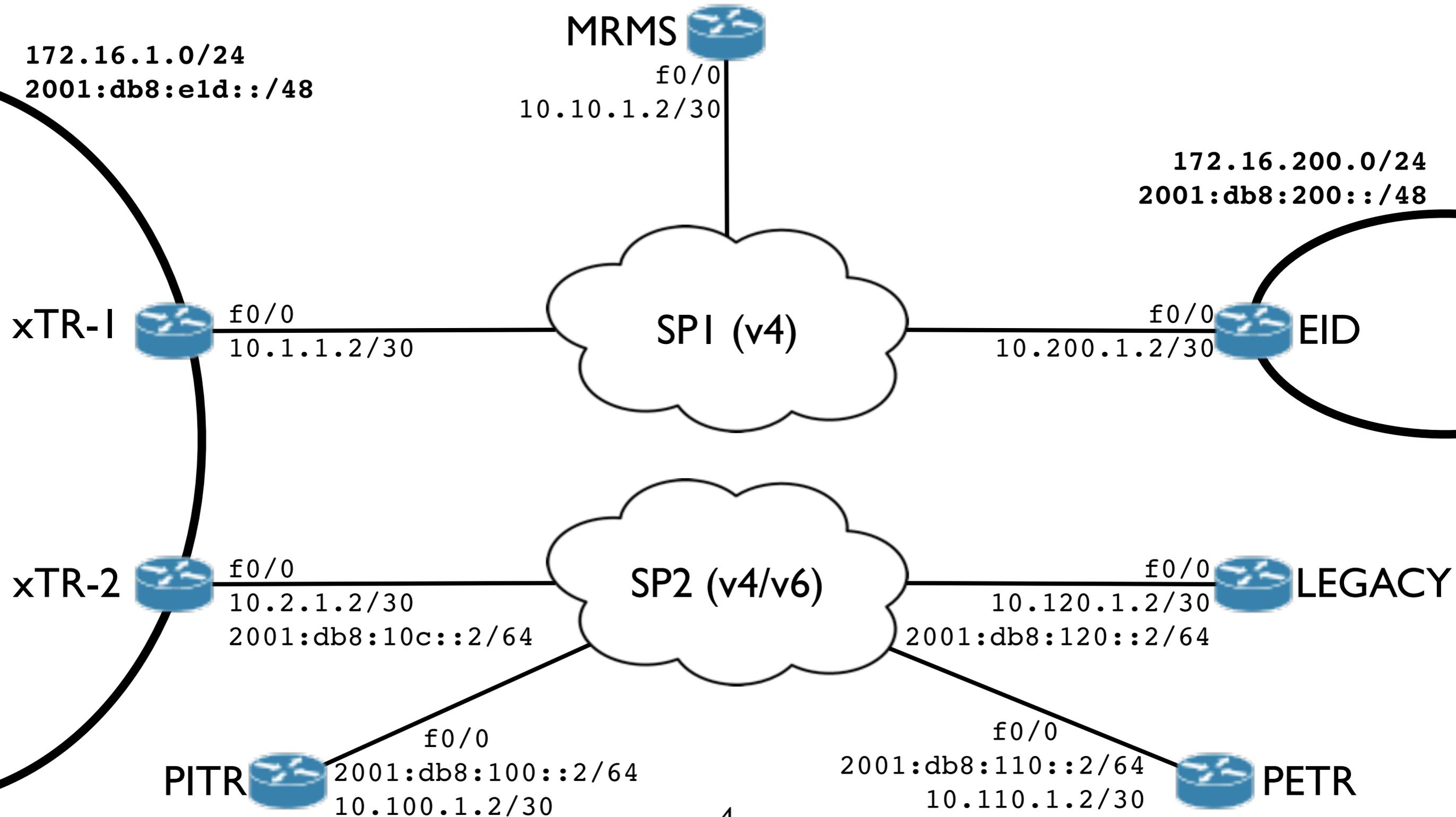# LISP Hands On | Damien Saucez

Agenda

- Playing with IOS

  - OpenLISP

- Deployed public network: LISP4.net

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Play with LISP?

- Cisco IOS 15.1XB

  - 1801, 1802, 1803, 1805, 1811, 1812, 1841, 1861,1941,1941W, 2801, 2811, 2821, 2851, 2901, 2911, 2921, 2951, 3825, 3845, 3925, 3945, 7201, 7204VXR, 7206VXR

- Cisco IOS XE 2.5.1XA

  - ASR1002, ASR1002-F, ASR1004, ASR1006

- Cisco NX-OS 5.0(3.lisp)

  - Nexus 7000 Series

- OpenLISP 0.2.0 (open source)

  - FreeBSD 7.3, 7.4, 8.1, 8.2

- LISPmob (open source)

  - Linux 2.6.32

- https://github.com/aless/linux-2.6-lisp (?)

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Lab Topology

MRMS

f0/0
10.10.1.2/30

172.16.1.0/24
2001:db8:e1d::/48

172.16.200.0/24
2001:db8:200::/48

xTR-1

f0/0
10.1.1.2/30

SP1 (v4)

f0/0
10.200.1.2/30

EID

xTR-2

f0/0
10.2.1.2/30
2001:db8:10c::2/64

SP2 (v4/v6)

f0/0
10.120.1.2/30
2001:db8:120::2/64

LEGACY

PITR

f0/0
2001:db8:100::2/64
10.100.1.2/30

f0/0
2001:db8:110::2/64
10.110.1.2/30

PETR

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Single-homed xTR

```
hostname xTR-1
!
ip route 0.0.0.0 0.0.0.0 10.1.1.1
!
router lisp
 !
 ipv4 itr
 ipv4 etr
 !
 ! database
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 100
 !
 ! retrieve the mappings via MRMS
 ipv4 itr map-resolver 10.10.1.2
 !
 ! register the database to MRMS
 ipv4 etr map-server 10.10.1.2 key 0 PASSWORD_MS
```

Multi-connected xTR

```
hostname xTR-2
!
interface FastEthernet0/0
 description xTR-2 with SP2
 ip address 10.2.1.2 255.255.255.252
 ipv6 address 2001:db8:10c::2/64
!
router lisp
 !
 ipv4 itr
 ipv4 etr
 !
 ! database
 database-mapping 172.16.1.0/24 10.2.1.2 priority 1 weight 100
 database-mapping 172.16.1.0/24 2001:db8:10c::2 priority 99 weight 100
 !
 ! retrieve the mappings via MRMS
 ipv4 itr map-resolver 10.10.1.2
 !
 ! register the database to MRMS
 ipv4 etr map-server 10.10.1.2 key 0 PASSWORD_MS
```

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MR / MS

```
hostname MRMS
!
router lisp
 !
 ! ===== Map-Resolver Part ============
 ipv4 map-resolver
 !
 ! ===== Map-Server Part ==============
 ipv4 alt-vrf lisp
 !
 site LEFT-Site
  authentication-key PASSWORD_MS
  eid-prefix 172.16.1.0/24
  exit
 !
vrf definition lisp
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
```

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Is it registered?

```
MRMS#show lisp site
LISP Site Registration Information
```

Site Name	Last Register	Up	Who Last Registered	Inst ID	EID Prefix
LEFT-Site	00:00:13	yes	10.2.1.2		172.16.1.0/24

```
MRMS#show lisp site name LEFT-Site
Site name: LEFT-Site
Allowed configured locators: any
Allowed EID-prefixes:
  EID-prefix: 172.16.1.0/24 *** site inconsistent ***
    First registered:     00:02:10
    Routing table tag:     0
    Origin:                Configuration
    Merge active:          No
    Proxy reply:           No
    TTL:                   1d00h
    Registration errors:
      Authentication failures:   0
      Allowed locators mismatch: 0
    ETR 10.2.1.2, last registered 00:00:10, no proxy-reply, no map-notify
              TTL 1d00h, no merge
      Locator            Local  State       Pri/Wgt
      10.2.1.2           yes    up            2/100
      2001:DB8:10C::2    yes    up          100/100
    ETR 10.1.1.2, last registered 00:00:12, no proxy-reply, no map-notify
              TTL 1d00h, no merge
      Locator            Local  State       Pri/Wgt
      10.1.1.2           yes    up            1/100
```

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What do xTRs see?

```
xTR-1#show ip lisp database
LISP ETR IPv4 Mapping Database for EID-table default (IID 0), LSBs: 0x1, 1
entries


172.16.1.0/24
  Locator     Pri/Wgt  Source      State
  10.1.1.2     1/100   cfg-addr    site-self, reachable

xTR-2#show ip lisp database
LISP ETR IPv4 Mapping Database for EID-table default (IID 0), LSBs: 0x3, 1
entries


172.16.1.0/24
  Locator           Pri/Wgt  Source      State
  10.2.1.2            2/100   cfg-addr    site-self, reachable
  2001:DB8:10C::2   100/100   cfg-addr    site-self, reachable
```

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Multi-homed xTRs

```
hostname xTR-2
!
router lisp
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 100
 database-mapping 172.16.1.0/24 10.2.1.2 priority 10 weight 100
 database-mapping 172.16.1.0/24 2001:db8:10c::2 priority 99 weight 100
```

xTR-2#show ip lisp database
```
LISP ETR IPv4 Mapping Database for EID-table default (IID 0), LSBs: 0x7, 1 entries
```

```
172.16.1.0/24
```
  *** MISMATCH IN RLOC CONFIGURATION WITH OTHER SITE xTRs ***
```
  Locator           Pri/Wgt  Source       State
```
  10.1.1.2   1/100 cfg-addr   site-other, report-reachable
```
  10.2.1.2             10/100  cfg-addr    site-self, reachable
  2001:DB8:10C::2   99/100  cfg-addr    site-self, reachable
```

xTR-1#show ip lisp database
```
LISP ETR IPv4 Mapping Database for EID-table default (IID 0), LSBs: 0x1, 1 entries
```

```
172.16.1.0/24
  Locator    Pri/Wgt  Source       State
  10.1.1.2     1/100  cfg-addr    site-self, reachable
```

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Multi-homed xTRs

```
hostname xTR-1
!
router lisp
 database-mapping 172.16.1.0/24 10.1.1.2 priority 1 weight 100
 database-mapping 172.16.1.0/24 10.2.1.2 priority 10 weight 100
 database-mapping 172.16.1.0/24 2001:db8:10c::2 priority 99 weight 100

xTR-1#show ip lisp database
LISP ETR IPv4 Mapping Database for EID-table default (IID 0), LSBs: 0x3, 1 entries

172.16.1.0/24
  Locator           Pri/Wgt  Source     State
  10.1.1.2            1/100   cfg-addr   site-self, reachable
  10.2.1.2           10/100   cfg-addr   site-other, report-reachable
  2001:DB8:10C::2    99/100   cfg-addr   no-route

xTR-2#show ip lisp database
LISP ETR IPv4 Mapping Database for EID-table default (IID 0), LSBs: 0x7, 1 entries

172.16.1.0/24
  Locator           Pri/Wgt  Source     State
  10.1.1.2            1/100   cfg-addr   site-other, report-reachable
  10.2.1.2           10/100   cfg-addr   site-self, reachable
  2001:DB8:10C::2    99/100   cfg-addr   site-self, reachable
```

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Populating the cache

```
xTR-1#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 1 entries

0.0.0.0/0, uptime: 00:17:48, expires: never, via static send map-request
  Negative cache entry, action: send-map-request

EID#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 1 entries

0.0.0.0/0, uptime: 00:39:11, expires: never, via static send map-request
  Negative cache entry, action: send-map-request

xTR-1#ping 172.16.200.1 source 172.16.1.1 repeat 1
Type escape sequence to abort.
Sending 1, 100-byte ICMP Echos to 172.16.200.1, timeout is 2 seconds:
Packet sent with a source address of 172.16.1.1
.
Success rate is 0 percent (0/1)

xTR-1#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 2 entries

0.0.0.0/0, uptime: 00:20:19, expires: never, via static send map-request
  Negative cache entry, action: send-map-request
172.16.200.0/24, uptime: 00:00:08, expires: 23:59:44, via map-reply, complete
  Locator      Uptime    State       Pri/Wgt
  10.200.1.2  00:00:08  up           1/100

EID#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 1 entries

0.0.0.0/0, uptime: 00:42:07, expires: never, via static send map-request
  Negative cache entry, action: send-map-request     12
```

Populating the cache

```
xTR-1#ping 172.16.200.1 source 172.16.1.1 repeat 1
Type escape sequence to abort.
Sending 1, 100-byte ICMP Echos to 172.16.200.1, timeout is 2 seconds:
Packet sent with a source address of 172.16.1.1
.
Success rate is 0 percent (0/1)

EID#show ip lisp map-cache
LISP IPv4 Mapping Cache for EID-table default (IID 0), 2 entries

0.0.0.0/0, uptime: 00:42:56, expires: never, via static send map-request
  Negative cache entry, action: send-map-request
172.16.1.0/24, uptime: 00:00:24, expires: 23:59:28, via map-reply, complete
   Locator            Uptime     State         Pri/Wgt
   10.1.1.2           00:00:24   up               1/100
   10.2.1.2           00:00:24   up              10/100
   2001:DB8:10C::2    00:00:24   no-route        99/100

xTR-1#ping 172.16.200.1 source 172.16.1.1 repeat 1
Type escape sequence to abort.
Sending 1, 100-byte ICMP Echos to 172.16.200.1, timeout is 2 seconds:
Packet sent with a source address of 172.16.1.1
!
Success rate is 100 percent (1/1), round-trip min/avg/max = 12/12/12 ms

debug lisp forwarding data-signal-map-request
```

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Statistics

```
xTR-1#show ip lisp statistics
LISP Statistics for instance ID 0 - last cleared: never
Control Packets:
  Map-Requests in/out:                          0/1
    Encapsulated Map-Requests in/out:           0/1
    RLOC-probe Map-Requests in/out:             0/0
    SMR-based Map-Requests in/out:              0/0
    Map-Resolver Map-Requests forwarded:        0
    Map-Server Map-Requests forwarded:          0
  Map-Reply records in/out:                     1/0
    Authoritative records in/out:               1/0
    Non-authoritative records in/out:           0/0
    Negative records in/out:                    0/0
    RLOC-probe records in/out:                  0/0
    Map-Server Proxy-Reply records out:         0
  Map-Register records in/out:                  0/5
    Authentication failures:                    0
  Map-Notify records in/out:                    0/0
    Authentication failures:                    0
Errors:
  Map-Request format errors:                    0
  Map-Reply format errors:                      0
  Mapping record TTL alerts:                    0
Cache Related:
  Cache entries created/deleted:                3/1
  Number of EID-prefixes in map-cache:          2
  Number of negative entries in map-cache:      1
  Total number of RLOCs in map-cache:           1
  Average RLOCs per EID-prefix:                 1
Forwarding:
  Number of data signals processed:             1 (+ dropped 0)
  Number of reachability reports:               0 (+ dropped 0)
ITR Map-Resolvers:
  Map-Resolver        LastReply   Metric  ReqsSent  Positive  Negative  No-Reply
  10.10.1.2           00:00:27    15      1         1         0         0
```
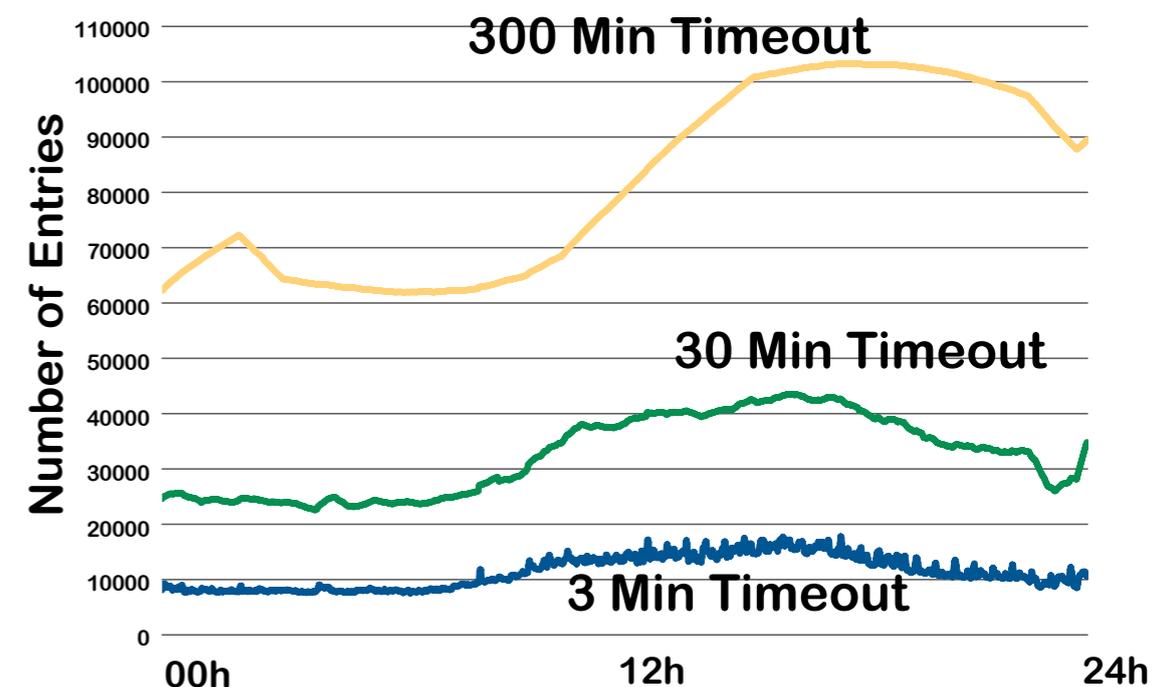

Iannone and Bonaventure, On the Cost of Caching Locator/ID Mappings, CoNEXT, 2007

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LISP Internet Groper

```
xTR-1#lig self
Mapping information for EID 172.16.1.0 from 10.2.1.2 with RTT 24 msecs
172.16.1.0/24, uptime: 00:00:56, expires: 23:59:52, via map-reply, self
   Locator            Uptime      State         Pri/Wgt
   10.1.1.2           00:00:56    up, self       1/100
   10.2.1.2           00:00:56    up            10/100
   2001:DB8:10C::2    00:00:56    no-route      99/100

xTR-1#lig 172.16.200.1 source 172.16.1.1 to 10.10.1.2
Mapping information for EID 172.16.200.1 from 10.200.1.2 with RTT 16 msecs
172.16.200.0/24, uptime: 00:08:16, expires: 23:59:52, via map-reply, complete
   Locator       Uptime      State         Pri/Wgt
   10.200.1.2  00:08:16  up                1/100

xTR-1#lig 192.0.2.1 source 172.16.1.1 to 10.10.1.2
Mapping information for EID 192.0.2.1 from 10.10.1.2 with RTT 12 msecs
192.0.0.0/2, uptime: 00:00:00, expires: 00:14:52, via map-reply, forward-native
   Negative cache entry, action: forward-native
```

OpenLISP

- FreeBSD kernel patch at www.openlisp.org (`options LISP`)

- ```
  gateway_enable="YES"
  ipv6_gateway_enable="YES"
  mapd_enable="YES"
  ```

- ```
  map add -cache
          -inet 172.16.1.0/24
          -inet 10.1.1.2 1 100 1
          -inet 10.2.1.2 2 100 1
          -inet6 2001:db8:10c::2 99 100 1
  ```

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Statistics

```
# mapstat -X
Mapping tables:

Internet:
EID                  Flags   RLOC(s)              P     W F
1.1.0.0/16           SU      ARennes-651-1-1      1   100 U
                             n003-000-000-00      2   100 U
                             4.4.4.4              3   100
                             5.5.5.5            255   100


# mapstat -s -p lisp
lisp over ip:
      0 Datagrams received
            (0 of which had IPv6 outer header)
            0 with incomplete header
            0 with bad encap header
            0 with bad data length field
            0 with bad source version number field
            0 with bad destination version number field
            0 delivered
      0 datagrams output
            (0 of which with IPv6 inner packet)
            0 dropped due to cache-miss
            0 dropped due to no suitable RLOC
            0 dropped due to MTU
            0 dropped due to no buffer space
            0 dropped on output
            0 sent
lisp over ip6:
      0 Datagrams received
            (0 had IPv4 outer header)
            0 with incomplete header
            0 with bad encap header
            0 with bad data length field
            0 with bad source version number field
            0 with bad destination version number field
            0 delivered
      0 datagrams output
            (0 of which with IPv4 inner packet)
            0 dropped due to cache-miss
            0 dropped due to no suitable RLOC
            0 dropped due to MTU
            0 dropped due to no buffer space
            0 dropped on output
            0 sent
```

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Deployed public network: LISP4.net

- Open network for the community

- 129 xTRs, 9 PxTR, 11 MR/MS, rely on ALT

- EID prefix: 153.16.0.0/16, 2610:00D0::/32

- Monitoring tools (google maps, smoke ping, looking glasses, reverse DNS, archives)

- How to participate? www.lisp4.net

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International LISP Beta Network High Level Topology – Connecting LISP Service Providers Together

Saturday 3 December 11
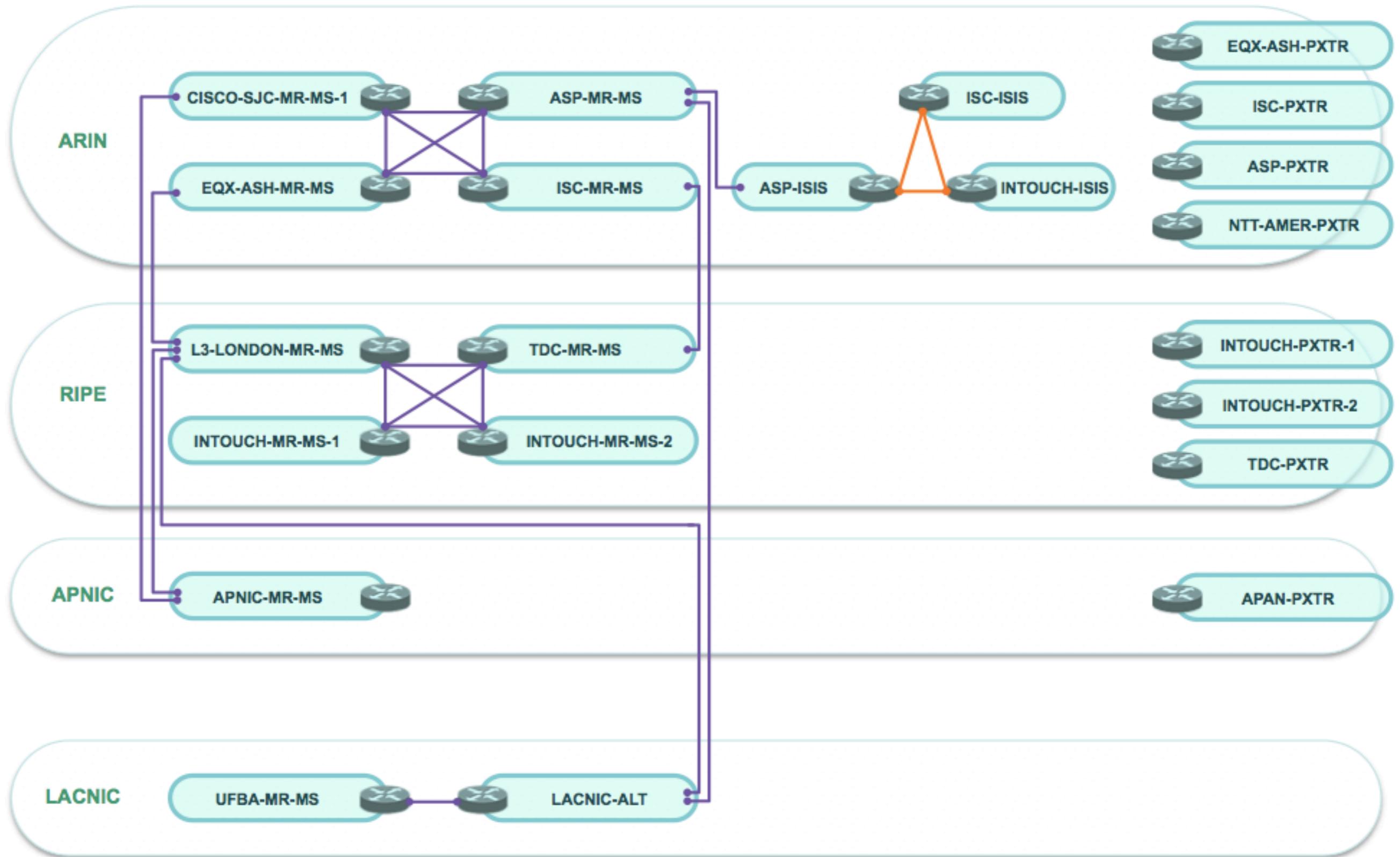
More?

- Dynamips on my laptop

  - Lab configured and ready to play

  - 9 Cisco 7206VXR with IOS 5.1(4)XB5 (fc1)

  - just ask to get a console @beer event ;-)

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