Segment Routing for Network Slicing

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Segment Routing Overview

- Source routing paradigm
  - Segment identifies network nodes and links
    - Node-SIDs, adj-SIDs, etc.
  - Use ordered SID list in packet header to specify the service path
- Scalability
  - Avoid per-path/flow state inside the network
- Simplicity
  - Use IGP/BGP as control plane to advertise SIDs
  - Eliminate the path signaling protocols: LDP, RSVP-TE
- Two data plane instantiations
  - SR-MPLS
  - SRv6

Why SR for Network Slicing?

- SR will be the predominant technology for 5G transport
  - Networks are/will be migrating towards SR-MPLS/SRv6 in 5G era
- Simplicity and scalability of SR is important for network slicing
  - To reduce the complexity and cost in provisioning and maintaining multiple network slices

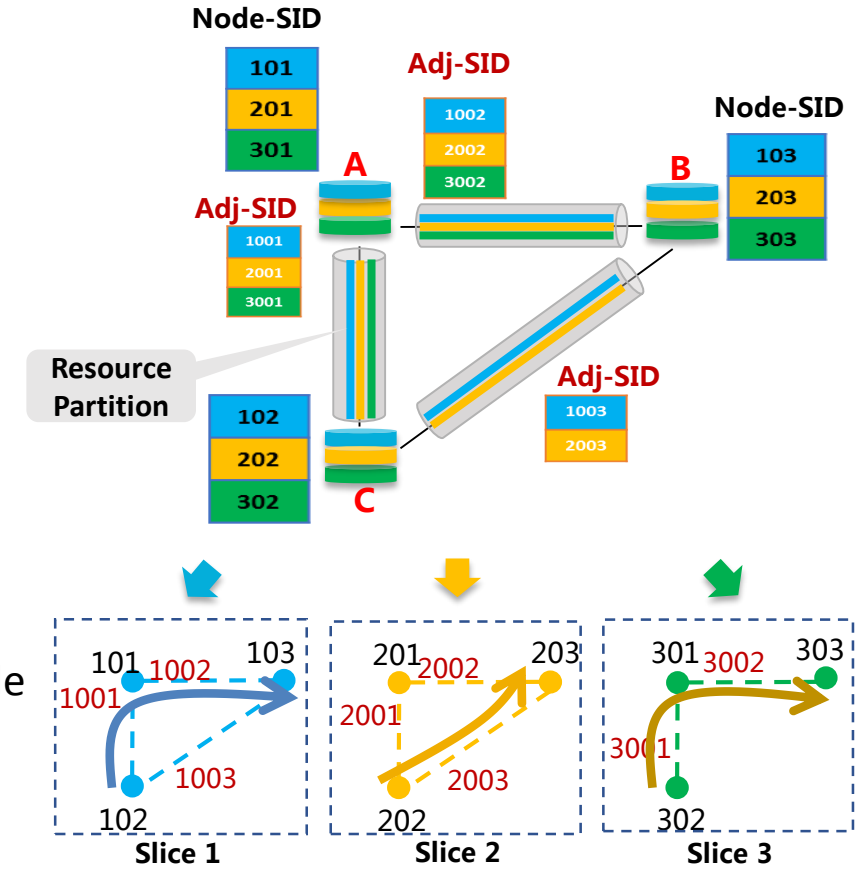
Challenges in using SR for Network Slicing

- SR was mainly designed for source routing
  - SIDs are topological or service instructions
  - Services share the same group of SIDs
  - How to identify different network slices using SR?
- SR did not take resource reservation into consideration
  - Rely on DiffServ QoS for traffic differentiation
  - May not meet the SLA requirement of 5G critical applications
  - How to achieve guaranteed/bounded SLA with SR?

SR based Network Slicing: Data Plane

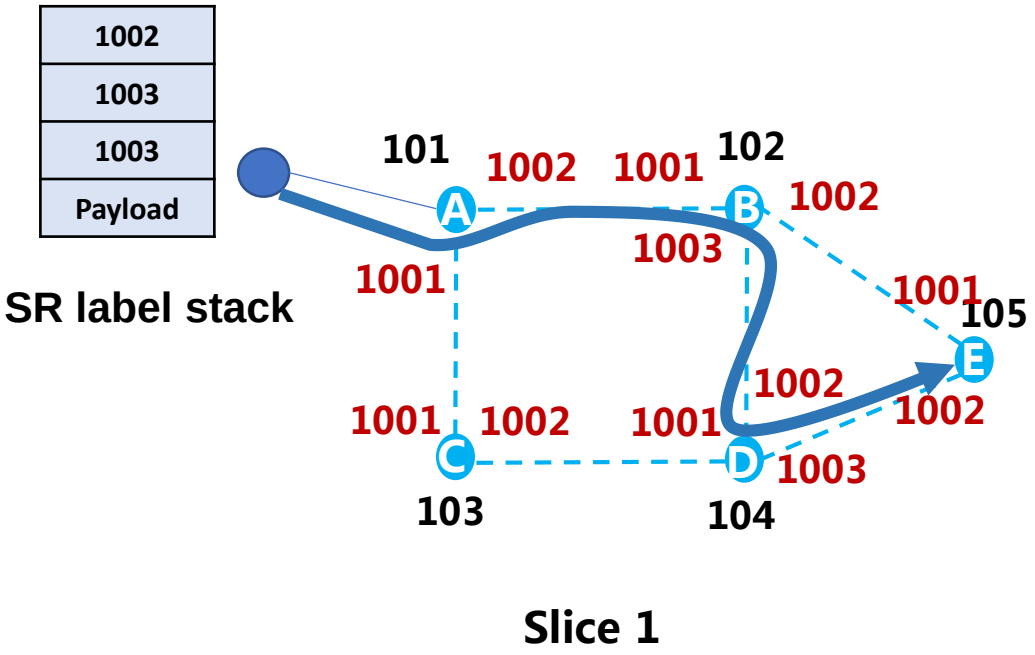
- Use different SIDs to identify the same network segment (node, link) in different network slices
  - SR-MPLS: Different node-SIDs and adj-SIDs
  - SRv6: Different locators are used to identify network slices, SRv6 SIDs inherit the slice information from locator

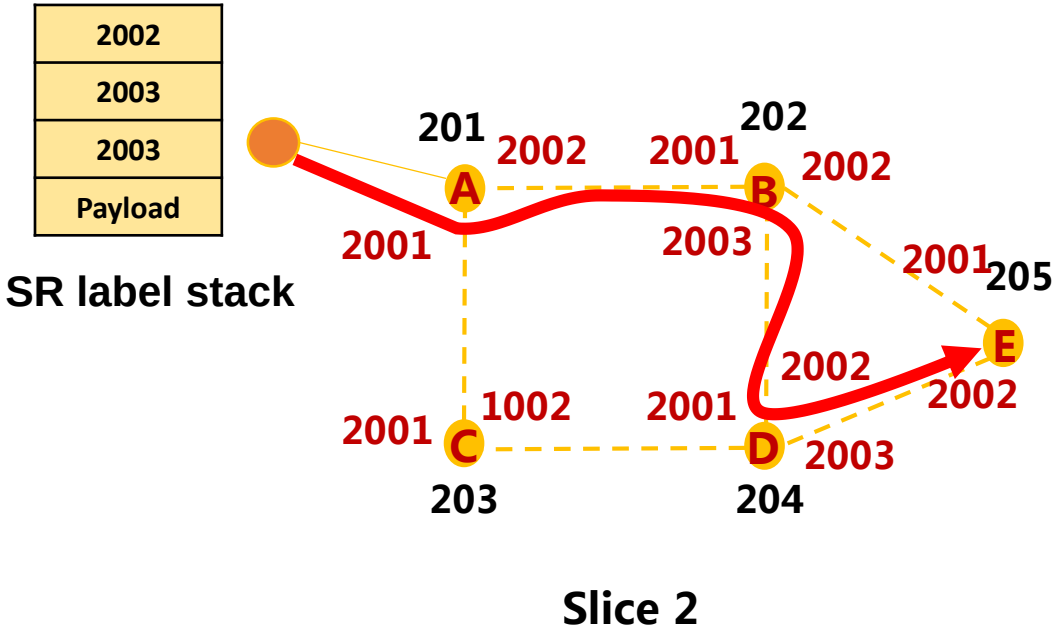
- In addition, SIDs can also be used to identify a set of network resources allocated to a particular network slice
  - SR-MPLS
    - Adj-SIDs to identify link resource allocated to different slices
    - Node-SIDs for loose path forwarding within slice, may also identify node resources
  - SRv6
    - Locators are used on transit nodes
    - SRv6 SIDs are used on end nodes



SR based Network Slicing: Data Plane

SR-TE in different network slices : A-B-D-E

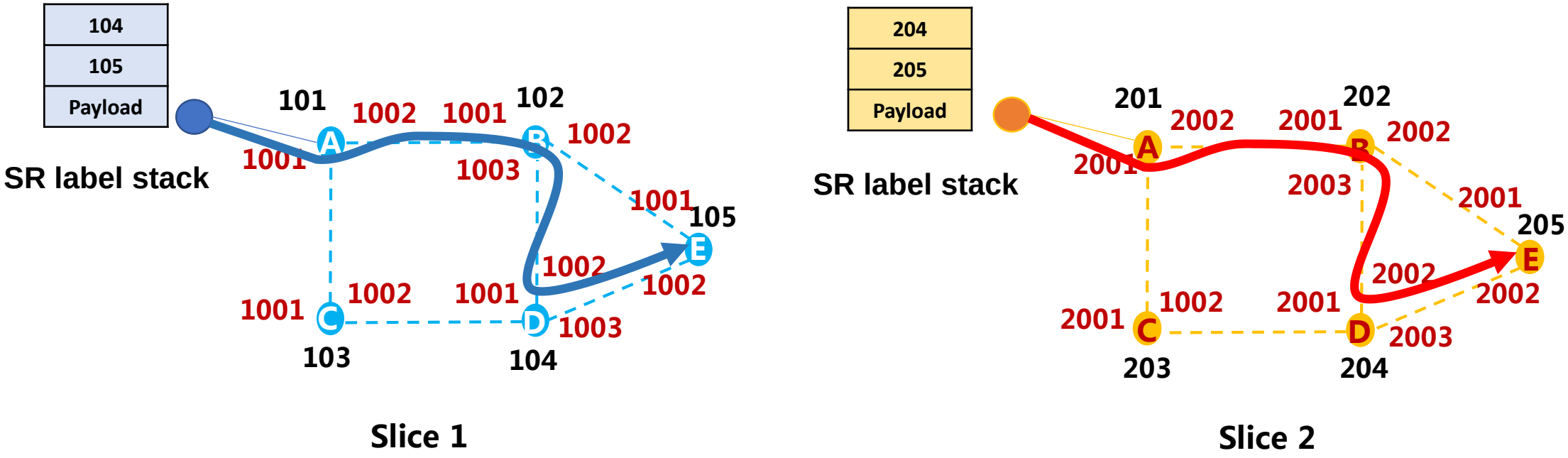




Network resource in different network slices can be shared or isolated

SR based Network Slicing: Data Plane

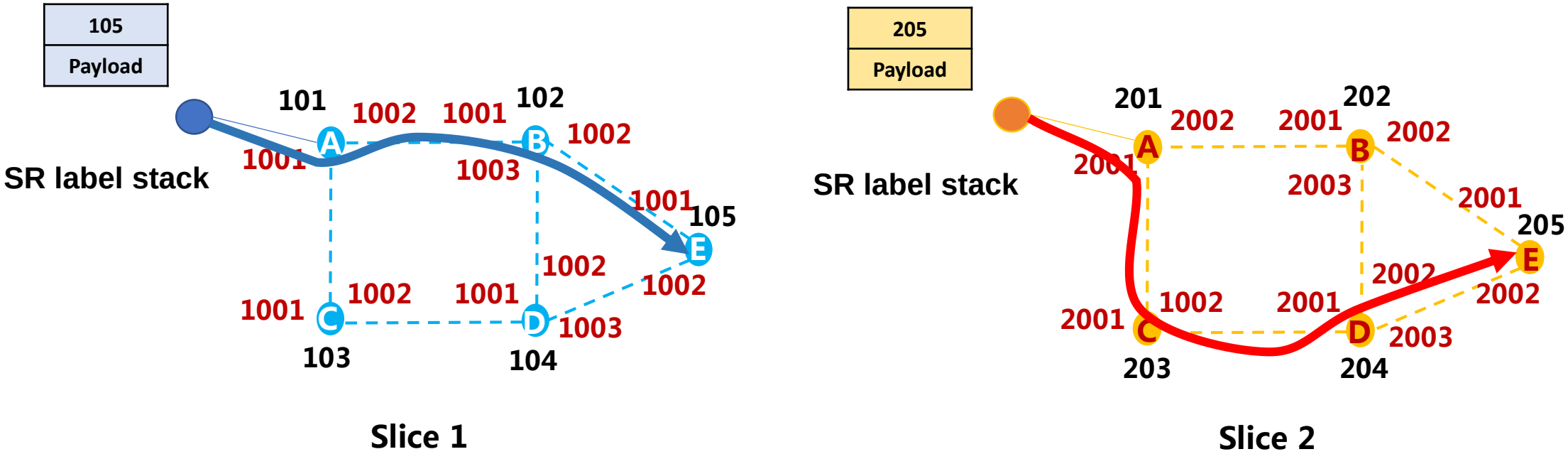
SR-TE with loose path in different network slices: A-D-E



Network resource in different network slices can be shared or isolated

SR based Network Slicing: Data Plane

SR with one SID in network slices: A-E



Network resource in different network slices can be shared or isolated

SR based Network Slicing: Data Plane

- SR based network slicing may be seen as an aggregated IntServ model with per-slice segmented resource reservation

- Benefits
  - Guaranteed SLA compared with DiffServ
  - No per-path state compared with IntServ

SR based Network Slicing: Procedures

- Controller
  - Collect the underlay network topology and resource information
  - Receive network slice request with service topology and SLA requirement
  - Compute the virtual network topology and the resources needed according to network slice requirement
  - Instruct nodes to allocate per-segment resources and SIDs for the network slice

- Devices
  - Join the requested network slice
  - Allocate network resources and SIDs for the network slice
  - Advertise the network slice identifier, SIDs and the associated resource information into network
  - Based on the collected information, compute network slice topology and the forwarding entries of the network slice

Next Steps

- Reach consensus on SR based network slicing data plane and procedures
  - Independent from the control plane extensions

- The next step further is to discuss the candidate control plane extensions and build a converged control plane solution

Thank You!