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Building blocks for Slicing in SR Network

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Draft Summary

- Elaborates how to build network slice using SR technology.
- Describes SR building blocks for network slicing.

The Building Blocks

SR provides a fully integrated solution for overlay, underlay and service programming to satisfy network slicing requirements:

- SR Policy - with or without Flexible Algorithm
- Flexible Algorithm
- TI-LFA with O(50 msec) protection in the underlay slice
- SR VPN
- SR Service Programming (NFV, SFC)
- OAM and Performance Management (PM) in the underlay slice
- QoS
- Orchestration at the Controller

SR Policy

- Traffic steering along any arbitrary path in the network.
  - This allows operators to enforce low-latency and / or disjoint paths, regardless of the normal forwarding paths
- Optimization objectives (IGP metric, TE metric, Extended TE metric) and constraints (TE affinity, SRLG, metric etc.)
- ODN enables on-demand creation of SR Policies for service traffic
  - provides optimized service paths to meet customer and application SLAs (such as latency, disjointness)
  - Network Service Orchestrator can deploy the service based on their requirements
  - The endpoint and the color are used to automate the steering of service or transport routes on SR Policies

SR Policy – Cont’ed

- Automated Steering (A/S):
  - Automatically steering traffic into a Network Slice is fundamental req.
    > An SR policy can be used to traffic engineer paths within a slice and then "automatically steer" traffic to the right slice
- Interdomain considerations:
  - The network slicing needs to be extended across multiple domains
  - SR policies are designed to span multiple domains using a PCE based solution

SR Flexible-Algorithm

- Flex-Algo associates an "intent" to Prefix SIDs and allows IGPs to compute paths constraint by the "intent" represented by the Flex-Algorithm.
  - Flex Algo definition in terms of optimization metric & constraints
  - IGPs run SPF computation based on the definition and participation of nodes in specific algorithm topology
- A Network Slice can be created by associating a Flex- Algo value with the Slice via provisioning

TILFA and Microloop Avoidance

- Network Slicing in Segment Routing works seamlessly with TI-LFA and microloop avoidance within a Slice
  - The primary (and/or backup) paths only uses resources available to the Slice.

SR VPN

- Virtual Private Networks (VPNs) provide a mean for creating a logically separated network to a different set of users access to a common network.
- Segment Routing is equipped with the rich multi-service VPN capabilities, including Layer 3 VPN (L3VPN), Virtual Private Wire Service (VPWS), Virtual Private LAN Service (VPLS), and Ethernet VPN (EVPN).
- The ability of Segment Routing to support different VPN technologies is one of the fundamental building blocks for creating slicing an SR network.

Service Programming

- An important part of the Network Slicing is the orchestration of virtualized service containers (in the context of a Slice).
- SR achieves this via introduction of service segments to achieve stateless service programming in SR (SR-MPLS and SRv6) networks.
  - The ability of encoding the service segments along with the topological segment enables service providers to forward packets along a specific network path, but also steer them through VNFs or physical service appliances available in the network.

OAM

- Various OAM elements that are critical to satisfy Network Slicing requirements:
  - Measuring per-link TE Metric
  - Flooding per-link TE Metric
  - Taking TE Matric into account during path calculation.
  - SLA Monitoring:
    - > Service Provider can monitor each SR Policy in a Slice to Monitor SLA offered by the Policy using PM techniques
      - This includes monitoring end-to-end delays on all ECMP paths of the Policy as well as monitoring traffic loss on a Policy.
    - > Remedial mechanisms can be used to ensure that the SR policy conforms to the SLA contract of the slice.

QoS

- Segment Routing relies on MPLS and IP Differentiated Services.
- The DiffServ architecture achieves scalability by implementing complex classification and conditioning functions only at network boundary nodes, and by applying per-hop behaviors to aggregates of traffic depending on the traffic marker
  - The node at the ingress of the DiffServ domain conditions, classifies and marks the traffic into a limited number of traffic classes.
  - The function is used to ensure that the slice's traffic conforms to the contract associated with the slice.
- Additional QoS considerations for resource separation among slides is a local treatment.

Orchestration at the Controller

- A controller plays a vital role in orchestrating the SR building blocks to create Network Slices.
- The SDN friendliness of the SR technology becomes handy to realize the orchestration.
- The controller may use PCEP or Netconf to interact with the routers.
  - The technology supports appropriate Yang model for each of the building block for SR-based network slicing.

Next Steps

- The authors like to request the WG for their feedback.