Big Red Infinity

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IU’s Big Red Supercomputer in 2030?

• Today’s Big Red 2 Performance is about 1 Petaflops
• Extrapolation of earlier trends suggest Big Red 2030 Performance: 1 Exaflops
• But Big Problems are Intruding with Barriers to Progress
  • Moore’s Law, Dennard Scaling, Power & Clock speed
  • Productivity, Portability, Reliability, Cost, Size
Projected Performance Development

![Graph showing projected performance development with data points and labels for Gflop/s, Tflop/s, and Pflop/s at various years from 1994 to 2020.](image)

Courtesy of Erich Strohmaier, LBNL
Three-segment approximation

(4.42, 6.22e6)

(36.6, 9.52e5)
Technology Demands new Response

Figure courtesy of Kunle Olukotun, Lance Hammond, Herb Sutter, and Burton Smith
Innovative Paradigm, Software, Architecture

• Paradigm – Execution Model (Asct. Prof. Jeremy Siek, CS)
  • Replaces conventional CSP for reduced starvation, latency, overhead, contention

• Runtime Software (Asct. Prof. Ryan Newton, CS)
  • Exploits runtime information for dynamic resource management
  • Performs adaptive task scheduling for best utilization
  • PRS software to be delivered to open source community for efficiency & scalability

• Parallel Computer Architecture (Prof. Thomas Sterling, ISE)
  • Non-von Neumann architecture to eliminate legacy bottlenecks
  • Exposes parallelism, increases bandwidth, reduces latency, lower power
  • Simultac non von Neumann architecture highly replicates tiny Fontons
Fundamental System Components

- Fonton
- On-chip low-latency network
- Socket
- Module
- Global interconnect
Exaflops Simultac System

Footprint: 36.9 m² (396 ft²)
THANK YOU

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