Modeling 802.11ax

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WiFi Knowledge Summit 2019

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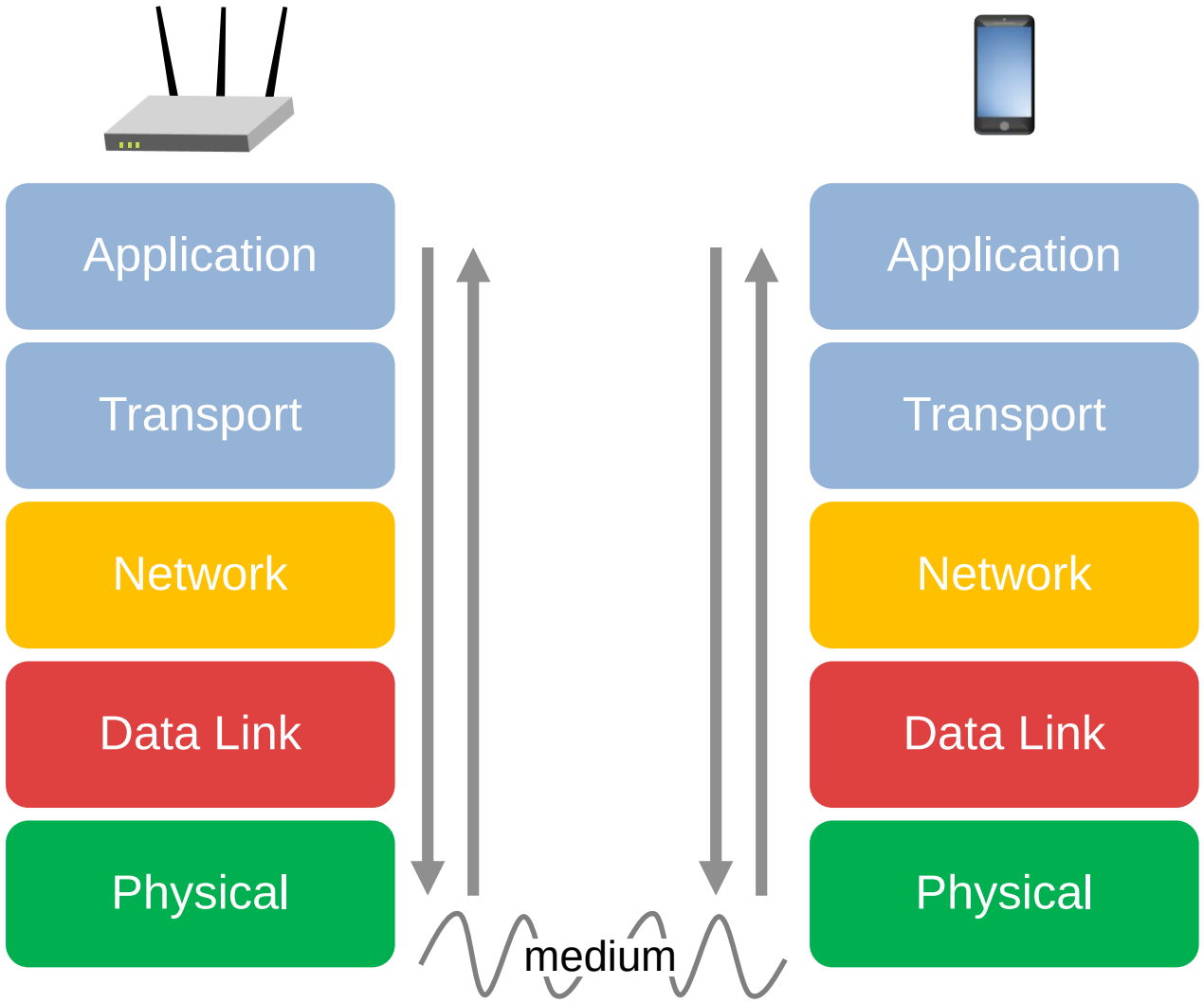
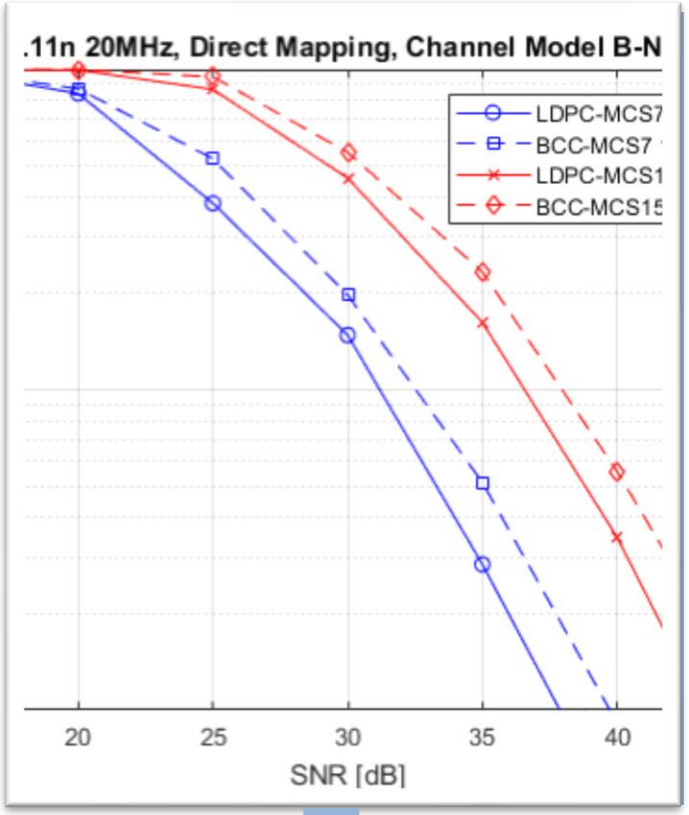
Modeling 802.11ax

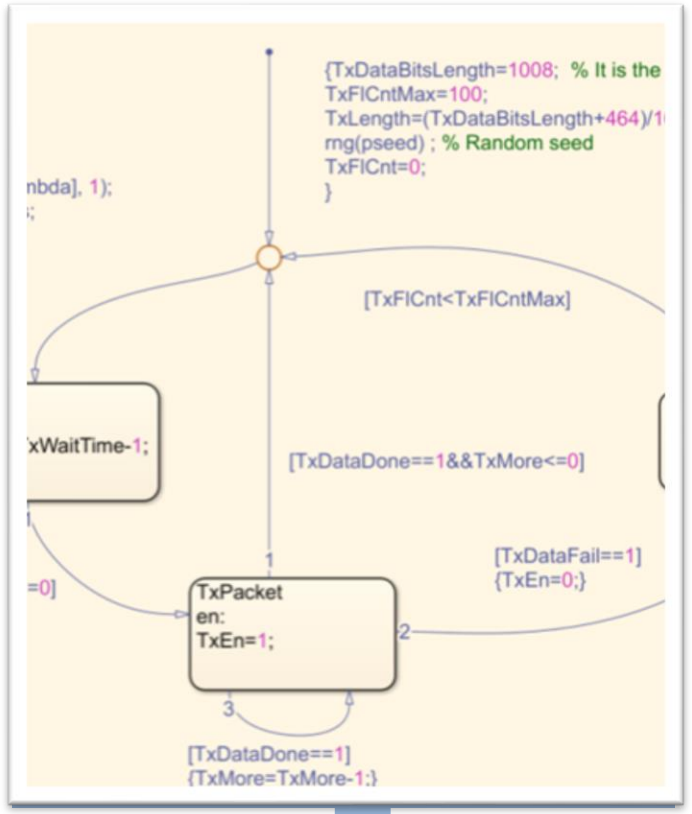


Types of 802.11ax Simulation

Physical Layer



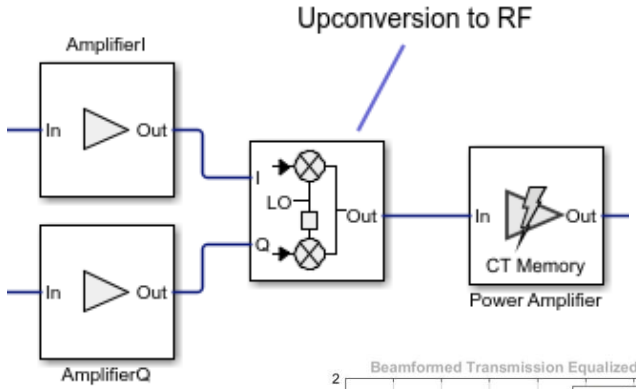
MAC and Protocol

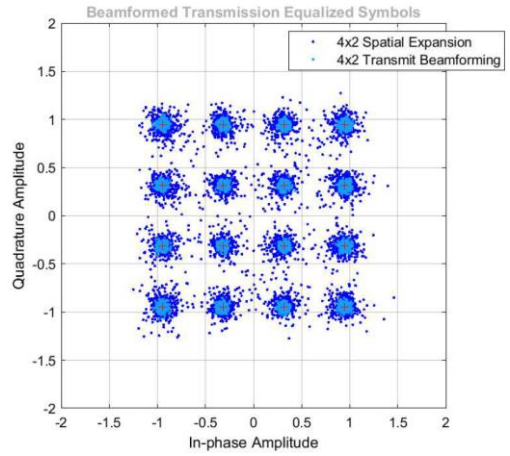


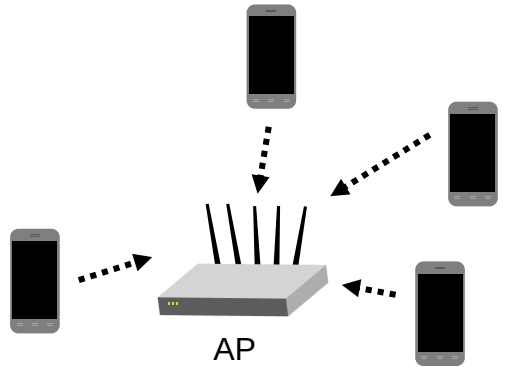
Integrated

802.11ax Physical Layer Challenges

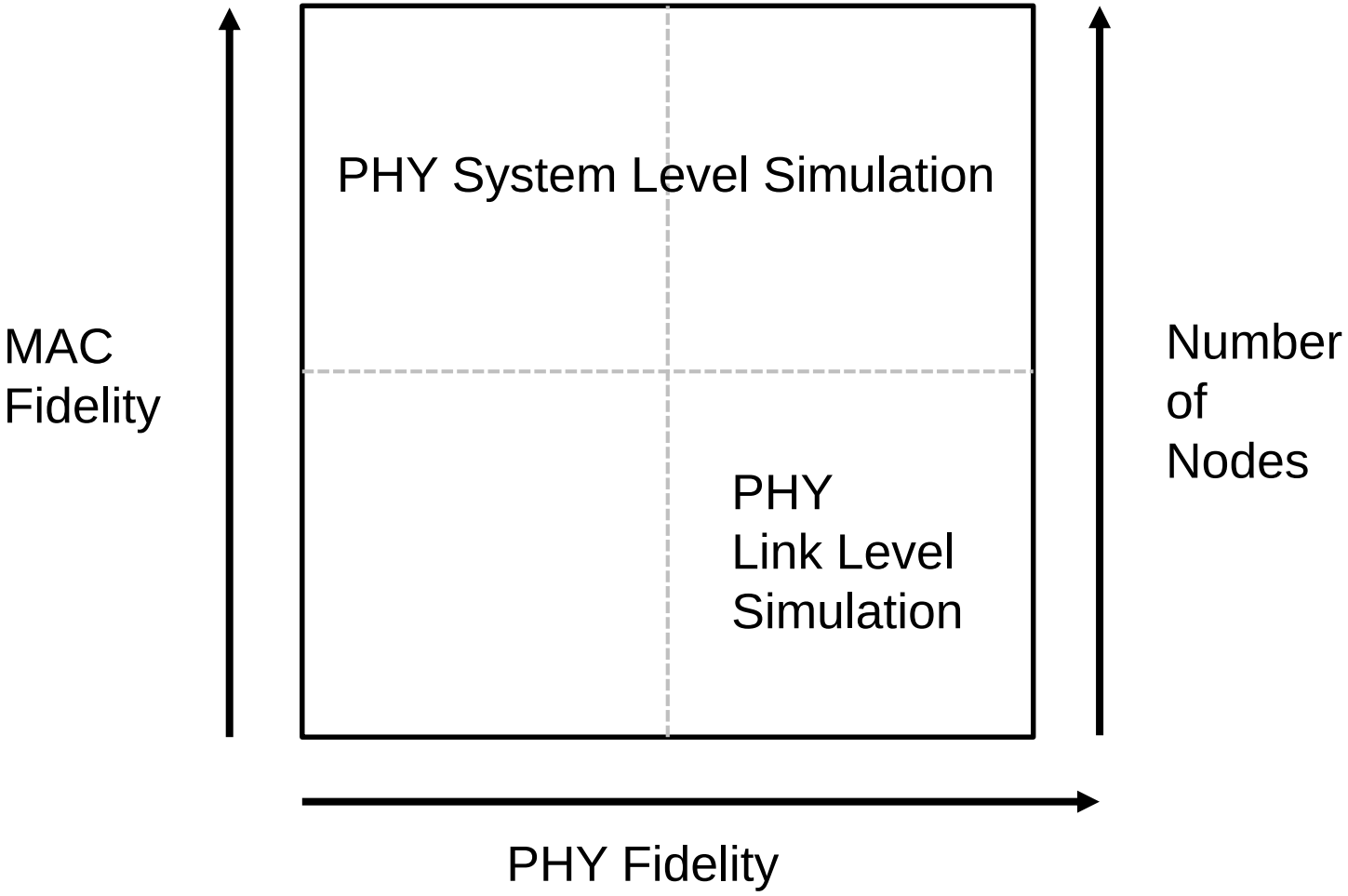
- High Throughput
  - 1024 QAM requires a high SNR and is sensitive to RF front-end impairments
- Outdoor Operation
  - New modes require new receiver algorithms and channel model
    - Dual carrier modulation
    - Midamble
- Dense Scenarios
  - OFDMA and MU-MIMO
  - Uplink-TB: timing, frequency and power pre-correction





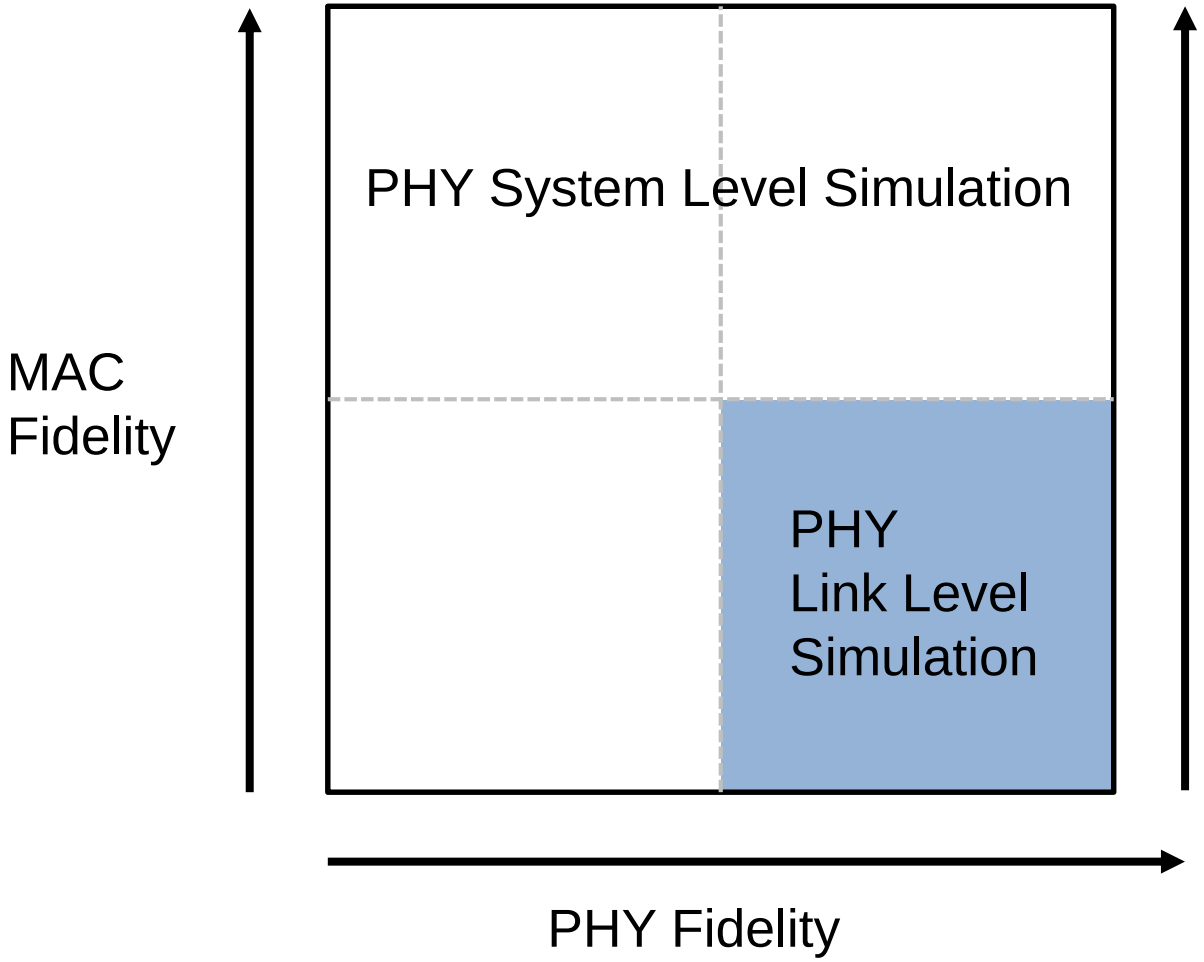


Physical Layer Simulation

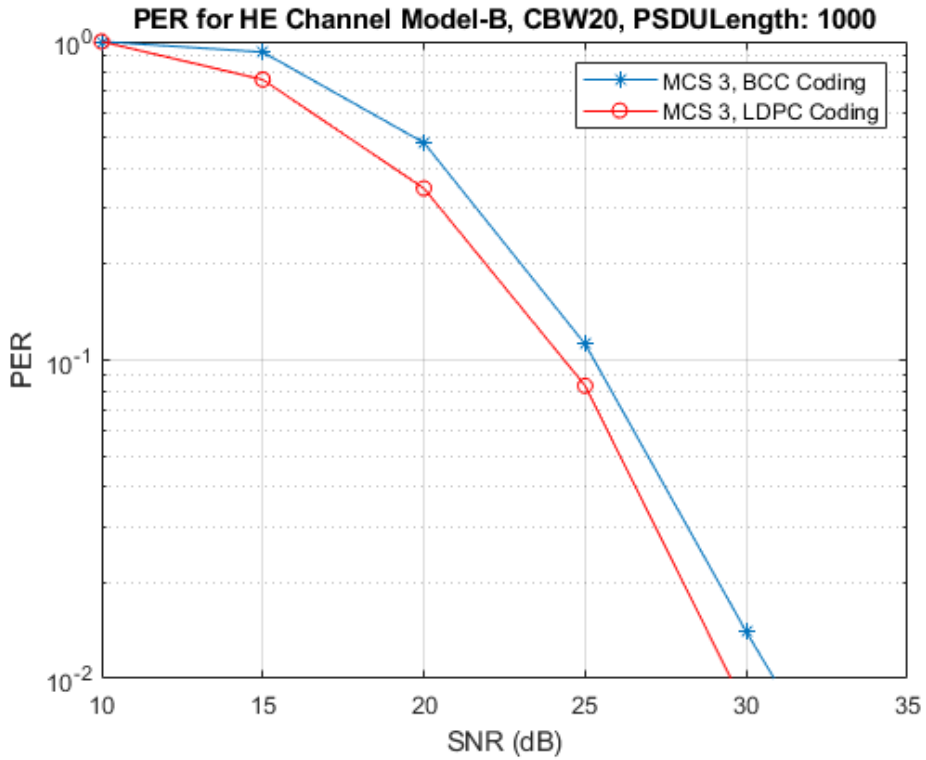


Physical Layer Link Level Simulation

- Focus on PHY modelling fidelity with no MAC

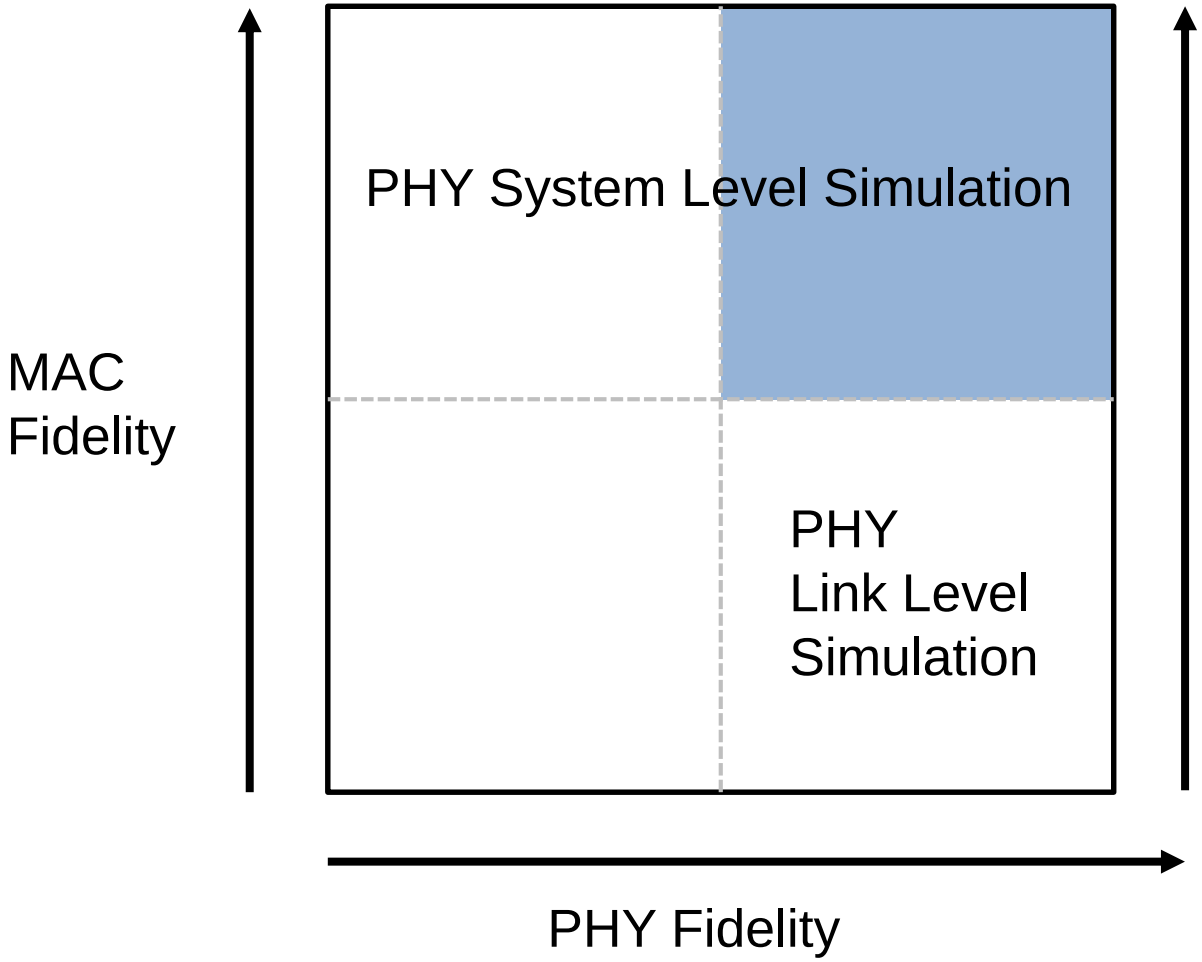


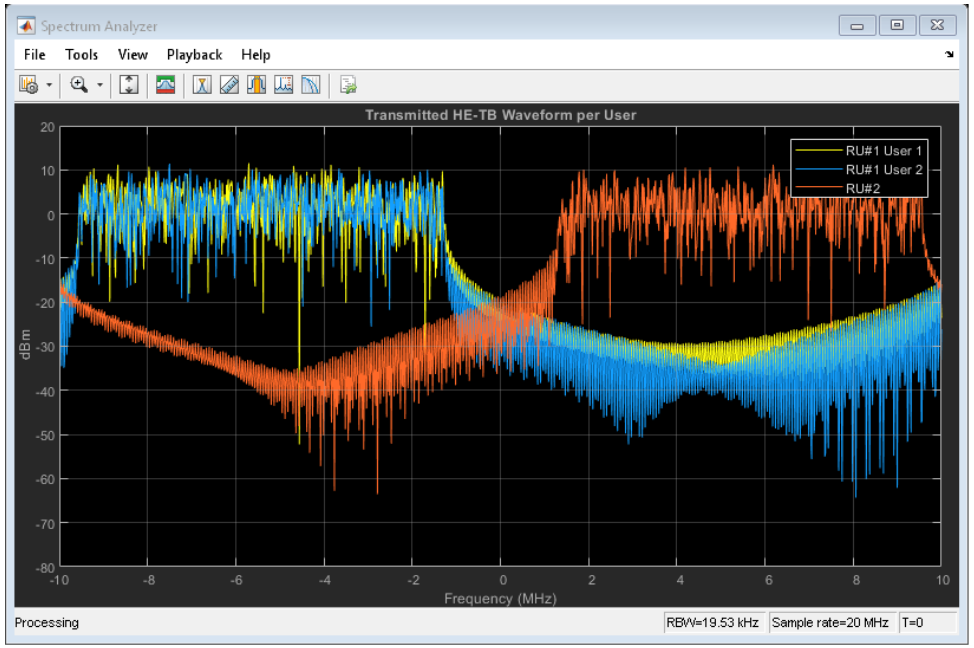
Number of Nodes



Physical Layer System Level Simulation

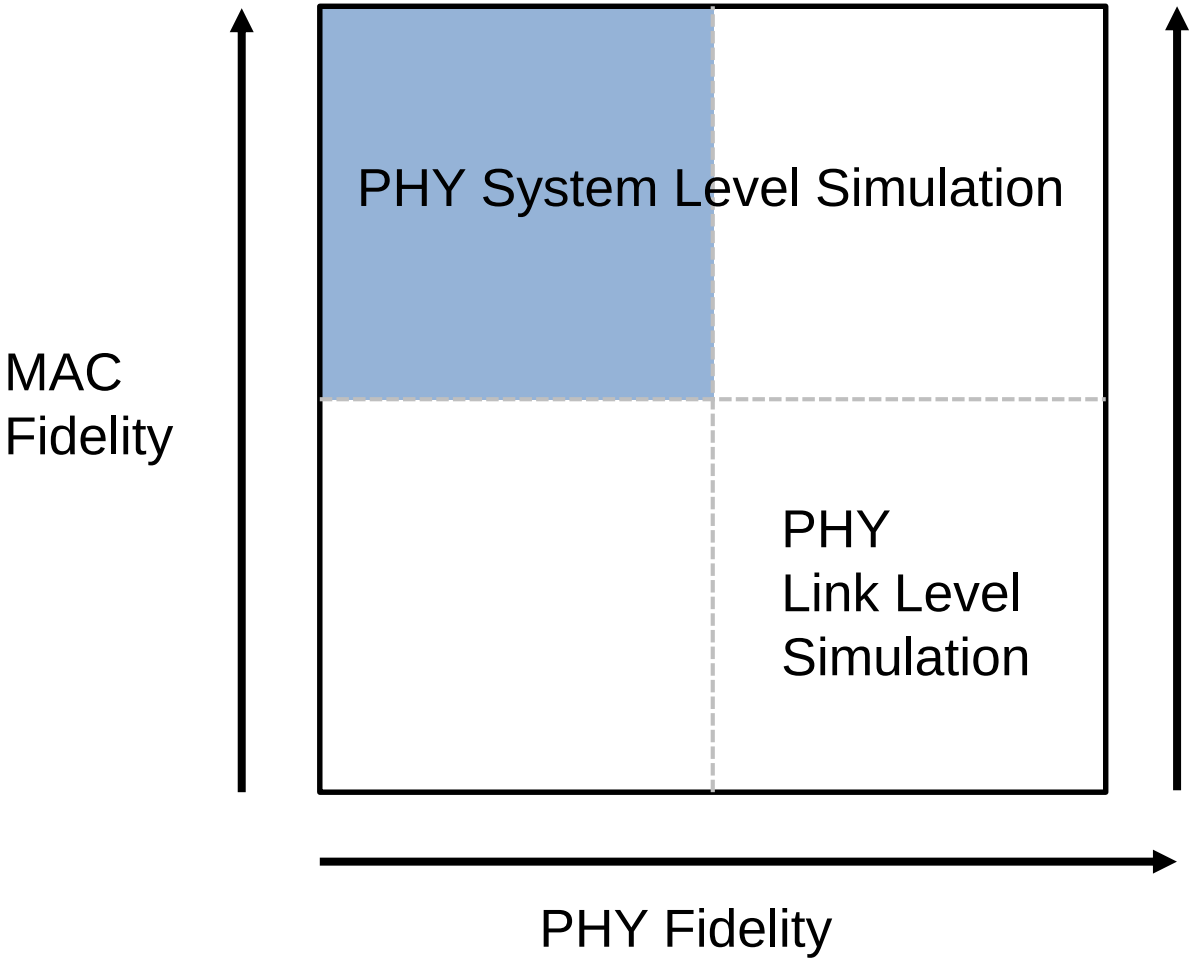
- Focus on PHY modelling fidelity with simple MAC





Physical Layer System Level Simulation

- Abstract part of PHY for simulation speed-up



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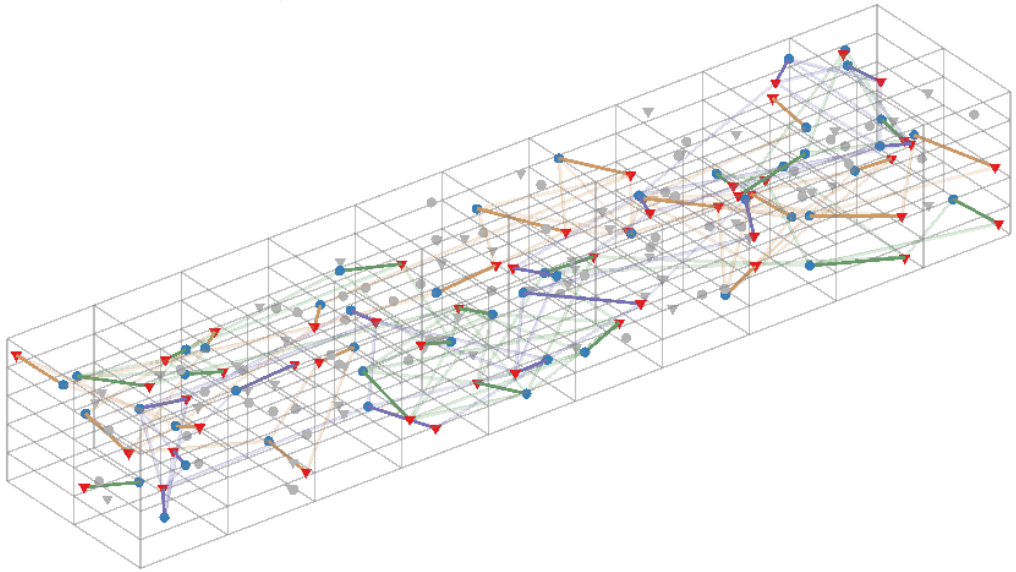
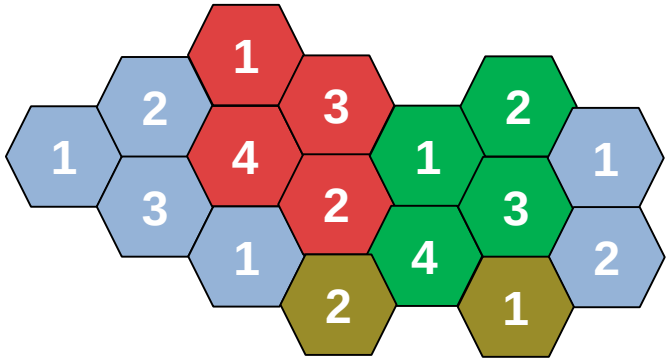
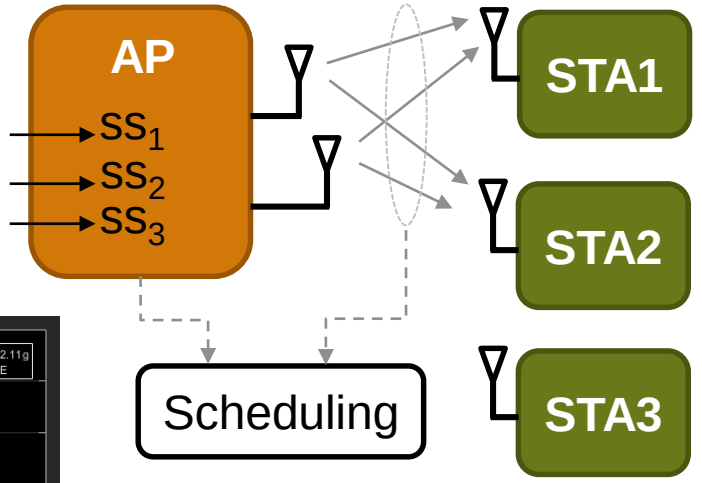


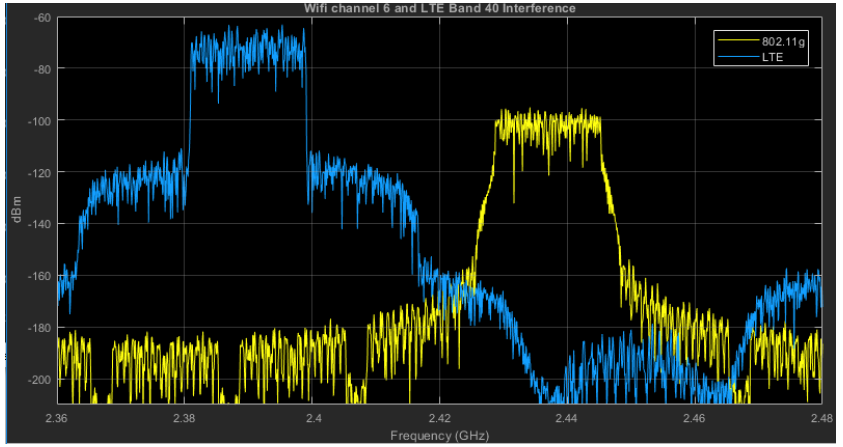
https://www.mathworks.com/help/wlan/examples/802-11ax-phy-focused-system-level simulation.html

802.11ax Challenges Above the Physical Layer

- Dense Networks
  - Color coding – selecting thresholds
  - Scheduling OFDMA and MU-MIMO transmissions
- Cross-Layer Algorithms
  - MU-MIMO beamforming
  - Rate adaption
- Coexistence is Coming
  - LTE-LAA
  - 5G NR-U

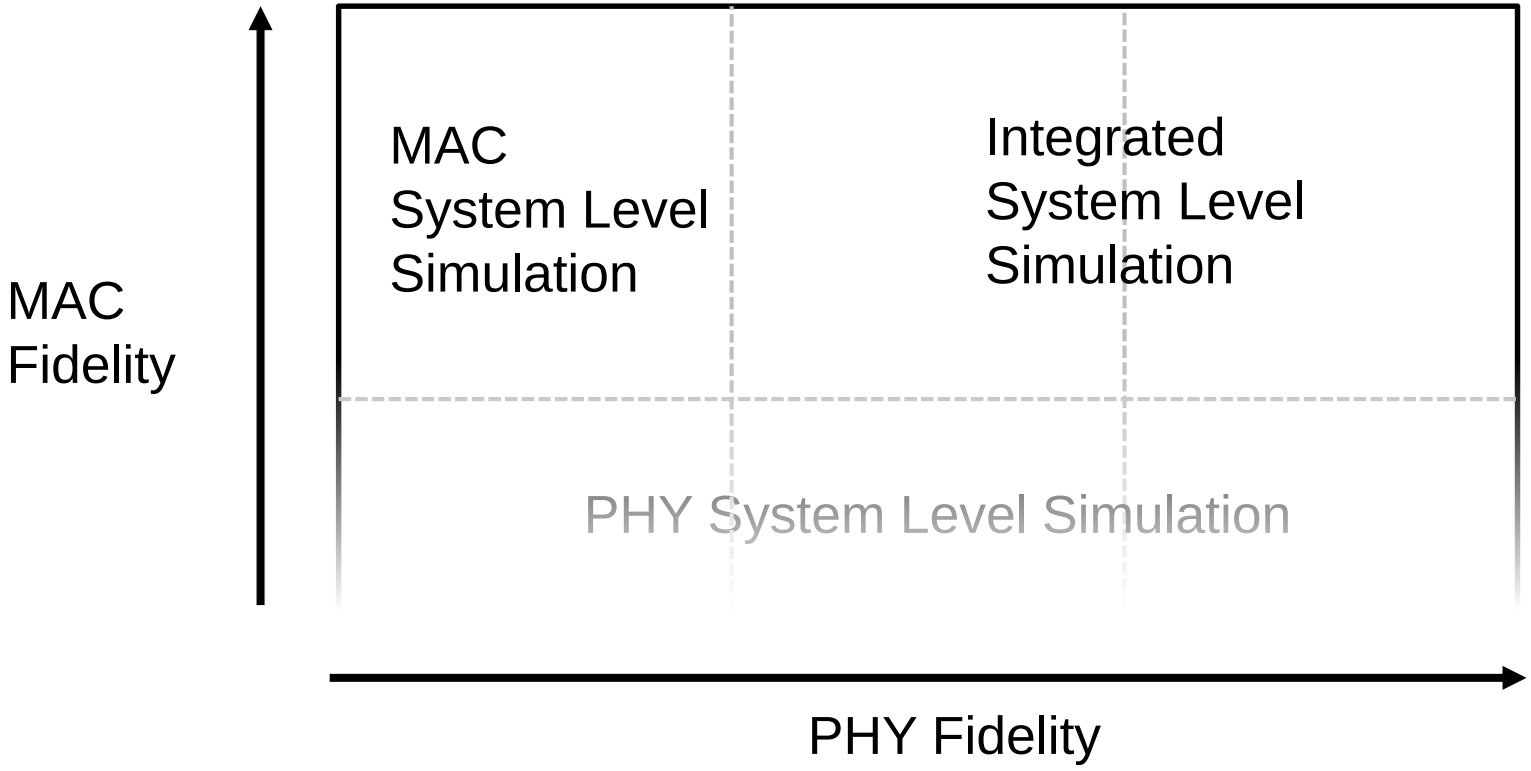






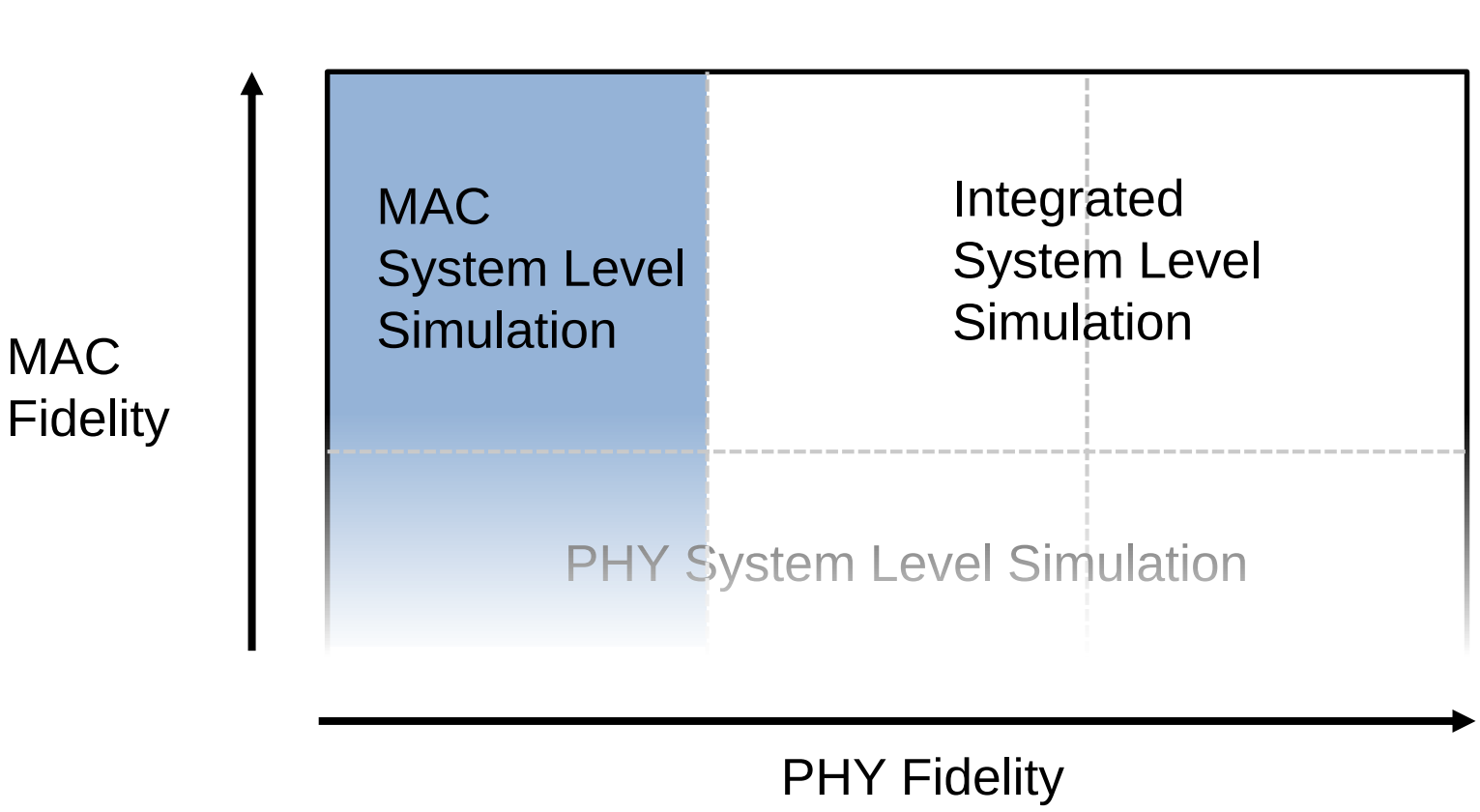
MAC and Protocol Modelling

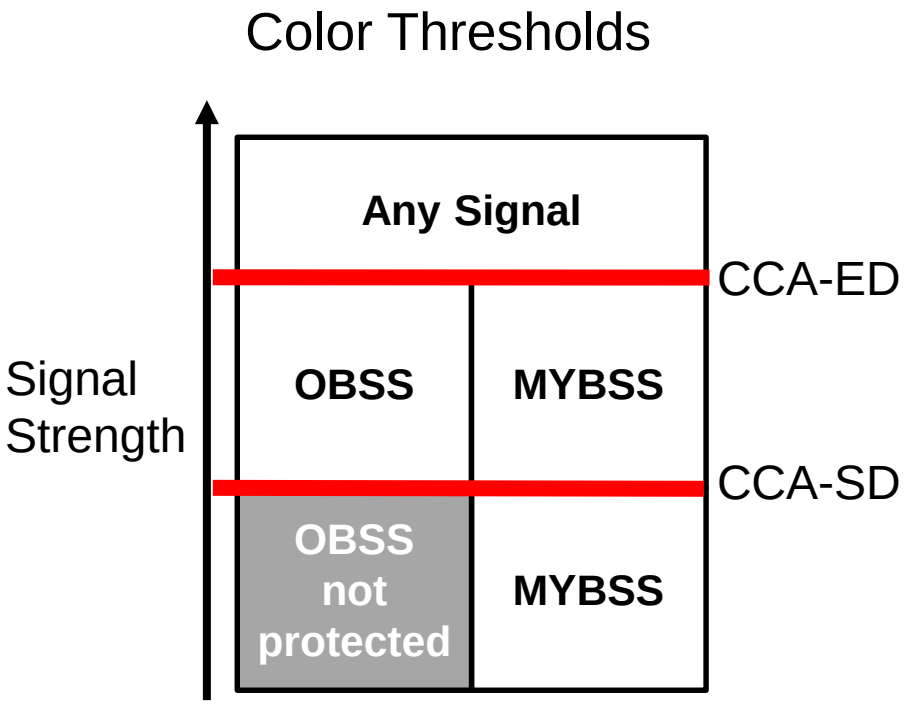
- Focus on MAC modelling fidelity
- Can “turn up” PHY modelling fidelity as required



MAC System Level Simulation

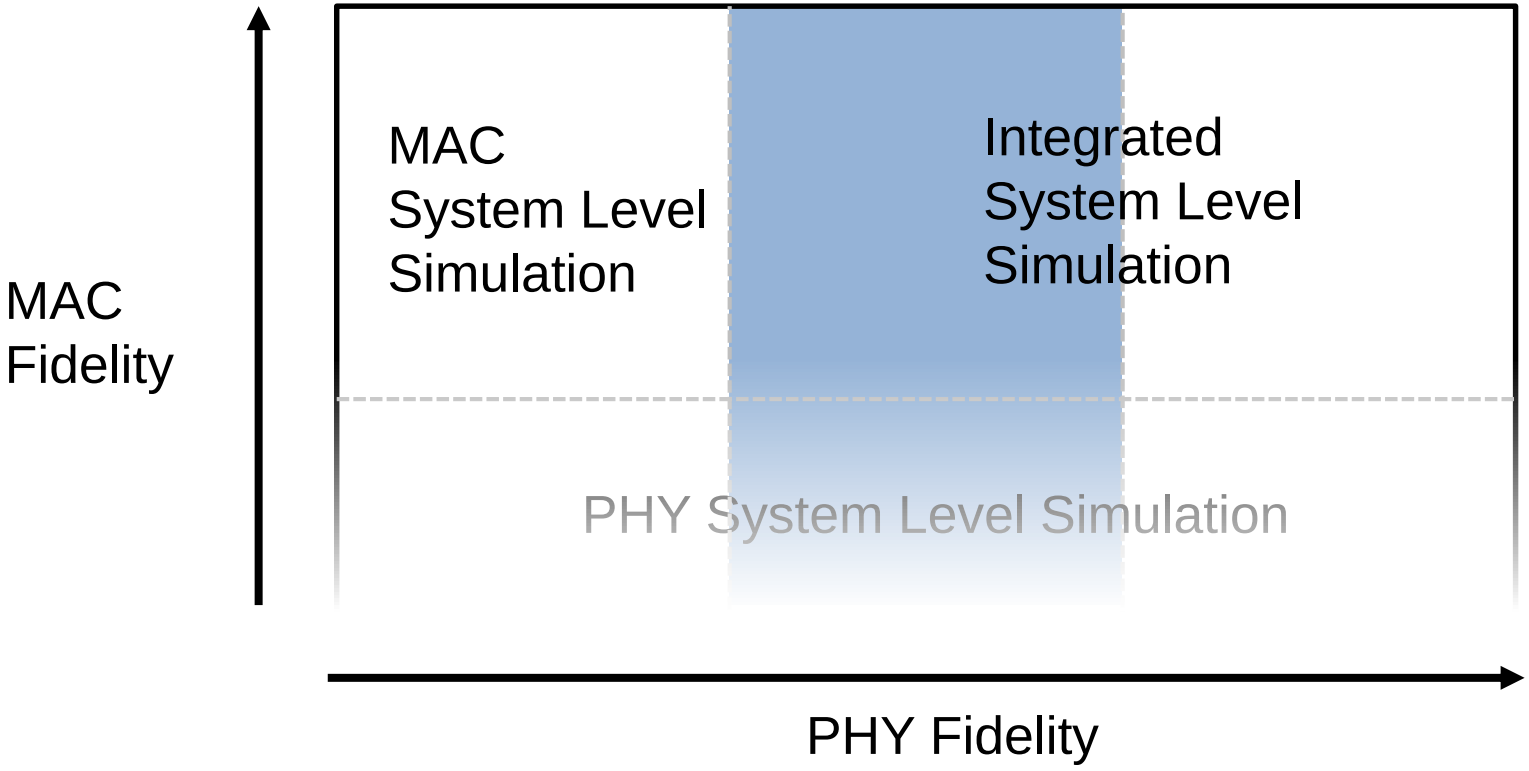
- Very simple PHY e.g. abstracted AWGN SISO





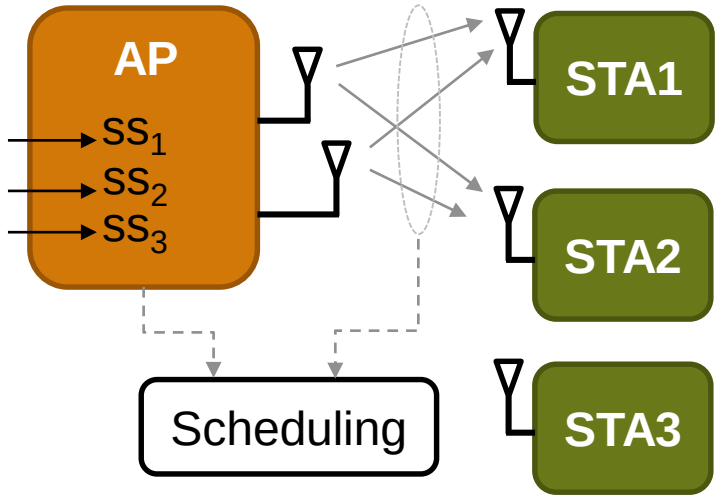
Integrated System Level Simulation

- Complex abstracted PHY e.g. MIMO and fading



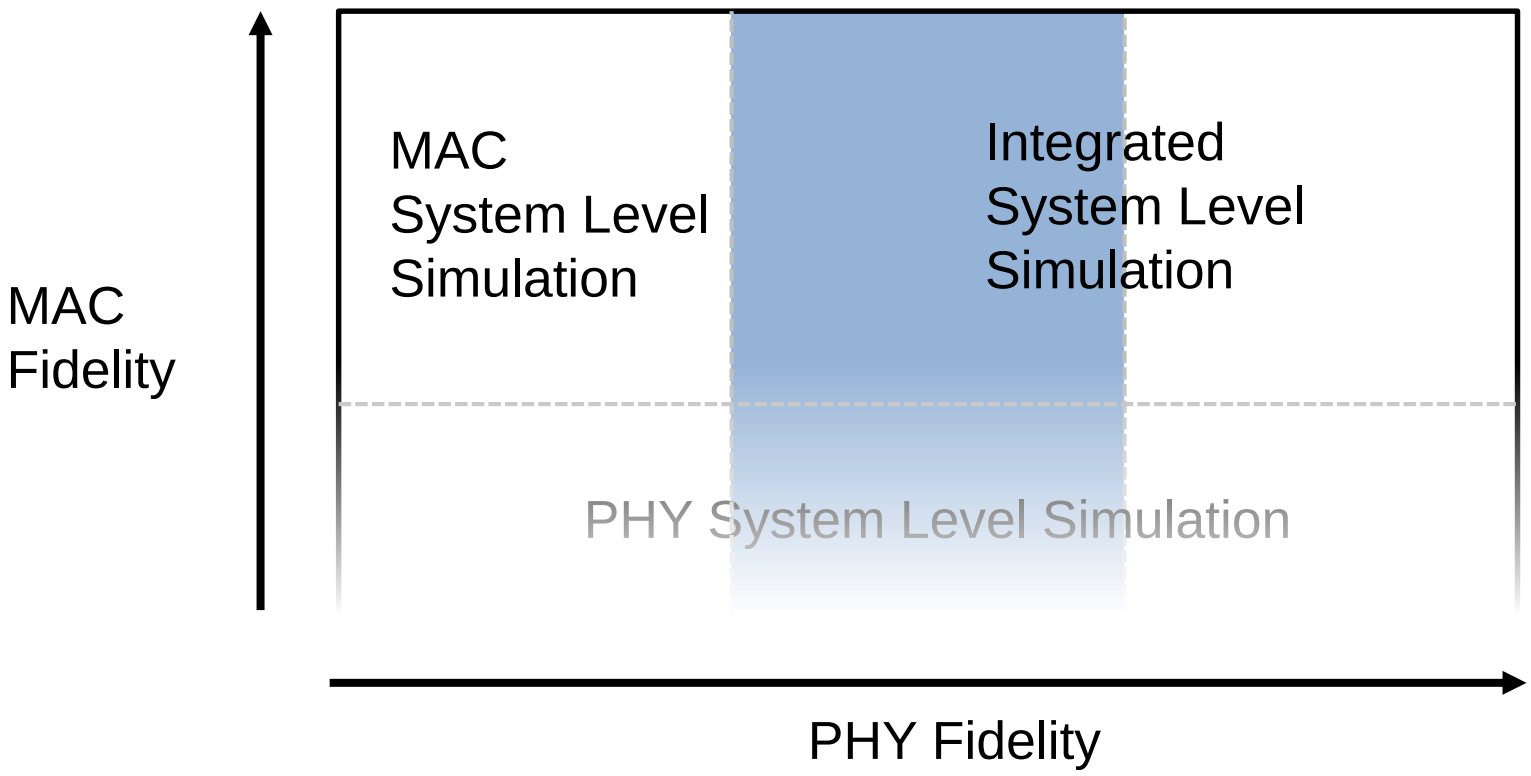
Cross-Layer algorithms:

- MU-MIMO
- Scheduling
- Rate adaptation

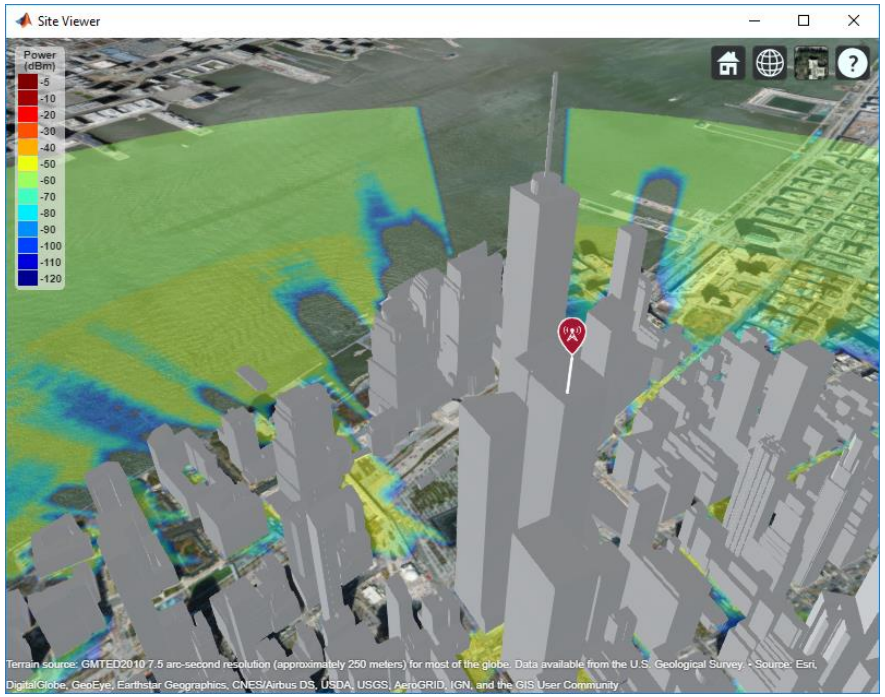


Integrated System Level Simulation

- Complex abstracted PHY e.g. MIMO and fading

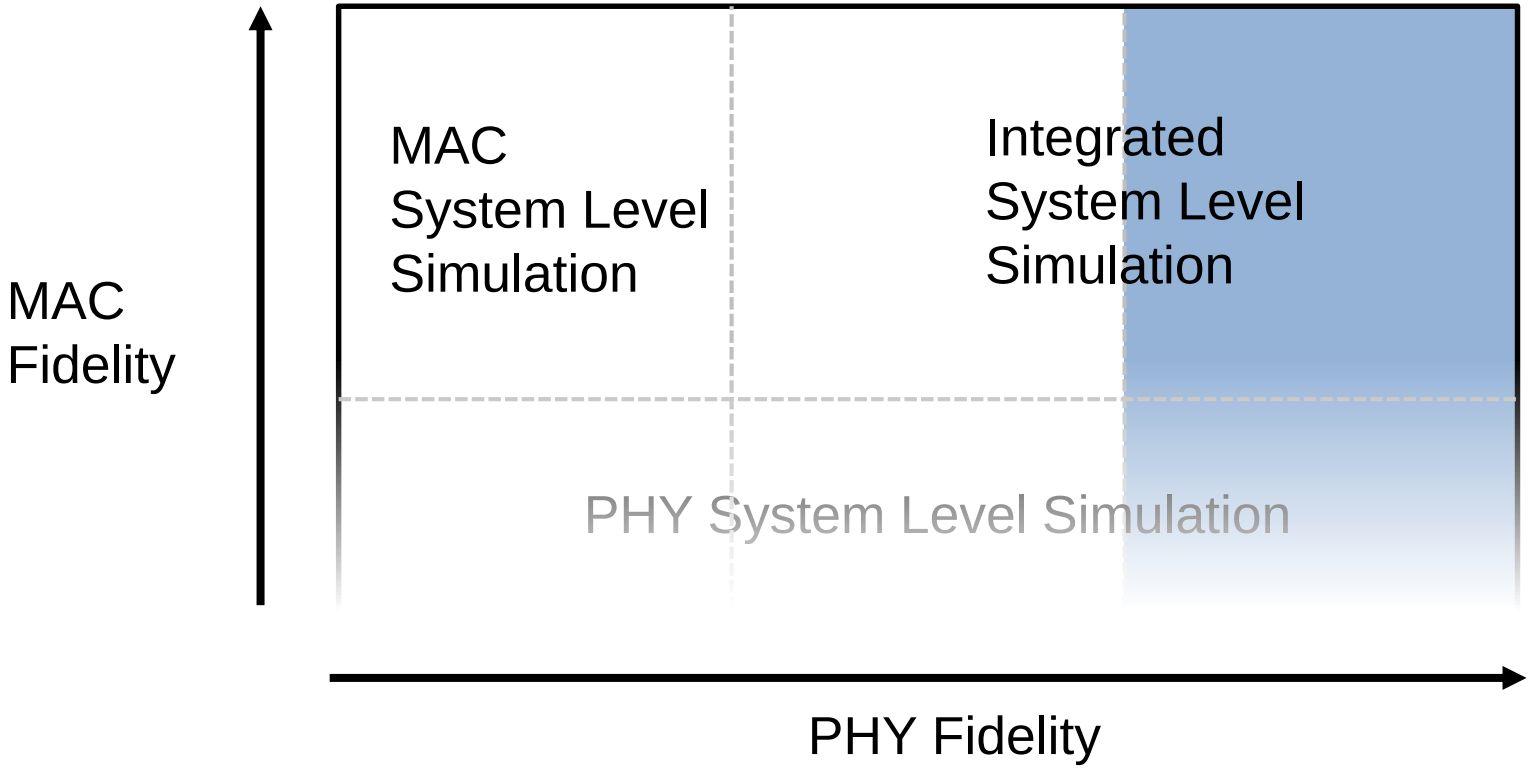


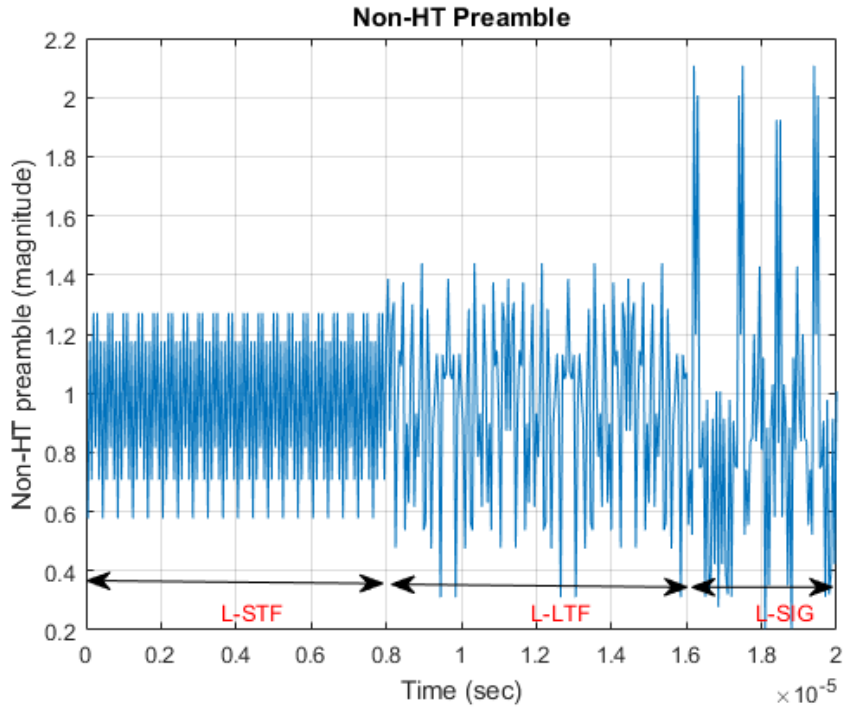
Coexistence with 5G



Integrated System Level Simulation

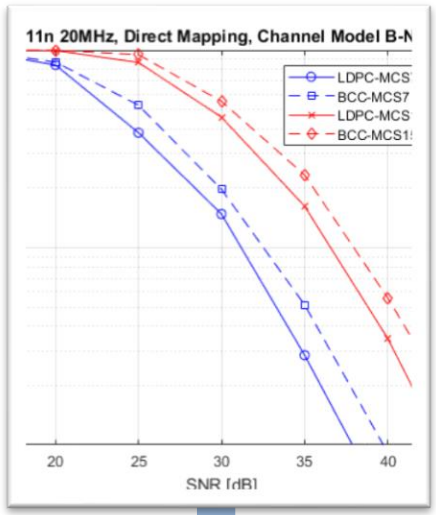
- Full fidelity PHY modelling



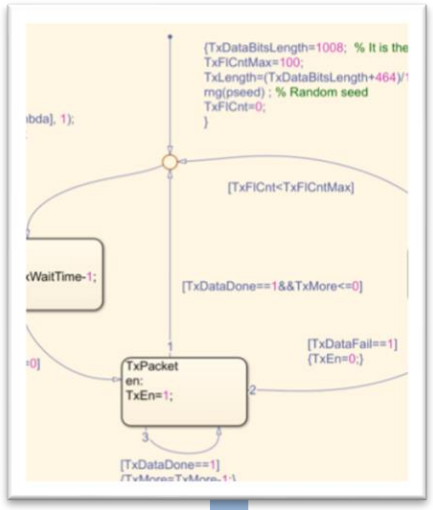


Summary

Physical Layer



MAC and Protocol



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WLAN Toolbox

Simulate, analyze, and test the physical layer of WLAN communications systems

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