ITU Kaleidoscope 2014

Living in a converged world - impossible without standards?

A software defined approach To Unified IPv6 Transition

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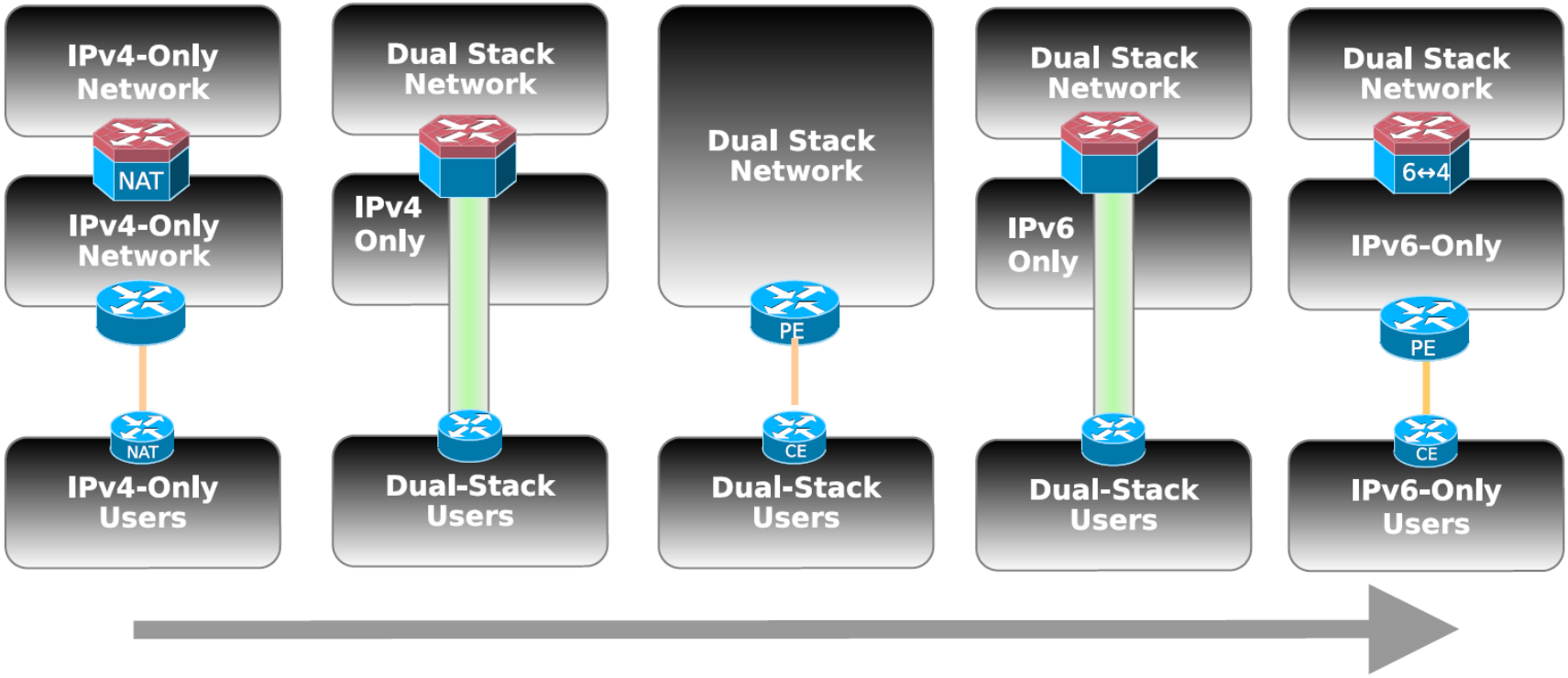
IPv6: Status Quo and Challenges

- Current state of IPv6 transition
  - ***Many*** solutions and multiple scenarios co-exist, e.g. 4-6-4, 6-6-4, etc.
  - ***Slow*** transition



Motivation & Rationale

- Design a ***low-cost***, ***unified*** approach to IPv6 transition

  •Low-cost: a virtual CPEs(e.g. vRGW) or a SDN enabled CPE can cover different scenarios of IPv6 transition. carriers do **NOT** have to upgrade/manage CPEs to support a specific IPv6 transition scheme

  •Unified: the design should be compatible (or accommodate) existing and future IPv6 transition schemes

- Users / applications should be able to decide for themselves ***when and how*** to start the IPv6 transition

SD-IPv6: A Low-Cost, Unified Approach to IPv6 Transition

- Leverage the SDN capability to
  - **Decouple** network equipment (i.e., data plane) and ***operating*** specific IPv6 transition schemes (i.e., control plane)
    - By leveraging SDN's separation of control / data plane
  - **Decouple** network equipment and ***implementation*** of specific IPv6 transition schemes
    - by leveraging SDN's NBI to efficiently implement IPv6 apps
  - **Decouple** network equipment and ***deployment*** of specific IPv6 transition schemes
    - As a result of the above two enablers

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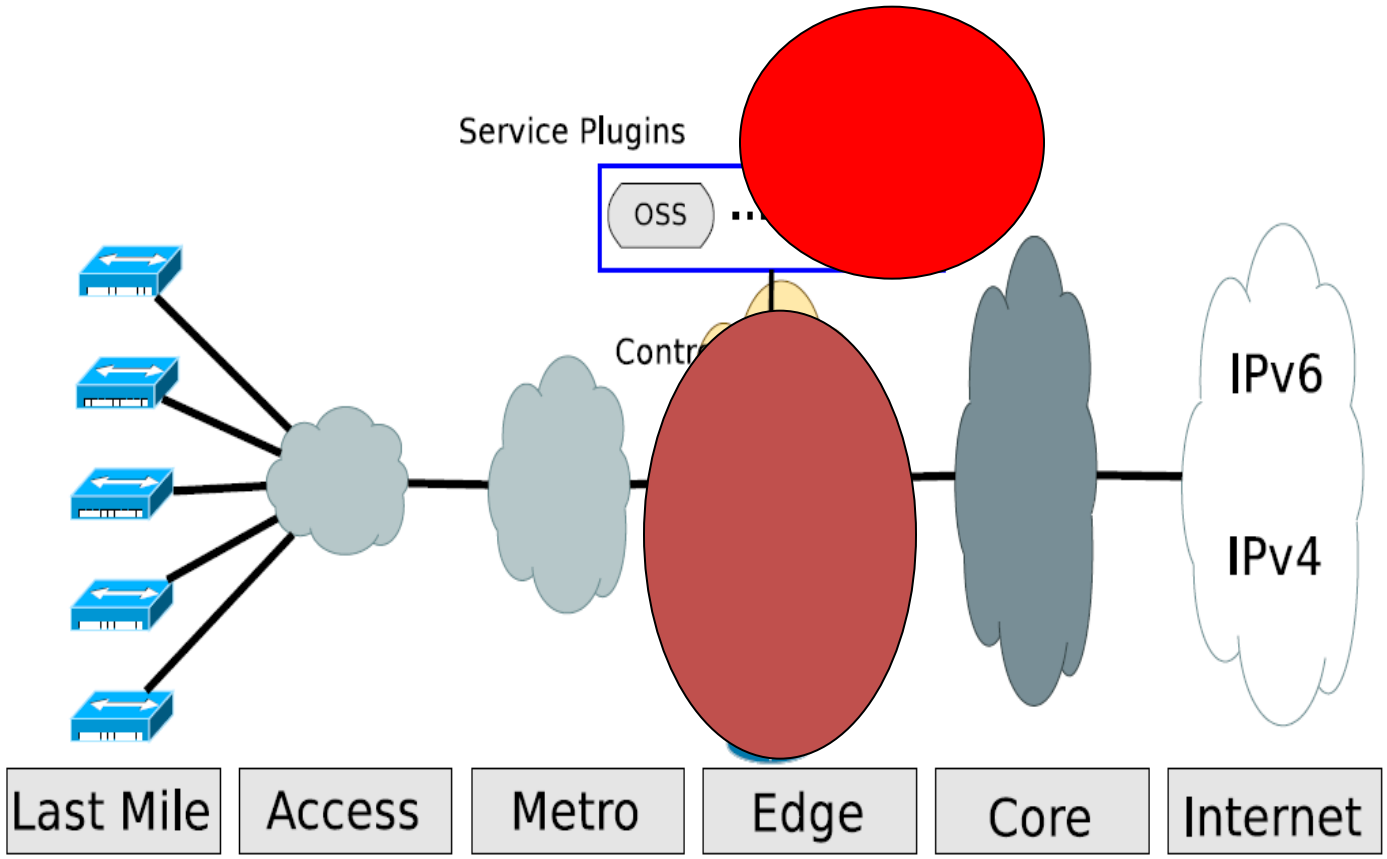
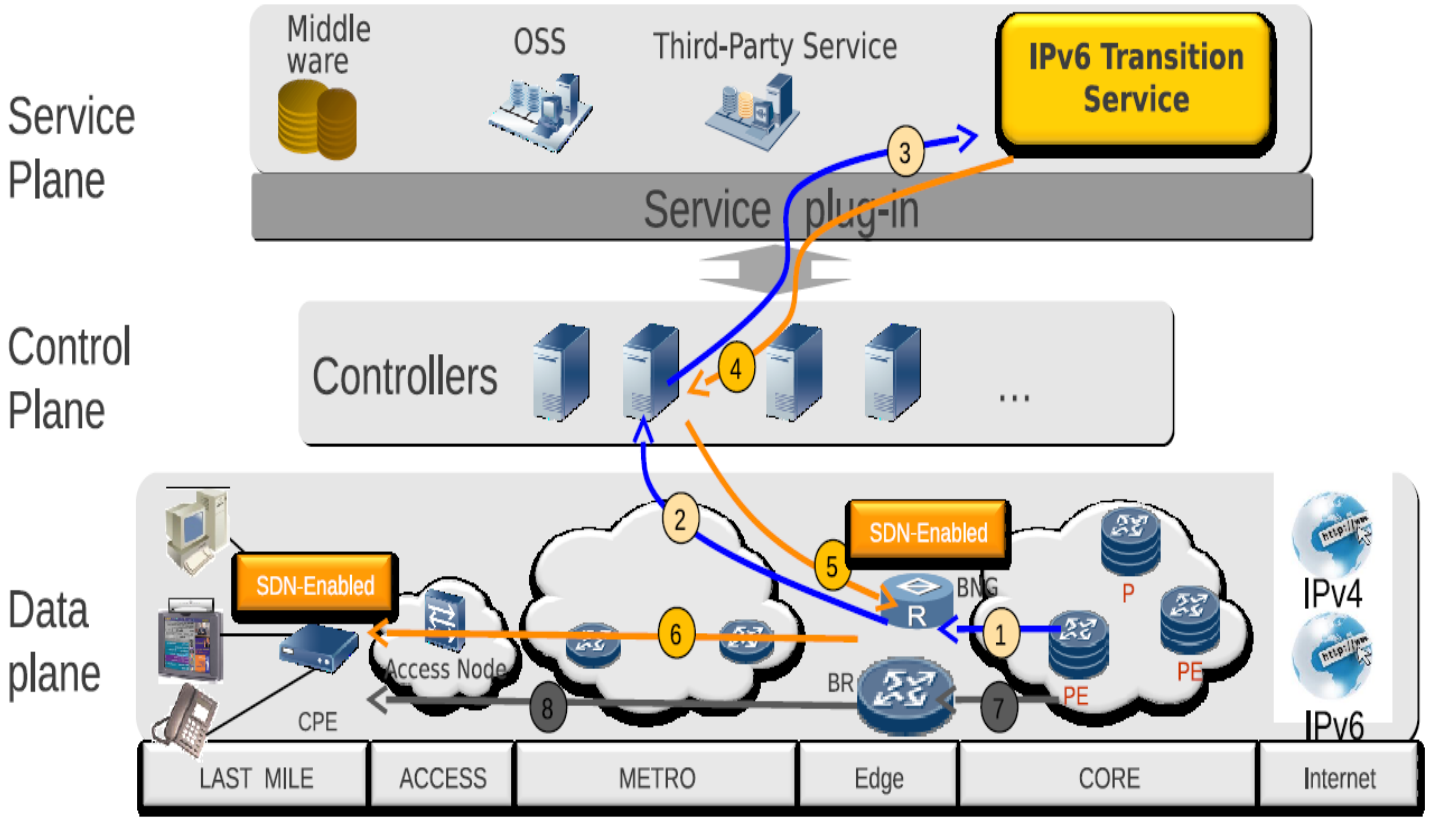
SD-IPv6: Architecture

- Network equipment is SDN compatible
- IPv6 schemes are implemented as SDN apps
  - SDN apps communicate with SDN controller via NBI

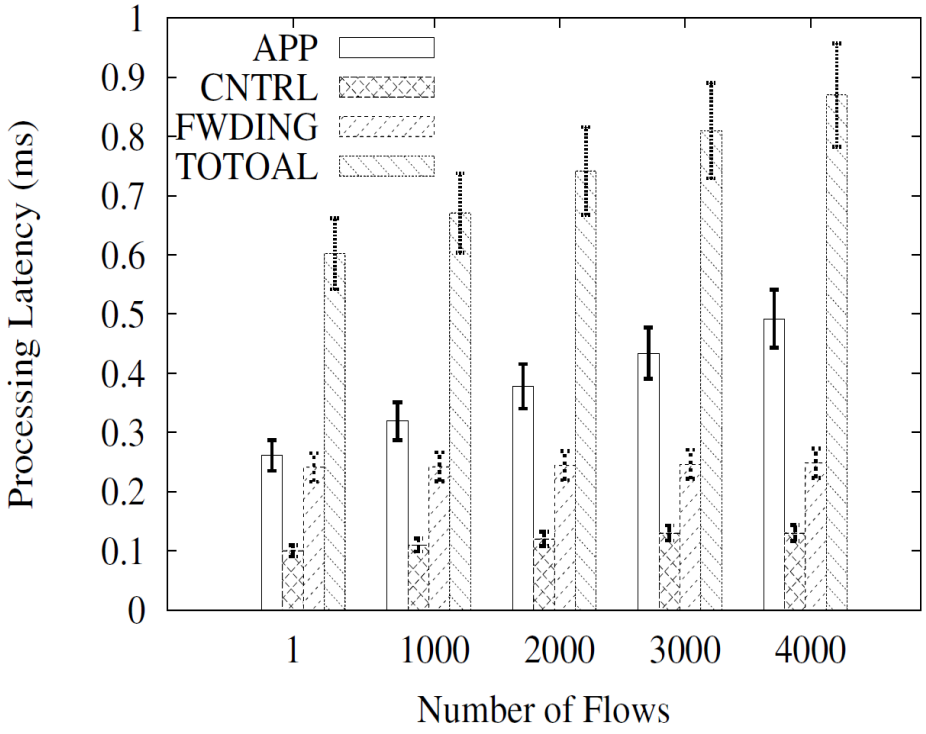


SD-IPv6: Data / Control Flow



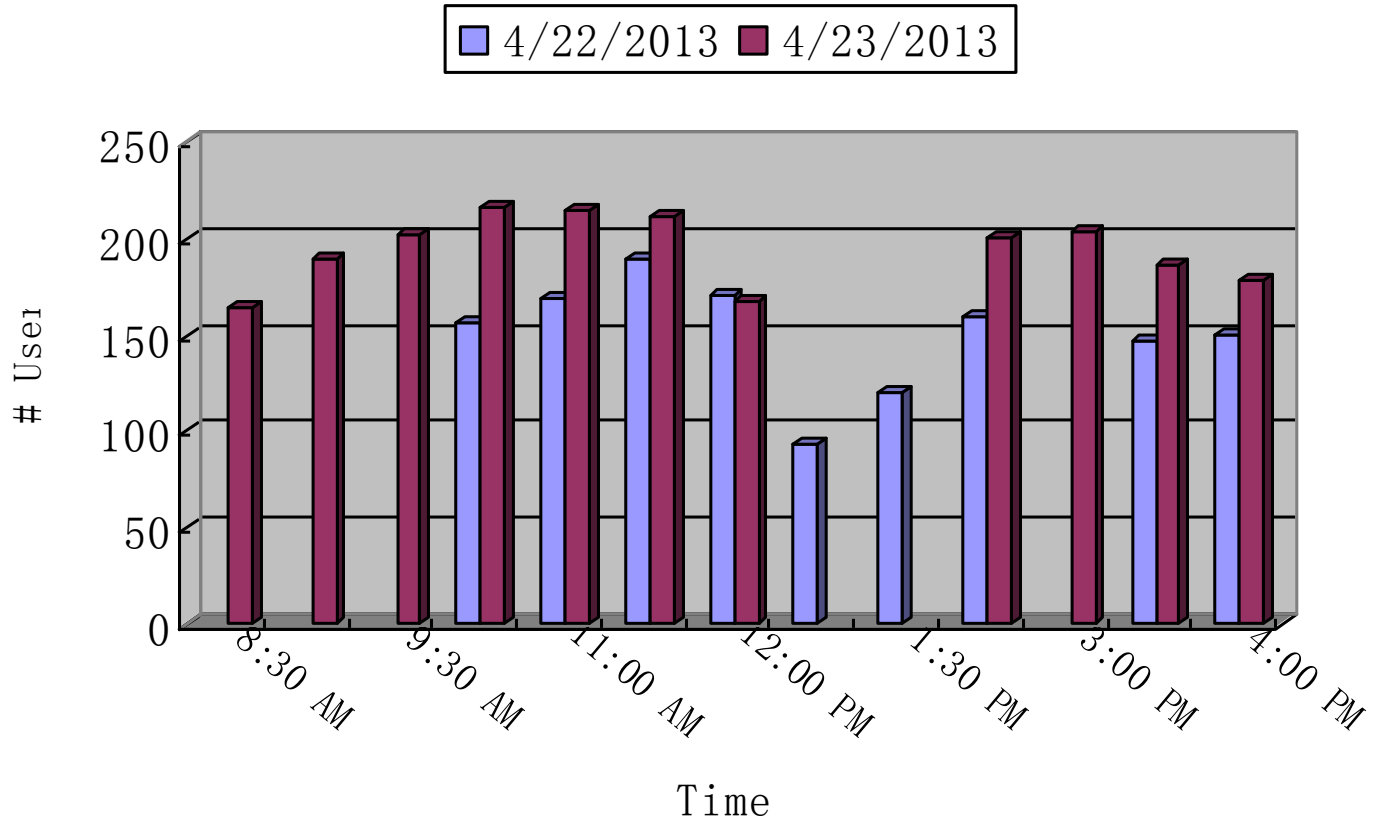
Evaluations I: Lab Experiments

- Experiment setup
  - •Use flow generators to generator a varying number of flows
  - •Use commodity hardware
- Result
  - •SD-IPv6 can handle a reasonably large number of flows with *very high cost-performance efficiency*



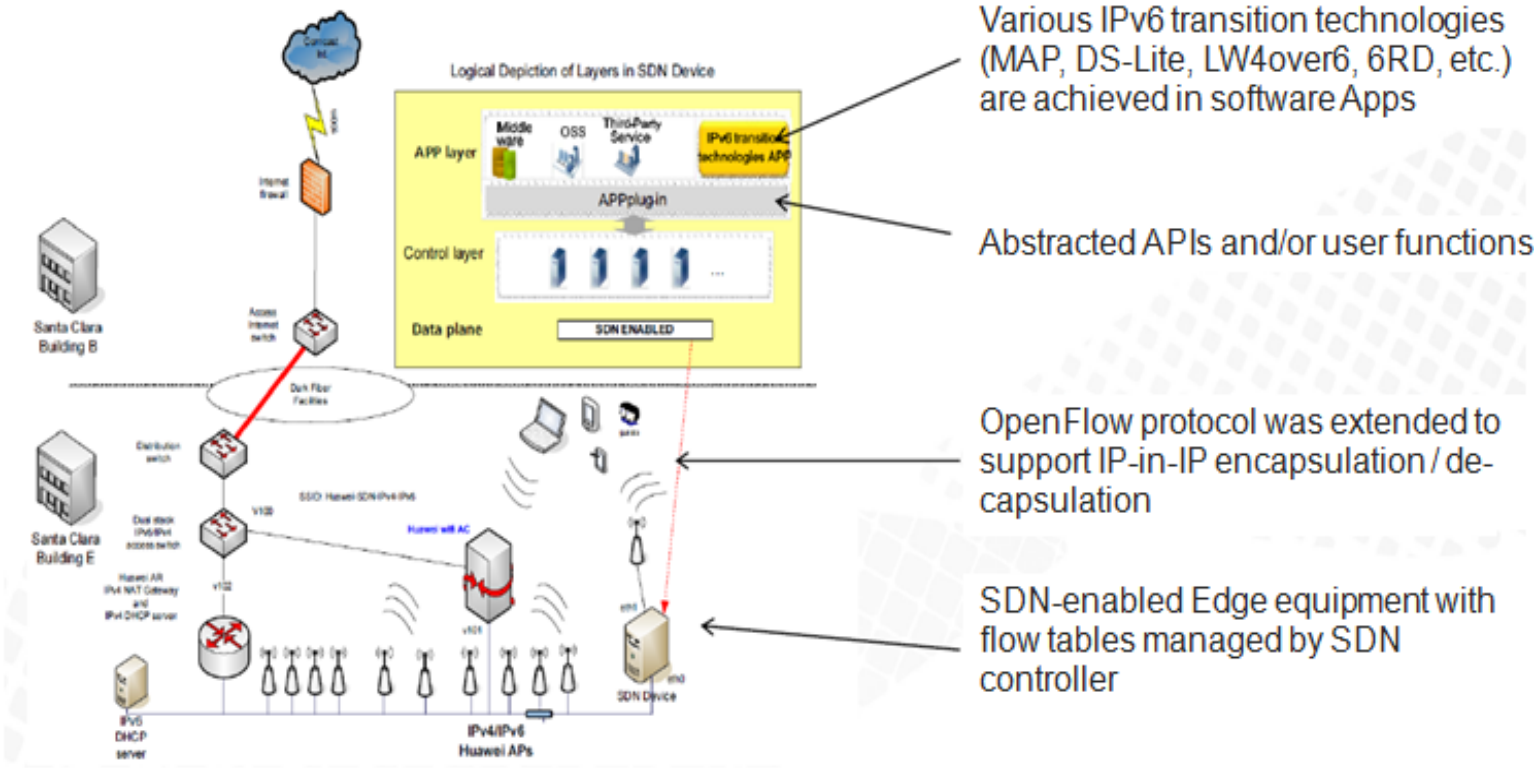
Evaluations II: Live Experiments

- Provide live Internet access for 270+ participants of ETSI Network Function Virtualization 2nd meeting on April 22–23, 2013

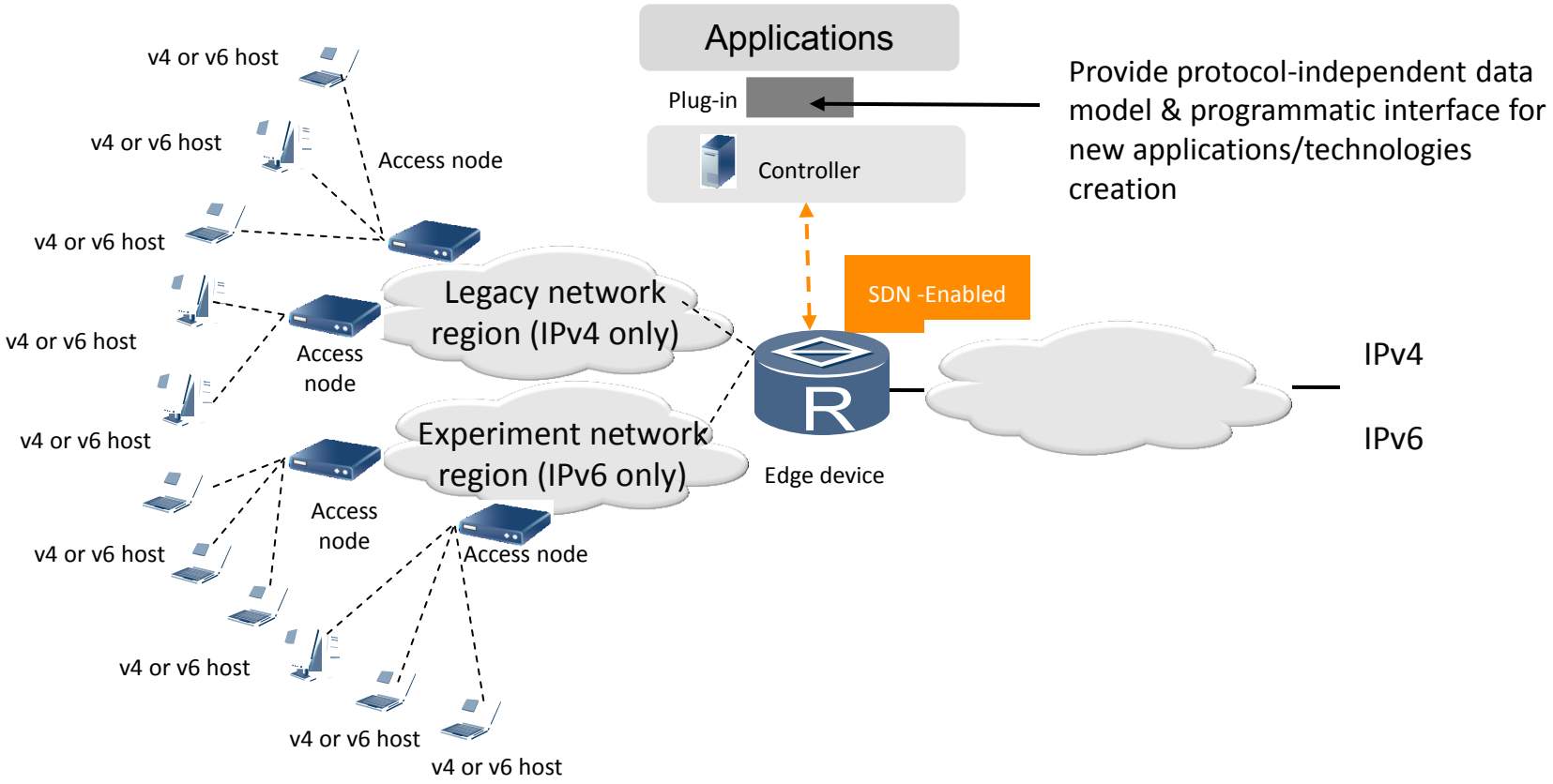


Deployments I: Santa Clara

We have deployed an SDN-IPv6 trial in an enterprise campus in Santa Clara. The following drawing is the network diagram.



Deployments II: Shenzhen



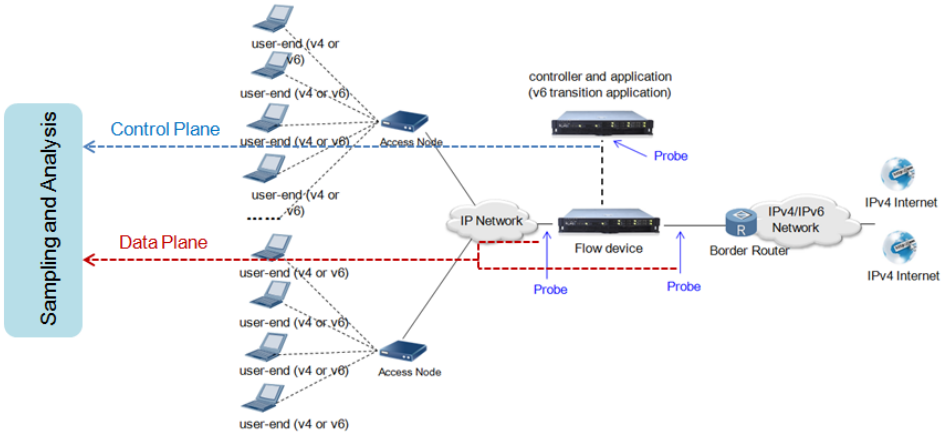
App

- IPv6 transition App, called “SDN IPv6” and available for download at http://www.huawei.com/enmobile/app/ and Google Play, and also at Apple Store soon.
- Visitors can watch the configuration of SDN-IPv6 deployed in Santa Clara via the App. Administrator can modify the configuration of SDN-IPv6 via the App.

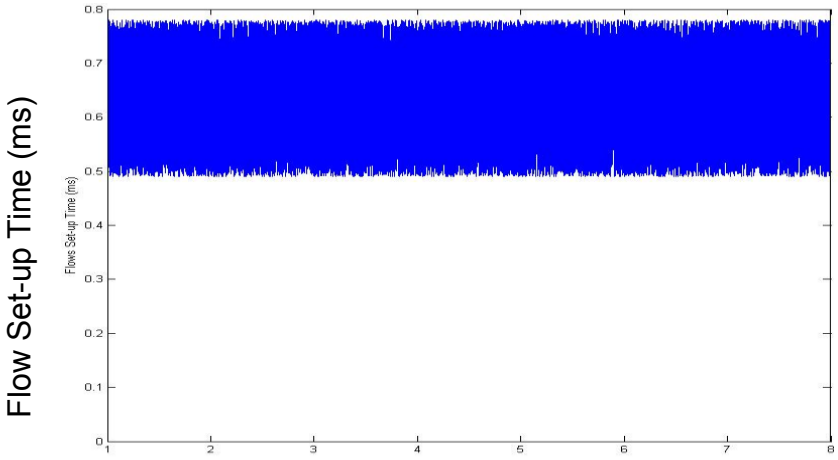
Metrics & Tools

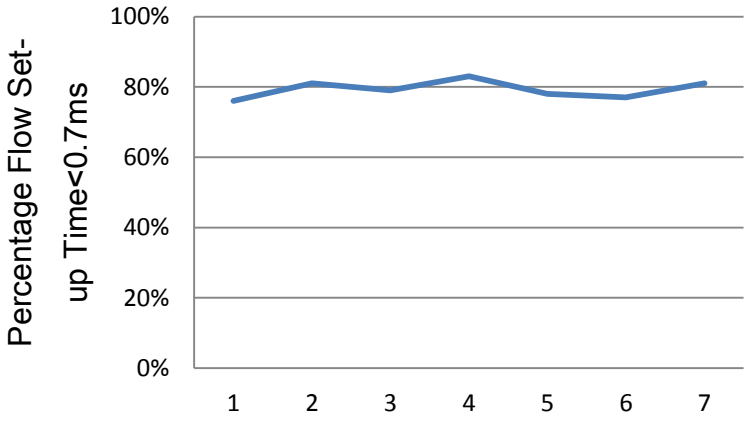
- Provide live Internet access for 800+ participants of SDN-IPv6 Internet Access for the Global Open Networking and SDN Conference 2013 in Beijing on Aug 29-30, 2013
- The following metrics and tools are summary from this live experiments.

SDN IPv6 Deployment
Metrics & Tools (1)



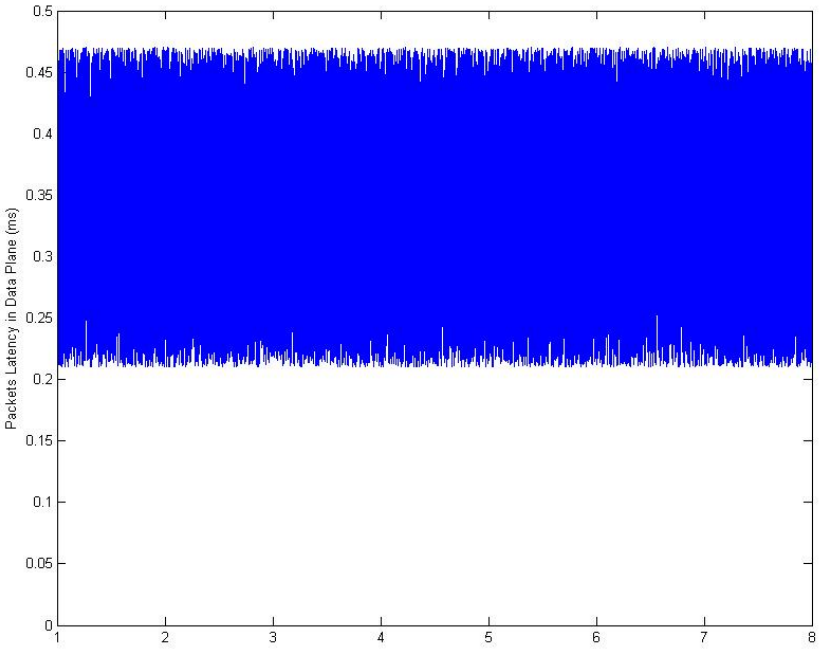
Monitoring for SDN IPv6



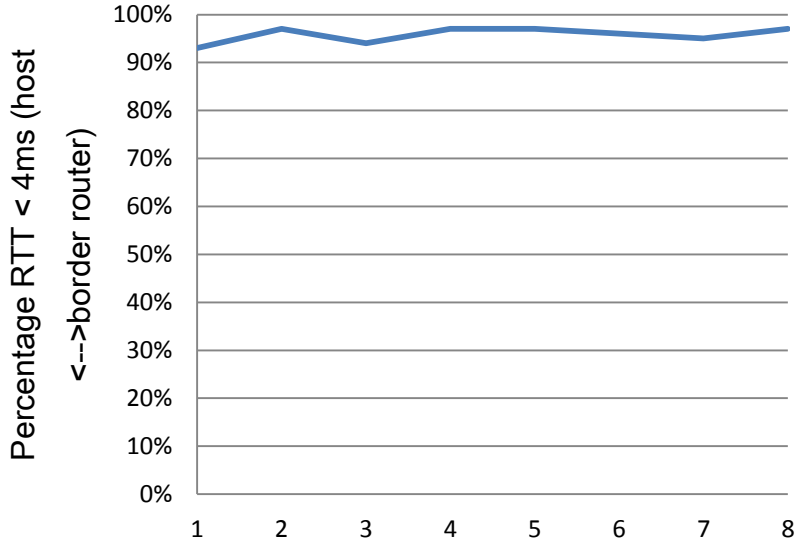


Flow Set-up Time

SDN IPv6 Deployment
Metrics & Tools (2)

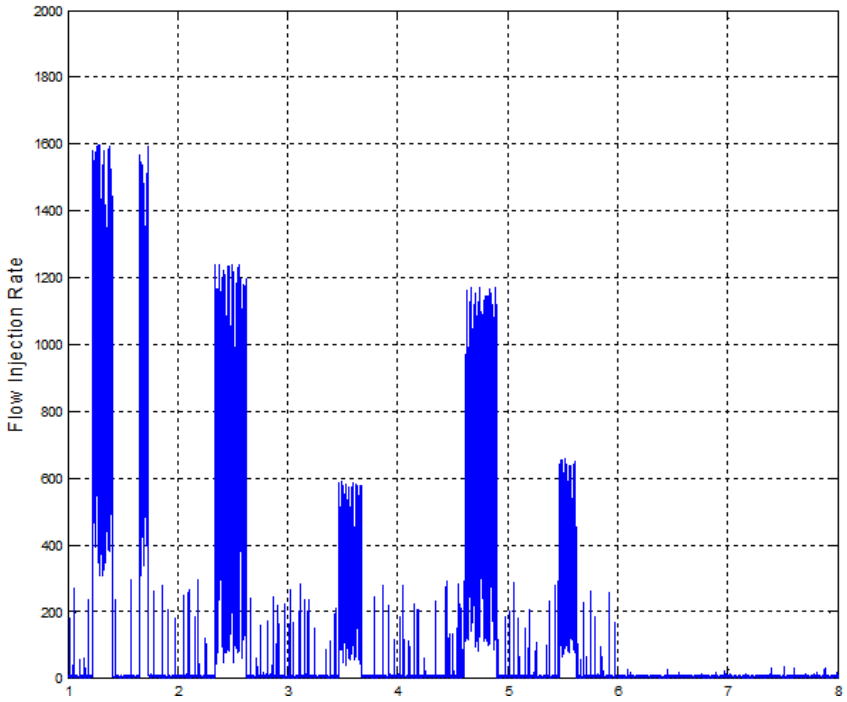


Packet Latency in Data Plane

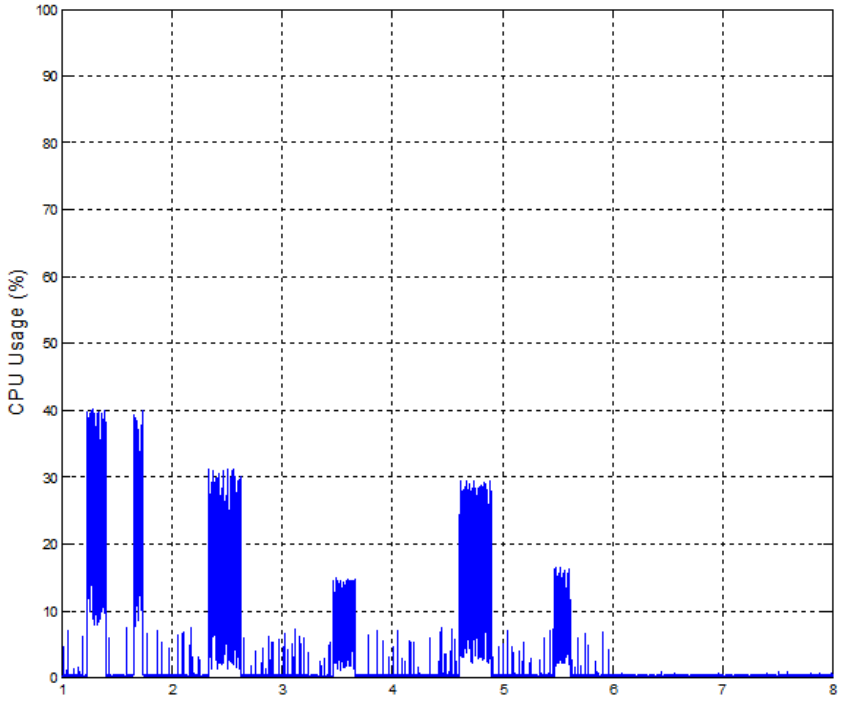


Percentage RTT<4ms

SDN IPv6 Deployment
Metrics & Tools (3)

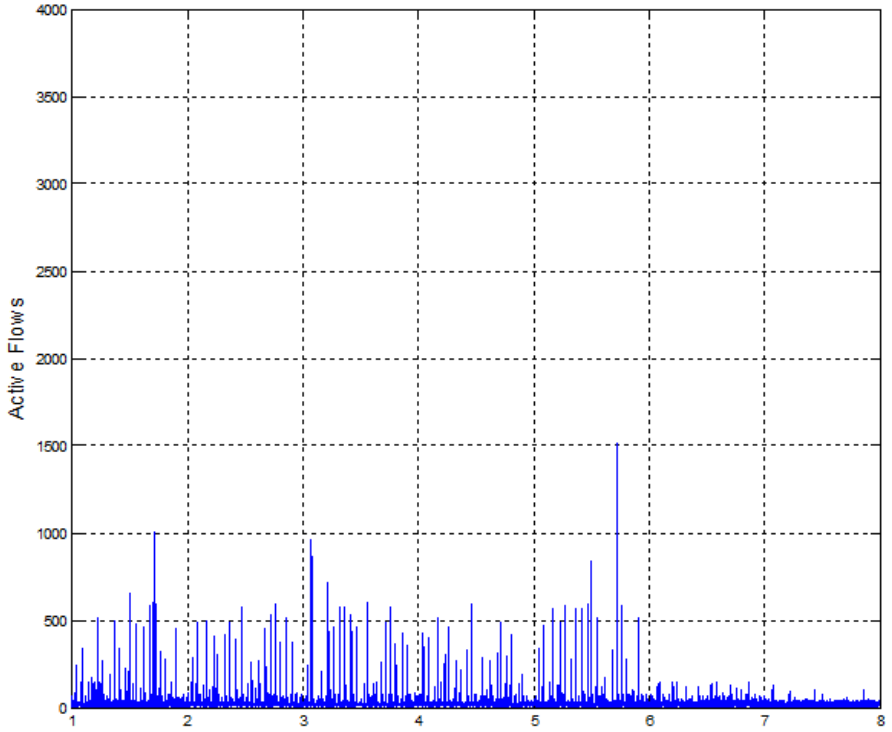


Flow Injection Rate

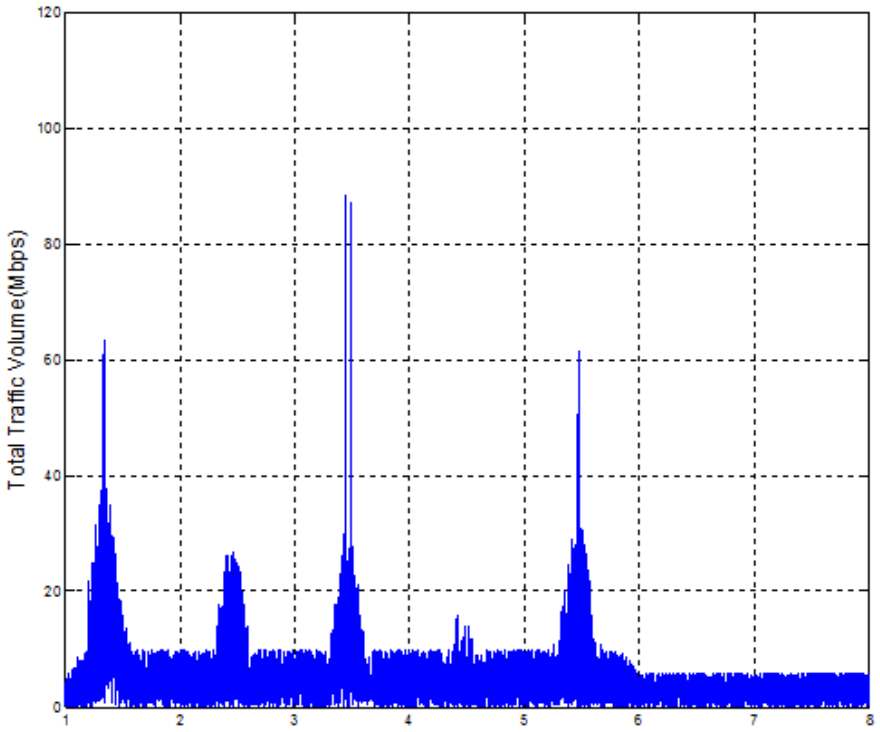


CPU Usage

SDN IPv6 Deployment
Metrics & Tools (4)



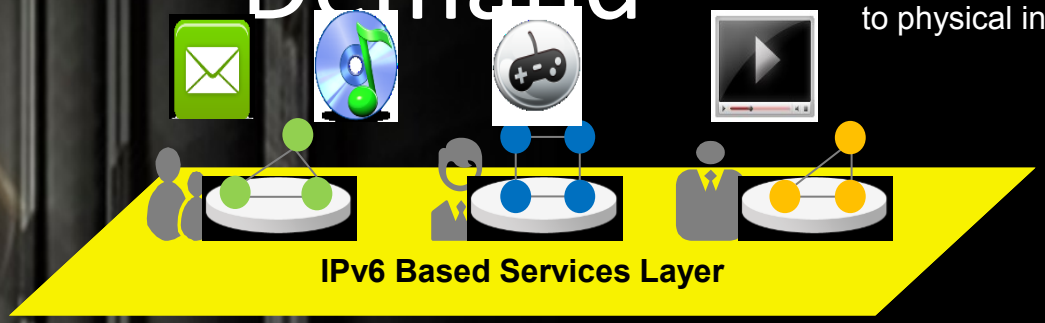
Active Flow



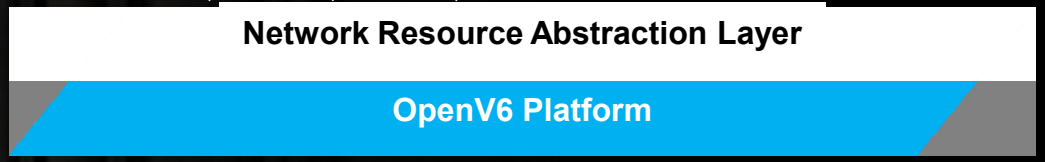
Total Traffic Volume

Programmable Networks on Demand

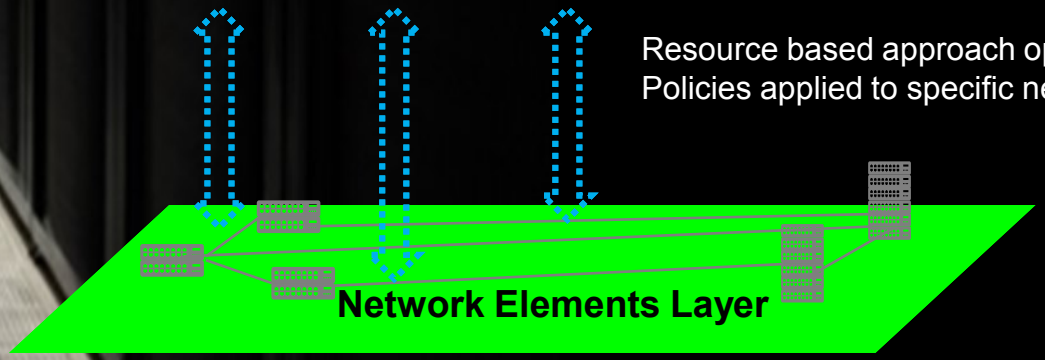
Dynamically create, enable, and disable services without changes to physical infrastructure.



Programming logic resides here.
Nurtures development of native applications.
Simplifies IPv6 transition from existing complex mechanism.



Resource based approach opens the network.
Policies applied to specific networks.



Summary

- We provide a software defined approach to IPv6 transition
  - Low cost
  - High performance
  - Unifying existing IPv6 schemes
  - Extensible: easy to add / implement new IPv6 schemes
  - Easy to implement, deploy and operate

For more details, please refer to our ACM SIGCOMM 2013 poster titled "*A Software Defined Approach to Unified IPv6 Transition*".

Questions