Problem Statement

• What if LISP xTRs didn’t need to depend on a third-party

• What if LISP xTRs could multi-home and roam to inform each other about new RLOCs

• What if LISP xTRs could be their own mapping system

• Let’s build a purely democratized and decentralized control-plane

Endpoint IDs (EIDs)  Routing Locators (RLOCs)
Today’s Model Mapping System
Network Connectivity
LISP Control-Plane Messages

Internet

RLOC space

ms1
ms3
ms2
ms4

xTR1
xTR2

Map-Register
10.0.0.0/8 to 3.3.3.3

Map-Register
10.0.0.0/8 to 1.1.1.1

Map-Register
2001:5:3::/48 to 2.2.2.2

Map-Register
2001:5:3::/48 to 4.4.4.4
Decentralized Map-Server?

- What if each xTR was a Map-Server
- What if each xTR could Map-Register to each xTR
- The mapping system would be synchronized
- An xTR could be a Map-Resolver for itself
How to Define a Mapping System

• A consolidated mapping system is identified by a multicast group address

• The xTRs that are part of a mapping system join the same multicast group

• Map-Registers are sent to the group - all xTRs receive all mappings

• Efficient distribution when underlay supports multicast or head-end replication at each xTR
LISP-Decent Control-Plane Messages

Map-Register
1.0.0.0/8 to 224.1.1.1
xTR1

Map-Register
3.0.0.0/8 to 224.1.1.1
xTR3

Map-Register
5.0.0.0/8 to 224.1.1.1
xTR5

Map-Register
2001:5:2::/48 to 224.2.2.2
xTR2

Map-Register
2001:5:4::/48 to 224.2.2.2
xTR4

Map-Register
2001:5:6::/48 to 224.2.2.2
xTR6

Internet

Mapping system
1.0.0.0/8 -> xTR1
3.0.0.0/8 -> xTR3
5.0.0.0/8 -> xTR5

Mapping system
2001:5:6::/48 -> xTR6
2001:5:2::/48 -> xTR2
2001:5:4::/48 -> xTR4
2001:5:6::/48 -> xTR6
Benefits

- xTRs only depend on each other - they do so already if they want to talk to each other
- No third-party trust or dependency exists
- Map-Request lookup has low latency
- xTRs build and send 1 Map-Register for n xTRs
- Management simplified by accessing one xTR to get all mappings
- Pretty much same benefits as peer-to-peer networking
Use-Cases

• Crypto-Currency Applications
• Emergency Networking (Mesh Networks)
• Plug-and-Play VPN Networking
• Space Networking (Software-Defined Satellites)
• Sharable Economy Apps
Brief LISP-Decent Demo

- 3 containers each running a lispers.net xTR
- Docker bridge NOT doing multicast
- xTRs are doing head-end replication
- xTRs register an IPv4 EID-prefix and a Name EID
LISP-Decent in Action

### lispers.net

**Scalable Open Overlay Networking**

Enter EID for Site-Cache lookup:  
Submit

### LISP-MS Site Information:

<table>
<thead>
<tr>
<th>Site Name</th>
<th>EID-Prefix or (S,G)</th>
<th>Registered</th>
<th>Last Registerer</th>
<th>Last Registered</th>
<th>First Registered</th>
<th>Registration Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIDs</td>
<td>[1]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[1]9.3.3.3/32</td>
<td>yes (dynamic)</td>
<td>[0]172.17.0.7</td>
<td>00:00:29</td>
<td>00:03:34</td>
<td>p-s-l-t-r-m-n</td>
</tr>
<tr>
<td></td>
<td>[1]nexus-n3'</td>
<td>yes (dynamic)</td>
<td>[0]172.17.0.7</td>
<td>00:00:29</td>
<td>00:03:34</td>
<td>p-s-l-t-r-m-n</td>
</tr>
<tr>
<td></td>
<td>[1]1.1.1.1/32</td>
<td>yes (dynamic)</td>
<td>[0]172.17.0.5</td>
<td>00:00:33</td>
<td>00:01:33</td>
<td>p-s-l-t-r-m-n</td>
</tr>
<tr>
<td></td>
<td>[1]nexus-n1'</td>
<td>yes (dynamic)</td>
<td>[0]172.17.0.5</td>
<td>00:00:33</td>
<td>00:01:33</td>
<td>p-s-l-t-r-m-n</td>
</tr>
<tr>
<td></td>
<td>[1]2.2.2.2/32</td>
<td>yes (dynamic)</td>
<td>[0]172.17.0.6</td>
<td>00:00:30</td>
<td>00:01:30</td>
<td>p-s-l-t-r-m-n</td>
</tr>
<tr>
<td></td>
<td>[1]nexus-n2'</td>
<td>yes (dynamic)</td>
<td>[0]172.17.0.6</td>
<td>00:00:30</td>
<td>00:01:30</td>
<td>p-s-l-t-r-m-n</td>
</tr>
<tr>
<td>peer-groups</td>
<td>[1][0.0.0.0/224.0.0.0/4]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[1][0.0.0.0/224.1.1.0/32]</td>
<td>yes (dynamic)</td>
<td>[0]172.17.0.7</td>
<td>00:00:05</td>
<td>00:03:18</td>
<td>P-s-l-I-R-m-n</td>
</tr>
</tbody>
</table>
LISP-Decent in Action

lispers.net
Scalable Open Overlay Networking

Site name: peer-groups, EID-prefix: [1](0.0.0.0/0, 224.1.1.1/32), registered: yes, dynamic
  Description:
  Last registered: [0]172.17.0.6, xTR-ID: 0x6bc2b4849e579d, site-ID: 0
  First registered: 0:10:39, last registered: 0:00:01, auth-type: sha1, registration flags: P-s-I-t-R-m-n
  Default registration timeout TTL: 180 seconds
  Forcing proxy Map-Reply: yes
  Forcing proxy Map-Reply for xTRs behind NATs: no
  Send drop-action proxy Map-Reply to PITR: no
  Proxy Map-Reply action: not configured
  Allowed RLOC-set: any

Registered RLOC-set (merge-semantics):
  [0]no-address, state: up-state, up/uw/mp/mw: 255/0/1/100
    rle: 172.17.0.5(L128), 172.17.0.6(L128), 172.17.0.7(L128)

LISP-ITR Map-Cache:

Enter EID for Map-Cache lookup:

<table>
<thead>
<tr>
<th>EID-Prefix or (S,G)</th>
<th>Uptime TTL</th>
<th>RLOC Record RLOC Keys</th>
<th>Map-Reply Source</th>
<th>RLOC Send Stats</th>
<th>RLOC State RLOC Action</th>
<th>Unicast Priority/Weight Multicast Priority/Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1](0.0.0.0/0, 224.1.1.1/32)</td>
<td>0:05:05 24 hours</td>
<td>rle: 172.17.0.5(L128), 172.17.0.7(L128), 172.17.0.6(L128)</td>
<td>map-notify</td>
<td>packet-count: 35 byte-count: 5315</td>
<td>up-state since 0:05:05 encapsulate</td>
<td>255/0 1/100</td>
</tr>
</tbody>
</table>
Questions/Reactions/Tomatoes?