SPRING (Source Packet Routing in Networking) WG

IETF-92, Dallas

March 26, 2015

Chairs: Bruno Decraene, John Scudder

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Charter Progress

"The SPRING working group is chartered for the following list of items:

- Identification and evaluation of use cases for SPRING. These use cases must include a definition of the data plane for the environment in which they are to be deployed.
- Definition of requirements for any new data plane encodings and procedures, required to implement the use cases. Such procedures must include the necessary security considerations.
- Definition of requirements and if necessary any new control plane mechanism needed to enable the use cases.
- Definition of requirements and if necessary management plane mechanisms needed to manage and operate a SPRING enabled network."

Milestones, Drafts

- Attempted to categorize drafts that are candidates to complete a milestone
- Best-effort, drafts may be missing or mis-categorized!
- No judgment implied about WG acceptance!

Use Cases

"Identification and evaluation of use cases for SPRING. These use cases must include a definition of the data plane for the environment in which they are to be deployed."

- "Jul 2014 - One or more documents describing SPRING use cases."
  - draft-ietf-spring-ipv6-use-cases, draft-ietf-spring-problem-statement, draft-ietf-spring-resiliency-use-cases, draft-filsfils-spring-segment-routing-msdc, draft-geib-spring-oam-usecase, draft-filsfils-spring-segment-routing-central-epe

draft-ietf-spring-problem-statement

- WGLC completed some time ago
- Awaiting document update for shepherd comments

Data Plane Encodings [1]

"Definition of requirements for any new data plane encodings and procedures, required to implement the use cases. Such procedures must include the necessary security considerations."

- Nov 2014 - Specification of a high-level abstract architecture for SPRING.
  - draft-ietf-spring-segment-routing
- Dec 2014 - Requirements for modifications if any to MPLS architecture to support SPRING use cases.
  - N/A
- Jan 2015 - Requirements for modifications if any to IPv6 architecture to support SPRING use cases.
  - N/A

Data Plane Encodings [2]

- Mar 2015 - Specification of any required new procedures to support SPRING use cases.
- Jul 2015 - One or more data plane extension requirements documents, including documenting the impact on existing deployments of the existing data planes.
  - Requirements – implicit in architecture + data plane extension documents?
  - draft-ietf-spring-segment-routing-mpls, draft-ietf-mpls-spring-entropy-label
  - draft-previdi-6man-segment-routing-header

Control Plane

"Definition of requirements and if necessary any new control plane mechanism needed to enable the use cases."

- Jul 2015 - One or more control protocol extensions requirements documents.
- Requirements – implicit in architecture + control plane extensions?
  - draft-ietf-isis-segment-routing-extensions, draft-ietf-ospf-segment-routing-extensions, draft-ietf-ospf-ospfv3-segment-routing-extensions, draft-keyupate-idr-bgp-prefix-sid, draft-previdi-idr-bgpls-segment-routing-epe, draft-ietf-pce-segment-routing, draft-sivabalan-pce-lsp-setup-type, draft-francois-spring-segment-routing-ti-lfa

Management Plane

"Definition of requirements and if necessary management plane mechanisms needed to manage and operate a SPRING enabled network."

- Jul 2015 - Management requirements document.
  - draft-litkowski-spring-sr-yang, draft-hu-spring-yang
- Nov 2015 - Specify the OAM mechanisms needed to support SPRING.
  - draft-kumar-spring-sr-oam-requirement, draft-kumarkini-mpls-spring-lsp-ping, draft-mirsky-mpls-bfd-directed, draft-akiya-bfd-seamless-sr
  - IPv6 ?

Interworking

- Nov 2015 - Document inter-working and co-existence between the new procedures and the existing signalling and routing protocols.
  - draft-filsfils-spring-segment-routing-ldp-interop
  - draft-bowers-spring-advertising-lsps-with-sr ?
  - draft-gredler-idr-bgp-ls-segment-routing-extension

Coordination with 6man and MPLS

"The initial data planes that will be considered are MPLS and IPv6."

- draft-previdi-6man-segment-routing-header and draft-vyncke-6man-segment-routing-security presented at 6man on Monday
  - 6man WG adoption requested
  - Please consider contributing on 6man mailing list

WG Plan

- Update milestones (dates, draft names, etc)
- Work to move use cases documents forward
- … then architecture documents
- Coordinate with other WGs as needed (notably MPLS, 6man)
- Not seeking additional use cases unless they impact requirements/architecture

Agenda

- Update on WG drafts — 10 minutes
  Stefano Previdi
- Bidirectional Forwarding Detection (BFD) Directed Return Path
  draft-mirsky-mpls-bfd-directed-03
  Greg Mirsky — 5 minutes
- YANG Data Model for Segment Routing (I) — 10 minutes
  draft-litkowski-spring-sr-yang-00
  Stéphane Litkowski
- YANG Data model for Segment Routing (II) — 10 minutes
  draft-hu-spring-yang-00
  Fangwei Hu
- Entropy Label for SR-MPLS — 5 minutes
  draft-ietf-mpls-spring-entropy-label-00
  Sriganesh Kini
- Multi-Topology (MT) Segment in Segment Routing — 5 minutes
  draft-li-spring-multi-topology-segment-00
  Eric Wu

SPRING WG

Segment Routing Drafts Update

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IETF92 – Dallas, March 2015

Current WG drafts

- draft-ietf-spring-segment-routing
  - Updated upon received comments
  - Ready for last call
- draft-ietf-spring-ipv6-use-cases
  - SRH draft (draft-previdi-6man-segment-routing-header) is being discussed in 6MAN WG
  - SRH Security (draft-vyncke-6man-segment-routing-security) also discussed in 6MAN WG
- draft-ietf-spring-segment-routing-mpls
  - no changes
- draft-ietf-spring-problem-statement
  - In review for last call
  - Update in progress…
- draft-ietf-spring-resiliency-use-case
  - no changes

Important drafts that could be consider for WG ITEMS

- SR Use cases: draft-filsfils-spring-segment-routing-use-cases
  - Complete and exhaustive document explaining how SR applies to the requirements expressed in the problem statement
  - Needs to be renamed and some editing so to remove text duplication with problem-statement
  - Need to focus primarily on TE (other use cases have been documented in other documents)

- draft-filsfils-spring-segment-routing-ldp-interop
  - Stable and ready for adoption
  - Describes the SR Mapping Server function using IGP extensions defined in OSPF and ISIS drafts
  - At least 4 implementations exist

- SR-BGP based
  - draft-filsfils-spring-segment-routing-msdc
  - draft-filsfils-spring-segment-routing-central-epe

- draft-francois-spring-segment-routing-ti-lfa
  - Addresses resiliency use cases
  - Maybe better to be discussed in RTGWG

Directed BFD Return Path

draft-mirsky-mpls-bfd-directed-03

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IETF-92 March, 2015, Dallas

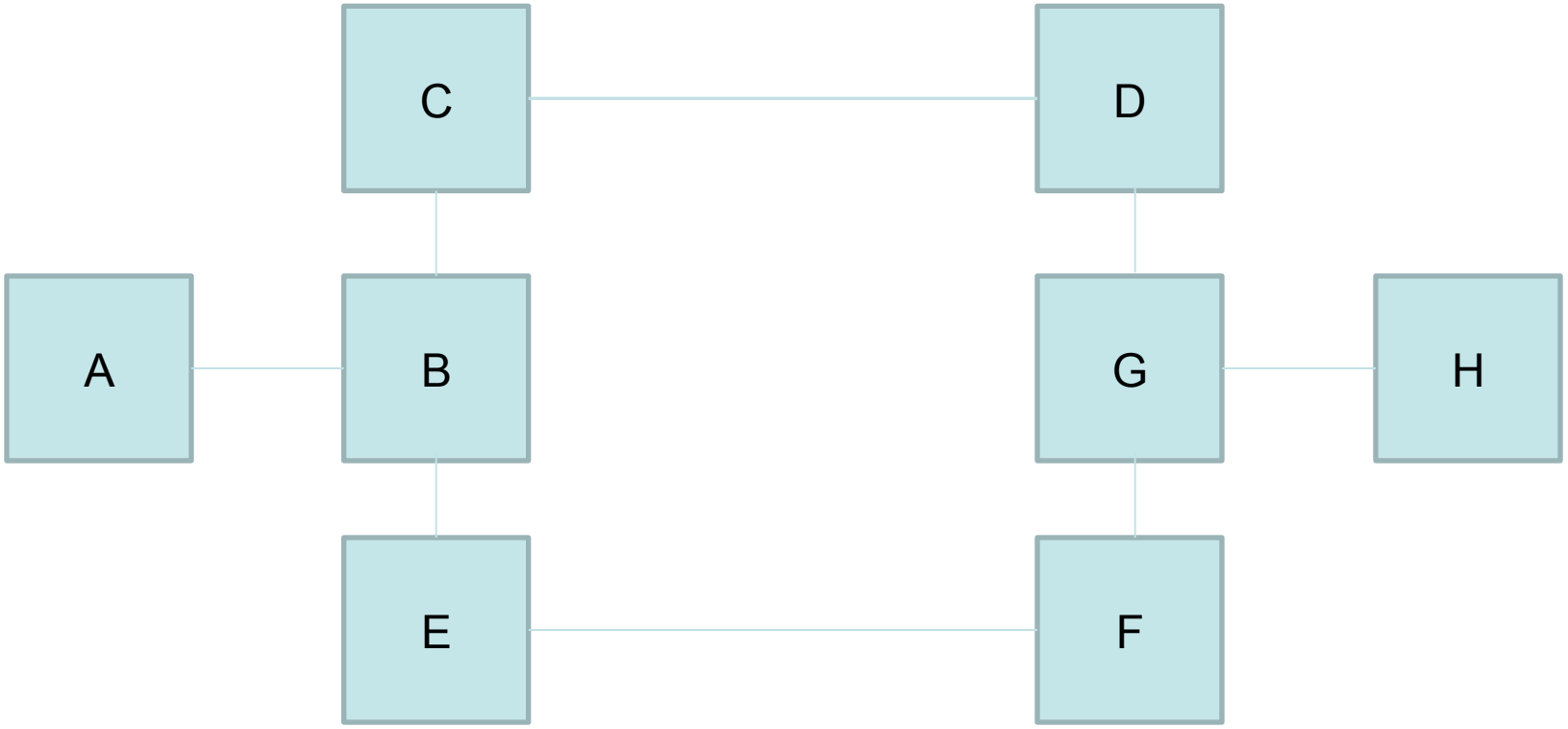
Update

- Welcome Mach Chen as co-author
- much obliged to Loa Andersson for thorough review and thoughtful comments
- From -01 to -03 version:
  - new return code
  - Use Case section
  - changed near-end/far-end to ingress/egress terminology

New Return Code

- If the egress LSR fails to establish the BFD session because path specified in the Reverse Path TLV is not known, the egress MAY establish the BFD session over IP network [RFC5884] and MAY send Echo Reply with the Reverse Path TLV received and the return code set to "Failed to establish the BFD session. The specified reverse path was not found" (TBD4) Section 3.4.
- If the egress LSR cannot find path specified in the Reverse Path TLV and does not establish BFD session per RFC 5884, it MUST send Echo Reply with the Reverse Path TLV received and the return code set to "Failed to establish the BFD session. The specified reverse path was not found".
- The IANA is requested to assign a new Return Code value from the "Multi-Protocol Label Switching (MPLS) Label Switched Paths (LSPs) Ping Parameters" registry, "Return Codes" sub-registry, as follows using a Standards Action value.

Use Case Scenario



Node A:

- to monitor A-B-C-D-G-H allocates discriminator N. Bootstraps BFD session with BFD Discriminator TLV. May use BFD Reverse Path TLV H-G-D-C-B-A.
- to monitor A-B-E-F-G-H allocates discriminator M. Bootstraps BFD session with BFD Discriminator TLV. May use BFD Reverse Path TLV H-G-F-E-B-A.

Next steps

- Comments are always welcome
- Asking MPLS WG to adopt this work

draft-litkowski-spring-sr-yang-00

S. Litkowski, Orange
A. Lindem, Cisco
P. Sarkar, Juniper
I. Chen, Ericsson

Goal

- Calls for standardization of Segment Routing configuration and operation using YANG

Model structure

- Global Config

```
module: ietf-segment-routing
augment /rt:routing/rt:routing-instance:
   +--rw segment-routing
      +--rw transport-type?   identityref
      +--rw bindings
      |  +--rw mapping-server {mapping-server}?
      |     +--rw ipv4
      |     |  +--rw mapping-entry* [prefix]
      |     |     +--rw prefix       inet:ipv4-prefix
      |     |     +--rw start-sid?   uint32
      |     |     +--rw range?       uint32
      |     +--rw ipv6
      |        +--rw mapping-entry* [prefix]
      |           +--rw prefix       inet:ipv6-prefix
      |           +--rw start-sid?   uint32
      |           +--rw range?       uint32
      +--rw srgb* [lower-bound upper-bound]
      |  +--rw lower-bound    uint32
      |  +--rw upper-bound    uint32
```

Model structure

- Some debate to have here …
  - Is the SRGB a protocol config, an instance config, a chassis wide config ?
  - Same question for transport plane …

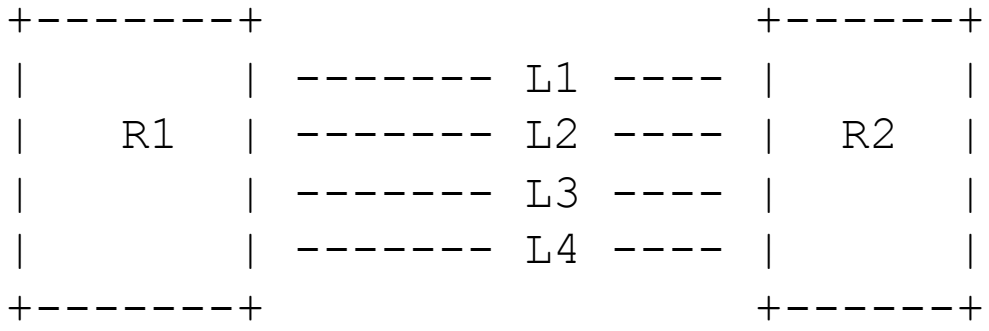
Model structure

- Interface Config

```
…
      +--rw interfaces
         +--rw interface* [name]
            +--rw name                if:interface-ref
            +--rw adjacency-sid
            |  +--rw advertise-adj-group-sid* [group-id]
            |  |  +--rw group-id    uint32
            |  +--rw advertise-protection?      enumeration
            +--rw prefix-sid
               +--rw ipv4
               |  +--rw prefix-sid* [value]
               |     +--rw value-type?          enumeration
               |     +--rw value                uint32
               |     +--rw node-flag?           boolean
               |     +--rw last-hop-behavior?   enumeration
               +--rw ipv6
                  +--rw prefix-sid* [value]
                     +--rw value-type?          enumeration
                     +--rw value                uint32
                     +--rw node-flag?           boolean
                     +--rw last-hop-behavior?   enumeration
```

Model structure

- Interface Config :
  - We introduce S-flag usage in the model
  - Group-ID permit to find how interfaces are bundled together (idea to discuss …)



L1/L2 part of group 10, use a common Adj-SID X
L3/L4 part of group 20, use a common Adj-SID Y

Model structure

- Protocol extensions :
  - We use augmentation

```
augment /rt:routing/rt:routing-instance/rt:routing-protocols/
rt:routing-protocol/isis:isis/isis:instance:
   +--rw segment-routing
      +--rw enabled?    boolean
      +--rw bindings
         +--rw advertise?   boolean
         +--rw receive?     boolean
augment /rt:routing/rt:routing-instance/rt:routing-protocols/
rt:routing-protocol/ospf:ospf/ospf:instance:
   +--rw segment-routing
      +--rw enabled?    boolean
      +--rw bindings
         +--rw advertise?   boolean
         +--rw receive?     boolean
```

Model structure

- Discussion to have :
  - How to handle protocol specific ?
    - All in SR model and do augmentation ?
    - All in protocol models ?
    - Mix ?
  - Now we have some stuffs also in ISIS model that we may consider to remove

Model structure

- Ops state and notifications :

```
augment /rt:routing-state/rt:routing-instance:
   +--ro segment-routing
      +--ro label-blocks*
      |  +--ro lower-bound?   uint32
      |  +--ro upper-bound?   uint32
      |  +--ro size?          uint32
      |  +--ro free?          uint32
      |  +--ro used?          uint32
      +--ro global-sid-list
         +--ro sid* [target sid source source-protocol binding-type]
            +--ro target             string
            +--ro sid                uint32
            +--ro algorithm?         uint8
            +--ro source             inet:ip-address
            +--ro used?              boolean
            +--ro source-protocol    leafref
            +--ro binding-type       enumeration
notifications:
   +---n segment-routing-global-sid-collision
   |  +--ro received-target?    string
   |  +--ro original-target?    string
   |  +--ro index?              uint32
   |  +--ro routing-protocol?   leafref
   +---n segment-routing-index-out-of-range
      +--ro received-target?    string
      +--ro received-index?     uint32
      +--ro routing-protocol?   leafref
```

Next steps

- Already multiple people in the design team (coming from ISIS and OSPF)
- Model is quite advanced for basic SR codes which are shipped today
- It's time NOW to work on it (CLI adaptation still possible) and we need to make it fast ! (not a huge job)
- Working items :
  - Need a consensus on SRGB scope
  - Need a consensus on transport-plane scope
  - Need a consensus on how to handle protocol extensions
  - Address comments from WG

- Ask for WG adoption

Yang Data model for Segment Routing

draft-hu-spring-yang-00
Fangwei Hu
Ran Chen
Frank. Feng
ZTE Corporation

Goals

- Define Segment Routing data model
- Help for product implementation for Segment Routing

Configuration Hierarchy

```
+--rw global-block
   |  +--rw Min
   |  +--rw Max
   +--rw segment
   |  +--rw name
   |  +--rw sid
   |  +--rw type
   |  +--rw scope
   |  +--rw prefix-flag
   |  +--rw adjacency-flag
   +--rw fec-mapping
   |  +--fec-prefix
   |  +--sid
   |  +--sid-label-binding-flag
   +--ro sr-Label-entity
   |  +--ro sid
   |  +--ro incoming
   |  +--ro outgoing
   |  +--ro next-hop
   |  +--ro header-operation
   |  +--ro egress-interface
   +--ro sr-path
   |  +--ro name
   |  +--ro ingress-sid
   |  +--ro egress-sid
   |  +--ro priority
   |  +--ro explicit-route
   |  +--ro path-type
   |  +--ro frr-protection-method
```

Notification

```
notifications:
   +--n sr-path-event
   |  +--ro name
   |  +--ro sr-path-creation
   |  +--ro sr-path-deletion
   |  +--ro sr-path-state
   |  +--ro frr-status-change
   |  +--ro path-protection-status-change
```

Comments received

- Add SRMS node
  - rabah guedrez' comments
- Remove the TE related nodes, and the forwarding label entity nodes.
  - Stephane , Acee and Rob's comments

Next Step

- Comments welcome
- Do more research based on the product implementation

Thanks!

Entropy Label for SR-MPLS

draft-ietf-mpls-spring-entropy-label-00

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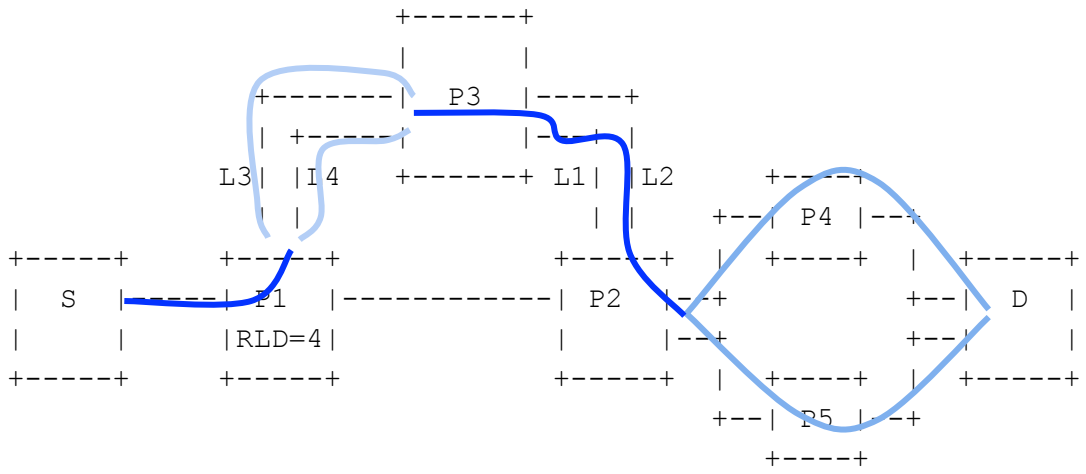
Since IETF 91

- Addressed remaining MPLS-RT review comments
- Changed use-case to a traffic-engineered use-case
- Improved the readability of sample algorithm

Use case



S=Source LSR, D=Destination LSR, P1,P2,P3,P4,P5=Transit LSRs,
L1,L2,L3,L4=Links

<L_N-P3, **ELI**, **EL**, L_A-L1, L_N-D, **ELI**, **EL**>

Other related discussion

- Making the 'Readable Label Depth' parameter as interface specific

- OAM

Multi-Topology (MT) Segment in Segment Routing

draft-li-spring-multi-topology-segment-00

Robin Li(lizhenbin@huawei.com)
Eric Wu(eric.wu@huawei.com)

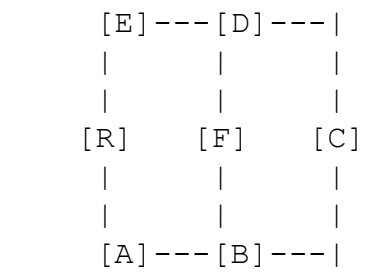
Multi-Topology in Segment Routing

- Multi-Topology Segment, MT-SID
  - An IGP segment attached to an IGP topology
  - Global within the SR/IGP domain
  - Indicate one specified topology
- Propose Multi-Topology Segment for SR
- MT-SID is used to identify the specified topology

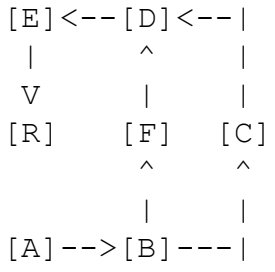
Use Case

MRT-FRR

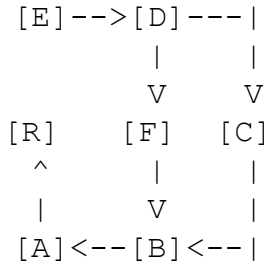
- MRT-Red & MRT-Blue used for alternates
- No extra bits for IP header to indicate topology
- Allocating MT-SID for MRT-Red & MRT-Blue



(a) a 2-connected graph



(b) Blue MRT towards R



(c) Red MRT towards R

Forwarding Mechanisms

- MRT-FRR

- Ingress router, PUSH MT-Blue-SID or MT-Red-SID, steer the packet along the alternate path.
- Transit router, CONTINUE MT-SID indicating topology FIB to look up.
- Egress router, NEXT segment is active.

Procedures of Control Plane

- MRT-FRR

- IGP extension for Multi-Topology Segment
- Unique within IGP domain
- RECOMMENDED allocated in centralized manner
- Assigned manually or chosen automatically. Detail is TBD.

Next step

- Collect feedback and comments for proposed draft.
- Improve this draft based on comments and plan.
  - Defining protocol extensions
  - Elaborating more about forwarding and control plane.
  - ?
- Looking for interested people...