Abstraction of Communication and Concurrency in VHDL

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Complexity Management

- For system-level design of behavior
  - abstraction of data
  - abstraction of communication & timing
  - abstraction of concurrency
- SUAVE:
  - SAVANT & University of Adelaide VHDL Extensions
  - object-oriented data modeling
  - genericity
  - communication & concurrency

Design Objectives

- Abstract communication (*cf* signals)
- Dynamic process creation/termination
- Avoid bias toward hardware or software
- Integration with existing language and oo/genericity extensions
- superset of existing language

Communication

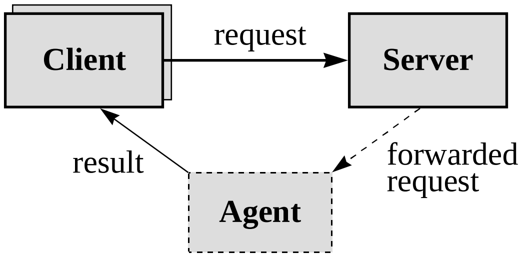
- Channel types
- Channel objects
- Interface channels
  - – ports and parameters
- Dynamically created channels
  - – access-to-channel types
- Message passing
  - – send/receive
  - – select (non-deterministic choice)

Concurrency

- Process declaration
  - generic and port clauses define interface
- Static instantiation
- Dynamic instantiation

Example

- Client-server system
  - number of clients not known *a priori*
  - multi-threaded server
  - creates new process to handle a request



System Overview

```
architecture system_level of client_server_system is
    type result_value is …;
    type result_channel is channel result_value;
    type result_ref is access result_channel;
    type request_info is record
        ...;  -- info for the transaction
        result_please : result_ref;
    end record request_info;
    process client is …
    process server is …
    channel server_request : request_info;
begin
    the_server : process server
        port map ( request => server_request );
    a_client : process client
        port map ( request => server_request );
end architecture system_level;
```

Client Process Declaration

```
    process client is
        port ( channel request : out request_channel );
        variable result : result_ref := new result_channel;
    begin
        ...
        send ( …, result ) to request;
        receive … from result.all;
        ...
    end process client;
```

Server Process Declaration

```
process server is
      port ( channel request : in request_channel );
      process agent is
            port ( channel request : in request_channel );
            variable info : request_info;
      begin
            receive info from request;
            …;  -- perform transaction
            send … to info.result_please.all;
            terminate;
      end process agent;
      variable info : request_info;
      variable new_agent_request : request_ref;
begin
      receive info from request;
      new_agent_request := new request_channel;
      process agent
            port map ( request => new_agent_request.all );
      send info to new_agent_request.all;
end process server;
```

Summary

- Complexity management ⇒ abstraction
- SUAVE: abstraction for
  - – data modeling
  - – communication & timing
  - – concurrency
- System-level modeling
  - – pre hardware/software partitioning
- Further info
  - – http://www.ececs.uc.edu/~petera/suave.html