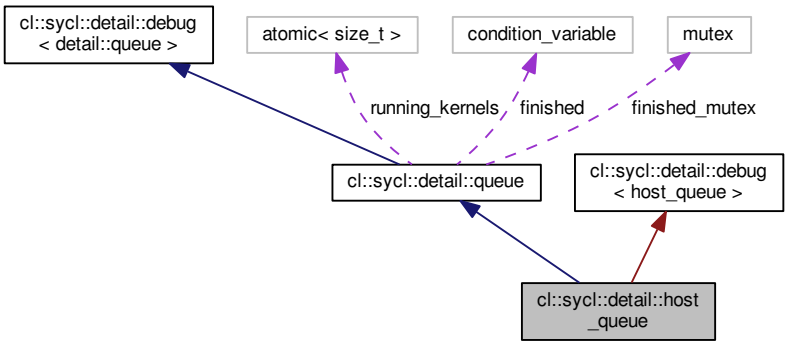
Some implementation details about the SYCL queue.

`#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

10.14.1 Detailed Description

Some implementation details about the SYCL queue.

Todo Once a triSYCL queue is no longer blocking, make this a singleton

Definition at line 29 of file host_queue.hpp.

10.14.2 Member Function Documentation

10.14.2.1 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 38 of file host_queue.hpp.

```
00038                                       {
00039     throw non_cl_error("The host queue has no OpenCL command queue");
00040   }
```

10.14.2.2 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 48 of file host_queue.hpp.

```
00048                                                    {
00049     throw non_cl_error("The host queue has no OpenCL command queue");
00050   }
```

10.14.2.3 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 55 of file host_queue.hpp.

```
00055                                          {
00056     // Return the default context which is the host context
00057     return {};
00058   }
```

10.14.2.4 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 62 of file host_queue.hpp.

```
00062                                         {
00063     // Return the default device which is the host device
00064     return {};
00065   }
```

10.14.2.5 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 69 of file host_queue.hpp.

```
00069                                {
00070     return true;
00071   }
```

The documentation for this class was generated from the following file:

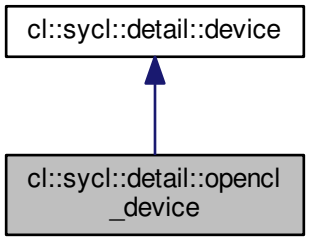
- include/CL/sycl/queue/detail/host_queue.hpp

10.15 cl::sycl::detail::opencl_device Class Reference

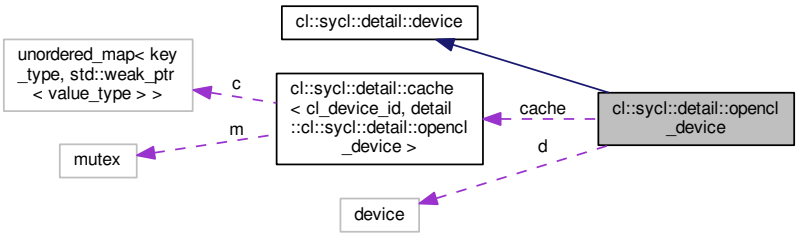
SYCL OpenCL device.

`#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.
- 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 built 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 cl::sycl::detail::opencl_device::opencl_device (const boost::compute::device & *d*) [inline], [private]

Only the instance factory can built it.

Definition at line 123 of file opencl_device.hpp.

```
00123 : d { d } {}
```

10.15.2.2 cl::sycl::detail::opencl_device::~opencl_device ( ) [inline], [override]

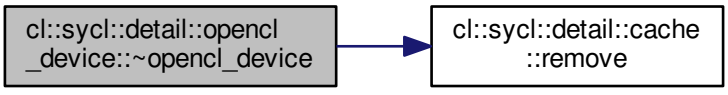
Unregister from the cache on destruction.

Definition at line 128 of file opencl_device.hpp.

References cache, cl::sycl::detail::cache< Key, Value >::remove(), and TRISYCL_WEAK_ATTRIB_PREFIX.

```
00128                                {
00129     cache.remove(d.id());
00130   }
```

Here is the call graph for this function:



10.15.3 Member Function Documentation

10.15.3.1 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 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.

Todo To be implemented

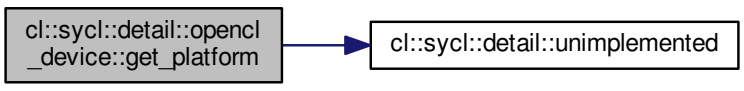
Implements cl::sycl::detail::device.

Definition at line 83 of file opencl_device.hpp.

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

```
00083                                              {
00084     detail::unimplemented();
00085     return {};
00086   }
```

Here is the call graph for this function:



10.15.3.3 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

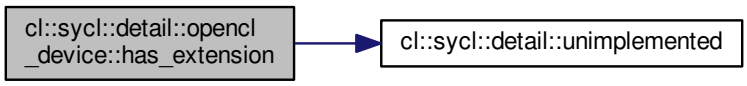
Implements cl::sycl::detail::device.

Definition at line 107 of file opencl_device.hpp.

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

```
00107                                                                    {
00108     detail::unimplemented();
00109     return {};
00110   }
```

Here is the call graph for this function:



10.15.3.4 static std::shared_ptr<opencl_device> cl::sycl::detail::opencl_device::instance (const boost::compute::device & *d*) [inline], [static]

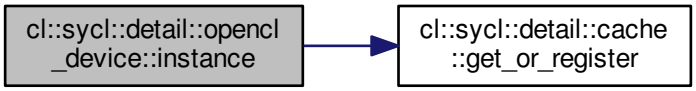
Definition at line 115 of file opencl_device.hpp.

References cl::sycl::detail::cache< Key, Value >::get_or_register().

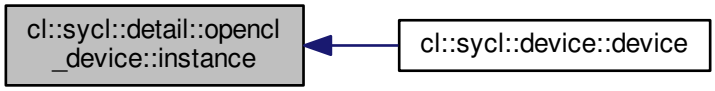
Referenced by cl::sycl::device::device().

```
00115                                        {
00116     return cache.get_or_register(d.id(),
00117                                  [&] { return new opencl_device { d }; });
00118   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



10.15.3.5 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 71 of file opencl_device.hpp.

```
00071                                       {
00072     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00073     return d.type() & boost::compute::device::accelerator;
00074   }
```

10.15.3.6 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 57 of file opencl_device.hpp.

```
00057                                 {
00058     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00059     return d.type() & boost::compute::device::cpu;
00060   }
```

10.15.3.7 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 64 of file opencl_device.hpp.

```
00064                                 {
00065     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00066     return d.type() & boost::compute::device::gpu;
00067   }
```

10.15.3.8 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 51 of file opencl_device.hpp.

```
00051                                {
00052     return false;
00053   }
```

10.15.4 Member Data Documentation

10.15.4.1 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 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.

The documentation for this class was generated from the following file:

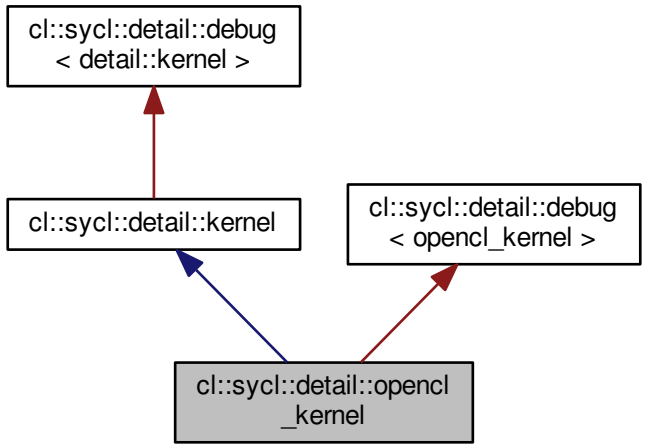
- include/CL/sycl/device/detail/opencl_device.hpp

10.16 cl::sycl::detail::opencl_kernel Class Reference

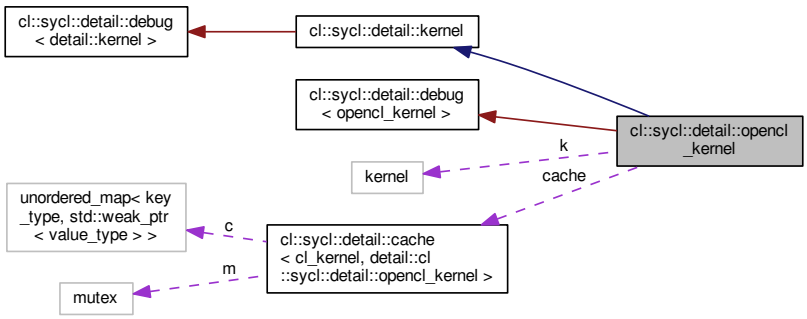
An abstraction of the OpenCL kernel.

`#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.
- 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 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 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 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.

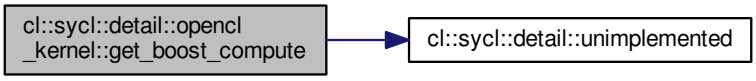
Implements cl::sycl::detail::kernel.

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 static std::shared_ptr<opencl_kernel> cl::sycl::detail::opencl_kernel::instance (const boost::compute::kernel & *k*) [inline], [static]

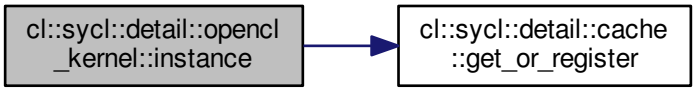
Definition at line 48 of file opencl_kernel.hpp.

References cl::sycl::detail::cache< Key, Value >::get_or_register().

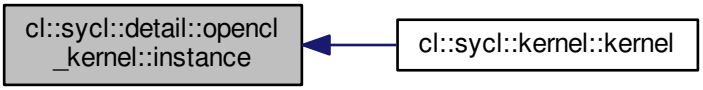
Referenced by cl::sycl::kernel::kernel().

```
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 cl::sycl::detail::opencl_kernel::TRISYCL_ParallelForKernel_RANGE (1) [inline],[override]

Unregister from the cache on destruction.

Definition at line 111 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.

```
00118                                {
00119     cache.remove(k.get());
00120   }
```

Here is the call graph for this function:

10.16.4 Member Data Documentation

10.16.4.1 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 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:

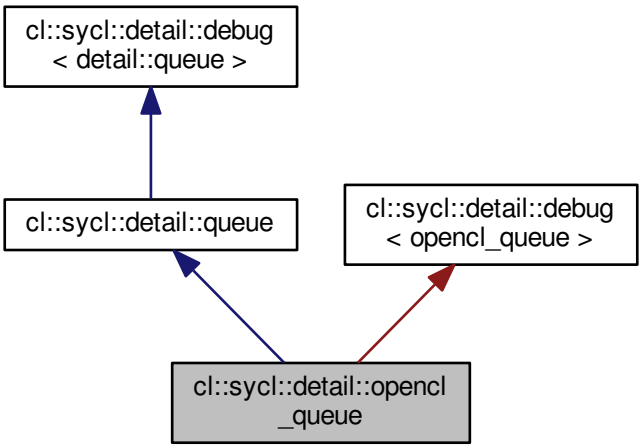
- include/CL/sycl/kernel/detail/opencl_kernel.hpp

10.17 cl::sycl::detail::opencl_queue Class Reference

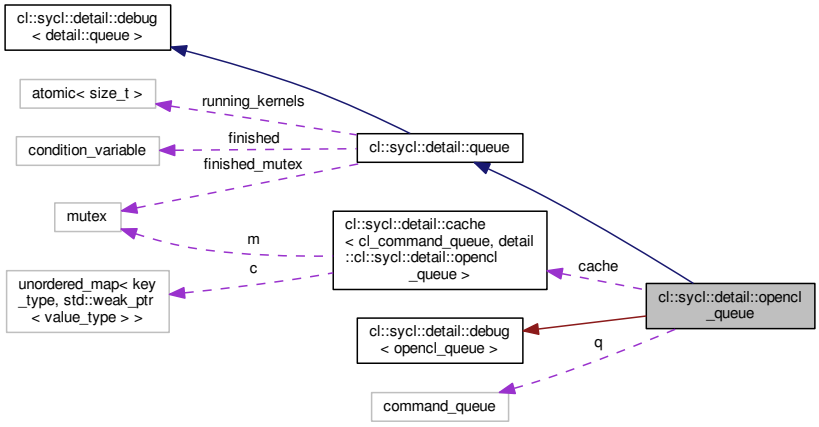
Some implementation details about the SYCL queue.

```
#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)

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 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 69 of file opencl_queue.hpp.

```
00069 : q { q } {}
```

10.17.2.2 cl::sycl::detail::opencl_queue::~opencl_queue ( ) [inline], [override]

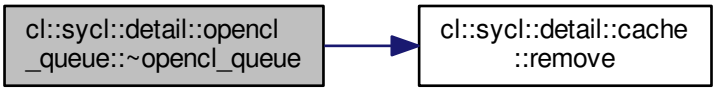
Unregister from the cache on destruction.

Definition at line 82 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.

```
00082                           {
00083     cache.remove(q.get());
00084   }
```

Here is the call graph for this function:



10.17.3 Member Function Documentation

10.17.3.1 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 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 cl::sycl::context cl::sycl::detail::opencl_queue::get_context ( ) const [inline], [override], [private], [virtual]

Return the SYCL context associated to the queue.

Todo Finish context

Implements cl::sycl::detail::queue.

Definition at line 49 of file opencl_queue.hpp.

```
00049                                          {
00050 //    return q.get_context();
00051     return {};
00052   }
```

10.17.3.4 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 56 of file opencl_queue.hpp.

```
00056                                                {
00057     return q.get_device();
00058   }
```

10.17.3.5 static std::shared_ptr<opencl_queue> cl::sycl::detail::opencl_queue::instance (const boost::compute::command_queue & *q*) [inline], [static]

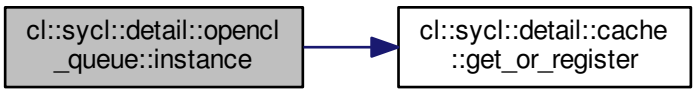
Definition at line 75 of file opencl_queue.hpp.

References cl::sycl::detail::cache< Key, Value >::get_or_register().

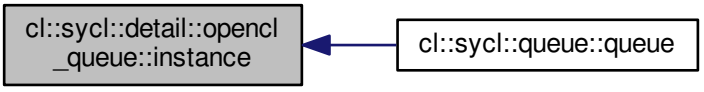
Referenced by cl::sycl::queue::queue().

```
00075                                                    {
00076     return cache.get_or_register(q.get(),
00077                                  [&] { return new opencl_queue { q }; });
00078   }
```

Here is the call graph for this function:



Here is the caller graph for this function:



10.17.3.6 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 62 of file opencl_queue.hpp.

```
00062                                {
00063     return false;
00064   }
```

10.17.4 Member Data Documentation

10.17.4.1 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 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:

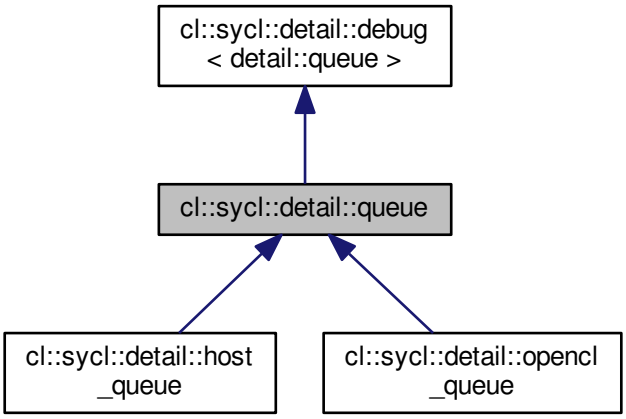
- include/CL/sycl/info/param_traits.hpp

10.19 cl::sycl::detail::queue Struct Reference

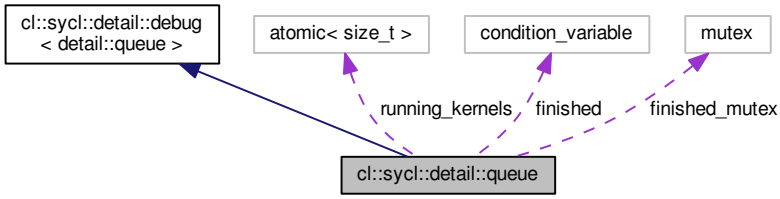
Some implementation details about the SYCL queue.

`#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 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 virtual cl::sycl::detail::queue::~queue ( ) [inline], [virtual]

Wait for all kernel completion before the queue destruction.

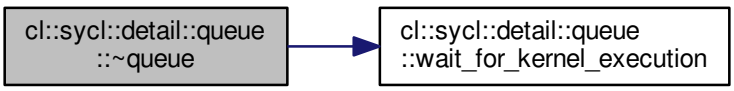
Todo Update according spec since queue destruction is non blocking

Definition at line 114 of file queue.hpp.

References wait_for_kernel_execution().

```
00114                   {
00115     wait_for_kernel_execution();
00116   }
```

Here is the call graph for this function:



10.19.3 Member Function Documentation

10.19.3.1 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.

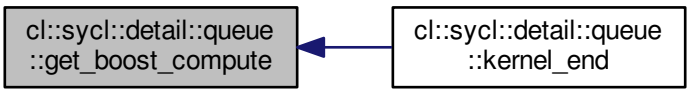
10.19.3.2 virtual boost::compute::command_queue& cl::sycl::detail::queue::get_boost_compute ( ) [pure virtual]

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 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 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 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 void cl::sycl::detail::queue::kernel_end ( ) [inline]

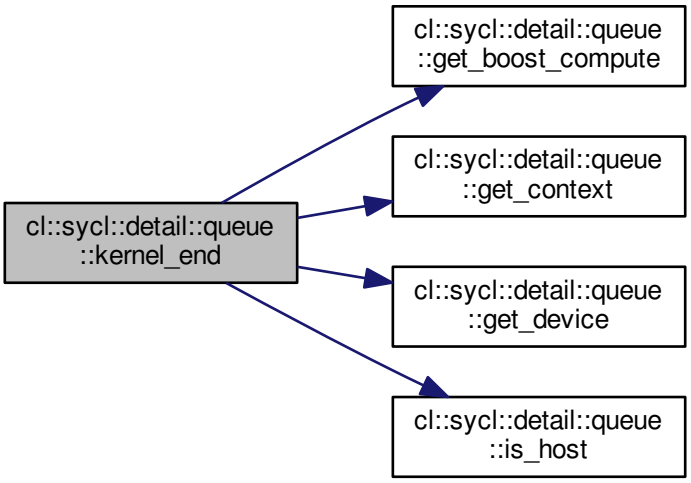
Signal that a new kernel finished on this queue.

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       finished.notify_one();
00072     }
00073   }
```

Here is the call graph for this function:



10.19.3.7 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 void cl::sycl::detail::queue::wait_for_kernel_execution ( ) [inline]

Wait for all kernel completion.

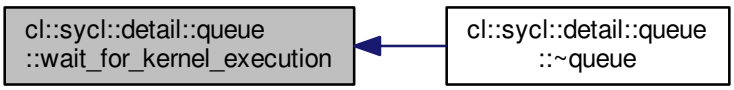
Definition at line 47 of file queue.hpp.

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 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 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 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:

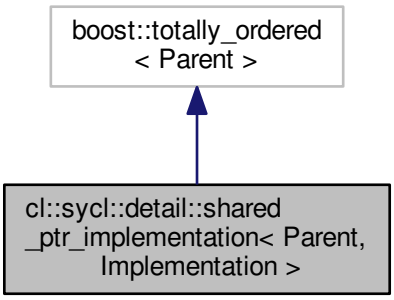
- include/CL/sycl/queue/detail/queue.hpp

10.20 cl::sycl::detail::shared_ptr_implementation< Parent, Implementation > Struct Template Reference

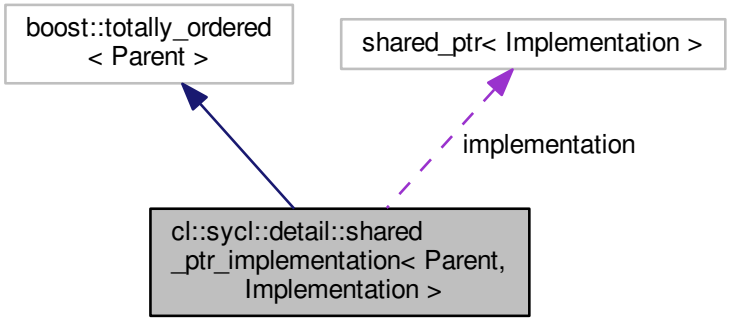
Provide an implementation as shared_ptr with total ordering and hashing to be used with algorithms and in (un)ordered containers.

`#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 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 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.

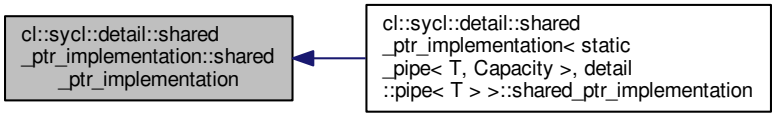
```
00051 : implementation { i } {}
```

10.20.2.3 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 template<typename Parent, typename Implementation> auto cl::sycl::detail::shared_ptr_implementation< Parent, Implementation >::hash ( ) const [inline]

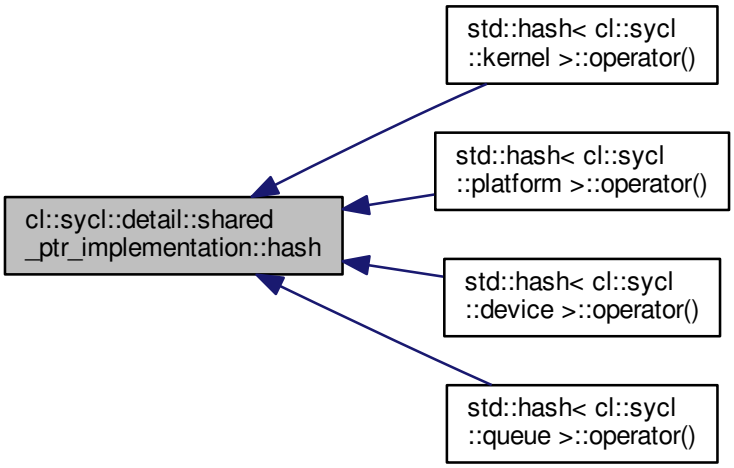
Forward the hashing for unordered containers to the implementation.

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::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 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 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 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().

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 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:

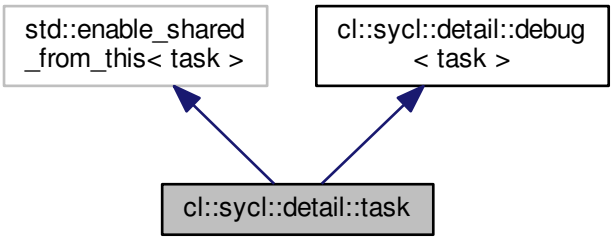
- include/CL/sycl/detail/singleton.hpp

10.22 cl::sycl::detail::task Struct Reference

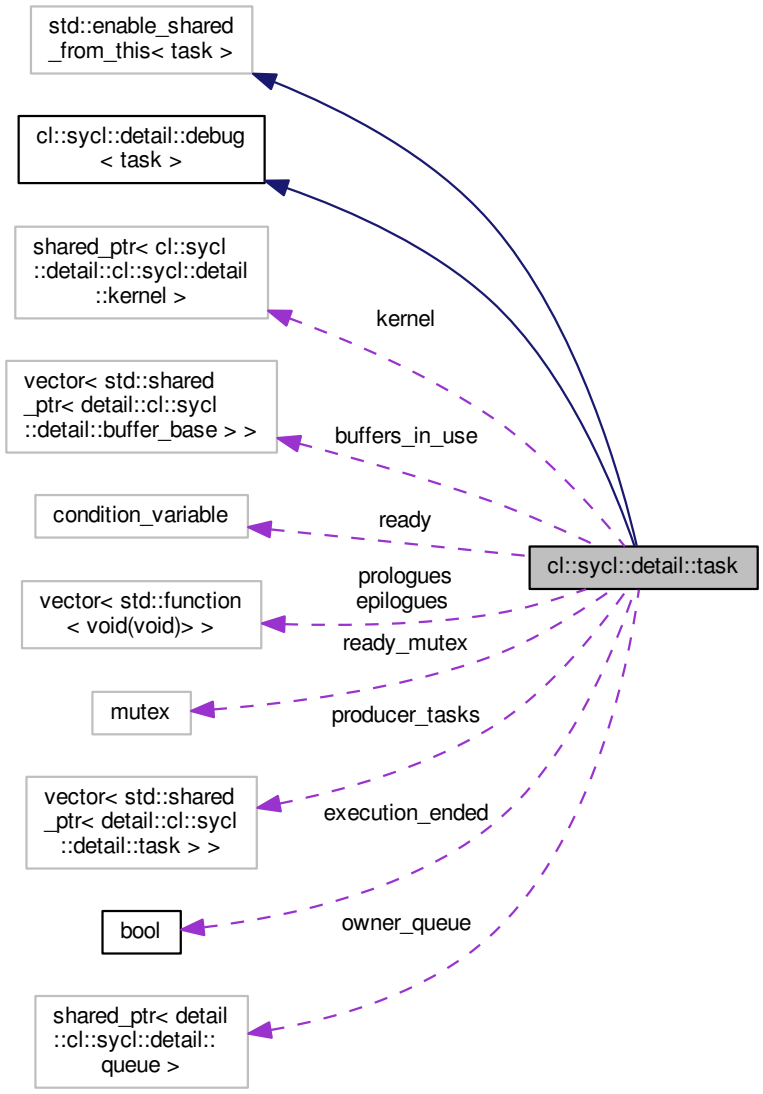
The abstraction to represent SYCL tasks executing inside command_group.

`#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 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 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 167 of file task.hpp.

References TRISYCL_DUMP_T.

```
00168                                     {
00169     TRISYCL_DUMP_T("Add buffer " << buf << " in task " << this);
00170     /* Keep track of the use of the buffer to notify its release at
00171        the end of the execution */
00172     buffers_in_use.push_back(buf);
00173     // To be sure the buffer does not disappear before the kernel can run
00174     buf->use();
00175
00176     std::shared_ptr<detail::task> latest_producer;
00177     if (is_write_mode) {
00178       /* Set this task as the latest producer of the buffer so that
00179          another kernel may wait on this task */
00180       latest_producer = buf->set_latest_producer(shared_from_this());
00181     }
00182     else
00183       latest_producer = buf->get_latest_producer();
00184
00185     /* If the buffer is to be produced by a task, add the task in the
00186        producer list to wait on it before running the task core */
00187     if (latest_producer)
00188       producer_tasks.push_back(latest_producer);
00189   }
```

10.22.3.2 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 219 of file task.hpp.

```
00219                                                 {
00220     epilogues.push_back(f);
00221   }
```

10.22.3.3 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 213 of file task.hpp.

```
00213                                                  {
00214     prologues.push_back(f);
00215   }
```

10.22.3.4 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 240 of file task.hpp.

References kernel.

```
00240                                    {
00241     if (!kernel)
00242       throw non_cl_error("Cannot use an OpenCL kernel in this context");
00243     return *kernel;
00244   }
```

10.22.3.5 auto cl::sycl::detail::task::get_queue ( ) [inline]

Get the queue behind the task to run a kernel on.

Definition at line 225 of file task.hpp.

References owner_queue.

```
00225                     {
00226     return owner_queue;
00227   }
```

10.22.3.6 void cl::sycl::detail::task::notify_consumers ( ) [inline]

Notify the waiting tasks that we are done.

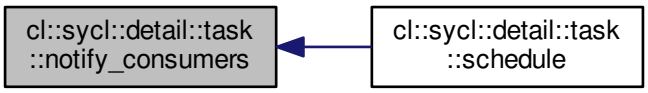
Definition at line 143 of file task.hpp.

References TRISYCL_DUMP_T.

Referenced by schedule().

```
00143                           {
00144     TRISYCL_DUMP_T("Notify all the task waiting for this task " << this);
00145     execution_ended = true;
00146     /* \todo Verify that the memory model with the notify does not
00147        require some fence or atomic */
00148     ready.notify_all();
00149   }
```

Here is the caller graph for this function:



10.22.3.7 void cl::sycl::detail::task::postlude ( ) [inline]

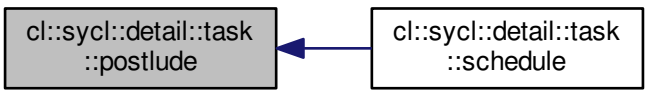
Execute the epilogues.

Definition at line 203 of file task.hpp.

Referenced by schedule().

```
00203                   {
00204     for (const auto &p : epilogues)
00205       p();
00206     /* Free the functors that may own an accessor owning a buffer
00207        preventing the command group to complete */
00208     epilogues.clear();
00209   }
```

Here is the caller graph for this function:



10.22.3.8 void cl::sycl::detail::task::prelude ( ) [inline]

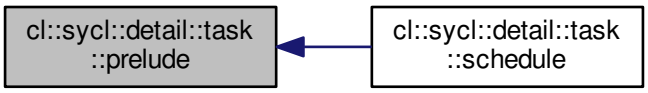
Execute the prologues.

Definition at line 193 of file task.hpp.

Referenced by schedule().

```
00193                 {
00194     for (const auto &p : prologues)
00195       p();
00196     /* Free the functors that may own an accessor owning a buffer
00197        preventing the command group to complete */
00198     prologues.clear();
00199   }
```

Here is the caller graph for this function:



10.22.3.9 void cl::sycl::detail::task::release_buffers ( ) [inline]

Release the buffers that have been used by this task.

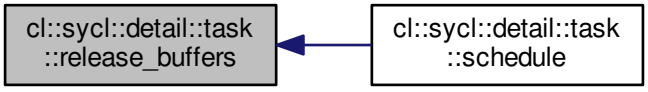
Definition at line 134 of file task.hpp.

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 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

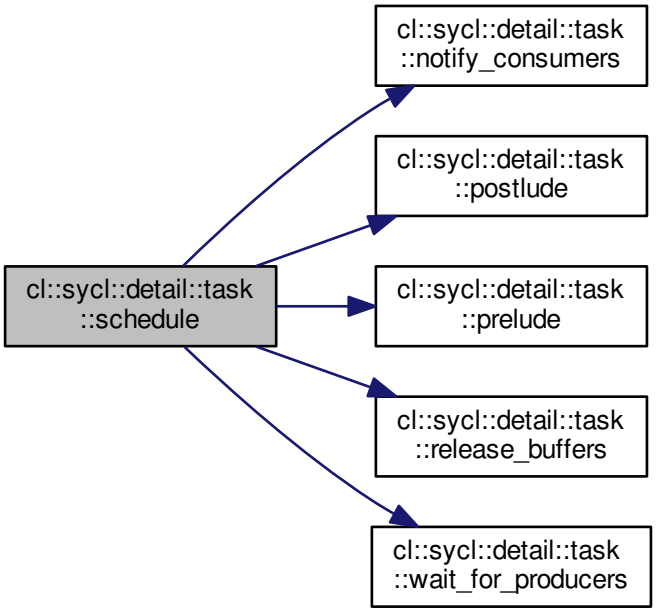
Todo This is an issue if there is an exception in the kernel

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 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 231 of file task.hpp.

```
00231                                                          {
00232     kernel = k;
00233   }
```

10.22.3.12 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 156 of file task.hpp.

References execution_ended, and TRISYCL_DUMP_T.

```
00156               {
00157     TRISYCL_DUMP_T("The task wait for task " << this << " to end");
00158     std::unique_lock<std::mutex> ul { ready_mutex };
00159     ready.wait(ul, [&] { return execution_ended; });
00160   }
```

10.22.3.13 void cl::sycl::detail::task::wait_for_producers ( ) [inline]

Wait for the required producer tasks to be ready.

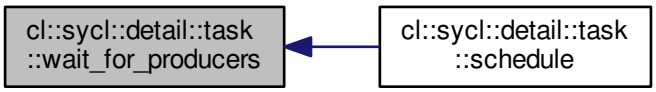
Definition at line 124 of file task.hpp.

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 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 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 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 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 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 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 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 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 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

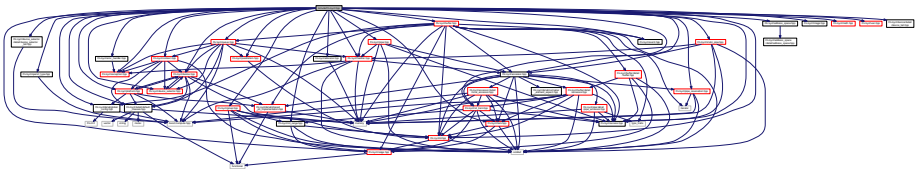
Chapter 11

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_type.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 dependency graph for sycl.hpp:



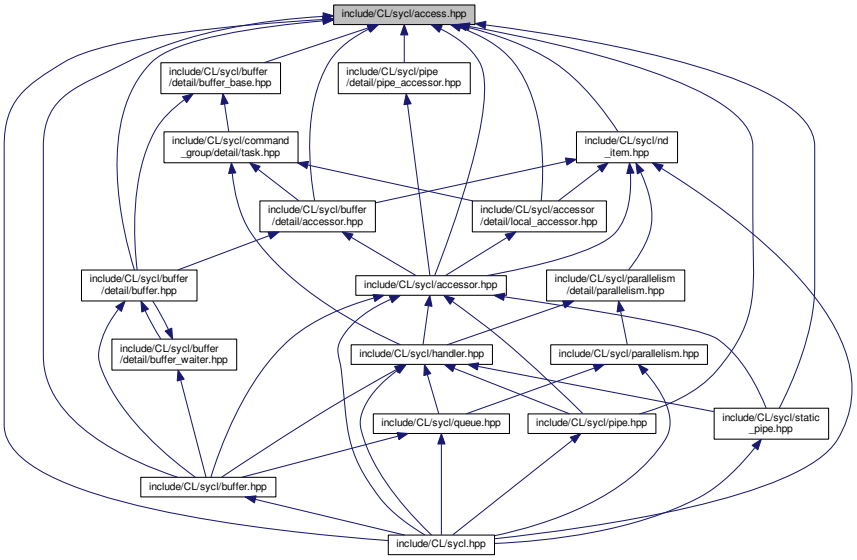
11.2 sycl.hpp

```
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_type.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
00069 /*
00070     # Some Emacs stuff:
00071     ### Local Variables:
00072     ### ispell-local-dictionary: "american"
00073     ### eval: (flyspell-prog-mode)
00074     ### End:
00075 */
```

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

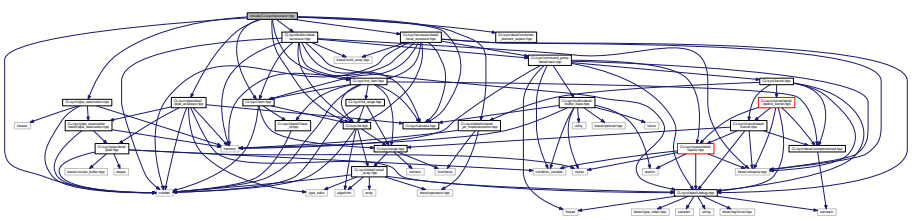
```
00001 #ifndef TRISYCL_SYCL_ACCESS_HPP
00002 #define TRISYCL_SYCL_ACCESS_HPP
00003
00004 /** \file The OpenCL SYCL access naming space
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT 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
```

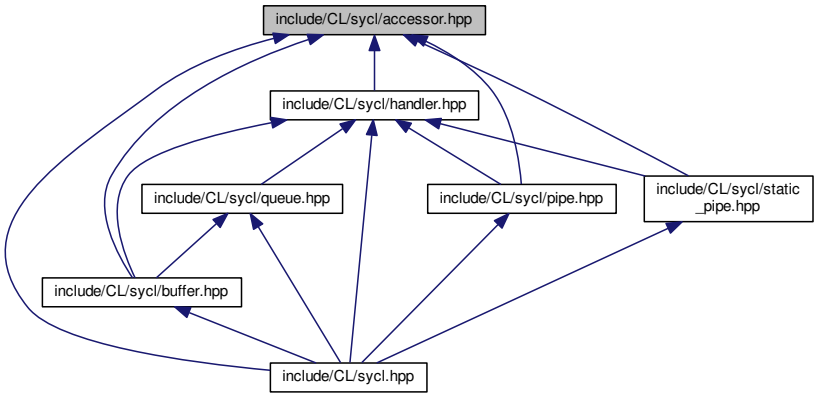
11.5 include/CL/sycl/accessor.hpp File Reference

```
#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 >

  <T, Dimensions, Mode, Target>up data Data access and storage in SYCL
- 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 public:
00058
00059   /// \todo in the specification: store the dimension for user request
00060   static constexpr auto dimensionality = Dimensions;
00061
00062 private:
00063
00064   using accessor_detail = typename detail::accessor<DataType,
00065                                                     Dimensions,
00066                                                     AccessMode,
00067                                                     Target>;
00068
00069   // The type encapsulating the implementation
00070   using implementation_t = typename
      accessor::shared_ptr_implementation;
00071
00072   // Allows the comparison operation to access the implementation
00073   friend implementation_t;
00074
00075  public:
00076
00077   // Make the implementation member directly accessible in this class
00078   using implementation_t::implementation;
00079
00080   /** Construct a buffer accessor from a buffer using a command group
00081       handler object from the command group scope
00082
00083       Constructor only available for global_buffer or constant_buffer
```

```
00084       target.
00085
00086       access_target defines the form of access being obtained.
00087
00088       \todo Add template allocator type in all the accessor
00089       constructors in the specification or just use a more opaque
00090       Buffer type?
00091
00092       \todo fix specification where access mode should be target
00093       instead
00094    */
00095    template <typename Allocator>
00096    accessor(buffer<DataType, Dimensions, Allocator> &
      target_buffer,
00097             handler &command_group_handler) : implementation_t {
00098      new detail::accessor<DataType, Dimensions, AccessMode, Target>
       {
00099       target_buffer.implementation->implementation, command_group_handler }
00100    } {
00101      static_assert(Target == access::target::global_buffer
00102                    || Target == access::target::constant_buffer,
00103                    "access target should be global_buffer or constant_buffer "
00104                    "when a handler is used");
00105    }
00106
00107
00108    /** Construct a buffer accessor from a buffer
00109
00110       Constructor only available for host_buffer target.
00111
00112       access_target defines the form of access being obtained.
00113    */
00114    template <typename Allocator>
00115    accessor(buffer<DataType, Dimensions, Allocator> &
      target_buffer)
00116      : implementation_t {
00117      new detail::accessor<DataType, Dimensions, AccessMode, Target>
       {
00118       target_buffer.implementation->implementation }
00119    } {
00120      static_assert(Target == access::target::host_buffer,
00121                    "without a handler, access target should be host_buffer");
00122    }
00123
00124
00125    /** Construct a buffer accessor from a buffer given a specific range for
00126       access permissions and an offset that provides the starting point
00127       for the access range using a command group handler object from the
00128       command group scope
00129
00130       This accessor limits the processing of the buffer to the [offset,
00131       offset+range[ for every dimension. Any other parts of the buffer
00132       will be unaffected.
00133
00134       Constructor only available for access modes global_buffer, and
00135       constant_buffer (see Table "Buffer accessor constructors").
00136       access_target defines the form of access being obtained.
00137
00138       This accessor is recommended for discard-write and discard read
00139       write access modes, when the unaffected parts of the processing
00140       should be retained.
00141    */
00142    template <typename Allocator>
00143    accessor(buffer<DataType, Dimensions, Allocator> &
      target_buffer,
00144             handler &command_group_handler,
00145             const range<Dimensions> &offset,
00146             const range<Dimensions> &range) {
00147      detail::unimplemented();
00148    }
00149
00150
00151    /** Construct an accessor of dimension Dimensions with elements of type
00152       DataType using the passed range to specify the size in each
00153       dimension
00154
00155       It needs as a parameter a command group handler object from the
00156       command group scope. Constructor only available if AccessMode is
00157       local, see Table 3.25.
00158    */
00159    accessor(const range<Dimensions> &allocation_size,
00160             handler &command_group_handler)
00161      : implementation_t { new detail::accessor<DataType,
00162                                                Dimensions,
00163                                                AccessMode,
00164                                                access::target::local> {
00165       allocation_size, command_group_handler
```

```
00166         }
00167   }
00168   {
00169     static_assert(Target == access::target::local,
00170                   "This accessor constructor requires "
00171                   "access target be local");
00172   }
00173
00174
00175   /** Return a range object representing the size of the buffer in
00176       terms of number of elements in each dimension as passed to the
00177       constructor
00178
00179       \todo Move on
00180       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00181       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00182   */
00183   auto get_range() const {
00184     /* Interpret the shape which is a pointer to the first element as an
00185        array of Dimensions elements so that the range<Dimensions>
00186        constructor is happy with this collection
00187
00188        \todo Add also a constructor in range<> to accept a const
00189        std::size_t *?
00190     */
00191     return implementation->get_range();
00192   }
00193
00194
00195   /** Returns the total number of elements behind the accessor
00196
00197       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
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_count() const {
00204     return implementation->get_count();
00205   }
00206
00207
00208   /** Returns the size of the underlying buffer storage in bytes
00209
00210       \todo It is incompatible with buffer get_size() in the spec
00211
00212       \todo Move on
00213       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00214       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00215   */
00216   auto get_size() const {
00217     return implementation->get_size();
00218   }
00219
00220
00221   /** Use the accessor with integers à la [][][]
00222
00223       Use array_view_type::reference instead of auto& because it does not
00224       work in some dimensions.
00225    */
00226   typename accessor_detail::reference operator[](std::size_t index) {
00227     return (*implementation)[index];
00228   }
00229
00230
00231   /** Use the accessor with integers à la [][][]
00232
00233       Use array_view_type::reference instead of auto& because it does not
00234       work in some dimensions.
00235    */
00236   typename accessor_detail::reference operator[](std::size_t index) const {
00237     return (*implementation)[index];
00238   }
00239
00240
00241   /// To use the accessor with [id<>]
00242   auto &operator[](id<dimensionality> index) {
00243     return (*implementation)[index];
00244   }
00245
00246
00247   /// To use the accessor with [id<>]
00248   auto &operator[](id<dimensionality> index) const {
00249     return (*implementation)[index];
00250   }
00251
00252
```

```
00253   /// To use an accessor with [item<>]
00254   auto &operator[](item<dimensionality> index) {
00255     return (*this)[index.get()];
00256   }
00257
00258
00259   /// To use an accessor with [item<>]
00260   auto &operator[](item<dimensionality> index) const {
00261     return (*this)[index.get()];
00262   }
00263
00264
00265   /** To use an accessor with an [nd_item<>]
00266
00267       \todo Add in the specification because used by HPC-GPU slide 22
00268   */
00269   auto &operator[](nd_item<dimensionality> index) {
00270     return (*this)[index.get_global()];
00271   }
00272
00273   /** To use an accessor with an [nd_item<>]
00274
00275       \todo Add in the specification because used by HPC-GPU slide 22
00276   */
00277   auto &operator[](nd_item<dimensionality> index) const {
00278     return (*this)[index.get_global()];
00279   }
00280
00281
00282     /** Get the first element of the accessor
00283
00284       Useful with an accessor on a scalar for example.
00285
00286       \todo Add in the specification
00287   */
00288   typename accessor_detail::reference operator*() {
00289     return **implementation;
00290   }
00291
00292
00293   /** Get the first element of the accessor
00294
00295       Useful with an accessor on a scalar for example.
00296
00297       \todo Add in the specification?
00298
00299       \todo Add the concept of 0-dim buffer and accessor for scalar
00300       and use an implicit conversion to value_type reference to access
00301       the value with the accessor?
00302   */
00303   typename accessor_detail::reference operator*() const {
00304     return **implementation;
00305   }
00306
00307
00308   /** Get the pointer to the start of the data
00309
00310       \todo Should it be named data() instead? */
00311   auto
00312   get_pointer() const {
00313     return implementation->get_pointer();
00314   }
00315
00316
00317   /** Forward all the iterator functions to the implementation
00318
00319       \todo Add these functions to the specification
00320
00321       \todo The fact that the lambda capture make a const copy of the
00322       accessor is not yet elegantly managed... The issue is that
00323       begin()/end() dispatch is made according to the accessor
00324       constness and not from the array member constness...
00325
00326       \todo try to solve it by using some enable_if on array
00327       constness?
00328
00329       \todo The issue is that the end may not be known if it is
00330       implemented by a raw OpenCL cl_mem... So only provide on the
00331       device the iterators related to the start? Actually the accessor
00332       needs to know a part of the shape to have the multidimentional
00333       addressing. So this only require a size_t more...
00334
00335       \todo Factor out these in a template helper
00336   */
00337
00338
00339   // iterator begin() { return array.begin(); }
```

```
00340   typename accessor_detail::iterator begin() const {
00341     return implementation->begin();
00342   }
00343
00344
00345   // iterator end() { return array.end(); }
00346   typename accessor_detail::iterator end() const {
00347     return implementation->end();
00348   }
00349
00350
00351   // const_iterator begin() const { return implementation->begin(); }
00352
00353
00354   // const_iterator end() const { return implementation->end(); }
00355
00356
00357   typename accessor_detail::const_iterator cbegin() const {
00358     return implementation->cbegin();
00359   }
00360
00361
00362   typename accessor_detail::const_iterator cend() const {
00363     return implementation->cend();
00364   }
00365
00366
00367   typename accessor_detail::reverse_iterator rbegin() const {
00368     return implementation->rbegin();
00369   };
00370
00371
00372   typename accessor_detail::reverse_iterator rend() const {
00373     return implementation->rend();
00374   }
00375
00376
00377   // const_reverse_iterator rbegin() const { return array.rbegin(); }
00378
00379
00380   // const_reverse_iterator rend() const { return array.rend(); }
00381
00382
00383   typename accessor_detail::const_reverse_iterator crbegin() const {
00384     return implementation->rbegin();
00385   }
00386
00387
00388   typename accessor_detail::const_reverse_iterator crend() const {
00389     return implementation->rend();
00390   }
00391
00392 };
00393
00394
00395 /** The pipe accessor abstracts the way pipe data are accessed inside
00396     a kernel
00397
00398     A specialization for an non-blocking pipe
00399 */
00400 template <typename DataType,
00401           access::mode AccessMode>
00402 class accessor<DataType, 1, AccessMode, access::target::pipe> :
00403     public detail::pipe_accessor<DataType, AccessMode, access::target::pipe> {
00404 public:
00405
00406   using accessor_detail =
00407     detail::pipe_accessor<DataType, AccessMode, access::target::pipe>
      ;
00408   // Inherit of the constructors to have accessor constructor from detail
00409   using accessor_detail::accessor_detail;
00410
00411   /** Construct a pipe accessor from a pipe using a command group
00412       handler object from the command group scope
00413
00414       access_target defines the form of access being obtained.
00415   */
00416   accessor(pipe<DataType> &p, handler &command_group_handler)
00417     : accessor_detail { p.implementation, command_group_handler } { }
00418
00419   /// Make a reservation inside the pipe
00420   pipe_reservation<accessor> reserve(std::size_t size) const {
00421     return accessor_detail::reserve(size);
00422   }
00423
00424
00425   /// Get the underlying pipe implementation
```

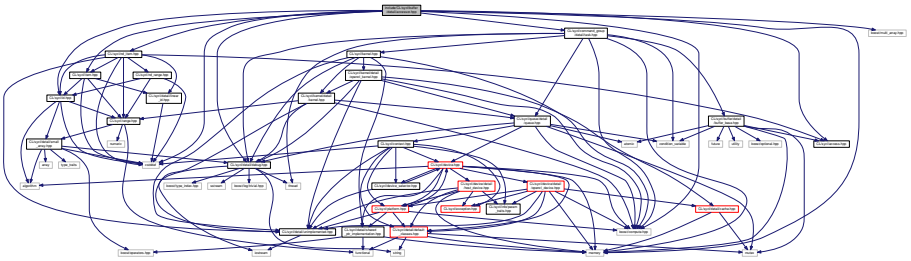
```
00426   auto &get_pipe_detail() {
00427     return accessor_detail::get_pipe_detail();
00428   }
00429
00430 };
00431
00432
00433 /** The pipe accessor abstracts the way pipe data are accessed inside
00434     a kernel
00435
00436     A specialization for a blocking pipe
00437 */
00438 template <typename DataType,
00439           access::mode AccessMode>
00440 class accessor<DataType, 1, AccessMode, access::target::blocking_pipe> :
00441     public detail::pipe_accessor<DataType, AccessMode, access::target::blocking_pipe>
      {
00442 public:
00443
00444   using accessor_detail =
00445     detail::pipe_accessor<DataType, AccessMode, access::target::blocking_pipe>
    ;
00446   // Inherit of the constructors to have accessor constructor from detail
00447   using accessor_detail::accessor_detail;
00448
00449   /** Construct a pipe accessor from a pipe using a command group
00450       handler object from the command group scope
00451
00452       access_target defines the form of access being obtained.
00453   */
00454   accessor(pipe<DataType> &p, handler &command_group_handler)
00455     : accessor_detail { p.implementation, command_group_handler } { }
00456
00457
00458   /// Make a reservation inside the pipe
00459   pipe_reservation<accessor> reserve(std::size_t size) const {
00460     return accessor_detail::reserve(size);
00461   }
00462
00463
00464   /// Get the underlying pipe implementation
00465   auto &get_pipe_detail() {
00466     return accessor_detail::get_pipe_detail();
00467   }
00468
00469 };
00470
00471
00472 /** Top-level function to break circular dependencies on the the types
00473     to get the pipe implementation */
00474 template <typename Accessor>
00475 static inline auto &get_pipe_detail(Accessor &a) {
00476   return a.get_pipe_detail();
00477   }
00478
00479 /// @} End the data Doxygen group
00480
00481 }
00482 }
00483
00484 /*
00485     # Some Emacs stuff:
00486     ### Local Variables:
00487     ### ispell-local-dictionary: "american"
00488     ### eval: (flyspell-prog-mode)
00489     ### End:
00490 */
00491
00492 #endif // TRISYCL_SYCL_ACCESSOR_HPP
```

11.7 include/CL/sycl/buffer/detail/accessor.hpp File Reference

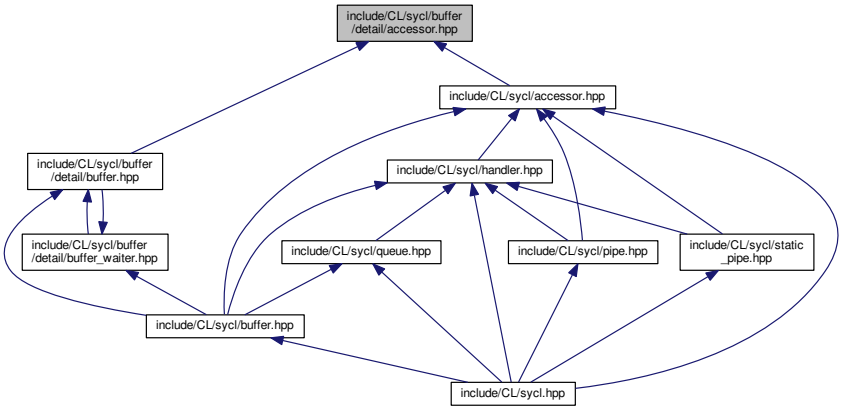
```
#include <cstddef>
```

```
#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 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 #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::buffer for use in accessor
00035 template <typename T, int Dimensions> class buffer;
00036
00037 /** \addtogroup data Data access and storage in SYCL
00038     @{
00039 */
00040
00041 /** The buffer accessor abstracts the way buffer data are accessed
00042     inside a kernel in a multidimensional variable length array way.
00043
00044     This implementation relies on boost::multi_array to provide this
00045     nice syntax and behaviour.
00046
00047     Right now the aim of this class is just to access to the buffer in
00048     a read-write mode, even if capturing the multi_array_ref from a
00049     lambda make it const (since in examples we have lambda with [=]
00050     without mutable lambda).
00051
00052     \todo Use the access::mode
00053 */
00054 template <typename T,
00055           int Dimensions,
00056           access::mode Mode,
00057           access::target Target /* = access::global_buffer */>
00058 class accessor : public detail::debug<accessor<T,
00059                                                Dimensions,
00060                                                Mode,
00061                                                Target>> {
00062   /** Keep a reference to the accessed buffer
00063
00064       Beware that it owns the buffer, which means that the accessor
00065       has to be destroyed to release the buffer and potentially
00066       unblock a kernel at the end of its execution
00067   */
00068   std::shared_ptr<detail::buffer<T, Dimensions>> buf;
00069
00070   /// The implementation is a multi_array_ref wrapper
00071   using array_view_type = boost::multi_array_ref<T, Dimensions>;
00072
00073   // The same type but writable
00074   using writable_array_view_type =
00075     typename std::remove_const<array_view_type>::type;
00076
00077   /** The way the buffer is really accessed
00078
00079       Use a mutable member because the accessor needs to be captured
00080       by value in the lambda which is then read-only. This is to avoid
00081       the user to use mutable lambda or have a lot of const_cast as
00082       previously done in this implementation
00083    */
00084   mutable array_view_type array;
```

```
00085
00086   /// The task where the accessor is used in
00087   std::shared_ptr<detail::task> task;
00088
00089 #ifdef TRISYCL_OPENCL
00090   /// The OpenCL buffer used by an OpenCL accessor
00091   boost::optional<boost::compute::buffer> cl_buf;
00092 #endif
00093
00094 public:
00095
00096   /** \todo in the specification: store the dimension for user request
00097
00098       \todo Use another name, such as from C++17 committee discussions.
00099    */
00100   static constexpr auto dimensionality = Dimensions;
00101
00102   /** \todo in the specification: store the types for user request as STL
00103       or C++AMP */
00104   using value_type = T;
00105   using element = T;
00106   using reference = typename array_view_type::reference;
00107   using const_reference = typename array_view_type::const_reference;
00108
00109   /** Inherit the iterator types from the implementation
00110
00111       \todo Add iterators to accessors in the specification
00112   */
00113   using iterator = typename array_view_type::iterator;
00114   using const_iterator = typename array_view_type::const_iterator;
00115   using reverse_iterator = typename array_view_type::reverse_iterator;
00116   using const_reverse_iterator =
00117     typename array_view_type::const_reverse_iterator;
00118
00119
00120   /** Construct a host accessor from an existing buffer
00121
00122       \todo fix the specification to rename target that shadows
00123       template parm
00124   */
00125   accessor(std::shared_ptr<detail::buffer<T, Dimensions>>
      target_buffer) :
00126     buf { target_buffer }, array { target_buffer->access } {
00127     target_buffer->template track_access_mode<Mode>();
00128     TRISYCL_DUMP_T("Create a host accessor write = " <<
      is_write_access());
00129     static_assert(Target == access::target::host_buffer,
00130                   "without a handler, access target should be host_buffer");
00131     /* The host needs to wait for all the producers of the buffer to
00132        have finished */
00133     buf->wait();
00134   }
00135
00136
00137   /** Construct a device accessor from an existing buffer
00138
00139       \todo fix the specification to rename target that shadows
00140       template parm
00141   */
00142   accessor(std::shared_ptr<detail::buffer<T, Dimensions>>
      target_buffer,
00143            handler &command_group_handler) :
00144     buf { target_buffer }, array { target_buffer->access } {
00145     target_buffer->template track_access_mode<Mode>();
00146     TRISYCL_DUMP_T("Create a kernel accessor write = " <<
      is_write_access());
00147     static_assert(Target == access::target::global_buffer
00148                   || Target == access::target::constant_buffer,
00149                   "access target should be global_buffer or constant_buffer "
00150                   "when a handler is used");
00151     // Register the buffer to the task dependencies
00152     task = buffer_add_to_task(buf, &command_group_handler,
      is_write_access());
00153   }
00154
00155
00156   /** Return a range object representing the size of the buffer in
00157       terms of number of elements in each dimension as passed to the
00158       constructor
00159
00160       \todo Move on
00161       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00162       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00163   */
00164   auto get_range() const {
00165     /* Interpret the shape which is a pointer to the first element as an
00166        array of Dimensions elements so that the range<Dimensions>
```

```
00167       constructor is happy with this collection
00168
00169       \todo Add also a constructor in range<> to accept a const
00170       std::size_t *?
00171     */
00172     return range<Dimensions> {
00173       *(const std::size_t (*)[Dimensions])(array.shape())
00174         };
00175   }
00176
00177
00178   /** Returns the total number of elements behind the accessor
00179
00180       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
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_count() const {
00187     return array.num_elements();
00188   }
00189
00190
00191   /** Returns the size of the underlying buffer storage in bytes
00192
00193       \todo Move on
00194       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00195       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00196   */
00197   auto get_size() const {
00198     return get_count()*sizeof(value_type);
00199   }
00200
00201
00202   /** Use the accessor with integers à la [][][]
00203
00204       Use array_view_type::reference instead of auto& because it does not
00205       work in some dimensions.
00206    */
00207   reference operator[](std::size_t index) {
00208     return array[index];
00209   }
00210
00211
00212   /** Use the accessor with integers à la [][][]
00213
00214       Use array_view_type::reference instead of auto& because it does not
00215       work in some dimensions.
00216    */
00217   reference operator[](std::size_t index) const {
00218     return array[index];
00219   }
00220
00221
00222   /// To use the accessor with [id<>]
00223   auto &operator[](id<dimensionality> index) {
00224     return array(index);
00225   }
00226
00227
00228   /// To use the accessor with [id<>]
00229   auto &operator[](id<dimensionality> index) const {
00230     return array(index);
00231   }
00232
00233
00234   /// To use an accessor with [item<>]
00235   auto &operator[](item<dimensionality> index) {
00236     return (*this)[index.get()];
00237   }
00238
00239
00240   /// To use an accessor with [item<>]
00241   auto &operator[](item<dimensionality> index) const {
00242     return (*this)[index.get()];
00243   }
00244
00245
00246   /** To use an accessor with an [nd_item<>]
00247
00248       \todo Add in the specification because used by HPC-GPU slide 22
00249   */
00250   auto &operator[](nd_item<dimensionality> index) {
00251     return (*this)[index.get_global()];
00252   }
00253
```

```
00254   /** To use an accessor with an [nd_item<>]
00255
00256       \todo Add in the specification because used by HPC-GPU slide 22
00257   */
00258   auto &operator[](nd_item<dimensionality> index) const {
00259     return (*this)[index.get_global()];
00260   }
00261
00262
00263   /** Get the first element of the accessor
00264
00265       Useful with an accessor on a scalar for example.
00266
00267       \todo Add in the specification
00268   */
00269   reference operator*() {
00270     return *array.data();
00271   }
00272
00273
00274   /** Get the first element of the accessor
00275
00276       Useful with an accessor on a scalar for example.
00277
00278       \todo Add in the specification?
00279
00280       \todo Add the concept of 0-dim buffer and accessor for scalar
00281       and use an implicit conversion to value_type reference to access
00282       the value with the accessor?
00283   */
00284   reference operator*() const {
00285     return *array.data();
00286   }
00287
00288
00289   /// Get the buffer used to create the accessor
00290   detail::buffer<T, Dimensions> &get_buffer() {
00291     return *buf;
00292   }
00293
00294
00295   /** Test if the accessor has a read access right
00296
00297       \todo Strangely, it is not really constexpr because it is not a
00298       static method...
00299
00300       \todo to move in the access::mode enum class and add to the
00301       specification ?
00302   */
00303   constexpr bool is_read_access() const {
00304     return Mode == access::mode::read
00305       || Mode == access::mode::read_write
00306       || Mode == access::mode::discard_read_write;
00307   }
00308
00309
00310   /** Test if the accessor has a write access right
00311
00312       \todo Strangely, it is not really constexpr because it is not a
00313       static method...
00314
00315       \todo to move in the access::mode enum class and add to the
00316       specification ?
00317   */
00318   constexpr bool is_write_access() const {
00319     return Mode == access::mode::write
00320       || Mode == access::mode::read_write
00321       || Mode == access::mode::discard_write
00322       || Mode == access::mode::discard_read_write;
00323   }
00324
00325
00326   /** Return the pointer to the data
00327
00328       \todo Implement the various pointer address spaces
00329   */
00330   auto
00331   get_pointer() {
00332     return array.data();
00333   }
00334
00335
00336   /** Forward all the iterator functions to the implementation
00337
00338       \todo Add these functions to the specification
00339
00340       \todo The fact that the lambda capture make a const copy of the
```

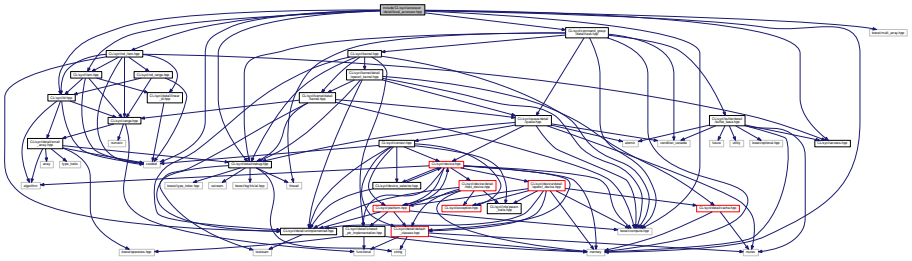
```
00341       accessor is not yet elegantly managed... The issue is that
00342       begin()/end() dispatch is made according to the accessor
00343       constness and not from the array member constness...
00344
00345       \todo try to solve it by using some enable_if on array
00346       constness?
00347
00348       \todo The issue is that the end may not be known if it is
00349       implemented by a raw OpenCL cl_mem... So only provide on the
00350       device the iterators related to the start? Actually the accessor
00351       needs to know a part of the shape to have the multidimentional
00352       addressing. So this only require a size_t more...
00353
00354       \todo Factor out these in a template helper
00355
00356       \todo Do we need this in detail::accessor too or only in accessor?
00357   */
00358
00359
00360   // iterator begin() { return array.begin(); }
00361   iterator begin() const {
00362     return const_cast<writable_array_view_type &>(array).
      begin();
00363   }
00364
00365
00366   // iterator end() { return array.end(); }
00367   iterator end() const {
00368     return const_cast<writable_array_view_type &>(array).
      end();
00369   }
00370
00371
00372   // const_iterator begin() const { return array.begin(); }
00373
00374
00375   // const_iterator end() const { return array.end(); }
00376
00377
00378   const_iterator cbegin() const { return array.begin(); }
00379
00380
00381   const_iterator cend() const { return array.end(); }
00382
00383
00384   // reverse_iterator rbegin() { return array.rbegin(); }
00385   reverse_iterator rbegin() const {
00386     return const_cast<writable_array_view_type &>(array).
      rbegin();
00387   }
00388
00389
00390   // reverse_iterator rend() { return array.rend(); }
00391   reverse_iterator rend() const {
00392     return const_cast<writable_array_view_type &>(array).
      rend();
00393   }
00394
00395
00396   // const_reverse_iterator rbegin() const { return array.rbegin(); }
00397
00398
00399   // const_reverse_iterator rend() const { return array.rend(); }
00400
00401
00402   const_reverse_iterator crbegin() const { return array.rbegin(); }
00403
00404
00405   const_reverse_iterator crend() const { return array.rend(); }
00406
00407 private:
00408
00409   // The following function are used from handler
00410   friend handler;
00411
00412 #ifdef TRISYCL_OPENCL
00413   /// Get the boost::compute::buffer or throw if unset
00414   auto get_cl_buffer() const {
00415     // This throws if not set
00416     return cl_buf.value();
00417   }
00418
00419
00420   /** Lazily associate a CL buffer to the SYCL buffer and copy data in
00421       if required
00422
00423       \todo Move this into the buffer with queue/device-based caching
```

```
00424   */
00425   void copy_in_cl_buffer() {
00426     // This should be a constexpr
00427     cl_mem_flags flags = is_read_access() && is_write_access() ?
00428       CL_MEM_READ_WRITE | CL_MEM_COPY_HOST_PTR
00429       : is_read_access() ? CL_MEM_READ_ONLY | CL_MEM_COPY_HOST_PTR
00430                          : CL_MEM_WRITE_ONLY;
00431
00432     /* Create the OpenCL buffer and copy in data from the host if in
00433        read mode */
00434     cl_buf = boost::compute::buffer {
00435       task->get_queue()->get_boost_compute().get_context(),
00436       get_size(),
00437       flags,
00438       is_read_access() ? array.data() : 0
00439     };
00440   }
00441
00442
00443   /** Copy back the CL buffer to the SYCL if required
00444
00445       \todo Move this into the buffer with queue/device-based caching
00446   */
00447   void copy_back_cl_buffer() {
00448     // \todo Use if constexpr in C++17
00449     if (is_write_access())
00450       task->get_queue()->get_boost_compute()
00451         .enqueue_read_buffer(get_cl_buffer(),
00452                              0 /*< Offset */,
00453                              get_size(),
00454                              array.data());
00455   }
00456 #endif
00457
00458 };
00459
00460 /// @} End the data Doxygen group
00461
00462 }
00463 }
00464 }
00465
00466 /*
00467     # Some Emacs stuff:
00468     ### Local Variables:
00469     ### ispell-local-dictionary: "american"
00470     ### eval: (flyspell-prog-mode)
00471     ### End:
00472 */
00473
00474 #endif // TRISYCL_SYCL_ACCESSOR_DETAIL_ACCESSOR_HPP
```

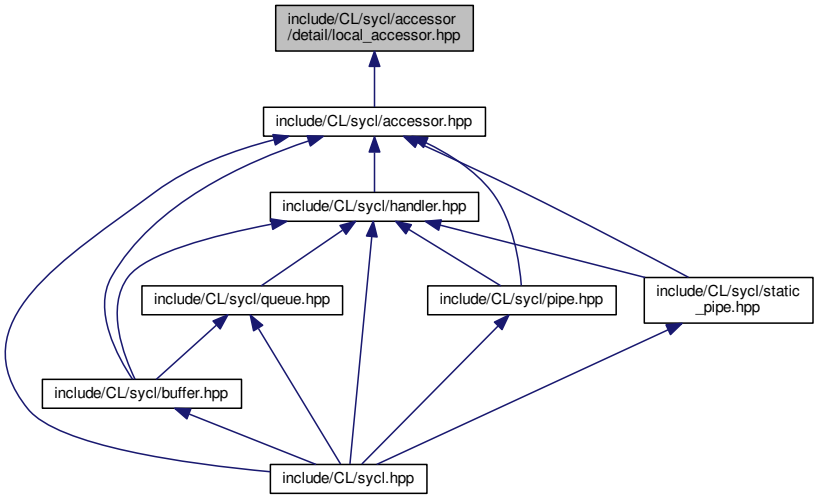
11.9 include/CL/sycl/accessor/detail/local_accessor.hpp File Reference

```
#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<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 public:
00078
00079   /** \todo in the specification: store the dimension for user request
00080
00081       \todo Use another name, such as from C++17 committee discussions.
00082    */
00083   static constexpr auto dimensionality = Dimensions;
00084
```

```
00085   /** \todo in the specification: store the types for user request as STL
00086       or C++AMP */
00087   using value_type = T;
00088   using element = T;
00089   using reference = typename array_type::reference;
00090   using const_reference = typename array_type::const_reference;
00091
00092   /** Inherit the iterator types from the implementation
00093
00094       \todo Add iterators to accessors in the specification
00095   */
00096   using iterator = typename array_type::iterator;
00097   using const_iterator = typename array_type::const_iterator;
00098   using reverse_iterator = typename array_type::reverse_iterator;
00099   using const_reverse_iterator =
00100     typename array_type::const_reverse_iterator;
00101
00102
00103   /** Construct a device accessor from an existing buffer
00104
00105       \todo fix the specification to rename target that shadows
00106       template parm
00107   */
00108   accessor(const range<Dimensions> &allocation_size,
00109            handler &command_group_handler) :
00110     array { allocation_size } {}
00111
00112
00113   /** Return a range object representing the size of the buffer in
00114       terms of number of elements in each dimension as passed to the
00115       constructor
00116
00117       \todo Move on
00118       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00119       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00120   */
00121   auto get_range() const {
00122     /* Interpret the shape which is a pointer to the first element as an
00123        array of Dimensions elements so that the range<Dimensions>
00124        constructor is happy with this collection
00125
00126        \todo Add also a constructor in range<> to accept a const
00127        std::size_t *?
00128     */
00129     return range<Dimensions> {
00130       *(const std::size_t (*)[Dimensions])(array.shape())
00131         };
00132   }
00133
00134
00135   /** Returns the total number of elements behind the accessor
00136
00137       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
00138
00139       \todo Move on
00140       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00141       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00142   */
00143   auto get_count() const {
00144     return array.num_elements();
00145   }
00146
00147
00148   /** Returns the size of the underlying buffer storage in bytes
00149
00150       \todo Move on
00151       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15564 and
00152       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=14404
00153   */
00154   auto get_size() const {
00155     return get_count()*sizeof(value_type);
00156   }
00157
00158
00159   /** Use the accessor with integers à la [][][]
00160
00161       Use array_view_type::reference instead of auto& because it does not
00162       work in some dimensions.
00163    */
00164   reference operator[](std::size_t index) {
00165     return array[index];
00166   }
00167
00168
00169   /** Use the accessor with integers à la [][][]
00170
00171       Use array_view_type::reference instead of auto& because it does not
```

```
00172       work in some dimensions.
00173    */
00174   reference operator[](std::size_t index) const {
00175     return array[index];
00176   }
00177
00178
00179   /// To use the accessor with [id<>]
00180   auto &operator[](id<dimensionality> index) {
00181     return array(index);
00182   }
00183
00184
00185   /// To use the accessor with [id<>]
00186   auto &operator[](id<dimensionality> index) const {
00187     return array(index);
00188   }
00189
00190
00191   /// To use an accessor with [item<>]
00192   auto &operator[](item<dimensionality> index) {
00193     return (*this)[index.get()];
00194   }
00195
00196
00197   /// To use an accessor with [item<>]
00198   auto &operator[](item<dimensionality> index) const {
00199     return (*this)[index.get()];
00200   }
00201
00202
00203   /** To use an accessor with an [nd_item<>]
00204
00205       \todo Add in the specification because used by HPC-GPU slide 22
00206   */
00207   auto &operator[](nd_item<dimensionality> index) {
00208     return (*this)[index.get_global()];
00209   }
00210
00211   /** To use an accessor with an [nd_item<>]
00212
00213       \todo Add in the specification because used by HPC-GPU slide 22
00214   */
00215   auto &operator[](nd_item<dimensionality> index) const {
00216     return (*this)[index.get_global()];
00217   }
00218
00219
00220   /** Get the first element of the accessor
00221
00222       Useful with an accessor on a scalar for example.
00223
00224       \todo Add in the specification
00225   */
00226   reference operator*() {
00227     return *array.data();
00228   }
00229
00230
00231   /** Get the first element of the accessor
00232
00233       Useful with an accessor on a scalar for example.
00234
00235       \todo Add in the specification?
00236
00237       \todo Add the concept of 0-dim buffer and accessor for scalar
00238       and use an implicit conversion to value_type reference to access
00239       the value with the accessor?
00240   */
00241   reference operator*() const {
00242     return *array.data();
00243   }
00244
00245
00246   /** Test if the accessor has a read access right
00247
00248       \todo Strangely, it is not really constexpr because it is not a
00249       static method...
00250
00251       \todo to move in the access::mode enum class and add to the
00252       specification ?
00253   */
00254   constexpr bool is_read_access() const {
00255     return Mode == access::mode::read
00256       || Mode == access::mode::read_write
00257       || Mode == access::mode::discard_read_write;
00258   }
```

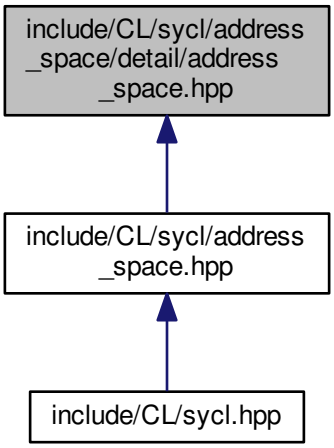
```
00259
00260
00261   /** Test if the accessor has a write access right
00262
00263       \todo Strangely, it is not really constexpr because it is not a
00264       static method...
00265
00266       \todo to move in the access::mode enum class and add to the
00267       specification ?
00268   */
00269   constexpr bool is_write_access() const {
00270     return Mode == access::mode::write
00271       || Mode == access::mode::read_write
00272       || Mode == access::mode::discard_write
00273       || Mode == access::mode::discard_read_write;
00274   }
00275
00276
00277   /** Forward all the iterator functions to the implementation
00278
00279       \todo Add these functions to the specification
00280
00281       \todo The fact that the lambda capture make a const copy of the
00282       accessor is not yet elegantly managed... The issue is that
00283       begin()/end() dispatch is made according to the accessor
00284       constness and not from the array member constness...
00285
00286       \todo try to solve it by using some enable_if on array
00287       constness?
00288
00289       \todo The issue is that the end may not be known if it is
00290       implemented by a raw OpenCL cl_mem... So only provide on the
00291       device the iterators related to the start? Actually the accessor
00292       needs to know a part of the shape to have the multidimentional
00293       addressing. So this only require a size_t more...
00294
00295       \todo Factor out these in a template helper
00296
00297       \todo Do we need this in detail::accessor too or only in accessor?
00298   */
00299
00300
00301   // iterator begin() { return array.begin(); }
00302   iterator begin() const {
00303     return const_cast<writable_array_type &>(array).
      begin();
00304   }
00305
00306
00307   // iterator end() { return array.end(); }
00308   iterator end() const {
00309     return const_cast<writable_array_type &>(array).end();
00310   }
00311
00312
00313   // const_iterator begin() const { return array.begin(); }
00314
00315
00316   // const_iterator end() const { return array.end(); }
00317
00318
00319   const_iterator cbegin() const { return array.begin(); }
00320
00321
00322   const_iterator cend() const { return array.end(); }
00323
00324
00325   // reverse_iterator rbegin() { return array.rbegin(); }
00326   reverse_iterator rbegin() const {
00327     return const_cast<writable_array_type &>(array).
      rbegin();
00328   }
00329
00330
00331   // reverse_iterator rend() { return array.rend(); }
00332   reverse_iterator rend() const {
00333     return const_cast<writable_array_type &>(array).rend();
00334   }
00335
00336
00337   // const_reverse_iterator rbegin() const { return array.rbegin(); }
00338
00339
00340   // const_reverse_iterator rend() const { return array.rend(); }
00341
00342
00343   const_reverse_iterator crbegin() const { return array.rbegin(); }
```

```
00344
00345
00346   const_reverse_iterator crend() const { return array.rend(); }
00347
00348 private:
00349
00350   // The following function are used from handler
00351   friend handler;
00352
00353 };
00354
00355 /// @} End the data Doxygen group
00356
00357 }
00358 }
00359 }
00360
00361 /*
00362     # Some Emacs stuff:
00363     ### Local Variables:
00364     ### ispell-local-dictionary: "american"
00365     ### eval: (flyspell-prog-mode)
00366     ### End:
00367 */
00368
00369 #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
```

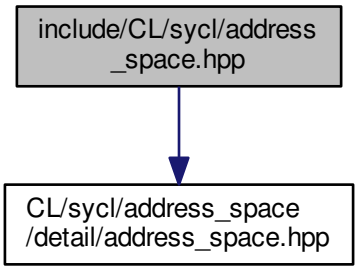
```
00340
00341     The class implementation is just inheriting of T so that all methods
00342     and non-member operators on T work also on address_space_object<T>
00343
00344     \todo Verify/improve to deal with const/volatile?
00345
00346     \todo what about T having some final methods?
00347 */
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

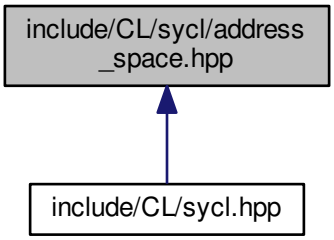
Implement OpenCL address spaces in SYCL with C++-style.

```
#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

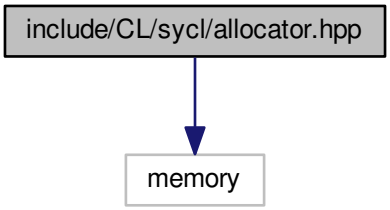
```
00001 #ifndef TRISYCL_SYCL_ADDRESS_SPACE_HPP
00002 #define TRISYCL_SYCL_ADDRESS_SPACE_HPP
00003
00004 /** \file
00005
00006     Implement OpenCL address spaces in SYCL with C++-style.
00007
00008     Note that in SYCL 1.2, only pointer types should be specified but
00009     in this implementation 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
```

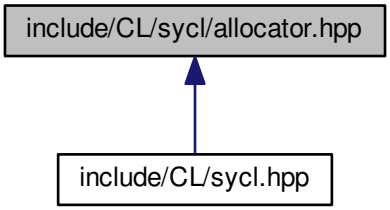
11.15 include/CL/sycl/allocator.hpp File Reference

```
#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.

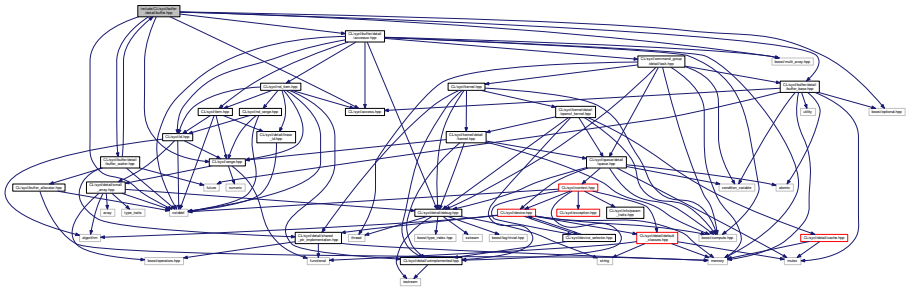
11.16 allocator.hpp

```
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
```

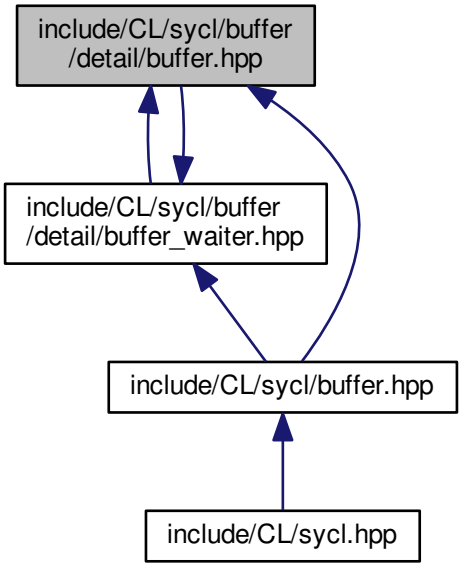
11.17 include/CL/sycl/buffer/detail/buffer.hpp File Reference

```
#include <cstddef>
#include <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
00014 #include <boost/multi_array.hpp>
00015 // \todo Use C++17 optional when it is mainstream
00016 #include <boost/optional.hpp>
00017
00018 #include "CL/sycl/access.hpp"
00019 #include "CL/sycl/buffer/detail/accessor.hpp"
00020 #include "CL/sycl/buffer/detail/buffer_base.hpp"
00021 #include "CL/sycl/buffer/detail/buffer_waiter.hpp"
00022 #include "CL/sycl/range.hpp"
00023
00024 namespace cl {
00025 namespace sycl {
00026 namespace detail {
00027
00028
00029 /** \addtogroup data Data access and storage in SYCL
00030     @{
00031 */
00032
00033 /** A SYCL buffer is a multidimensional variable length array (à la C99
00034     VLA or even Fortran before) that is used to store data to work on.
00035
00036     In the case we initialize it from a pointer, for now we just wrap the
00037     data with boost::multi_array_ref to provide the VLA semantics without
00038     any storage.
00039 */
00040 template <typename T,
00041           int Dimensions = 1>
00042 class buffer : public detail::buffer_base,
00043                public detail::debug<buffer<T, Dimensions>> {
00044 public:
00045
00046   // Extension to SYCL: provide pieces of STL container interface
00047   using element = T;
00048   using value_type = T;
00049   /* Even if the buffer is read-only use a non-const type so at
00050      least the current implementation can copy the data too */
00051   using non_const_value_type = std::remove_const_t<value_type>;
00052
00053 private:
00054
00055   /** If some allocation is requested, it is managed by this multi_array
00056       to ease initialization from data */
00057   boost::multi_array<non_const_value_type, Dimensions> allocation;
00058
00059   // \todo Replace U and D somehow by T and Dimensions
00060   // To allow allocation access
00061   template <typename U,
00062             int D,
00063             access::mode Mode,
00064             access::target Target /* = access::global_buffer */>
00065     friend class detail::accessor;
00066
00067
00068   /** This is the multi-dimensional interface to the data that may point
00069       to either allocation in the case of storage managed by SYCL itself
00070       or to some other memory location in the case of host memory or
```

```
00071       storage<> abstraction use
00072   */
00073   boost::multi_array_ref<value_type, Dimensions> access;
00074
00075   /* How to copy back data on buffer destruction, can be modified with
00076      set_final_data( ... )
00077    */
00078   boost::optional<std::function<void(void)>> final_write_back;
00079
00080   // Used to store the shared pointer used to create the buffer
00081   shared_ptr_class<T> input_shared_pointer;
00082
00083
00084   // Track if the buffer memory is provided as host memory
00085   bool data_host = false;
00086
00087   // Track if data should be copied if a modification occurs
00088   bool copy_if_modified = false;
00089
00090   // Track if data have been modified
00091   bool modified = false;
00092
00093 public:
00094
00095   /// Create a new read-write buffer of size \param r
00096   buffer(const range<Dimensions> &r) : allocation { r },
00097                                        access { allocation }
00098                                        {}
00099
00100
00101   /** Create a new read-write buffer from \param host_data of size
00102       \param r without further allocation */
00103   buffer(T *host_data, const range<Dimensions> &r) :
00104     access { host_data, r },
00105     data_host { true }
00106   {}
00107
00108
00109   /** Create a new read-only buffer from \param host_data of size \param r
00110       without further allocation
00111
00112       If the buffer is non const, use a copy-on-write mechanism with
00113       internal writable memory.
00114
00115       \todo Clarify the semantics in the spec. What happens if the
00116       host change the host_data after buffer creation?
00117
00118       Only enable this constructor if the value type is not constant,
00119       because if it is constant, the buffer is constant too.
00120   */
00121   template <typename Dependent = T,
00122             typename = std::enable_if_t<!std::is_const<Dependent>::value>>
00123   buffer(const T *host_data, const range<Dimensions> &r) :
00124     /* The buffer is read-only, even if the internal multidimensional
00125        wrapper is not. If a write accessor is requested, there should
00126        be a copy on write. So this pointer should not be written and
00127        this const_cast should be acceptable. */
00128     access { const_cast<T *>(host_data), r },
00129     data_host { true },
00130     /* Set copy_if_modified to true, so that if an accessor with write
00131        access is created, data are copied before to be modified. */
00132     copy_if_modified { true }
00133   {}
00134
00135
00136   /** Create a new buffer with associated memory, using the data in
00137       host_data
00138
00139       The ownership of the host_data is shared between the runtime and the
00140       user. In order to enable both the user application and the SYCL
00141       runtime to use the same pointer, a cl::sycl::mutex_class is
00142       used.
00143   */
00144   buffer(shared_ptr_class<T> &host_data, const
      range<Dimensions> &r) :
00145     access { host_data.get(), r },
00146     input_shared_pointer { host_data },
00147     data_host { true }
00148   {}
00149
00150
00151   /** Create a new buffer with associated memory, using the data owned in
00152       a unique pointer
00153
00154       SYCL's runtime has full ownership of the host_data.
00155   */
00156   template<typename Deleter>
```

```
00157   buffer(unique_ptr_class<T, Deleter> &&host_data,
00158          const range<Dimensions> &r) :
00159     access { host_data.get(), r },
00160       /* Use the fact that there is an implicit constructor of a \c
00161          std::shared_ptr from a \c std::unique_ptr to avoid storing
00162          the unique pointer. Doing so would need to implement
00163          ourselves some type erasure on the \c Deleter to avoid it
00164          leaking out of the \c buffer type and \c accessor type.
00165
00166          It still works as expected since, if we own a shared pointer,
00167          the \c Deleter is correctly handled and if we own it and its
00168          use-count is 1, we are the only owner and we can skip the
00169          copy-back later.
00170       */
00171     input_shared_pointer { std::move(host_data) },
00172     data_host { true }
00173   {}
00174
00175
00176   /// Create a new allocated 1D buffer from the given elements
00177   template <typename Iterator>
00178   buffer(Iterator start_iterator, Iterator end_iterator) :
00179     // The size of a multi_array is set at creation time
00180     allocation { boost::extents[std::distance(start_iterator, end_iterator)] },
00181     access { allocation }
00182     // If iterators are const ones, then we do not write back
00183     {
00184       /* Then assign allocation since this is the only multi_array
00185          method with this iterator interface */
00186       allocation.assign(start_iterator, end_iterator);
00187     }
00188
00189
00190   /** Create a new sub-buffer without allocation to have separate
00191       accessors later
00192
00193       \todo To implement and deal with reference counting
00194   buffer(buffer<T, Dimensions> b,
00195          index<Dimensions> base_index,
00196          range<Dimensions> sub_range)
00197   */
00198
00199   /// \todo Allow CLHPP objects too?
00200   ///
00201   /*
00202   buffer(cl_mem mem_object,
00203          queue from_queue,
00204          event available_event)
00205   */
00206
00207
00208   /** The buffer content may be copied back on destruction to some
00209       final location */
00210   ~buffer() {
00211     if (modified && final_write_back)
00212       (*final_write_back)();
00213   }
00214
00215
00216   /** Enforce the buffer to be considered as being modified.
00217       Same as creating an accessor with write access.
00218    */
00219   void mark_as_written() {
00220     modified = true;
00221   }
00222
00223
00224   // Use BOOST_DISABLE_ASSERTS at some time to disable range checking
00225
00226
00227   /** This method is to be called whenever an acessor is created.
00228       Its current purpose is to track if an accessor with write access
00229       is created and acting acordingly.
00230    */
00231   template <access::mode Mode,
00232             access::target Target = access::target::host_buffer>
00233   void track_access_mode() {
00234     // test if write access is required
00235     if (   Mode == access::mode::write
00236         || Mode == access::mode::read_write
00237         || Mode == access::mode::discard_write
00238         || Mode == access::mode::discard_read_write
00239         || Mode == access::mode::atomic
00240        ) {
00241       modified = true;
00242       if (copy_if_modified) {
00243         copy_if_modified = false;
```

```
00244         data_host = false;
00245         allocation = boost::multi_array<T, Dimensions> { access };
00246         access = boost::multi_array_ref<T, Dimensions> { allocation };
00247       }
00248     }
00249   }
00250
00251
00252  /** Return a range object representing the size of the buffer in
00253      terms of number of elements in each dimension as passed to the
00254      constructor
00255   */
00256   auto get_range() const {
00257     /* Interpret the shape which is a pointer to the first element as an
00258        array of Dimensions elements so that the range<Dimensions>
00259        constructor is happy with this collection
00260
00261        \todo Add also a constructor in range<> to accept a const
00262        std::size_t *?
00263     */
00264     return range<Dimensions> {
00265       *(const std::size_t (*)[Dimensions])(access.shape())
00266         };
00267   }
00268
00269
00270   /** Returns the total number of elements in the buffer
00271
00272       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
00273   */
00274   auto get_count() const {
00275     return access.num_elements();
00276   }
00277
00278
00279   /** Returns the size of the buffer storage in bytes
00280
00281       \todo rename to something else. In
00282       http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2015/p0122r0.pdf
00283       it is named bytes() for example
00284   */
00285   auto get_size() const {
00286     return get_count()*sizeof(value_type);
00287   }
00288
00289
00290   /** Set the weak pointer as destination for write-back on buffer destruction.
00291   */
00292   void set_final_data(std::weak_ptr<T> && final_data) {
00293     final_write_back = [=] {
00294       if (auto sptr = final_data.lock()) {
00295         std::copy_n(access.data(), access.num_elements(), sptr.get());
00296       }
00297     };
00298   }
00299
00300
00301   /** Provide destination for write-back on buffer destruction as a
00302       shared pointer.
00303    */
00304   void set_final_data(std::shared_ptr<T> && final_data) {
00305     final_write_back = [=] {
00306       std::copy_n(access.data(), access.num_elements(), final_data.get());
00307     };
00308   }
00309
00310
00311   /** Disable write-back on buffer destruction as an iterator.
00312   */
00313   void set_final_data(std::nullptr_t) {
00314     final_write_back = boost::none;
00315   }
00316
00317
00318   /** Provide destination for write-back on buffer destruction as an iterator.
00319   */
00320   template <typename Iterator>
00321   void set_final_data(Iterator final_data) {
00322  /*   using type_ = typename iterator_value_type<Iterator>::value_type;
00323     static_assert(std::is_same<type_, T>::value, "buffer type mismatch");
00324     static_assert(!(std::is_const<type_>::value), "const iterator is not allowed");*/
00325     final_write_back = [=] {
00326       std::copy_n(access.data(), access.num_elements(), final_data);
00327     };
00328   }
00329
00330
```

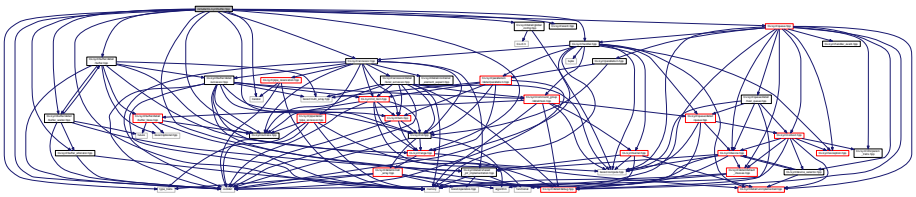
```
00331 private:
00332
00333   /** Get a \c future to wait from inside the \c cl::sycl::buffer in
00334       case there is something to copy back to the host
00335
00336       \return A \c future in the \c optional if there is something to
00337       wait for, otherwise an empty \c optional
00338   */
00339   boost::optional<std::future<void>> get_destructor_future() {
00340     /* If there is only 1 shared_ptr user of the buffer, this is the
00341        caller of this function, the \c buffer_waiter, so there is no
00342        need to get a \ future otherwise there will be a dead-lock if
00343        there is only 1 thread waiting for itself.
00344
00345        Since \c use_count() is applied to a \c shared_ptr just created
00346        for this purpose, it actually increase locally the count by 1,
00347        so check for 1 + 1 use count instead...
00348     */
00349     // If the buffer's destruction triggers a write-back, wait
00350     if ((shared_from_this().use_count() > 2) &&
00351         modified && (final_write_back || data_host)) {
00352       // Create a promise to wait for
00353       notify_buffer_destructor = std::promise<void> {};
00354       // And return the future to wait for it
00355       return notify_buffer_destructor->get_future();
00356     }
00357     return boost::none;
00358   }
00359
00360
00361   // Allow buffer_waiter destructor to access get_destructor_future()
00362   // friend detail::buffer_waiter<T, Dimensions>::~buffer_waiter();
00363   /* \todo Work around to Clang bug
00364      https://llvm.org/bugs/show_bug.cgi?id=28873 cannot use destructor
00365      here */
00366   friend detail::buffer_waiter<T, Dimensions>;
00367
00368 };
00369
00370
00371 /** Proxy function to avoid some circular type recursion
00372
00373     \return a shared_ptr<task>
00374
00375     \todo To remove with some refactoring
00376 */
00377 template <typename BufferDetail>
00378 static std::shared_ptr<detail::task>
00379 buffer_add_to_task(BufferDetail buf,
00380                    handler *command_group_handler,
00381                    bool is_write_mode) {
00382     return buf->add_to_task(command_group_handler, is_write_mode);
00383   }
00384
00385 /// @} End the data Doxygen group
00386
00387 }
00388 }
00389 }
00390
00391 /*
00392     # Some Emacs stuff:
00393     ### Local Variables:
00394     ### ispell-local-dictionary: "american"
00395     ### eval: (flyspell-prog-mode)
00396     ### End:
00397 */
00398
00399 #endif // TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_HPP
```

11.19 include/CL/sycl/buffer.hpp File Reference

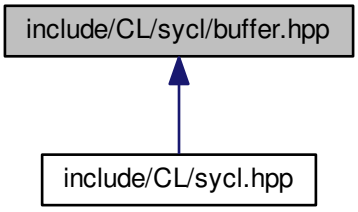
```
#include <cstddef>
```

```
#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 >

  < T, Dimensions, Mode, Target > up data Data access and storage in SYCL
- 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 /** \addtogro<T, Dimensions, Mode, Target>up 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(new
      detail::buffer<T, Dimensions>
00115                           { 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 buffer which is initialized by host_data
00236
00237       \param[in] host_data points to the storage and values used to
00238       initialize the buffer
00239
00240       \param[in] r defines the size
00241
00242       \param[in] allocator is to be used by the SYCL runtime, of type
00243       cl::sycl::buffer_allocator<T> by default
00244
00245       The SYCL runtime receives full ownership of the host_data unique_ptr
00246       and there in effect there is no synchronization with the application
00247       code using host_data.
00248
00249       \todo Update the API to add template <typename D =
00250       std::default_delete<T>> because the
00251       unique_ptr_class/std::unique_ptr have the destructor type as
00252       dependent
00253   */
```

```
00254   buffer(unique_ptr_class<T> &&host_data,
00255          const range<Dimensions> &r,
00256          Allocator allocator = {})
00257     : implementation_t { detail::waiter(new
        detail::buffer<T, Dimensions>
00258                          { std::move(host_data), r }) }
00259   {}
00260
00261
00262   /** Create a new allocated 1D buffer initialized from the given
00263       elements ranging from first up to one before last
00264
00265       The data is copied to an intermediate memory position by the
00266       runtime. Data is written back to the same iterator set if the
00267       iterator is not a const iterator.
00268
00269       \param[inout] start_iterator points to the first element to copy
00270
00271       \param[in] end_iterator points to just after the last element to copy
00272
00273       \param[in] allocator is to be used by the SYCL runtime, of type
00274       cl::sycl::buffer_allocator<T> by default
00275
00276       \todo Implement the copy back at buffer destruction
00277
00278       \todo Generalize this for n-D and provide column-major and row-major
00279       initialization
00280
00281       \todo a reason to have this nD is that
00282             set_final_data(weak_ptr_class<T> & finalData) is actually
00283             doing this linearization anyway
00284
00285       \todo Allow read-only buffer construction too
00286
00287       \todo update the specification to deal with forward iterators
00288       instead and rewrite back only when it is non const and output
00289       iterator at least
00290
00291       \todo Allow initialization from ranges and collections à la STL
00292   */
00293   template <typename InputIterator,
00294             /* To force some iterator concept checking to avoid GCC 4.9
00295                diving into this when initializing from ({ int, int })
00296                which is a range<> and and not an iterator... */
00297             typename ValueType =
00298             typename std::iterator_traits<InputIterator>::value_type>
00299   buffer(InputIterator start_iterator,
00300          InputIterator end_iterator,
00301          Allocator allocator = {}) :
00302     implementation_t { detail::waiter(new
        detail::buffer<T, Dimensions>
00303                        { start_iterator, end_iterator }) }
00304   {}
00305
00306
00307   /** Create a new sub-buffer without allocation to have separate
00308       accessors later
00309
00310       \param[inout] b is the buffer with the real data
00311
00312       \param[in] base_index specifies the origin of the sub-buffer inside the
00313       buffer b
00314
00315       \param[in] sub_range specifies the size of the sub-buffer
00316
00317       \todo To be implemented
00318
00319       \todo Update the specification to replace index by id
00320   */
00321   buffer(buffer<T, Dimensions, Allocator> &b,
00322          const id<Dimensions> &base_index,
00323          const range<Dimensions> &sub_range,
00324          Allocator allocator = {}) { detail::unimplemented(); }
00325
00326
00327 #ifdef TRISYCL_OPENCL
00328   /** Create a buffer from an existing OpenCL memory object associated
00329       with a context after waiting for an event signaling the
00330       availability of the OpenCL data
00331
00332       \param[inout] mem_object is the OpenCL memory object to use
00333
00334       \param[inout] from_queue is the queue associated to the memory
00335       object
00336
00337       \param[in] available_event specifies the event to wait for if
00338       non null
```

```
00339
00340       Note that a buffer created from a cl_mem object will only have
00341       one underlying cl_mem for the lifetime of the buffer and use on
00342       an incompatible queue constitues an error.
00343
00344       \todo To be implemented
00345
00346       \todo Improve the specification to allow CLHPP objects too
00347   */
00348   buffer(cl_mem mem_object,
00349          queue from_queue,
00350          event available_event = {},
00351          Allocator allocator = {}) { detail::unimplemented();  }
00352 #endif
00353
00354
00355   // Use BOOST_DISABLE_ASSERTS at some time to disable range checking
00356
00357   /** Get an accessor to the buffer with the required mode
00358
00359       \param Mode is the requested access mode
00360
00361       \param Target is the type of object to be accessed
00362
00363       \param[in] command_group_handler is the command group handler in
00364       which the kernel is to be executed
00365
00366       \todo Do we need for an accessor to increase the reference count of
00367       a buffer object? It does make more sense for a host-side accessor.
00368
00369       \todo Implement the modes and targets
00370   */
00371   template <access::mode Mode,
00372             access::target Target = access::target::global_buffer
     >
00373   accessor<T, Dimensions, Mode, Target>
00374   get_access(handler &command_group_handler) {
00375     static_assert(Target == access::target::global_buffer
00376                   || Target == access::target::constant_buffer,
00377                   "get_access(handler) can only deal with access::global_buffer"
00378                   " or access::constant_buffer (for host_buffer accessor"
00379                   " do not use a command group handler");
00380     implementation->implementation->template track_access_mode<Mode, Target>();
00381     return { *this, command_group_handler };
00382   }
00383
00384
00385   /** Force the buffer to behave like if we had created
00386       an accessor in write mode.
00387    */
00388   void mark_as_written() {
00389     return implementation->implementation->mark_as_written();
00390   }
00391
00392
00393   /** Get a host accessor to the buffer with the required mode
00394
00395       \param Mode is the requested access mode
00396
00397       \todo Implement the modes
00398
00399       \todo More elegant solution
00400   */
00401   template <access::mode Mode,
00402             access::target Target = access::target::host_buffer>
00403   accessor<T, Dimensions, Mode, Target>
00404   get_access() {
00405     static_assert(Target == access::target::host_buffer,
00406                   "get_access() without a command group handler is only"
00407                   " for host_buffer accessor");
00408     implementation->implementation->template track_access_mode<Mode, Target>();
00409     return { *this };
00410   }
00411
00412
00413   /** Return a range object representing the size of the buffer in
00414       terms of number of elements in each dimension as passed to the
00415       constructor
00416
00417       \todo rename to the equivalent from array_ref proposals? Such
00418       as size() in
00419       http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2016/p0009r2.html
00420   */
00421   auto get_range() const {
00422     /* Interpret the shape which is a pointer to the first element as an
00423        array of Dimensions elements so that the range<Dimensions>
00424        constructor is happy with this collection
```

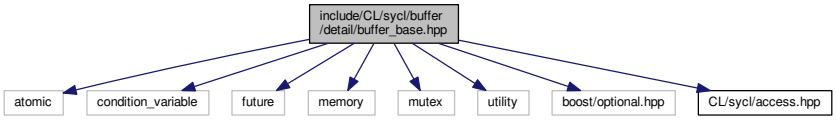
```
00425     */
00426     return implementation->implementation->get_range();
00427   }
00428
00429
00430   /** Returns the total number of elements in the buffer
00431
00432       Equal to get_range()[0] * ... * get_range()[Dimensions-1].
00433   */
00434   auto get_count() const {
00435     return implementation->implementation->get_count();
00436   }
00437
00438
00439   /** Returns the size of the buffer storage in bytes
00440
00441       Equal to get_count()*sizeof(T).
00442
00443       \todo rename to something else. In
00444       http://www.open-std.org/jtc1/sc22/wg21/docs/papers/2015/p0122r0.pdf
00445       it is named bytes() for example
00446   */
00447   size_t get_size() const {
00448     return implementation->implementation->get_size();
00449   }
00450
00451
00452   /** Returns the number of buffers that are shared/referenced
00453
00454       For example
00455       \code
00456       cl::sycl::buffer<int> b { 1000 };
00457       // Here b.use_count() should return 1
00458       cl::sycl::buffer<int> c { b };
00459       // Here b.use_count() and b.use_count() should return 2
00460       \endcode
00461
00462       \todo Add to the specification, useful for validation
00463   */
00464   auto use_count() const {
00465     // Rely on the shared_ptr<> use_count()
00466     return implementation.use_count();
00467   }
00468
00469
00470   /** Ask for read-only status of the buffer
00471
00472       \todo Add to specification
00473   */
00474   bool constexpr is_read_only() const {
00475     return std::is_const<T>::value;
00476   }
00477
00478
00479   /** Set destination of buffer data on destruction
00480
00481       The finalData points to the host memory to which, the outcome of all
00482       the buffer processing is going to be copied to.
00483
00484       This is the final pointer, which is going to be accessible after the
00485       destruction of the buffer and in the case where this is a valid
00486       pointer, the data are going to be copied to this host address.
00487
00488       finalData is different from the original host address, if the buffer
00489       was created associated with one. This is mainly to be used when a
00490       shared_ptr is given in the constructor and the output data will
00491       reside in a different location from the initialization data.
00492
00493       It is defined as a weak_ptr referring to a shared_ptr that is not
00494       associated with the cl::sycl::buffer, and so the cl::sycl::buffer
00495       will have no ownership of finalData.
00496
00497       \todo Update the API to take finalData by value instead of by
00498             reference.  This way we can have an implicit conversion
00499             possible at the API call from a shared_ptr<>, avoiding an
00500             explicit weak_ptr<> creation
00501
00502       \todo figure out how set_final_data() interact with the other
00503       way to write back some data or with some data sharing with the
00504       host that can not be undone
00505   */
00506   void set_final_data(shared_ptr_class<T> finalData) {
00507     implementation->implementation->set_final_data(std::move(finalData));
00508   }
00509
00510
00511   /** Set destination of buffer data on destruction.
```

```
00512    */
00513   void set_final_data(weak_ptr_class<T> finalData) {
00514     implementation->implementation->set_final_data(std::move(finalData));
00515   }
00516
00517
00518   /** Disable write-back on buffer destruction.
00519    */
00520   void set_final_data(std::nullptr_t) {
00521     implementation->implementation->set_final_data(nullptr);
00522   }
00523
00524
00525   /** Set destination of buffer data on destruction.
00526
00527       WARNING: the user has to ensure that the object refered to by the
00528       iterator will be alive after buffer destruction, otherwise the behaviour
00529       is undefined.
00530    */
00531   template<typename Iterator>
00532   void set_final_data(Iterator&& finalData) {
00533     implementation->implementation->
00534       set_final_data(std::forward<Iterator>(finalData));
00535   }
00536
00537 };
00538
00539 /// @} End the data Doxygen group
00540
00541 }
00542 }
00543
00544 /* Inject a custom specialization of std::hash to have the buffer
00545    usable into an unordered associative container
00546
00547    \todo Add this to the spec
00548 */
00549 namespace std {
00550
00551 template <typename T,
00552           int Dimensions,
00553           typename Allocator>
00554 struct hash<cl::sycl::buffer<T, Dimensions, Allocator>> {
00555
00556   auto operator()(const cl::sycl::buffer<T, Dimensions, Allocator>
       &b) const {
00557     // Forward the hashing to the implementation
00558     return b.hash();
00559   }
00560
00561 };
00562
00563 }
00564
00565 /*
00566     # Some Emacs stuff:
00567     ### Local Variables:
00568     ### ispell-local-dictionary: "american"
00569     ### eval: (flyspell-prog-mode)
00570     ### End:
00571 */
00572
00573 #endif // TRISYCL_SYCL_BUFFER_HPP
```

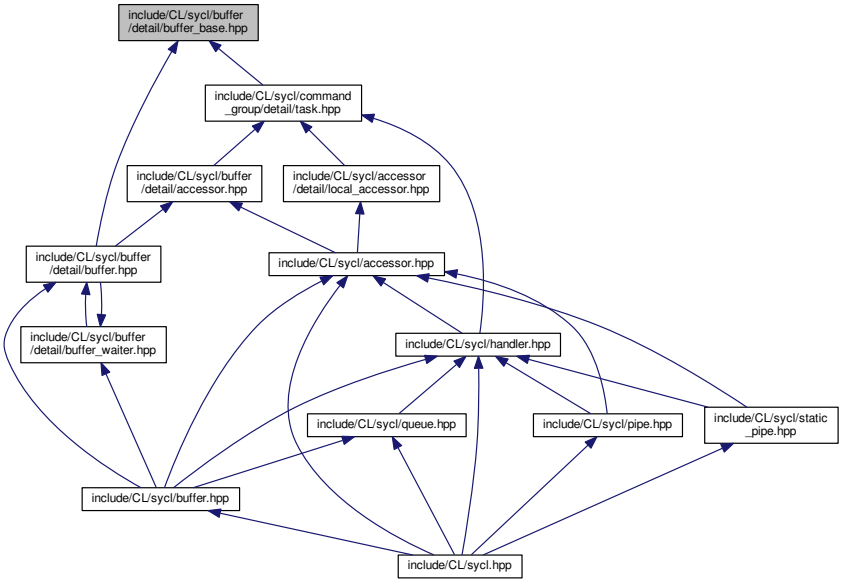
11.21 include/CL/sycl/buffer/detail/buffer_base.hpp File Reference

```
#include <atomic>
#include <condition_variable>
#include <future>
#include <memory>
#include <mutex>
#include <utility>
#include <boost/optional.hpp>
#include "CL/sycl/access.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.

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

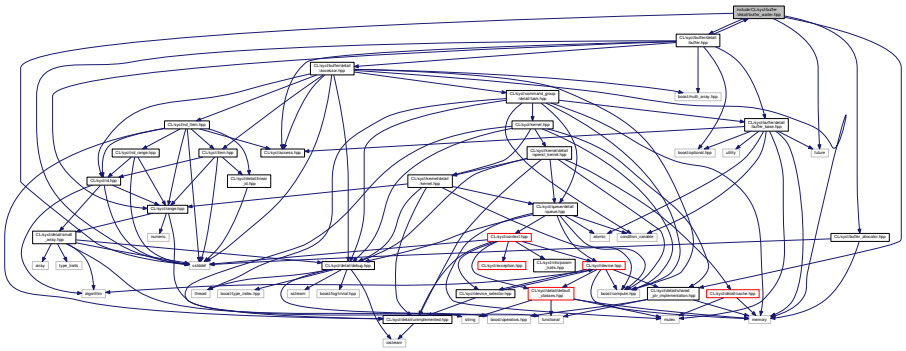
```
00001 #ifndef TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_BASE_HPP
00002 #define TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_BASE_HPP
00003
00004 /** \file The buffer_base behind the buffers, independent of the data
00005     type
00006
00007     Ronan at Keryell point FR
00008
00009     This file is distributed under the University of Illinois Open Source
00010     License. See LICENSE.TXT for details.
00011 */
00012
00013 #include <atomic>
00014 #include <condition_variable>
00015 #include <future>
00016 #include <memory>
00017 #include <mutex>
00018 #include <utility>
00019
00020 // \todo Use C++17 optional when it is mainstream
00021 #include <boost/optional.hpp>
00022
00023 #include "CL/sycl/access.hpp"
00024
00025 namespace cl {
00026 namespace sycl {
00027
00028 class handler;
00029
00030 namespace detail {
00031
00032 struct task;
00033 struct buffer_base;
00034 inline static std::shared_ptr<detail::task>
00035 add_buffer_to_task(handler *command_group_handler,
00036                    std::shared_ptr<detail::buffer_base> b,
00037                    bool is_write_mode);
00038
00039 /** Factorize some template independent buffer aspects in a base class
00040  */
00041 struct buffer_base : public std::enable_shared_from_this<buffer_base> {
00042
00043   //// Keep track of the number of kernel accessors using this buffer
00044   std::atomic<size_t> number_of_users;
00045
00046   /// Track the latest task to produce this buffer
00047   std::weak_ptr<detail::task> latest_producer;
00048   /// To protect the access to latest_producer
00049   std::mutex latest_producer_mutex;
00050
00051   /// To signal when this buffer ready
00052   std::condition_variable ready;
00053   /// To protect the access to the condition variable
00054   std::mutex ready_mutex;
00055
00056   /** If the SYCL user buffer destructor is blocking, use this to
00057       block until this buffer implementation is destroyed.
00058
00059       Use a void promise since there is no value to send, only
00060       waiting */
00061   boost::optional<std::promise<void>> notify_buffer_destructor;
00062
00063
00064   /// Create a buffer base
00065   buffer_base() : number_of_users { 0 } {}
00066
00067
00068   /// The destructor wait for not being used anymore
00069   ~buffer_base() {
00070     wait();
00071     // If there is the last SYCL user buffer waiting, notify it
00072     if (notify_buffer_destructor)
00073       notify_buffer_destructor->set_value();
00074   }
00075
00076
00077   /// Wait for this buffer to be ready, which is no longer in use
00078   void wait() {
00079     std::unique_lock<std::mutex> ul { ready_mutex };
00080     ready.wait(ul, [&] {
00081         // When there is no producer for this buffer, we are ready to use it
00082         return number_of_users == 0;
00083       });
00084   }
```

```
00085
00086
00087   /// Mark this buffer in use by a task
00088   void use() {
00089     // Increment the use count
00090     ++number_of_users;
00091   }
00092
00093
00094   /// A task has released the buffer
00095   void release() {
00096     if (--number_of_users == 0)
00097       // Notify the host consumers or the buffer destructor that it is ready
00098       ready.notify_all();
00099   }
00100
00101
00102   /// Return the latest producer for the buffer
00103   std::shared_ptr<detail::task> get_latest_producer() {
00104     std::lock_guard<std::mutex> lg { latest_producer_mutex };
00105     // Return the valid shared_ptr to the task, if any
00106     return latest_producer.lock();
00107   }
00108
00109
00110   /** Return the latest producer for the buffer and set another
00111       future producer
00112   */
00113   std::shared_ptr<detail::task>
00114   set_latest_producer(std::weak_ptr<detail::task> newer_latest_producer) {
00115     std::lock_guard<std::mutex> lg { latest_producer_mutex };
00116     using std::swap;
00117
00118     swap(newer_latest_producer, latest_producer);
00119     // Return the valid shared_ptr to the previous producing task, if any
00120     return newer_latest_producer.lock();
00121   }
00122
00123
00124   /// Add a buffer to the task running the command group
00125   std::shared_ptr<detail::task>
00126   add_to_task(handler *command_group_handler, bool is_write_mode) {
00127     return add_buffer_to_task(command_group_handler,
00128                               shared_from_this(),
00129                               is_write_mode);
00130   }
00131
00132 };
00133
00134 }
00135 }
00136 }
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_BUFFER_DETAIL_BUFFER_BASE_HPP
```

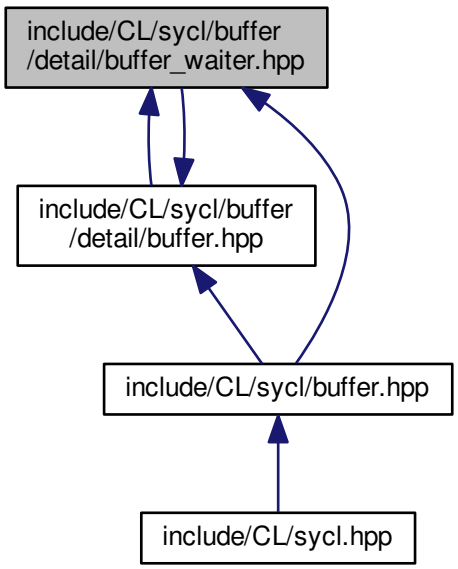
11.23 include/CL/sycl/buffer/detail/buffer_waiter.hpp File Reference

```
#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>
  auto cl::sycl::detail::waiter (detail::buffer< T, Dimensions > *b)

  Helper function to create a new buffer_waiter.

11.24 buffer_waiter.hpp

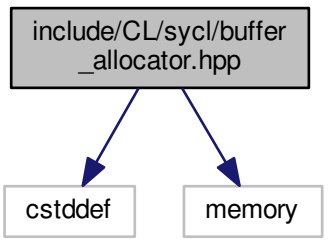
```
00001 #ifndef TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_WAITER_HPP
00002 #define TRISYCL_SYCL_BUFFER_DETAIL_BUFFER_WAITER_HPP
00003
00004 /** \file A helper class to wait for the buffer<> detail
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois 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 inline auto waiter(detail::buffer<T, Dimensions> *b) {
00079   return new buffer_waiter<T, Dimensions> { b };
00080 }
00081
00082 /// @} End the data Doxygen group
00083
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_BUFFER_DETAIL_BUFFER_WAITER_HPP
```

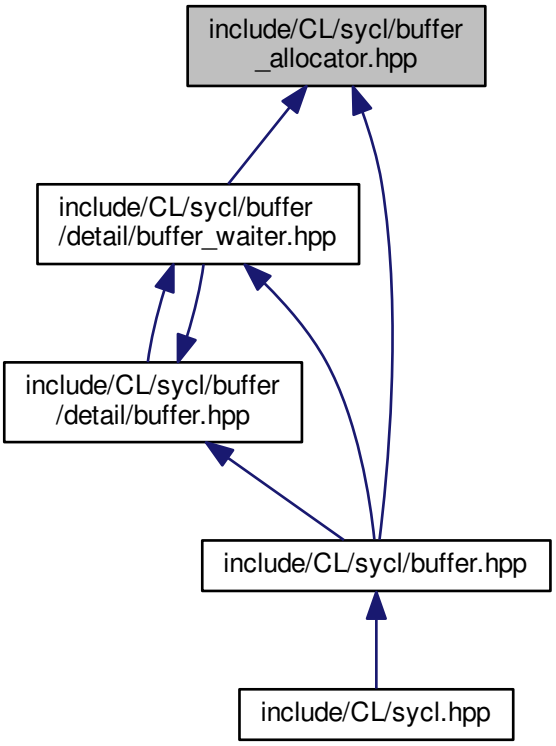
11.25 include/CL/sycl/buffer_allocator.hpp File Reference

```
#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

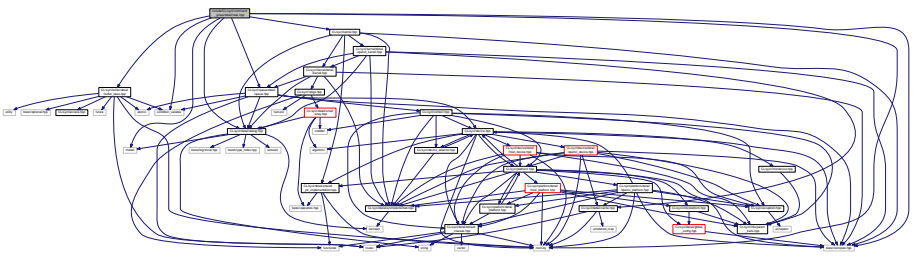
```
00001 #ifndef TRISYCL_SYCL_BUFFER_ALLOCATOR_HPP
00002 #define TRISYCL_SYCL_BUFFER_ALLOCATOR_HPP
00003
00004 /** \file The OpenCL SYCL buffer_allocator
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. 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
```

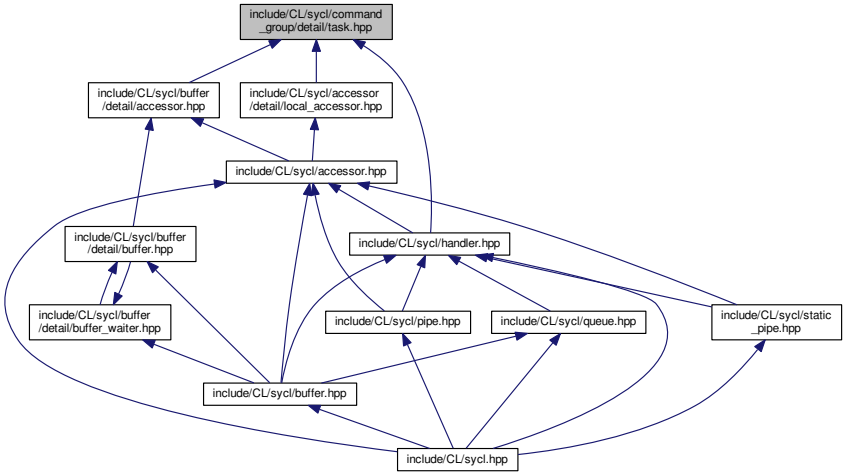
11.27 include/CL/sycl/command_group/detail/task.hpp File Reference

```
#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
```

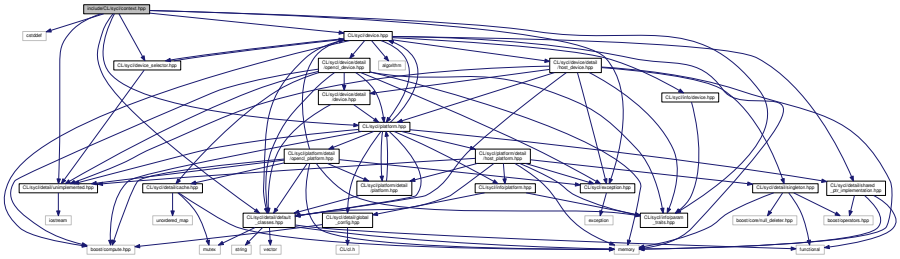
```
00113         \todo This is an issue if there is an exception in the kernel
00114     */
00115     thread.detach();
00116 #else
00117     // Just a synchronous execution otherwise
00118     execution();
00119 #endif
00120   }
00121
00122
00123   /// Wait for the required producer tasks to be ready
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     execution_ended = true;
00146     /* \todo Verify that the memory model with the notify does not
00147        require some fence or atomic */
00148     ready.notify_all();
00149   }
00150
00151
00152   /** Wait for this task to be ready
00153
00154       This is to be called from another thread
00155   */
00156   void wait() {
00157     TRISYCL_DUMP_T("The task wait for task " << this << " to end");
00158     std::unique_lock<std::mutex> ul { ready_mutex };
00159     ready.wait(ul, [&] { return execution_ended; });
00160   }
00161
00162
00163   /** Register a buffer to this task
00164
00165       This is how the dependency graph is incrementally built.
00166   */
00167   void add_buffer(std::shared_ptr<detail::buffer_base> &buf,
00168                   bool is_write_mode) {
00169     TRISYCL_DUMP_T("Add buffer " << buf << " in task " << this);
00170     /* Keep track of the use of the buffer to notify its release at
00171        the end of the execution */
00172     buffers_in_use.push_back(buf);
00173     // To be sure the buffer does not disappear before the kernel can run
00174     buf->use();
00175
00176     std::shared_ptr<detail::task> latest_producer;
00177     if (is_write_mode) {
00178       /* Set this task as the latest producer of the buffer so that
00179          another kernel may wait on this task */
00180       latest_producer = buf->set_latest_producer(shared_from_this());
00181     }
00182     else
00183       latest_producer = buf->get_latest_producer();
00184
00185     /* If the buffer is to be produced by a task, add the task in the
00186        producer list to wait on it before running the task core */
00187     if (latest_producer)
00188       producer_tasks.push_back(latest_producer);
00189   }
00190
00191
00192   /// Execute the prologues
00193   void prelude() {
00194     for (const auto &p : prologues)
00195       p();
00196     /* Free the functors that may own an accessor owning a buffer
00197        preventing the command group to complete */
00198     prologues.clear();
00199   }
```

```
00200
00201
00202   /// Execute the epilogues
00203   void postlude() {
00204     for (const auto &p : epilogues)
00205       p();
00206     /* Free the functors that may own an accessor owning a buffer
00207        preventing the command group to complete */
00208     epilogues.clear();
00209   }
00210
00211
00212   /// Add a function to the prelude to run before kernel execution
00213   void add_prelude(const std::function<void(void)> &f) {
00214     prologues.push_back(f);
00215   }
00216
00217
00218   /// Add a function to the postlude to run after kernel execution
00219   void add_postlude(const std::function<void(void)> &f) {
00220     epilogues.push_back(f);
00221   }
00222
00223
00224   /// Get the queue behind the task to run a kernel on
00225   auto get_queue() {
00226     return owner_queue;
00227   }
00228
00229
00230   /// Set the kernel running this task if any
00231   void set_kernel(const std::shared_ptr<cl::sycl::detail::kernel> &k) {
00232     kernel = k;
00233   }
00234
00235
00236   /** Get the kernel running if any
00237
00238       \todo Specify this error in the spec
00239   */
00240   cl::sycl::detail::kernel &get_kernel() {
00241     if (!kernel)
00242       throw non_cl_error("Cannot use an OpenCL kernel in this context");
00243     return *kernel;
00244   }
00245
00246 };
00247
00248 }
00249 }
00250 }
00251
00252 /*
00253     # Some Emacs stuff:
00254     ### Local Variables:
00255     ### ispell-local-dictionary: "american"
00256     ### eval: (flyspell-prog-mode)
00257     ### End:
00258 */
00259
00260 #endif // TRISYCL_SYCL_TASK_HPP
```

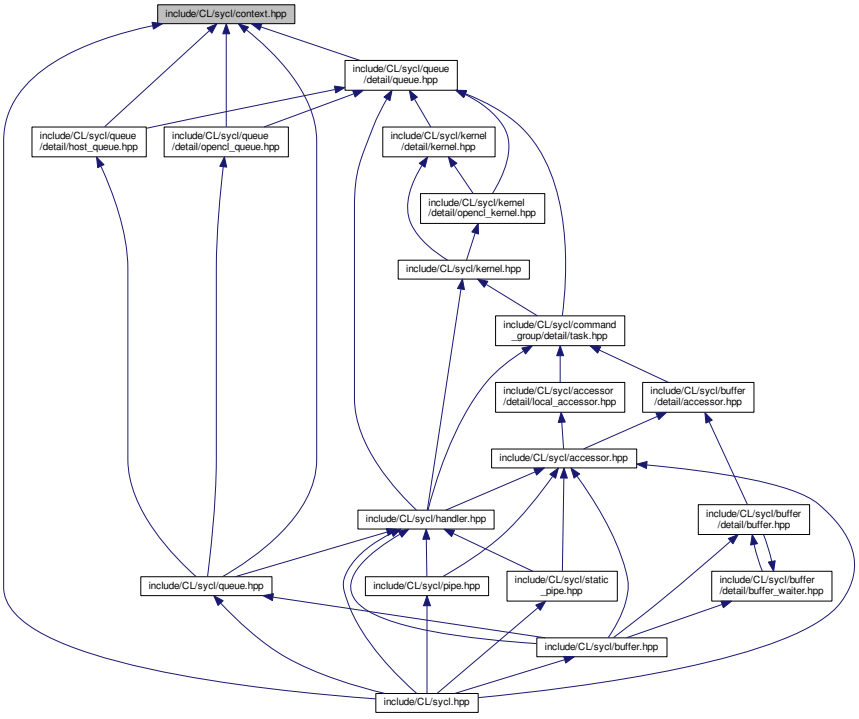
11.29 include/CL/sycl/context.hpp File Reference

```
#include <cstddef>
#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/info/param_traits.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...

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.

11.30 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/detail/default_classes.hpp"
00015 #include "CL/sycl/detail/unimplemented.hpp"
00016 #include "CL/sycl/device.hpp"
00017 #include "CL/sycl/device_selector.hpp"
00018 #include "CL/sycl/exception.hpp"
00019 #include "CL/sycl/info/param_traits.hpp"
00020 #include "CL/sycl/platform.hpp"
00021
00022 namespace cl {
00023 namespace sycl {
00024
00025 /** \addtogroup execution Platforms, contexts, devices and queues
00026     @{
00027 */
00028
00029 namespace info {
00030
00031 using gl_context_interop = bool;
00032
00033 /** Context information descriptors
00034
00035     \todo Should be unsigned int to be consistent with others?
00036 */
00037 enum class context : int {
00038   reference_count,
00039   num_devices,
00040   devices,
00041   gl_interop
00042 };
00043
00044
00045 /** Query the return type for get_info() on context stuff
00046
00047     \todo To be implemented
00048 */
00049 TRISYCL_INFO_PARAM_TRAITS_ANY_T(info::context, void)
00050
00051 }
00052
00053
00054 /** SYCL context
00055
00056     The context class encapsulates an OpenCL context, which is implicitly
00057     created and the lifetime of the context instance defines the lifetime
00058     of the underlying OpenCL context instance.
00059
00060     On destruction clReleaseContext is called.
00061
00062     The default context is the SYCL host context containing only the SYCL
00063     host device.
```

```
00064
00065     \todo The implementation is quite minimal for now.
00066 */
00067 class context {
00068
00069 public:
00070
00071   /** Constructs a context object for SYCL host using an async_handler for
00072       handling asynchronous errors
00073
00074       Note that the default case asyncHandler = nullptr is handled by the
00075       default constructor.
00076   */
00077   explicit context(async_handler asyncHandler) {
00078     detail::unimplemented();
00079   }
00080
00081
00082 #ifdef TRISYCL_OPENCL
00083   /* Context constructor, where the underlying OpenCL context is given as
00084      a parameter
00085
00086      The constructor executes a retain on the cl_context.
00087
00088      Return synchronous errors via the SYCL exception class and
00089      asynchronous errors are handled via the async_handler, if provided.
00090   */
00091   context(cl_context clContext, async_handler asyncHandler = nullptr) {
00092     detail::unimplemented();
00093   }
00094 #endif
00095
00096   /** Constructs a context object using a device_selector object
00097
00098       The context is constructed with a single device retrieved from the
00099       device_selector object provided.
00100
00101       Return synchronous errors via the SYCL exception class and
00102       asynchronous errors are handled via the async_handler, if provided.
00103   */
00104   context(const device_selector &deviceSelector,
00105           info::gl_context_interop interopFlag,
00106           async_handler asyncHandler = nullptr) {
00107     detail::unimplemented();
00108   }
00109
00110
00111   /** Constructs a context object using a device object
00112
00113       Return synchronous errors via the SYCL exception class and
00114       asynchronous errors are handled via the async_handler, if provided.
00115   */
00116   context(const device &dev,
00117           info::gl_context_interop interopFlag,
00118           async_handler asyncHandler = nullptr) {
00119     detail::unimplemented();
00120   }
00121
00122
00123   /** Constructs a context object using a platform object
00124
00125       Return synchronous errors via the SYCL exception class and
00126       asynchronous errors are handled via the async_handler, if provided.
00127   */
00128   context(const platform &plt,
00129           info::gl_context_interop interopFlag,
00130           async_handler asyncHandler = nullptr) {
00131     detail::unimplemented();
00132   }
00133
00134
00135   /* Constructs a context object using a vector_class of device objects
00136
00137      Return synchronous errors via the SYCL exception class and
00138      asynchronous errors are handled via the async_handler, if provided.
00139
00140      \todo Update the specification to replace vector by collection
00141      concept.
00142   */
00143   context(const vector_class<device> &deviceList,
00144           info::gl_context_interop interopFlag,
00145           async_handler asyncHandler = nullptr) {
00146     detail::unimplemented();
00147   }
00148
00149   /** Default constructor that chooses the context according the
00150       heuristics of the default selector
```

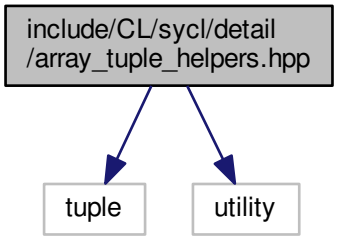
```
00151
00152       Return synchronous errors via the SYCL exception class.
00153
00154       Get the default constructors back.
00155   */
00156   context() = default;
00157
00158
00159 #ifdef TRISYCL_OPENCL
00160   /* Returns the underlying cl_context object, after retaining the cl_context.
00161
00162      Retains a reference to the returned cl_context object.
00163
00164      Caller should release it when finished.
00165   */
00166   cl_context get() const {
00167     detail::unimplemented();
00168     return {};
00169   }
00170 #endif
00171
00172
00173   /// Specifies whether the context is in SYCL Host Execution Mode.
00174   bool is_host() const {
00175     return true;
00176   }
00177
00178
00179   /** Returns the SYCL platform that the context is initialized for
00180
00181       \todo To be implemented
00182   */
00183   platform get_platform();
00184
00185
00186   /** Returns the set of devices that are part of this context
00187
00188       \todo To be implemented
00189   */
00190   vector_class<device> get_devices() const {
00191     detail::unimplemented();
00192     return {};
00193   }
00194
00195
00196   /** Queries OpenCL information for the under-lying cl context
00197
00198       \todo To be implemented
00199   */
00200   template <info::context Param>
00201   typename info::param_traits<info::context, Param>::type
      get_info() const {
00202     detail::unimplemented();
00203     return {};
00204   }
00205
00206 };
00207
00208 /// @} to end the execution Doxygen group
00209
00210 }
00211 }
00212
00213 /*
00214     # Some Emacs stuff:
00215     ### Local Variables:
00216     ### ispell-local-dictionary: "american"
00217     ### eval: (flyspell-prog-mode)
00218     ### End:
00219 */
00220
00221 #endif // TRISYCL_SYCL_CONTEXT_HPP
```

11.31 include/CL/sycl/detail/array_tuple_helpers.hpp File Reference

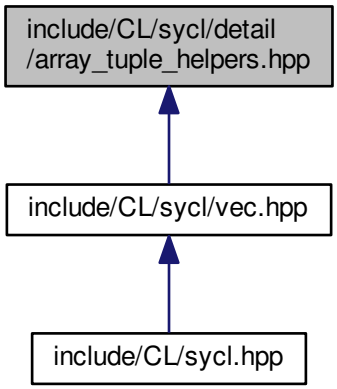
Some helpers to do array-tuple conversions.

```
#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.

11.31.1 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.

11.32 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 { }
```

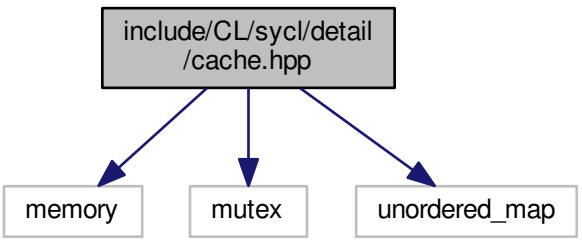
```
00040      construction from each tuple element:
00041      { std::get<0>(t), std::get<1>(t), ..., std::get<dimension-1>(t) }
00042
00043      The static cast is here to avoid the warning when there is a loss
00044      of precision, for example when initializing an int from a float.
00045   */
00046   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
```

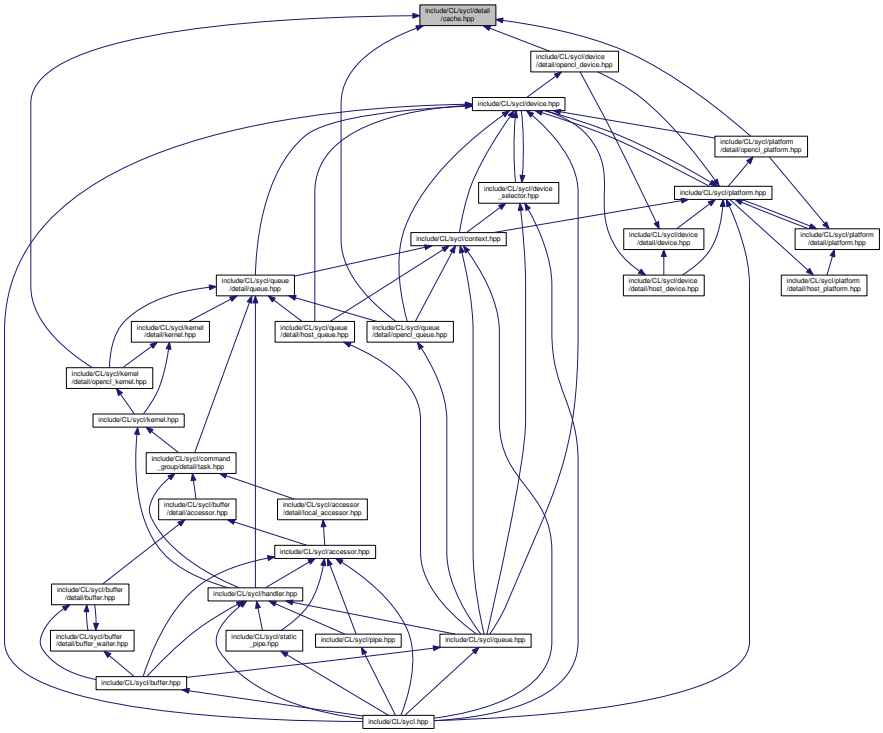
11.33 include/CL/sycl/detail/cache.hpp File Reference

```
#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

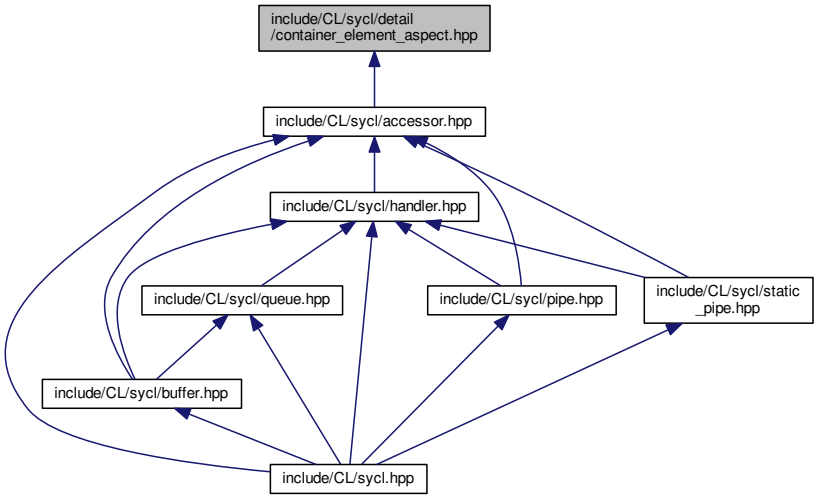
11.34 cache.hpp

```
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       // Return the found element
00069       return std::shared_ptr<value_type>{ i->second };
00070
00071     // Otherwise create and insert a new element
00072     std::shared_ptr<value_type> e { create_element() };
00073     c.insert({ k, e });
00074     return e;
00075   }
00076
00077
00078   /** Remove an entry from the cache
00079
00080       \param[in] k is the key associated to the value to remove from
00081       the cache
00082   */
00083   void remove(const key_type &k) {
00084     std::lock_guard<std::mutex> lg { m };
00085     c.erase(k);
00086   }
00087
00088 };
00089
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_DEVICE_CACHE_HPP
```

11.35 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

11.36 container_element_aspect.hpp

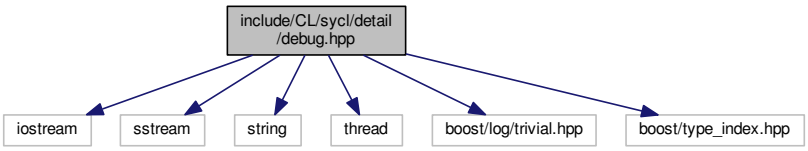
```
00001 #ifndef TRISYCL_SYCL_DETAIL_CONTAINER_ELEMENT_ASPECT_HPP
00002 #define TRISYCL_SYCL_DETAIL_CONTAINER_ELEMENT_ASPECT_HPP
00003
00004 /** \file Implement basic types à la STL related to container
00005     elements, such as value_type, reference...
00006
00007     Ronan at Keryell point FR
00008
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
```

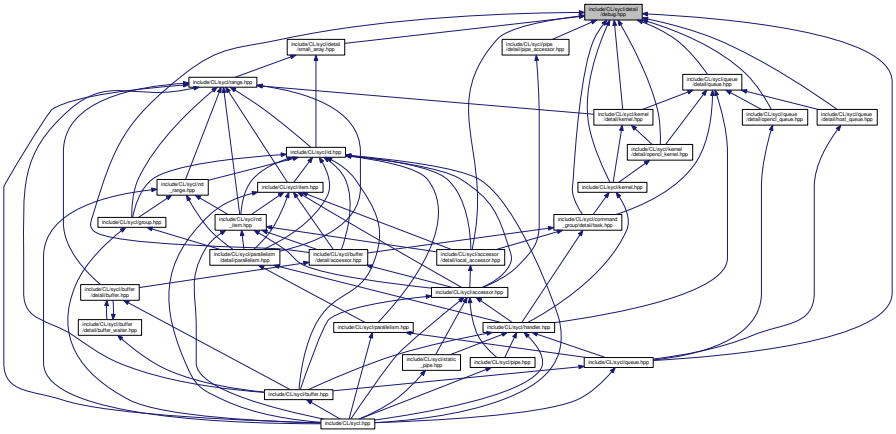
11.37 include/CL/sycl/detail/debug.hpp File Reference

```
#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.

11.37.1 Macro Definition Documentation

11.37.1.1 #define TRISYCL_DUMP(*expression*) TRISYCL_INTERNAL_DUMP(expression)

Definition at line 43 of file debug.hpp.

11.37.1.2 #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().

11.37.1.3 #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().

11.38 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.
```

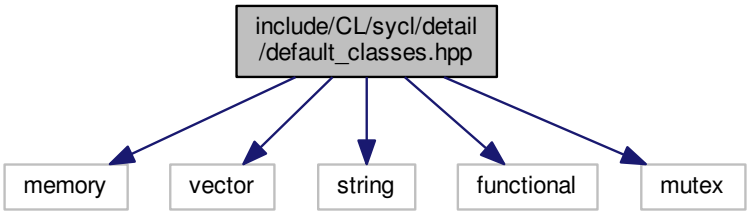
```
00085   */
00086   template <typename U = T>
00087   debug(debug const &,
00088         /* Use intermediate U type to have the type dependent for
00089            enable_if to work
00090
00091         \todo Use is_copy_constructible_v when moving to C++17 */
00092         std::enable_if_t<std::is_copy_constructible<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
```

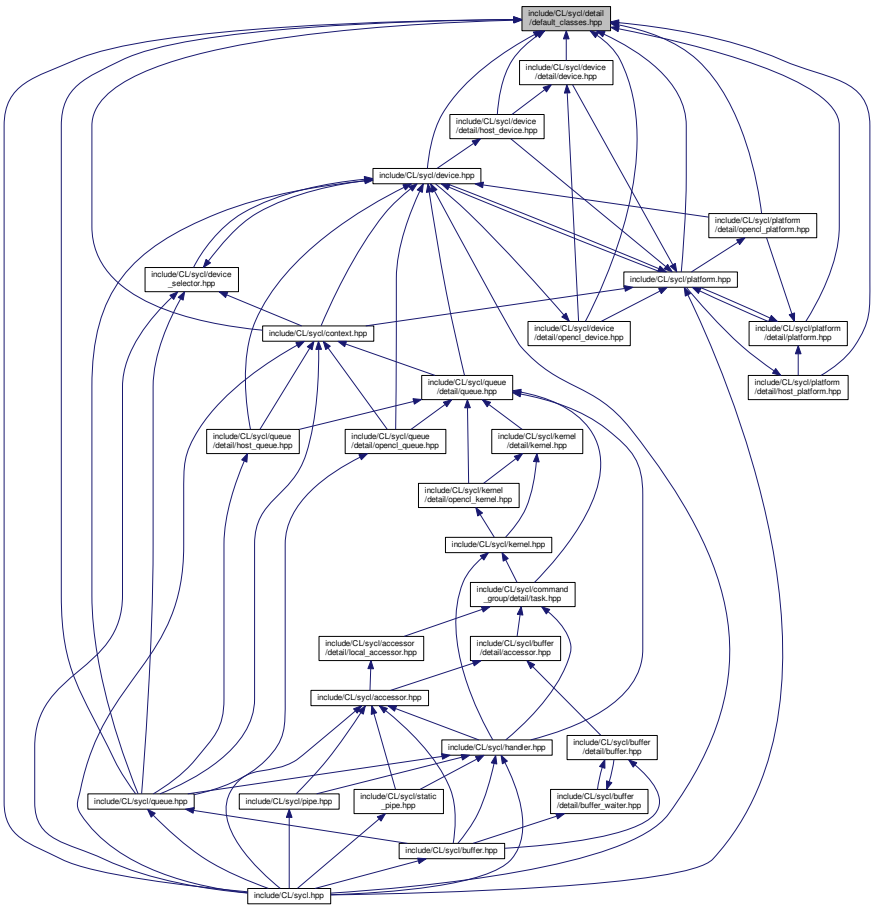
11.39 include/CL/sycl/detail/default_classes.hpp File Reference

```
#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 >

11.40 default_classes.hpp

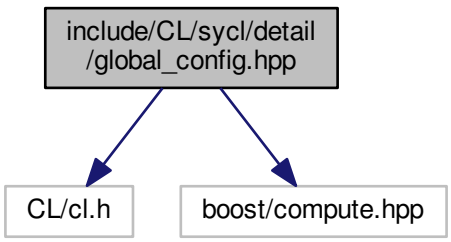
```
00001 #ifndef TRISYCL_SYCL_DETAIL_DEFAULT_CLASSES_HPP
00002 #define TRISYCL_SYCL_DETAIL_DEFAULT_CLASSES_HPP
00003
00004 /** \file The OpenCL SYCL default classes to use from the STL according to
00005     section 3.2 of SYCL 1.2 specification
00006
00007     Ronan at Keryell point FR
00008
00009     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 /// @} End the defaults Doxygen group
00121
00122 /*
00123     # Some Emacs stuff:
00124     ### Local Variables:
00125     ### ispell-local-dictionary: "american"
00126     ### eval: (flyspell-prog-mode)
00127     ### End:
00128 */
00129
00130 #endif // TRISYCL_SYCL_DETAIL_DEFAULT_CLASSES_HPP
```

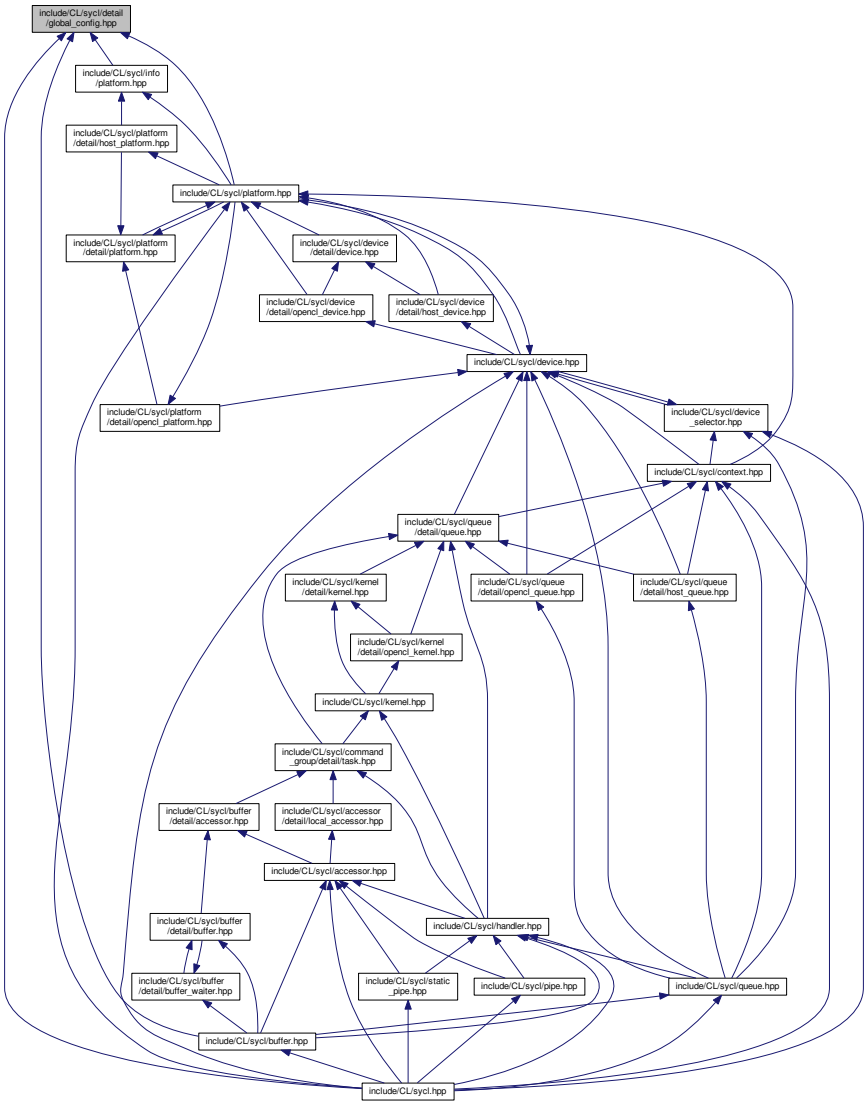
11.41 include/CL/sycl/detail/global_config.hpp File Reference

```
#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))

11.41.1 Macro Definition Documentation

11.41.1.1 #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_device::~opencl_device(), cl::sycl::detail::opencl_platform::~opencl_platform(), and cl::sycl::detail::opencl_queue::~opencl_queue().

11.41.1.2 #define TRISYCL_WEAK_ATTRIB_SUFFIX __attribute__((weak))

Definition at line 66 of file global_config.hpp.

Referenced by cl::sycl::device::get_platform().

11.42 global_config.hpp

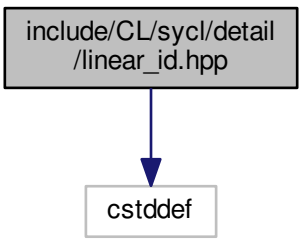
```
00001 #ifndef TRISYCL_SYCL_DETAIL_GLOBAL_CONFIG_HPP
00002 #define TRISYCL_SYCL_DETAIL_GLOBAL_CONFIG_HPP
00003
00004 /** \file The OpenCL SYCL details on the global triSYCL configuration
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois 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
```

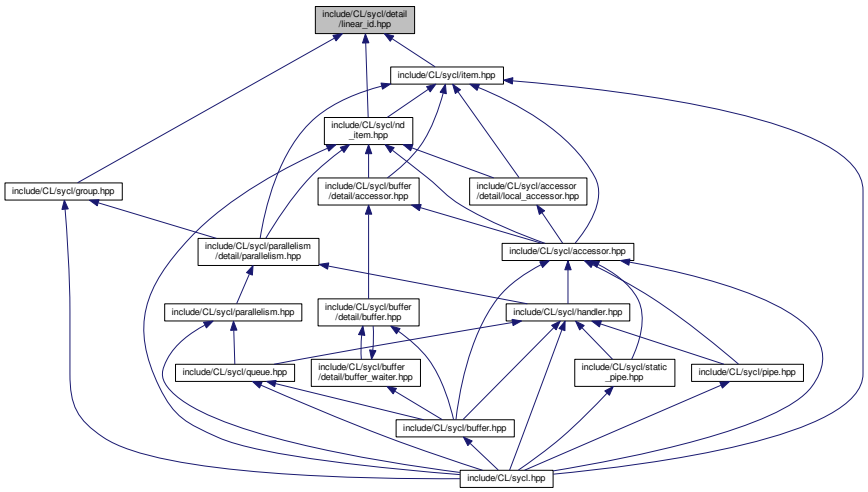
11.43 include/CL/sycl/detail/linear_id.hpp File Reference

`#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.

11.44 linear_id.hpp

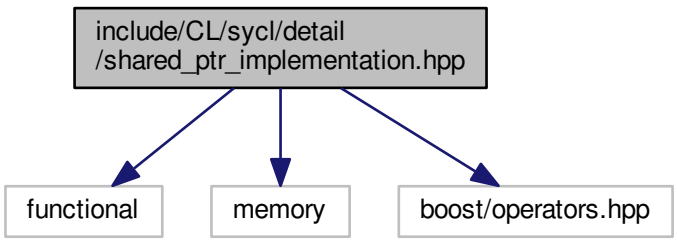
```
00001 #ifndef TRISYCL_SYCL_DETAIL_LINEAR_ID_HPP
00002 #define TRISYCL_SYCL_DETAIL_LINEAR_ID_HPP
00003
00004 /** \file Compute linearized array access
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. 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
```

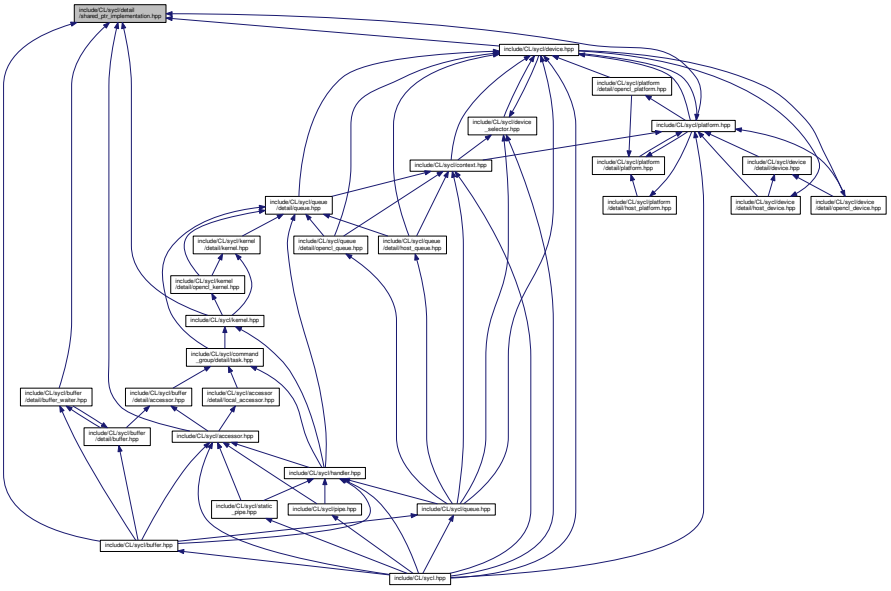
11.45 include/CL/sycl/detail/shared_ptr_implementation.hpp File Reference

```
#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

11.46 shared_ptr_implementation.hpp

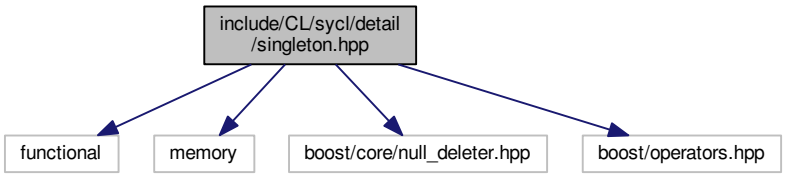
```
00001 #ifndef TRISYCL_SYCL_DETAIL_SHARED_PTR_IMPLEMENTATION_HPP
00002 #define TRISYCL_SYCL_DETAIL_SHARED_PTR_IMPLEMENTATION_HPP
00003
00004 /** \file Mix-in to add an implementation as shared_ptr with total
00005     ordering and hashing so that the class can be used with algorithms
00006     and 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
```

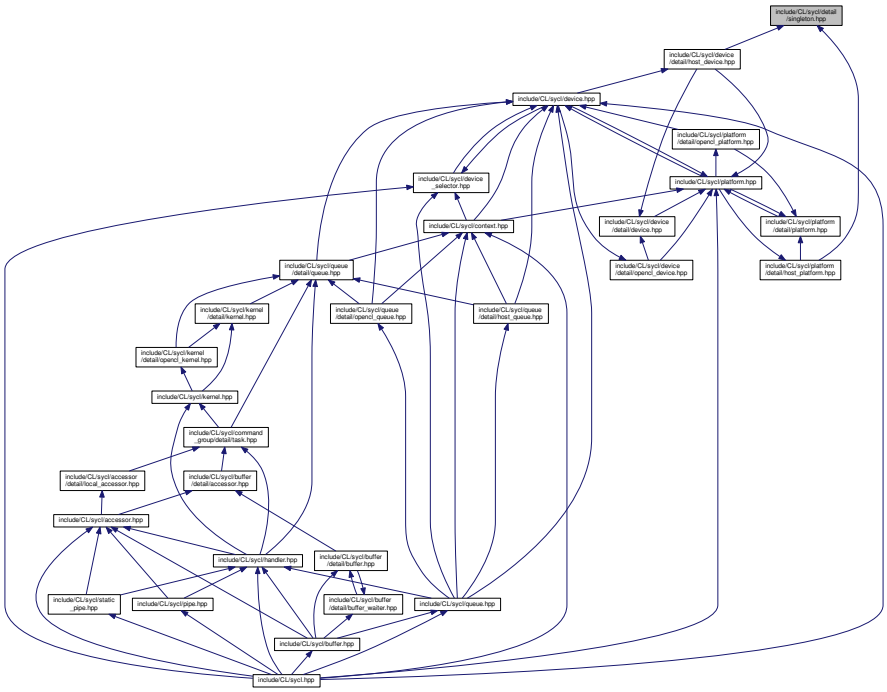
11.47 include/CL/sycl/detail/singleton.hpp File Reference

```
#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

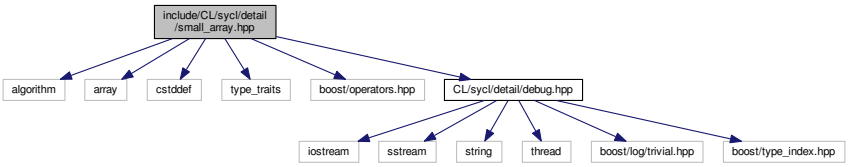
11.48 singleton.hpp

```
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
```

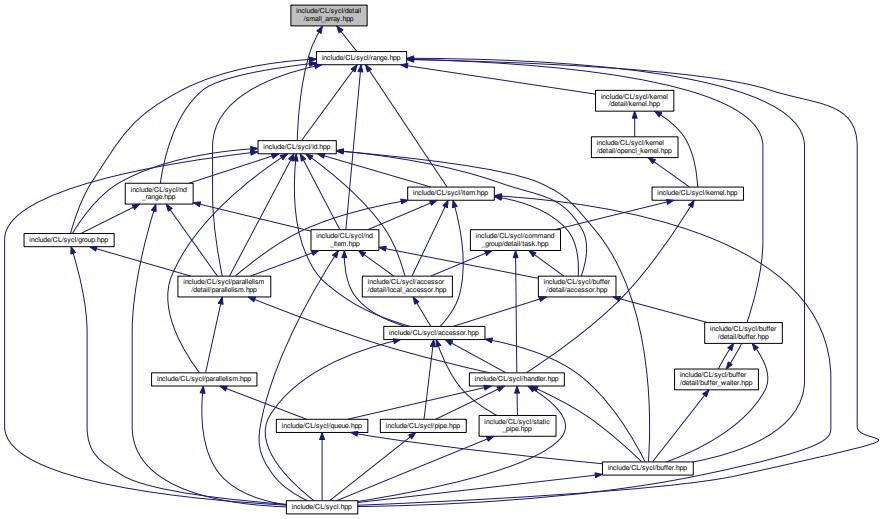
11.49 include/CL/sycl/detail/small_array.hpp File Reference

```
#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.

11.50 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 a multi-dimensional index, used for example to locate a work
00042     item or a buffer element
00043
00044     Unfortunately, even if std::array is an aggregate class allowing
00045     native list initialization, it is no longer an aggregate if we derive
00046     from an aggregate. Thus we have to redeclare the constructors.
00047
00048     \param BasicType is the type element, such as int
00049
00050     \param Dims is the dimension number, typically between 1 and 3
00051
00052     \param FinalType is the final type, such as range<> or id<>, so that
00053     boost::operator can return the right type
00054
00055     \param EnableArgsConstructor adds a constructors from Dims variadic
00056     elements when true. It is false by default.
00057
00058     std::array<> provides the collection concept, with .size(), == and !=
00059     too.
00060 */
00061 template <typename BasicType,
00062           typename FinalType,
00063           std::size_t Dims,
00064           bool EnableArgsConstructor = false>
00065 struct small_array : std::array<BasicType, Dims>,
00066   // To have all the usual arithmetic operations on this type
00067   boost::euclidean_ring_operators<FinalType>,
00068   // Bitwise operations
00069   boost::bitwise<FinalType>,
00070   // Shift operations
00071   boost::shiftable<FinalType>,
00072   // Already provided by array<> lexicographically:
00073   // boost::equality_comparable<FinalType>,
```

```
00074   // boost::less_than_comparable<FinalType>,
00075   // Add a display() method
00076   detail::display_vector<FinalType> {
00077
00078   /// \todo add this Boost::multi_array or STL concept to the
00079   /// specification?
00080   static const auto dimensionality = Dims;
00081
00082   /* Note that constexpr size() from the underlying std::array provides
00083      the same functionality */
00084   static const size_t dimension = Dims;
00085   using element_type = BasicType;
00086
00087
00088   /** A constructor from another array
00089
00090       Make it explicit to avoid spurious range<> constructions from int *
00091       for example
00092   */
00093   template <typename SourceType>
00094   small_array(const SourceType src[Dims]) {
00095     // (*this)[0] is the first element of the underlying array
00096     std::copy_n(src, Dims, &(*this)[0]);
00097   }
00098
00099
00100   /** An accessor to the first variable of a small array
00101   */
00102   BasicType& x(){
00103     static_assert(Dims >= 1, "can't access to small_array[0] if Dims < 1");
00104     return (*this)[0];
00105   }
00106
00107
00108   /** An accessor to the second variable of a small array
00109   */
00110   BasicType& y(){
00111     static_assert(Dims >= 2, "can't access to small_array[1] if Dims < 2");
00112     return (*this)[1];
00113   }
00114
00115
00116   /** An accessor to the third variable of a small array
00117   */
00118   BasicType& z(){
00119     static_assert(Dims >= 3, "can't access to small_array[2] if Dims < 3");
00120     return (*this)[2];
00121   }
00122
00123
00124   /// A constructor from another small_array of the same size
00125   template <typename SourceBasicType,
00126             typename SourceFinalType,
00127             bool SourceEnableArgsConstructor>
00128   small_array(const small_array<SourceBasicType,
00129               SourceFinalType,
00130               Dims,
00131               SourceEnableArgsConstructor> &src) {
00132     std::copy_n(&src[0], Dims, &(*this)[0]);
00133   }
00134
00135
00136   /** Initialize the array from a list of elements
00137
00138       Strangely, even when using the array constructors, the
00139       initialization of the aggregate is not available. So recreate an
00140       equivalent here.
00141
00142       Since there are inherited types that defines some constructors with
00143       some conflicts, make it optional here, according to
00144       EnableArgsConstructor template parameter.
00145    */
00146   template <typename... Types,
00147             // Just to make enable_if depend of the template and work
00148             bool Depend = true,
00149             typename = typename std::enable_if_t<EnableArgsConstructor
00150                                                  && Depend>>
00151   small_array(const Types &... args)
00152     : std::array<BasicType, Dims> {
00153     // Allow a loss of precision in initialization with the static_cast
00154     { static_cast<BasicType>(args)... }
00155   }
00156   {
00157     static_assert(sizeof...(args) == Dims,
00158                   "The number of initializing elements should match "
00159                   "the dimension");
00160   }
```

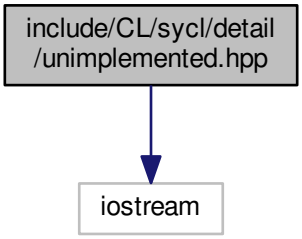
```
00161
00162
00163   /// Construct a small_array from a std::array
00164   template <typename SourceBasicType>
00165   small_array(const std::array<SourceBasicType, Dims> &src)
00166   : std::array<BasicType, Dims>(src) {}
00167
00168
00169   /// Keep other constructors from the underlying std::array
00170   using std::array<BasicType, Dims>::array;
00171
00172   /// Keep the synthesized constructors
00173   small_array() = default;
00174
00175   /// Return the element of the array
00176   auto get(std::size_t index) const {
00177     return (*this)[index];
00178   }
00179
00180   /* Implement minimal methods boost::euclidean_ring_operators needs to
00181      generate everything */
00182   /// Add + like operations on the id<> and others
00183   TRISYCL_BOOST_OPERATOR_VECTOR_OP(+=)
00184
00185   /// Add - like operations on the id<> and others
00186   TRISYCL_BOOST_OPERATOR_VECTOR_OP(-=)
00187
00188   /// Add * like operations on the id<> and others
00189   TRISYCL_BOOST_OPERATOR_VECTOR_OP(*=)
00190
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
00213   /** Since the boost::operator work on the small_array, add an implicit
00214       conversion to produce the expected type */
00215   operator FinalType () {
00216     return *static_cast<FinalType *>(this);
00217   }
00218
00219 };
00220
00221
00222 /** A small array of 1, 2 or 3 elements with the implicit constructors */
00223 template <typename BasicType, typename FinalType, std::size_t Dims>
00224 struct small_array_123 : small_array<BasicType, FinalType, Dims> {
00225   static_assert(1 <= Dims && Dims <= 3,
00226                 "Dimensions are between 1 and 3");
00227 };
00228
00229
00230 /** Use some specializations so that some function overloads can be
00231     determined according to some implicit constructors and to have an
00232     implicit conversion from/to BasicType (such as an int typically) if
00233     Dimensions = 1
00234 */
00235 template <typename BasicType, typename FinalType>
00236 struct small_array_123<BasicType, FinalType, 1>
00237   : public small_array<BasicType, FinalType, 1> {
00238   /// A 1-D constructor to have implicit conversion from from 1 integer
00239   /// and automatic inference of the dimensionality
00240   small_array_123(BasicType x) {
00241     (*this)[0] = x;
00242   }
00243
00244
00245   /// Keep other constructors
00246   small_array_123() = default;
00247
```

```
00248   using small_array<BasicType, FinalType, 1>::small_array;
00249
00250   /** Conversion so that an for example an id<1> can basically be used
00251       like an integer */
00252   operator BasicType() const {
00253     return (*this)[0];
00254   }
00255 };
00256
00257
00258 template <typename BasicType, typename FinalType>
00259 struct small_array_123<BasicType, FinalType, 2>
00260   : public small_array<BasicType, FinalType, 2> {
00261   /// A 2-D constructor to have implicit conversion from from 2 integers
00262   /// and automatic inference of the dimensionality
00263   small_array_123(BasicType x, BasicType y) {
00264     (*this)[0] = x;
00265     (*this)[1] = y;
00266   }
00267
00268
00269   /** Broadcasting constructor initializing all the elements with the
00270       same value
00271
00272       \todo Add to the specification of the range, id...
00273   */
00274   explicit small_array_123(BasicType e) : small_array_123 { e, e } { }
00275
00276
00277   /// Keep other constructors
00278   small_array_123() = default;
00279
00280   using small_array<BasicType, FinalType, 2>::small_array;
00281 };
00282
00283
00284 template <typename BasicType, typename FinalType>
00285 struct small_array_123<BasicType, FinalType, 3>
00286   : public small_array<BasicType, FinalType, 3> {
00287   /// A 3-D constructor to have implicit conversion from from 3 integers
00288   /// and automatic inference of the dimensionality
00289   small_array_123(BasicType x, BasicType y, BasicType z) {
00290     (*this)[0] = x;
00291     (*this)[1] = y;
00292     (*this)[2] = z;
00293   }
00294
00295
00296   /** Broadcasting constructor initializing all the elements with the
00297       same value
00298
00299       \todo Add to the specification of the range, id...
00300   */
00301   explicit small_array_123(BasicType e) : small_array_123 { e, e, e } { }
00302
00303
00304   /// Keep other constructors
00305   small_array_123() = default;
00306
00307   using small_array<BasicType, FinalType, 3>::small_array;
00308 };
00309
00310 /// @} End the helpers Doxygen group
00311
00312 }
00313 }
00314 }
00315
00316 /*
00317     # Some Emacs stuff:
00318     ### Local Variables:
00319     ### ispell-local-dictionary: "american"
00320     ### eval: (flyspell-prog-mode)
00321     ### End:
00322 */
00323
00324 #endif // TRISYCL_SYCL_DETAIL_SMALL_ARRAY_HPP
```

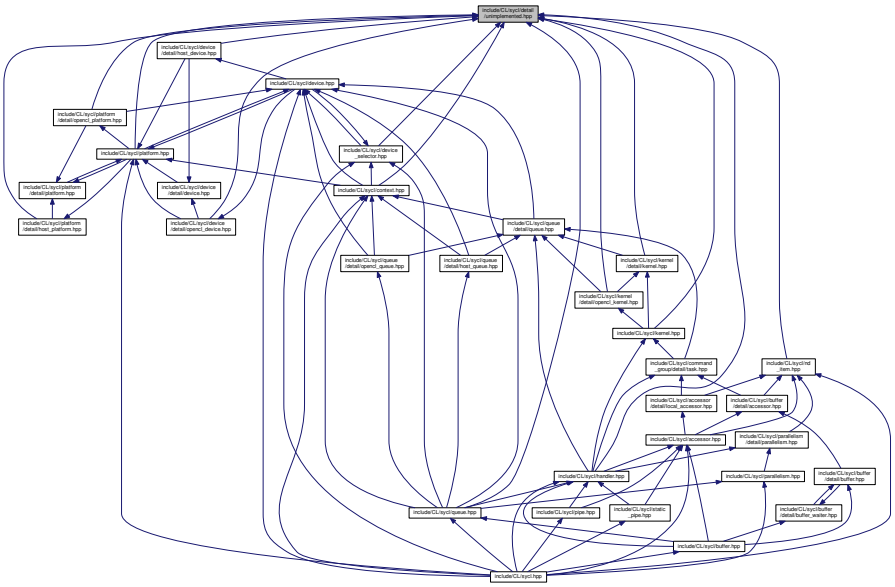
11.51 include/CL/sycl/detail/unimplemented.hpp File Reference

```
#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.

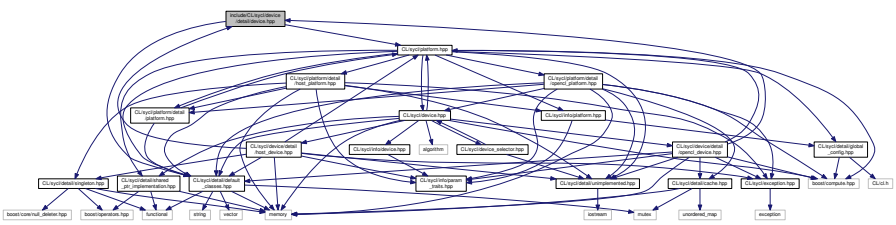
11.52 unimplemented.hpp

```
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   std::cerr << "Error: using a non implemented feature!!!" << std::endl
00027             << "Please contribute to the open source implementation. :-)"
00028             << std::endl;
00029 }
00030
00031 /// @} End the helpers Doxygen group
00032
00033 }
00034 }
00035 }
00036
00037 /*
00038     # Some Emacs stuff:
00039     ### Local Variables:
00040     ### ispell-local-dictionary: "american"
00041     ### eval: (flyspell-prog-mode)
00042     ### End:
00043 */
00044
00045 #endif // TRISYCL_SYCL_DETAIL_UNIMPLEMENTED_HPP
```

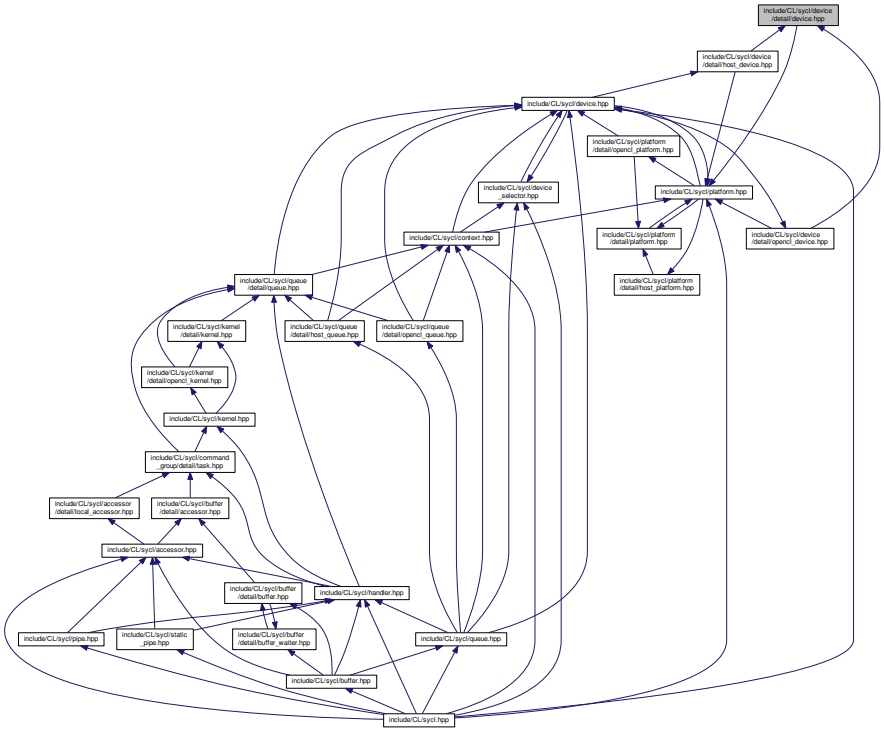
11.53 include/CL/sycl/device/detail/device.hpp File Reference

```
#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

11.54 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
```

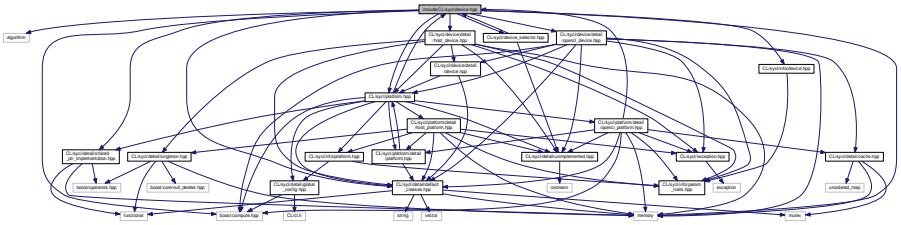
```
00016 namespace cl {
00017 namespace sycl {
00018 namespace detail {
00019
00020 /** \addtogroup execution Platforms, contexts, devices and queues
00021     @{
00022 */
00023
00024 /// An abstract class representing various models of SYCL devices
00025 class device {
00026
00027 public:
00028
00029 #ifdef TRISYCL_OPENCL
00030   /// Return the cl_device_id of the underlying OpenCL platform
00031   virtual cl_device_id get() const = 0;
00032 #endif
00033
00034
00035   /// Return true if the device is a SYCL host device
00036   virtual bool is_host() const = 0;
00037
00038
00039   /// Return true if the device is an OpenCL CPU device
00040   virtual bool is_cpu() const = 0;
00041
00042
00043   /// Return true if the device is an OpenCL GPU device
00044   virtual bool is_gpu() const = 0;
00045
00046
00047   /// Return true if the device is an OpenCL accelerator device
00048   virtual bool is_accelerator() const = 0;
00049
00050
00051   /// Return the platform of device
00052   virtual cl::sycl::platform get_platform() const = 0;
00053
00054
00055   /// Query the device for OpenCL info::device info
00056   /** \todo virtual cannot be templated
00057   template <typename T>
00058   virtual T get_info(info::device param) const = 0;
00059   */
00060
00061
00062   /// Specify whether a specific extension is supported on the device.
00063   virtual bool has_extension(const string_class &extension) const = 0;
00064
00065
00066   // Virtual to call the real destructor
00067   virtual ~device() {}
00068
00069 };
00070
00071 /// @} to end the execution Doxygen group
00072
00073 }
00074 }
00075 }
00076
00077 /*
00078     # Some Emacs stuff:
00079     ### Local Variables:
00080     ### ispell-local-dictionary: "american"
00081     ### eval: (flyspell-prog-mode)
00082     ### End:
00083 */
00084
00085 #endif // TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_HPP
```

11.55 include/CL/sycl/device.hpp File Reference

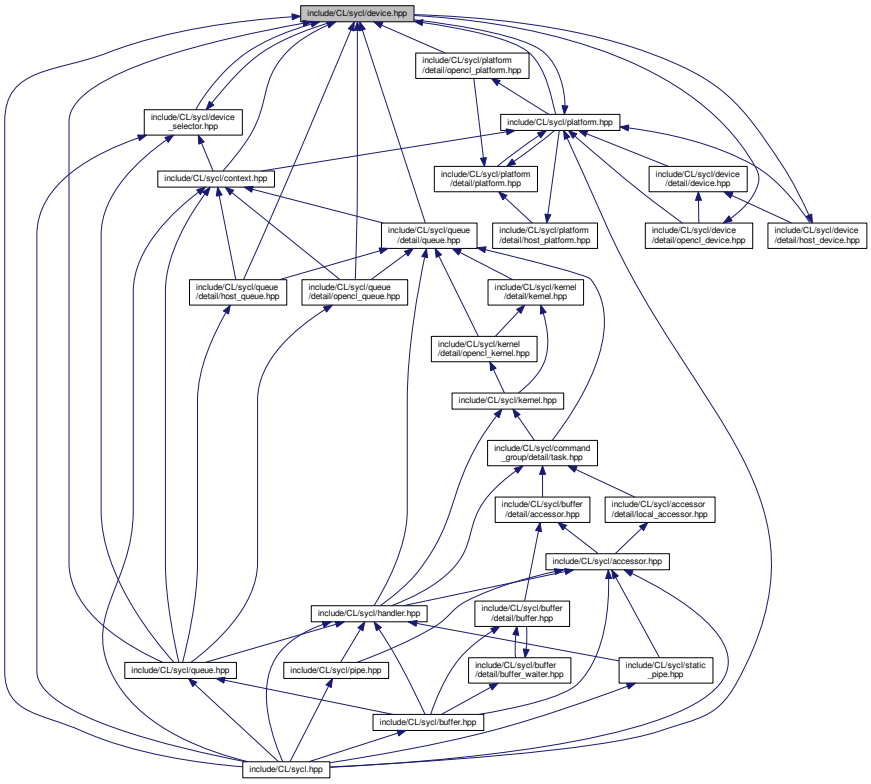
```
#include <algorithm>
```

```
#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::vendor > () const

11.56 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 #endif
00128
00129
00130   /// Return true if the device is the SYCL host device
00131   bool is_host() const {
00132     return implementation->is_host();
```

```
00133   }
00134
00135
00136   /// Return true if the device is an OpenCL CPU device
00137   bool is_cpu() const {
00138     return implementation->is_cpu();
00139   }
00140
00141
00142   /// Return true if the device is an OpenCL GPU device
00143   bool is_gpu() const {
00144     return implementation->is_gpu();
00145   }
00146
00147
00148   /// Return true if the device is an OpenCL accelerator device
00149   bool is_accelerator() const {
00150     return implementation->is_accelerator();
00151   }
00152
00153
00154
00155   /** Return the device_type of a device
00156
00157       \todo Present in Boost.Compute, to be added to the specification
00158   */
00159   info::device_type type() const {
00160     if (is_host())
00161       return info::device_type::host;
00162     else if (is_cpu())
00163       return info::device_type::cpu;
00164     else if (is_gpu())
00165       return info::device_type::gpu;
00166     else if (is_accelerator())
00167       return info::device_type::accelerator;
00168     else
00169       // \todo Put a SYCL exception
00170       throw std::domain_error("Unknown cl::sycl::info::device_type");
00171   }
00172
00173
00174   /** Return the platform of device
00175
00176       Return synchronous errors via the SYCL exception class.
00177   */
00178   platform get_platform() const {
00179     return implementation->get_platform();
00180   }
00181
00182
00183   /** Return a list of all available devices
00184
00185       Return synchronous errors via SYCL exception classes.
00186   */
00187 #ifdef _MSC_VER
00188   inline
00189 #endif
00190   static vector_class<device>
00191     get_devices(info::device_type device_type =
      info::device_type::all)
00192     TRISYCL_WEAK_ATTRIB_SUFFIX;
00193
00194   /** Query the device for OpenCL info::device info
00195
00196       Return synchronous errors via the SYCL exception class.
00197
00198       \todo
00199   */
00200   template <typename T>
00201   T get_info(info::device param) const {
00202     //return implementation->get_info<Param>(param);
00203   }
00204
00205
00206   /** Query the device for OpenCL info::device info
00207
00208       Return synchronous errors via the SYCL exception class.
00209
00210       \todo
00211   */
00212   template <info::device Param>
00213   inline auto get_info() const;
00214   /*{
00215     // Forward to the version where the info parameter is not a template
00216     //return get_info<typename info::param_traits_t<info::device, Param>>(Param);
00217     detail::unimplemented();
00218     return 0;
```

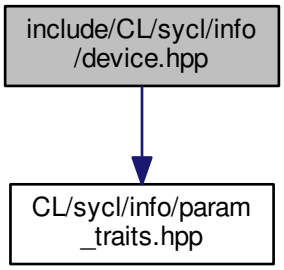
```
00219   }*/
00220
00221
00222   /// Test if a specific extension is supported on the device
00223   bool has_extension(const string_class &extension) const {
00224     return implementation->has_extension(extension);
00225   }
00226
00227
00228 #ifdef XYZTRISYCL_OPENCL
00229   /** Partition the device into sub devices based upon the properties
00230       provided
00231
00232       Return synchronous errors via SYCL exception classes.
00233
00234       \todo
00235   */
00236   vector_class<device>
00237   create_sub_devices(info::device_partition_type partition_type,
00238                      info::device_partition_property partition_property,
00239                      info::device_affinity_domain affinity_domain) const {
00240     return implementation->create_sub_devices(partition_type,
00241                                               partition_property,
00242                                               affinity_domain);
00243   }
00244 #endif
00245
00246 };
00247
00248
00249 template <>
00250 inline auto device::get_info<info::device::max_work_group_size>() const {
00251   return size_t { 63 };
00252 }
00253
00254
00255 template <>
00256 inline auto device::get_info<info::device::max_compute_units>() const {
00257   return size_t { 56 };
00258 }
00259
00260 template <>
00261 inline auto device::get_info<info::device::device_type>() const {
00262   return info::device_type::cpu;
00263 }
00264
00265 template <>
00266 inline auto device::get_info<info::device::local_mem_size>() const {
00267   return size_t { 32000 };
00268 }
00269
00270 template <>
00271 inline auto device::get_info<info::device::vendor>() const {
00272   return string_class {};
00273 }
00274
00275 /// @} to end the Doxygen group
00276
00277 }
00278 }
00279
00280
00281 /* Inject a custom specialization of std::hash to have the buffer
00282    usable into an unordered associative container
00283
00284    \todo Add this to the spec
00285 */
00286 namespace std {
00287
00288 template <> struct hash<cl::sycl::device> {
00289
00290   auto operator()(const cl::sycl::device &d) const {
00291     // Forward the hashing to the implementation
00292     return d.hash();
00293   }
00294
00295 };
00296
00297 }
00298
00299 /*
00300     # Some Emacs stuff:
00301     ### Local Variables:
00302     ### ispell-local-dictionary: "american"
00303     ### eval: (flyspell-prog-mode)
00304     ### End:
00305 */
```

```
00306
00307 #endif // TRISYCL_SYCL_DEVICE_HPP
```

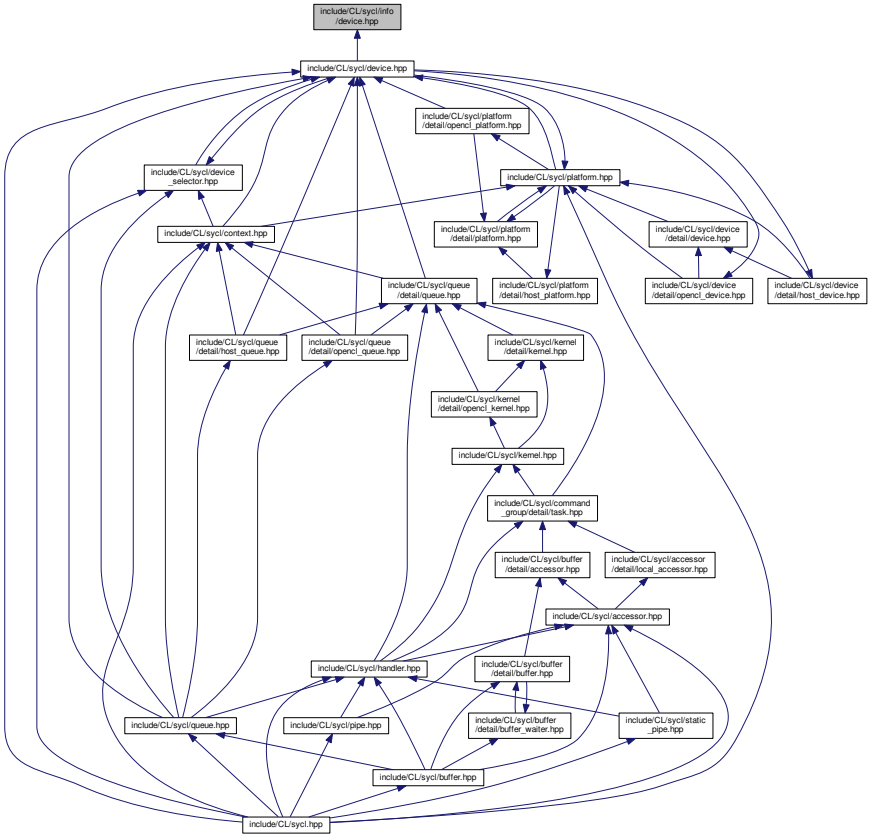
11.57 include/CL/sycl/info/device.hpp File Reference

```
#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 }

11.58 device.hpp

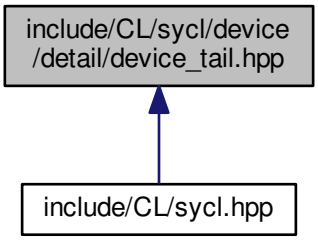
```
00001 #ifndef TRISYCL_SYCL_INFO_DEVICE_HPP
00002 #define TRISYCL_SYCL_INFO_DEVICE_HPP
00003
00004 /** \file The OpenCL SYCL device information parameters
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. 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
```

11.59 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

11.60 device_tail.hpp

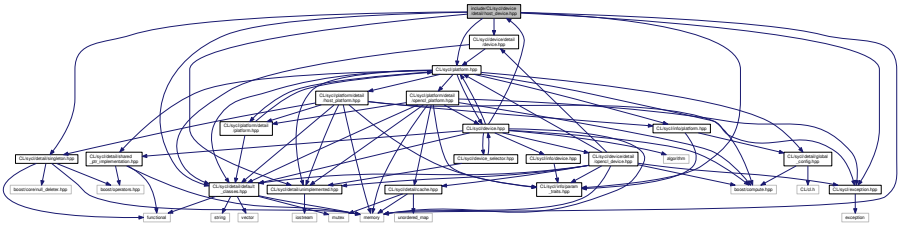
```
00001 #ifndef TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_TAIL_HPP
00002 #define TRISYCL_SYCL_DEVICE_DETAIL_DEVICE_TAIL_HPP
00003
00004 /** \file The ending part of of OpenCL SYCL device
00005
00006     This is here to break a dependence between device and device_selector
00007
00008     Ronan at Keryell point 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
```

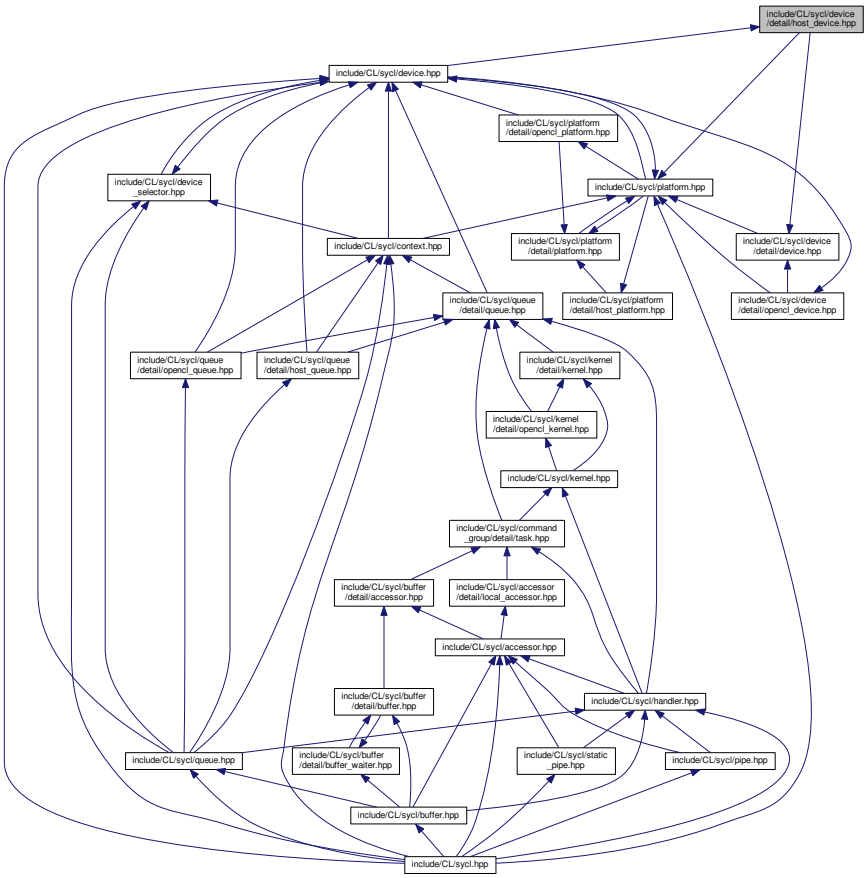
11.61 include/CL/sycl/device/detail/host_device.hpp File Reference

```
#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

11.62 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
```

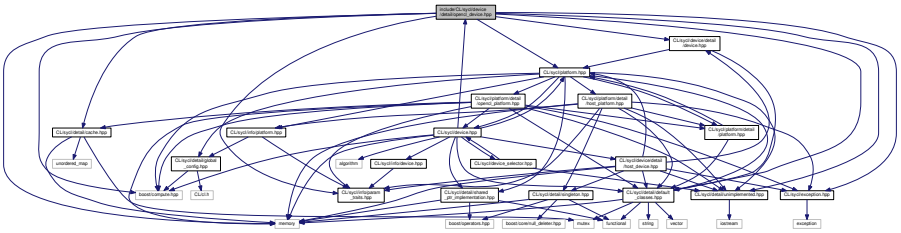
```
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
00012 #include <memory>
00013
00014 #include "CL/sycl/detail/default_classes.hpp"
00015
00016 #include "CL/sycl/detail/singleton.hpp"
00017 #include "CL/sycl/detail/unimplemented.hpp"
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 #endif
00046
00047
00048   /// Return true since the device is a SYCL host device
00049   bool is_host() const override {
00050     return true;
00051   }
00052
00053
00054   /// Return false since the host device is not an OpenCL CPU device
00055   bool is_cpu() const override {
00056     return false;
00057   }
00058
00059
00060   /// Return false since the host device is not an OpenCL GPU device
00061   bool is_gpu() const override {
00062     return false;
00063   }
00064
00065
00066   /// Return false since the host device is not an OpenCL accelerator device
00067   bool is_accelerator() const override {
00068     return false;
00069   }
00070
00071
00072   /** Return the platform of device
00073
00074       Return synchronous errors via the SYCL exception class.
00075
00076       \todo To be implemented
00077   */
00078   cl::sycl::platform get_platform() const override {
00079     detail::unimplemented();
00080     return {};
00081   }
00082
00083 #if 0
00084   /** Query the device for OpenCL info::device info
00085
00086       Return synchronous errors via the SYCL exception class.
00087
00088       \todo To be implemented
00089   */
00090   template <info::device Param>
00091   typename info::param_traits<info::device, Param>::type
00092   get_info() const override {
00093     detail::unimplemented();
00094     return {};
```

```
00095   }
00096 #endif
00097
00098   /** Specify whether a specific extension is supported on the device
00099
00100       \todo To be implemented
00101   */
00102   bool has_extension(const string_class &extension) const override {
00103     detail::unimplemented();
00104     return {};
00105   }
00106
00107
00108 };
00109
00110 /// @} to end the execution Doxygen group
00111
00112 }
00113 }
00114 }
00115
00116 /*
00117     # Some Emacs stuff:
00118     ### Local Variables:
00119     ### ispell-local-dictionary: "american"
00120     ### eval: (flyspell-prog-mode)
00121     ### End:
00122 */
00123
00124 #endif // TRISYCL_SYCL_DEVICE_DETAIL_HOST_DEVICE_HPP
```

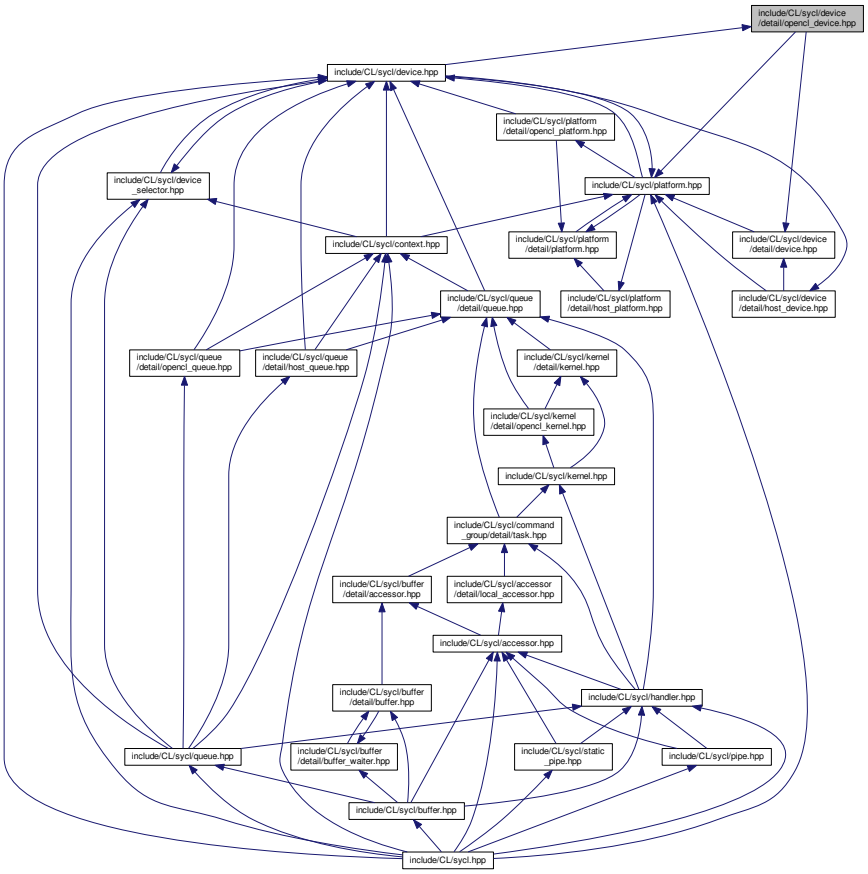
11.63 include/CL/sycl/device/detail/opencl_device.hpp File Reference

```
#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

Variables

- TRISYCL_WEAK_ATTRIB_PREFIX detail::cache< cl_device_id, detail::opencl_device > opencl_device↩ ::cache cl::sycl::detail::TRISYCL_WEAK_ATTRIB_SUFFIX

11.64 opencl_device.hpp

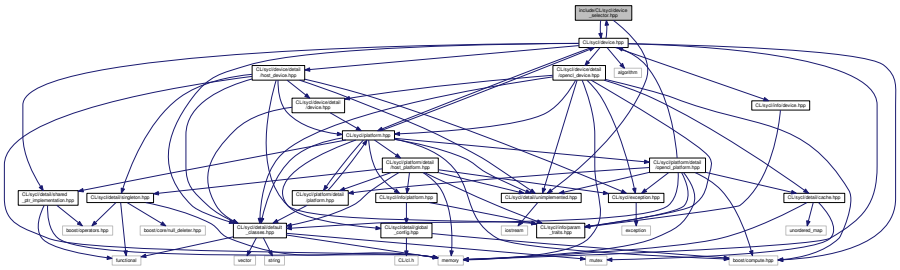
```
00001 #ifndef TRISYCL_SYCL_DEVICE_DETAIL_OPENCL_DEVICE_HPP
00002 #define TRISYCL_SYCL_DEVICE_DETAIL_OPENCL_DEVICE_HPP
00003
00004 /** \file The SYCL OpenCL device implementation
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open 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 false since an OpenCL device is not the SYCL host device
00051   bool is_host() const override {
00052     return false;
00053   }
00054
00055
00056   /// Test if the OpenCL is a CPU device
00057   bool is_cpu() const override {
00058     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00059     return d.type() & boost::compute::device::cpu;
00060   }
00061
00062
00063   /// Test if the OpenCL is a GPU device
00064   bool is_gpu() const override {
00065     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00066     return d.type() & boost::compute::device::gpu;
00067   }
00068
00069
00070   /// Test if the OpenCL is an accelerator device
00071   bool is_accelerator() const override {
00072     // Even in Boost.Compute the type is a bit-field, so use & instead of ==
00073     return d.type() & boost::compute::device::accelerator;
00074   }
00075
00076
00077   /** Return the platform of device
00078
00079       Return synchronous errors via the SYCL exception class.
00080
00081       \todo To be implemented
00082   */
00083   cl::sycl::platform get_platform() const override {
```

```
00084     detail::unimplemented();
00085     return {};
00086   }
00087
00088 #if 0
00089   /** Query the device for OpenCL info::device info
00090
00091       Return synchronous errors via the SYCL exception class.
00092
00093       \todo To be implemented
00094   */
00095   template <info::device Param>
00096   typename info::param_traits<info::device, Param>::type
00097   get_info() const override {
00098     detail::unimplemented();
00099     return {};
00100   }
00101 #endif
00102
00103   /** Specify whether a specific extension is supported on the device.
00104
00105       \todo To be implemented
00106   */
00107   bool has_extension(const string_class &extension) const override {
00108     detail::unimplemented();
00109     return {};
00110   }
00111
00112
00113   ///// Get a singleton instance of the opencl_device
00114   static std::shared_ptr<opencl_device>
00115   instance(const boost::compute::device &d) {
00116     return cache.get_or_register(d.id(),
00117                                  [&] { return new opencl_device { d }; });
00118   }
00119
00120 private:
00121
00122   /// Only the instance factory can built it
00123   opencl_device(const boost::compute::device &d) : d { d } {}
00124
00125 public:
00126
00127   /// Unregister from the cache on destruction
00128   ~opencl_device() override {
00129     cache.remove(d.id());
00130   }
00131
00132 };
00133
00134 /* Allocate the cache here but since this is a pure-header library,
00135    use a weak symbol so that only one remains when SYCL headers are
00136    used in different compilation units of a program
00137 */
00138 TRISYCL_WEAK_ATTRIB_PREFIX
00139 detail::cache<cl_device_id, detail::opencl_device>
     opencl_device::cache
00140 TRISYCL_WEAK_ATTRIB_SUFFIX;
00141
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_DETAIL_OPENCL_DEVICE_HPP
```

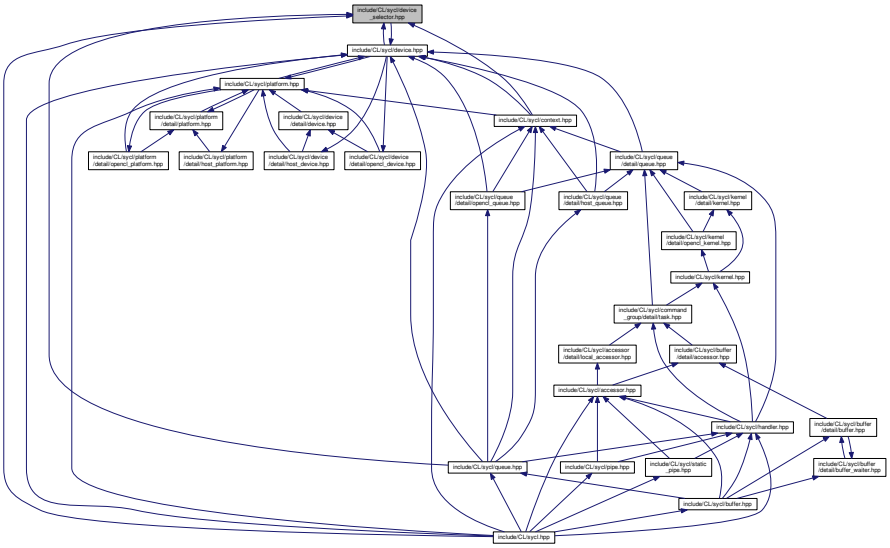
11.65 include/CL/sycl/device_selector.hpp File Reference

```
#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

11.66 device_selector.hpp

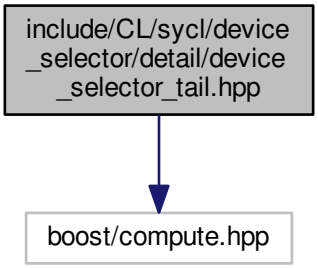
```
00001 #ifndef TRISYCL_SYCL_DEVICE_SELECTOR_HPP
00002 #define TRISYCL_SYCL_DEVICE_SELECTOR_HPP
00003
00004 /** \file The OpenCL SYCL device_selector
```

```
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
```

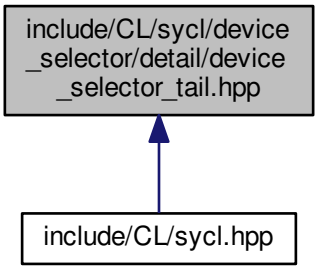
11.67 include/CL/sycl/device_selector/detail/device_selector_tail.hpp File Reference

```
#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.

11.68 device_selector_tail.hpp

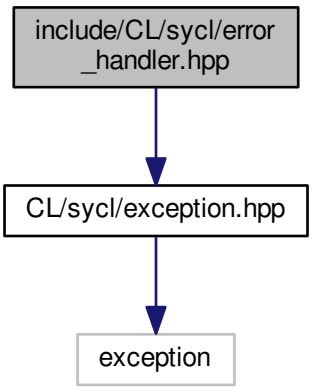
```
00001 #ifndef TRISYCL_SYCL_DEVICE_SELECTOR_DETAIL_DEVICE_SELECTOR_TAIL_HPP
00002 #define TRISYCL_SYCL_DEVICE_SELECTOR_DETAIL_DEVICE_SELECTOR_TAIL_HPP
00003
00004 /** \file The ending part of of the OpenCL SYCL device_selector
00005
00006     This is here to break a dependence between device and device_selector
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 }
```

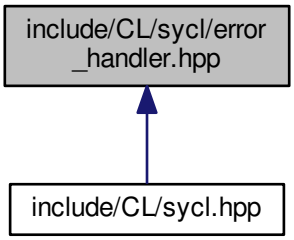
```
00144 }
00145
00146 /*
00147     # Some Emacs stuff:
00148     ### Local Variables:
00149     ### ispell-local-dictionary: "american"
00150     ### eval: (flyspell-prog-mode)
00151     ### End:
00152 */
00153
00154 #endif // TRISYCL_SYCL_DEVICE_SELECTOR_DETAIL_DEVICE_SELECTOR_TAIL_HPP
```

11.69 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

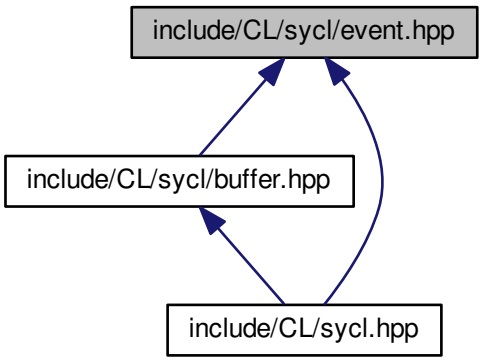
11.70 error_handler.hpp

```
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
00047 namespace trisycl {
00048
00049   struct default_error_handler : error_handler {
00050
00051     void report_error(exception &) override {
00052     }
00053   };
00054 }
00055
00056   // \todo finish initialization
```

```
00057   //error_handler::default_handler = nullptr;
00058
00059
00060 /// @} End the error_handling Doxygen group
00061
00062 }
00063 }
00064
00065 /*
00066     # Some Emacs stuff:
00067     ### Local Variables:
00068     ### ispell-local-dictionary: "american"
00069     ### eval: (flyspell-prog-mode)
00070     ### End:
00071 */
00072
00073 #endif // TRISYCL_SYCL_ERROR_HANDLER_HPP
```

11.71 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

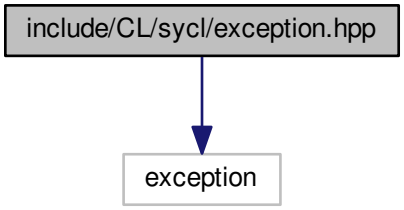
11.72 event.hpp

```
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
```

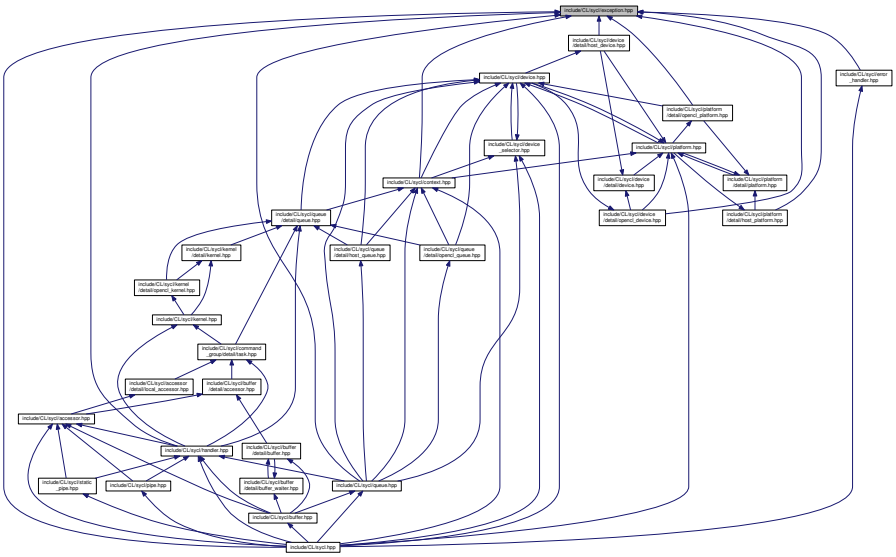
11.73 include/CL/sycl/exception.hpp File Reference

```
#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 >

11.74 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
```

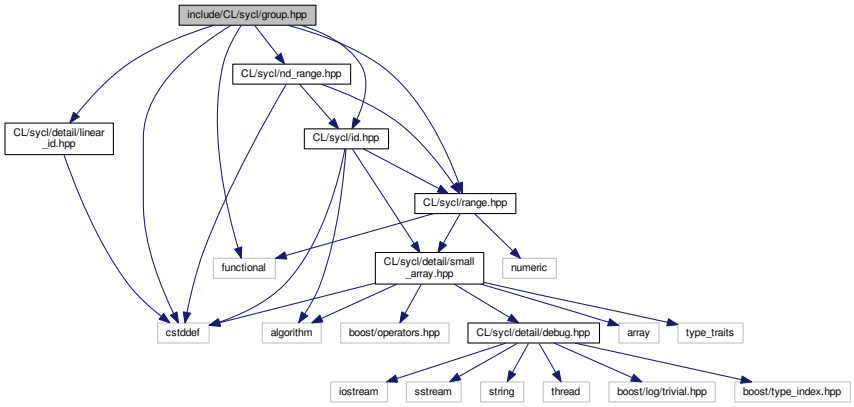
```
00084   cl_int get_cl_code() const {
00085     return cl_code;
00086   }
00087 #endif
00088
00089 };
00090
00091
00092 /// An error stored in an exception_list for asynchronous errors
00093 struct async_exception : exception {
00094   using exception::exception;
00095 };
00096
00097
00098 class runtime_error : 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
```

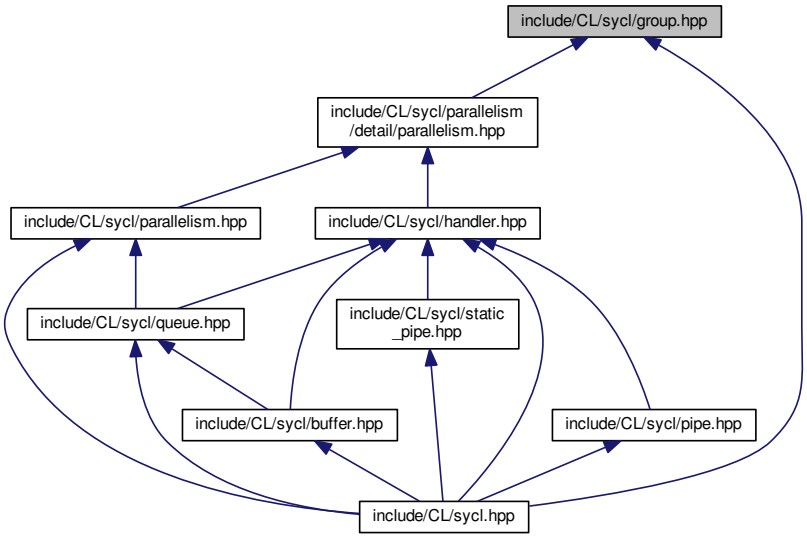
11.75 include/CL/sycl/group.hpp File Reference

```
#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.

11.76 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
```

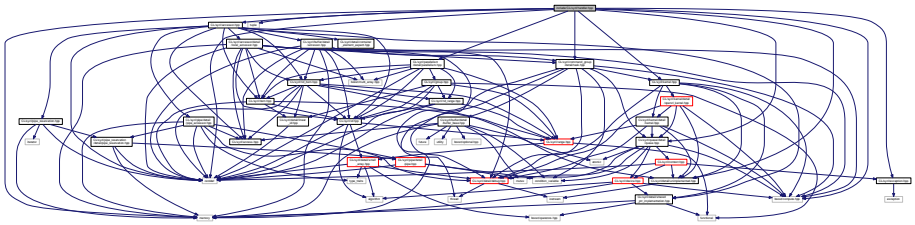
```
00072
00073   /** To be able to copy and assign group, use default constructors too
00074
00075       \todo Make most of them protected, reserved to implementation
00076   */
00077   group() = default;
00078
00079
00080   /** Return an id representing the index of the group within the nd_range
00081       for every dimension
00082   */
00083   id<Dimensions> get() const { return group_id; }
00084
00085
00086   /// Return the index of the group in the given dimension
00087   size_t get(int dimension) const { return get()[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());
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
```

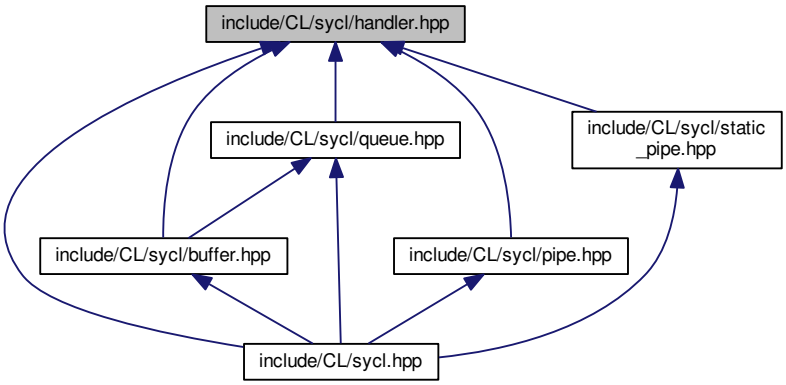
11.77 include/CL/sycl/handler.hpp File Reference

```
#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/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.

11.77.1 Macro Definition Documentation

11.77.1.1 #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 198 of file handler.hpp.

11.77.1.2 #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);           \
        }));                                               \
  }
```

11.77.1.3 #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 366 of file handler.hpp.

11.78 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/parallelism/detail/parallelism.hpp"
00026 #include "CL/sycl/queue/detail/queue.hpp"
00027
00028 namespace cl {
00029 namespace sycl {
00030
00031 /** \addtogroup execution Platforms, contexts, devices and queues
00032     @{
00033 */
00034
00035 /** Command group handler class
00036
00037     A command group handler object can only be constructed by the SYCL runtime.
00038
00039     All of the accessors defined in the command group scope take as a
```

```
00040     parameter an instance of the command group handler and all the kernel
00041     invocation functions are methods of this class.
00042 */
00043 class handler {
00044
00045 public:
00046
00047   /** Attach the task and accessors to it.
00048    */
00049   std::shared_ptr<detail::task> task;
00050
00051
00052   /* Create a command group handler from the queue detail
00053
00054      The queue detail is used to track kernel completion.
00055
00056      Note that this is an implementation dependent constructor. Normal
00057      users cannot construct handler from scratch.
00058
00059      \todo Make this constructor private
00060   */
00061   handler(const std::shared_ptr<detail::queue> &q) {
00062     // Create a new task for this command_group
00063     task = std::make_shared<detail::task>(q);
00064   }
00065
00066
00067 #ifdef TRISYCL_OPENCL
00068   /** Set accessor kernel arg for an OpenCL kernel which is used through the
00069       SYCL/OpenCL interop interface
00070
00071       The index value specifies which parameter of the OpenCL kernel is
00072       being set and the accessor object, which OpenCL buffer or image is
00073       going to be given as kernel argument.
00074
00075       \todo Update the specification to use a ref && to the accessor instead?
00076
00077       \todo It is not that clean to have set_arg() associated to a
00078       command handler. Rethink the specification?
00079
00080       \todo It seems more logical to have these methods on kernel instead
00081   */
00082   template <typename DataType,
00083             int Dimensions,
00084             access::mode Mode,
00085             access::target Target = access::target::global_buffer
      >
00086   void set_arg(int arg_index,
00087                accessor<DataType, Dimensions, Mode, Target> &&
      acc_obj) {
00088     /* Before running the kernel, make sure the cl_mem behind this
00089        accessor is up-to-date on the device if needed and pass it to
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         acc_obj.implementation->copy_in_cl_buffer();
00096         task->get_kernel().get_boost_compute()
00097           .set_arg(arg_index, acc_obj.implementation->get_cl_buffer());
00098       });
00099     /* After running the kernel, make sure the cl_mem behind this
00100        accessor is up-to-date on the host if needed */
00101     task->add_postlude([=] {
00102         acc_obj.implementation->copy_back_cl_buffer();
00103       });
00104   }
00105
00106
00107   /** Set kernel args for an OpenCL kernel which is used through the
00108       SYCL/OpenCL interoperability interface
00109   */
00110   template <typename T>
00111   void set_arg(int arg_index, T && scalar_value) {
00112     /* Explicitly capture task by copy instead of having this captured
00113        by reference and task by reference by side effect */
00114     task->add_prelude([=, task = task] {
00115         task->get_kernel().get_boost_compute()
00116           .set_arg(arg_index, scalar_value);
00117       });
00118   }
00119
00120
00121 private:
00122
00123   /// Helper to individually call set_arg() for each argument
00124   template <std::size_t... Is, typename... Ts>
```

```
00125   void dispatch_set_arg(std::index_sequence<Is...>, Ts&&... args) {
00126     // Use an intermediate tuple to ease individual argument access
00127     auto &&t = std::make_tuple(std::forward<Ts>(args)...);
00128     // Dispatch individual set_arg() for each argument
00129     auto just_to_evaluate = {
00130       0 /*< At least 1 element to deal with empty set_args() */,
00131       ( set_arg(Is, std::forward<Ts>(std::get<Is>(t))), 0)...
00132     };
00133     // Remove the warning about unused variable
00134     static_cast<void>(just_to_evaluate);
00135   }
00136
00137 public:
00138
00139   /** Set all kernel args for an OpenCL kernel which is used through the
00140       SYCL/OpenCL interop interface
00141
00142       \todo Update the specification to add this function according to
00143       https://cvs.khronos.org/bugzilla/show_bug.cgi?id=15978 proposal
00144   */
00145   template <typename... Ts>
00146   void set_args(Ts &&... args) {
00147     /* Construct a set of increasing argument index to be able to call
00148        the real set_arg */
00149     dispatch_set_arg(std::index_sequence_for<Ts...>{},
00150                      std::forward<Ts>(args)...);
00151   }
00152 #endif
00153
00154
00155   /** Kernel invocation method of a kernel defined as a lambda or
00156       functor. If it is a lambda function or the functor type is globally
00157       visible there is no need for the developer to provide a kernel name type
00158       (typename KernelName) for it, as described in 3.5.3
00159
00160       SYCL single_task launches a computation without parallelism at
00161       launch time.
00162
00163       \param F specify the kernel to be launched as a single_task
00164
00165       \param KernelName is a class type that defines the name to be used for
00166       the underlying kernel
00167   */
00168   template <typename KernelName = std::nullptr_t>
00169   void single_task(std::function<void(void)> F) {
00170     task->schedule(detail::trace_kernel<KernelName>(F));
00171   }
00172
00173
00174   /** SYCL parallel_for launches a data parallel computation with
00175       parallelism specified at launch time by a range<>
00176
00177       Kernel invocation method of a kernel defined as a lambda or functor,
00178       for the specified range and given an id or item for indexing in the
00179       indexing space defined by range.
00180
00181       If it is a lambda function or the if the functor type is globally
00182       visible there is no need for the developer to provide a kernel name
00183       type (typename KernelName) for it, as described in detail in 3.5.3
00184
00185       \param global_size is the full size of the range<>
00186
00187       \param N dimensionality of the iteration space
00188
00189       \param f is the kernel functor to execute
00190
00191       \param KernelName is a class type that defines the name to be used
00192       for the underlying kernel
00193
00194       Unfortunately, to have implicit conversion to work on the range, the
00195       function can not be templated, so instantiate it for all the
00196       Dimensions
00197   */
00198 #define TRISYCL_parallel_for_functor_GLOBAL(N)                          \
00199   template <typename KernelName = std::nullptr_t,                       \
00200             typename ParallelForFunctor>                                \
00201   void parallel_for(range<N> global_size,                               \
00202                     ParallelForFunctor f) {                             \
00203     task->schedule(detail::trace_kernel<KernelName>([=] {               \
00204           detail::parallel_for(global_size, f);                         \
00205         }));                                                            \
00206   }
00207
00208   TRISYCL_parallel_for_functor_GLOBAL(1)
00209   TRISYCL_parallel_for_functor_GLOBAL(2)
00210   TRISYCL_parallel_for_functor_GLOBAL(3)
00211
```

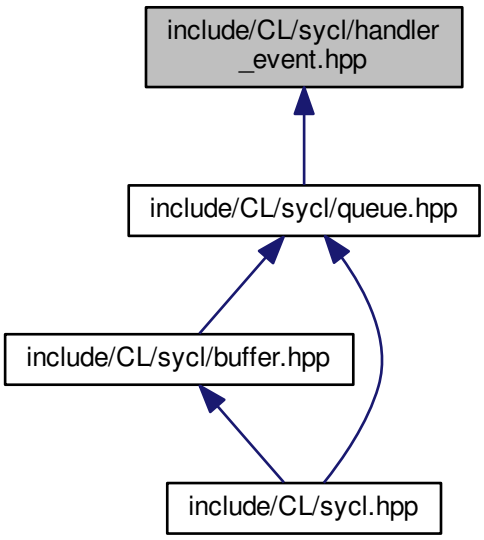
```
00212
00213   /** Kernel invocation method of a kernel defined as a lambda or functor,
00214       for the specified range and offset and given an id or item for
00215       indexing in the indexing space defined by range
00216
00217       If it is a lambda function or the if the functor type is globally
00218       visible there is no need for the developer to provide a kernel name
00219       type (typename KernelName) for it, as described in detail in 3.5.3
00220
00221       \param global_size is the global size of the range<>
00222
00223       \param offset is the offset to be add to the id<> during iteration
00224
00225       \param f is the kernel functor to execute
00226
00227       \param ParallelForFunctor is the kernel functor type
00228
00229       \param KernelName is a class type that defines the name to be used for
00230       the underlying kernel
00231
00232       Unfortunately, to have implicit conversion to work on the range, the
00233       function can not be templated, so instantiate it for all the
00234       dimensions
00235   */
00236 #define TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(N)       \
00237   template <typename KernelName = std::nullptr_t,         \
00238             typename ParallelForFunctor>                  \
00239   void parallel_for(range<N> global_size,                 \
00240                     id<N> offset,                         \
00241                     ParallelForFunctor f) {               \
00242     task->schedule(detail::trace_kernel<KernelName>([=] { \
00243           detail::parallel_for_global_offset(global_size, \
00244                                              offset,      \
00245                                              f);          \
00246         }));                                              \
00247   }
00248
00249   TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(1)
00250   TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(2)
00251   TRISYCL_ParallelForFunctor_GLOBAL_OFFSET(3)
00252
00253
00254   /** Kernel invocation method of a kernel defined as a lambda or functor,
00255       for the specified nd_range and given an nd_item for indexing in the
00256       indexing space defined by the nd_range
00257
00258       If it is a lambda function or the if the functor type is globally
00259       visible there is no need for the developer to provide a kernel name
00260       type (typename KernelName) for it, as described in detail in 3.5.3
00261
00262       \param r defines the iteration space with the work-group layout and
00263       offset
00264
00265       \param Dimensions dimensionality of the iteration space
00266
00267       \param f is the kernel functor to execute
00268
00269       \param ParallelForFunctor is the kernel functor type
00270
00271       \param KernelName is a class type that defines the name to be used for
00272       the underlying kernel
00273   */
00274   template <typename KernelName,
00275             int Dimensions,
00276             typename ParallelForFunctor>
00277   void parallel_for(nd_range<Dimensions> r, ParallelForFunctor f) {
00278     task->schedule(detail::trace_kernel<KernelName>([=] {
00279           detail::parallel_for(r, f);
00280         }));
00281   }
00282
00283
00284   /** Hierarchical kernel invocation method of a kernel defined as a
00285       lambda encoding the body of each work-group to launch
00286
00287       May contain multiple kernel built-in parallel_for_work_item
00288       functions representing the execution on each work-item.
00289
00290       Launch num_work_groups work-groups of runtime-defined
00291       size. Described in detail in 3.5.3.
00292
00293       \param r defines the iteration space with the work-group layout and
00294       offset
00295
00296       \param Dimensions dimensionality of the iteration space
00297
00298       \param f is the kernel functor to execute
```

```
00299
00300       \param ParallelForFunctor is the kernel functor type
00301
00302       \param KernelName is a class type that defines the name to be used for
00303       the underlying kernel
00304   */
00305   template <typename KernelName = std::nullptr_t,
00306             int Dimensions = 1,
00307             typename ParallelForFunctor>
00308   void parallel_for_work_group(nd_range<Dimensions> r,
00309                                ParallelForFunctor f) {
00310     task->schedule(detail::trace_kernel<KernelName>([=] {
00311           detail::parallel_for_workgroup(r, f); }));
00312   }
00313
00314
00315   /** Hierarchical kernel invocation method of a kernel defined as a
00316       lambda encoding the body of each work-group to launch
00317
00318       May contain multiple kernel built-in parallel_for_work_item
00319       functions representing the execution on each work-item.
00320
00321       Launch num_work_groups work-groups of runtime-defined
00322       size. Described in detail in 3.5.3.
00323
00324       \param r defines the iteration space with the work-group layout and
00325       offset
00326
00327       \param Dimensions dimensionality of the iteration space
00328
00329       \param f is the kernel functor to execute
00330
00331       \param ParallelForFunctor is the kernel functor type
00332
00333       \param KernelName is a class type that defines the name to be used for
00334       the underlying kernel
00335   */
00336   template <typename KernelName = std::nullptr_t,
00337             int Dimensions = 1,
00338             typename ParallelForFunctor>
00339   void parallel_for_work_group(range<Dimensions> r1,
      range<Dimensions> r2,
00340                                ParallelForFunctor f) {
00341     parallel_for_work_group(nd_range<Dimensions> { r1, r2 }, f);
00342   }
00343
00344
00345   /** Kernel invocation method of a kernel defined as pointer to a kernel
00346       object, described in detail in 3.5.3
00347
00348       \todo Add in the spec a version taking a kernel and a functor,
00349       to have host fall-back
00350
00351       \todo To be implemented
00352   */
00353   void single_task(kernel syclKernel) {
00354     detail::unimplemented();
00355   }
00356
00357
00358   /** Kernel invocation method of a kernel defined as a kernel object,
00359       for the specified range and given an id or item for indexing in
00360       the indexing space defined by range, described in detail in
00361       5.4.
00362
00363       \todo Add in the spec a version taking a kernel and a functor,
00364       to have host fall-back
00365   */
00366 #define TRISYCL_ParallelForKernel_RANGE(N)                              \
00367   void parallel_for(range<N> num_work_items,                            \
00368                     kernel sycl_kernel) {                               \
00369     /* For now just use the usual host task system to schedule          \
00370        manually the OpenCL kernels instead of using OpenCL event-based  \
00371        scheduling                                                       \
00372                                                                         \
00373        \todo Move the tracing inside the kernel implementation          \
00374                                                                         \
00375        \todo Simplify this 2 step ugly interface                        \
00376     */                                                                  \
00377     task->set_kernel(sycl_kernel.implementation);                       \
00378     /* Use an intermediate variable to capture task by copy because     \
00379        otherwise "this" is captured by reference and havoc with task    \
00380        just accessing the dead "this". Nasty bug to find... */          \
00381     task->schedule(detail::trace_kernel<kernel>([=, t = task] {         \
00382           sycl_kernel.implementation->parallel_for(t, t->get_queue(),   \
00383                                                    num_work_items); })); \
00384   }
```

```
00385
00386   /* Do not use a template parameter since otherwise the parallel_for
00387      functor is selected instead of this one
00388
00389      \todo Clean this
00390   */
00391   TRISYCL_ParallelForKernel_RANGE(1)
00392   TRISYCL_ParallelForKernel_RANGE(2)
00393   TRISYCL_ParallelForKernel_RANGE(3)
00394 #undef TRISYCL_ParallelForKernel_RANGE
00395
00396   /** Kernel invocation method of a kernel defined as pointer to a kernel
00397       object, for the specified nd_range and given an nd_item for indexing
00398       in the indexing space defined by the nd_range, described in detail
00399       in 3.5.3
00400
00401       \todo Add in the spec a version taking a kernel and a functor,
00402       to have host fall-back
00403
00404       \todo To be implemented
00405   */
00406   template <int Dimensions = 1>
00407   void parallel_for(nd_range<Dimensions>, kernel syclKernel) {
00408     detail::unimplemented();
00409   }
00410
00411 };
00412
00413 namespace detail {
00414
00415 /** Register a buffer as used by a task
00416
00417     This is a proxy function to avoid complicated type recursion.
00418 */
00419 static std::shared_ptr<detail::task>
00420 add_buffer_to_task(handler *command_group_handler,
00421                    std::shared_ptr<detail::buffer_base> b,
00422                    bool is_write_mode) {
00423   command_group_handler->task->add_buffer(b, is_write_mode);
00424   return command_group_handler->task;
00425 }
00426
00427 }
00428
00429 /// @} End the execution Doxygen group
00430
00431 }
00432 }
00433
00434 /*
00435     # Some Emacs stuff:
00436     ### Local Variables:
00437     ### ispell-local-dictionary: "american"
00438     ### eval: (flyspell-prog-mode)
00439     ### End:
00440 */
00441
00442 #endif // TRISYCL_SYCL_HANDLER_HPP
```

11.79 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.

11.80 handler_event.hpp

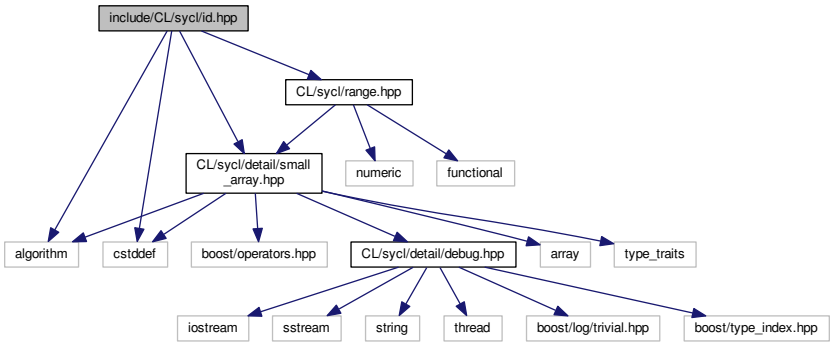
```
00001 #ifndef TRISYCL_SYCL_HANDLER_EVENT_HPP
00002 #define TRISYCL_SYCL_HANDLER_EVENT_HPP
00003
00004 /** \file The handler event
00005
00006     Implement parallel constructions to launch kernels
00007
00008     Ronan at keryell dot FR
00009
00010     This file is distributed under the University 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
```

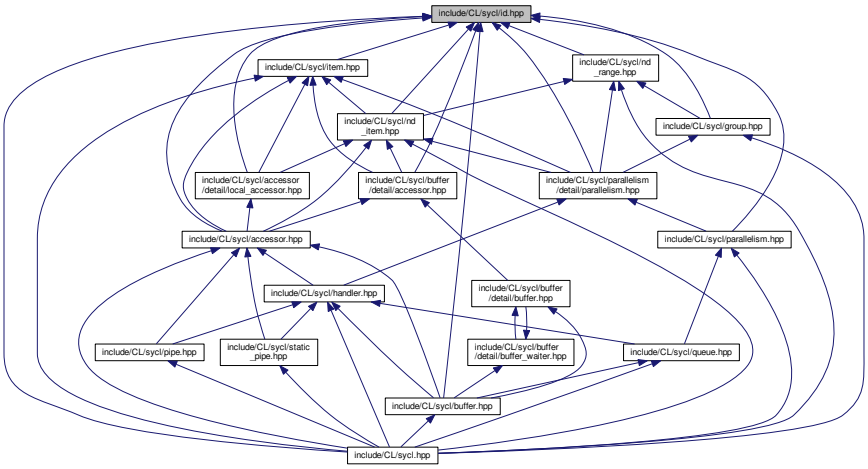
11.81 include/CL/sycl/id.hpp File Reference

```
#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)

11.82 id.hpp

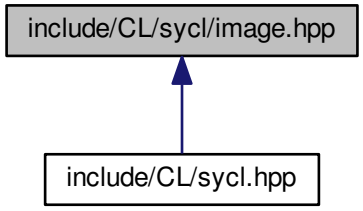
```
00001 #ifndef TRISYCL_SYCL_ID_HPP
00002 #define TRISYCL_SYCL_ID_HPP
00003
00004 /** \file The OpenCL SYCL id<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
00011
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() }
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
```

11.83 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

11.83.1 Detailed Description

OpenCL SYCL image class.

Ronan at Keryell point FR

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Definition in file image.hpp.

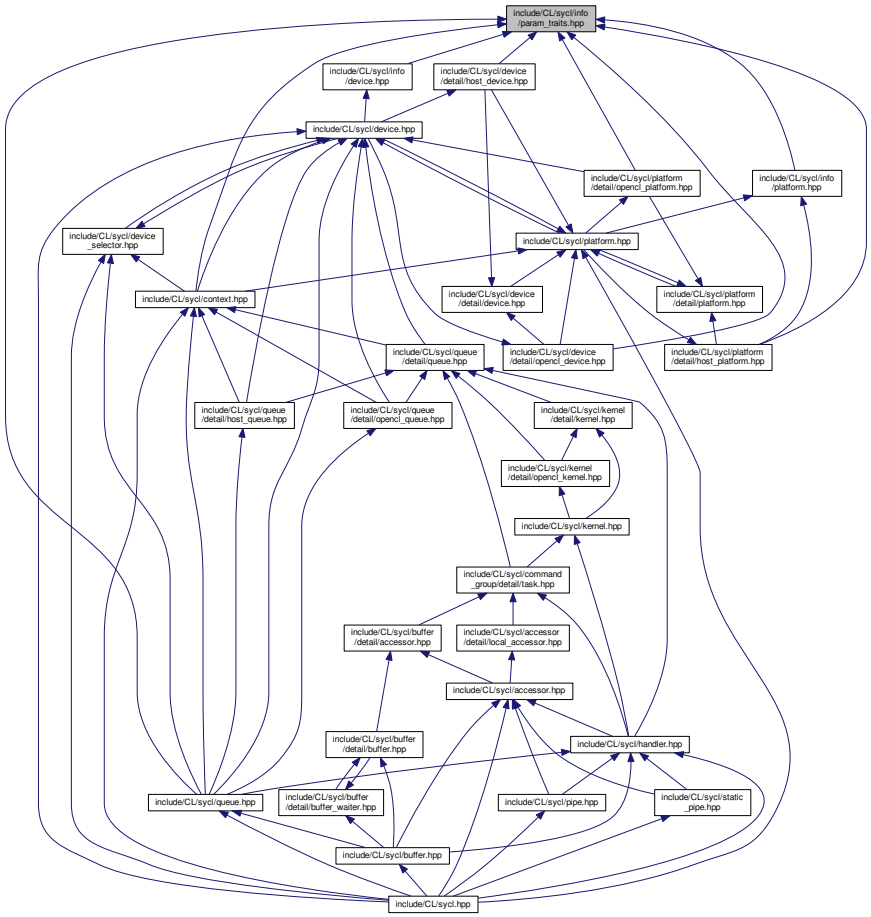
11.84 image.hpp

```
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
```

11.85 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.

11.85.1 Macro Definition Documentation

11.85.1.1 #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.

11.85.1.2 #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.

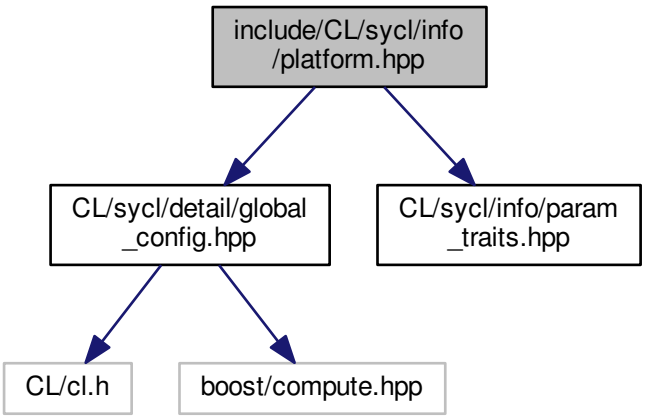
11.86 param_traits.hpp

```
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
```

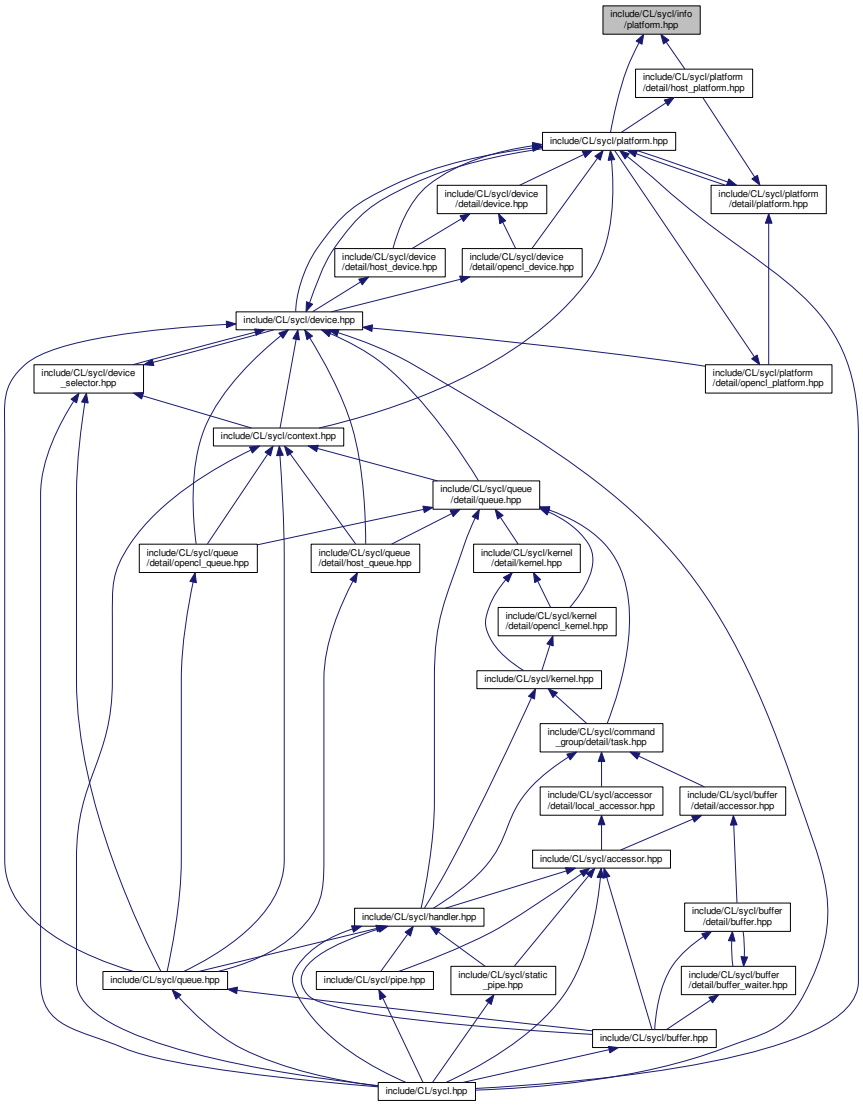
11.87 include/CL/sycl/info/platform.hpp File Reference

```
#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.

11.88 platform.hpp

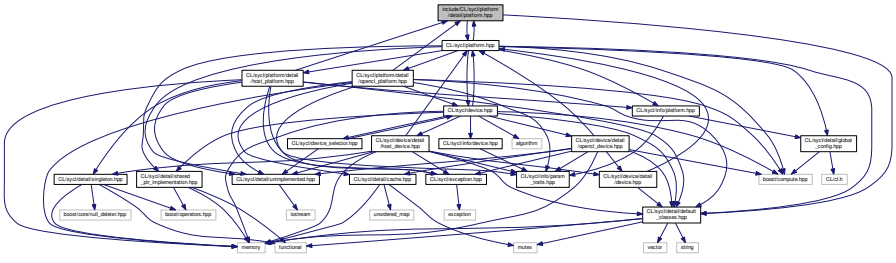
```
00001 #ifndef TRISYCL_SYCL_INFO_PLATFORM_HPP
00002 #define TRISYCL_SYCL_INFO_PLATFORM_HPP
00003
00004 /** \file The OpenCL SYCL platform information parameters
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     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
```

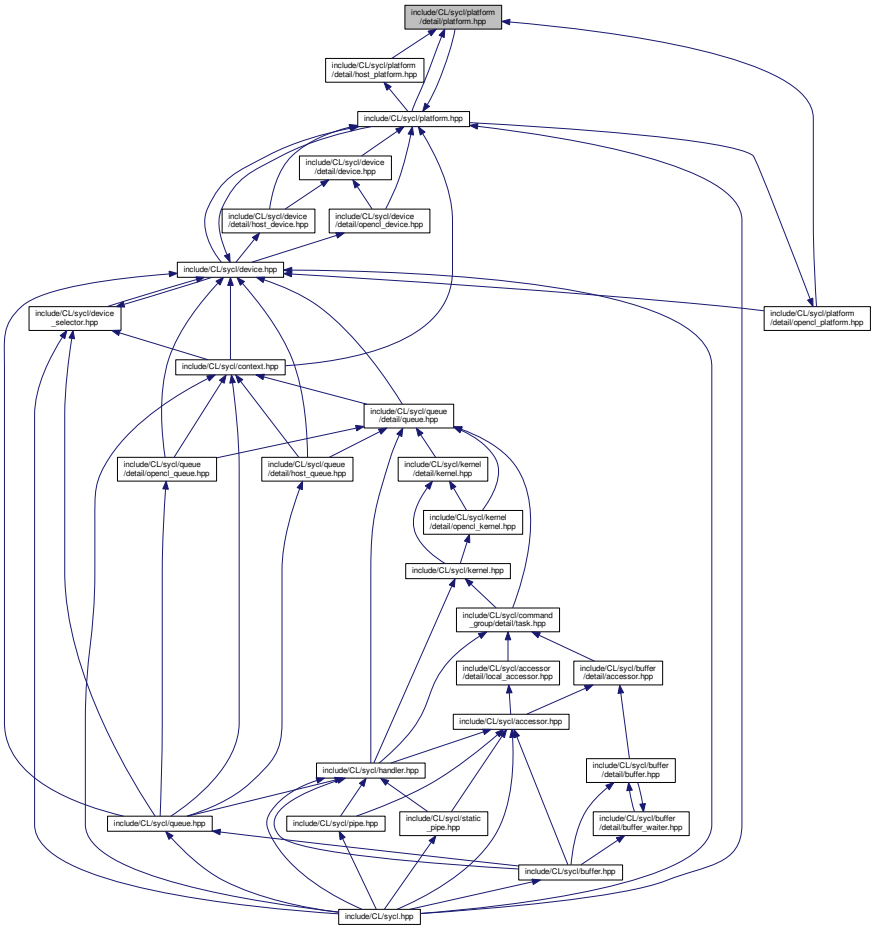
11.89 include/CL/sycl/platform/detail/platform.hpp File Reference

```
#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

11.90 platform.hpp

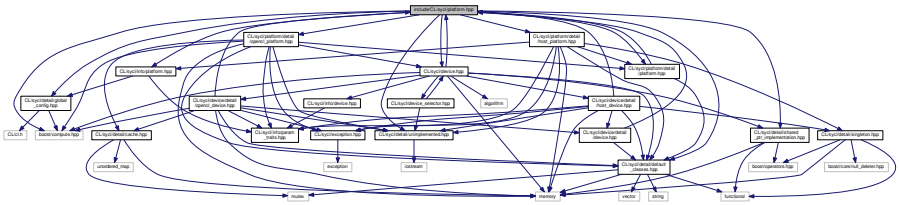
```
00001 #ifndef TRISYCL_SYCL_PLATFORM_DETAIL_PLATFORM_HPP
00002 #define TRISYCL_SYCL_PLATFORM_DETAIL_PLATFORM_HPP
00003
00004 /** \file The OpenCL SYCL abstract platform
00005
```

```
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 namespace detail {
00019
00020 /** \addtogroup execution Platforms, contexts, devices and queues
00021     @{
00022 */
00023
00024 /// An abstract class representing various models of SYCL platforms
00025 class platform {
00026
00027 public:
00028
00029 #ifdef TRISYCL_OPENCL
00030   /// Return the cl_platform_id of the underlying OpenCL platform
00031   virtual cl_platform_id get() const = 0;
00032 #endif
00033
00034
00035   /// Return true if the platform is a SYCL host platform
00036   virtual bool is_host() const = 0;
00037
00038
00039   /// Query the platform for OpenCL string info::platform info
00040   virtual string_class get_info_string(info::platform param) const
      = 0;
00041
00042
00043   /// Specify whether a specific extension is supported on the platform.
00044   virtual bool has_extension(const string_class &extension) const = 0;
00045
00046
00047   // Virtual to call the real destructor
00048   virtual ~platform() {}
00049
00050 };
00051
00052 /// @} to end the execution Doxygen group
00053
00054 }
00055 }
00056 }
00057
00058 /*
00059     # Some Emacs stuff:
00060     ### Local Variables:
00061     ### ispell-local-dictionary: "american"
00062     ### eval: (flyspell-prog-mode)
00063     ### End:
00064 */
00065
00066 #endif // TRISYCL_SYCL_PLATFORM_DETAIL_PLATFORM_HPP
```

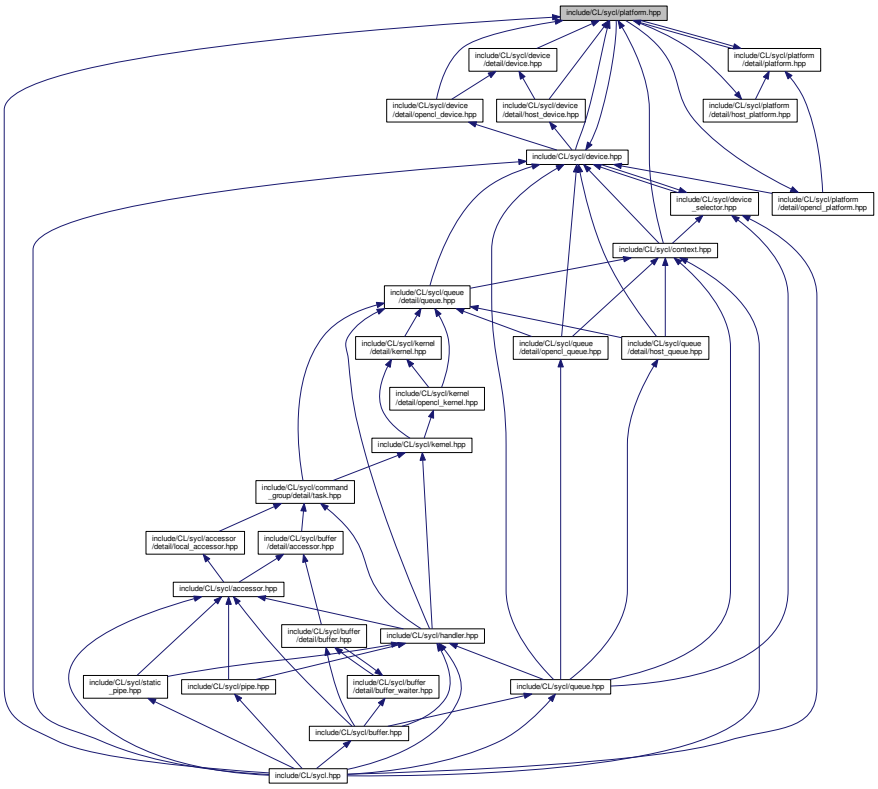
11.91 include/CL/sycl/platform.hpp File Reference

```
#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/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 "CL/sycl/info/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

11.92 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/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 #include "CL/sycl/info/platform.hpp"
00028
00029 namespace cl {
00030 namespace sycl {
00031
00032 class device_selector;
00033 class device;
00034
00035 /** \addtogroup execution Platforms, contexts, devices and queues
00036     @{
00037 */
00038
00039 /** Abstract the OpenCL platform
00040
00041     \todo triSYCL Implementation
00042 */
00043 class platform
00044   /* Use the underlying platform implementation that can be shared in the
00045      SYCL model */
00046   : public detail::shared_ptr_implementation<platform, detail::platform> {
00047
00048   // Allows the comparison operation to access the implementation
00049   friend shared_ptr_implementation;
00050
00051 public:
00052
00053   // Make the implementation member directly accessible in this class
00054   using shared_ptr_implementation::implementation;
00055
00056   /** Default constructor for platform which is the host platform
00057
00058       Returns errors via the SYCL exception class.
00059   */
00060   platform() :
00061     shared_ptr_implementation {
      detail::host_platform::instance() } {}
00062
00063
00064 #ifdef TRISYCL_OPENCL
00065   /** Construct a platform class instance using cl_platform_id of the
00066       OpenCL device
00067
00068       Return synchronous errors via the SYCL exception class.
00069
00070       Retain a reference to the OpenCL platform.
00071   */
00072   platform(cl_platform_id platform_id)
00073     : platform { boost::compute::platform { platform_id } } {}
00074
00075
00076   /** Construct a platform class instance using a boost::compute::platform
00077
00078       This is a triSYCL extension for boost::compute interoperation.
00079
00080       Return synchronous errors via the SYCL exception class.
00081   */
00082   platform(const boost::compute::platform &p)
00083     : shared_ptr_implementation {
```

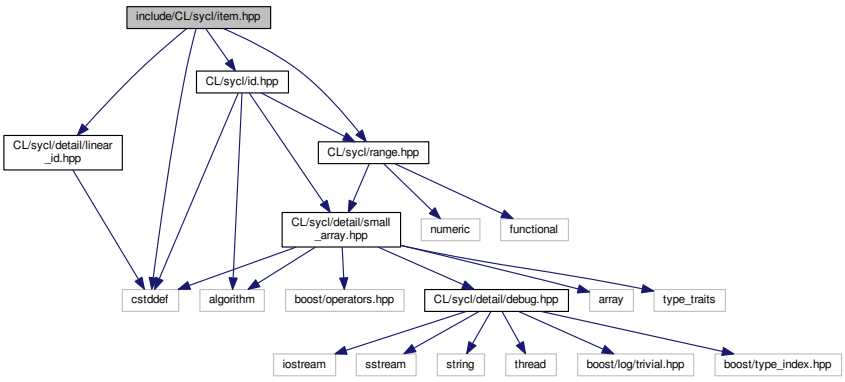
```
    detail::opencl_platform::instance(p) } {}
00084 #endif
00085
00086
00087   /**  Construct a platform object from the device selected by a device
00088        selector of the user's choice
00089
00090        Returns errors via the SYCL exception class.
00091   */
00092   explicit platform(const device_selector &dev_selector) {
00093     detail::unimplemented();
00094   }
00095
00096
00097 #ifdef TRISYCL_OPENCL
00098   /** Returns the cl_platform_id of the underlying OpenCL platform
00099
00100       If the platform is not a valid OpenCL platform, for example if it is
00101       the SYCL host, an exception is thrown
00102
00103       \todo Define a SYCL exception for this
00104   */
00105   cl_platform_id get() const {
00106     return implementation->get();
00107   }
00108 #endif
00109
00110
00111   /// Get the list of all the platforms available to the application
00112   static vector_class<platform> get_platforms() {
00113     // Start with the default platform
00114     vector_class<platform> platforms { {} };
00115
00116 #ifdef TRISYCL_OPENCL
00117     // Then add all the OpenCL platforms
00118     for (const auto &d : boost::compute::system::platforms())
00119       platforms.emplace_back(d);
00120 #endif
00121
00122     return platforms;
00123   }
00124
00125 #if 0
00126   /** Returns all the available devices for this platform, of type device
00127       type, which is defaulted to info::device_type::all
00128
00129       By default returns all the devices.
00130
00131       \todo To be implemented
00132   */
00133   vector_class<device>
00134   get_devices(info::device_type device_type =
    info::device_type::all) const {
00135     detail::unimplemented();
00136     return {};
00137   }
00138 #endif
00139
00140
00141   /** Get the OpenCL information about the requested parameter
00142
00143       \todo Add to the specification
00144   */
00145   template <typename ReturnT>
00146   ReturnT get_info(info::platform param) const {
00147     // Only strings are needed here
00148     return implementation->get_info_string(param);
00149   }
00150
00151
00152   /// Get the OpenCL information about the requested template parameter
00153   template <info::platform Param>
00154   typename info::param_traits<info::platform, Param>::type
00155   get_info() const {
00156     /* Forward to the implementation without using template parameter
00157        but with a parameter instead, since it is incompatible with
00158        virtual function and because fortunately only strings are
00159        needed here */
00160     return get_info<typename info::param_traits<
    info::platform,
00161                                                 Param>::type>(Param);
00162   }
00163
00164
00165   /// Test if an extension is available on the platform
00166   bool has_extension(const string_class &extension) const {
00167     return implementation->has_extension(extension);
```

```
00168   }
00169
00170
00171   /// Test if this platform is a host platform
00172   bool is_host() const {
00173     return implementation->is_host();
00174   }
00175
00176 };
00177
00178 /// @} to end the execution Doxygen group
00179
00180 }
00181 }
00182
00183
00184 /* Inject a custom specialization of std::hash to have the buffer
00185    usable into an unordered associative container
00186
00187    \todo Add this to the spec
00188 */
00189 namespace std {
00190
00191 template <> struct hash<cl::sycl::platform> {
00192
00193   auto operator()(const cl::sycl::platform &p) const {
00194     // Forward the hashing to the implementation
00195     return p.hash();
00196   }
00197
00198 };
00199
00200 }
00201
00202 /*
00203     # Some Emacs stuff:
00204     ### Local Variables:
00205     ### ispell-local-dictionary: "american"
00206     ### eval: (flyspell-prog-mode)
00207     ### End:
00208 */
00209
00210 #endif // TRISYCL_SYCL_PLATFORM_HPP
```

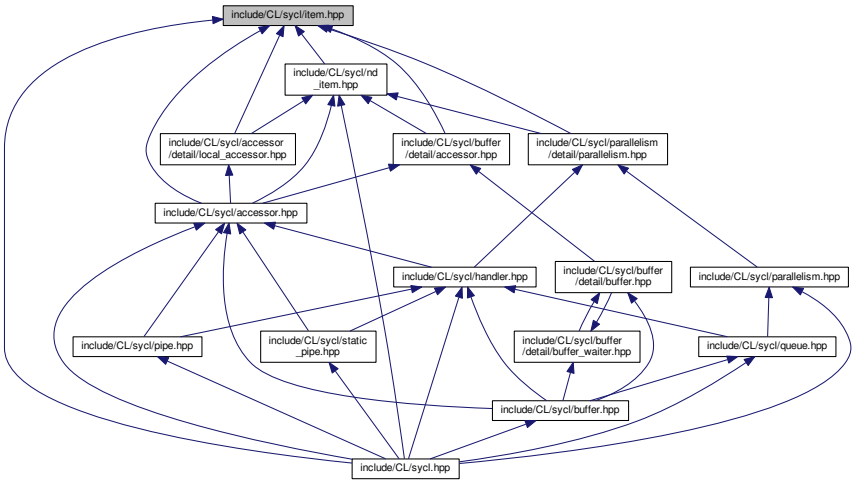
11.93 include/CL/sycl/item.hpp File Reference

```
#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

11.94 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.
```

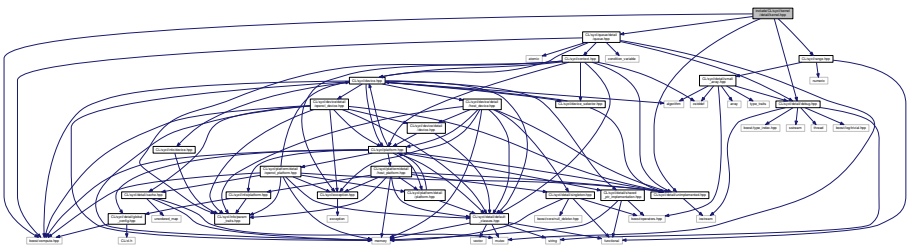
```
00027 */
00028 template <int Dimensions = 1>
00029 class item {
00030
00031 public:
00032
00033   /// \todo add this Boost::multi_array or STL concept to the
00034   /// specification?
00035   static constexpr auto dimensionality = Dimensions;
00036
00037 private:
00038
00039   range<Dimensions> 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() 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(int dimension) const { return get()[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(),
      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
```

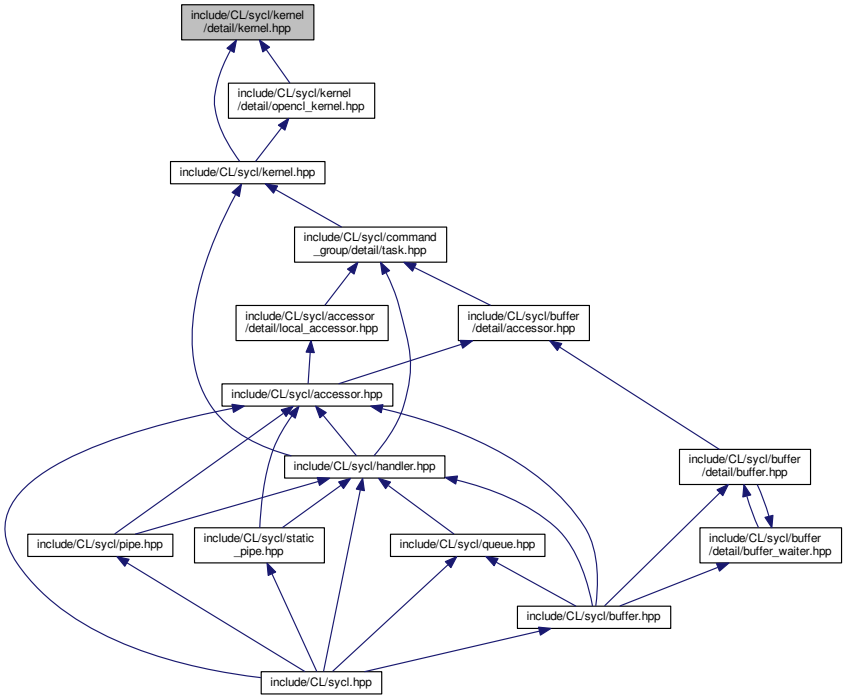
11.95 include/CL/sycl/kernel/detail/kernel.hpp File Reference

```
#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<>

11.95.1 Macro Definition Documentation

11.95.1.1 #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 58 of file kernel.hpp.

11.96 kernel.hpp

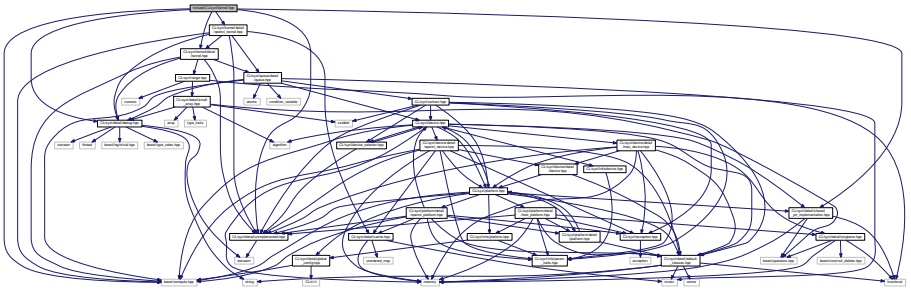
```
00001 #ifndef TRISYCL_SYCL_KERNEL_DETAIL_KERNEL_HPP
00002 #define TRISYCL_SYCL_KERNEL_DETAIL_KERNEL_HPP
00003
00004 /** \file The OpenCL SYCL kernel
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See 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 kernel with a range<>
00053
00054       Do not use a template since it does not work with virtual functions
00055
00056       \todo Think to a cleaner solution
00057   */
00058 #define TRISYCL_ParallelForKernel_RANGE(N)                              \
00059   virtual void parallel_for(std::shared_ptr<detail::task> task, std::shared_ptr<detail::queue> q,     \
00060                             const range<N> &num_work_items) = 0;
00061
00062   TRISYCL_ParallelForKernel_RANGE(1)
00063   TRISYCL_ParallelForKernel_RANGE(2)
00064   TRISYCL_ParallelForKernel_RANGE(3)
00065 #undef TRISYCL_ParallelForKernel_RANGE
00066
00067
00068   /// Return the context that this kernel is defined for
00069   //virtual context get_context() const;
00070
00071   /// Return the program that this kernel is part of
00072   //virtual program get_program() const;
00073
00074   // Virtual to call the real destructor
00075   virtual ~kernel() {}
00076
00077 };
00078
00079 /// @} End the execution Doxygen group
00080
00081 }
00082 }
00083 }
00084
00085 /*
00086     # Some Emacs stuff:
00087     ### Local Variables:
00088     ### ispell-local-dictionary: "american"
00089     ### eval: (flyspell-prog-mode)
00090     ### End:
00091 */
00092
00093 #endif // TRISYCL_SYCL_DETAIL_KERNEL_KERNEL_HPP
```

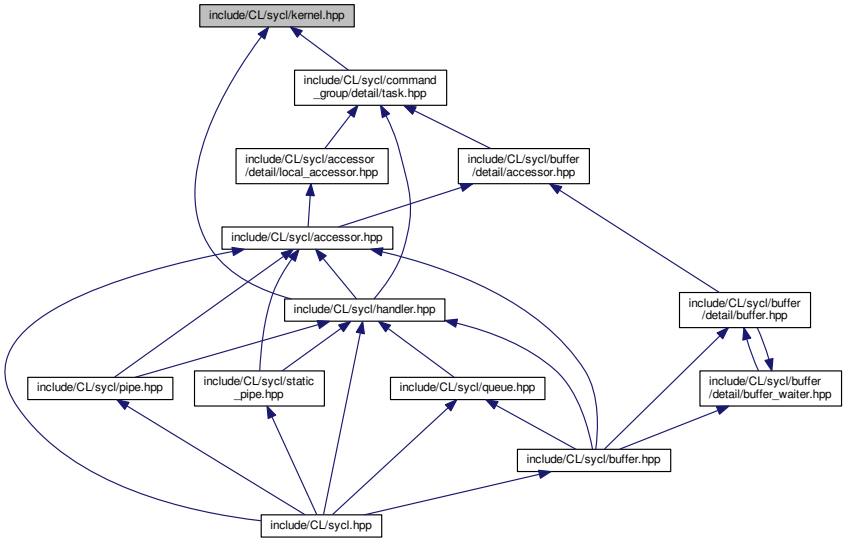
11.97 include/CL/sycl/kernel.hpp File Reference

```
#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

11.98 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"
```

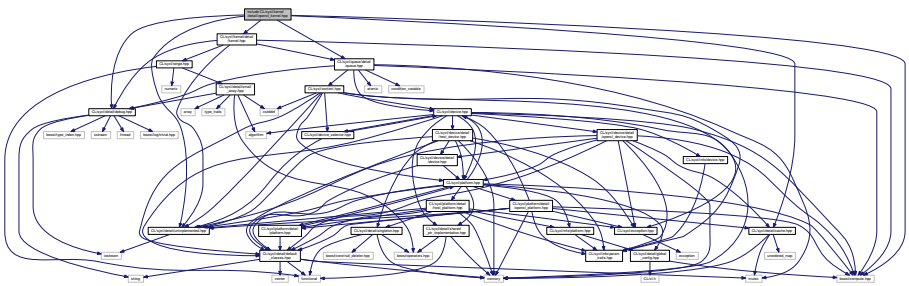
```
00021 #ifdef TRISYCL_OPENCL
00022 #include "CL/sycl/kernel/detail/opencl_kernel.hpp"
00023 #endif
00024
00025 namespace cl {
00026 namespace sycl {
00027
00028 /** \addtogroup execution Platforms, contexts, devices and queues
00029     @{
00030 */
00031
00032 /** SYCL kernel
00033
00034     \todo 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
```

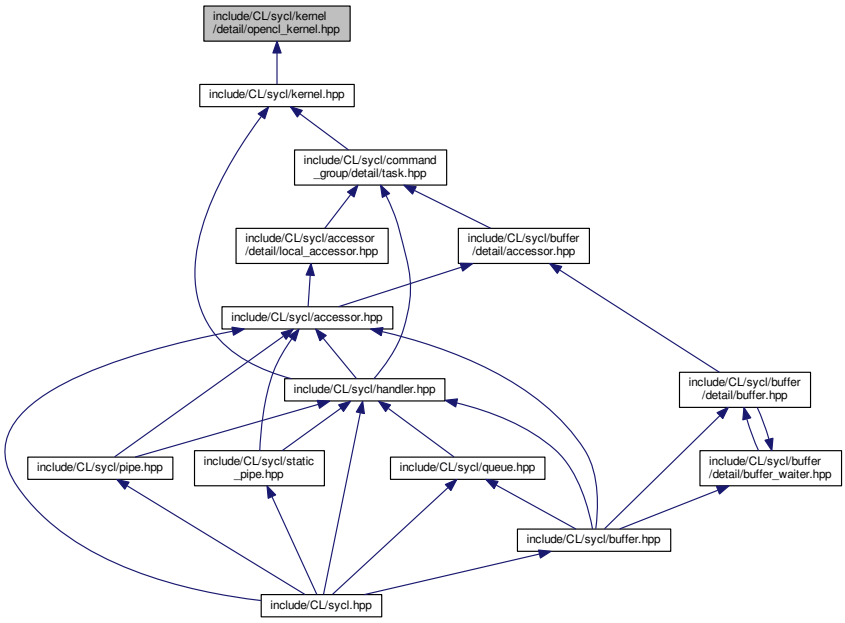
11.99 include/CL/sycl/kernel/detail/opencl_kernel.hpp File Reference

```
#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<>

11.99.1 Macro Definition Documentation

11.99.1.1 #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

Definition at line 93 of file opencl_kernel.hpp.

11.100 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
```

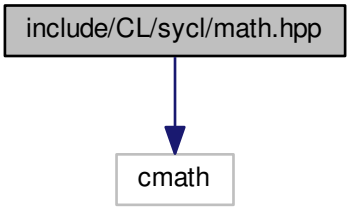
```
00047   static std::shared_ptr<opencl_kernel>
00048   instance(const boost::compute::kernel &k) {
00049     return cache.get_or_register(k.get(),
00050                                  [&] { return new opencl_kernel { k }; });
00051   }
00052
00053   /** Return the underlying OpenCL object
00054
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 an OpenCL kernel with a range<>
00088
00089       Do not use a template since it does not work with virtual functions
00090
00091       \todo Think to a cleaner solution
00092   */
00093 #define TRISYCL_ParallelForKernel_RANGE(N)                              \
00094   void parallel_for(std::shared_ptr<detail::task> task,\
00095   std::shared_ptr<detail::queue> q,                                     \
00096                     const range<N> &num_work_items) override {          \
00097     static_assert(sizeof(range<N>::value_type) == sizeof(size_t),       \
00098                   "num_work_items::value_type compatible with "         \
00099                   "Boost.Compute");                                     \
00100     q->get_boost_compute().enqueue_nd_range_kernel                      \
00101       (k,                                                               \
00102        static_cast<size_t>(N),                                          \
00103        NULL,                                                            \
00104        static_cast<const size_t *>(num_work_items.data()),              \
00105        NULL);                                                           \
00106     /* For now use a crude synchronization mechanism to map directly a  \
00107        host task to an accelerator task */                              \
00108     q->get_boost_compute().finish();                                    \
00109   };
00110
00111   TRISYCL_ParallelForKernel_RANGE(1)
00112   TRISYCL_ParallelForKernel_RANGE(2)
00113   TRISYCL_ParallelForKernel_RANGE(3)
00114 #undef TRISYCL_ParallelForKernel_RANGE
00115
00116
00117   /// Unregister from the cache on destruction
00118   ~opencl_kernel() override {
00119     cache.remove(k.get());
00120   }
00121
00122 };
00123
00124 /* Allocate the cache here but since this is a pure-header library,
00125    use a weak symbol so that only one remains when SYCL headers are
00126    used in different compilation units of a program
00127 */
00128 TRISYCL_WEAK_ATTRIB_PREFIX
00129 detail::cache<cl_kernel, detail::opencl_kernel>
      opencl_kernel::cache
00130 TRISYCL_WEAK_ATTRIB_SUFFIX;
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_DETAIL_OPENCL_KERNEL_HPP
```

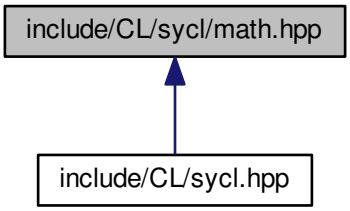
11.101 include/CL/sycl/math.hpp File Reference

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_WRA↩ P2(rotate) namespace native

Variables

- T cl::sycl::y
- T T cl::sycl::z

11.101.1 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.

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Definition in file math.hpp.

11.101.2 Macro Definition Documentation

11.101.2.1 #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.

11.101.2.2 #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.

11.101.2.3 #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.

11.101.2.4 #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.

11.101.2.5 #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.

11.101.2.6 #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.

11.102 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)
```

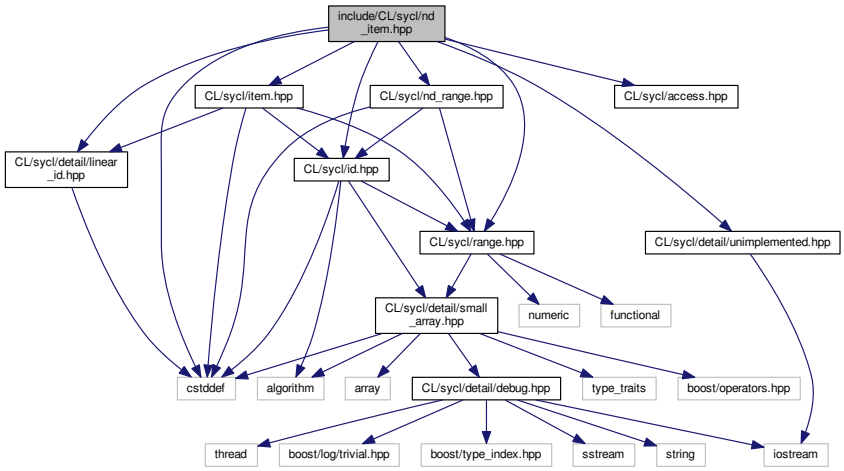
```
00085  */
00086 TRISYCL_MATH_WRAP2s(fmax)
00087 TRISYCL_MATH_WRAP2s(fmin)
00088 TRISYCL_MATH_WRAP2(fmod)
00089 //*TRISYCL_MATH_WRAP2s(fract)
00090 TRISYCL_MATH_WRAP2s(frexp)
00091 //*TRISYCL_MATH_WRAP(hadd)
00092 TRISYCL_MATH_WRAP2(hypot)
00093 //log
00094 //ilogb
00095 //ldexp
00096 TRISYCL_MATH_WRAP(lgamma)
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
```

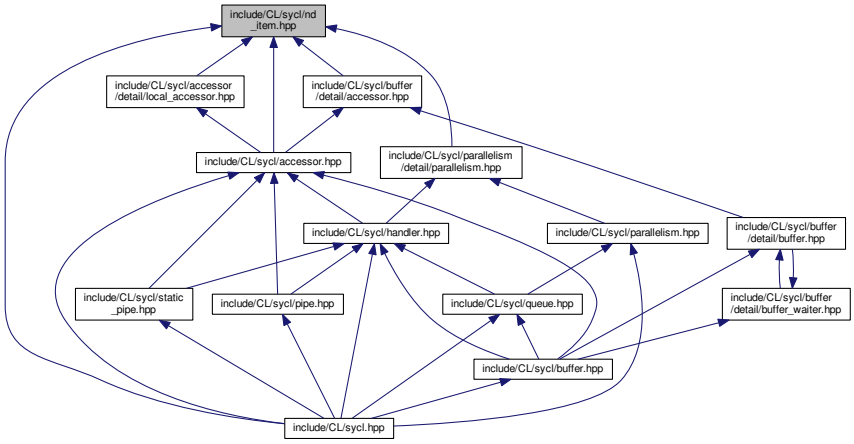
11.103 include/CL/sycl/nd_item.hpp File Reference

```
#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

11.104 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
```

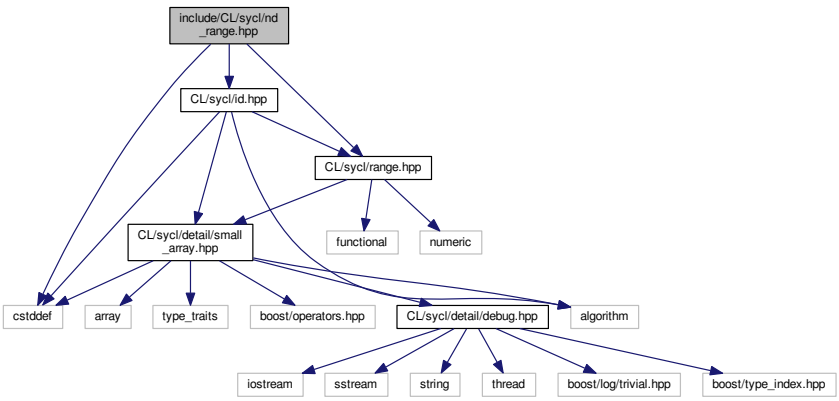
```
00113   /** Return the flattened id of the current work-item within the current
00114       work-group
00115    */
00116   size_t get_local_linear_id() const {
00117     return detail::linear_id(get_local_range(),
      get_local());
00118   }
00119
00120
00121   /** Return the constituent group 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
```

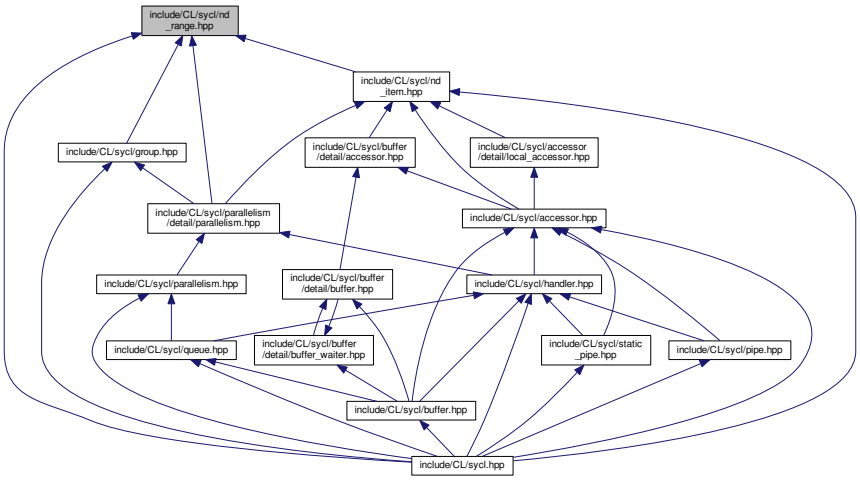
11.105 include/CL/sycl/nd_range.hpp File Reference

```
#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

11.106 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
```

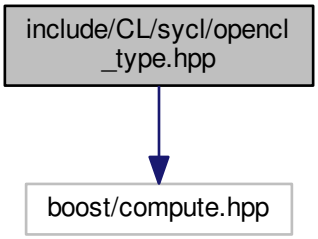
```
00028     needed.
00029
00030     \todo add copy constructors in the specification
00031 */
00032 template <int Dimensions = 1>
00033 struct nd_range {
00034   /// \todo add this Boost::multi_array or STL concept to the
00035   /// specification?
00036   static constexpr auto dimensionality = Dimensions;
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 eange 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
```

11.107 include/CL/sycl/opencl_type.hpp File Reference

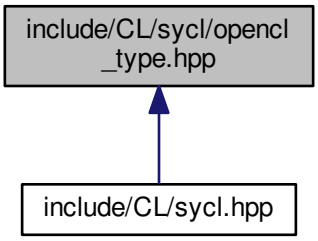
triSYCL wrapper for openCL types Joan DOT Thibault AT ens-rennes DOT fr This file is distributed under the University of Illinois Open Source License.

```
#include <boost/compute.hpp>
```

Include dependency graph for opencl_type.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class cl::sycl::cl_float3

  Wrapper of Boost::compute's cl_float3.

Namespaces

- cl

  The vector type to be used as SYCL vector.
- cl::sycl

11.107.1 Detailed Description

triSYCL wrapper for openCL types Joan DOT Thibault AT ens-rennes DOT fr This file is distributed under the University of Illinois Open Source License.

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Definition in file opencl_type.hpp.

11.108 opencl_type.hpp

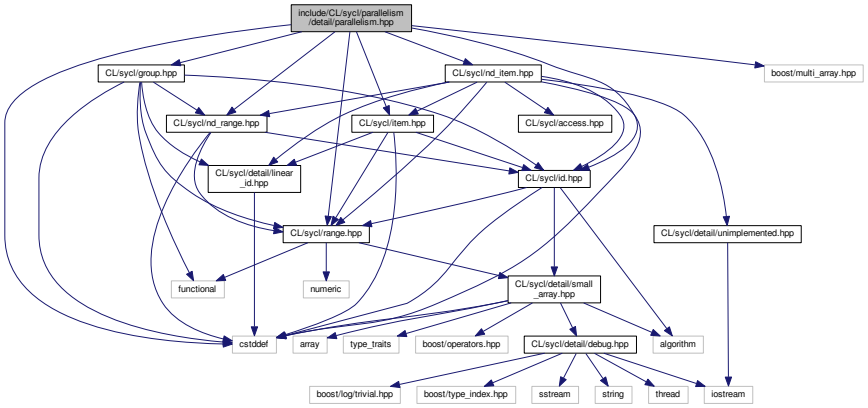
```
00001 #ifndef TRISYCL_SYCL_OPENCL_TYPE_HPP
00002 #define TRISYCL_SYCL_OPENCL_TYPE_HPP
00003
00004 /** \file
00005     triSYCL wrapper for openCL types
00006     Joan DOT Thibault AT ens-rennes DOT fr
00007     This file is distributed under the University of Illinois Open Source
00008     License. See LICENSE.TXT for details.
00009 */
00010
00011 #include <boost/compute.hpp>
00012
00013 namespace cl {
00014 namespace sycl {
00015
00016 /** Wrapper of Boost::compute's cl_float3
00017  */
00018 class cl_float3 {
00019
00020   ::cl_float3 self;
00021
00022 public :
00023
00024   cl_float3 () = default;
00025
00026
00027   cl_float3 (::cl_float3 self_) : self { self_ }
00028   {}
00029
00030
00031   cl_float3 (float x, float y, float z) : self { x, y, z }
00032   {}
00033
00034
00035   /* Return the first element of the vector
00036    */
00037   auto& x() {
00038     return self.s[0];
00039   }
00040
00041
00042   /* Return the second element of the vector
00043    */
00044   auto& y() {
00045     return self.s[1];
00046   }
00047
00048
00049   /* Return the third element of the vector
00050    */
00051   auto& z() {
00052     return self.s[2];
00053   }
00054
00055 };
00056
00057 }
00058 }
00059
00060 /*
00061     # Some Emacs stuff:
00062     ### Local Variables:
00063     ### ispell-local-dictionary: "american"
00064     ### eval: (flyspell-prog-mode)
00065     ### End:
00066 */
00067
00068 #endif //  TRISYCL_SYCL_OPENCL_TYPE_HPP
```

11.109 include/CL/sycl/parallelism/detail/parallelism.hpp File Reference

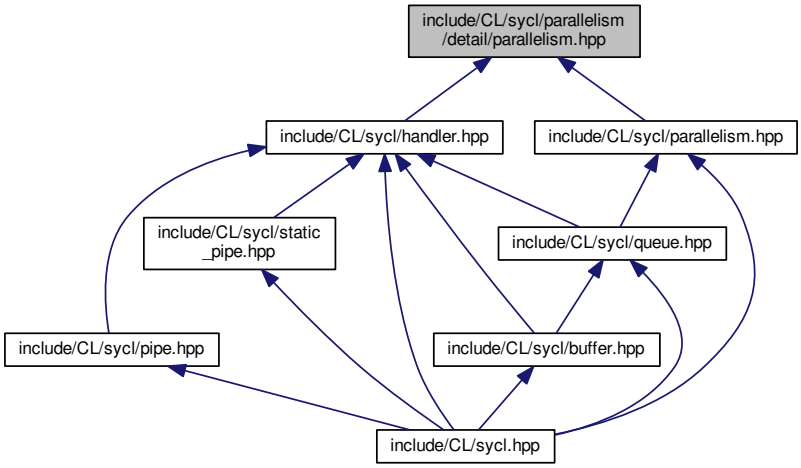
Implement the detail of the parallel constructions to launch kernels.

```
#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.

11.109.1 Detailed Description

Implement the detail of the parallel constructions to launch kernels.

Ronan at keryell dot FR

Definition in file parallelism.hpp.

11.110 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, typename Range, typename ParallelForFunctor, typename Id>
00047 struct parallel_for_iterate {
00048   parallel_for_iterate(Range r, ParallelForFunctor &f, Id &index) {
00049     for (boost::multi_array_types::index _sycl_index = 0,
00050            _sycl_end = r[Range::dimensionality - level];
00051          _sycl_index < _sycl_end;
00052          _sycl_index++) {
00053       // Set the current value of the index for this dimension
00054       index[Range::dimensionality - level] = _sycl_index;
00055       // Iterate further on lower dimensions
00056       parallel_for_iterate<level - 1,
00057                            Range,
00058                            ParallelForFunctor,
00059                            Id> { r, f, index };
00060     }
00061   }
00062 };
00063
00064
00065 /** A top-level recursive multi-dimensional iterator variant using OpenMP
00066
00067     Only the top-level loop uses OpenMP and goes on with the normal
00068     recursive multi-dimensional.
00069 */
00070 template <std::size_t level,
00071           typename Range,
00072           typename ParallelForFunctor,
00073           typename Id>
00074 struct parallel_OpenMP_for_iterate {
00075   parallel_OpenMP_for_iterate(Range r, ParallelForFunctor &f) {
00076     // Create the OpenMP threads before the for-loop to avoid creating an
00077     // index in each iteration
00078 #pragma omp parallel
00079     {
00080       // Allocate an OpenMP thread-local index
00081       Id index;
00082       // Make a simple loop end condition for OpenMP
00083       boost::multi_array_types::index _sycl_end =
00084         r[Range::dimensionality - level];
```

```
00085       /* Distribute the iterations on the OpenMP threads. Some OpenMP
00086          "collapse" could be useful for small iteration space, but it
00087          would need some template specialization to have real contiguous
00088          loop nests */
00089 #pragma omp for
00090       for (boost::multi_array_types::index _sycl_index = 0;
00091            _sycl_index < _sycl_end;
00092            _sycl_index++) {
00093         // Set the current value of the index for this dimension
00094         index[Range::dimensionality - level] = _sycl_index;
00095         // Iterate further on lower dimensions
00096         parallel_for_iterate<level - 1,
00097                              Range,
00098                              ParallelForFunctor,
00099                              Id> { r, f, index };
00100       }
00101     }
00102   }
00103 };
00104
00105
00106 /** Stop the recursion when level reaches 0 by simply calling the
00107     kernel functor with the constructed id */
00108 template <typename Range, typename ParallelForFunctor, typename Id>
00109 struct parallel_for_iterate<0, Range, ParallelForFunctor, Id> {
00110   parallel_for_iterate(Range r, ParallelForFunctor &f, Id &index) {
00111     f(index);
00112   }
00113 };
00114
00115
00116 /** Implementation of a data parallel computation with parallelism
00117     specified at launch time by a range<>. Kernel index is id or int.
00118
00119     This implementation use OpenMP 3 if compiled with the right flag.
00120 */
00121 template <int Dimensions = 1, typename ParallelForFunctor, typename Id>
00122 void parallel_for(range<Dimensions> r,
00123                   ParallelForFunctor f,
00124                   Id) {
00125 #ifdef _OPENMP
00126   // Use OpenMP for the top loop level
00127   parallel_OpenMP_for_iterate<Dimensions,
00128                               range<Dimensions>,
00129                               ParallelForFunctor,
00130                               id<Dimensions>> { r, f };
00131 #else
00132   // In a sequential execution there is only one index processed at a time
00133   id<Dimensions> index;
00134   parallel_for_iterate<Dimensions,
00135                        range<Dimensions>,
00136                        ParallelForFunctor,
00137                        id<Dimensions>> { r, f, index };
00138 #endif
00139 }
00140
00141
00142 /** Implementation of a data parallel computation with parallelism
00143     specified at launch time by a range<>. Kernel index is item.
00144
00145     This implementation use OpenMP 3 if compiled with the right flag.
00146 */
00147 template <int Dimensions = 1, typename ParallelForFunctor>
00148 void parallel_for(range<Dimensions> r,
00149                   ParallelForFunctor f,
00150                   item<Dimensions>) {
00151   auto reconstruct_item = [&] (id<Dimensions> l) {
00152     // Reconstruct the global item
00153     item<Dimensions> index { r, l };
00154     // Call the user kernel with the item<> instead of the id<>
00155     f(index);
00156   };
00157 #ifdef _OPENMP
00158   // Use OpenMP for the top loop level
00159   parallel_OpenMP_for_iterate<Dimensions,
00160                               range<Dimensions>,
00161                               decltype(reconstruct_item),
00162                               id<Dimensions>> { r, reconstruct_item };
00163 #else
00164   // In a sequential execution there is only one index processed at a time
00165   id<Dimensions> index;
00166   parallel_for_iterate<Dimensions,
00167                        range<Dimensions>,
00168                        decltype(reconstruct_item),
00169                        id<Dimensions>> { r, reconstruct_item, index };
00170 #endif
00171 }
```

```
00172
00173
00174 /** Calls the appropriate ternary parallel_for overload based on the
00175     index type of the kernel function object f
00176
00177 */
00178 template <int Dimensions = 1, typename ParallelForFunctor>
00179 void parallel_for(range<Dimensions> r, ParallelForFunctor f) {
00180   using mf_t  = decltype(std::mem_fn(&ParallelForFunctor::operator()));
00181   using arg_t = typename mf_t::second_argument_type;
00182   parallel_for(r,f,arg_t{});
00183 }
00184
00185
00186 /** Implementation of parallel_for with a range<> and an offset */
00187 template <int Dimensions = 1, typename ParallelForFunctor>
00188 void parallel_for_global_offset(range<Dimensions> global_size,
00189                                 id<Dimensions> offset,
00190                                 ParallelForFunctor f) {
00191   // Reconstruct the item from its id<> and its offset
00192   auto reconstruct_item = [&] (id<Dimensions> l) {
00193     // Reconstruct the global item
00194     item<Dimensions> index { global_size, l + offset, offset };
00195     // Call the user kernel with the item<> instead of the id<>
00196     f(index);
00197   };
00198
00199   // First iterate on all the work-groups
00200   parallel_for(global_size, reconstruct_item);
00201 }
00202
00203
00204 /** Implement a variation of parallel_for to take into account a
00205     nd_range<>
00206
00207     \todo Add an OpenMP implementation
00208
00209     \todo Deal with incomplete work-groups
00210
00211     \todo Implement with parallel_for_workgroup()/parallel_for_workitem()
00212 */
00213 template <int Dimensions = 1, typename ParallelForFunctor>
00214 void parallel_for(nd_range<Dimensions> r,
00215                   ParallelForFunctor f) {
00216   // In a sequential execution there is only one index processed at a time
00217   nd_item<Dimensions> index { r };
00218   // To iterate on the work-group
00219   id<Dimensions> group;
00220   range<Dimensions> group_range = r.get_group();
00221   // To iterate on the local work-item
00222   id<Dimensions> local;
00223
00224   range<Dimensions> local_range = r.get_local();
00225
00226   // Reconstruct the nd_item from its group and local id
00227   auto reconstruct_item = [&] (id<Dimensions> l) {
00228     //local.display();
00229     // Reconstruct the global nd_item
00230     index.set_local(local);
00231     // Upgrade local_range to an id<> so that we can * with the group (an id<>)
00232     index.set_global(local + id<Dimensions>(local_range)*group);
00233     // Call the user kernel at last
00234     f(index);
00235   };
00236
00237   /* To recycle the parallel_for on range<>, wrap the ParallelForFunctor f
00238      into another functor that iterates inside the work-group and then
00239      calls f */
00240   auto iterate_in_work_group = [&] (id<Dimensions> g) {
00241     //group.display();
00242     // Then iterate on the local work-groups
00243     parallel_for_iterate<Dimensions,
00244                          range<Dimensions>,
00245                          decltype(reconstruct_item),
00246                          id<Dimensions>> { local_range,
00247                                            reconstruct_item,
00248                                            local };
00249   };
00250
00251   // First iterate on all the work-groups
00252   parallel_for_iterate<Dimensions,
00253                        range<Dimensions>,
00254                        decltype(iterate_in_work_group),
00255                        id<Dimensions>> { group_range,
00256                                          iterate_in_work_group,
00257       group };
00258 }
```

```
00259
00260
00261 /// Implement the loop on the work-groups
00262 template <int Dimensions = 1, typename ParallelForFunctor>
00263 void parallel_for_workgroup(nd_range<Dimensions> r,
00264                             ParallelForFunctor f) {
00265   // In a sequential execution there is only one index processed at a time
00266   group<Dimensions> g { r };
00267
00268   // First iterate on all the work-groups
00269   parallel_for_iterate<Dimensions,
00270                        range<Dimensions>,
00271                        ParallelForFunctor,
00272                        group<Dimensions>> {
00273     r.get_group(),
00274     f,
00275     g };
00276 }
00277
00278
00279 /** Implement the loop on the work-items inside a work-group
00280
00281     \todo Better type the functor
00282 */
00283 template <int Dimensions, typename ParallelForFunctor>
00284 void parallel_for_workitem(const group<Dimensions> &g,
00285                            ParallelForFunctor f) {
00286 #if defined(_OPENMP) && (!defined(TRISYCL_NO_BARRIER) && !defined(_MSC_VER))
00287   /* To implement barriers With OpenMP, one thread is created for each
00288      work-item in the group and thus an OpenMP barrier has the same effect
00289      of an OpenCL barrier executed by the work-items in a workgroup
00290
00291      The issue is that the parallel_for_workitem() execution is slow even
00292      when nd_item::barrier() is not used
00293   */
00294
00295
00296   // Is the above comment true anymore ?
00297   // Maybe the following will be enough
00298   // #ifdef _OPENMP
00299
00300   // With OMP, one task is created for each work-item in the group
00301
00302   range<Dimensions> l_r = g.get_nd_range().get_local();
00303   std::size_t tot = l_r.get(0);
00304   for (int i = 1; i < (int) Dimensions; ++i){
00305     tot *= l_r.get(i);
00306   }
00307 #pragma omp parallel
00308   {
00309 #pragma omp single nowait
00310     {
00311       for (int th_id = 0; th_id < tot; ++th_id) {
00312 #pragma omp task firstprivate(th_id)
00313         {
00314           nd_item<Dimensions> index { g.get_nd_range() };
00315           id<Dimensions> local; // to initialize correctly
00316
00317           if (Dimensions ==1) {
00318             local[0] = th_id;
00319           } else if (Dimensions == 2) {
00320             local[0] = th_id / l_r.get(1);
00321             local[1] = th_id - local[0]*l_r.get(1);
00322           } else if (Dimensions == 3) {
00323             int tmp = l_r.get(1)*l_r.get(2);
00324             local[0] = th_id / tmp;
00325             local[1] = (th_id - local[0]*tmp) / l_r.get(1);
00326             local[2] = th_id - local[0]*tmp - local[1]*l_r.get(1);
00327           }
00328           index.set_local(local);
00329           index.set_global(local + id<Dimensions>(l_r)*g.get());
00330           f(index);
00331         }
00332       }
00333     }
00334   }
00335 #else
00336   // In a sequential execution there is only one index processed at a time
00337   nd_item<Dimensions> index { g.get_nd_range() };
00338   // To iterate on the local work-item
00339   id<Dimensions> local;
00340
00341   // Reconstruct the nd_item from its group and local id
00342   auto reconstruct_item = [&] (id<Dimensions> l) {
00343     //local.display();
00344     //l.display();
00345     // Reconstruct the global nd_item
```

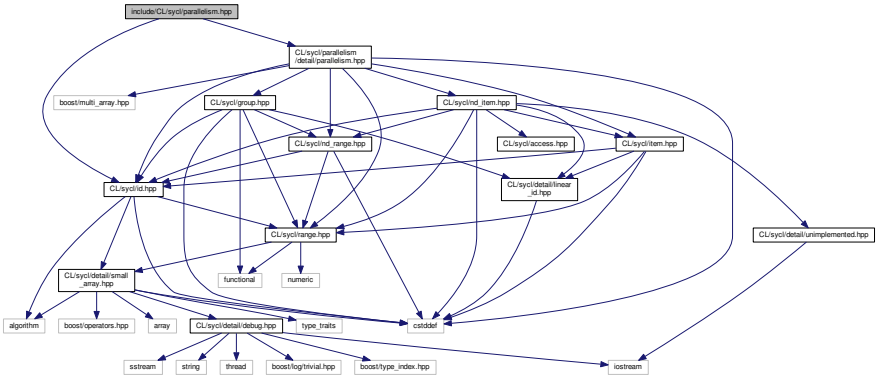
```
00346     index.set_local(local);
00347     // \todo Some strength reduction here
00348     index.set_global(local + id<Dimensions>(g.get_local_range())*g.
      get());
00349     // Call the user kernel at last
00350     f(index);
00351   };
00352
00353   // Then iterate on all the work-items of the work-group
00354   parallel_for_iterate<Dimensions,
00355                        range<Dimensions>,
00356                        decltype(reconstruct_item),
00357                        id<Dimensions>> {
00358     g.get_local_range(),
00359     reconstruct_item,
00360     local };
00361 #endif
00362 }
00363 /// @} End the parallelism Doxygen group
00364
00365 } // namespace detail
00366 }
00367 }
00368
00369 /*
00370     # Some Emacs stuff:
00371     ### Local Variables:
00372     ### ispell-local-dictionary: "american"
00373     ### eval: (flyspell-prog-mode)
00374     ### End:
00375 */
00376
00377 #endif // TRISYCL_SYCL_PARALLELISM_DETAIL_PARALLELISM_HPP
```

11.111 include/CL/sycl/parallelism.hpp File Reference

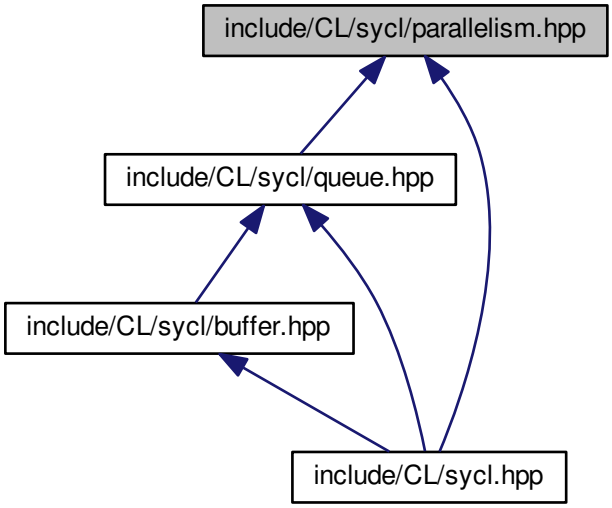
Implement parallel constructions to launch kernels.

```
#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.

11.111.1 Detailed Description

Implement parallel constructions to launch kernels.

Ronan at keryell dot FR

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Definition in file parallelism.hpp.

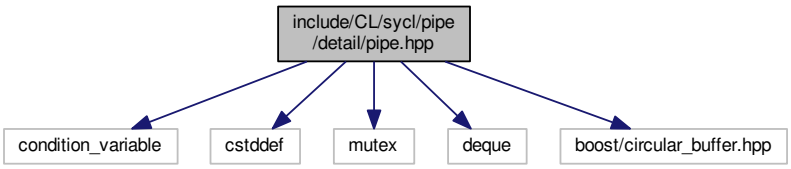
11.112 parallelism.hpp

```
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
```

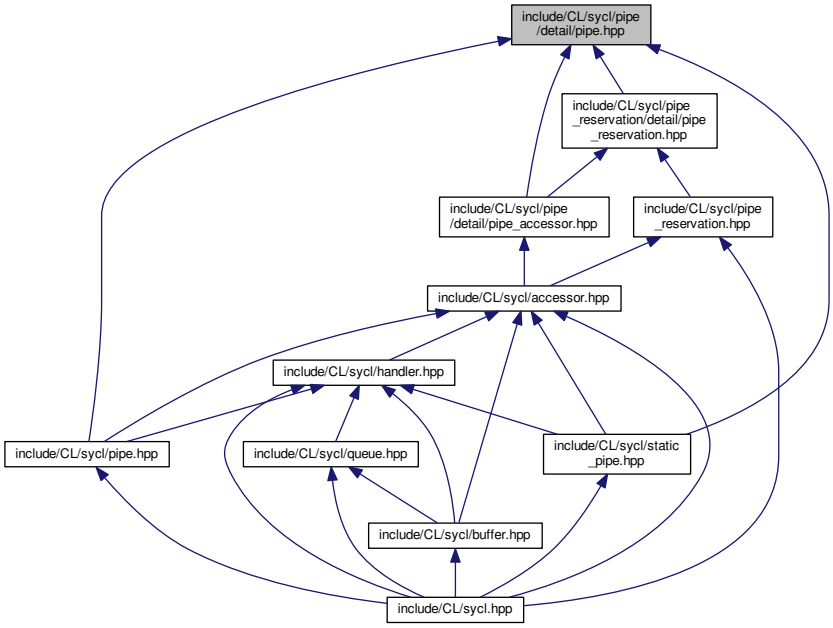
11.113 include/CL/sycl/pipe/detail/pipe.hpp File Reference

```
#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

11.114 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;
```

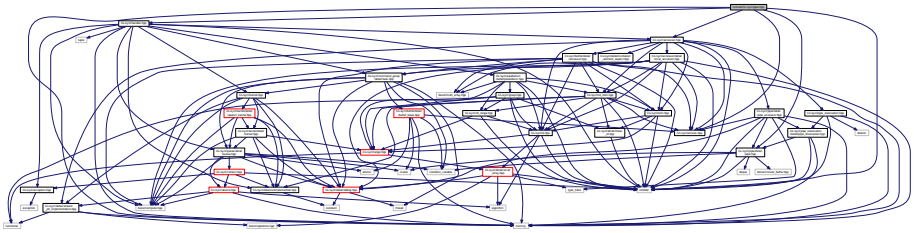
```
00346
00347     if (blocking)
00348       /* If in blocking mode, wait for enough elements to read in the
00349          pipe for the reservation. This condition can change when a
00350          write is done */
00351       write_done.wait(ul, [&] { return s <= size(); });
00352     else if (s > 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
```

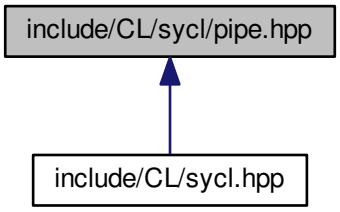
11.115 include/CL/sycl/pipe.hpp File Reference

```
#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

11.116 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"
```

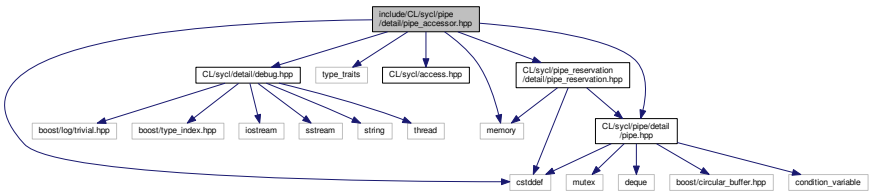
```
00016 #include "CL/sycl/accessor.hpp"
00017 #include "CL/sycl/handler.hpp"
00018 #include "CL/sycl/pipe/detail/pipe.hpp"
00019
00020 namespace cl {
00021 namespace sycl {
00022
00023 /** \addtogroup data Data access and storage in SYCL
00024     @{
00025 */
00026
00027 /** A SYCL pipe
00028
00029     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
```

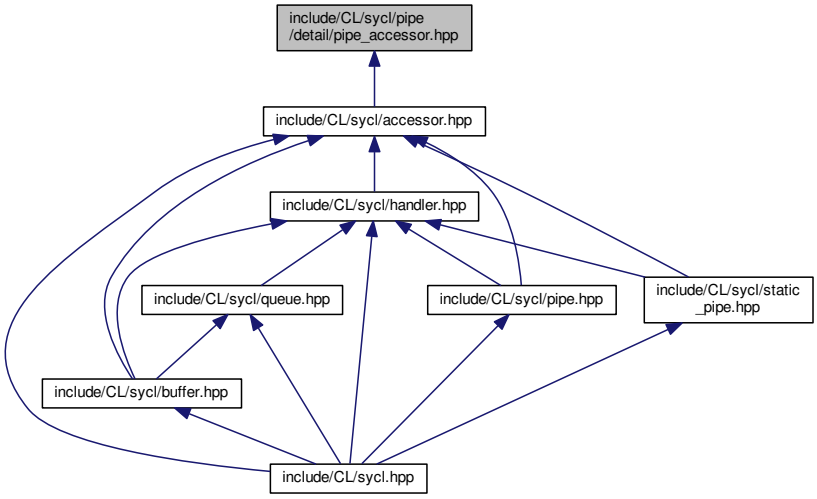
11.117 include/CL/sycl/pipe/detail/pipe_accessor.hpp File Reference

```
#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

11.118 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 <<
```

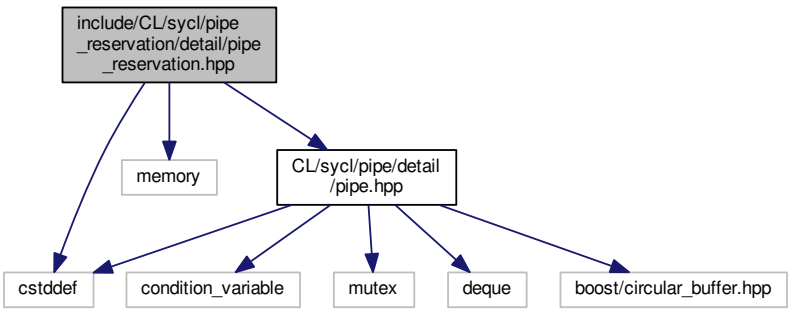
```
00157       some_value \endcode when the type of \code some_value \endcode
00158       is not the same type as the pipe type.
00159
00160       \return true on success of the previous read or write operation
00161   */
00162   explicit operator bool() const {
00163     return ok;
00164   }
00165
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
```

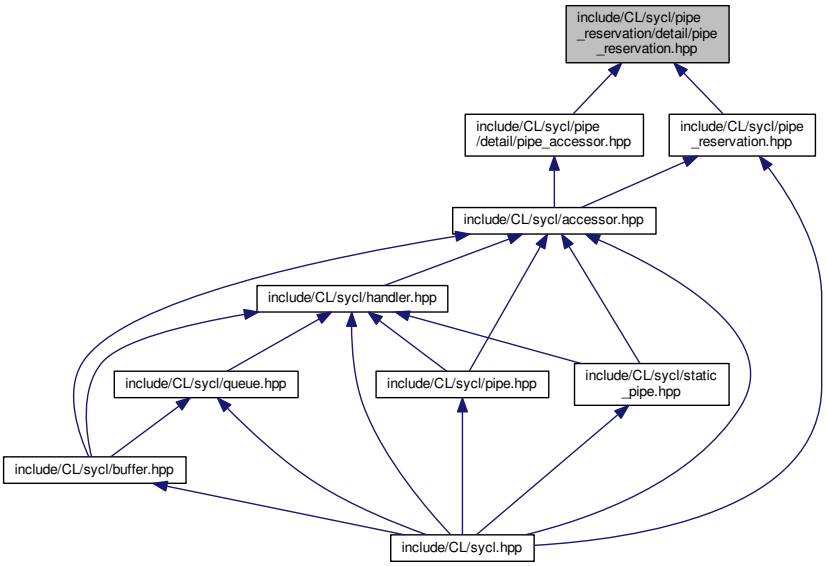
11.119 include/CL/sycl/pipe_reservation/detail/pipe_reservation.hpp File Reference

```
#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

11.120 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 } {
```

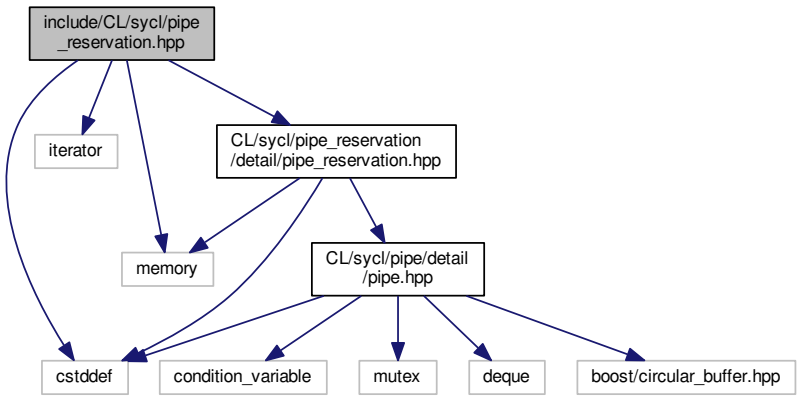
```
00079     static_assert(mode == access::mode::write
00080                   || mode == access::mode::read,
00081                   "A pipe can only be accesed in read or write mode,"
00082                   " exclusively");
00083
00084     /* Since this test is constexpr and dependent of a template
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
```

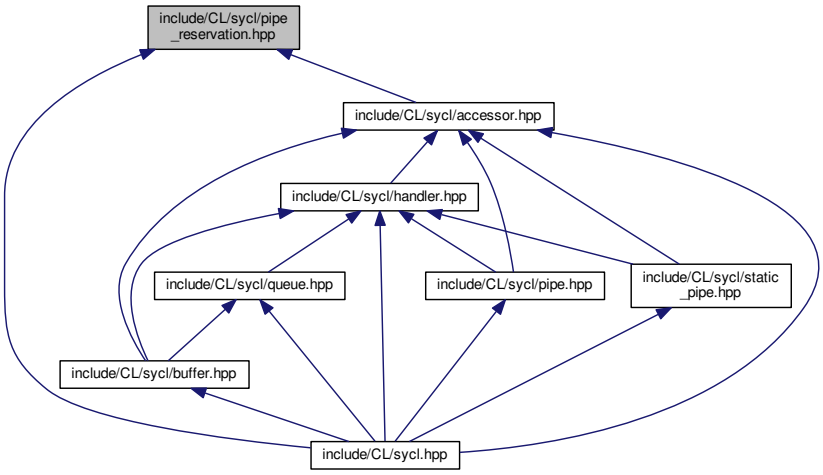
11.121 include/CL/sycl/pipe_reservation.hpp File Reference

```
#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

11.122 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
```

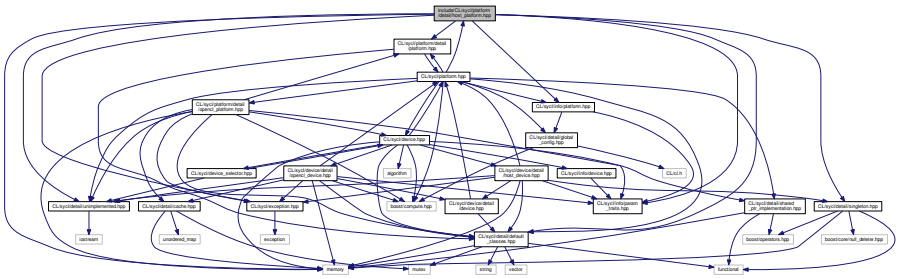
```
00107
00108   /** Force a commit operation
00109
00110       Normally the commit is implicitly done in the destructor, but
00111       sometime it is useful to do it earlier.
00112   */
00113   void commit() const {
00114     return implementation->commit();
00115   }
00116
00117
00118   /// Get 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
```

11.123 include/CL/sycl/platform/detail/host_platform.hpp File Reference

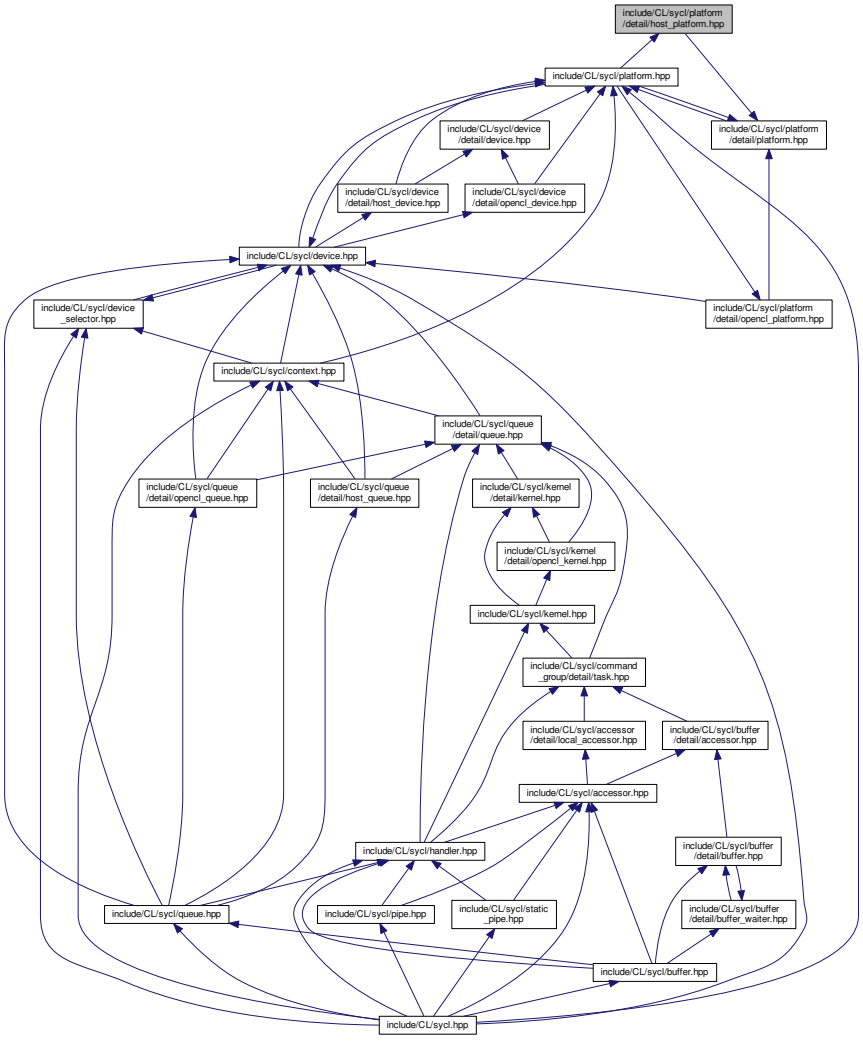
```
#include <memory>
```

```
#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

11.124 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 #endif
00049
00050
00051   /// Return true since this platform is the SYCL host platform
00052   bool is_host() const override {
00053     return true;
00054   }
00055
00056
00057 #if 0
00058   /** Returns at most the host device for this platform, according to
00059       the requested kind
00060
```

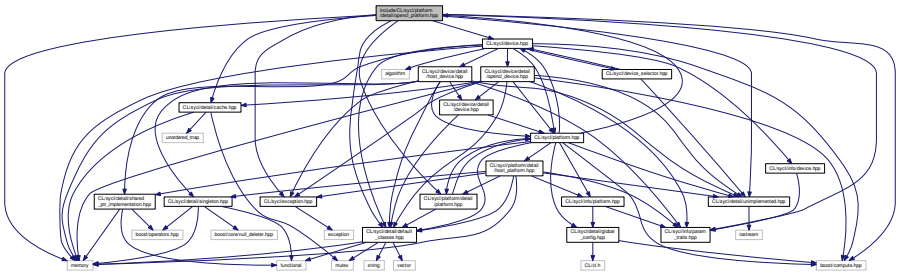
```
00061       By default returns all the devices, which is obviously the host
00062       one here
00063
00064       \todo To be implemented
00065   */
00066   vector_class<device>
00067   get_devices(info::device_type device_type =
      info::device_type::all)
00068     const override
00069   {
00070     detail::unimplemented();
00071     return {};
00072   }
00073 #endif
00074
00075
00076   /** Returning the information parameters for the host platform
00077       implementation
00078   */
00079   string_class get_info_string(info::platform param) const
       override {
00080     switch (param) {
00081     case info::platform::profile:
00082       /* Well... Is the host platform really a full profile whereas it
00083          is not really OpenCL? */
00084       return "FULL_PROFILE";
00085
00086     case info::platform::version:
00087       // \todo I guess it should include the software version too...
00088       return "2.2";
00089
00090     case info::platform::name:
00091       return "triSYCL host platform";
00092
00093     case info::platform::vendor:
00094       return "triSYCL Open Source project";
00095
00096     case info::platform::extensions:
00097       return platform_extensions;
00098
00099     default:
00100       // \todo Define some SYCL exception type for this type of errors
00101       throw std::invalid_argument {
00102         "Unknown parameter value for SYCL platform information" };
00103     }
00104   }
00105
00106
00107   /** Specify whether a specific extension is supported on the platform
00108
00109       \todo To be implemented
00110   */
00111   bool has_extension(const string_class &extension) const override {
00112     detail::unimplemented();
00113     return {};
00114   }
00115
00116 };
00117
00118 /// @} to end the execution Doxygen group
00119
00120 }
00121 }
00122 }
00123
00124 /*
00125     # Some Emacs stuff:
00126     ### Local Variables:
00127     ### ispell-local-dictionary: "american"
00128     ### eval: (flyspell-prog-mode)
00129     ### End:
00130 */
00131
00132 #endif // TRISYCL_SYCL_PLATFORM_DETAIL_HOST_PLATFORM_HPP
```

11.125 include/CL/sycl/platform/detail/opencl_platform.hpp File Reference

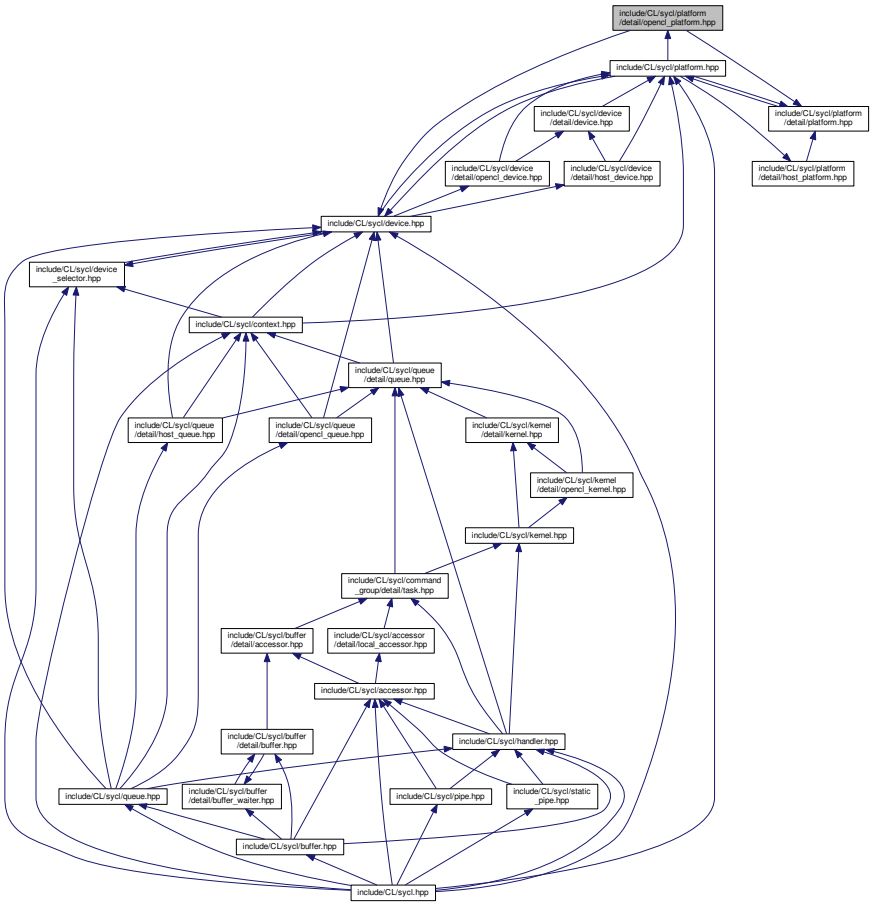
```
#include <memory>
```

```
#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

11.126 opencl_platform.hpp

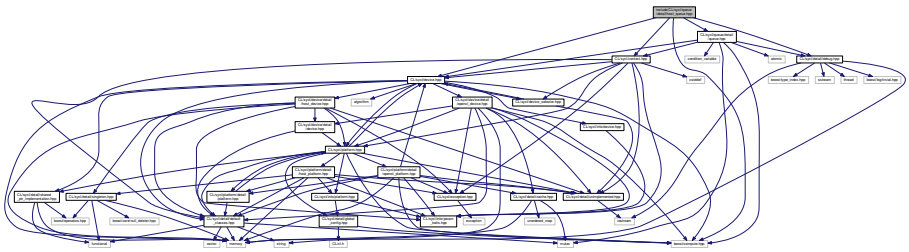
```
00001 #ifndef TRISYCL_SYCL_PLATFORM_DETAIL_OPENCL_PLATFORM_HPP
00002 #define TRISYCL_SYCL_PLATFORM_DETAIL_OPENCL_PLATFORM_HPP
00003
00004 /** \file The OpenCL triSYCL OpenCL platform implementation
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University 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 false since an OpenCL platform is not the SYCL host platform
00057   bool is_host() const override {
00058     return false;
00059   }
```

```
00060
00061
00062 #if 0
00063   /** Returns at most the host device for this platform, according to
00064       the requested kind
00065
00066       By default returns all the devices, which is obviously the host
00067       one here
00068
00069       \todo To be implemented
00070   */
00071   vector_class<cl::sycl::device>
00072   get_devices(info::device_type device_type =
      info::device_type::all)
00073     const override
00074   {
00075     detail::unimplemented();
00076     return {};
00077   }
00078 #endif
00079
00080
00081   /// Returning the information string parameters for the OpenCL platform
00082   string_class get_info_string(info::platform param) const
      override {
00083     /* Use the fact that the triSYCL info values are the same as the
00084        OpenCL ones used in Boost.Compute to just cast the enum class
00085        to the int value */
00086     return p.get_info<std::string>(static_cast<cl_platform_info>(param));
00087   }
00088
00089
00090   /// Specify whether a specific extension is supported on the platform
00091   bool has_extension(const string_class &extension) const override {
00092     return p.supports_extension(extension);
00093   }
00094
00095
00096   ///// Get a singleton instance of the opencl_platform
00097   static std::shared_ptr<opencl_platform>
00098   instance(const boost::compute::platform &p) {
00099     return cache.get_or_register(p.id(),
00100                                  [&] { return new opencl_platform { p }; });
00101   }
00102
00103 private:
00104
00105   /// Only the instance factory can built it
00106   opencl_platform(const boost::compute::platform &p) : p { p } {}
00107
00108 public:
00109
00110   /// Unregister from the cache on destruction
00111   ~opencl_platform() override {
00112     cache.remove(p.id());
00113   }
00114
00115 };
00116
00117 /* Allocate the cache here but since this is a pure-header library,
00118    use a weak symbol so that only one remains when SYCL headers are
00119    used in different compilation units of a program
00120 */
00121 TRISYCL_WEAK_ATTRIB_PREFIX
00122 detail::cache<cl_platform_id, detail::opencl_platform>
      opencl_platform::cache
00123 TRISYCL_WEAK_ATTRIB_SUFFIX;
00124
00125 /// @} to end the execution Doxygen group
00126
00127 }
00128 }
00129 }
00130
00131 /*
00132     # Some Emacs stuff:
00133     ### Local Variables:
00134     ### ispell-local-dictionary: "american"
00135     ### eval: (flyspell-prog-mode)
00136     ### End:
00137 */
00138
00139 #endif // TRISYCL_SYCL_PLATFORM_DETAIL_HOST_PLATFORM_HPP
```

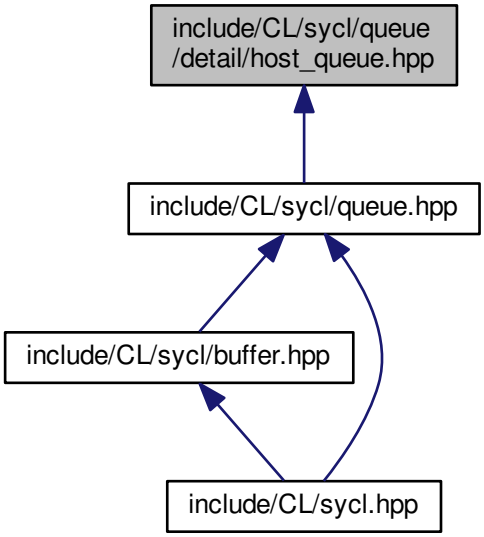
11.127 include/CL/sycl/queue/detail/host_queue.hpp File Reference

```
#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

11.128 host_queue.hpp

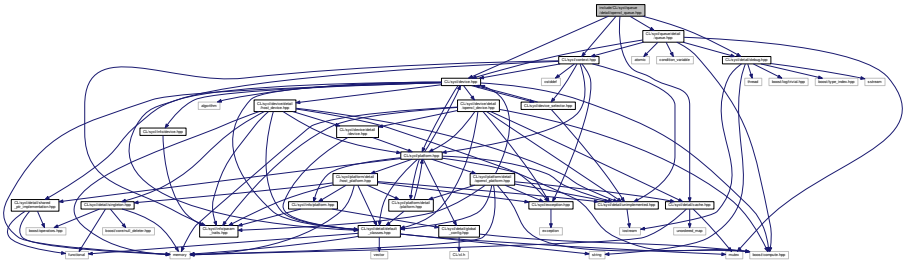
```
00001 #ifndef TRISYCL_SYCL_QUEUE_DETAIL_HOST_QUEUE_HPP
00002 #define TRISYCL_SYCL_QUEUE_DETAIL_HOST_QUEUE_HPP
00003
00004 /** \file Some implementation details of the host queue
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open 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     \todo Once a triSYCL queue is no longer blocking, make this a singleton
00028  */
00029 class host_queue : public detail::queue,
00030                    detail::debug<host_queue> {
00031
00032 #ifdef TRISYCL_OPENCL
00033   /** Return the cl_command_queue of the underlying OpenCL queue
00034
00035       This throws an error since there is no OpenCL queue associated
00036       to the host queue.
00037   */
00038   cl_command_queue get() const override {
00039     throw non_cl_error("The host queue has no OpenCL command queue");
00040   }
00041
00042
00043   /** Return the underlying Boost.Compute command queue
00044
00045       This throws an error since there is no OpenCL queue associated
00046       to the host queue.
00047   */
00048   boost::compute::command_queue &get_boost_compute() override {
00049     throw non_cl_error("The host queue has no OpenCL command queue");
00050   }
00051 #endif
00052
00053
00054   /// Return the SYCL host queue's host context
00055   cl::sycl::context get_context() const override {
00056     // Return the default context which is the host context
00057     return {};
00058   }
00059
00060
00061   /// Return the SYCL host device the host queue is associated with
00062   cl::sycl::device get_device() const override {
00063     // Return the default device which is the host device
00064     return {};
00065   }
00066
00067
00068   /// Claim proudly that the queue is executing on the SYCL host device
00069   bool is_host() const override {
00070     return true;
00071   }
00072
00073
00074 };
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_QUEUE_DETAIL_HOST_QUEUE_HPP
```

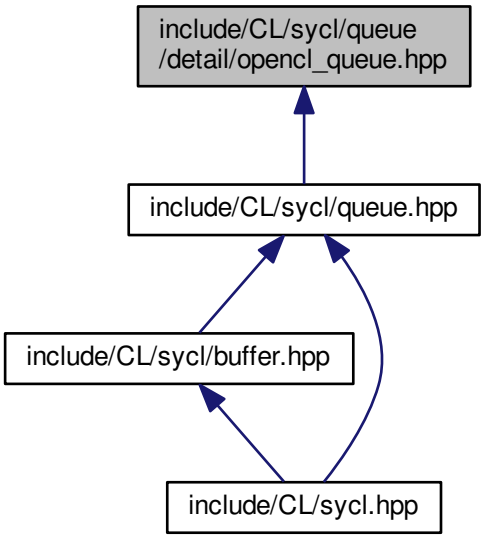
11.129 include/CL/sycl/queue/detail/opencl_queue.hpp File Reference

```
#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

11.130 opencl_queue.hpp

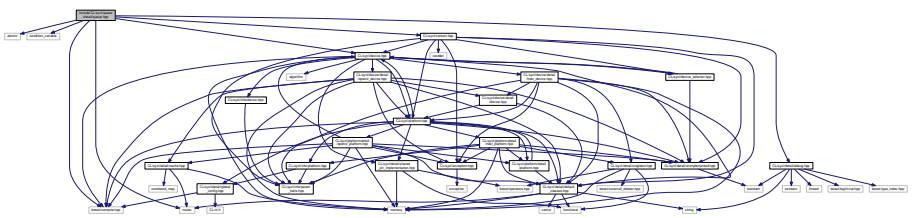
```
00001 #ifndef TRISYCL_SYCL_QUEUE_DETAIL_OPENCL_QUEUE_HPP
00002 #define TRISYCL_SYCL_QUEUE_DETAIL_OPENCL_QUEUE_HPP
00003
00004 /** \file Some implementation details of the OpenCL queue
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois 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   /// \todo Finish context
00049   cl::sycl::context get_context() const override {
00050 //    return q.get_context();
00051     return {};
00052   }
00053
00054
00055   /// Return the SYCL device associated to the queue
00056   cl::sycl::device get_device() const override {
00057     return q.get_device();
00058   }
00059
00060
00061   /// Claim proudly that an OpenCL queue cannot be the SYCL host queue
00062   bool is_host() const override {
00063     return false;
00064   }
00065
00066 private:
00067
00068   /// Only the instance factory can built it
00069   opencl_queue(const boost::compute::command_queue &q) : q { q } {}
```

```
00070
00071 public:
00072
00073   ///// Get a singleton instance of the opencl_queue
00074   static std::shared_ptr<opencl_queue>
00075   instance(const boost::compute::command_queue &q) {
00076     return cache.get_or_register(q.get(),
00077                                  [&] { return new opencl_queue { q }; });
00078   }
00079
00080
00081   /// Unregister from the cache on destruction
00082   ~opencl_queue() override {
00083     cache.remove(q.get());
00084   }
00085
00086 };
00087
00088 /* Allocate the cache here but since this is a pure-header library,
00089    use a weak symbol so that only one remains when SYCL headers are
00090    used in different compilation units of a program
00091 */
00092 TRISYCL_WEAK_ATTRIB_PREFIX
00093 detail::cache<cl_command_queue, detail::opencl_queue>
      opencl_queue::cache
00094 TRISYCL_WEAK_ATTRIB_SUFFIX;
00095
00096 }
00097 }
00098 }
00099
00100 /*
00101     # Some Emacs stuff:
00102     ### Local Variables:
00103     ### ispell-local-dictionary: "american"
00104     ### eval: (flyspell-prog-mode)
00105     ### End:
00106 */
00107
00108 #endif // TRISYCL_SYCL_QUEUE_DETAIL_OPENCL_QUEUE_HPP
```

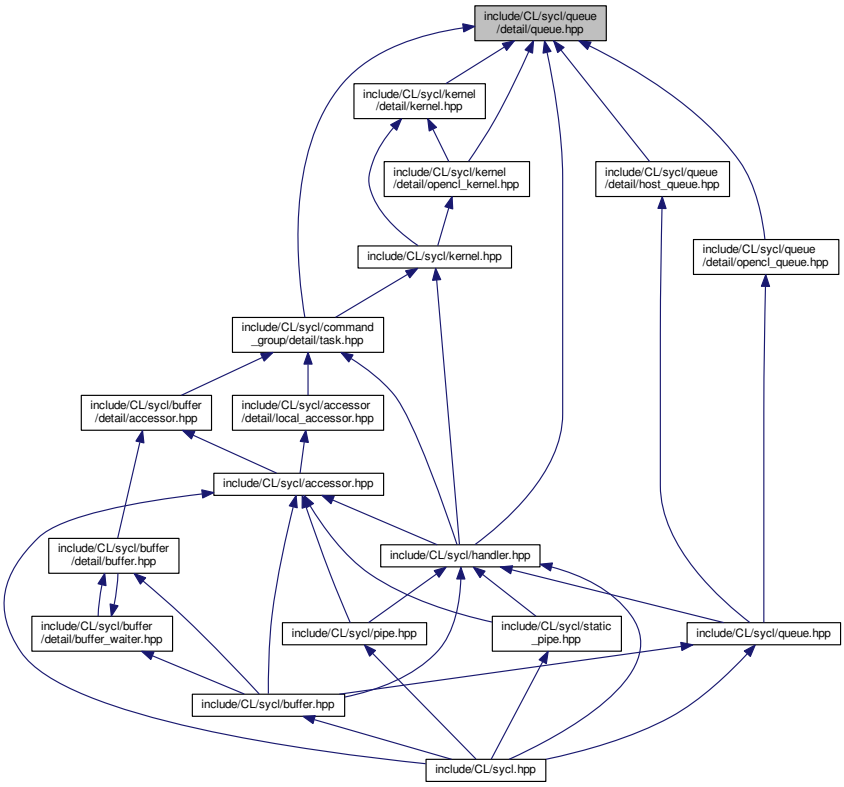
11.131 include/CL/sycl/queue/detail/queue.hpp File Reference

```
#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

11.132 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
```

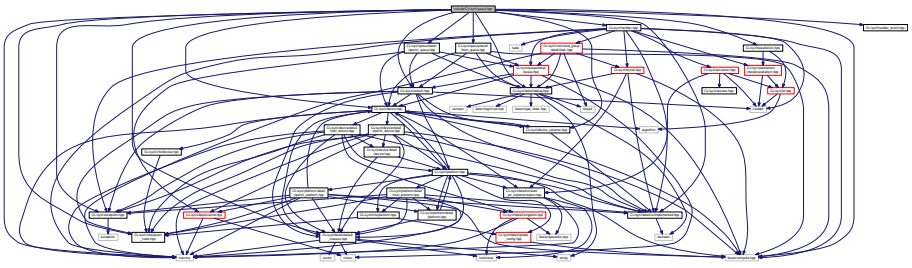
```
00012 #include <atomic>
00013 #include <condition_variable>
00014 #include <mutex>
00015
00016 #ifdef TRISYCL_OPENCL
00017 #include <boost/compute.hpp>
00018 #endif
00019
00020 #include "CL/sycl/context.hpp"
00021 #include "CL/sycl/device.hpp"
00022 #include "CL/sycl/detail/debug.hpp"
00023
00024 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       finished.notify_one();
00072     }
00073   }
00074
00075
00076 #ifdef TRISYCL_OPENCL
00077   /** Return the underlying OpenCL command queue after doing a retain
00078
00079       This memory object is expected to be released by the developer.
00080
00081       Retain a reference to the returned cl_command_queue object.
00082
00083       Caller should release it when finished.
00084
00085       If the queue is a SYCL host queue then an exception is thrown.
00086   */
00087   virtual cl_command_queue get() const = 0;
00088
00089   /// Return the underlying Boost.Compute command queue
00090   virtual boost::compute::command_queue &get_boost_compute() = 0;
00091 #endif
00092
00093
00094   /** Return the SYCL queue's context
00095
00096       Report errors using SYCL exception classes.
00097   */
00098   virtual cl::sycl::context get_context() const = 0;
```

```
00099
00100
00101   /** Return the SYCL device the queue is associated with
00102
00103       Report errors using SYCL exception classes.
00104   */
00105   virtual cl::sycl::device get_device() const = 0;
00106
00107
00108   /// Return whether the queue is executing on a SYCL host device
00109   virtual bool is_host() const = 0;
00110
00111
00112   /// Wait for all kernel completion before the queue destruction
00113   /// \todo Update according spec since queue destruction is non blocking
00114   virtual ~queue() {
00115     wait_for_kernel_execution();
00116   }
00117
00118 };
00119
00120 }
00121 }
00122 }
00123
00124 /*
00125     # Some Emacs stuff:
00126     ### Local Variables:
00127     ### ispell-local-dictionary: "american"
00128     ### eval: (flyspell-prog-mode)
00129     ### End:
00130 */
00131
00132 #endif // TRISYCL_SYCL_QUEUE_DETAIL_QUEUE_HPP
```

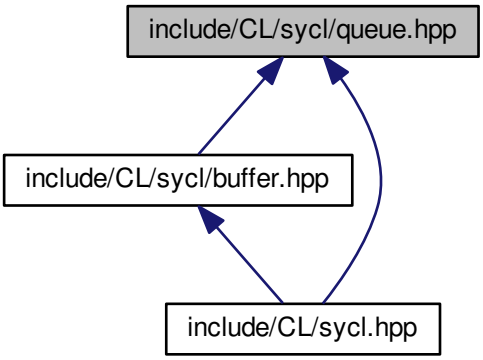
11.133 include/CL/sycl/queue.hpp File Reference

```
#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.

11.134 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   queue() : implementation_t { new detail::host_queue } {}
00105
00106
00107   /** This constructor creates a SYCL queue from an OpenCL queue
00108
00109       At construction it does a retain on the queue memory object.
00110
00111       Retain a reference to the cl_command_queue object. Caller should
00112       release the passed cl_command_queue object when it is no longer
00113       needed.
00114
00115       Return synchronous errors regarding the creation of the queue and
00116       report asynchronous errors via the async_handler callback function
00117       in conjunction with the synchronization and throw methods.
00118
00119       Note that the default case asyncHandler = nullptr is handled by the
00120       default constructor.
00121
00122   */
00123   explicit queue(async_handler asyncHandler) : queue { } {
00124     detail::unimplemented();
00125   }
00126
00127
00128   /** Creates a queue for the device provided by the device selector
00129
00130       If no device is selected, an error is reported.
00131
00132       Return synchronous errors regarding the creation of the queue and
00133       report asynchronous errors via the async_handler callback
00134       function if and only if there is an async_handler provided.
00135   */
00136   queue(const device_selector &deviceSelector,
00137         async_handler asyncHandler = nullptr) : queue { } {
00138     detail::unimplemented();
00139   }
00140
00141
00142   /** A queue is created for syclDevice
00143
00144       Return asynchronous errors via the async_handler callback function.
00145   */
00146   queue(const device &syclDevice,
00147         async_handler asyncHandler = nullptr) : queue { } {
00148     detail::unimplemented();
00149   };
00150
00151
00152   /** This constructor chooses a device based on the provided
00153       device_selector, which needs to be in the given context.
00154
00155       If no device is selected, an error is reported.
00156
00157       Return synchronous errors regarding the creation of the queue.
00158
00159       If and only if there is an asyncHandler provided, it reports
00160       asynchronous errors via the async_handler callback function in
00161       conjunction with the synchronization and throw methods.
00162   */
00163   queue(const context &syclContext,
00164         const device_selector &deviceSelector,
00165         async_handler asyncHandler = nullptr) : queue { } {
00166     detail::unimplemented();
00167   }
00168
00169
```

```
00170   /** Creates a command queue using clCreateCommandQueue from a context
00171       and a device
00172
00173       Return synchronous errors regarding the creation of the queue.
00174
00175       If and only if there is an asyncHandler provided, it reports
00176       asynchronous errors via the async_handler callback function in
00177       conjunction with the synchronization and throw methods.
00178   */
00179   queue(const context &syclContext,
00180         const device &syclDevice,
00181         async_handler asyncHandler = nullptr) : queue { } {
00182     detail::unimplemented();
00183   }
00184
00185
00186   /** Creates a command queue using clCreateCommandQueue from a context
00187       and a device
00188
00189       It enables profiling on the queue if the profilingFlag is set to
00190       true.
00191
00192       Return synchronous errors regarding the creation of the queue. If
00193       and only if there is an asyncHandler provided, it reports
00194       asynchronous errors via the async_handler callback function in
00195       conjunction with the synchronization and throw methods.
00196   */
00197   queue(const context &syclContext,
00198         const device &syclDevice,
00199         info::queue_profiling profilingFlag,
00200         async_handler asyncHandler = nullptr) : queue { } {
00201     detail::unimplemented();
00202   }
00203
00204
00205 #ifdef TRISYCL_OPENCL
00206   /** This constructor creates a SYCL queue from an OpenCL queue
00207
00208       At construction it does a retain on the queue memory object.
00209
00210       Return synchronous errors regarding the creation of the queue. If
00211       and only if there is an async_handler provided, it reports
00212       asynchronous errors via the async_handler callback function in
00213       conjunction with the synchronization and throw methods.
00214   */
00215   queue(const cl_command_queue &q, async_handler ah = nullptr)
00216     : queue { boost::compute::command_queue { q }, ah } {}
00217
00218
00219   /** Construct a queue instance using a boost::compute::command_queue
00220
00221       This is a triSYCL extension for boost::compute interoperation.
00222
00223       Return synchronous errors via the SYCL exception class.
00224
00225       \todo Deal with handler
00226   */
00227   queue(const boost::compute::command_queue &q, async_handler ah = nullptr)
00228     : implementation_t { detail::opencl_queue::instance(q) }
      {}
00229 #endif
00230
00231
00232 #ifdef TRISYCL_OPENCL
00233   /** Return the underlying OpenCL command queue after doing a retain
00234
00235       This memory object is expected to be released by the developer.
00236
00237       Retain a reference to the returned cl_command_queue object.
00238
00239       Caller should release it when finished.
00240
00241       If the queue is a SYCL host queue then an exception is thrown.
00242   */
00243   cl_command_queue get() const {
00244     return implementation->get();
00245   }
00246 #endif
00247
00248
00249   /** Return the SYCL queue's context
00250
00251       Report errors using SYCL exception classes.
00252   */
00253   context get_context() const {
00254     return implementation->get_context();
00255   }
```

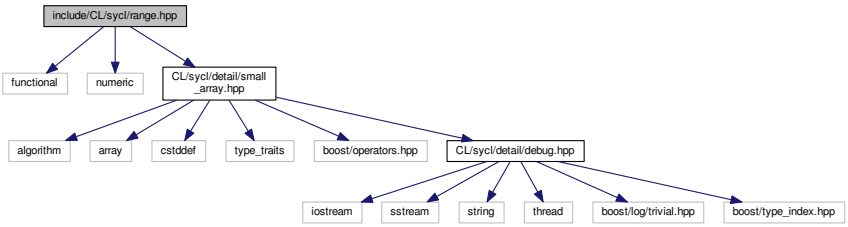
```
00256
00257
00258   /** Return the SYCL device the queue is associated with
00259
00260       Report errors using SYCL exception classes.
00261   */
00262   device get_device() const {
00263     return implementation->get_device();
00264   }
00265
00266
00267   /// Return whether the queue is executing on a SYCL host device
00268   bool is_host() const {
00269     return implementation->is_host();
00270   }
00271
00272
00273   /** Performs a blocking wait for the completion all enqueued tasks in
00274       the queue
00275
00276       Synchronous errors will be reported through SYCL exceptions.
00277   */
00278   void wait() {
00279     implementation->wait_for_kernel_execution();
00280   }
00281
00282
00283   /** Perform a blocking wait for the completion all enqueued tasks in the queue
00284
00285       Synchronous errors will be reported via SYCL exceptions.
00286
00287       Asynchronous errors will be passed to the async_handler passed to the
00288       queue on construction.
00289
00290       If no async_handler was provided then asynchronous exceptions will
00291       be lost.
00292   */
00293   void wait_and_throw() {
00294     detail::unimplemented();
00295   }
00296
00297
00298   /** Checks to see if any asynchronous errors have been produced by the
00299       queue and if so reports them by passing them to the async_handler
00300       passed to the queue on construction
00301
00302       If no async_handler was provided then asynchronous exceptions will
00303       be lost.
00304   */
00305   void throw_asynchronous() {
00306     detail::unimplemented();
00307   }
00308
00309
00310   /// Queries the platform for cl_command_queue info
00311   template <info::queue param>
00312   typename info::param_traits<info::queue, param>::type
      get_info() const  {
00313     detail::unimplemented();
00314     return {};
00315   }
00316
00317
00318   /** Submit a command group functor to the queue, in order to be
00319       scheduled for execution on the device
00320
00321       Use an explicit functor parameter taking a handler& so we can use
00322       "auto" in submit() lambda parameter.
00323
00324       \todo Add in the spec an implicit conversion of handler_event to
00325       queue& so it is possible to chain operations on the queue
00326
00327       \todo Update the spec to replace std::function by a templated
00328       type to avoid memory allocation
00329   */
00330   handler_event submit(std::function<void(handler &)> cgf) {
00331     handler command_group_handler { implementation };
00332     cgf(command_group_handler);
00333     return {};
00334   }
00335
00336
00337   /** Submit a command group functor to the queue, in order to be
00338       scheduled for execution on the device
00339
00340       On kernel error, this command group functor, then it is scheduled
00341       for execution on the secondary queue.
```

```
00342
00343       Return a command group functor event, which is corresponds to the
00344       queue the command group functor is being enqueued on.
00345   */
00346   handler_event submit(std::function<void(handler &)> cgf,
      queue &secondaryQueue) {
00347     detail::unimplemented();
00348     // Since it is not implemented, always submit on the main queue
00349     return submit(cgf);
00350   }
00351
00352 };
00353
00354 /// @} to end the execution Doxygen group
00355
00356 }
00357 }
00358
00359 /* Inject a custom specialization of std::hash to have the buffer
00360    usable into an unordered associative container
00361
00362    \todo Add this to the spec
00363 */
00364 namespace std {
00365
00366 template <> struct hash<cl::sycl::queue> {
00367
00368   auto operator()(const cl::sycl::queue &q) const {
00369     // Forward the hashing to the implementation
00370     return q.hash();
00371   }
00372
00373 };
00374
00375 }
00376
00377 /*
00378     # Some Emacs stuff:
00379     ### Local Variables:
00380     ### ispell-local-dictionary: "american"
00381     ### eval: (flyspell-prog-mode)
00382     ### End:
00383 */
00384
00385 #endif // TRISYCL_SYCL_QUEUE_HPP
```

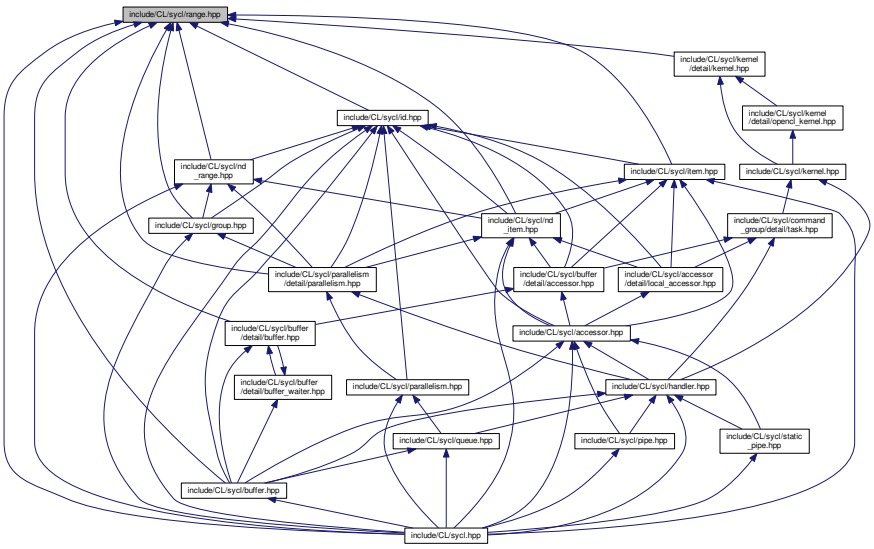
11.135 include/CL/sycl/range.hpp File Reference

```
#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)

11.136 range.hpp

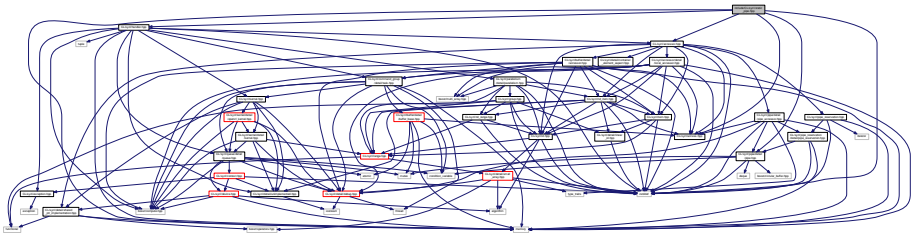
```
00001 #ifndef TRISYCL_SYCL_RANGE_HPP
00002 #define TRISYCL_SYCL_RANGE_HPP
00003
00004 /** \file The OpenCL SYCL range<>
00005
00006     Ronan at Keryell point FR
00007
00008     This file is distributed under the University of Illinois Open Source
00009     License. See LICENSE.TXT for details.
00010 */
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() {
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
```

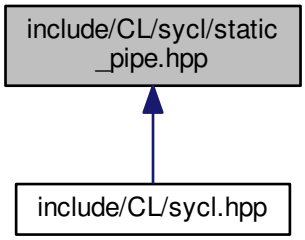
11.137 include/CL/sycl/static_pipe.hpp File Reference

```
#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

11.138 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
```

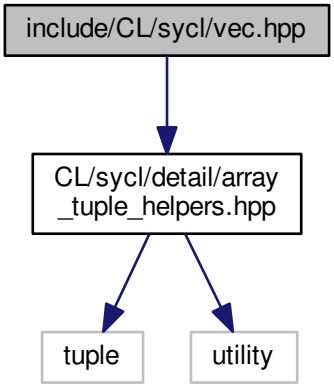
```
00071
00072   /// Construct a static-scoped pipe able to store up to Capacity T objects
00073   static_pipe()
00074     : implementation_t { new detail::pipe<T> { Capacity } } { }
00075
00076
00077   /** Get an accessor to the pipe with the required mode
00078
00079       \param Mode is the requested 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
```

11.139 include/CL/sycl/vec.hpp File Reference

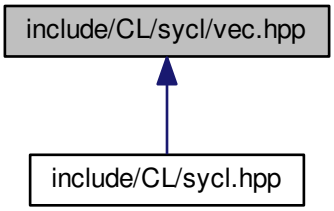
Implement the small OpenCL vector class.

```
#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 real_type=unsigned char, uchar4 is equivalent to vec<float, 4>
- #define TRISYCL_DEFINE_VEC_TYPE(type, actual_type)

  Declare the vector types of a type for all the sizes.

11.139.1 Detailed Description

Implement the small OpenCL vector class.

Ronan at Keryell point FR

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Definition in file vec.hpp.

11.140 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   /** A macro to define type alias, such as for type=uchar, size=4 and
00156       real_type=unsigned char, uchar4 is equivalent to vec<float, 4>
00157   */
00158 #define TRISYCL_DEFINE_VEC_TYPE_SIZE(type, size, actual_type) \
00159   using type##size = vec<actual_type, size>;
00160
00161   /// Declare the vector types of a type for all the sizes
00162 #define TRISYCL_DEFINE_VEC_TYPE(type, actual_type)           \
00163   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 1, actual_type)         \
00164   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 2, actual_type)         \
00165   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 3, actual_type)         \
00166   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 4, actual_type)         \
00167   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 8, actual_type)         \
00168   TRISYCL_DEFINE_VEC_TYPE_SIZE(type, 16, actual_type)
00169
00170   /// Declare all the possible vector type aliases
00171   TRISYCL_DEFINE_VEC_TYPE(char, char)
00172   TRISYCL_DEFINE_VEC_TYPE(uchar, unsigned char)
00173   TRISYCL_DEFINE_VEC_TYPE(short, short int)
00174   TRISYCL_DEFINE_VEC_TYPE(ushort, unsigned short int)
00175   TRISYCL_DEFINE_VEC_TYPE(int, int)
00176   TRISYCL_DEFINE_VEC_TYPE(uint, unsigned int)
00177   TRISYCL_DEFINE_VEC_TYPE(long, long int)
00178   TRISYCL_DEFINE_VEC_TYPE(ulong, unsigned long int)
00179   TRISYCL_DEFINE_VEC_TYPE(float, float)
00180   TRISYCL_DEFINE_VEC_TYPE(double, double)
00181
00182 /// @} End the vector Doxygen group
00183
00184
00185 }
00186 }
00187
00188 /*
00189     # Some Emacs stuff:
00190     ### Local Variables:
00191     ### ispell-local-dictionary: "american"
00192     ### eval: (flyspell-prog-mode)
00193     ### End:
00194 */
00195
00196 #endif // TRISYCL_SYCL_VEC_HPP
```

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