Your Customers are deploying LISP

See how it impacts you as a Service Provider

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Why would we deploy all this?

Our customers are moving to the “cloud”

– Want high availability.
– Extra bandwidth/availability for accessing the “cloud.”
– Expecting benefits beyond BGP.
Customer Self-Reliant Deployment

Starting Point – No LISP
Customer Self-Reliant Deployment

Upgrade Egress routers to serve as xTR

Enterprise Edge
- Upgrade to xTR
- Add MS/MR

Datacenter Edge
- Upgrade to xTR
- Add MS/MR

simpler. smarter. better.
Customer Self-Reliant Deployment

- Upgrade Egress routers to serve as xTR
- Add MS/MR
- LISP
Customer Self-Reliant Deployment

Enterprise Edge
- Add PxTR for address mobility
- Upgrade to xTR
- Add MS/MR
- Add PxTR
- Upgrade to xTR

Datacenter Edge
- Upgrade to xTR
- Add MS/MR
- Add PxTR
- Upgrade to xTR

BGP
BGP
BGP
BGP
LISP
LISP
LISP
LISP

simpler. smarter. better.
Customer / SP Deployment

Enterprise Edge

Upgrade to xTR

Datacenter Edge

Upgrade to xTR

BGP

LISP
Where do the pieces go?

- Clients do everything
- Or...
  - Client xTR – Site
  - Datacenter xTR – Client or SP Site
  - Service Provider – Site and/or Infrastructure
Is LISP on your network today?

– LISP Control – UDP/4342 (0x10F6)
– LISP Data – UDP/4341 (0x10F5)

Router#sho ip cache flow | inc 10F

<table>
<thead>
<tr>
<th>SrcIf</th>
<th>SrcIPaddress</th>
<th>DstIf</th>
<th>DstIPaddress</th>
<th>Pr</th>
<th>SrcP</th>
<th>DstP</th>
<th>Pkts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi0/0</td>
<td>199.119.74.6</td>
<td>Gi0/1.2</td>
<td>38.122.8.142</td>
<td>11</td>
<td>A7F8</td>
<td>10F5</td>
<td>3</td>
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<tr>
<td>Gi0/0</td>
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<td>Local</td>
<td>38.122.8.142</td>
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<td>10F6</td>
<td>10F5</td>
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<td>Gi0/1.2</td>
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<td>Gi0/0</td>
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<td>Gi0/1.2</td>
<td>38.122.8.142</td>
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<td>Gi0/1.2</td>
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<td>Gi0/1.2</td>
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<td>11</td>
<td>DC9D</td>
<td>10F5</td>
<td>7</td>
</tr>
</tbody>
</table>
Tunneling is done in UDP not GRE

– LISP Data – UDP/4341 (0x10F5)

Our traffic share was 80:1 before LISP. It is 8:1 after LISP

Why not 1:1?

IPSec Traffic: 1 source – 1 destination

<table>
<thead>
<tr>
<th>SrcIf</th>
<th>SrcIPaddress</th>
<th>DstIf</th>
<th>DstIPaddress</th>
<th>Pr SrcP DstP</th>
<th>Pkts</th>
</tr>
</thead>
<tbody>
<tr>
<td>LI0</td>
<td>38.125.5.14</td>
<td>Local</td>
<td>199.119.75.17</td>
<td>32 C2A6 288C</td>
<td>65</td>
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<tr>
<td>BV1</td>
<td>199.119.75.17</td>
<td>LI0*</td>
<td>38.125.5.14</td>
<td>32 E915 27E5</td>
<td>7</td>
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<tr>
<td>BV1</td>
<td>199.119.75.17</td>
<td>LI0*</td>
<td>38.125.5.14</td>
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<td>14K</td>
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<tr>
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<td>32 E2DD 9274</td>
<td>12K</td>
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<tr>
<td>BV11</td>
<td>199.119.75.17</td>
<td>LI0*</td>
<td>38.125.5.14</td>
<td>32 9F2E 8E31</td>
<td>4</td>
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<tr>
<td>BV1</td>
<td>199.119.75.17</td>
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<td>38.125.5.14</td>
<td>32 9F2E 8E31</td>
<td>11K</td>
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<tr>
<td>BV1</td>
<td>199.119.75.17</td>
<td>LI0*</td>
<td>38.125.5.14</td>
<td>32 9F2E 8E31</td>
<td>970</td>
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<tr>
<td>LI0</td>
<td>38.125.5.14</td>
<td>BV1</td>
<td>199.119.75.17</td>
<td>32 941C 3028</td>
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<td>LI0</td>
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<td>BV1</td>
<td>199.119.75.17</td>
<td>32 941C 3028</td>
<td>3</td>
</tr>
</tbody>
</table>
Production LISP Volume

– It’s not just the LISP Beta Network

LISP Beta Network MRTG Index Page

Total PxTR Internet Traffic
Production LISP Volume

• NJEDge.net is a non-profit technology consortium of academic and research institutions in New Jersey.

• NJEDge's LISP traffic volume is sustained at 2G.

http://www.njedge.net/
Impact to You

You provide transit for Customer A running LISP.
- **HQ** (LISP)
- **DC** (LISP)

You provide transit for Customer B not running LISP.

How does your traffic flow?
Site vs. PxTR Traffic Flows

Bits In/Out (High Speed)

In Avg: 803.81 k Min: 359.34 k Max: 3.82 M
Out Avg: 890.50 k Min: 343.71 k Max: 6.17 M
Tot In: 69.31 G Tot Out: 70.79 G Tot: 146.10 G

Bits In/Out (High Speed)

In Avg: 297.56 k Min: 110.47 k Max: 5.09 M
Out Avg: 24.33 k Min: 2.00 k Max: 193.81 k
Tot In: 21.69 G Tot Out: 177 G Tot: 23.47 G
# Traffic Flow

<table>
<thead>
<tr>
<th>Source</th>
<th>Dest</th>
<th>EIDs in MS?</th>
<th>PxTR</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-EID</td>
<td>Non-EID</td>
<td>NA</td>
<td>No</td>
<td>SRC - DST global routing</td>
</tr>
<tr>
<td>Non-EID</td>
<td>EID</td>
<td>Yes</td>
<td>Via PiTR</td>
<td>SRC to PiTR (IP) PiTR to EID (LISP)</td>
</tr>
<tr>
<td>EID</td>
<td>Non-EID</td>
<td>Yes</td>
<td>Via PeTR*</td>
<td>EID to PeTR (LISP) PeTR to DST (IP)</td>
</tr>
<tr>
<td>EID</td>
<td>EID</td>
<td>Yes</td>
<td>No</td>
<td>LOC-LOC (LISP) global routing</td>
</tr>
<tr>
<td>EID</td>
<td>EID</td>
<td>No</td>
<td>Via PiTR/PeTR*</td>
<td>EID to PeTR (LISP) PeTR to PiTR (IP) PiTR to EID (LISP)</td>
</tr>
</tbody>
</table>

* PeTR is optional but needed for uRPF and IPv6 over IPv4 environments
DDT  The Global Mapping System for LISP

- EID – EID in separate islands is the worst case for traffic.
- DDT allows for lookup across disparate islands.

<table>
<thead>
<tr>
<th>Source</th>
<th>Dest</th>
<th>EIDs in MS?</th>
<th>PxTR</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>EID</td>
<td>EID</td>
<td>No</td>
<td>Via PiTR/PeTR*</td>
<td>EID to PeTR (LISP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PeTR to PiTR (IP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PiTR to EID (LISP)</td>
</tr>
<tr>
<td>EID</td>
<td>EID</td>
<td>Yes (via DDT)</td>
<td>No</td>
<td>LOC-LOC (LISP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>global routing</td>
</tr>
</tbody>
</table>

* PeTR is optional but needed for uRPF and IPv6 over IPv4 environments
Use RIG to see DDT Referrals

VXNet EID Space

rig 199.119.75.0 to 199.119.73.8
Send Map-Request to DDT-node 199.119.73.8 ... node referral, rtt: 4 ms
EID-prefix: [0] 199.119.75.0/24, ttl: 1440
referrals: 199.119.73.6, 2607:1F00:0:4::6

Send Map-Request to DDT-node 199.119.73.6 ... delegation hole, rtt: 0 ms
EID-prefix: [0] 199.119.75.0/28, ttl: 15
## Use RIG to see DDT Referrals

### LISP Beta Network

<table>
<thead>
<tr>
<th>VXNet-01#rig 153.16.0.0 to 199.119.73.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Send Map-Request to DDT-node 199.119.73.8 ... node referral, rtt: 0 ms</td>
</tr>
<tr>
<td>EID-prefix: [0] 153.16.0.0/16, ttl: 1440</td>
</tr>
<tr>
<td>referrals: 158.38.1.91, 173.36.254.167, 208.217.187.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Send Map-Request to DDT-node 158.38.1.91 ... node referral, rtt: 112 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>EID-prefix: [0] 153.16.0.0/19, ttl: 1440</td>
</tr>
<tr>
<td>referrals: 173.36.254.164, 206.223.132.89, 198.6.255.37, 149.20.48.61</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Send Map-Request to DDT-node 173.36.254.164 ... map-server not registered, rtt: 80 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>EID-prefix: [0] 153.16.0.0/24, ttl: 1</td>
</tr>
<tr>
<td>referrals: 149.20.48.61, 198.6.255.37, 173.36.254.164, 206.223.132.89</td>
</tr>
</tbody>
</table>
Operational Issues

**MTU**

**LISPAdj:** IP midchain out of LISP0, addr 96.56.153.210
Change MTU from 9180 to 1464 due to PMTU 1500

**LISPAdj:** IP midchain out of LISP0, addr 96.56.153.210
pick source RLOC 199.119.74.6 MTU 1464 (pMTU 1500)

*(Our MTU problems were L2 at IX)*

**Latency to PxTR** *(Less of an issue than expected)*

**RLOC = Routing by Uplink** *(Are all uplinks routable?)*
Resources

- lisp.cisco.com
- lisp4.net
- ddt-root.org
- openlisp.org
- lispmob.org
Questions?