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CORBA Based Co-Verification Methodology For SystemC

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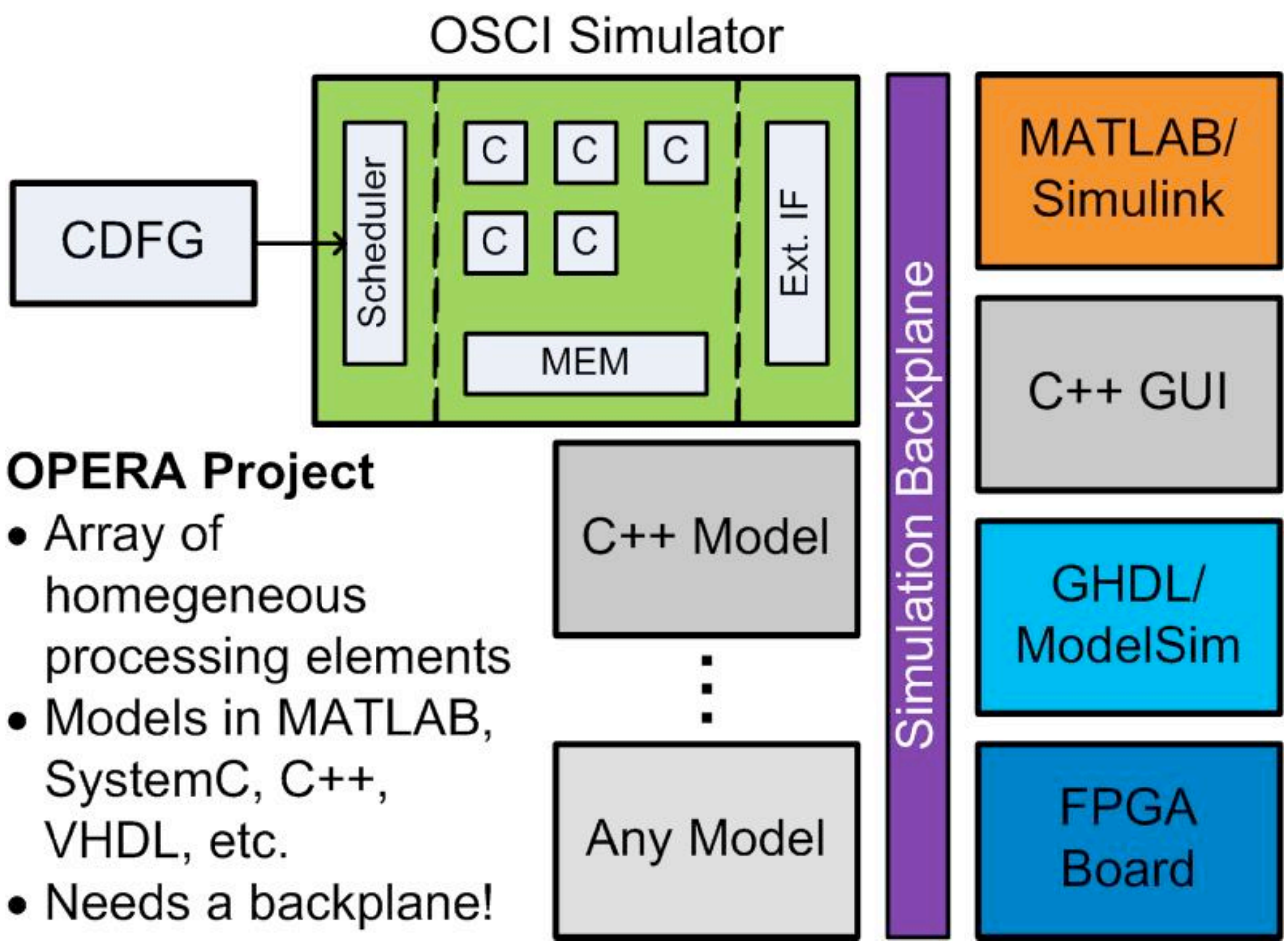
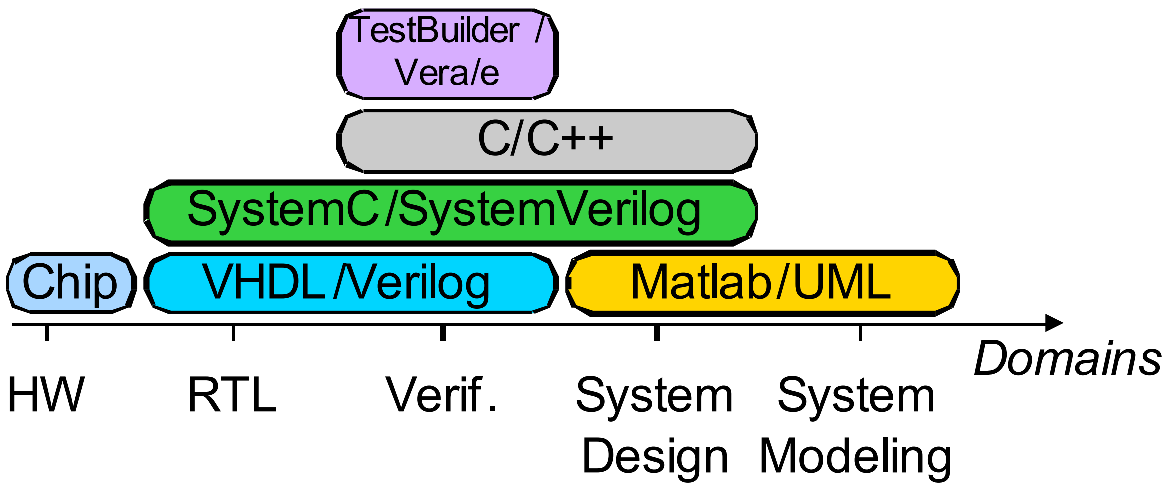
octasic semiconductor
Communicate. Your Way.

Motivation


OSCI Simulator
CDFG
Scheduler
C
C
C
C
C
MEM
Ext. IF
Simulation Backplane
MATLAB/ Simulink
C++ GUI
GHDL/ ModelSim
FPGA Board
C++ Model
Any Model
OPERA Project
• Array of homegeneous processing elements
• Models in MATLAB, SystemC, C++, VHDL, etc.
• Needs a backplane!

Problem description

- Design complexity
- Various modeling languages: heterogeneous design and verification components
- Specialized and complementary simulators and/or tools excelling in their respective domains
- Design architecture may change

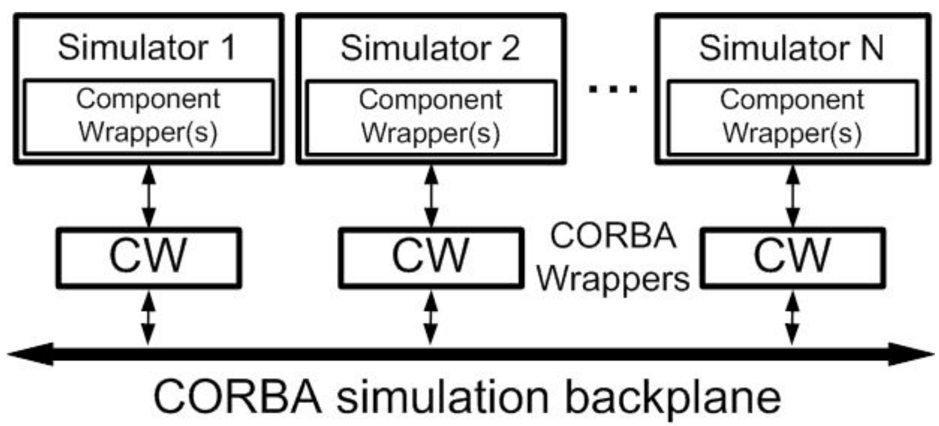


Outline

- Proposed Methodology
  - Communication
  - Data Adaptation
  - Tools Involved
- Results
  - Demo
  - Observed Benefits
- Conclusion & Future Work

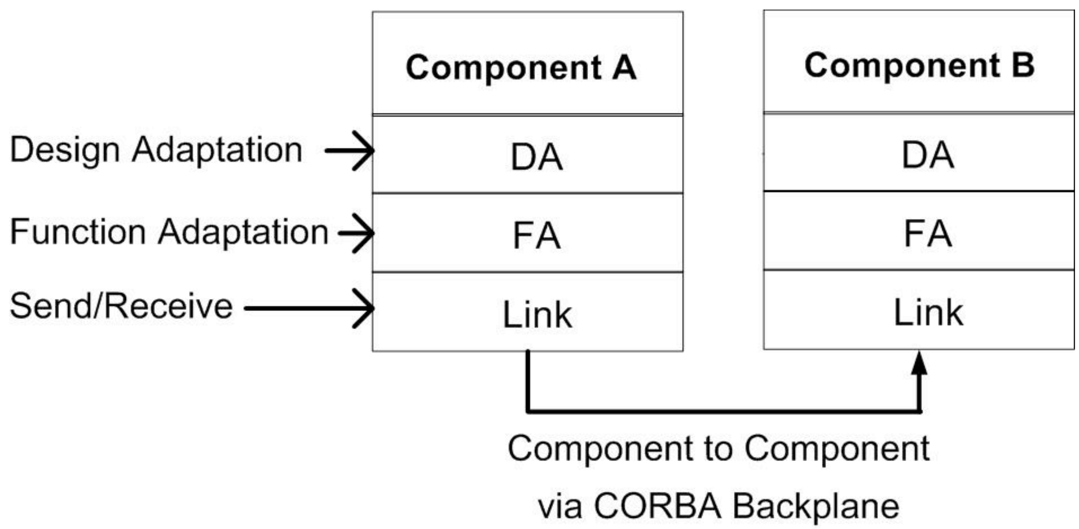
Proposed Methodology (1/2)

- Communication
  - Make simulators and tools communicate in a standard way
  - Use CORBA as a simulation backplane



Proposed Methodology (2/2)

- Data adaptation
  - Convert data where abstraction levels have different representations
  - Implement transactor concept



Communication: Why CORBA? (1/2)

- Broadly accepted and used architecture
  - From military to free/libre software hobbyists
  - From real-time hardware to software
- Language and platform independent
  - Code generators for a plethora of languages e.g. C/C++, Ada, Python and VHDL
  - Implementation for various platforms such as MS Windows, GNU/Linux, MacOS X, etc.

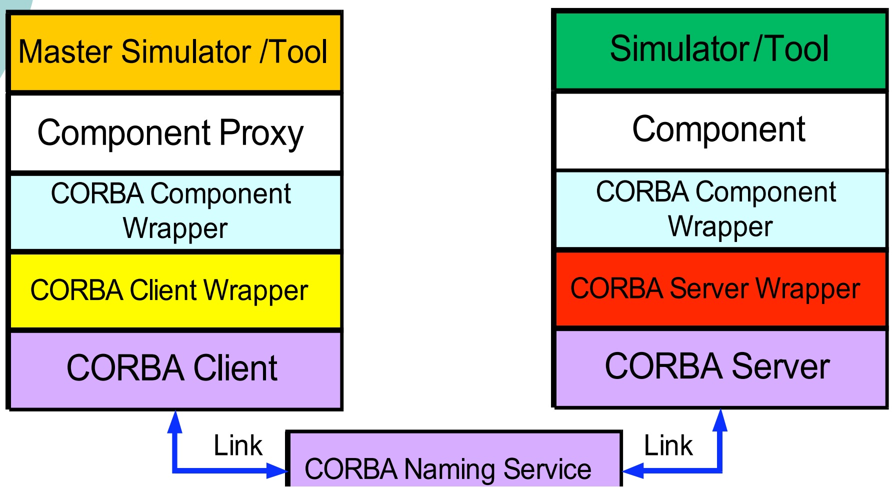
Communication: Why CORBA? (2/2)

- Supports various transport and pseudo-transport protocols
  - e.g. TCP/IP, SSH, shared memory and file.
- Extensible Transport Framework allows addition of unsupported protocols
- Hardware support starts to appear
  - PrismTech's Integrated Circuit ORB
  - Objective Interface Systems' ORB*express* FPGA
- Allows distributed processing

Communication: CORBA Introduction

- Component interfaces are described using the Interface Definition Language (IDL)
- Any tool/simulator can be used as a master or slave as long as it can integrate an ORB server or client
- A Naming Service keeps track of the ORBs providing objects (components)
- Any transport protocol can be used as long as the Naming Service supports it (ETF allows more)

Communication: Layered Structure



CORBA Component Wrapper

Transactor, performs signal adaptation and synchronization

CORBA Client /Server Wrapper

Handles CORBA Client /Server initialization and destruction

CORBA Client /Server

Autogenerated Client /Server requesting /providing components

CORBA Naming Service

Makes the connection between components requesters /providers.

Link

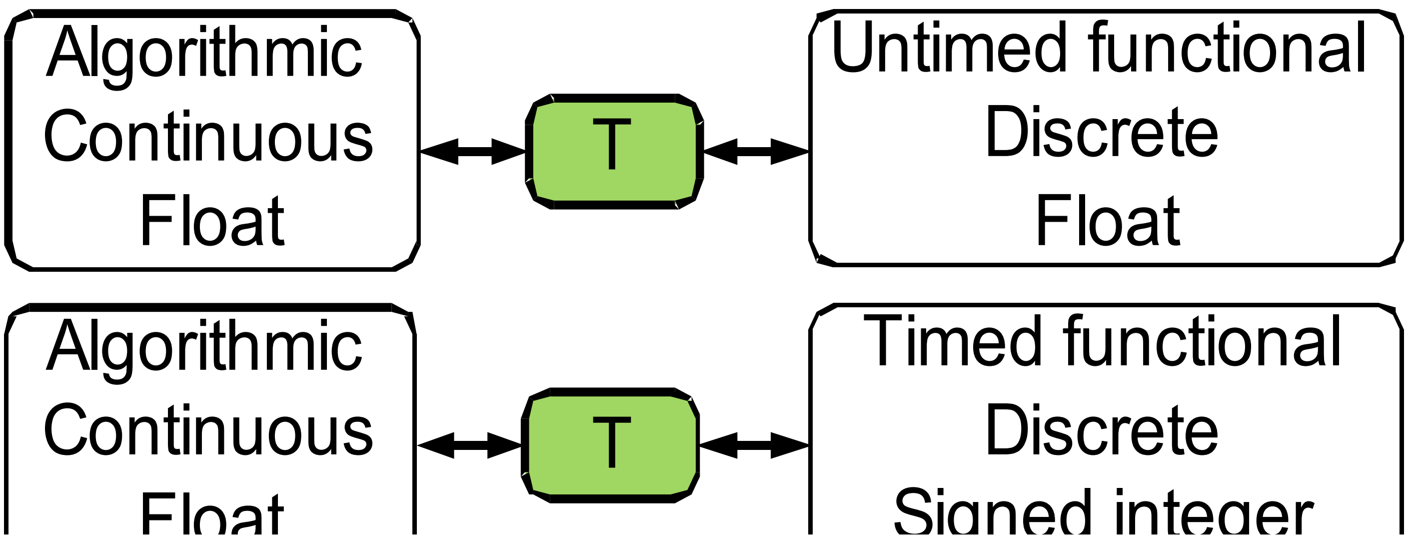
Implements any transport protocol supported by the CORBA Naming Service e.g. TCP/IP

Communication: Integrating CORBA to SystemC

- Required steps:
  - Defining components interfaces (IDL file)
  - Autogenerate CORBA servers and clients (feeding IDL file to code generator)
  - Write CORBA Wrappers for…
    - Components
    - Servers
    - Clients
- Easy to implement once we've been through the first wrapper
- Less than week to implement demo

Data Adaptation: Transactor examples

- Component Wrappers also are transactors
- Transactors can either be on the client or server side



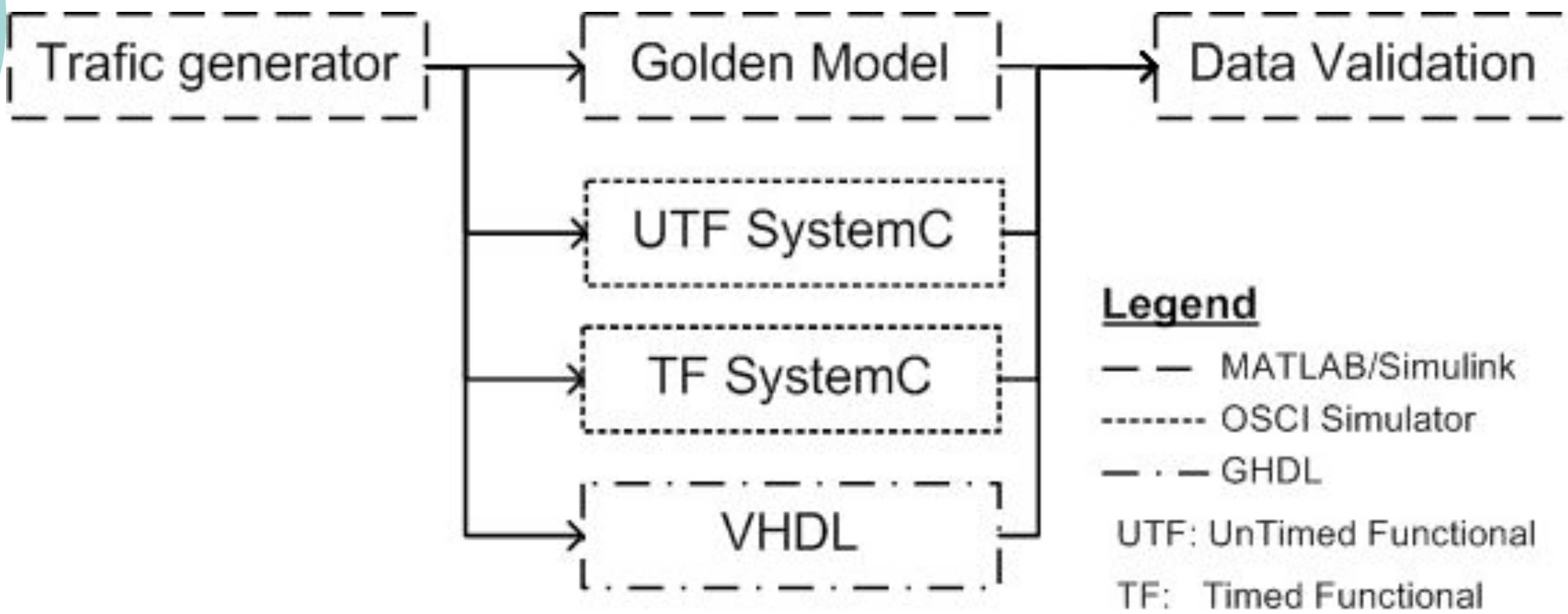
Tools Involved

- MathWorks MATLAB
  - Algorithmic Modeling
- Open SystemC Initiative Simulator
  - System Level Design
- GHDL
  - RTL Modeling
- TAO
  - CORBA Backplane
  - Code generation
- GCC and Autotools
  - Configuration and compilation

Results/Demonstration (1/2)

- Design a FIR filter from algorithmic modeling to RTL design
- One testbench
- Generate data with MATLAB/Simulink
- Feed data to all implementations:
  - Algorithmic level (MATLAB)
  - System level – UTF (SystemC)
  - System level – TF (SystemC)
  - RTL (VHDL)
- Display/validate results in MATLAB/Simulink

Results/Demonstration (2/2)



Results: Observed Benefits

- Seamless integration of multiple:
  - Levels of abstraction
  - Modeling languages
  - "*Physical*" location and/or simulators/tools
- Same testbench across all implementations
- Language independence : from Algorithmic level to RTL
- Platform independence: anything that can implement CORBA
- Components can be refined independently

Conclusion

- Simulator/Tool-independent solution addressing heterogeneity
- Integrates to OSCI simulator w/o any modification to the core
- CORBA client/server wrappers hide communication complexity
- Data can be adapted by CORBA Component Wrappers acting as transactors
- Has a distributed topology
- Promotes open standards

Future Work

- Cleaner SystemC integration (TLM-2)
- Performance evaluation/tweaking
- Add support for ModelSim
- Hardware-In-the-Loop with PrismTech ICO

References

- The ACE ORB
  - http://www.cs.wustl.edu/~schmidt/TAO.html
- SystemC
  - http://www.systemc.org
- MathWorks MATLAB
  - http://www.mathworks.com
- GHDL
  - http://ghdl.free.fr
- PrismTech ICO
  - http://www.prismtech.com

Questions?

Thank you for listening!

Contact me at

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