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.