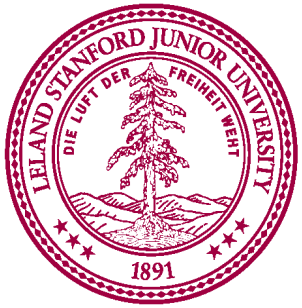


Programmable Open Mobile Internet POMI 2020 pomi.stanford.edu

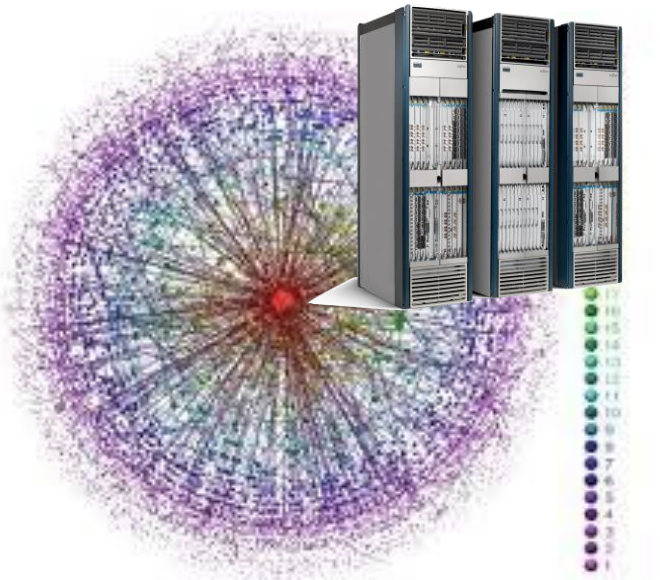
Expeditions in Computing PI Meeting
May 14-16, 2013

PI
Nick McKeown
nickm@stanford.edu

Presenters
Monica Lam
lam@cs.stanford.edu

Guru Parulkar
parulkar@stanford.edu

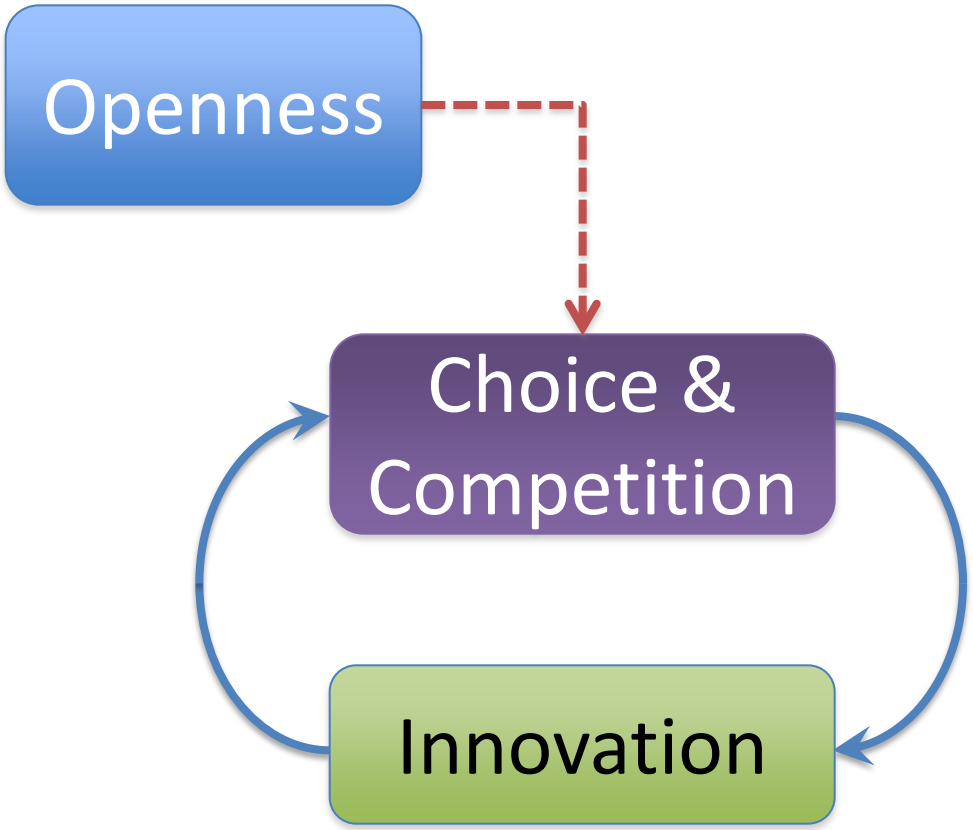
Trends of 2007-08



Emergence of yet another computing paradigm

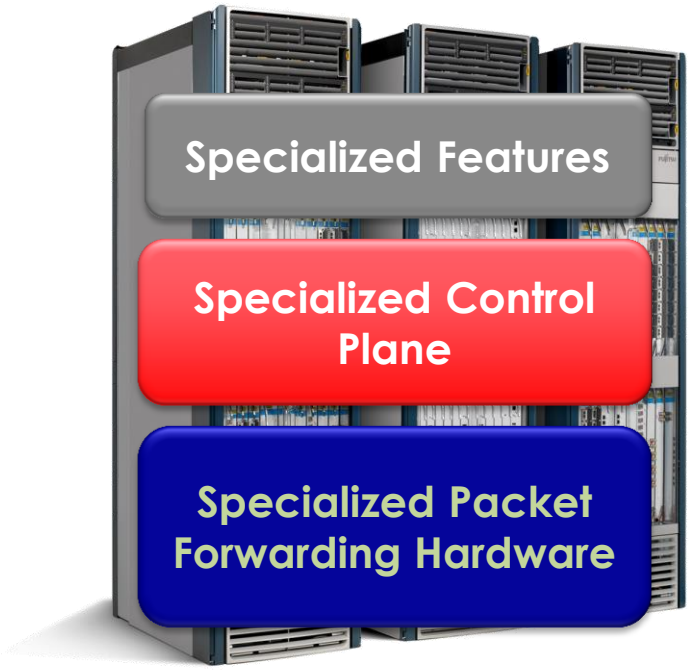
Closed proprietary solutions taking over computing?

Our Focus: Enable Innovation with Openness and Choice



- Mobile Handheld
- Computing/Data Substrate
- Choice of Wireless Nets
- Internet Infrastructure

Example: Internet Infrastructure



Hundreds of protocols
6,500 RFCs

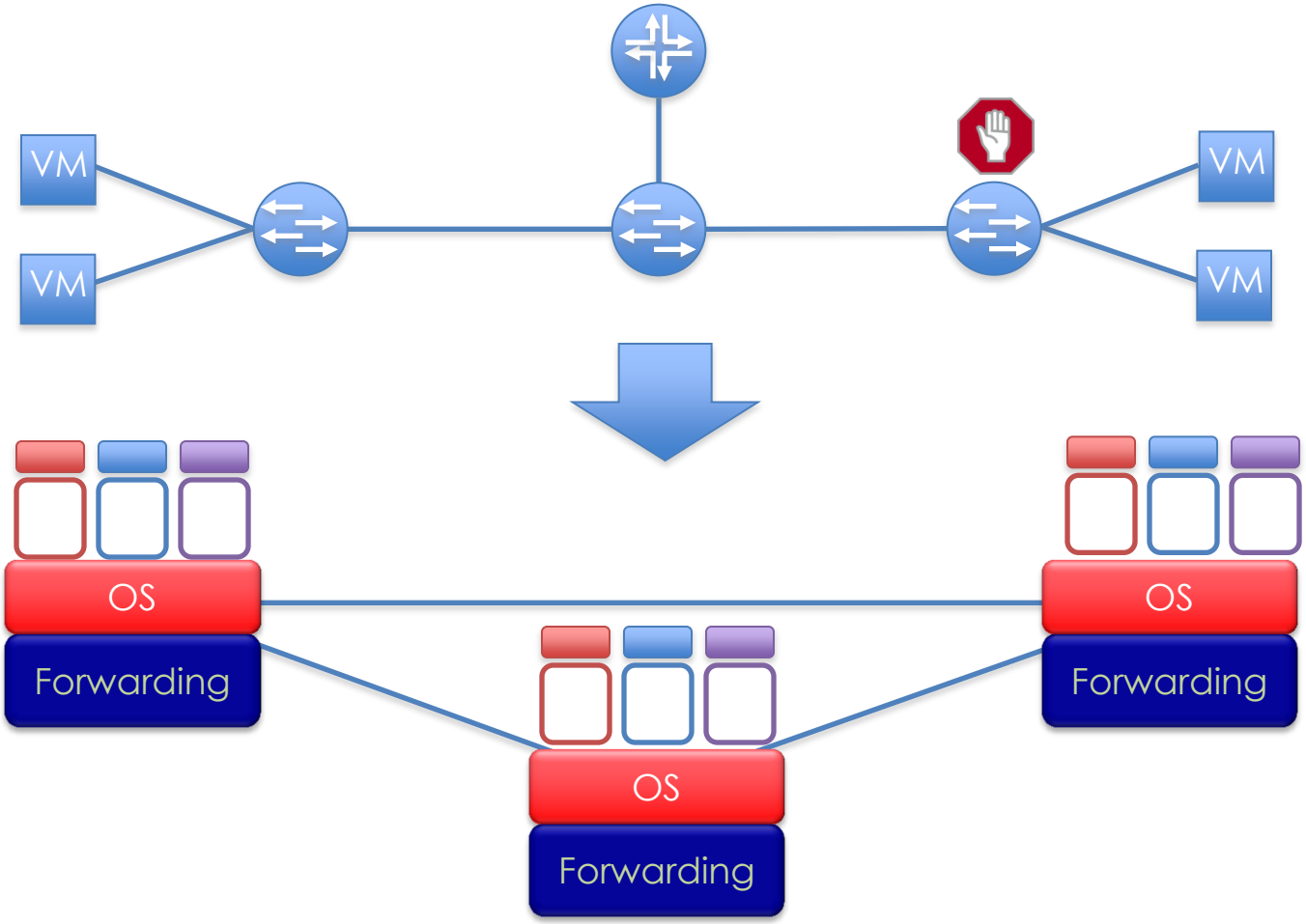
Tens of Millions of lines of code
Closed, proprietary, outdated

Billions of gates
Power hungry and bloated

Vertically integrated, complex, closed, proprietary

Not good for network owners and users

Support Virtual Infrastructure on Demand?

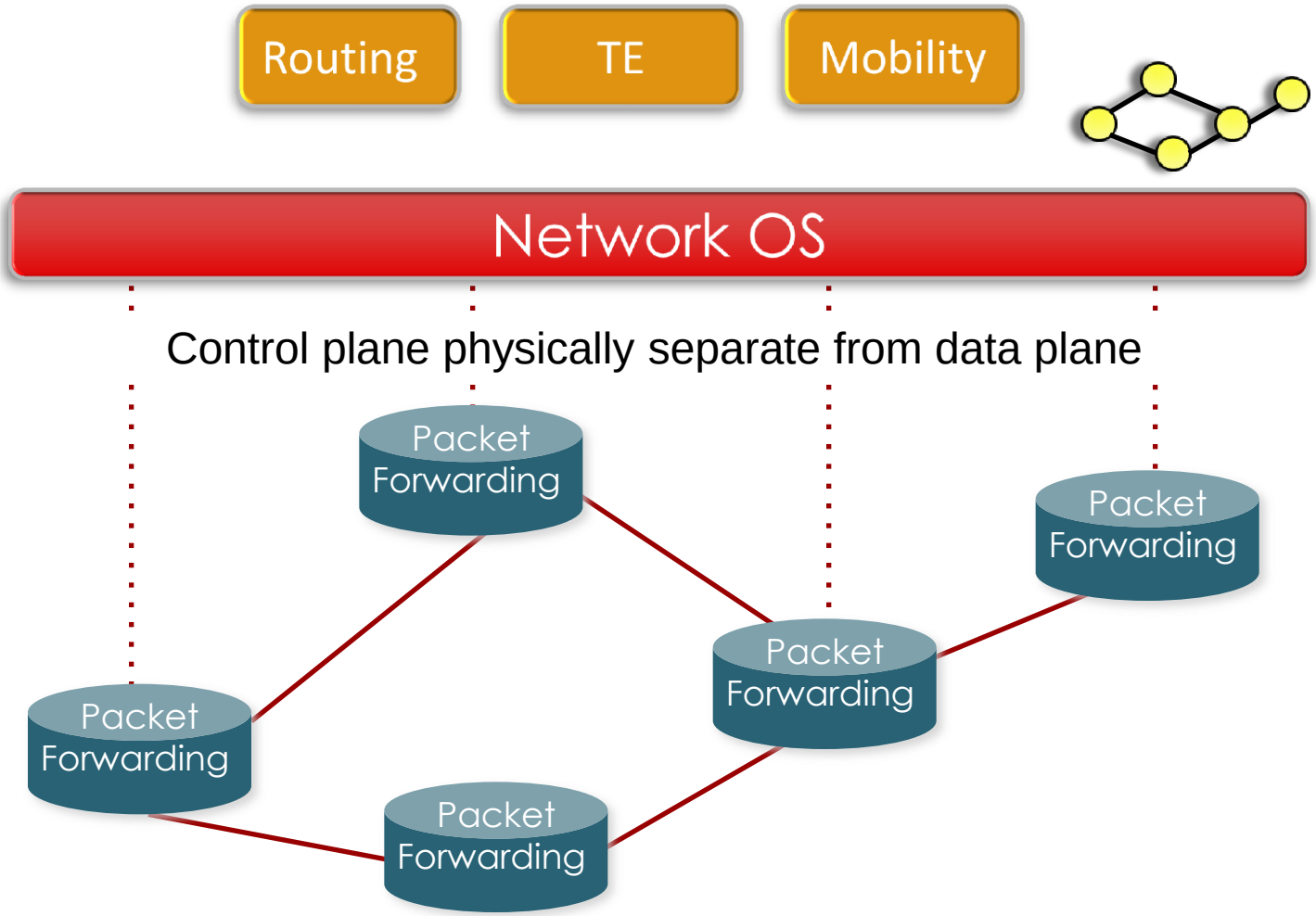


Everyone needs their own infrastructure on demand

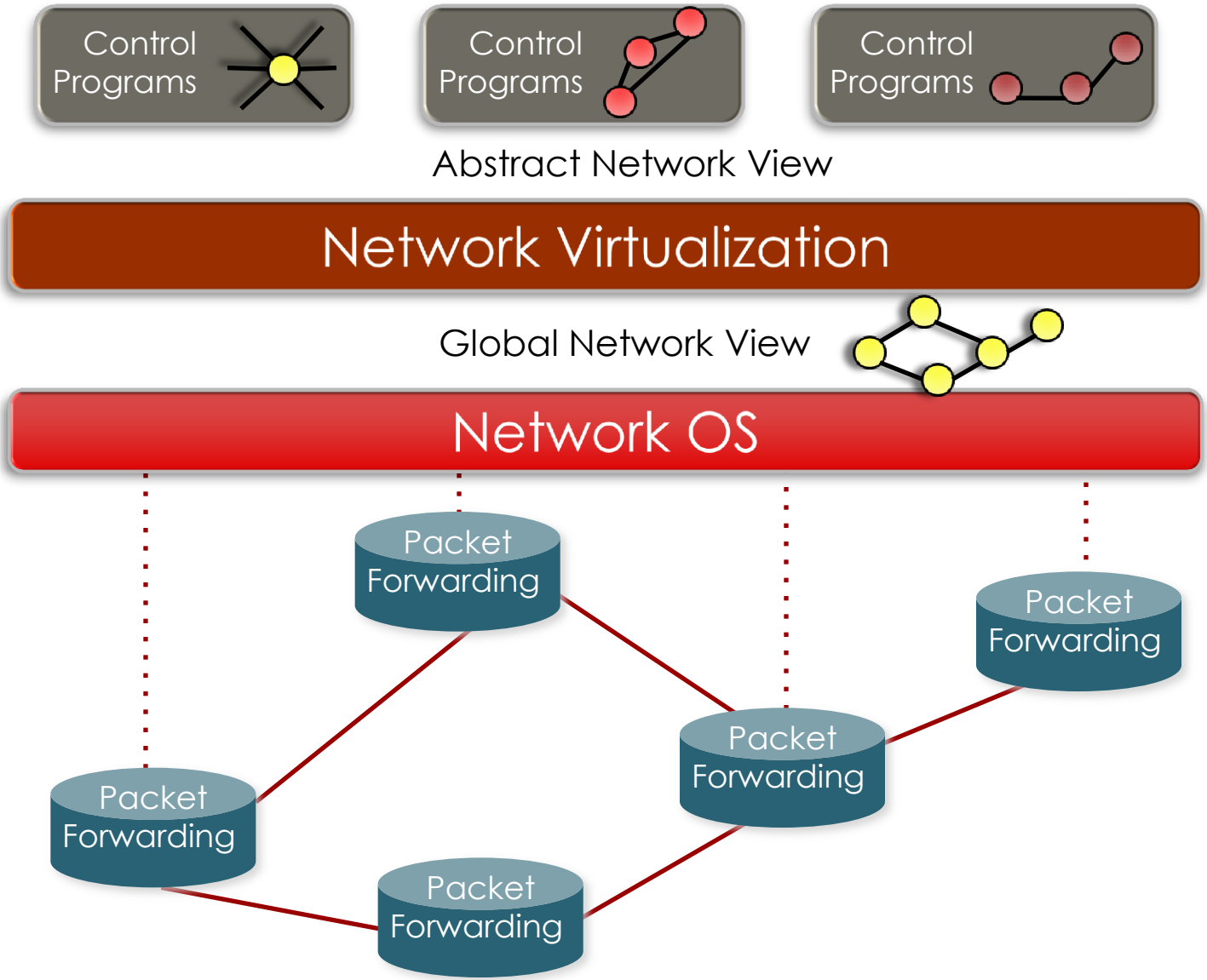
How to support dynamic virtual infrastructure on physical networks that are not programmable

Software Defined Network (SDN): Fundamental Elements

Single control plane controls several forwarding devices



SDN with Virtualization

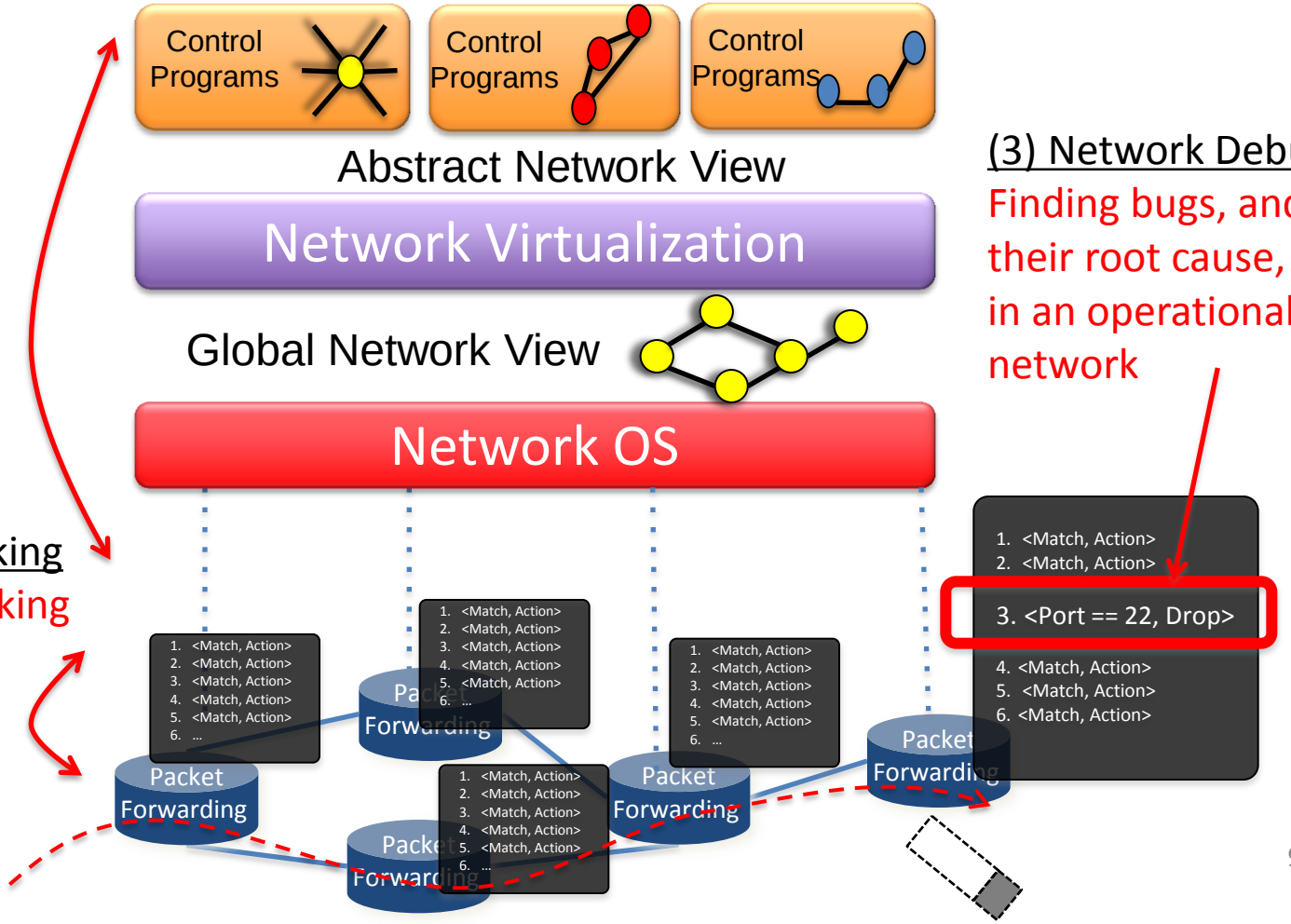


SDN Abstractions Benefits: Network Trouble Shooting

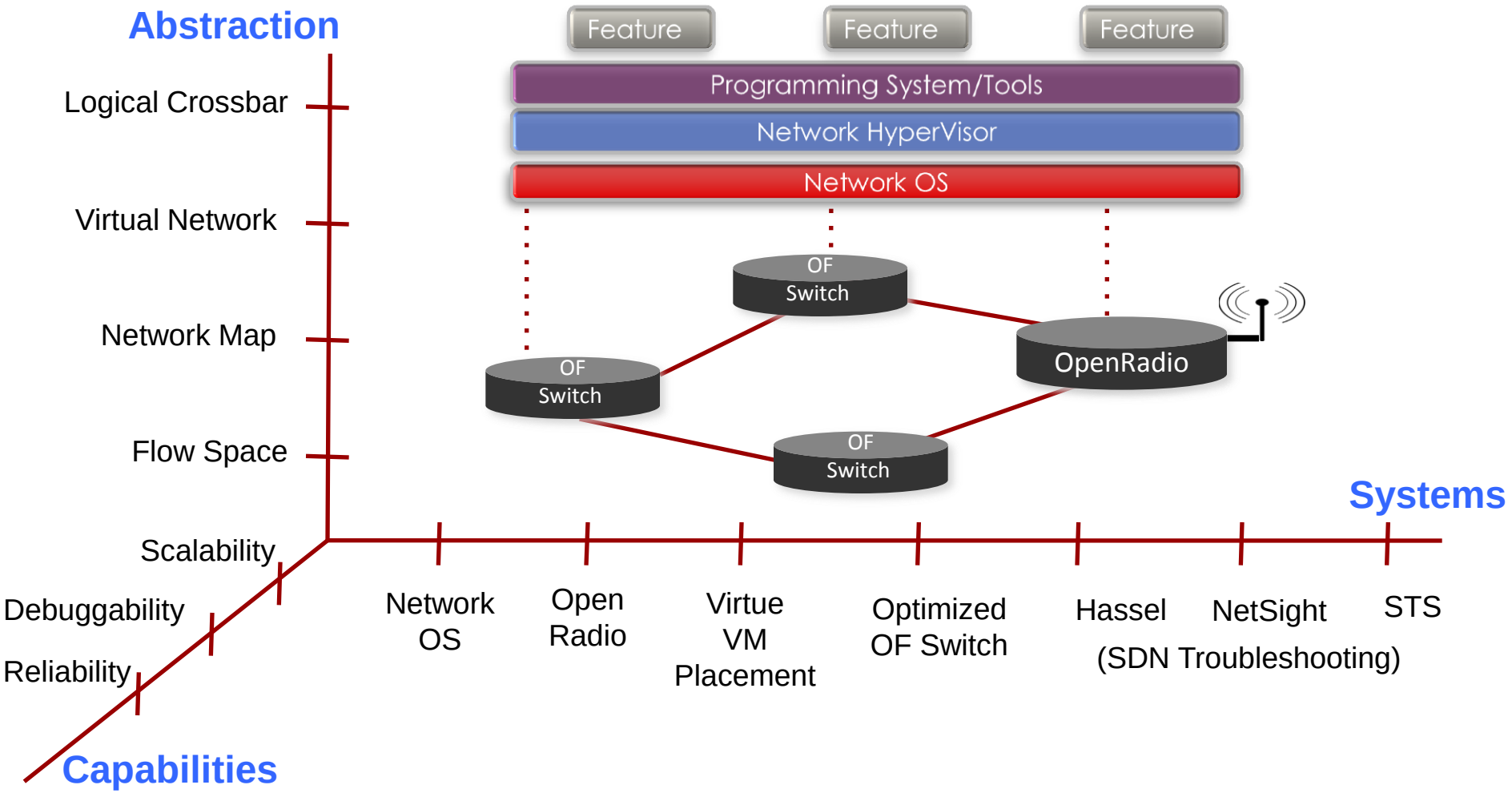
(1) Static Checking
Is the "policy" correctly compiled to the forwarding rules?

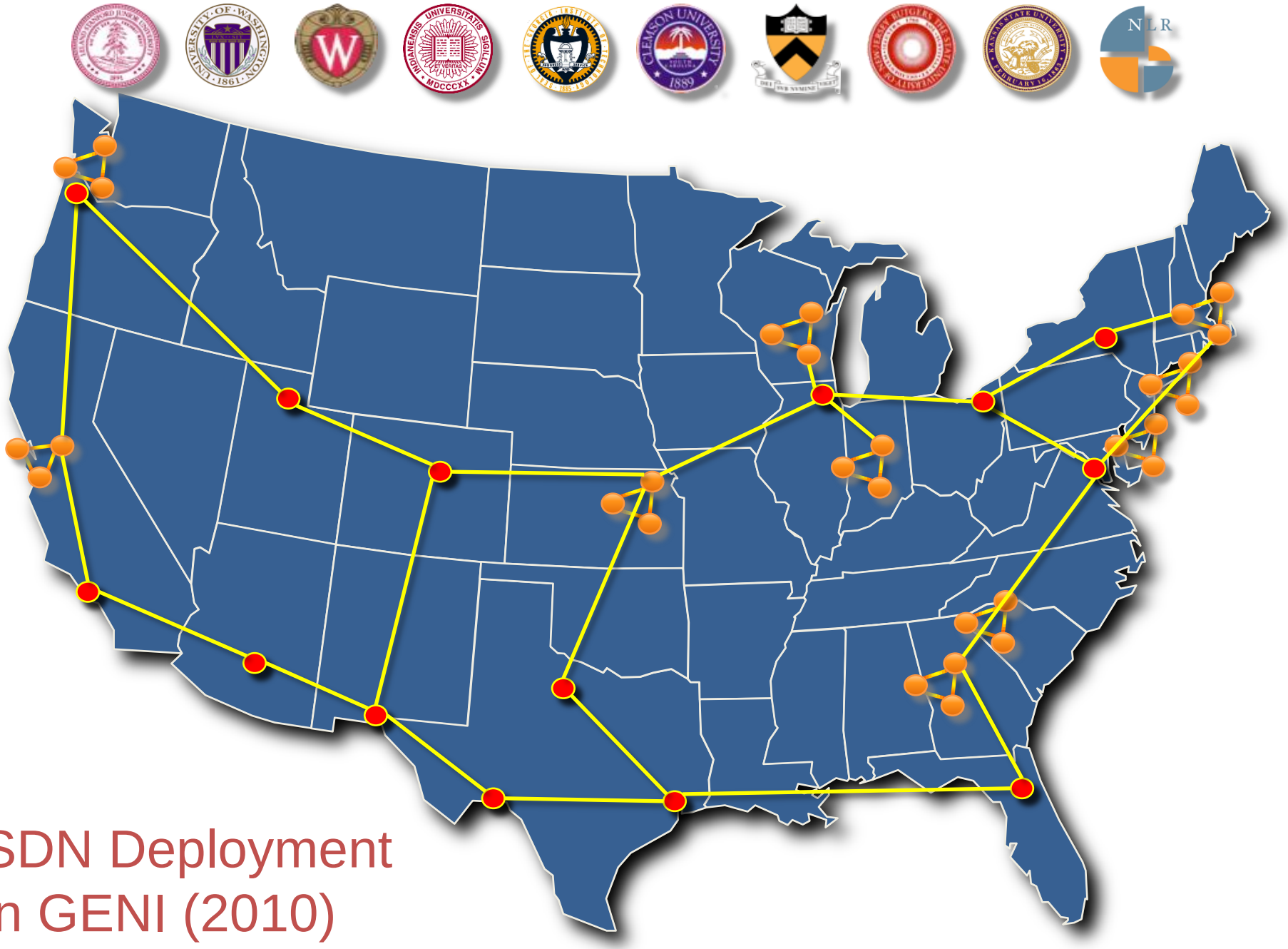
(2) Automatic Checking
Is the datapath working as specified?

(3) Network Debugger
Finding bugs, and their root cause, in an operational network



Research Agenda




SDN Deployment
in GENI (2010)

Products Announced/Available

anuta networks

Many Start-Ups
Most active area for VC investment!

vmware

IBM

NEC

vello SYSTEMS

big switch networks

PICA8 OPEN NETWORKING

embrane

pertino

cisco

DELL

contrail systems

midokura

PLEXXI

hp

Lyatiss

PLUMgrid

PLURIBUS NETWORKS

juniper NETWORKS

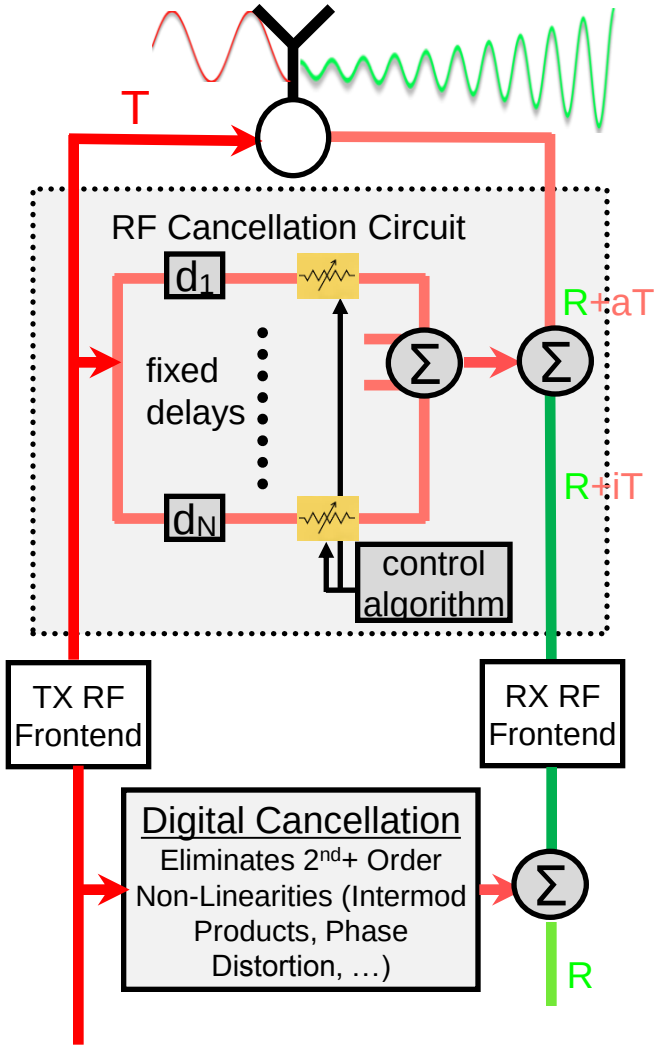
SDN Early Adopters

Full Duplex Radios

(Sigcomm 13, Mobicom 12,11)

"It is generally not possible for radios to receive and transmit on the same frequency band because of the interference that results."

- Andrea Goldsmith, "Wireless Communications," Cambridge Press, 2005.

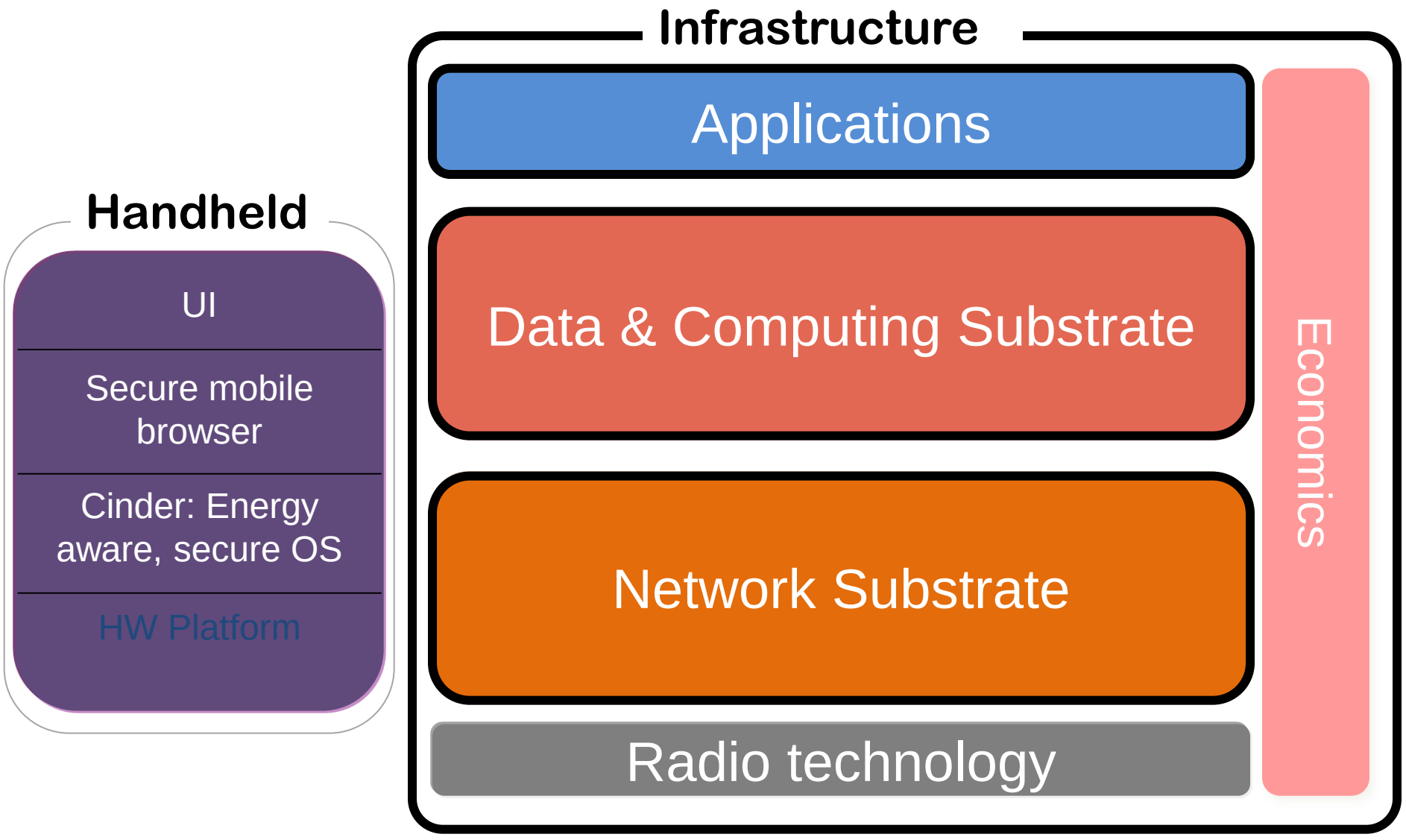


We have invented In-Band Full Duplex Radios

- Allows radios to simultaneously TX/RX by cancelling self interference
- 110dB of cancellation over 40MHz BW at 2.4GHz, 22dbM TX power

Phil Levis, Sachin Katti, and their students

POMI Research Agenda



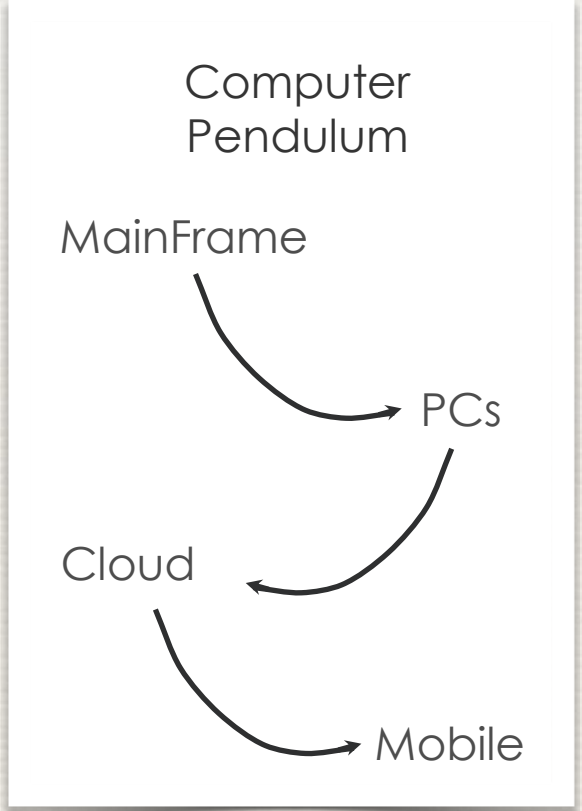
The Big Picture of Social

Proprietary Social Network

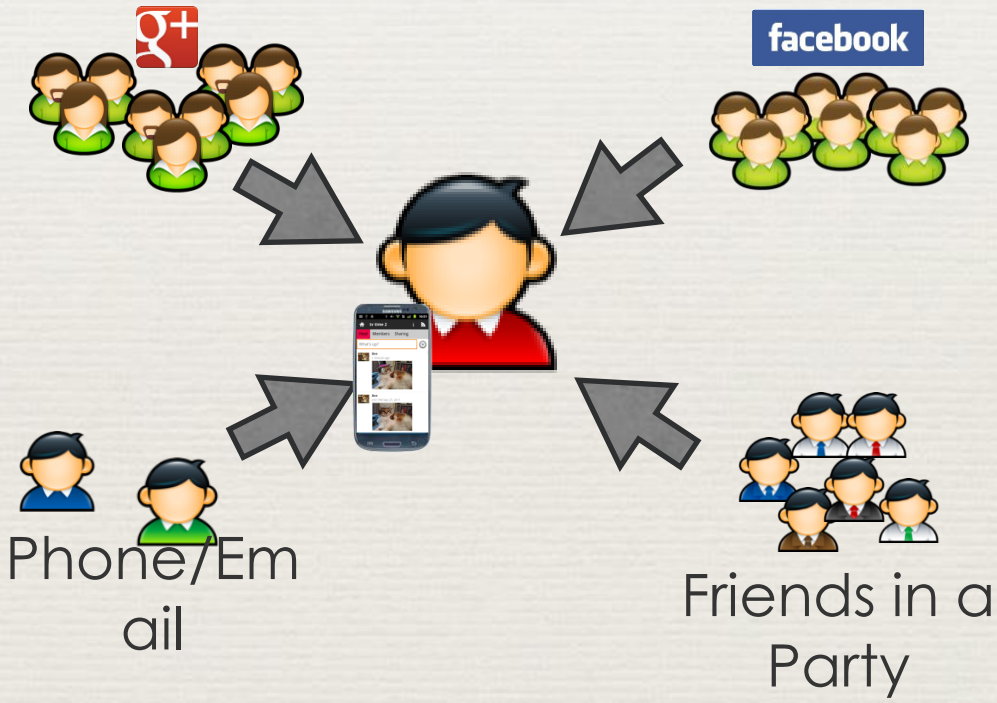
Proprietary App Platform

Proprietary Messaging

Mobile Can Disrupt

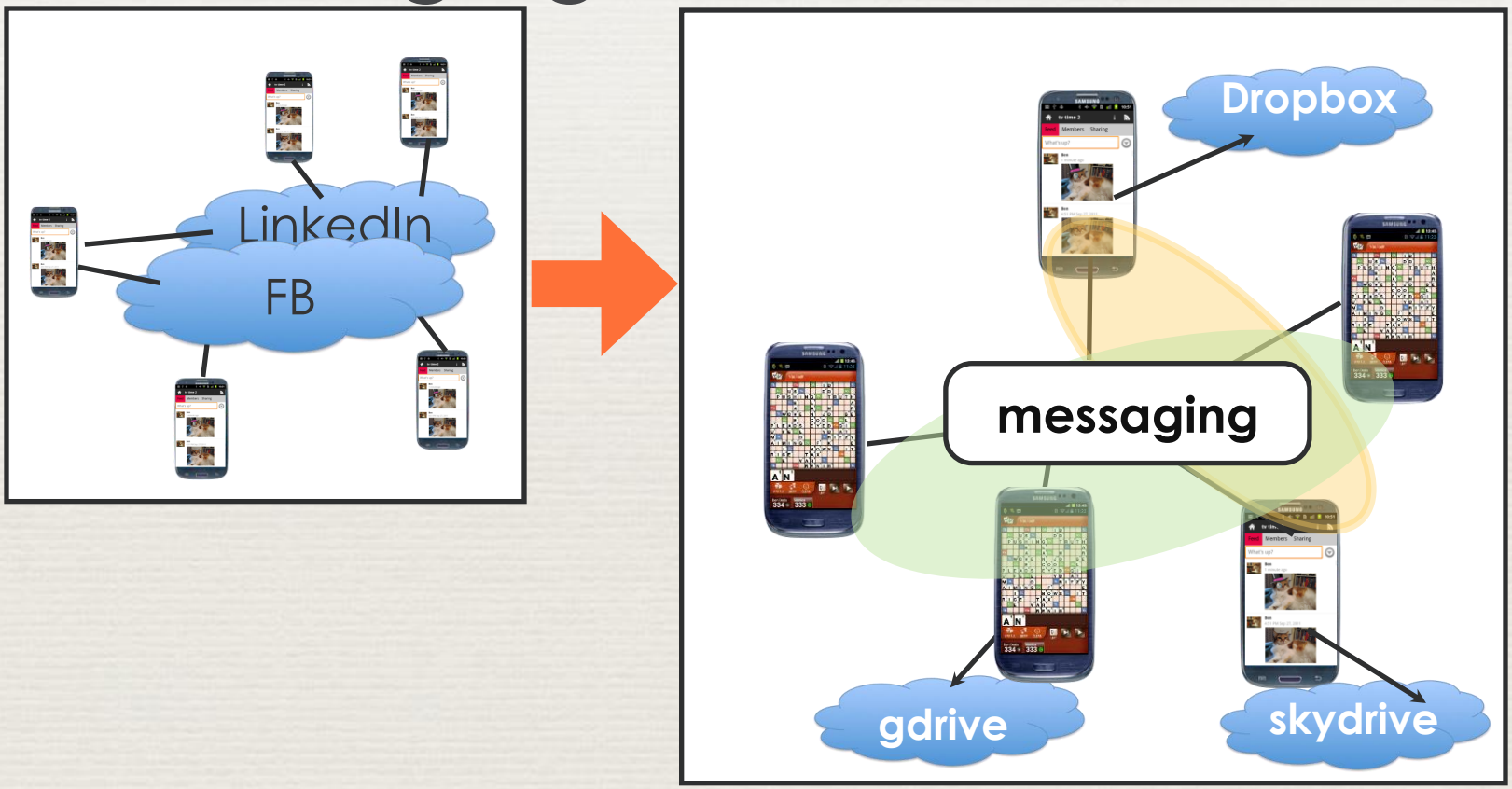


More available!
More cycles!



Largest ego net!

Open Social Mobile (OSM) Messaging-Based Network



OSM delivers messages based on user identities. Leverages personal phones & abundant cloud providers.
(Musubi version: end-to-end encryption)

The Big Picture

Proprietary Social Network  Proprietary App Platform  Proprietary Messaging

Open Social Network  Open App Platform  Open Messaging

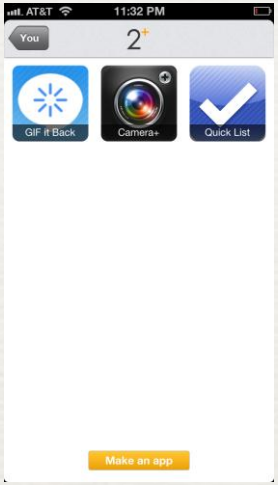
PRIVACY MONOPOLY SCALABILITY

But kids don’t care.

shallow, narcissistic

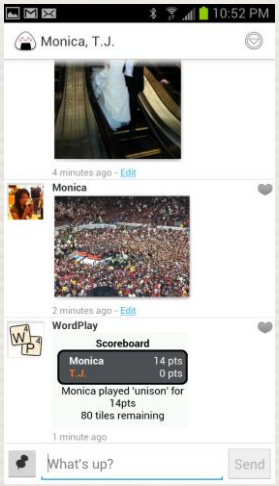
↓

genuine collaborative sharing

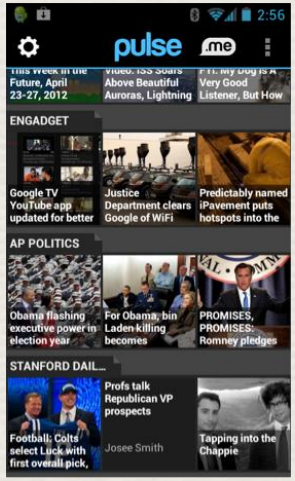


Contextual sharing extensible with 3rd party apps

On-the-spot sharing



Playing a multi-party game before the other has even downloaded the game.



Identity-firewall: Sharing without disclosing identities to 3rd party app.

1. proprietary

Open Social Mobile (OSM)

MUSUBI

2nd best student paper WWW, 2012

Open-source

DISPATCH

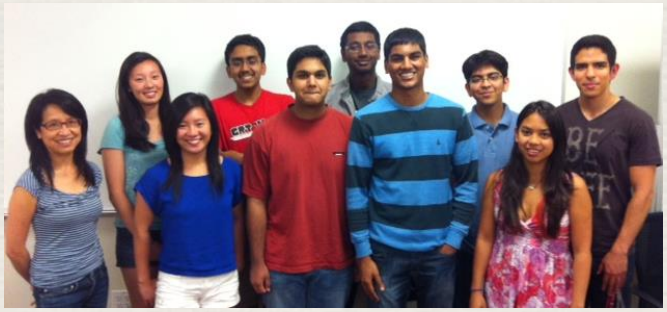
Citizen journalism protection

Joint research with Columbia University

MIGO

High-school research program

Video competition to break nerdy CS stereotype



2plus

Startup:

MobiSocial Inc.

Available in iTunes store

2. centralized, faceless global

local social networks enhanced with programmable community displays

Gatherings

Wedding

Community Building

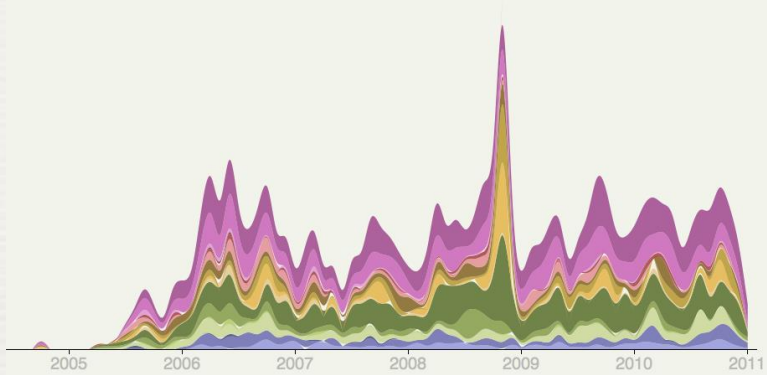
4 Seasons Hotel, San Francisco

Individual Voice

Stanford Dining Hall

DIY Social Networks for Kids

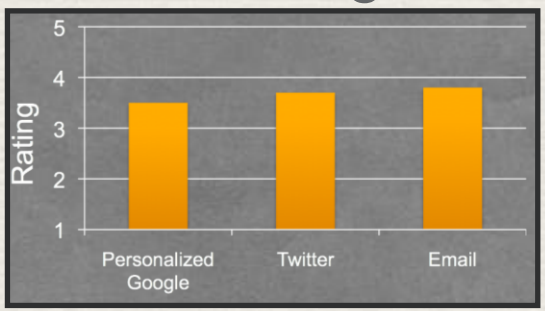
3. big data
for marketeers



for personal use

MUSE:
Memories USing Email

Experience-Infused software
browser, search-engine



Analysis of email archives
Libraries:
Stanford, Smithsonian, NYPL, Columbia, Oxford

Gamification of memory exercises
Physicians, psychologists
(Alzheimer's)

Conclusions

- Software defined networks
- Distributed social networks
- Commercial and social impact