
SV to C, C to SV Function Call Proposal

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SV-to-C Declaration Syntax

```
extern_decl ::=  
    extern [attribute {, attribute}]  
        return_type fname ( [arg {, arg}] ) ["cname"];
```

```
attribute ::= pure | queueable
```

Examples:

```
// Declare an SV callable, pure, C function  
extern pure integer MyCFunc( input integer portID );  
  
// Declare an pure SV callable, void C function  
extern pure void MyCFunc(  
    input integer portID, output integer mappedID );  
  
// Declare an SV callable, queueable, aliased C function  
extern queueable void MyCFunc( input integer portID )  
    "AliasedCFunc";
```

SV-to-C Simple Function Binding

- For free functions, i.e. no contexts involved, no special binding API call required.
- Simply define the function on the C side ...

```
int MyCFunc( int portID ){  
    return map(portID);  
}
```

- ... and call it from the SV side.

```
always @( my_clock ) begin  
    if( my_reset ) begin  
        // Blah, blah, blah;  
    end  
    else begin  
        if( state == READY ) begin  
            mappedID <= MyCFunc( portID ); // Call to C.  
            state <= WAITING;  
        end  
        // Blah, blah, blah;  
    end  
end
```

SV-to-C Context Specific Function Binding

- For context specific functions use `tf_isetworkarea()`, `tf_igetworkarea()`, `tf_getinstance()`, `tf_mipname()` in current PLI interface to establish context to be associated with each instance specific SV call.
- The equivalent can probably also be done using VPI functions as well (exercise left to reader !).
- Define a function on the C side that calls `tf_getinstance()` and `tf_igetworkarea()` to fetch a *context* pointer previously established as described above:

```
void MyCFunc(int portID, int *mappedID ){
    MyCModel *me = (MyCModel *)tf_igetworkarea(
        tf_getinstance() );
    *mappedID = me->map(portID);
}
```

- During initialization, bind the model context to the SV caller instance:

```
void MyCModel::Init( ){
    tf_isetworkarea( this, tf_mipname("top.u1") );
}
```

C-to-SV Declaration Syntax

```
export_decl ::=  
    export [attribute {, attribute}]  
        [scopename{::scopename}::]fname ["cname"];
```

```
scopename ::= modulename|interfacename
```

```
attribute ::= pure | queueable
```

Example:

```
// Declare a C callable, context specific, SV function  
export MySvModule::MySvFunc "MySvModule_MySvFunc";
```

```
module MySvModule( ... );  
    ...  
    function MySvFunc;  
        input integer portID;  
        output integer mappedID;  
  
        mappedID = map[portID];  
    endfunction  
    ...  
endmodule
```

C-to-SV Context Specific Function Binding

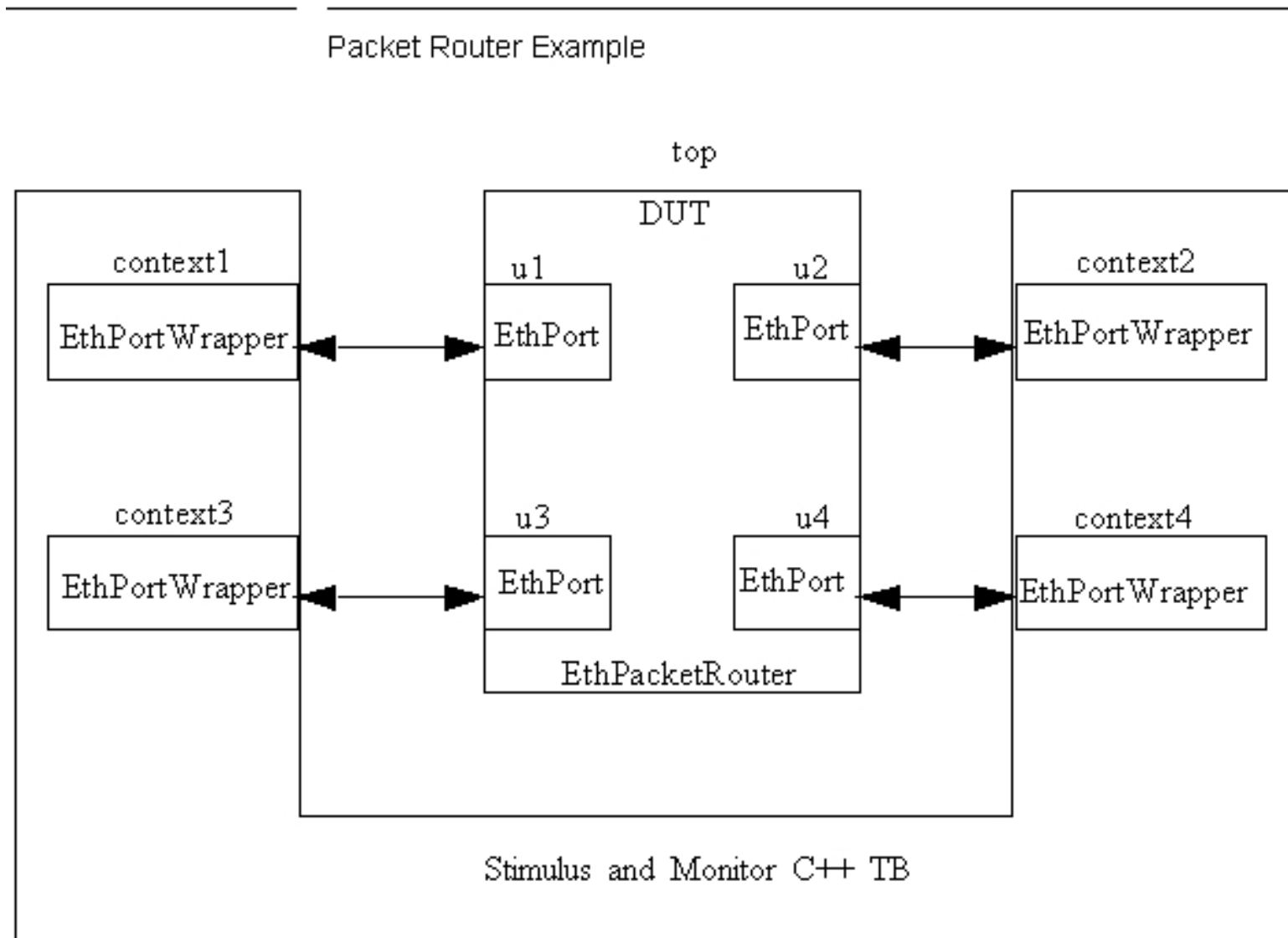
- For context specific functions use `tf_mipname( )` to establish context to be associated with each instance specific SV callee:
- The equivalent can probably also be done using VPI functions as well (exercise left to reader !).
- During initialization, establish a context handle to the SV callee instance:

```
void MyCModel::Init( ){  
    dSvContext = tf_mipname( "top.u1" );  
}
```

- Now at run-time call the SV function from C passing the context handle as the first argument:

```
void MyCModel::RunTest( int portID ){  
    MySvModule_MySvFunc( dSvContext, portID, &mappedID );  
    . . .  
}
```

Packet Router Example



Packet Router Example: SystemC Testbench Root

```
1  SC_MODULE( TestBench ){
2      private:
3          EthPortWrapper *context1;
4          EthPortWrapper *context2;
5          EthPortWrapper *context3;
6          EthPortWrapper *context4;
7          int numOutputs;
8
9          void testThread(); // Main test driver thread.
10     public:
11         SC_CTOR( System ) : numOutputs(0) {
12
13             SC_THREAD( testThread );
14             sensitive << UTick;
15
16             // Construct 4 instances of reusable EthPortWrapper
17             // class for each of 4 different HDL module instances.
18             context1 = new EthPortWrapper( "c1" ); context1->Bind( "top.u1", this );
19             context2 = new EthPortWrapper( "c2" ); context2->Bind( "top.u2", this );
20             context3 = new EthPortWrapper( "c3" ); context3->Bind( "top.u3", this );
21             context4 = new EthPortWrapper( "c4" ); context4->Bind( "top.u4", this );
22         }
23         void BumpNumOutputs(){ numOutputs++; }
24     };
25
26     void TestBench::testThread(){
27         // Now run a test that sends random packets to each input port.
28         context1->PutPacket( generateRandomPayload() );
29         context2->PutPacket( generateRandomPayload() );
30         context3->PutPacket( generateRandomPayload() );
31         context4->PutPacket( generateRandomPayload() );
32
33         while( numOutputs < 4 ) // Wait until all 4 packets have been received.
34             sc_wait();
35     }
```

Packet Router Example: SystemC EthPortWrapper Module

```
1  SC_MODULE( EthPortWrapper ){
2      private:
3          void *dSvContext;
4          sc_module *myParent;
5
6      public:
7          SC_CTOR( EthPortWrapper ) : dSvContext(0), myParent(0) { }
8          void Bind( const char *hdlPath, sc_module *parent );
9          void PutPacket( vec32 *packet );
10
11      friend void HandleOutputPacket( int portID, vec32 *payload );
12  };
13
14  void EthPortWrapper::Bind( const char *hdlPath, sc_module *parent ){
15      myParent = parent;
16      dSvContext = tf_mipname( hdlPath );
17      tf_isetworkarea( this, tf_mipname(hdlPath) );
18  }
19
20  void EthPortWrapper::PutPacket( sv_handle *packet ){
21      EthPort_PutPacket( dSvContext, packet ); // Call SV function.
22  }
23
24  friend void HandleOutputPacket( int portID, sv_handle *payload ){
25      EthPortWrapper *me = (EthPortWrapper *)tf_igetworkarea( tf_getinstance() );
26
27      me->myParent->BumpNumOutputs(); // Let top level know another packet received.
28
29      printf( "Received output on port on port %\n", portID );
30      me->DumpPayload( payload );
31  }
```

Packet Router Example: SystemVerilog EthPort Module

```
1  module EthPort(
2      MiiOutData,          MiiInData,
3      MiiOutEnable,        MiiInEnable,
4      MiiOutError,         MiiInError,
5      clk, reset );
6
7      input [7:0] MiiOutData;      output [7:0] mii_data;
8                                  reg    [7:0] mii_data;
9      input MiiOutEnable;         output mii_enable;
10                                   reg    mii_enable;
11      input MiiOutError;         output mii_error;
12                                   reg    mii_error;
13      input clk, reset;
14
15      extern HandleOutputPacket(
16          input integer portID, input reg [1439:0] *payload );
17
18      export PutPacket "EthPort_PutPacket";
19
20      reg packetReceivedFlag;
21      reg [1499:0] packetData;
22
23      function PutPacket;
24          input reg [1499:0] packet;
25
26          packetData = packet;
27          packetReceivedFlag = 1;
28      endfunction
```

Packet Router Example: SystemVerilog EthPort Module (cont'd)

```
1      always @( clk ) begin          // input packet FSM
2          if( reset ) begin
3              // Blah, blah, blah ...
4          end
5          else begin
6              if( instate == READY ) begin
7                  if( packetReceived )
8                      state <= PROCESS_INPUT_PACKET;
9              end
10             else if( instate == PROCESS_INPUT_PACKET ) begin
11                 // Start processing input packet byte by byte ...
12             end
13         end
14     end
15
16     always @( clk ) begin          // output packet FSM
17         if( reset ) begin
18             // Blah, blah, blah ...
19         end
20         else begin
21             if( outstate == READY ) begin
22                 if( MiiOutEnable )
23                     state <= PROCESS_OUTPUT_PACKET;
24             end
25             else if( outstate == PROCESS_OUTPUT_PACKET ) begin
26                 // Start assembling output packet byte by byte ...
27                 ...
28                 // Make call to C side to handle it.
29                 HandleOutputPacket( myPortID, outPacketVector );
30             end
31         end
32     end
33 endmodule
```