Computer Architecture @ Purdue ECE

- Focus: Architecture
  - Prof. Yung-Hsiang Lu
  - Prof. Vijaykumar
  - Prof. Mithuna Thottethodi

- Productive Collaborations
  - Within ECE
  - CS Department

Prof. Thottethodi’s Research Interests

- Distributed Micro-architectures (DMAs)

- Communication fabrics for DMAs
  - How do distributed elements communicate/co-operate?

- Uniprocessor Micro-architecture
  - Exposing intra-instruction communication
  - Energy efficiency
  - Fault-tolerance

- Education/research tools
  - Animated micro-architecture simulators
Motivation

- Why worry about hardware organization and/or architecture?
  - Consistent performance growth (technology + architecture)
  - End of the road?

(Source: Intel)

Diminishing Returns

- Technology constraints: Wire delays, Pipeline limits
- Challenge
  - New growth path
Distributed Micro-architectures

Today

- Bang for the buck
- Extras
  - Redundant computation (fault tolerance)
  - Increased throughput
  - Energy efficiency

Tomorrow?

Yung-Hsiang Lu

low-power, design automation, architecture, distributed systems

- Automatic computers design
  ⇒ make computers design themselves
- Fault-tolerant sensor networks
  ⇒ balance robustness and energy consumption
- Distributed mobile robots
  ⇒ create a group of intelligent robots that can work together
- Image processing in handheld devices
  ⇒ bring high-quality images / videos everywhere
### Prof. Vijaykumar's Projects At a Glance

#### Power-related (with Prof. Roy, Mike Powell)
- leakage, dynamic power, power density, di/dt noise

#### Fault Tolerance (with Prof. Pomeranz, Mohamed Gomaa, Chad Scarbrough)
- Using simultaneous multithreading & chip multiprocessors

#### Network Processors (with Jahangir Hasan)
- Memory bandwidth optimizations

#### Java/Garbage collection (with Prof. Hosking, Kailash Agrawal)
- Memory/architecture support for garbage collection

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### Prof. Vijaykumar's Projects At a Glance

#### Speculation/speculative threading (with Il Park, Chong Ooi)
- For future billion-transistor chips
- With Prof. Eigenmann: Compiler techniques

#### Security (with Prof. Brodley, Ankit Jalote)
- Hardware support to stop buffer overflow attacks

#### Software Reliability (Prof. Bagchi, Yen Shue, Jin-Yi Wang)
- Architecture support for improved software reliability

#### Architectures for future VLSI technologies (with Zeshan Chishti, Ethan Schuchman)
- Technology scaling issues