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Hardware Description Languages (HDL)

talarico@gonzaga.edu

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Common HDLs

- Verilog
  - IEEE Standard 1364-2005
- VHDL = VHSIC HDL
  - IEEE Standard 1076-2008 ← First to be standardized
- System Verilog (SV)
  - IEEE Standard 1800-2012
- SpecC
- SystemC
  - IEEE Standard 1666-2011
- …

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VHDL

V *Very High Speed Integrated Circuit*

H *Hardware*

D *Description*

L *Language*

HDLs vs. Software Languages

Concurrent (parallel) statements

vs.

Sequential statements

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Role of HDLs

- Design Description and Documentation
  - unambiguous definition of components, functionality and interfaces
- Design Simulation
  - verify system/subsystem performance and functional correctness prior to design implementation
- Design Synthesis
  - automated generation of hardware circuit

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HDL Benefits

- Raising the design abstraction level (hiding details)
  - The design task become simpler
  - The design is less error prone
  - Productivity is increased
- Interoperability: it is possible to combine models at multiple levels of abstraction
- Technology independence: models are portable
- Design re-use (faster design to market)
- Cost reduction

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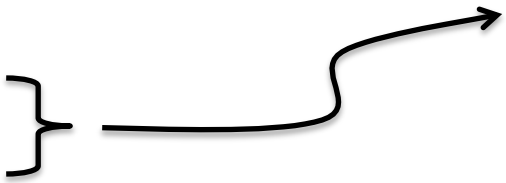
HDL coding styles

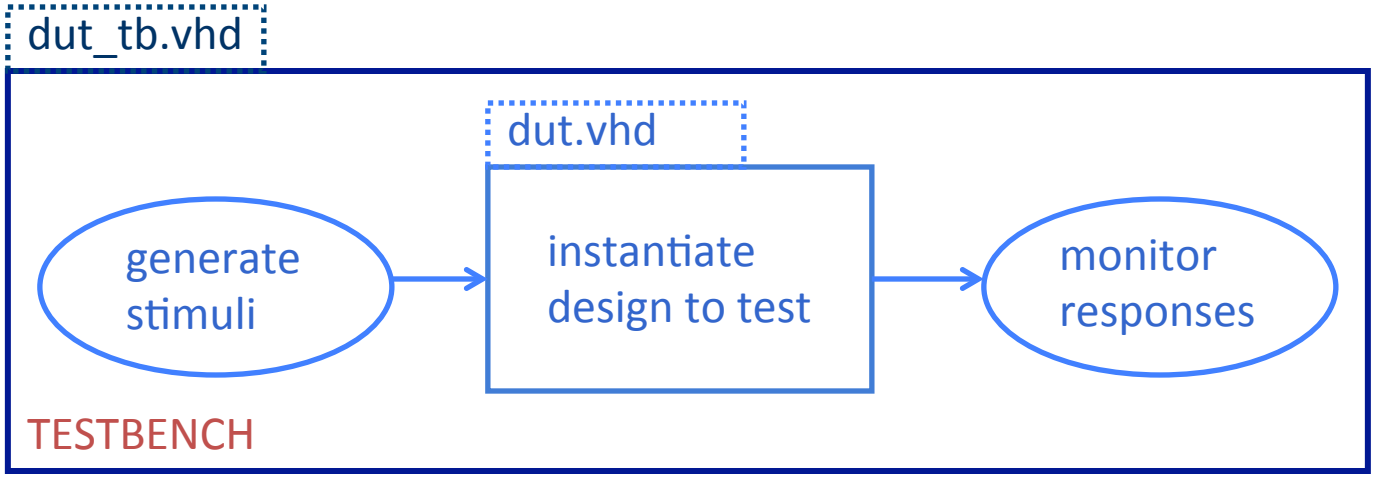
- Register Transfer Level
- Structural
- Behavioral



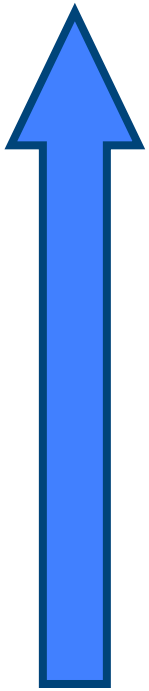
Be careful NOT everybody gives the same meaning to the term BEHAVIORAL !

HDL Applications

- High Level Modeling (Behavioral style)
- Design Entry (Structural & RTL styles)
- Simulation (Behavioral style)
  - Validation by mean of a test bench



HDL coding styles vs. Abstraction



Behavioral

RTL

Structural

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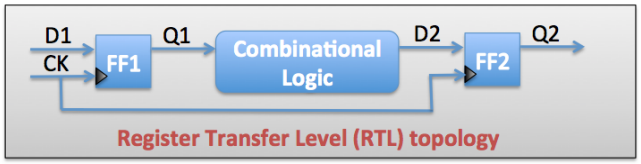
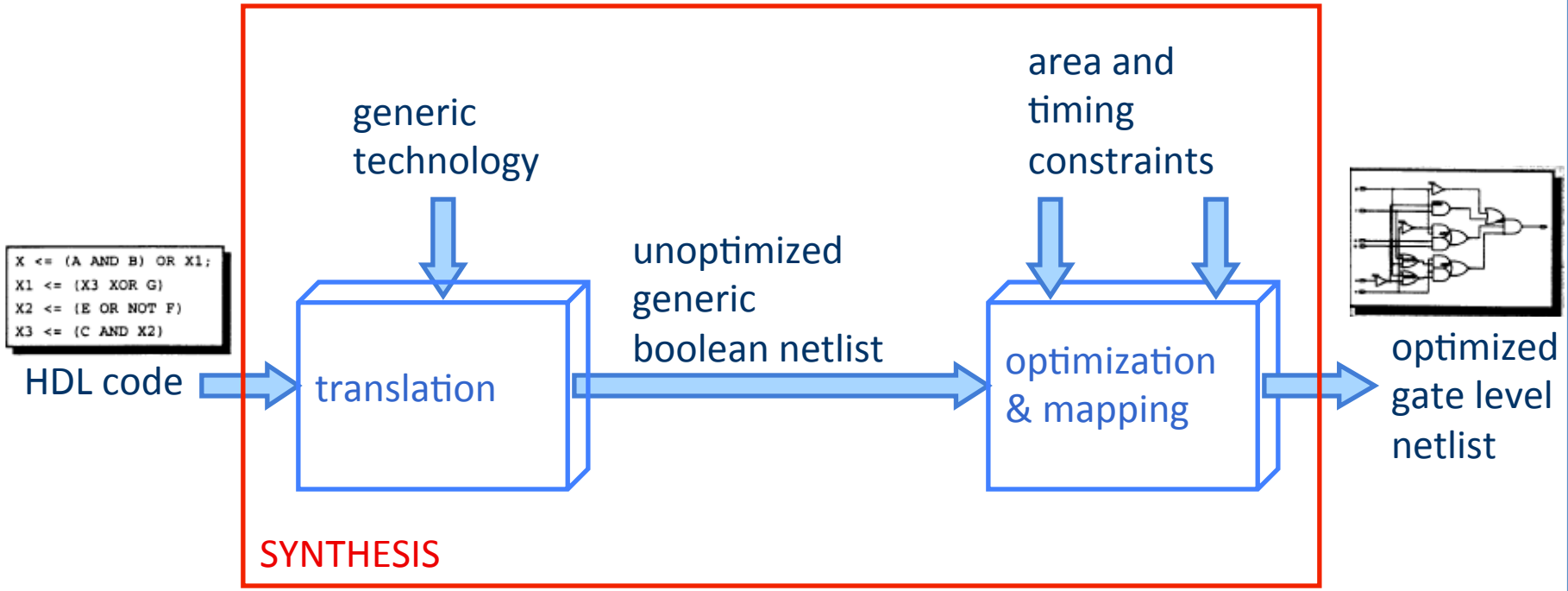
Behavioral coding

- Describe Behavior
  - functionality and performances
- All language features can be used



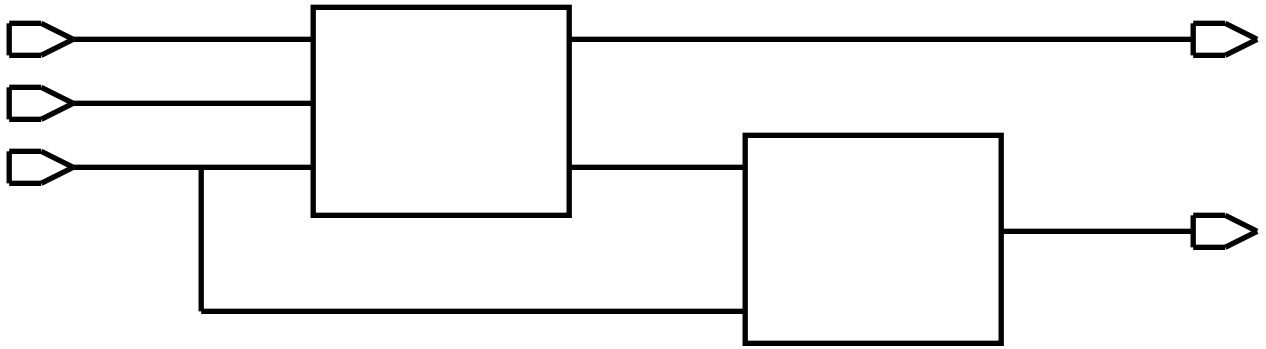
RTL coding

- Only a small subset of the Language statements can be mapped into “Silicon”.



Structural Level coding

- Sub-Modules interconnection
- Primitive cells interconnection (net-list)
- The code consists of a bunch of port mappings and components



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VHDL Building Units

- Entity
  the "symbol" interface (input/output ports)
- Architecture
  one of the several possible implementation of the design
- Configuration
  binding between the symbol and one of the many possible implementation.
  It can be used to express hierarchy