POMI2020 Overview and Update

Guru Parulkar
parulkar@stanford.edu
pomi.stanford.edu

The Vision We all Share

Borrow the display, keyboard, memory, etc

PC, TV at home, on the road, in hotels, on the plane

Great opportunities
- Revolution in Mobile Computing will change our field.
- Opportunity to bring change before ossification.

Today

Problem with the network.
- 3G: Cellular networks vs IP
- IP: Bad for mobility, security, management
- Need a network that continually evolves

Where we will end up otherwise

Barriers
1. Big-brother portals will own our data
2. We will be locked-in to applications
3. Wireless capacity will stay closed
4. Network will stay ossified

What we found ourselves talking a lot about...

Choice of
- Data-location
- Wireless network
- Spectrum

Lack of innovation
- Network

Choice & Competition

Innovation

Openness
Beyond Barriers ...

Handhelds:
1. Give users more control of energy usage
2. Improve the security of the OS and applications
3. Make it easier to develop applications for new populations

Infrastructure:
1. Improve our connectivity to the cloud
2. Improve the privacy of our data in the cloud
3. Allow us to offload computation to the cloud

POMI Research Agenda

Infrastructure
- Handheld
  - UI
  - Secure mobile browser
  - Cinder: Energy aware, secure OS
  - HW Platform

Data & Computing Substrate
- PPI, Junction and Concierge

Network Substrate
- Software Defined Network & OpenFlow

Radio technology

Applications

Economics

UI

Security

OS

Networking

Radio

Dan Boneh
Monica Lam
David Mazières
Mendel Rosenblum
Phil Levis
Ramesh Johari
Fouad Tobagi
Arogyaswami Paulraj

+ 67 graduate students

Departments of EE, CS, MS&E and School of Education

POMI Team
Network Substrate: OpenFlow/Software Defined Networking

Internet has been wildly successful

Internet has many problems: Well known for many years

Root cause: Internet has been closed for innovations

Why Is Internet Closed for Innovation?

Routing, management, mobility management, access control, VPNs, ...

- Million of lines of source code
- 6000+ RFCs
- Billions of gates
- Bloated
- Power Hungry

Vertically integrated, complex, closed, proprietary
Not suitable for experimental ideas
Not good for network owners & users; Not good for researchers.

From Vertically Integrated to ...
Open Software Defined Networks

- Well-defined open API
- Constructs a logical map of the network
- Open vendor agnostic protocol
- SIMPLE Packet Forwarding Hardware

Example Research Enabled
- Data center: energy conservation, routing, and management
- Seamless use of diverse wireless networks
- Network based load balancing
- Packet/circuit convergence, traffic engineering
- Simpler control plane for converged packet/circuit MPLS networks
- Slicing and scalable remote control/management of home networks
- Distributed snap shot of VMs (by DOCOMO researchers)
- Inter-domain routing with pathlets (by UIUC)
- Redundant traffic elimination [for CDNs] (by Univ of Wisconsin)
- And many more …

Early Ecosystem
Interest from providers/data center operators

Nation-wide OpenFlow Infrastructure
Part of NSF’s GENI
Scope of Activities

9:00am - 9:45am Keynote Speaker: Scaling Across Mobile Devices - David Fetterman, Facebook
9:45am - 10:30am Virtualized Wireless Infrastructure - Sachin Katti, Stanford
10:30am - 11:00am Break
11:00am - 11:45am How People Trust and Evaluate One Another in Social Media - Jure Leskovec, Stanford
11:45am - 12:15pm Sharing Information in Rural Communities Through Voice Interaction - Neil Patel, Stanford
12:15pm - 1:15pm Lunch

1:15pm - 1:45pm Achieving Single Channel Wireless Full-Duplex - Mayank Jain, Stanford
1:45pm - 3:15pm The MobiSocial Computing Laboratory, Monica Lam, Stanford
Peer-to-Peer Social Computing with NFC - Ben Dodson, Stanford
Social Topologies Derived from Email and Photo Tags - T. J. Purcell, Stanford
Mr. Privacy: An Open Social Networking Platform Based on Email - Michael Fischer, Stanford
3:15pm - 3:45pm Break
3:45pm - 4:15pm Enhancing the Mobile Experience Through Interlinked Image Collections - Leo Guibas, Stanford
4:15pm - 4:45pm Load Balancing and Traffic Engineering: Constructive Interference - Ramesh Johari, Stanford
4:45pm - 5:00pm Wrap-up