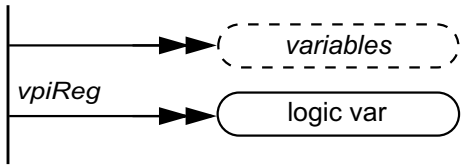
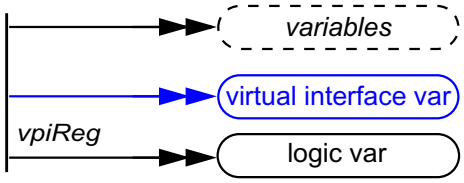
Proposal for Mantis Item #1477

37.12 Scope

REPLACE



WITH



REPLACE

5) A task func can have zero or more statements (see 13.3 and 13.4). If the number of statements is greater than 1, the **vpiStmt** relation shall return an unnamed **`begin`** that contains the statements of the task or function. If the number of statements is zero, the **vpiStmt** relation shall return `NULL`.

WITH

5) A task func can have zero or more statements (see 13.3 and 13.4). If the number of statements is greater than 1, the **vpiStmt** relation shall return an unnamed **`begin`** that contains the statements of the task or function. If the number of statements is zero, the **vpiStmt** relation shall return `NULL`.

6) The **vpiVirtualInterfaceVar** iteration is supported only within elaborated contexts, and is not supported within lexical contexts such as class defns (<ref. to>37.27). If the scope declares an array of virtual interfaces, the **vpiVirtualInterfaceVar** iteration shall return each element of the array separately. However, the **vpiVariables** iteration shall return the array declaration as a single **vpiArrayVar**.

37.13 IO Declaration

REPLACE

2) A ref obj type handle may be returned for the **vpiExpr** of an io decl if it is passed by reference or if the io decl is an interface or a modport.

3) If the **vpiExpr** of an io decl is a ref obj and if the **vpiActual** of the ref obj is an interface or modport declaration,then the **vpiDirection** of the io decl shall be undefined.

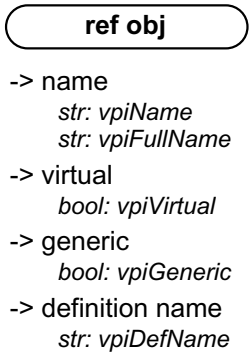
WITH

2) A ref obj type handle ~~may~~ shall be returned for the **vpiExpr** of an io decl if it is passed by reference or if the io decl is an interface or a modport. If the io decl is a virtual interface, **vpiExpr** shall return a **vpiVirtualInterfaceVar**.

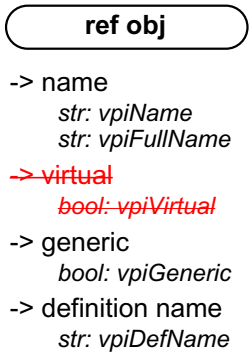
3) If the **vpiExpr** of an io decl is a ref obj and if the **vpiActual** of the ref obj is an interface or modport declaration, then the **vpiDirection** of the io decl shall be undefined. The **vpiDirection** shall also be undefined if the **vpiExpr** is a virtual interface var.

37.15 Reference Objects

REPLACE



WITH



REPLACE

1) A ref obj represents a declared object or sub-element of that object that is a reference to an actual instantiated object. A ref obj exists for ports with **ref** direction, for an interface port, a modport port, or for formal task function ref arguments. The specific cases for a ref obj are:

   — A variable, named event, named event array that is the lowconn of a ref port

   — Any subelement expression of the above

   — A local declaration of an interface or modport passed through a port or any net, variable, named event, named event array of those

   — A virtual interface declaration in a class definition

   — A ref formal argument of a task or function, or sub-element expression of it

2) A ref obj may be obtained when walking port connections (lowConn, highConn), when traversing an expression that is a use of such ref obj, when accessing the virtual interface of a class, or when accessing the io decl of an instance or task or function.

WITH

1) A ref obj represents a declared object or sub-element of that object that is a reference to an actual instantiated object. A ref obj exists for ports with **ref** direction, for an interface port, a modport port, or for formal task function ref arguments. The specific cases for a ref obj are:

   — A variable, named event, named event array that is the lowconn of a ref port

   — Any subelement expression of the above

   — A local declaration of an interface or modport passed through a port or any net, variable, named event, named event array of those

   ~~— A virtual interface declaration in a class definition~~

   — A ref formal argument of a task or function, or sub-element expression of it

2) A ref obj may be obtained when walking port connections (lowConn, highConn), when traversing an expression that is a use of such ref obj, ~~when accessing the virtual interface of a class,~~ or when accessing the io decl of an instance or task or function.

REPLACE

```
endmodule
```

5) The **vpiVirtual** property shall return TRUE if the ref obj is a reference to a virtual interface and FALSE if the ref obj is a reference to an interface that is not a virtual interface. The **vpiVirtual** property shall return **vpiUndefined** for all other kinds of ref obj.

6) The **vpiGeneric** property shall return TRUE if the ref obj is a reference to a generic interface and FALSE if the ref obj is a reference to an interface that is not a generic interface. The **vpiGeneric** property shall return **vpiUndefined** for all other kinds of ref obj.

WITH

```
endmodule
```

~~5) The **vpiVirtual** property shall return TRUE if the ref obj is a reference to a virtual interface and FALSE if the ref obj is a reference to an interface that is not a virtual interface. The **vpiVirtual** property shall return **vpiUndefined** for all other kinds of ref obj.~~

6) The **vpiGeneric** property shall return TRUE if the ref obj is a reference to a generic interface and FALSE if the ref obj is a reference to an interface that is not a generic interface. The **vpiGeneric** property shall return **vpiUndefined** for all other kinds of ref obj.

REPLACE

11) Variables of type **vpiArrayVar** or **vpiClassVar** do not have a value property. Struct var and union var variables for which the **vpiVector** property is FALSE do not have a value property.

WITH

11) Variables of type ~~**vpiArrayVar** or~~ **vpiArrayVar,** **vpiClassVar**, or **vpiVirtualInterfaceVar** do not have a value property. Struct var and union var variables for which the **vpiVector** property is FALSE do not have a value property.

DELETE

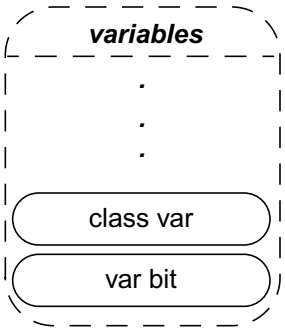
Example 2: virtual interface declaration in a class definition:

```
interface SBus; // A Simple bus interface
  logic req, grant;
  logic [7:0] addr, data;
endinterface

class SBusTransactor; // SBus transactor class
  virtual SBus bus; // virtual interface of type SBus
  function new( virtual SBus s );
    bus = s; // initialize the virtual interface
  endfunction
  task request(); // request the bus
    bus.req <= 1'b1;
  endtask
  task wait_for_bus(); // wait for the bus to be granted
    @(posedge bus.grant);
  endtask
endclass

module devA( Sbus s ); ... endmodule // devices that use SBus

module devB( Sbus s ); ... endmodule

module top;
  SBus s[1:4] (); // instantiate 4 interfaces
  devA a1( s[1] ); // instantiate 4 devices
  devB b1( s[2] );
  devA a2( s[3] );
  devB b2( s[4] );
  initial begin
    SbusTransactor t[1:4]; // create 4 bus-transactors and bind
    t[1] = new( s[1] );
    t[2] = new( s[2] );
    t[3] = new( s[3] );
    t[4] = new( s[4] );
  end
endmodule
```

A ref obj is returned for the left hand side expression of the statement "`bus = s`" in the constructor of the class definition `SBustransactor`. The **vpiName** of that ref obj is "`bus`" and its **vpiDefName** is the name of the interface"`SBus`". The **vpiActual** relationship returns the interface instance associated with that particular call to new after the assignment has executed. For example if it was "`new ( s[1] )`", **vpiActual** would return the interface `s[1]`. If **vpiActual** is queried before the assignment is executed, the method may return NULL if the virtual "`bus`" interface is uninitialized. The right-hand side expression also returns a ref obj which **vpiActual** is the interface instance passed to the call to new.

37.17 Variables

REPLACE



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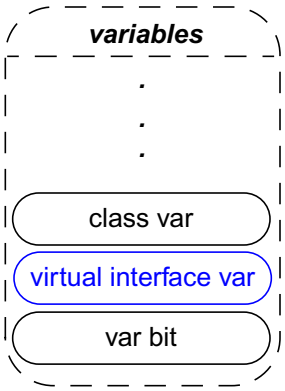
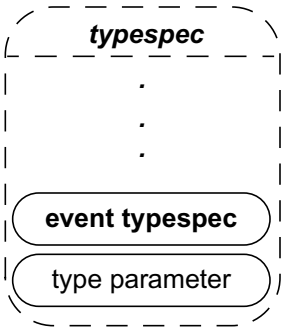
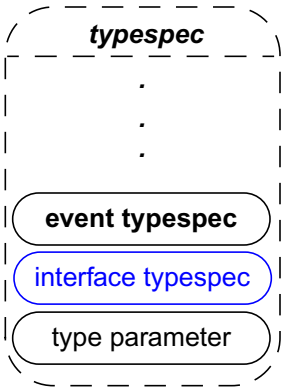


37.23 Typespec

REPLACE

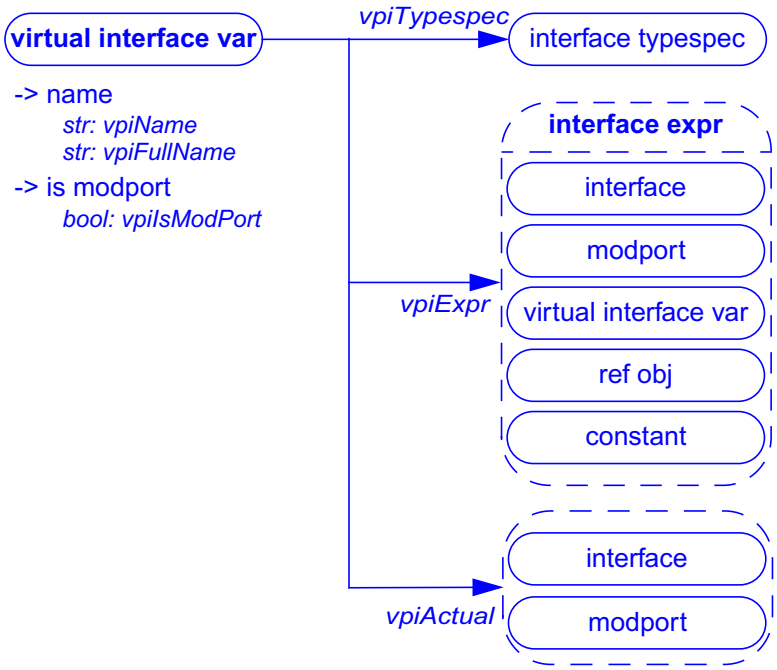


WITH



ADD (after 37.26)

37.27 Virtual interface (NEW section- renumber sections following)



Details:

1) The **vpiExpr** relation shall return the interface instance assigned to the virtual interface in its declaration, if any; otherwise, **vpiExpr** shall return NULL.

2) A ref obj may be an interface expr only if it is a local declaration of an interface or modport passed through a port. A constant may be an interface expr only if it has a **vpiConstType** of **vpiNullConst**.

Example 1:

```
interface SBus #(parameter WIDTH=8);
  logic req, grant;
  logic [WIDTH-1:0] addr, data;
  modport phy(input addr, inout data);
endinterface

module top;

  parameter SIZE = 4;

  virtual SBus#(16) V16;
  virtual SBus#(32).phy V32_Array [1:SIZE];
  ....
endmodule
```

In this example, `V16` is a virtual interface, while `V32_Array` is an array var. The **vpiVariables** iteration from module top includes both `V16` and `V32_Array`, while the **vpiVirtualInterfaceVar** iteration returns

`V16` together with the individual elements of `V32_Array`, that is, `V32_Array[1]` through `V32_Array[4]`.

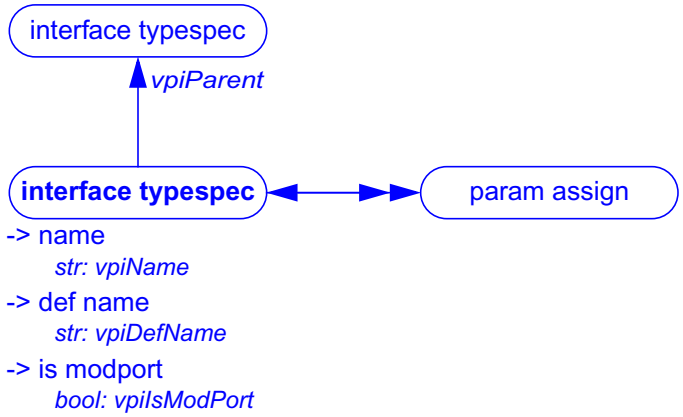
Example 2: Virtual interface declaration in a class definition:

```
interface SBus; // A Simple bus interface
  logic req, grant;
  logic [7:0] addr, data;
endinterface

class SBusTransactor; // SBus transactor class
  virtual SBus bus; // virtual interface of type SBus
  function new( virtual SBus s );
    bus = s; // initialize the virtual interface
  endfunction
  task request(); // request the bus
    bus.req <= 1'b1;
  endtask
  task wait_for_bus(); // wait for the bus to be granted
    @(posedge bus.grant);
  endtask
endclass

module devA( SBus s ); ... endmodule // devices that use SBus

module devB( SBus s ); ... endmodule

module top;
  SBus s[1:4] (); // instantiate 4 interfaces
  devA a1( s[1] ); // instantiate 4 devices
  devB b1( s[2] );
  devA a2( s[3] );
  devB b2( s[4] );
  initial begin
    SbusTransactor t[1:4]; // create 4 bus-transactors and bind
    t[1] = new( s[1] );
    t[2] = new( s[2] );
    t[3] = new( s[3] );
    t[4] = new( s[4] );
  end
endmodule
```

A virtual interface var is returned for the left hand side expression of the statement "`bus = s`" in the constructor of the class definition `SBusTransactor`. The **vpiName** of the virtual interface var is "`bus`", and it has a **vpiInterfaceTypespec** for which the **vpiDefName** is "`SBus`". The **vpiActual** relationship returns the interface instance associated with that particular call to new after the assignment has executed. For example if it was "`new(s[1])`", **vpiActual** would return the interface `s[1]`. If **vpiActual** is queried before the assignment is executed, the method shall return NULL if the virtual interface is uninitialized. In addition, the right-hand side expression of "bus = s" returns a virtual interface var for which **vpiActual** is the interface instance passed to the call to new.

ADD (after 37.26 and new Virtual Interface section)

37.28 Interface typespec (NEW section- renumber following sections)



Details:

1) The **vpiDefName** of an interface typespec that represents a modport shall be the mod port identifier. The **vpiDefName** of an interface typespec that represents an interface shall be the identifier of the interface declaration.

2) For an interface typespec that represents a modport, **vpiParent** shall return an interface typespec of the corresponding interface. For an interface typespec that represents an interface, **vpiParent** shall return NULL.

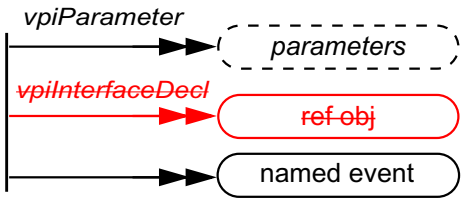
3) In the example below, the first typedef defines an interface typespec corresponding to "`virtual SBus#(16)`" whose **vpiName** is `SB16`. The **vpiDefname** of this typespec shall be `SBus`, and the assigned parameter value of `16` shall be derived by iterating on **vpiParamAssign**. The typedef `SBphy`, however, is an array typespec for which the **vpiElemTypespec** returns an interface typespec corresponding to "`virtual SBus#(32).phy`".

   The **vpiTypedef** iteration from the module `top` returns handles to both `SB16` and `SBphy` interface typespecs.

```
interface SBus #(parameter WIDTH=8);
  logic req, grant;
  logic [WIDTH-1:0] addr, data;
  modport phy(input addr, inout data);
endinterface

module top;

  parameter SIZE = 4;

  typedef virtual SBus#(16) SB16;
  typedef virtual SBus#(32).phy SBphy [1:SIZE];
  ....
endmodule
```

37.27 Class definition (section # reflects original numbering)

REPLACE



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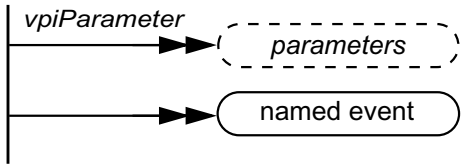


REPLACE

6) The relation to **vpiExtends** exists whenever one class is derived from another class (refer to 8.12). The relation from extends to class typespec provides the base class. The **vpiArgument** iterator from extends shall provide the arguments used in constructor chaining (refer to 8.16).

7) The **vpiInterfaceDecl** iteration returns the virtual interface declarations in the class definition.

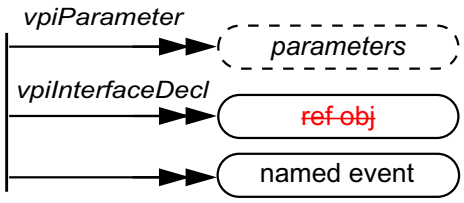
WITH

6) The relation to **vpiExtends** exists whenever one class is derived from another class (refer to 8.12). The relation from extends to class typespec provides the base class. The **vpiArgument** iterator from extends shall provide the arguments used in constructor chaining (refer to 8.16).

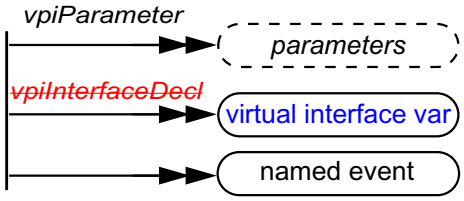
~~7) The **vpiInterfaceDecl** iteration returns the virtual interface declarations in the class definition.~~

37.28 Class typespec (section # reflects original numbering)

REPLACE



WITH



REPLACE

2) For a class typespec that represents only a lexical construct, the one-to-many relations **vpiVariables, vpiMethods**, **vpiConstraint**, **vpiInterfaceDecl**, **vpiNamedEvent**, **vpiNamedEventArray**, **vpiTypedef,** and **vpiInternalScope** are not supported.

WITH

2) For a class typespec that represents only a lexical construct, the one-to-many relations **vpiVariables, vpiMethods**, **vpiConstraint**, ~~**vpiInterfaceDecl,** ~~**vpiNamedEvent**, **vpiNamedEventArray**, **vpiTypedef,** and **vpiInternalScope** are not supported.

REPLACE

10) The **vpiClassTypespec** iteration from a class defn shall return the class specializations derived directly (and not by inheritance) from that class defn.

11) The **vpiInterfaceDecl** iteration shall return the virtual interface declarations in the class specialization.

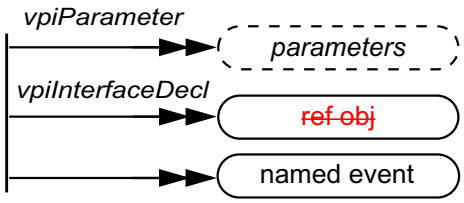
WITH

10) The **vpiClassTypespec** iteration from a class defn shall return the class specializations derived directly (and not by inheritance) from that class defn.

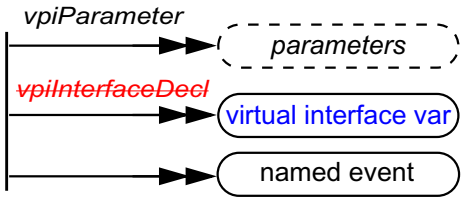
11) ~~The **vpiInterfaceDecl** iteration shall return the virtual interface declarations in the class specialization.~~The **vpiVirtualInterfaceVar** iteration (formerly **vpiInterfaceDecl**- now deprecated in this standard) shall return the virtual interface var declarations in the class specialization (see 37.12 detail 6 (new)). If an array of virtual interfaces is declared, the **vpiVirtualInterfaceVar** iteration shall return each element of the array separately. However, the **vpiVariables** iteration shall return the array declaration as a single **vpiArrayVar**.

37.29 Class variables and class objects (section # reflects original numbering)

REPLACE



WITH



REPLACE

6) From a class obj, the iterations over **vpiVariables**, **vpiMethods**, **vpiNamedEvent**, and **vpiNamedEventArray** shall return both static and automatic properties or methods. However, the iteration over **vpiMethods** shall not include built-in methods for which there is no explicit declaration.

7) The **vpiInterfaceDecl** iteration returns the virtual interfaces of the class object.

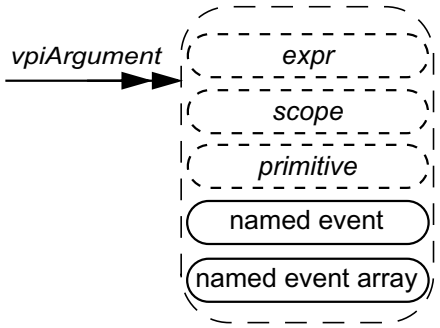
WITH

6) From a class obj, the iterations over **vpiVariables**, **vpiMethods**, **vpiNamedEvent**, and **vpiNamedEventArray** shall return both static and automatic properties or methods. However, the iteration over **vpiMethods** shall not include built-in methods for which there is no explicit declaration.

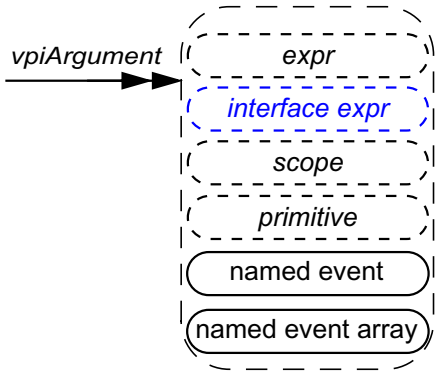
7) ~~The **vpiInterfaceDecl** iteration returns the virtual interfaces of the class object.~~ The **vpiVirtualInterfaceVar** iteration (formerly **vpiInterfaceDecl**- now deprecated in this standard) shall return the virtual interface var declarations in the class object. If an array of virtual interfaces is declared, the **vpiVirtualInterfaceVar** iteration shall return each element of the array separately. However, the **vpiVariables** iteration shall return the array declaration as a single **vpiArrayVar**.

37.38 Task and function call

REPLACE

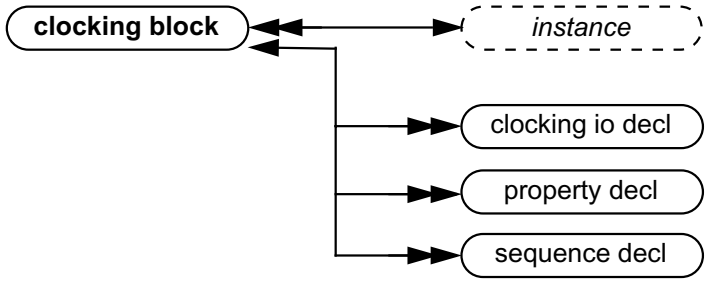


WITH

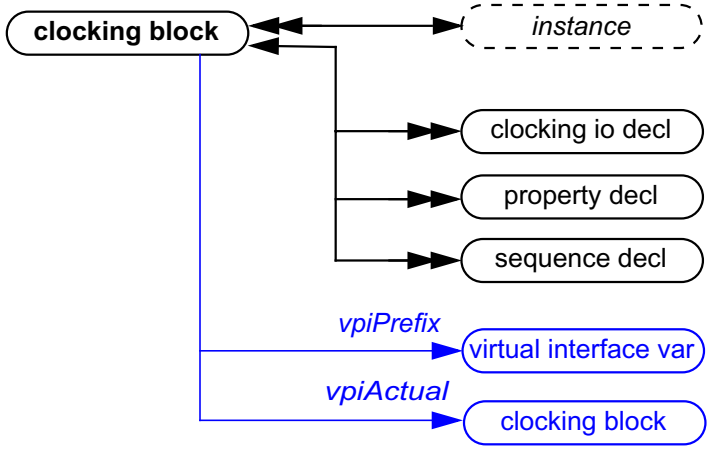


37.44 Clocking block

REPLACE



WITH



REPLACE

Details:

1) The methods, **vpiInputSkew** and **vpiOutputSkew**, and properties **vpiInputEdge** and **vpiOutputEdge**, on the `clocking` block apply to the default constructs. The same methods and properties on the clocking io decl apply to the clocking io decl itself.

2) **vpiExpr** shall return the expression or ref obj referenced by the clocking io decl. Consider input `enable = top.mem1.enable`. Here, "`enable`" is represented by a clocking io decl, and the **vpiExpr** relation returns a handle to "`top.mem1.enable`".

WITH

Details:

1) The methods, **vpiInputSkew** and **vpiOutputSkew**, and properties **vpiInputEdge** and **vpiOutputEdge**, on the `clocking` block apply to the default constructs. The same methods and properties on the clocking io decl apply to the clocking io decl itself.

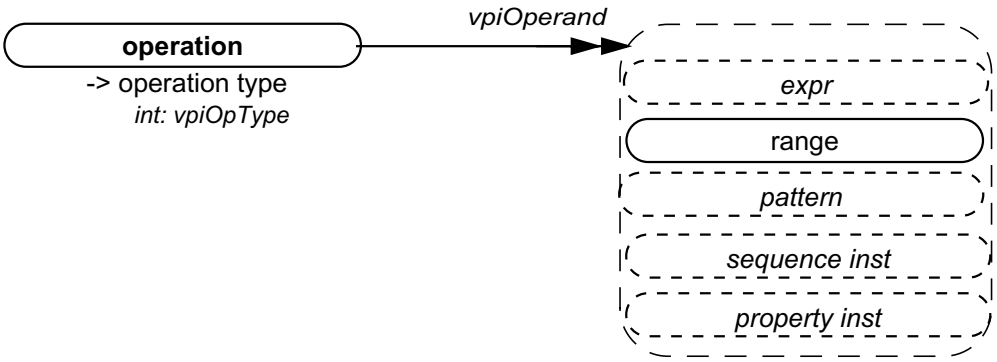
2) The **vpiPrefix** relation shall be non-NULL when the clocking block represents an expression in the SystemVerilog source code immediately prefixed by a virtual interface.

3) If a prefix of a clocking block is a virtual interface that has no value at the current simulation time, the **vpiActual** relation shall return NULL.

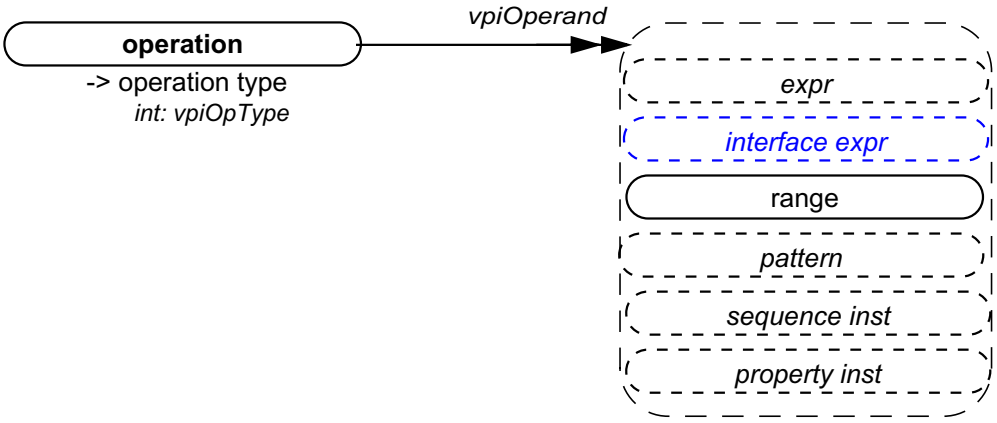
4) **vpiExpr** shall return the expression or ref obj referenced by the clocking io decl. Consider input `enable = top.mem1.enable`. Here, "`enable`" is represented by a clocking io decl, and the **vpiExpr** relation returns a handle to "`top.mem1.enable`".

37.55 Expressions

REPLACE

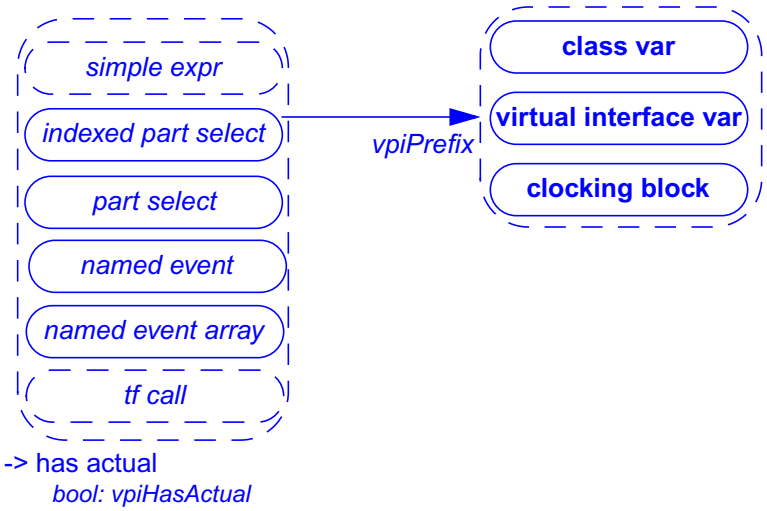


WITH



ADD (after 37.56)

37.57 Dynamic prefixing (NEW section)



Details:

1) The **vpiPrefix** relation shall be non-NULL when the object represents an expression or task call in the SystemVerilog source code prefixed by a virtual interface or a clocking block, or when the object is all or part of a non-static class property prefixed by a class var.

2) The memory allocation scheme value for an object for which a class var or virtual interface var **vpiPrefix** is non-NULL shall be the same as for the prefix.

3) The property **vpiHasActual** shall return TRUE

   — whenever the prefix object has a corresponding actual at the current simulation time.

   — if the object is all or part of a statically declared object in an elaborated context.

   — if the object is part or all of an automatically allocated variable obtained from a frame (<ref. to>37.39).

   The propertly **vpiHasActual** shall return FALSE

   — whenever the prefix object has no corresponding actual at the current simulation time.

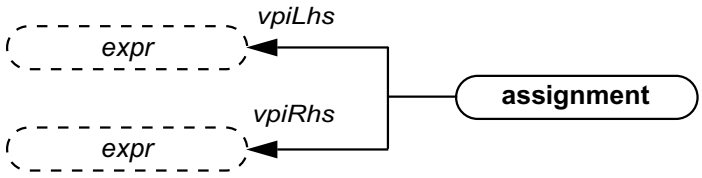
   — if the object is obtained from a lexical context, such as from a class defn (<ref. to>37.27).

   — if the object is part or all of a nonstatic class property variable referenced relative to its class typespec(<ref. to>37.28).

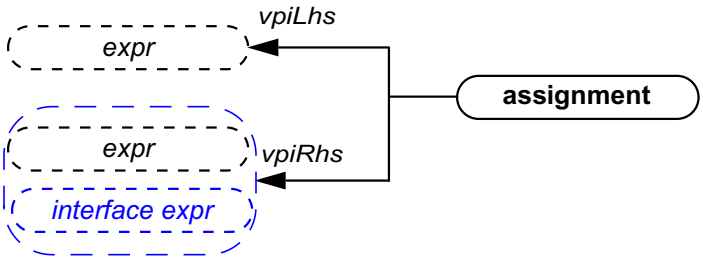
   — if the object is part or all of a automatically allocated variable obtained from a task or function declaration (<ref. to>37.37).

37.59 Assignment

REPLACE



WITH



C.4 Constructs identified for deprecation

ADD

C.4.3 VPI definitions

Certain object, relationship, and property definitions have been deprecated to implement corrections and improvements to VPI. Some have been inherited from IEEE Std 1364 (see 36.12.1) and some have been changed or removed to maintain consistency with related improvements, as follows:

1) **vpiMemory** (as an object type)

The **vpiArrayVar** (**vpiRegArray**) object type has been generalized to include **vpiMemory** and all other arrays of variables. **vpiMemory** therefore no longer represents a VPI object type, except under certain backwards compatibility modes (see 36.12.1). However, it is still in use as a transition (see 37.20 diagram and detail 1).

2) **vpiMemoryWord** (as an object type)

This was exclusively used to represent elements of **vpiMemory** objects in IEEE Std 1364. Since **vpiArrayVar** (**vpiRegArray**) has replaced the definition of **vpiMemory**, and variable object types now represent their elements, this is represented by **vpiLogicVar** (**vpiReg**) types. Therefore, it no longer represents a VPI object type, except under certain backwards compatibility modes (see 36.12.1). It is still in use as a transition, however(see 37.20 diagram and detail 1).

3) **vpiArray** property

In IEEE Std 1364, variable types **vpiIntegerVar**, **vpiTimeVar**, and **vpiRealVar** could represent single variable objects or arrays of those objects. The **vpiArray** property was required to distinguish those cases (the property returned `TRUE` when they were arrays). Also, the property indicated when **vpiReg** types represented elements of **vpiRegArray**s. These two uses became conflicting and unnecessary when **vpiRegArray**s and arrays of integer, time, and real variables were generalized as **vpiArrayVar** (**vpiRegArray**) objects. To distinguish when any variable is an element of an array, the **vpiArrayMember** property is now used, thus replacing the original use of **vpiArray** for reg types. The **vpiArray** property now has only limited use in IEEE 1364 backwards compatibility modes when **vpiIntegerVar**, **vpiTimeVar**, and **vpiRealVar** could represent arrays (see 36.12.1).

4) **vpiValid** property

Significant revisions to VPI have rendered the original **vpiValid** property inconsistent with its original purpose, which was to determine the extent to which a *transient* object represented by a VPI handle was active or "alive" (see 37.2.4 and 37.3.7). Since the VPI object model no longer supports maintaining handles to objects whose lifetimes have ended, such "validity" is implicit in their existence, and their status must be determined by other means (see 38.36.1).

5) **vpiInterfaceDecl** one-to-many relationship

This relationship was used to return **vpiRefObj** objects representing virtual interface variables from any scope. Its definition has been made equivalent to **vpiVirtualInterfaceVar**, which instead returns **vpiVirtualInterfaceVar** object types. This was done to correctly reflect the true variable-like characteristics of these objects (see 37.28 (adjust to new section #) detail 11).

M.2 Source code [appendix M, sv_vpi_user.h]

REPLACE:

```
#define vpiPackedArrayVar 623
```

WITH:

```
#define vpiPackedArrayVar 623
#define vpiVirtualInterfaceVar 728
```

.....

REPLACE:

```
#define vpiInterfaceDecl 728
```

WITH:

```
#define vpiInterfaceDecl vpiVirtualInterfaceVar /* interface decl deprecated */
```

.....

REPLACE:

```
#define vpiVirtual 635
```

WITH:

```
#define vpiVirtual 635
#define vpiHasActual 636
```

.....

REPLACE:

```
/*********************** task/function properties ***********************/
#define vpiOtherFunc 6 /* returns other types; for property vpiFuncType */
/* vpiValid,vpiValidTrue,vpiValidFalse are deprecated in 1800-2009 */

/************************ value for vpiValid ****************************/
#define vpiValidUnknown 2 /* Validity of variable is unknown */
```

WITH:

```
/*********************** task/function properties ***********************/
#define vpiOtherFunc 6 /* returns other types; for property vpiFuncType */

/* vpiValid and vpiValidUnknown are deprecated in 1800-2009 */
/************************ value for vpiValid ****************************/
#define vpiValidUnknown 2 /* Validity of variable is unknown */
```