2016 Winter Review: Lab Overview and Update

John Ousterhout
Faculty Director
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Platform Lab Motivation

New platforms enable new applications

- **Platform**: general-purpose substrate
  - Software and/or hardware
  - Makes it easier to build applications or higher-level platforms
  - Solves significant problems
  - Usually introduces some restrictions

- **Example**: Map/Reduce computational model
  - Simplifies construction of applications that use hundreds of servers to compute on large datasets
  - Hides communication latency: data transferred in large blocks
  - Masks failures & slow servers
  - Restrictions: 2 levels of computation, sequential data access
Platform Lab Mission

Create the next generation of platforms to stimulate new classes of applications

Platforms

Large Systems  Collaboration
Platform Lab Faculty

Bill Dally
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Christos Kozyrakis
Phil Levis
Nick McKeown
John Ousterhout
Guru Parulkar
Mendel Rosenblum
Keith Weinstein
Faculty Director
Executive Director
Drivers For New Platforms

Goals:

Ease of Use (Raise productivity)
High Performance (Achieve physical limits)

??

Techniques:

Scalability and elasticity
- Build large systems out of many small, cheap components
- Vary scale by adding/removing components
- Challenges:
  - Fault tolerance
  - Scale-independent architectures

Specialization and heterogeneity
- Special-purpose components much more efficient than general-purpose
- Build future systems out of heterogeneous collections?
- Challenges:
  - High design cost of components
  - Integration

February 1, 2016
Platform Lab Overview and Update
Lab Progress

- Identify an over-arching goal: Swarm Control Infrastructure
- Initiate a few flagship projects:
  - Scalable control planes
  - ??
  - ??
- Create a more collaborative environment
  - Weekly Platform Lab Seminar
  - Connect with application experts
Opportunity: New Datacenter Clusters

- Increasing Core Density
- Large Nonvolatile Memories
- Specialized Components
- Low Latency Interconnects
- Large Nonvolatile Memories
Opportunity: Swarms of Devices

Game Changers:

- More and larger swarms
- Increasing collaboration (more centralized management)
Opportunity: Changing Interconnects

- Increasing Bandwidth
- Separation of Control and Data Planes
- Decreasing Latency
- Software Defined Control and Data Planes
- Open Source Implementations of Infrastructure
- Wired/Wireless Networks
Uber-Goal: Swarm Control Infrastructure

Next-Generation Datacenter Cluster

Wired/Wireless Networks

Device Swarms
Research Projects

- RAMCloud Storage System
- Programmable Network Fabrics
- Self-Incentivizing Networks
- Scalable Control Planes
- New Memory/Storage Systems
- IX Operating System
- Low-Latency Software Stack
- Wired/Wireless Networks
- Next-Generation Datacenter Cluster
- Device Swarms
Lab Progress

- Identify an over-arching goal: **Swarm Control Infrastructure**

- Initiate a few flagship projects:
  - Scalable control planes
  - ??
  - ??

- Create a more collaborative environment
  - Weekly Platform Lab Seminar
  - Connect with application experts
Other News

- PhD students interviewing this year:
  - Adam Belay: IX operating system
  - Ankita Kejriwal: secondary indexes in RAMCloud
  - Yiannis Yiakoumis

- We even have a logo!
Conclusion

● **Momentum is building:**
  - People
  - Ideas
  - Projects
  - Collaborations

● **Next steps:**
  - Define additional flagship project(s)
  - Learn more about applications
  - Continue to develop collaborations
Questions/Discussion