Challenges in Research Organization and Infrastructure for Cross-Layer Reliability

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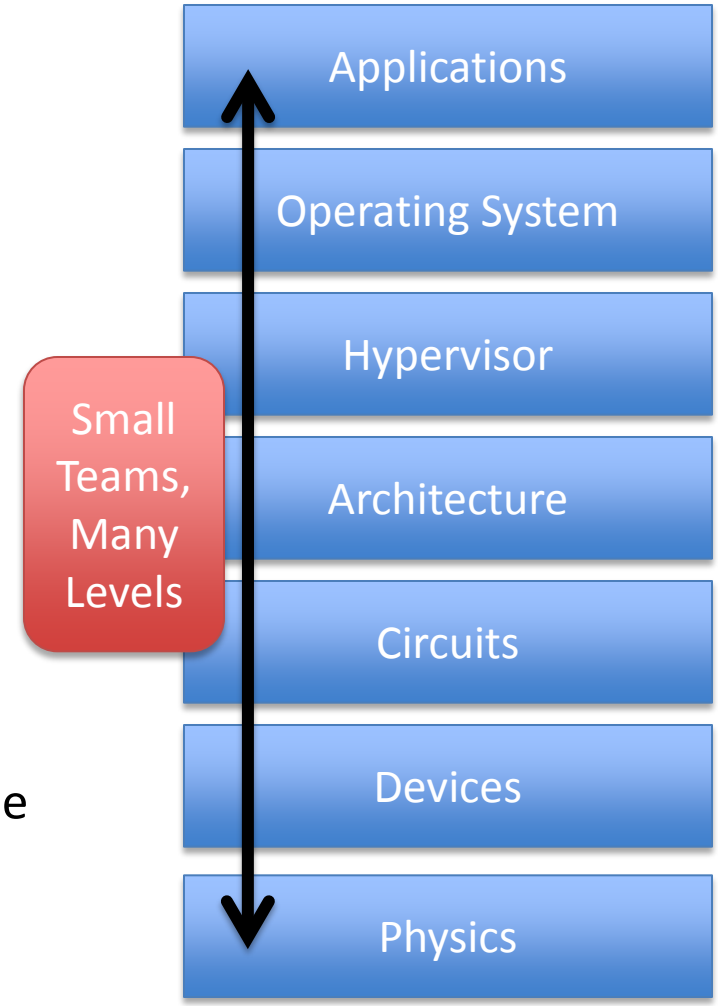
Questions:

- What infrastructure and resources are required to allow productive academic research on cross-layer reliable systems?
- How can funding agencies provide, or fund the efforts that will provide, that infrastructure?
  - Motivated by conversations with NSF program managers about how this research could fit into their funding model

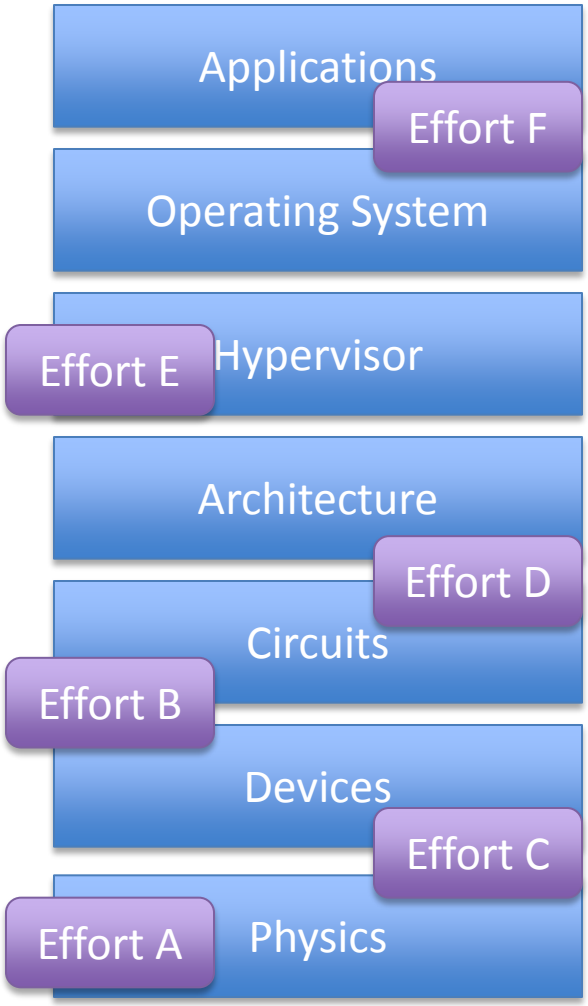
What are the Challenges?

- Tremendous breadth required to address all layers simultaneously
- Academic groups typically small
  - Consequence of funding, university structure
- Prohibitive cost of full experimental evaluation
  - Prototype chips
  - Beam testing
  - Would results have predictive value by the time you're done?



What Do we Need?

- Concurrent effort across all layers
  - Can't afford to serialize development of approaches at adjacent layers, much less across entire stack
- Fast propagation of results between groups
  - Don't require complete re-work of tools to build on someone else's results
- Are we getting recursive?
  - Models and abstractions to research models and abstractions to …



Why Won't Current Approaches Work?

- Lack of a standard "framework" for cross-layer systems
  - Need to build/simulate an entire system
    - Effort
    - Hard to compare results
  - Analogy to computer architecture before freely-available simulation tools
- Lack of confidence in error models
  - Models empirical, lack of good connection to physics
  - Phenomena change so much from generation to generation
- Multi-layer simulation performance unacceptable
  - Ever tried running Spice on a processor netlist?

Some Ideas

- Fund large centers or DARPA-style teams
  - Could generate good results, but limits number of researchers
- Fund shared infrastructure resources
  - FPGA-based simulation fabrics?
  - Databases of error logs/diagnosis?
  - Grid platforms?

- Are research infrastructures for reliability themselves a research area?
  - If so, how do we fund such an effort under existing agency models?
    - Deliverables?
    - Support?
    - Code that doesn't need to be shipped with a grad student?