OpenADN: Mobile Apps on Global Clouds Using OpenFlow and Software Defined Networking

RAJ JAIN

Project Leader: Subharthi Paul
Washington University in Saint Louis
Saint Louis, MO 63130
Jain@cse.wustl.edu

MAN-SEC-CC Workshop at Globecom 2012

These slides and audio/video recordings are available at:
http://www.cse.wustl.edu/~jain/talks/ad_gc12p.htm

Overview

1. Networking Application Trends
2. OpenFlow and SDN
3. OpenADN Vision and Extensions
4. Key Features

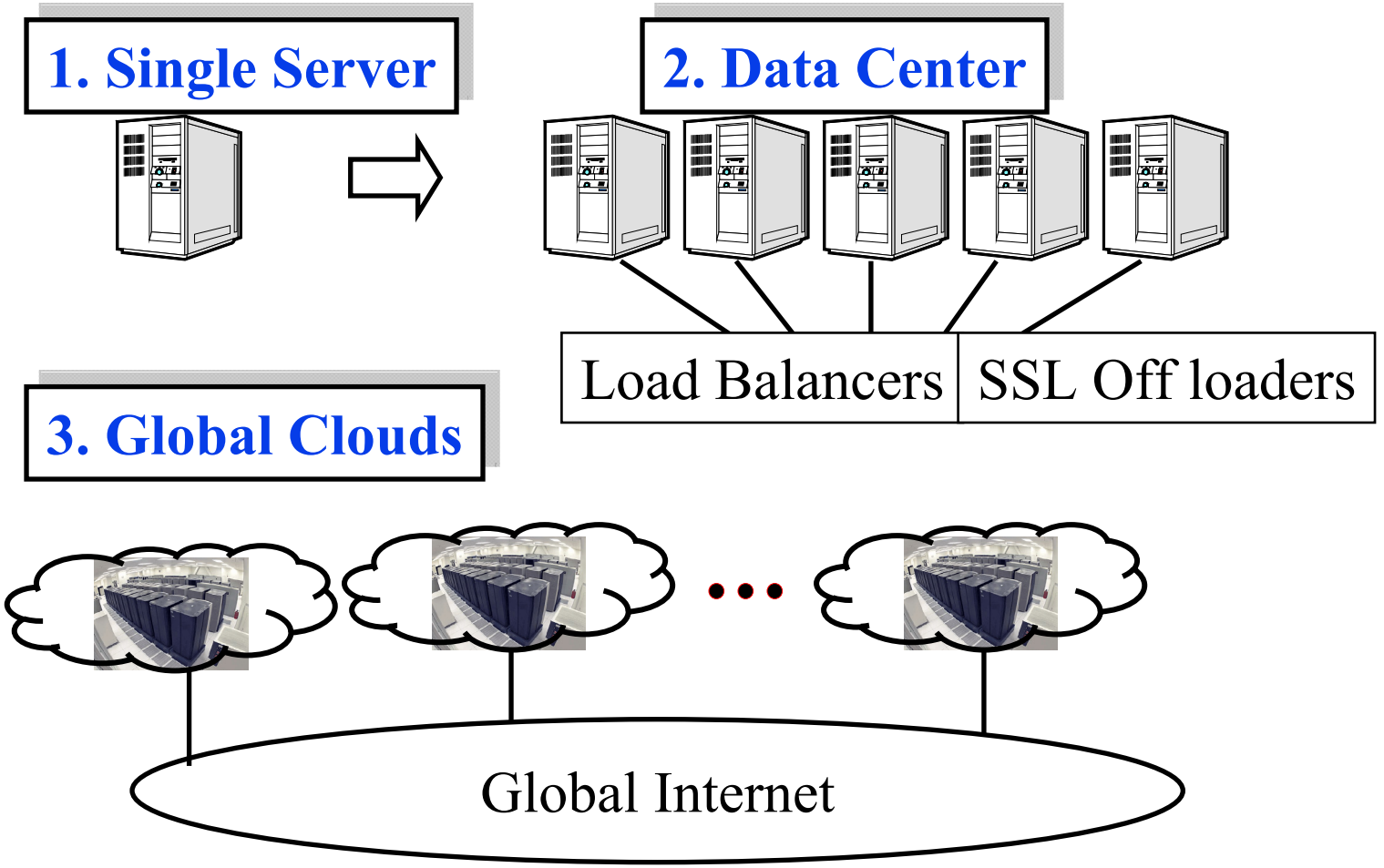
Trend: Explosion of Mobile Apps and Clouds

- All top 50 Internet sites are services [Alexa]
- Almost all services are now mobile apps: Google, Facebook, Bank of America, …
- Almost all services need to be global (World is flat)
- Almost all services use cloud computing (Easy management)

Networks need to support efficient service setup and delivery

Ref: Top 500 sites on the web, http://www.alexa.com/topsites

Service Center Evolution

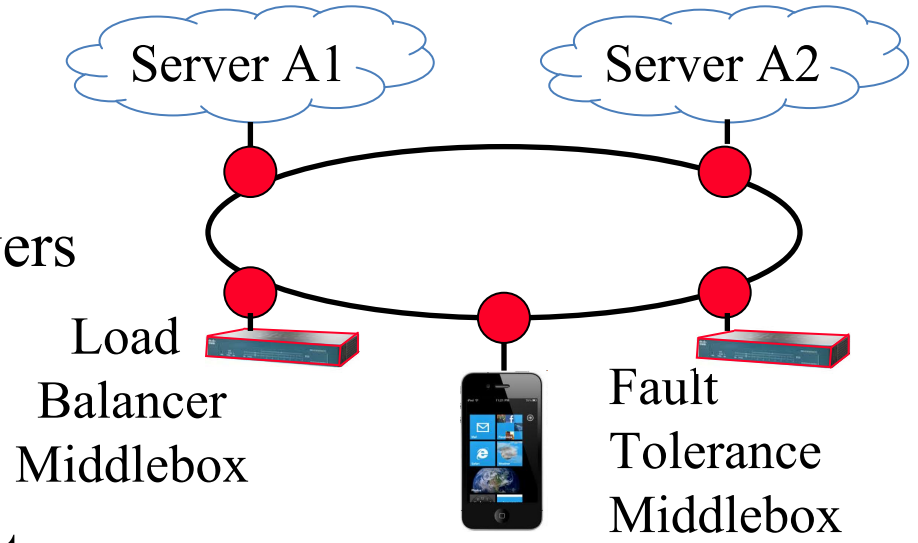


Need to make the global Internet look like a data center

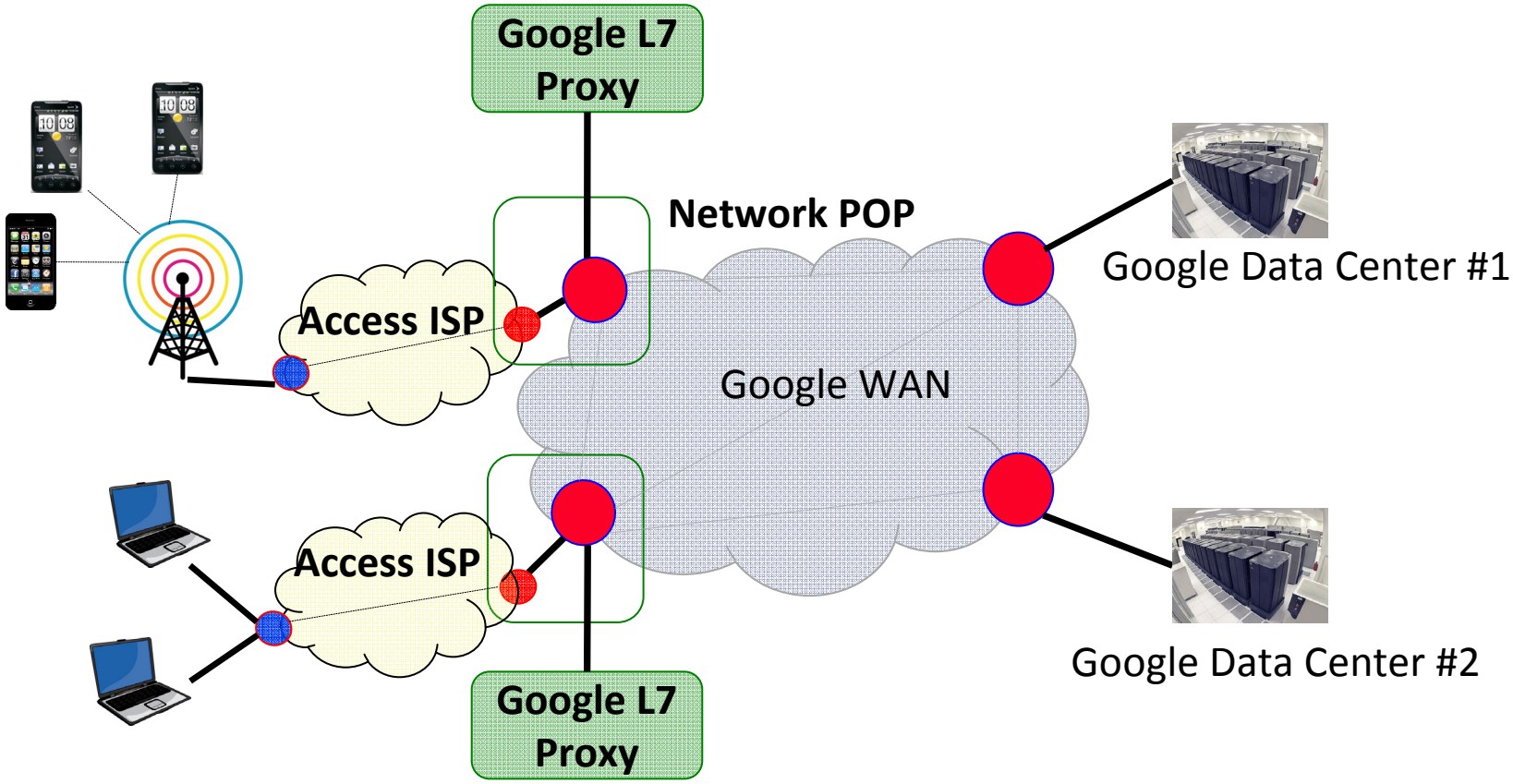
Application Delivery

Message level:

- Server selection
- Load balancing between servers
- Fault tolerance
- Server mobility
- User Mobility
- Secure L5-L7 headers and data
- Middlebox services: Intrusion detection, Content based routers, application firewalls, …
  - Control plane and data plane MBs
- Middlebox traversal sequence
- Message level policies
- TCP Splicing



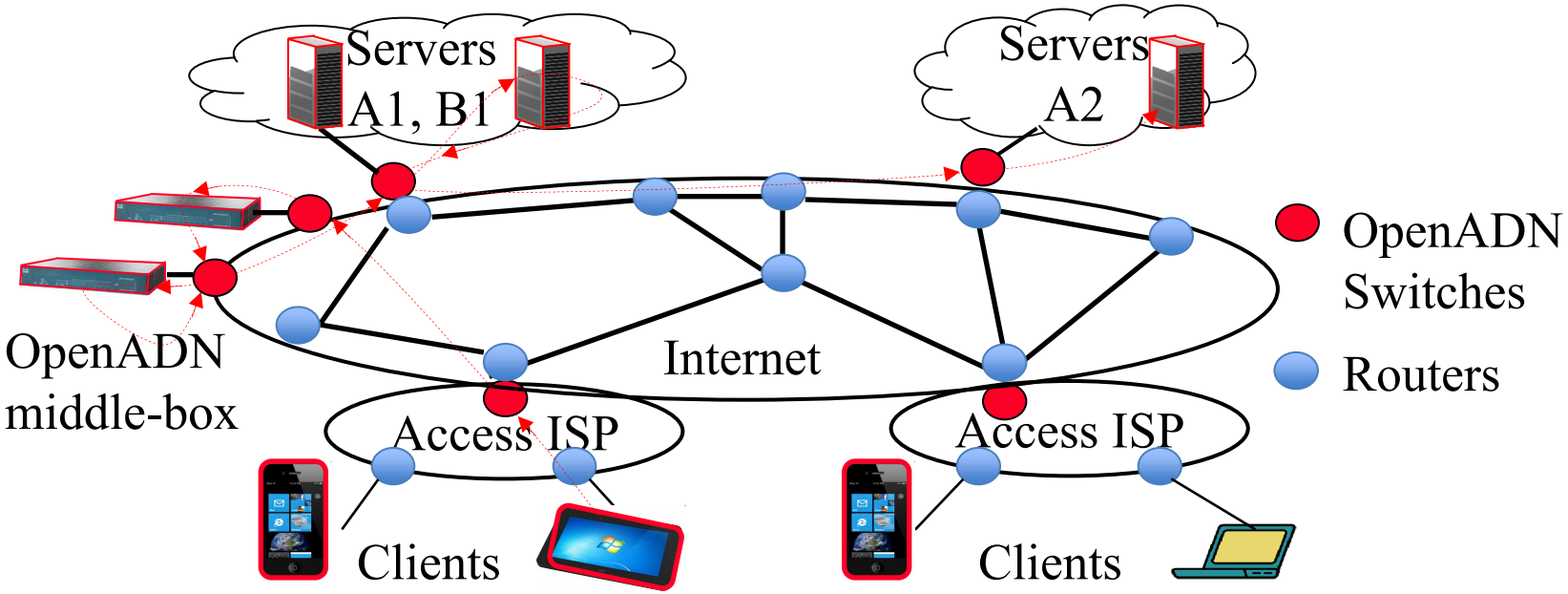
Google WAN



- OpenADN appliances are like Google appliances in Tier 3 ISPs
- Details of Google WAN are not public
- ISPs can not use it: L7 proxies require app msg reassembly

Our Solution: OpenADN

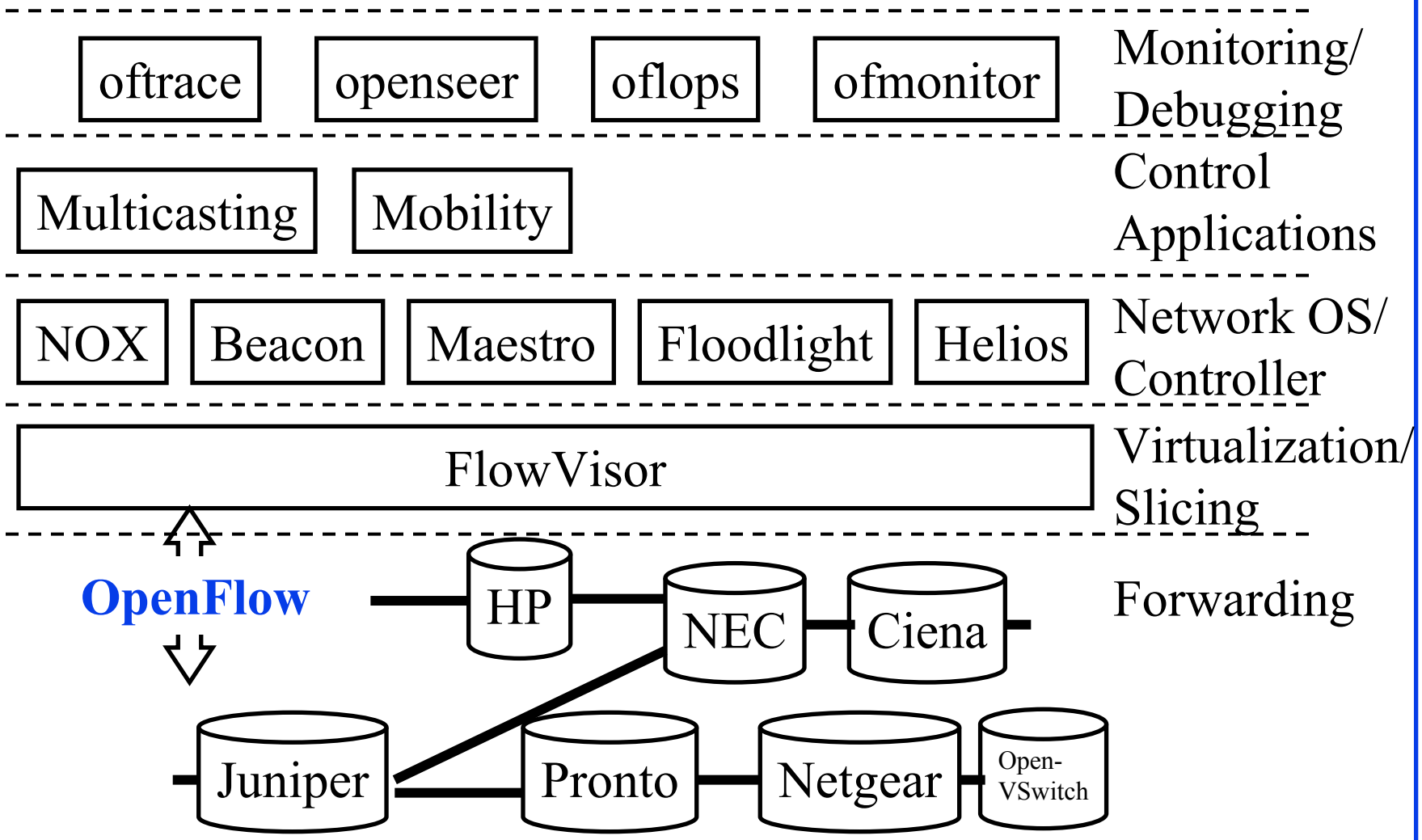
- Open Application Delivery Networking Platform
  Platform = OpenADN aware clients, servers, switches, and middle-boxes
- Allows Application Service Providers (ASPs) to quickly setup services on Internet using cloud computing



OpenADN Innovations

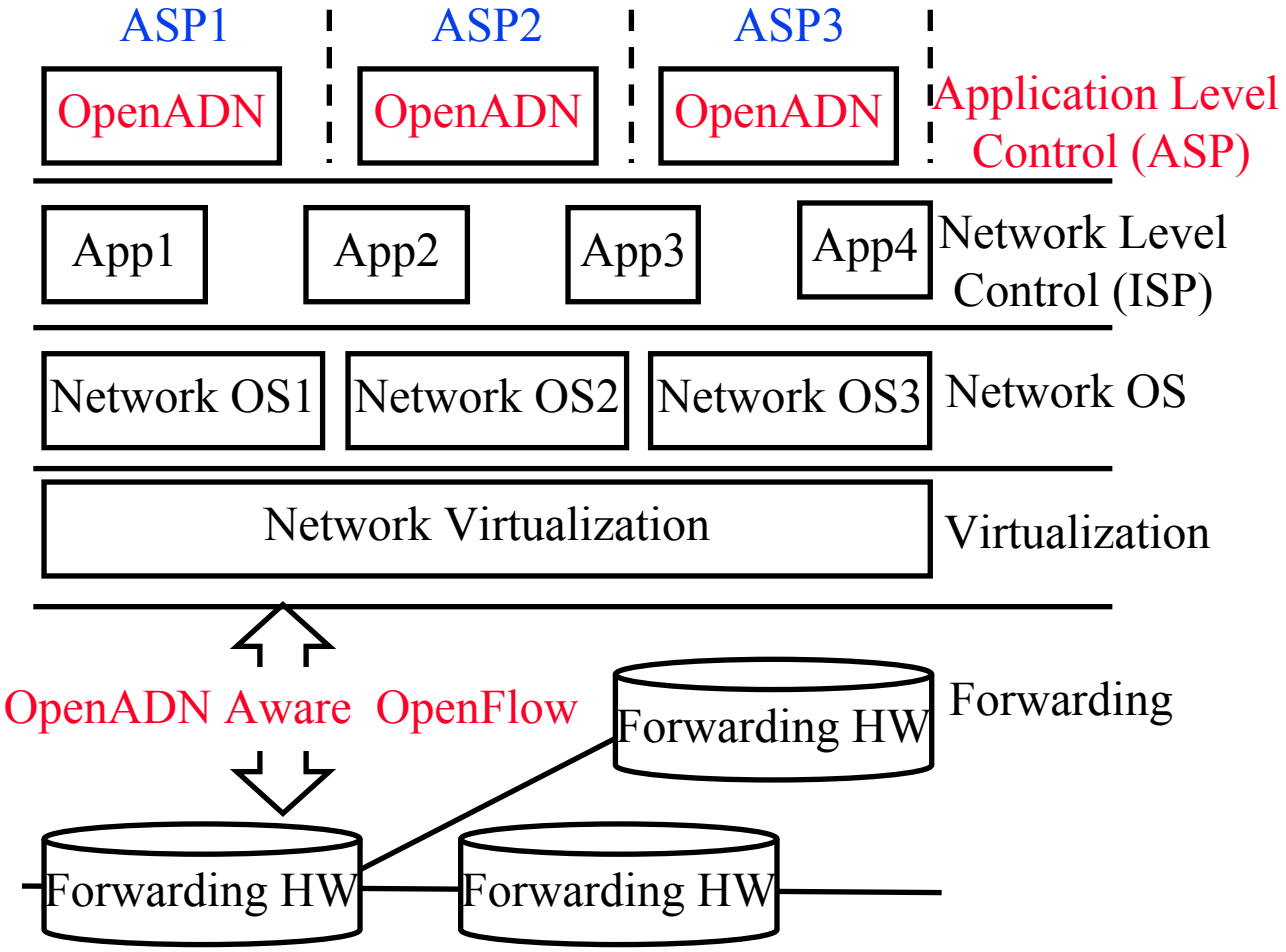
1. Cross-Layer Communication
2. MPLS like Labels
3. Extended OpenFlow flow-based handling, centralized policy control
4. Software Defined Networking: Standardized abstractions, Multi-Tenants, Control Plane programming for data plane
5. ID/Locator Split
6. Layer 7 Proxies without layer 7 visibility

SDN Architecture Component Examples



Ref: https://courses.soe.ucsc.edu/courses/cmpe259/Fall11/01/pages/lectures/srini-sdn.pdf
http://www.cse.wustl.edu/~jain/talks/ad_gc12p.htm

OpenADN in SDN's Layered Abstraction



- SDN provides standardized mechanisms for distribution of control information

Key Features of OpenADN

1. Edge devices only.
   Core network can be current TCP/IP based, OpenFlow or future SDN based
2. Coexistence (Backward compatibility):
   Old on New. New on Old
3. Incremental Deployment
4. Economic Incentive for first adopters
5. Resource owners (ISPs) keep complete control over their resources

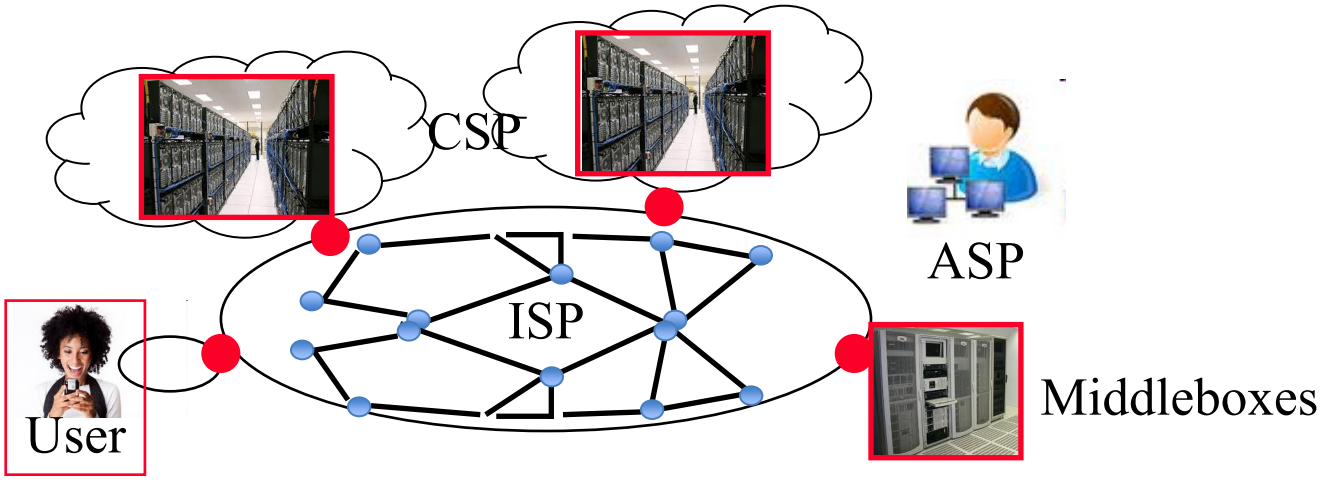
Most versions of Ethernet followed these principles.
Many versions of IP did not.

Resource Control

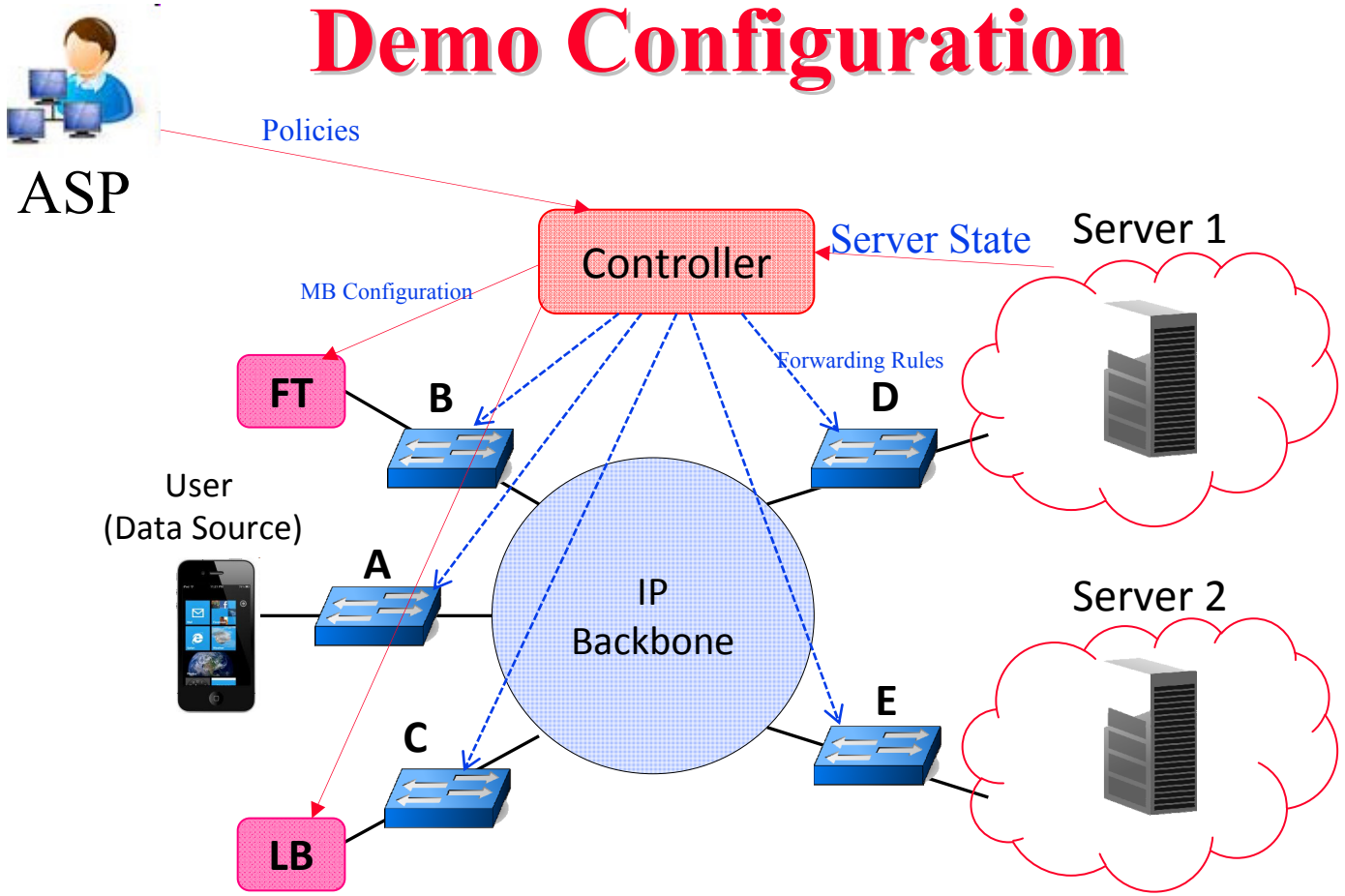
- ASPs keep complete control of their data.
  ISP does not have to look at the application headers or data to enforce application level policies
- ISPs keep complete control of their equipment.
  ASPs communicate their policies to ISP's control plane
- Middle boxes can be located anywhere on the global Internet
  (Of course, performance is best when they are close by)
- ISPs own OpenADN switches and offer them as a service
- ASPs or ISPs can own OpenADN middle boxes
- No changes to the core Internet

Beneficiaries of This Technology

- Equipment/Software vendors: OpenADN-aware appliances
- ASPs: Deploy servers anywhere and move them anytime
- ISPs: Offer new application delivery/middlebox services
- Cloud Service Providers (CSPs): Freedom to move VMs, Less impact of downtime
- CDNs, e.g., Akamai, can extend into application delivery

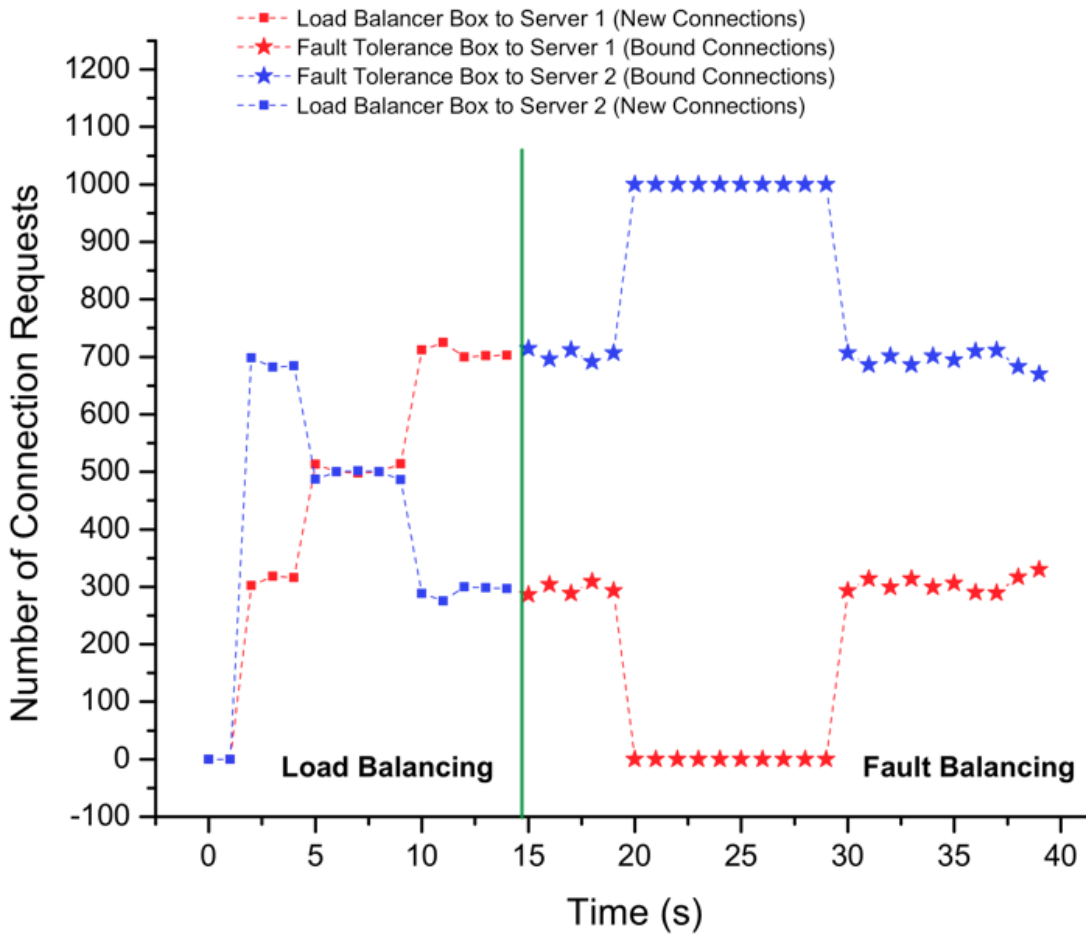


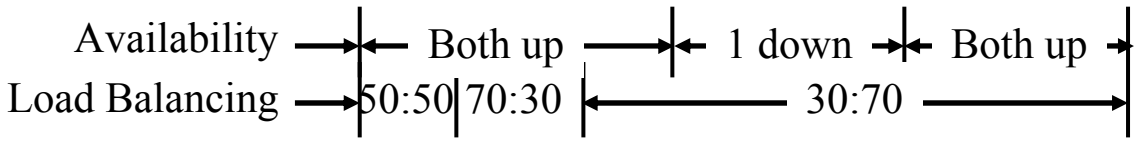
Demo Configuration



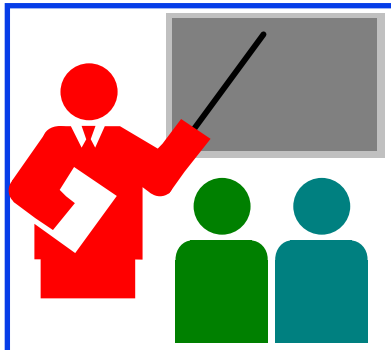
- Single user and single ASP with 2 servers
- OpenADN Appliances: A, B, C, D, E
- ISP offers ADN services: Fault tolerance and Load Balancing

Validation of Functionality





http://www.cse.wustl.edu/~jain/talks/ad_gc12p.htm

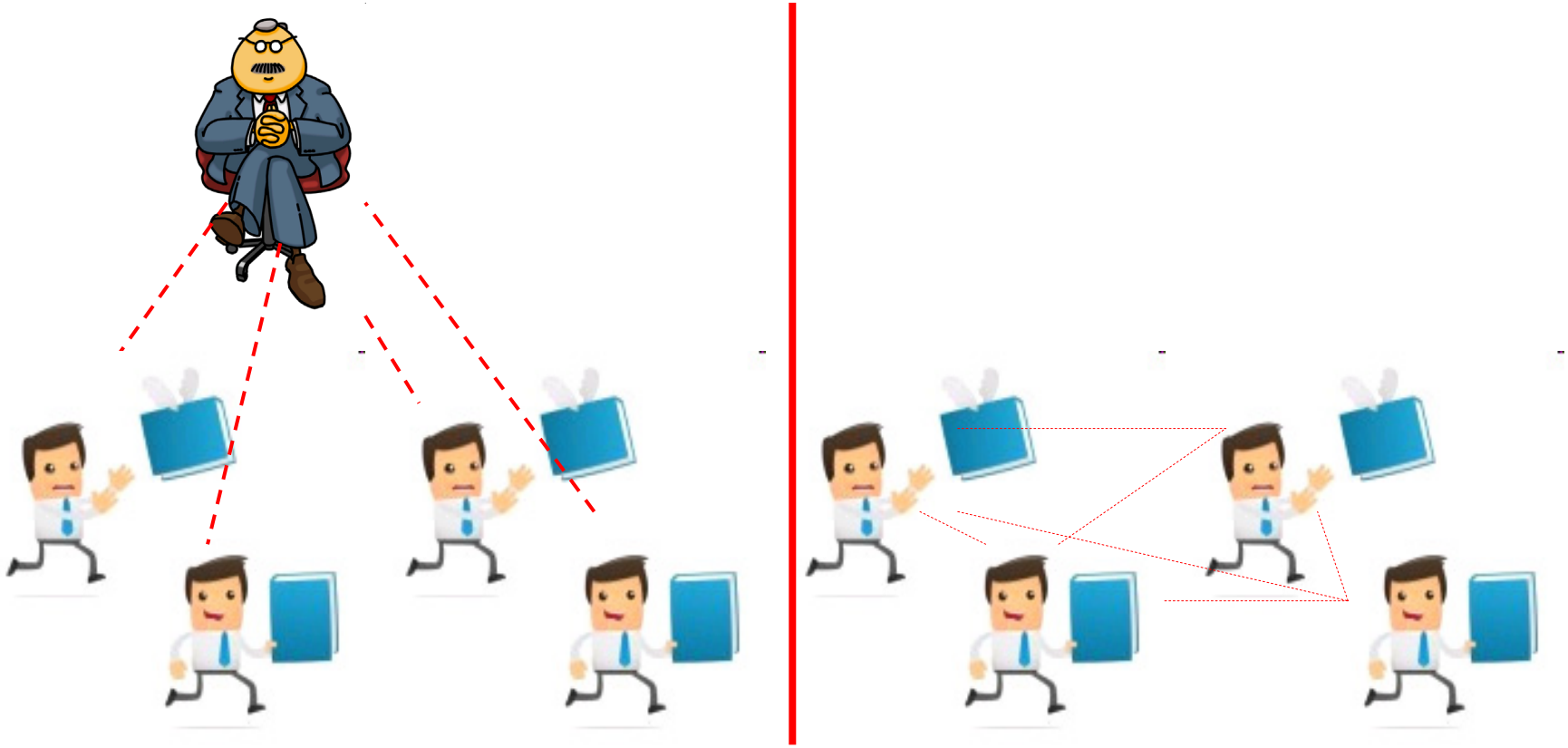


Summary

1. Knee of **mobile internet** paradigm shift
   Explosion of Apps using cloud services
2. OpenADN appliances can provide ASPs networking services they need
3. OpenADN extends using best of OpenFlow, SDN, MPLS, ID/Locator Split, Cross-layer communications, middle box appliances
4. Keeps resource control under resource owners.
   Can be implemented incrementally now
5. Trend is towards simplifying and standardizing router interfaces ⇒ Software defined networking

Application Delivery: Opportunity for ISP's

Centralized vs. Distributed



- Fully centralized is not scalable.
  Fully distributed is not manageable.
  ⇒ Hierarchy