OVM Class Reference

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OVM Class Reference

The OVM Class Library provides the building blocks needed to quickly develop well-constructed and reusable verification components and test environments in SystemVerilog.

This OVM Class Reference Guide provides detailed reference information for each user-visible class in the OVM library. For additional information on using OVM, see the OVM User Guide located in the top level directory within the OVM kit.

We divide the OVM classes and utilities into categories pertaining to their role or function. A more detailed overview of each category-- and the classes comprising them-- can be found in the menu at left.

Base	This basic building blocks for all environments are components, which do the actual work, transactions, which convey information between components, and ports, which provide the interfaces used to convey transactions. The OVM's core *base* classes provide these building blocks. See Core Base Classes for more information.
Reporting	The *reporting* classes provide a facility for issuing reports (messages) with consistent formatting and configurable side effects, such as logging to a file or exiting simulation. Users can also filter out reports based on their verbosity , unique ID, or severity. See Reporting Classes for more information.
Factory	As the name implies, the OVM factory is used to manufacture (create) OVM objects and components. Users can configure the factory to produce an object of a given type on a global or instance basis. Use of the factory allows dynamically configurable component hierarchies and object substitutions without having to modify their code and without breaking encapsulation. See Factory Classes for details.
Sychronization	The OVM provides event and barrier synchronization classes for process synchronization. See Synchronization Classes for more information.
Policies	Each of OVM's policy classes perform a specific task for ovm_object-based objects: printing, comparing, recording, packing, and unpacking. They are implemented separately from ovm_object so that users can plug in different ways to print, compare, etc. without modifying the object class being operated on. The user can simply apply a different printer or compare "policy" to change how an object is printed or compared. See Policy Classes for more information.
TLM	The OVM TLM library defines several abstract, transaction-level interfaces and the ports and exports that facilitate their use. Each TLM interface consists of one or more methods used to transport data, typically whole transactions (objects) at a time. Component designs that use TLM ports and exports to communicate are inherently more reusable, interoperable, and modular. See TLM Interfaces, Ports, and Exports for details.
Components	Components form the foundation of the OVM. They encapsulate behavior of drivers, scoreboards, and other objects in a testbench. The OVM library provides a set of predefined component types, all derived directly or indirectly from ovm_component. See Predefined Component Classes for more information.

Sequencers — The sequencer serves as an arbiter for controlling transaction flow from multiple stimulus generators. More specifically, the sequencer controls the flow of ovm_sequence_item-based transactions generated by one or more ovm_sequence #(REQ,RSP)-based sequences. See Sequencer Classes for more information.

Sequences — Sequences encapsulate user-defined procedures that generate multiple ovm_sequence_item-based transactions. Such sequences can be reused, extended, randomized, and combined sequentially and hierarchically in interesting ways to produce realistic stimulus to your DUT. See Sequence Classes for more information.

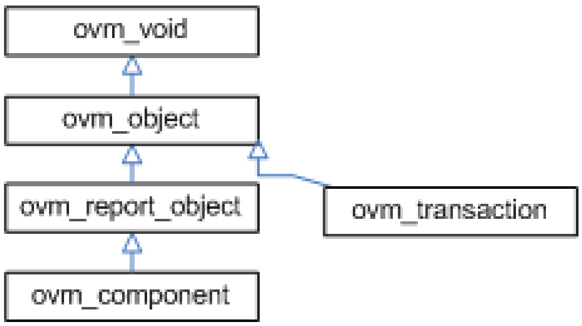
Macros — The OVM provides several macros to help increase user productivity. See <Utility and Field Macros> and Sequence and Do Action Macros for a complete list.

Globals — This category defines a small list of types, variables, functions, and tasks defined in *ovm_pkg* scope. These items are accessible from any scope that imports the *ovm_pkg*. See Types and Enumerations and Globals for details.

Core Base Classes

The OVM library defines a set of base classes and utilities that facilitate the design of modular, scalable, reusable verification environments.

The basic building blocks for all environments are components and the transactions they use to communicate. The OVM provides base classes for these, as shown below.



- ovm_object - All components and transactions derive from *ovm_object*, which defines an interface of core class-based operations: create, copy, compare, print, sprint, record, etc. It also defines interfaces for instance identification (name, type name, unique id, etc.) and random seeding.
- ovm_component - The *ovm_component* class is the root base class for all OVM components. Components are quasi-static objects that exist throughout simulation. This allows them to establish structural hierarchy much like *modules* and *program blocks*. Every component is uniquely addressable via a hierarchical path name, e.g. "env1.pci1.master3.driver". The *ovm_component* also defines a phased test flow that components follow during the course of simulation. Each phase-- *build*, *connect*, *run*, etc.-- is defined by a callback that is executed in precise order. Finally, the *ovm_component* also defines configuration, reporting, transaction recording, and factory interfaces.
- ovm_transaction - The *ovm_transaction* is the root base class for OVM transactions, which, unlike *ovm_components*, are transient in nature. It extends ovm_object to include a timing and recording interface. Simple transactions can derive directly from *ovm_transaction*, while sequence-enabled transactions derive from *ovm_sequence_item*.
- ovm_root - The *ovm_root* class is special *ovm_component* that serves as the top-level component for all OVM components, provides phasing control for all OVM components, and other global services.

ovm_void

The *ovm_void* class is the base class for all OVM classes. It is an abstract class with no data members or functions. It allows for generic containers of objects to be created, similar to a void pointer in the C programming language. User classes derived directly from *ovm_void* inherit none of the OVM functionality, but such classes may be placed in *ovm_void*-typed containers along with other OVM objects.

ovm_object

The ovm_object class is the base class for all OVM data and hierarchical classes. Its primary role is to define a set of methods for such common operations as create, copy, compare, print, and record. Classes deriving from ovm_object must implement the pure virtual methods such as create and get_type_name.

Summary

ovm_object

The ovm_object class is the base class for all OVM data and hierarchical classes.

Class Declaration

```
virtual class ovm_object extends ovm_void
```

new	Creates a new ovm_object with the given instance *name*.
Seeding	
use_ovm_seeding	This bit enables or disables the OVM seeding mechanism.
reseed	Calls *srandom* on the object to reseed the object using the OVM seeding mechanism, which sets the seed based on type name and instance name instead of based on instance position in a thread.
Identification	
set_name	Sets the instance name of this object, overwriting any previously given name.
get_name	Returns the name of the object, as provided by the *name* argument in the new constructor or set_name method.
get_full_name	Returns the full hierarchical name of this object.
get_inst_id	Returns the object's unique, numeric instance identifier.
get_inst_count	Returns the current value of the instance counter, which represents the total number of ovm_object-based objects that have been allocated in simulation.
get_type	Returns the type-proxy (wrapper) for this object.
get_object_type	Returns the type-proxy (wrapper) for this object.
get_type_name	This function returns the type name of the object, which is typically the type identifier enclosed in quotes.
Creation	
create	The create method allocates a new object of the same type as this object and returns it via a base ovm_object handle.
clone	The clone method creates and returns an exact copy of this object.
Printing	
print	The print method deep-prints this object's properties in a format and manner governed by the given *printer* argument; if the *printer* argument is not provided, the global ovm_default_printer is used.
sprint	The *sprint* method works just like the print method, except the output is returned in a string rather than displayed.

do_print	The *do_print* method is the user-definable hook called by print and sprint that allows users to customize what gets printed or sprinted beyond the field information provided by the <`ovm_field_*> macros.
convert2string	This virtual function is a user-definable hook, called directly by the user, that allows users to provide object information in the form of a string.
Fields declared in <`ovm_field_*> macros, if used, will not	automatically appear in calls to convert2string.
Recording	
record	The record method deep-records this object's properties according to an optional *recorder* policy.
do_record	The do_record method is the user-definable hook called by the record method.
Copying	
copy	The copy method returns a deep copy of this object.
do_copy	The do_copy method is the user-definable hook called by the copy method.
Comparing	
compare	The compare method deep compares this data object with the object provided in the *rhs* (right-hand side) argument.
do_compare	The do_compare method is the user-definable hook called by the compare method.
Packing	
pack	
pack_bytes	
pack_ints	The pack methods bitwise-concatenate this object's properties into an array of bits, bytes, or ints.
do_pack	The do_pack method is the user-definable hook called by the pack methods.
Unpacking	
unpack	
unpack_bytes	
unpack_ints	The unpack methods extract property values from an array of bits, bytes, or ints.
do_unpack	The do_unpack method is the user-definable hook called by the unpack method.
Configuration	
set_int_local	
set_string_local	
set_object_local	These methods provide write access to integral, string, and ovm_object-based properties indexed by a *field_name* string.

new

```
function new (string name = ""                                    )
```

Creates a new ovm_object with the given instance *name*. If *name* is not supplied, the object is unnamed.

Seeding

use_ovm_seeding

```
static bit use_ovm_seeding = 1
```

This bit enables or disables the OVM seeding mechanism. It globally affects the operation of the reseed method.

When enabled, OVM-based objects are seeded based on their type and full hierarchical name rather than allocation order. This improves random stability for objects whose instance names are unique across each type. The ovm_component class is an example of a type that has a unique instance name.

reseed

```
function void reseed ()
```

Calls *srandom* on the object to reseed the object using the OVM seeding mechanism, which sets the seed based on type name and instance name instead of based on instance position in a thread.

If the use_ovm_seeding static variable is set to 0, then reseed() does not perform any function.

Identification

set_name

```
virtual function void set_name (string name)
```

Sets the instance name of this object, overwriting any previously given name.

get_name

```
virtual function string get_name ()
```

Returns the name of the object, as provided by the *name* argument in the new constructor or set_name method.

get_full_name

```
virtual function string get_full_name ()
```

Returns the full hierarchical name of this object. The default implementation is the same as get_name, as ovm_objects do not inherently possess hierarchy.

Objects possessing hierarchy, such as ovm_components, override the default implementation. Other objects might be associated with component hierarchy but are not themselves components. For example, ovm_sequence #(REQ,RSP) classes are typically associated with a ovm_sequencer #(REQ,RSP). In this case, it is useful to override get_full_name to return the sequencer's full name concatenated with the sequence's name. This provides the sequence a full context, which is useful when debugging.

get_inst_id

```
virtual function int get_inst_id ()
```

Returns the object's unique, numeric instance identifier.

get_inst_count

```
static function int get_inst_count()
```

Returns the current value of the instance counter, which represents the total number of ovm_object-based objects that have been allocated in simulation. The instance counter is used to form a unique numeric instance identifier.

get_type

```
static function ovm_object_wrapper get_type ()
```

Returns the type-proxy (wrapper) for this object. The ovm_factory's type-based override and creation methods take arguments of ovm_object_wrapper. This method, if implemented, can be used as convenient means of supplying those arguments.

The default implementation of this method produces an error and returns null. To enable use of this method, a user's subtype must implement a version that returns the subtype's wrapper.

For example

```
class cmd extends ovm_object;
  typedef ovm_object_registry #(cmd) type_id;
  static function type_id get_type();
    return type_id::get();
  endfunction
endclass
```

Then, to use

```
factory.set_type_override(cmd::get_type(),subcmd::get_type());
```

This function is implemented by the `ovm_*_utils macros, if employed.

get_object_type

`virtual function ovm_object_wrapper get_object_type ()`

Returns the type-proxy (wrapper) for this object. The ovm_factory's type-based override and creation methods take arguments of ovm_object_wrapper. This method, if implemented, can be used as convenient means of supplying those arguments. This method is the same as the static get_type method, but uses an already allocated object to determine the type-proxy to access (instead of using the static object.

The default implementation of this method does a factory lookup of the proxy using the return value from get_type_name. If the type returned by get_type_name is not registered with the factory, then a null handle is returned.

For example

```
class cmd extends ovm_object;
  typedef ovm_object_registry #(cmd) type_id;
  static function type_id get_type();
    return type_id::get();
  endfunction
  virtual function type_id get_object_type();
    return type_id::get();
  endfunction
endclass
```

This function is implemented by the `ovm_*_utils macros, if employed.

get_type_name

`virtual function string get_type_name ()`

This function returns the type name of the object, which is typically the type identifier enclosed in quotes. It is used for various debugging functions in the library, and it is used by the factory for creating objects.

This function must be defined in every derived class.

A typical implementation is as follows

```
class mytype extends ovm_object;
  ...
  const static string type_name = "mytype";

  virtual function string get_type_name();
    return type_name;
  endfunction
```

We define the <type_name> static variable to enable access to the type name without need of an object of the class, i.e., to enable access via the scope operator, *mytype::type_name*.

Creation

create

`virtual function ovm_object create (string name = "" )`

The create method allocates a new object of the same type as this object and returns it via a base ovm_object handle. Every class deriving from ovm_object, directly or indirectly, must implement the create method.

A typical implementation is as follows

```
class mytype extends ovm_object;
  ...
  virtual function ovm_object create(string name="");
    mytype t = new(name);
    return t;
```

```
endfunction
```

clone

```
virtual function ovm_object clone ()
```

The clone method creates and returns an exact copy of this object.

The default implementation calls create followed by copy. As clone is virtual, derived classes may override this implementation if desired.

Printing

print

```
function void print (ovm_printer printer = null )
```

The print method deep-prints this object's properties in a format and manner governed by the given *printer* argument; if the *printer* argument is not provided, the global ovm_default_printer is used. See ovm_printer for more information on printer output formatting. See also ovm_line_printer, ovm_tree_printer, and ovm_table_printer for details on the pre-defined printer "policies," or formatters, provided by the OVM.

The *print* method is not virtual and must not be overloaded. To include custom information in the *print* and *sprint* operations, derived classes must override the do_print method and use the provided printer policy class to format the output.

sprint

```
function string sprint (ovm_printer printer = null )
```

The *sprint* method works just like the print method, except the output is returned in a string rather than displayed.

The *sprint* method is not virtual and must not be overloaded. To include additional fields in the *print* and *sprint* operation, derived classes must override the do_print method and use the provided printer policy class to format the output. The printer policy will manage all string concatenations and provide the string to *sprint* to return to the caller.

do_print

```
virtual function void do_print (ovm_printer printer)
```

The *do_print* method is the user-definable hook called by print and sprint that allows users to customize what gets printed or sprinted beyond the field information provided by the <`ovm_field_*> macros.

The *printer* argument is the policy object that governs the format and content of the output. To ensure correct print and sprint operation, and to ensure a consistent output format, the *printer* must be used by all do_print implementations. That is, instead of using $display or string concatenations directly, a *do_print* implementation must call through the *printer's* API to add information to be printed or sprinted.

An example implementation of *do_print* is as follows

```
class mytype extends ovm_object;
  data_obj data;
  int f1;
  virtual function void do_print (ovm_printer printer);
    super.do_print(printer);
    printer.print_field("f1", f1, $bits(f1), DEC);
    printer.print_object("data", data);
  endfunction
```

Then, to print and sprint the object, you could write

```
mytype t = new;
t.print();
ovm_report_info("Received",t.sprint());
```

See ovm_printer for information about the printer API.

convert2string

This virtual function is a user-definable hook, called directly by the user, that allows users to provide object information in the form of a string. Unlike sprint, there is no requirement to use an ovm_printer policy object. As such, the format and content of the output is fully customizable, which may be suitable for applications not requiring the consistent formatting offered by the print/sprint/do_print API.

Fields declared in <`ovm_field_*> macros, if used, will not

automatically appear in calls to convert2string.

An example implementation of convert2string follows.

```
class base extends ovm_object;
  string field = "foo";
  virtual function string convert2string();
    convert2string = {"base_field=",field};
  endfunction
endclass

class obj2 extends ovm_object;
  string field = "bar";
  virtual function string convert2string();
    convert2string = {"child_field=",field};
  endfunction
endclass

class obj extends base;
  int addr = 'h123;
  int data = 'h456;
  bit write = 1;
  obj2 child = new;
  virtual function string convert2string();
     convert2string = {super.convert2string(),
       $psprintf(" write=%0d addr=%8h data=%8h ",write,addr,data),
       child.convert2string()};
  endfunction
endclass
```

Then, to display an object, you could write

```
obj o = new;
ovm_report_info("BusMaster",{"Sending:\n ",o.convert2string()});
```

The output will look similar to

```
OVM_INFO @ 0: reporter [BusMaster] Sending:
   base_field=foo write=1 addr=00000123 data=00000456 child_field=bar
```

Recording

record

```
function void record (ovm_recorder recorder = null )
```

The record method deep-records this object's properties according to an optional *recorder* policy. The method is not virtual and must not be overloaded. To include additional fields in the record operation, derived classes should override the do_record method.

The optional *recorder* argument specifies the recording policy, which governs how recording takes place. If a recorder policy is not provided explicitly, then the global ovm_default_recorder policy is used. See ovm_recorder for information.

A simulator's recording mechanism is vendor-specific. By providing access via a common interface, the ovm_recorder policy provides vendor-independent access to a simulator's recording capabilities.

do_record

```
virtual function void do_record (ovm_recorder recorder)
```

The do_record method is the user-definable hook called by the record method. A derived class should override this method to include its fields in a record operation.

The *recorder* argument is policy object for recording this object. A do_record implementation should call the appropriate recorder methods for each of its fields. Vendor-specific recording implementations are encapsulated in the *recorder* policy, thereby insulating user-code from vendor-specific behavior. See ovm_recorder for more information.

A typical implementation is as follows

```
class mytype extends ovm_object;
  data_obj data;
  int f1;
  function void do_record (ovm_recorder recorder);
    recorder.record_field_int("f1", f1, $bits(f1), DEC);
    recorder.record_object("data", data);
  endfunction
```

Copying

copy

```
function void copy (ovm_object rhs)
```

The copy method returns a deep copy of this object.

The copy method is not virtual and should not be overloaded in derived classes. To copy the fields of a derived class, that class should override the do_copy method.

do_copy

```
virtual function void do_copy (ovm_object rhs)
```

The do_copy method is the user-definable hook called by the copy method. A derived class should override this method to include its fields in a copy operation.

A typical implementation is as follows

```
class mytype extends ovm_object;
  ...
  int f1;
  function void do_copy (ovm_object rhs);
    mytype rhs_;
    super.do_copy(rhs);
    $cast(rhs_,rhs);
    field_1 = rhs_.field_1;
  endfunction
```

The implementation must call *super.do_copy*, and it must $cast the rhs argument to the derived type before copying.

Comparing

compare

```
function bit compare (ovm_object   rhs,
                      ovm_comparer comparer = null              )
```

The compare method deep compares this data object with the object provided in the *rhs* (right-hand side) argument.

The compare method is not virtual and should not be overloaded in derived classes. To compare the fields of a derived class, that class should override the do_compare method.

The optional *comparer* argument specifies the comparison policy. It allows you to control some aspects of the comparison operation. It also stores the results of the comparison, such as field-by-field miscompare information and the total number of miscompares. If a compare policy is not provided, then the global *ovm_default_comparer* policy is used. See ovm_comparer for more information.

do_compare

```
virtual function bit do_compare (ovm_object   rhs,
                                 ovm_comparer comparer)
```

The do_compare method is the user-definable hook called by the compare method. A derived class should override this method to include its fields in a compare operation.

A typical implementation is as follows

```
class mytype extends ovm_object;
  ...
  int f1;
  virtual function bit do_compare (ovm_object rhs,ovm_comparer comparer);
    mytype rhs_;
    do_compare = super.do_compare(rhs,comparer);
    $cast(rhs_,rhs);
    do_compare &= comparer.compare_field_int("f1", f1, rhs_.f1);
  endfunction
```

A derived class implementation must call super.do_compare to ensure its base class' properties, if any, are included in the comparison. Also, the rhs argument is provided as a generic ovm_object. Thus, you must $cast it to the type of this object before comparing.

The actual comparison should be implemented using the ovm_comparer object rather than direct field-by-field comparison. This enables users of your class to customize how comparisons are performed and how much miscompare information is collected. See ovm_comparer for more details.

Packing

pack

```
function int pack (  ref bit          bitstream[],
                   input ovm_packer packer       = null          )
```

pack_bytes

```
function int pack_bytes (ref byte unsigned   bytestream[],
                            input ovm_packer packer        = null       )
```

pack_ints

```
function int pack_ints (ref int unsigned   intstream[],
                           input ovm_packer packer       = null         )
```

The pack methods bitwise-concatenate this object's properties into an array of bits, bytes, or ints. The methods are not virtual and must not be overloaded. To include additional fields in the pack operation, derived classes should override the do_pack method.

The optional *packer* argument specifies the packing policy, which governs the packing operation. If a packer policy is not provided, the global ovm_default_packer policy is used. See ovm_packer for more information.

The return value is the total number of bits packed into the given array. Use the array's built-in *size* method to get the number of bytes or ints consumed during the packing process.

do_pack

```
virtual function void do_pack (ovm_packer packer)
```

The do_pack method is the user-definable hook called by the pack methods. A derived class should override this method to include its fields in a pack operation.

The *packer* argument is the policy object for packing. The policy object should be used to pack objects.

A typical example of an object packing itself is as follows

```
class mysubtype extends mysupertype;
  ...
  shortint myshort;
  obj_type myobj;
  byte myarray[];
  ...
  function void do_pack (ovm_packer packer);
    super.do_pack(packer); // pack mysupertype properties
    packer.pack_field_int(myarray.size(), 32);
    foreach (myarray)
      packer.pack_field_int(myarray[index], 8);
    packer.pack_field_int(myshort, $bits(myshort));
    packer.pack_object(myobj);
```

```
endfunction
```

The implementation must call *super.do_pack* so that base class properties are packed as well.

If your object contains dynamic data (object, string, queue, dynamic array, or associative array), and you intend to unpack into an equivalent data structure when unpacking, you must include meta-information about the dynamic data when packing as follows.

- For queues, dynamic arrays, or associative arrays, pack the number of elements in the array in the 32 bits immediately before packing individual elements, as shown above.
- For string data types, append a zero byte after packing the string contents.
- For objects, pack 4 bits immediately before packing the object. For null objects, pack 4'b0000. For non-null objects, pack 4'b0001.

When the `ovm_*_field macros are used, the above meta information is included provided the ovm_packer's <use_metadata> variable is set.

Packing order does not need to match declaration order. However, unpacking order must match packing order.

Unpacking

unpack

```
function int unpack (  ref bit         bitstream[],
                     input ovm_packer packer       = null              )
```

unpack_bytes

```
function int unpack_bytes (ref byte unsigned   bytestream[],
                               input ovm_packer packer        = null      )
```

unpack_ints

```
function int unpack_ints (ref int unsigned   intstream[],
                              input ovm_packer packer       = null        )
```

The unpack methods extract property values from an array of bits, bytes, or ints. The method of unpacking must exactly correspond to the method of packing. This is assured if (a) the same *packer* policy is used to pack and unpack, and (b) the order of unpacking is the same as the order of packing used to create the input array.

The unpack methods are fixed (non-virtual) entry points that are directly callable by the user. To include additional fields in the unpack operation, derived classes should override the do_unpack method.

The optional *packer* argument specifies the packing policy, which governs both the pack and unpack operation. If a packer policy is not provided, then the global *ovm_default_packer* policy is used. See ovm_packer for more information.

The return value is the actual number of bits unpacked from the given array.

do_unpack

```
virtual function void do_unpack (ovm_packer packer)
```

The do_unpack method is the user-definable hook called by the unpack method. A derived class should override this method to include its fields in an unpack operation.

The *packer* argument is the policy object for both packing and unpacking. It must be the same packer used to pack the object into bits. Also, do_unpack must unpack fields in the same order in which they were packed. See ovm_packer for more information.

The following implementation corresponds to the example given in do_pack.

```
function void do_unpack (ovm_packer packer);
 int sz;
  super.do_unpack(packer); // unpack super's properties
  sz = packer.unpack_field_int(myarray.size(), 32);
  myarray.delete();
  for(int index=0; index<sz; index++)
    myarray[index] = packer.unpack_field_int(8);
  myshort = packer.unpack_field_int($bits(myshort));
  packer.unpack_object(myobj);
endfunction
```

If your object contains dynamic data (object, string, queue, dynamic array, or associative array), and you intend to unpack into an equivalent data structure, you must have included meta-information about the dynamic data when it was packed.

- For queues, dynamic arrays, or associative arrays, unpack the number of elements in the array from the 32 bits immediately before unpacking individual elements, as shown above.
- For string data types, unpack into the new string until a null byte is encountered.
- For objects, unpack 4 bits into a byte or int variable. If the value is 0, the target

object should be set to null and unpacking continues to the next property, if any. If the least significant bit is 1, then the target object should be allocated and its properties unpacked.

Configuration

set_int_local

```
virtual function void set_int_local (string           field_name,
                                     ovm_bitstream_t value,
                                     bit              recurse     = 1     )
```

set_string_local

```
virtual function void set_string_local (string field_name,
                                        string value,
                                        bit    recurse     = 1           )
```

set_object_local

```
virtual function void set_object_local (string     field_name,
                                        ovm_object value,
                                        bit        clone       = 1,
                                        bit        recurse     = 1       )
```

These methods provide write access to integral, string, and ovm_object-based properties indexed by a *field_name* string. The object designer choose which, if any, properties will be accessible, and overrides the appropriate methods depending on the properties' types. For objects, the optional *clone* argument specifies whether to clone the *value* argument before assignment.

The global ovm_is_match function is used to match the field names, so *field_name* may contain wildcards.

An example implementation of all three methods is as follows.

```
class mytype extends ovm_object;

  local int myint;
  local byte mybyte;
  local shortint myshort; // no access
```

```
    local string mystring;
    local obj_type myobj;

    // provide access to integral properties
    function void set_int_local(string field_name, ovm_bitstream_t value);
      if (ovm_is_match (field_name, "myint"))
        myint = value;
      else if (ovm_is_match (field_name, "mybyte"))
        mybyte = value;
    endfunction

    // provide access to string properties
    function void set_string_local(string field_name, string value);
      if (ovm_is_match (field_name, "mystring"))
        mystring = value;
    endfunction

    // provide access to sub-objects
    function void set_object_local(string field_name, ovm_object value,
                                   bit clone=1);
      if (ovm_is_match (field_name, "myobj")) begin
        if (value != null) begin
          obj_type tmp;
          // if provided value is not correct type, produce error
          if (!$cast(tmp, value)
            /* error */
          else
            myobj = clone ? tmp.clone() : tmp;
        end
        else
          myobj = null; // value is null, so simply assign null to myobj
      end
    endfunction
    ...
```

Although the object designer implements these methods to provide outside access to one or more properties, they are intended for internal use (e.g., for command-line debugging and auto-configuration) and should not be called directly by the user.

ovm_transaction

The ovm_transaction class is the root base class for OVM transactions. Inheriting all the methods of ovm_object, ovm_transaction adds a timing and recording interface.

Summary

ovm_transaction

The ovm_transaction class is the root base class for OVM transactions.

Class Hierarchy

ovm_object

ovm_transaction

Class Declaration

```
virtual class ovm_transaction extends ovm_object
```

Methods

new	Creates a new transaction object.
accept_tr	Calling accept_tr indicates that the transaction has been accepted for processing by a consumer component, such as an ovm_driver.
do_accept_tr	This user-definable callback is called by accept_tr just before the accept event is triggered.
begin_tr	This function indicates that the transaction has been started and is not the child of another transaction.
begin_child_tr	This function indicates that the transaction has been started as a child of a parent transaction given by parent_handle.
do_begin_tr	This user-definable callback is called by begin_tr and begin_child_tr just before the begin event is triggered.
end_tr	This function indicates that the transaction execution has ended.
do_end_tr	This user-definable callback is called by end_tr just before the end event is triggered.
get_tr_handle	Returns the handle associated with the transaction, as set by a previous call to begin_child_tr or begin_tr with transaction recording enabled.
disable_recording	Turns off recording for the transaction stream.
enable_recording	Turns on recording to the stream specified by stream, whose interpretation is implementation specific.
is_recording_enabled	Returns 1 if recording is currently on, 0 otherwise.
is_active	Returns 1 if the transaction has been started but has not yet been ended.
get_event_pool	Returns the event pool associated with this transaction.
set_initiator	Sets initiator as the initiator of this transaction.
get_initiator	Returns the component that produced or started the transaction, as set by a previous call to set_initiator.
get_accept_time	
get_begin_time	
get_end_time	Returns the time at which this transaction was accepted, begun, or ended, as by a previous call to accept_tr, begin_tr, begin_child_tr, or end_tr.
set_transaction_id	Sets this transaction’s numeric identifier to id.
get_transaction_id	Returns this transaction’s numeric identifier, which is -1 if not set explicitly by set_transaction_id.

Methods

new

```
function new (string        name      = "",
              ovm_component initiator = null          )
```

Creates a new transaction object. The name is the instance name of the transaction. If not supplied, then the object is unnamed.

accept_tr

```
function void accept_tr (time accept_time = )
```

Calling accept_tr indicates that the transaction has been accepted for processing by a consumer component, such as an ovm_driver. With some protocols, the transaction may not be started immediately after it is accepted. For example, a bus driver may have to wait for a bus grant before starting the transaction.

This function performs the following actions

- The transaction's internal accept time is set to the current simulation time, or to accept_time if provided and non-zero. The accept_time may be any time, past or future.
- The transaction's internal accept event is triggered. Any processes waiting on the this event will resume in the next delta cycle.
- The do_accept_tr method is called to allow for any post-accept action in derived classes.

do_accept_tr

```
virtual protected function void do_accept_tr ()
```

This user-definable callback is called by accept_tr just before the accept event is triggered. Implementations should call super.do_accept_tr to ensure correct operation.

begin_tr

```
function integer begin_tr (time begin_time = )
```

This function indicates that the transaction has been started and is not the child of another transaction. Generally, a consumer component begins execution of the transactions it receives.

This function performs the following actions

- The transaction's internal start time is set to the current simulation time, or to begin_time if provided and non-zero. The begin_time may be any time, past or future, but should not be less than the accept time.
- If recording is enabled, then a new database-transaction is started with the same begin time as above. The record method inherited from ovm_object is then called, which records the current property values to this new transaction.
- The do_begin_tr method is called to allow for any post-begin action in derived classes.
- The transaction's internal begin event is triggered. Any processes waiting on this event will resume in the next delta cycle.

The return value is a transaction handle, which is valid (non-zero) only if recording is enabled. The meaning of the handle is implementation specific.

begin_child_tr

```
function integer begin_child_tr (time    begin_time    = 0,
                                 integer parent_handle = 0          )
```

This function indicates that the transaction has been started as a child of a parent transaction given by parent_handle. Generally, a consumer component begins execution of the transactions it receives.

The parent handle is obtained by a previous call to begin_tr or begin_child_tr. If the parent_handle is invalid (=0), then this function behaves the same as begin_tr.

This function performs the following actions

- The transaction's internal start time is set to the current simulation time, or to begin_time if provided and non-zero. The begin_time may be any time, past or future, but should not be less than the accept time.
- If recording is enabled, then a new database-transaction is started with the same begin time as above. The record method inherited from ovm_object is then called, which records the current property values to this new transaction. Finally, the newly started transaction is linked to the parent transaction given by parent_handle.
- The do_begin_tr method is called to allow for any post-begin action in derived classes.
- The transaction's internal begin event is triggered. Any processes waiting on this

event will resume in the next delta cycle.

The return value is a transaction handle, which is valid (non-zero) only if recording is enabled. The meaning of the handle is implementation specific.

do_begin_tr

```
virtual protected function void do_begin_tr ()
```

This user-definable callback is called by begin_tr and begin_child_tr just before the begin event is triggered. Implementations should call super.do_begin_tr to ensure correct operation.

end_tr

```
function void end_tr (time end_time    = 0,
                      bit  free_handle = 1                                      )
```

This function indicates that the transaction execution has ended. Generally, a consumer component ends execution of the transactions it receives.

This function performs the following actions

- The transaction's internal end time is set to the current simulation time, or to end_time if provided and non-zero. The end_time may be any time, past or future, but should not be less than the begin time.
- If recording is enabled and a database-transaction is currently active, then the record method inherited from ovm_object is called, which records the final property values. The transaction is then ended. If free_handle is set, the transaction is released and can no longer be linked to (if supported by the implementation).
- The do_end_tr method is called to allow for any post-end action in derived classes.
- The transaction's internal end event is triggered. Any processes waiting on this event will resume in the next delta cycle.

do_end_tr

```
virtual protected function void do_end_tr ()
```

This user-definable callback is called by end_tr just before the end event is triggered. Implementations should call super.do_end_tr to ensure correct operation.

get_tr_handle

```
function integer get_tr_handle ()
```

Returns the handle associated with the transaction, as set by a previous call to begin_child_tr or begin_tr with transaction recording enabled.

disable_recording

```
function void disable_recording ()
```

Turns off recording for the transaction stream. This method does not effect a component's recording streams.

enable_recording

```
function void enable_recording (string stream)
```

Turns on recording to the stream specified by stream, whose interpretation is implementation specific.

If transaction recording is on, then a call to record is made when the transaction is started and when it is ended.

is_recording_enabled

```
function bit is_recording_enabled()
```

Returns 1 if recording is currently on, 0 otherwise.

is_active

```
function bit is_active ()
```

Returns 1 if the transaction has been started but has not yet been ended. Returns 0 if the transaction has not been started.

get_event_pool

```
function ovm_event_pool get_event_pool ()
```

Returns the event pool associated with this transaction.

By default, the event pool contains the events: begin, accept, and end. Events can also be added by derivative objects. See ovm_event_pool for more information.

set_initiator

```
function void set_initiator (ovm_component initiator)
```

Sets initiator as the initiator of this transaction.

The initiator can be the component that produces the transaction. It can also be the component that started the transaction. This or any other usage is up to the transaction designer.

get_initiator

```
function ovm_component get_initiator ()
```

Returns the component that produced or started the transaction, as set by a previous call to set_initiator.

get_accept_time

```
function time get_accept_time ()
```

get_begin_time

```
function time get_begin_time ()
```

get_end_time

```
function time get_end_time ()
```

Returns the time at which this transaction was accepted, begun, or ended, as by a previous call to accept_tr, begin_tr, begin_child_tr, or end_tr.

set_transaction_id

```
function void set_transaction_id(integer id)
```

Sets this transaction’s numeric identifier to id. If not set via this method, the transaction ID defaults to -1.

When using sequences to generate stimulus, the transaction ID is used along with the sequence ID to route responses in sequencers and to correlate responses to requests.

get_transaction_id

```
function integer get_transaction_id()
```

Returns this transaction’s numeric identifier, which is -1 if not set explicitly by set_transaction_id.

When using sequences to generate stimulus, the transaction ID is used along with the sequence ID to route responses in sequencers and to correlate responses to requests.

ovm_component

The ovm_component class is the root base class for OVM components. In addition to the features inherited from ovm_object and ovm_report_object, ovm_component provides the following interfaces:

Hierarchy	provides methods for searching and traversing the component hierarchy.
Configuration	provides methods for configuring component topology and other parameters ahead of and during component construction.
Phasing	defines a phased test flow that all components follow. Derived components implement one or more of the predefined phase callback methods to perform their function. During simulation, all components' callbacks are executed in precise order. Phasing is controlled by ovm_top, the singleton instance of ovm_root.
Reporting	provides a convenience interface to the ovm_report_handler. All messages, warnings, and errors are processed through this interface.
Transaction recording	provides methods for recording the transactions produced or consumed by the component to a transaction database (vendor specific).
Factory	provides a convenience interface to the ovm_factory. The factory is used to create new components and other objects based on type-wide and instance-specific configuration.

The ovm_component is automatically seeded during construction using OVM seeding, if enabled. All other objects must be manually reseeded, if appropriate. See ovm_object::reseed for more information.

Summary

ovm_component

The ovm_component class is the root base class for OVM components.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

Class Declaration

```
virtual class ovm_component extends ovm_report_object
```

new	Creates a new component with the given leaf instance *name* and handle to to its *parent*.
Hierarchy Interface	These methods provide user access to information about the component hierarchy, i.e., topology.
get_parent	Returns a handle to this component's parent, or null if it has no parent.
get_full_name	Returns the full hierarchical name of this object.
get_child	
get_next_child	
get_first_child	These methods are used to iterate through this component's children, if any.
get_num_children	Returns the number of this component's children.
has_child	Returns 1 if this component has a child with the given *name*, 0 otherwise.
set_name	Renames this component to *name* and recalculates all descendants' full names.
lookup	Looks for a component with the given hierarchical *name* relative to this component.
Phasing Interface	Components execute their behavior in strictly ordered, pre-defined phases.
build	The build phase callback is the first of several methods automatically called during the course of simulation.
connect	The connect phase callback is one of several methods automatically called during the course of simulation.
end_of_elaboration	The end_of_elaboration phase callback is one of several methods automatically called during the course of simulation.
start_of_simulation	The start_of_simulation phase callback is one of several methods automatically called during the course of simulation.

run	The run phase callback is the only predefined phase that is time-consuming, i.e., task-based.
extract	The extract phase callback is one of several methods automatically called during the course of simulation.
check	The check phase callback is one of several methods automatically called during the course of simulation.
report	The report phase callback is the last of several predefined phase methods automatically called during the course of simulation.
suspend	Suspends the process tree spawned from this component's currently executing task-based phase, e.g.
resume	Resumes the process tree spawned from this component's currently executing task-based phase, e.g.
status	Returns the status of the parent process associated with the currently running task-based phase, e.g., run.
kill	Kills the process tree associated with this component's currently running task-based phase, e.g., run.
do_kill_all	Recursively calls kill on this component and all its descendants, which abruptly ends the currently running task-based phase, e.g., run.
stop	The stop task is called when this component's enable_stop_interrupt bit is set and global_stop_request is called during a task-based phase, e.g., run.
enable_stop_interrupt	This bit allows a component to raise an objection to the stopping of the current phase.
resolve_bindings	Processes all port, export, and imp connections.
Configuration Interface	Components can be designed to be user-configurable in terms of its topology (the type and number of children it has), mode of operation, and run-time parameters (knobs).
set_config_int	
set_config_string	
set_config_object	Calling set_config_* causes configuration settings to be created and placed in a table internal to this component.
get_config_int	
get_config_string	
get_config_object	These methods retrieve configuration settings made by previous calls to their set_config_* counterparts.
check_config_usage	Check all configuration settings in a components configuration table to determine if the setting has been used, overridden or not used.
apply_config_settings	Searches for all config settings matching this component's instance path.
print_config_settings	Called without arguments, print_config_settings prints all configuration information for this component, as set by previous calls to set_config_*.
print_config_matches	Setting this static variable causes get_config_* to print info about matching configuration settings as they are being applied.
Objection Interface	These methods provide object level hooks into the ovm_objection mechanism.
raised	The raised callback is called when a decendant of the component instance raises the specfied *objection*.
dropped	The dropped callback is called when a decendant of the component instance raises the specfied *objection*.
all_dropped	The all_dropped callback is called when a decendant of the component instance raises the specfied *objection*.
Factory Interface	The factory interface provides convenient access to a portion of OVM's ovm_factory interface.
create_component	A convenience function for ovm_factory::create_component_by_name, this method calls upon the factory to create a new child component whose type corresponds to the preregistered type name, *requested_type_name*, and instance name, *name*.
create_object	A convenience function for ovm_factory::create_object_by_name, this method calls upon the factory to create a new object whose type corresponds to the preregistered type name, *requested_type_name*, and instance name, *name*.
set_type_override_by_type	A convenience function for ovm_factory::set_type_override_by_type, this method registers a factory override for components and objects created at this level of hierarchy or below.
set_inst_override_by_type	A convenience function for ovm_factory::set_inst_override_by_type, this method registers a factory override for components and objects created at this level of hierarchy or below.

set_type_override	A convenience function for ovm_factory::set_type_override_by_name, this method configures the factory to create an object of type *override_type_name* whenever the factory is asked to produce a type represented by *original_type_name*.
set_inst_override	A convenience function for ovm_factory::set_inst_override_by_type, this method registers a factory override for components created at this level of hierarchy or below.
print_override_info	This factory debug method performs the same lookup process as create_object and create_component, but instead of creating an object, it prints information about what type of object would be created given the provided arguments.
Hierarchical Reporting Interface	This interface provides versions of the set_report_* methods in the ovm_report_object base class that are applied recursively to this component and all its children.
set_report_severity_action_hier	
set_report_id_action_hier	
set_report_severity_id_action_hier	These methods recursively associate the specified action with reports of the given *severity*, *id*, or *severity-id* pair.
set_report_default_file_hier	
set_report_severity_file_hier	
set_report_id_file_hier	
set_report_severity_id_file_hier	These methods recursively associate the specified FILE descriptor with reports of the given *severity*, *id*, or *severity-id* pair.
set_report_verbosity_level_hier	This method recursively sets the maximum verbosity level for reports for this component and all those below it.
Recording Interface	These methods comprise the component-based transaction recording interface.
accept_tr	This function marks the acceptance of a transaction, *tr*, by this component.
do_accept_tr	The accept_tr method calls this function to accommodate any user-defined post-accept action.
begin_tr	This function marks the start of a transaction, *tr*, by this component.
begin_child_tr	This function marks the start of a child transaction, *tr*, by this component.
do_begin_tr	The begin_tr and begin_child_tr methods call this function to accommodate any user-defined post-begin action.
end_tr	This function marks the end of a transaction, *tr*, by this component.
do_end_tr	The end_tr method calls this function to accommodate any user-defined post-end action.
record_error_tr	This function marks an error transaction by a component.
record_event_tr	This function marks an event transaction by a component.
print_enabled	This bit determines if this component should automatically be printed as a child of its parent object.

new

```
function new (string        name,
              ovm_component parent)
```

Creates a new component with the given leaf instance *name* and handle to to its *parent*. If the component is a top-level component (i.e. it is created in a static module or interface), *parent* should be null.

The component will be inserted as a child of the *parent* object, if any. If *parent* already has a child by the given *name*, an error is produced.

If *parent* is null, then the component will become a child of the implicit top-level component, *ovm_top*.

All classes derived from ovm_component must call super.new(name,parent).

Hierarchy Interface

These methods provide user access to information about the component hierarchy, i.e., topology.

get_parent

```
virtual function ovm_component get_parent ()
```

Returns a handle to this component's parent, or null if it has no parent.

get_full_name

```
virtual function string get_full_name ()
```

Returns the full hierarchical name of this object. The default implementation concatenates the hierarchical name of the parent, if any, with the leaf name of this object, as given by ovm_object::get_name.

get_child

```
function ovm_component get_child (string name)
```

get_next_child

```
function int get_next_child (ref string name)
```

get_first_child

```
function int get_first_child (ref string name)
```

These methods are used to iterate through this component's children, if any. For example, given a component with an object handle, *comp*, the following code calls ovm_object::print for each child:

```
string name;
ovm_component child;
if (comp.get_first_child(name))
  do begin
    child = comp.get_child(name);
    child.print();
  end while (comp.get_next_child(name));
```

get_num_children

```
function int get_num_children ()
```

Returns the number of this component's children.

has_child

```
function int has_child (string name)
```

Returns 1 if this component has a child with the given *name*, 0 otherwise.

set_name

```
virtual function void set_name (string name)
```

Renames this component to *name* and recalculates all descendants' full names.

lookup

```
function ovm_component lookup (string name)
```

Looks for a component with the given hierarchical *name* relative to this component. If the given *name* is preceded with a '.' (dot), then the search begins relative to the top level (absolute lookup). The handle of the matching component is returned, else null. The name must not contain wildcards.

Phasing Interface

Components execute their behavior in strictly ordered, pre-defined phases. Each phase is defined by its own method, which derived components can override to incorporate component-specific behavior. During simulation, the phases are executed one by one, where one phase must complete before the next phase begins. The following briefly describe each phase:

new	Also known as the *constructor*, the component does basic initialization of any members not subject to configuration.
build	The component constructs its children. It uses the get_config interface to obtain any configuration for itself, the set_config interface to set any configuration for its own children, and the factory interface for actually creating the children and other objects it might need.
connect	The component now makes connections (binds TLM ports and exports) from child-to-child or from child-to-self (i.e. to promote a child port or export up the hierarchy for external access. Afterward, all connections are checked via resolve_bindings before entering the end_of_elaboration phase.
end_of_elaboration	At this point, the entire testbench environment has been built and connected. No new components and connections may be created from this point forward. Components can do final checks for proper connectivity, and it can initiate communication with other tools that require stable, quasi-static component structure..
start_of_simulation	The simulation is about to begin, and this phase can be used to perform any pre-run activity such as displaying banners, printing final testbench topology and configuration information.
run	This is where verification takes place. It is the only predefined, time-consuming phase. A component's primary function is implemented in the run task. Other processes may be forked if desired. When a component returns from its run task, it does not signify completion of its run phase. Any processes that it may have forked *continue to run*. The run phase terminates in one of four ways:

stop	When a component's enable_stop_interrupt bit is set and global_stop_request is called, the component's stop task is called. Components can implement stop to allow completion of in-progress transactions, <flush> queues, etc. Upon return from stop() by all enabled components, a do_kill_all is issued. If the ovm_test_done_objection is being used, this stopping procedure is deferred until all outstanding objections on ovm_test_done have been dropped.
objections dropped	The ovm_test_done_objection will implicitly call global_stop_request when all objections to ending the phase are dropped. The stop procedure described above is then allowed to proceed normally.
kill	When called, all component's run processes are killed immediately. While kill can be called directly, it is recommended that components use the stopping mechanism, which affords a more ordered and safe shut-down.
timeout	If a timeout was set, then the phase ends if it expires before either of the above occur. Without a stop, kill, or timeout, simulation can continue "forever", or the simulator may end simulation prematurely if it determines that all processes are waiting.
extract	This phase can be used to extract simulation results from coverage collectors and scoreboards, collect status/error counts, statistics, and other information from components in bottom-up order. Being a separate phase, extract ensures all relevant data from potentially independent sources (i.e. other components) are collected before being checked in the next phase.
check	Having extracted vital simulation results in the previous phase, the check phase can be used to validate such data and determine the overall simulation outcome. It too executes bottom-up.
report	Finally, the report phase is used to output results to files and/or the screen.

All task-based phases (run is the only pre-defined task phase) will run forever until killed or stopped via kill or global_stop_request. The latter causes each component's stop task to get called back if its enable_stop_interrupt bit is set. After all components' stop tasks return, the OVM will end the phase.

Note- the post_new, export_connections, import_connections, configure, and pre_run phases are deprecated. build replaces post_new, connect replaces both import_ and export_connections, and start_of_simulation replaces pre_run.

build

```
virtual function void build ()
```

The build phase callback is the first of several methods automatically called during the course of simulation. The build phase is the second of a two-pass construction process (the first is the built-in new method).

The build phase can add additional hierarchy based on configuration information not available at time of initial construction. Any override should call super.build().

Starting after the initial construction phase (new method) has completed, the build phase consists of calling all components' build methods recursively top-down, i.e., parents' build are executed before the children. This is the only phase that executes top-down.

The build phase of the ovm_component class executes the automatic configuration of fields registed in the component by calling apply_config_settings. To turn off automatic configuration for a component, do not call super.build() in the subtype's build method.

See ovm_phase for more information on phases.

connect

```
virtual function void connect ()
```

The connect phase callback is one of several methods automatically called during the course of simulation.

Starting after the build phase has completed, the connect phase consists of calling all components' connect methods recursively in depth-first, bottom-up order, i.e., children are executed before their parents.

Generally, derived classes should override this method to make port and export connections via the similarly-named ovm_port_base #(IF)::connect method. Any override should call super.connect().

This method should never be called directly.

See ovm_phase for more information on phases.

end_of_elaboration

```
virtual function void end_of_elaboration ()
```

The end_of_elaboration phase callback is one of several methods automatically called during the course of simulation.

Starting after the connect phase has completed, this phase consists of calling all components' end_of_elaboration methods recursively in depth-first, bottom-up order, i.e., children are executed before their parents.

Generally, derived classes should override this method to perform any checks on the elaborated hierarchy before the simulation phases begin. Any override should call super.end_of_elaboration().

This method should never be called directly.

See ovm_phase for more information on phases.

start_of_simulation

```
virtual function void start_of_simulation ()
```

The start_of_simulation phase callback is one of several methods automatically called during the course of simulation.

Starting after the end_of_elaboration phase has completed, this phase consists of calling all components' start_of_simulation methods recursively in depth-first, bottom-up order, i.e. children are executed before their parents.

Generally, derived classes should override this method to perform component- specific pre-run operations, such as discovery of the elaborated hierarchy, printing banners, etc. Any override should call super.start_of_simulation().

This method should never be called directly.

See ovm_phase for more information on phases.

run

```
virtual task run ()
```

The run phase callback is the only predefined phase that is time-consuming, i.e., task-based. It executes after the start_of_simulation phase has completed. Derived classes should override this method to perform the bulk of its functionality, forking additional processes if needed.

In the run phase, all components' run tasks are forked as independent processes. Returning from its run task does not signify completion of a component's run phase; any processes forked by run continue to run.

The run phase terminates in one of four ways.

1. explicit call to global_stop_request - When global_stop_request is called, an ordered shut-down for the currently running phase begins. First, all enabled components' status tasks are called bottom-up, i.e., childrens' stop tasks are called before the parent's. A component is enabled by its enable_stop_interrupt bit. Each component can implement stop to allow completion of in-progress transactions, flush queues, and other shut-down activities. Upon return from stop by all enabled components, the recursive do_kill_all is called on all top-level component(s). If the ovm_test_done objection> is being used, this stopping procedure is deferred until all outstanding objections on ovm_test_done have been dropped.
2. all objections to ovm_test_done have been dropped - When all objections on the ovm_test_done objection have been dropped, global_stop_request is called automatically, thus kicking off the stopping procedure described above. See ovm_objection for details on using the objection mechanism.
3. explicit call to kill or do_kill_all - When kill is called, this component's run processes are killed immediately. The do_kill_all methods applies to this component and all its descendants. Use of this method is not recommended. It is better to use the stopping mechanism, which affords a more ordered, safer shut-down.
4. timeout - The phase ends if the timeout expires before an explicit call to global_stop_request or kill. By default, the timeout is set to near the maximum simulation time possible. You may override this via set_global_timeout, but you cannot disable the timeout completely.

If the default timeout occurs in your simulation, or if simulation never ends despite completion of your test stimulus, then it usually indicates a missing call to global_stop_request.

The run task should never be called directly.

See ovm_phase for more information on phases.

extract

```
virtual function void extract ()
```

The extract phase callback is one of several methods automatically called during the course of simulation.

Starting after the run phase has completed, the extract phase consists of calling all components' extract methods recursively in depth-first, bottom-up order, i.e., children are executed before their parents.

Generally, derived classes should override this method to collect information for the subsequent check phase when such information needs to be collected in a hierarchical, bottom-up manner. Any override should call super.extract().

This method should never be called directly.

See ovm_phase for more information on phases.

check

```
virtual function void check ()
```

The check phase callback is one of several methods automatically called during the course of simulation.

Starting after the extract phase has completed, the check phase consists of calling all components' check methods recursively in depth-first, bottom-up order, i.e., children are executed before their parents.

Generally, derived classes should override this method to perform component specific, end-of-test checks. Any override should call super.check().

This method should never be called directly.

See ovm_phase for more information on phases.

report

```
virtual function void report ()
```

The report phase callback is the last of several predefined phase methods automatically called during the course of simulation.

Starting after the check phase has completed, the report phase consists of calling all components' report methods recursively in depth-first, bottom-up order, i.e., children are executed before their parents.

Generally, derived classes should override this method to perform component-specific reporting of test results. Any override should call super.report().

This method should never be called directly.

See ovm_phase for more information on phases.

suspend

```
virtual task suspend ()
```

Suspends the process tree spawned from this component's currently executing task-based phase, e.g. run.

resume

```
virtual task resume ()
```

Resumes the process tree spawned from this component's currently executing task-based phase, e.g. run.

status

```
function string status ()
```

Returns the status of the parent process associated with the currently running task-based phase, e.g., run.

kill

```
virtual function void kill ()
```

Kills the process tree associated with this component's currently running task-based phase, e.g., run.

An alternative mechanism for stopping the run phase is the stop request. Calling global_stop_request causes all components' run processes to be killed, but only after all components have had the opportunity to complete in progress transactions and shutdown cleanly via their stop tasks.

do_kill_all

```
virtual function void do_kill_all ()
```

Recursively calls kill on this component and all its descendants, which abruptly ends the currently running task-based phase, e.g., run. See run for better options to ending a task-based phase.

stop

```
virtual task stop (string ph_name)
```

The stop task is called when this component's enable_stop_interrupt bit is set and global_stop_request is called during a task-based phase, e.g., run.

Before a phase is abruptly ended, e.g., when a test deems the simulation complete, some components may need extra time to shut down cleanly. Such components may implement stop to finish the currently executing transaction, flush the queue, or perform other cleanup. Upon return from its stop, a component signals it is ready to be stopped.

The stop method will not be called if enable_stop_interrupt is 0.

The default implementation of stop is empty, i.e., it will return immediately.

This method should never be called directly.

enable_stop_interrupt

```
protected int enable_stop_interrupt = 0
```

This bit allows a component to raise an objection to the stopping of the current phase. It affects only time consuming phases (such as the run phase).

When this bit is set, the stop task in the component is called as a result of a call to global_stop_request. Components that are sensitive to an immediate killing of its run-time processes should set this bit and implement the stop task to prepare for shutdown.

resolve_bindings

```
virtual function void resolve_bindings ()
```

Processes all port, export, and imp connections. Checks whether each port's min and max connection requirements are met.

It is called just before the end_of_elaboration phase.

Users should not call directly.

Configuration Interface

Components can be designed to be user-configurable in terms of its topology (the type and number of children it has), mode of operation, and run-time parameters (knobs). The configuration interface accommodates this common need, allowing component composition and state to be modified without having to derive new classes or new class hierarchies for every configuration scenario.

set_config_int

```
virtual function void set_config_int (string          inst_name,
                                      string          field_name,
                                      ovm_bitstream_t value      )
```

set_config_string

```
virtual function void set_config_string (string inst_name,
                                         string field_name,
                                         string value      )
```

set_config_object

```
virtual function void set_config_object (string     inst_name,
                                         string     field_name,
                                         ovm_object value,
                                         bit        clone      = 1              )
```

Calling set_config_* causes configuration settings to be created and placed in a table internal to this component. There are similar global methods that store settings in a global table. Each setting stores the supplied *inst_name*, *field_name*, and *value* for later use by descendent components during their construction. (The global table applies to all components and takes precedence over the component tables.)

When a descendant component calls a get_config_* method, the *inst_name* and *field_name* provided in the get call are matched against all the configuration settings stored in the global table and then in each component in the parent hierarchy, top-down. Upon the first match, the value stored in the configuration setting is returned. Thus, precedence is global, following by the top-level component, and so on down to the descendent component's parent.

These methods work in conjunction with the get_config_* methods to provide a configuration setting mechanism for integral, string, and ovm_object-based types. Settings of other types, such as virtual interfaces and arrays, can be indirectly supported by defining a class that contains them.

Both *inst_name* and *field_name* may contain wildcards.

- For set_config_int, *value* is an integral value that can be anything from 1 bit to 4096 bits.
- For set_config_string, *value* is a string.
- For set_config_object, *value* must be an ovm_object-based object or null. Its clone argument specifies whether the object should be cloned. If set, the object is cloned both going into the table (during the set) and coming out of the table (during the get), so that multiple components matched to the same setting (by way of wildcards) do not end up sharing the same object.

The following message tags are used for configuration setting. You can use the standard ovm report messaging interface to control these messages. CFGNTS -- The configuration setting was not used by any component. This is a warning. CFGOVR -- The configuration setting was overridden by a setting above. CFGSET -- The configuration setting was used at least once.

See get_config_int, get_config_string, and get_config_object for information on getting the configurations set by these methods.

get_config_int

```
virtual function bit get_config_int (       string          field_name,
                                       inout ovm_bitstream_t value      )
```

get_config_string

```
virtual function bit get_config_string (       string field_name,
                                          inout string value      )
```

get_config_object

```
virtual function bit get_config_object (       string     field_name,
                                          inout ovm_object value,
                                          input bit        clone       = 1      )
```

These methods retrieve configuration settings made by previous calls to their set_config_* counterparts. As the methods' names suggest, there is direct support for integral types, strings, and objects. Settings of other types can be indirectly supported by defining an object to contain them.

Configuration settings are stored in a global table and in each component instance. With each call to a get_config_* method, a top-down search is made for a setting that matches this component's full name and the given *field_name*. For example, say this component's full instance name is top.u1.u2. First, the global configuration table is searched. If that fails, then it searches the configuration table in component 'top', followed by top.u1.

The first instance/field that matches causes *value* to be written with the value of the configuration setting and 1 is returned. If no match is found, then *value* is unchanged and the 0 returned.

Calling the get_config_object method requires special handling. Because *value* is an output of type ovm_object, you must provide an ovm_object handle to assign to (<u>not</u> a derived class handle). After the call, you can then $cast to the actual type.

For example, the following code illustrates how a component designer might call upon the configuration mechanism to assign its *data* object property, whose type myobj_t derives from ovm_object.

```
class mycomponent extends ovm_component;

  local myobj_t data;

  function void build();
    ovm_object tmp;
    super.build();
    if(get_config_object("data", tmp))
      if (!$cast(data, tmp))
        $display("error! config setting for 'data' not of type myobj_t");
      endfunction
    ...
```

The above example overrides the build method. If you want to retain any base functionality, you must call super.build().

The *clone* bit clones the data inbound. The get_config_object method can also clone the data outbound.

See Members for information on setting the global configuration table.

check_config_usage

`function void check_config_usage (bit recurse = 1 )`

Check all configuration settings in a components configuration table to determine if the setting has been used, overridden or not used. When *recurse* is 1 (default), configuration for this and all child components are recursively checked. This function is automatically called in the check phase, but can be manually called at any time.

Additional detail is provided by the following message tags

- CFGOVR -- lists all configuration settings that have been overridden from above.
- CFGSET -- lists all configuration settings that have been set.

To get all configuration information prior to the run phase, do something like this in your top object:

```
function void start_of_simulation();
  set_report_id_action_hier(CFGOVR, OVM_DISPLAY);
  set_report_id_action_hier(CFGSET, OVM_DISPLAY);
  check_config_usage();
endfunction
```

apply_config_settings

`virtual function void apply_config_settings (bit verbose = )`

Searches for all config settings matching this component’s instance path. For each match, the appropriate set_*_local method is called using the matching config setting’s field_name and value.

Provided the set_*_local method is implemented, the component property associated with the field_name is assigned the given value.

This function is called by ovm_component::build.

The apply_config_settings method determines all the configuration settings targeting this component and calls the appropriate set_*_local method to set each one. To work, you must override one or more set_*_local methods to accommodate setting of your component's specific properties. Any properties registered with the optional `ovm_*_field macros do not require special handling by the set_*_local methods; the macros provide the set_*_local functionality for you.

If you do not want apply_config_settings to be called for a component, then the build() method should be overloaded and you should not call super.build(). If this case, you must also set the m_build_done bit. Likewise, apply_config_settings can be overloaded to customize automated configuration.

When the *verbose* bit is set, all overrides are printed as they are applied. If the component's print_config_matches property is set, then apply_config_settings is automatically called with *verbose* = 1.

print_config_settings

```
function void print_config_settings (string        field   = "",
                                     ovm_component comp    = null,
                                     bit           recurse = 0              )
```

Called without arguments, print_config_settings prints all configuration information for this component, as set by previous calls to set_config_*. The settings are printing in the order of their precedence.

If *field* is specified and non-empty, then only configuration settings matching that field, if any, are printed. The field may not contain wildcards.

If *comp* is specified and non-null, then the configuration for that component is printed.

If *recurse* is set, then configuration information for all *comp*'s children and below are printed as well.

print_config_matches

```
static bit print_config_matches = 0
```

Setting this static variable causes get_config_* to print info about matching configuration settings as they are applied.

Objection Interface

These methods provide object level hooks into the ovm_objection mechanism.

raised

```
virtual function void raised (ovm_objection objection,
                              ovm_object    source_obj,
                              int           count      )
```

The raised callback is called when a decendant of the component instance raises the specfied *objection*. The *source_obj* is the object which originally raised the object. *count* is an optional count that was used to indicate a number of objections which were raised.

dropped

```
virtual function void dropped (ovm_objection objection,
                               ovm_object    source_obj,
                               int           count      )
```

The dropped callback is called when a decendant of the component instance raises the specfied *objection*. The *source_obj* is the object which originally dropped the object. *count* is an optional count that was used to indicate a number of objections which were dropped.

all_dropped

```
virtual task all_dropped (ovm_objection objection,
                          ovm_object    source_obj,
                          int           count      )
```

The all_dropped callback is called when a decendant of the component instance raises the specfied *objection*. The *source_obj* is the object which originally all_dropped the object. *count* is an optional count that was used to indicate a number of objections which were dropped. This callback is time-consuming and the all_dropped conditional will not be propagated up to the object's parent until the callback returns.

Factory Interface

The factory interface provides convenient access to a portion of OVM's ovm_factory interface. For creating new objects and components, the preferred method of accessing the factory is via the object or component wrapper (see ovm_component_registry #(T,Tname) and ovm_object_registry #(T, Tname)). The wrapper also provides functions for setting type and instance overrides.

create_component

```
function ovm_component create_component (string requested_type_name,
                                         string name                )
```

A convenience function for ovm_factory::create_component_by_name, this method calls upon the factory to create a new child component whose type corresponds to the preregistered type name, *requested_type_name*, and instance name, *name*. This method is equivalent to:

```
factory.create_component_by_name(requested_type_name,
                                 get_full_name(), name, this);
```

If the factory determines that a type or instance override exists, the type of the component created may be different than the requested type. See set_type_override and set_inst_override. See also ovm_factory for details on factory operation.

create_object

```
function ovm_object create_object (string requested_type_name,
                                   string name                = ""          )
```

A convenience function for ovm_factory::create_object_by_name, this method calls upon the factory to create a new object whose type corresponds to the preregistered type name, *requested_type_name*, and instance name, *name*. This method is equivalent to:

```
factory.create_object_by_name(requested_type_name,
                              get_full_name(), name);
```

If the factory determines that a type or instance override exists, the type of the object created may be different than the requested type. See ovm_factory for details on factory operation.

set_type_override_by_type

```
static function void set_type_override_by_type (
   ovm_object_wrapper original_type,
   ovm_object_wrapper override_type,
   bit                replace       = 1
)
```

A convenience function for ovm_factory::set_type_override_by_type, this method registers a factory override for components and objects created at this level of hierarchy or below. This method is equivalent to:

```
factory.set_type_override_by_type(original_type, override_type,replace);
```

The *relative_inst_path* is relative to this component and may include wildcards. The *original_type* represents the type that is being overridden. In subsequent calls to ovm_factory::create_object_by_type or ovm_factory::create_component_by_type, if the requested_type matches the *original_type* and the instance paths match, the factory will produce the *override_type*.

The original and override type arguments are lightweight proxies to the types they represent. See set_inst_override_by_type for information on usage.

set_inst_override_by_type

```
function void set_inst_override_by_type(string             relative_inst_path,
                                        ovm_object_wrapper original_type,
                                        ovm_object_wrapper override_type      )
```

A convenience function for ovm_factory::set_inst_override_by_type, this method registers a factory override for components and objects created at this level of hierarchy or below. In typical usage, this method is equivalent to:

```
factory.set_inst_override_by_type({get_full_name(),".",
                                   relative_inst_path},
                                   original_type,
                                   override_type);
```

The *relative_inst_path* is relative to this component and may include wildcards. The *original_type* represents the type that is being overridden. In subsequent calls to ovm_factory::create_object_by_type or ovm_factory::create_component_by_type, if the requested_type matches the *original_type* and the instance paths match, the factory will produce the *override_type*.

The original and override types are lightweight proxies to the types they represent. They can be obtained by calling type::get_type(), if implemented, or by directly calling type::type_id::get(), where type is the user type and type_id is the name of the typedef to ovm_object_registry #(T, Tname) or ovm_component_registry #(T,Tname).

If you are employing the `ovm_*_utils macros, the typedef and the get_type method will be implemented for you.

The following example shows `ovm_*_utils usage

```
class comp extends ovm_component;
  `ovm_component_utils(comp)
  ...
endclass

class mycomp extends ovm_component;
  `ovm_component_utils(mycomp)
  ...
endclass

class block extends ovm_component;
  `ovm_component_utils(block)
  comp c_inst;
  virtual function void build();
    set_inst_override_by_type("c_inst",comp::get_type(),
                                       mycomp::get_type());
  endfunction
  ...
endclass
```

set_type_override

```
static function void set_type_override(string original_type_name,
                                       string override_type_name,
                                       bit    replace             = 1          )
```

A convenience function for ovm_factory::set_type_override_by_name, this method configures the factory to create an object of type *override_type_name* whenever the factory is asked to produce a type represented by *original_type_name*. This method is equivalent to:

```
factory.set_type_override_by_name(original_type_name,
                                  override_type_name, replace);
```

The *original_type_name* typically refers to a preregistered type in the factory. It may, however, be any arbitrary string. Subsequent calls to create_component or create_object with the same string and matching instance path will produce the type represented by override_type_name. The *override_type_name* must refer to a preregistered type in the factory.

set_inst_override

```
function void set_inst_override(string relative_inst_path,
                                string original_type_name,
                                string override_type_name )
```

A convenience function for ovm_factory::set_inst_override_by_type, this method registers a factory override for components created at this level of hierarchy or below. In typical usage, this method is equivalent to:

```
factory.set_inst_override_by_name({get_full_name(),".",
                                   relative_inst_path},
                                    original_type_name,
                                   override_type_name);
```

The *relative_inst_path* is relative to this component and may include wildcards. The *original_type_name* typically refers to a preregistered type in the factory. It may, however, be any arbitrary string. Subsequent calls to create_component or create_object with the same string and matching instance path will produce the type represented by *override_type_name*. The *override_type_name* must refer to a preregistered type in the factory.

print_override_info

```
function void print_override_info(string requested_type_name,
                                  string name                = ""           )
```

This factory debug method performs the same lookup process as create_object and create_component, but instead of creating an object, it prints information about what type of object would be created given the provided arguments.

Hierarchical Reporting Interface

This interface provides versions of the set_report_* methods in the ovm_report_object base class that are applied recursively to this component and all its children.

When a report is issued and its associated action has the LOG bit set, the report will be sent to its associated FILE descriptor.

set_report_severity_action_hier

```
function void set_report_severity_action_hier (ovm_severity severity,
                                               ovm_action   action   )
```

set_report_id_action_hier

```
function void set_report_id_action_hier (string     id,
                                         ovm_action action)
```

set_report_severity_id_action_hier

```
function void set_report_severity_id_action_hier(ovm_severity severity,
                                                 string       id,
                                                 ovm_action   action   )
```

These methods recursively associate the specified action with reports of the given *severity*, *id*, or *severity-id* pair. An action associated with a particular severity-id pair takes precedence over an action associated with id, which takes precedence over an an action associated with a severity.

For a list of severities and their default actions, refer to ovm_report_handler.

set_report_default_file_hier

```
function void set_report_default_file_hier (OVM_FILE file)
```

set_report_severity_file_hier

```
function void set_report_severity_file_hier (ovm_severity severity,
                                             OVM_FILE     file     )
```

set_report_id_file_hier

```
function void set_report_id_file_hier (string   id,
                                       OVM_FILE file)
```

set_report_severity_id_file_hier

```
function void set_report_severity_id_file_hier(ovm_severity severity,
                                               string       id,
                                               OVM_FILE     file     )
```

These methods recursively associate the specified FILE descriptor with reports of the given *severity*, *id*, or *severity-id* pair. A FILE associated with a particular severity-id pair takes precedence over a FILE associated with id, which take precedence over an a FILE associated with a severity, which takes precedence over the default FILE descriptor.

For a list of severities and other information related to the report mechanism, refer to ovm_report_handler.

set_report_verbosity_level_hier

```
function void set_report_verbosity_level_hier (int verbosity)
```

This method recursively sets the maximum verbosity level for reports for this component and all those below it. Any report from this component subtree whose verbosity exceeds this maximum will be ignored.

See ovm_report_handler for a list of predefined message verbosity levels and their meaning.

Recording Interface

These methods comprise the component-based transaction recording interface. The methods can be used to record the transactions that this component "sees", i.e. produces or consumes.

The API and implementation are subject to change once a vendor-independent use-model is determined.

accept_tr

```
function void accept_tr (ovm_transaction tr,
                         time            accept_time = )
```

This function marks the acceptance of a transaction, *tr*, by this component. Specifically, it performs the following actions:

- Calls the *tr*'s ovm_transaction::accept_tr method, passing to it the *accept_time* argument.
- Calls this component's do_accept_tr method to allow for any post-begin action in derived classes.
- Triggers the component's internal accept_tr event. Any processes waiting on this event will resume in the next delta cycle.

do_accept_tr

```
virtual protected function void do_accept_tr (ovm_transaction tr)
```

The accept_tr method calls this function to accommodate any user-defined post-accept action. Implementations should call super.do_accept_tr to ensure correct operation.

begin_tr

```
function integer begin_tr (ovm_transaction tr,
                           string          stream_name = "main",
                           string          label       = "",
                           string          desc        = "",
                           time            begin_time  = 0                )
```

This function marks the start of a transaction, *tr*, by this component. Specifically, it performs the following actions:

- Calls *tr*'s ovm_transaction::begin_tr method, passing to it the *begin_time* argument. The *begin_time* should be greater than or equal to the accept time. By default, when *begin_time* = 0, the current simulation time is used.

If recording is enabled (recording_detail != OVM_OFF), then a new database-transaction is started on the component's transaction stream given by the stream argument. No transaction properties are recorded at this time.

- Calls the component's do_begin_tr method to allow for any post-begin action in derived classes.
- Triggers the component's internal begin_tr event. Any processes waiting on this event will resume in the next delta cycle.

A handle to the transaction is returned. The meaning of this handle, as well as the interpretation of the arguments *stream_name*, *label*, and *desc* are vendor specific.

begin_child_tr

```
function integer begin_child_tr (ovm_transaction tr,
                                 integer         parent_handle = 0,
                                 string          stream_name   = "main",
                                 string          label         = "",
                                 string          desc          = "",
                                 time            begin_time    = 0            )
```

This function marks the start of a child transaction, *tr*, by this component. Its operation is identical to that of begin_tr, except that an association is made between this transaction and the provided parent transaction. This association is vendor-specific.

do_begin_tr

```
virtual protected function void do_begin_tr (ovm_transaction tr,
                                             string          stream_name,
                                             integer         tr_handle   )
```

The begin_tr and begin_child_tr methods call this function to accommodate any user-defined post-begin action. Implementations should call super.do_begin_tr to ensure correct operation.

end_tr

```
function void end_tr (ovm_transaction tr,
                      time            end_time    = 0,
                      bit             free_handle = 1                       )
```

This function marks the end of a transaction, *tr*, by this component. Specifically, it performs the following actions:

- Calls *tr*'s ovm_transaction::end_tr method, passing to it the *end_time* argument. The *end_time* must at least be greater than the begin time. By default, when *end_time* = 0, the current simulation time is used.

The transaction's properties are recorded to the database-transaction on which it was started, and then the transaction is ended. Only those properties handled by the transaction's do_record method (and optional `ovm_*_field macros) are recorded.

- Calls the component's do_end_tr method to accommodate any post-end action in derived classes.

- Triggers the component's internal end_tr event. Any processes waiting on this event will resume in the next delta cycle.

The *free_handle* bit indicates that this transaction is no longer needed. The implementation of free_handle is vendor-specific.

do_end_tr

```
virtual protected function void do_end_tr (ovm_transaction tr,
                                           integer         tr_handle)
```

The end_tr method calls this function to accommodate any user-defined post-end action. Implementations should call super.do_end_tr to ensure correct operation.

record_error_tr

```
function integer record_error_tr (string     stream_name = "main",
                                  ovm_object info        = null,
                                  string     label       = "error_tr",
                                  string     desc        = "",
                                  time       error_time  = 0,
                                  bit        keep_active = 0                )
```

This function marks an error transaction by a component. Properties of the given ovm_object, *info*, as implemented in its <do_record> method, are recorded to the transaction database.

An *error_time* of 0 indicates to use the current simulation time. The *keep_active* bit determines if the handle should remain active. If 0, then a zero-length error transaction is recorded. A handle to the database-transaction is returned.

Interpretation of this handle, as well as the strings *stream_name*, *label*, and *desc*, are vendor-specific.

record_event_tr

```
function integer record_event_tr (string     stream_name = "main",
                                  ovm_object info        = null,
                                  string     label       = "event_tr",
                                  string     desc        = "",
                                  time       event_time  = 0,
                                  bit        keep_active = 0                )
```

This function marks an event transaction by a component.

An *event_time* of 0 indicates to use the current simulation time.

A handle to the transaction is returned. The *keep_active* bit determines if the handle may be used for other vendor-specific purposes.

The strings for *stream_name*, *label*, and *desc* are vendor-specific identifiers for the transaction.

print_enabled

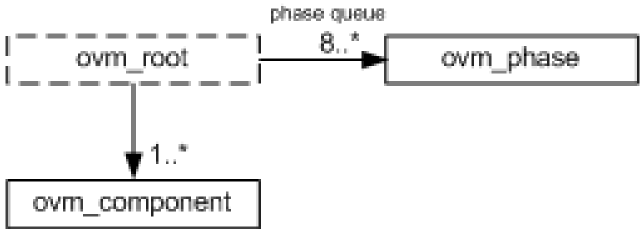
```
bit print_enabled = 1
```

This bit determines if this component should automatically be printed as a child of its parent object.

By default, all children are printed. However, this bit allows a parent component to disable the printing of specific children.

ovm_root

The *ovm_root* class serves as the implicit top-level and phase controller for all OVM components. Users do not directly instantiate *ovm_root*. The OVM automatically creates a single instance of ovm_root that users can access via the global (ovm_pkg-scope) variable, *ovm_top*.



The *ovm_top* instance of *ovm_root* plays several key roles in the OVM.

Implicit top-level	The *ovm_top* serves as an implicit top-level component. Any component whose parent is specified as NULL becomes a child of *ovm_top*. Thus, all OVM components in simulation are descendants of *ovm_top*.
Phase control	*ovm_top* manages the phasing for all components. There are eight phases predefined in every component: build, connect, end_of_elaboration, start_of_simulation, run, extract, check, and report. Of these, only the run phase is a task. All others are functions. OVM's flexible phasing mechanism allows users to insert any number of custom function and task-based phases. See run_test, insert_phase, and stop_request, and others.
Search	Use *ovm_top* to search for components based on their hierarchical name. See find and find_all.
Report configuration	Use *ovm_top* to globally configure report verbosity, log files, and actions. For example, *ovm_top.set_report_verbosity_level_hier(OVM_FULL)* would set full verbosity for all components in simulation.
Global reporter	Because *ovm_top* is globally accessible (in ovm_pkg scope), OVM's reporting mechanism is accessible from anywhere outside *ovm_component*, such as in modules and sequences. See ovm_report_error, ovm_report_warning, and other global methods.

Summary

ovm_root

The *ovm_root* class serves as the implicit top-level and phase controller for all OVM components.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_root

Class Declaration

```
class ovm_root extends ovm_component
```

Methods	
run_test	Phases all components through all registered phases.
stop_request	Calling this function triggers the process of shutting down the currently running task-based phase.
in_stop_request	This function returns 1 if a stop request is currently active, and 0 otherwise.
insert_phase	Inserts a new phase given by new_phase after the existing phase given by exist_phase.
find	
find_all	Returns the component handle (find) or list of components handles (find_all) matching a given string.
get_current_phase	Returns the handle of the currently executing phase.
get_phase_by_name	Returns the handle of the phase having the given *name*.
Variables	
phase_timeout	
stop_timeout	These set watchdog timers for task-based phases and stop tasks.
enable_print_topology	If set, then the entire testbench topology is printed just after completion of the end_of_elaboration phase.
finish_on_completion	If set, then run_test will call $finish after all phases are executed.
ovm_top	This is the top-level that governs phase execution and provides component search interface.
Methods	
raised	
all_dropped	

Methods

run_test

```
virtual task run_test (string test_name = "" )
```

Phases all components through all registered phases. If the optional test_name argument is provided, or if a command-line plusarg, +OVM_TESTNAME=TEST_NAME, is found, then the specified component is created just prior to phasing. The test may contain new verification components or the entire testbench, in which case the test and testbench can be chosen from the command line without forcing recompilation. If the global (package) variable, finish_on_completion, is set, then $finish is called after phasing completes.

stop_request

```
function void stop_request()
```

Calling this function triggers the process of shutting down the currently running task-based phase. This process involves calling all components' stop tasks for those components whose enable_stop_interrupt bit is set. Once all stop tasks return, or once the optional global_stop_timeout expires, all components' kill method is called, effectively ending the current phase. The ovm_top will then begin execution of the next phase, if any.

in_stop_request

```
function bit in_stop_request()
```

This function returns 1 if a stop request is currently active, and 0 otherwise.

insert_phase

```
function void insert_phase (ovm_phase new_phase,
                            ovm_phase exist_phase)
```

Inserts a new phase given by new_phase after the existing phase given by exist_phase. The ovm_top maintains a queue of phases executed in consecutive order. If exist_phase is null, then new_phase is inserted at the head of the queue, i.e., it becomes the first phase.

find

```
function ovm_component find (string comp_match)
```

find_all

```
function void find_all (      string        comp_match,
                          ref ovm_component comps[$],
                        input ovm_component comp        = null        )
```

Returns the component handle (find) or list of components handles (find_all) matching a given string. The string may contain the wildcards,

- and ?. Strings beginning with '.' are absolute path names. If optional comp arg is provided, then search begins from that component down (default=all components).

get_current_phase

```
function ovm_phase get_current_phase ()
```

Returns the handle of the currently executing phase.

get_phase_by_name

```
function ovm_phase get_phase_by_name (string name)
```

Returns the handle of the phase having the given *name*.

Variables

phase_timeout

```
time phase_timeout = 0
```

stop_timeout

```
time stop_timeout = 0
```

These set watchdog timers for task-based phases and stop tasks. You can not disable the timeouts. When set to 0, a timeout of the maximum time possible is applied. A timeout at this value usually indicates a problem with your testbench. You should lower the timeout to prevent “never-ending” simulations.

enable_print_topology

```
bit enable_print_topology = 0
```

If set, then the entire testbench topology is printed just after completion of the end_of_elaboration phase.

finish_on_completion

```
bit finish_on_completion = 1
```

If set, then run_test will call $finish after all phases are executed.

ovm_top

```
`const ovm_root ovm_top = ovm_root::get()
```

This is the top-level that governs phase execution and provides component search interface. See ovm_root for more information.

Methods

raised

```
function void ovm_root::raised (ovm_objection objection,
                                ovm_object    source_obj,
                                int           count      )
```

all_dropped

```
task ovm_root::all_dropped (ovm_objection objection,
                            ovm_object    source_obj,
                            int           count      )
```

ovm_phase

The ovm_phase class is used for defining phases for ovm_component and its subclasses. For a list of predefined phases see ovm_component::Phasing Interface

Summary

ovm_phase

The ovm_phase class is used for defining phases for ovm_component and its subclasses.

Class Declaration

```
virtual class ovm_phase
```

Methods

new	Creates a phase object.
get_name	Returns the name of the phase object as supplied in the constructor.
is_task	Returns 1 if the phase is time consuming and 0 if not.
is_top_down	Returns 1 if the phase executes top-down (executes the parent¿s phase callback before executing the children¿s callback) and 0 otherwise.
get_type_name	Derived classes should override this method to return the phase type name.
wait_start	Waits until the phase has beed started.
wait_done	Waits until the phase has been completed.
is_in_progress	Returns 1 if the phase is currently in progress (active), 0 otherwise.
is_done	Returns 1 if the phase has completed, 0 otherwise.
reset	Resets phase state such that is_done and is_in_progress both return 0.
call_task	Calls the task-based phase of the component given by parent, which must be derived from ovm_component.
call_func	Calls the function-based phase of the component given by parent.

Methods

new

```
function new (string name,
              bit    is_top_down,
              bit    is_task     )
```

Creates a phase object.

The name is the name of the phase. When is_top_down is set, the parent is phased before its children. is_task indicates whether the phase callback is a task (1) or function (0). Only tasks may consume simulation time and execute blocking statements.

get_name

```
function string get_name ()
```

Returns the name of the phase object as supplied in the constructor.

is_task

```
function bit is_task ()
```

Returns 1 if the phase is time consuming and 0 if not.

is_top_down

```
function bit is_top_down ()
```

Returns 1 if the phase executes top-down (executes the parent¿s phase callback before executing the children¿s callback) and 0 otherwise.

get_type_name

```
virtual function string get_type_name()
```

Derived classes should override this method to return the phase type name.

wait_start

```
task wait_start ()
```

Waits until the phase has beed started.

wait_done

```
task wait_done ()
```

Waits until the phase has been completed.

is_in_progress

```
function bit is_in_progress ()
```

Returns 1 if the phase is currently in progress (active), 0 otherwise.

is_done

```
function bit is_done ()
```

Returns 1 if the phase has completed, 0 otherwise.

reset

```
function void reset ()
```

Resets phase state such that is_done and is_in_progress both return 0.

call_task

```
virtual task call_task (ovm_component parent)
```

Calls the task-based phase of the component given by parent, which must be derived from ovm_component. A task-based phase is defined by subtyping ovm_phase and overriding this method. The override must $cast the base parent handle to the actual component type that defines the phase callback, and then call the phase callback.

call_func

```
virtual function void call_func (ovm_component parent)
```

Calls the function-based phase of the component given by parent. A function-based phase is defined by subtyping ovm_phase and overriding this method. The override must $cast the base parent handle to the actual component type that defines the phase callback, and then call that phase callback.

Usage

Phases are a synchronizing mechanism for the environment. They are represented by callback methods. A set of predefined phases and corresponding callbacks are provided in ovm_component. Any class deriving from ovm_component may implement any or all of these callbacks, which are executed in a particular order. Depending on the properties of any given phase, the corresponding callback is either a function or task, and it is executed in top-down or bottom-up order.

The OVM provides the following predefined phases for all ovm_components.

build	Depending on configuration and factory settings, create and configure additional component hierarchies.
connect	Connect ports, exports, and implementations (imps).
end_of_elaboration	Perform final configuration, topology, connection, and other integrity checks.
start_of_simulation	Do pre-run activities such as printing banners, pre-loading memories, etc.
run	Most verification is done in this time-consuming phase. May fork other processes. Phase ends when global_stop_request is called explicitly.
extract	Collect information from the run in preparation for checking.
check	Check simulation results against expected outcome.
report	Report simulation results.

A phase is defined by an instance of an *ovm_phase* subtype. If a phase is to be shared among several component types, the instance must be accessible from a common scope, such as a package.

To have a user-defined phase get called back during simulation, the phase object must be registered with the top-level OVM phase controller, ovm_top.

Inheriting from the *ovm_phase* Class

When creating a user-defined phase, you must do the following.

1. Define a new phase class, which must extend *ovm_phase*. To enable use of the phase by any component, we recommend this class be parameterized. The easiest way to define a new phase is to invoke a predefined macro. For example:

```
`ovm_phase_func_topdown_decl( preload )
```

This convenient phase declaration macro is described below.

2. Create a single instance of the phase in a convenient placein a package, or in the same scope as the component classes that will use the phase.

```
typedef class my_memory;
preload_phase #(my_memory) preload_ph = new;
```

3. Register the phase object with ovm_top.

```
class my_memory extends ovm_component;
  function new(string name, ovm_component parent);
    super.new(name,parent);
```

```
    ovm_top.insert_phase(preload_ph, start_of_simulation_ph);
  endfunction
  virtual function void preload(); // our new phase
    ...
  endfunction
endclass
```

Phase Macros (Optional)

The following macros simplify the process of creating a user-defined phase. They create a phase type that is parameterized to the component class that uses the phase.

Summary

Usage	Phases are a synchronizing mechanism for the environment.
Macros	
`ovm_phase_func_decl	`ovm_phase_func_decl (PHASE_NAME, TOP_DOWN)
`ovm_phase_task_decl	
`ovm_phase_func_topdown_decl	
`ovm_phase_func_bottomup_decl	
`ovm_phase_task_topdown_decl	
`ovm_phase_task_bottomup_decl	These alternative macros have a single phase name argument.

Macros

`ovm_phase_func_decl

`ovm_phase_func_decl (PHASE_NAME, TOP_DOWN)

The *PHASE_NAME* argument is used to define the name of the phase, the name of the component method that is called back during phase execution, and the prefix of the type-name of the phase class that gets generated.

The above macro creates the following class definition.

```
class PHASE_NAME``_phase #(type PARENT=int) extends ovm_phase;

  PARENT m_parent;

  function new();
     super.new(`"NAME`",TOP_DOWN,1);
  endfunction
  virtual function void call_func();
     m_parent.NAME(); // call the component¿s phase callback
  endtask
```

```
  virtual task execute(ovm_component parent);
     assert($cast(m_parent,parent));
     call_func();
  endtask
endclass
```

`ovm_phase_task_decl

```
`ovm_phase_task_decl (PHASE_NAME, TOP_DOWN)
```

The above macro creates the following class definition.

```
class PHASE_NAME``_phase #(type PARENT=int) extends ovm_phase;
  PARENT m_parent;
  function new();
   super.new(`"NAME`",TOP_DOWN,1);
  endfunction
  virtual task call_task();
       m_parent.NAME(); // call the component¿s phase callback
  endtask
  virtual task execute(ovm_component parent);
       assert($cast(m_parent,parent));
       call_task();
  endtask
endclass
```

`ovm_phase_func_topdown_decl

`ovm_phase_func_bottomup_decl

`ovm_phase_task_topdown_decl

`ovm_phase_task_bottomup_decl

These alternative macros have a single phase name argument. The top-down or bottom-up selection is specified in the macro name, which makes them more self-documenting than those with a 0 or 1 2nd argument.

```
`define ovm_phase_func_topdown_decl  `ovm_phase_func_decl (PHASE_NAME,1)
`define ovm_phase_func_bottomup_decl `ovm_phase_func_decl (PHASE_NAME,0)
`define ovm_phase_task_topdown_decl  `ovm_phase_task_decl (PHASE_NAME,1)
`define ovm_phase_task_bottomup_decl `ovm_phase_task_decl (PHASE_NAME,0)
```

ovm_port_base #(IF)

Transaction-level communication between components is handled via its ports, exports, and imps, all of which derive from this class.

The ovm_port_base extends IF, which is the type of the interface implemented by derived port, export, or implementation. IF is also a type parameter to ovm_port_base.
*IF*The interface type implemented by the subtype to this base port

The OVM provides a complete set of ports, exports, and imps for the OSCI- standard TLM interfaces. They can be found in the ../src/tlm/ directory. For the TLM interfaces, the IF parameter is always tlm_if_base #(T1,T2).

Just before ovm_component::end_of_elaboration, an internal ovm_component::resolve_bindings process occurs, after which each port and export holds a list of all imps connected to it via hierarchical connections to other ports and exports. In effect, we are collapsing the port's fanout, which can span several levels up and down the component hierarchy, into a single array held local to the port. Once the list is determined, the port's min and max connection settings can be checked and enforced.

ovm_port_base possesses the properties of components in that they have a hierarchical instance path and parent. Because SystemVerilog does not support multiple inheritance, ovm_port_base can not extend both the interface it implements and ovm_component. Thus, ovm_port_base contains a local instance of ovm_component, to which it delegates such commands as get_name, get_full_name, and get_parent.

Summary

ovm_port_base #(IF)

Transaction-level communication between components is handled via its ports, exports, and imps, all of which derive from this class.

Class Hierarchy

IF

ovm_port_base#(IF)

Class Declaration

```
virtual class ovm_port_base #(
    type   IF  =  ovm_void
) extends IF
```

Methods

new	The first two arguments are the normal ovm_component constructor arguments.
get_name	Returns the leaf name of this port.
get_full_name	Returns the full hierarchical name of this port.
get_parent	Returns the handle to this port's parent, or null if it has no parent.
get_comp	Returns a handle to the internal proxy component representing this port.
get_type_name	Returns the type name to this port.

min_size	Returns the mininum number of implementation ports that must be connected to this port by the end_of_elaboration phase.
max_size	Returns the maximum number of implementation ports that must be connected to this port by the end_of_elaboration phase.
is_unbounded	Returns 1 if this port has no maximum on the number of implementation (imp) ports this port can connect to.
is_port	
is_export	
is_imp	Returns 1 if this port is of the type given by the method name, 0 otherwise.
size	Gets the number of implementation ports connected to this port.
set_default_index	Sets the default implementation port to use when calling an interface method.
connect	Connects this port to the given *provider* port.
debug_connected_to	The debug_connected_to method outputs a visual text display of the port/export/imp network to which this port connects (i.e., the port's fanout).
debug_provided_to	The debug_provided_to method outputs a visual display of the port/export network that ultimately connect to this port (i.e., the port's fanin).
resolve_bindings	This callback is called just before entering the end_of_elaboration phase.
get_if	Returns the implementation (imp) port at the given index from the array of imps this port is connected to.

Methods

new

```
function new (string           name,
              ovm_component    parent,
              ovm_port_type_e  port_type,
              int              min_size   = 0,
              int              max_size   = 1                    )
```

The first two arguments are the normal ovm_component constructor arguments.

The *port_type* can be one of OVM_PORT, OVM_EXPORT, or OVM_IMPLEMENTATION.

The *min_size* and *max_size* specify the minimum and maximum number of implementation (imp) ports that must be connected to this port base by the end of elaboration. Setting *max_size* to OVM_UNBOUNDED_CONNECTIONS sets no maximum, i.e., an unlimited number of connections are allowed.

By default, the parent/child relationship of any port being connected to this port is not checked. This can be overridden by configuring the port's *check_connection_relationships* bit via set_config_int. See connect for more information.

get_name

```
function string get_name()
```

Returns the leaf name of this port.

get_full_name

```
virtual function string get_full_name()
```

Returns the full hierarchical name of this port.

get_parent

```
virtual function ovm_component get_parent()
```

Returns the handle to this port's parent, or null if it has no parent.

get_comp

```
virtual function ovm_port_component_base get_comp()
```

Returns a handle to the internal proxy component representing this port.

Ports are considered components. However, they do not inherit ovm_component. Instead, they contain an instance of <ovm_port_component #(PORT)> that serves as a proxy to this port.

get_type_name

```
virtual function string get_type_name()
```

Returns the type name to this port. Derived port classes must implement this method to return the concrete type. Otherwise, only a generic "ovm_port", "ovm_export" or "ovm_implementation" is returned.

min_size

Returns the mininum number of implementation ports that must be connected to this port by the end_of_elaboration phase.

max_size

Returns the maximum number of implementation ports that must be connected to this port by the end_of_elaboration phase.

is_unbounded

```
function bit is_unbounded ()
```

Returns 1 if this port has no maximum on the number of implementation (imp) ports this port can connect to. A port is unbounded when the *max_size* argument in the constructor is specified as OVM_UNBOUNDED_CONNECTIONS.

is_port

```
function bit is_port ()
```

is_export

```
function bit is_export ()
```

is_imp

```
function bit is_imp ()
```

Returns 1 if this port is of the type given by the method name, 0 otherwise.

size

```
function int size ()
```

Gets the number of implementation ports connected to this port. The value is not valid before the end_of_elaboration phase, as port connections have not yet been resolved.

set_default_index

```
function void set_default_index (int index)
```

Sets the default implementation port to use when calling an interface method. This method should only be called on OVM_EXPORT types. The value must not be set before the end_of_elaboration phase, when port connections have not yet been resolved.

connect

```
virtual function void connect (this_type provider)
```

Connects this port to the given *provider* port. The ports must be compatible in the following ways

- Their type parameters must match
- The *provider*'s interface type (blocking, non-blocking, analysis, etc.) must be compatible. Each port has an interface mask that encodes the interface(s) it supports. If the bitwise AND of these masks is equal to the this port's mask, the requirement is met and the ports are compatible. For example, an ovm_blocking_put_port #(T) is compatible with an ovm_put_export #(T) and ovm_blocking_put_imp #(T) because the export and imp provide the interface required by the ovm_blocking_put_port.
- Ports of type OVM_EXPORT can only connect to other exports or imps.
- Ports of type OVM_IMPLEMENTATION can not be connected, as they are bound to the component that implements the interface at time of construction.

In addition to type-compatibility checks, the relationship between this port and the *provider* port will also be checked if the port's *check_connection_relationships* configuration has been set. (See new for more information.)

Relationships, when enabled, are checked are as follows

- If this port is an OVM_PORT type, the *provider* can be a parent port, or a sibling export or implementation port.
- If this port is an OVM_EXPORT type, the provider can be a child export or implementation port.

If any relationship check is violated, a warning is issued.

Note- the ovm_component::connect method is related to but not the same as this method. The component's connect method is a phase callback where port's connect method calls are made.

debug_connected_to

```
function void debug_connected_to (int level     = 0,
                                  int max_level = -1                         )
```

The debug_connected_to method outputs a visual text display of the port/export/imp network to which this port connects (i.e., the port’s fanout).

This method must not be called before the end_of_elaboration phase, as port connections are not resolved until then.

debug_provided_to

```
function void debug_provided_to (int level     = 0,
                                 int max_level = -1                          )
```

The debug_provided_to method outputs a visual display of the port/export network that ultimately connect to this port (i.e., the port’s fanin).

This method must not be called before the end_of_elaboration phase, as port connections are not resolved until then.

resolve_bindings

```
virtual function void resolve_bindings()
```

This callback is called just before entering the end_of_elaboration phase. It recurses through each port’s fanout to determine all the imp destina- tions. It then checks against the required min and max connections. After resolution, size returns a valid value and get_if can be used to access a particular imp.

This method is automatically called just before the start of the end_of_elaboration phase. Users should not need to call it directly.

get_if

```
function ovm_port_base #(IF) get_if(int index=0)
```

Returns the implementation (imp) port at the given index from the array of imps this port is connected to. Use size to get the valid range for index. This method can only be called at the end_of_elaboration phase or after, as port connections are not resolved before then.

ovm_barrier_pool

Summary

ovm_barrier_pool

Class Hierarchy

ovm_object

ovm_barrier_pool

Class Declaration

```
class ovm_barrier_pool extends ovm_object
```

Methods

new	Creates a new barrier pool with the given *name*.
get_global_pool	Returns the singleton global barrier pool.
get	Returns the barrier with the given *name*.
num	Returns the number of uniquely named barriers stored in the pool.
delete	Removes the barrier with the given *name* from the pool.
exists	Returns 1 if a barrier with the given *name* exists in the pool, 0 otherwise.
first	Returns the name of the first barrier stored in the pool.
last	Returns the name of the last barrier stored in the pool.
next	Returns the name of the next barrier in the pool.
prev	Returns the name of the previous barrier in the pool.

Methods

new

```
function new (string name = "" )
```

Creates a new barrier pool with the given *name*.

get_global_pool

```
static function ovm_barrier_pool get_global_pool ()
```

Returns the singleton global barrier pool.

This allows barriers to be shared amongst components throughout the verification environment.

get

```
virtual function ovm_barrier get (string name)
```

Returns the barrier with the given *name*.

If no barrier exists by that name, a new barrier is created with that name and returned.

num

```
virtual function int num ()
```

Returns the number of uniquely named barriers stored in the pool.

delete

```
virtual function void delete (string name)
```

Removes the barrier with the given *name* from the pool.

exists

```
virtual function int exists (string name)
```

Returns 1 if a barrier with the given *name* exists in the pool, 0 otherwise.

first

```
virtual function int first (ref string name)
```

Returns the name of the first barrier stored in the pool.

If the pool is empty, then *name* is unchanged and 0 is returned.

If the pool is not empty, then *name* is name of the first barrier and 1 is returned.

last

```
virtual function int last (ref string name)
```

Returns the name of the last barrier stored in the pool.

If the pool is empty, then 0 is returned and *name* is unchanged.

If the pool is not empty, then *name* is set to the last name in the pool and 1 is returned.

next

```
virtual function int next (ref string name)
```

Returns the name of the next barrier in the pool.

If the input *name* is the last name in the pool, then *name* is left unchanged and 0 is returned.

If a next name is found, then *name* is updated with that name and 1 is returned.

prev

```
virtual function int prev (ref string name)
```

Returns the name of the previous barrier in the pool.

If the input *name* is the first name in the pool, then *name* is left unchanged and 0 is returned.

If a previous name is found, then *name* is updated with that name and 1 is returned.

ovm_event_pool

The ovm_event_pool is essentially an associative array of ovm_event objects indexed by the string name of the event.

Summary

ovm_event_pool

The ovm_event_pool is essentially an associative array of ovm_event objects indexed by the string name of the event.

Class Hierarchy

ovm_object

ovm_event_pool

Class Declaration

```
class ovm_event_pool extends ovm_object
```

Methods

new	Creates a new event pool with the given *name*.
get_global_pool	Returns the singleton global event pool.
get	Returns the event with the given *name*.
num	Returns the number of uniquely named events stored in the pool.
delete	Removes the event with the given *name* from the pool.
exists	Returns 1 if an event with the given *name* exists in the pool, 0 otherwise.
first	Returns the name of the first event stored in the pool.
last	Returns the name of the last event stored in the pool.
next	Returns the name of the next event in the pool.
prev	Returns the name of the previous event in the pool.

Methods

new

```
function new (string name = ""                    )
```

Creates a new event pool with the given *name*.

get_global_pool

```
static function ovm_event_pool get_global_pool ()
```

Returns the singleton global event pool.

This allows events to be shared between components throughout the verification environment.

get

```
virtual function ovm_event get (string name)
```

Returns the event with the given *name*.

If no event exists by that name, a new event is created with that name and returned.

num

```
virtual function int num ()
```

Returns the number of uniquely named events stored in the pool.

delete

```
virtual function void delete (string name)
```

Removes the event with the given *name* from the pool.

exists

```
virtual function int exists (string name)
```

Returns 1 if an event with the given *name* exists in the pool, 0 otherwise.

first

```
virtual function int first (ref string name)
```

Returns the name of the first event stored in the pool.

If the pool is empty, then *name* is unchanged and 0 is returned.

If the pool is not empty, then *name* is name of the first event and 1 is returned.

last

```
virtual function int last (ref string name)
```

Returns the name of the last event stored in the pool.

If the pool is empty, then 0 is returned and *name* is unchanged.

If the pool is not empty, then *name* is set to the last name in the pool and 1 is returned.

next

```
virtual function int next (ref string name)
```

Returns the name of the next event in the pool.

If the input *name* is the last name in the pool, then name is unchanged and 0 is returned.

If a next name is found, then *name* is updated with that name and 1 is returned.

prev

```
virtual function int prev (ref string name)
```

Returns the name of the previous event in the pool.

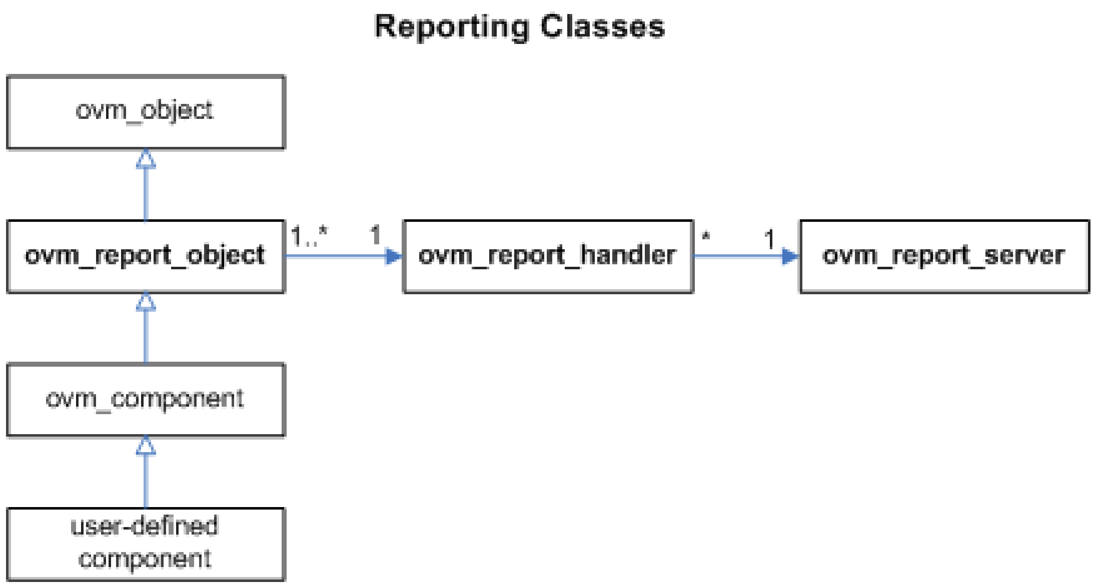
If the input *name* is the first name in the pool, then *name* is left unchanged and 0 is returned.

If a previous name is found, then *name* is updated with that name and 1 is returned.

Reporting Classes

The reporting classes provide a facility for issuing reports with consistent formatting. Users can configure what actions to take and what files to send output to based on report severity, ID, or both severity and ID. Users can also filter messages based on their verbosity settings.

The primary interface to the OVM reporting facility is the ovm_report_object from which all ovm_components extend. The ovm_report_object delegates most tasks to its internal ovm_report_handler. If the report handler determines the report is not filtered based the configured verbosity setting, it sends the report to the central ovm_report_server for formatting and processing.



ovm_report_object

The ovm_report_object provides an interface to the OVM reporting facility. Through this interface, components issue the various messages that occur during simulation. Users can configure what actions are taken and what file(s) are output for individual messages from a particular component or for all messages from all components in the environment. Defaults are applied where there is no explicit configuration.

Most methods in ovm_report_object are delegated to an internal instance of an ovm_report_handler, which stores the reporting configuration and determines whether an issued message should be displayed based on that configuration. Then, to display a message, the report handler delegates the actual formatting and production of messages to a central ovm_report_server.

A report consists of an id string, severity, verbosity level, and the textual message itself. They may optionally include the filename and line number from which the message came. If the verbosity level of a report is greater than the configured maximum verbosity level of its report object, it is ignored. If a report passes the verbosity filter in effect, the report's action is determined. If the action includes output to a file, the configured file descriptor(s) are determined.

Actions — can be set for (in increasing priority) severity, id, and (severity,id) pair. They include output to the screen OVM_DISPLAY, whether the message counters should be incremented OVM_COUNT, and whether a $finish should occur OVM_EXIT.

Default Actions — The following provides the default actions assigned to each severity. These can be overridden by any of the set_*_action methods.

```
OVM_INFO -       OVM_DISPLAY
OVM_WARNING -    OVM_DISPLAY
OVM_ERROR -      OVM_DISPLAY | OVM_COUNT
OVM_FATAL -      OVM_DISPLAY | OVM_EXIT
```

File descriptors — These can be set by (in increasing priority) default, severity level, an id, or (severity,id) pair. File descriptors are standard verilog file descriptors; they may refer to more than one file. It is the user's responsibility to open and close them.

Default file handle — The default file handle is 0, which means that reports are not sent to a file even if an OVM_LOG attribute is set in the action associated with the report. This can be overridden by any of the set_*_file methods.

Summary

ovm_report_object

The ovm_report_object provides an interface to the OVM reporting facility.

Class Hierarchy

ovm_object

ovm_report_object

Class Declaration

```
virtual class ovm_report_object extends ovm_object
```

new	Creates a new report object with the given name.
Reporting	
ovm_report_info	
ovm_report_warning	
ovm_report_error	
ovm_report_fatal	These are the primary reporting methods in the OVM.
Callbacks	
report_info_hook	
report_error_hook	
report_warning_hook	
report_fatal_hook	
report_hook	These hook methods can be defined in derived classes to perform additional actions when reports are issued.
report_header	Prints version and copyright information.
report_summarize	Outputs statistical information on the reports issued by the central report server.
die	This method is called by the report server if a report reaches the maximum quit count or has an OVM_EXIT action associated with it, e.g., as with fatal errors.
Configuration	
set_report_verbosity_level	This method sets the maximum verbosity level for reports for this component.
set_report_severity_action	
set_report_id_action	
set_report_severity_id_action	These methods associate the specified action or actions with reports of the given *severity*, *id*, or *severity-id* pair.
set_report_default_file	
set_report_severity_file	
set_report_id_file	
set_report_severity_id_file	These methods configure the report handler to direct some or all of its output to the given file descriptor.
get_report_verbosity_level	Gets the verbosity level in effect for this object.
get_report_action	Gets the action associated with reports having the given *severity* and *id*.
get_report_file_handle	Gets the file descriptor associated with reports having the given *severity* and *id*.
ovm_report_enabled	Returns 1 if the configured verbosity for this object is greater than *verbosity* and the action associated with the given *severity* and *id* is not OVM_NO_ACTION, else returns 0.
set_report_max_quit_count	Sets the maximum quit count in the report handler to *max_count*.
Setup	
set_report_handler	Sets the report handler, overwriting the default instance.
get_report_handler	Returns the underlying report handler to which most reporting tasks are delegated.
reset_report_handler	Resets the underlying report handler to its default settings.
get_report_server	Returns the ovm_report_server instance associated with this report object.
dump_report_state	This method dumps the internal state of the report handler.
new	Creates a new reporter instance with the given name.

new

```
function new(string name = "")
```

Creates a new report object with the given name. This method also creates a new ovm_report_handler object to which most tasks are delegated.

Reporting

ovm_report_info

```
virtual function void ovm_report_info(string id,
                                      string message,
                                      int    verbosity = OVM_MEDIUM,
                                      string filename  = "",
                                      int    line      = 0         )
```

ovm_report_warning

```
virtual function void ovm_report_warning(string id,
                                         string message,
                                         int    verbosity = OVM_MEDIUM,
                                         string filename  = "",
                                         int    line      = 0         )
```

ovm_report_error

```
virtual function void ovm_report_error(string id,
                                       string message,
                                       int    verbosity = OVM_LOW,
                                       string filename  = "",
                                       int    line      = 0      )
```

ovm_report_fatal

```
virtual function void ovm_report_fatal(string id,
                                       string message,
                                       int    verbosity = OVM_NONE,
                                       string filename  = "",
                                       int    line      = 0            )
```

These are the primary reporting methods in the OVM. Using these instead of *$display* and other ad hoc approaches ensures consistent output and central control over where output is directed and any actions that result. All reporting methods have the same arguments, although each has a different default verbosity:

id	a unique id for the report or report group that can be used for identification and therefore targeted filtering. You can configure an individual report's actions and output file(s) using this id string.
message	the message body, preformatted if necessary to a single string.
verbosity	the verbosity of the message, indicating its relative importance. If this number is less than or equal to the effective verbosity level (see <set_report_verbosity_level>), then the report is issued, subject to the configured action and file descriptor settings. Verbosity is ignored for warnings, errors, and fatals to ensure users do not inadvertently filter them out. It remains in the methods for backward compatibility.
filename/line	(Optional) The location from which the report was issued. Use the predefined macros, \`__FILE__ and \`__LINE__. If specified, it is displayed in the output.

Callbacks

report_info_hook

```
virtual function bit report_info_hook(string id,
                                      string message,
                                      int    verbosity,
                                      string filename,
                                      int    line      )
```

report_error_hook

```
virtual function bit report_error_hook(string id,
                                       string message,
                                       int    verbosity,
                                       string filename,
                                       int    line      )
```

report_warning_hook

```
virtual function bit report_warning_hook(string id,
                                         string message,
                                         int    verbosity,
                                         string filename,
                                         int    line      )
```

report_fatal_hook

```
virtual function bit report_fatal_hook(string id,
                                       string message,
                                       int    verbosity,
                                       string filename,
                                       int    line      )
```

report_hook

```
virtual function bit report_hook(string id,
                                 string message,
                                 int    verbosity,
                                 string filename,
                                 int    line      )
```

These hook methods can be defined in derived classes to perform additional actions when reports are issued. They are called only if the OVM_CALL_HOOK bit is specified in the action associated with the report. The default implementations return 1, which allows the report to be processed. If an override returns 0, then the report is not processed.

First, the hook method associated with the report's severity is called with the same arguments as the given the report. If it returns 1, the catch-all method, report_hook, is then called. If the severity-specific hook returns 0, the catch-all hook is not called.

report_header

```
virtual function void report_header(OVM_FILE file = 0                    )
```

Prints version and copyright information. This information is sent to the command line if *file* is 0, or to the file descriptor *file* if it is not 0. The ovm_root::run_test task calls this method just before it component phasing begins.

report_summarize

```
virtual function void report_summarize(OVM_FILE file = 0 )
```

Outputs statistical information on the reports issued by the central report server. This information will be sent to the command line if *file* is 0, or to the file descriptor *file* if it is not 0.

The run_test method in ovm_top calls this method.

die

```
virtual function void die()
```

This method is called by the report server if a report reaches the maximum quit count or has an OVM_EXIT action associated with it, e.g., as with fatal errors.

If this report object is an ovm_component and we're in a task-based phase (e.g. run), then die will issue a global_stop_request, which ends the phase and allows simulation to continue to the next phase.

If not a component, die calls report_summarize and terminates simulation with *$finish*.

Configuration

set_report_verbosity_level

```
function void set_report_verbosity_level (int verbosity_level)
```

This method sets the maximum verbosity level for reports for this component. Any report from this component whose verbosity exceeds this maximum will be ignored.

set_report_severity_action

```
function void set_report_severity_action (ovm_severity severity,
                                          ovm_action   action   )
```

set_report_id_action

```
function void set_report_id_action (string     id,
                                    ovm_action action)
```

set_report_severity_id_action

```
function void set_report_severity_id_action (ovm_severity severity,
                                             string       id,
                                             ovm_action   action   )
```

These methods associate the specified action or actions with reports of the given *severity*, *id*, or *severity*-*id* pair. An action associated with a particular *severity*-*id* pair takes precedence over an action associated with *id*, which take precedence over an an action associated with a *severity*.

The *action* argument can take the value OVM_NO_ACTION, or it can be a bitwise OR of any combination of OVM_DISPLAY, OVM_LOG, OVM_COUNT, <OVM_STOP>, OVM_EXIT, and OVM_CALL_HOOK.

set_report_default_file

```
function void set_report_default_file (OVM_FILE file)
```

set_report_severity_file

```
function void set_report_severity_file (ovm_severity severity,
                                        OVM_FILE     file     )
```

set_report_id_file

```
function void set_report_id_file (string   id,
                                  OVM_FILE file)
```

set_report_severity_id_file

```
function void set_report_severity_id_file (ovm_severity severity,
                                           string       id,
                                           OVM_FILE     file     )
```

These methods configure the report handler to direct some or all of its output to the given file descriptor. The *file* argument must be a multi-channel descriptor (mcd) or file id compatible with $fdisplay.

A FILE descriptor can be associated with with reports of the given *severity*, *id*, or *severity-id* pair. A FILE associated with a particular *severity-id* pair takes precedence over a FILE associated with *id*, which take precedence over an a FILE associated with a *severity*, which takes precedence over the default FILE descriptor.

When a report is issued and its associated action has the OVM_LOG bit set, the report will be sent to its associated FILE descriptor. The user is responsible for opening and closing these files.

get_report_verbosity_level

```
function int get_report_verbosity_level()
```

Gets the verbosity level in effect for this object. Reports issued with verbosity greater than this will be filtered out.

get_report_action

```
function int get_report_action(ovm_severity severity,
                               string       id       )
```

Gets the action associated with reports having the given *severity* and *id*.

get_report_file_handle

```
function int get_report_file_handle(ovm_severity severity,
                                    string       id       )
```

Gets the file descriptor associated with reports having the given *severity* and *id*.

ovm_report_enabled

```
function int ovm_report_enabled(int          verbosity,
                                ovm_severity severity   = OVM_INFO,
                                string       id         = ""            )
```

Returns 1 if the configured verbosity for this object is greater than *verbosity* and the action associated with the given *severity* and *id* is not OVM_NO_ACTION, else returns 0.

See also get_report_verbosity_level and get_report_action, and the global version of ovm_report_enabled.

set_report_max_quit_count

```
function void set_report_max_quit_count(int max_count)
```

Sets the maximum quit count in the report handler to *max_count*. When the number of OVM_COUNT actions reaches *max_count*, the die method is called.

The default value of 0 indicates that there is no upper limit to the number of OVM_COUNT reports.

Setup

set_report_handler

```
function void set_report_handler(ovm_report_handler handler)
```

Sets the report handler, overwriting the default instance. This allows more than one component to share the same report handler.

get_report_handler

```
function ovm_report_handler get_report_handler()
```

Returns the underlying report handler to which most reporting tasks are delegated.

reset_report_handler

```
function void reset_report_handler
```

Resets the underlying report handler to its default settings. This clears any settings made with the set_report_* methods (see below).

get_report_server

```
function ovm_report_server get_report_server()
```

Returns the ovm_report_server instance associated with this report object.

dump_report_state

```
function void dump_report_state()
```

This method dumps the internal state of the report handler. This includes information about the maximum quit count, the maximum verbosity, and the action and files associated with severities, ids, and (severity, id) pairs.

new

```
function new(string name = "reporter"                                        )
```

Creates a new reporter instance with the given name.

ovm_report_handler

The ovm_report_handler is the class to which most methods in ovm_report_object delegate. It stores the maximum verbosity, actions, and files that affect the way reports are handled.

The report handler is not intended for direct use. See ovm_report_object for information on the OVM reporting mechanism.

The relationship between ovm_report_object (a base class for ovm_component) and ovm_report_handler is typically one to one, but it can be many to one if several ovm_report_objects are configured to use the same ovm_report_handler_object. See ovm_report_object::set_report_handler.

The relationship between ovm_report_handler and ovm_report_server is many to one.

Summary

ovm_report_handler

The ovm_report_handler is the class to which most methods in ovm_report_object delegate.

Class Declaration

```
class ovm_report_handler
```

Methods

new	Creates and initializes a new ovm_report_handler object.
run_hooks	The run_hooks method is called if the OVM_CALL_HOOK action is set for a report.
get_verbosity_level	Returns the configured maximum verbosity level.
get_action	Returns the action associated with the given *severity* and *id*.
get_file_handle	Returns the file descriptor associated with the given *severity* and *id*.
report	This is the common handler method used by the four core reporting methods (e.g., ovm_report_error) in ovm_report_object.
format_action	Returns a string representation of the *action*, e.g., "DISPLAY".

Methods

new

```
function new()
```

Creates and initializes a new ovm_report_handler object.

run_hooks

```
virtual function bit run_hooks(ovm_report_object client,
                               ovm_severity      severity,
                               string            id,
                               string            message,
                               int               verbosity,
                               string            filename,
                               int               line      )
```

The run_hooks method is called if the OVM_CALL_HOOK action is set for a report. It first calls the client's <report_hook> method, followed by the appropriate severity-specific hook method. If either returns 0, then the report is not processed.

get_verbosity_level

```
function int get_verbosity_level()
```

Returns the configured maximum verbosity level.

get_action

```
function ovm_action get_action(ovm_severity severity,
                               string       id       )
```

Returns the action associated with the given *severity* and *id*.

First, if there is an action associated with the *(severity,id)* pair, return that. Else, if there is an action associated with the *id*, return that. Else, if there is an action associated with the *severity*, return that. Else, return the default action associated with the *severity*.

get_file_handle

```
function OVM_FILE get_file_handle(ovm_severity severity,
                                  string       id       )
```

Returns the file descriptor associated with the given *severity* and *id*.

First, if there is a file handle associated with the *(severity,id)* pair, return that. Else, if there is a file handle associated with the *id*, return that. Else, if there is an file handle associated with the *severity*, return that. Else, return the default file handle.

report

```
virtual function void report(ovm_severity      severity,
                             string            name,
                             string            id,
                             string            message,
                             int               verbosity_level,
                             string            filename,
                             int               line,
                             ovm_report_object client          )
```

This is the common handler method used by the four core reporting methods (e.g., ovm_report_error) in ovm_report_object.

format_action

```
function string format_action(ovm_action action)
```

Returns a string representation of the *action*, e.g., "DISPLAY".

ovm_report_server

ovm_report_server is a global server that processes all of the reports generated by an ovm_report_handler. None of its methods are intended to be called by normal testbench code, although in some circumstances the virtual methods process_report and/or compose_ovm_info may be overloaded in a subclass.

Summary

ovm_report_server

ovm_report_server is a global server that processes all of the reports generated by an ovm_report_handler.

Class Declaration

```
class ovm_report_server
```

Variables

id_count	An associative array holding the number of occurences for each unique report ID.

Methods

new	Creates the central report server, if not already created.
set_max_quit_count	
get_max_quit_count	Get or set the maximum number of COUNT actions that can be tolerated before an OVM_EXIT action is taken.
set_quit_count	
get_quit_count	
incr_quit_count	
reset_quit_count	Set, get, increment, or reset to 0 the quit count, i.e., the number of COUNT actions issued.
is_quit_count_reached	If is_quit_count_reached returns 1, then the quit counter has reached the maximum.
set_severity_count	
get_severity_count	
incr_severity_count	
reset_severity_counts	Set, get, or increment the counter for the given severity, or reset all severity counters to 0.
set_id_count	
get_id_count	
incr_id_count	Set, get, or increment the counter for reports with the given id.
process_report	Calls compose_message to construct the actual message to be output.
compose_message	Constructs the actual string sent to the file or command line from the severity, component name, report id, and the message itself.
summarize	See ovm_report_object::report_summarize method.
dump_server_state	Dumps server state information.
get_server	Returns a handle to the central report server.

Variables

id_count

```
protected int id_count[string]
```

An associative array holding the number of occurences for each unique report ID.

Methods

new

```
function new()
```

Creates the central report server, if not already created. Else, does nothing. The constructor is protected to enforce a singleton.

set_max_quit_count

```
function void set_max_quit_count(int count)
```

get_max_quit_count

```
function int get_max_quit_count()
```

Get or set the maximum number of COUNT actions that can be tolerated before an OVM_EXIT action is taken. The default is 0, which specifies no maximum.

set_quit_count

```
function void set_quit_count(int quit_count)
```

get_quit_count

```
function int get_quit_count()
```

incr_quit_count

```
function void incr_quit_count()
```

reset_quit_count

```
function void reset_quit_count()
```

Set, get, increment, or reset to 0 the quit count, i.e., the number of COUNT actions issued.

is_quit_count_reached

```
function bit is_quit_count_reached()
```

If is_quit_count_reached returns 1, then the quit counter has reached the maximum.

set_severity_count

```
function void set_severity_count(ovm_severity severity,
                                 int          count    )
```

get_severity_count

```
function int get_severity_count(ovm_severity severity)
```

incr_severity_count

```
function void incr_severity_count(ovm_severity severity)
```

reset_severity_counts

```
function void reset_severity_counts()
```

Set, get, or increment the counter for the given severity, or reset all severity counters to 0.

set_id_count

```
function void set_id_count(string id,
                           int    count)
```

get_id_count

```
function int get_id_count(string id)
```

incr_id_count

```
function void incr_id_count(string id)
```

Set, get, or increment the counter for reports with the given id.

process_report

```
virtual function void process_report(ovm_severity      severity,
                                     string            name,
                                     string            id,
                                     string            message,
                                     ovm_action        action,
                                     OVM_FILE          file,
                                     string            filename,
                                     int               line,
                                     string            composed_message,
                                     int               verbosity_level,
                                     ovm_report_object client           )
```

Calls compose_message to construct the actual message to be output. It then takes the appropriate action according to the value of action and file.

This method can be overloaded by expert users to customize the way the reporting system processes reports and the actions enabled for them.

compose_message

```
virtual function string compose_message(ovm_severity severity,
                                        string       name,
                                        string       id,
                                        string       message,
                                        string       filename,
                                        int          line     )
```

Constructs the actual string sent to the file or command line from the severity, component name, report id, and the message itself.

Expert users can overload this method to customize report formatting.

summarize

```
virtual function void summarize(OVM_FILE file = )
```

See ovm_report_object::report_summarize method.

dump_server_state

```
function void dump_server_state()
```

Dumps server state information.

get_server

```
function ovm_report_server get_server()
```

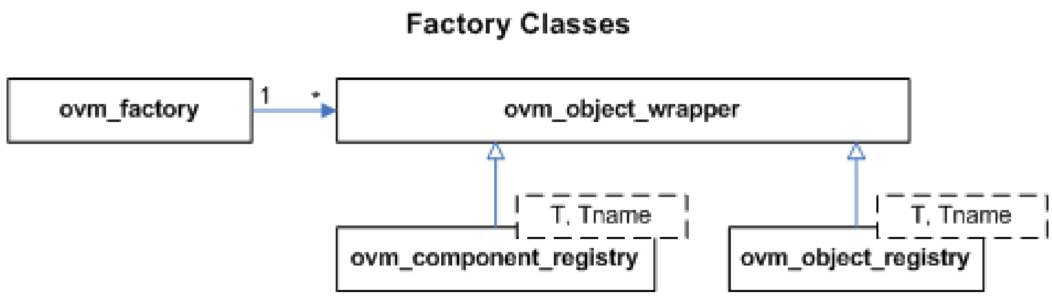
Returns a handle to the central report server.

Factory Classes

As the name implies, the ovm_factory is used to manufacture (create) OVM objects and components. Only one instance of the factory is present in a given simulation.

User-defined object and component types are registered with the factory via typedef or macro invocation, as explained in ovm_factory::Usage. The factory generates and stores lightweight proxies to the user-defined objects and components: ovm_object_registry #(T,Tname) for objects and ovm_component_registry #(T,Tname) for components. Each proxy only knows how to create an instance of the object or component it represents, and so is very efficient in terms of memory usage.

When the user requests a new object or component from the factory (e.g. ovm_factory::create_object_by_type), the factory will determine what type of object to create based on its configuration, then ask that type's proxy to create an instance of the type, which is returned to the user.



ovm_component_registry #(T,Tname)

The ovm_component_registry serves as a lightweight proxy for a component of type *T* and type name *Tname*, a string. The proxy enables efficient registration with the ovm_factory. Without it, registration would require an instance of the component itself.

See Usage section below for information on using ovm_component_registry.

Summary

ovm_component_registry #(T,Tname)

The ovm_component_registry serves as a lightweight proxy for a component of type *T* and type name *Tname*, a string.

Class Hierarchy

ovm_object_wrapper

ovm_component_registry#(T,Tname)

Class Declaration

```
class ovm_component_registry #(
   type   T     = ovm_component,
   string Tname = "<unknown>"
) extends ovm_object_wrapper
```

Methods

create_component	Creates a component of type T having the provided *name* and *parent*.
get_type_name	Returns the value given by the string parameter, *Tname*.
get	Returns the singleton instance of this type.
create	Returns an instance of the component type, *T*, represented by this proxy, subject to any factory overrides based on the context provided by the *parent*'s full name.
set_type_override	Configures the factory to create an object of the type represented by *override_type* whenever a request is made to create an object of the type, *T*, represented by this proxy, provided no instance override applies.
set_inst_override	Configures the factory to create a component of the type represented by *override_type* whenever a request is made to create an object of the type, *T*, represented by this proxy, with matching instance paths.

Methods

create_component

```
virtual function ovm_component create_component (string        name,
                                                 ovm_component parent)
```

Creates a component of type T having the provided *name* and *parent*. This is an override of the method in ovm_object_wrapper. It is called by the factory after determining the type of object to create. You should not call this method directly. Call create instead.

get_type_name

```
virtual function string get_type_name()
```

Returns the value given by the string parameter, *Tname*. This method overrides the method in ovm_object_wrapper.

get

```
static function this_type get()
```

Returns the singleton instance of this type. Type-based factory operation depends on there being a single proxy instance for each registered type.

create

```
static function T create(string        name,
                         ovm_component parent,
                         string        contxt  = ""                   )
```

Returns an instance of the component type, *T*, represented by this proxy, subject to any factory overrides based on the context provided by the *parent*'s full name. The *contxt* argument, if supplied, supercedes the *parent*'s context. The new instance will have the given leaf *name* and *parent*.

set_type_override

```
static function void set_type_override (ovm_object_wrapper override_type,
                                        bit                replace       = 1  )
```

Configures the factory to create an object of the type represented by *override_type* whenever a request is made to create an object of the type, *T*, represented by this proxy, provided no instance override applies. The original type, *T*, is typically a super class of the override type.

set_inst_override

```
static function void set_inst_override(ovm_object_wrapper override_type,
                                       string             inst_path,
                                       ovm_component      parent        = null)
```

Configures the factory to create a component of the type represented by *override_type* whenever a request is made to create an object of the type, *T*, represented by this proxy, with matching instance paths. The original type, *T*, is typically a super class of the override type.

If *parent* is not specified, *inst_path* is interpreted as an absolute instance path, which enables instance overrides to be set from outside component classes. If *parent* is specified, *inst_path* is interpreted as being relative to the *parent*'s hierarchical instance path, i.e. *{parent.get_full_name(),".",inst_path}* is the instance path that is registered with the override. The *inst_path* may contain wildcards for matching against multiple contexts.

ovm_object_registry #(T,Tname)

The ovm_object_registry serves as a lightweight proxy for an ovm_object of type *T* and type name *Tname*, a string. The proxy enables efficient registration with the ovm_factory. Without it, registration would require an instance of the object itself.

See Usage section below for information on using ovm_component_registry.

Summary

ovm_object_registry #(T,Tname)

The ovm_object_registry serves as a lightweight proxy for an ovm_object of type *T* and type name *Tname*, a string.

Class Hierarchy

ovm_object_wrapper

ovm_object_registry#(T,Tname)

Class Declaration

```
class ovm_object_registry #(
   type   T      = ovm_object,
   string Tname = "<unknown>"
) extends ovm_object_wrapper
```

create_object	Creates an object of type *T* and returns it as a handle to an ovm_object.
get_type_name	Returns the value given by the string parameter, *Tname*.
get	Returns the singleton instance of this type.
create	Returns an instance of the object type, *T*, represented by this proxy, subject to any factory overrides based on the context provided by the *parent*'s full name.
set_type_override	Configures the factory to create an object of the type represented by *override_type* whenever a request is made to create an object of the type represented by this proxy, provided no instance override applies.
set_inst_override	Configures the factory to create an object of the type represented by *override_type* whenever a request is made to create an object of the type represented by this proxy, with matching instance paths.
Usage	This section describes usage for the ovm_*_registry classes.

create_object

```
virtual function ovm_object create_object(string name = "")
```

Creates an object of type *T* and returns it as a handle to an ovm_object. This is an override of the method in ovm_object_wrapper. It is called by the factory after determining the type of object to create. You should not call this method directly. Call create instead.

get_type_name

```
virtual function string get_type_name()
```

Returns the value given by the string parameter, *Tname*. This method overrides the method in ovm_object_wrapper.

get

```
static function this_type get()
```

Returns the singleton instance of this type. Type-based factory operation depends on there being a single proxy instance for each registered type.

create

```
static function T create (string        name   = "",
                          ovm_component parent = null,
                          string        contxt = ""                    )
```

Returns an instance of the object type, *T*, represented by this proxy, subject to any factory overrides based on the context provided by the *parent*'s full name. The *contxt* argument, if supplied, supercedes the *parent*'s context. The new instance will have the given leaf *name*, if provided.

set_type_override

```
static function void set_type_override (ovm_object_wrapper override_type,
                                        bit                replace       = 1  )
```

Configures the factory to create an object of the type represented by *override_type* whenever a request is made to create an object of the type represented by this proxy, provided no instance override applies. The original type, *T*, is typically a super class of the override type.

set_inst_override

```
static function void set_inst_override(ovm_object_wrapper override_type,
                                       string             inst_path,
                                       ovm_component      parent        = null)
```

Configures the factory to create an object of the type represented by *override_type* whenever a request is made to create an object of the type represented by this proxy, with matching instance paths. The original type, *T*, is typically a super class of the override type.

If *parent* is not specified, *inst_path* is interpreted as an absolute instance path, which enables instance overrides to be set from outside component classes. If *parent* is specified, *inst_path* is interpreted as being relative to the *parent*'s hierarchical instance path, i.e. *{parent.get_full_name(),".",inst_path}* is the instance path that is registered with the override. The *inst_path* may contain wildcards for matching against multiple contexts.

Usage

This section describes usage for the ovm_*_registry classes.

The wrapper classes are used to register lightweight proxies of objects and components.

To register a particular component type, you need only typedef a specialization of its proxy class, which is typically done inside the class.

For example, to register an OVM component of type *mycomp*

```
class mycomp extends ovm_component;
  typedef ovm_component_registry #(mycomp,"mycomp") type_id;
endclass
```

However, because of differences between simulators, it is necessary to use a macro to ensure vendor interoperability with factory registration. To register an OVM component of type *mycomp* in a vendor-independent way, you would write instead:

```
class mycomp extends ovm_component;
  `ovm_component_utils(mycomp);
  ...
endclass
```

The `ovm_component_utils macro is for non-parameterized classes. In this example, the typedef underlying the macro specifies the *Tname* parameter as "mycomp", and *mycomp*'s get_type_name() is defined to return the same. With *Tname* defined, you can use the factory's name-based methods to set overrides and create objects and components of non-parameterized types.

For parameterized types, the type name changes with each specialization, so you can not specify a *Tname* inside a parameterized class and get the behavior you want; the same type name string would be registered for all specializations of the class! (The factory would produce warnings for each specialization beyond the first.) To avoid the warnings and simulator interoperability issues with parameterized classes, you must register parameterized classes with a different macro.

For example, to register an OVM component of type driver #(T), you would write:

```
class driver #(type T=int) extends ovm_component;
  `ovm_component_param_utils(driver #(T));
  ...
endclass
```

The `ovm_component_param_utils and `ovm_object_param_utils macros are used to register parameterized classes with the factory. Unlike the the non-param versions, these macros do not specify the *Tname* parameter in the underlying ovm_component_registry typedef, and they do not define the get_type_name method for the user class. Consequently, you will not be able to use the factory's name-based methods for parameterized classes.

The primary purpose for adding the factory's type-based methods was to accommodate registration of parameterized types and eliminate the many sources of errors associated with string-based factory usage. Thus, use of name-based lookup in ovm_factory is no longer recommended.

OVM Factory

This page covers the following classes.

- ovm_factory - creates objects and components according to user-defined type and instance-based overrides.
- ovm_object_wrapper - a lightweight substitute (proxy) representing a user-defined object or component.

Summary

OVM Factory
This page covers the following classes.

ovm_factory

As the name implies, ovm_factory is used to manufacture (create) OVM objects and components. Only one instance of the factory is present in a given simulation (termed a singleton). Object and component types are registered with the factory using lightweight proxies to the actual objects and components being created. The ovm_object_registry #(T,Tname) and ovm_component_registry #(T,Tname) class are used to proxy ovm_objects and ovm_components.

The factory provides both name-based and type-based interfaces.

type-based The type-based interface is far less prone to errors in usage. When errors do occur, they are caught at compile-time.

name-based The name-based interface is dominated by string arguments that can be misspelled and provided in the wrong order. Errors in name-based requests might only be caught at the time of the call, if at all. Further, the name-based interface is not portable across simulators when used with parameterized classes.

See Usage section for details on configuring and using the factory.

Summary

ovm_factory
As the name implies, ovm_factory is used to manufacture (create) OVM objects and components.

Class Declaration

```
class ovm_factory
```

Registering Types

register	Registers the given proxy object, *obj*, with the factory.

Type & Instance Overrides

set_inst_override_by_type	
set_inst_override_by_name	Configures the factory to create an object of the override's type whenever a request is made to create an object of the original type using a context that matches *full_inst_path*.
set_type_override_by_type	
set_type_override_by_name	Configures the factory to create an object of the override's type whenever a request is made to create an object of the original type, provided no instance override applies.

Creation

create_object_by_type	
create_component_by_type	
create_object_by_name	
create_component_by_name	Creates and returns a component or object of the requested type, which may be specified by type or by name.

Debug

debug_create_by_type	
debug_create_by_name	These methods perform the same search algorithm as the create_* methods, but they do not create new objects.
find_override_by_type	
find_override_by_name	These methods return the proxy to the object that would be created given the arguments.
print	Prints the state of the ovm_factory, including registered types, instance overrides, and type overrides.
Usage	Using the factory involves three basic operations

Registering Types

register

```
function void register (ovm_object_wrapper obj)
```

Registers the given proxy object, *obj*, with the factory. The proxy object is a lightweight substitute for the component or object it represents. When the factory needs to create an object of a given type, it calls the proxy's create_object or create_component method to do so.

When doing name-based operations, the factory calls the proxy's get_type_name method to match against the *requested_type_name* argument in subsequent calls to create_component_by_name and create_object_by_name. If the proxy object's get_type_name method returns the empty string, name-based lookup is effectively disabled.

Type & Instance Overrides

set_inst_override_by_type

```
function void set_inst_override_by_type (ovm_object_wrapper original_type,
                                         ovm_object_wrapper override_type,
                                         string             full_inst_path)
```

set_inst_override_by_name

```
function void set_inst_override_by_name (string original_type_name,
                                         string override_type_name,
                                         string full_inst_path     )
```

Configures the factory to create an object of the override's type whenever a request is made to create an object of the original type using a context that matches *full_inst_path*. The original type is typically a super class of the override type.

When overriding by type, the *original_type* and *override_type* are handles to the types' proxy objects. Preregistration is not required.

When overriding by name, the *original_type_name* typically refers to a preregistered type in the factory. It may, however, be any arbitrary string. Future calls to any of the create_* methods with the same string and matching instance path will produce the type represented by *override_type_name*, which must be preregistered with the factory.

The *full_inst_path* is matched against the contentation of {*parent_inst_path*, ".", *name*} provided in future create requests. The *full_inst_path* may include wildcards (* and ?) such that a single instance override can be applied in multiple contexts. A *full_inst_path* of "*" is effectively a type override, as it will match all contexts.

When the factory processes instance overrides, the instance queue is processed in order of override registrations, and the first override match prevails. Thus, more specific overrides should be registered first, followed by more general overrides.

set_type_override_by_type

```
function void set_type_override_by_type (ovm_object_wrapper original_type,
                                         ovm_object_wrapper override_type,
                                         bit                replace        = 1            )
```

set_type_override_by_name

```
function void set_type_override_by_name (string original_type_name,
                                         string override_type_name,
                                         bit    replace               = 1                 )
```

Configures the factory to create an object of the override's type whenever a request is made to create an object of the original type, provided no instance override applies. The original type is typically a super class of the override type.

When overriding by type, the *original_type* and *override_type* are handles to the types' proxy objects. Preregistration is not required.

When overriding by name, the *original_type_name* typically refers to a preregistered type in the factory. It may, however, be any arbitrary string. Future calls to any of the create_* methods with the same string and matching instance path will produce the type represented by *override_type_name*, which must be preregistered with the factory.

When *replace* is 1, a previous override on *original_type_name* is replaced, otherwise a previous override, if any, remains intact.

Creation

create_object_by_type

```
function ovm_object create_object_by_type (ovm_object_wrapper requested_type,
                                           string             parent_inst_path = "",
                                           string             name             = ""      )
```

create_component_by_type

```
function ovm_component create_component_by_type (
   ovm_object_wrapper  requested_type,
   string              parent_inst_path  = "",
   string              name,
   ovm_component       parent
)
```

create_object_by_name

```
function ovm_object create_object_by_name (string requested_type_name,
                                           string parent_inst_path     = "",
                                           string name                 = ""                )
```

create_component_by_name

```
function ovm_component create_component_by_name (string        requested_type_name,
                                                  string        parent_inst_path     = "",
                                                  string        name,
                                                  ovm_component parent                     )
```

Creates and returns a component or object of the requested type, which may be specified by type or by name. A requested component must be derived from the ovm_component base class, and a requested object must be derived from the ovm_object base class.

When requesting by type, the *requested_type* is a handle to the type's proxy object. Preregistration is not required.

When requesting by name, the *request_type_name* is a string representing the requested type, which must have been registered with the factory with that name prior to the request. If the factory does not recognize the *requested_type_name*, an error is produced and a null handle returned.

If the optional *parent_inst_path* is provided, then the concatenation, {*parent_inst_path*, ".",~name~}, forms an instance path (context) that is used to search for an instance override. The *parent_inst_path* is typically obtained by calling the ovm_component::get_full_name on the parent.

If no instance override is found, the factory then searches for a type override.

Once the final override is found, an instance of that component or object is returned in place of the requested type. New components will have the given *name* and *parent*. New objects will have the given *name*, if provided.

Override searches are recursively applied, with instance overrides taking precedence over type overrides. If *foo* overrides *bar*, and *xyz* overrides *foo*, then a request for *bar* will produce *xyz*. Recursive loops will result in an error, in which case the type returned will be that which formed the loop. Using the previous example, if *bar* overrides *xyz*, then *bar* is returned after the error is issued.

Debug

debug_create_by_type

```
function void debug_create_by_type (ovm_object_wrapper requested_type,
                                    string             parent_inst_path = "",
                                    string             name             = ""               )
```

debug_create_by_name

```
function void debug_create_by_name (string requested_type_name,
                                    string parent_inst_path     = "",
                                    string name                 = ""                       )
```

These methods perform the same search algorithm as the create_* methods, but they do not create new objects. Instead, they provide detailed information about what type of object it would return, listing each override that was applied to arrive at the result. Interpretation of the arguments are exactly as with the create_* methods.

find_override_by_type

```
function ovm_object_wrapper find_override_by_type (
    ovm_object_wrapper        requested_type,
    string                    full_inst_path
)
```

find_override_by_name

```
function ovm_object_wrapper find_override_by_name (string requested_type_name,
                                                   string full_inst_path      )
```

These methods return the proxy to the object that would be created given the arguments. The *full_inst_path* is typically derived from the parent's instance path and the leaf name of the object to be created, i.e. { parent.get_full_name(), ".", name }.

print

```
function void print (int all_types = 1                                                     )
```

Prints the state of the ovm_factory, including registered types, instance overrides, and type overrides.

When *all_types* is 0, only type and instance overrides are displayed. When *all_types* is 1 (default), all registered user-defined types are printed as well, provided they have names associated with them. When *all_types* is 2, the OVM types (prefixed with ovm_) are included in the list of registered types.

Usage

Using the factory involves three basic operations

1. Registering objects and components types with the factory
2. Designing components to use the factory to create objects or components
3. Configuring the factory with type and instance overrides, both within and outside components

We'll briefly cover each of these steps here. More reference information can be found at Utility Macros, ovm_component_registry #(T,Tname), ovm_object_registry #(T,Tname), ovm_component.

1 -- Registering objects and component types with the factory

When defining ovm_object and ovm_component-based classes, simply invoke the appropriate macro. Use of macros are required to ensure portability across different vendors' simulators.

Objects that are not parameterized are declared as

```
class packet extends ovm_object;
  `ovm_object_utils(packet)
endclass

class packetD extends packet;
  `ovm_object_utils(packetD)
endclass
```

Objects that are parameterized are declared as

```
class packet #(type T=int, int WIDTH=32) extends ovm_object;
  `ovm_object_param_utils(packet #(T,WIDTH))
 endclass
```

Components that are not parameterized are declared as

```
class comp extends ovm_component;
  `ovm_component_utils(comp)
endclass
```

Components that are parameterized are declared as

```
class comp #(type T=int, int WIDTH=32) extends ovm_component;
  `ovm_component_param_utils(comp #(T,WIDTH))
endclass
```

The `ovm_*_utils macros for simple, non-parameterized classes will register the type with the factory and define the get_type, get_type_name, and create virtual methods inherited from ovm_object. It will also define a static type_name variable in the class, which will allow you to determine the type without having to allocate an instance.

The `ovm_*_param_utils macros for parameterized classes differ from `ovm_*_utils classes in the following ways:

- The get_type_name method and static type_name variable are not defined. You will need to implement these manually.
- A type name is not associated with the type when registeriing with the factory, so the factory's *_by_name operations will not work with parameterized classes.
- The factory's print, debug_create_by_type, and debug_create_by_name methods, which depend on type names to convey information, will list parameterized types as <unknown>.

It is worth noting that environments that exclusively use the type-based factory methods (*_by_type) do not require type registration. The factory's type-based methods will register the types involved "on the fly," when first used. However, registering with the `ovm_*_utils macros enables name-based factory usage and implements some useful utility functions.

2 -- Designing components that defer creation to the factory

Having registered your objects and components with the factory, you can now make requests for new objects and components via the factory. Using the factory instead of allocating them directly (via new) allows different objects to be substituted for the original without modifying the requesting class. The following code defines a driver class that is parameterized.

```
class driverB #(type T=ovm_object) extends ovm_driver;

  // parameterized classes must use the _param_utils version
  `ovm_component_param_utils(driverB #(T))

  // our packet type; this can be overridden via the factory
  T pkt;

  // standard component constructor
  function new(string name, ovm_component parent=null);
    super.new(name,parent);
  endfunction

  // get_type_name not implemented by macro for parameterized classes
  const static string type_name = {"driverB #(",T::type_name,")"};
  virtual function string get_type_name();
    return type_name;
  endfunction

  // using the factory allows pkt overrides from outside the class
  virtual function void build();
    pkt = packet::type_id::create("pkt",this);
  endfunction

  // print the packet so we can confirm its type when printing
  virtual function void do_print(ovm_printer printer);
    printer.print_object("pkt",pkt);
  endfunction

endclass
```

For purposes of illustrating type and instance overrides, we define two subtypes of the *driverB* class. The subtypes are also parameterized, so we must again provide an implementation for ovm_object::get_type_name, which we recommend writing in terms of a static string constant.

```
class driverD1 #(type T=ovm_object) extends driverB #(T);

  `ovm_component_param_utils(driverD1 #(T))

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
  endfunction

  const static string type_name = {"driverD1 #(",T::type_name,")"};
  virtual function string get_type_name();
    ...return type_name;
  endfunction

endclass

class driverD2 #(type T=ovm_object) extends driverB #(T);

  `ovm_component_param_utils(driverD2 #(T))

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
  endfunction

  const static string type_name = {"driverD2 #(",T::type_name,")"};
  virtual function string get_type_name();
    return type_name;
  endfunction
```

```
endclass

// typedef some specializations for convenience
typedef driverB  #(packet) B_driver;   // the base driver
typedef driverD1 #(packet) D1_driver;  // a derived driver
typedef driverD2 #(packet) D2_driver;  // another derived driver
```

Next, we’ll define a agent component, which requires a utils macro for non-parameterized types. Before creating the drivers using the factory, we override *driver0*’s packet type to be *packetD*.

```
class agent extends ovm_agent;

  `ovm_component_utils(agent)
  ...
  B_driver driver0;
  B_driver driver1;

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
  endfunction

  virtual function void build();

    // override the packet type for driver0 and below
    packet::type_id::set_inst_override(packetD::get_type(),"driver0.*");

    // create using the factory; actual driver types may be different
    driver0 = B_driver::type_id::create("driver0",this);
    driver1 = B_driver::type_id::create("driver1",this);

  endfunction

endclass
```

Finally we define an environment class, also not parameterized. Its build method shows three methods for setting an instance override on a grandchild component with relative path name, *agent1.driver1*, all equivalent.

```
class env extends ovm_env;

  `ovm_component_utils(env)

  agent agent0;
  agent agent1;

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
  endfunction

  virtual function void build();

    // three methods to set an instance override for agent1.driver1
    // - via component convenience method...
    set_inst_override_by_type("agent1.driver1",
                              B_driver::get_type(),
                              D2_driver::get_type());

    // - via the component's proxy (same approach as create)...
    B_driver::type_id::set_inst_override(D2_driver::get_type(),
                                         "agent1.driver1",this);

    // - via a direct call to a factory method...
    factory.set_inst_override_by_type(B_driver::get_type(),
                                      D2_driver::get_type(),
                                      {get_full_name(),".agent1.driver1"});

    // create agents using the factory; actual agent types may be different
    agent0 = agent::type_id::create("agent0",this);
    agent1 = agent::type_id::create("agent1",this);
```

```
  endfunction

  // at end_of_elaboration, print topology and factory state to verify
  virtual function void end_of_elaboration();
    ovm_top.print_topology();
  endfunction

  virtual task run();
    #100 global_stop_request();
  endfunction

endclass
```

3 -- Configuring the factory with type and instance overrides

In the previous step, we demonstrated setting instance overrides and creating components using the factory within component classes. Here, we will demonstrate setting overrides from outside components, as when initializing the environment prior to running the test.

```
module top;

  env env0;

  initial begin

    // Being registered first, the following overrides take precedence
    // over any overrides made within env0's construction & build.

    // Replace all base drivers with derived drivers...
    B_driver::type_id::set_type_override(D_driver::get_type());

    // ...except for agent0.driver0, whose type remains a base driver.
    //     (Both methods below have the equivalent result.)

    // - via the component's proxy (preferred)
    B_driver::type_id::set_inst_override(B_driver::get_type(),
                                         "env0.agent0.driver0");

    // - via a direct call to a factory method
    factory.set_inst_override_by_type(B_driver::get_type(),
                                      B_driver::get_type(),
                                  {get_full_name(),"env0.agent0.driver0"});

    // now, create the environment; our factory configuration will
    // govern what topology gets created
    env0 = new("env0");

    // run the test (will execute build phase)
    run_test();

  end

endmodule
```

When the above example is run, the resulting topology (displayed via a call to <ovm_top.print_topology> in env's ovm_component::end_of_elaboration method) is similar to the following:

```
# OVM_INFO @ 0 [RNTST] Running test ...
# OVM_INFO @ 0 [OVMTOP] OVM testbench topology:
# ----------------------------------------------------------------------
# Name                     Type                Size                Value
# ----------------------------------------------------------------------
# env0                     env                 -                  env0@2
#   agent0                 agent               -                agent0@4
#     driver0              driverB #(packet)   -               driver0@8
#       pkt                packet              -                  pkt@21
#     driver1              driverD #(packet)   -              driver1@14
#       pkt                packet              -                  pkt@23
#   agent1                 agent               -                agent1@6
```

```
#     driver0              driverD #(packet)   -              driver0@24
#       pkt                packet              -                  pkt@37
#     driver1              driverD2 #(packet)  -              driver1@30
#       pkt                packet              -                  pkt@39
# ----------------------------------------------------------------------
```

ovm_object_wrapper

The ovm_object_wrapper provides an abstract interface for creating object and component proxies. Instances of these lightweight proxies, representing every ovm_object-based and ovm_component-based object available in the test environment, are registered with the ovm_factory. When the factory is called upon to create an object or component, it finds and delegates the request to the appropriate proxy.

Summary

ovm_object_wrapper

The ovm_object_wrapper provides an abstract interface for creating object and component proxies.

Class Declaration

```
virtual class ovm_object_wrapper
```

Methods

create_object	Creates a new object with the optional *name*.
create_component	Creates a new component, passing to its constructor the given *name* and *parent*.
get_type_name	Derived classes implement this method to return the type name of the object created by create_component or create_object.

Methods

create_object

```
virtual function ovm_object create_object (string name = "")
```

Creates a new object with the optional *name*. An object proxy (e.g., ovm_object_registry #(T, Tname)) implements this method to create an object of a specific type, T.

create_component

```
virtual function ovm_component create_component (string        name,
                                                 ovm_component parent)
```

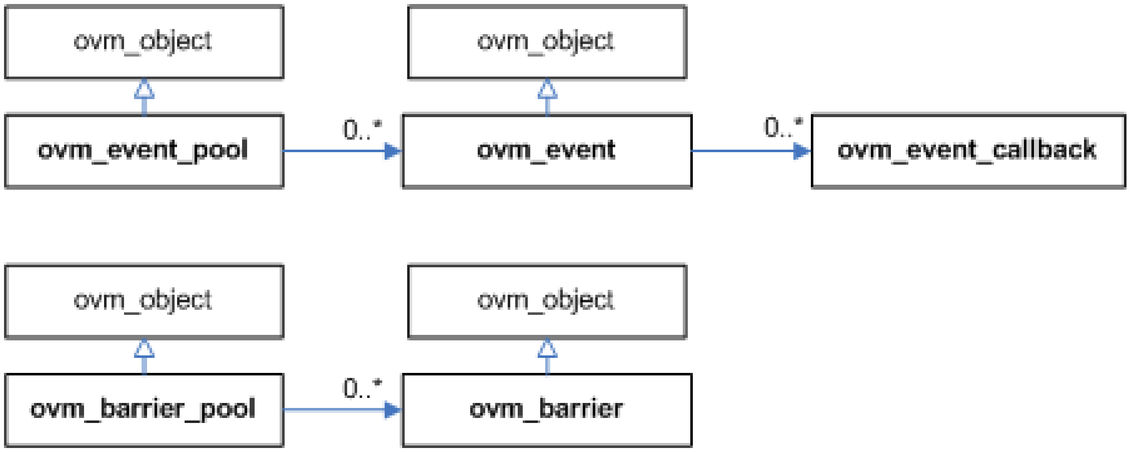
Creates a new component, passing to its constructor the given *name* and *parent*. A component proxy (e.g. ovm_component_registry #(T,Tname)) implements this method to create a component of a specific type, T.

get_type_name

```
pure virtual function string get_type_name()
```

Derived classes implement this method to return the type name of the object created by create_component or create_object. The factory uses this name when matching against the requested type in name-based lookups.

Synchronization Classes



The OVM provides event and barrier synchronization classes for managing concurrent processes.

- ovm_event - OVM's event class augments the SystemVerilog event datatype with such services as setting callbacks and data delivery.
- ovm_barrier - A barrier is used to prevent a pre-configured number of processes from continuing until all have reached a certain point in simulation.
- ovm_event_pool and ovm_barrier_pool - The event and barrier pool classes are used to store collections of events and barriers, all indexed by string name. Each pool class contains a static, "global" pool instance for sharing across all processes.

ovm_event

The ovm_event class is a wrapper class around the SystemVerilog event construct. It provides some additional services such as setting callbacks and maintaining the number of waiters.

Summary

ovm_event

The ovm_event class is a wrapper class around the SystemVerilog event construct.

Class Hierarchy

ovm_object

ovm_event

Class Declaration

```
class ovm_event extends ovm_object
```

Methods

new	Creates a new event object.
wait_on	Waits for the event to be activated for the first time.
wait_off	If the event has already triggered and is "on", this task waits for the event to be turned "off" via a call to reset.
wait_trigger	Waits for the event to be triggered.
wait_ptrigger	Waits for a persistent trigger of the event.
wait_trigger_data	This method calls wait_trigger followed by get_trigger_data.
wait_ptrigger_data	This method calls wait_ptrigger followed by get_trigger_data.
trigger	Triggers the event, resuming all waiting processes.
get_trigger_data	Gets the data, if any, provided by the last call to trigger.
get_trigger_time	Gets the time that this event was last triggered.
is_on	Indicates whether the event has been triggered since it was last reset.
is_off	Indicates whether the event has been triggered or been reset.
reset	Resets the event to its off state.
add_callback	Registers a callback object, *cb*, with this event.
delete_callback	Unregisters the given callback, *cb*, from this event.
cancel	Decrements the number of waiters on the event.
get_num_waiters	Returns the number of processes waiting on the event.

Methods

new

```
function new (string name = ""                                    )
```

Creates a new event object.

wait_on

```
virtual task wait_on (bit delta = )
```

Waits for the event to be activated for the first time.

If the event has already been triggered, this task returns immediately. If *delta* is set, the caller will be forced to wait a single delta #0 before returning. This prevents the caller from returning before previously waiting processes have had a chance to resume.

Once an event has been triggered, it will be remain "on" until the event is reset.

wait_off

```
virtual task wait_off (bit delta = )
```

If the event has already triggered and is "on", this task waits for the event to be turned "off" via a call to reset.

If the event has not already been triggered, this task returns immediately. If *delta* is set, the caller will be forced to wait a single delta #0 before returning. This prevents the caller from returning before previously waiting processes have had a chance to resume.

wait_trigger

```
virtual task wait_trigger ()
```

Waits for the event to be triggered.

If one process calls wait_trigger in the same delta as another process calls trigger, a race condition occurs. If the call to wait occurs before the trigger, this method will return in this delta. If the wait occurs after the trigger, this method will not return until the next trigger, which may never occur and thus cause deadlock.

wait_ptrigger

```
virtual task wait_ptrigger ()
```

Waits for a persistent trigger of the event. Unlike wait_trigger, this views the trigger as persistent within a given time-slice and thus avoids certain race conditions. If this method is called after the trigger but within the same time-slice, the caller returns immediately.

wait_trigger_data

```
virtual task wait_trigger_data (output ovm_object data)
```

This method calls wait_trigger followed by get_trigger_data.

wait_ptrigger_data

```
virtual task wait_ptrigger_data (output ovm_object data)
```

This method calls wait_ptrigger followed by get_trigger_data.

trigger

```
virtual function void trigger (ovm_object data = null )
```

Triggers the event, resuming all waiting processes.

An optional *data* argument can be supplied with the enable to provide trigger-specific information.

get_trigger_data

```
virtual function ovm_object get_trigger_data ()
```

Gets the data, if any, provided by the last call to trigger.

get_trigger_time

```
virtual function time get_trigger_time ()
```

Gets the time that this event was last triggered. If the event has not been triggered, or the event has been reset, then the trigger time will be 0.

is_on

```
virtual function bit is_on ()
```

Indicates whether the event has been triggered since it was last reset.

A return of 1 indicates that the event has triggered.

is_off

```
virtual function bit is_off ()
```

Indicates whether the event has been triggered or been reset.

A return of 1 indicates that the event has not been triggered.

reset

```
virtual function void reset (bit wakeup = )
```

Resets the event to its off state. If *wakeup* is set, then all processes currently waiting for the event are activated before the reset.

No callbacks are called during a reset.

add_callback

```
virtual function void add_callback (ovm_event_callback cb,
                                    bit                append = 1         )
```

Registers a callback object, *cb*, with this event. The callback object may include pre_trigger and post_trigger functionality. If *append* is set to 1, the default, *cb* is added to the back of the callback list. Otherwise, *cb* is placed at the front of the callback list.

delete_callback

```
virtual function void delete_callback (ovm_event_callback cb)
```

Unregisters the given callback, *cb*, from this event.

cancel

```
virtual function void cancel ()
```

Decrements the number of waiters on the event.

This is used if a process that is waiting on an event is disabled or activated by some other means.

get_num_waiters

```
virtual function int get_num_waiters ()
```

Returns the number of processes waiting on the event.

ovm_event_callback

The ovm_event_callback class is an abstract class that is used to create callback objects which may be attached to ovm_events. To use, you derive a new class and override any or both pre_trigger and post_trigger.

Callbacks are an alternative to using processes that wait on events. When a callback is attached to an event, that callback object's callback function is called each time the event is triggered.

Summary

ovm_event_callback

The ovm_event_callback class is an abstract class that is used to create callback objects which may be attached to ovm_events.

Class Hierarchy

ovm_object

ovm_event_callback

Class Declaration

```
virtual class ovm_event_callback extends ovm_object
```

Methods

new	Creates a new callback object.
pre_trigger	This callback is called just before triggering the associated event.
post_trigger	This callback is called after triggering the associated event.

Methods

new

```
function new (string name = "" )
```

Creates a new callback object.

pre_trigger

```
virtual function bit pre_trigger (ovm_event  e,
                                  ovm_object data = null )
```

This callback is called just before triggering the associated event. In a derived class, override this method to implement any pre-trigger functionality.

If your callback returns 1, then the event will not trigger and the post-trigger callback is not called. This provides a way for a callback to prevent the event from triggering.

In the function, *e* is the ovm_event that is being triggered, and *data* is the optional data associated with the event trigger.

post_trigger

```
virtual function void post_trigger (ovm_event  e,
                                    ovm_object data = null          )
```

This callback is called after triggering the associated event. In a derived class, override this method to implement any post-trigger functionality.

In the function, *e* is the ovm_event that is being triggered, and *data* is the optional data associated with the event trigger.

ovm_barrier

The ovm_barrier class provides a multiprocess synchronization mechanism. It enables a set of processes to block until the desired number of processes get to the synchronization point, at which time all of the processes are released.

Summary

ovm_barrier

The ovm_barrier class provides a multiprocess synchronization mechanism.

Class Hierarchy

ovm_object

ovm_barrier

Class Declaration

```
class ovm_barrier extends ovm_object
```

Methods

new	Creates a new barrier object.
wait_for	Waits for enough processes to reach the barrier before continuing.
reset	Resets the barrier.
set_auto_reset	Determines if the barrier should reset itself after the threshold is reached.
set_threshold	Sets the process threshold.
get_threshold	Gets the current threshold setting for the barrier.
get_num_waiters	Returns the number of processes currently waiting at the barrier.
cancel	Decrements the waiter count by one.

Methods

new

```
function new (string name      = "",
              int    threshold = 0                 )
```

Creates a new barrier object.

wait_for

```
virtual task wait_for()
```

Waits for enough processes to reach the barrier before continuing.

The number of processes to wait for is set by the set_threshold method.

reset

```
virtual function void reset (bit wakeup = 1                              )
```

Resets the barrier. This sets the waiter count back to zero.

The threshold is unchanged. After reset, the barrier will force processes to wait for the threshold again.

If the *wakeup* bit is set, any currently waiting processes will be activated.

set_auto_reset

```
virtual function void set_auto_reset (bit value = 1                       )
```

Determines if the barrier should reset itself after the threshold is reached.

The default is on, so when a barrier hits its threshold it will reset, and new processes will block until the threshold is reached again.

If auto reset is off, then once the threshold is achieved, new processes pass through without being blocked until the barrier is reset.

set_threshold

```
virtual function void set_threshold (int threshold)
```

Sets the process threshold.

This determines how many processes must be waiting on the barrier before the processes may proceed.

Once the *threshold* is reached, all waiting processes are activated.

If *threshold* is set to a value less than the number of currently waiting processes, then the barrier is reset and waiting processes are activated.

get_threshold

```
virtual function int get_threshold ()
```

Gets the current threshold setting for the barrier.

get_num_waiters

```
virtual function int get_num_waiters ()
```

Returns the number of processes currently waiting at the barrier.

cancel

```
virtual function void cancel ()
```

Decrements the waiter count by one. This is used when a process that is waiting on the barrier is killed or activated by some other means.

ovm_objection

Objections provide a facility for coordinating status information between two or more participating components, objects, and even module-based IP. In particular, the *ovm_test_done* built-in objection provides a means for coordinating when to end a test, i.e. when to call global_stop_request to end the ovm_component::run phase. When all participating components have dropped their raised objections with *ovm_test_done*, an implicit call to *global_stop_request* is issued.

Summary

ovm_objection

Objections provide a facility for coordinating status information between two or more participating components, objects, and even module-based IP.

Class Hierarchy

ovm_object

ovm_report_object

ovm_objection

Class Declaration

```
class ovm_objection extends ovm_report_object
```

new	Creates a new objection instance.
Objection Control	
raise_objection	Raises the number of objections for the source *object* by *count*, which defaults to 1.
drop_objection	Drops the number of objections for the source *object* by *count*, which defaults to 1.
set_drain_time	Sets the drain time on the given *object* to *drain*.
Callback Hooks	
raised	Objection callback that is called when a raise_objection has reached *obj*.
dropped	Objection callback that is called when a drop_objection has reached *obj*.
all_dropped	Objection callback that is called when a drop_objection has reached *obj*, and the total count for *obj* goes to zero.
Objection Status	
get_objection_count	Returns the current number of objections raised by the given *object*.
get_objection_total	Returns the current number of objections raised by the given *object* and all descendants.
get_drain_time	Returns the current drain time set for the given *object* (default: 0 ns).
display_objections	Displays objection information about the given *object*.

new

```
function new(string name = "" )
```

Creates a new objection instance.

Objection Control

raise_objection

```
function void raise_objection (ovm_object obj   = null,
                               int        count = 1    )
```

Raises the number of objections for the source *object* by *count*, which defaults to 1. The *object* is usually the *this* handle of the caller. If *object* is not specified or null, the implicit top-level component, *ovm_top*, is chosen.

Rasing an objection causes the following.

- The source and total objection counts for *object* are increased by *count*.
- The objection's raised virtual method is called, which calls the ovm_component::raised method for all of the components up the hierarchy.

drop_objection

```
function void drop_objection (ovm_object obj   = null,
                              int        count = 1    )
```

Drops the number of objections for the source *object* by *count*, which defaults to 1. The *object* is usually the *this* handle of the caller. If *object* is not specified or null, the implicit top-level component, *ovm_top*, is chosen.

Dropping an objection causes the following.

- The source and total objection counts for *object* are decreased by *count*. It is an error to drop the objection count for *object* below zero.
- The objection's dropped virtual method is called, which calls the ovm_component::dropped method for all of the components up the hierarchy.
- If the total objection count has not reached zero for *object*, then the drop is propagated up the object hierarchy as with raise_objection. Then, each object in the hierarchy will have updated their *source* counts--objections that they originated--and *total* counts--the total number of objections by them and all their descendants.

If the total objection count reaches zero, propagation up the hierarchy is deferred until a configurable drain-time has passed and the ovm_component::all_dropped callback for the current hierarchy level has returned. The following process occurs for each instance up the hierarchy from the source caller:

A process is forked in a non-blocking fashion, allowing the *drop* call to return. The forked process then does the following:

- If a drain time was set for the given *object*, the process waits for that amount of time.
- The objection's all_dropped virtual method is called, which calls the ovm_component::all_dropped method (if *object* is a component).

- The process then waits for the *all_dropped* callback to complete.
- After the drain time has elapsed and all_dropped callback has completed, propagation of the dropped objection to the parent proceeds as described in raise_objection, except as described below.

If a new objection for this *object* or any of its descendents is raised during the drain time or during execution of the all_dropped callback at any point, the hierarchical chain described above is terminated and the dropped callback does not go up the hierarchy. The raised objection will propagate up the hierarchy, but the number of raised propagated up is reduced by the number of drops that were pending waiting for the all_dropped/drain time completion. Thus, if exactly one objection caused the count to go to zero, and during the drain exactly one new objection comes in, no raises or drops are propagted up the hierarchy,

As an optimization, if the *object* has no set drain-time and no registered callbacks, the forked process can be skipped and propagation proceeds immediately to the parent as described.

set_drain_time

```
function void set_drain_time (ovm_object obj,
                              time       drain)
```

Sets the drain time on the given *object* to *drain*.

The drain time is the amount of time to wait once all objections have been dropped before calling the all_dropped callback and propagating the objection to the parent.

If a new objection for this *object* or any of its descendents is raised during the drain time or during execution of the all_dropped callbacks, the drain_time/all_dropped execution is terminated.

Callback Hooks

raised

```
virtual function void raised (ovm_object obj,
                              ovm_object source_obj,
                              int        count      )
```

Objection callback that is called when a raise_objection has reached *obj*. The default implementation calls ovm_component::raised.

dropped

```
virtual function void dropped (ovm_object obj,
                               ovm_object source_obj,
                               int        count      )
```

Objection callback that is called when a drop_objection has reached *obj*. The default implementation calls ovm_component::dropped.

all_dropped

```
virtual task all_dropped (ovm_object obj,
                          ovm_object source_obj,
                          int        count      )
```

Objection callback that is called when a drop_objection has reached *obj*, and the total count for *obj* goes to zero. This callback is executed after the drain time associated with *obj*. The default implementation calls ovm_component::all_dropped.

Objection Status

get_objection_count

```
function int get_objection_count (ovm_object obj)
```

Returns the current number of objections raised by the given *object*.

get_objection_total

```
function int get_objection_total (ovm_object obj = null )
```

Returns the current number of objections raised by the given *object* and all descendants.

get_drain_time

```
function time get_drain_time (ovm_object obj)
```

Returns the current drain time set for the given *object* (default: 0 ns).

display_objections

```
protected function string m_display_objections(ovm_object obj         = null,
                                                bit        show_header = 1    )
```

Displays objection information about the given *object*. If *object* is not specified or *null*, the implicit top-level component, <ovm_top>, is chosen. The *show_header* argument allows control of whether a header is output.

ovm_test_done_objection

Built-in end-of-test coordination

Summary

ovm_test_done_objection

Built-in end-of-test coordination

Class Hierarchy

ovm_object
ovm_report_object
ovm_objection
ovm_test_done_objection

Class Declaration

```
class ovm_test_done_objection extends ovm_objection
```

Methods

qualify	Checks that the given *object* is derived from either ovm_component or ovm_sequence_base.
all_dropped	This callback is called when the given *object's* objection count reaches zero; if the *object* is the implicit top-level, <ovm_top> then it means there are no more objections raised for the *ovm_test_done* objection.
raise_objection	Calls ovm_objection::raise_objection after calling qualify.
drop	Calls ovm_objection::drop_objection after calling qualify.
force_stop	

Methods

qualify

```
virtual function void qualify(ovm_object obj      = null,
                              bit        is_raise       )
```

Checks that the given *object* is derived from either ovm_component or ovm_sequence_base.

all_dropped

```
virtual task all_dropped (ovm_object obj,
                          ovm_object source_obj,
                          int        count      )
```

This callback is called when the given *object's* objection count reaches zero; if the *object* is the implicit top-level, <ovm_top> then it means there are no more objections raised for the *ovm_test_done* objection. Thus, after calling ovm_objection::all_dropped, this method will call global_stop_request to stop the current task-based phase (e.g. run).

raise_objection

```
virtual function void raise_objection (ovm_object obj   = null,
                                       int        count = 1           )
```

Calls ovm_objection::raise_objection after calling qualify. If the *object* is not provided or is *null*, then the implicit top-level component, *ovm_top*, is chosen.

drop

```
virtual function void drop_objection (ovm_object obj   = null,
                                      int        count = 1           )
```

Calls ovm_objection::drop_objection after calling qualify. If the *object* is not provided or is *null*, then the implicit top-level component, *ovm_top*, is chosen.

force_stop

```
virtual task force_stop(ovm_object obj = null                          )
```

ovm_pool #(T)

Implements a class-based dynamic associative array. Allows sparse arrays to be allocated on demand, and passed and stored by reference.

Summary

ovm_pool #(T)

Implements a class-based dynamic associative array.

Class Hierarchy

ovm_object

ovm_pool#(T)

Class Declaration

```
class ovm_pool #(type KEY = int,
                      T   = ovm_void                ) extends ovm_object
```

Methods

new	Creates a new pool with the given *name*.
get_global_pool	Returns the singleton global pool for the item type, T.
get_global	Returns the specified item instance from the global item pool.
get	Returns the item with the given *key*.
add	Adds the given (*key*, *item*) pair to the pool.
num	Returns the number of uniquely keyed items stored in the pool.
delete	Removes the item with the given *key* from the pool.
exists	Returns 1 if a item with the given *key* exists in the pool, 0 otherwise.
first	Returns the key of the first item stored in the pool.
last	Returns the key of the last item stored in the pool.
next	Returns the key of the next item in the pool.
prev	Returns the key of the previous item in the pool.

Methods

new

```
function new (string name = ""                    )
```

Creates a new pool with the given *name*.

get_global_pool

```
static function this_type get_global_pool ()
```

Returns the singleton global pool for the item type, T.

This allows items to be shared amongst components throughout the verification environment.

get_global

```
static function T get_global (KEY key)
```

Returns the specified item instance from the global item pool.

get

```
virtual function T get (KEY key)
```

Returns the item with the given *key*.

If no item exists by that key, a new item is created with that key and returned.

add

```
virtual function void add (KEY key,
                           T   item)
```

Adds the given (*key*, *item*) pair to the pool.

num

```
virtual function int num ()
```

Returns the number of uniquely keyed items stored in the pool.

delete

```
virtual function void delete (KEY key)
```

Removes the item with the given *key* from the pool.

exists

```
virtual function int exists (KEY key)
```

Returns 1 if a item with the given *key* exists in the pool, 0 otherwise.

first

```
virtual function int first (ref KEY key)
```

Returns the key of the first item stored in the pool.

If the pool is empty, then *key* is unchanged and 0 is returned.

If the pool is not empty, then *key* is key of the first item and 1 is returned.

last

```
virtual function int last (ref KEY key)
```

Returns the key of the last item stored in the pool.

If the pool is empty, then 0 is returned and *key* is unchanged.

If the pool is not empty, then *key* is set to the last key in the pool and 1 is returned.

next

```
virtual function int next (ref KEY key)
```

Returns the key of the next item in the pool.

If the input *key* is the last key in the pool, then *key* is left unchanged and 0 is returned.

If a next key is found, then *key* is updated with that key and 1 is returned.

prev

```
virtual function int prev (ref KEY key)
```

Returns the key of the previous item in the pool.

If the input *key* is the first key in the pool, then *key* is left unchanged and 0 is returned.

If a previous key is found, then *key* is updated with that key and 1 is returned.

ovm_object_string_pool #(T)

This provides a specialization of the generic <ovm_pool #(KEY,T) class for an associative

array of ovm_object-based objects indexed by string. Specializations of this class include the *ovm_event_pool* and *ovm_barrier_pool* classes.

Summary

ovm_object_string_pool #(T)

This provides a specialization of the generic <ovm_pool #(KEY,T) class for an associative array of ovm_object-based objects indexed by string.

Class Hierarchy

ovm_pool#(string,T)

ovm_object_string_pool#(T)

Class Declaration

```
class ovm_object_string_pool #(
    type   T =  ovm_object
) extends ovm_pool #(string,T)
```

Methods

new	Creates a new pool with the given *name*.
get_type_name	Returns the type name of this object.
get_global_pool	Returns the singleton global pool for the item type, T.
get	Returns the object item at the given string *key*.
delete	Removes the item with the given string *key* from the pool.

Methods

new

```
function new (string name = "" )
```

Creates a new pool with the given *name*.

get_type_name

```
virtual function string get_type_name()
```

Returns the type name of this object.

get_global_pool

```
static function this_type get_global_pool ()
```

Returns the singleton global pool for the item type, T.

This allows items to be shared amongst components throughout the verification environment.

get

```
virtual function T get (string key)
```

Returns the object item at the given string *key*.

If no item exists by the given *key*, a new item is created for that key and returned.

delete

```
virtual function void delete (string key)
```

Removes the item with the given string *key* from the pool.

ovm_queue #(T)

Implements a class-based dynamic queue. Allows queues to be allocated on demand, and passed and stored by reference.

Summary

ovm_queue #(T)

Implements a class-based dynamic queue.

Class Hierarchy

ovm_object

ovm_queue#(T)

Class Declaration

```
class ovm_queue #(type T = int ) extends ovm_object
```

Methods

new	Creates a new queue with the given *name*.
get_global_queue	Returns the singleton global queue for the item type, T.
get_global	Returns the specified item instance from the global item queue.
get	Returns the item at the given *index*.
size	Returns the number of items stored in the queue.
insert	Inserts the item at the given *index* in the queue.
delete	Removes the item at the given *index* from the queue; if *index* is not provided, the entire contents of the queue are deleted.
pop_front	Returns the first element in the queue (index=0), or *null* if the queue is empty.
pop_back	Returns the last element in the queue (index=size()-1), or *null* if the queue is empty.
push_front	Inserts the given *item* at the front of the queue.
push_back	Inserts the given *item* at the back of the queue.

Methods

new

```
function new (string name = "" )
```

Creates a new queue with the given *name*.

get_global_queue

```
static function this_type get_global_queue ()
```

Returns the singleton global queue for the item type, T.

This allows items to be shared amongst components throughout the verification environment.

get_global

```
static function T get_global (int index)
```

Returns the specified item instance from the global item queue.

get

```
virtual function T get (int index)
```

Returns the item at the given *index*.

If no item exists by that key, a new item is created with that key and returned.

size

```
virtual function int size ()
```

Returns the number of items stored in the queue.

insert

```
virtual function void insert (int index,
                              T   item  )
```

Inserts the item at the given *index* in the queue.

delete

```
virtual function void delete (int index = -1 )
```

Removes the item at the given *index* from the queue; if *index* is not provided, the entire contents of the queue are deleted.

pop_front

```
virtual function T pop_front()
```

Returns the first element in the queue (index=0), or *null* if the queue is empty.

pop_back

```
virtual function T pop_back()
```

Returns the last element in the queue (index=size()-1), or *null* if the queue is empty.

push_front

```
virtual function void push_front(T item)
```

Inserts the given *item* at the front of the queue.

push_back

```
virtual function void push_back(T item)
```

Inserts the given *item* at the back of the queue.

ovm_callbacks #(T,CB)

The *ovm_callbacks* class provides a base class for implementing callbacks, which are typically used to modify or augment component behavior without changing the component class. To work effectively, the developer of the component class defines a set of "hook" methods that enable users to customize certain behaviors of the component in a manner that is controlled by the component developer. The integrity of the component's overall behavior is intact, while still allowing certain customizable actions by the user.

To enable compile-time type-safety, the class is parameterized on both the user-defined callback interface implementation as well as the object type associated with the callback.

To provide the most flexibility for end-user customization and reuse, it is recommended that the component developer also define a corresponding set of virtual method hooks in the component itself. This affords users the ability to customize via inheritance/factory overrides as well as callback object registration. The implementation of each virtual method would provide the default traversal algorithm for the particular callback being called. Being virtual, users can define subtypes that override the default algorithm, perform tasks before and/or after calling super.<method> to execute any registered callbacks, or to not call the base implementation, effectively disabling that particalar hook. A demonstration of this methodology is provided in an example included in the kit.

Summary

ovm_callbacks #(T,CB)

The *ovm_callbacks* class provides a base class for implementing callbacks, which are typically used to modify or augment component behavior without changing the component class.

Class Hierarchy

ovm_pool#(T,ovm_queue#(CB))

ovm_callbacks#(T,CB)

Class Declaration

```
class ovm_callbacks #(
     type     T    =    int,
              CB   =    int
) extends ovm_pool #(T,ovm_queue #(CB))
```

Parameters

T	This type parameter specifies the base object type with which the CB callback objects will be registered.
CB	This type parameter specifies the base callback type that will be managed by this callback class.

Methods

new	Creates a new ovm_callbacks object, giving it an optional *name*.
get_global_cbs	Returns the global callback pool for this type.
add_cb	Registers the given callback object, *cb*, with the given *obj* handle.
delete_cb	Removes a previously registered callback, *cb*, for the given object, *obj*.
trace_mode	This function takes a single argument to turn on (1) or off (0) tracing.
display_cbs	Displays information about all registered callbacks for the given *obj* handle.

Parameters

T

This type parameter specifies the base object type with which the CB callback objects will be registered.

CB

This type parameter specifies the base callback type that will be managed by this callback class. The callback type is typically a interface class, which defines one or more virtual method prototypes that users can override in subtypes.

Methods

new

```
function new(string name = "ovm_callback")
```

Creates a new ovm_callbacks object, giving it an optional *name*.

get_global_cbs

Returns the global callback pool for this type.

This allows items to be shared amongst components throughout the verification environment.

add_cb

```
virtual function void add_cb(T   obj,
                             CB  cb,
                             bit append = 1)
```

Registers the given callback object, *cb*, with the given *obj* handle. The *obj* handle can be null, which allows registration of callbacks without an object context. If *append* is 1 (default), the callback will be executed after previously added callbacks, else the callback will be executed ahead of previously added callbacks.

delete_cb

```
virtual function void delete_cb(T  obj,
                                CB cb  )
```

Removes a previously registered callback, *cb*, for the given object, *obj*.

trace_mode

```
function void trace_mode(bit mode)
```

This function takes a single argument to turn on (1) or off (0) tracing. The default is to turn tracing on.

display_cbs

```
function void display_cbs(T obj = null )
```

Displays information about all registered callbacks for the given *obj* handle. If *obj* is not provided or is null, then information about all callbacks for all objects is displayed.

ovm_callback

The *ovm_callback* class is the base class for user-defined callback classes. Typically, the component developer defines an application-specific callback class that extends from this class. In it, he defines one or more virtual methods, called a *callback interface*, that represent the hooks available for user override.

Methods intended for optional override should not be declared *pure.* Usually, all the callback methods are defined with empty implementations so users have the option of overriding any or all of them.

The prototypes for each hook method are completely application specific with no restrictions.

Summary

ovm_callback

The *ovm_callback* class is the base class for user-defined callback classes.

Class Hierarchy

ovm_object

ovm_callback

Class Declaration

```
class ovm_callback extends ovm_object
```

Methods

new	Creates a new ovm_callback object, giving it an optional *name*.
callback_mode	Enable/disable callbacks (modeled like rand_mode and constraint_mode).
is_enabled	Returns 1 if the callback is enabled, 0 otherwise.
get_type_name	Returns the type name of this callback object.

Methods

new

```
function new(string name = "ovm_callback"                    )
```

Creates a new ovm_callback object, giving it an optional *name*.

callback_mode

```
function void callback_mode(bit on)
```

Enable/disable callbacks (modeled like rand_mode and constraint_mode).

is_enabled

```
function bit is_enabled()
```

Returns 1 if the callback is enabled, 0 otherwise.

get_type_name

```
virtual function string get_type_name()
```

Returns the type name of this callback object.

Policy Classes

Each of OVM's policy classes perform a specific task for ovm_object-based objects: printing, comparing, recording, packing, and unpacking. They are implemented separately from *ovm_object* so that users can plug in different ways to print, compare, etc. without modifying the object class being operated on. The user can simply apply a different printer or compare "policy" to change how an object is printed or compared.

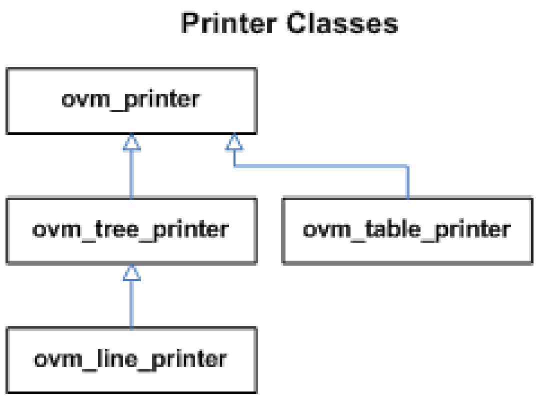
Each policy class includes several user-configurable parameters that control the operation. Users may also customize operations by deriving new policy subtypes from these base types. For example, the OVM provides four different *ovm_printer*-based policy classes, each of which print objects in a different format.

- ovm_printer - performs deep printing of *ovm_object*-based objects. The OVM provides several subtypes to *ovm_printer* that print objects in a specific format: ovm_table_printer, ovm_tree_printer, and ovm_line_printer. Each such printer has many configuration options that goven what and how object members are printed.
- ovm_comparer - performs deep comparison of *ovm_object*-based objects. Users may configure what is compared and how miscompares are reported.
- ovm_recorder - performs the task of recording *ovm_object*-based objects to a transaction data base. The implementation is vendor-specific.
- ovm_packer - used to pack (serialize) and unpack *ovm_object*-based properties into bit, byte, or int arrays and back again.

ovm_printer

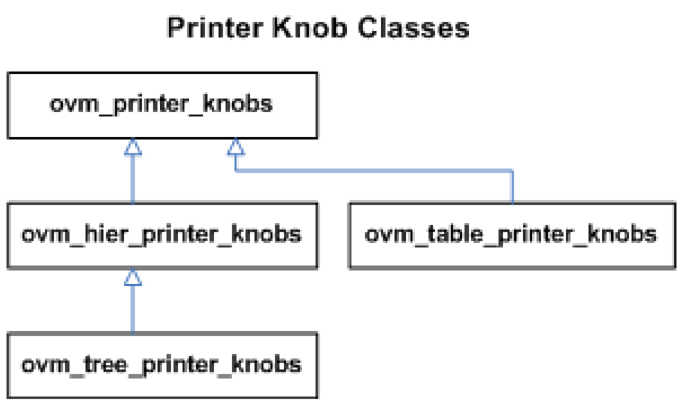
The ovm_printer class provides an interface for printing ovm_objects in various formats. Subtypes of ovm_printer implement different print formats, or policies.

A user-defined printer format can be created, or one of the following four built-in printers can be used:



- ovm_printer - provides raw, essentially un-formatted output
- ovm_table_printer - prints the object in a tabular form.
- ovm_tree_printer - prints the object in a tree form.
- ovm_line_printer - prints the information on a single line, but uses the same object separators as the tree printer.

Printers have knobs that you use to control what and how information is printed. These knobs are contained in separate knob classes:



- ovm_printer_knobs - common printer settings
- ovm_hier_printer_knobs - settings for printing hierarchically
- ovm_table_printer_knobs - settings specific to the table printer
- ovm_tree_printer_knobs - settings specific to the tree printer

For convenience, global instances of each printer type are available for direct reference in your testbenches.

- ovm_default_tree_printer
- ovm_default_line_printer
- ovm_default_table_printer
- ovm_default_printer (set to default_table_printer by default)

The ovm_default_printer is used by ovm_object::print and ovm_object::sprint when the optional *ovm_printer* argument to these methods is not provided.

Summary

ovm_printer

The ovm_printer class provides an interface for printing ovm_objects in various formats.

Class Declaration

```
class ovm_printer
```

knobs	The knob object provides access to the variety of knobs associated with a specific printer instance.
Methods for printer usage	
print_field	Prints an integral field.
print_object_header	Prints the header of an object.
print_object	Prints an object.
print_string	Prints a string field.
print_time	Prints a time value.
Methods for printer subtyping	
print_header	Prints header information.
print_footer	Prints footer information.
print_id	Prints a field’s name, or *id*, which is the full instance name.
print_type_name	Prints a field’s type name.
print_size	Prints a field’s size.
print_newline	Prints a newline character.
print_value	Prints an integral field’s value.
print_value_object	Prints a unique handle identifier for the given object.
print_value_string	Prints a string field’s value.
print_value_array	Prints an array’s value.
print_array_header	Prints the header of an array.
print_array_range	Prints a range using ellipses for values.
print_array_footer	Prints the header of a footer.

knobs

```
ovm_printer_knobs knobs = new
```

The knob object provides access to the variety of knobs associated with a specific printer instance.

Each derived printer class overwrites the knobs variable with the a derived knob class that extends ovm_printer_knobs. The derived knobs class adds more knobs to the base knobs.

Methods for printer usage

print_field

```
virtual function void print_field (string          name,
                                   ovm_bitstream_t value,
                                   int             size,
                                   ovm_radix_enum  radix           = OVM_NORADIX,
                                   byte            scope_separator = ".",
                                   string          type_name       = ""          )
```

Prints an integral field.

name	The name of the field.
value	The value of the field.
size	The number of bits of the field (maximum is 4096).
radix	The radix to use for printingthe printer knob for radix is used if no radix is specified.
scope_separator	is used to find the leaf name since many printers only print the leaf name of a field. Typical values for the separator are . (dot) or [(open bracket).

print_object_header

```
virtual function void print_object_header (string     name,
                                           ovm_object value,
                                           byte       scope_separator = "."       )
```

Prints the header of an object.

This function is called when an object is printed by reference. For this function, the object will not be recursed.

print_object

```
virtual function void print_object (string     name,
                                    ovm_object value,
                                    byte       scope_separator = "."       )
```

Prints an object. Whether the object is recursed depends on a variety of knobs, such as the depth knob; if the current depth is at or below the depth setting, then the object is not recursed.

By default, the children of ovm_components are printed. To turn this behavior off, you must set the ovm_component::print_enabled bit to 0 for the specific children you do not want automatically printed.

print_string

```
virtual function void print_string (string name,
                                    string value,
                                    byte   scope_separator = "."          )
```

Prints a string field.

print_time

```
virtual function void print_time (string name,
                                  time   value,
                                  byte   scope_separator = "."            )
```

Prints a time value. name is the name of the field, and value is the value to print.

The print is subject to the *$timeformat* system task for formatting time values.

Methods for printer subtyping

print_header

```
virtual function void print_header ()
```

Prints header information. It is called when the current depth is 0, before any fields have been printed.

print_footer

```
virtual function void print_footer ()
```

Prints footer information. It is called when the current depth is 0, after all fields have been printed.

print_id

```
virtual protected function void print_id (string id,
                                          byte   scope_separator = "."    )
```

Prints a field's name, or *id*, which is the full instance name.

The intent of the separator is to mark where the leaf name starts if the printer if configured to print only the leaf name of the identifier.

print_type_name

```
virtual protected function void print_type_name (string name,
                                                  bit    is_object = )
```

Prints a field's type name.

The *is_object* bit indicates that the item being printed is an object derived from ovm_object.

print_size

```
virtual protected function void print_size (int size = -1                        )
```

Prints a field's size. A size of -1 indicates that no size is available, in which case the printer inserts the appropriate white space if the format requires it.

print_newline

```
virtual protected function void print_newline (bit do_global_indent = 1           )
```

Prints a newline character. It is up to the printer to determine how or whether to display new lines. The *do_global_indent* bit indicates whether the call to print_newline() should honor the indent knob.

print_value

```
virtual protected function void print_value (ovm_bitstream_t value,
                                             int             size,
                                             ovm_radix_enum  radix  = OVM_NORADIX)
```

Prints an integral field's value.

The *value* vector is up to 4096 bits, and the *size* input indicates the number of bits to actually print.

The *radix* input is the radix that should be used for printing the value.

print_value_object

```
virtual protected function void print_value_object (ovm_object value)
```

Prints a unique handle identifier for the given object.

print_value_string

```
virtual protected function void print_value_string (string value)
```

Prints a string field's value.

print_value_array

```
virtual function void print_value_array (string value = "",
                                         int    size  = 0                          )
```

Prints an array's value.

This only prints the header value of the array, which means that it implements the printer-specific print_array_header().

value is the value to be printed for the array. It is generally the string representation of *size*, but it may be any string. *size* is the number of elements in the array.

print_array_header

```
virtual function void print_array_header(string name,
                                         int    size,
                                         string arraytype       = "array",
                                         byte   scope_separator = "."          )
```

Prints the header of an array. This function is called before each individual element is printed. print_array_footer is called to mark the completion of array printing.

print_array_range

```
virtual function void print_array_range (int min,
                                         int max )
```

Prints a range using ellipses for values. This method is used when honoring the array knobs for partial printing of large arrays, ovm_printer_knobs::begin_elements and ovm_printer_knobs::end_elements.

This function should be called after begin_elements have been printed and after end_elements have been printed.

print_array_footer

```
virtual function void print_array_footer (int size = )
```

Prints the header of a footer. This function marks the end of an array print. Generally, there is no output associated with the array footer, but this method lets the printer know that the array printing is complete.

ovm_table_printer

The table printer prints output in a tabular format.

The following shows sample output from the table printer.

```
---------------------------------------------------
Name        Type            Size        Value
---------------------------------------------------
c1          container       -           @1013
d1          mydata          -           @1022
v1          integral        32          'hcb8f1c97
e1          enum            32          THREE
str         string          2           hi
value       integral        12          'h2d
---------------------------------------------------
```

Summary

ovm_table_printer

The table printer prints output in a tabular format.

Class Hierarchy

ovm_printer

ovm_table_printer

Class Declaration

```
class ovm_table_printer extends ovm_printer
```

Variables

new	Creates a new instance of *ovm_table_printer*.
knobs	An instance of ovm_table_printer_knobs, which govern the content and format of the printed table.

Variables

new

```
function new()
```

Creates a new instance of *ovm_table_printer*.

knobs

```
ovm_table_printer_knobs knobs = new
```

An instance of ovm_table_printer_knobs, which govern the content and format of the printed table.

ovm_tree_printer

By overriding various methods of the ovm_printer super class, the tree printer prints output in a tree format.

The following shows sample output from the tree printer.

```
c1: (container@1013) {
  d1: (mydata@1022) {
       v1: 'hcb8f1c97
       e1: THREE
       str: hi
  }
  value: 'h2d
}
```

Summary

ovm_tree_printer

By overriding various methods of the ovm_printer super class, the tree printer prints output in a tree format.

Class Hierarchy

ovm_printer

ovm_tree_printer

Class Declaration

```
class ovm_tree_printer extends ovm_printer
```

Variables

new	Creates a new instance of *ovm_tree_printer*.
knobs	An instance of ovm_tree_printer_knobs, which govern the content and format of the printed tree.

Variables

new

```
function new()
```

Creates a new instance of *ovm_tree_printer*.

knobs

```
ovm_tree_printer_knobs knobs = new
```

An instance of ovm_tree_printer_knobs, which govern the content and format of the printed tree.

ovm_line_printer

The line printer prints output in a line format.

The following shows sample output from the line printer.

```
c1: (container@1013) { d1: (mydata@1022) { v1: 'hcb8f1c97 e1: THREE str: hi } value: 'h2d }
```

Summary

ovm_line_printer

The line printer prints output in a line format.

Class Hierarchy

ovm_printer

ovm_tree_printer

ovm_line_printer

Class Declaration

```
class ovm_line_printer extends ovm_tree_printer
```

Variables

new	Creates a new instance of *ovm_line_printer*.

Methods

print_newline	Overrides ovm_printer::print_newline to not print a newline, effectively making everything appear on a single line.

Variables

new

```
function new()
```

Creates a new instance of *ovm_line_printer*.

Methods

print_newline

```
virtual function void print_newline (bit do_global_indent = 1 )
```

Overrides ovm_printer::print_newline to not print a newline, effectively making everything appear on a single line.

ovm_printer_knobs

The *ovm_printer_knobs* class defines the printer settings available to all printer subtypes. Printer subtypes may subtype this class to provide additional knobs for their specific format. For example, the ovm_table_printer uses the ovm_table_printer_knobs, which defines knobs for setting table column widths.

Summary

ovm_printer_knobs

The *ovm_printer_knobs* class defines the printer settings available to all printer subtypes.

Class Declaration

```
class ovm_printer_knobs
```

Variables

max_width	The maximum with of a field.
truncation	Specifies the character to use to indicate a field was truncated.
header	Indicates whether the <print_header> function should be called when printing an object.
footer	Indicates whether the <print_footer> function should be called when printing an object.
global_indent	Specifies the number of spaces of indentation to add whenever a newline is printed.
full_name	Indicates whether <print_id> should print the full name of an identifier or just the leaf name.
identifier	Indicates whether <print_id> should print the identifier.
depth	Indicates how deep to recurse when printing objects.
reference	Controls whether to print a unique reference ID for object handles.
type_name	Controls whether to print a field's type name.
size	Controls whether to print a field's size.
begin_elements	Defines the number of elements at the head of a list to print.
end_elements	This defines the number of elements at the end of a list that should be printed.
show_radix	Indicates whether the radix string ('h, and so on) should be prepended to an integral value when one is printed.
prefix	Specifies the string prepended to each output line
mcd	This is a file descriptor, or multi-channel descriptor, that specifies where the print output should be directed.
default_radix	This knob sets the default radix to use for integral values when no radix enum is explicitly supplied to the print_field() method.
dec_radix	This string should be prepended to the value of an integral type when a radix of OVM_DEC is used for the radix of the integral object.
bin_radix	This string should be prepended to the value of an integral type when a radix of OVM_BIN is used for the radix of the integral object.
oct_radix	This string should be prepended to the value of an integral type when a radix of OVM_OCT is used for the radix of the integral object.
unsigned_radix	This is the string which should be prepended to the value of an integral type when a radix of OVM_UNSIGNED is used for the radix of the integral object.
hex_radix	This string should be prepended to the value of an integral type when a radix of OVM_HEX is used for the radix of the integral object.

Methods

get_radix_str	Converts the radix from an enumerated to a printable radix according to the radix printing knobs (bin_radix, and so on).

Variables

max_width

```
int max_width = 999
```

The maximum with of a field. Any field that requires more characters will be truncated.

truncation

```
string truncation = "+"
```

Specifies the character to use to indicate a field was truncated.

header

```
bit header = 1
```

Indicates whether the <print_header> function should be called when printing an object.

footer

```
bit footer = 1
```

Indicates whether the <print_footer> function should be called when printing an object.

global_indent

```
int global_indent = 0
```

Specifies the number of spaces of indentation to add whenever a newline is printed.

full_name

```
bit full_name = 1
```

Indicates whether <print_id> should print the full name of an identifier or just the leaf name. The line, table, and tree printers ignore this bit and always print only the leaf name.

identifier

```
bit identifier = 1
```

Indicates whether <print_id> should print the identifier. This is useful in cases where you just want the values of an object, but no identifiers.

depth

```
int depth = -1
```

Indicates how deep to recurse when printing objects. A depth of -1 means to print everything.

reference

```
bit reference = 1
```

Controls whether to print a unique reference ID for object handles. The behavior of this knob is simulator-dependent.

type_name

```
bit type_name = 1
```

Controls whether to print a field's type name.

size

```
bit size = 1
```

Controls whether to print a field's size.

begin_elements

```
int begin_elements = 5
```

Defines the number of elements at the head of a list to print. Use -1 for no max.

end_elements

```
int end_elements = 5
```

This defines the number of elements at the end of a list that should be printed.

show_radix

```
bit show_radix = 1
```

Indicates whether the radix string ('h, and so on) should be prepended to an integral value when one is printed.

prefix

```
string prefix = ""
```

Specifies the string prepended to each output line

mcd

```
int mcd = OVM_STDOUT
```

This is a file descriptor, or multi-channel descriptor, that specifies where the print output should be directed.

By default, the output goes to the standard output of the simulator.

default_radix

```
ovm_radix_enum default_radix = OVM_HEX
```

This knob sets the default radix to use for integral values when no radix enum is explicitly supplied to the print_field() method.

dec_radix

```
string dec_radix = "'d"
```

This string should be prepended to the value of an integral type when a radix of OVM_DEC is used for the radix of the integral object.

When a negative number is printed, the radix is not printed since only signed decimal values can print as negative.

bin_radix

```
string bin_radix = "'b"
```

This string should be prepended to the value of an integral type when a radix of OVM_BIN is used for the radix of the integral object.

oct_radix

```
string oct_radix = "'o"
```

This string should be prepended to the value of an integral type when a radix of OVM_OCT is used for the radix of the integral object.

unsigned_radix

```
string unsigned_radix = "'d"
```

This is the string which should be prepended to the value of an integral type when a radix of OVM_UNSIGNED is used for the radix of the integral object.

hex_radix

```
string hex_radix = "'h"
```

This string should be prepended to the value of an integral type when a radix of OVM_HEX is used for the radix of the integral object.

Methods

get_radix_str

```
function string get_radix_str (ovm_radix_enum radix)
```

Converts the radix from an enumerated to a printable radix according to the radix printing knobs (bin_radix, and so on).

ovm_hier_printer_knobs

The *ovm_hier_printer_knobs* is a simple container class that extends <ovm_printer::ovm_printer_knobs> with settings for printing information hierarchically.

Summary

ovm_hier_printer_knobs

The *ovm_hier_printer_knobs* is a simple container class that extends <ovm_printer::ovm_printer_knobs> with settings for printing information hierarchically.

Class Hierarchy

ovm_printer_knobs

ovm_hier_printer_knobs

Class Declaration

```
class ovm_hier_printer_knobs extends ovm_printer_knobs
```

Variables

indent_str	This knob specifies the string to use for level indentation.
show_root	This setting indicates whether or not the initial object that is printed (when current depth is 0) prints the full path name.

Variables

indent_str

```
string indent_str = "  "
```

This knob specifies the string to use for level indentation. The default level indentation is two spaces.

show_root

```
bit show_root = 0
```

This setting indicates whether or not the initial object that is printed (when current depth is 0) prints the full path name. By default, the first object is treated like all other objects and only the leaf name is printed.

ovm_table_printer_knobs

The *ovm_table_printer_knobs* is a simple container class that extends <ovm_printer:: ovm_hier_printer_knobs> with settings specific to printing in table format.

Summary

ovm_table_printer_knobs

The *ovm_table_printer_knobs* is a simple container class that extends <ovm_printer::ovm_hier_printer_knobs> with settings specific to printing in table format.

Class Hierarchy

ovm_printer_knobs

ovm_hier_printer_knobs

ovm_table_printer_knobs

Class Declaration

```
class ovm_table_printer_knobs extends ovm_hier_printer_knobs
```

Variables

name_width	Sets the width of the *name* column.
type_width	Sets the width of the *type* column.
size_width	Sets the width of the *size* column.
value_width	Sets the width of the *value* column.

Variables

name_width

```
int name_width = 25
```

Sets the width of the *name* column. If set to 0, the column is not printed.

type_width

```
int type_width = 20
```

Sets the width of the *type* column. If set to 0, the column is not printed.

size_width

```
int size_width = 5
```

Sets the width of the *size* column. If set to 0, the column is not printed.

value_width

```
int value_width = 20
```

Sets the width of the *value* column. If set to 0, the column is not printed.

ovm_tree_printer_knobs

The *ovm_tree_printer_knobs* is a simple container class that extends <ovm_printer::ovm_hier_printer_knobs> with settings specific to printing in tree format.

Summary

ovm_tree_printer_knobs

The *ovm_tree_printer_knobs* is a simple container class that extends <ovm_printer::ovm_hier_printer_knobs> with settings specific to printing in tree format.

Class Hierarchy

ovm_printer_knobs

ovm_hier_printer_knobs

ovm_tree_printer_knobs

Class Declaration

```
class ovm_tree_printer_knobs extends ovm_hier_printer_knobs
```

Variables

separator	Determines the opening and closing separators used for nested objects.

Variables

separator

```
string separator = "{}"
```

Determines the opening and closing separators used for nested objects.

ovm_comparer

The ovm_comparer class provides a policy object for doing comparisons. The policies determine how miscompares are treated and counted. Results of a comparison are stored in the comparer object. The ovm_object::compare and ovm_object::do_compare methods are passed an ovm_comparer policy object.

Summary

ovm_comparer

The ovm_comparer class provides a policy object for doing comparisons.

Class Declaration

```
class ovm_comparer
```

Variables

policy	Determines whether comparison is OVM_DEEP, OVM_REFERENCE, or OVM_SHALLOW.
show_max	Sets the maximum number of messages to send to the messager for miscompares of an object.
verbosity	Sets the verbosity for printed messages.
sev	Sets the severity for printed messages.
miscompares	This string is reset to an empty string when a comparison is started.
physical	This bit provides a filtering mechanism for fields.
abstract	This bit provides a filtering mechanism for fields.
check_type	This bit determines whether the type, given by ovm_object::get_type_name, is used to verify that the types of two objects are the same.
result	This bit stores the number of miscompares for a given compare operation.

Methods

compare_field	Compares two integral values.
compare_field_int	This method is the same as compare_field except that the arguments are small integers, less than or equal to 64 bits.
compare_field_real	This method is the same as compare_field except that the arguments are real numbers.
compare_object	Compares two class objects using the policy knob to determine whether the comparison should be deep, shallow, or reference.
compare_string	Compares two string variables.
print_msg	Causes the error count to be incremented and the message, *msg*, to be appended to the miscompares string (a newline is used to separate messages).

Variables

policy

```
ovm_recursion_policy_enum policy = OVM_DEFAULT_POLICY
```

Determines whether comparison is OVM_DEEP, OVM_REFERENCE, or OVM_SHALLOW.

show_max

```
int unsigned show_max = 1
```

Sets the maximum number of messages to send to the messager for miscompares of an object.

verbosity

```
int unsigned verbosity = OVM_LOW
```

Sets the verbosity for printed messages.

The verbosity setting is used by the messaging mechanism to determine whether messages should be suppressed or shown.

sev

```
ovm_severity sev = OVM_INFO
```

Sets the severity for printed messages.

The severity setting is used by the messaging mechanism for printing and filtering messages.

miscompares

```
string miscompares = ""
```

This string is reset to an empty string when a comparison is started.

The string holds the last set of miscompares that occurred during a comparison.

physical

```
bit physical = 1
```

This bit provides a filtering mechanism for fields.

The abstract and physical settings allow an object to distinguish between two different classes of fields.

It is up to you, in the ovm_object::do_compare method, to test the setting of this field if you want to use the physical trait as a filter.

abstract

```
bit abstract = 1
```

This bit provides a filtering mechanism for fields.

The abstract and physical settings allow an object to distinguish between two different classes of fields.

It is up to you, in the ovm_object::do_compare method, to test the setting of this field if you want to use the abstract trait as a filter.

check_type

```
bit check_type = 1
```

This bit determines whether the type, given by ovm_object::get_type_name, is used to verify that the types of two objects are the same.

This bit is used by the compare_object method. In some cases it is useful to set this to 0 when the two operands are related by inheritance but are different types.

result

```
int unsigned result = 0
```

This bit stores the number of miscompares for a given compare operation. You can use the result to determine the number of miscompares that were found.

Methods

compare_field

```
virtual function bit compare_field (string          name,
                                    ovm_bitstream_t lhs,
                                    ovm_bitstream_t rhs,
                                    int             size,
                                    ovm_radix_enum  radix = OVM_NORADIX    )
```

Compares two integral values.

The *name* input is used for purposes of storing and printing a miscompare.

The left-hand-side *lhs* and right-hand-side *rhs* objects are the two objects used for comparison.

The size variable indicates the number of bits to compare; size must be less than or equal to 4096.

The radix is used for reporting purposes, the default radix is hex.

compare_field_int

```
virtual function bit compare_field_int (string         name,
                                        logic[63:0]    lhs,
                                        logic[63:0]    rhs,
                                        int            size,
                                        ovm_radix_enum radix = OVM_NORADIX)
```

This method is the same as compare_field except that the arguments are small integers, less than or equal to 64 bits. It is automatically called by compare_field if the operand size is less than or equal to 64.

compare_field_real

```
virtual function bit compare_field_real (string name,
                                         real   lhs,
                                         real   rhs  )
```

This method is the same as compare_field except that the arguments are real numbers.

compare_object

```
virtual function bit compare_object (string     name,
                                     ovm_object lhs,
                                     ovm_object rhs  )
```

Compares two class objects using the policy knob to determine whether the comparison should be deep, shallow, or reference.

The name input is used for purposes of storing and printing a miscompare.

The *lhs* and *rhs* objects are the two objects used for comparison.

The *check_type* determines whether or not to verify the object types match (the return from *lhs.get_type_name()* matches *rhs.get_type_name()*).

compare_string

```
virtual function bit compare_string (string name,
                                     string lhs,
                                     string rhs  )
```

Compares two string variables.

The *name* input is used for purposes of storing and printing a miscompare.

The *lhs* and *rhs* objects are the two objects used for comparison.

print_msg

```
function void print_msg (string msg)
```

Causes the error count to be incremented and the message, *msg*, to be appended to the miscompares string (a newline is used to separate messages).

If the message count is less than the show_max setting, then the message is printed to standard-out using the current verbosity and severity settings. See the verbosity and sev variables for more information.

ovm_recorder

The ovm_recorder class provides a policy object for recording ovm_objects. The policies determine how recording should be done.

A default recorder instance, ovm_default_recorder, is used when the ovm_object::record is called without specifying a recorder.

Summary

ovm_recorder

The ovm_recorder class provides a policy object for recording ovm_objects.

Class Declaration

```
class ovm_recorder
```

Variables

tr_handle	This is an integral handle to a transaction object.
default_radix	This is the default radix setting if record_field is called without a radix.
physical	This bit provides a filtering mechanism for fields.
abstract	This bit provides a filtering mechanism for fields.
identifier	This bit is used to specify whether or not an object's reference should be recorded when the object is recorded.
recursion_policy	Sets the recursion policy for recording objects.

Methods

record_field	Records an integral field (less than or equal to 4096 bits).
record_field_real	Records an real field.
record_object	Records an object field.
record_string	Records a string field.
record_time	Records a time value.
record_generic	Records the name-value pair, where value has been converted to a string, e.g.

Variables

tr_handle

```
integer tr_handle = 0
```

This is an integral handle to a transaction object. Its use is vendor specific.

A handle of 0 indicates there is no active transaction object.

default_radix

```
ovm_radix_enum default_radix = OVM_HEX
```

This is the default radix setting if record_field is called without a radix.

physical

```
bit physical = 1
```

This bit provides a filtering mechanism for fields.

The abstract and physical settings allow an object to distinguish between two different classes of fields.

It is up to you, in the ovm_object::do_record method, to test the setting of this field if you want to use the physical trait as a filter.

abstract

```
bit abstract = 1
```

This bit provides a filtering mechanism for fields.

The abstract and physical settings allow an object to distinguish between two different classes of fields.

It is up to you, in the ovm_object::do_record method, to test the setting of this field if you want to use the abstract trait as a filter.

identifier

```
bit identifier = 1
```

This bit is used to specify whether or not an object's reference should be recorded when the object is recorded.

recursion_policy

```
ovm_recursion_policy_enum policy = OVM_DEFAULT_POLICY
```

Sets the recursion policy for recording objects.

The default policy is deep (which means to recurse an object).

Methods

record_field

```
virtual function void record_field (string          name,
                                    ovm_bitstream_t value,
                                    int             size,
                                    ovm_radix_enum  radix  = OVM_NORADIX )
```

Records an integral field (less than or equal to 4096 bits). *name* is the name of the field.

value is the value of the field to record. *size* is the number of bits of the field which apply. *radix* is the ovm_radix_enum to use.

record_field_real

```
virtual function void record_field_real (string name,
                                         real   value)
```

Records an real field. *value* is the value of the field to record.

record_object

```
virtual function void record_object (string     name,
                                     ovm_object value)
```

Records an object field. *name* is the name of the recorded field.

This method uses the recursion <policy> to determine whether or not to recurse into the object.

record_string

```
virtual function void record_string (string name,
                                     string value)
```

Records a string field. *name* is the name of the recorded field.

record_time

```
virtual function void record_time (string name,
                                   time   value)
```

Records a time value. *name* is the name to record to the database.

record_generic

```
virtual function void record_generic (string name,
                                      string value)
```

Records the name-value pair, where value has been converted to a string, e.g. via $psprintf (“%<format>”,<some variable>);

ovm_packer

The ovm_packer class provides a policy object for packing and unpacking ovm_objects. The policies determine how packing and unpacking should be done. Packing an object causes the object to be placed into a bit (byte or int) array. If the `ovm_field_* macro are used to implement pack and unpack, by default no metadata information is stored for the packing of dynamic objects (strings, arrays, class objects).

Summary

ovm_packer

The ovm_packer class provides a policy object for packing and unpacking ovm_objects.

Packing	
pack_field	Packs an integral value (less than or equal to 4096 bits) into the packed array.
pack_field_int	Packs the integral value (less than or equal to 64 bits) into the pack array.
pack_string	Packs a string value into the pack array.
pack_time	Packs a time *value* as 64 bits into the pack array.
pack_real	Packs a real *value* as 64 bits into the pack array.
pack_object	Packs an object value into the pack array.
Unpacking	
is_null	This method is used during unpack operations to peek at the next 4-bit chunk of the pack data and determine if it is 0.
unpack_field_int	Unpacks bits from the pack array and returns the bit-stream that was unpacked.
unpack_field	Unpacks bits from the pack array and returns the bit-stream that was unpacked.
unpack_string	Unpacks a string.
unpack_time	Unpacks the next 64 bits of the pack array and places them into a time variable.
unpack_real	Unpacks the next 64 bits of the pack array and places them into a real variable.
unpack_object	Unpacks an object and stores the result into *value*.
get_packed_size	Returns the number of bits that were packed.
Variables	
physical	This bit provides a filtering mechanism for fields.
abstract	This bit provides a filtering mechanism for fields.
use_metadata	This flag indicates whether to encode metadata when packing dynamic data, or to decode metadata when unpacking.
big_endian	This bit determines the order that integral data is packed (using pack_field, pack_field_int, pack_time, or pack_real) and how the data is unpacked from the pack array (using unpack_field, unpack_field_int, unpack_time, or unpack_real).

Packing

pack_field

```
virtual function void pack_field (ovm_bitstream_t value,
                                  int             size  )
```

Packs an integral value (less than or equal to 4096 bits) into the packed array. *size* is the number of bits of *value* to pack.

pack_field_int

```
virtual function void pack_field_int (logic[63:0] value,
                                      int         size  )
```

Packs the integral value (less than or equal to 64 bits) into the pack array. The *size* is the number of bits to pack, usually obtained by *$bits*. This optimized version of pack_field is useful for sizes up to 64 bits.

pack_string

```
virtual function void pack_string (string value)
```

Packs a string value into the pack array.

When the metadata flag is set, the packed string is terminated by a null character to mark the end of the string.

This is useful for mixed language communication where unpacking may occur outside of SystemVerilog OVM.

pack_time

```
virtual function void pack_time (time value)
```

Packs a time *value* as 64 bits into the pack array.

pack_real

```
virtual function void pack_real (real value)
```

Packs a real *value* as 64 bits into the pack array.

The real *value* is converted to a 6-bit scalar value using the function $real2bits before it is packed into the array.

pack_object

```
virtual function void pack_object (ovm_object value)
```

Packs an object value into the pack array.

A 4-bit header is inserted ahead of the string to indicate the number of bits that was packed. If a null object was packed, then this header will be 0.

This is useful for mixed-language communication where unpacking may occur outside of SystemVerilog OVM.

Unpacking

is_null

```
virtual function bit is_null ()
```

This method is used during unpack operations to peek at the next 4-bit chunk of the pack data and determine if it is 0.

If the next four bits are all 0, then the return value is a 1; otherwise it is 0.

This is useful when unpacking objects, to decide whether a new object needs to be allocated or not.

unpack_field_int

```
virtual function logic[63:0] unpack_field_int (int size)
```

Unpacks bits from the pack array and returns the bit-stream that was unpacked.

size is the number of bits to unpack; the maximum is 64 bits. This is a more efficient variant than unpack_field when unpacking into smaller vectors.

unpack_field

```
virtual function ovm_bitstream_t unpack_field (int size)
```

Unpacks bits from the pack array and returns the bit-stream that was unpacked. *size* is the number of bits to unpack; the maximum is 4096 bits.

unpack_string

```
virtual function string unpack_string (int num_chars = -1 )
```

Unpacks a string.

num_chars bytes are unpacked into a string. If num_chars is -1 then unpacking stops on at the first null character that is encountered.

unpack_time

```
virtual function time unpack_time ()
```

Unpacks the next 64 bits of the pack array and places them into a time variable.

unpack_real

```
virtual function real unpack_real ()
```

Unpacks the next 64 bits of the pack array and places them into a real variable.

The 64 bits of packed data are converted to a real using the $bits2real system function.

unpack_object

```
virtual function void unpack_object (ovm_object value)
```

Unpacks an object and stores the result into *value*.

value must be an allocated object that has enough space for the data being unpacked. The first four bits of packed data are used to determine if a null object was packed into the array.

The is_null function can be used to peek at the next four bits in the pack array before calling this method.

get_packed_size

```
virtual function int get_packed_size()
```

Returns the number of bits that were packed.

Variables

physical

```
bit physical = 1
```

This bit provides a filtering mechanism for fields.

The abstract and physical settings allow an object to distinguish between two different classes of fields. It is up to you, in the ovm_object::do_pack and ovm_object::do_unpack methods, to test the setting of this field if you want to use it as a filter.

abstract

```
bit abstract = 0
```

This bit provides a filtering mechanism for fields.

The abstract and physical settings allow an object to distinguish between two different classes of fields. It is up to you, in the ovm_object::do_pack and ovm_object::do_unpack routines, to test the setting of this field if you want to use it as a filter.

use_metadata

```
bit use_metadata = 0
```

This flag indicates whether to encode metadata when packing dynamic data, or to decode metadata when unpacking. Implementations of <do_pack> and <do_unpack> should regard this bit when performing their respective operation. When set, metadata should be encoded as follows:

- For strings, pack an additional null byte after the string is packed.
- For objects, pack 4 bits prior to packing the object itself. Use 4'b0000 to indicate the object being packed is null, otherwise pack 4'b0001 (the remaining 3 bits are reserved).
- For queues, dynamic arrays, and associative arrays, pack 32 bits indicating the size of the array prior to to packing individual elements.

big_endian

```
bit big_endian = 1
```

This bit determines the order that integral data is packed (using pack_field, pack_field_int, pack_time, or pack_real) and how the data is unpacked from the pack array (using unpack_field, unpack_field_int, unpack_time, or unpack_real). When the bit is set, data is associated msb to lsb; otherwise, it is associated lsb to msb.

The following code illustrates how data can be associated msb to lsb and lsb to msb:

```
class mydata extends ovm_object;

  logic[15:0] value = 'h1234;

  function void do_pack (ovm_packer packer);
    packer.pack_field_int(value, 16);
  endfunction

  function void do_unpack (ovm_packer packer);
    value = packer.unpack_field_int(16);
  endfunction
endclass

mydata d = new;
bit bits[];

initial begin
  d.pack(bits);  // 'b0001001000110100
  ovm_default_packer.big_endian = 0;
  d.pack(bits);  // 'b0010110001001000
end
```

TLM Interfaces, Ports, and Exports

The OVM TLM library defines several abstract, transaction-level interfaces and the ports and exports that facilitate their use. Each TLM interface consists of one or more methods used to transport data, typically whole transactions (objects) at a time. Component designs that use TLM ports and exports to communicate are inherently more reusable, interoperable, and modular.

Interface Overview

The TLM standard specifies the required behavior (semantic) of each interface method. Classes (components) that implement a TLM interface must meet the specified semantic.

Each TLM interface is either blocking, non-blocking, or a combination of these two.

blocking A blocking interface conveys transactions in blocking fashion; its methods do not return until the transaction has been successfully sent or retrieved. Because delivery may consume time to complete, the methods in such an interface are declared as tasks.

non-blocking A non-blocking interface attempts to convey a transaction without consuming simulation time. Its methods are declared as functions. Because delivery may fail (e.g. the target component is busy and can not accept the request), the methods may return with failed status.

combination A combination interface contains both the blocking and non-blocking variants. In SystemC, combination interfaces are defined through multiple inheritance. Because SystemVerilog does not support multiple inheritance, the OVM emulates hierarchical interfaces via a common base class and interface mask.

Like their SystemC counterparts, the OVM's TLM port and export implementations allow connections between ports whose interfaces are not an exact match. For example, an *ovm_blocking_get_port* can be connected to any port, export or imp port that provides *at the least* an implementation of the blocking_get interface, which includes the *ovm_get_** ports and exports, *ovm_blocking_get_peek_** ports and exports, and *ovm_get_peek_** ports and exports.

The sections below provide and overview of the unidirectional and bidirectional TLM interfaces, ports, and exports.

Summary

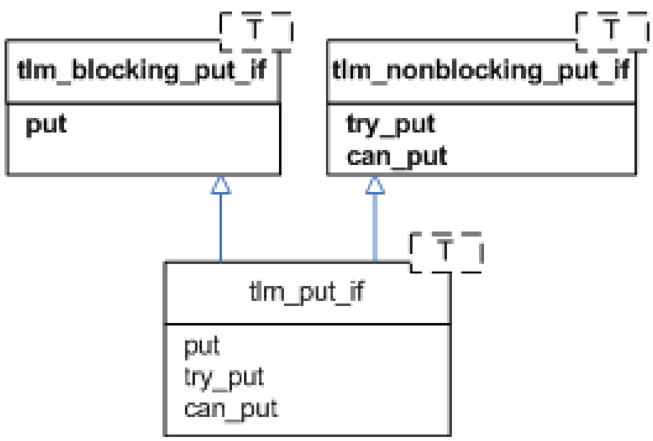
TLM Interfaces, Ports, and Exports	
The OVM TLM library defines several abstract, transaction-level interfaces and the ports and exports that facilitate their use.	
Unidirectional Interfaces & Ports	The unidirectional TLM interfaces consist of blocking, non-blocking, and combined blocking and non-blocking variants of the *put*, *get* and *peek* interfaces, plus a non-blocking *analysis* interface.
Put	The *put* interfaces are used to send, or *put*, transactions to other components.
Get and Peek	The *get* interfaces are used to retrieve transactions from other components.
Analysis	The *analysis* interface is used to perform non-blocking broadcasts of transactions to connected components.

Unidirectional Interfaces & Ports

The unidirectional TLM interfaces consist of blocking, non-blocking, and combined blocking and non-blocking variants of the *put*, *get* and *peek* interfaces, plus a non-blocking *analysis* interface.

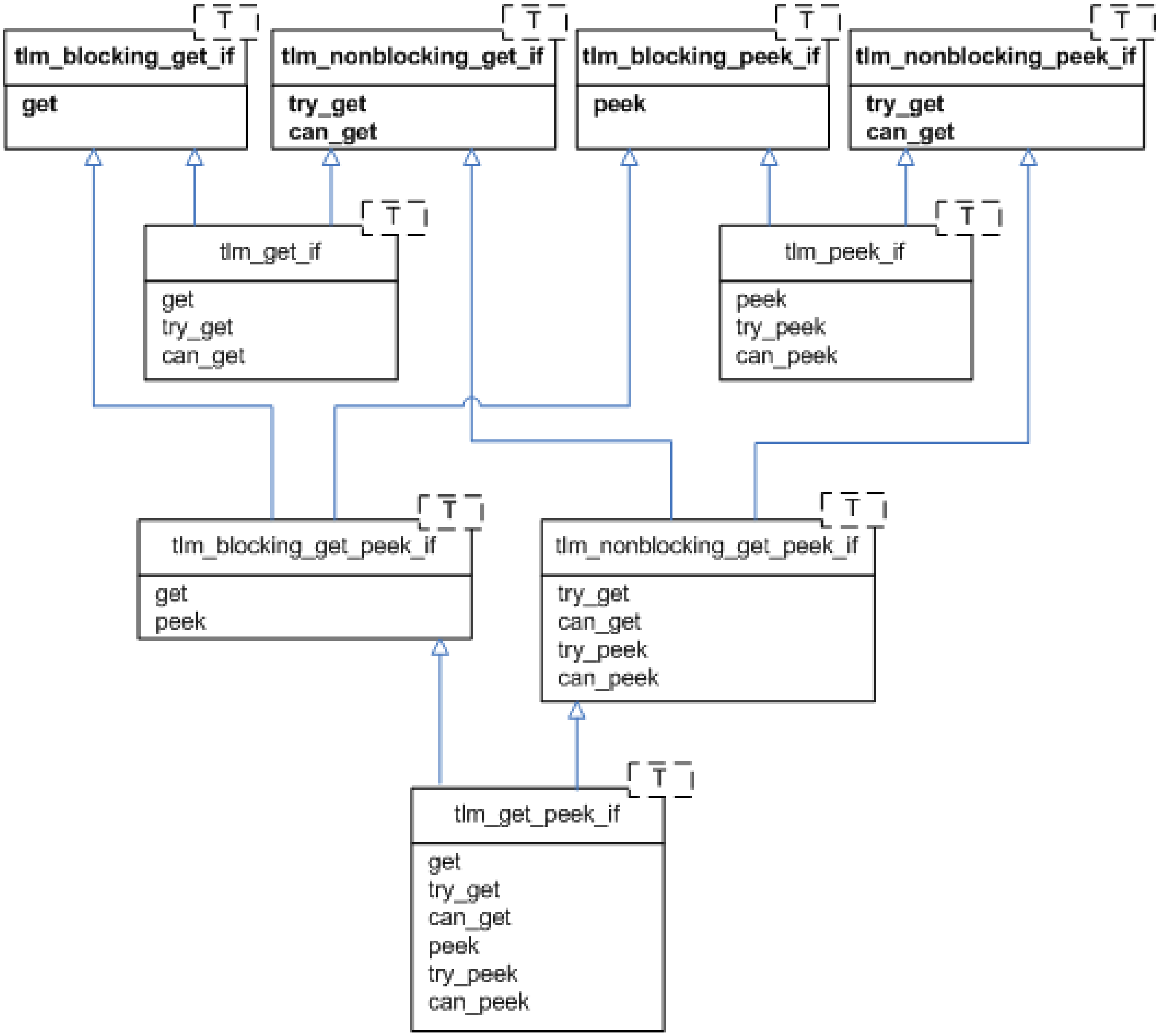
Put

The *put* interfaces are used to send, or *put*, transactions to other components. Successful completion of a put guarantees its delivery, not execution.



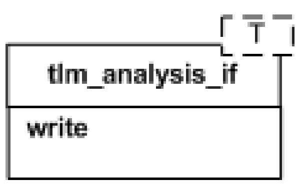
Get and Peek

The *get* interfaces are used to retrieve transactions from other components. The *peek* interfaces are used for the same purpose, except the retrieved transaction is not consumed; successive calls to *peek* will return the same object. Combined *get_peek* interfaces are also defined.



Analysis

The *analysis* interface is used to perform non-blocking broadcasts of transactions to connected components. It is typically used by such components as monitors to publish transactions observed on a bus to its subscribers, which are typically scoreboards and response/coverage collectors.



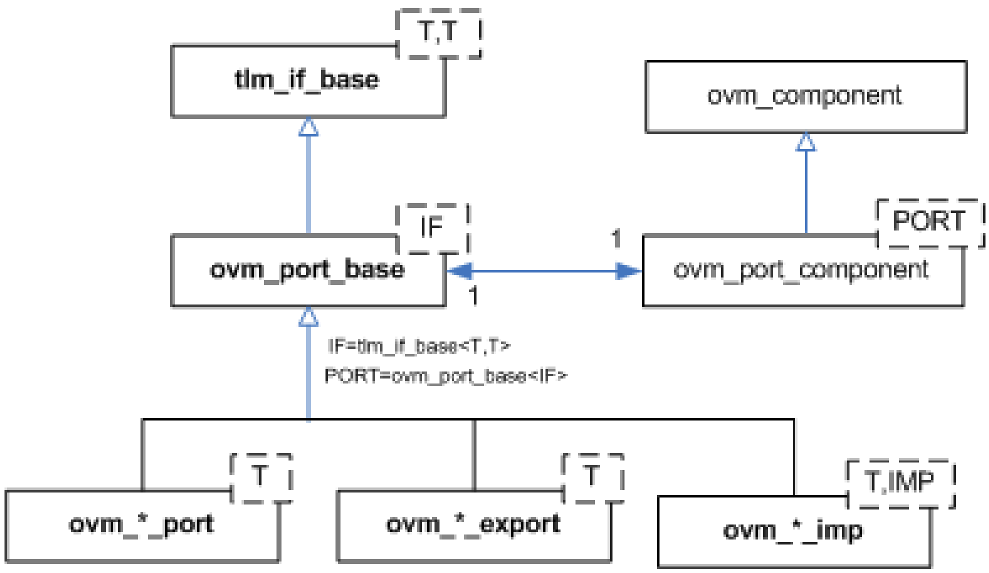
Ports, Exports, and Imps

The OVM provides unidirectional ports, exports, and implementation ports for connecting your components via the TLM interfaces.

Ports instantiated in components that *require*, or *use*, the associate interface to initiate transaction requests.

Exports instantiated by components that *forward* an implementation of the methods defined in the associated interface. The implementation is typically provided by an *imp* port in a child component.

Imps instantiated by components that *provide* or *implement* an implementation of the methods defined in the associated interface.



A summary of port, export, and imp declarations are

```
class ovm_*_export #(type T=int)
  extends ovm_port_base #(tlm_if_base #(T,T));

class ovm_*_port #(type T=int)
  extends ovm_port_base #(tlm_if_base #(T,T));

class ovm_*_imp #(type T=int)
  extends ovm_port_base #(tlm_if_base #(T,T));
```

where the asterisk can be any of

```
blocking_put
nonblocking_put
put
```

```
blocking_get
nonblocking_get
get

blocking_peek
nonblocking_peek
peek

blocking_get_peek
nonblocking_get_peek
get_peek

analysis
```

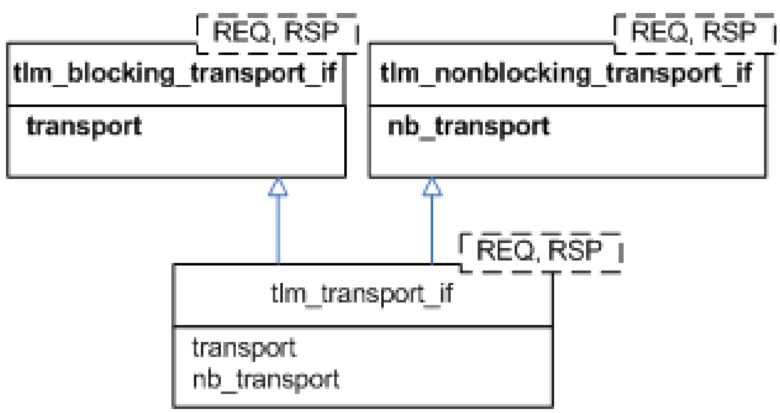
Bidirectional Interfaces & Ports

The bidirectional interfaces consist of blocking, non-blocking, and combined blocking and non-blocking variants of the *transport*, *master*, and *slave* interfaces.

Bidirectional interfaces involve both a transaction request and response.

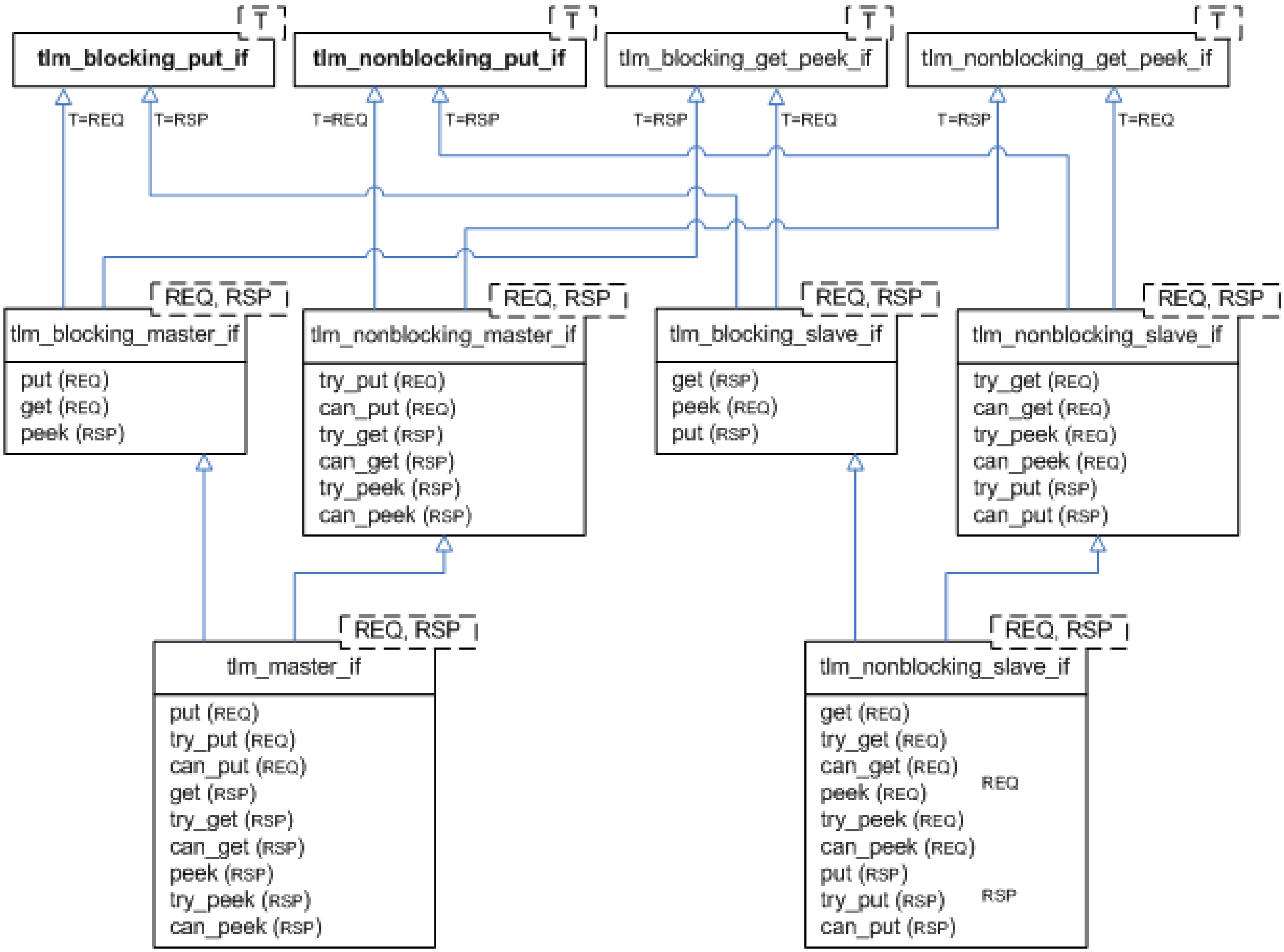
Transport

The *transport* interface sends a request transaction and returns a response transaction in a single task call, thereby enforcing an in-order execution semantic. The request and response transactions can be different types.



Master and Slave

The primitive, unidirectional *put*, *get*, and *peek* interfaces are combined to form bidirectional master and slave interfaces. The master puts requests and gets or peeks responses. The slave gets or peeks requests and puts responses. Because the put and the get come from different function interface methods, the requests and responses are not coupled as they are with the *transport* interface.



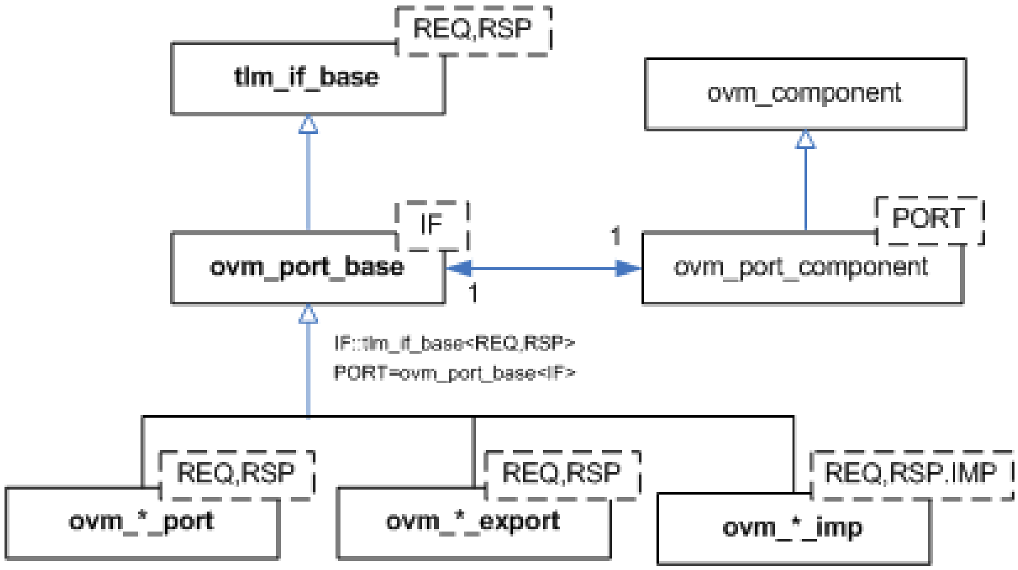
Ports, Exports, and Imps

The OVM provides bidirectional ports, exports, and implementation ports for connecting your components via the TLM interfaces.

Ports instantiated in components that *require*, or *use*, the associate interface to initiate transaction requests.

Exports instantiated by components that *forward* an implementation of the methods defined in the associated interface. The implementation is typically provided by an *imp* port in a child component.

Imps instantiated by components that *provide* or *implement* an implementation of the methods defined in the associated interface.



A summary of port, export, and imp declarations are

```
class ovm_*_port #(type REQ=int, RSP=int)
  extends ovm_port_base #(tlm_if_base #(REQ, RSP));

class ovm_*_export #(type REQ=int, RSP=int)
  extends ovm_port_base #(tlm_if_base #(REQ, RSP));

class ovm_*_imp #(type REQ=int, RSP=int)
  extends ovm_port_base #(tlm_if_base #(REQ, RSP));
```

where the asterisk can be any of

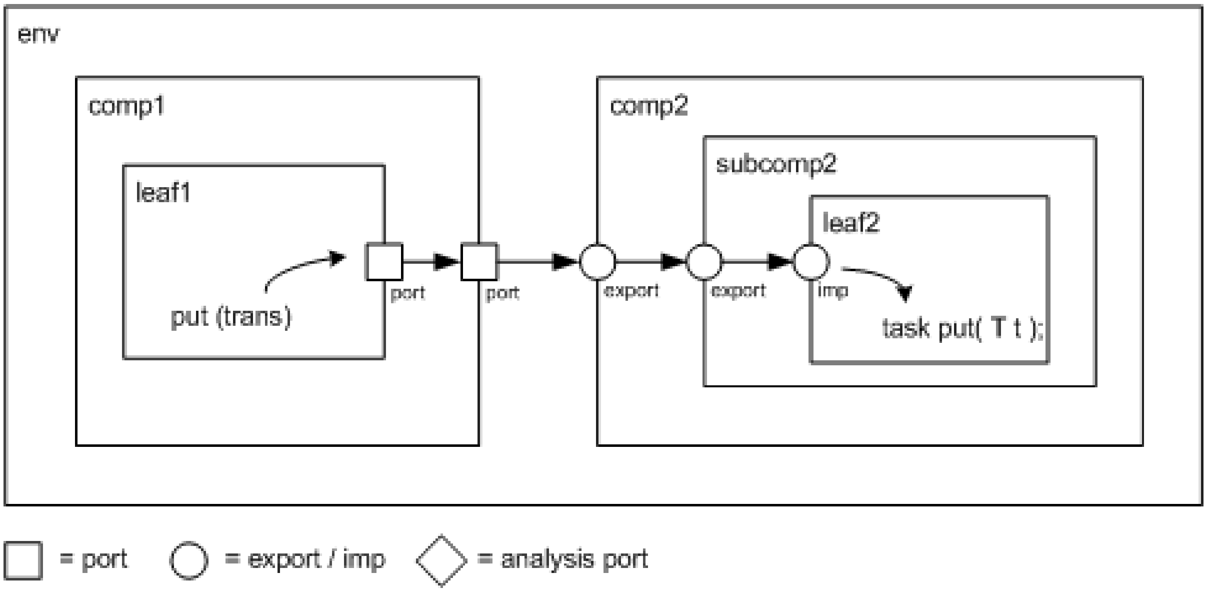
```
transport
blocking_transport
nonblocking_transport

blocking_master
nonblocking_master
master

blocking_slave
nonblocking_slave
slave
```

Usage

We provide an example to illustrate basic TLM connectivity using the blocking put inteface.



port-to-port	leaf1's *out* port is connected to its parent's (comp1) *out* port
port-to-export	comp1's *out* port is connected to comp2's *in* export
export-to-export	comp2's *in* export is connected to its child's (subcomp2) *in* export
export-to-imp	subcomp2's *in* export is connected leaf2's *in* imp port.
imp-to-implementation	leaf2's *in* imp port is connected to its implementation, leaf2

Hierarchical port connections are resolved and optimized just before the ovm_component:: end_of_elaboration phase. After optimization, calling any port's interface method (e.g. leaf1. out.put(trans)) incurs a single hop to get to the implementation (e.g. leaf2's put task), no matter how far up and down the hierarchy the implementation resides.

```
`include "ovm_pkg.sv"
import ovm_pkg::*;

class trans extends ovm_transaction;
  rand int addr;
  rand int data;
  rand bit write;
endclass

class leaf1 extends ovm_component;

  `ovm_component_utils(leaf1)

  ovm_blocking_put_port #(trans) out;

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
    out = new("out",this);
  endfunction

  virtual task run();
    trans t;
    t = new;
    t.randomize();
    out.put(t);
  endtask
```

```
endclass


class comp1 extends ovm_component;

  `ovm_component_utils(comp1)

  ovm_blocking_put_port #(trans) out;

  leaf1 leaf;

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
  endfunction

  virtual function void build();
    out = new("out",this);
    leaf = new("leaf1",this);
  endfunction

  // connect port to port
  virtual function void connect();
    leaf.out.connect(out);
  endfunction

endclass


class leaf2 extends ovm_component;

  `ovm_component_utils(leaf2)

  ovm_blocking_put_imp #(trans,leaf2) in;

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
    // connect imp to implementation (this)
    in = new("in",this);
  endfunction

  virtual task put(trans t);
    $display("Got trans: addr=%0d, data=%0d, write=%0d",
        t.addr, t.data, t.write);
  endtask

endclass


class subcomp2 extends ovm_component;

  `ovm_component_utils(subcomp2)

  ovm_blocking_put_export #(trans) in;

  leaf2 leaf;

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
  endfunction

  virtual function void build();
    in = new("in",this);
    leaf = new("leaf2",this);
  endfunction
```

```
  // connect export to imp
  virtual function void connect();
    in.connect(leaf.in);
  endfunction

endclass


class comp2 extends ovm_component;

  `ovm_component_utils(comp2)

  ovm_blocking_put_export #(trans) in;

  subcomp2 subcomp;

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
  endfunction

  virtual function void build();
    in = new("in",this);
    subcomp = new("subcomp2",this);
  endfunction

  // connect export to export
  virtual function void connect();
    in.connect(subcomp.in);
  endfunction

endclass


class env extends ovm_component;

  `ovm_component_utils(comp1)

  comp1 comp1_i;
  comp2 comp2_i;

  function new(string name, ovm_component parent=null);
    super.new(name,parent);
  endfunction

  virtual function void build();
    comp1_i = new("comp1",this);
    comp2_i = new("comp2",this);
  endfunction

  // connect port to export
  virtual function void connect();
    comp1_i.out.connect(comp2_i.in);
  endfunction

endclass


module top;
  env e = new("env");
  initial run_test();
  initial #10 ovm_top.stop_request();
endmodule
```

tlm_if_base #(T1,T2)

This class declares all of the methods of the TLM API.

Various subsets of these methods are combined to form primitive TLM interfaces, which are then paired in various ways to form more abstract "combination" TLM interfaces. Components that require a particular interface use ports to convey that requirement. Components that provide a particular interface use exports to convey its availability.

Communication between components is established by connecting ports to compatible exports, much like connecting module signal-level output ports to compatible input ports. The difference is that OVM ports and exports bind interfaces (groups of methods), not signals and wires. The methods of the interfaces so bound pass data as whole transactions (e.g. objects). The set of primitve and combination TLM interfaces afford many choices for designing components that communicate at the transaction level.

Summary

tlm_if_base #(T1,T2)

This class declares all of the methods of the TLM API.

Class Declaration

```
virtual class tlm_if_base #(type T1 = int,
                             type T2 = int                         )
```

Blocking put	
put	Sends a user-defined transaction of type T.
Blocking get	
get	Provides a new transaction of type T.
Blocking peek	
peek	Obtain a new transaction without consuming it.
Non-blocking put	
try_put	Sends a transaction of type T, if possible.
can_put	Returns 1 if the component is ready to accept the transaction; 0 otherwise.
Non-blocking get	
try_get	Provides a new transaction of type T.
can_get	Returns 1 if a new transaction can be provided immediately upon request, 0 otherwise.
Non-blocking peek	
try_peek	Provides a new transaction without consuming it.
can_peek	Returns 1 if a new transaction is available; 0 otherwise.
Blocking transport	
transport	Executes the given request and returns the response in the given output argument.
Non-blocking transport	
nb_transport	Executes the given request and returns the response in the given output argument.
Analysis	
write	Broadcasts a user-defined transaction of type T to any number of listeners.

Blocking put

put

```
virtual task put(input T1 t)
```

Sends a user-defined transaction of type T.

Components implementing the put method will block the calling thread if it cannot immediately accept delivery of the transaction.

Blocking get

get

```
virtual task get(output T2 t)
```

Provides a new transaction of type T.

The calling thread is blocked if the requested transaction cannot be provided immediately. The new transaction is returned in the provided output argument.

The implementation of get must regard the transaction as consumed. Subsequent calls to get must return a different transaction instance.

Blocking peek

peek

```
virtual task peek(output T2 t)
```

Obtain a new transaction without consuming it.

If a transaction is available, then it is written to the provided output argument. If a transaction is not available, then the calling thread is blocked until one is available.

The returned transaction is not consumed. A subsequent peek or get will return the same transaction.

Non-blocking put

try_put

```
virtual function bit try_put(input T1 t)
```

Sends a transaction of type T, if possible.

If the component is ready to accept the transaction argument, then it does so and returns 1, otherwise it returns 0.

can_put

```
virtual function bit can_put()
```

Returns 1 if the component is ready to accept the transaction; 0 otherwise.

Non-blocking get

try_get

```
virtual function bit try_get(output T2 t)
```

Provides a new transaction of type T.

If a transaction is immediately available, then it is written to the output argument and 1 is returned. Otherwise, the output argument is not modified and 0 is returned.

can_get

```
virtual function bit can_get()
```

Returns 1 if a new transaction can be provided immediately upon request, 0 otherwise.

Non-blocking peek

try_peek

```
virtual function bit try_peek(output T2 t)
```

Provides a new transaction without consuming it.

If available, a transaction is written to the output argument and 1 is returned. A subsequent peek or get will return the same transaction. If a transaction is not available, then the argument is unmodified and 0 is returned.

can_peek

```
virtual function bit can_peek()
```

Returns 1 if a new transaction is available; 0 otherwise.

Blocking transport

transport

```
virtual task transport(input T1 req ,
                       output T2  rsp)
```

Executes the given request and returns the response in the given output argument. The calling thread may block until the operation is complete.

Non-blocking transport

nb_transport

```
virtual function bit nb_transport( input T1 req,
                                   output T2 rsp )
```

Executes the given request and returns the response in the given output argument. Completion of this operation must occur without blocking.

If for any reason the operation could not be executed immediately, then a 0 must be returned; otherwise 1.

Analysis

write

```
virtual function void write(input T1 t)
```

Broadcasts a user-defined transaction of type T to any number of listeners. The operation must complete without blocking.

ovm_*_port #(T)

These unidirectional ports are instantiated by components that *require*, or *use*, the associated interface to convey transactions. A port can be connected to any compatible port, export, or imp port. Unless its *min_size* is 0, a port *must* be connected to at least one implementation of its assocated interface.

The asterisk in *ovm_*_port* is any of the following

```
blocking_put
nonblocking_put
put

blocking_get
nonblocking_get
get

blocking_peek
nonblocking_peek
peek

blocking_get_peek
nonblocking_get_peek
get_peek

analysis
```

Type parameters
*T*The type of transaction to be communicated by the export

Ports are connected to interface implementations directly via ovm_*_imp #(T,IMP) ports or indirectly via hierarchical connections to ovm_*_port #(T) and ovm_*_export #(T) ports.

Summary

ovm_*_port #(T)
These unidirectional ports are instantiated by components that *require*, or *use*, the associated interface to convey transactions.
Methods
new The *name* and *parent* are the standard ovm_component constructor arguments.

Methods

new

The *name* and *parent* are the standard ovm_component constructor arguments. The *min_size* and *max_size* specify the minimum and maximum number of interfaces that must have been connected to this port by the end of elaboration.

```
function new (string name,
              ovm_component parent,
              int min_size=1,
              int max_size=1)
```

ovm_*_port #(REQ,RSP)

These bidirectional ports are instantiated by components that *require*, or *use*, the associated interface to convey transactions. A port can be connected to any compatible port, export, or imp port. Unless its *min_size* is 0, a port *must* be connected to at least one implementation of its assocated interface.

The asterisk in *ovm_*_port* is any of the following

```
blocking_transport
nonblocking_transport
transport

blocking_master
nonblocking_master
master

blocking_slave
nonblocking_slave
slave
```

Ports are connected to interface implementations directly via ovm_*_imp #(REQ,RSP,IMP, REQ_IMP,RSP_IMP) ports or indirectly via hierarchical connections to ovm_*_port #(REQ, RSP) and ovm_*_export #(REQ,RSP) ports.

Type parameters
REQ The type of request transaction to be communicated by the export
RSP The type of response transaction to be communicated by the export

Summary

ovm_*_port #(REQ,RSP)

These bidirectional ports are instantiated by components that *require*, or *use*, the associated interface to convey transactions.

Methods

new	The *name* and *parent* are the standard ovm_component constructor arguments.

Methods

new

The *name* and *parent* are the standard ovm_component constructor arguments. The *min_size* and *max_size* specify the minimum and maximum number of interfaces that must have been supplied to this port by the end of elaboration.

```
function new (string name, ovm_component parent, int min_size=1, int max_size=1)
```

ovm_*_export #(T)

The unidirectional ovm_*_export is a port that *forwards* or *promotes* an interface implementation from a child component to its parent. An export can be connected to any compatible child export or imp port. It must ultimately be connected to at least one implementation of its associated interface.

The interface type represented by the asterisk is any of the following

```
blocking_put
nonblocking_put
put

blocking_get
nonblocking_get
get

blocking_peek
nonblocking_peek
peek

blocking_get_peek
nonblocking_get_peek
get_peek

analysis
```

Type parameters
*T*The type of transaction to be communicated by the export

Exports are connected to interface implementations directly via ovm_*_imp #(T,IMP) ports or indirectly via other ovm_*_export #(T) exports.

Summary

ovm_*_export #(T)

The unidirectional ovm_*_export is a port that *forwards* or *promotes* an interface implementation from a child component to its parent.

Methods

new	The *name* and *parent* are the standard ovm_component constructor arguments.

Methods

new

The *name* and *parent* are the standard ovm_component constructor arguments. The *min_size* and *max_size* specify the minimum and maximum number of interfaces that must have been supplied to this port by the end of elaboration.

```
function new (string name,
              ovm_component parent,
              int min_size=1,
              int max_size=1)
```

ovm_*_export #(REQ,RSP)

The bidirectional ovm_*_export is a port that *forwards* or *promotes* an interface implementation from a child component to its parent. An export can be connected to any compatible child export or imp port. It must ultimately be connected to at least one implementation of its associated interface.

The interface type represented by the asterisk is any of the following

```
blocking_transport
nonblocking_transport
transport

blocking_master
nonblocking_master
master

blocking_slave
nonblocking_slave
slave
```

Type parameters
REQ The type of request transaction to be communicated by the export
RSP The type of response transaction to be communicated by the export

Exports are connected to interface implementations directly via <ovm_*_imp #(REQ,RSP,IMP)> ports or indirectly via other ovm_*_export #(REQ,RSP) exports.

Summary

ovm_*_export #(REQ,RSP)
The bidirectional ovm_*_export is a port that *forwards* or *promotes* an interface implementation from a child component to its parent.

Methods

new	The *name* and *parent* are the standard ovm_component constructor arguments.

Methods

new

The *name* and *parent* are the standard ovm_component constructor arguments. The *min_size* and *max_size* specify the minimum and maximum number of interfaces that must have been supplied to this port by the end of elaboration.

```
function new (string name,
              ovm_component parent,
              int min_size=1,
              int max_size=1)
```

ovm_*_imp ports

This page documents the following port classes

- ovm_*_imp #(T,IMP) - unidirectional implementation ports
- ovm_*_imp #(REQ, RSP, IMP, REQ_IMP, RSP_IMP) - bidirectional implementation ports

Summary

ovm_*_imp #(T,IMP)

Unidirectional implementation (imp) port classes--An imp port provides access to an implementation of the associated interface to all connected *ports* and *exports*. Each imp port instance *must* be connected to the component instance that implements the associated interface, typically the imp port's parent. All other connections-- e.g. to other ports and exports-- are prohibited.

The asterisk in *ovm_*_imp* may be any of the following

```
blocking_put
nonblocking_put
put

blocking_get
nonblocking_get
get

blocking_peek
nonblocking_peek
peek

blocking_get_peek
nonblocking_get_peek
get_peek

analysis
```

Type parameters

T The type of transaction to be communicated by the imp

IMP The type of the component implementing the interface. That is, the class to which this imp will delegate.

The interface methods are implemented in a component of type *IMP*, a handle to which is passed in a constructor argument. The imp port delegates all interface calls to this component.

Summary

ovm_*_imp #(T,IMP)

Unidirectional implementation (imp) port classes--An imp port provides access to an implementation of the associated interface to all connected *ports* and *exports*.

Methods

new	Creates a new unidirectional imp port with the given *name* and *parent*.

Methods

new

Creates a new unidirectional imp port with the given *name* and *parent*. The *parent* must implement the interface associated with this port. Its type must be the type specified in the imp's type-parameter, *IMP*.

```
function new (string name, IMP parent);
```

ovm_*_imp #(REQ, RSP, IMP, REQ_IMP, RSP_IMP)

Bidirectional implementation (imp) port classes--An imp port provides access to an implementation of the associated interface to all connected *ports* and *exports*. Each imp port instance *must* be connected to the component instance that implements the associated interface, typically the imp port's parent. All other connections-- e.g. to other ports and exports-- are prohibited.

The interface represented by the asterisk is any of the following

```
blocking_transport
nonblocking_transport
transport
```

```
blocking_master
nonblocking_master
master

blocking_slave
nonblocking_slave
slave
```

Type parameters

REQ	Request transaction type
RSP	Response transaction type
IMP	Component type that implements the interface methods, typically the the parent of this imp port.
REQ_IMP	Component type that implements the request side of the interface. Defaults to IMP. For master and slave imps only.
RSP_IMP	Component type that implements the response side of the interface. Defaults to IMP. For master and slave imps only.

The interface methods are implemented in a component of type *IMP*, a handle to which is passed in a constructor argument. The imp port delegates all interface calls to this component.

The master and slave imps have two modes of operation.

- A single component of type IMP implements the entire interface for both requests and responses.
- Two sibling components of type REQ_IMP and RSP_IMP implement the request and response interfaces, respectively. In this case, the IMP parent instantiates this imp port *and* the REQ_IMP and RSP_IMP components.

The second mode is needed when a component instantiates more than one imp port, as in the tlm_req_rsp_channel #(REQ,RSP) channel.

Summary

ovm_*_imp #(REQ, RSP, IMP, REQ_IMP, RSP_IMP)

Bidirectional implementation (imp) port classes--An imp port provides access to an implementation of the associated interface to all connected *ports* and *exports*.

Methods

new	Creates a new bidirectional imp port with the given *name* and *parent*.

Methods

new

Creates a new bidirectional imp port with the given *name* and *parent*. The *parent*, whose type is specified by *IMP* type parameter, must implement the interface associated with this port.

Transport imp constructor

```
function new(string name, IMP imp)
```

Master and slave imp constructor

The optional *req_imp* and *rsp_imp* arguments, available to master and slave imp ports, allow the requests and responses to be handled by different subcomponents. If they are specified, they must point to the underlying component that implements the request and response methods, respectively.

```
function new(string name, IMP imp,
                          REQ_IMP req_imp=imp, RSP_IMP rsp_imp=imp)
```

tlm_fifo_base #(T)

This class is the base for tlm_fifo #(T). It defines the TLM exports through which all transaction-based FIFO operations occur. It also defines default implementations for each inteface method provided by these exports.

The interface methods provided by the put_export and the get_peek_export are defined and described by tlm_if_base #(T1,T2). See the TLM Overview section for a general discussion of TLM interface definition and usage.

Parameter type
*T*The type of transactions to be stored by this FIFO.

Summary

tlm_fifo_base #(T)

This class is the base for tlm_fifo #(T).

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

tlm_fifo_base#(T)

Class Declaration

```
virtual class tlm_fifo_base #(
      type      T  =    int
) extends ovm_component
```

Ports

put_export	The *put_export* provides both the blocking and non-blocking put interface methods to any attached port:
get_peek_export	The *get_peek_export* provides all the blocking and non-blocking get and peek interface methods:
put_ap	Transactions passed via *put* or *try_put* (via any port connected to the put_export) are sent out this port via its *write* method.
get_ap	Transactions passed via *get*, *try_get*, *peek*, or *try_peek* (via any port connected to the get_peek_export) are sent out this port via its *write* method.

Methods

new	The *name* and *parent* are the normal ovm_component constructor arguments.

Ports

put_export

The *put_export* provides both the blocking and non-blocking put interface methods to any attached port:

```
task put (input T t)
function bit can_put ()
function bit try_put (input T t)
```

Any *put* port variant can connect and send transactions to the FIFO via this export, provided the transaction types match. See tlm_if_base #(T1,T2) for more information on each of the above interface methods.

get_peek_export

The *get_peek_export* provides all the blocking and non-blocking get and peek interface methods:

```
task get (output T t)
function bit can_get ()
function bit try_get (output T t)
task peek (output T t)
function bit can_peek ()
function bit try_peek (output T t)
```

Any *get* or *peek* port variant can connect to and retrieve transactions from the FIFO via this export, provided the transaction types match. See tlm_if_base #(T1,T2) for more information on each of the above interface methods.

put_ap

Transactions passed via *put* or *try_put* (via any port connected to the put_export) are sent out this port via its *write* method.

```
function void write (T t)
```

All connected analysis exports and imps will receive put transactions. See tlm_if_base #(T1, T2) for more information on the *write* interface method.

get_ap

Transactions passed via *get*, *try_get*, *peek*, or *try_peek* (via any port connected to the get_peek_export) are sent out this port via its *write* method.

```
function void write (T t)
```

All connected analysis exports and imps will receive get transactions. See tlm_if_base #(T1, T2) for more information on the *write* method.

Methods

new

```
function new(string        name,
             ovm_component parent = null                    )
```

The *name* and *parent* are the normal ovm_component constructor arguments. The *parent* should be null if the tlm_fifo is going to be used in a statically elaborated construct (e.g., a module). The *size* indicates the maximum size of the FIFO. A value of zero indicates no upper bound.

tlm_fifo #(T)

This class provides storage of transactions between two independently running processes. Transactions are put into the FIFO via the *put_export*. transactions are fetched from the FIFO in the order they arrived via the *get_peek_export*. The *put_export* and *get_peek_export* are inherited from the tlm_fifo_base #(T) super class, and the interface methods provided by these exports are defined by the tlm_if_base #(T1,T2) class.

Summary

tlm_fifo #(T)

This class provides storage of transactions between two independently running processes.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

tlm_fifo_base#(T)

tlm_fifo#(T)

Class Declaration

```
class tlm_fifo #(
    type    T  =   int
) extends tlm_fifo_base #(T)
```

Methods

new	The *name* and *parent* are the normal ovm_component constructor arguments.
size	Returns the capacity of the FIFO-- that is, the number of entries the FIFO is capable of holding.
used	Returns the number of entries put into the FIFO.
is_empty	Returns 1 when there are no entries in the FIFO, 0 otherwise.
is_full	Returns 1 when the number of entries in the FIFO is equal to its size, 0 otherwise.
flush	Removes all entries from the FIFO, after which used returns 0 and is_empty returns 1.

Methods

new

```
function new(string         name,
             ovm_component parent = null,
             int           size   = 1                                    )
```

The *name* and *parent* are the normal ovm_component constructor arguments. The *parent* should be null if the tlm_fifo is going to be used in a statically elaborated construct (e.g., a module). The *size* indicates the maximum size of the FIFO; a value of zero indicates no upper bound.

size

```
virtual function int size()
```

Returns the capacity of the FIFO-- that is, the number of entries the FIFO is capable of holding. A return value of 0 indicates the FIFO capacity has no limit.

used

```
virtual function int used()
```

Returns the number of entries put into the FIFO.

is_empty

```
virtual function bit is_empty()
```

Returns 1 when there are no entries in the FIFO, 0 otherwise.

is_full

```
virtual function bit is_full()
```

Returns 1 when the number of entries in the FIFO is equal to its size, 0 otherwise.

flush

```
virtual function void flush()
```

Removes all entries from the FIFO, after which used returns 0 and is_empty returns 1.

tlm_analysis_fifo #(T)

An analysis_fifo is a tlm_fifo with an unbounded size and a write interface. It can be used any place an <ovm_subscriber #(T)> is used. Typical usage is as a buffer between an analysis_port in a monitor and an analysis component (e.g., a component derived from ovm_subscriber).

Summary

tlm_analysis_fifo #(T)

An analysis_fifo is a tlm_fifo with an unbounded size and a write interface.

Class Hierarchy

- ovm_object
- ovm_report_object
- ovm_component
- tlm_fifo_base#(T)
- tlm_fifo#(T)
- **tlm_analysis_fifo#(T)**

Class Declaration

```
class tlm_analysis_fifo #(
     type    T  =   int
) extends tlm_fifo #(T)
```

Ports

analysis_port #(T)	The analysis_export provides the write method to all connected analysis ports and parent exports:

Methods

new	This is the standard ovm_component constructor.

Ports

analysis_port #(T)

The analysis_export provides the write method to all connected analysis ports and parent exports:

```
function void write (T t)
```

Access via ports bound to this export is the normal mechanism for writing to an analysis FIFO. See write method of tlm_if_base #(T1,T2) for more information.

Methods

new

```
function new(string name ,
             ovm_component parent = null )
```

This is the standard ovm_component constructor. *name* is the local name of this component. The *parent* should be left unspecified when this component is instantiated in statically elaborated constructs and must be specified when this component is a child of another OVM component.

tlm_req_rsp_channel #(REQ,RSP)

The tlm_req_rsp_channel contains a request FIFO of type *REQ* and a response FIFO of type *RSP*. These FIFOs can be of any size. This channel is particularly useful for dealing with pipelined protocols where the request and response are not tightly coupled.

Type parameters

REQ Type of the request transactions conveyed by this channel.
RSP Type of the reponse transactions conveyed by this channel.

Summary

tlm_req_rsp_channel #(REQ,RSP)

The tlm_req_rsp_channel contains a request FIFO of type *REQ* and a response FIFO of type *RSP*.

Class Hierarchy

ovm_object
ovm_report_object
ovm_component
tlm_req_rsp_channel#(REQ,RSP)

Class Declaration

```
class tlm_req_rsp_channel #(
    type    REQ   =   int,
    type    RSP   =   REQ
) extends ovm_component
```

Ports

put_request_export	The put_export provides both the blocking and non-blocking put interface methods to the request FIFO:
get_peek_response_export	The get_peek_response_export provides all the blocking and non-blocking get and peek interface methods to the response FIFO:
get_peek_request_export	The get_peek_export provides all the blocking and non-blocking get and peek interface methods to the response FIFO:
put_response_export	The put_export provides both the blocking and non-blocking put interface methods to the response FIFO:
request_ap	Transactions passed via put or try_put (via any port connected to the put_request_export) are sent out this port via its write method.
response_ap	Transactions passed via put or try_put (via any port connected to the put_response_export) are sent out this port via its write method.
master_export	Exports a single interface that allows a master to put requests and get or peek responses.
slave_export	Exports a single interface that allows a slave to get or peek requests and to put responses.

Methods

new	The *name* and *parent* are the standard ovm_component constructor arguments.

Ports

put_request_export

The put_export provides both the blocking and non-blocking put interface methods to the request FIFO:

```
task put (input T t);
function bit can_put ();
function bit try_put (input T t);
```

Any put port variant can connect and send transactions to the request FIFO via this export, provided the transaction types match.

get_peek_response_export

The get_peek_response_export provides all the blocking and non-blocking get and peek interface methods to the response FIFO:

```
task get (output T t);
function bit can_get ();
function bit try_get (output T t);
task peek (output T t);
function bit can_peek ();
function bit try_peek (output T t);
```

Any get or peek port variant can connect to and retrieve transactions from the response FIFO via this export, provided the transaction types match.

get_peek_request_export

The get_peek_export provides all the blocking and non-blocking get and peek interface methods to the response FIFO:

```
task get (output T t);
function bit can_get ();
function bit try_get (output T t);
task peek (output T t);
```

```
function bit can_peek ();
function bit try_peek (output T t);
```

Any get or peek port variant can connect to and retrieve transactions from the response FIFO via this export, provided the transaction types match.

put_response_export

The put_export provides both the blocking and non-blocking put interface methods to the response FIFO:

```
task put (input T t);
function bit can_put ();
function bit try_put (input T t);
```

Any put port variant can connect and send transactions to the response FIFO via this export, provided the transaction types match.

request_ap

Transactions passed via put or try_put (via any port connected to the put_request_export) are sent out this port via its write method.

```
function void write (T t);
```

All connected analysis exports and imps will receive these transactions.

response_ap

Transactions passed via put or try_put (via any port connected to the put_response_export) are sent out this port via its write method.

```
function void write (T t);
```

All connected analysis exports and imps will receive these transactions.

master_export

Exports a single interface that allows a master to put requests and get or peek responses. It is a combination of the put_request_export and get_peek_response_export.

slave_export

Exports a single interface that allows a slave to get or peek requests and to put responses. It is a combination of the get_peek_request_export and put_response_export.

Methods

new

```
function new (string        name,
              ovm_component parent             = null,
              int           request_fifo_size  = 1,
              int           response_fifo_size = 1                    )
```

The *name* and *parent* are the standard ovm_component constructor arguments. The *parent* must be null if this component is defined within a static component such as a module, program block, or interface. The last two arguments specify the request and response FIFO sizes, which have default values of 1.

tlm_transport_channel #(REQ,RSP)

A tlm_transport_channel is a tlm_req_rsp_channel #(REQ,RSP) that implements the transport interface. It is useful when modeling a non-pipelined bus at the transaction level. Because the requests and responses have a tightly coupled one-to-one relationship, the request and response FIFO sizes are both set to one.

Summary

tlm_transport_channel #(REQ,RSP)

A tlm_transport_channel is a tlm_req_rsp_channel #(REQ,RSP) that implements the transport interface.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

tlm_req_rsp_channel#(REQ,RSP)

tlm_transport_channel#(REQ,RSP)

Class Declaration

```
class tlm_transport_channel #(
      type      REQ    =    int,
      type      RSP    =    REQ
) extends tlm_req_rsp_channel #(REQ, RSP)
```

Ports

transport_export	The put_export provides both the blocking and non-blocking transport interface methods to the response FIFO:

Methods

new	The *name* and *parent* are the standard ovm_component constructor arguments.

Ports

transport_export

The put_export provides both the blocking and non-blocking transport interface methods to the response FIFO:

```
task transport(REQ request, output RSP response);
function bit nb_transport(REQ request, output RSP response);
```

Any transport port variant can connect to and send requests and retrieve responses via this export, provided the transaction types match. Upon return, the response argument carries the response to the request.

Methods

new

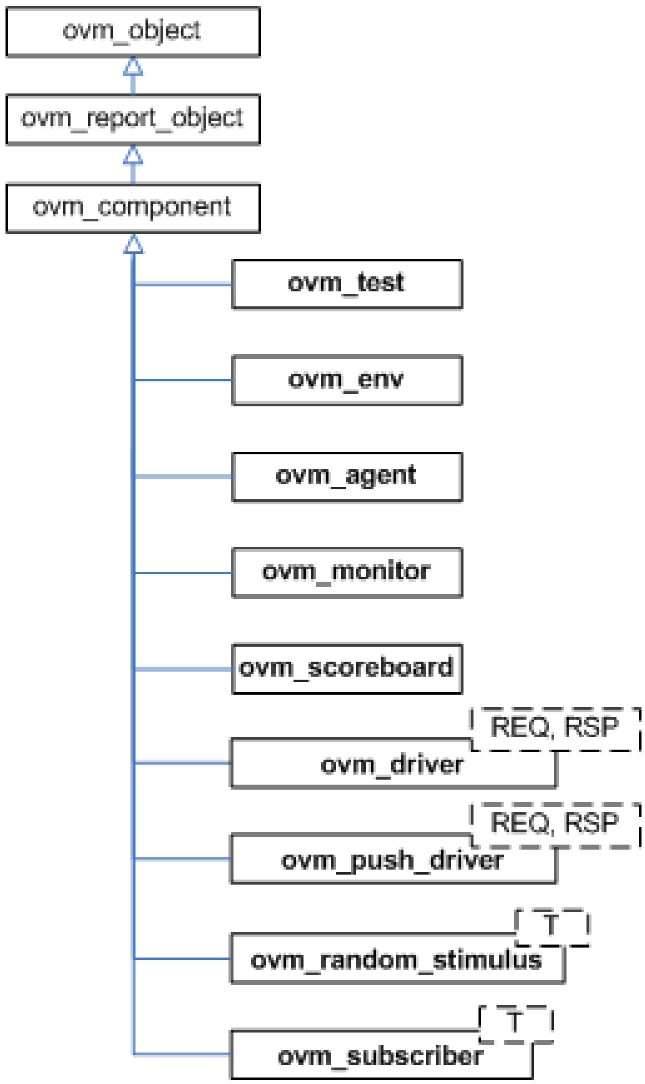
```
function new (string        name,
              ovm_component parent = null                                    )
```

The *name* and *parent* are the standard ovm_component constructor arguments. The *parent* must be null if this component is defined within a statically elaborated construct such as a module, program block, or interface.

Predefined Component Classes

Components form the foundation of the OVM. They encapsulate behavior of drivers, scoreboards, and other objects in a testbench. The OVM library provides a set of predefined component types, all derived directly or indirectly from ovm_component.

Predefined Components



ovm_test

This class is the virtual base class for the user-defined tests.

The ovm_test virtual class should be used as the base class for user-defined tests. Doing so provides the ability to select which test to execute using the OVM_TESTNAME command line or argument to the ovm_root::run_test task.

For example

```
prompt> SIM_COMMAND +OVM_TESTNAME=test_bus_retry
```

The global run_test() task should be specified inside an initial block such as

```
initial run_test();
```

Multiple tests, identified by their type name, are compiled in and then selected for execution from the command line without need for recompilation. Random seed selection is also available on the command line.

If +OVM_TESTNAME=test_name is specified, then an object of type 'test_name' is created by factory and phasing begins. Here, it is presumed that the test will instantiate the test environment, or the test environment will have already been instantiated before the call to run_test().

If the specified test_name cannot be created by the ovm_factory, then a fatal error occurs. If run_test() is called without OVM_TESTNAME being specified, then all components constructed before the call to run_test will be cycled through their simulation phases.

Deriving from ovm_test will allow you to distinguish tests from other component types that inherit from ovm_component directly. Such tests will automatically inherit features that may be added to ovm_test in the future.

Summary

ovm_test

This class is the virtual base class for the user-defined tests.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_test

Class Declaration

```
virtual class ovm_test extends ovm_component
```

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

ovm_env

The base class for hierarchical containers of other components that together comprise a complete environment. The environment may initially consist of the entire testbench. Later, it can be reused as a sub-environment in even larger system-level environments.

Summary

ovm_env

The base class for hierarchical containers of other components that together comprise a complete environment.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_env

Class Declaration

```
virtual class ovm_env extends ovm_component
```

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

Methods

new

```
function new (string        name   = "env",
              ovm_component parent = null      )
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

ovm_agent

The ovm_agent virtual class should be used as the base class for the user- defined agents. Deriving from ovm_agent will allow you to distinguish agents from other component types also using its inheritance. Such agents will automatically inherit features that may be added to ovm_agent in the future.

While an agent's build function, inherited from ovm_component, can be implemented to define any agent topology, an agent typically contains three subcomponents: a driver, sequencer, and monitor. If the agent is active, subtypes should contain all three subcomponents. If the agent is passive, subtypes should contain only the monitor.

Summary

ovm_agent

The ovm_agent virtual class should be used as the base class for the user- defined agents.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_agent

Class Declaration

```
virtual class ovm_agent extends ovm_component
```

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

ovm_monitor

This class should be used as the base class for user-defined monitors.

Deriving from ovm_monitor allows you to distinguish monitors from generic component types inheriting from ovm_component. Such monitors will automatically inherit features that may be added to ovm_monitor in the future.

Summary

ovm_monitor

This class should be used as the base class for user-defined monitors.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_monitor

Class Declaration

```
virtual class ovm_monitor extends ovm_component
```

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

ovm_scoreboard

The ovm_scoreboard virtual class should be used as the base class for user-defined scoreboards.

Deriving from ovm_scoreboard will allow you to distinguish scoreboards from other component types inheriting directly from ovm_component. Such scoreboards will automatically inherit and benefit from features that may be added to ovm_scoreboard in the future.

Summary

ovm_scoreboard

The ovm_scoreboard virtual class should be used as the base class for user-defined scoreboards.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_scoreboard

Class Declaration

```
virtual class ovm_scoreboard extends ovm_component
```

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

ovm_driver #(REQ,RSP)

The base class for drivers that initiate requests for new transactions via a ovm_seq_item_pull_port. The ports are typically connected to the exports of an appropriate sequencer component.

This driver operates in pull mode. Its ports are typically connected to the corresponding exports in a pull sequencer as follows:

```
driver.seq_item_port.connect(sequencer.seq_item_export);
driver.rsp_port.connect(sequencer.rsp_export);
```

The *rsp_port* needs connecting only if the driver will use it to write responses to the analysis export in the sequencer.

Summary

ovm_driver #(REQ,RSP)

The base class for drivers that initiate requests for new transactions via a ovm_seq_item_pull_port.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_driver#(REQ,RSP)

Class Declaration

```
class ovm_driver #(
   type REQ = ovm_sequence_item,
   type RSP = REQ
) extends ovm_component
```

Ports

seq_item_port	Derived driver classes should use this port to request items from the sequencer.
rsp_port	This port provides an alternate way of sending responses back to the originating sequencer.

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

Ports

seq_item_port

Derived driver classes should use this port to request items from the sequencer. They may also use it to send responses back.

rsp_port

This port provides an alternate way of sending responses back to the originating sequencer. Which port to use depends on which export the sequencer provides for connection.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

ovm_push_driver #(REQ,RSP)

Base class for a driver that passively receives transactions, i.e. does not initiate requests transactions. Also known as *push* mode. Its ports are typically connected to the corresponding ports in a push sequencer as follows:

```
push_sequencer.req_port.connect(push_driver.req_export);
push_driver.rsp_port.connect(push_sequencer.rsp_export);
```

The *rsp_port* needs connecting only if the driver will use it to write responses to the analysis export in the sequencer.

Summary

ovm_push_driver #(REQ,RSP)

Base class for a driver that passively receives transactions, i.e.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_push_driver#(REQ,RSP)

Class Declaration

```
class ovm_push_driver #(
   type REQ = ovm_sequence_item,
   type RSP = REQ
) extends ovm_component
```

Ports

req_export	This export provides the blocking put interface whose default implementation produces an error.
rsp_port	This analysis port is used to send response transactions back to the originating sequencer.

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

Ports

req_export

This export provides the blocking put interface whose default implementation produces an error. Derived drivers must override *put* with an appropriate implementation (and not call super.put). Ports connected to this export will supply the driver with transactions.

rsp_port

This analysis port is used to send response transactions back to the originating sequencer.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

ovm_random_stimulus #(T)

A general purpose unidirectional random stimulus class.

The ovm_random_stimulus class generates streams of T transactions. These streams may be generated by the randomize method of T, or the randomize method of one of its subclasses. The stream may go indefinitely, until terminated by a call to stop_stimulus_generation, or we may specify the maximum number of transactions to be generated.

By using inheritance, we can add directed initialization or tidy up after random stimulus generation. Simply extend the class and define the run task, calling super.run() when you want to begin the random stimulus phase of simulation.

While very useful in its own right, this component can also be used as a template for defining other stimulus generators, or it can be extended to add additional stimulus generation methods and to simplify test writing.

Summary

ovm_random_stimulus #(T)

A general purpose unidirectional random stimulus class.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_random_stimulus#(T)

Class Declaration

```
class ovm_random_stimulus #(
   type T = ovm_transaction
) extends ovm_component
```

Ports

blocking_put_port	The blocking_put_port is used to send the generated stimulus to the rest of the testbench.

Methods

new	Creates a new instance of a specialization of this class.
generate_stimulus	Generate up to max_count transactions of type T.
stop_stimulus_generation	Stops the generation of stimulus.

Ports

blocking_put_port

The blocking_put_port is used to send the generated stimulus to the rest of the testbench.

Methods

new

```
function new(string        name,
             ovm_component parent)
```

Creates a new instance of a specialization of this class. Also, displays the random state obtained from a get_randstate call. In subsequent simulations, set_randstate can be called with the same value to reproduce the same sequence of transactions.

generate_stimulus

```
virtual task generate_stimulus(T   t         = null,
                               int max_count = 0          )
```

Generate up to max_count transactions of type T. If t is not specified, a default instance of T is allocated and used. If t is specified, that transaction is used when randomizing. It must be a subclass of T.

max_count is the maximum number of transactions to be generated. A value of zero indicates no maximum - in this case, generate_stimulus will go on indefinitely unless stopped by some other process

The transactions are cloned before they are sent out over the blocking_put_port

stop_stimulus_generation

```
virtual function void stop_stimulus_generation
```

Stops the generation of stimulus. If a subclass of this method has forked additional processes, those processes will also need to be stopped in an overridden version of this method

ovm_subscriber

This class provides an analysis export for receiving transactions from a connected analysis export. Making such a connection "subscribes" this component to any transactions emitted by the connected analysis port.

Subtypes of this class must define the write method to process the incoming transactions. This class is particularly useful when designing a coverage collector that attaches to a monitor.

Summary

ovm_subscriber

This class provides an analysis export for receiving transactions from a connected analysis export.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_subscriber

Class Declaration

```
virtual class ovm_subscriber #(
      type      T  =    int
) extends ovm_component
```

Ports

analysis_export	This export provides access to the write method, which derived subscribers must implement.

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.
write	A pure virtual method that must be defined in each subclass.

Ports

analysis_export

This export provides access to the write method, which derived subscribers must implement.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

write

```
pure virtual function void write(T t)
```

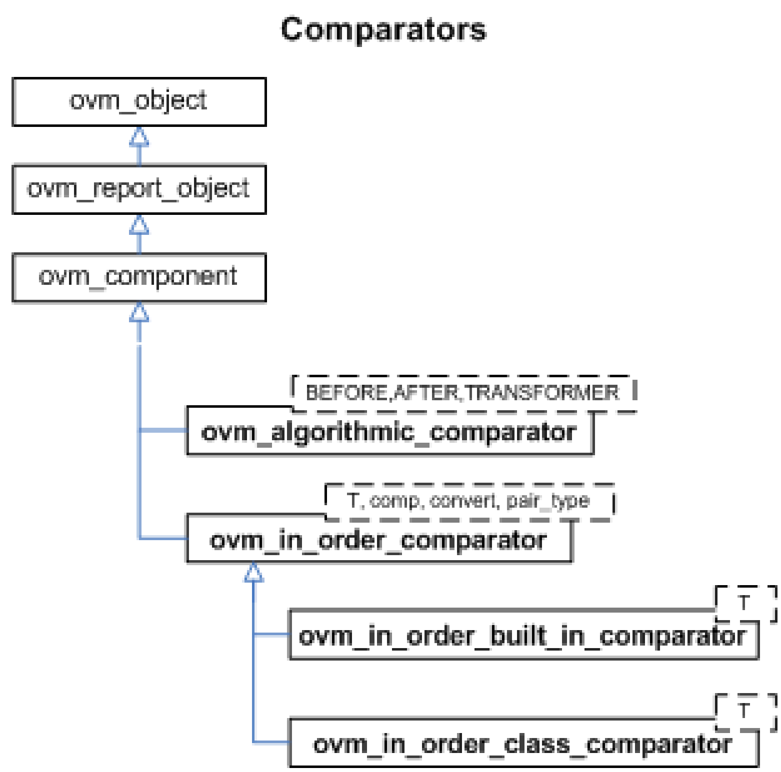
A pure virtual method that must be defined in each subclass. Access to this method by outside components should be done via the analysis_export.

Comparators

A common function of testbenches is to compare streams of transactions for equivalence. For example, a testbench may compare a stream of transactions from a DUT with expected results.

The OVM library provides a base class called *ovm_in_order_comparator* and two derived classes: *ovm_in_order_built_in_comparator* for comparing streams of built-in types and *ovm_in_order_class_comparator* for comparing streams of class objects.

The *ovm_algorithmic_comparator* also compares two streams of transactions, but the transaction streams might be of different type objects. Thus, this comparator will employ a user-defined transformation function to convert one type to another before performing a comparison.



ovm_in_order_comparator #(T,comp_type,convert,pair_type)

Compares two streams of data objects of type T, a parameter to this class. These transactions may either be classes or built-in types. To be successfully compared, the two streams of data must be in the same order. Apart from that, there are no assumptions made about the relative timing of the two streams of data.

Type parameters

T	Specifies the type of transactions to be compared.
comp	The type of the comparator to be used to compare the two transaction streams.
convert	A policy class to allow convert2string() to be called on the transactions being compared. If T is an extension of ovm_transaction, then it uses T::convert2string (). If T is a built-in type, then the policy provides a convert2string() method for the comparator to call.
pair_type	A policy class to allow pairs of transactions to be handled as a single ovm_transaction type.

Built in types (such as ints, bits, logic, and structs) can be compared using the default values for comp_type, convert, and pair_type. For convenience, you can use the subtype, <ovm_in_order_builtin_comparator #(T)> for built-in types.

When T is a class, T must implement comp and convert2string, and you must specify class-based policy classes for comp_type, convert, and pair_type. In most cases, you can use the convenient subtype, ovm_in_order_class_comparator #(T).

Comparisons are commutative, meaning it does not matter which data stream is connected to which export, before_export or after_export.

Comparisons are done in order and as soon as a transaction is received from both streams. Internal fifos are used to buffer incoming transactions on one stream until a transaction to compare arrives on the other stream.

Summary

ovm_in_order_comparator #(T,comp_type,convert,pair_type)

Compares two streams of data objects of type T, a parameter to this class.

Ports

before_export	The export to which one stream of data is written.
after_export	The export to which the other stream of data is written.
pair_ap	The comparator sends out pairs of transactions across this analysis port.

Methods

flush	This method sets m_matches and m_mismatches back to zero.

Ports

before_export

The export to which one stream of data is written. The port must be connected to an analysis port that will provide such data.

after_export

The export to which the other stream of data is written. The port must be connected to an analysis port that will provide such data.

pair_ap

The comparator sends out pairs of transactions across this analysis port. Both matched and unmatched pairs are published via a pair_type objects. Any connected analysis export(s) will receive these transaction pairs.

Methods

flush

```
virtual function void flush()
```

This method sets m_matches and m_mismatches back to zero. The tlm_fifo #(T)::flush takes care of flushing the FIFOs.

in_order_built_in_comparator #(T)

This class uses the ovm_built_in_* comparison, converter, and pair classes. Use this class for built-in types (int, bit, string, etc.)

Summary

in_order_built_in_comparator #(T)
This class uses the ovm_built_in_* comparison, converter, and pair classes.

Class Hierarchy

ovm_in_order_comparator#(T)

in_order_built_in_comparator#(T)

Class Declaration

```
class ovm_in_order_built_in_comparator #(
      type      T  =    int
) extends ovm_in_order_comparator #(T)
```

in_order_class_comparator #(T)

This class uses the ovm_class_* comparison, converter, and pair classes. Use this class for comparing user-defined objects of type T, which must provide implementations of comp and convert2string.

ovm_algorithmic_comparator.svh

Summary

ovm_algorithmic_comparator.svh
Comparators A common function of testbenches is to compare streams of transactions for equivalence.

Comparators

A common function of testbenches is to compare streams of transactions for equivalence. For example, a testbench may compare a stream of transactions from a DUT with expected results.

The OVM library provides a base class called ovm_in_order_comparator and two derived classes, which are ovm_in_order_built_in_comparator for comparing streams of built-in types and ovm_in_order_class_comparator for comparing streams of class objects.

The ovm_algorithmic_comparator also compares two streams of transactions; however, the transaction streams might be of different type objects. This device will use a user-written transformation function to convert one type to another before performing a comparison.

ovm_algorithmic_comparator #(BEFORE,AFTER,TRANSFORMER)

Compares two streams of data objects of different types, BEFORE and AFTER.

The algorithmic comparator is a wrapper around ovm_in_order_class_comparator. Like the in-order comparator, the algorithmic comparator compares two streams of transactions, the BEFORE stream and the AFTER stream. It is often the case when two streams of transactions need to be compared that the two streams are in different forms. That is, the type of the BEFORE transaction stream is different than the type of the AFTER transaction stream.

The ovm_algorithmic_comparator's TRANSFORMER type parameter specifies the class responsible for converting transactions of type BEFORE into those of type AFTER. This transformer class must provide a transform() method with the following prototype:

function AFTER transform (BEFORE b);

Matches and mistmatches are reported in terms of the AFTER transactions. For more information, see the ovm_in_order_comparator #(...) class.

Summary

ovm_algorithmic_comparator #(BEFORE,AFTER,TRANSFORMER)
Compares two streams of data objects of different types, BEFORE and AFTER.
Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_algorithmic_comparator#(BEFORE,AFTER,TRANSFORMER)

Class Declaration

```
class ovm_algorithmic_comparator #(
    type   BEFORE          =  int,
    type   AFTER           =  int,
    type   TRANSFORMER     =  int
) extends ovm_component
```

Ports

before_export	The export to which a data stream of type BEFORE is sent via a connected analysis port.
after_export	The export to which a data stream of type AFTER is sent via a connected analysis port.

Methods

new	Creates an instance of a specialization of this class.

Ports

before_export

The export to which a data stream of type BEFORE is sent via a connected analysis port. Publishers (monitors) can send in an ordered stream of transactions against which the transformed BEFORE transactions will (be compared.

after_export

The export to which a data stream of type AFTER is sent via a connected analysis port. Publishers (monitors) can send in an ordered stream of transactions to be transformed and compared to the AFTER transactions.

Methods

new

```
function new(       TRANSFORMER   transformer,
             string name          ,
                    ovm_component parent       )
```

Creates an instance of a specialization of this class. In addition to the standard ovm_component constructor arguments, *name* and *parent*, the constructor takes a handle to a *transformer* object, which must already be allocated (no null handles) and must implement the transform() method.

ovm_pair #(T1,T2)

Container holding handles to two objects whose types are specified by the type parameters, T1 and T2.

Summary

ovm_pair #(T1,T2)

Container holding handles to two objects whose types are specified by the type parameters, T1 and T2.

Methods

new	Creates an instance of ovm_pair that holds a handle to two objects, as provided by the first two arguments.

Methods

new

```
function new (T1     f    = null,
              T2     s    = null,
              string name = ""                          )
```

Creates an instance of ovm_pair that holds a handle to two objects, as provided by the first two arguments. The optional *name* argument gives a name to the new pair object.

ovm_built_in_pair #(T1,T2)

Container holding two variables of built-in types (int, string, etc.). The types are specified by the type parameters, T1 and T2.

Summary

ovm_built_in_pair #(T1,T2)

Container holding two variables of built-in types (int, string, etc.)

Class Hierarchy

ovm_object

ovm_transaction

ovm_built_in_pair#(T1,T2)

Class Declaration

```
class ovm_built_in_pair #(
     type    T1  =   int,
             T2  =   T1
) extends ovm_transaction
```

Methods

new	Creates an instance of ovm_pair that holds a handle to two elements, as provided by the first two arguments.

Methods

new

```
function new (T1     f,
              T2     s,
              string name = ""                                          )
```

Creates an instance of ovm_pair that holds a handle to two elements, as provided by the first two arguments. The optional name argument gives a name to the new pair object.

ovm_policies.svh

Summary

ovm_policies.svh	
Policy Classes	Policy classes are used to implement polymorphic operations that differ between built-in types and class-based types.

Policy Classes

Policy classes are used to implement polymorphic operations that differ between built-in types and class-based types. Generic components can then be built that work with either classes or built-in types, depending on what policy class is used.

ovm_built_in_comp #(T)

This policy class is used to compare built-in types.

Provides a comp method that compares, AVM-style, the built-in type, T, for which the == operator is defined.

Summary

ovm_built_in_comp #(T)

This policy class is used to compare built-in types.

Class Declaration

```
class ovm_built_in_comp #(type T = int )
```

ovm_built_in_converter #(T)

This policy class is used to convert built-in types to strings.

Provides a convert2string method that converts the built-in type, T, to a string using the %p format specifier.

Summary

ovm_built_in_converter #(T)

This policy class is used to convert built-in types to strings.

Class Declaration

```
class ovm_built_in_converter #(type T = int )
```

ovm_built_in_clone #(T)

This policy class is used to clone built-in types via the = operator.

Provides a clone metod that returns a copy of the built-in type, T.

Summary

ovm_built_in_clone #(T)

This policy class is used to clone built-in types via the = operator.

Class Declaration

```
class ovm_built_in_clone #(type T = int )
```

ovm_class_comp #(T)

This policy class is used to compare two objects of the same type.

Provides a comp method that compares two objects of type T. The class T must implement the comp method, to which this class delegates the operation.

Summary

ovm_class_comp #(T)

This policy class is used to compare two objects of the same type.

Class Declaration

```
class ovm_class_comp #(type T = int )
```

ovm_class_converter #(T)

This policy class is used to convert a class object to a string.

Provides a convert2string method that converts the built-in type, T, to a string. The class T must implement the convert2string method, to which this class delegates the operation.

Summary

ovm_class_converter #(T)

This policy class is used to convert a class object to a string.

Class Declaration

```
class ovm_class_converter #(type T = int                                     )
```

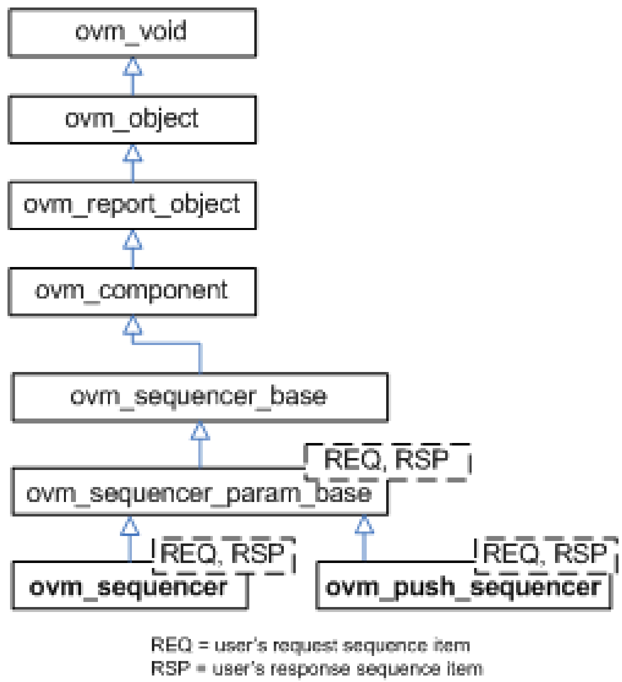
ovm_class_clone #(T)

This policy class is used to clone class objects.

Provides a clone metod that returns a copy of the built-in type, T. The class T must implement the clone method, to which this class delegates the operation.

Sequencer Classes

The sequencer serves as an arbiter for controlling transaction flow from multiple stimulus generators. More specifically, the sequencer controls the flow of ovm_sequence_item-based transactions generated by one or more ovm_sequence #(REQ,RSP)-based sequences.



There are two sequencer variants available.

- ovm_sequencer #(REQ,RSP) - Requests for new sequence items are initiated by the driver. Upon such requests, the sequencer selects a sequence from a list of available sequences to produce and deliver the next item to execute. This sequencer is typically connected to a user-extension of ovm_driver #(REQ,RSP).
- ovm_push_sequencer #(REQ,RSP) - Sequence items (from the currently running sequences) are pushed by the sequencer to the driver, which blocks item flow when it is not ready to accept new transactions. This sequencer is typically connected to a user-extension of ovm_push_driver #(REQ,RSP).

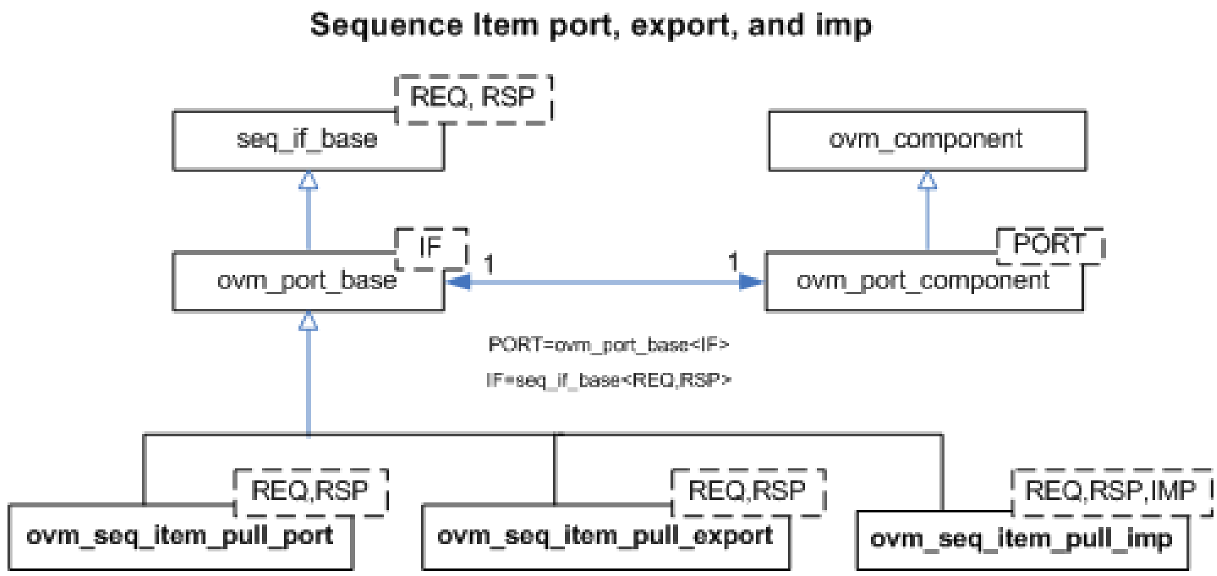
Sequencer-driver communication follows a *pull* or *push* semantic, depending on which sequencer type is used. However, sequence-sequencer communication is *always* initiated by the user-defined sequence, i.e. follows a push semantic.

See Sequence Classes for an overview on sequences and sequence items.

Sequence Item Ports

As with all OVM components, the sequencers and drivers described above use TLM Interfaces, Ports, and Exports to communicate transactions.

The ovm_sequencer #(REQ,RSP) and ovm_driver #(REQ,RSP) pair also uses a *sequence item pull port* to achieve the special execution semantic needed by the sequencer-driver pair.



sequencers and drivers use a *seq_item_port* specifically supports sequencer-driver communication. Connections to these ports are made in the same fashion as the TLM ports.

sqr_if_base #(REQ,RSP)

This class defines an interface for sequence drivers to communicate with sequencers. The driver requires the interface via a port, and the sequencer implements it and provides it via an export.

Summary

sqr_if_base #(REQ,RSP)

This class defines an interface for sequence drivers to communicate with sequencers.

Class Declaration

```
virtual class sqr_if_base #(type T1 = ovm_object,
                                 T2 = T1                    )
```

Methods

get_next_item	Retrieves the next available item from a sequence.
try_next_item	Retrieves the next available item from a sequence if one is available.
item_done	Indicates that the request is completed to the sequencer.
wait_for_sequences	Waits for a sequence to have a new item available.
has_do_available	Indicates whether a sequence item is available for immediate processing.
get	Retrieves the next available item from a sequence.
peek	Returns the current request item if one is in the sequencer fifo.
put	Sends a response back to the sequence that issued the request.

Methods

get_next_item

```
virtual task get_next_item(output T1 t)
```

Retrieves the next available item from a sequence. The call will block until an item is available. The following steps occur on this call:

1. Arbitrate among requesting, unlocked, relevant sequences - choose the highest priority sequence based on the current sequencer arbitration mode. If no sequence is available, wait for a requesting unlocked relevant sequence, then re-arbitrate.
2. The chosen sequence will return from wait_for_grant
3. The chosen sequence pre_do is called
4. The chosen sequence item is randomized
5. The chosen sequence post_do is called
6. Return with a reference to the item

Once get_next_item is called, item_done must be called to indicate the completion of the request to the sequencer. This will remove the request item from the sequencer fifo.

try_next_item

```
virtual task try_next_item(output T1 t)
```

Retrieves the next available item from a sequence if one is available. Otherwise, the function returns immediately with request set to null. The following steps occur on this call:

1. Arbitrate among requesting, unlocked, relevant sequences - choose the highest priority sequence based on the current sequencer arbitration mode. If no sequence is available, return null.
2. The chosen sequence will return from wait_for_grant
3. The chosen sequence pre_do is called
4. The chosen sequence item is randomized
5. The chosen sequence post_do is called
6. Return with a reference to the item

Once try_next_item is called, item_done must be called to indicate the completion of the request to the sequencer. This will remove the request item from the sequencer fifo.

item_done

```
virtual function void item_done(input T2 t = null )
```

Indicates that the request is completed to the sequencer. Any wait_for_item_done calls made by a sequence for this item will return.

The current item is removed from the sequencer fifo.

If a response item is provided, then it will be sent back to the requesting sequence. The response item must have it's sequence ID and transaction ID set correctly, using the set_id_info method:

```
rsp.set_id_info(req);
```

Before item_done is called, any calls to peek will retrieve the current item that was obtained by get_next_item. After item_done is called, peek will cause the sequencer to arbitrate for a new item.

wait_for_sequences

```
virtual task wait_for_sequences()
```

Waits for a sequence to have a new item available. The default implementation in the sequencer delays pound_zero_count delta cycles. (This variable is defined in ovm_sequencer_base.) User-derived sequencers may override its wait_for_sequences implementation to perform some other application-specific implementation.

has_do_available

```
virtual function bit has_do_available()
```

Indicates whether a sequence item is available for immediate processing. Implementations should return 1 if an item is available, 0 otherwise.

get

```
virtual task get(output T1 t)
```

Retrieves the next available item from a sequence. The call blocks until an item is available. The following steps occur on this call:

1. Arbitrate among requesting, unlocked, relevant sequences - choose the highest priority sequence based on the current sequencer arbitration mode. If no sequence is available, wait for a requesting unlocked relevant sequence, then re-arbitrate.
2. The chosen sequence will return from wait_for_grant
3. The chosen sequence <pre_do> is called
4. The chosen sequence item is randomized
5. The chosen sequence post_do is called
6. Indicate item_done to the sequencer
7. Return with a reference to the item

When get is called, item_done may not be called. A new item can be obtained by calling get again, or a response may be sent using either put, or rsp_port.write.

peek

```
virtual task peek(output T1 t)
```

Returns the current request item if one is in the sequencer fifo. If no item is in the fifo, then the call will block until the sequencer has a new request. The following steps will occur if the sequencer fifo is empty:

1. Arbitrate among requesting, unlocked, relevant sequences - choose the highest priority sequence based on the current sequencer arbitration mode. If no sequence is available, wait for a requesting unlocked relevant sequence, then re-arbitrate.
2. The chosen sequence will return from wait_for_grant
3. The chosen sequence pre_do is called
4. The chosen sequence item is randomized
5. The chosen sequence post_do is called

Once a request item has been retrieved and is in the sequencer fifo, subsequent calls to peek will return the same item. The item will stay in the fifo until either get or item_done is called.

put

```
virtual task put(input T2 t)
```

Sends a response back to the sequence that issued the request. Before the response is put, it must have it’s sequence ID and transaction ID set to match the request. This can be done using the set_id_info call:

rsp.set_id_info(req);

This task will not block. The response will be put into the sequence response_queue or it will be sent to the sequence response handler.

ovm_seq_item_pull_port #(REQ,RSP)

OVM provides a port, export, and imp connector for use in sequencer-driver communication. All have standard port connector constructors, except that ovm_seq_item_pull_port's default min_size argument is 0; it can be left unconnected.

Summary

ovm_seq_item_pull_port #(REQ,RSP)

OVM provides a port, export, and imp connector for use in sequencer-driver communication.

Class Hierarchy

ovm_port_base#(sqr_if_base#(REQ,RSP))

ovm_seq_item_pull_port#(REQ,RSP)

Class Declaration

```
class ovm_seq_item_pull_port #(
      type       REQ     =    int,
      type       RSP     =    REQ
) extends ovm_port_base #(sqr_if_base #(REQ, RSP))
```

ovm_seq_item_pull_export #(REQ,RSP)

This export type is used in sequencer-driver communication. It has the standard constructor for exports.

Summary

ovm_seq_item_pull_export #(REQ,RSP)

This export type is used in sequencer-driver communication.

Class Hierarchy

ovm_port_base#(sqr_if_base#(REQ,RSP))

ovm_seq_item_pull_export#(REQ,RSP)

Class Declaration

```
class ovm_seq_item_pull_export #(
      type       REQ     =    int,
      type       RSP     =    REQ
) extends ovm_port_base #(sqr_if_base #(REQ, RSP))
```

ovm_seq_item_pull_imp #(REQ,RSP,IMP)

This imp type is used in sequencer-driver communication. It has the standard constructor for imp-type ports.

Summary

ovm_seq_item_pull_imp #(REQ,RSP,IMP)

This imp type is used in sequencer-driver communication.

Class Hierarchy

ovm_port_base#(sqr_if_base#(REQ,RSP))

ovm_seq_item_pull_imp#(REQ,RSP,IMP)

Class Declaration

```
class ovm_seq_item_pull_imp #(
      type       REQ     =    int,
      type       RSP     =    REQ,
      type       IMP     =    int
) extends ovm_port_base #(sqr_if_base #(REQ, RSP))
```

end

ovm_sequencer_base

Controls the flow of sequences, which generate the stimulus (sequence item transactions) that is passed on to drivers for execution.

Summary

ovm_sequencer_base

Controls the flow of sequences, which generate the stimulus (sequence item transactions) that is passed on to drivers for execution.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_sequencer_base

Class Declaration

```
class ovm_sequencer_base extends ovm_component
```

Variables

pound_zero_count	Set this variable via set_config_int to set the number of delta cycles to insert in the wait_for_sequences task.
count	Sets the number of items to execute.
max_random_count	Set this variable via set_config_int to set the number of sequence items to generate, at the discretion of the derived sequence.
max_random_depth	Used for setting the maximum depth inside random sequences.
default_sequence	This property defines the sequence type (by name) that will be auto-started.

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: name is the name of the instance, and parent is the handle to the hierarchical parent.
start_default_sequence	Sequencers provide the start_default_sequence task to execute the default sequence in the run phase.
user_priority_arbitration	If the sequencer arbitration mode is set to SEQ_ARB_USER (via the *set_arbitration* method), then the sequencer will call this function each time that it needs to arbitrate among sequences.
is_child	Returns 1 if the child sequence is a child of the parent sequence, 0 otherwise.
wait_for_grant	This task issues a request for the specified sequence.
wait_for_item_done	A sequence may optionally call wait_for_item_done.
is_blocked	Returns 1 if the sequence referred to by sequence_ptr is currently locked out of the sequencer.
has_lock	Returns 1 if the sequence refered to in the parameter currently has a lock on this sequencer, 0 otherwise.
lock	Requests a lock for the sequence specified by sequence_ptr.
grab	Requests a lock for the sequence specified by sequence_ptr.
unlock	Removes any locks and grabs obtained by the specified sequence_ptr.
ungrab	Removes any locks and grabs obtained by the specified sequence_ptr.
stop_sequences	Tells the sequencer to kill all sequences and child sequences currently operating on the sequencer, and remove all requests, locks and responses that are currently queued.
is_grabbed	Returns 1 if any sequence currently has a lock or grab on this sequencer, 0 otherwise.
current_grabber	Returns a reference to the sequence that currently has a lock or grab on the sequence.
has_do_available	Determines if a sequence is ready to supply a transaction.
set_arbitration	Specifies the arbitration mode for the sequencer.

wait_for_sequences	Waits for a sequence to have a new item available.
add_sequence	Adds a sequence of type specified in the type_name paramter to the sequencer’s sequence library.
get_seq_kind	Returns an int seq_kind correlating to the sequence of type type_name in the sequencer¿s sequence library.
get_sequence	Returns a reference to a sequence specified by the seq_kind int.
num_sequences	Returns the number of sequences in the sequencer¿s sequence library.
send_request	Derived classes implement this function to send a request item to the sequencer, which will forward it to the driver.

Variables

pound_zero_count

```
int unsigned pound_zero_count = 6
```

Set this variable via set_config_int to set the number of delta cycles to insert in the wait_for_sequences task. The delta cycles are used to ensure that a sequence with back-to-back items has an opportunity to fill the action queue when the driver uses the non-blocking try_get interface.

count

```
int count = -1
```

Sets the number of items to execute.

Supercedes the max_random_count variable for ovm_random_sequence class for backward compatibility.

max_random_count

```
int unsigned max_random_count = 10
```

Set this variable via set_config_int to set the number of sequence items to generate, at the discretion of the derived sequence. The predefined ovm_random_sequence uses count to determine the number of random items to generate.

max_random_depth

```
int unsigned max_random_depth = 4
```

Used for setting the maximum depth inside random sequences. (Beyond that depth, random creates only simple sequences.)

default_sequence

```
protected string default_sequence = "ovm_random_sequence"
```

This property defines the sequence type (by name) that will be auto-started. The default sequence is initially set to ovm_random_sequence. It can be configured through the ovm_component's set_config_string method using the field name "default_sequence".

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: name is the name of the instance, and parent is the handle to the hierarchical parent.

start_default_sequence

```
virtual task start_default_sequence()
```

Sequencers provide the start_default_sequence task to execute the default sequence in the run phase. This method is not intended to be called externally, but may be overridden in a derivative sequencer class if special behavior is needed when the default sequence is started. The user class ovm_sequencer_param_base #(REQ,RSP) implements this method.

user_priority_arbitration

```
virtual function integer user_priority_arbitration(integer avail_sequences[$])
```

If the sequencer arbitration mode is set to SEQ_ARB_USER (via the *set_arbitration* method), then the sequencer will call this function each time that it needs to arbitrate among sequences.

Derived sequencers may override this method to perform a custom arbitration policy. Such an override must return one of the entries from the avail_sequences queue, which are int indexes into an internal queue, arb_sequence_q.

The default implementation behaves like SEQ_ARB_FIFO, which returns the entry at avail_sequences [0].

If a user specifies that the sequencer is to use user_priority_arbitration through the call set_arbitration(SEQ_ARB_USER), then the sequencer will call this function each time that it needs to arbitrate among sequences.

This function must return an int that matches one of the available sequences that is passed into the call through the avail_sequences parameter

Each int in avail_sequences points to an entry in the arb_sequence_q, which is a protected queue that may be accessed from this function.

To modify the operation of user_priority_arbitration, the function may arbitrarily choose any sequence among the list of avail_sequences. It is important to choose only an available sequence.

is_child

```
function bit is_child (ovm_sequence_base parent,
                       ovm_sequence_base child   )
```

Returns 1 if the child sequence is a child of the parent sequence, 0 otherwise.

wait_for_grant

```
virtual task wait_for_grant(ovm_sequence_base sequence_ptr,
                            int               item_priority = -1,
                            bit               lock_request  = 0                )
```

This task issues a request for the specified sequence. If item_priority is not specified, then the current sequence priority will be used by the arbiter. If a lock_request is made, then the sequencer will issue a lock immediately before granting the sequence. (Note that the lock may be granted without the sequence being granted if is_relevant is not asserted).

When this method returns, the sequencer has granted the sequence, and the sequence must call send_request without inserting any simulation delay other than delta cycles. The driver is currently waiting for the next item to be sent via the send_request call.

wait_for_item_done

```
virtual task wait_for_item_done(ovm_sequence_base sequence_ptr,
                                int               transaction_id)
```

A sequence may optionally call wait_for_item_done. This task will block until the driver calls item_done() or put() on a transaction issued by the specified sequence. If no transaction_id parameter is specified, then the call will return the next time that the driver calls item_done() or put (). If a specific transaction_id is specified, then the call will only return when the driver indicates that it has completed that specific item.

Note that if a specific transaction_id has been specified, and the driver has already issued an item_done or put for that transaction, then the call will hang waiting for that specific transaction_id.

is_blocked

```
function bit is_blocked(ovm_sequence_base sequence_ptr)
```

Returns 1 if the sequence referred to by sequence_ptr is currently locked out of the sequencer. It will return 0 if the sequence is currently allowed to issue operations.

Note that even when a sequence is not blocked, it is possible for another sequence to issue a lock before this sequence is able to issue a request or lock.

has_lock

```
function bit has_lock(ovm_sequence_base sequence_ptr)
```

Returns 1 if the sequence refered to in the parameter currently has a lock on this sequencer, 0 otherwise.

Note that even if this sequence has a lock, a child sequence may also have a lock, in which case the sequence is still blocked from issueing operations on the sequencer

lock

```
virtual task lock(ovm_sequence_base sequence_ptr)
```

Requests a lock for the sequence specified by sequence_ptr.

A lock request will be arbitrated the same as any other request. A lock is granted after all earlier requests are completed and no other locks or grabs are blocking this sequence.

The lock call will return when the lock has been granted.

grab

```
virtual task grab(ovm_sequence_base sequence_ptr)
```

Requests a lock for the sequence specified by sequence_ptr.

A grab request is put in front of the arbitration queue. It will be arbitrated before any other requests. A grab is granted when no other grabs or locks are blocking this sequence.

The grab call will return when the grab has been granted.

unlock

```
virtual function void unlock(ovm_sequence_base sequence_ptr)
```

Removes any locks and grabs obtained by the specified sequence_ptr.

ungrab

```
virtual function void ungrab(ovm_sequence_base sequence_ptr)
```

Removes any locks and grabs obtained by the specified sequence_ptr.

stop_sequences

```
virtual function void stop_sequences()
```

Tells the sequencer to kill all sequences and child sequences currently operating on the sequencer, and remove all requests, locks and responses that are currently queued. This essentially resets the sequencer to an idle state.

is_grabbed

```
virtual function bit is_grabbed()
```

Returns 1 if any sequence currently has a lock or grab on this sequencer, 0 otherwise.

current_grabber

```
virtual function ovm_sequence_base current_grabber()
```

Returns a reference to the sequence that currently has a lock or grab on the sequence. If multiple hierarchical sequences have a lock, it returns the child that is currently allowed to perform operations on the sequencer.

has_do_available

```
virtual function bit has_do_available()
```

Determines if a sequence is ready to supply a transaction. A sequence that obtains a transaction in pre-do must determine if the upstream object is ready to provide an item

Returns 1 if a sequence is ready to issue an operation. Returns 0 if no unblocked, relevant sequence is requesting.

set_arbitration

```
function void set_arbitration(SEQ_ARB_TYPE val)
```

Specifies the arbitration mode for the sequencer. It is one of

SEQ_ARB_FIFO	Requests are granted in FIFO order (default)
SEQ_ARB_WEIGHTED	Requests are granted randomly by weight
SEQ_ARB_RANDOM	Requests are granted randomly
SEQ_ARB_STRICT_FIFO	Requests at highest priority granted in fifo order
SEQ_ARB_STRICT_RANDOM	Requests at highest priority granted in randomly
SEQ_ARB_USER	Arbitration is delegated to the user-defined function, user_priority_arbitration. That function will specify the next sequence to grant.

The default user function specifies FIFO order.

wait_for_sequences

```
virtual task wait_for_sequences()
```

Waits for a sequence to have a new item available. The default implementation in the sequencer delays pound_zero_count delta cycles. (This variable is defined in ovm_sequencer_base.) User-derived sequencers may override its wait_for_sequences implementation to perform some other application-specific implementation.

add_sequence

```
function void add_sequence(string type_name)
```

Adds a sequence of type specified in the type_name paramter to the sequencer’s sequence library.

get_seq_kind

```
function int get_seq_kind(string type_name)
```

Returns an int seq_kind correlating to the sequence of type type_name in the sequencer¿s sequence library. If the named sequence is not registered a SEQNF warning is issued and -1 is returned.

get_sequence

```
function ovm_sequence_base get_sequence(int req_kind)
```

Returns a reference to a sequence specified by the seq_kind int. The seq_kind int may be obtained using the get_seq_kind() method.

num_sequences

```
function int num_sequences()
```

Returns the number of sequences in the sequencer¿s sequence library.

send_request

```
virtual function void send_request(ovm_sequence_base sequence_ptr,
                                   ovm_sequence_item t,
                                   bit               rerandomize   = 0        )
```

Derived classes implement this function to send a request item to the sequencer, which will forward it to the driver. If the rerandomize bit is set, the item will be randomized before being sent to the driver.

This function may only be called after a wait_for_grant call.

ovm_sequencer_param_base #(REQ,RSP)

Provides base functionality used by the ovm_sequencer and ovm_push_sequencer. The implementation is dependent on REQ and RSP parameters.

Summary

ovm_sequencer_param_base #(REQ,RSP)

Provides base functionality used by the ovm_sequencer and ovm_push_sequencer.

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_sequencer_base

ovm_sequencer_param_base#(REQ,RSP)

Class Declaration

```
class ovm_sequencer_param_base #(
   type REQ = ovm_sequence_item,
   type RSP = REQ
) extends ovm_sequencer_base
```

Ports

rsp_export	This is the analysis export used by drivers or monitors to send responses to the sequencer.

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: name is the name of the instance, and parent is the handle to the hierarchical parent, if any.
send_request	The send_request function may only be called after a wait_for_grant call.
get_current_item	Returns the request_item currently being executed by the sequencer.
start_default_sequence	Called when the run phase begins, this method starts the default sequence, as specified by the default_sequence member variable.
get_num_reqs_sent	Returns the number of requests that have been sent by this sequencer.
get_num_rsps_received	Returns the number of responses received thus far by this sequencer.
set_num_last_reqs	Sets the size of the last_requests buffer.
get_num_last_reqs	Returns the size of the last requests buffer, as set by set_num_last_reqs.
last_req	Returns the last request item by default.
set_num_last_rsps	Sets the size of the last_responses buffer.
get_num_last_rsps	Returns the max size of the last responses buffer, as set by set_num_last_rsps.
last_rsp	Returns the last response item by default.
execute_item	This task allows the user to supply an item or sequence to the sequencer and have it be executed procedurally.

Ports

rsp_export

This is the analysis export used by drivers or monitors to send responses to the sequencer. When a driver wishes to send a response, it may do so through exactly one of three methods:

```
seq_item_port.item_done(response)
seq_item_done.put(response)
rsp_port.write(response)
```

The rsp_port in the driver and/or monitor must be connected to the rsp_export in this sequencer in order to send responses through the response analysis port.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: name is the name of the instance, and parent is the handle to the hierarchical parent, if any.

send_request

```
virtual function void send_request(ovm_sequence_base sequence_ptr,
                                   ovm_sequence_item t,
                                   bit               rerandomize   = 0   )
```

The send_request function may only be called after a wait_for_grant call. This call will send the request item, t, to the sequencer pointed to by sequence_ptr. The sequencer will forward it to the driver. If rerandomize is set, the item will be randomized before being sent to the driver.

get_current_item

```
function REQ get_current_item()
```

Returns the request_item currently being executed by the sequencer. If the sequencer is not currently executing an item, this method will return null.

The sequencer is executing an item from the time that get_next_item or peek is called until the time that get or item_done is called.

Note that a driver that only calls get() will never show a current item, since the item is completed at the same time as it is requsted.

start_default_sequence

```
task start_default_sequence()
```

Called when the run phase begins, this method starts the default sequence, as specified by the default_sequence member variable.

get_num_reqs_sent

```
function int get_num_reqs_sent()
```

Returns the number of requests that have been sent by this sequencer.

get_num_rsps_received

```
function int get_num_rsps_received()
```

Returns the number of responses received thus far by this sequencer.

set_num_last_reqs

```
function void set_num_last_reqs(int unsigned max)
```

Sets the size of the last_requests buffer. Note that the maximum buffer size is 1024. If max is greater than 1024, a warning is issued, and the buffer is set to 1024. The default value is 1.

get_num_last_reqs

```
function int unsigned get_num_last_reqs()
```

Returns the size of the last requests buffer, as set by set_num_last_reqs.

last_req

```
function REQ last_req(int unsigned n = 0 )
```

Returns the last request item by default. If n is not 0, then it will get the n¿th before last request item. If n is greater than the last request buffer size, the function will return null.

set_num_last_rsps

```
function void set_num_last_rsps(int unsigned max)
```

Sets the size of the last_responses buffer. The maximum buffer size is 1024. If max is greater than 1024, a warning is issued, and the buffer is set to 1024. The default value is 1.

get_num_last_rsps

```
function int unsigned get_num_last_rsps()
```

Returns the max size of the last responses buffer, as set by set_num_last_rsps.

last_rsp

```
function RSP last_rsp(int unsigned n = 0 )
```

Returns the last response item by default. If n is not 0, then it will get the nth-before-last response item. If n is greater than the last response buffer size, the function will return null.

execute_item

```
virtual task execute_item(ovm_sequence_item item)
```

This task allows the user to supply an item or sequence to the sequencer and have it be executed procedurally. The parent sequence for the item or sequence is a temporary sequence that is automatically created. There is no capability to retrieve responses. The sequencer will drop responses to items done using this interface.

ovm_sequencer #(REQ,RSP)

Summary

ovm_sequencer #(REQ,RSP)

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_sequencer_base

ovm_sequencer_param_base#(REQ,RSP)

ovm_sequencer#(REQ,RSP)

Class Declaration

```
class ovm_sequencer #(
    type   REQ  =  ovm_sequence_item,
    type   RSP  =  REQ
) extends ovm_sequencer_param_base #(REQ, RSP)
```

Variables

seq_item_export	This export provides access to this sequencer's implementation of the sequencer interface, sqr_if_base #(REQ,RSP), which defines the following methods:

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: name is the name of the instance, and parent is the handle to the hierarchical parent, if any.
stop_sequences	Tells the sequencer to kill all sequences and child sequences currently operating on the sequencer, and remove all requests, locks and responses that are currently queued.

Variables

seq_item_export

```
ovm_seq_item_pull_imp #(REQ,
                        RSP,
                        this_type) seq_item_export
```

This export provides access to this sequencer's implementation of the sequencer interface, sqr_if_base #(REQ,RSP), which defines the following methods:

```
virtual task          get_next_item      (output REQ request);
virtual task          try_next_item      (output REQ request);
virtual function void item_done          (input RSP response=null);
virtual task          wait_for_sequences ();
virtual function bit  has_do_available   ();
virtual task          get                (output REQ request);
virtual task          peek               (output REQ request);
virtual task          put                (input RSP response);
```

See sqr_if_base #(REQ,RSP) for information about this interface.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: name is the name of the instance, and parent is the handle to the hierarchical parent, if any.

stop_sequences

```
virtual function void stop_sequences()
```

Tells the sequencer to kill all sequences and child sequences currently operating on the sequencer, and remove all requests, locks and responses that are currently queued. This essentially resets the sequencer to an idle state.

ovm_push_sequencer #(REQ,RSP)

Summary

ovm_push_sequencer #(REQ,RSP)

Class Hierarchy

ovm_object

ovm_report_object

ovm_component

ovm_sequencer_base

ovm_sequencer_param_base#(REQ,RSP)

ovm_push_sequencer#(REQ,RSP)

Class Declaration

```
class ovm_push_sequencer #(
    type   REQ  =  ovm_sequence_item,
    type   RSP  =  REQ
) extends ovm_sequencer_param_base #(REQ, RSP)
```

Ports

req_port	The push sequencer requires access to a blocking put interface.

Methods

new	Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.
run	The push sequencer continuously selects from its list of available sequences and sends the next item from the selected sequence out its req_port using req_port.put(item).

Ports

req_port

The push sequencer requires access to a blocking put interface. Continual sequence items, based on the list of available sequences loaded into this sequencer, are sent out this port.

Methods

new

```
function new (string        name,
              ovm_component parent)
```

Creates and initializes an instance of this class using the normal constructor arguments for ovm_component: *name* is the name of the instance, and *parent* is the handle to the hierarchical parent, if any.

run

```
task run()
```

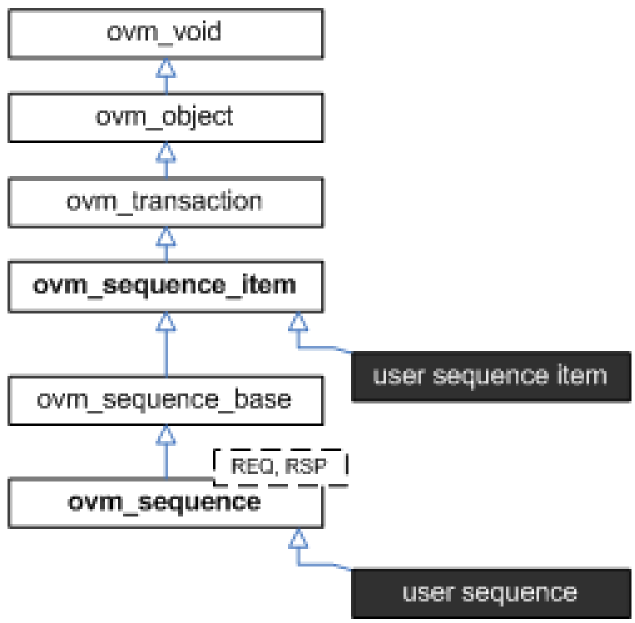
The push sequencer continuously selects from its list of available sequences and sends the next item from the selected sequence out its req_port using req_port.put(item). Typically, the req_port would be connected to the req_export on an instance of an ovm_push_driver #(REQ,RSP), which would be responsible for executing the item.

Sequence Classes

Sequences encapsulate user-defined procedures that generate multiple ovm_sequence_item-based transactions. Such sequences can be reused, extended, randomized, and combined sequentially and hierarchically in interesting ways to produce realistic stimulus to your DUT.

With *ovm_sequence* objects, users can encapsulate DUT initializaton code, bus-based stress tests, network protocol stacks-- anything procedural-- then have them all execute in specific or random order to more quickly reach corner cases and coverage goals.

The OVM sequence item and sequence class hierarchy is shown below.



- ovm_sequence_item - The *ovm_sequence_item* is the base class for user-defined transactions that leverage the stimulus generation and control capabilities of the sequence-sequencer mechanism.
- ovm_sequence #(REQ,RSP) - The *ovm_sequence* extends *ovm_sequence_item* to add the ability to generate streams of *ovm_sequence_items*, either directly or by recursively execting other *ovm_sequences*.

ovm_sequence_item

The base class for user-defined sequence items and also the base class for the ovm_sequence class. The ovm_sequence_item class provides the basic functionality for objects, both sequence items and sequences, to operate in the sequence mechanism.

Summary

ovm_sequence_item

The base class for user-defined sequence items and also the base class for the ovm_sequence class.

Class Hierarchy

ovm_object

ovm_transaction

ovm_sequence_item

Class Declaration

```
class ovm_sequence_item extends ovm_transaction
```

Methods

new	The constructor method for ovm_sequence_item.
get_sequence_id	private
set_use_sequence_info	
get_use_sequence_info	These methods are used to set and get the status of the use_sequence_info bit.
set_id_info	Copies the sequence_id and transaction_id from the referenced item into the calling item.
set_sequencer	
get_sequencer	These routines set and get the reference to the sequencer to which this sequence_item communicates.
set_parent_sequence	Sets the parent sequence of this sequence_item.
get_parent_sequence	Returns a reference to the parent sequence of any sequence on which this method was called.
set_depth	The depth of any sequence is calculated automatically.
get_depth	Returns the depth of a sequence from it's parent.
is_item	This function may be called on any sequence_item or sequence.
start_item	start_item and finish_item together will initiate operation of either a sequence_item or sequence object.
finish_item	finish_item, together with start_item together will initiate operation of either a sequence_item or sequence object.
get_root_sequence_name	Provides the name of the root sequence (the top-most parent sequence).
get_root_sequence	Provides a reference to the root sequence (the top-most parent sequence).
get_sequence_path	Provides a string of names of each sequence in the full hierarchical path.

Methods

new

```
function new (string              name            = "ovm_sequence_item",
              ovm_sequencer_base sequencer       = null,
              ovm_sequence_base  parent_sequence = null                   )
```

The constructor method for ovm_sequence_item. The sequencer and parent_sequence may be specified in the constructor, or directly using ovm_sequence_item methods.

get_sequence_id

```
function int get_sequence_id()
```

private

Get_sequence_id is an internal method that is not intended for user code. The sequence_id is not a simple integer. The get_transaction_id is meant for users to identify specific transactions.

These methods allow access to the sequence_item sequence and transaction IDs. get_transaction_id and set_transaction_id are methods on the ovm_transaction base_class. These IDs are used to identify sequences to the sequencer, to route responses back to the sequence that issued a request, and to uniquely identify transactions.

The sequence_id is assigned automatically by a sequencer when a sequence initiates communication through any sequencer calls (i.e. `ovm_do_xxx, wait_for_grant). A sequence_id will remain unique for this sequence until it ends or it is killed. However, a single sequence may have multiple valid sequence ids at any point in time. Should a sequence start again after it has ended, it will be given a new unique sequence_id.

The transaction_id is assigned automatically by the sequence each time a transaction is sent to the sequencer with the transaction_id in its default (-1) value. If the user sets the transaction_id to any non-default value, that value will be maintained.

Responses are routed back to this sequences based on sequence_id. The sequence may use the transaction_id to correlate responses with their requests.

set_use_sequence_info

```
function void set_use_sequence_info(bit value)
```

get_use_sequence_info

```
function bit get_use_sequence_info()
```

These methods are used to set and get the status of the use_sequence_info bit. Use_sequence_info controls whether the sequence information (sequencer, parent_sequence, sequence_id, etc.) is printed, copied, or recorded. When use_sequence_info is the default value of 0, then the sequence information is not used. When use_sequence_info is set to 1, the sequence information will be used in printing and copying.

set_id_info

```
function void set_id_info(ovm_sequence_item item)
```

Copies the sequence_id and transaction_id from the referenced item into the calling item. This routine should always be used by drivers to initialize responses for future compatibility.

set_sequencer

```
function void set_sequencer(ovm_sequencer_base sequencer)
```

get_sequencer

```
function ovm_sequencer_base get_sequencer()
```

These routines set and get the reference to the sequencer to which this sequence_item communicates.

set_parent_sequence

```
function void set_parent_sequence(ovm_sequence_base parent)
```

Sets the parent sequence of this sequence_item. This is used to identify the source sequence of a sequence_item.

get_parent_sequence

```
function ovm_sequence_base get_parent_sequence()
```

Returns a reference to the parent sequence of any sequence on which this method was called. If this is a parent sequence, the method returns null.

set_depth

```
function void set_depth(int value)
```

The depth of any sequence is calculated automatically. However, the user may use set_depth to specify the depth of a particular sequence. This method will override the automatically calculated depth, even if it is incorrect.

get_depth

```
function int get_depth()
```

Returns the depth of a sequence from it's parent. A parent sequence will have a depth of 1, it's child will have a depth of 2, and it's grandchild will have a depth of 3.

is_item

```
virtual function bit is_item()
```

This function may be called on any sequence_item or sequence. It will return 1 for items and 0 for sequences (which derive from this class).

start_item

```
virtual task start_item(ovm_sequence_item item,
                        int               set_priority = -1          )
```

start_item and finish_item together will initiate operation of either a sequence_item or sequence object. If the object has not been initiated using create_item, then start_item will be initialized in start_item to use the default sequencer specified by m_sequencer. Randomization may be done between start_item and finish_item to ensure late generation

finish_item

```
virtual task finish_item(ovm_sequence_item item,
                         int               set_priority = -1          )
```

finish_item, together with start_item together will initiate operation of either a sequence_item or sequence object. Finish_item must be called after start_item with no delays or delta-cycles. Randomization, or other functions may be called between the start_item and finish_item calls.

get_root_sequence_name

```
function string get_root_sequence_name()
```

Provides the name of the root sequence (the top-most parent sequence).

get_root_sequence

```
function ovm_sequence_base get_root_sequence()
```

Provides a reference to the root sequence (the top-most parent sequence).

get_sequence_path

```
function string get_sequence_path()
```

Provides a string of names of each sequence in the full hierarchical path. A "." is used as the separator between each sequence.

ovm_sequence_base

The ovm_sequence_base class provides the interfaces needed to create streams of sequence items and/or other sequences.

Summary

ovm_sequence_base

The ovm_sequence_base class provides the interfaces needed to create streams of sequence items and/or other sequences.

Class Hierarchy

ovm_object

ovm_transaction

ovm_sequence_item

ovm_sequence_base

Class Declaration

```
class ovm_sequence_base extends ovm_sequence_item
```

Variables

seq_kind	Used as an identifier in constraints for a specific sequence type.

Methods

new	The constructor for ovm_sequence_base.
get_sequence_state	Returns the sequence state as an enumerated value.
wait_for_sequence_state	Waits until the sequence reaches the given *state*.
start	The start task is called to begin execution of a sequence
pre_body	This task is a user-definable callback task that is called before the execution of the body, unless the sequence is started with call_pre_post=0.
post_body	This task is a user-definable callback task that is called after the execution of the body, unless the sequence is started with call_pre_post=0.
pre_do	This task is a user-definable callback task that is called after the sequence has issued a wait_for_grant() call and after the sequencer has selected this sequence, and before the item is randomized.
body	This is the user-defined task where the main sequence code resides.
is_item	This function may be called on any sequence_item or sequence object.
mid_do	This function is a user-definable callback function that is called after the sequence item has been randomized, and just before the item is sent to the driver.
post_do	This function is a user-definable callback function that is called after the driver has indicated that it has completed the item, using either this item_done or put methods.
num_sequences	Returns the number of sequences in the sequencer’s sequence library.
get_seq_kind	This function returns an int representing the sequence kind that has been registerd with the sequencer.
get_sequence	This function returns a reference to a sequence specified by req_kind, which can be obtained using the get_seq_kind method.
get_sequence_by_name	Internal method.
do_sequence_kind	This task will start a sequence of kind specified by req_kind, which can be obtained using the get_seq_kind method.
set_priority	The priority of a sequence may be changed at any point in time.

get_priority	This function returns the current priority of the sequence.
wait_for_relevant	This method is called by the sequencer when all available sequences are not relevant.
is_relevant	The default is_relevant implementation returns 1, indicating that the sequence is always relevant.
is_blocked	Returns a bit indicating whether this sequence is currently prevented from running due to another lock or grab.
has_lock	Returns 1 if this sequence has a lock, 0 otherwise.
lock	Requests a lock on the specified sequencer.
grab	Requests a lock on the specified sequencer.
unlock	Removes any locks or grabs obtained by this sequence on the specified sequencer.
ungrab	Removes any locks or grabs obtained by this sequence on the specified sequencer.
wait_for_grant	This task issues a request to the current sequencer.
send_request	The send_request function may only be called after a wait_for_grant call.
wait_for_item_done	A sequence may optionally call wait_for_item_done.
set_sequencer	Sets the default sequencer for the sequence to run on.
get_sequencer	Returns a reference to the current default sequencer of the sequence.
kill	This function will kill the sequence, and cause all current locks and requests in the sequence's default sequencer to be removed.
use_response_handler	When called with enable set to 1, responses will be sent to the response handler.
get_use_response_handler	Returns the state of the use_response_handler bit.
response_handler	When the use_reponse_handler bit is set to 1, this virtual task is called by the sequencer for each response that arrives for this sequence.
create_item	Create_item will create and initialize a sequence_item or sequence using the factory.
start_item	start_item and finish_item together will initiate operation of either a sequence_item or sequence object.
finish_item	finish_item, together with start_item together will initiate operation of either a sequence_item or sequence object.

Variables

seq_kind

```
rand int unsigned seq_kind
```

Used as an identifier in constraints for a specific sequence type.

Methods

new

```
function new (string            name          = "ovm_sequence",
              ovm_sequencer_base sequencer_ptr = null,
              ovm_sequence_base  parent_seq    = null           )
```

The constructor for ovm_sequence_base.

The sequencer_ptr and parent_seq arguments are deprecated in favor of their being set in the start method.

get_sequence_state

```
function ovm_sequence_state_enum get_sequence_state()
```

Returns the sequence state as an enumerated value. Can use to wait on the sequence reaching or changing from one or more states.

```
wait(get_sequence_state() & (STOPPED|FINISHED));
```

wait_for_sequence_state

```
task wait_for_sequence_state(ovm_sequence_state_enum state)
```

Waits until the sequence reaches the given *state*. If the sequence is already in this state, this method returns immediately. Convenience for wait (get_sequence_state == *state*);

start

```
virtual task start (ovm_sequencer_base sequencer,
                    ovm_sequence_base  parent_sequence = null,
                    integer            this_priority   = 100,
                    bit                call_pre_post   = 1       )
```

The start task is called to begin execution of a sequence

If parent_sequence is null, then the sequence is a parent, otherwise it is a child of the specified parent.

By default, the priority of a sequence is 100. A different priority may be specified by this_priority. Higher numbers indicate higher priority.

If call_pre_post is set to 1, then the pre_body and post_body tasks will be called before and after the sequence body is called.

pre_body

```
virtual task pre_body()
```

This task is a user-definable callback task that is called before the execution of the body, unless the sequence is started with call_pre_post=0. This method should not be called directly by the user.

post_body

```
virtual task post_body()
```

This task is a user-definable callback task that is called after the execution of the body, unless the sequence is started with call_pre_post=0. This method should not be called directly by the user.

pre_do

```
virtual task pre_do(bit is_item)
```

This task is a user-definable callback task that is called after the sequence has issued a wait_for_grant() call and after the sequencer has selected this sequence, and before the item is randomized. This method should not be called directly by the user.

Although pre_do is a task, consuming simulation cycles may result in unexpected behavior on the driver.

body

```
virtual task body()
```

This is the user-defined task where the main sequence code resides. This method should not be called directly by the user.

is_item

```
virtual function bit is_item()
```

This function may be called on any sequence_item or sequence object. It will return 1 on items and 0 on sequences.

mid_do

```
virtual function void mid_do(ovm_sequence_item this_item)
```

This function is a user-definable callback function that is called after the sequence item has been randomized, and just before the item is sent to the driver. This mehod should not be called directly by the user.

post_do

```
virtual function void post_do(ovm_sequence_item this_item)
```

This function is a user-definable callback function that is called after the driver has indicated that it has completed the item, using either this item_done or put methods. This method should not be called directly by the user.

num_sequences

```
function int num_sequences()
```

Returns the number of sequences in the sequencer's sequence library.

get_seq_kind

```
function int get_seq_kind(string type_name)
```

This function returns an int representing the sequence kind that has been registerd with the sequencer. The seq_kind int may be used with the get_sequence or do_sequence_kind methods.

get_sequence

```
function ovm_sequence_base get_sequence(int unsigned req_kind)
```

This function returns a reference to a sequence specified by req_kind, which can be obtained using the get_seq_kind method.

get_sequence_by_name

```
function ovm_sequence_base get_sequence_by_name(string seq_name)
```

Internal method.

do_sequence_kind

```
task do_sequence_kind(int unsigned req_kind)
```

This task will start a sequence of kind specified by req_kind, which can be obtained using the get_seq_kind method.

set_priority

```
function void set_priority (int value)
```

The priority of a sequence may be changed at any point in time. When the priority of a sequence is changed, the new priority will be used by the sequencer the next time that it arbitrates between sequences.

The default priority value for a sequence is 100. Higher values result in higher priorities.

get_priority

```
function int get_priority()
```

This function returns the current priority of the sequence.

wait_for_relevant

```
virtual task wait_for_relevant()
```

This method is called by the sequencer when all available sequences are not relevant. When wait_for_relevant returns the sequencer attempt to re-arbitrate.

Returning from this call does not guarantee a sequence is relevant, although that would be the ideal. The method provide some delay to prevent an infinite loop.

If a sequence defines is_relevant so that it is not always relevant (by default, a sequence is always relevant), then the sequence must also supply a wait_for_relevant method.

is_relevant

```
virtual function bit is_relevant()
```

The default is_relevant implementation returns 1, indicating that the sequence is always relevant.

Users may choose to override with their own virtual function to indicate to the sequencer that the sequence is not currently relevant after a request has been made.

When the sequencer arbitrates, it will call is_relevant on each requesting, unblocked sequence to see if it is relevant. If a 0 is returned, then the sequence will not be chosen.

If all requesting sequences are not relevant, then the sequencer will call wait_for_relevant on all sequences and re-arbitrate upon its return.

Any sequence that implements is_relevant must also implement wait_for_relevant so that the sequencer has a way to wait for a sequence to become relevant.

is_blocked

```
function bit is_blocked()
```

Returns a bit indicating whether this sequence is currently prevented from running due to another lock or grab. A 1 is returned if the sequence is currently blocked. A 0 is returned if no lock or grab prevents this sequence from executing. Note that even if a sequence is not blocked, it is possible for another sequence to issue a lock or grab before this sequence can issue a request.

has_lock

```
function bit has_lock()
```

Returns 1 if this sequence has a lock, 0 otherwise.

Note that even if this sequence has a lock, a child sequence may also have a lock, in which case the sequence is still blocked from issuing operations on the sequencer>

lock

```
task lock(ovm_sequencer_base sequencer = null )
```

Requests a lock on the specified sequencer. If sequencer is null, the lock will be requested on the current default sequencer.

A lock request will be arbitrated the same as any other request. A lock is granted after all earlier requests are completed and no other locks or grabs are blocking this sequence.

The lock call will return when the lock has been granted.

grab

```
task grab(ovm_sequencer_base sequencer = null                    )
```

Requests a lock on the specified sequencer. If no argument is supplied, the lock will be requested on the current default sequencer.

A grab equest is put in front of the arbitration queue. It will be arbitrated before any other requests. A grab is granted when no other grabs or locks are blocking this sequence.

The grab call will return when the grab has been granted.

unlock

```
function void unlock(ovm_sequencer_base sequencer = null         )
```

Removes any locks or grabs obtained by this sequence on the specified sequencer. If sequencer is null, then the unlock will be done on the current default sequencer.

ungrab

```
function void ungrab(ovm_sequencer_base sequencer = null         )
```

Removes any locks or grabs obtained by this sequence on the specified sequencer. If sequencer is null, then the unlock will be done on the current default sequencer.

wait_for_grant

```
virtual task wait_for_grant(int item_priority = -1,
                            bit lock_request  = 0                )
```

This task issues a request to the current sequencer. If item_priority is not specified, then the current sequence priority will be used by the arbiter. If a lock_request is made, then the sequencer will issue a lock immediately before granting the sequence. (Note that the lock may be granted without the sequence being granted if is_relevant is not asserted).

When this method returns, the sequencer has granted the sequence, and the sequence must call send_request without inserting any simulation delay other than delta cycles. The driver is currently waiting for the next item to be sent via the send_request call.

send_request

```
virtual function void send_request(ovm_sequence_item request,
                                   bit               rerandomize = 0     )
```

The send_request function may only be called after a wait_for_grant call. This call will send the request item to the sequencer, which will forward it to the driver. If the rerandomize bit is set, the item will be randomized before being sent to the driver.

wait_for_item_done

```
virtual task wait_for_item_done(int transaction_id = -1                  )
```

A sequence may optionally call wait_for_item_done. This task will block until the driver calls item_done or put. If no transaction_id parameter is specified, then the call will return the next time that the driver calls item_done or put. If a specific transaction_id is specified, then the call will return when the driver indicates completion of that specific item.

Note that if a specific transaction_id has been specified, and the driver has already issued an item_done or put for that transaction, then the call will hang, having missed the earlier notification.

set_sequencer

```
virtual function void set_sequencer(ovm_sequencer_base sequencer)
```

Sets the default sequencer for the sequence to run on. It will take effect immediately, so it should not be called while the sequence is actively communicating with the sequencer.

get_sequencer

```
virtual function ovm_sequencer_base get_sequencer()
```

Returns a reference to the current default sequencer of the sequence.

kill

```
function void kill()
```

This function will kill the sequence, and cause all current locks and requests in the sequence’s default sequencer to be removed. The sequence state will change to STOPPED, and its post_body() method, if will not b

If a sequence has issued locks, grabs, or requests on sequencers other than the default sequencer, then care must be taken to unregister the sequence with the other sequencer(s) using the sequencer unregister_sequence() method.

use_response_handler

```
function void use_response_handler(bit enable)
```

When called with enable set to 1, responses will be sent to the response handler. Otherwise, responses must be retrieved using get_response.

By default, responses from the driver are retrieved in the sequence by calling get_response.

An alternative method is for the sequencer to call the response_handler function with each response.

get_use_response_handler

```
function bit get_use_response_handler()
```

Returns the state of the use_response_handler bit.

response_handler

```
virtual function void response_handler(ovm_sequence_item response)
```

When the use_reponse_handler bit is set to 1, this virtual task is called by the sequencer for each response that arrives for this sequence.

create_item

```
protected function ovm_sequence_item create_item(
    ovm_object_wrapper       type_var,
    ovm_sequencer_base       l_sequencer,
    string                   name
)
```

Create_item will create and initialize a sequence_item or sequence using the factory. The sequence_item or sequence will be initialized to communicate with the specified sequencer.

start_item

start_item and finish_item together will initiate operation of either a sequence_item or sequence object. If the object has not been initiated using create_item, then start_item will be initialized in start_item to use the default sequencer specified by m_sequencer. Randomization may be done between start_item and finish_item to ensure late generation

```
virtual task start_item(ovm_sequence_item item, int set_priority = -1);
```

finish_item

finish_item, together with start_item together will initiate operation of either a sequence_item or sequence object. Finish_item must be called after start_item with no delays or delta-cycles. Randomization, or other functions may be called between the start_item and finish_item calls.

```
virtual task finish_item(ovm_sequence_item item, int set_priority = -1);
```

ovm_sequence #(REQ,RSP)

The ovm_sequence class provides the interfaces necessary in order to create streams of sequence items and/or other sequences.

Summary

ovm_sequence #(REQ,RSP)

The ovm_sequence class provides the interfaces necessary in order to create streams of sequence items and/or other sequences.

Class Hierarchy

ovm_object

ovm_transaction

ovm_sequence_item

ovm_sequence_base

ovm_sequence#(REQ,RSP)

Class Declaration

```
virtual class ovm_sequence #(
   type REQ = ovm_sequence_item,
   type RSP = REQ
) extends ovm_sequence_base
```

Methods

new	Creates and initializes a new sequence object.
start	The start task is called to begin execution of a sequence.
send_request	This method will send the request item to the sequencer, which will forward it to the driver.
get_current_item	Returns the request item currently being executed by the sequencer.
get_response	By default, sequences must retrieve responses by calling get_response.
set_sequencer	Sets the default sequencer for the sequence to sequencer.
set_response_queue_error_report_disabled	By default, if the response_queue overflows, an error is reported.
get_response_queue_error_report_disabled	When this bit is 0 (default value), error reports are generated when the response queue overflows.
set_response_queue_depth	The default maximum depth of the response queue is 8.
get_response_queue_depth	Returns the current depth setting for the response queue.

Methods

new

```
function new (string              name          = "ovm_sequence",
              ovm_sequencer_base sequencer_ptr = null,
              ovm_sequence_base  parent_seq    = null                  )
```

Creates and initializes a new sequence object.

The *sequencer_ptr* and *parent_seq* arguments are deprecated in favor of their being set in the start method.

start

```
virtual task start (ovm_sequencer_base sequencer,
                    ovm_sequence_base  parent_sequence = null,
                    integer            this_priority   = 100,
                    bit                call_pre_post   = 1          )
```

The start task is called to begin execution of a sequence.

The *sequencer* argument specifies the sequencer on which to run this sequence. The sequencer must be compatible with the sequence.

If *parent_sequence* is null, then the sequence is a parent, otherwise it is a child of the specified parent.

By default, the *priority* of a sequence is 100. A different priority may be specified by this_priority. Higher numbers indicate higher priority.

If *call_pre_post* is set to 1, then the pre_body and post_body tasks will be called before and after the sequence body is called.

send_request

```
function void send_request(ovm_sequence_item request,
                           bit               rerandomize = 0            )
```

This method will send the request item to the sequencer, which will forward it to the driver. If the rerandomize bit is set, the item will be randomized before being sent to the driver. The send_request function may only be called after ovm_sequence_base::wait_for_grant returns.

get_current_item

```
function REQ get_current_item()
```

Returns the request item currently being executed by the sequencer. If the sequencer is not currently executing an item, this method will return null.

The sequencer is executing an item from the time that get_next_item or peek is called until the time that get or item_done is called.

Note that a driver that only calls get will never show a current item, since the item is completed at the same time as it is requested.

get_response

```
task get_response(output RSP response,
                  input int transaction_id = -1                    )
```

By default, sequences must retrieve responses by calling get_response. If no transaction_id is specified, this task will return the next response sent to this sequence. If no response is available in the response queue, the method will block until a response is recieved.

If a transaction_id is parameter is specified, the task will block until a response with that transaction_id is received in the response queue.

The default size of the response queue is 8. The get_response method must be called soon enough to avoid an overflow of the response queue to prevent responses from being dropped.

If a response is dropped in the response queue, an error will be reported unless the error reporting is disabled via set_response_queue_error_report_disabled.

set_sequencer

```
virtual function void set_sequencer(ovm_sequencer_base sequencer)
```

Sets the default sequencer for the sequence to sequencer. It will take effect immediately, so it should not be called while the sequence is actively communicating with the sequencer.

set_response_queue_error_report_disabled

```
function void set_response_queue_error_report_disabled(bit value)
```

By default, if the response_queue overflows, an error is reported. The response_queue will overflow if more responses are sent to this sequence from the driver than get_response calls are made. Setting value to 0 disables these errors, while setting it to 1 enables them.

get_response_queue_error_report_disabled

```
function bit get_response_queue_error_report_disabled()
```

When this bit is 0 (default value), error reports are generated when the response queue overflows. When this bit is 1, no such error reports are generated.

set_response_queue_depth

```
function void set_response_queue_depth(int value)
```

The default maximum depth of the response queue is 8. These method is used to examine or change the maximum depth of the response queue.

Setting the response_queue_depth to -1 indicates an arbitrarily deep response queue. No checking is done.

get_response_queue_depth

```
function int get_response_queue_depth()
```

Returns the current depth setting for the response queue.

ovm_random_sequence

This sequence randomly selects and executes a sequence from the sequencer¿s sequence library, excluding ovm_random_sequence itself, and ovm_exhaustive_sequence.

The ovm_random_sequence class is a built-in sequence that is preloaded into every sequencer’s sequence library with the name “ovm_random_sequence”.

The number of selections and executions is determined by the count property of the sequencer (or virtual sequencer) on which ovm_random_sequence is operating. See ovm_sequencer_base for more information.

Summary

ovm_random_sequence

This sequence randomly selects and executes a sequence from the sequencer¿s sequence library, excluding ovm_random_sequence itself, and ovm_exhaustive_sequence.

Class Hierarchy

ovm_sequence#(ovm_sequence_item)

ovm_random_sequence

Class Declaration

```
class ovm_random_sequence extends ovm_sequence #(
        ovm_sequence_item
)
```

Methods

get_count Returns the count of the number of sub-sequences which are randomly generated.

Methods

get_count

```
function int unsigned get_count()
```

Returns the count of the number of sub-sequences which are randomly generated. By default, count is equal to the value from the sequencer’s count variable. However, if the sequencer’s count variable is -1, then a random value between 0 and sequencer.max_random_count (exclusive) is chosen. The sequencer’s count variable is subsequently reset to the random value that was used. If get_count() is call before the sequence has started, the return value will be sequencer.count, which may be -1.

ovm_exhaustive_sequence

This sequence randomly selects and executes each sequence from the sequencer's sequence library once, excluding itself and ovm_random_sequence.

The ovm_exhaustive_sequence class is a built-in sequence that is preloaded into every sequencer's sequence library with the name "ovm_exaustive_sequence".

Summary

ovm_exhaustive_sequence

This sequence randomly selects and executes each sequence from the sequencer's sequence library once, excluding itself and ovm_random_sequence.

Class Hierarchy

ovm_sequence#(ovm_sequence_item)

ovm_exhaustive_sequence

Class Declaration

```
class ovm_exhaustive_sequence extends ovm_sequence #(
        ovm_sequence_item
)
```

ovm_simple_sequence

This sequence simply executes a single sequence item.

The item parameterization of the sequencer on which the ovm_simple_sequence is executed defines the actual type of the item executed.

The ovm_simple_sequence class is a built-in sequence that is preloaded into every sequencer's sequence library with the name "ovm_simple_sequence".

See ovm_sequencer #(REQ,RSP) for more information on running sequences.

Summary

ovm_simple_sequence

This sequence simply executes a single sequence item.

Class Hierarchy

ovm_sequence#(ovm_sequence_item)

ovm_simple_sequence

Class Declaration

```
class ovm_simple_sequence extends ovm_sequence #(
       ovm_sequence_item
)
```

end

Report Macros

This set of macros provides wrappers around the ovm_report_* Reporting functions. The macros serve two essential purposes:

- To reduce the processing overhead associated with filtered out messages, a check is made against the report's verbosity setting and the action for the id/severity pair before any string formatting is performed. This affects only `ovm_info reports.
- The `__FILE__ and `__LINE__ information is automatically provided to the underlying ovm_report_* call. Having the file and line number from where a report was issued aides in debug. You can disable display of file and line information in reports by defining OVM_DISABLE_REPORT_FILE_LINE on the command line.

The macros also enforce a verbosity setting of OVM_NONE for warnings, errors and fatals so that they cannot be mistakingly turned off by setting the verbosity level too low (warning and errors can still be turned off by setting the actions appropriately).

To use the macros, replace the previous call to ovm_report_* with the corresponding macro.

```
//Previous calls to ovm_report_*
ovm_report_info("MYINFO1", $sformatf("val: %0d", val), OVM_LOW);
ovm_report_warning("MYWARN1", "This is a warning");
ovm_report_error("MYERR", "This is an error");
ovm_report_fatal("MYFATAL", "A fatal error has occurred");
```

The above code is replaced by

```
//New calls to `ovm_*
`ovm_info("MYINFO1", $sformatf("val: %0d", val), OVM_LOW)
`ovm_warning("MYWARN1", "This is a warning")
`ovm_error("MYERR", "This is an error")
`ovm_fatal("MYFATAL", "A fatal error has occurred")
```

Macros represent text substitutions, not statements, so they should not be terminated with semi-colons.

Summary

Report Macros

This set of macros provides wrappers around the ovm_report_* Reporting functions.

Macros

`ovm_info	Calls ovm_report_info if *VERBOSITY* is lower than the configured verbosity of the associated reporter.
`ovm_warning	Calls ovm_report_warning with a verbosity of OVM_NONE.
`ovm_error	Calls ovm_report_error with a verbosity of OVM_NONE.

`ovm_fatal	Calls ovm_report_fatal with a verbosity of OVM_NONE.

Macros

`ovm_info

Calls ovm_report_info if *VERBOSITY* is lower than the configured verbosity of the associated reporter. *ID* is given as the message tag and *MSG* is given as the message text. The file and line are also sent to the ovm_report_info call.

`ovm_warning

Calls ovm_report_warning with a verbosity of OVM_NONE. The message can not be turned off using the reporter's verbosity setting, but can be turned off by setting the action for the message. *ID* is given as the message tag and *MSG* is given as the message text. The file and line are also sent to the ovm_report_warning call.

`ovm_error

Calls ovm_report_error with a verbosity of OVM_NONE. The message can not be turned off using the reporter's verbosity setting, but can be turned off by setting the action for the message. *ID* is given as the message tag and *MSG* is given as the message text. The file and line are also sent to the ovm_report_error call.

`ovm_fatal

Calls ovm_report_fatal with a verbosity of OVM_NONE. The message can not be turned off using the reporter's verbosity setting, but can be turned off by setting the action for the message. *ID* is given as the message tag and *MSG* is given as the message text. The file and line are also sent to the ovm_report_fatal call.

Utility and Field Macros for Components and Objects

Summary

Utility and Field Macros for Components and Objects	
Utility Macros	The utility macros provide implementations of the ovm_object::create method, which is needed for cloning, and the ovm_object::get_type_name method, which is needed for a number of debugging features.
`ovm_field_utils_begin	
`ovm_field_utils_end	These macros form a block in which `ovm_field_* macros can be placed.
`ovm_object_utils	
`ovm_object_param_utils	
`ovm_object_utils_begin	
`ovm_object_param_utils_begin	
`ovm_object_utils_end	ovm_object-based class declarations may contain one of the above forms of utility macros.
`ovm_component_utils	
`ovm_component_param_utils	
`ovm_component_utils_begin	
`ovm_component_param_utils_begin	
`ovm_component_end	ovm_component-based class declarations may contain one of the above forms of utility macros.
Field Macros	The `ovm_field_* macros are invoked inside of the `ovm_*_utils_begin and `ovm_*_utils_end macro blocks to form "automatic" implementations of the core data methods: copy, compare, pack, unpack, record, print, and sprint.
`ovm_field_* macros	Macros that implement data operations for scalar properties.
`ovm_field_int	Implements the data operations for any packed integral property.
`ovm_field_object	Implements the data operations for an ovm_object-based property.
`ovm_field_string	Implements the data operations for a string property.
`ovm_field_enum	Implements the data operations for an enumerated property.
`ovm_field_real	Implements the data operations for any real property.
`ovm_field_event	Implements the data operations for an event property.
`ovm_field_sarray_* macros	Macros that implement data operations for one-dimensional static array properties.
`ovm_field_sarray_int	Implements the data operations for a one-dimensional static array of integrals.
`ovm_field_sarray_object	Implements the data operations for a one-dimensional static array of ovm_object-based objects.
`ovm_field_sarray_string	Implements the data operations for a one-dimensional static array of strings.
`ovm_field_sarray_enum	Implements the data operations for a one-dimensional static array of enums.
`ovm_field_array_* macros	Macros that implement data operations for one-dimensional dynamic array properties.
`ovm_field_array_int	Implements the data operations for a one-dimensional dynamic array of integrals.
`ovm_field_array_object	Implements the data operations for a one-dimensional dynamic array of ovm_object-based objects.

`ovm_field_array_string	Implements the data operations for a one-dimensional dynamic array of strings.
`ovm_field_array_enum	Implements the data operations for a one-dimensional dynamic array of enums.
`ovm_field_queue_* macros	Macros that implement data operations for dynamic queues.
`ovm_field_queue_int	Implements the data operations for a queue of integrals.
`ovm_field_queue_object	Implements the data operations for a queue of ovm_object-based objects.
`ovm_field_queue_string	Implements the data operations for a queue of strings.
`ovm_field_queue_enum	Implements the data operations for a one-dimensional queue of enums.
`ovm_field_aa_*_string macros	Macros that implement data operations for associative arrays indexed by *string*.
`ovm_field_aa_int_string	Implements the data operations for an associative array of integrals indexed by *string*.
`ovm_field_aa_object_string	Implements the data operations for an associative array of ovm_object-based objects indexed by *string*.
`ovm_field_aa_string_string	Implements the data operations for an associative array of strings indexed by *string*.
`ovm_field_aa_*_int macros	Macros that implement data operations for associative arrays indexed by an integral type.
`ovm_field_aa_object_int	Implements the data operations for an associative array of ovm_object-based objects indexed by the *int* data type.
`ovm_field_aa_int_int	Implements the data operations for an associative array of integral types indexed by the *int* data type.
`ovm_field_aa_int_int_unsigned	Implements the data operations for an associative array of integral types indexed by the *int unsigned* data type.
`ovm_field_aa_int_integer	Implements the data operations for an associative array of integral types indexed by the *integer* data type.
`ovm_field_aa_int_integer_unsigned	Implements the data operations for an associative array of integral types indexed by the *integer unsigned* data type.
`ovm_field_aa_int_byte	Implements the data operations for an associative array of integral types indexed by the *byte* data type.
`ovm_field_aa_int_byte_unsigned	Implements the data operations for an associative array of integral types indexed by the *byte unsigned* data type.
`ovm_field_aa_int_shortint	Implements the data operations for an associative array of integral types indexed by the *shortint* data type.
`ovm_field_aa_int_shortint_unsigned	Implements the data operations for an associative array of integral types indexed by the *shortint unsigned* data type.
`ovm_field_aa_int_longint	Implements the data operations for an associative array of integral types indexed by the *longint* data type.
`ovm_field_aa_int_longint_unsigned	Implements the data operations for an associative array of integral types indexed by the *longint unsigned* data type.
`ovm_field_aa_int_key	Implements the data operations for an associative array of integral types indexed by any integral key data type.
`ovm_field_aa_int_enumkey	Implements the data operations for an associative array of integral types indexed by any enumeration key data type.

Utility Macros

The utility macros provide implementations of the ovm_object::create method, which is needed for cloning, and the ovm_object::get_type_name method, which is needed for a number of debugging features. They also register the type with the ovm_factory, and they implement a *get_type* method, which is used when configuring the factory. And they implement the virtual ovm_object::get_object_type method for accessing the factory proxy of an allocated object.

Below is an example usage of the utility and field macros. By using the macros, you do not have to implement any of the data methods to get all of the capabilities of an ovm_object.

```
class mydata extends ovm_object;

  string str;
  mydata subdata;
  int field;
  myenum e1;
  int queue[$];

  `ovm_object_utils_begin(mydata) //requires ctor with default args
    `ovm_field_string(str, OVM_DEFAULT)
    `ovm_field_object(subdata, OVM_DEFAULT)
    `ovm_field_int(field, OVM_DEC) //use decimal radix
    `ovm_field_enum(myenum, e1, OVM_DEFAULT)
    `ovm_field_queue_int(queue, OVM_DEFAULT)
  `ovm_object_utils_end

endclass
```

`ovm_field_utils_begin

`ovm_field_utils_end

These macros form a block in which `ovm_field_* macros can be placed. Used as

```
`ovm_field_utils_begin(TYPE)
  `ovm_field_* macros here
`ovm_field_utils_end
```

These macros do NOT perform factory registration, implement get_type_name, nor implement the create method. Use this form when you need custom implementations of these two methods, or when you are setting up field macros for an abstract class (i.e. virtual class).

`ovm_object_utils

`ovm_object_param_utils

`ovm_object_utils_begin

`ovm_object_param_utils_begin

`ovm_object_utils_end

ovm_object-based class declarations may contain one of the above forms of utility macros.

For simple objects with no field macros, use

```
`ovm_object_utils(TYPE)
```

For simple objects with field macros, use

```
`ovm_object_utils_begin(TYPE)
  `ovm_field_* macro invocations here
`ovm_object_utils_end
```

For parameterized objects with no field macros, use

```
`ovm_object_param_utils(TYPE)
```

For parameterized objects, with field macros, use

```
`ovm_object_param_utils_begin(TYPE)
  `ovm_field_* macro invocations here
`ovm_object_utils_end
```

Simple (non-parameterized) objects use the ovm_object_utils* versions, which do the following:

- Implements get_type_name, which returns TYPE as a string
- Implements create, which allocates an object of type TYPE by calling its constructor with no arguments. TYPE's constructor, if defined, must have default values on all it arguments.
- Registers the TYPE with the factory, using the string TYPE as the factory lookup string for the type.
- Implements the static get_type() method which returns a factory proxy object for the type.
- Implements the virtual get_object_type() method which works just like the static get_type() method, but operates on an already allocated object.

Parameterized classes must use the ovm_object_param_utils* versions. They differ from `ovm_object_utils only in that they do not supply a type name when registering the object with the factory. As such, name-based lookup with the factory for parameterized classes is not possible.

The macros with _begin suffixes are the same as the non-suffixed versions except that they also start a block in which `ovm_field_* macros can be placed. The block must be terminated by `ovm_object_utils_end.

Objects deriving from ovm_sequence must use the `ovm_sequence_* macros instead of these macros. See `ovm_sequence_utils for details.

`ovm_component_utils

`ovm_component_param_utils

`ovm_component_utils_begin

`ovm_component_param_utils_begin

`ovm_component_end

ovm_component-based class declarations may contain one of the above forms of utility macros.

For simple components with no field macros, use

```
`ovm_component_utils(TYPE)
```

For simple components with field macros, use

```
`ovm_component_utils_begin(TYPE)
  `ovm_field_* macro invocations here
`ovm_component_utils_end
```

For parameterized components with no field macros, use

```
`ovm_component_param_utils(TYPE)
```

For parameterized components with field macros, use

```
`ovm_component_param_utils_begin(TYPE)
  `ovm_field_* macro invocations here
`ovm_component_utils_end
```

Simple (non-parameterized) components must use the ovm_components_utils* versions, which do the following:

- Implements get_type_name, which returns TYPE as a string.
- Implements create, which allocates a component of type TYPE using a two argument constructor. TYPE’s constructor must have a name and a parent argument.
- Registers the TYPE with the factory, using the string TYPE as the factory lookup string for the type.
- Implements the static get_type() method which returns a factory proxy object for the type.
- Implements the virtual get_object_type() method which works just like the static get_type() method, but operates on an already allocated object.

Parameterized classes must use the ovm_object_param_utils* versions. They differ from `ovm_object_utils only in that they do not supply a type name when registering the object with the factory. As such, name-based lookup with the factory for parameterized classes is not possible.

The macros with _begin suffixes are the same as the non-suffixed versions except that they also start a block in which `ovm_field_* macros can be placed.  The block must be terminated by `ovm_component_utils_end.

Components deriving from ovm_sequencer must use the `ovm_sequencer_* macros instead of these macros. See `ovm_sequencer_utils for details.

Field Macros

The `ovm_field_* macros are invoked inside of the `ovm_*_utils_begin and `ovm_*_utils_end macro blocks to form "automatic" implementations of the core data methods: copy, compare, pack, unpack, record, print, and sprint. For example:

```
class my_trans extends ovm_transaction;
  string my_string;
  `ovm_object_utils_begin(my_trans)
    `ovm_field_string(my_string, OVM_ALL_ON)
  `ovm_object_utils_end
endclass
```

Each `ovm_field_* macro is named to correspond to a particular data type: integrals, strings, objects, queues, etc., and each has at least two arguments: *ARG* and *FLAG*.

ARG is the instance name of the variable, whose type must be compatible with the macro being invoked. In the example, class variable my_string is of type string, so we use the `ovm_field_string macro.

If *FLAG* is set to *OVM_ALL_ON*, as in the example, the ARG variable will be included in all data methods. The FLAG, if set to something other than *OVM_ALL_ON* or *OVM_DEFAULT*, specifies which data method implementations will NOT include the given variable. Thus, if *FLAG* is specified as *NO_COMPARE*, the ARG variable will not affect comparison operations, but it will be included in everything else.

All possible values for *FLAG* are listed and described below. Multiple flag values can be bitwise ORed together (in most cases they may be added together as well, but care must be taken when using the + operator to ensure that the same bit is not added more than once).

OVM_ALL_ON	Set all operations on (default).
OVM_DEFAULT	Use the default flag settings.
OVM_NOCOPY	Do not copy this field.
OVM_NOCOMPARE	Do not compare this field.
OVM_NOPRINT	Do not print this field.
OVM_NODEFPRINT	Do not print the field if it is the same as its
OVM_NOPACK	Do not pack or unpack this field.
OVM_PHYSICAL	Treat as a physical field. Use physical setting in policy class for this field.
OVM_ABSTRACT	Treat as an abstract field. Use the abstract setting in the policy class for this field.
OVM_READONLY	Do not allow setting of this field from the set_*_local methods.

A radix for printing and recording can be specified by OR'ing one of the following constants in the *FLAG* argument

OVM_BIN	Print / record the field in binary (base-2).
OVM_DEC	Print / record the field in decimal (base-10).
OVM_UNSIGNED	Print / record the field in unsigned decimal (base-10).
OVM_OCT	Print / record the field in octal (base-8).
OVM_HEX	Print / record the field in hexidecimal (base-16).
OVM_STRING	Print / record the field in string format.
OVM_TIME	Print / record the field in time format.

Radix settings for integral types. Hex is the default radix if none is specified.

`ovm_field_* macros

Macros that implement data operations for scalar properties.

`ovm_field_int

Implements the data operations for any packed integral property.

```
`ovm_field_int(ARG,FLAG)
```

ARG is an integral property of the class, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_object

Implements the data operations for an ovm_object-based property.

```
`ovm_field_object(ARG,FLAG)
```

ARG is an object property of the class, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_string

Implements the data operations for a string property.

```
`ovm_field_string(ARG,FLAG)
```

ARG is a string property of the class, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_enum

Implements the data operations for an enumerated property.

```
`ovm_field_enum(T,ARG,FLAG)
```

T is an enumerated type, *ARG* is an instance of that type, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_real

Implements the data operations for any real property.

```
`ovm_field_real(ARG,FLAG)
```

ARG is an real property of the class, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_event

Implements the data operations for an event property.

```
`ovm_field_event(ARG,FLAG)
```

ARG is an event property of the class, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_sarray_* macros

Macros that implement data operations for one-dimensional static array properties.

`ovm_field_sarray_int

Implements the data operations for a one-dimensional static array of integrals.

```
`ovm_field_sarray_int(ARG,FLAG)
```

ARG is a one-dimensional static array of integrals, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_sarray_object

Implements the data operations for a one-dimensional static array of ovm_object-based objects.

```
`ovm_field_sarray_object(ARG,FLAG)
```

ARG is a one-dimensional static array of ovm_object-based objects, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_sarray_string

Implements the data operations for a one-dimensional static array of strings.

```
`ovm_field_sarray_string(ARG,FLAG)
```

ARG is a one-dimensional static array of strings, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_sarray_enum

Implements the data operations for a one-dimensional static array of enums.

```
`ovm_field_sarray_enum(T,ARG,FLAG)
```

T is a one-dimensional dynamic array of enums type, *ARG* is an instance of that type, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_array_* macros

Macros that implement data operations for one-dimensional dynamic array properties.

`ovm_field_array_int

Implements the data operations for a one-dimensional dynamic array of integrals.

```
`ovm_field_array_int(ARG,FLAG)
```

ARG is a one-dimensional dynamic array of integrals, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_array_object

Implements the data operations for a one-dimensional dynamic array of ovm_object-based objects.

```
`ovm_field_array_object(ARG,FLAG)
```

ARG is a one-dimensional dynamic array of ovm_object-based objects, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_array_string

Implements the data operations for a one-dimensional dynamic array of strings.

```
`ovm_field_array_string(ARG,FLAG)
```

ARG is a one-dimensional dynamic array of strings, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_array_enum

Implements the data operations for a one-dimensional dynamic array of enums.

```
`ovm_field_array_enum(T,ARG,FLAG)
```

T is a one-dimensional dynamic array of enums type, *ARG* is an instance of that type, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_queue_* macros

Macros that implement data operations for dynamic queues.

`ovm_field_queue_int

Implements the data operations for a queue of integrals.

```
`ovm_field_queue_int(ARG,FLAG)
```

ARG is a one-dimensional queue of integrals, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_queue_object

Implements the data operations for a queue of ovm_object-based objects.

```
`ovm_field_queue_object(ARG,FLAG)
```

ARG is a one-dimensional queue of ovm_object-based objects, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_queue_string

Implements the data operations for a queue of strings.

```
`ovm_field_queue_string(ARG,FLAG)
```

ARG is a one-dimensional queue of strings, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_queue_enum

Implements the data operations for a one-dimensional queue of enums.

```
`ovm_field_queue_enum(T,ARG,FLAG)
```

T is a queue of enums type, *ARG* is an instance of that type, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_*_string macros

Macros that implement data operations for associative arrays indexed by *string*.

`ovm_field_aa_int_string

Implements the data operations for an associative array of integrals indexed by *string*.

```
`ovm_field_aa_int_string(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with string key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_object_string

Implements the data operations for an associative array of ovm_object-based objects indexed by *string*.

```
`ovm_field_aa_object_string(ARG,FLAG)
```

ARG is the name of a property that is an associative array of objects with string key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_string_string

Implements the data operations for an associative array of strings indexed by *string*.

```
`ovm_field_aa_string_string(ARG,FLAG)
```

ARG is the name of a property that is an associative array of strings with string key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_*_int macros

Macros that implement data operations for associative arrays indexed by an integral type.

`ovm_field_aa_object_int

Implements the data operations for an associative array of ovm_object-based objects indexed by the *int* data type.

```
`ovm_field_aa_object_int(ARG,FLAG)
```

ARG is the name of a property that is an associative array of objects with *int* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_int

Implements the data operations for an associative array of integral types indexed by the *int* data type.

```
`ovm_field_aa_int_int(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *int* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_int_unsigned

Implements the data operations for an associative array of integral types indexed by the *int unsigned* data type.

```
`ovm_field_aa_int_int_unsigned(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *int unsigned* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_integer

Implements the data operations for an associative array of integral types indexed by the *integer* data type.

```
`ovm_field_aa_int_integer(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *integer* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_integer_unsigned

Implements the data operations for an associative array of integral types indexed by the *integer unsigned* data type.

```
`ovm_field_aa_int_integer_unsigned(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *integer unsigned* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_byte

Implements the data operations for an associative array of integral types indexed by the *byte* data type.

```
`ovm_field_aa_int_byte(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *byte* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_byte_unsigned

Implements the data operations for an associative array of integral types indexed by the *byte unsigned* data type.

```
`ovm_field_aa_int_byte_unsigned(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *byte unsigned* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_shortint

Implements the data operations for an associative array of integral types indexed by the *shortint* data type.

```
`ovm_field_aa_int_shortint(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *shortint* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_shortint_unsigned

Implements the data operations for an associative array of integral types indexed by the *shortint unsigned* data type.

```
`ovm_field_aa_int_shortint_unsigned(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *shortint unsigned* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_longint

Implements the data operations for an associative array of integral types indexed by the *longint* data type.

```
`ovm_field_aa_int_longint(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *longint* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_longint_unsigned

Implements the data operations for an associative array of integral types indexed by the *longint unsigned* data type.

```
`ovm_field_aa_int_longint_unsigned(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *longint unsigned* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_key

Implements the data operations for an associative array of integral types indexed by any integral key data type.

```
`ovm_field_aa_int_key(long unsigned,ARG,FLAG)
```

KEY is the data type of the integral key, *ARG* is the name of a property that is an associative array of integrals, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

`ovm_field_aa_int_enumkey

Implements the data operations for an associative array of integral types indexed by any enumeration key data type.

```
`ovm_field_aa_int_longint_unsigned(ARG,FLAG)
```

ARG is the name of a property that is an associative array of integrals with *longint unsigned* key, and *FLAG* is a bitwise OR of one or more flag settings as described in Field Macros above.

Sequence and Do Action Macros

Summary

Sequence and Do Action Macros	
Sequence Registration Macros	The sequence-specific macros perform the same function as the set of `ovm_object_*_utils macros, except they also set the default sequencer type the sequence will run on.
`ovm_declare_p_sequencer	This macro is used to set up a specific sequencer type with the sequence type the macro is placed in.
`ovm_sequence_utils_begin	
`ovm_sequence_utils_end	
`ovm_sequence_utils	The sequence macros can be used in non-parameterized <ovm_sequence> extensions to pre-register the sequence with a given <ovm_sequencer> type.
Sequencer Registration Macros	The sequencer-specific macros perform the same function as the set of `ovm_componenent_*utils macros except that they also declare the plumbing necessary for creating the sequencer's sequence library.
`ovm_update_sequence_lib	This macro populates the instance-specific sequence library for a sequencer.
`ovm_update_sequence_lib_and_item	This macro populates the instance specific sequence library for a sequencer, and it registers the given *USER_ITEM* as an instance override for the simple sequence's item variable.
`ovm_sequencer_utils	
`ovm_sequencer_utils_begin	
`ovm_sequencer_param_utils	
`ovm_sequencer_param_utils_begin	
`ovm_sequencer_utils_end	The sequencer macros are used in ovm_sequencer-based class declarations in one of four ways.
Sequence Action Macros	These macros are used to start sequences and sequence items that were either registered with a <`ovm-sequence_utils> macro or whose associated sequencer was already set using the <set_sequencer> method.
`ovm_create	This action creates the item or sequence using the factory.
`ovm_do	This macro takes as an argument a ovm_sequence_item variable or object.
`ovm_do_pri	This is the same as `ovm_do except that the sequene item or sequence is executed with the priority specified in the argument
`ovm_do_with	This is the same as `ovm_do except that the constraint block in the 2nd argument is applied to the item or sequence in a randomize with statement before execution.
`ovm_do_pri_with	This is the same as `ovm_do_pri except that the given constraint block is applied to the item or sequence in a randomize with statement before execution.
`ovm_send	This macro processes the item or sequence that has been created using `ovm_create.
`ovm_send_pri	This is the same as `ovm_send except that the sequene item or sequence is executed with the priority specified in the argument.
`ovm_rand_send	This macro processes the item or sequence that has been already been allocated (possibly with `ovm_create).

`ovm_rand_send_pri	This is the same as `ovm_rand_send except that the sequene item or sequence is executed with the priority specified in the argument.
`ovm_rand_send_with	This is the same as `ovm_rand_send except that the given constraint block is applied to the item or sequence in a randomize with statement before execution.
`ovm_rand_send_pri_with	This is the same as `ovm_rand_send_pri except that the given constraint block is applied to the item or sequence in a randomize with statement before execution.
Sequence on Sequencer Action Macros	These macros are used to start sequences and sequence items on a specific sequencer, given in a macro argument.
`ovm_create_on	This is the same as `ovm_create except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument.
`ovm_do_on	This is the same as `ovm_do except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument.
`ovm_do_on_pri	This is the same as `ovm_do_pri except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument.
`ovm_do_on_with	This is the same as `ovm_do_with except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument.
`ovm_do_on_pri_with	This is the same as `ovm_do_pri_with except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument.

Sequence Registration Macros

The sequence-specific macros perform the same function as the set of `ovm_object_*_utils macros, except they also set the default sequencer type the sequence will run on.

`ovm_declare_p_sequencer

This macro is used to set up a specific sequencer type with the sequence type the macro is placed in. This macro is implicit in the <ovm_sequence_utils> macro, but may be used directly in cases when the sequence is not to be registered in the sequencer's library.

The example below shows using the the ovm_declare_p_sequencer macro along with the ovm_object_utils macros to set up the sequence but not register the sequence in the sequencer's library.

```
class mysequence extends ovm_sequence#(mydata);
  `ovm_object_utils(mysequence)
  `ovm_declare_p_sequencer(some_seqr_type)
  task body;
    //Access some variable in the user's custom sequencer
    if(p_sequencer.some_variable) begin
      ...
    end
  endtask
endclass
```

`ovm_sequence_utils_begin

`ovm_sequence_utils_end

`ovm_sequence_utils

The sequence macros can be used in non-parameterized <ovm_sequence> extensions to pre-register the sequence with a given <ovm_sequencer> type.

For sequences that do not use any `ovm_field macros

```
`ovm_sequence_utils(TYPE_NAME,SQR_TYPE_NAME)
```

For sequences employing with field macros

```
`ovm_sequence_utils_begin(TYPE_NAME,SQR_TYPE_NAME)
  `ovm_field_* macro invocations here
`ovm_sequence_utils_end
```

The sequence-specific macros perform the same function as the set of `ovm_object_*_utils macros except that they also register the sequence’s type, TYPE_NAME, with the given sequencer type, SQR_TYPE_NAME, and define the p_sequencer variable and m_set_p_sequencer method.

Use `ovm_sequence_utils[_begin] for non-parameterized classes and `ovm_sequence_param_utils[_begin] for parameterized classes.

Sequencer Registration Macros

The sequencer-specific macros perform the same function as the set of `ovm_componenent_*utils macros except that they also declare the plumbing necessary for creating the sequencer’s sequence library.

`ovm_update_sequence_lib

This macro populates the instance-specific sequence library for a sequencer. It should be invoked inside the sequencer¿s constructor.

`ovm_update_sequence_lib_and_item

This macro populates the instance specific sequence library for a sequencer, and it registers the given *USER_ITEM* as an instance override for the simple sequence’s item variable.

The macro should be invoked inside the sequencer’s constructor.

`ovm_sequencer_utils

`ovm_sequencer_utils_begin

`ovm_sequencer_param_utils

`ovm_sequencer_param_utils_begin

`ovm_sequencer_utils_end

The sequencer macros are used in ovm_sequencer-based class declarations in one of four ways.

For simple sequencers, no field macros

`ovm_sequencer_utils(SQR_TYPE_NAME)

For simple sequencers, with field macros

`ovm_sequencer_utils_begin(SQR_TYPE_NAME) `ovm_field_* macros here
`ovm_sequencer_utils_end

For parameterized sequencers, no field macros

`ovm_sequencer_param_utils(SQR_TYPE_NAME)

For parameterized sequencers, with field macros

`ovm_sequencer_param_utils_begin(SQR_TYPE_NAME) `ovm_field_* macros here
`ovm_sequencer_utils_end

The sequencer-specific macros perform the same function as the set of `ovm_componenent_*utils macros except that they also declare the plumbing necessary for creating the sequencer's sequence library. This includes:

1. Declaring the type-based static queue of strings registered on the sequencer type.

2. Declaring the static function to add strings to item #1 above.

3. Declaring the static function to remove strings to item #1 above.

4. Declaring the function to populate the instance specific sequence library for a sequencer.

Use `ovm_sequencer_utils[_begin] for non-parameterized classes and `ovm_sequencer_param_utils[_begin] for parameterized classes.

Sequence Action Macros

These macros are used to start sequences and sequence items that were either registered with a <`ovm-sequence_utils> macro or whose associated sequencer was already set using the <set_sequencer> method.

`ovm_create

This action creates the item or sequence using the factory. It intentionally does zero processing. After this action completes, the user can manually set values, manipulate rand_mode and constraint_mode, etc.

`ovm_do

This macro takes as an argument a ovm_sequence_item variable or object. ovm_sequence_item's are randomized at the time the sequencer grants the do request. This is called late-randomization or late-generation. In the case of a sequence a sub-sequence is spawned. In the case of an item, the item is sent to the driver through the associated sequencer.

`ovm_do_pri

This is the same as `ovm_do except that the sequene item or sequence is executed with the priority specified in the argument

`ovm_do_with

This is the same as `ovm_do except that the constraint block in the 2nd argument is applied to the item or sequence in a randomize with statement before execution.

`ovm_do_pri_with

This is the same as `ovm_do_pri except that the given constraint block is applied to the item or sequence in a randomize with statement before execution.

`ovm_send

This macro processes the item or sequence that has been created using `ovm_create. The processing is done without randomization. Essentially, an `ovm_do without the create or randomization.

`ovm_send_pri

This is the same as `ovm_send except that the sequene item or sequence is executed with the priority specified in the argument.

`ovm_rand_send

This macro processes the item or sequence that has been already been allocated (possibly with `ovm_create). The processing is done with randomization. Essentially, an `ovm_do without the create.

`ovm_rand_send_pri

This is the same as `ovm_rand_send except that the sequene item or sequence is executed with the priority specified in the argument.

`ovm_rand_send_with

This is the same as `ovm_rand_send except that the given constraint block is applied to the item or sequence in a randomize with statement before execution.

`ovm_rand_send_pri_with

This is the same as `ovm_rand_send_pri except that the given constraint block is applied to the item or sequence in a randomize with statement before execution.

Sequence on Sequencer Action Macros

These macros are used to start sequences and sequence items on a specific sequencer, given in a macro argument.

`ovm_create_on

This is the same as `ovm_create except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument.

`ovm_do_on

This is the same as `ovm_do except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument.

`ovm_do_on_pri

This is the same as `ovm_do_pri except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument.

`ovm_do_on_with

This is the same as `ovm_do_with except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument. The user must supply brackets around the constraints.

`ovm_do_on_pri_with

This is the same as `ovm_do_pri_with except that it also sets the parent sequence to the sequence in which the macro is invoked, and it sets the sequencer to the specified *SEQUENCER_REF* argument.

TLM Implementation Port Declaration Macros

The TLM implemenation declaration macros provide a way for an implementer to provide multiple implemenation ports of the same implementation interface. When an implementation port is defined using the built-in set of imps, there must be exactly one implementation of the interface.

For example, if a component needs to provide a put implemenation then it would have an implementation port defined like:

```
class mycomp extends ovm_component;
  ovm_put_imp#(data_type, mycomp) put_imp;
  ...
  virtual task put (data_type t);
    ...
  endtask
endclass
```

There are times, however, when you need more than one implementation for for an interface. This set of declarations allow you to easily create a new implemenation class to allow for multiple implementations. Although the new implemenation class is a different class, it can be bound to the same types of exports and ports as the original class. Extending the put example above, lets say that mycomp needs to provide two put implementation ports. In that case, you would do something like:

```
//Define two new put interfaces which are compatible with ovm_put_ports
//and ovm_put_exports.

`ovm_put_imp_decl(_1)
`ovm_put_imp_decl(_2)

class my_put_imp#(type T=int) extends ovm_component;
   ovm_put_imp_1#(T) put_imp1;
   ovm_put_imp_2#(T) put_imp2;
   ...
   function void put_1 (input T t);
     //puts comming into put_imp1
     ...
   endfunction
   function void put_2(input T t);
     //puts comming into put_imp2
     ...
   endfunction
endclass
```

The important thing to note is that each `ovm_<interface>_imp_decl creates a new class of type ovm_<interface>_imp<suffix>, where suffix is the input argument to the macro. For this reason, you will typically want to put these macros in a seperate package to avoid collisions and to allow sharing of the definitions.

Summary

TLM Implementation Port Declaration Macros

The TLM implemenation declaration macros provide a way for an implementer to provide multiple implemenation ports of the same implementation interface.

Macros

`ovm_blocking_put_imp_decl	Define the class ovm_blocking_put_impSFX for providing blocking put implementations.
`ovm_nonblocking_put_imp_decl	Define the class ovm_nonblocking_put_impSFX for providing non-blocking put implementations.
`ovm_put_imp_decl	Define the class ovm_put_impSFX for providing both blocking and non-blocking put implementations.
`ovm_blocking_get_imp_decl	Define the class ovm_blocking_get_impSFX for providing blocking get implementations.
`ovm_nonblocking_get_imp_decl	Define the class ovm_nonblocking_get_impSFX for providing non-blocking get implementations.
`ovm_get_imp_decl	Define the class ovm_get_impSFX for providing both blocking and non-blocking get implementations.
`ovm_blocking_peek_imp_decl	Define the class ovm_blocking_peek_impSFX for providing blocking peek implementations.
`ovm_nonblocking_peek_imp_decl	Define the class ovm_nonblocking_peek_impSFX for providing non-blocking peek implementations.
`ovm_peek_imp_decl	Define the class ovm_peek_impSFX for providing both blocking and non-blocking peek implementations.
`ovm_blocking_get_peek_imp_decl	Define the class ovm_blocking_get_peek_impSFX for providing the blocking get_peek implemenation.
`ovm_nonblocking_get_peek_imp_decl	Define the class ovm_nonblocking_get_peek_impSFX for providing non-blocking get_peek implemenation.
`ovm_get_peek_imp_decl	Define the class ovm_get_peek_impSFX for providing both blocking and non-blocking get_peek implementations.
`ovm_blocking_master_imp_decl	Define the class ovm_blocking_master_impSFX for providing the blocking master implemenation.
`ovm_nonblocking_master_imp_decl	Define the class ovm_nonblocking_master_impSFX for providing the non-blocking master implemenation.
`ovm_master_imp_decl	Define the class ovm_master_impSFX for providing both blocking and non-blocking master implementations.
`ovm_blocking_slave_imp_decl	Define the class ovm_blocking_slave_impSFX for providing the blocking slave implemenation.
`ovm_nonblocking_slave_imp_decl	Define the class ovm_nonblocking_slave_impSFX for providing the non-blocking slave implemenation.
`ovm_slave_imp_decl	Define the class ovm_slave_impSFX for providing both blocking and non-blocking slave implementations.
`ovm_blocking_transport_imp_decl	Define the class ovm_blocking_transport_impSFX for providing the blocking transport implemenation.
`ovm_nonblocking_transport_imp_decl	Define the class ovm_nonblocking_transport_impSFX for providing the non-blocking transport implemenation.
`ovm_transport_imp_decl	Define the class ovm_transport_impSFX for providing both blocking and non-blocking transport implementations.
`ovm_analysis_imp_decl	Define the class ovm_analysis_impSFX for providing an analysis implementation.

Macros

`ovm_blocking_put_imp_decl

Define the class ovm_blocking_put_impSFX for providing blocking put implementations. *SFX* is the suffix for the new class type.

`ovm_nonblocking_put_imp_decl

Define the class ovm_nonblocking_put_impSFX for providing non-blocking put implementations. *SFX* is the suffix for the new class type.

`ovm_put_imp_decl

Define the class ovm_put_impSFX for providing both blocking and non-blocking put implementations. *SFX* is the suffix for the new class type.

`ovm_blocking_get_imp_decl

Define the class ovm_blocking_get_impSFX for providing blocking get implementations. *SFX* is the suffix for the new class type.

`ovm_nonblocking_get_imp_decl

Define the class ovm_nonblocking_get_impSFX for providing non-blocking get implementations. *SFX* is the suffix for the new class type.

`ovm_get_imp_decl

Define the class ovm_get_impSFX for providing both blocking and non-blocking get implementations. *SFX* is the suffix for the new class type.

`ovm_blocking_peek_imp_decl

Define the class ovm_blocking_peek_impSFX for providing blocking peek implementations. *SFX* is the suffix for the new class type.

`ovm_nonblocking_peek_imp_decl

Define the class ovm_nonblocking_peek_impSFX for providing non-blocking peek implementations. *SFX* is the suffix for the new class type.

`ovm_peek_imp_decl

Define the class ovm_peek_impSFX for providing both blocking and non-blocking peek implementations. *SFX* is the suffix for the new class type.

`ovm_blocking_get_peek_imp_decl

Define the class ovm_blocking_get_peek_impSFX for providing the blocking get_peek implemenation.

`ovm_nonblocking_get_peek_imp_decl

Define the class ovm_nonblocking_get_peek_impSFX for providing non-blocking get_peek implemenation.

`ovm_get_peek_imp_decl

Define the class ovm_get_peek_impSFX for providing both blocking and non-blocking get_peek implementations. *SFX* is the suffix for the new class type.

`ovm_blocking_master_imp_decl

Define the class ovm_blocking_master_impSFX for providing the blocking master implemenation.

`ovm_nonblocking_master_imp_decl

Define the class ovm_nonblocking_master_impSFX for providing the non-blocking master implemenation.

`ovm_master_imp_decl

Define the class ovm_master_impSFX for providing both blocking and non-blocking master implementations. *SFX* is the suffix for the new class type.

`ovm_blocking_slave_imp_decl

Define the class ovm_blocking_slave_impSFX for providing the blocking slave implemenation.

`ovm_nonblocking_slave_imp_decl

Define the class ovm_nonblocking_slave_impSFX for providing the non-blocking slave implemenation.

`ovm_slave_imp_decl

Define the class ovm_slave_impSFX for providing both blocking and non-blocking slave implementations. *SFX* is the suffix for the new class type.

`ovm_blocking_transport_imp_decl

Define the class ovm_blocking_transport_impSFX for providing the blocking transport implemenation.

`ovm_nonblocking_transport_imp_decl

Define the class ovm_nonblocking_transport_impSFX for providing the non-blocking transport implemenation.

`ovm_transport_imp_decl

Define the class ovm_transport_impSFX for providing both blocking and non-blocking transport implementations. *SFX* is the suffix for the new class type.

`ovm_analysis_imp_decl

Define the class ovm_analysis_impSFX for providing an analysis implementation. *SFX* is the suffix for the new class type. The analysis implemenation is the write function. The `ovm_analysis_imp_decl allows for a scoreboard (or other analysis component) to support input from many places. For example:

```
`ovm_analysis_imp_decl(_ingress)
`ovm_analysis_imp_port(_egress)

class myscoreboard extends ovm_component;
  ovm_analysis_imp_ingress#(mydata, myscoreboard) ingress;
  ovm_analysis_imp_egress#(mydata, myscoreboard) egress;
  mydata ingress_list[$];
  ...

  function new(string name, ovm_component parent);
    super.new(name,parent);
    ingress = new("ingress", this);
    egress = new("egress", this);
  endfunction

  function void write_ingress(mydata t);
    ingress_list.push_back(t);
  endfunction

  function void write_egress(mydata t);
    find_match_in_ingress_list(t);
  endfunction

  function void find_match_in_ingress_list(mydata t);
    //implement scoreboarding for this particular dut
    ...
  endfunction
endclass
```

Callback Macros

Summary

ovm_callback_defines.svh	
Callback Macros	
`ovm_do_callbacks	Calls the given *METHOD* of all callbacks of type *CB* registered with the calling object (i.e.
`ovm_do_obj_callbacks	Calls the given *METHOD* of all callbacks based on type *CB* registered with the given object, *OBJ*, which is or is based on type *T*.
`ovm_do_callbacks_exit_on	Calls the given *METHOD* of all callbacks of type *CB* registered with the calling object (i.e.
`ovm_do_obj_callbacks_exit_on	Calls the given *METHOD* of all callbacks of type *CB* registered with the given object *OBJ*, which must be or be based on type *T*, and returns upon the first callback that returns the bit value given by *VAL*.
`ovm_do_task_callbacks	Calls the given *METHOD* of all callbacks of type *CB* registered with the calling object (i.e.
`ovm_do_ext_task_callbacks	This macro is identical to <ovm_do_task_callbacks> macro except there is an additional *OBJ* argument that allows the user to execute callbacks associated with an external object instance *OBJ* instead of the calling (*this*) object.

Callback Macros

`ovm_do_callbacks

Calls the given *METHOD* of all callbacks of type *CB* registered with the calling object (i.e. *this* object), which is or is based on type *T*.

This macro executes all of the callbacks associated with the calling object (i.e. *this* object). The macro takes three arguments:

- CB is the class type of the callback objects to execute. The class type must have a function signature that matches the FNC argument.
- T is the type associated with the callback. Typically, an instance of type T is passed as one the arguments in the *METHOD* call.
- METHOD is the method call to invoke, with all required arguments as if they were invoked directly.

For example, given the following callback class definition

```
virtual class mycb extends ovm_cb;
  pure function void my_function (mycomp comp, int addr, int data);
endclass
```

A component would invoke the macro as

```
task mycomp::run();
   int curr_addr, curr_data;
   ...
   `ovm_do_callbacks(mycb, mycomp, my_function(this, curr_addr, curr_data)
   ...
endtask
```

`ovm_do_obj_callbacks

Calls the given *METHOD* of all callbacks based on type *CB* registered with the given object, *OBJ*, which is or is based on type *T*.

This macro is identical to <ovm_do_callbacks (CB,T,METHOD)> macro, but it has an additional *OBJ* argument to allow the specification of an external object to associate the callback with. For example, if the callbacks are being applied in a sequence, *OBJ* could be specified as the associated sequencer or parent sequence.

`ovm_do_callbacks_exit_on

Calls the given *METHOD* of all callbacks of type *CB* registered with the calling object (i.e. *this* object), which is or is based on type *T*, returning upon the first callback returning the bit value given by *VAL*.

This macro executes all of the callbacks associated with the calling object (i.e. *this* object). The macro takes three arguments:

- CB is the class type of the callback objects to execute. The class type must have a function signature that matches the FNC argument.
- T is the type associated with the callback. Typically, an instance of type T is passed as one the arguments in the *METHOD* call.
- METHOD is the method call to invoke, with all required arguments as if they were invoked directly.
- VAL, if 1, says return upon the first callback invocation that returns 1. If 0, says return upon the first callback invocation that returns 0.

For example, given the following callback class definition

```
virtual class mycb extends ovm_cb;
  pure function bit drop_trans (mycomp comp, my_trans trans);
endclass
```

A component would invoke the macro as

```
task mycomp::run();
   my_trans trans;
   forever begin
     get_port.get(trans);
     if (`ovm_do_callbacks_exit_on(mycb, mycomp, extobj, drop_trans(this,trans), 1)
       ovm_report_info("DROPPED",{"trans dropped: %s",trans.convert2string()});
     // execute transaction
   end
endtask
```

`ovm_do_obj_callbacks_exit_on

Calls the given *METHOD* of all callbacks of type *CB* registered with the given object *OBJ*, which must be or be based on type *T*, and returns upon the first callback that returns the bit value given by *VAL*.

`ovm_do_task_callbacks

Calls the given *METHOD* of all callbacks of type *CB* registered with the calling object (i.e. *this* object), which is or is based on type *T*.

This macro is the same as the <ovm_do_callbacks> macro except that each callback is executed inside of its own thread. The threads are concurrent, but the execution order of the threads is simulator dependent. The macro does not return until all forked callbacks have completed.

```
virtual class mycb extends ovm_cb;
  pure task my_task(mycomp, int addr, int data);
endclass
```

```
task mycomp::run();
   int curr_addr, curr_data;
   ...
   `ovm_callback(mycb, mycomp, my_task(this, curr_addr, curr_data))
   ...
endtask
```

`ovm_do_ext_task_callbacks

This macro is identical to <ovm_do_task_callbacks> macro except there is an additional *OBJ* argument that allows the user to execute callbacks associated with an external object instance *OBJ* instead of the calling (*this*) object.

Types and Enumerations

Summary

Types and Enumerations	
ovm_bitstream_t	The bitstream type is used as a argument type for passing integral values in such methods as set_int_local, get_int_local, get_config_int, report, pack and unpack.
ovm_radix_enum	
ovm_recursion_policy_enum	
Reporting	
ovm_severity	Defines all possible values for report severity.
ovm_action	Defines all possible values for report actions.
ovm_verbosity	Defines standard verbosity levels for reports.
Port Type	
ovm_port_type_e	
Sequences	
ovm_sequence_state_enum	
Default Policy Classes	Policy classes for ovm_object basic functions, ovm_object::copy, ovm_object::compare, ovm_object::pack, ovm_object::unpack, and ovm_object::record.
ovm_default_table_printer	The table printer is a global object that can be used with ovm_object::do_print to get tabular style printing.
ovm_default_tree_printer	The tree printer is a global object that can be used with ovm_object::do_print to get multi-line tree style printing.
ovm_default_line_printer	The line printer is a global object that can be used with ovm_object::do_print to get single-line style printing.
ovm_default_printer	The default printer is a global object that is used by ovm_object::print or ovm_object::sprint when no specific printer is set.
ovm_default_packer	The default packer policy.
ovm_default_comparer	The default compare policy.
ovm_default_recorder	The default recording policy.

ovm_bitstream_t

The bitstream type is used as a argument type for passing integral values in such methods as set_int_local, get_int_local, get_config_int, report, pack and unpack.

ovm_radix_enum

OVM_BIN	Selects binary (%b) format
OVM_DEC	Selects decimal (%d) format
OVM_UNSIGNED	Selects unsigned decimal (%u) format

OVM_OCT	Selects octal (%o) format
OVM_HEX	Selects hexidecimal (%h) format
OVM_STRING	Selects string (%s) format
OVM_TIME	Selects time (%t) format
OVM_ENUM	Selects enumeration value (name) format

ovm_recursion_policy_enum

OVM_DEEP	Objects are deep copied (object must implement copy method)
OVM_SHALLOW	Objects are shallow copied using default SV copy.
OVM_REFERENCE	Only object handles are copied.

Reporting

ovm_severity

Defines all possible values for report severity.

OVM_INFO	Informative messsage.
OVM_WARNING	Indicates a potential problem.
OVM_ERROR	Indicates a real problem. Simulation continues subject to the configured message action.
OVM_FATAL	Indicates a problem from which simulation can not recover. Simulation exits via $finish after a #0 delay.

ovm_action

Defines all possible values for report actions. Each report is configured to execute one or more actions, determined by the bitwise OR of any or all of the following enumeration constants.

OVM_NO_ACTION	No action is taken
OVM_DISPLAY	Sends the report to the standard output
OVM_LOG	Sends the report to the file(s) for this (severity,id) pair
OVM_COUNT	Counts the number of reports with the COUNT attribute. When this value reaches max_quit_count, the simulation terminates
OVM_EXIT	Terminates the simulation immediately.
OVM_CALL_HOOK	Callback the report hook methods

ovm_verbosity

Defines standard verbosity levels for reports.

OVM_NONE	Report is always printed. Verbosity level setting can not disable it.
OVM_LOW	Report is issued if configured verbosity is set to OVM_LOW or above.
OVM_MEDIUM	Report is issued if configured verbosity is set to OVM_MEDIUM or above.
OVM_HIGH	Report is issued if configured verbosity is set to OVM_HIGH or above.
OVM_FULL	Report is issued if configured verbosity is set to OVM_FULL or above.

Port Type

ovm_port_type_e

OVM_PORT	The port requires the interface that is its type parameter.
OVM_EXPORT	The port provides the interface that is its type parameter via a connection to some other export or implementation.
OVM_IMPLEMENTATION	The port provides the interface that is its type parameter, and it is bound to the component that implements the interface.

Sequences

ovm_sequence_state_enum

CREATED	The sequence has been allocated.
PRE_BODY	The sequence is started and the pre_body task is being executed.
BODY	The sequence is started and the body task is being executed.
POST_BODY	The sequence is started and the post_body task is being executed.
ENDED	The sequence has ended by the completion of the body task.
STOPPED	The sequence has been forcibly ended by issuing a kill() on the sequence.
FINISHED	The sequence is completely finished executing.

Default Policy Classes

Policy classes for ovm_object basic functions, ovm_object::copy, ovm_object::compare, ovm_object::pack, ovm_object::unpack, and ovm_object::record.

ovm_default_table_printer

```
ovm_table_printer ovm_default_table_printer = new()
```

The table printer is a global object that can be used with ovm_object::do_print to get tabular style printing.

ovm_default_tree_printer

```
ovm_tree_printer ovm_default_tree_printer = new()
```

The tree printer is a global object that can be used with ovm_object::do_print to get multi-line tree style printing.

ovm_default_line_printer

```
ovm_line_printer ovm_default_line_printer = new()
```

The line printer is a global object that can be used with ovm_object::do_print to get single-line style printing.

ovm_default_printer

```
ovm_printer ovm_default_printer = ovm_default_table_printer
```

The default printer is a global object that is used by ovm_object::print or ovm_object::sprint when no specific printer is set.

The default printer may be set to any legal ovm_printer derived type, including the global line, tree, and table printers described above.

ovm_default_packer

```
ovm_packer ovm_default_packer = new()
```

The default packer policy. If a specific packer instance is not supplied in calls to ovm_object::pack and ovm_object::unpack, this instance is selected.

ovm_default_comparer

```
ovm_comparer ovm_default_comparer = new()
```

The default compare policy. If a specific comparer instance is not supplied in calls to ovm_object::compare, this instance is selected.

ovm_default_recorder

```
ovm_recorder ovm_default_recorder = new()
```

The default recording policy. If a specific recorder instance is not supplied in calls to ovm_object::record.

Globals

Summary

Globals	
Simulation Control	
run_test	Convenience function for ovm_top.run_test().
ovm_test_done	An instance of the ovm_test_done_objection class, this object is used by components to coordinate when to end the currently running task-based phase.
global_stop_request	Convenience function for ovm_top.stop_request().
set_global_timeout	Convenience function for ovm_top.phase_timeout = timeout.
set_global_stop_timeout	Convenience function for ovm_top.stop_timeout = timeout.
Reporting	
ovm_report_enabled	Returns 1 if the configured verbosity in <ovm_top> is greater than *verbosity* and the action associated with the given *severity* and *id* is not OVM_NO_ACTION, else returns 0.
ovm_report_info	
ovm_report_warning	
ovm_report_error	
ovm_report_fatal	These methods, defined in package scope, are convenience functions that delegate to the corresponding component methods in *ovm_top*.
Verbosity is ignored for warnings, errors, and fatals to ensure users	do not inadvertently filter them out.
Configuration	
set_config_int	This is the global version of set_config_int in ovm_component.
set_config_object	This is the global version of set_config_object in ovm_component.
set_config_string	This is the global version of set_config_string in ovm_component.
Miscellaneous	
ovm_is_match	Returns 1 if the two strings match, 0 otherwise.
ovm_string_to_bits	Converts an input string to its bit-vector equivalent.
ovm_bits_to_string	Converts an input bit-vector to its string equivalent.
ovm_wait_for_nba_region	Call this task to wait for a delta cycle.

Simulation Control

run_test

```
task run_test (string test_name = ""                                          )
```

Convenience function for ovm_top.run_test(). See ovm_root for more information.

ovm_test_done

```
ovm_test_done_objection ovm_test_done = ovm_test_done_objection::get()
```

An instance of the ovm_test_done_objection class, this object is used by components to coordinate when to end the currently running task-based phase. When all participating components have dropped their raised objections, an implicit call to global_stop_request is issued to end the run phase (or any other task-based phase).

global_stop_request

```
function void global_stop_request()
```

Convenience function for ovm_top.stop_request(). See ovm_root for more information.

set_global_timeout

```
function void set_global_timeout(time timeout)
```

Convenience function for ovm_top.phase_timeout = timeout. See ovm_root for more information.

set_global_stop_timeout

```
function void set_global_stop_timeout(time timeout)
```

Convenience function for ovm_top.stop_timeout = timeout. See ovm_root for more information.

Reporting

ovm_report_enabled

```
function bit ovm_report_enabled (int          verbosity,
                                 ovm_severity severity   = OVM_INFO,
                                 string       id         = ""        )
```

Returns 1 if the configured verbosity in <ovm_top> is greater than *verbosity* and the action associated with the given *severity* and *id* is not OVM_NO_ACTION, else returns 0.

See also ovm_report_object::ovm_report_enabled.

Static methods of an extension of ovm_report_object, e.g. ovm_compoent-based objects, can not call *ovm_report_enabled* because the call will resolve to the ovm_report_object:: ovm_report_enabled, which is non-static. Static methods can not call non-static methods of the same class.

ovm_report_info

```
function void ovm_report_info(string id,
                              string message,
                              int    verbosity = OVM_MEDIUM,
                              string filename  = "",
                              int    line      = 0          )
```

ovm_report_warning

```
function void ovm_report_warning(string id,
                                 string message,
                                 int    verbosity = OVM_MEDIUM,
                                 string filename  = "",
                                 int    line      = 0          )
```

ovm_report_error

```
function void ovm_report_error(string id,
                               string message,
                               int    verbosity = OVM_LOW,
                               string filename  = "",
                               int    line      = 0       )
```

ovm_report_fatal

These methods, defined in package scope, are convenience functions that delegate to the corresponding component methods in *ovm_top*. They can be used in module-based code to use the same reporting mechanism as class-based components. See ovm_report_object for details on the reporting mechanism.

Verbosity is ignored for warnings, errors, and fatals to ensure users

do not inadvertently filter them out. It remains in the methods for backward compatibility.

Configuration

set_config_int

```
function void set_config_int (string          inst_name,
                              string          field_name,
                              ovm_bitstream_t value      )
```

This is the global version of set_config_int in ovm_component. This function places the configuration setting for an integral field in a global override table, which has highest precedence over any component-level setting. See ovm_component::set_config_int for details on setting configuration.

set_config_object

```
function void set_config_object (string     inst_name,
                                 string     field_name,
                                 ovm_object value,
                                 bit        clone       = 1            )
```

This is the global version of set_config_object in ovm_component. This function places the configuration setting for an object field in a global override table, which has highest precedence over any component-level setting. See ovm_component::set_config_object for details on setting configuration.

set_config_string

```
function void set_config_string (string inst_name,
                                 string field_name,
                                 string value      )
```

This is the global version of set_config_string in ovm_component. This function places the configuration setting for an string field in a global override table, which has highest precedence over any component-level setting. See ovm_component::set_config_string for details on setting configuration.

Miscellaneous

ovm_is_match

```
`ifdef OVM_DPI import "DPI" function bit ovm_is_match (string expr,
                                                      string str  )
```

Returns 1 if the two strings match, 0 otherwise.

The first string, *expr*, is a string that may contain '*' and '?' characters. A * matches zero or more characters, and ? matches any single character. The 2nd argument, *str*, is the string begin matched against. It must not contain any wildcards.

ovm_string_to_bits

```
function logic[OVM_LARGE_STRING:0] ovm_string_to_bits(string str)
```

Converts an input string to its bit-vector equivalent. Max bit-vector length is approximately 14000 characters.

ovm_bits_to_string

```
function string ovm_bits_to_string(logic [OVM_LARGE_STRING:0] str)
```

Converts an input bit-vector to its string equivalent. Max bit-vector length is approximately 14000 characters.

ovm_wait_for_nba_region

```
task ovm_wait_for_nba_region
```

Call this task to wait for a delta cycle. Program blocks don’t have an nba so just delay for a #0 in a program block.

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