

# Segment Routing for Enhanced VPN Service (VPN+)

*draft-dong-spring-sr-for-enhanced-vpn-00*

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# Motivation

- VPNs have been widely deployed to support multi-tenancy in operator networks
- New/emerging services have more stringent isolation and performance requirements (e.g. bandwidth, latency, jitter, etc.) on a shared network infrastructure
- Enhanced VPN aims to:
  - Enable multiple customers with demanding services in a shared network
  - Ensure high performance with reasonable cost and scalability
  - Provide an underpin for 5G network slicing
- Note: replacing existing VPN is NOT the goal
  - Existing VPNs work fine for many existing services
  - Enhanced VPN is for services with high demand on isolation and performance

# Existing VPNs

- Overlay VPN
  - Provide separation of address space and routing/forwarding table
  - The only requirement on the underlay is connectivity
  - Compete for shared network resources, result in uncertainty in performance
- VPN with TE-LSPs as underlay
  - Per-path traffic engineering and improved resiliency (FRR)
  - Shared TE-LSPs does not provide isolation between VPNs
  - Scalability concerns with per-VPN service dedicated TE-LSPs
- VPN with SR as underlay
  - Less protocols and states to maintain
  - Flexible service path programmability
  - Shared SIDs indicate resource sharing in data plane

# Enhanced VPN

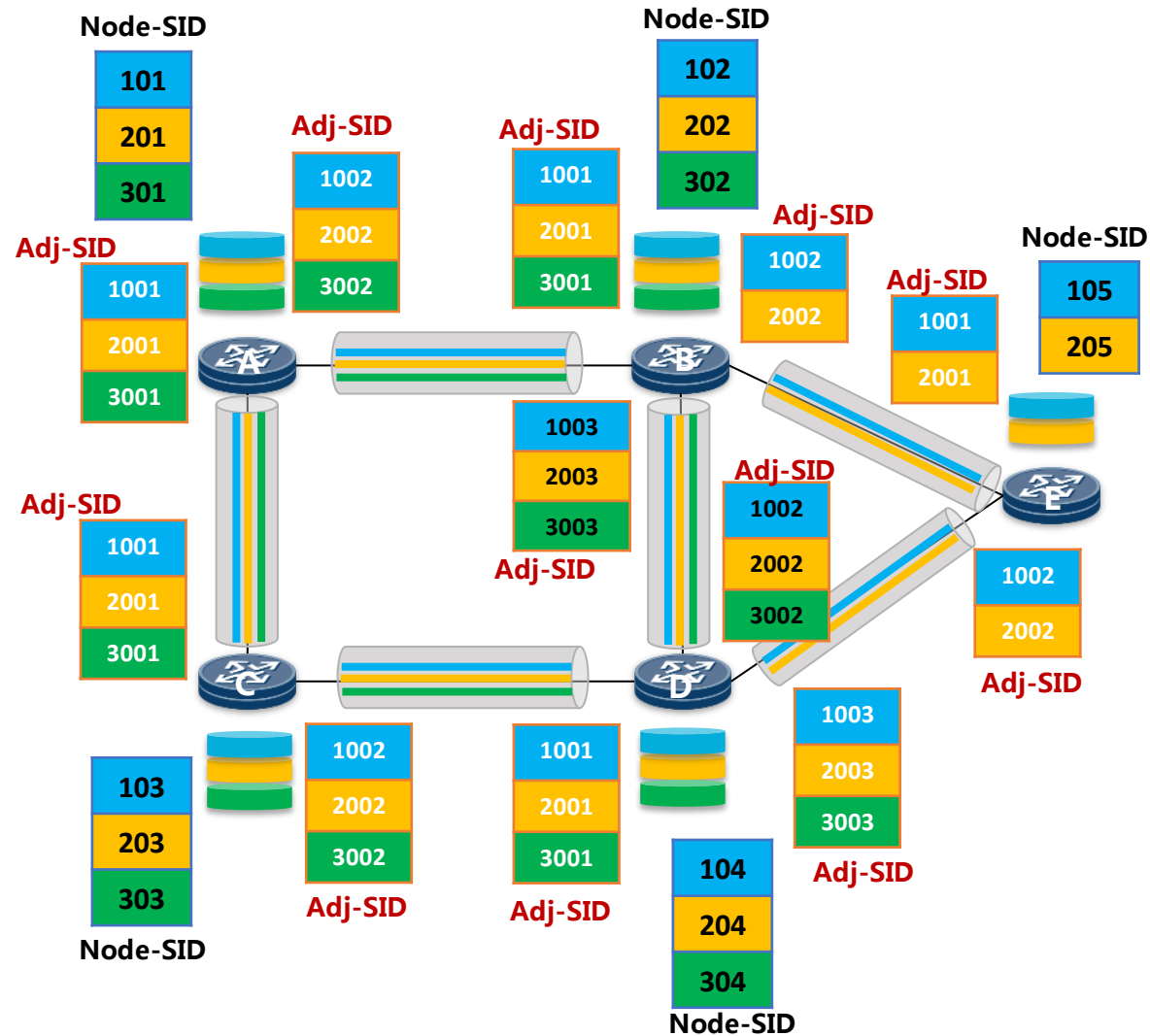
- Tight integration between overlay VPN and underlay network resources
  - Independent of the overlay VPN signaling
    - L3VPN, L2VPN, EVPN, etc.
- Enhancements to the forwarding plane are needed
  - The foundation for guaranteed resource
  - Refer to technologies described in draft-bryant-rtgwg-enhanced-vpn
- What about the control plane?
  - Create customized virtual networks with dedicated network resources
  - Should be agnostic to specific forwarding plane mechanism used
  - Scalability must be taken into consideration

# SR and Resource Reservation

- Currently SR does not fully support resource reservation
  - Services passing through the same link/node share the resources in data plane
  - Resource contention is possible due to the nature of IP traffic
- Extend SR for resource reservation
  - Per-topology aggregated resource reservation
    - Comply to SR paradigm, no per-path/flow state
    - On each network segment, different SIDs are used to represent different partitions of resources allocated to different topology
    - A group of SIDs used to construct a SR virtual network with reserved resources
  - VPN services map to dedicated SR virtual networks
    - Provide the required isolation and performance guarantee

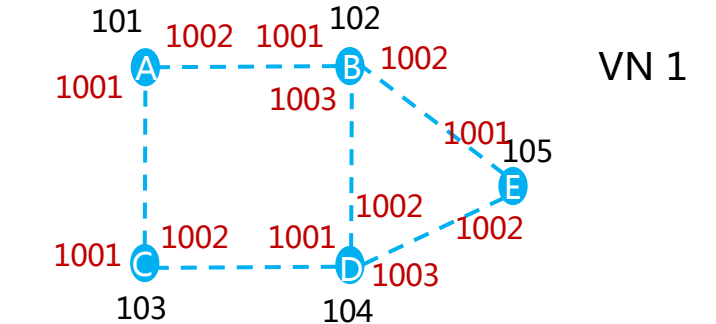
# Example: SIDs Allocation

- Dedicated SIDs for partitioned link/node resources

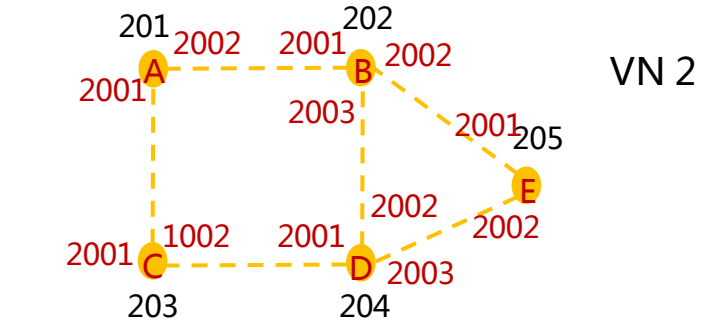


- SIDs construct isolated virtual networks

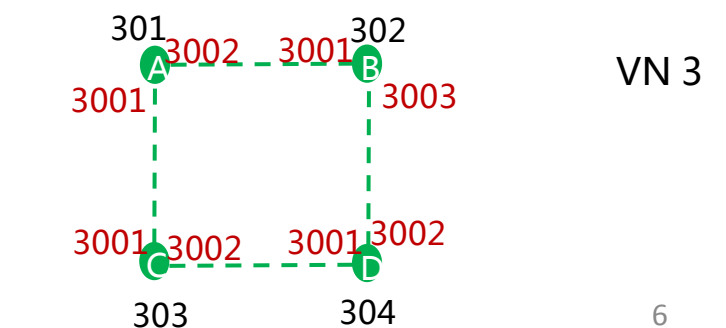
SIDs for VN 1



SIDs for VN 2

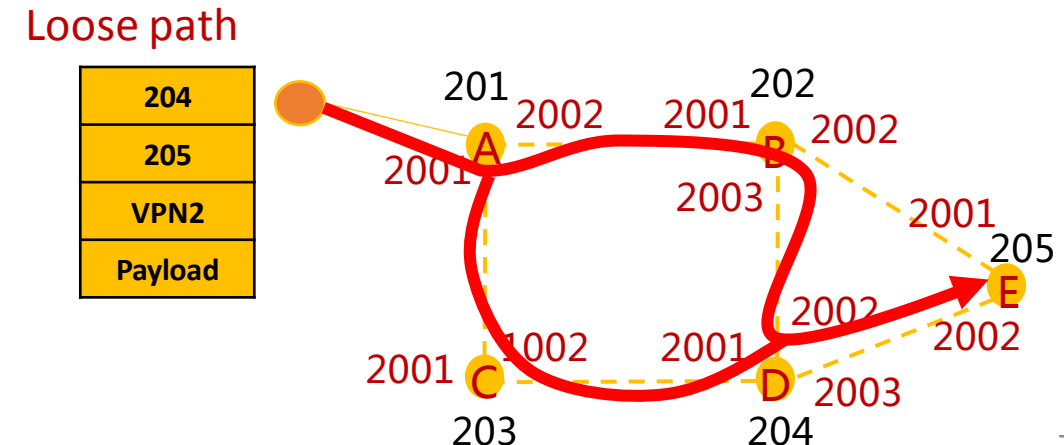
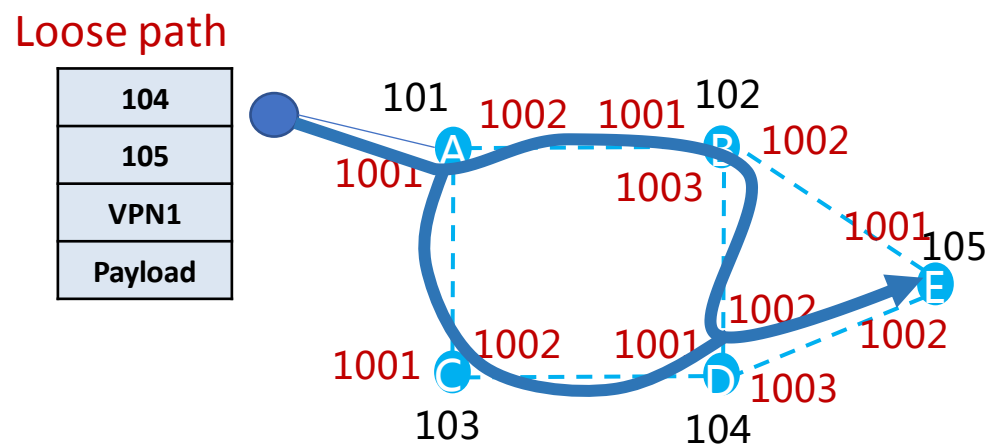
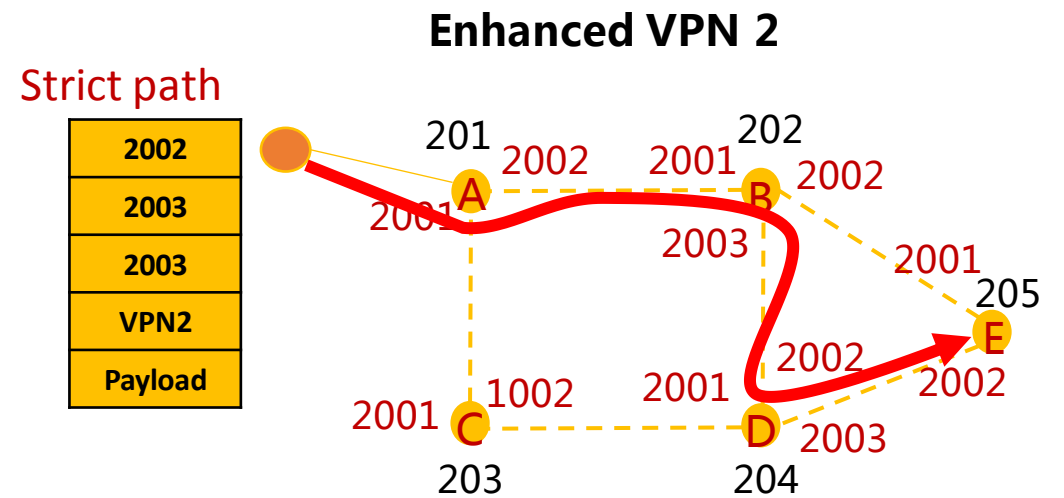
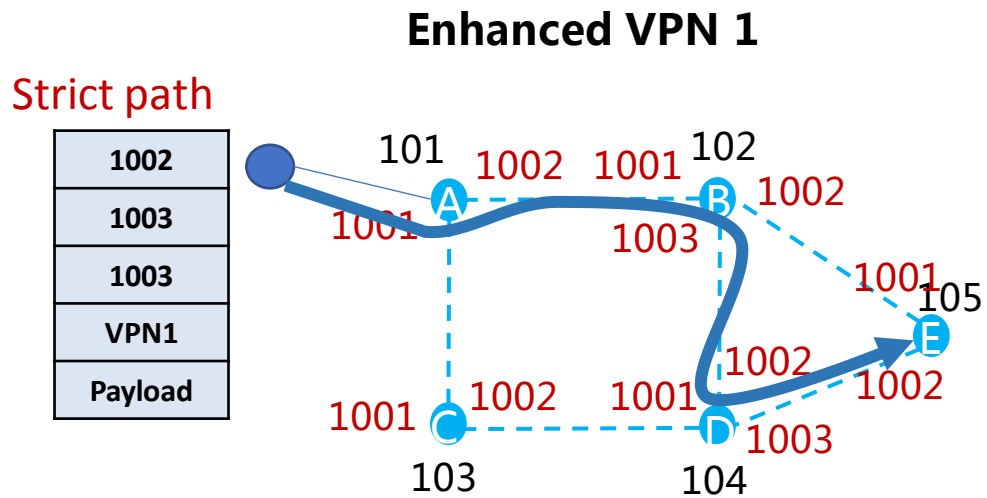


SIDs for VN 3



# Example: Forwarding Plane

- Service of enhanced VPN is constrained to its own virtual network topology/resource







# Next Steps

- The proposed mechanism extends SR for resource reservation to support the enhanced VPN services
  - Comply to the SPRING charter:  
*“Some types of network virtualization, including multi-topology networks and the partitioning of network resources for VPNs”*
- In general the mechanism is applicable to both SR-MPLS and SRv6
- IGP extensions in progress and will be done in LSR WG
- Feedbacks and contributions are welcome!

Thank You