ARC'14

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السنوي للبحوث

QATAR FOUNDATION
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وابتكارات عالمية

Towards World-class
Research and
Innovation

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OpenADN

Middleware Architecture for Cloud Based Services

11/18/2014

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Overview

1. Global Multi-Cloud Application Delivery
2. Relevance to Qatar's Research Grand Challenges
3. Novelty/Originality
4. Methods and Results
5. Significance and Impact

These slides and video recording of this presentation are at
http://www.cse.wustl.edu/~jain/talks/adn_arc.htm

What's Common?

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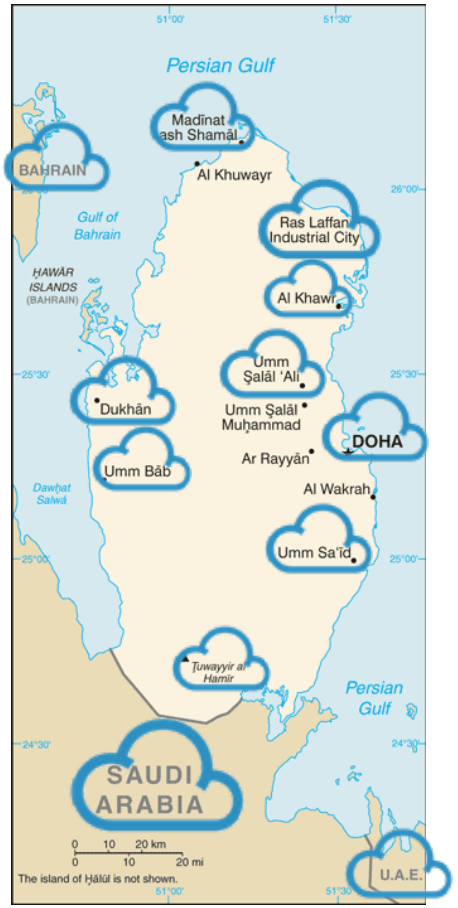
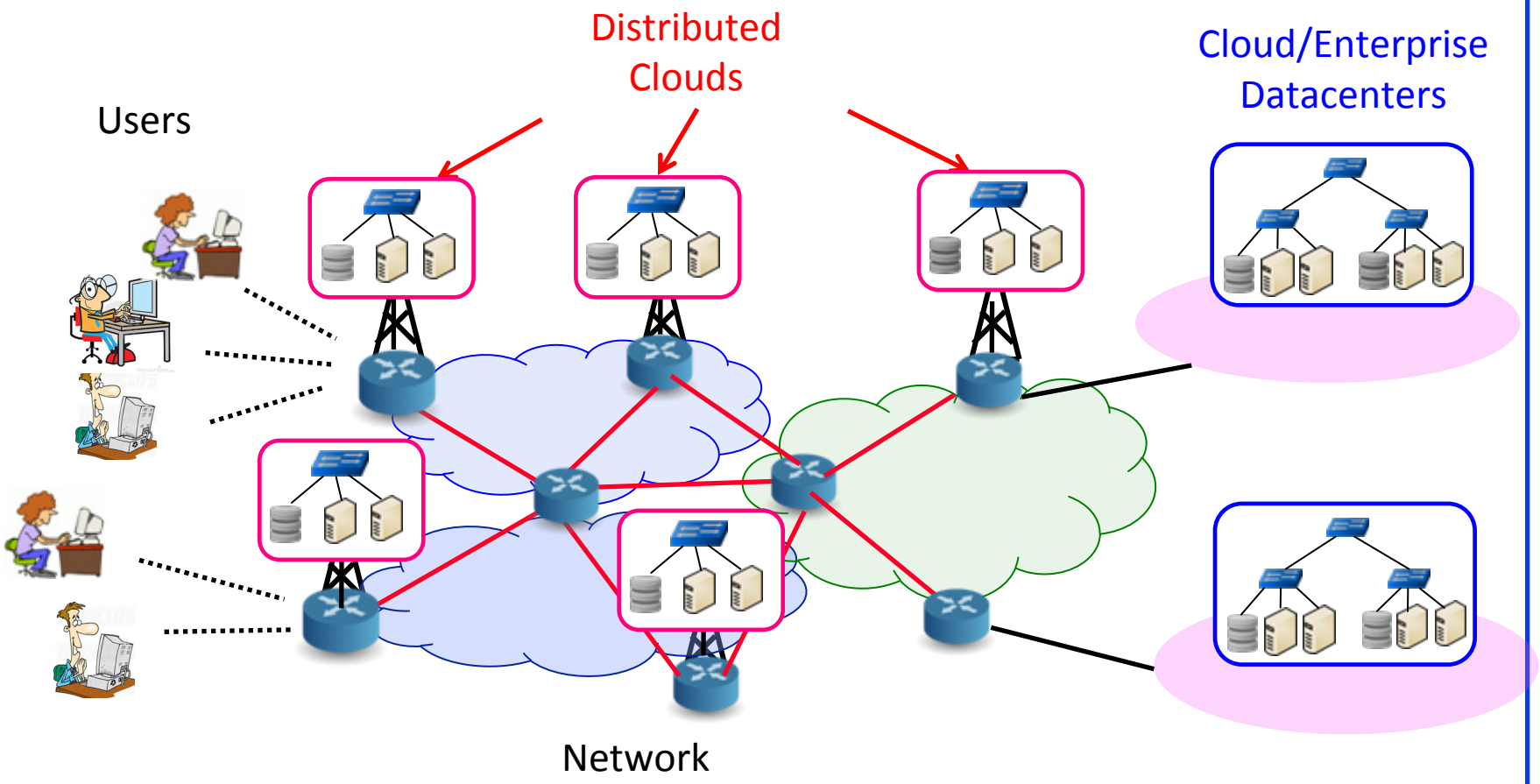
All are based in Qatar
All are multi-national
All use cloud computing

Trend: Explosion of Cloud Based Services



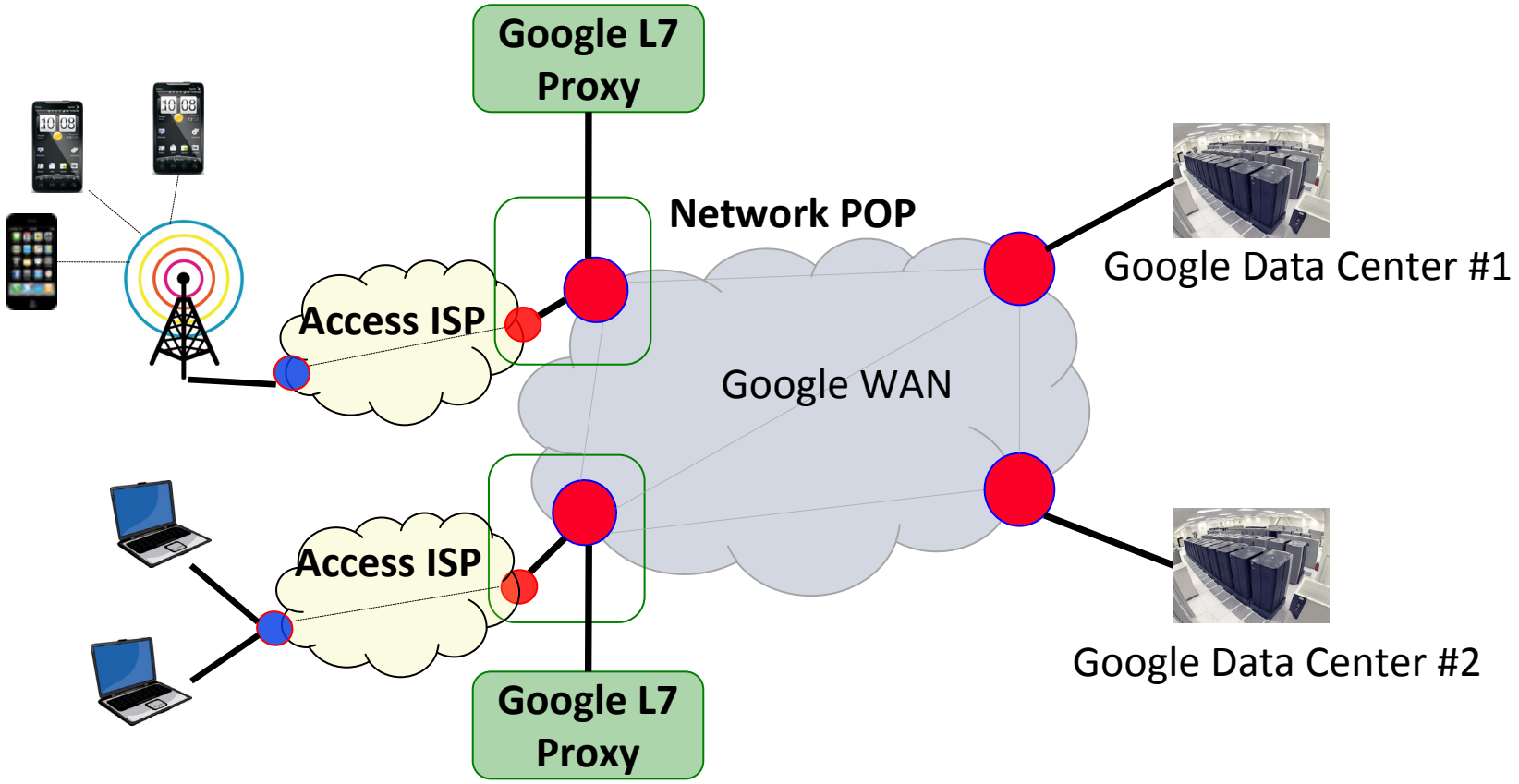
- August 25, 2006: Amazon announced EC2
  ⇒ Birth of Cloud Computing in reality
- June 29, 2007: Apple announced iPhone
  ⇒ Birth of Mobile Internet, Mobile Apps
- Most businesses now have mobile apps:
  Qatar Airways, Qatar National Bank, Ooredoo, …
- Almost all services use cloud computing (Easy management)
- Almost all services need to be global (World is flat)

Multi-Cloud Application Delivery



New Business Opportunities: Datacenters on Towers, Internet of Things

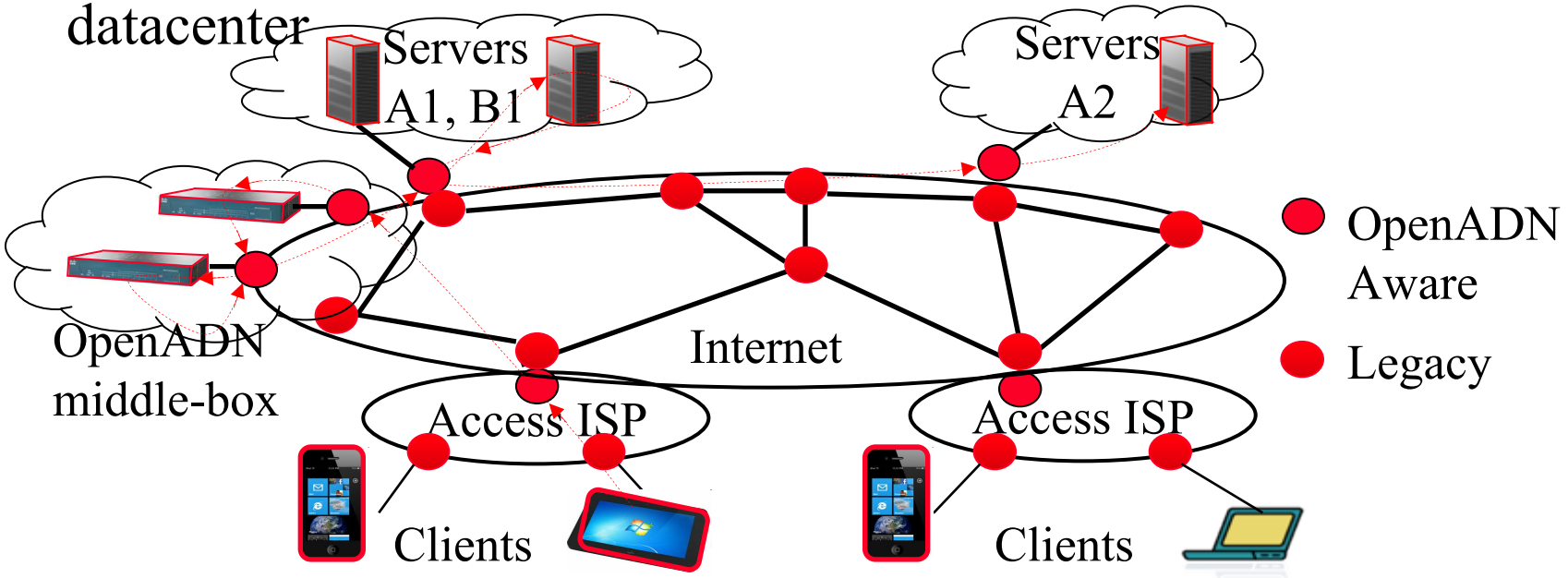
Google WAN



- Google appliances in Tier 3 ISPs
- Details of Google WAN are not public
- ISPs can not use it: L7 proxies require data visibility

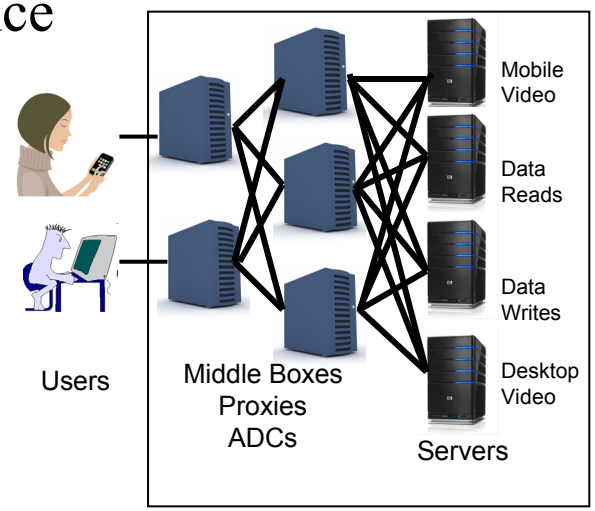
Our Solution: OpenADN

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



Application Delivery in a Data Center

- **Replication**: Performance and Fault Tolerance
- **Content-Based Partitioning**:
  - Video messages to Server S1
  - Accounting to Server S2
- **Context Based Partitioning**:
  - Network Context:
    - If link to US broken, send to UK
  - Application Context:
    - Reads to S1, Writes to S2
    - If Load on S1 >0.5, send to S2
  - User Context:
    - If Windows Phone user, send to S1
    - If laptop user, send to HD, send to S2
- **Multi-Segment**: User-ISP Proxy-Load Balancer-Firewall-Server

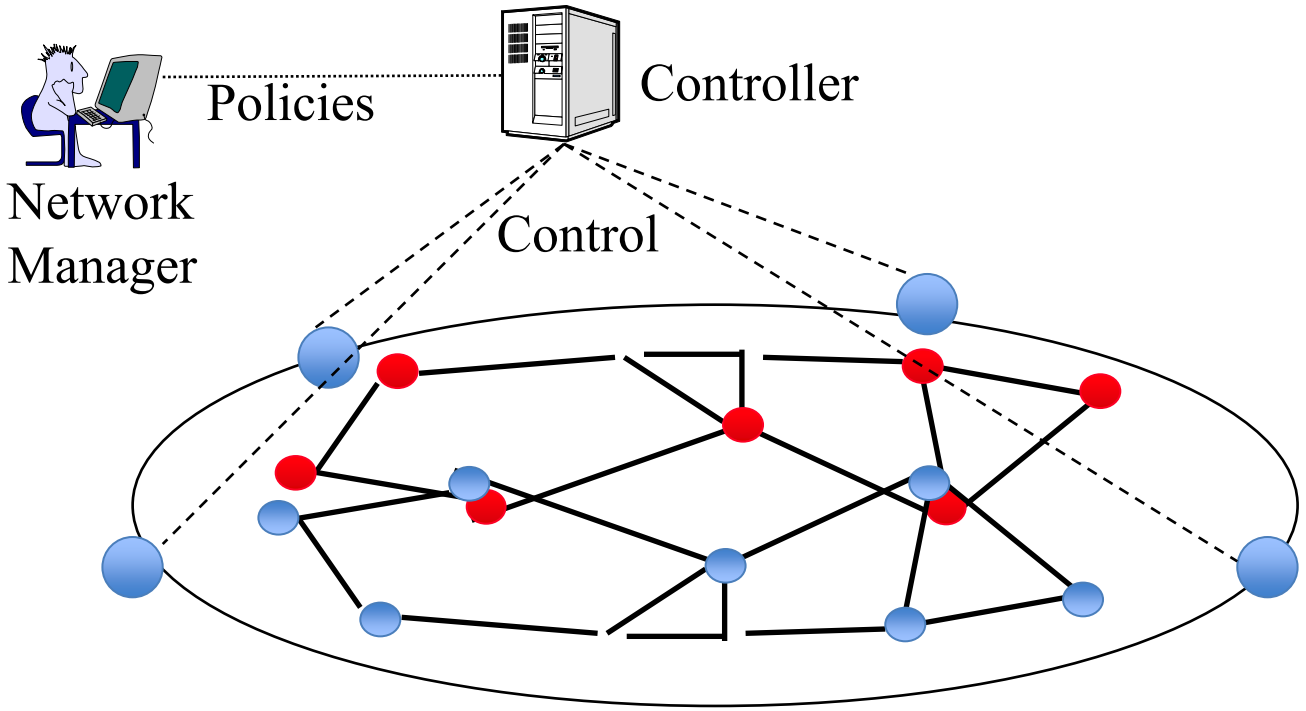


Novelty/Originality

- Extends 8 of the latest networking developments:

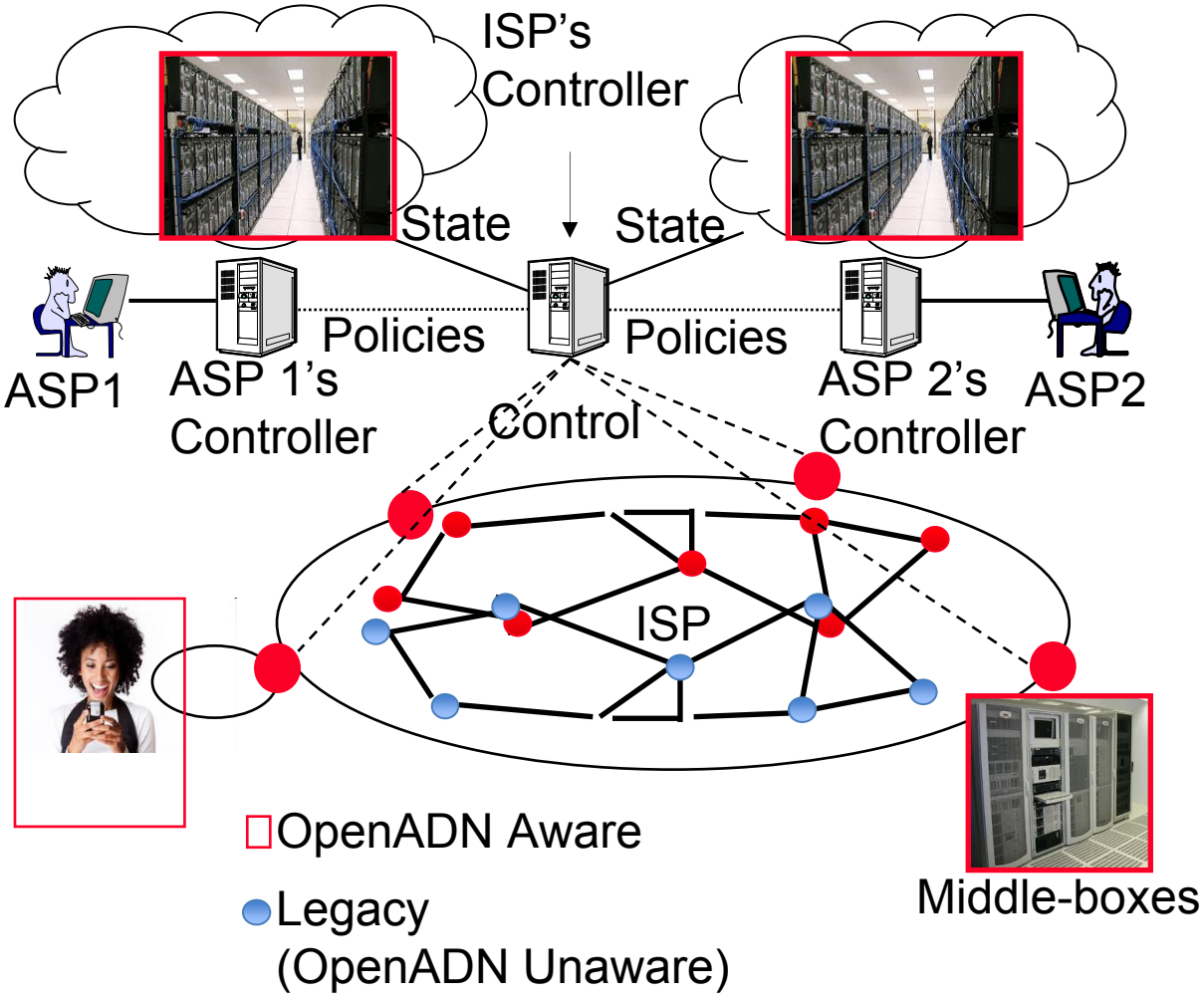
1. Software defined networking:
    1. Data and control plane separation
    2. Centralization of control plane
2. OpenFlow: Protocol between controller and forwarding elements
3. Cross-Layer Communication
4. OpenADN tags: Layer 7 Proxies without layer 7 visibility
5. MPLS like Labels
6. ID/Locator Split
7. Late Multi-stage binding
8. Rule-Based Delegation

Software Defined Networking



- Policies can be changed on the fly
  ⇒Software Defined

Rule-Based Delegation



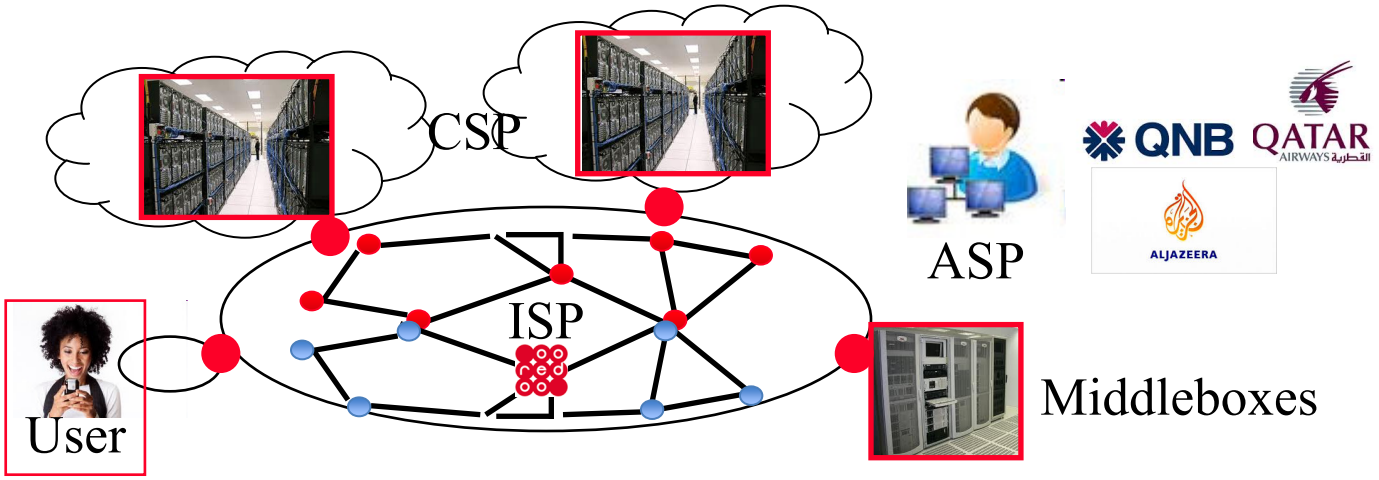
Results: Key Features of OpenADN

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.

Beneficiaries of This Technology

- ASPs: Companies like Qatar National Bank. Deploy servers anywhere and move them anytime
- ISPs: Ooredoo. Offer new services
- Cloud Service Providers (CSPs): Freedom to move VMs, Less impact of downtime



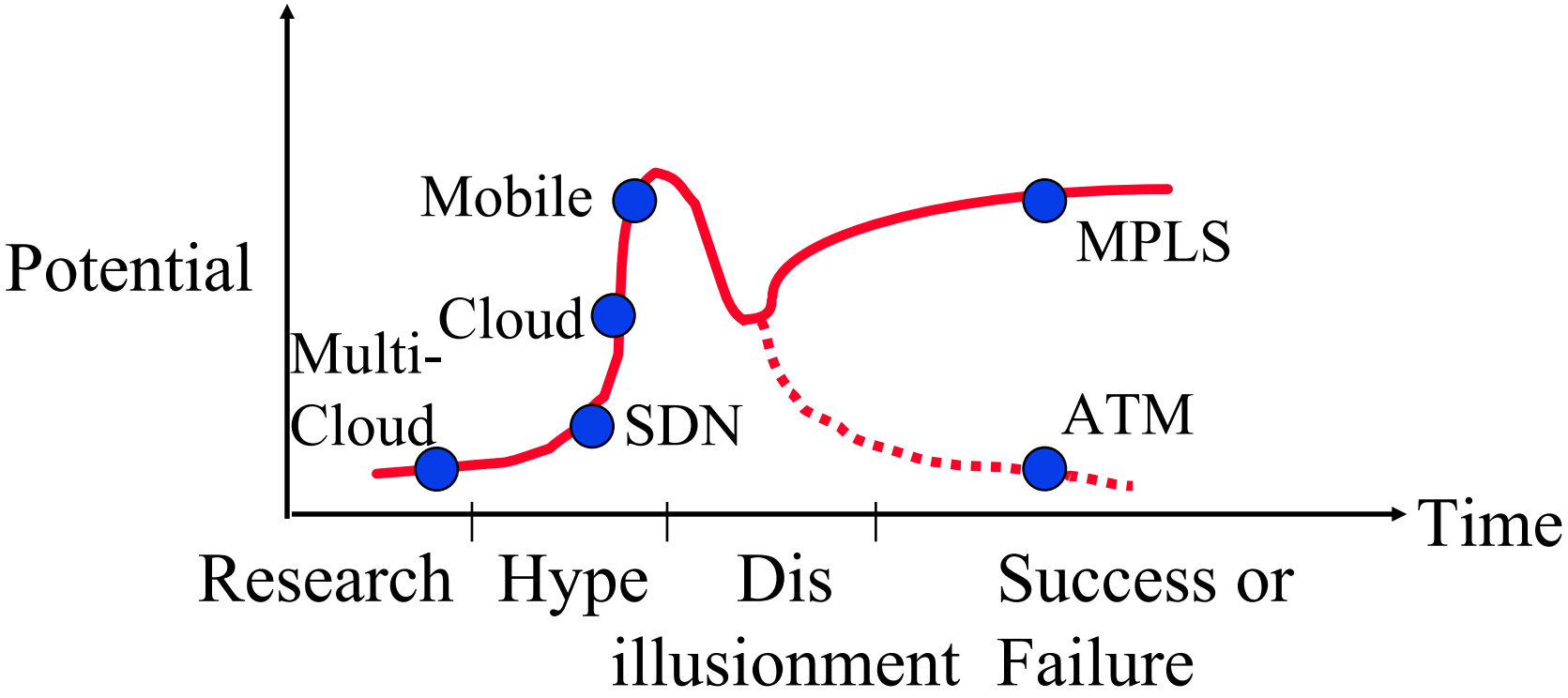
Qatar's Research Grand Challenges

- Qatar National Vision 2030:
  - Address 3 of the 4 pillars: **Human Development**,
  - **Social Development**, **Economic Development**
  - Mobile and Cloud Technologies are key to the future of all large multi-national corporations
- Qatar's Cross-Cutting Research Grand Challenges:
  - Directly addresses 3 of the 12 grand challenges
  - **5. Sustainable Urbanization – Doha as a smart city**: Distributed Cloud Computing ⇒ Smart Computing and Communication
  - **9. Managing the Transition to a Diversified, Knowledge-Based Society**: Several QU students are getting started on their MS projects
  - **12. Assure Cyber Security:** Networking, Mobile Technologies, Cloud Computing technologies are being developed

Importance of leading in Future Internet?

Billion dollar question!

Life Cycles of Technologies



Industry Growth: Formula for Success

Innovators
⇒ Startups
⇒ Technology Differentiation

Big Companies
Manufacturing
⇒ Price differentiation

Number of Companies

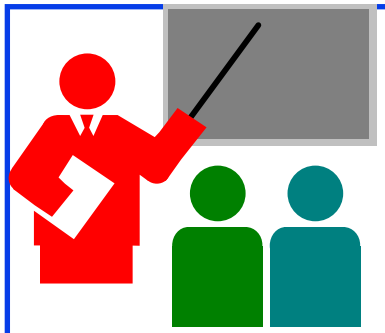
New Entrants

Consoli-dation

Stable Growth

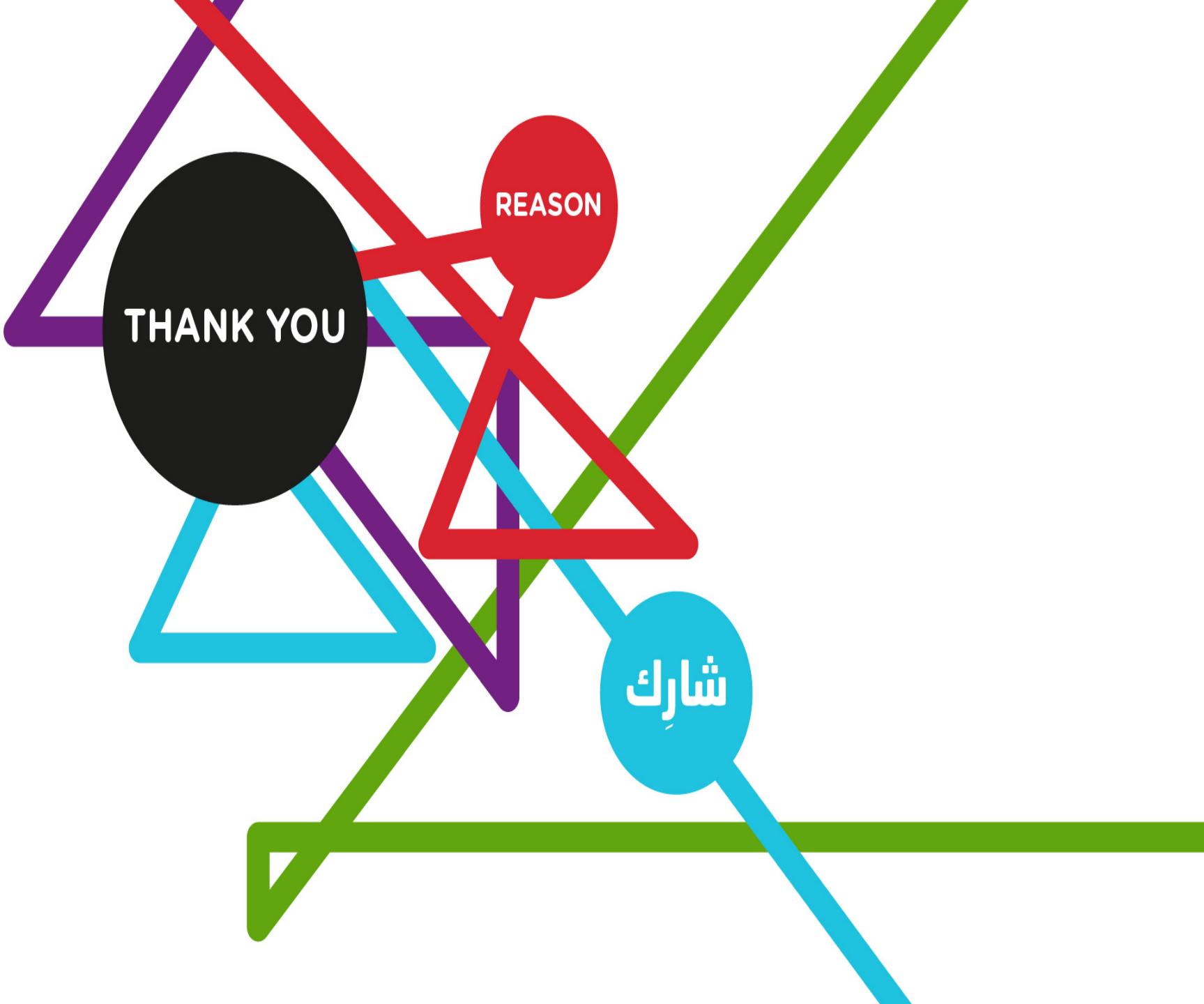
Time

- Paradigm Shifts ⇒ Leadership Shift
- Old market leaders stick to old paradigm and loose
- Mini Computers → PC, Phone → Smart Phone, PC → Smart Phone



Summary

1. Most large enterprises use multiple globally distributed clouds OpenADN can provide these enterprises networking services they need to manage multiple clouds
2. Address 3 of 12 Qatar's Research Grand Challenges and 3 of the 4 pillars of Qatar National Vision 2030
3. Novelty: OpenADN extends the best in recent networking technologies: OpenFlow, SDN, MPLS, ID/Locator Split, Cross-layer communications
4. Methods and Results: Designing the architecture and implementing a demo testbed
5. Significance and Impact: Will help Qatar businesses come to the forefront of IT revolution


THANK YOU
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