A Software Defined Approach to Unified IPv6 Transition

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Status Quo in IPv6 Transition

- Slow transition
- Many solutions and multiple scenarios co-exist
- Equipment does not support multiple IPv6 transition technologies at the same time
- Operational complexity and risks in the phased approaches
The Goals

- Design a unified approach to IPv6 transition
  - Supported by uniform equipment
- Low deployment and operational costs
  - In despite of the migration path
  - And even able to adapt to different ones
- Able to accommodate existing and future IPv6 transition
- Keep user/application control on the when and how to start the transition
Applying SDN

• Decouple network equipment and the operation of specific IPv6 transition schemes
  • The archetypal data/control planes separation in SDN
• Decouple network equipment and the implementation of specific IPv6 transition schemes
  • Relying on a NBI supporting the dynamic management of IPv6 transition apps
• As a result, support a flexible and adaptive framework for IPv6 transition
  • And move towards network DevOps
The Architecture

- SDN forwarding elements at the IP edge
- IPv6 transition schemas are implemented as SDN Apps
  - Loadable plugins for the controller
- OSS uses a NBI to load apps and configure them
The Data and Control Flows

- Require support for IP-in-IP encapsulation in OpenFlow
  - Being discussed as an extension
  - MTU issues
- Require a NBI spec able to support plugin deployment
The Lab Experiments

- Use flow generators to generate a varying number of flows
- Use commodity hardware
- The results showed that a reasonably large number of flows could be handled with very high cost-performance efficiency
The First Live Experiment

- Internet access for 270+ participants at the ETSI Network Function Virtualization 2nd meeting on 22-23 April 2013
And a Second One

- Internet access for 800+ participants the Global Open Networking and SDN Conference 2013 in Beijing on 29-30 August 2013
Monitoring the Live Labs

Sampling and Analysis

Control Plane

Data Plane

Graph showing user counts over time for 4/22/2013 and 4/23/2013.
Monitoring Results

Flow Set-up Time

Packet Latency in Data Plane

Percentage Flow Set-up Time < 0.7ms

Percentage RTT < 4ms (host <-> border router)
An OSS-like Mobile App

- Demonstration of the NBI concepts
- Controls the deployment and configuration of several IPv6 transition mechanisms
  - Illustrated through the Santa Clara live experiment
- Available for Android and iOS
  - http://www.huawei.com/enmobile/app/
  - Google Play
  - (Apple Store soon)
As a Summary

• SDN is applicable to ease IPv6 transition
  • Low cost
  • High performance
  • Unifying existing IPv6 schemes
• A practical solution for this has been demonstrated
  • Eating our own dog food
  • Mature enough to go for real deployment
• In the path of network DevOps
  • Extensibility via programmability
  • Implementation, deployment and operation
  • Streamline the OSS

For more details, please refer to our ACM SIGCOMM 2013 poster titled “A Software Defined Approach to Unified IPv6 Transition”
More on This at IETF 88

• Demo at Bits 'N Bites
  • 7th November, 19:00-21:00. Regency Ballroom D,E,F

• Several -00 drafts
  • draft-sun-openv6-problem-statement-00, Problem Statement for Openv6 Scheme
  • draft-liu-openv6-architecture-00, Openv6 Architecture for IPv6 Deployment
  • draft-sun-v6ops-openv6-address-pool-management-00, Address Management for IPv6 Transition
  • draft-zhou-netmod-openv6-transition-cfg-00, A YANG Data Model for Open IPv6 Transition

• And a call for a Bar BoF