LISP ELP Probing to Enhance LISP Traffic Engineering

draft-filyurin-lisp-elp-probing-00.txt

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What prompted us to think of this (New technology or just a use case?)

We stumbled on the idea.

Part of research effort in building pure routed fabrics (DC, metro, campus, etc.)

Using commodity hardware and commodity software features.

Or at least reduced to commodity simple middleware and switch abstraction layers.

Consideration for using IGP protocols with very minimal configuration and functionality.

Possibly take advantage of various IS-IS DC fabric drafts.

Cluster based decentralized control system (no central controller, but one database).

Any form of physical topology is a design option. (fabrics, meshes, trees, etc.).

Potential ability to dynamically reconfigure these topologies based on system usage.

Multiple equal and unequal cost paths between endpoints.

Desire to perform deterministic end to end probing on all paths and exclusively rely on destination based forwarding.

Yet Another Attempt to Solve TE Problem

Path telemetry collection is just a use case.

Not exactly a new problem and debated for years.

Trying to do away with path reservation and maintain the equivalent of reservation state.

Maintain path information in a packet without too much overhead in an efficient way

Be compatible with various data plane protocols.

Avoid header manipulation on the path.

Numerous solutions exist including for pure IP/IPv6 routed networks.

Which range from automated static route installation to flooding and propagation and additional decision process to install relevant information into the FIB.

We did like the idea of what projects like Fibbing did as well as ideas for vector routing.

The mechanisms are great, but all they rely on systems that flood/propagate information and some schema that systems must use to accept it.

And this ultimately requires 1:1 Path/EID relationship.

So Why LISP and LISP TE?

Various micro-service architectures nicely fit into the Locator/Endpoint model.

Relatively simple header, which adapted to VXLAN GPE

Possibility of Locator/EID being IGP/LISP + LISP-TE.

While LISP is not a pure IP routing protocol, it can offer TE capabilities.

Using both overlay mechanisms and hop by hop routing based on requirements

With a central database that can become distributed without changing LISP protocol.

Can be combined with actual routing protocols to be Inter-Domain

Ability to react to path changes using LISP publisher/subscriber or notify system

TE mechanism with ELPs provided by ETRs making it more compatible with destination based routing.

So What Was Missing, or ELP Probing at a Glance

Creation of EIDs continues to be decoupled from LISP-TE. This can allow network topology monitoring systems to take ELPs out of service, for example.

ELPs come from topology aware systems and not always E2E Telemetry/Reachability aware systems.

LISP always came with RLOC probing allowing reroute capabilities.

Enhance RLOC probing to probe ELP end-to-end, effectively creating path monitoring

ELP probes are specialized RLOC probes.

Periodic probes maintain path integrity.

Use of ELP probing information can be optional.

At the same time ELP probing can collect TTLs, timestamps, RTT, and other user defined data as each node in the ELP appends its RLOC record to the probe.

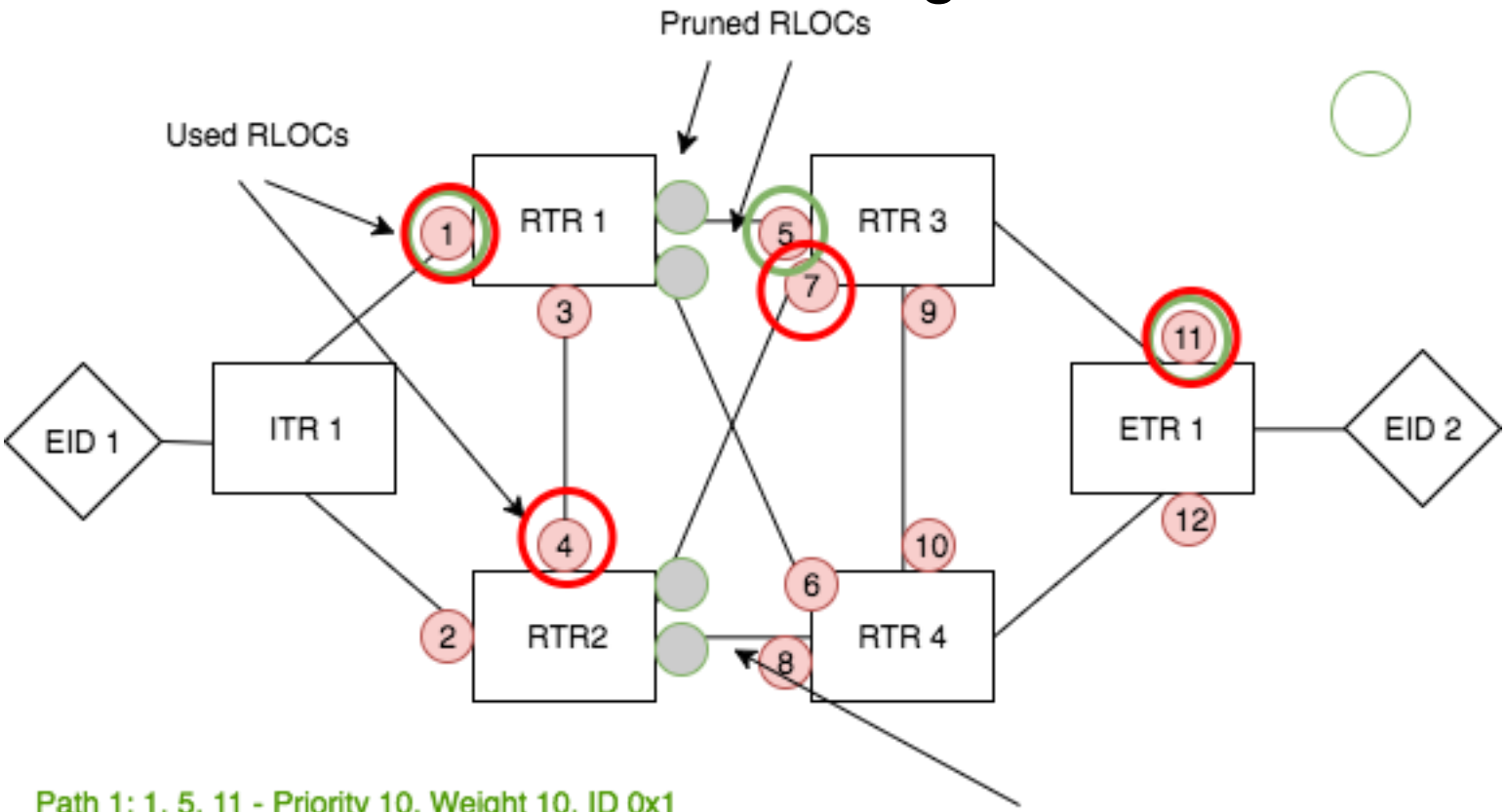
ELP probes can be periodic and insure caches do not expire.

Encode path identifier in LISP header or any other header that supports 24 bit ID.

ITRs can use path IDs to ensure the traffic is sent on particular ELP, thus giving ITRs source routing control.

Multiple paths can traverse the same RTRs.

ELP Probing



Path 1: 1, 5, 11 - Priority 10, Weight 10, ID 0x1
Path 2: 2, 8, 12 - Priority 10, Weight 10, ID 0x2
Path 3: 1, 6, 12 - Priority 10, Weight 9, ID 0x2
Path N: 1, 4, 7, 11 -- Priority 5, Weight 1, ID 0xN

LISP Packet:
SRL - RTR2
DRL - RTR4
L Bit - 1
Nonce - 0x2 (optional)
LSB - 0x2 (path id)
EID 1 to 2 inner header

So What Started the Idea

Initial idea is pure path monitoring.

LS IGP can operate independent of traditional BGP fabric design, or any other traditional routing design.

EIDs and their ELPs can be selectively registered with the mapping system.

Mapping system can be deployed on some devices in the topology or outside controller.

Use Link State Database to create ELPs. Other intent based mechanisms can be used.

ITRs look up EIDs and probe the paths. Both 1:1 and N:N Path/EID relationships possible.

Use any probing protocol to verify E2E reachability as well as ELP probes.

Use LISP header to select a path.

Future Work

LISP-TE with IGP and DC-BGP setups can operate as “ships in the night”

Registration of EID or even BGP next hop determines forwarding behavior.

Operation over various forms of unnumbered interfaces; Use of V6 LL.

IGP for RLOCs and LISP for service nodes (processes, pods, containers, unikernels)

LISP header gets mapped to another form of header information.

Use case of S-BFD in combination with LISP-TE.

S-BFD takes on the probing, but LISP-TE can provide the paths and discriminators.

Use ELP probing mechanism to build Multicast trees from source ITR to branch ETRs.

LISP as a control system for IGP/SR based fabrics.