A Software Development and Validation Framework for SDR Platforms

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Outline

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- Problem Statement
- Framework (XMSF) Implementation
  - XMSS server
  - Graphical logger
  - IMEC SDR
  - TCP/IP connection
- Framework (XMSF) Simulation Results
  - 802.11a PHY
  - 802.11 MAC
  - Platform Exploration
- Conclusion

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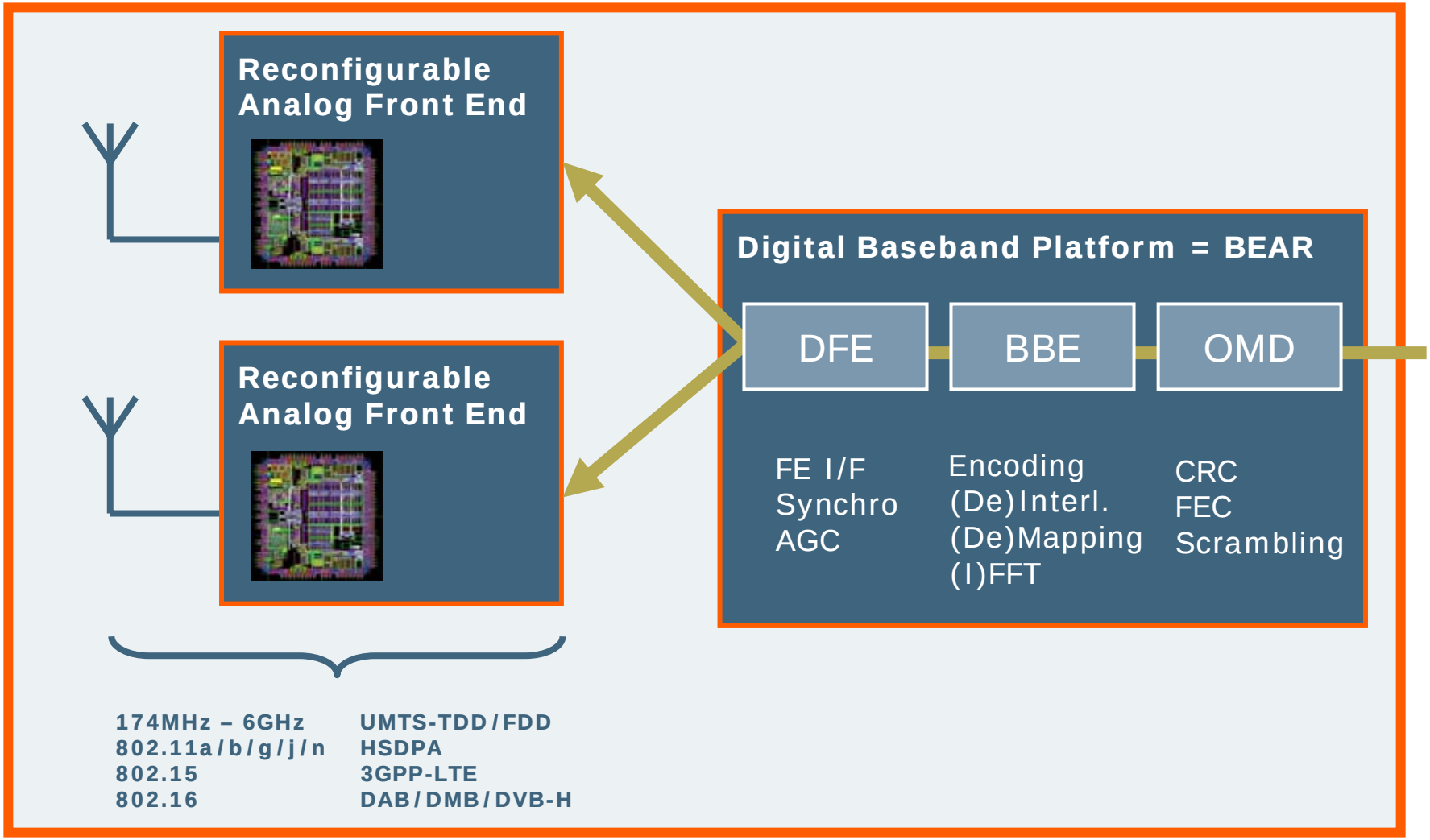
IMEC SDR Platform: Functional View



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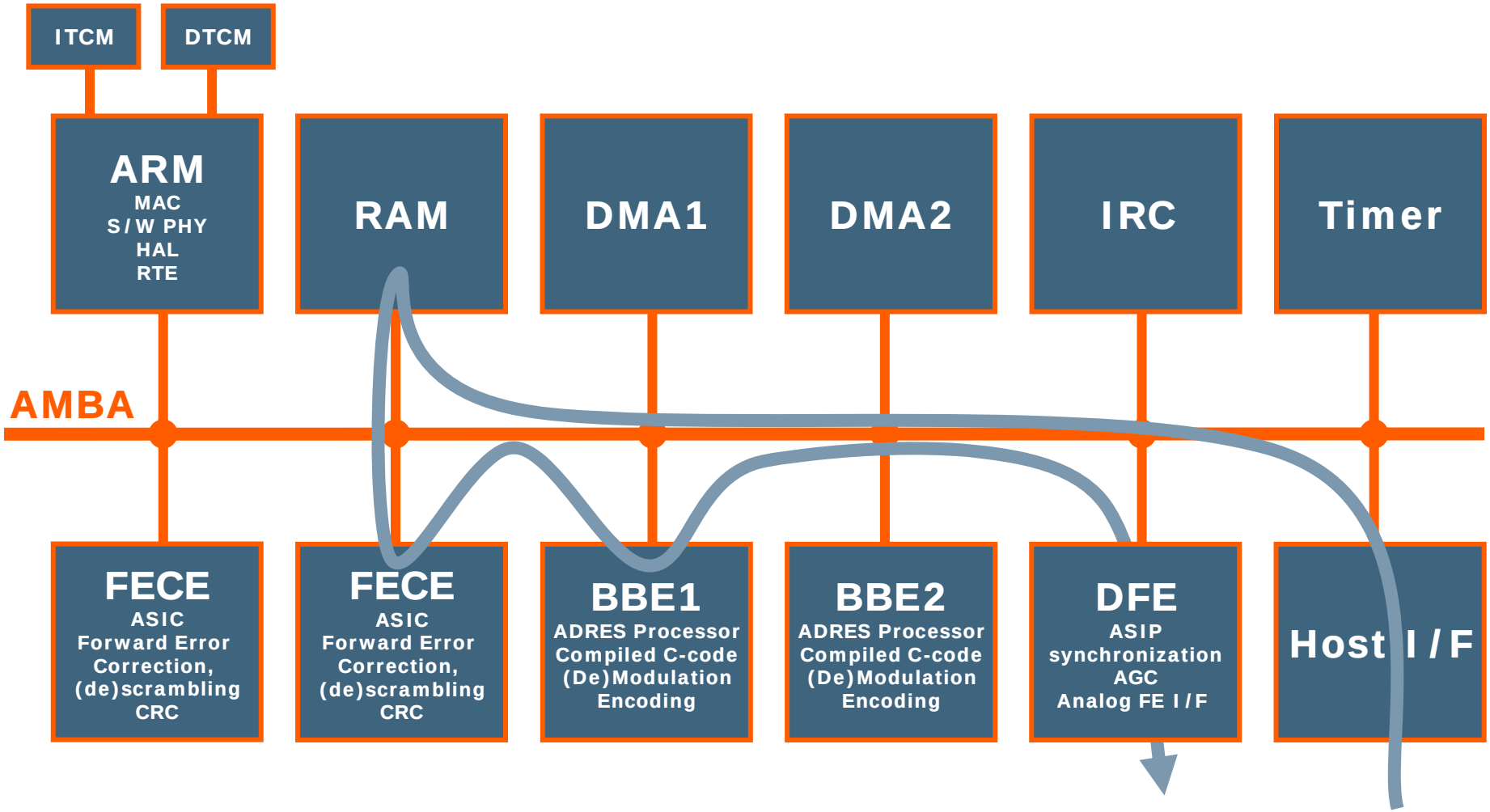
IMEC SDR Platform: BEAR Chip



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Problem Statement: Intention

- Simulation of native PHY/MAC software code on a specific SDR platform (IMEC SDR)
- Visualize the impact on the hardware components (DMA, timer, BBE, DFE, OMD…)
- Existing solution (see next): TLM

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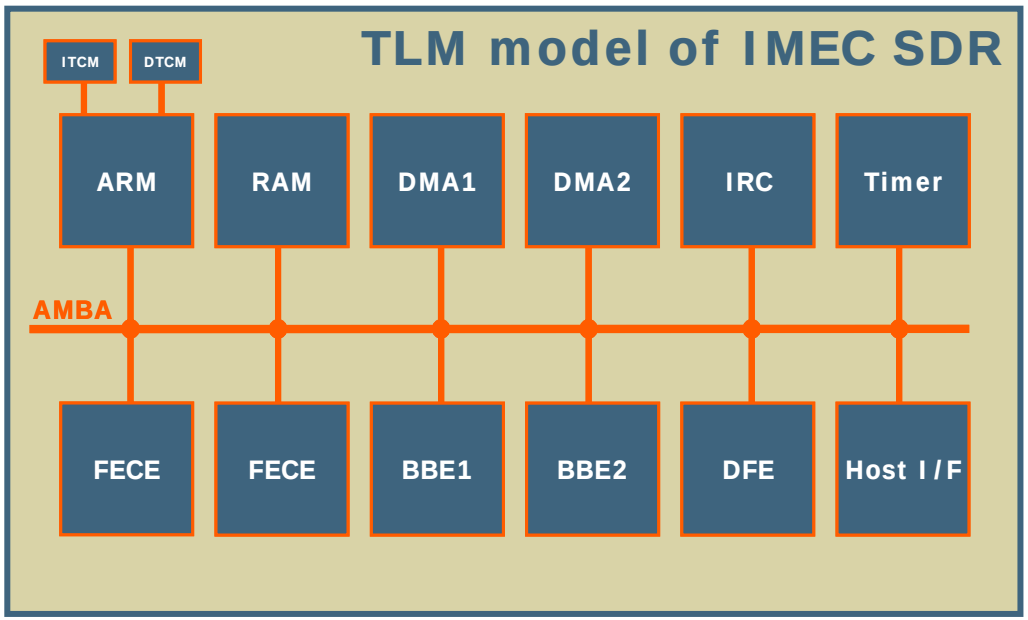
Problem Statement: TLM



MAC

PHY

- Byte accurate
- Bus simulations
- Sw/Hw cosimulations
- Full Hw validation
- Runs native code

- No channel
- No multiple terminals
- No TCP/IP
- No full MAC/PHY s/w validation possible
- 2 minutes simulation / packet

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Problem Statement: Requirements

- Development/ Simulation/ Validation platform for system code (SDR PHY/MAC control software)
- Multiple terminals connected together
- Simulate native compiled PHY/MAC code
- Fast enough for network simulations

XMSF

(cross layer –XL- MAC Simulation Framework)

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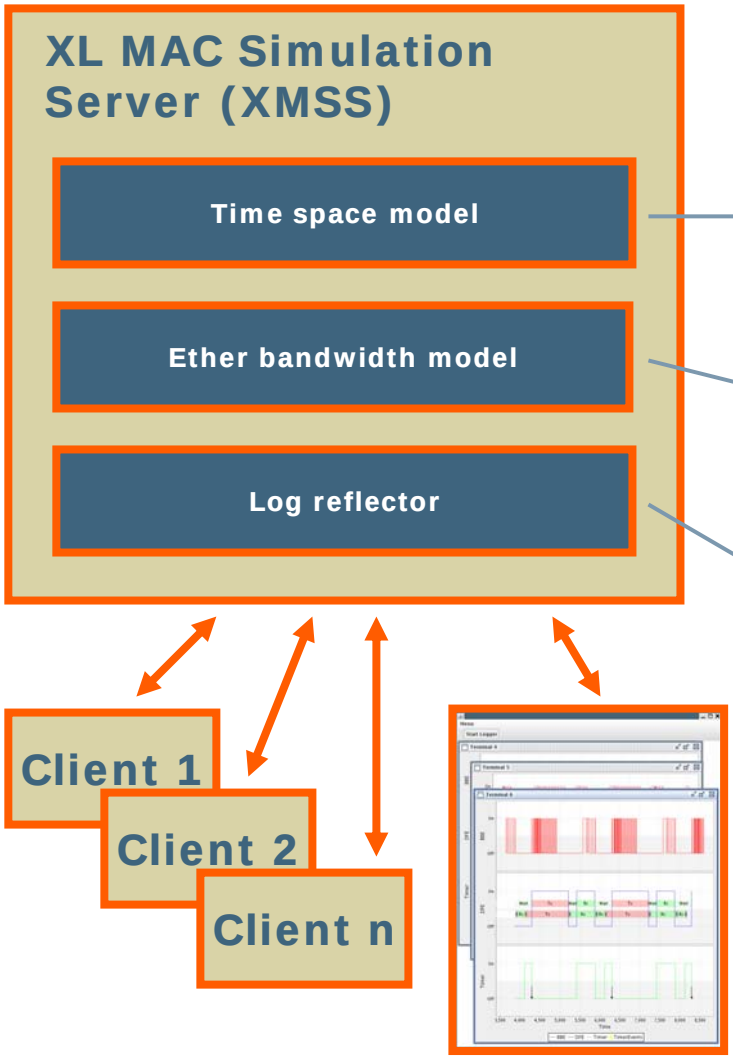
XMSF: XMSS



XMSS: Server process that accepts connections from clients

- Add Events to a global timeline
- Callback when event elapses

- Perfect Air Interface Model
- Add complex channel models through dll libraries

- Centralized logging point
- Graphical analyzer using logs

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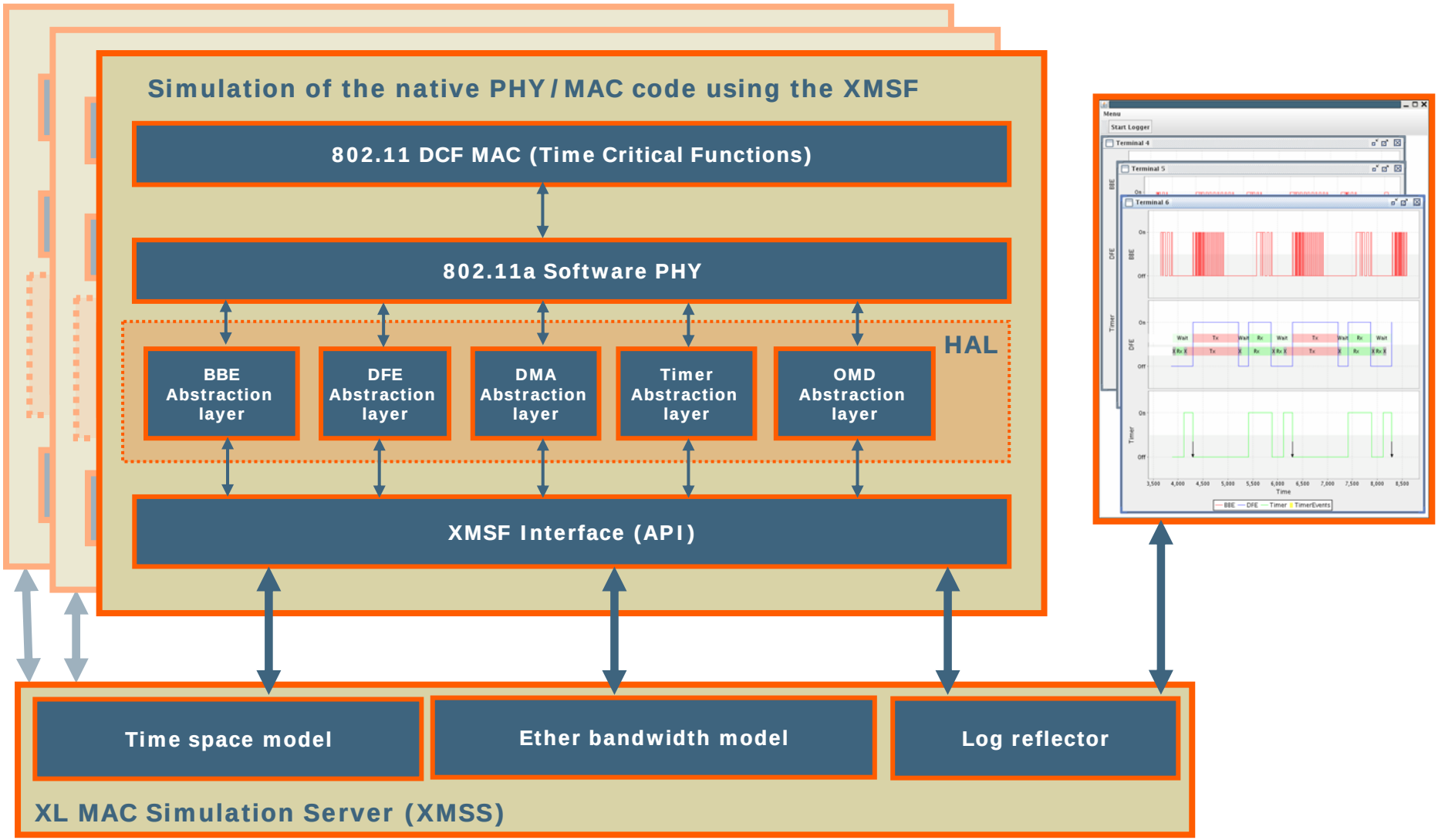
XMSF: Implementation of PHY/MAC



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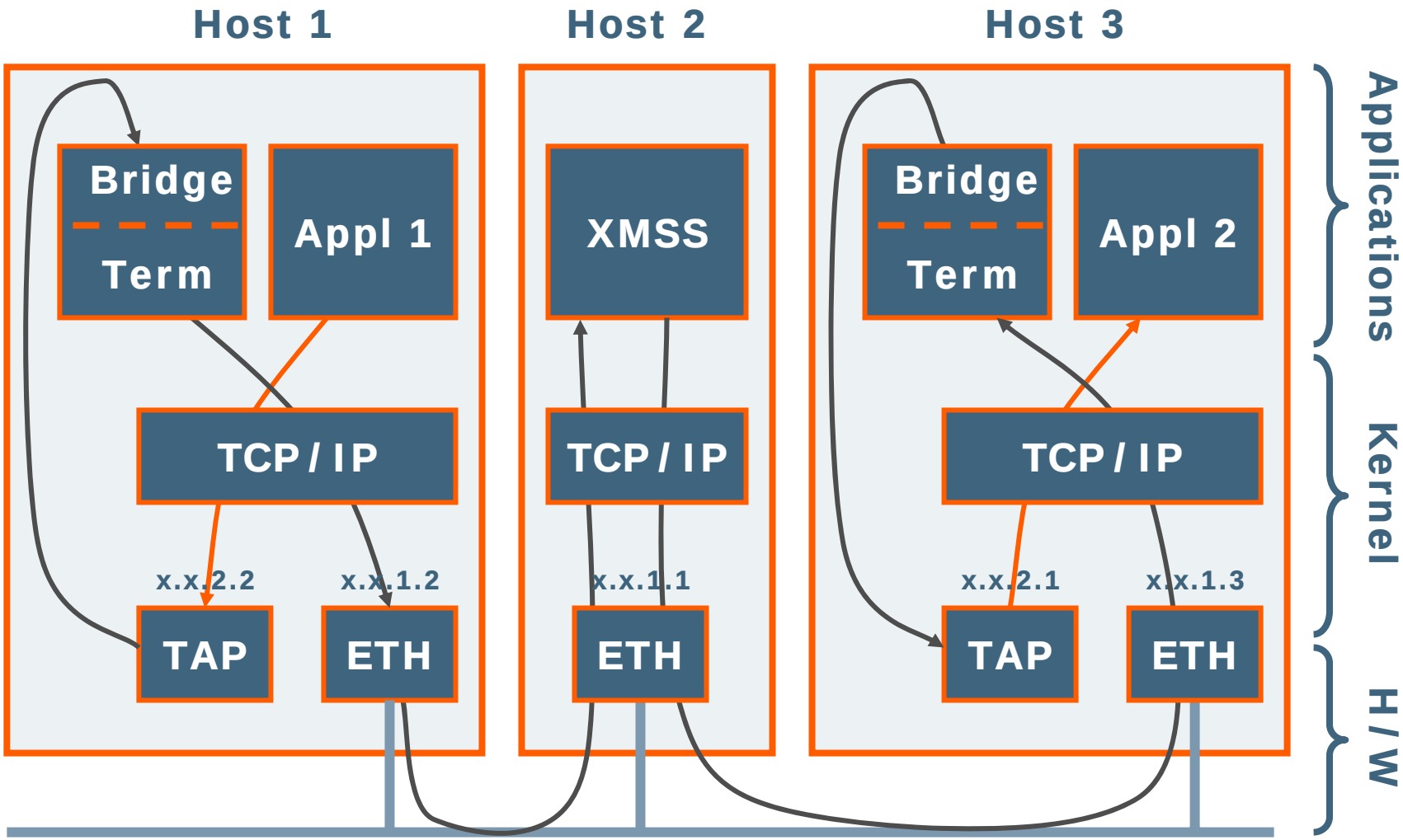
XMSF: Integration with TCP/IP



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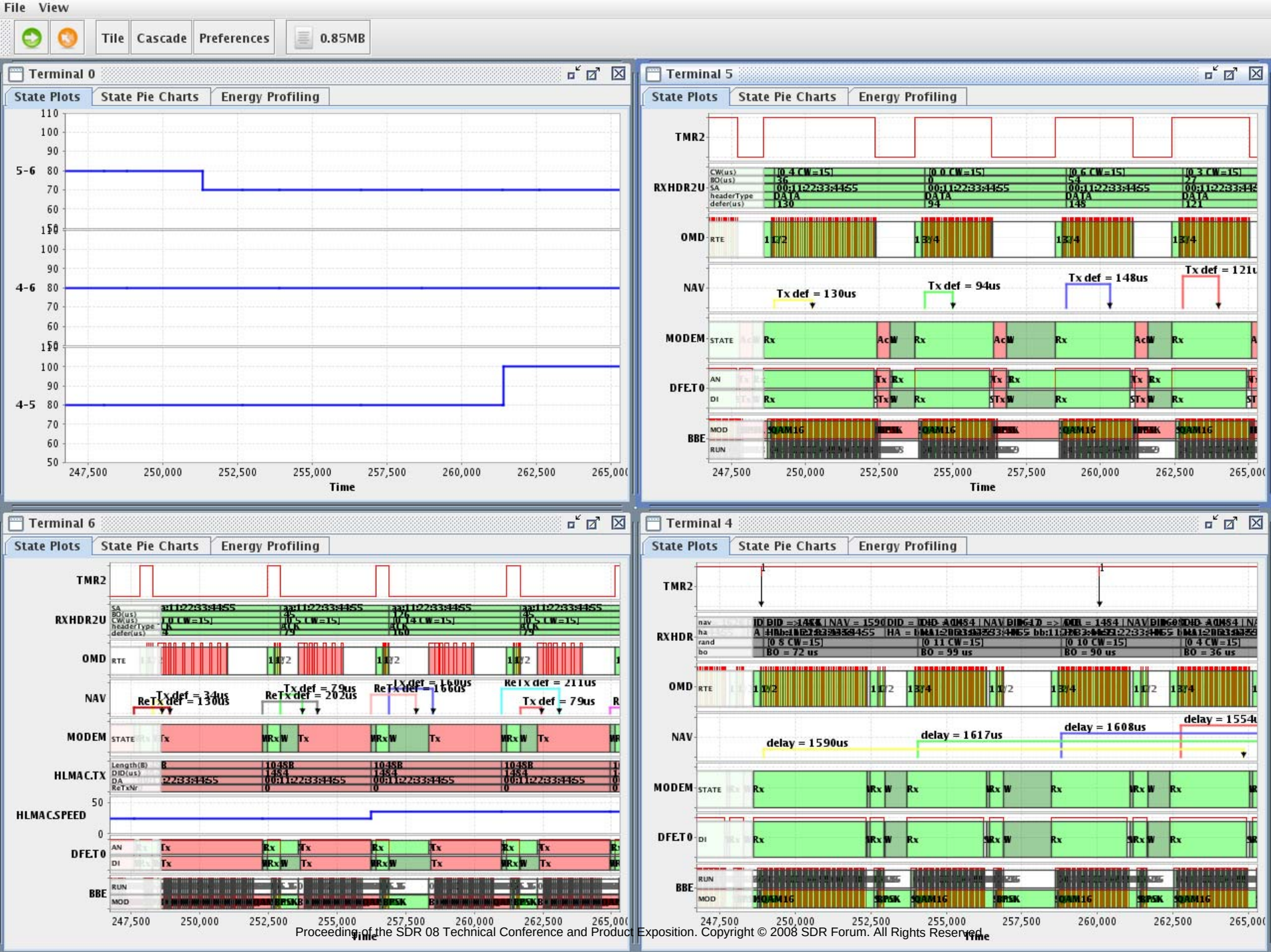
File View
Tile
Cascade
Preferences
0.85MB
Terminal 0
State Plots
State Pie Charts
Energy Profiling
5-6
4-6
4-5
Time
Terminal 5
TMR2
RXHDR2U
OMD
NAV
Tx def = 130us
Tx def = 94us
Tx def = 148us
MODEM
DFE.TO
BBE
Terminal 6
HLMAC.TX
HLMAC.SPEED
ReTx def = 130us
ReTx def = 202us
ReTx def = 166us
Tx def = 34us
Tx def = 79us
Terminal 4
RXHDR
delay = 1590us
delay = 1617us
delay = 1608us
delay = 1554u
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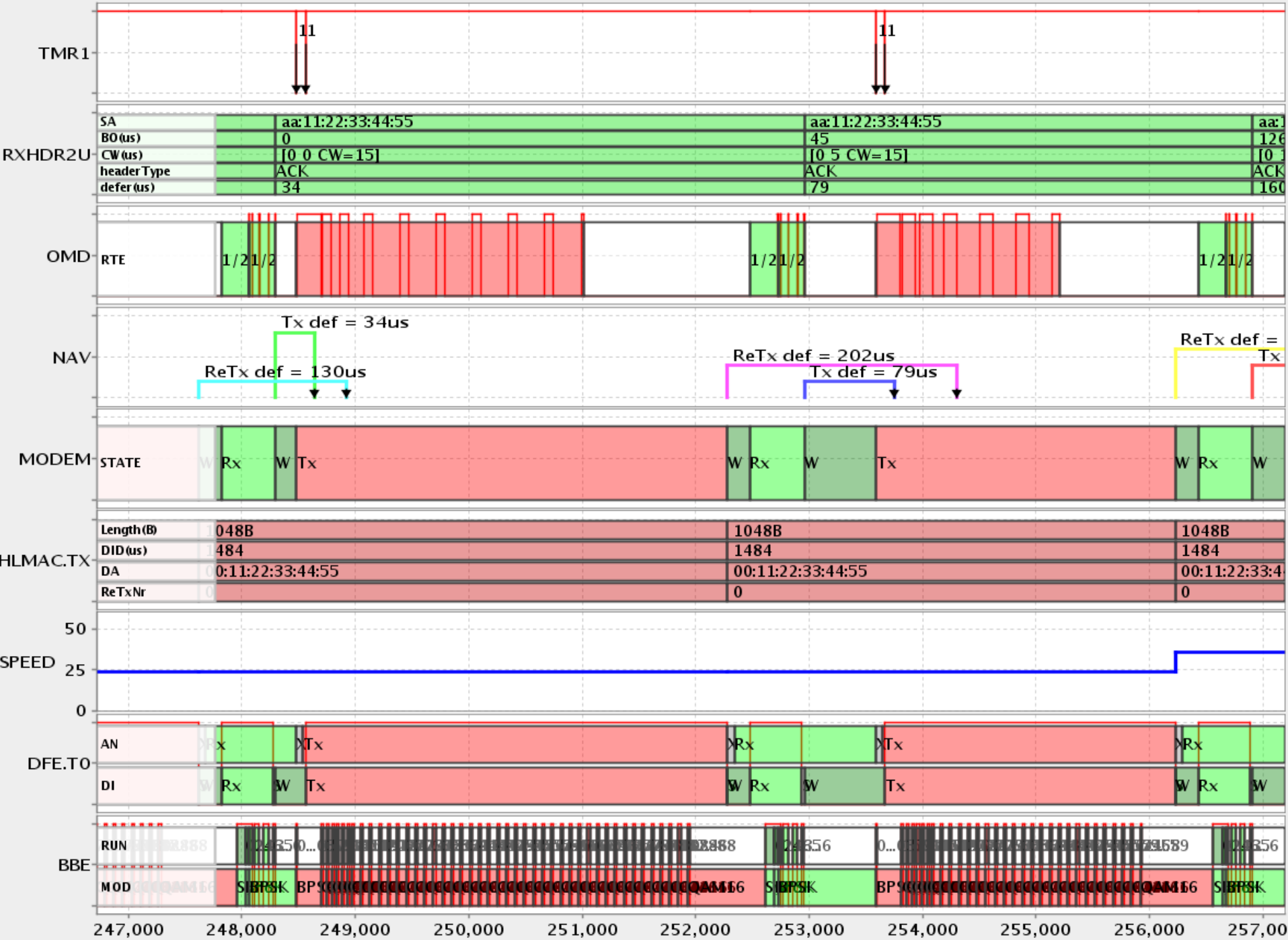

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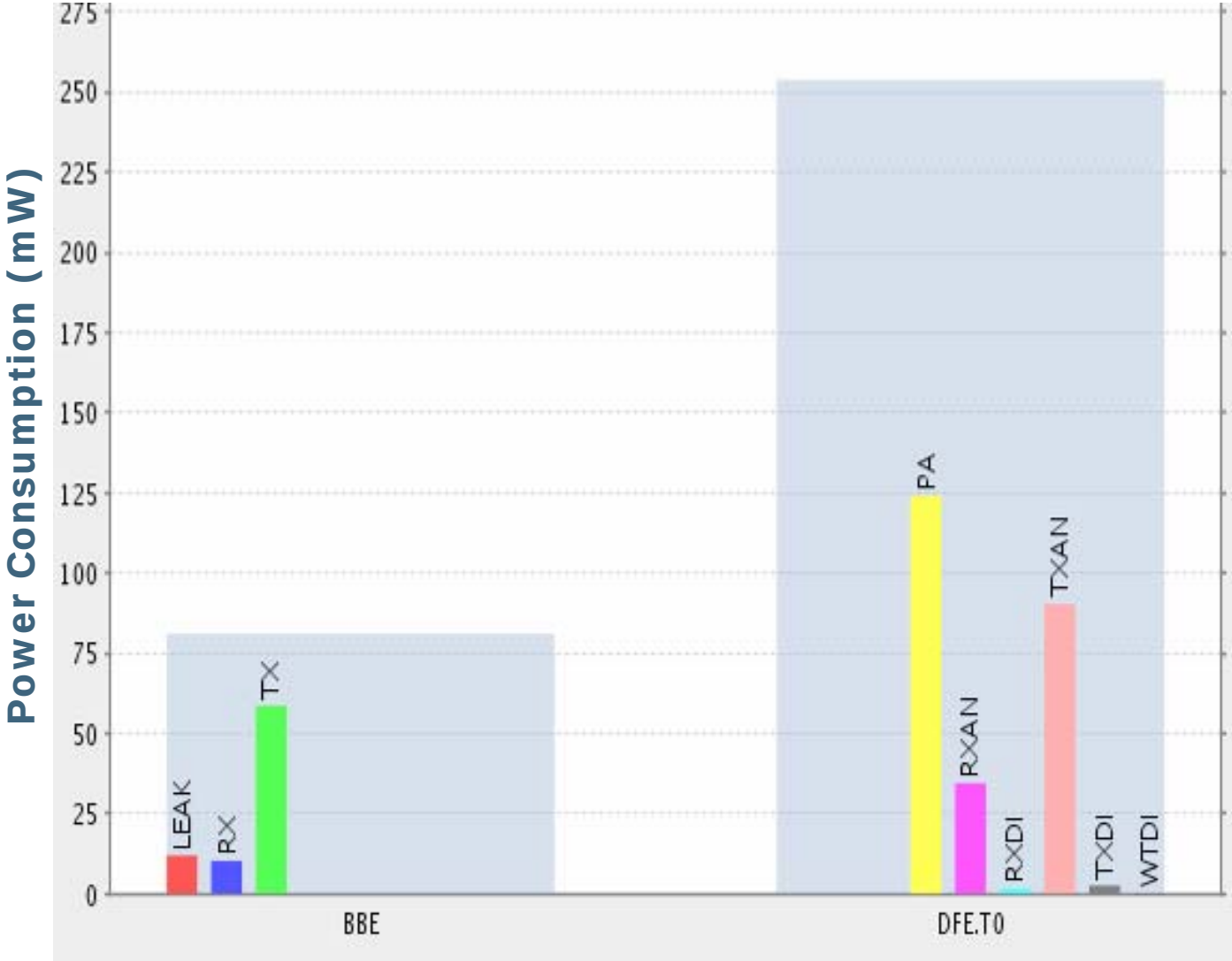
XMSF Simulation Results: Energy Profiling



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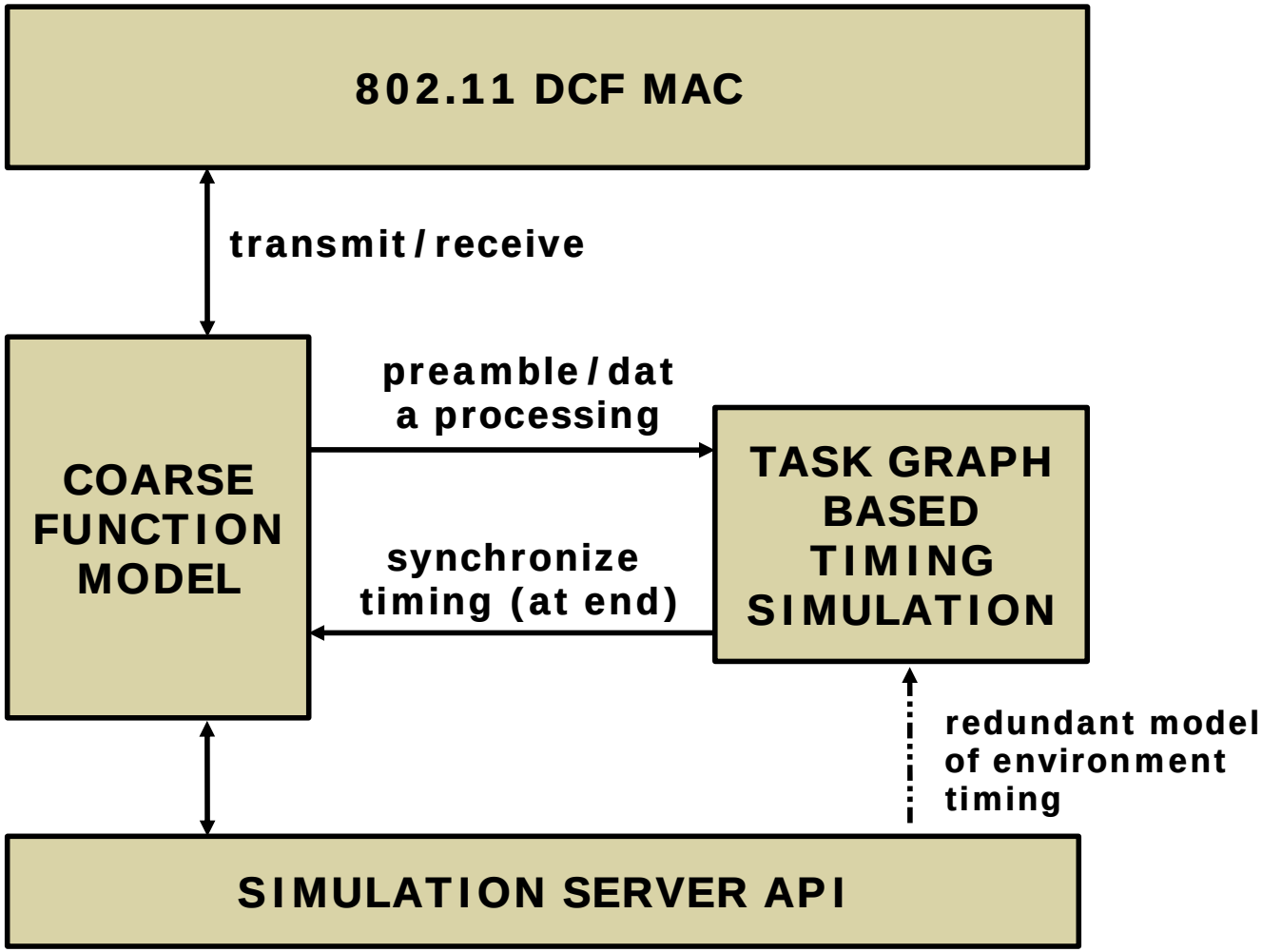
XMSF Simulation Results: Platform Exploration



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XMSF: Other Features

- Coupling between CoWare ConvergenSC tools (SystemC/VHDL co-simulator), the XMSS server and graphical analyzer.
- Synchronize the XMSS server with the Spooks streaming video server

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Future Work

- GUI for channel model
- 802.11n (MIMO) PHY
- 3GPP-LTE PHY/MAC
- Handover
- Scheduler for multiple streams on SDR

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