SerDes Modeling: IBIS-ATM & Model Validation

July 2007
IBIS-ATM Effort

• Goal: SerDes Rx/TX model interoperability
  – Multiple EDA environments
  – Multiple SerDes vendor models
  – Protect SerDes vendor IP

• IBIS-ATM committee participation
  – EDA: SiSoft, Cadence, Mentor, Agilent
  – Semiconductor: IBM, TI, Intel, Micron, Xilinx, ST-Micro
  – System: Cisco

• Two part modeling standard
  – Electrical model: TX / RX analog characteristics
  – Algorithmic model: equalization, clock recovery, device optimization algorithms
Serial Link Analysis

TX
- Serializer
- Transmit Equalizer
- Package Interconnect
- System Interconnect
- Package Interconnect

RX
- Receive Equalizer
- Clock Recovery
- Data Recovery

TX EQ
LTI or non-LTI
- TX Equalization
- TX Optimization

Channel & Analog I/O
Linear, Time-Invariant
- Channel Characterization (Impulse response)

RX EQ, CDR
LTI or non-LTI
- RX Equalization
- RX Clock Recovery
- RX Optimization
IBIS-ATM Algorithmic Models

LTI
- Model Settings
- TX “INIT”
- Channel Impulse Response
- With TX EQ
- RX “INIT”
- With TX, RX EQ

Non-LTI
- Model Settings
- TX “GETWAVE”
- Stimulus
- With TX EQ
- RX “GETWAVE”
- Recovered Clock
- With TX, RX EQ

IBIS-ATM Model Validation – July 2007
IBIS-ATM Status

• Subcommittee work, presentations & BIRD available on-line:

• First draft of BIRD approved by IBIS-ATM subcommittee for model & EDA platform development

• Sample models for public reference - 7/17/07
Challenges

• IBISCHK cannot check compiled models
  – Similar problem to AMS model calls
• API interface is complex by IBIS standards
• Several possible sources of platform/model incompatibility
  – Incorrect EDA tool implementation
  – Incorrect model implementation
  – Incompatible run-time libraries

• A “reference standard” for IBIS-ATM is needed
  – Reference platform implementation
  – Reference model implementation
IBIS_ATM_Test

- Allows IBIS-ATM .dll models to be run as standalone “executables”
  - Facilitates model debug
  - Provides standard environment for testing model compliance
  - Can be supplied as part of IP vendor model “kit”
- Authored by SiSoft, source code to be turned over to IBIS Open Forum
  - Executable to be widely available
SiSoft IBIS_ATM TX Model

IBIS Model

- Reference IBIS file
- Reference API model
  - Impulse response and waveform processing
  - 4 tap equalizer
    - Pre-cursor tap
    - Cursor tap
    - 2 post-cursor taps
    - Model normalizes tap sum
  - Scalable transmit swing
  - Executable and source code to be widely available

API Model Code
Supporting Data

- Sample impulse response
- Sample stimulus data
- Batch files
- Documentation
Impulse Response Processing

**IBIS_ATM_test** -f **IBIS_ATM_Tx.dll** -i **impulse.csv**

- impulse.csv
  - Impulse response
  - Model settings

- IBIS_ATM_Tx.dll model (IBIS_ATM_Tx.dll)

- impulse_out.csv
  - Equalized impulse response
Waveform Processing

IBIS_ATM_test -f IBIS_ATM_Tx.dll -i tx_impulse.csv -g waveform.csv -c

- impulse.csv
  - Impulse response
  - Model settings

- impulse_out.csv
  - Equalized impulse response

- waveform.csv
  - Stimulus waveform

- waveform_out.csv
  - Equalized waveform
No TX EQ

Impulse Response

Eye Diagram

Signal @ Rx pad, Stimulus

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TX EQ: (-.15, .7, -.125, -.025)*0.8

Impulse Response

Eye Diagram

Signal @ Rx pad, Stimulus

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IBIS-ATM Evaluation Toolkit

• Goal: allow interested parties to evaluate & develop IBIS-ATM models
• Initially available on-request from SiSoft
  – Will reassess distribution model once support requirements are better understood
• Contents
  – IBIS_ATM_Test utility
  – Sample TX model and source code
  – Sample input data, scripts, documentation
• IBIS_ATM_Test source will be turned over to IBIS Open Forum (similar to IBISCHK)