LISP for SDN and NFV

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Agenda

• LISP Overview
• LISP and SDN
• Availability in open source
• LISP in OpenDaylight
• Demos: Service Chaining and Disaster Recovery
• LISP and NFV
Locator/ID Separation Protocol

LISP creates a Level of Indirection with two namespaces: EID and RLOC

- **EID (Endpoint Identifier)** is the IP address of a host – just as it is today
- **RLOC (Routing Locator)** is the IP address of the LISP router for the host
- **EID-to-RLOC mapping** is the distributed architecture that maps EIDs to RLOCs
Locator/ID Separation Protocol

Open Protocol:
RFC published

Data Plane:
Encapsulation protocol to build a Multitenant Overlay
- MAC in IP
- IP in IP

Control Plane:
Mapping of Overlay address Space to underlying physical Network including policy routing

Any Physical Network:
LAN, WAN, Hybrid
Locator/ID Separation Protocol - policies

**Open Protocol:**
RFC published

**Data Plane:**
Multitenant Overlay

**Control Plane:**
Mapping (+ policy) of overlay to underlying network

**Policy:**
- Multihoming
- Load Balancing
- Disaster Recovery
Locator/ID Separation Protocol - policies

**Open Protocol:**
RFC published

**Data Plane:**
Multitenant Overlay

**Control Plane:**
Mapping (+ policy) of overlay to underlying network

**Policy:**
- Traffic Engineering
- Service Chaining
SDN and LISP

• The consensus on SDN
  • Decoupling of Network Control Plane form the Data Plane
  • Programmable
  • Open

• The goals of SDN
  • Increase flexibility and development speed of features and functionalities

• LISP as we just saw
  • Enables network virtualization via dynamic multitenant overlays
  • Decoupled control plane and data plane
  • Programmable mapping system
  • Open
LISP in Open Source

• LISPmob.org
  • Linux
  • Android
  • OpenWRT

• Open vSwitch
  • LISP DP

• OpenDaylight
  • LISP CP

• OpenStack
  • *coming soon
LISP in OpenDaylight

Legend:
- LISP
- OpenFlow
- ODL
- OVSDB

Network applications, orchestration, and services

Controller platform

Southbound interfaces & protocols

Data plane elements (virtual switches, physical device interfaces)

User interfaces

network applications

network service functions

platform services

LD OpenDaylight APIs (REST)

Service Abstraction Layer (SAL)

OpenFlow

OVSDB

LISP Plugin

LISP tunnel

OVS

LISPmob

LISP CP Enabled Device

Legend:
- LISP
- OpenFlow
- ODL
- OVSDB
Available Interfaces

ODL LISP Service

Northbound

Java API

Implementation

Map Server

Map Resolver

DAO

Southbound
Northbound API

• Resources:
  • Key
  • Mapping
    • EID
    • src/dest

• Supported mapping address types:
  • IPv4/IPv6/MAC
  • Distinguished Name
  • AS Numbers
  • Segment ID
  • Src/Dst
  • Explicit Locator Path (Traffic Eng/Service Chaining)
REST API: key

- **PUT**
  - http://localhost:8080/lispflowmapping/nb/v2/default/key

- **GET**
  - [...] /nb/v2/default/key/{iid}/{afi}/{address}/{mask}

- **GET (src/dst)**
  - [...] /default/key/{iid}/{afi}/{srcAdd}/{srcML}/{dstAdd}/{dstML}

Request URL: [http://localhost:8080/lispflowmapping/nb/v2/default/key](http://localhost:8080/lispflowmapping/nb/v2/default/key)
Request body in JSON:

```json
{
  "key" : "asdf",
  "maskLength" : 24,
  "address" :
  {
    "ipAddress" : "10.0.0.1",
    "afi" : 1
  }
}
```
REST API: mapping

- **PUT**
  - http://localhost:8080/lispflowmapping/nb/v2/default/mapping

- **GET**
  - [...] /nb/v2/default/mapping/{iid}/{afi}/{address}/{mask}

- **GET (src/dst)**
  - [...] /default/mapping/{iid}/{afi}/{srcAdd}/{srcML}/{dstAdd}/{dstML}

---

Request URL: [http://localhost:8080/lispflowmapping/nb/v2/default/mapping](http://localhost:8080/lispflowmapping/nb/v2/default/mapping)

Request body in JSON:

```json
{
  "key": "asdf",
  "mapregister": {
    "eidToLocatorRecords": [
      {
        "prefixGeneric": {
          "ipAddress": "10.0.0.1",
          "afi": 1
        },
        "maskLength": 24,
        "locators": [
          {
            "locatorGeneric": {
              "ipAddress": "10.154.10.17", "afi": 1, "priority": 1, "weight": 50
            }
          }
        ]
      }
    ]
  }
}
```
Demo

• Demo 1: Disaster Recovery
• Demo 2: Service Chaining

• >> Thanks to Lori Jakab.

• Thanks to Alberto Rodriguez-Natal and the ConteXtream engineering team!
Demo topology

Mapping Service

Northbound

API

Impl.

Map Server

Map Resolver

DAO

Southbound

LISPmob Server 1

EID: 2.2.2.2

LISPmob Server 2

EID: 1.1.1.1

Net Admin

LISPmob Client
Demo – Disaster Recovery

Mapping Service

Northbound

API

Impl.

Map Server

Map Resolver

Southbound

DAO

Define Key, mappings

Net Admin

LISPmob Server 1

EID: 2.2.2.2

LISPmob Server 2

LISPmob Client

EID: 1.1.1.1
Demo – Disaster Recovery

Mapping Service

Northbound

API

Impl.

Map Server

Map Resolver

DAO

Southbound

LISPmob

Server 1

EID: 2.2.2.2

LISPmob

Server 2

EID: 2.2.2.2

Net Admin

Where is 2.2.2.2?

Ping 2.2.2.2

LISPmob

Client

EID: 1.1.1.1
Demo – Disaster Recovery

Mapping Service

Northbound

API

Impl.

Map Server

Map Resolver

DAO

Southbound

Net Admin

EID: 1.1.1.1

Ping 2.2.2.2

LISPmob Client

EID: 2.2.2.2

LISPmob Server 1

Ping 2.2.2.2

EID: 2.2.2.2

LISPmob Server 2
Demo – Disaster Recovery

Mapping Service

Northbound
- Map Server
- Map Resolver

Southbound

API
- Impl.
- DAO

Net Admin

LISPmob Server 1
EID: 2.2.2.2

LISPmob Server 2

Ping 2.2.2.2

LISPmob Client
EID: 1.1.1.1

Ping 2.2.2.2

2.2.2.2: Server 2 has priority
Demo – Disaster Recovery

Mapping Service

Northbound
- Map Server
- DAO

Southbound
- API
  - Impl.
- Map Resolver

Net Admin

LISPmob Server 1
EID: 2.2.2.2

LISPmob Server 2

Ping 2.2.2.2

Ping 2.2.2.2
EID: 1.1.1.1

LISPmob Client

Ping 2.2.2.2

Demo – Service Chaining

Net Admin

2.2.2.2: Insert service node

Ping 2.2.2.2

EID: 1.1.1.1

Ping 2.2.2.2

EID: 2.2.2.2

Ping 2.2.2.2

LISPmob

Server 1

LISPmob

Server 2

LISPmob

Service-Node

Mapping Service

Northbound

API

Impl.

Map Server

Map Resolver

DAO

Southbound

LISPmob

Client

LISPmob

Server 1

LISPmob

Server 2

LISPmob

Service-Node
Demo – Service Chaining

Mapping Service

Northbound
- Map Server
- Map Resolver
- DAO

Southbound

API

Impl.

LISPmob Server 1
EID: 2.2.2.2

LISPmob Server 2

Ping 2.2.2.2

LISPmob Service-Node

Ping 2.2.2.2

Ping 2.2.2.2

Net Admin

LISPmob Client
EID: 1.1.1.1
Demo – Service Chaining

Mapping Service

Northbound
API
Impl.
Map Server
Map Resolver
DAO
Southbound

Policy=drop/forward

LISPmob
Net Admin

Ping 2.2.2.2

LISPmob
Server 1

LISPmob
Server 2

LISPmob
Service-Node

LISPmob
Client
Stay tuned…

• Support for proactive SMR in case of policy change
• Seamless integration with OVS

• Tutorial for demo + API spec is on the Wiki:
LISP and NFV
Network Functions

Before NFV
Coupled with routing topology, capacity, availability, and routing hardware appliances

After NFV
Decoupled from routing, cloud capacity, elasticity, availability, standard servers capacity
Programmable Network

Before NFV
Programmable Overlay Coupled with routing interfaces, VLANs, LSPs, VRFs

After NFV
Programmable Overlay Decoupled from Underlay, map & encap methodology
LISP Ideal for SDN-NFV

- Map & Encap uses IP for both transport & database
- 5-tuple flows: as the basis for mapping lookup-cache
- Publish-Subscribe: for mapped lookups, change-SMR
- Application specific LISP XTRs: Flow handlers and ALGs
- Mapping Affinity: of subscriber to function available globally
- Mapping Balancing: between function VIP EID to instances EID
- Mapping Chaining: of subscribers EID to service EID to RLOCS
- Mapping as the basis for NFV orchestration integration Neutron+
Creating ODL XTR for NFV
Layout and Orchestration
Example: Balance-Chain IMS-SBC
Do it Yourself: XTR Patch-Panels NFVs

SDN Forwarding

OpenFlow Switch
- 3 tuples: source, dest, protocol
- layer 2 (vRails, VL2)
- layer 3 (NVO3/LISP)
- CXTR service selection

ALG Switch
- 5 tuple: source dest ports, protocol
- layer 4: TCP, UDP, SR, Chain-Balance
- layer 5: SIP, GRE, GTP, S1, RSVP, UIDH
- layer 6: URL Transcoding, SSL
- layer 7: NFS, CDN, X1, DRA

SDN Control

OpenDaylight SAL
- PacketIn FlowHandlers
- Basic LISP for VL2/3 IP-Mac:RLOC
- Protocol specific flowHandlers
- Global lookup / Local decision

OpenDaylight Services
- Mapping LISP & Restful API
- Mapping caching & registrations
- Mapping backend DB Wrapper
- Mapping north orchestration
- Mapping DHT DB (Cassandra)
Thanks!

lispmob.org