Overlay Transport Virtualization (OTV)

Dino Farinacci
Hasmit Grover
Victor Moreno
Dhananjaya Rao
Introduction

- OTV is a L2/L3 Virtualization Solution for Enterprise environments
- Transparent L2 extension for enterprise sites
- L2 and/or L3 connectivity for site devices
- Multi-site multi-point connectivity
- Core transport infrastructure agnostic
- Extremely simple provisioning and management
Overview

• **MAC Routing**
  – Uses control plane advertisements instead of data plane learning
  – Remote site MACs learnt via routing protocol
  – No unknown unicast flooding through core

• **Inter-site data encapsulated in IP**
  – Routed across core to destination site
  – No pre-built tunnels
Overview

• OTV forms an overlay network across core
• Dynamically discovers member Edge Devices
• EDs exchange L2 routing information
  – Unicast MACs of hosts and routers in site
  – Active Multicast Sources in site
  – Interested Multicast Groups
• OTV functionality only in edge devices
  – Transparent to core and site devices
• STP terminated at each site
Overlay Network

Legend:
- **red**: switch or L2 link
- **green**: router or L3 link
- **blue**: L2 overlay network

Note: Subnets span across all sites.
VLANs span across all sites.
Each site has its own Spanning Tree.
No L2 flooding or learning on overlay.
Data Forwarding

• Unicast data sent to “next-hop” EDs
  – Packets load-balanced across core ECMPs

• Multicast uses Delivery Groups across core
  – Source ED encapsulates site data in a (DS,DG)
  – Core optimally replicates to interested EDs

• Broadcast data sent as IP multicast
  – All Edge Devices join this core multicast tree
Multi-homing

- OTV provides loop-free multi-homing
- Authoritative Edge Device (AED) per site
  - Edge Devices in the site elect AED
- Only AEDs forward traffic on overlay
  - Avoids loops and duplicates
- Site traffic load-balanced among EDs
  - Per-VLAN AED
MAC Mobility

• MAC moves supported by control plane
  – MAC advertised with default metric
  – When MAC moves, ED in new site advertises MAC with lower metric to indicate MAC move
  – When original advertiser sees this, withdraws its own advertisement
  – New site ED then readvertises with default metric
## OTV UDP Encapsulation

```
+-------------------+-------------------+-------------------+
<table>
<thead>
<tr>
<th>Version</th>
<th>IHL</th>
<th>Type of Service</th>
<th>Total Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
+-------------------+-------------------+-------------------+
| Identification | Flags | Fragment Offset |
|                |       |                |
+-------------------+-------------------+-------------------+
| Time to Live | Protocol = 17 | Header Checksum |
|                |                   |                 |
+-------------------+-------------------+-------------------+
| Source-site OTV Edge Device IP Address |
| Destination-site OTV Edge Device (or multicast) Address |
| Source Port = xxxx | Dest Port = 8472 |
| UDP length | UDP Checksum = 0 |
|             |                 |
+-------------------+-------------------+-------------------+
| R|R|R|R|I|R|R| | Overlay ID |
| | | | | | | | |
+-------------------+-------------------+-------------------+
| Instance ID | Reserved |
|             |         |
+-------------------+-------------------+-------------------+
| Frame in Ethernet or 802.1Q Format |
+-------------------+-------------------+-------------------+
```
Overlay Routing Protocol

• Routing protocol for OTV control plane
  – Discovers overlay members
  – Forms adjacencies on overlay
  – Exchanges unicast and multicast routes

• IS-IS used as oUMRP
  – Overlay forms a logical LAN over the core
  – Edge Devices run IS-IS at L2 on overlay
  – Leverages Layer-2 IS-IS extensions
I-Ds

• Overlay Transport Virtualization
  http://www.ietf.org/id/draft-hasmit-otv-03

• IS-IS Extensions to support OTV
Comments?

- Authors would like to solicit feedback and suggestions