Platform Lab
Overview and Update

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Thank You, Sponsors!
Special Thanks To...

vmware®
Platform Lab Faculty

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Guru Parulkar
Executive Director
Mendel Rosenblum
Keith Winstein
Platform Lab Overview

- **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

- **Recent examples**
  - HTTP + HTML + Javascript
  - GFS + MapReduce
  - Smart phones + GPS
  - OpenFlow

*New platforms enable new applications*
Platform Lab Mission

Create the next generation of platforms
Stimulate new classes of applications

- Variety of projects
- Mostly focused on computing at scale:
  - Datacenters
  - Networks
- One or two flagship projects
  - Magnets for collaboration
- Current flagship: Big Control
Lab History

2014
- Discussions with VMware

2015
- Founding gift from VMURF
- Transition retreat: SEDCL, PL
- Kickoff faculty retreat
- Other companies join lab as affiliates

2016
- NSF Expedition pre-proposal: Big Control
- Winter Review
- Today: 2016 Retreat

VMware challenge: think big!
Flagship Project: Big Control

- Infrastructure for collaborative device swarms
- Many related research challenges:
  - Networking (wide area, datacenter)
  - Low-latency datacenter technologies
  - State management, notifications
  - Data ingestion, inference
  - Declarative planning
  - Security
  - Applications
- Submitted NSF Expedition proposal
  - Includes other faculty in CS, EE, Aero/Astro
- Next talk will discuss in detail
Major Research Thrusts

- **Programmable fabrics (Cisco, Google, Facebook, VMware)**
  - Pisces: P4 front-end for OVS scheduling (Choi)
  - PIFO: new abstraction for packet scheduling

- **Low-latency datacenter (Facebook)**
  - Homa network protocol for RPCs (Montazeri)
  - Core-aware thread scheduling (Qin)
  - IX operating system (Belay)
  - Indexes and transactions in RAMCloud (Kejriwal, Lee, Park, Yang)
  - Cliffhanger: better memcached memory allocation (Cidon, Eisenman)

- **Scalable control planes (VMware)**
  - Discussion group (Stanford, VMware, ONLab)
Major Research Thrusts, cont’d

- **Resource-efficient datacenters**
  - ML and dynamic control in cluster management (Delimitrou)
  - Starling HPC scheduler (Qu, Mashayekhi, Terei)
  - IX operating system (Belay)
  - Flash disaggregation (Klimovic, Litz)
  - XFabric: bandwidth allocation in datacenters (Nagaraj, Bharadia)

- **Hardware support for deep neural networks**
  - Pruning, compression, acceleration (Han, Liu)

- **In-memory graph processing systems**
  - Grazelle (Grossman)
  - TorcDb (Ellithorpe)
Major Research Thrusts, cont’d

- Application-transport codesign for better networking performance (Facebook):
  - DrCloud: cluster job planner (Terei, Mashtizadeh, Qu)
  - ExCamera: massively distributed video encoder (Fouladi, Wahby)
  - Koho: utility-maximizing transport for the developing world (Hill, Yan)
## Recent/Soon-To-Be Graduates

<table>
<thead>
<tr>
<th>Name</th>
<th>Research Focus</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>Adam Belay</td>
<td>OSes for low latency and high throughput</td>
<td>MIT</td>
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<td>Dinesh Bharadia</td>
<td>Full-duplex radios</td>
<td>Postdoc</td>
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<td>Christina Delimitrou</td>
<td>Resource-efficient datacenter management</td>
<td>Cornell</td>
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<td>Subhasis Das</td>
<td>Cache (re)placement policies</td>
<td>Zoox</td>
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<td>Kiran Joshi</td>
<td>Sensing using wireless signals</td>
<td>startup</td>
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<td>Ankita Kejriwal</td>
<td>Secondary indexes for RAMCloud</td>
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<td>Rakesh Misra</td>
<td>Low latency control for wireless networks</td>
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<td>Milad Mohadammi</td>
<td>Energy-efficient out-of-order execution</td>
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<td>Nic McDonald</td>
<td>Service-oriented NIC architectures</td>
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<td>Yiannis Yiakoumis</td>
<td>User-defined networks</td>
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Retreat Agenda Highlights

- Numerous technical talks
- Breakout discussions:
  - Applications for Big Control (today)
  - Technologies for Big Control (tomorrow)
- Lightning talks and poster session (today)
- Long break for recreation/discussion (tomorrow)
- Industrial feedback (tomorrow)
Conclusion

- Momentum continues to build
- Expect new projects to start over the next year
  - More aligned with Big Control
  - Initial projects likely to be exploratory, possibly throw-away
- Looking for opportunities to collaborate on Big Control
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