

# EECS 222: Embedded System Modeling Lecture 19

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## Lecture 19: Overview

- Course Administration
  - Instructor evaluation
- Communication Abstractions
  - Bus Functional Model (BFM)
  - Transaction Level Modeling (TLM)
  - Transaction Level Modeling, TLM-2.0
- SystemC TLM-2.0
  - Overview
- SystemC TLM-2.0
  - *“The Definitive Guide to SystemC: TLM-2.0 and the IEEE 1666-2011 Standard”*
  - by David Black, Doulos

## Course Administration

- Final Course Evaluation
  - 9<sup>th</sup> through 10<sup>th</sup> week
  - Feb. 25, 2019, through March 17, 2019, 11:45pm
  - Open until next Sunday night
  - Online via EEE evaluation application
- Evaluation of Course and Instructor
  - Voluntary
  - Anonymous
  - Very valuable!
- Please help to improve this class!
  - Please spend 5 minutes!

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## Communication Abstractions

- Communication Modeling
  - Bus Functional Model (BFM)
    - Cycle-accurate, pin-accurate communication
    - Ports, signal assignments
    - Slow (1x)
  - Transaction Level Modeling (TLM)
    - Modules/behaviors, channels, interfaces
    - Method calls
    - Fast (100x)
  - New Transaction Level Modeling: SystemC TLM-2.0
    - Initiators, targets, sockets
    - Method calls with Direct Memory Interface (DMI)
    - Very fast (1000x)

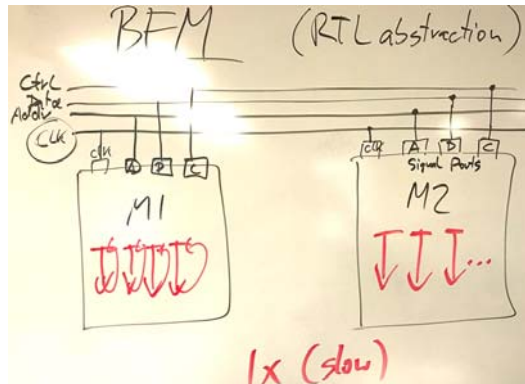
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## Communication Abstractions

- Traditional Bus Functional Model (BFM)
  - Cycle-accurate, pin-accurate communication
  - Ports, signal assignments
  - Lowest abstraction, slow (1x)



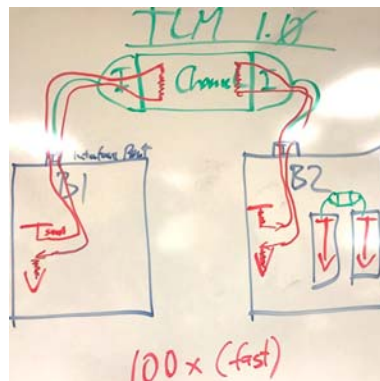
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## Communication Abstractions

- Regular Transaction Level Modeling: TLM 1.0
  - Modules/behaviors, channels, interfaces
  - Method calls
  - High abstraction, fast (100x)



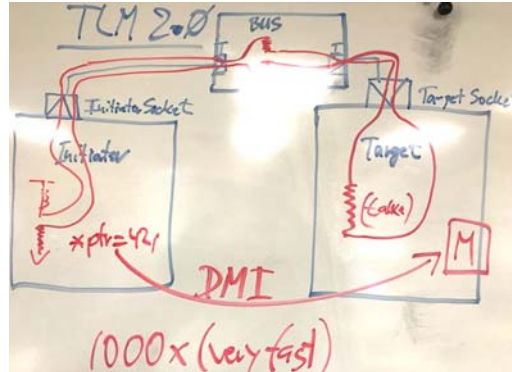
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## Communication Abstractions

- New Transaction Level Modeling: TLM-2.0
  - Initiators, targets, sockets
  - Method calls with Direct Memory Interface (DMI)
  - Very high abstraction, very fast (1000x)



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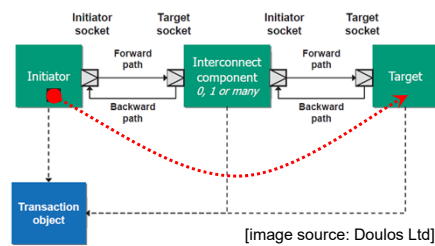
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## SystemC TLM-2.0 Overview

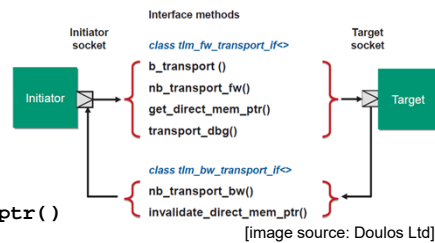
### – Initiators and Targets

- Sockets
- Forward path
- Backward path
- Shared transaction object
- DMI bypass



### – Well-defined Socket API

1. `b_transport()`
2. `nb_transport_fw()`
3. `nb_transport_bw()`
4. `transport_dbg()`
5. `get_direct_mem_ptr()`
6. `invalidate_direct_mem_ptr()`



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## SystemC TLM-2.0 Overview

- Classic TLM 1.0: Producer-Consumer Example

- Threads operate in their own modules or protected channels
- Well-behaved execution in safe execution contexts

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## SystemC TLM-2.0 Overview

- New TLM-2.0: Producer-Consumer Example

- No channels! Threads operate directly in others' modules
- Fast, but unprotected execution in foreign territory

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## IEEE SystemC Language

- Transaction Level Modeling with SystemC:  
TLM 1.0 and TLM-2.0
  - `DAC15_SystemC-TLM20_Training.pdf`,  
by David Black, Doulos
    - Selected slides
    - SystemC training day at Design Automation Conference 2015
  - *“The Definitive Guide to SystemC:  
TLM-2.0 and the IEEE 1666-2011 Standard”*
    - Transaction Level Modeling
    - The architecture of TLM-2.0
    - Initiator, interconnect, target & sockets
    - The generic payload
    - Loosely-timed coding style