

ONOS based Segment Routing in the Data Center and Transport Network

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✓ Content

- **Brief about Segment Routing**
- Segment Routing in SDN
- Network Slicing related SDN Solution
- Transport Network Slicing Architecture in ONOS
- Network Slicing Use cases
- Future enhancements

A source-routing architecture that seeks the right balance between distributed intelligence and centralized optimization.

The application steers its packets through an ordered list of instructions and realizes end-to-end policy without creating any per-flow state in the network.

Simple

Segment Routing provides complete control over the forwarding paths by combining simple network instructions. It does not require any additional protocol. Indeed in some cases it removes unnecessary protocols simplifying your network.

Scalable

Segment routing does not require any path signaling. Hence, per-flow state only needs to be maintained at the ingress node of the SR domain increasing your network flexibility while reducing cost.

Traffic Engineering

Segment Routing can be used to steer traffic along any arbitrary path in the network. This allows operators to enforce low-latency and / or disjoint paths, regardless of the normal forwarding paths.

Source: segment-routing.net

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Segment Routing Customer Adoption

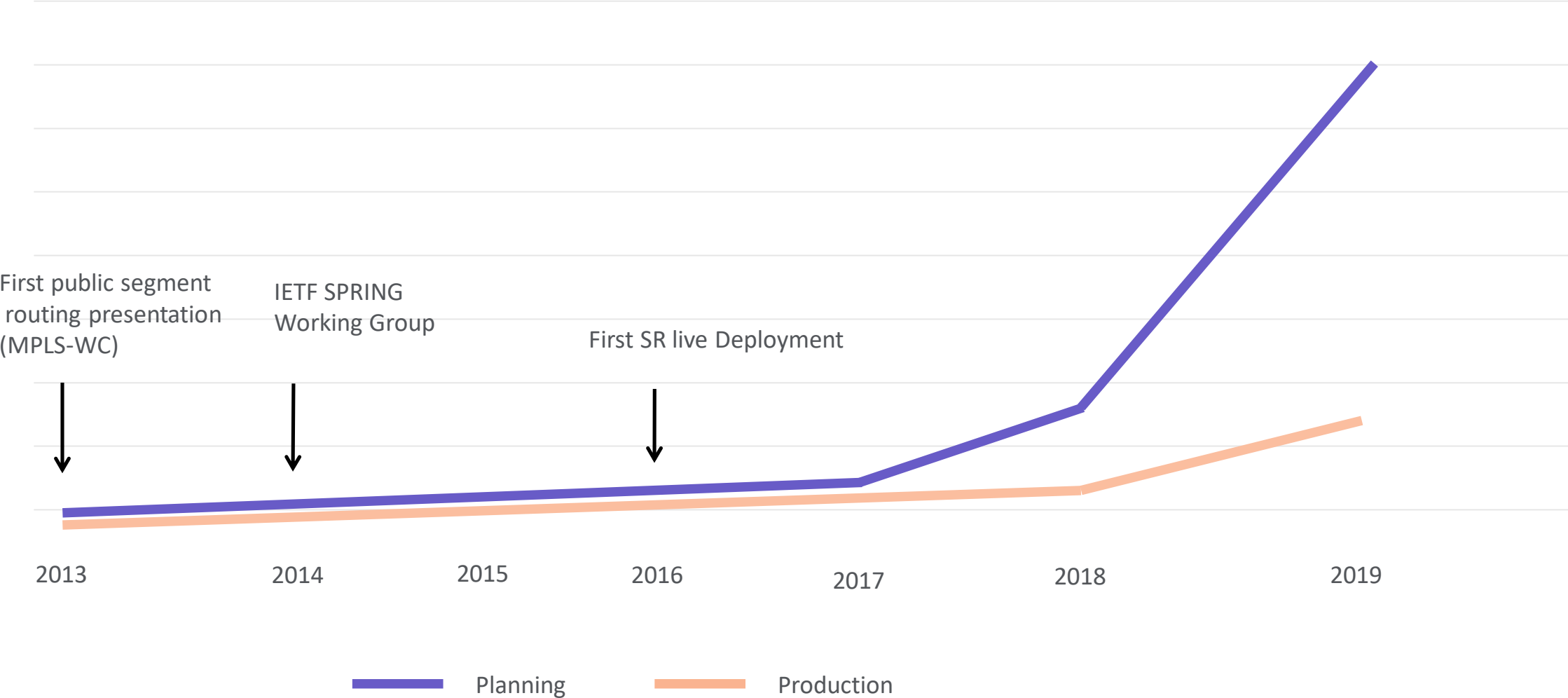
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Segment-Routing : 2018



Segment Routing Customer Adoption

6 Years old



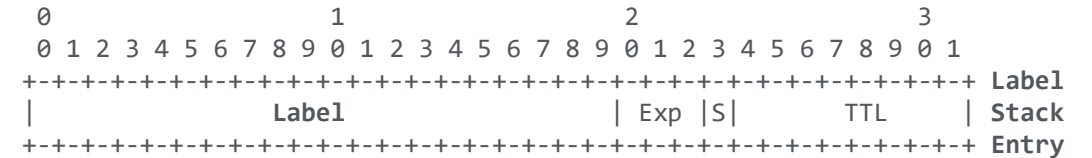
Source: Cisco Research

- Segment Routing architecture is RFC8402 defining SR over MPLS (SR-MPLS) and SR over IPv6 (SRv6).
- SRv6 uses a new type of routing header called the SR Header (SRH)
- SPRING working group's charter and milestones are solely about completing SRv6 standardization

Segment Routing Segments

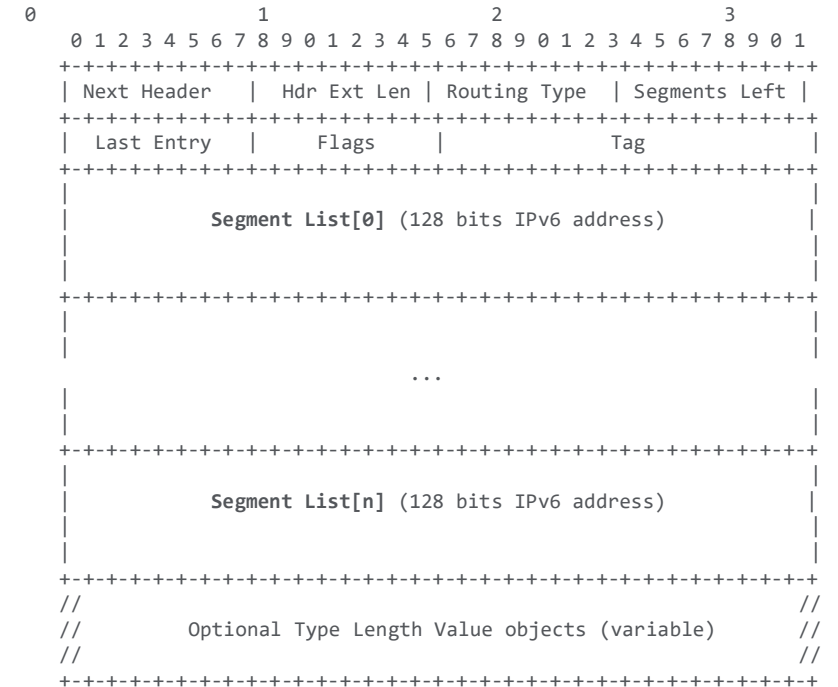
IPv4 – MPLS

Segments are encoded in MPLS label stack



IPv6 – SRH

Segments are encoded in the IPv6 extension header



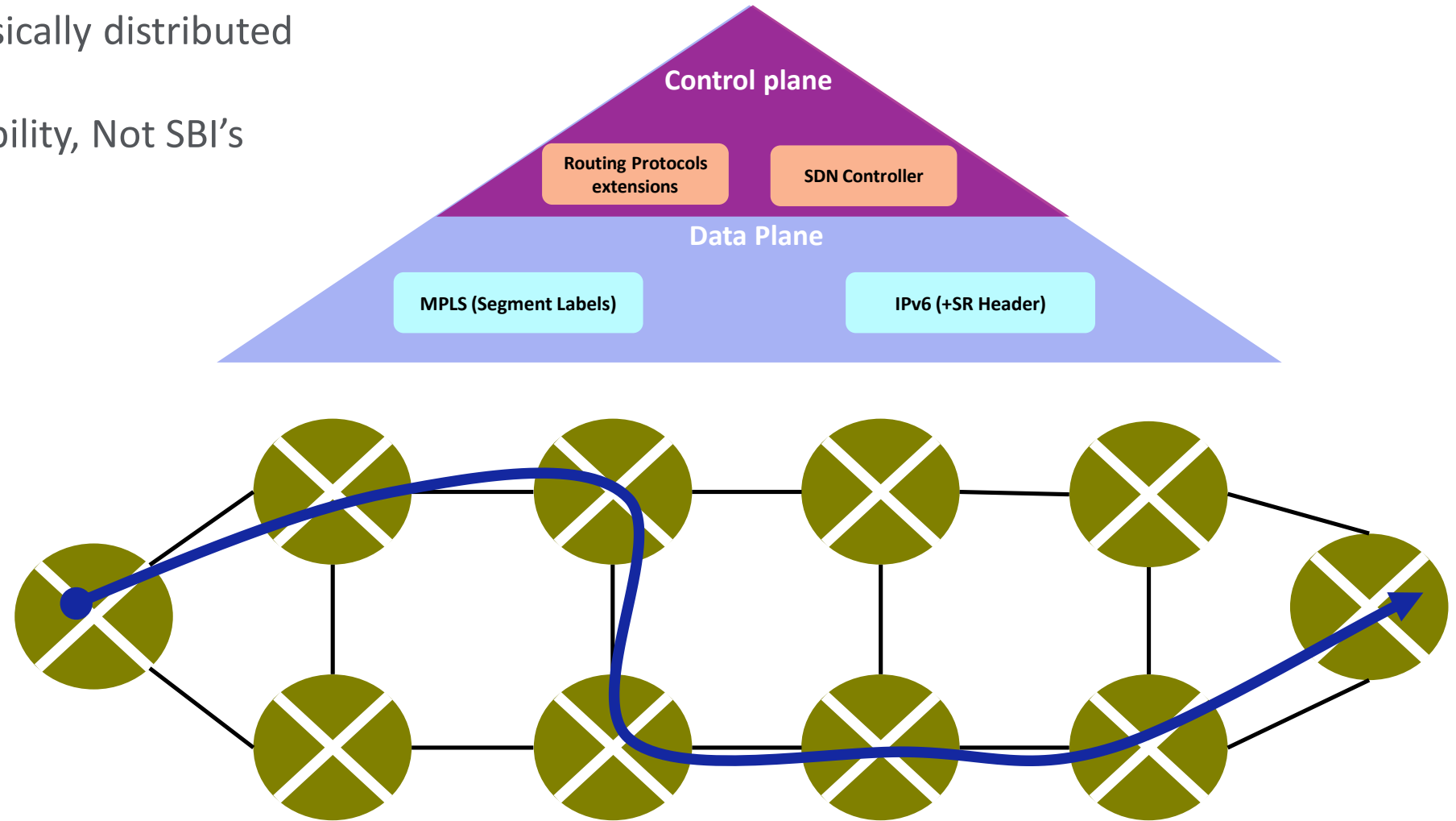
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Segment Routing in SDN

Logically Centralized, Physically distributed

SDN is about programmability, Not SBI's

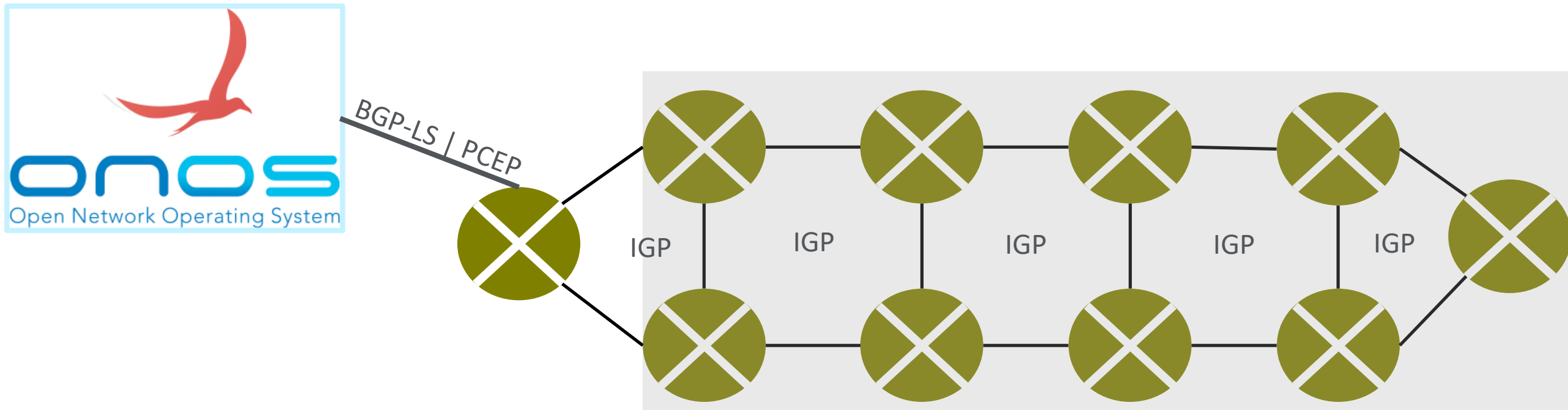


Segment Routing in SDN

SDN Controller builds network topology using BGP-LS

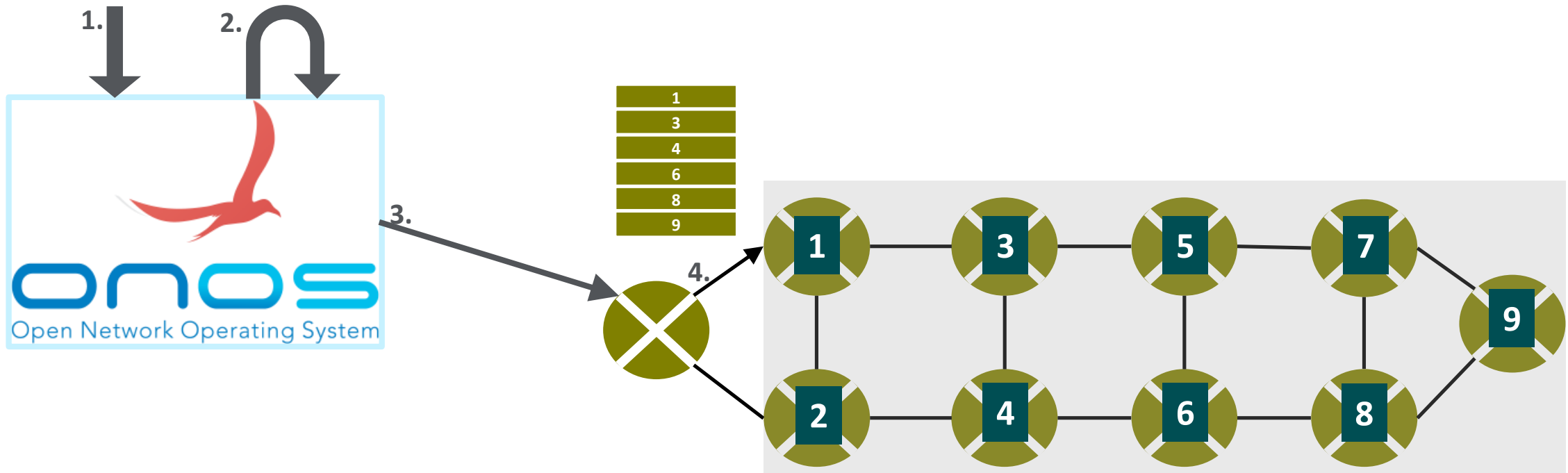
SDN Controller configures only source routers using PCEP

No configuration is needed in intermediate routers



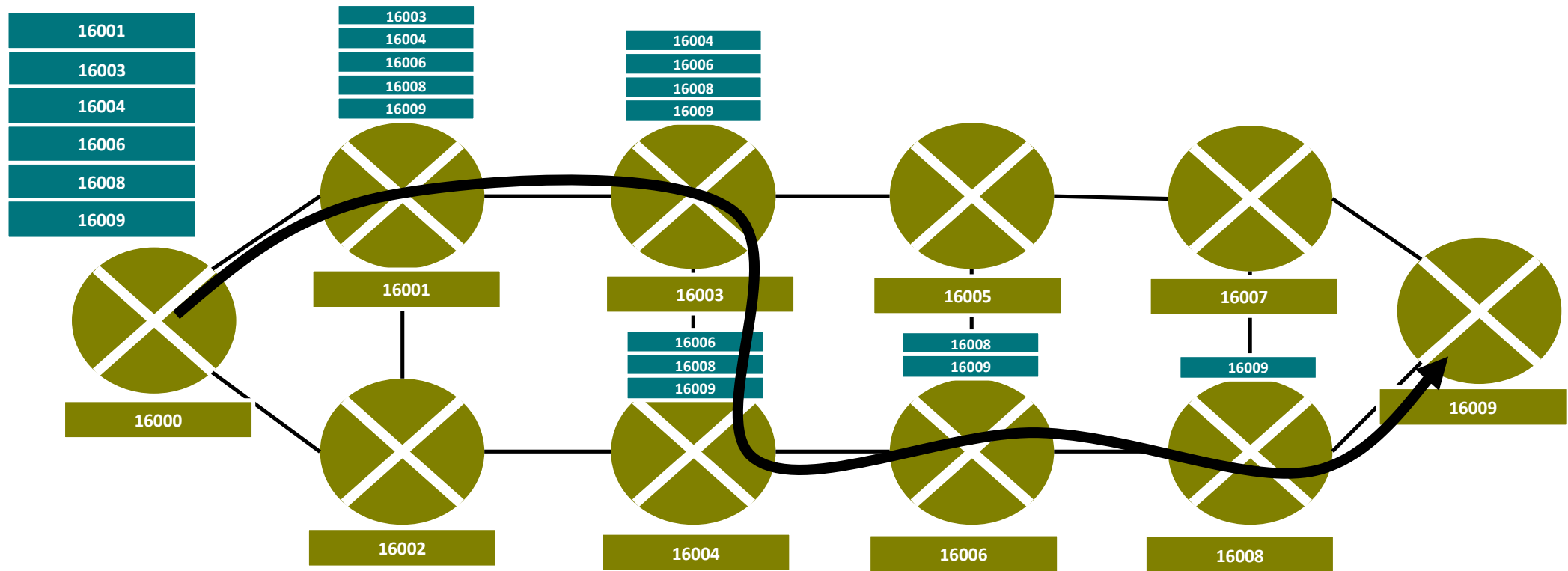
Segment Routing in SDN

1. SDN Controller identifies demand requirement (i.e. NBI request from Orchestrator)
2. SDN Controller calculates the path based on QoS requirements
3. SDN Controller installs a new rule at Source Router using PCEP
4. Source Router encodes Segment Stack according to SR rules and forwards the packets to next hop



Segment Routing in SDN

1. Source Router encodes Segment Stack according to SR rules and forwards the packets to next hop
2. Each intermediate router forwards packet(with shortened segment stack) using active label



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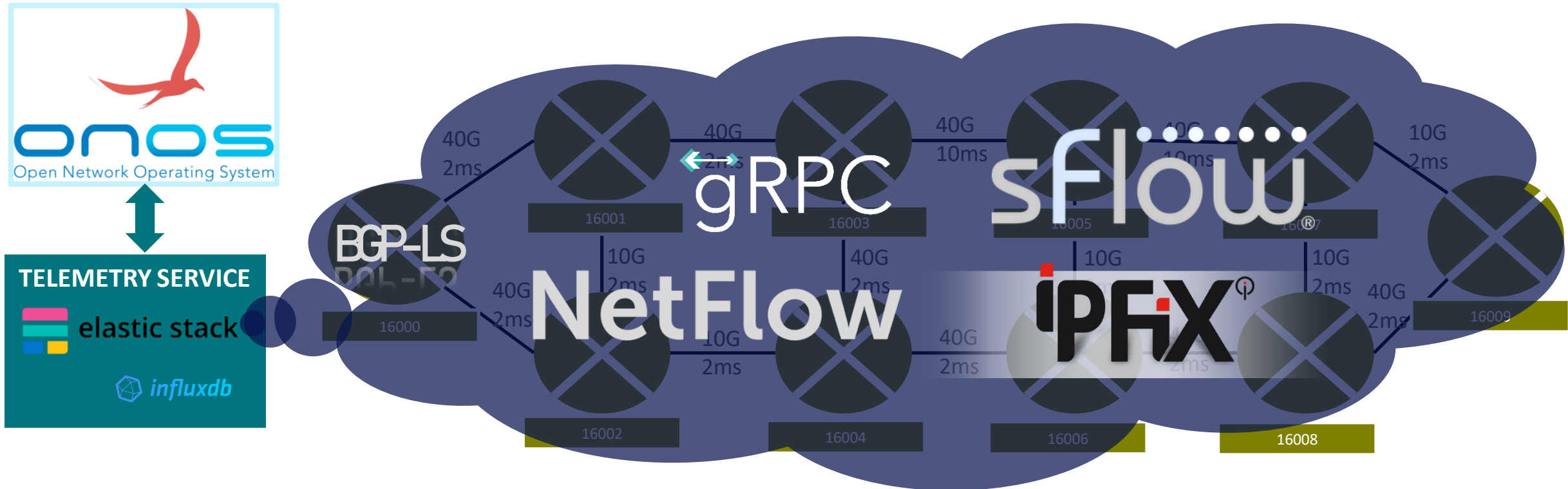
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SDN Solution – Telemetry Service

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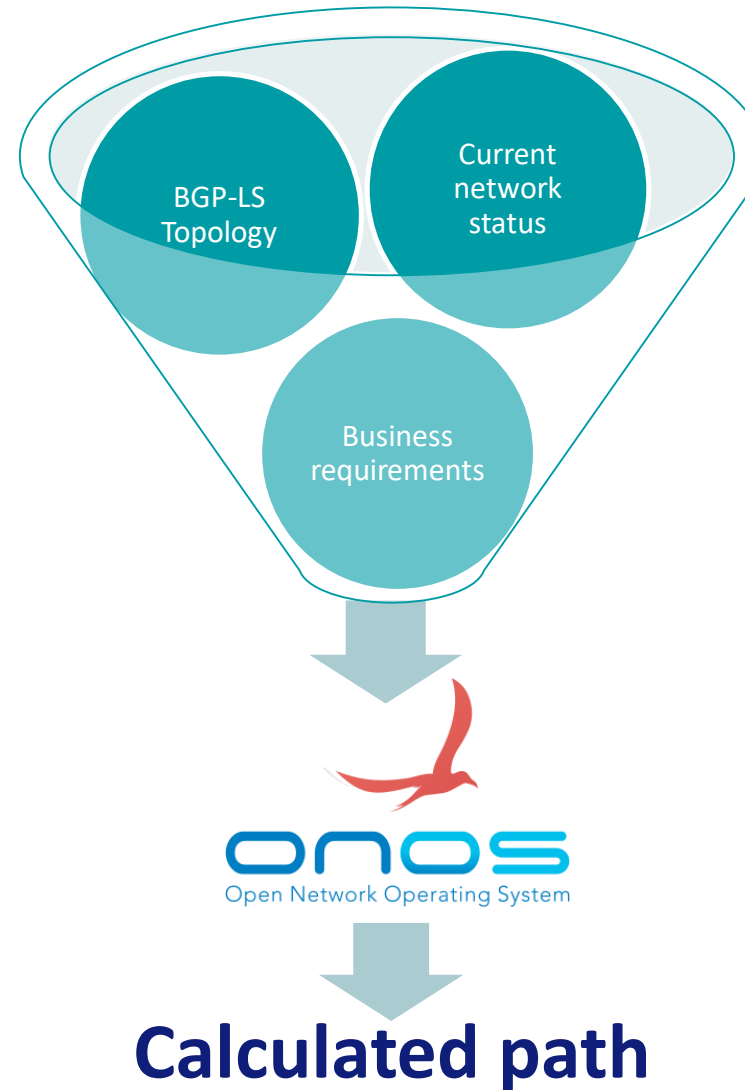
Telemetry Service monitors current network status using multiplies technologies
That includes but is not limited to links latency, residual bandwidth and topology changes

SDN Controller uses stored data to calculate best path according to demand



SDN Solution – Path Computation

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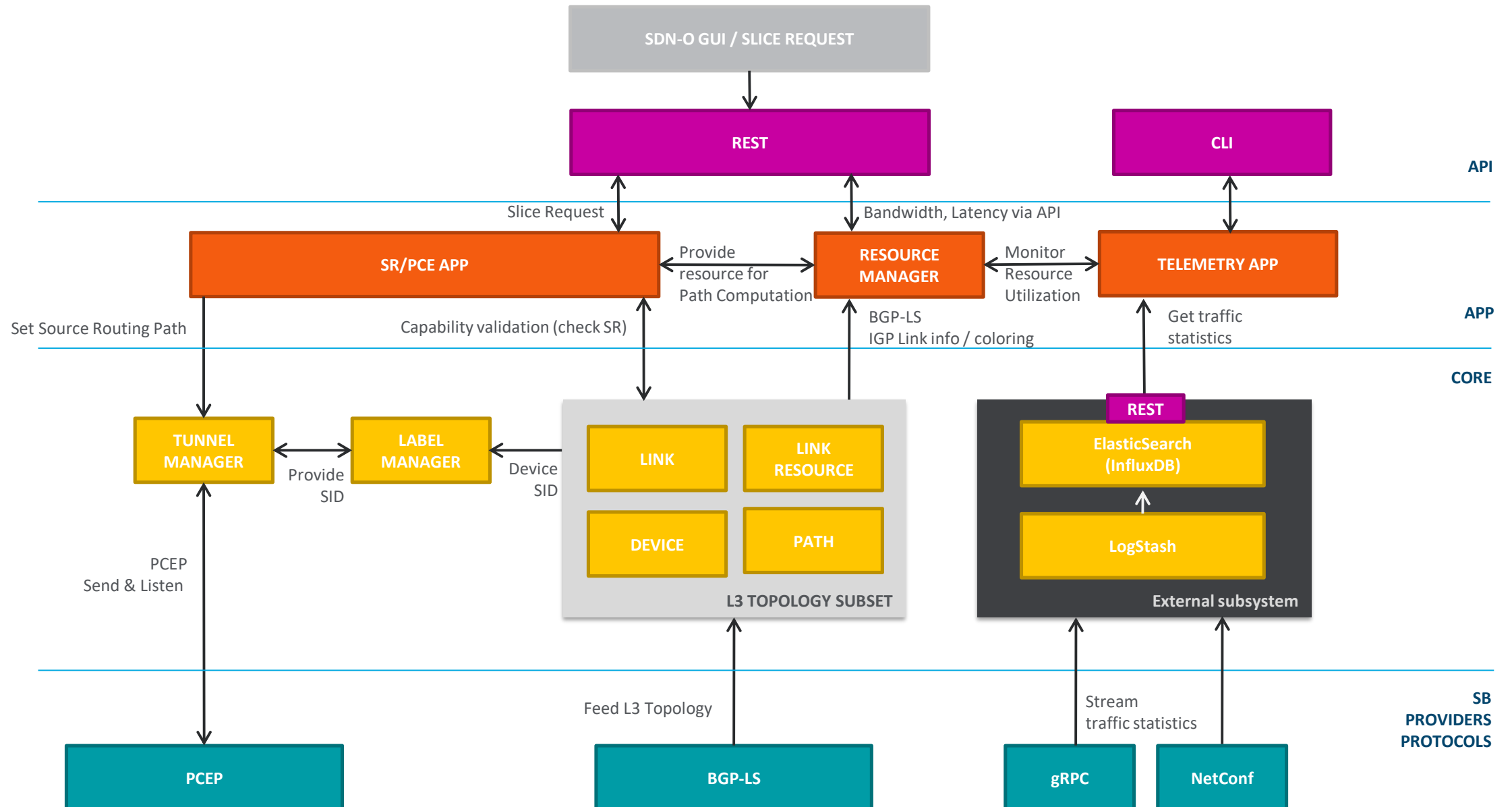


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Transport Network Slicing Architecture in ONOS

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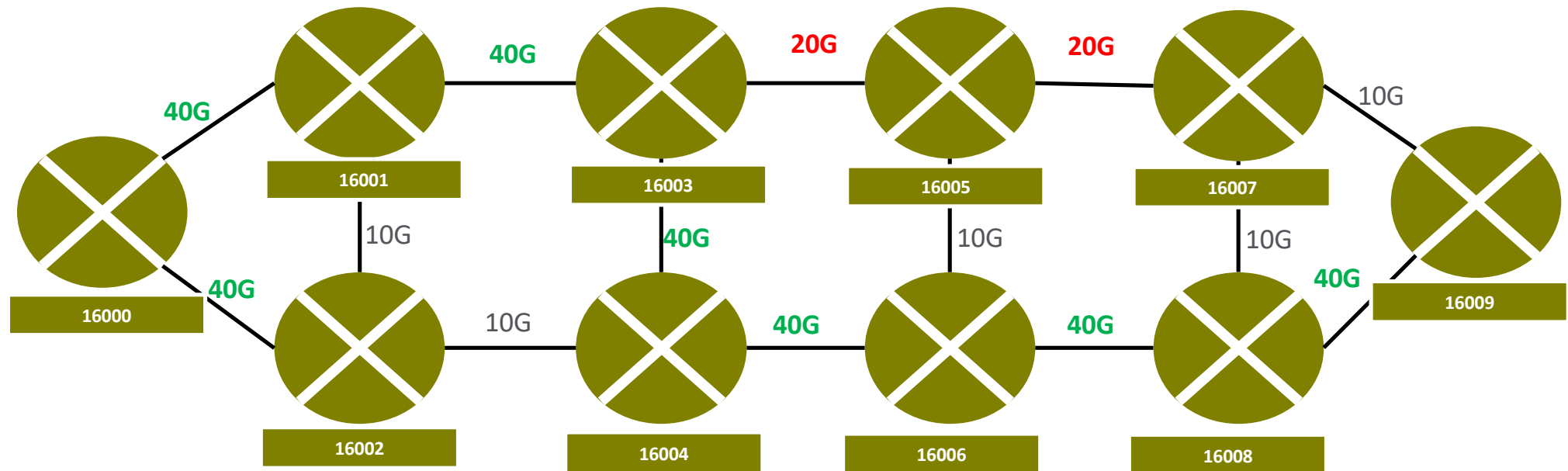


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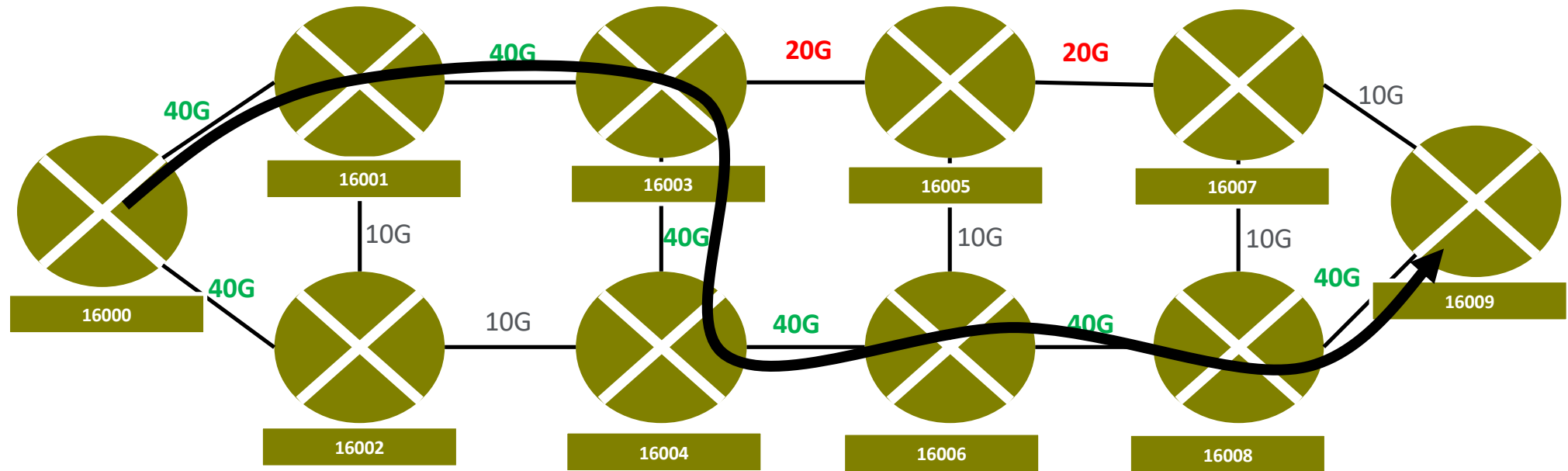
Network Slicing Use case - eMBB

1. Some kind of traffic demands minimum bandwidth



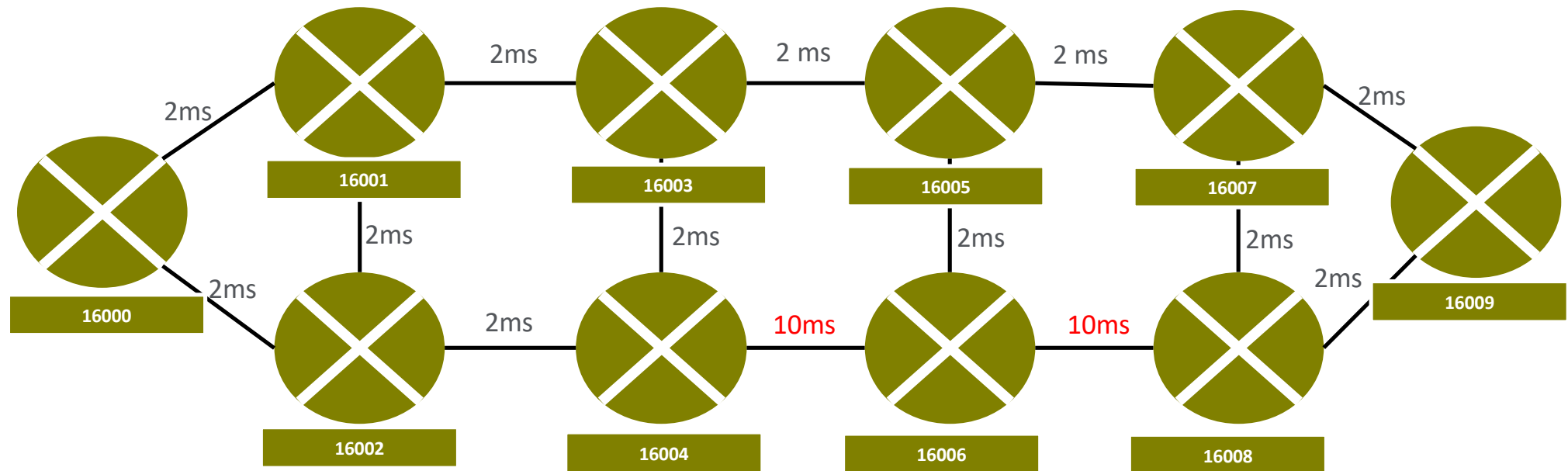
Network Slicing Use case - eMBB

1. Some kind of traffic demands minimum bandwidth
2. Thus SDN Controllers sets the only path that satisfies this requirement



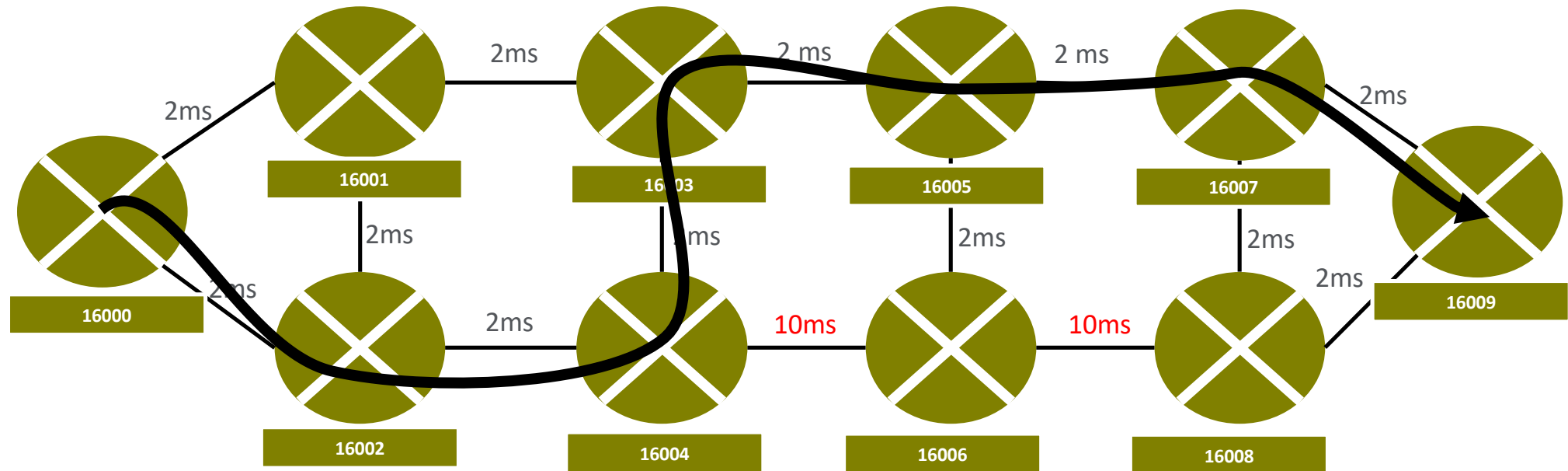
Network Slicing Use case - uRLLC

1. Some kind of traffic demands low-latency



Network Slicing Use case - uRLLC

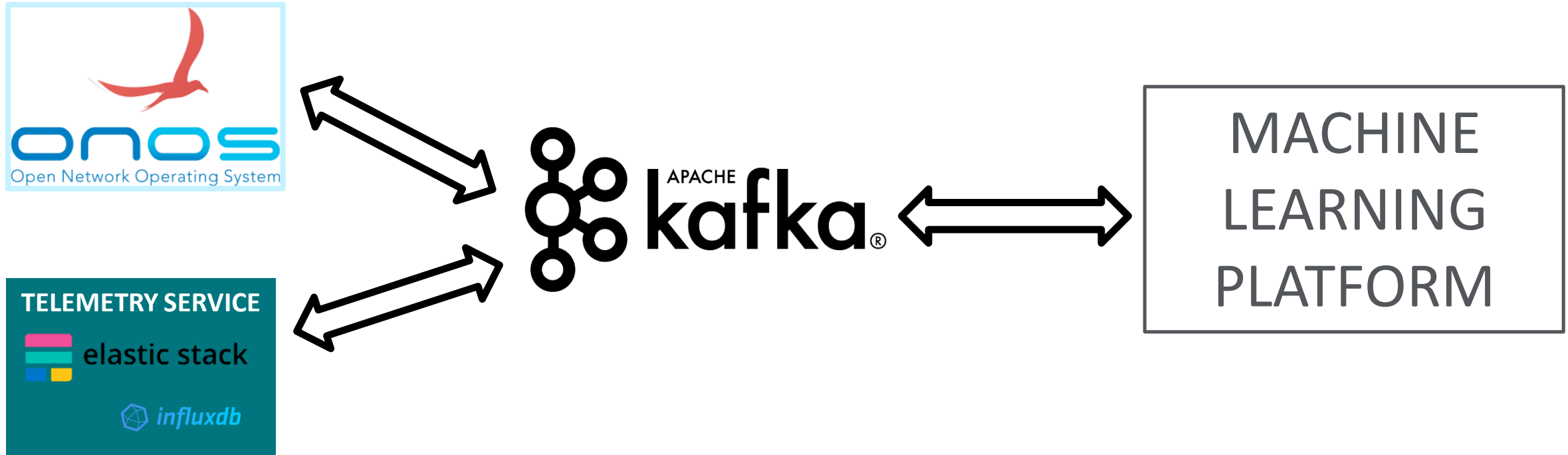
1. Some kind of traffic demands low-latency
2. Thus SDN Controller sets path with bigger number of hops but smaller accumulated latency



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- Telemetry Service monitors current network status using multiplies technologies
- Based on stored data, SDN Controller prepares best paths with lowest accumulated cost for whole network
- Final solution is based on stored data, so if we can predict stored data, we will be able to predict the paths (topology) that we will need in the future
- Predicting stored data is a task for ML



Q&A

Thank you

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