MemoryAllocationRoutines

5.1

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Module Documentation

6.1 Externally-usable macros

The supported use of the JEOD memory model is via those macros advertised as externally-usable.

Macros

- #define JEOD_MEMORY_DEBUG 2

  Specifies the level of checking performed by the JEOD memory model.
- #define JEOD_REGISTER_CLASS(type) jeod::JeodMemoryManager::register_class(jeod::JeodMemoryTypePreDescriptorDer
  _ref())

  Register the type type with the memory manager.
- #define JEOD_REGISTER_INCOMPLETE_CLASS(type) JEOD_REGISTER_CLASS(type)

  Register the incomplete class type with the memory manager.
- #define JEOD_REGISTER_NONEXPORTED_CLASS(type) jeod::JeodMemoryManager::register_class(jeod::JeodMemoryTyp
  _ref())

  Register the type type with the memory manager, but with the class marked as not exportable to the simulation engine.
- #define JEOD_REGISTER_CHECKPOINTABLE(owner, elem_name)

  Register the data member elem_name of the owner as a Checkpointable object.
- #define JEOD_DEREGISTER_CHECKPOINTABLE(owner, elem_name)

  Register the data member elem_name of the owner as a Checkpointable object.
- #define JEOD_ALLOC_CLASS_MULTI_POINTER_ARRAY(nelem, type, asters) JEOD_ALLOC_ARRAY_INTERNAL(type asters, nelem, JEOD_ALLOC_POINTER_FILL, JEOD_REGISTER_CLASS(type asters))

  Allocate an array of nelem multi-level pointers to the specified type.
- #define JEOD_ALLOC_CLASS_POINTER_ARRAY(nelem, type) JEOD_ALLOC_CLASS_MULTI_POINTER_ARRAY(nelem, type, ∗)

  Allocate an array of nelem pointers to the specified type.
- #define JEOD_ALLOC_CLASS_ARRAY(nelem, type) JEOD_ALLOC_ARRAY_INTERNAL(type, nelem, JEOD_ALLOC_OBJECT_FILL, JEOD_REGISTER_CLASS(type))

  Allocate an array of nelem instances of the specified structured type.
- #define JEOD_ALLOC_PRIM_ARRAY(nelem, type) JEOD_ALLOC_ARRAY_INTERNAL(type, nelem, JEOD_ALLOC_PRIMITIVE_FILL, JEOD_REGISTER_CLASS(type))

  Allocate nelem elements of the specified primitive type.
- #define JEOD_ALLOC_CLASS_OBJECT(type, constr) JEOD_ALLOC_OBJECT_INTERNAL(type, JEOD_ALLOC_OBJECT_FILL, constr, JEOD_REGISTER_CLASS(type))

  *Allocate **one** instance of the specified class.*

- #define JEOD_ALLOC_PRIM_OBJECT(type, initial) JEOD_ALLOC_OBJECT_INTERNAL(type, JEOD_ALLOC_PRIMITIVE_FI (initial), JEOD_REGISTER_CLASS(type))

  *Allocate **one** instance of the specified type.*
- #define JEOD_IS_ALLOCATED(ptr) jeod::JeodMemoryManager::is_allocated(jeod::jeod_alloc_get_allocated_pointer(ptr), __FILE__, __LINE__)

  Determine if ptr was allocated by some `JEOD_ALLOC_xxx_ARRAY` macro.
- #define JEOD_DELETE_ARRAY(ptr) JEOD_DELETE_INTERNAL(ptr, true)

  Free memory at ptr that was earlier allocated with some `JEOD_ALLOC_xxx_ARRAY` macro.
- #define JEOD_DELETE_OBJECT(ptr) JEOD_DELETE_INTERNAL(ptr, false)

  Free memory at ptr that was earlier allocated with some `JEOD_ALLOC_xxx_OBJECT` macro.
- #define JEOD_DELETE_2D(ptr, size, is_array)

6.1.1 Detailed Description

The supported use of the JEOD memory model is via those macros advertised as externally-usable.

These externally-usable macros expand into invocations of internal macros, which in turn expand into calls to methods of classes defined in the memory model.

6.1.2 Macro Definition Documentation

6.1.2.1 JEOD_ALLOC_CLASS_ARRAY

```
#define JEOD_ALLOC_CLASS_ARRAY(
              nelem,
              type ) JEOD_ALLOC_ARRAY_INTERNAL(type, nelem, JEOD_ALLOC_OBJECT_FILL, JEOD_REGISTER_CLASS(type))
```

Allocate an array of *nelem* instances of the specified structured *type*.

The default constructor is invoked to initialize each allocated object.

Returns

Allocated array of specified type.

Parameters

nelem	Size of the array.
type	The underlying type, which must be a structured type.

Example:

```
Foo ** foo_array = JEOD_ALLOC_CLASS_ARRAY(2,Foo);
```

This allocates two objects of the class Foo.

Definition at line 394 of file jeod_alloc.hh.

6.1.2.2 JEOD_ALLOC_CLASS_MULTI_POINTER_ARRAY

```
#define JEOD_ALLOC_CLASS_MULTI_POINTER_ARRAY(
              nelem,
              type,
              asters ) JEOD_ALLOC_ARRAY_INTERNAL(type asters, nelem, JEOD_ALLOC_POINTER_FILL,
JEOD_REGISTER_CLASS(type asters))
```

Allocate an array of *nelem* multi-level pointers to the specified *type*.

The *asters* are asterisks that specify the pointer level. The allocated memory is initialized via `new`.

Returns

Allocated array of specified type.

Parameters

nelem	Size of the array.
type	The underlying type, which must be a structured type.
asters	A bunch of asterisks.

Example:

```
Foo *** foo_array = JEOD_ALLOC_CLASS_MULTI_POINTER_ARRAY(2,Foo,**);
```

This allocates two pointers-to-pointers to the class Foo. Note that this does not allocate either the Foo objects or pointers to the Foo objects.

Definition at line 361 of file jeod_alloc.hh.

6.1.2.3 JEOD_ALLOC_CLASS_OBJECT

```
#define JEOD_ALLOC_CLASS_OBJECT(
              type,
              constr ) JEOD_ALLOC_OBJECT_INTERNAL(type, JEOD_ALLOC_OBJECT_FILL, constr, JEOD_REGISTER_CLASS(ty
```

Allocate **one** instance of the specified class.

The supplied constructor arguments, *constr*, are used as arguments to `new`. The default constructor will be invoked if the *constr* argument is the empty list; a non-default constructor will be invoked for a non-empty list.

Returns

Pointer to allocated object.

Parameters

type	The underlying type, which must be a structured type.
constr	Constructor arguments, enclosed in parentheses.

Example:

```
Foo * foo = JEOD_ALLOC_CLASS_OBJECT(Foo, (bar,baz));
```

This allocates a new object of type Foo, invoking the `Foo::Foo(bar,baz)` constructor.

Definition at line 431 of file jeod_alloc.hh.

6.1.2.4 JEOD_ALLOC_CLASS_POINTER_ARRAY

```
#define JEOD_ALLOC_CLASS_POINTER_ARRAY(
              nelem,
              type ) JEOD_ALLOC_CLASS_MULTI_POINTER_ARRAY(nelem, type, *)
```

Allocate an array of *nelem* pointers to the specified *type*.

The allocated memory is initialized via `new`.

Returns

Allocated array of specified type.

Parameters

nelem	Size of the array.
type	The underlying type, which must be a structured type.

Example:

```
Foo ** foo_array = JEOD_ALLOC_CLASS_POINTER_ARRAY(2,Foo);
```

This allocates two pointers to the class Foo. Note that this does not allocate the Foo objects themselves.

Definition at line 378 of file jeod_alloc.hh.

6.1.2.5 JEOD_ALLOC_PRIM_ARRAY

```
#define JEOD_ALLOC_PRIM_ARRAY(
              nelem,
              type ) JEOD_ALLOC_ARRAY_INTERNAL(type, nelem, JEOD_ALLOC_PRIMITIVE_FILL, JEOD_REGISTER_CLASS(typ
```

Allocate *nelem* elements of the specified primitive *type*.

The allocated array is zero-filled.

Returns

Allocated array of specified type.

Parameters

nelem	Size of the array.
type	The underlying type, which must be a C++ primitive type.

Example:

```
double * double_array = JEOD_ALLOC_PRIM_ARRAY(2,double);
```

This allocates an array of two doubles.

Definition at line 410 of file jeod_alloc.hh.

6.1.2.6 JEOD_ALLOC_PRIM_OBJECT

```
#define JEOD_ALLOC_PRIM_OBJECT(
                type,
                initial ) JEOD_ALLOC_OBJECT_INTERNAL(type, JEOD_ALLOC_PRIMITIVE_FILL, (initial),
JEOD_REGISTER_CLASS(type))
```

Allocate **one** instance of the specified *type*.

The object is initialized with the supplied *initial* value.

Returns

Pointer to allocated primitive.

Parameters

type	The underlying type, which must be a C++ primitive type.
initial	Initial value.

Example:

```
double * foo = JEOD_ALLOC_PRIM_OBJECT(double, 3.14159265358979323846);
```

This allocates a double and initializes it to pi.

Definition at line 447 of file jeod_alloc.hh.

6.1.2.7 JEOD_DELETE_2D

```
#define JEOD_DELETE_2D(
                ptr,
                size,
                is_array )
```

Value:

```
if(ptr != nullptr)
              \
    {
                  \
        for(unsigned int ii = 0; ii < size; ++ii)
                  \
        {
                  \
            if(is_array)
                  \
            {
                  \
                JEOD_DELETE_ARRAY(ptr[ii]);
                  \
            }
                  \
            else
                  \
            {
                  \
                JEOD_DELETE_OBJECT(ptr[ii]);
                  \
            }
                  \
        }
                  \
    }
                  \
    JEOD_DELETE_ARRAY(ptr);
```

Definition at line 501 of file jeod_alloc.hh.

6.1.2.8 JEOD_DELETE_ARRAY

```
#define JEOD_DELETE_ARRAY(
                ptr ) JEOD_DELETE_INTERNAL(ptr, true)
```

Free memory at *ptr* that was earlier allocated with some `JEOD_ALLOC_xxx_ARRAY` macro.

Parameters

ptr	Memory to be released.

Example:

```
Foo * foo_array = JEOD_ALLOC_CLASS_ARRAY(2,Foo);
...
JEOD_DELETE_ARRAY(foo_array);
```

The above allocates a chunk of memory and then frees it.

Definition at line 484 of file jeod_alloc.hh.

6.1.2.9 JEOD_DELETE_OBJECT

```
#define JEOD_DELETE_OBJECT(
                ptr ) JEOD_DELETE_INTERNAL(ptr, false)
```

Free memory at *ptr* that was earlier allocated with some `JEOD_ALLOC_xxx_OBJECT` macro.

Parameters

ptr	Memory to be released.

Example:

```
Foo * foo1 = JEOD_ALLOC_CLASS_OBJECT(Foo, ());
...
JEOD_DELETE_OBJECT(foo1);
```

The above allocates a chunk of memory and then frees it.

Definition at line 499 of file jeod_alloc.hh.

6.1.2.10 JEOD_DEREGISTER_CHECKPOINTABLE

```
#define JEOD_DEREGISTER_CHECKPOINTABLE(
                owner,
                elem_name )
```

Value:

```
jeod::JeodMemoryManager::deregister_container(
      jeod::jeod_alloc_get_allocated_pointer(owner),
      \
                                             typeid(*owner),
                  \
                                             #elem_name,
                  \
                                             elem_name)
```

Register the data member *elem_name* of the *owner* as a Checkpointable object.

Assumptions and Limitations:

- The *owner* must be a pointer, typically this.
- The *owner* class must have been registered with the memory manager via JEOD_REGISTER_CLASS.
- The *elem_name* must identify a data member of the *owner* whose type derives from Checkpointable.

Parameters

owner	The object that contains the Checkpointable object.
elem_name	The Checkpointable object.

Definition at line 309 of file jeod_alloc.hh.

6.1.2.11 JEOD_IS_ALLOCATED

```
#define JEOD_IS_ALLOCATED(
              ptr ) jeod::JeodMemoryManager::is_allocated(jeod::jeod_alloc_get_allocated_pointer(ptr),
__FILE__, __LINE__)
```

Determine if *ptr* was allocated by some `JEOD_ALLOC_xxx_ARRAY` macro.

Returns

true if *ptr* was allocated by this module, false otherwise.

Parameters

ptr	Memory to be checked.

Example:

```
char * name;
...
if (JEOD_IS_ALLOCATED(name)) {
JEOD_DELETE_ARRAY(name);
name = NULL;
}
```

The above deletes the memory at *name*, but only if that memory was allocated by the JEOD memory management module.

Definition at line 468 of file jeod_alloc.hh.

6.1.2.12 JEOD_MEMORY_DEBUG

```
#define JEOD_MEMORY_DEBUG 2
```

Specifies the level of checking performed by the JEOD memory model.

0 - JEOD memory management off
1 - Error checking only
2 - Summary checking
3 - Blow-by-block account of allocation, deallocation.

Definition at line 134 of file jeod_alloc.hh.

6.1.2.13 JEOD_REGISTER_CHECKPOINTABLE

```
#define JEOD_REGISTER_CHECKPOINTABLE(
                owner,
                elem_name )
```

Value:

```
jeod::JeodMemoryManager::register_container(
      jeod::jeod_alloc_get_allocated_pointer(owner),
        \
                                                 typeid(*owner),
                  \
                                                 #elem_name,
                  \
                                                 elem_name)
```

Register the data member *elem_name* of the *owner* as a Checkpointable object.

Assumptions and Limitations:

- The *owner* must be a pointer, typically this.
- The *owner* class must have been registered with the memory manager via JEOD_REGISTER_CLASS.
- The *elem_name* must identify a data member of the *owner* whose type derives from Checkpointable.

Parameters

owner	The object that contains the Checkpointable object.
elem_name	The Checkpointable object.

Definition at line 288 of file jeod_alloc.hh.

6.1.2.14 JEOD_REGISTER_CLASS

```
#define JEOD_REGISTER_CLASS(
                type ) jeod::JeodMemoryManager::register_class(jeod::JeodMemoryTypePreDescriptorDerived<type>(t
_ref())
```

Register the type *type* with the memory manager.

Parameters

type	Data type (C token, not a string).

Definition at line 249 of file jeod_alloc.hh.

6.1.2.15 JEOD_REGISTER_INCOMPLETE_CLASS

```
#define JEOD_REGISTER_INCOMPLETE_CLASS(
              type ) JEOD_REGISTER_CLASS(type)
```

Register the incomplete class *type* with the memory manager.

The type mechanism now does the "right thing" with types. This macro is deprecated.

Parameters

type	Data type (C token, not a string).

Definition at line 260 of file jeod_alloc.hh.

6.1.2.16 JEOD_REGISTER_NONEXPORTED_CLASS

```
#define JEOD_REGISTER_NONEXPORTED_CLASS(
              type ) jeod::JeodMemoryManager::register_class(jeod::JeodMemoryTypePreDescriptorDerived<type>(f
_ref())
```

Register the type *type* with the memory manager, but with the class marked as not exportable to the simulation engine.

Instances of a non-exported class allocated with JEOD_ALLOC_xxx will not be registered with the simulation engine.

Parameters

type	Data type (C token, not a string).

Definition at line 270 of file jeod_alloc.hh.

6.2 Internal macros

The internal macros act as the bridge between the externally-usable memory model macros and the publicly-visible memory model class methods.

Macros

- #define JEOD_ALLOC_OBJECT_FILL 0xdf

  Fill pattern for non-primitive types.
- #define JEOD_ALLOC_PRIMITIVE_FILL 0

  Fill pattern for primitive types.
- #define JEOD_ALLOC_POINTER_FILL 0

  Fill pattern for pointer types.
- #define JEOD_CREATE_MEMORY(is_array, nelem, fill, tentry) jeod::JeodMemoryManager::create_memory(is↩ _array, nelem, fill, tentry, __FILE__, __LINE__)

  Allocate and register memory to be populated via placement new.
- #define JEOD_ALLOC_ARRAY_INTERNAL(type, nelem, fill, tentry) new(JEOD_CREATE_MEMORY(true, nelem, fill, tentry)) type[nelem]

  Allocate nelem elements of pointers to the specified structured type.
- #define JEOD_ALLOC_OBJECT_INTERNAL(type, fill, constr, tentry) new(JEOD_CREATE_MEMORY(false, 1, fill, tentry)) type constr

  Allocate an instance of the specified class using the specified constructor arguments.
- #define JEOD_DELETE_INTERNAL(ptr, is_array)

  Free memory allocated with some JEOD_ALLOC macro.

6.2.1 Detailed Description

The internal macros act as the bridge between the externally-usable memory model macros and the publicly-visible memory model class methods.

6.2.2 Macro Definition Documentation

6.2.2.1 JEOD_ALLOC_ARRAY_INTERNAL

```
#define JEOD_ALLOC_ARRAY_INTERNAL(
              type,
              nelem,
              fill,
              tentry ) new(JEOD_CREATE_MEMORY(true, nelem, fill, tentry)) type[nelem]
```

Allocate nelem elements of pointers to the specified structured type.

Parameters

type	Data type.
nelem	Size of the array.
fill	Fill pattern.
fill	Fill pattern.
tentry	JEOD type descriptor entry.

Definition at line 193 of file jeod_alloc.hh.

6.2.2.2 JEOD_ALLOC_OBJECT_FILL

```
#define JEOD_ALLOC_OBJECT_FILL 0xdf
```

Fill pattern for non-primitive types.

This is a nasty fill pattern that forces JEOD developers to write constructors that initialize every element of a class.

Definition at line 153 of file jeod_alloc.hh.

6.2.2.3 JEOD_ALLOC_OBJECT_INTERNAL

```
#define JEOD_ALLOC_OBJECT_INTERNAL(
              type,
              fill,
              constr,
              tentry ) new(JEOD_CREATE_MEMORY(false, 1, fill, tentry)) type constr
```

Allocate an instance of the specified class using the specified constructor arguments.

Parameters

type	Data type.
fill	Fill pattern.
constr	Constructor arguments, enclosed in parentheses.
tentry	JEOD type descriptor entry.

Definition at line 205 of file jeod_alloc.hh.

6.2.2.4 JEOD_ALLOC_POINTER_FILL

```
#define JEOD_ALLOC_POINTER_FILL 0
```

Fill pattern for pointer types.

Pointer types are initialized to null pointers. Note that this may change in the future. JEOD developers are strongly encouraged to initialize pointer arrays after allocating them.

Definition at line 171 of file jeod_alloc.hh.

6.2.2.5 JEOD_ALLOC_PRIMITIVE_FILL

```
#define JEOD_ALLOC_PRIMITIVE_FILL 0
```

Fill pattern for primitive types.

Primitive types are initialized to all zero.

Definition at line 161 of file jeod_alloc.hh.

6.2.2.6 JEOD_CREATE_MEMORY

```
#define JEOD_CREATE_MEMORY(
              is_array,
              nelem,
              fill,
              tentry ) jeod::JeodMemoryManager::create_memory(is_array, nelem, fill, tentry, ↩
__FILE__, __LINE__)
```

Allocate and register memory to be populated via placement new.

Parameters

is_array	Allocated as an array?
nelem	Size of the array.
fill	Fill pattern.
tentry	JEOD type descriptor entry.

Definition at line 181 of file jeod_alloc.hh.

6.2.2.7 JEOD_DELETE_INTERNAL

```
#define JEOD_DELETE_INTERNAL(
              ptr,
              is_array )
```

Value:

```
do
              \
    {
                  \
        if(ptr != nullptr && JEOD_IS_ALLOCATED(ptr))
                                  \
        {
                  \
            jeod::JeodMemoryManager::destroy_memory(
      jeod::jeod_alloc_get_allocated_pointer(ptr),                     \
                                                    is_array,
                  \
                                                    __FILE__,
                  \
                                                                    __LINE__);
                        \
            ptr = nullptr;
                        \
        }
                        \
    } while(0)
```

Free memory allocated with some JEOD_ALLOC macro.

Depends on

```
dynamic_cast<void*>(ptr)
```

yielding a pointer to the most derived object pointed to by *ptr*. See ISO/IEC 14882:2003 section 5.2.7.7.

Parameters

ptr	Memory to be released.
is_array	True for DELETE_ARRAY, false for DELETE_OBJECT.

Definition at line 218 of file jeod_alloc.hh.

6.3 Support classes

The memory model classes are the workhorses of the JEOD memory model.

Namespaces

- jeod

    Namespace jeod.

Macros

- #define MAGIC0 0x2203992c
- #define MAGIC1 0x6c052d84
- #define __STDC_LIMIT_MACROS
- #define MAKE_MEMORY_MESSAGE_CODE(id) JEOD_MAKE_MESSAGE_CODE(MemoryMessages, "utils/memory/", id)

6.3.1 Detailed Description

The memory model classes are the workhorses of the JEOD memory model.

6.3.2 Macro Definition Documentation

6.3.2.1 __STDC_LIMIT_MACROS

```
#define __STDC_LIMIT_MACROS
```

Definition at line 35 of file memory_manager_protected.cc.

6.3.2.2 MAGIC0

```
#define MAGIC0 0x2203992c
```

Definition at line 51 of file memory_manager.cc.

Referenced by jeod::JeodMemoryManager::allocate_memory(), and jeod::JeodMemoryManager::free_memory().

6.3.2.3 MAGIC1

```
#define MAGIC1 0x6c052d84
```

Definition at line 52 of file memory_manager.cc.

Referenced by jeod::JeodMemoryManager::allocate_memory(), and jeod::JeodMemoryManager::free_memory().

6.3.2.4 MAKE_MEMORY_MESSAGE_CODE

```
#define MAKE_MEMORY_MESSAGE_CODE(
              id ) JEOD_MAKE_MESSAGE_CODE(MemoryMessages, "utils/memory/", id)
```

Definition at line 39 of file memory_messages.cc.

6.4 Models

Modules

- Utils

6.4.1 Detailed Description

6.5 Utils

Modules

- Memory

6.5.1 Detailed Description

6.6 Memory

Modules

- Externally-usable macros

    The supported use of the JEOD memory model is via those macros advertised as externally-usable.
- Internal macros

    The internal macros act as the bridge between the externally-usable memory model macros and the publicly-visible memory model class methods.
- Support classes

    The memory model classes are the workhorses of the JEOD memory model.

Files

- file class_declarations.hh

    Forward declarations of classes defined in the utils/memory model.
- file jeod_alloc.hh

    Define JEOD memory allocation macros.
- file jeod_alloc_construct_destruct.hh

    Define templates for use by jeod_alloc.hh.
- file jeod_alloc_get_allocated_pointer.hh

    Define function template jeod_alloc_get_allocated_pointer.
- file memory_attributes_templates.hh

    Define the class template JeodSimEngineAttributes.
- file memory_item.hh

    Define the class JeodMemoryItem.
- file memory_manager.hh

    Define the JeodMemoryManager class, the central agent of the memory model.
- file memory_manager_hide_from_trick.hh

    Trick doesn't understand these.
- file memory_messages.hh

    Define the class MemoryMessages, the class that specifies the message IDs used in the memory model.
- file memory_table.hh

    Define classes for representing data types.
- file memory_type.hh

    Define the abstract class JeodMemoryTypeDescriptor and templates that create instantiable classes that derive from JeodMemoryTypeDescriptor.
- file memory_item.cc

    Implement the JeodMemoryItem class.
- file memory_manager.cc

    Implement the JeodMemoryManager class.
- file memory_manager_protected.cc

    Implement those JeodMemoryManager member functions that access data members that need to be treated with care to make the memory manager thread safe.
- file memory_manager_static.cc

    Implement the static methods of the JeodMemoryManager class.
- file memory_messages.cc

    Implement the class MemoryMessages.
- file memory_type.cc

    Implement destructors for the classes for representing data types.

Namespaces

- jeod

  Namespace jeod.

6.6.1 Detailed Description

Chapter 7

Namespace Documentation

7.1 jeod Namespace Reference

Namespace jeod.

Data Structures

- class JeodAllocHelperAllocatedPointer

    Class template that provides a static function cast that casts a pointer to an object of type T to a void∗ pointer.
- class JeodAllocHelperAllocatedPointer< T, true >

    Partial instantiation of JeodAllocHelperAllocatedPointer for polymorphic classes.
- class JeodAllocHelperConstructDestruct

    Class template that provides static functions construct and destruct that construct an array of objects.
- class JeodAllocHelperConstructDestruct< T, false, is_abstract >

    Partial instantiation for non-classes.
- class JeodAllocHelperConstructDestruct< T, true, false >

    Partial instantiation for non-abstract classes.
- class JeodMemoryItem

    A JeodMemoryItem contains metadata about some chunk of allocated memory.
- class JeodMemoryManager

    This class provides the interface between the macros in jeod_alloc.hh and the rest of the JEOD memory model.
- class JeodMemoryReflectiveTable

    A JeodMemoryReflectiveTable maps strings to themselves.
- class JeodMemoryTable

    A JeodMemoryTable maps strings to values with a coordinated map/vector pair.
- class JeodMemoryTableClonable

    A JeodMemoryTableClonable is a JeodMemoryTable that implements the required clone() functionality by invoking the ValueType's clone() method to create a clone of the input value.
- class JeodMemoryTableCopyable

    A JeodMemoryTableCopyable is a JeodMemoryTable that implements the required clone() functionality by invoking the ValueType's copy constructor to create a clone of the input value.
- class JeodMemoryTypeDescriptor

    Abstract class for managing data allocated as some specific type.
- class JeodMemoryTypeDescriptorDerived

    Extends JeodMemoryTypeDescriptor to describe a specific type.

- class JeodMemoryTypePreDescriptor

    Abstract class for describing a type without necessarily needing to create a JeodMemoryTypeDescriptor of that type.
- class JeodMemoryTypePreDescriptorDerived

    A JeodMemoryTypePreDescriptorDerived describes a Type.
- class JeodSimEngineAttributes

    Class template to construct a simulation engine attributes object that represents some type.
- class JeodSimEngineAttributes< Type ∗, false >

    Partial template instantiation of JeodSimEngineAttributes for a pointer type.
- class JeodSimEngineAttributes< Type, true >

    Partial template instantiation of JeodSimEngineAttributes for a class.
- class JeodSimEngineAttributes< void ∗, false >

    Template specialization of JeodSimEngineAttributes for void∗.
- class MemoryMessages

    Declares messages associated with the integration test model.

Typedefs

- using AllocTable = std::map< const void ∗, JeodMemoryItem >

    An AllocTable maps memory addresses to memory descriptions.
- using TypeTable = JeodMemoryTableClonable< JeodMemoryTypeDescriptor >

    The type type itself is a memory table with copy implemented by clone().

Functions

- template<typename T >
  void ∗ jeod_alloc_construct_array (std::size_t nelem, void ∗addr)

    Construct an array of objects of type T.
- template<typename T >
  void jeod_alloc_destruct_array (std::size_t nelem, void ∗addr)

    Destruct an array of objects of type T.
- template<typename T >
  void ∗ jeod_alloc_get_allocated_pointer (T ∗pointer)

    Cast a pointer to some object to a pointer to void∗ such that a pointer to a polymorphic object, downcast to a base class pointer, becomes a pointer to the original object, but also such that a pointer to an instance of a non-polymorphic class or a pointer to a non-class type is handled correctly.

7.1.1 Detailed Description

Namespace jeod.

7.1.2 Typedef Documentation

7.1.2.1 AllocTable

```
using jeod::AllocTable = typedef std::map<const void *, JeodMemoryItem>
```

An AllocTable maps memory addresses to memory descriptions.

Definition at line 76 of file memory_manager_hide_from_trick.hh.

7.1.2.2 TypeTable

```
using jeod::TypeTable = typedef JeodMemoryTableClonable<JeodMemoryTypeDescriptor>
```

The type type itself is a memory table with copy implemented by clone().

Definition at line 81 of file memory_manager_hide_from_trick.hh.

7.1.3 Function Documentation

7.1.3.1 jeod_alloc_construct_array()

```
template<typename T >
void* jeod::jeod_alloc_construct_array (
             std::size_t nelem,
             void * addr )  [inline]
```

Construct an array of objects of type *T*.

Template Parameters

T	Pointed-to type.

Parameters

nelem	Number of elements in the array
addr	Address to be constructed

Returns

Constructed array.

Definition at line 202 of file jeod_alloc_construct_destruct.hh.

7.1.3.2 jeod_alloc_destruct_array()

```
template<typename T >
void jeod::jeod_alloc_destruct_array (
             std::size_t nelem,
             void * addr )  [inline]
```

Destruct an array of objects of type *T*.

Template Parameters

T	Pointed-to type.

Parameters

nelem	Number of elements in the array
addr	Address to be destructed

Definition at line 214 of file jeod_alloc_construct_destruct.hh.

7.1.3.3 jeod_alloc_get_allocated_pointer()

```
template<typename T >
void* jeod::jeod_alloc_get_allocated_pointer (
             T * pointer )  [inline]
```

Cast a pointer to some object to a pointer to void∗ such that a pointer to a polymorphic object, downcast to a base class pointer, becomes a pointer to the original object, but also such that a pointer to an instance of a non-polymorphic class or a pointer to a non-class type is handled correctly.

Template Parameters

T	Pointed-to type.

Parameters

pointer	Pointer to be cast to void∗.

Usage:

```
jeod_alloc_get_allocated_pointer(pointer)
```

Note that the template parameter does not need to be specified. The compiler automagically determines the type.

Assumptions and limitations:

- The function argument *pointer* is a pointer.
- The pointer is not *cv* qualified (i.e., neither const nor volatile).
- Inheritance is public for polymorphic classes.
- `jeod_alloc_get_allocated_pointer(&array[1])`
  does not return a pointer to

  ```
  &array[0]
  ```

  .

Definition at line 153 of file jeod_alloc_get_allocated_pointer.hh.

References jeod::JeodAllocHelperAllocatedPointer< T, is_poly >::cast().

Referenced by jeod::JeodMemoryTypeDescriptorDerived< Type >::most_derived_pointer().

Chapter 8

Data Structure Documentation

8.1 jeod::JeodMemoryTypeDescriptor::attr Struct Reference

The simulation engine attributes that describe the type.trick_io(∗∗)

```
#include <memory_type.hh>
```

8.1.1 Detailed Description

The simulation engine attributes that describe the type.trick_io(∗∗)

Definition at line 348 of file memory_type.hh.

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

- memory_type.hh

8.2 jeod::JeodAllocHelperAllocatedPointer< T, is_poly > Class Template Reference

Class template that provides a static function *cast* that casts a pointer to an object of type *T* to a void∗ pointer.

```
#include <jeod_alloc_get_allocated_pointer.hh>
```

Static Public Member Functions

- static void ∗ cast (T ∗pointer)

  Cast a pointer to a non-polymorphic class via an implicit cast.

8.2.1 Detailed Description

template<typename T, bool is_poly>
class jeod::JeodAllocHelperAllocatedPointer< T, is_poly >

Class template that provides a static function *cast* that casts a pointer to an object of type *T* to a void∗ pointer.

Template Parameters

T	Type
is_poly	True if the type T is a polymorphic class.

This class template is intended for used by jeod_alloc_get_allocated_pointer. Use in any other context is caveat emptor.

This template provides a default implementation for non-polymorphic classes (`is_poly == false`) that uses implicit cast. The partial template instantiation that immediately follows provides n an implementation that uses dynamic_cast when *is_poly* is true.

Definition at line 92 of file jeod_alloc_get_allocated_pointer.hh.

8.2.2 Member Function Documentation

8.2.2.1 cast()

```
template<typename T , bool is_poly>
static void* jeod::JeodAllocHelperAllocatedPointer< T, is_poly >::cast (
             T * pointer )  [inline], [static]
```

Cast a pointer to a non-polymorphic class via an implicit cast.

Returns

Input pointer cast to void* via implicit cast.

Parameters

pointer	Pointer

Definition at line 100 of file jeod_alloc_get_allocated_pointer.hh.

Referenced by jeod::jeod_alloc_get_allocated_pointer().

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

- jeod_alloc_get_allocated_pointer.hh

8.3 jeod::JeodAllocHelperAllocatedPointer< T, true > Class Template Reference

Partial instantiation of JeodAllocHelperAllocatedPointer for polymorphic classes.

`#include <jeod_alloc_get_allocated_pointer.hh>`

Static Public Member Functions

- static void ∗ cast (T ∗pointer)

  Cast a pointer to a non-class object via dynamic_cast.

8.3.1 Detailed Description

template<typename T>
class jeod::JeodAllocHelperAllocatedPointer< T, true >

Partial instantiation of JeodAllocHelperAllocatedPointer for polymorphic classes.

This class uses the fact that `dynamic_cast<void*>(ptr)` results in a pointer to the most derived object pointed to by `ptr`. See ISO/IEC 14882:2003 section 5.2.7.7 for details.

Definition at line 112 of file jeod_alloc_get_allocated_pointer.hh.

8.3.2 Member Function Documentation

8.3.2.1 cast()

```
template<typename T >
static void* jeod::JeodAllocHelperAllocatedPointer< T, true >::cast (
            T * pointer )  [inline], [static]
```

Cast a pointer to a non-class object via dynamic_cast.

Returns

Input pointer cast to void∗ via dynamic_cast.

Parameters

pointer	Pointer

Definition at line 120 of file jeod_alloc_get_allocated_pointer.hh.

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

- jeod_alloc_get_allocated_pointer.hh

8.4 jeod::JeodAllocHelperConstructDestruct< T, is_class, is_abstract > Class Template Reference

Class template that provides static functions *construct* and *destruct* that construct an array of objects.

`#include <jeod_alloc_construct_destruct.hh>`

Static Public Member Functions

- static void ∗ construct (std::size_t nelem, void ∗addr)

    Construct an array of objects.
- static void destruct (std::size_t nelem, void ∗addr)

    Destruct an array of objects.

8.4.1 Detailed Description

template<typename T, bool is_class, bool is_abstract>
class jeod::JeodAllocHelperConstructDestruct< T, is_class, is_abstract >

Class template that provides static functions *construct* and *destruct* that construct an array of objects.

Template Parameters

T	Type
is_class	True if the type T is a class.
is_abstract	True if the type T is an abstract class.

This class template is intended for used by jeod_alloc_construct_array and jeod_alloc_destruct_array. Use in any other context is caveat emptor.

This template provides do-nothing implementations, which is about all one can do for arrays of abstract objects (which can't exist).

Definition at line 102 of file jeod_alloc_construct_destruct.hh.

8.4.2 Member Function Documentation

8.4.2.1 construct()

```
template<typename T, bool is_class, bool is_abstract>
static void* jeod::JeodAllocHelperConstructDestruct< T, is_class, is_abstract >::construct (
             std::size_t nelem,
             void * addr )  [inline], [static]
```

Construct an array of objects.

Returns

Constructed array.

Parameters

nelem	Number of elements in the array
addr	Address to be constructed

Definition at line 111 of file jeod_alloc_construct_destruct.hh.

8.4.2.2 destruct()

```
template<typename T, bool is_class, bool is_abstract>
static void jeod::JeodAllocHelperConstructDestruct< T, is_class, is_abstract >::destruct (
             std::size_t nelem,
             void * addr ) [inline], [static]
```

Destruct an array of objects.

Parameters

nelem	Number of elements in the array
addr	Address to be destructed

Definition at line 121 of file jeod_alloc_construct_destruct.hh.

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

- jeod_alloc_construct_destruct.hh

8.5 jeod::JeodAllocHelperConstructDestruct< T, false, is_abstract > Class Template Reference

Partial instantiation for non-classes.

```
#include <jeod_alloc_construct_destruct.hh>
```

Static Public Member Functions

- static void ∗ construct (std::size_t nelem, void ∗addr)
  Construct an array of objects.
- static void destruct (std::size_t nelem, void ∗addr)
  Destruct an array of objects.

8.5.1 Detailed Description

template<typename T, bool is_abstract>
class jeod::JeodAllocHelperConstructDestruct< T, false, is_abstract >

Partial instantiation for non-classes.

Definition at line 130 of file jeod_alloc_construct_destruct.hh.

8.5.2 Member Function Documentation

8.5.2.1 construct()

```
template<typename T , bool is_abstract>
static void* jeod::JeodAllocHelperConstructDestruct< T, false, is_abstract >::construct (
            std::size_t nelem,
            void * addr )  [inline], [static]
```

Construct an array of objects.

Returns

Constructed array.

Parameters

nelem	Number of elements in the array
addr	Address to be constructed

Definition at line 139 of file jeod_alloc_construct_destruct.hh.

8.5.2.2 destruct()

```
template<typename T , bool is_abstract>
static void jeod::JeodAllocHelperConstructDestruct< T, false, is_abstract >::destruct (
            std::size_t nelem,
            void * addr )  [inline], [static]
```

Destruct an array of objects.

Parameters

nelem	Number of elements in the array
addr	Address to be destructed

Definition at line 150 of file jeod_alloc_construct_destruct.hh.

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

- jeod_alloc_construct_destruct.hh

8.6 jeod::JeodAllocHelperConstructDestruct< T, true, false > Class Template Reference

Partial instantiation for non-abstract classes.

```
#include <jeod_alloc_construct_destruct.hh>
```

Static Public Member Functions

- static void ∗ construct (std::size_t nelem, void ∗addr)
  Construct an array of objects.
- static void destruct (std::size_t nelem, void ∗addr)
  Destruct an array of objects.

8.6.1 Detailed Description

template<typename T>
class jeod::JeodAllocHelperConstructDestruct< T, true, false >

Partial instantiation for non-abstract classes.

Definition at line 159 of file jeod_alloc_construct_destruct.hh.

8.6.2 Member Function Documentation

8.6.2.1 construct()

```
template<typename T >
static void* jeod::JeodAllocHelperConstructDestruct< T, true, false >::construct (
                std::size_t nelem,
                void * addr )  [inline], [static]
```

Construct an array of objects.

Returns

Constructed array.

Parameters

nelem	Number of elements in the array
addr	Address to be constructed

Definition at line 168 of file jeod_alloc_construct_destruct.hh.

8.6.2.2 destruct()

```
template<typename T >
static void jeod::JeodAllocHelperConstructDestruct< T, true, false >::destruct (
            std::size_t nelem,
            void * addr ) [inline], [static]
```

Destruct an array of objects.

Parameters

nelem	Number of elements in the array
addr	Address to be destructed

Definition at line 178 of file jeod_alloc_construct_destruct.hh.

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

- jeod_alloc_construct_destruct.hh

8.7 jeod::JeodMemoryItem Class Reference

A JeodMemoryItem contains metadata about some chunk of allocated memory.

```
#include <memory_item.hh>
```

Public Types

- enum Flags {
  PlacementNew = 1, IsArray = 2, IsGuarded = 4, IsStructured = 8,
  IsRegistered = 16, CheckPointed = 32 }

  Identifies by name the bit flags the comprise a JeodMemoryItem::flag.

Public Member Functions

- JeodMemoryItem ()=default
- JeodMemoryItem (bool placement_new, bool is_array, bool is_guarded, bool is_structured, unsigned int nelems_in, unsigned int type_idx, unsigned int alloc_idx)

  Construct a JeodMemoryItem.
- ∼JeodMemoryItem ()=default
- void set_unique_id (uint32_t id)

  Set the unique identifier.
- void set_is_registered (bool value)

  Set the is_registered flag.
- uint32_t get_nelems () const

  Access the array size.
- uint32_t get_alloc_index () const

  Access the allocation information index.

- uint32_t get_unique_id () const

  Access the unique identifier.
- uint32_t get_descriptor_index () const

  Access the type descriptor index.
- bool get_is_array () const

  Access the is_array flag.
- bool get_is_guarded () const

  Access the is_guarded flag.
- bool get_placement_new () const

  Access the placement_new flag.
- bool is_structured_data () const

  Is the associated data a structure/class?
- bool get_is_registered () const

  Access the checkpointed flag.
- bool get_checkpointed () const

  Access the checkpointed flag.

Static Private Member Functions

- static uint8_t construct_flags (bool placement_new, bool is_array, bool is_guarded, bool is_structured)

  Construct the flags for a new JeodMemoryItem.

Private Attributes

- uint32_t nelems {}

  Number of elements in the allocated array.
- uint32_t alloc_info_index {}

  Allocation information index, max of 2^32-2 tracked locations.
- uint32_t unique_id {}

  Unique identifier, max of 2^32-2 allocations (zero is not used).
- uint16_t descriptor_index_hi {}

  High order bits of the descriptor index.
- uint8_t descriptor_index_lo {}

  Low order bits of the descriptor index.
- uint8_t flags {}

  Flags indicating whether.

8.7.1 Detailed Description

A JeodMemoryItem contains metadata about some chunk of allocated memory.

This is a simple datatype that contains POD elements only. All data members are private and are accessible only through getters; the members are essentially constant. The only way to change the values is via a wholesale copy.

Definition at line 86 of file memory_item.hh.

8.7.2 Member Enumeration Documentation

8.7.2.1 Flags

`enum jeod::JeodMemoryItem::Flags`

Identifies by name the bit flags the comprise a JeodMemoryItem::flag.

Enumerator

PlacementNew	Was the item constructed with placement new? There is no functional placement delete in C++.
IsArray	Was the item an array constructed via new []? This addresses the delete[] versus delete issue.
IsGuarded	Is the allocated buffer surrounded by guard words? This flag is always false in regular new mode.
IsStructured	Is the item a class (versus a primitive type)? Classes add several other twists.
IsRegistered	Has the item been registered with the simulation engine?
CheckPointed	Reserved for future work, as are flag bits 6 ando 7 (64 and 128).

Definition at line 93 of file memory_item.hh.

8.7.3 Constructor & Destructor Documentation

8.7.3.1 JeodMemoryItem() [1/2]

```
jeod::JeodMemoryItem::JeodMemoryItem ( )  [default]
```

8.7.3.2 JeodMemoryItem() [2/2]

```
jeod::JeodMemoryItem::JeodMemoryItem (
             bool placement_new,
             bool is_array,
             bool is_guarded,
             bool is_structured,
             unsigned int nelems_in,
             unsigned int type_idx,
             unsigned int alloc_idx )
```

Construct a JeodMemoryItem.

The data are essentially constant, so the only viable way to set elements to meaningful values is via this non-default constructor.

Parameters

in	*placement_new*	Constructed with placement new?
in	*is_array*	Constructed with new []?
in	*is_guarded*	Is the item an array?
in	*is_structured*	Is the item a structured data type?
in	*nelems_in*	Number of elements
in	*type_idx*	Type descriptor (index)
in	*alloc_idx*	Macro invocation info (index)

Definition at line 86 of file memory_item.cc.

8.7.3.3 ∼JeodMemoryItem()

```
jeod::JeodMemoryItem::∼JeodMemoryItem ( )  [default]
```

8.7.4 Member Function Documentation

8.7.4.1 construct_flags()

```
uint8_t jeod::JeodMemoryItem::construct_flags (
             bool placement_new,
             bool is_array,
             bool is_guarded,
             bool is_structured )  [static], [private]
```

Construct the flags for a new JeodMemoryItem.

Returns

Constructed flags

Parameters

in	*placement_new*	Constructed with placement new?
in	*is_array*	Constructed with new []?
in	*is_guarded*	Is the item an array?
in	*is_structured*	Is the item a structured data type?

Definition at line 47 of file memory_item.cc.

References flags, IsArray, IsGuarded, IsStructured, and PlacementNew.

8.7.4.2 get_alloc_index()

```
uint32_t jeod::JeodMemoryItem::get_alloc_index ( ) const  [inline]
```

Access the allocation information index.

Returns

Allocation information index

Definition at line 246 of file memory_item.hh.

References alloc_info_index.

Referenced by jeod::JeodMemoryManager::destroy_memory_internal(), jeod::JeodMemoryManager::generate_↩ shutdown_report(), and jeod::JeodMemoryManager::restart_clear_memory().

8.7.4.3 get_checkpointed()

```
bool jeod::JeodMemoryItem::get_checkpointed ( ) const  [inline]
```

Access the checkpointed flag.

Returns

Checkpointed?

Definition at line 309 of file memory_item.hh.

References CheckPointed, and flags.

8.7.4.4 get_descriptor_index()

```
uint32_t jeod::JeodMemoryItem::get_descriptor_index ( ) const  [inline]
```

Access the type descriptor index.

Returns

Type descriptor index

Definition at line 255 of file memory_item.hh.

References descriptor_index_hi, and descriptor_index_lo.

8.7.4.5 get_is_array()

```
bool jeod::JeodMemoryItem::get_is_array ( ) const  [inline]
```

Access the is_array flag.

Returns

Allocated as an array?

Definition at line 273 of file memory_item.hh.

References flags, and IsArray.

Referenced by jeod::JeodMemoryManager::destroy_memory_internal(), jeod::JeodMemoryManager::restart_↩ clear_memory(), and jeod::JeodMemoryTypeDescriptor::type_spec().

8.7.4.6 get_is_guarded()

```
bool jeod::JeodMemoryItem::get_is_guarded ( ) const  [inline]
```

Access the is_guarded flag.

Returns

Is allocated memory guarded?

Definition at line 282 of file memory_item.hh.

References flags, and IsGuarded.

Referenced by jeod::JeodMemoryManager::destroy_memory_internal(), and jeod::JeodMemoryManager::restart↩ _clear_memory().

8.7.4.7 get_is_registered()

```
bool jeod::JeodMemoryItem::get_is_registered ( ) const  [inline]
```

Access the checkpointed flag.

Returns

Registered with sim engine?

Definition at line 300 of file memory_item.hh.

References flags, and IsRegistered.

Referenced by jeod::JeodMemoryManager::destroy_memory_internal(), jeod::JeodMemoryManager::restart_↩ clear_memory(), and jeod::JeodMemoryManager::∼JeodMemoryManager().

8.7.4.8 get_nelems()

```
uint32_t jeod::JeodMemoryItem::get_nelems ( ) const  [inline]
```

Access the array size.

Returns

Array size

Definition at line 228 of file memory_item.hh.

References nelems.

Referenced by jeod::JeodMemoryManager::add_allocation_atomic(), jeod::JeodMemoryTypeDescriptor::buffer←↩ _end(), jeod::JeodMemoryTypeDescriptor::buffer_size(), jeod::JeodMemoryManager::destroy_memory_internal(), jeod::JeodMemoryManager::restart_clear_memory(), and jeod::JeodMemoryTypeDescriptor::type_spec().

8.7.4.9 get_placement_new()

```
bool jeod::JeodMemoryItem::get_placement_new ( ) const  [inline]
```

Access the placement_new flag.

Returns

Allocated for placement new?

Definition at line 264 of file memory_item.hh.

References flags, and PlacementNew.

Referenced by jeod::JeodMemoryManager::destroy_memory_internal(), and jeod::JeodMemoryManager::restart←↩ _clear_memory().

8.7.4.10 get_unique_id()

```
uint32_t jeod::JeodMemoryItem::get_unique_id ( ) const  [inline]
```

Access the unique identifier.

Returns

Unique identifier

Definition at line 237 of file memory_item.hh.

References unique_id.

8.7.4.11 is_structured_data()

```
bool jeod::JeodMemoryItem::is_structured_data ( ) const  [inline]
```

Is the associated data a structure/class?

Returns

True for structured data

Definition at line 291 of file memory_item.hh.

References flags, and IsStructured.

8.7.4.12 set_is_registered()

```
void jeod::JeodMemoryItem::set_is_registered (
             bool value )
```

Set the is_registered flag.

Parameters

in	*value*	New value of the is_registered flag

Definition at line 132 of file memory_item.cc.

References flags, and IsRegistered.

8.7.4.13 set_unique_id()

```
void jeod::JeodMemoryItem::set_unique_id (
             uint32_t id )
```

Set the unique identifier.

Parameters

in	*id*	Unique identifier

Definition at line 105 of file memory_item.cc.

References jeod::MemoryMessages::internal_error, and unique_id.

Referenced by jeod::JeodMemoryManager::register_memory_internal().

8.7.5 Field Documentation

8.7.5.1 alloc_info_index

```
uint32_t jeod::JeodMemoryItem::alloc_info_index {}  [private]
```

Allocation information index, max of 2^32-2 tracked locations.

The allocation information is a string of the form "file.cc:line#" that indicates where in the code the data was allocated. The underlying string is maintained in the global memory manager's string table.trick_units(–)

Definition at line 190 of file memory_item.hh.

Referenced by get_alloc_index().

8.7.5.2 descriptor_index_hi

```
uint16_t jeod::JeodMemoryItem::descriptor_index_hi {}  [private]
```

High order bits of the descriptor index.

The descriptor_index specifies the type decriptor that describes the data. The underlying descriptor is maintained in the global memory manager's type descriptor table.trick_units(–)

Definition at line 205 of file memory_item.hh.

Referenced by get_descriptor_index().

8.7.5.3 descriptor_index_lo

```
uint8_t jeod::JeodMemoryItem::descriptor_index_lo {}  [private]
```

Low order bits of the descriptor index.

trick_units(–)

Definition at line 210 of file memory_item.hh.

Referenced by get_descriptor_index().

8.7.5.4 flags

```
uint8_t jeod::JeodMemoryItem::flags {}  [private]
```

Flags indicating whether.

- The data was constructed with default new or placement new
- The data was allocated as an array or as a single object
- The allocated are guarded
- The data is a structured or non-structured data type
- The data has been checkpointed (future)
- Plus three more future-use spares.trick_units(–)

Definition at line 221 of file memory_item.hh.

Referenced by construct_flags(), get_checkpointed(), get_is_array(), get_is_guarded(), get_is_registered(), get_↩
placement_new(), is_structured_data(), and set_is_registered().

8.7.5.5 nelems

```
uint32_t jeod::JeodMemoryItem::nelems {}  [private]
```

Number of elements in the allocated array.

trick_units(–)

Definition at line 182 of file memory_item.hh.

Referenced by get_nelems().

8.7.5.6 unique_id

```
uint32_t jeod::JeodMemoryItem::unique_id {}  [private]
```

Unique identifier, max of 2^32-2 allocations (zero is not used).

The unique identifier forms the basis of the item name sent to the simulation engine for this memory item.trick_↩
units(–)

Definition at line 197 of file memory_item.hh.

Referenced by get_unique_id(), and set_unique_id().

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

- memory_item.hh
- memory_item.cc

8.8 jeod::JeodMemoryManager Class Reference

This class provides the interface between the macros in jeod_alloc.hh and the rest of the JEOD memory model.

```
#include <memory_manager.hh>
```

Data Structures

- struct TypeEntry

  The type table is indexed by an integer and contains type descriptors.

Public Types

- enum DebugLevel { Debug_off = 0, Summary_only = 1, Error_details = 2, Full_details = 3 }

  The memory manager as a whole and individual operations have a debug level.
- enum NameType { Typeid_type_name = 0, Demangled_type_name = 1 }

  The type lookup by type name needs to know whether the provided name is a typeid name or a demangled name.

Public Member Functions

- JeodMemoryManager ()=delete
- JeodMemoryManager (const JeodMemoryManager &)=delete
- JeodMemoryManager & operator= (const JeodMemoryManager &)=delete
- JeodMemoryManager (JeodMemoryInterface &)

  Construct a MemoryManager object.
- virtual ∼JeodMemoryManager ()

  Destruct a MemoryManager object.
- void restart_clear_memory ()

  Wipe out all allocated memory in anticipation of restoring the memory in some previously recording checkpoint file.
- void restart_reallocate (const std::string &mangled_type_name, uint32_t unique_id, uint32_t nelements, bool is_array)

  Restore one chunk of allocated memory per a checkpoint file entry.

Static Public Member Functions

- static const TypeEntry register_class (JeodMemoryTypePreDescriptor &tdesc)

  Register a class with the memory manager.
- static const JeodMemoryTypeDescriptor ∗ get_type_descriptor (const std::type_info &typeid_info)

  Get a type descriptor from the memory manager's type table.
- static const JeodMemoryTypeDescriptor ∗ get_type_descriptor (NameType name_type, const std::string &name)

  Get a type descriptor from the memory manager's type table.
- static void ∗ create_memory (bool is_array, unsigned int nelems, int fill, const TypeEntry &tentry, const char ∗file, unsigned int line)

  Allocate memory and register the allocated memory with JEOD.
- static bool is_allocated (const void ∗addr, const char ∗file, unsigned int line)

  Query whether some address was allocated by JEOD.
- static void destroy_memory (void ∗addr, bool delete_array, const char ∗file, unsigned int line)

Destroy memory previously registered with JEOD.

- static void register_container (const void ∗container, const std::type_info &container_type, const std::string &elem_name, JeodCheckpointable &checkpointable)

  Register a checkpointable object with the memory manager.
- static void deregister_container (const void ∗container, const std::type_info &container_type, const std::string &elem_name, JeodCheckpointable &checkpointable)

  Deregister all checkpointable object contained within some object.
- static void set_mode (JeodSimulationInterface::Mode new_mode)

  Set the memory manager's simulation interface mode.
- static void set_debug_level (unsigned int level)

  Set the debug level.
- static void set_debug_level (DebugLevel level)

  Set the debug level.
- static void set_guard_enabled (bool value)

  Set the guard_enabled flag.
- static bool is_table_empty ()

  Query whether all allocated memory has been freed.

Private Types

- using AllocTable = std::map< const void ∗, JeodMemoryItem >

  An AllocTable maps memory addresses to memory descriptions.
- using TypeTable = JeodMemoryTableClonable< JeodMemoryTypeDescriptor >

  The type type itself is a memory table with copy implemented by clone().

Private Member Functions

- void generate_shutdown_report ()

  Generate a shutdown report.
- void ∗ create_memory_internal (bool is_array, unsigned int nelems, int fill, const TypeEntry &tentry, const char ∗file, unsigned int line)

  Allocate memory for use with placement new and register that memory with with the memory manager and with the simulation engine.
- void register_memory_internal (const void ∗addr, uint32_t unique_id, bool placement_new, bool is_array, unsigned int nelems, const TypeEntry &tentry, const char ∗file, unsigned int line)

  Allocate memory if that was not already done by the caller and register the memory with JEOD and with an external agent.
- bool is_allocated_internal (const void ∗addr, const char ∗file, unsigned int line)

  Query whether some address was allocated by JEOD.
- void destroy_memory_internal (void ∗addr, bool delete_array, const char ∗file, unsigned int line)

  Destroy a chunk of memory and knowledge about it.
- void set_mode_internal (JeodSimulationInterface::Mode new_mode)

  Set the mode and perform mode transitions.
- void begin_atomic_block () const

  Prepare for a set of operations that must be done atomically.
- void end_atomic_block (bool ignore_errors) const

  End an atomic set of operations.
- const TypeEntry get_type_entry_atomic (JeodMemoryTypePreDescriptor &tdesc)

  Return the type entry for the input type descriptor, adding the descriptor to the type table if the type has not yet been registered.

- const TypeEntry get_type_entry_atomic (NameType name_type, const std::string &type_name) const

  Retrieve the descriptor for the specified type from the type table.
- bool get_type_index_nolock (const JeodMemoryTypeDescriptor &tdesc, uint32_t ∗idx)

  Retrieve the index for the specified type from the type table, adding an entry if needed.
- const JeodMemoryTypeDescriptor ∗ get_type_descriptor_atomic (const std::type_info &typeid_info) const

  Retrieve the descriptor for the specified type from the type table.
- const JeodMemoryTypeDescriptor & get_type_descriptor_atomic (unsigned int idx) const

  Retrieve the descriptor for the specified type from the type table.
- const JeodMemoryTypeDescriptor & get_type_descriptor_nolock (const JeodMemoryItem &item) const

  Retrieve the descriptor for the specified type from the type table.
- const std::string & get_string_atomic (unsigned int idx) const

  Retrieve the specified string from the string table.
- unsigned int add_string_atomic (const std::string &str)

  Add a location identifier string to the string table.
- uint32_t get_alloc_id_atomic (const char ∗file, unsigned int line)

  Create a unique identifier for an allocation.
- void reset_alloc_id_atomic (uint32_t unique_id)

  Reset the unique identifier for a restart.
- void find_alloc_entry_atomic (const void ∗addr, bool delete_entry, const char ∗file, unsigned int line, void ∗&found_addr, JeodMemoryItem &found_item, const JeodMemoryTypeDescriptor ∗&found_type)

  Find the allocation table entry that matches the input address, and delete it if delete_entry is true.
- void add_allocation_atomic (const void ∗addr, const JeodMemoryItem &item, const JeodMemoryTypeDescriptor &tdesc, const char ∗file, unsigned int line)

  Add the specified addr/item pair to the table.
- void delete_oldest_alloc_entry_atomic (void ∗&addr, JeodMemoryItem &item, const JeodMemoryTypeDescriptor ∗&type)

  Find and delete the alloc table entry with the smallest unique id, setting the provided references with info about the deleted item.
- void ∗ allocate_memory (std::size_t nelems, std::size_t elem_size, bool guard, int fill) const

  Allocate memory.
- void free_memory (void ∗addr, std::size_t length, bool guard, unsigned int alloc_idx, const char ∗file, unsigned int line) const

  Release memory.

Static Private Member Functions

- static bool check_master (bool error_is_fatal, int line)

  Many of the static methods are a pass-through to a private non-static method, with the static method testing that the pass-through is valid.

Private Attributes

- JeodMemoryInterface & sim_interface

  The interface to the simulation engine's memory manager.
- DebugLevel debug_level {Error_details}

  Debugging level.
- size_t cur_data_size {}

  Number of allocated user bytes (excludes management overhead).
- size_t max_data_size {}

  Maximum value attained by cur_data_size.

- unsigned int max_table_size {}

  Maximum value attained by alloc_table.size().
- unsigned int allocation_number {}

  Number of allocations.
- AllocTable alloc_table

  Maps memory addresses to the descriptions of those addresses.
- TypeTable type_table

  Maps typeid names to type descriptors.
- JeodMemoryReflectiveTable string_table

  Maps unique strings to themselves.
- pthread_mutex_t mutex {}

  Mutex that synchronizes access to the tables.
- JeodSimulationInterface::Mode mode {JeodSimulationInterface::Construction}

  Simulation interface mode.
- bool guard_enabled {true}

  Data can be guarded if this is set.

Static Private Attributes

- static JeodMemoryManager ∗ Master = nullptr

  The singleton instance of the JeodMemoryManager class.

Friends

- class InputProcessor
- void init_attrjeod__JeodMemoryManager ()

8.8.1 Detailed Description

This class provides the interface between the macros in jeod_alloc.hh and the rest of the JEOD memory model.

The public interface is via the publicly visible static methods. All nonstatic member functions are private. Each public static method relays the method call to the singleton memory manager via a correspondingly named private member function.

Singleton

The class is intended to be a singleton. The private static member JeodMemoryManager::Master points to this singular instance. The constructor sets that static member if it is null. The constructor issues a non-fatal error when multiple instances of the class are created.

Thread Safety

This class contains objects that must be accessed and updated in a thread-safe manner. The member data that must be used atomically are

- JeodMemoryManager::alloc_table - Maps memory addresses to memory items
- JeodMemoryManager::type_table - Maps RTTI names to type descriptors
- JeodMemoryManager::string_table - Maps unique strings to themselves.
- JeodMemoryManager::cur_data_size - Current size of allocated data.

- JeodMemoryManager::max_data_size - Maximum of the above.
- JeodMemoryManager::max_table_size - Maximum allocation table size.
- JeodMemoryManager::allocation_number - Number of allocations made.

To ensure the constraint is satisfied, access to the these elements is protected by means of a mutex and is limited to a small number of methods. A pair of methods, JeodMemoryManager::begin_atomic_block and JeodMemoryManager::end_atomic_block systematize the use of the mutex. The methods that operate on the protected data are

- Constructor and destructor.
  The constructor operates on the protected data before it creates the mutex and marks the JeodMemoryManager object as usable. The destructor marks the object as unusable and destroys the mutex before operating on the protected data.
- JeodMemoryManager::generate_shutdown_report, which is called by the destructor after it has destroyed the mutex.
- Methods whose names end with _atomic. These methods use the begin_atomic_block / end_atomic_↩ block paradigm to ensure that the operations are carried out atomically.
- Methods whose names end with _nolock. These methods operate on protected data but do so without atomic protection. These methods are called only by _atomic methods from within their atomic protection block.

Forbidden Word - Mutable

The data member JeodMemoryManager::mutex is mutable, a forbidden word per the JEOD coding standards. The coding standards allow for waivers to the standards if the exception is justified. This section provides the explanation needed to enable the use of that word in this case.

The *mutable* keyword tells the compiler to ignore modifications to mutable elements in an otherwise *const* method. The *mutex* is mutable because, athough its value does change with a successful lock, it is restored to its prelock value with an unlock. A method that could otherwise qualify as a const method can still be a const method by marking the mutex as mutable. Mutexes are one of the well-accepted types of data that typically marked as mutable.

Assumptions and Constraints on the Simulation Developer

This class places restrictions on the simulation developer.

- The simulation's MessageHandler object must be constructed prior to constructing the simulation's JeodMemoryManager object.
- The simulation's MessageHandler object must not be destroyed prior to constructing the simulation's JeodMemoryManager object.
- The simulation's JeodMemoryManager object must be constructed prior to invoking any of the JEOD_↩ ALLOC_xxx macros in other models.
- The simulation's JeodMemoryManager object must not be destroyed before other models release their allocated memory.

The recommended solution is to create an instance of a compliant SimulationInterface before creating any other models and to destroy that SimulationInterface object after destroying all other models. A simple way to achieve this in a Trick-07 simulation is to define a Trick sim object that contains a TrickSimulationInterface element and to place this sim object immediately after the sys sim object.

Assumptions and Constraints on the Simulation Engine

This class makes certain assumptions of the behavior of the simulation engine.

- The simulation engine will not spawn threads that use the JEOD memory model to allocate memory until after the SimulationInterface object has been constructed.
- The simulation engine will join all threads that use the JEOD memory model prior to destroying the SimulationInterface object.

The Trick-07 and Trick-10 simulation engines satisfies these constraints.

Assumptions and Constraints on the Simulation Developer

This class places certain limitations on the architecture of a JEOD-based simulation.

- The JeodMemoryManager destructor uses the simulation's message handler to report errors discovered during destruction and may eventually use the simulation's simulation engine memory interface to revoke the registration of memory allocated by JEOD that has not been freed. This in turn means that: – The simulation's message handler and simulation engine memory interface must be destructed after destructing the memory manager. – The destructors for those objects cannot use the memory manager.
- The JEOD memory allocation and deallocation macros expand into calls to memory manager methods. The memory manager must be viable (post construction, pre destruction) for these calls to function properly. This in turn means that the memory manager must be constructed very early in the overall construction process and destructed very late in in the overall destruction process.
- The supported solution to both of these issues is to use a compliant derived class of the JeodSimulation↩ Interface class and to ensure that this composite object created early and destroyed late. In a Trick-07 simulation, this can be accomplished simply by placing a declaration of an object of type JeodTrickSim↩ Interface near the top of an S_define file. The recommended placement is just after the Trick system sim object.

Definition at line 212 of file memory_manager.hh.

8.8.2 Member Typedef Documentation

8.8.2.1 AllocTable

```
using jeod::JeodMemoryManager::AllocTable = std::map<const void *, JeodMemoryItem>  [private]
```

An AllocTable maps memory addresses to memory descriptions.

Definition at line 350 of file memory_manager.hh.

8.8.2.2 TypeTable

```
using jeod::JeodMemoryManager::TypeTable = JeodMemoryTableClonable<JeodMemoryTypeDescriptor>
[private]
```

The type type itself is a memory table with copy implemented by clone().

Definition at line 355 of file memory_manager.hh.

8.8.3 Member Enumeration Documentation

8.8.3.1 DebugLevel

```
enum jeod::JeodMemoryManager::DebugLevel
```

The memory manager as a whole and individual operations have a debug level.

The debug levels and the message handler must be set to a sufficiently high level to enable and see the debugging output.

Enumerator

Debug_off	Debugging is off.
Summary_only	Summary information; Allocation data are not stored.
Error_details	Allocation data stored and used with error messages.
Full_details	Blow-by-blow accounting of all transactions.

Definition at line 226 of file memory_manager.hh.

8.8.3.2 NameType

```
enum jeod::JeodMemoryManager::NameType
```

The type lookup by type name needs to know whether the provided name is a typeid name or a demangled name.

Enumerator

Typeid_type_name	Name is from a std::type_info.name()
Demangled_type_name	Name is what people might use.

Definition at line 238 of file memory_manager.hh.

8.8.4 Constructor & Destructor Documentation

8.8.4.1 JeodMemoryManager() [1/3]

```
jeod::JeodMemoryManager::JeodMemoryManager ( )  [delete]
```

8.8.4.2 JeodMemoryManager() [2/3]

```
jeod::JeodMemoryManager::JeodMemoryManager (
            const JeodMemoryManager &  )  [explicit], [delete]
```

8.8.4.3 JeodMemoryManager() [3/3]

```
jeod::JeodMemoryManager::JeodMemoryManager (
            JeodMemoryInterface & interface )  [explicit]
```

Construct a MemoryManager object.

Parameters

in,out	*interface*	The memory interface with the simulation engine

Definition at line 62 of file memory_manager.cc.

References MAKE_DESCRIPTOR, Master, mutex, and jeod::MemoryMessages::singleton_error.

8.8.4.4 ∼JeodMemoryManager()

```
jeod::JeodMemoryManager::∼JeodMemoryManager ( )  [virtual]
```

Destruct a MemoryManager object.

Assumptions and Limitations

- In a multi-threaded environment,
  - This destructor shall be called once and once only to destroy the singleton JeodMemoryManager object.
  - The thread that calls this destructor shall wait until all other threads that access JEOD memory have finished, either by default or by force.

  Note that this is a constraint on the simulation engine, not on JEOD.

Definition at line 136 of file memory_manager.cc.

References alloc_table, generate_shutdown_report(), jeod::JeodMemoryItem::get_is_registered(), get_type_↩
descriptor_nolock(), Master, mutex, and sim_interface.

8.8.5 Member Function Documentation

8.8.5.1 add_allocation_atomic()

```
void jeod::JeodMemoryManager::add_allocation_atomic (
             const void * addr,
             const JeodMemoryItem & item,
             const JeodMemoryTypeDescriptor & tdesc,
             const char * file,
             unsigned int line ) [private]
```

Add the specified addr/item pair to the table.

Assumptions and Limitations

- Operations on the map must be atomic. This method satisfies that requirement.
- The specified address must not already be in the table.

Parameters

in	*addr*	Newly allocated memory
in	*item*	Description of that memory
in	*tdesc*	Description of the type
in	*file*	Source file containing JEOD_ALLOC
in	*line*	Line number containing JEOD_ALLOC

Definition at line 700 of file memory_manager_protected.cc.

References alloc_table, begin_atomic_block(), jeod::JeodMemoryTypeDescriptor::buffer_end(), jeod::Jeod↩ MemoryTypeDescriptor::buffer_size(), jeod::MemoryMessages::corrupted_memory, cur_data_size, end_atomic_↩ block(), jeod::JeodMemoryItem::get_nelems(), get_type_descriptor_nolock(), max_data_size, and max_table_size.

Referenced by register_memory_internal().

8.8.5.2 add_string_atomic()

```
unsigned int jeod::JeodMemoryManager::add_string_atomic (
             const std::string & str ) [private]
```

Add a location identifier string to the string table.

Assumptions and Limitations

- Operations on the map must be atomic. This method satisfies that requirement.

Returns

String table index

Parameters

in	*str*	String to add

Definition at line 188 of file memory_manager_protected.cc.

References jeod::JeodMemoryReflectiveTable::add(), begin_atomic_block(), end_atomic_block(), and string_table.

Referenced by register_memory_internal().

8.8.5.3 allocate_memory()

```
void * jeod::JeodMemoryManager::allocate_memory (
             std::size_t nelems,
             std::size_t elem_size,
             bool guard,
             int fill ) const  [private]
```

Allocate memory.

Assumptions and Limitations

- This is a low-level allocation function. It does not
  - Register the allocated memory with JEOD or with an external agent.
  - Construct the newly-allocated memory.
- The returned address should not be released using the C free function or C++ delete operator. Failure to obey this restriction will result in big problems.

Returns

Allocated memory

Parameters

in	*nelems*	Number of elements
in	*elem_size*	Size of each element
in	*guard*	Allocate guard bytes if set
in	*fill*	Fill pattern (ref. memset)

Definition at line 700 of file memory_manager.cc.

References MAGIC0, MAGIC1, and jeod::MemoryMessages::out_of_memory.

Referenced by create_memory_internal(), and restart_reallocate().

8.8.5.4 begin_atomic_block()

```
void jeod::JeodMemoryManager::begin_atomic_block ( ) const  [private]
```

Prepare for a set of operations that must be done atomically.

Assumptions and Limitations

- This method must be used in conjunction with end_atomic_block.

  ```
  try {
     begin_atomic_block ();
     operate_on_protected_members();
     end_atomic_block (false);
  }
  catch (...) {
     end_atomic_block (true);
     throw;
  }
  ```

- See the class header for a detailed description. Purpose: (Prepare for a set of operations that must be done atomically.) Assumptions and limitations: This method must be used in conjunction with end_↩atomic_block.

  ```
  try {
     begin_atomic_block ();
     operate_on_protected_members();
     end_atomic_block (false);
  }
  catch (...) {
     end_atomic_block (true);
     throw;
  }
  ```

  (See the class header for a detailed description.))

Definition at line 97 of file memory_manager_protected.cc.

References jeod::MemoryMessages::lock_error, and mutex.

Referenced by add_allocation_atomic(), add_string_atomic(), delete_oldest_alloc_entry_atomic(), find_alloc_↩entry_atomic(), get_alloc_id_atomic(), get_string_atomic(), get_type_descriptor_atomic(), get_type_entry_atomic(), and reset_alloc_id_atomic().

8.8.5.5 check_master()

```
bool jeod::JeodMemoryManager::check_master (
             bool error_is_fatal,
             int line )  [static], [private]
```

Many of the static methods are a pass-through to a private non-static method, with the static method testing that the pass-through is valid.

This method performs that test and handles the failure response.

Returns

True if Master is not null

Parameters

in	*error_is_fatal*	True => call fail
in	*line*	**LINE**

Definition at line 59 of file memory_manager_static.cc.

References Master, and jeod::MemoryMessages::singleton_error.

Referenced by create_memory(), deregister_container(), destroy_memory(), get_type_descriptor(), is_allocated(), is_table_empty(), register_class(), register_container(), set_debug_level(), set_guard_enabled(), and set_mode().

8.8.5.6 create_memory()

```
void * jeod::JeodMemoryManager::create_memory (
            bool is_array,
            unsigned int nelems,
            int fill,
            const TypeEntry & tentry,
            const char * file,
            unsigned int line )  [static]
```

Allocate memory and register the allocated memory with JEOD.

Assumptions and Limitations

- This method must not be called before the singleton memory manager has been created or after it has been destroyed. A fatal error results when this is not true.
- The allocated memory is not constructed by this method. The calling routine should initialize the memory with placement new.
- Access to this method is through the JEOD memory allocation macros. Use in any other context is caveat emptor.

Returns

Allocated memory

Parameters

in	*is_array*	Memory constructed by new[] if set
in	*nelems*	Number of elements to be allocated
in	*fill*	Byte fill pattern
in	*tentry*	Type entry
in	*file*	Source file containing JEOD_ALLOC
in	*line*	Line number containing JEOD_ALLOC

Definition at line 243 of file memory_manager_static.cc.

References check_master(), create_memory_internal(), and Master.

8.8.5.7 create_memory_internal()

```
void * jeod::JeodMemoryManager::create_memory_internal (
            bool is_array,
            unsigned int nelems,
            int fill,
            const TypeEntry & tentry,
            const char * file,
            unsigned int line )  [private]
```

Allocate memory for use with placement new and register that memory with with the memory manager and with the simulation engine.

Assumptions and Limitations

- This method will be invoked via the JEOD memory allocation macros. Use in any other context is a case of caveat emptor.
- The type descriptor index must index the type descriptor that describes the type to be created.
- The memory is allocated but not constructed. Construction is the responsibility of the caller. The JEOD memory allocation macros construct the allocated memory via placement new.

Returns

Allocated memory

Parameters

in	*is_array*	Memory constructed by new[] if set
in	*nelems*	Number of elements to be allocated
in	*fill*	Byte fill pattern
in	*tentry*	Type entry
in	*file*	Source file containing JEOD_ALLOC
in	*line*	Line number containing JEOD_ALLOC

Definition at line 387 of file memory_manager.cc.

References allocate_memory(), jeod::JeodMemoryTypeDescriptor::get_size(), guard_enabled, register_memory↩_internal(), and jeod::JeodMemoryManager::TypeEntry::tdesc.

Referenced by create_memory().

8.8.5.8 delete_oldest_alloc_entry_atomic()

```
void jeod::JeodMemoryManager::delete_oldest_alloc_entry_atomic (
            void *& addr,
            JeodMemoryItem & item,
            const JeodMemoryTypeDescriptor *& type )   [private]
```

Find and delete the alloc table entry with the smallest unique id, setting the provided references with info about the deleted item.

The addr and type are set to NULL if the table is empty.

Assumptions and Limitations

- Operations on the map must be atomic. This method satisfies that requirement.
- If the restore doesn't work the sim will be knee deep in alligators.

Parameters

out	*addr*	Address found in table
out	*item*	Descriptor for above
out	*type*	Type descriptor

Definition at line 802 of file memory_manager_protected.cc.

References alloc_table, allocation_number, begin_atomic_block(), jeod::JeodMemoryTypeDescriptor::buffer_size(), cur_data_size, end_atomic_block(), and get_type_descriptor_nolock().

Referenced by restart_clear_memory().

8.8.5.9 deregister_container()

```
void jeod::JeodMemoryManager::deregister_container (
            const void * container,
            const std::type_info & container_type,
            const std::string & elem_name,
            JeodCheckpointable & checkpointable )   [static]
```

Deregister all checkpointable object contained within some object.

Assumptions and Limitations

- This method must not be called before the singleton memory manager has been created or after it has been destroyed. A fatal error results when this is not true.

Parameters

in	*container*	Object container
in	*container_type*	Container type info
in	*elem_name*	Element name
in,out	*checkpointable*	Checkpointable object

Definition at line 368 of file memory_manager_static.cc.

References check_master(), get_type_descriptor_atomic(), Master, jeod::MemoryMessages::null_pointer, and sim_interface.

8.8.5.10 destroy_memory()

```
void jeod::JeodMemoryManager::destroy_memory (
            void * addr,
            bool delete_array,
            const char * file,
            unsigned int line )  [static]
```

Destroy memory previously registered with JEOD.

Assumptions and Limitations

- This method must not be called before the singleton memory manager has been created or after it has been destroyed. A fatal error results when this is not true.
- The provided memory shall not be used in any way after calling this method. This method destructs and frees that memory.
- Access to this method is through the JEOD memory allocation macros. Use in any other context is caveat emptor.

Parameters

in,out	*addr*	Memory to be destroyed
in	*delete_array*	DELETE_ARRAY (true) vs. DELETE_OBJECT
in	*file*	Source file containing delete
in	*line*	Line number containing delete

Definition at line 300 of file memory_manager_static.cc.

References check_master(), destroy_memory_internal(), and Master.

8.8.5.11 destroy_memory_internal()

```
void jeod::JeodMemoryManager::destroy_memory_internal (
            void * addr,
            bool delete_array,
            const char * file,
            unsigned int line )  [private]
```

Destroy a chunk of memory and knowledge about it.

This includes

- De-registering the memory with JEOD and with an external agent.
- Invoking the destructor in the case of a structured type.
- Releasing the memory to the system.

Parameters

`in,out`	*addr*	Memory to be destroyed
`in`	*delete_array*	DELETE_ARRAY (true) vs. DELETE_OBJECT
`in`	*file*	Source file containing delete
`in`	*line*	Line number containing delete

Definition at line 549 of file memory_manager.cc.

References jeod::JeodMemoryTypeDescriptor::buffer_size(), jeod::MemoryMessages::debug, debug_level, jeod↩ ::JeodMemoryTypeDescriptor::destroy_memory(), find_alloc_entry_atomic(), free_memory(), jeod::JeodMemory↩ Item::get_alloc_index(), jeod::JeodMemoryItem::get_is_array(), jeod::JeodMemoryItem::get_is_guarded(), jeod↩ ::JeodMemoryItem::get_is_registered(), jeod::JeodMemoryItem::get_nelems(), jeod::JeodMemoryItem::get_↩ placement_new(), get_string_atomic(), jeod::MemoryMessages::null_pointer, sim_interface, jeod::Memory↩ Messages::suspect_pointer, and jeod::JeodMemoryTypeDescriptor::type_spec().

Referenced by destroy_memory().

8.8.5.12 end_atomic_block()

```
void jeod::JeodMemoryManager::end_atomic_block (
            bool ignore_errors ) const  [private]
```

End an atomic set of operations.

Parameters

`in`	*ignore_errors*	Ignore errors from unlock?

Definition at line 117 of file memory_manager_protected.cc.

References jeod::MemoryMessages::lock_error, and mutex.

Referenced by add_allocation_atomic(), add_string_atomic(), delete_oldest_alloc_entry_atomic(), find_alloc_↩ entry_atomic(), get_alloc_id_atomic(), get_string_atomic(), get_type_descriptor_atomic(), get_type_entry_atomic(), and reset_alloc_id_atomic().

8.8.5.13 find_alloc_entry_atomic()

```
void jeod::JeodMemoryManager::find_alloc_entry_atomic (
            const void * addr,
            bool delete_entry,
            const char * file,
            unsigned int line,
            void *& found_addr,
            JeodMemoryItem & found_item,
            const JeodMemoryTypeDescriptor *& found_type )  [private]
```

Find the allocation table entry that matches the input address, and delete it if delete_entry is true.

The matching is strict. A match occurs only if the input address is a key in the allocation table. An error is reported if the input address is inside the allocated space corresponding to one of the allocation table entries.

Output values:

- Entry not found:
  - The *found_addr* and *found_type* are set to NULL.
  - The *found_item* is not touched.
- Entry found:
  - The *found_addr* is set to the key of the found entry.
  - The *found_item* is copied from the value of the found entry.
  - The *found_type* points to the type_descriptor entry for the found item's type.

Assumptions and Limitations

- Operations on the map must be atomic. This method satisfies that requirement.

Parameters

`in`	*addr*	Address
`in`	*delete_entry*	Indicates entry is to be deleted
`in`	*file*	Source file containing JEOD_XXX
`in`	*line*	Line number containing JEOD_XXX
`out`	*found_addr*	Address found in table
`out`	*found_item*	Descriptor for above
`out`	*found_type*	Type descriptor

Definition at line 587 of file memory_manager_protected.cc.

References alloc_table, begin_atomic_block(), jeod::JeodMemoryTypeDescriptor::buffer_size(), cur_data_size, end_atomic_block(), jeod::JeodMemoryTypeDescriptor::get_name(), get_type_descriptor_nolock(), and jeod::↩ MemoryMessages::suspect_pointer().

Referenced by destroy_memory_internal(), and is_allocated_internal().

8.8.5.14 free_memory()

```
void jeod::JeodMemoryManager::free_memory (
            void * addr,
            std::size_t length,
            bool guard,
            unsigned int alloc_idx,
            const char * file,
            unsigned int line ) const  [private]
```

Release memory.

Assumptions and Limitations

- This is a low-level de-allocation function. It does not
  - De-register the memory with JEOD or with an external agent.
  - Destruct the memory.

Parameters

`in,out`	*addr*	Memory to be freed
`in`	*length*	Buffer size
`in`	*guard*	Memory was guarded if set
`in`	*alloc_idx*	Allocation index
`in`	*file*	Source file containing delete
`in`	*line*	Line number containing delete

Definition at line 775 of file memory_manager.cc.

References jeod::MemoryMessages::corrupted_memory, get_string_atomic(), MAGIC0, and MAGIC1.

Referenced by destroy_memory_internal(), and restart_clear_memory().

8.8.5.15 generate_shutdown_report()

```
void jeod::JeodMemoryManager::generate_shutdown_report ( )  [private]
```

Generate a shutdown report.

Assumptions and Limitations

- This method is to be called by the destructor only. It freely accesses tabular data, the assumption being that the mutex and flags that protect that data are now gone.

Definition at line 180 of file memory_manager.cc.

References alloc_table, jeod::MemoryMessages::corrupted_memory, jeod::MemoryMessages::debug, debug↵ _level, jeod::JeodMemoryTable< ValueType >::get(), jeod::JeodMemoryItem::get_alloc_index(), get_type_↵ descriptor_nolock(), max_data_size, max_table_size, string_table, and jeod::JeodMemoryTypeDescriptor::type_↵ spec().

Referenced by ∼JeodMemoryManager().

8.8.5.16 get_alloc_id_atomic()

```
uint32_t jeod::JeodMemoryManager::get_alloc_id_atomic (
             const char * file,
             unsigned int line )  [private]
```

Create a unique identifier for an allocation.

Assumptions and Limitations

- Operations on the map must be atomic. This method satisfies that requirement.

Returns

Allocation ID

Parameters

in	*file*	Source file containing JEOD_ALLOC
in	*line*	Line number containing JEOD_ALLOC

Definition at line 490 of file memory_manager_protected.cc.

References allocation_number, begin_atomic_block(), jeod::MemoryMessages::corrupted_memory, and end_↩ atomic_block().

Referenced by register_memory_internal().

8.8.5.17 get_string_atomic()

```
const std::string & jeod::JeodMemoryManager::get_string_atomic (
            unsigned int idx ) const  [private]
```

Retrieve the specified string from the string table.

Assumptions and Limitations

- Operations on the map must be atomic. This method satisfies that requirement.

Returns

String table index

Parameters

in	*idx*	Class index

Definition at line 154 of file memory_manager_protected.cc.

References begin_atomic_block(), end_atomic_block(), jeod::JeodMemoryTable< ValueType >::get(), jeod::↩ MemoryMessages::internal_error, and string_table.

Referenced by destroy_memory_internal(), and free_memory().

8.8.5.18 get_type_descriptor() [1/2]

```
const JeodMemoryTypeDescriptor * jeod::JeodMemoryManager::get_type_descriptor (
            const std::type_info & typeid_info )  [static]
```

Get a type descriptor from the memory manager's type table.

Assumptions and Limitations

- This method must not be called before the singleton memory manager has been created or after it has been destroyed. A fatal error results when this is not true.

Returns

Type descriptor

Parameters

in	*typeid_info*	C++ type descriptor

Definition at line 184 of file memory_manager_static.cc.

References check_master(), get_type_descriptor_atomic(), and Master.

Referenced by jeod::JeodMemoryTypeDescriptor::base_type().

8.8.5.19 get_type_descriptor() [2/2]

```
const JeodMemoryTypeDescriptor * jeod::JeodMemoryManager::get_type_descriptor (
            JeodMemoryManager::NameType name_type,
            const std::string & type_name )  [static]
```

Get a type descriptor from the memory manager's type table.

Assumptions and Limitations

- This method must not be called before the singleton memory manager has been created or after it has been destroyed. A fatal error results when this is not true.

Returns

Type descriptor

Parameters

in	*name_type*	Typeid or demangled name
in	*type_name*	Type name

Definition at line 209 of file memory_manager_static.cc.

References check_master(), get_type_entry_atomic(), Master, and jeod::JeodMemoryManager::TypeEntry::tdesc.

8.8.5.20 get_type_descriptor_atomic() [1/2]

```
const JeodMemoryTypeDescriptor * jeod::JeodMemoryManager::get_type_descriptor_atomic (
            const std::type_info & typeid_info ) const  [private]
```

Retrieve the descriptor for the specified type from the type table.

Assumptions and Limitations

- Operations on the map must be atomic. This method satisfies that requirement.

Returns

Type descriptor

Parameters

in	*typeid_info*	Type info

Definition at line 333 of file memory_manager_protected.cc.

References begin_atomic_block(), end_atomic_block(), jeod::JeodMemoryTable< ValueType >::find(), jeod::↩
JeodMemoryTable< ValueType >::get(), and type_table.

Referenced by deregister_container(), get_type_descriptor(), and register_container().

8.8.5.21 get_type_descriptor_atomic() [2/2]

```
const JeodMemoryTypeDescriptor & jeod::JeodMemoryManager::get_type_descriptor_atomic (
            unsigned int idx ) const  [private]
```

Retrieve the descriptor for the specified type from the type table.

Assumptions and Limitations

- The input index is non-zero. This assumption is enforced.
- Operations on the map must be atomic. This method satisfies that requirement.

Returns

Type descriptor

Parameters

in	*idx*	Type index

Definition at line 442 of file memory_manager_protected.cc.

References begin_atomic_block(), end_atomic_block(), jeod::JeodMemoryTable< ValueType >::get(), jeod::↩
MemoryMessages::internal_error, and type_table.

8.8.5.22 get_type_descriptor_nolock()

```
const JeodMemoryTypeDescriptor & jeod::JeodMemoryManager::get_type_descriptor_nolock (
            const JeodMemoryItem & item ) const  [inline], [private]
```

Retrieve the descriptor for the specified type from the type table.

Assumptions and Limitations

- The type is in the table. A core dump will result if it is not.
- Operations on the type table must be atomic. This method *does not* satisfy that requirement.

Returns

Type descriptor

Parameters

in	*item*	Memory descriptor

Definition at line 561 of file memory_manager.hh.

Referenced by add_allocation_atomic(), delete_oldest_alloc_entry_atomic(), find_alloc_entry_atomic(), generate↩
_shutdown_report(), and ∼JeodMemoryManager().

8.8.5.23 get_type_entry_atomic() [1/2]

```
const JeodMemoryManager::TypeEntry jeod::JeodMemoryManager::get_type_entry_atomic (
            JeodMemoryTypePreDescriptor & tdesc )  [private]
```

Return the type entry for the input type descriptor, adding the descriptor to the type table if the type has not yet been registered.

Assumptions and Limitations

- The mangled name returned by the std::type_info name method is unique across all allocatable types and is invariant.
- Operations on the map must be atomic. This method satisfies that requirement.

Returns

Type descriptor index

Parameters

in	*tdesc*	Type pre-descriptor

Definition at line 273 of file memory_manager_protected.cc.

References jeod::JeodMemoryTable< ValueType >::add(), begin_atomic_block(), jeod::MemoryMessages::debug, debug_level, end_atomic_block(), jeod::JeodMemoryTable< ValueType >::find(), jeod::JeodMemoryTable< ValueType >::get(), jeod::JeodMemoryTypePreDescriptor::get_descriptor(), jeod::JeodMemoryTypeDescriptor↩ ::get_name(), jeod::JeodMemoryTypePreDescriptor::get_typeid(), and type_table.

Referenced by get_type_descriptor(), register_class(), and restart_reallocate().

8.8.5.24 get_type_entry_atomic() [2/2]

```
const JeodMemoryManager::TypeEntry jeod::JeodMemoryManager::get_type_entry_atomic (
            JeodMemoryManager::NameType name_type,
            const std::string & type_name ) const  [private]
```

Retrieve the descriptor for the specified type from the type table.

Assumptions and Limitations

- Operations on the map must be atomic. This method satisfies that requirement.

Returns

Type entry

Parameters

in	*name_type*	Name type spec
in	*type_name*	Type name

Definition at line 373 of file memory_manager_protected.cc.

References jeod::JeodMemoryTable< ValueType >::begin(), begin_atomic_block(), jeod::JeodMemoryTable< ValueType >::end(), end_atomic_block(), jeod::JeodMemoryTable< ValueType >::find(), jeod::JeodMemory↩ Table< ValueType >::get(), jeod::JeodMemoryTypeDescriptor::get_name(), type_table, and Typeid_type_name.

8.8.5.25 get_type_index_nolock()

```
bool jeod::JeodMemoryManager::get_type_index_nolock (
            const JeodMemoryTypeDescriptor & tdesc,
            uint32_t * idx )  [private]
```

Retrieve the index for the specified type from the type table, adding an entry if needed.

Assumptions and Limitations

- Operations on the type table must be atomic. This method *does not* satisfy that requirement.

Returns

True => table updated

Parameters

in	*tdesc*	Descriptor
out	*idx*	Type descriptor index

Definition at line 235 of file memory_manager_protected.cc.

References jeod::JeodMemoryTable< ValueType >::add(), jeod::JeodMemoryTable< ValueType >::find(), jeod::↩ JeodMemoryTypeDescriptor::get_typeid(), and type_table.

8.8.5.26 is_allocated()

```
bool jeod::JeodMemoryManager::is_allocated (
            const void * addr,
            const char * file,
            unsigned int line )  [static]
```

Query whether some address was allocated by JEOD.

Assumptions and Limitations

- This method must not be called before the singleton memory manager has been created or after it has been destroyed. A fatal error results when this is not true.

Returns

True if allocated by JEOD

Parameters

in	*addr*	Memory to be queried
in	*file*	Source file containing query
in	*line*	Line number containing query

Definition at line 270 of file memory_manager_static.cc.

References check_master(), is_allocated_internal(), and Master.

8.8.5.27 is_allocated_internal()

```
bool jeod::JeodMemoryManager::is_allocated_internal (
            const void * addr,
            const char * file,
            unsigned int line )  [private]
```

Query whether some address was allocated by JEOD.

Returns

True if the address in question was allocated by JEOD

Parameters

in	*addr*	Memory to be queried
in	*file*	Source file containing query
in	*line*	Line number containing query

Definition at line 519 of file memory_manager.cc.

References find_alloc_entry_atomic().

Referenced by is_allocated().

8.8.5.28 is_table_empty()

```
bool jeod::JeodMemoryManager::is_table_empty ( )  [static]
```

Query whether all allocated memory has been freed.

Assumptions and Limitations

- Intended for testing use only. This method does not use a thread-safe query.

Returns

Has all memory been freed?

Definition at line 132 of file memory_manager_static.cc.

References alloc_table, check_master(), and Master.

8.8.5.29 operator=()

```
JeodMemoryManager& jeod::JeodMemoryManager::operator= (
            const JeodMemoryManager & )  [delete]
```

8.8.5.30 register_class()

```
const JeodMemoryManager::TypeEntry jeod::JeodMemoryManager::register_class (
            JeodMemoryTypePreDescriptor & tdesc )  [static]
```

Register a class with the memory manager.

Assumptions and Limitations

- This method must not be called before the singleton memory manager has been created or after it has been destroyed. A fatal error results when this is not true.
- Access to this method is through the JEOD memory allocation macros. Use in any other context is caveat emptor.

Returns

Type entry for the class

Parameters

in	*tdesc*	Type pre-descriptor

Definition at line 158 of file memory_manager_static.cc.

References check_master(), get_type_entry_atomic(), and Master.

8.8.5.31 register_container()

```
void jeod::JeodMemoryManager::register_container (
            const void * container,
            const std::type_info & container_type,
            const std::string & elem_name,
            JeodCheckpointable & checkpointable )  [static]
```

Register a checkpointable object with the memory manager.

Assumptions and Limitations

- This method must not be called before the singleton memory manager has been created or after it has been destroyed. A fatal error results when this is not true.

Parameters

in	*container*	Object container
in	*container_type*	Container type info
in	*elem_name*	Element name
in,out	*checkpointable*	Checkpointable object

Definition at line 322 of file memory_manager_static.cc.

References check_master(), get_type_descriptor_atomic(), Master, jeod::MemoryMessages::null_pointer, and sim_interface.

8.8.5.32 register_memory_internal()

```
void jeod::JeodMemoryManager::register_memory_internal (
            const void * addr,
            uint32_t unique_id,
            bool placement_new,
            bool is_array,
            unsigned int nelems,
            const TypeEntry & tentry,
            const char * file,
            unsigned int line )  [private]
```

Allocate memory if that was not already done by the caller and register the memory with JEOD and with an external agent.

Assumptions and Limitations

- This method will be invoked via the JEOD memory allocation macros. Use in any other context is caveat emptor.
- The corresponding delete macro will be used to delete the memory. Using the C free function or the C++ delete operator can cause *big* problems.
- The delete macro will be expanded with the same placement new option as was used in the allocation macro that resulted in this call.
- The memory is not constructed. That is the job of the expansion of the JEOD_ALLOC macro.

Parameters

in	*addr*	Memory to be registered
in	*unique_id*	Unique id
in	*placement_new*	Was memory allocated by this model?
in	*is_array*	Was memory allocated as an array?
in	*nelems*	Array size
in	*tentry*	Type entry
in	*file*	Source file containing JEOD_ALLOC
in	*line*	Line number containing JEOD_ALLOC

Definition at line 421 of file memory_manager.cc.

References add_allocation_atomic(), add_string_atomic(), jeod::JeodMemoryTypeDescriptor::buffer_size(), jeod::MemoryMessages::debug, debug_level, get_alloc_id_atomic(), jeod::JeodMemoryTypeDescriptor::get_register_instances(), jeod::JeodMemoryManager::TypeEntry::index, jeod::MemoryMessages::invalid_size, jeod::JeodMemoryTypeDescriptor::is_structured(), reset_alloc_id_atomic(), jeod::JeodMemoryItem::set_unique_id(), sim_interface, jeod::JeodMemoryManager::TypeEntry::tdesc, and jeod::JeodMemoryTypeDescriptor::type_spec().

Referenced by create_memory_internal(), and restart_reallocate().

8.8.5.33 reset_alloc_id_atomic()

```
void jeod::JeodMemoryManager::reset_alloc_id_atomic (
            uint32_t unique_id )  [private]
```

Reset the unique identifier for a restart.

Assumptions and Limitations

- Operations on the map must be atomic. This method satisfies that requirement.

Parameters

in	*unique↩ _id*	Unique id of a restored allocation

Definition at line 537 of file memory_manager_protected.cc.

References allocation_number, begin_atomic_block(), and end_atomic_block().

Referenced by register_memory_internal().

8.8.5.34 restart_clear_memory()

```
void jeod::JeodMemoryManager::restart_clear_memory ( )
```

Wipe out all allocated memory in anticipation of restoring the memory in some previously recording checkpoint file.

Assumptions and Limitations

- If the restore doesn't work the sim will be knee deep in alligators.

Definition at line 272 of file memory_manager.cc.

References allocation_number, jeod::JeodMemoryTypeDescriptor::buffer_size(), cur_data_size, delete_oldest_↩ alloc_entry_atomic(), jeod::JeodMemoryTypeDescriptor::destroy_memory(), free_memory(), jeod::JeodMemory↩ Item::get_alloc_index(), jeod::JeodMemoryItem::get_is_array(), jeod::JeodMemoryItem::get_is_guarded(), jeod↩ ::JeodMemoryItem::get_is_registered(), jeod::JeodMemoryItem::get_nelems(), jeod::JeodMemoryItem::get_↩ placement_new(), max_data_size, max_table_size, and sim_interface.

8.8.5.35 restart_reallocate()

```
void jeod::JeodMemoryManager::restart_reallocate (
            const std::string & mangled_type_name,
            uint32_t unique_id,
            uint32_t nelements,
            bool is_array )
```

Restore one chunk of allocated memory per a checkpoint file entry.

Assumptions and Limitations

- This restores the allocation, but not the contents. The contents will soon be restored by the simulation engine.

Parameters

in	*mangled_type_name*	Mangled type name
in	*unique_id*	Unique id
in	*nelements*	Number of elements
in	*is_array*	True => an array

Definition at line 320 of file memory_manager.cc.

References allocate_memory(), jeod::JeodMemoryTypeDescriptor::construct_array(), jeod::JeodMemoryType↩ Descriptor::get_size(), get_type_entry_atomic(), guard_enabled, register_memory_internal(), jeod::Memory↩ Messages::suspect_pointer, jeod::JeodMemoryManager::TypeEntry::tdesc, and Typeid_type_name.

8.8.5.36 set_debug_level() [1/2]

```
void jeod::JeodMemoryManager::set_debug_level (
            unsigned int level )  [static]
```

Set the debug level.

Parameters

in	*level*	New debug level

Definition at line 98 of file memory_manager_static.cc.

References Full_details.

8.8.5.37 set_debug_level() [2/2]

```
void jeod::JeodMemoryManager::set_debug_level (
            DebugLevel level )  [static]
```

Set the debug level.

Parameters

in	*level*	New debug level

Definition at line 84 of file memory_manager_static.cc.

References check_master(), debug_level, and Master.

8.8.5.38 set_guard_enabled()

```
void jeod::JeodMemoryManager::set_guard_enabled (
             bool value )  [static]
```

Set the guard_enabled flag.

Parameters

in	*value*	New value

Definition at line 114 of file memory_manager_static.cc.

References check_master(), guard_enabled, and Master.

8.8.5.39 set_mode()

```
void jeod::JeodMemoryManager::set_mode (
             JeodSimulationInterface::Mode new_mode )  [static]
```

Set the memory manager's simulation interface mode.

Assumptions and Limitations

- This method must not be called before the singleton memory manager has been created or after it has been destroyed. A fatal error results when this is not true.

Parameters

in	*new_mode*	New mode

Definition at line 411 of file memory_manager_static.cc.

References check_master(), Master, and set_mode_internal().

8.8.5.40 set_mode_internal()

```
void jeod::JeodMemoryManager::set_mode_internal (
             JeodSimulationInterface::Mode new_mode )  [private]
```

Set the mode and perform mode transitions.

Parameters

in	*new_mode*	New mode

Definition at line 665 of file memory_manager.cc.

References mode.

Referenced by set_mode().

8.8.6 Friends And Related Function Documentation

8.8.6.1 init_attrjeod__JeodMemoryManager

```
void init_attrjeod__JeodMemoryManager ( )  [friend]
```

8.8.6.2 InputProcessor

```
friend class InputProcessor  [friend]
```

Definition at line 214 of file memory_manager.hh.

8.8.7 Field Documentation

8.8.7.1 alloc_table

```
AllocTable jeod::JeodMemoryManager::alloc_table  [private]
```

Maps memory addresses to the descriptions of those addresses.

trick_io(∗∗)

Definition at line 522 of file memory_manager.hh.

Referenced by add_allocation_atomic(), delete_oldest_alloc_entry_atomic(), find_alloc_entry_atomic(), generate↩
_shutdown_report(), is_table_empty(), and ∼JeodMemoryManager().

8.8.7.2 allocation_number

```
unsigned int jeod::JeodMemoryManager::allocation_number {}  [private]
```

Number of allocations.

This always increments and can be adjusted upward on restarts.trick_io(∗o) trick_units(–)

Definition at line 513 of file memory_manager.hh.

Referenced by delete_oldest_alloc_entry_atomic(), get_alloc_id_atomic(), reset_alloc_id_atomic(), and restart_↩
clear_memory().

8.8.7.3 cur_data_size

```
size_t jeod::JeodMemoryManager::cur_data_size {}  [private]
```

Number of allocated user bytes (excludes management overhead).

trick_io(∗o) trick_units(–)

Definition at line 497 of file memory_manager.hh.

Referenced by add_allocation_atomic(), delete_oldest_alloc_entry_atomic(), find_alloc_entry_atomic(), and restart_clear_memory().

8.8.7.4 debug_level

```
DebugLevel jeod::JeodMemoryManager::debug_level {Error_details}  [private]
```

Debugging level.

- 0 = Minimal output, errors only.
- 1 = Summary report, generated just before exit(0).
- 2 = Report unfreed memory as well.
- 3 = Blow-by-blow report of each allocation and deallocation.trick_units(–)

Definition at line 492 of file memory_manager.hh.

Referenced by destroy_memory_internal(), generate_shutdown_report(), get_type_entry_atomic(), register_↩
memory_internal(), and set_debug_level().

8.8.7.5 guard_enabled

```
bool jeod::JeodMemoryManager::guard_enabled {true}  [private]
```

Data can be guarded if this is set.

If not set, guards will never be established.trick_units(--)

Definition at line 548 of file memory_manager.hh.

Referenced by create_memory_internal(), restart_reallocate(), and set_guard_enabled().

8.8.7.6 Master

```
JeodMemoryManager * jeod::JeodMemoryManager::Master = nullptr  [static], [private]
```

The singleton instance of the JeodMemoryManager class.

The constructor sets this pointer.trick_io(*o) trick_units(--)

Definition at line 368 of file memory_manager.hh.

Referenced by check_master(), create_memory(), deregister_container(), destroy_memory(), get_type_↩ descriptor(), is_allocated(), is_table_empty(), JeodMemoryManager(), register_class(), register_container(), set_↩ debug_level(), set_guard_enabled(), set_mode(), and ∼JeodMemoryManager().

8.8.7.7 max_data_size

```
size_t jeod::JeodMemoryManager::max_data_size {}  [private]
```

Maximum value attained by cur_data_size.

trick_io(*o) trick_units(--)

Definition at line 502 of file memory_manager.hh.

Referenced by add_allocation_atomic(), generate_shutdown_report(), and restart_clear_memory().

8.8.7.8 max_table_size

```
unsigned int jeod::JeodMemoryManager::max_table_size {}  [private]
```

Maximum value attained by alloc_table.size().

trick_io(*o) trick_units(--)

Definition at line 507 of file memory_manager.hh.

Referenced by add_allocation_atomic(), generate_shutdown_report(), and restart_clear_memory().

8.8.7.9 mode

```
JeodSimulationInterface::Mode jeod::JeodMemoryManager::mode {JeodSimulationInterface::Construction}
[private]
```

Simulation interface mode.

trick_units(–)

Definition at line 542 of file memory_manager.hh.

Referenced by set_mode_internal().

8.8.7.10 mutex

```
pthread_mutex_t jeod::JeodMemoryManager::mutex {} [mutable], [private]
```

Mutex that synchronizes access to the tables.

trick_io(∗∗)

Definition at line 537 of file memory_manager.hh.

Referenced by begin_atomic_block(), end_atomic_block(), JeodMemoryManager(), and ∼JeodMemoryManager().

8.8.7.11 sim_interface

```
JeodMemoryInterface& jeod::JeodMemoryManager::sim_interface [private]
```

The interface to the simulation engine's memory manager.

trick_io(∗o) trick_units(–)

Definition at line 483 of file memory_manager.hh.

Referenced by deregister_container(), destroy_memory_internal(), register_container(), register_memory_↩
internal(), restart_clear_memory(), and ∼JeodMemoryManager().

8.8.7.12 string_table

```
JeodMemoryReflectiveTable jeod::JeodMemoryManager::string_table [private]
```

Maps unique strings to themselves.

trick_io(∗∗)

Definition at line 532 of file memory_manager.hh.

Referenced by add_string_atomic(), generate_shutdown_report(), and get_string_atomic().

8.8.7.13 type_table

```
TypeTable jeod::JeodMemoryManager::type_table  [private]
```

Maps typeid names to type descriptors.

trick_io(**)

Definition at line 527 of file memory_manager.hh.

Referenced by get_type_descriptor_atomic(), get_type_entry_atomic(), and get_type_index_nolock().

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

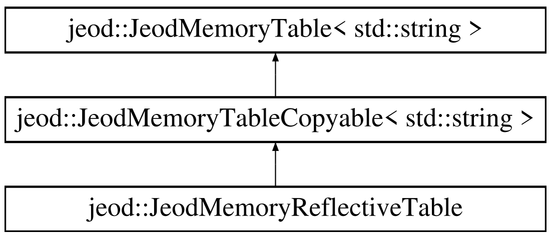
- memory_manager.hh
- memory_manager.cc
- memory_manager_protected.cc
- memory_manager_static.cc

8.9 jeod::JeodMemoryReflectiveTable Class Reference

A JeodMemoryReflectiveTable maps strings to themselves.

```
#include <memory_table.hh>
```

Inheritance diagram for jeod::JeodMemoryReflectiveTable:


jeod::JeodMemoryTable< std::string >
jeod::JeodMemoryTableCopyable< std::string >
jeod::JeodMemoryReflectiveTable

Public Member Functions

- JeodMemoryReflectiveTable ()
  Default constructor.
- JeodMemoryReflectiveTable (const JeodMemoryReflectiveTable &)=delete
- JeodMemoryReflectiveTable & operator= (const JeodMemoryReflectiveTable &)=delete
- unsigned int add (const std::string &keyval)
  Add a key to the table.

Private Member Functions

- unsigned int add (const std::string &key, const std::string &val)
  Not implemented.

Additional Inherited Members

8.9.1 Detailed Description

A JeodMemoryReflectiveTable maps strings to themselves.

Definition at line 413 of file memory_table.hh.

8.9.2 Constructor & Destructor Documentation

8.9.2.1 JeodMemoryReflectiveTable() [1/2]

```
jeod::JeodMemoryReflectiveTable::JeodMemoryReflectiveTable ( )  [inline]
```

Default constructor.

Definition at line 420 of file memory_table.hh.

8.9.2.2 JeodMemoryReflectiveTable() [2/2]

```
jeod::JeodMemoryReflectiveTable::JeodMemoryReflectiveTable (
             const JeodMemoryReflectiveTable &  )  [explicit], [delete]
```

8.9.3 Member Function Documentation

8.9.3.1 add() [1/2]

```
unsigned int jeod::JeodMemoryReflectiveTable::add (
             const std::string & key,
             const std::string & val )  [private]
```

Not implemented.

Referenced by jeod::JeodMemoryManager::add_string_atomic().

8.9.3.2 add() [2/2]

```
unsigned int jeod::JeodMemoryReflectiveTable::add (
             const std::string & keyval )  [inline]
```

Add a key to the table.

A reflective table has values equal to keys.

Returns

Index number mapped by the key.

Parameters

in	*keyval*	Key (and value) to be added to the table.

Definition at line 442 of file memory_table.hh.

References jeod::JeodMemoryTable< ValueType >::add().

8.9.3.3 operator=()

```
JeodMemoryReflectiveTable& jeod::JeodMemoryReflectiveTable::operator= (
            const JeodMemoryReflectiveTable &  )  [delete]
```

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

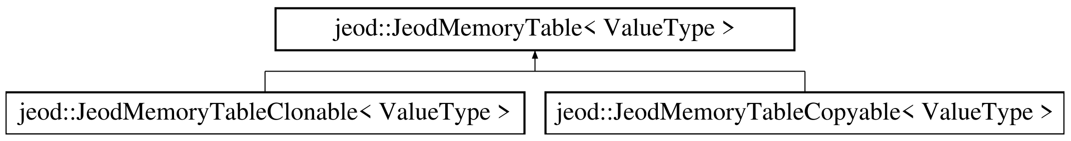
- memory_table.hh

8.10 jeod::JeodMemoryTable< ValueType > Class Template Reference

A JeodMemoryTable maps strings to values with a coordinated map/vector pair.

```
#include <memory_table.hh>
```

Inheritance diagram for jeod::JeodMemoryTable< ValueType >:


jeod::JeodMemoryTable< ValueType >
jeod::JeodMemoryTableClonable< ValueType >
jeod::JeodMemoryTableCopyable< ValueType >

Public Types

- using NameIndex = std::map< const std::string, unsigned int >

    Maps strings to an index number.
- using ValueList = std::vector< const ValueType $*$ >

    Maps index numbers to key values.
- using const_value_iterator = typename ValueList::const_iterator

    Const iterator over values.

Public Member Functions

- JeodMemoryTable ()

  Default constructor.
- virtual ∼JeodMemoryTable ()

  Destructor.
- JeodMemoryTable (const JeodMemoryTable &)=delete
- JeodMemoryTable & operator= (const JeodMemoryTable &)=delete
- unsigned int find (const std::string &key) const

  Find the index number at which key/value pair is stored in the table.
- const_value_iterator begin () const

  Returns a const iterator that points to the first element of the list.
- const_value_iterator end () const

  Returns a const iterator that points past the last element of the list.
- unsigned int add (const std::string &key, const ValueType &val)

  Add a key/value pair to the table.
- void del (const std::string &key)

  Delete the key and associated data from the table.
- const ValueType ∗ get (unsigned int idx) const

  Retrieve the value for the specified index from the list.

Protected Member Functions

- virtual const ValueType ∗ clone (const ValueType &value) const =0

  (Somehow) clone the input value.

Private Attributes

- NameIndex string_to_index

  Maps keys to indices in the value_list.
- ValueList value_list

  Vector of values.

8.10.1 Detailed Description

template<typename ValueType>
class jeod::JeodMemoryTable< ValueType >

A JeodMemoryTable maps strings to values with a coordinated map/vector pair.

Template Parameters

ValueType	The underlying type of the values maintained in the table. The stored values are pointers to this underlying type.

A JeodMemoryTable contains two data members: a std::map and a std::vector. The map data member maps keys to integers. The integer mapped by a key is the index into the vector where the value associated with the key is stored.

So why not just use a map? The reason is that storing an integer requires less memory than storing a string or a pointer to a string, particularly on 64 bit machines. In the application at hand, keeping track of memory allocations, the number of data types is relatively small compared to the to the number of allocated chunks of data. The extra overhead of maintaining a map and a vector is small compared to the savings that results from storing thousands of integers rather than pointers or strings.

Principal Operations

- add()
  Returns the integer value associated with a key in the table's map. In the case of a new key/value pair, a new key/vector size entry is added to the map and the value is added to the end of the vector. Note well: The value is ignored when the key is already in the map.
- del()
  Deletes the key from the table's map and deletes the cloned value at the corresponding index. The vector itself is modified (truncated) only in the special case of deleting the last-added entry. This ensures that stored indices will remain valid.
- get()
  Returns the value in the table's vector at the specified index.

Assumptions and Limitations

- The value is ignored for duplicate key entries. The underlying assumption is that all of the values for those duplicate entries are somehow equal to one another.
- As-is, the table is not thread-safe. Calls to add() and get() made in a multi-threaded environment should be protected by a mutex. This protection is the responsibility of the (programmatic) users.
- JEOD reserves index 0 for internal use. Valid indices are positive.
- The del() method should be used only if the (programmatic) user *knows* that no other references to the to-be-deleted entry exist.

Definition at line 123 of file memory_table.hh.

8.10.2 Member Typedef Documentation

8.10.2.1 const_value_iterator

```
template<typename ValueType>
using jeod::JeodMemoryTable< ValueType >::const_value_iterator = typename ValueList::const_↩
iterator
```

Const iterator over values.

Definition at line 140 of file memory_table.hh.

8.10.2.2 NameIndex

```
template<typename ValueType>
using jeod::JeodMemoryTable< ValueType >::NameIndex = std::map<const std::string, unsigned
int>
```

Maps strings to an index number.

Definition at line 130 of file memory_table.hh.

8.10.2.3 ValueList

```
template<typename ValueType>
using jeod::JeodMemoryTable< ValueType >::ValueList = std::vector<const ValueType *>
```

Maps index numbers to key values.

Definition at line 135 of file memory_table.hh.

8.10.3 Constructor & Destructor Documentation

8.10.3.1 JeodMemoryTable() [1/2]

```
template<typename ValueType>
jeod::JeodMemoryTable< ValueType >::JeodMemoryTable ( )  [inline]
```

Default constructor.

Note that JEOD reserves table index 0 as meaning nothing.

Definition at line 148 of file memory_table.hh.

8.10.3.2 ∼JeodMemoryTable()

```
template<typename ValueType>
virtual jeod::JeodMemoryTable< ValueType >::∼JeodMemoryTable ( )  [inline], [virtual]
```

Destructor.

The contents of the vector are clones created by add() and hence must be deleted to avoid a leak.

Definition at line 161 of file memory_table.hh.

8.10.3.3 JeodMemoryTable() [2/2]

```
template<typename ValueType>
jeod::JeodMemoryTable< ValueType >::JeodMemoryTable (
             const JeodMemoryTable< ValueType > & )  [delete]
```

8.10.4 Member Function Documentation

8.10.4.1 add()

```
template<typename ValueType>
unsigned int jeod::JeodMemoryTable< ValueType >::add (
             const std::string & key,
             const ValueType & val )  [inline]
```

Add a key/value pair to the table.

Returns

Index number mapped by the key

Parameters

in	*key*	Key
in	*val*	Value

Definition at line 231 of file memory_table.hh.

Referenced by jeod::JeodMemoryReflectiveTable::add(), jeod::JeodMemoryManager::get_type_entry_atomic(), and jeod::JeodMemoryManager::get_type_index_nolock().

8.10.4.2 begin()

```
template<typename ValueType>
const_value_iterator jeod::JeodMemoryTable< ValueType >::begin ( ) const  [inline]
```

Returns a const iterator that points to the first element of the list.

Definition at line 212 of file memory_table.hh.

Referenced by jeod::JeodMemoryManager::get_type_entry_atomic().

8.10.4.3 clone()

```
template<typename ValueType>
virtual const ValueType* jeod::JeodMemoryTable< ValueType >::clone (
            const ValueType & value ) const  [protected], [pure virtual]
```

(Somehow) clone the input value.

Returns

Clone of input value.

Parameters

in	*value*	Value to be cloned.

Implemented in jeod::JeodMemoryTableCopyable< ValueType >, jeod::JeodMemoryTableCopyable< std::string >, jeod::JeodMemoryTableClonable< ValueType >, and jeod::JeodMemoryTableClonable< JeodMemoryTypeDescriptor >.

Referenced by jeod::JeodMemoryTable< JeodMemoryTypeDescriptor >::add().

8.10.4.4 del()

```
template<typename ValueType>
void jeod::JeodMemoryTable< ValueType >::del (
            const std::string & key )  [inline]
```

Delete the key and associated data from the table.

Use with care.

Parameters

in	*key*	Key

Exceptions

std::invalid_argument	on attempting to delete an element that is not in the table.

Definition at line 262 of file memory_table.hh.

8.10.4.5 end()

```
template<typename ValueType>
const_value_iterator jeod::JeodMemoryTable< ValueType >::end ( ) const  [inline]
```

Returns a const iterator that points past the last element of the list.

Definition at line 220 of file memory_table.hh.

Referenced by jeod::JeodMemoryManager::get_type_entry_atomic().

8.10.4.6 find()

```
template<typename ValueType>
unsigned int jeod::JeodMemoryTable< ValueType >::find (
            const std::string & key ) const  [inline]
```

Find the index number at which key/value pair is stored in the table.

Returns

Index number mapped by the key

Parameters

in	*key*	Key

Definition at line 186 of file memory_table.hh.

Referenced by jeod::JeodMemoryManager::get_type_descriptor_atomic(), jeod::JeodMemoryManager::get_type↩_entry_atomic(), and jeod::JeodMemoryManager::get_type_index_nolock().

8.10.4.7 get()

```
template<typename ValueType>
const ValueType* jeod::JeodMemoryTable< ValueType >::get (
            unsigned int idx ) const  [inline]
```

Retrieve the value for the specified index from the list.

Returns

Value for specified index.

Parameters

in	*idx*	Table index whose value is to be retrieved.

Exceptions

std::out_of_range	for an index of zero or for an index beyond the range of the vector.

Exceptions

std::invalid_argument	when the index is in range but the value is null. This only happens when the item in question has previously been deleted.

Definition at line 301 of file memory_table.hh.

Referenced by jeod::JeodMemoryManager::generate_shutdown_report(), jeod::JeodMemoryManager::get_↩
string_atomic(), jeod::JeodMemoryManager::get_type_descriptor_atomic(), and jeod::JeodMemoryManager↩
::get_type_entry_atomic().

8.10.4.8 operator=()

```
template<typename ValueType>
JeodMemoryTable& jeod::JeodMemoryTable< ValueType >::operator= (
            const JeodMemoryTable< ValueType > &  )  [delete]
```

8.10.5 Field Documentation

8.10.5.1 string_to_index

```
template<typename ValueType>
NameIndex jeod::JeodMemoryTable< ValueType >::string_to_index  [private]
```

Maps keys to indices in the value_list.

trick_io(∗∗)

Definition at line 334 of file memory_table.hh.

Referenced by jeod::JeodMemoryTable< JeodMemoryTypeDescriptor >::add(), jeod::JeodMemoryTable< Jeod↩
MemoryTypeDescriptor >::del(), jeod::JeodMemoryTable< JeodMemoryTypeDescriptor >::find(), and jeod::Jeod↩
MemoryTable< JeodMemoryTypeDescriptor >::∼JeodMemoryTable().

8.10.5.2 value_list

```
template<typename ValueType>
ValueList jeod::JeodMemoryTable< ValueType >::value_list  [private]
```

Vector of values.

trick_io(∗∗)

Definition at line 339 of file memory_table.hh.

Referenced by jeod::JeodMemoryTable< JeodMemoryTypeDescriptor >::add(), jeod::JeodMemoryTable< Jeod↩
MemoryTypeDescriptor >::begin(), jeod::JeodMemoryTable< JeodMemoryTypeDescriptor >::del(), jeod::Jeod↩
MemoryTable< JeodMemoryTypeDescriptor >::end(), jeod::JeodMemoryTable< JeodMemoryTypeDescriptor >↩
::get(), jeod::JeodMemoryTable< JeodMemoryTypeDescriptor >::JeodMemoryTable(), and jeod::JeodMemory↩
Table< JeodMemoryTypeDescriptor >::∼JeodMemoryTable().

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

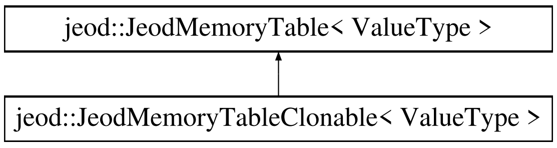
- memory_table.hh

8.11 jeod::JeodMemoryTableClonable< ValueType > Class Template Reference

A JeodMemoryTableClonable is a JeodMemoryTable that implements the required clone() functionality by invoking the *ValueType's* clone() method to create a clone of the input value.

```
#include <memory_table.hh>
```

Inheritance diagram for jeod::JeodMemoryTableClonable< ValueType >:


jeod::JeodMemoryTable< ValueType >
jeod::JeodMemoryTableClonable< ValueType >

Public Member Functions

- JeodMemoryTableClonable ()

    Default constructor.
- JeodMemoryTableClonable (const JeodMemoryTableClonable &)=delete
- JeodMemoryTableClonable & operator= (const JeodMemoryTableClonable &)=delete

Protected Member Functions

- const ValueType $*$ clone (const ValueType &value) const override

    Creates a copy of the input value by invoking its clone method.

Additional Inherited Members

8.11.1 Detailed Description

template<typename ValueType>
class jeod::JeodMemoryTableClonable< ValueType >

A JeodMemoryTableClonable is a JeodMemoryTable that implements the required clone() functionality by invoking the *ValueType's* clone() method to create a clone of the input value.

Definition at line 347 of file memory_table.hh.

8.11.2 Constructor & Destructor Documentation

8.11.2.1 JeodMemoryTableClonable() [1/2]

```
template<typename ValueType>
jeod::JeodMemoryTableClonable< ValueType >::JeodMemoryTableClonable ( )  [inline]
```

Default constructor.

Definition at line 354 of file memory_table.hh.

8.11.2.2 JeodMemoryTableClonable() [2/2]

```
template<typename ValueType>
jeod::JeodMemoryTableClonable< ValueType >::JeodMemoryTableClonable (
            const JeodMemoryTableClonable< ValueType > &  )  [delete]
```

8.11.3 Member Function Documentation

8.11.3.1 clone()

```
template<typename ValueType>
const ValueType* jeod::JeodMemoryTableClonable< ValueType >::clone (
            const ValueType & value ) const  [inline], [override], [protected], [virtual]
```

Creates a copy of the input value by invoking its clone method.

Returns

Duplicate of input value.

Parameters

in	*value*	Value to be cloned.

Implements jeod::JeodMemoryTable< ValueType >.

Definition at line 370 of file memory_table.hh.

8.11.3.2 operator=()

```
template<typename ValueType>
JeodMemoryTableClonable& jeod::JeodMemoryTableClonable< ValueType >::operator= (
            const JeodMemoryTableClonable< ValueType > &  )  [delete]
```

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

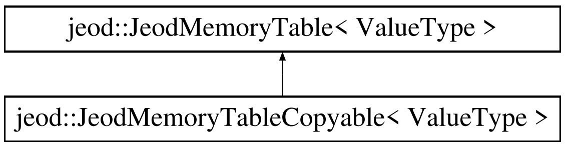
- memory_table.hh

8.12 jeod::JeodMemoryTableCopyable< ValueType > Class Template Reference

A JeodMemoryTableCopyable is a JeodMemoryTable that implements the required clone() functionality by invoking the *ValueType's* copy constructor to create a clone of the input value.

```
#include <memory_table.hh>
```

Inheritance diagram for jeod::JeodMemoryTableCopyable< ValueType >:



jeod::JeodMemoryTable< ValueType >
jeod::JeodMemoryTableCopyable< ValueType >

Public Member Functions

- JeodMemoryTableCopyable ()
  Default constructor.
- JeodMemoryTableCopyable (const JeodMemoryTableCopyable &)=delete
- JeodMemoryTableCopyable & operator= (const JeodMemoryTableCopyable &)=delete

Protected Member Functions

- const ValueType ∗ clone (const ValueType &value) const override
  Creates a copy of the input value by invoking its copy constructor.

Additional Inherited Members

8.12.1 Detailed Description

template<typename ValueType>
class jeod::JeodMemoryTableCopyable< ValueType >

A JeodMemoryTableCopyable is a JeodMemoryTable that implements the required clone() functionality by invoking the *ValueType's* copy constructor to create a clone of the input value.

Definition at line 381 of file memory_table.hh.

8.12.2 Constructor & Destructor Documentation

8.12.2.1 JeodMemoryTableCopyable() [1/2]

```
template<typename ValueType>
jeod::JeodMemoryTableCopyable< ValueType >::JeodMemoryTableCopyable ( )  [inline]
```

Default constructor.

Definition at line 388 of file memory_table.hh.

8.12.2.2 JeodMemoryTableCopyable() [2/2]

```
template<typename ValueType>
jeod::JeodMemoryTableCopyable< ValueType >::JeodMemoryTableCopyable (
            const JeodMemoryTableCopyable< ValueType > &  )  [delete]
```

8.12.3 Member Function Documentation

8.12.3.1 clone()

```
template<typename ValueType>
const ValueType* jeod::JeodMemoryTableCopyable< ValueType >::clone (
            const ValueType & value ) const  [inline], [override], [protected], [virtual]
```

Creates a copy of the input value by invoking its copy constructor.

Returns

Duplicate of input value.

Parameters

in	*value*	Value to be cloned.

Implements jeod::JeodMemoryTable< ValueType >.

Definition at line 404 of file memory_table.hh.

8.12.3.2 operator=()

```
template<typename ValueType>
JeodMemoryTableCopyable& jeod::JeodMemoryTableCopyable< ValueType >::operator= (
            const JeodMemoryTableCopyable< ValueType > &  )  [delete]
```

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

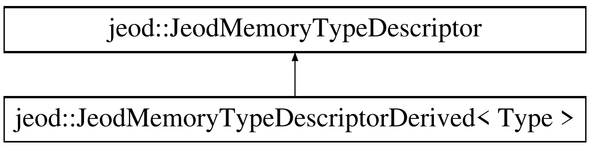
- memory_table.hh

8.13 jeod::JeodMemoryTypeDescriptor Class Reference

Abstract class for managing data allocated as some specific type.

```
#include <memory_type.hh>
```

Inheritance diagram for jeod::JeodMemoryTypeDescriptor:


jeod::JeodMemoryTypeDescriptor
jeod::JeodMemoryTypeDescriptorDerived< Type >

Data Structures

- struct attr

  The simulation engine attributes that describe the type.trick_io(∗∗)

Public Member Functions

- JeodMemoryTypeDescriptor (const std::type_info &obj_typeid, const struct ATTRIBUTES_tag &type_attr, std::size_t type_size, bool is_exportable=true)

  Non-default constructor.
- virtual ∼JeodMemoryTypeDescriptor ()=default
- JeodMemoryTypeDescriptor (const JeodMemoryTypeDescriptor &)=default
- JeodMemoryTypeDescriptor & operator= (const JeodMemoryTypeDescriptor &)=delete
- const std::type_info & get_typeid () const

  Get the type info for the type.
- const std::string & get_name () const

  Get the name of the type.
- std::size_t get_size () const

  Get the size of the type.
- const struct ATTRIBUTES_tag & get_attr () const

  Get the simulation engine attributes for the type.
- bool get_register_instances () const

  Get the simulation engine attributes for the type.
- std::size_t dimensionality () const

  Determine the dimensionality of the type.
- std::size_t buffer_size (unsigned int nelems) const

  Compute the size of a buffer.
- std::size_t buffer_size (const JeodMemoryItem &item) const

  Compute the size of a buffer.
- const void ∗ buffer_end (const void ∗addr, unsigned int nelems) const

  Compute the address of the byte just past the end a buffer.
- const void ∗ buffer_end (const void ∗addr, const JeodMemoryItem &item) const

Compute the address of the byte just past the end a buffer.

- const std::string type_spec (const JeodMemoryItem &item) const

  Construct a type specification string.
- void destroy_memory (bool placement_new, bool is_array, unsigned int nelem, void ∗addr) const

  Destroy memory.
- virtual JeodMemoryTypeDescriptor ∗ clone () const =0

  Create a copy of the descriptor.
- virtual bool is_structured () const =0

  Indicate whether the type associated with the descriptor is a structured (non-primitive, non-pointer) type.
- virtual void ∗ construct_array (std::size_t nelem, void ∗addr) const =0

  Construct an array of objects of the type.
- virtual const void ∗ most_derived_pointer (const void ∗addr) const =0

  Find the most-derived object corresponding to the input pointer.
- virtual void ∗ most_derived_pointer (void ∗addr) const =0

  Find the most-derived object corresponding to the input pointer.

Static Public Member Functions

- static void set_check_for_registration_errors (bool val)

  Enable/disable registration error messages.

Protected Member Functions

- virtual void delete_array (void ∗addr) const =0

  Delete an array of instances of the type associated with the descriptor.
- virtual void delete_object (void ∗addr) const =0

  Delete a single instance of the type associated with the descriptor.
- virtual void destruct_array (std::size_t nelem, void ∗addr) const =0

  Destruct (but do not delete) an array of nelem instances of the type associated with the descriptor.

Static Protected Member Functions

- static std::string initialize_type_name (const std::string &type_name)

  The jeod_alloc.hh macros insert a space between the type name and the asterisks.
- static std::size_t pointer_dimension (const std::string &demangled_name)

  Get the pointer dimensionality of the type.
- static const JeodMemoryTypeDescriptor ∗ base_type (const std::string &demangled_name)

  Get the descriptor for the base (non-pointer) of some pointer type.

Protected Attributes

- const std::type_info & obj_id

  The RTTI descriptor of the type.
- const std::string name

  The name of the type in code.
- const std::size_t size {}

  The size of an instance of the type.
- bool register_instances {}

  Should instances be registered with the simulation engine? If true (default value), instances of the type will be registered with the simulation engine; the simulation engine is responsible for checkpointing and restoring the contents of such instances.

Static Protected Attributes

- static bool check_for_registration_errors = false

  When set, suspect memory interface results will be reported as a warnings.

8.13.1 Detailed Description

Abstract class for managing data allocated as some specific type.

A JeodMemoryTypeDescriptor is a clonable object that contains the name and size of a specific data type. Instantiable subclasses of this class are created by the class templates that derive from this base class.

Definition at line 97 of file memory_type.hh.

8.13.2 Constructor & Destructor Documentation

8.13.2.1 JeodMemoryTypeDescriptor() [1/2]

```
jeod::JeodMemoryTypeDescriptor::JeodMemoryTypeDescriptor (
             const std::type_info & obj_typeid,
             const struct ATTRIBUTES_tag & type_attr,
             std::size_t type_size,
             bool is_exportable = true )
```

Non-default constructor.

Note that construction is via a char∗ as that is what the C preprocessor creates when it stringifies a token.

Parameters

in	*obj_typeid*	Type ID for type
in	*type_attr*	Type attributes
in	*type_size*	Type size
in	*is_exportable*	Register instances?

Definition at line 173 of file memory_type.cc.

8.13.2.2 ∼JeodMemoryTypeDescriptor()

```
virtual jeod::JeodMemoryTypeDescriptor::∼JeodMemoryTypeDescriptor ( )  [virtual], [default]
```

8.13.2.3 JeodMemoryTypeDescriptor() [2/2]

```
jeod::JeodMemoryTypeDescriptor::JeodMemoryTypeDescriptor (
            const JeodMemoryTypeDescriptor & ) [default]
```

8.13.3 Member Function Documentation

8.13.3.1 base_type()

```
const JeodMemoryTypeDescriptor * jeod::JeodMemoryTypeDescriptor::base_type (
            const std::string & demangled_name ) [static], [protected]
```

Get the descriptor for the base (non-pointer) of some pointer type.

Note

Assumes GNU c++ name mangling, where 'const' is always preceded by a space.

Definition at line 98 of file memory_type.cc.

References jeod::JeodMemoryManager::Demangled_type_name, and jeod::JeodMemoryManager::get_type_↩ descriptor().

8.13.3.2 buffer_end() [1/2]

```
const void* jeod::JeodMemoryTypeDescriptor::buffer_end (
            const void * addr,
            unsigned int nelems ) const [inline]
```

Compute the address of the byte just past the end a buffer.

Parameters

in	*addr*	Start of buffer
in	*nelems*	Size of the array

Definition at line 217 of file memory_type.hh.

References buffer_size().

Referenced by jeod::JeodMemoryManager::add_allocation_atomic(), and buffer_end().

8.13.3.3 buffer_end() [2/2]

```
const void* jeod::JeodMemoryTypeDescriptor::buffer_end (
            const void * addr,
            const JeodMemoryItem & item ) const [inline]
```

Compute the address of the byte just past the end a buffer.

Parameters

in	*addr*	Start of buffer
in	*item*	Buffer descriptor

Definition at line 227 of file memory_type.hh.

References buffer_end(), and jeod::JeodMemoryItem::get_nelems().

8.13.3.4 buffer_size() [1/2]

```
std::size_t jeod::JeodMemoryTypeDescriptor::buffer_size (
            unsigned int nelems ) const [inline]
```

Compute the size of a buffer.

Parameters

in	*nelems*	Size of the array

Returns

: Buffer size

Definition at line 197 of file memory_type.hh.

References size.

Referenced by jeod::JeodMemoryManager::add_allocation_atomic(), buffer_end(), buffer_size(), jeod::JeodMemoryManager::delete_oldest_alloc_entry_atomic(), jeod::JeodMemoryManager::destroy_memory_internal(), jeod::JeodMemoryManager::find_alloc_entry_atomic(), jeod::JeodMemoryManager::register_memory_internal(), and jeod::JeodMemoryManager::restart_clear_memory().

8.13.3.5 buffer_size() [2/2]

```
std::size_t jeod::JeodMemoryTypeDescriptor::buffer_size (
            const JeodMemoryItem & item ) const [inline]
```

Compute the size of a buffer.

Parameters

in	*item*	Buffer descriptor

Returns

: Buffer size

Definition at line 207 of file memory_type.hh.

References buffer_size(), and jeod::JeodMemoryItem::get_nelems().

8.13.3.6 clone()

```
virtual JeodMemoryTypeDescriptor* jeod::JeodMemoryTypeDescriptor::clone ( ) const  [pure virtual]
```

Create a copy of the descriptor.

Returns

Copy.

Implemented in jeod::JeodMemoryTypeDescriptorDerived< Type >.

Referenced by jeod::JeodMemoryTableClonable< JeodMemoryTypeDescriptor >::clone().

8.13.3.7 construct_array()

```
virtual void* jeod::JeodMemoryTypeDescriptor::construct_array (
            std::size_t nelem,
            void * addr ) const  [pure virtual]
```

Construct an array of objects of the type.

The default implementation does nothing, which is the right thing to do for primitive types, pointers, and abstract classes.

Implemented in jeod::JeodMemoryTypeDescriptorDerived< Type >.

Referenced by jeod::JeodMemoryManager::restart_reallocate().

8.13.3.8 delete_array()

```
virtual void jeod::JeodMemoryTypeDescriptor::delete_array (
            void * addr ) const  [protected], [pure virtual]
```

Delete an array of instances of the type associated with the descriptor.

In other words, delete[] addr.

Parameters

`in,out`	*addr*	Address to be deleted

Implemented in jeod::JeodMemoryTypeDescriptorDerived< Type >.

Referenced by destroy_memory().

8.13.3.9 delete_object()

```
virtual void jeod::JeodMemoryTypeDescriptor::delete_object (
            void * addr ) const  [protected], [pure virtual]
```

Delete a single instance of the type associated with the descriptor.

In other words, delete addr.

Parameters

`in,out`	*addr*	Address to be deleted

Implemented in jeod::JeodMemoryTypeDescriptorDerived< Type >.

Referenced by destroy_memory().

8.13.3.10 destroy_memory()

```
void jeod::JeodMemoryTypeDescriptor::destroy_memory (
            bool placement_new,
            bool is_array,
            unsigned int nelem,
            void * addr ) const  [inline]
```

Destroy memory.

Parameters

`in`	*placement_new*	Constructed with placement new?
`in`	*is_array*	Allocated as an array?
`in`	*nelem*	Number of elements
`in,out`	*addr*	Address to destroy

Definition at line 242 of file memory_type.hh.

References delete_array(), delete_object(), and destruct_array().

Referenced by jeod::JeodMemoryManager::destroy_memory_internal(), and jeod::JeodMemoryManager::restart↩
_clear_memory().

8.13.3.11 destruct_array()

```
virtual void jeod::JeodMemoryTypeDescriptor::destruct_array (
             std::size_t nelem,
             void * addr ) const  [protected], [pure virtual]
```

Destruct (but do not delete) an array of *nelem* instances of the type associated with the descriptor.

Parameters

in	*nelem*	Number of elements in addr
in,out	*addr*	Address to be destructed

Implemented in jeod::JeodMemoryTypeDescriptorDerived< Type >.

Referenced by destroy_memory().

8.13.3.12 dimensionality()

```
std::size_t jeod::JeodMemoryTypeDescriptor::dimensionality ( ) const  [inline]
```

Determine the dimensionality of the type.

Returns

: Type dimensionality

Definition at line 187 of file memory_type.hh.

References name, and pointer_dimension().

8.13.3.13 get_attr()

```
const struct ATTRIBUTES_tag& jeod::JeodMemoryTypeDescriptor::get_attr ( ) const  [inline]
```

Get the simulation engine attributes for the type.

Returns

Type attributes

Definition at line 167 of file memory_type.hh.

8.13.3.14 get_name()

```
const std::string& jeod::JeodMemoryTypeDescriptor::get_name ( ) const  [inline]
```

Get the name of the type.

Returns

Type name

Definition at line 149 of file memory_type.hh.

References name.

Referenced by jeod::JeodMemoryManager::find_alloc_entry_atomic(), and jeod::JeodMemoryManager::get_type↩
_entry_atomic().

8.13.3.15 get_register_instances()

```
bool jeod::JeodMemoryTypeDescriptor::get_register_instances ( ) const  [inline]
```

Get the simulation engine attributes for the type.

Returns

Type attributes

Definition at line 176 of file memory_type.hh.

References register_instances.

Referenced by jeod::JeodMemoryManager::register_memory_internal().

8.13.3.16 get_size()

```
std::size_t jeod::JeodMemoryTypeDescriptor::get_size ( ) const  [inline]
```

Get the size of the type.

Returns

Type size

Definition at line 158 of file memory_type.hh.

References size.

Referenced by jeod::JeodMemoryManager::create_memory_internal(), and jeod::JeodMemoryManager::restart_↩
reallocate().

8.13.3.17 get_typeid()

```
const std::type_info& jeod::JeodMemoryTypeDescriptor::get_typeid ( ) const  [inline]
```

Get the type info for the type.

Returns

Type info

Definition at line 140 of file memory_type.hh.

References obj_id.

Referenced by jeod::JeodMemoryManager::get_type_index_nolock().

8.13.3.18 initialize_type_name()

```
std::string jeod::JeodMemoryTypeDescriptor::initialize_type_name (
             const std::string & type_name )  [static], [protected]
```

The jeod_alloc.hh macros insert a space between the type name and the asterisks.

Delete that space.

Returns

Name, as c++ string

Parameters

in	*type_name*	Name, as C string

Definition at line 57 of file memory_type.cc.

8.13.3.19 is_structured()

```
virtual bool jeod::JeodMemoryTypeDescriptor::is_structured ( ) const  [pure virtual]
```

Indicate whether the type associated with the descriptor is a structured (non-primitive, non-pointer) type.

Implemented in jeod::JeodMemoryTypeDescriptorDerived< Type >.

Referenced by jeod::JeodMemoryManager::register_memory_internal().

8.13.3.20 most_derived_pointer() [1/2]

```
virtual const void* jeod::JeodMemoryTypeDescriptor::most_derived_pointer (
            const void * addr ) const  [pure virtual]
```

Find the most-derived object corresponding to the input pointer.

Implemented in jeod::JeodMemoryTypeDescriptorDerived< Type >.

8.13.3.21 most_derived_pointer() [2/2]

```
virtual void* jeod::JeodMemoryTypeDescriptor::most_derived_pointer (
            void * addr ) const  [pure virtual]
```

Find the most-derived object corresponding to the input pointer.

Implemented in jeod::JeodMemoryTypeDescriptorDerived< Type >.

8.13.3.22 operator=()

```
JeodMemoryTypeDescriptor& jeod::JeodMemoryTypeDescriptor::operator= (
            const JeodMemoryTypeDescriptor &  )  [delete]
```

8.13.3.23 pointer_dimension()

```
size_t jeod::JeodMemoryTypeDescriptor::pointer_dimension (
            const std::string & demangled_name )  [static], [protected]
```

Get the pointer dimensionality of the type.

Definition at line 74 of file memory_type.cc.

Referenced by dimensionality().

8.13.3.24 set_check_for_registration_errors()

```
static void jeod::JeodMemoryTypeDescriptor::set_check_for_registration_errors (
            bool val )  [inline], [static]
```

Enable/disable registration error messages.

Parameters

in	*val*	New value for check_for_registration_errors

Definition at line 106 of file memory_type.hh.

References check_for_registration_errors.

8.13.3.25 type_spec()

```
const std::string jeod::JeodMemoryTypeDescriptor::type_spec (
             const JeodMemoryItem & item ) const
```

Construct a type specification string.

Returns

Type string

Parameters

in	*item*	Item descriptor

Definition at line 190 of file memory_type.cc.

References jeod::JeodMemoryItem::get_is_array(), jeod::JeodMemoryItem::get_nelems(), and obj_id.

Referenced by jeod::JeodMemoryManager::destroy_memory_internal(), jeod::JeodMemoryManager::generate_↩
shutdown_report(), and jeod::JeodMemoryManager::register_memory_internal().

8.13.4 Field Documentation

8.13.4.1 check_for_registration_errors

```
bool jeod::JeodMemoryTypeDescriptor::check_for_registration_errors = false  [static], [protected]
```

When set, suspect memory interface results will be reported as a warnings.

No messages are issued when this flag is clear.trick_units(–)

Definition at line 330 of file memory_type.hh.

Referenced by set_check_for_registration_errors().

8.13.4.2 name

```
const std::string jeod::JeodMemoryTypeDescriptor::name [protected]
```

The name of the type in code.

trick_io(**)

Definition at line 342 of file memory_type.hh.

Referenced by dimensionality(), and get_name().

8.13.4.3 obj_id

```
const std::type_info& jeod::JeodMemoryTypeDescriptor::obj_id [protected]
```

The RTTI descriptor of the type.

trick_io(**)

Definition at line 337 of file memory_type.hh.

Referenced by get_typeid(), and type_spec().

8.13.4.4 register_instances

```
bool jeod::JeodMemoryTypeDescriptor::register_instances {} [protected]
```

Should instances be registered with the simulation engine? If true (default value), instances of the type will be registered with the simulation engine; the simulation engine is responsible for checkpointing and restoring the contents of such instances.

If false, instances will not be registered with the simulation engine; the simulation engine is not responsible for checkpointing/restarting such instances.trick_io(**)

Definition at line 365 of file memory_type.hh.

Referenced by get_register_instances().

8.13.4.5 size

```
const std::size_t jeod::JeodMemoryTypeDescriptor::size {} [protected]
```

The size of an instance of the type.

trick_io(**)

Definition at line 353 of file memory_type.hh.

Referenced by buffer_size(), and get_size().

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

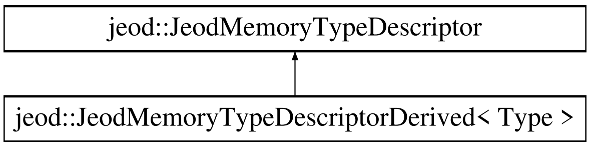
- memory_type.hh
- memory_type.cc

8.14 jeod::JeodMemoryTypeDescriptorDerived< Type > Class Template Reference

Extends JeodMemoryTypeDescriptor to describe a specific type.

```
#include <memory_type.hh>
```

Inheritance diagram for jeod::JeodMemoryTypeDescriptorDerived< Type >:


jeod::JeodMemoryTypeDescriptor
jeod::JeodMemoryTypeDescriptorDerived< Type >

Public Types

- using TypeDescriptor = JeodMemoryTypeDescriptorDerived< Type >

  This class.
- using Attributes = JeodSimEngineAttributes< Type, std::is_class< Type >::value >

  Attributes for the Type.

Public Member Functions

- JeodMemoryTypeDescriptorDerived (bool is_exportable=true)

  Default constructor.
- JeodMemoryTypeDescriptorDerived (const JeodMemoryTypeDescriptorDerived &src)

  Copy constructor; pass-through to the parent class equivalent.
- ∼JeodMemoryTypeDescriptorDerived () override=default
- JeodMemoryTypeDescriptorDerived & operator= (const JeodMemoryTypeDescriptorDerived &)=delete
- JeodMemoryTypeDescriptor ∗ clone () const override

  Create a copy of the descriptor.
- bool is_structured () const override

  Indicate whether the type associated with the descriptor is a structured (non-primitive, non-pointer) type.
- void ∗ construct_array (std::size_t nelem, void ∗addr) const override

  Construct an array of objects of the type.
- const void ∗ most_derived_pointer (const void ∗addr) const override

  Find the most-derived object corresponding to the input pointer.
- void ∗ most_derived_pointer (void ∗addr) const override

  Find the most-derived object corresponding to the input pointer.

Protected Member Functions

- void delete_array (void ∗addr) const override

  Delete an array of instances of type Type.
- void delete_object (void ∗addr) const override

  Delete a single instance of type Type.
- void destruct_array (std::size_t nelem, void ∗addr) const override

  Destroy an array of nelem instances of type Type.

Additional Inherited Members

8.14.1 Detailed Description

template<typename Type>
class jeod::JeodMemoryTypeDescriptorDerived< Type >

Extends JeodMemoryTypeDescriptor to describe a specific type.

tparam Type The type to be described.

Definition at line 372 of file memory_type.hh.

8.14.2 Member Typedef Documentation

8.14.2.1 Attributes

```
template<typename Type >
using jeod::JeodMemoryTypeDescriptorDerived< Type >::Attributes = JeodSimEngineAttributes<Type,
std::is_class<Type>::value>
```

Attributes for the Type.

Definition at line 385 of file memory_type.hh.

8.14.2.2 TypeDescriptor

```
template<typename Type >
using jeod::JeodMemoryTypeDescriptorDerived< Type >::TypeDescriptor = JeodMemoryTypeDescriptorDerived<Type>
```

This class.

Definition at line 380 of file memory_type.hh.

8.14.3 Constructor & Destructor Documentation

8.14.3.1 JeodMemoryTypeDescriptorDerived() [1/2]

```
template<typename Type >
jeod::JeodMemoryTypeDescriptorDerived< Type >::JeodMemoryTypeDescriptorDerived (
            bool is_exportable = true )  [inline]
```

Default constructor.

Invoke the parent class non-default constructor with type, attributes, and size information.

Definition at line 394 of file memory_type.hh.

Referenced by jeod::JeodMemoryTypeDescriptorDerived< Type >::clone().

8.14.3.2 JeodMemoryTypeDescriptorDerived() [2/2]

```
template<typename Type >
jeod::JeodMemoryTypeDescriptorDerived< Type >::JeodMemoryTypeDescriptorDerived (
            const JeodMemoryTypeDescriptorDerived< Type > & src )  [inline]
```

Copy constructor; pass-through to the parent class equivalent.

Parameters

in	*src*	Item to be copied

Definition at line 403 of file memory_type.hh.

8.14.3.3 ∼JeodMemoryTypeDescriptorDerived()

```
template<typename Type >
jeod::JeodMemoryTypeDescriptorDerived< Type >::∼JeodMemoryTypeDescriptorDerived ( )  [override],
[default]
```

8.14.4 Member Function Documentation

8.14.4.1 clone()

```
template<typename Type >
JeodMemoryTypeDescriptor* jeod::JeodMemoryTypeDescriptorDerived< Type >::clone ( ) const  [inline],
[override], [virtual]
```

Create a copy of the descriptor.

Returns

Copy.

Implements jeod::JeodMemoryTypeDescriptor.

Definition at line 418 of file memory_type.hh.

References jeod::JeodMemoryTypeDescriptorDerived< Type >::JeodMemoryTypeDescriptorDerived().

8.14.4.2 construct_array()

```
template<typename Type >
void* jeod::JeodMemoryTypeDescriptorDerived< Type >::construct_array (
             std::size_t nelem,
             void * addr ) const  [inline], [override], [virtual]
```

Construct an array of objects of the type.

Implements jeod::JeodMemoryTypeDescriptor.

Definition at line 436 of file memory_type.hh.

8.14.4.3 delete_array()

```
template<typename Type >
void jeod::JeodMemoryTypeDescriptorDerived< Type >::delete_array (
             void * addr ) const  [inline], [override], [protected], [virtual]
```

Delete an array of instances of type *Type*.

In other words, delete[] addr.

Parameters

in,out	*addr*	Address to be deleted

Implements jeod::JeodMemoryTypeDescriptor.

Definition at line 468 of file memory_type.hh.

8.14.4.4 delete_object()

```
template<typename Type >
void jeod::JeodMemoryTypeDescriptorDerived< Type >::delete_object (
             void * addr ) const  [inline], [override], [protected], [virtual]
```

Delete a single instance of type *Type*.

In other words, delete addr.

Parameters

`in,out`	*addr*	Address to be deleted

Implements jeod::JeodMemoryTypeDescriptor.

Definition at line 479 of file memory_type.hh.

8.14.4.5 destruct_array()

```
template<typename Type >
void jeod::JeodMemoryTypeDescriptorDerived< Type >::destruct_array (
             std::size_t nelem,
             void * addr ) const  [inline], [override], [protected], [virtual]
```

Destroy an array of *nelem* instances of type *Type*.

Implements jeod::JeodMemoryTypeDescriptor.

Definition at line 488 of file memory_type.hh.

8.14.4.6 is_structured()

```
template<typename Type >
bool jeod::JeodMemoryTypeDescriptorDerived< Type >::is_structured ( ) const  [inline], [override],
[virtual]
```

Indicate whether the type associated with the descriptor is a structured (non-primitive, non-pointer) type.

Implements jeod::JeodMemoryTypeDescriptor.

Definition at line 428 of file memory_type.hh.

8.14.4.7 most_derived_pointer() [1/2]

```
template<typename Type >
const void* jeod::JeodMemoryTypeDescriptorDerived< Type >::most_derived_pointer (
             const void * addr ) const  [inline], [override], [virtual]
```

Find the most-derived object corresponding to the input pointer.

Parameters

in	*addr*	Pointer to be examined

Returns

Pointer to most-derived object.

Implements jeod::JeodMemoryTypeDescriptor.

Definition at line 446 of file memory_type.hh.

8.14.4.8 most_derived_pointer() [2/2]

```
template<typename Type >
void* jeod::JeodMemoryTypeDescriptorDerived< Type >::most_derived_pointer (
            void * addr ) const  [inline], [override], [virtual]
```

Find the most-derived object corresponding to the input pointer.

Parameters

in	*addr*	Pointer to be examined

Returns

Pointer to most-derived object.

Implements jeod::JeodMemoryTypeDescriptor.

Definition at line 456 of file memory_type.hh.

References jeod::jeod_alloc_get_allocated_pointer().

8.14.4.9 operator=()

```
template<typename Type >
JeodMemoryTypeDescriptorDerived& jeod::JeodMemoryTypeDescriptorDerived< Type >::operator= (
            const JeodMemoryTypeDescriptorDerived< Type > & )  [delete]
```

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

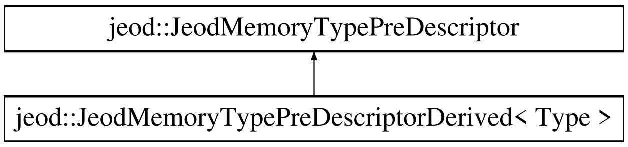
- memory_type.hh

8.15 jeod::JeodMemoryTypePreDescriptor Class Reference

Abstract class for describing a type without necessarily needing to create a JeodMemoryTypeDescriptor of that type.

```
#include <memory_type.hh>
```

Inheritance diagram for jeod::JeodMemoryTypePreDescriptor:


jeod::JeodMemoryTypePreDescriptor
jeod::JeodMemoryTypePreDescriptorDerived< Type >

Public Member Functions

- virtual ∼JeodMemoryTypePreDescriptor ()=default
- virtual const std::type_info & get_typeid () const =0

  Get the type info for the type.
- virtual const JeodMemoryTypeDescriptor & get_descriptor ()=0

  Get a type descriptor for the type.

8.15.1 Detailed Description

Abstract class for describing a type without necessarily needing to create a JeodMemoryTypeDescriptor of that type.

The intent is to avoid creating a type descriptor for a type if the type is already represented in the type table.

Usage of a JeodMemoryTypePreDescriptor is highly constrained. There are two simple rules:

- Never cache a pointer or reference to a JeodMemoryTypeDescriptor in long-term memory.
- Never cache a pointer or reference to a JeodMemoryTypeDescriptor obtained by calling the JeodMemoryTypeDescriptor's get_descriptor method.

Definition at line 507 of file memory_type.hh.

8.15.2 Constructor & Destructor Documentation

8.15.2.1 ∼JeodMemoryTypePreDescriptor()

```
virtual jeod::JeodMemoryTypePreDescriptor::∼JeodMemoryTypePreDescriptor ( )  [virtual], [default]
```

8.15.3 Member Function Documentation

8.15.3.1 get_descriptor()

```
virtual const JeodMemoryTypeDescriptor& jeod::JeodMemoryTypePreDescriptor::get_descriptor ( )
[pure virtual]
```

Get a type descriptor for the type.

The returned value should not be cached in a permanent store. The reference has a lifespan limited to that of the JeodMemoryTypePreDescriptor object.

Returns

Type descriptor.

Implemented in jeod::JeodMemoryTypePreDescriptorDerived< Type >.

Referenced by jeod::JeodMemoryManager::get_type_entry_atomic().

8.15.3.2 get_typeid()

```
virtual const std::type_info& jeod::JeodMemoryTypePreDescriptor::get_typeid ( ) const [pure
virtual]
```

Get the type info for the type.

Returns

Type info

Implemented in jeod::JeodMemoryTypePreDescriptorDerived< Type >.

Referenced by jeod::JeodMemoryManager::get_type_entry_atomic().

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

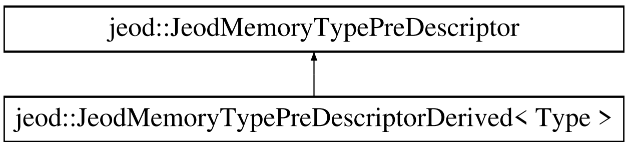
- memory_type.hh

8.16 jeod::JeodMemoryTypePreDescriptorDerived< Type > Class Template Reference

A JeodMemoryTypePreDescriptorDerived describes a *Type*.

`#include <memory_type.hh>`

Inheritance diagram for jeod::JeodMemoryTypePreDescriptorDerived< Type >:


jeod::JeodMemoryTypePreDescriptor
jeod::JeodMemoryTypePreDescriptorDerived< Type >

Public Types

- using TypeDescriptor = JeodMemoryTypeDescriptorDerived< Type >

  The type descriptor this class describes.

Public Member Functions

- JeodMemoryTypePreDescriptorDerived (bool exportable=true)

  Default constructor.
- JeodMemoryTypePreDescriptorDerived (const JeodMemoryTypePreDescriptorDerived &src)

  Copy constructor.
- ∼JeodMemoryTypePreDescriptorDerived () override

  Destructor.
- JeodMemoryTypePreDescriptor & get_ref ()

  Get a reference to this object.
- const std::type_info & get_typeid () const override

  Get the type info for the type.
- const JeodMemoryTypeDescriptor & get_descriptor () override

  Get a type descriptor for the type.

Private Attributes

- TypeDescriptor ∗ descriptor {}
- bool is_exportable {true}

8.16.1 Detailed Description

template<typename Type>
class jeod::JeodMemoryTypePreDescriptorDerived< Type >

A JeodMemoryTypePreDescriptorDerived describes a *Type*.

Definition at line 531 of file memory_type.hh.

8.16.2 Member Typedef Documentation

8.16.2.1 TypeDescriptor

```
template<typename Type >
using jeod::JeodMemoryTypePreDescriptorDerived< Type >::TypeDescriptor = JeodMemoryTypeDescriptorDerived<Type
```

The type descriptor this class describes.

Definition at line 539 of file memory_type.hh.

8.16.3 Constructor & Destructor Documentation

8.16.3.1 JeodMemoryTypePreDescriptorDerived() [1/2]

```
template<typename Type >
jeod::JeodMemoryTypePreDescriptorDerived< Type >::JeodMemoryTypePreDescriptorDerived (
            bool exportable = true )  [inline], [explicit]
```

Default constructor.

Definition at line 544 of file memory_type.hh.

8.16.3.2 JeodMemoryTypePreDescriptorDerived() [2/2]

```
template<typename Type >
jeod::JeodMemoryTypePreDescriptorDerived< Type >::JeodMemoryTypePreDescriptorDerived (
            const JeodMemoryTypePreDescriptorDerived< Type > & src )  [inline]
```

Copy constructor.

Definition at line 552 of file memory_type.hh.

References jeod::JeodMemoryTypePreDescriptorDerived< Type >::descriptor.

8.16.3.3 ∼JeodMemoryTypePreDescriptorDerived()

```
template<typename Type >
jeod::JeodMemoryTypePreDescriptorDerived< Type >::~JeodMemoryTypePreDescriptorDerived ( )
[inline], [override]
```

Destructor.

Definition at line 564 of file memory_type.hh.

References jeod::JeodMemoryTypePreDescriptorDerived< Type >::descriptor.

8.16.4 Member Function Documentation

8.16.4.1 get_descriptor()

```
template<typename Type >
const JeodMemoryTypeDescriptor& jeod::JeodMemoryTypePreDescriptorDerived< Type >::get_descriptor
( ) [inline], [override], [virtual]
```

Get a type descriptor for the type.

Note well: The referenced value has a lifespan limited to that of this object. The returned value must not be cached in a permanent store. Use new in conjunction with the copy constructor instead.

Returns

Type descriptor.

Implements jeod::JeodMemoryTypePreDescriptor.

Definition at line 606 of file memory_type.hh.

References jeod::JeodMemoryTypePreDescriptorDerived< Type >::descriptor, and jeod::JeodMemoryTypePre↩ DescriptorDerived< Type >::is_exportable.

8.16.4.2 get_ref()

```
template<typename Type >
JeodMemoryTypePreDescriptor& jeod::JeodMemoryTypePreDescriptorDerived< Type >::get_ref ( )
[inline]
```

Get a reference to this object.

This is an utter hack. Because the descriptor is created after the fact, a function that receives a JeodMemoryTypePreDescriptor must either take a copy or a non-const reference as input. A reference is preferred. The problem: Non-const references cannot be bound to rvalues. They can however be bound to other references, and hence this method.

Note well: The returned reference has a lifespan limited to that of this object. Use with great care. This is not intended for general consumption.

Returns

Reference to this object.

Definition at line 583 of file memory_type.hh.

8.16.4.3 get_typeid()

```
template<typename Type >
const std::type_info& jeod::JeodMemoryTypePreDescriptorDerived< Type >::get_typeid ( ) const
[inline], [override], [virtual]
```

Get the type info for the type.

Returns

Type info

Implements jeod::JeodMemoryTypePreDescriptor.

Definition at line 592 of file memory_type.hh.

8.16.5 Field Documentation

8.16.5.1 descriptor

```
template<typename Type >
TypeDescriptor* jeod::JeodMemoryTypePreDescriptorDerived< Type >::descriptor {} [private]
```

Definition at line 616 of file memory_type.hh.

Referenced by jeod::JeodMemoryTypePreDescriptorDerived< Type >::get_descriptor(), jeod::JeodMemory↩ TypePreDescriptorDerived< Type >::JeodMemoryTypePreDescriptorDerived(), and jeod::JeodMemoryTypePre↩ DescriptorDerived< Type >::∼JeodMemoryTypePreDescriptorDerived().

8.16.5.2 is_exportable

```
template<typename Type >
bool jeod::JeodMemoryTypePreDescriptorDerived< Type >::is_exportable {true} [private]
```

Definition at line 617 of file memory_type.hh.

Referenced by jeod::JeodMemoryTypePreDescriptorDerived< Type >::get_descriptor().

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

- memory_type.hh

8.17 jeod::JeodSimEngineAttributes< Type, is_class > Class Template Reference

Class template to construct a simulation engine attributes object that represents some type.

```
#include <memory_attributes_templates.hh>
```

Static Public Member Functions

- static struct ATTRIBUTES_tag attributes (bool)

  Construct a JEOD_ATTRIBUTES_TYPE that represents a primitive type.

8.17.1 Detailed Description

template<typename Type, bool is_class>
class jeod::JeodSimEngineAttributes< Type, is_class >

Class template to construct a simulation engine attributes object that represents some type.

All partial template instantiations of this template define a class with a single static function named attributes. This default implementation is for a primitive type. Subsequent partial instantiations will address other types.

Template Parameters

Type	The type for which an attributes is to be constructed.
is_class	True if the type is a class, false otherwise.

Definition at line 91 of file memory_attributes_templates.hh.

8.17.2 Member Function Documentation

8.17.2.1 attributes()

```
template<typename Type , bool is_class>
static struct ATTRIBUTES_tag jeod::JeodSimEngineAttributes< Type, is_class >::attributes (
             bool   )  [inline], [static]
```

Construct a JEOD_ATTRIBUTES_TYPE that represents a primitive type.

Returns

Constructed attributes object.

Definition at line 98 of file memory_attributes_templates.hh.

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

- memory_attributes_templates.hh

8.18 jeod::JeodSimEngineAttributes< Type *, false > Class Template Reference

Partial template instantiation of JeodSimEngineAttributes for a pointer type.

```
#include <memory_attributes_templates.hh>
```

Static Public Member Functions

- static struct ATTRIBUTES_tag attributes (bool is_exportable=true)

  Construct a JEOD_ATTRIBUTES_TYPE that represents a pointer type.

8.18.1 Detailed Description

template<typename Type>
class jeod::JeodSimEngineAttributes< Type *, false >

Partial template instantiation of JeodSimEngineAttributes for a pointer type.

Template Parameters

Type	The pointed-to type.

Definition at line 110 of file memory_attributes_templates.hh.

8.18.2 Member Function Documentation

8.18.2.1 attributes()

```
template<typename Type >
static struct ATTRIBUTES_tag jeod::JeodSimEngineAttributes< Type *, false >::attributes (
            bool is_exportable = true )  [inline], [static]
```

Construct a JEOD_ATTRIBUTES_TYPE that represents a pointer type.

Parameters

is_exportable	True => type is exportable.

Returns

Constructed attributes object.

Definition at line 118 of file memory_attributes_templates.hh.

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

- memory_attributes_templates.hh

8.19 jeod::JeodSimEngineAttributes< Type, true > Class Template Reference

Partial template instantiation of JeodSimEngineAttributes for a class.

```
#include <memory_attributes_templates.hh>
```

Static Public Member Functions

- static struct ATTRIBUTES_tag attributes (bool is_exportable=true)

  Construct a JEOD_ATTRIBUTES_TYPE that represents a structured type.

8.19.1 Detailed Description

template<typename Type>
class jeod::JeodSimEngineAttributes< Type, true >

Partial template instantiation of JeodSimEngineAttributes for a class.

Template Parameters

Type	The class.

Definition at line 148 of file memory_attributes_templates.hh.

8.19.2 Member Function Documentation

8.19.2.1 attributes()

```
template<typename Type >
static struct ATTRIBUTES_tag jeod::JeodSimEngineAttributes< Type, true >::attributes (
            bool is_exportable = true )  [inline], [static]
```

Construct a JEOD_ATTRIBUTES_TYPE that represents a structured type.

Parameters

is_exportable	True => type is exportable.

Returns

Constructed attributes object.

Definition at line 156 of file memory_attributes_templates.hh.

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

- memory_attributes_templates.hh

8.20 jeod::JeodSimEngineAttributes< void ∗, false > Class Template Reference

Template specialization of JeodSimEngineAttributes for void∗.

```
#include <memory_attributes_templates.hh>
```

Static Public Member Functions

- static struct ATTRIBUTES_tag attributes (bool)

  Construct a JEOD_ATTRIBUTES_TYPE that represents a void pointer.

8.20.1 Detailed Description

template<>
class jeod::JeodSimEngineAttributes< void ∗, false >

Template specialization of JeodSimEngineAttributes for void∗.

Definition at line 130 of file memory_attributes_templates.hh.

8.20.2 Member Function Documentation

8.20.2.1 attributes()

```
static struct ATTRIBUTES_tag jeod::JeodSimEngineAttributes< void *, false >::attributes (
            bool  )  [inline], [static]
```

Construct a JEOD_ATTRIBUTES_TYPE that represents a void pointer.

Returns

Constructed attributes object.

Definition at line 137 of file memory_attributes_templates.hh.

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

- memory_attributes_templates.hh

8.21 jeod::MemoryMessages Class Reference

Declares messages associated with the integration test model.

```
#include <memory_messages.hh>
```

Public Member Functions

- MemoryMessages ()=delete
- MemoryMessages (const MemoryMessages &)=delete
- MemoryMessages & operator= (const MemoryMessages &)=delete

Static Public Attributes

- static const char ∗ singleton_error = "utils/memory/" "singleton_error"

  Error issued when multiple instance of a class that should be a singleton are created or when no such instance exists (but should).
- static const char ∗ out_of_memory = "utils/memory/" "out_of_memory"

  Issued when malloc returns NULL.
- static const char ∗ lock_error = "utils/memory/" "lock_error"

  Issued when problems arise with in protection for atomic operations.
- static const char ∗ null_pointer = "utils/memory/" "null_pointer"

  Issued when the caller attempts to do something with a null pointer such as registering or freeing.
- static const char ∗ suspect_pointer = "utils/memory/" "suspect_pointer"

  Issued when the caller attempts to register memory that overlaps with previously recording allocations or attempts to destroy memory that was not previously registered.
- static const char ∗ invalid_size = "utils/memory/" "invalid_size"

  Issued when the caller attempts to allocate zero bytes.
- static const char ∗ corrupted_memory = "utils/memory/" "corrupted_memory"

  Issued when guard bytes have been overwritten.
- static const char ∗ registration_error = "utils/memory/" "registration_error"

  Issued when a model programmer messed up.
- static const char ∗ internal_error = "utils/memory/" "internal_error"

  Issued when the memory model programmer messed up.
- static const char ∗ debug = "utils/memory/" "debug"

  Used to identify debug output.

Friends

- class InputProcessor
- void init_attrjeod__MemoryMessages ()

8.21.1 Detailed Description

Declares messages associated with the integration test model.

Definition at line 85 of file memory_messages.hh.

8.21.2 Constructor & Destructor Documentation

8.21.2.1 MemoryMessages() [1/2]

```
jeod::MemoryMessages::MemoryMessages ( )  [delete]
```

8.21.2.2 MemoryMessages() [2/2]

```
jeod::MemoryMessages::MemoryMessages (
             const MemoryMessages &  )  [delete]
```

8.21.3 Member Function Documentation

8.21.3.1 operator=()

```
MemoryMessages& jeod::MemoryMessages::operator= (
             const MemoryMessages &  )  [delete]
```

8.21.4 Friends And Related Function Documentation

8.21.4.1 init_attrjeod__MemoryMessages

```
void init_attrjeod__MemoryMessages ( )  [friend]
```

8.21.4.2 InputProcessor

```
friend class InputProcessor  [friend]
```

Definition at line 87 of file memory_messages.hh.

8.21.5 Field Documentation

8.21.5.1 corrupted_memory

```
char const * jeod::MemoryMessages::corrupted_memory = "utils/memory/" "corrupted_memory"  [static]
```

Issued when guard bytes have been overwritten.

trick_units(–)

Definition at line 126 of file memory_messages.hh.

Referenced by jeod::JeodMemoryManager::add_allocation_atomic(), jeod::JeodMemoryManager::free_memory(), jeod::JeodMemoryManager::generate_shutdown_report(), and jeod::JeodMemoryManager::get_alloc_id_atomic().

8.21.5.2 debug

```
char const * jeod::MemoryMessages::debug = "utils/memory/" "debug"  [static]
```

Used to identify debug output.

trick_units(–)

Definition at line 141 of file memory_messages.hh.

Referenced by jeod::JeodMemoryManager::destroy_memory_internal(), jeod::JeodMemoryManager::generate↩_shutdown_report(), jeod::JeodMemoryManager::get_type_entry_atomic(), and jeod::JeodMemoryManager↩::register_memory_internal().

8.21.5.3 internal_error

```
char const * jeod::MemoryMessages::internal_error = "utils/memory/" "internal_error"  [static]
```

Issued when the memory model programmer messed up.

trick_units(–)

Definition at line 136 of file memory_messages.hh.

Referenced by jeod::JeodMemoryManager::get_string_atomic(), jeod::JeodMemoryManager::get_type_↩descriptor_atomic(), and jeod::JeodMemoryItem::set_unique_id().

8.21.5.4 invalid_size

```
char const * jeod::MemoryMessages::invalid_size = "utils/memory/" "invalid_size"  [static]
```

Issued when the caller attempts to allocate zero bytes.

trick_units(–)

Definition at line 121 of file memory_messages.hh.

Referenced by jeod::JeodMemoryManager::register_memory_internal().

8.21.5.5 lock_error

```
char const * jeod::MemoryMessages::lock_error = "utils/memory/" "lock_error"  [static]
```

Issued when problems arise with in protection for atomic operations.

trick_units(–)

Definition at line 103 of file memory_messages.hh.

Referenced by jeod::JeodMemoryManager::begin_atomic_block(), and jeod::JeodMemoryManager::end_atomic↩_block().

8.21.5.6 null_pointer

```
char const * jeod::MemoryMessages::null_pointer = "utils/memory/" "null_pointer"  [static]
```

Issued when the caller attempts to do something with a null pointer such as registering or freeing.

trick_units(–)

Definition at line 109 of file memory_messages.hh.

Referenced by jeod::JeodMemoryManager::deregister_container(), jeod::JeodMemoryManager::destroy_↩ memory_internal(), and jeod::JeodMemoryManager::register_container().

8.21.5.7 out_of_memory

```
char const * jeod::MemoryMessages::out_of_memory = "utils/memory/" "out_of_memory"  [static]
```

Issued when malloc returns NULL.

trick_units(–)

Definition at line 98 of file memory_messages.hh.

Referenced by jeod::JeodMemoryManager::allocate_memory().

8.21.5.8 registration_error

```
char const * jeod::MemoryMessages::registration_error = "utils/memory/" "registration_error"
[static]
```

Issued when a model programmer messed up.

trick_units(–)

Definition at line 131 of file memory_messages.hh.

8.21.5.9 singleton_error

```
char const * jeod::MemoryMessages::singleton_error = "utils/memory/" "singleton_error"  [static]
```

Error issued when multiple instance of a class that should be a singleton are created or when no such instance exists (but should).

trick_units(–)

Definition at line 93 of file memory_messages.hh.

Referenced by jeod::JeodMemoryManager::check_master(), and jeod::JeodMemoryManager::JeodMemory↩ Manager().

8.21.5.10 suspect_pointer

```
char const * jeod::MemoryMessages::suspect_pointer = "utils/memory/" "suspect_pointer"  [static]
```

Issued when the caller attempts to register memory that overlaps with previously recording allocations or attempts to destroy memory that was not previously registered.

trick_units(–)

Definition at line 116 of file memory_messages.hh.

Referenced by jeod::JeodMemoryManager::destroy_memory_internal(), jeod::JeodMemoryManager::find_alloc_↩ entry_atomic(), and jeod::JeodMemoryManager::restart_reallocate().

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

- memory_messages.hh
- memory_messages.cc

8.22 jeod::JeodMemoryManager::TypeEntry Struct Reference

The type table is indexed by an integer and contains type descriptors.

```
#include <memory_manager.hh>
```

Public Member Functions

- TypeEntry (uint32_t num, const JeodMemoryTypeDescriptor *desc)

  Pair constructor.

Data Fields

- uint32_t index

  Type table index number.
- const JeodMemoryTypeDescriptor * tdesc

  Type descriptor.

8.22.1 Detailed Description

The type table is indexed by an integer and contains type descriptors.

This class bundles the two together.

Definition at line 248 of file memory_manager.hh.

8.22.2 Constructor & Destructor Documentation

8.22.2.1 TypeEntry()

```
jeod::JeodMemoryManager::TypeEntry::TypeEntry (
            uint32_t num,
            const JeodMemoryTypeDescriptor * desc )  [inline]
```

Pair constructor.

Definition at line 263 of file memory_manager.hh.

8.22.3 Field Documentation

8.22.3.1 index

```
uint32_t jeod::JeodMemoryManager::TypeEntry::index
```

Type table index number.

trick_io(∗∗)

Definition at line 253 of file memory_manager.hh.

Referenced by jeod::JeodMemoryManager::register_memory_internal().

8.22.3.2 tdesc

```
const JeodMemoryTypeDescriptor* jeod::JeodMemoryManager::TypeEntry::tdesc
```

Type descriptor.

trick_io(∗∗)

Definition at line 258 of file memory_manager.hh.

Referenced by jeod::JeodMemoryManager::create_memory_internal(), jeod::JeodMemoryManager::get_type_↩
descriptor(), jeod::JeodMemoryManager::register_memory_internal(), and jeod::JeodMemoryManager::restart_↩
reallocate().

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

- memory_manager.hh

Chapter 9

File Documentation

9.1 class_declarations.hh File Reference

Forward declarations of classes defined in the utils/memory model.

Namespaces

- jeod

  Namespace jeod.

9.1.1 Detailed Description

Forward declarations of classes defined in the utils/memory model.

9.2 jeod_alloc.hh File Reference

Define JEOD memory allocation macros.

```
#include <cstddef>
#include <new>
#include "utils/sim_interface/include/memory_attributes.hh"
#include "jeod_alloc_get_allocated_pointer.hh"
#include "memory_manager.hh"
```

Macros

- #define JEOD_MEMORY_DEBUG 2

  Specifies the level of checking performed by the JEOD memory model.
- #define JEOD_ALLOC_OBJECT_FILL 0xdf

  Fill pattern for non-primitive types.
- #define JEOD_ALLOC_PRIMITIVE_FILL 0

  Fill pattern for primitive types.
- #define JEOD_ALLOC_POINTER_FILL 0

  Fill pattern for pointer types.
- #define JEOD_CREATE_MEMORY(is_array, nelem, fill, tentry) jeod::JeodMemoryManager::create_memory(is←_array, nelem, fill, tentry, __FILE__, __LINE__)

  Allocate and register memory to be populated via placement new.
- #define JEOD_ALLOC_ARRAY_INTERNAL(type, nelem, fill, tentry) new(JEOD_CREATE_MEMORY(true, nelem, fill, tentry)) type[nelem]

  Allocate nelem elements of pointers to the specified structured type.
- #define JEOD_ALLOC_OBJECT_INTERNAL(type, fill, constr, tentry) new(JEOD_CREATE_MEMORY(false, 1, fill, tentry)) type constr

  Allocate an instance of the specified class using the specified constructor arguments.
- #define JEOD_DELETE_INTERNAL(ptr, is_array)

  Free memory allocated with some JEOD_ALLOC macro.
- #define JEOD_REGISTER_CLASS(type) jeod::JeodMemoryManager::register_class(jeod::JeodMemoryTypePreDescriptorDer
_ref())

  Register the type type with the memory manager.
- #define JEOD_REGISTER_INCOMPLETE_CLASS(type) JEOD_REGISTER_CLASS(type)

  Register the incomplete class type with the memory manager.
- #define JEOD_REGISTER_NONEXPORTED_CLASS(type) jeod::JeodMemoryManager::register_class(jeod::JeodMemoryTyp
_ref())

  Register the type type with the memory manager, but with the class marked as not exportable to the simulation engine.
- #define JEOD_REGISTER_CHECKPOINTABLE(owner, elem_name)

  Register the data member elem_name of the owner as a Checkpointable object.
- #define JEOD_DEREGISTER_CHECKPOINTABLE(owner, elem_name)

  Register the data member elem_name of the owner as a Checkpointable object.
- #define JEOD_ALLOC_CLASS_MULTI_POINTER_ARRAY(nelem, type, asters) JEOD_ALLOC_ARRAY_INTERNAL(type asters, nelem, JEOD_ALLOC_POINTER_FILL, JEOD_REGISTER_CLASS(type asters))

  Allocate an array of nelem multi-level pointers to the specified type.
- #define JEOD_ALLOC_CLASS_POINTER_ARRAY(nelem, type) JEOD_ALLOC_CLASS_MULTI_POINTER_ARRAY(nelem, type, ∗)

  Allocate an array of nelem pointers to the specified type.
- #define JEOD_ALLOC_CLASS_ARRAY(nelem, type) JEOD_ALLOC_ARRAY_INTERNAL(type, nelem, JEOD_ALLOC_OBJECT_FILL, JEOD_REGISTER_CLASS(type))

  Allocate an array of nelem instances of the specified structured type.
- #define JEOD_ALLOC_PRIM_ARRAY(nelem, type) JEOD_ALLOC_ARRAY_INTERNAL(type, nelem, JEOD_ALLOC_PRIMITIVE_FILL, JEOD_REGISTER_CLASS(type))

  Allocate nelem elements of the specified primitive type.
- #define JEOD_ALLOC_CLASS_OBJECT(type, constr) JEOD_ALLOC_OBJECT_INTERNAL(type, JEOD_ALLOC_OBJECT_FILL, constr, JEOD_REGISTER_CLASS(type))

  *Allocate **one** instance of the specified class.*
- #define JEOD_ALLOC_PRIM_OBJECT(type, initial) JEOD_ALLOC_OBJECT_INTERNAL(type, JEOD_ALLOC_PRIMITIVE_FI
(initial), JEOD_REGISTER_CLASS(type))

  *Allocate **one** instance of the specified type.*
- #define JEOD_IS_ALLOCATED(ptr) jeod::JeodMemoryManager::is_allocated(jeod::jeod_alloc_get_allocated_pointer(ptr), __FILE__, __LINE__)

Determine if ptr was allocated by some `JEOD_ALLOC_xxx_ARRAY` macro.
- #define JEOD_DELETE_ARRAY(ptr) JEOD_DELETE_INTERNAL(ptr, true)

  Free memory at ptr that was earlier allocated with some `JEOD_ALLOC_xxx_ARRAY` macro.
- #define JEOD_DELETE_OBJECT(ptr) JEOD_DELETE_INTERNAL(ptr, false)

  Free memory at ptr that was earlier allocated with some `JEOD_ALLOC_xxx_OBJECT` macro.
- #define JEOD_DELETE_2D(ptr, size, is_array)

9.2.1 Detailed Description

Define JEOD memory allocation macros.

The jeod_alloc.hh memory macros can be viewed as

- Being externally-usable or for internal use only.
  The supported use of the JEOD memory model is via those macros advertised as externally-usable. These externally-usable macros expand into invocations of internal macros, which in turn expand into calls to methods of classes defined in the memory model. Those macros marked as internal are for internal use only by this file.
- Supporting allocation versus deletion.
  Some of the jeod_alloc.hh memory macros allocate memory while others delete it. With one exception, the allocation/delete nature of a macro is explicit in the macro name. Allocation macros start with JEOD_ALLOC. Macros that address deleting memory start with JEOD_DELETE.
- Operating on objects versus arrays.
  The memory management macros come in two basic forms: ARRAY and OBJECT. Memory allocated with an ARRAY allocator macro must be freed with JEOD_DELETE_ARRAY. Memory allocated with an OBJECT allocator macro must be freed with JEOD_DELETE_OBJECT. This corresponds to the C++ distiction between operator new[], delete[], new, and delete.
- Operating on structured versus non-structured data.
  The JEOD memory model registers allocated memory with the underlying simulation engine (e.g., Trick). To make the data in a structured type visible to the engine, the user must declare an external reference to the engine's description of the type. For example, to allocate an instance of some class Foo using the default constructor use

  ```
  JEOD_DECLARE_ATTRIBUTES (Foo)
  ...
   Foo * foo_obj = JEOD_ALLOC_CLASS (Foo, ());
  ```

  See JEOD_DECLARE_ATTRIBUTES.

Two compile -D options affect the behavior of these macros. These are

- JEOD_MEMORY_DEBUG - The memory model debugging level. The debugging level ranges from 0 (off) to 3 (all transactions). If this is not set in the compile flags the value is set to 0 (off).
- JEOD_MEMORY_GUARD - Guards will be added around allocated memory if this option is defined and has a non-zero value.

9.3 jeod_alloc_construct_destruct.hh File Reference

Define templates for use by jeod_alloc.hh.

```
#include "utils/sim_interface/include/jeod_class.hh"
#include <cstddef>
#include <cstring>
#include <type_traits>
```

Data Structures

- class jeod::JeodAllocHelperConstructDestruct< T, is_class, is_abstract >

  Class template that provides static functions construct and destruct that construct an array of objects.
- class jeod::JeodAllocHelperConstructDestruct< T, false, is_abstract >

  Partial instantiation for non-classes.
- class jeod::JeodAllocHelperConstructDestruct< T, true, false >

  Partial instantiation for non-abstract classes.

Namespaces

- jeod

  Namespace jeod.

Functions

- template<typename T >
  void ∗ jeod::jeod_alloc_construct_array (std::size_t nelem, void ∗addr)

  Construct an array of objects of type T.
- template<typename T >
  void jeod::jeod_alloc_destruct_array (std::size_t nelem, void ∗addr)

  Destruct an array of objects of type T.

9.3.1 Detailed Description

Define templates for use by jeod_alloc.hh.

These are isolated from jeod_alloc.hh because

- They are templates; everything in jeod_alloc.hh is a macro.
- Some of the templates might have wider interest than JEOD.
- Some of this stuff can go away with C++11.

The externally-usable items defined in this file are

- Function template jeod_alloc_construct_array, and
- Function template jeod_alloc_destruct_array.

9.4 jeod_alloc_get_allocated_pointer.hh File Reference

Define function template jeod_alloc_get_allocated_pointer.

```
#include <cstddef>
#include <cstring>
#include <type_traits>
```

Data Structures

- class jeod::JeodAllocHelperAllocatedPointer< T, is_poly >

  Class template that provides a static function cast that casts a pointer to an object of type T to a void∗ pointer.
- class jeod::JeodAllocHelperAllocatedPointer< T, true >

  Partial instantiation of JeodAllocHelperAllocatedPointer for polymorphic classes.

Namespaces

- jeod

  Namespace jeod.

Functions

- template<typename T >
  void ∗ jeod::jeod_alloc_get_allocated_pointer (T ∗pointer)

  Cast a pointer to some object to a pointer to void∗ such that a pointer to a polymorphic object, downcast to a base class pointer, becomes a pointer to the original object, but also such that a pointer to an instance of a non-polymorphic class or a pointer to a non-class type is handled correctly.

9.4.1 Detailed Description

Define function template jeod_alloc_get_allocated_pointer.

9.5 memory_attributes_templates.hh File Reference

Define the class template JeodSimEngineAttributes.

```
#include "utils/sim_interface/include/memory_attributes.hh"
#include "utils/sim_interface/include/memory_interface.hh"
#include "utils/sim_interface/include/simulation_interface.hh"
#include <type_traits>
#include <typeinfo>
```

Data Structures

- class jeod::JeodSimEngineAttributes< Type, is_class >

  Class template to construct a simulation engine attributes object that represents some type.
- class jeod::JeodSimEngineAttributes< Type ∗, false >

  Partial template instantiation of JeodSimEngineAttributes for a pointer type.
- class jeod::JeodSimEngineAttributes< void ∗, false >

  Template specialization of JeodSimEngineAttributes for void∗.
- class jeod::JeodSimEngineAttributes< Type, true >

  Partial template instantiation of JeodSimEngineAttributes for a class.

Namespaces

- jeod

  Namespace jeod.

9.5.1 Detailed Description

Define the class template JeodSimEngineAttributes.

9.6 memory_item.cc File Reference

Implement the JeodMemoryItem class.

```
#include "utils/message/include/message_handler.hh"
#include "../include/memory_item.hh"
#include "../include/memory_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.6.1 Detailed Description

Implement the JeodMemoryItem class.

9.7 memory_item.hh File Reference

Define the class JeodMemoryItem.

```
#include <cstdint>
#include "utils/sim_interface/include/jeod_class.hh"
```

Data Structures

- class jeod::JeodMemoryItem

  A JeodMemoryItem contains metadata about some chunk of allocated memory.

Namespaces

- jeod

  Namespace jeod.

9.7.1 Detailed Description

Define the class JeodMemoryItem.

9.8 memory_manager.cc File Reference

Implement the JeodMemoryManager class.

```
#include <cstddef>
#include <cstdint>
#include <cstdlib>
#include <iomanip>
#include <iostream>
#include <map>
#include <pthread.h>
#include <sstream>
#include <typeinfo>
#include "utils/message/include/message_handler.hh"
#include "../include/memory_item.hh"
#include "../include/memory_manager.hh"
#include "../include/memory_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

Macros

- #define MAGIC0 0x2203992c
- #define MAGIC1 0x6c052d84
- #define MAKE_DESCRIPTOR(type)

9.8.1 Detailed Description

Implement the JeodMemoryManager class.

9.8.2 Macro Definition Documentation

9.8.2.1 MAKE_DESCRIPTOR

```
#define MAKE_DESCRIPTOR(
            type )
```

Value:

```
do            \
    {               \
        JeodMemoryTypeDescriptorDerived<type> tdesc;
                \
        type_table.add(tdesc.get_typeid().name(), tdesc);
                \
    } while(0)
```

Referenced by jeod::JeodMemoryManager::JeodMemoryManager().

9.9 memory_manager.hh File Reference

Define the JeodMemoryManager class, the central agent of the memory model.

```
#include <cstddef>
#include <list>
#include <map>
#include <ostream>
#include <pthread.h>
#include <string>
#include <typeinfo>
#include "utils/container/include/checkpointable.hh"
#include "utils/sim_interface/include/config.hh"
#include "utils/sim_interface/include/jeod_class.hh"
#include "utils/sim_interface/include/memory_interface.hh"
#include "utils/sim_interface/include/simulation_interface.hh"
#include "memory_item.hh"
#include "memory_table.hh"
#include "memory_type.hh"
```

Data Structures

- class jeod::JeodMemoryManager

  This class provides the interface between the macros in jeod_alloc.hh and the rest of the JEOD memory model.
- struct jeod::JeodMemoryManager::TypeEntry

  The type table is indexed by an integer and contains type descriptors.

Namespaces

- jeod

  Namespace jeod.

9.9.1 Detailed Description

Define the JeodMemoryManager class, the central agent of the memory model.

9.10 memory_manager_hide_from_trick.hh File Reference

Trick doesn't understand these.

```
#include "memory_item.hh"
#include "memory_table.hh"
#include "memory_type.hh"
#include <map>
```

Namespaces

- jeod

  Namespace jeod.

Typedefs

- using jeod::AllocTable = std::map< const void $*$, JeodMemoryItem >

  An AllocTable maps memory addresses to memory descriptions.
- using jeod::TypeTable = JeodMemoryTableClonable< JeodMemoryTypeDescriptor >

  The type type itself is a memory table with copy implemented by clone().

9.10.1 Detailed Description

Trick doesn't understand these.

This file is included from the private part of memory_manager.hh. The types are private and the corresponding members hidden from Trick. These will be folded into memory_manager.hh when Trick ICG, both Trick 7 and Trick 10, understands these or provides a common mechanism for telling ICG to ignore content.

9.11 memory_manager_protected.cc File Reference

Implement those JeodMemoryManager member functions that access data members that need to be treated with care to make the memory manager thread safe.

```
#include <cstddef>
#include <cstdint>
#include <cstdlib>
#include <iomanip>
#include <iostream>
#include <map>
#include <pthread.h>
#include <sstream>
#include <typeinfo>
#include "utils/message/include/message_handler.hh"
#include "../include/memory_item.hh"
#include "../include/memory_manager.hh"
#include "../include/memory_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

Macros

- #define __STDC_LIMIT_MACROS

9.11.1 Detailed Description

Implement those JeodMemoryManager member functions that access data members that need to be treated with care to make the memory manager thread safe.

9.12 memory_manager_static.cc File Reference

Implement the static methods of the JeodMemoryManager class.

```
#include <string>
#include "utils/message/include/message_handler.hh"
#include "utils/named_item/include/named_item.hh"
#include "../include/memory_manager.hh"
#include "../include/memory_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

9.12.1 Detailed Description

Implement the static methods of the JeodMemoryManager class.

9.13 memory_messages.cc File Reference

Implement the class MemoryMessages.

```
#include "utils/message/include/make_message_code.hh"
#include "../include/memory_messages.hh"
```

Namespaces

- jeod

  Namespace jeod.

Macros

- #define MAKE_MEMORY_MESSAGE_CODE(id) JEOD_MAKE_MESSAGE_CODE(MemoryMessages, "utils/memory/", id)

9.13.1 Detailed Description

Implement the class MemoryMessages.

9.14 memory_messages.hh File Reference

Define the class MemoryMessages, the class that specifies the message IDs used in the memory model.

```
#include "utils/sim_interface/include/jeod_class.hh"
```

Data Structures

- class jeod::MemoryMessages

  Declares messages associated with the integration test model.

Namespaces

- jeod

  Namespace jeod.

9.14.1 Detailed Description

Define the class MemoryMessages, the class that specifies the message IDs used in the memory model.

9.15 memory_table.hh File Reference

Define classes for representing data types.

```
#include "utils/sim_interface/include/jeod_class.hh"
#include <cstddef>
#include <map>
#include <stdexcept>
#include <string>
#include <vector>
```

Data Structures

- class jeod::JeodMemoryTable< ValueType >

    A JeodMemoryTable maps strings to values with a coordinated map/vector pair.
- class jeod::JeodMemoryTableClonable< ValueType >

    A JeodMemoryTableClonable is a JeodMemoryTable that implements the required clone() functionality by invoking the ValueType's clone() method to create a clone of the input value.
- class jeod::JeodMemoryTableCopyable< ValueType >

    A JeodMemoryTableCopyable is a JeodMemoryTable that implements the required clone() functionality by invoking the ValueType's copy constructor to create a clone of the input value.
- class jeod::JeodMemoryReflectiveTable

    A JeodMemoryReflectiveTable maps strings to themselves.

Namespaces

- jeod

    Namespace jeod.

9.15.1 Detailed Description

Define classes for representing data types.

9.16 memory_type.cc File Reference

Implement destructors for the classes for representing data types.

```
#include <cstddef>
#include <sstream>
#include <string>
#include "utils/named_item/include/named_item.hh"
#include "utils/sim_interface/include/simulation_interface.hh"
#include "../include/memory_item.hh"
#include "../include/memory_manager.hh"
#include "../include/memory_type.hh"
```

Namespaces

- jeod

    Namespace jeod.

9.16.1 Detailed Description

Implement destructors for the classes for representing data types.

9.17 memory_type.hh File Reference

Define the abstract class JeodMemoryTypeDescriptor and templates that create instantiable classes that derive from JeodMemoryTypeDescriptor.

```
#include "jeod_alloc_construct_destruct.hh"
#include "jeod_alloc_get_allocated_pointer.hh"
#include "memory_attributes_templates.hh"
#include "memory_item.hh"
#include "memory_messages.hh"
#include "utils/message/include/message_handler.hh"
#include "utils/sim_interface/include/jeod_class.hh"
#include "utils/sim_interface/include/memory_attributes.hh"
#include <cstddef>
#include <cstring>
#include <new>
#include <string>
#include <type_traits>
#include <typeinfo>
```

Data Structures

- class jeod::JeodMemoryTypeDescriptor

  Abstract class for managing data allocated as some specific type.
- struct jeod::JeodMemoryTypeDescriptor::attr

  The simulation engine attributes that describe the type.trick_io(**)
- class jeod::JeodMemoryTypeDescriptorDerived< Type >

  Extends JeodMemoryTypeDescriptor to describe a specific type.
- class jeod::JeodMemoryTypePreDescriptor

  Abstract class for describing a type without necessarily needing to create a JeodMemoryTypeDescriptor of that type.
- class jeod::JeodMemoryTypePreDescriptorDerived< Type >

  A JeodMemoryTypePreDescriptorDerived describes a Type.

Namespaces

- jeod

  Namespace jeod.

9.17.1 Detailed Description

Define the abstract class JeodMemoryTypeDescriptor and templates that create instantiable classes that derive from JeodMemoryTypeDescriptor.

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