SDN and MPLS in DataCenters

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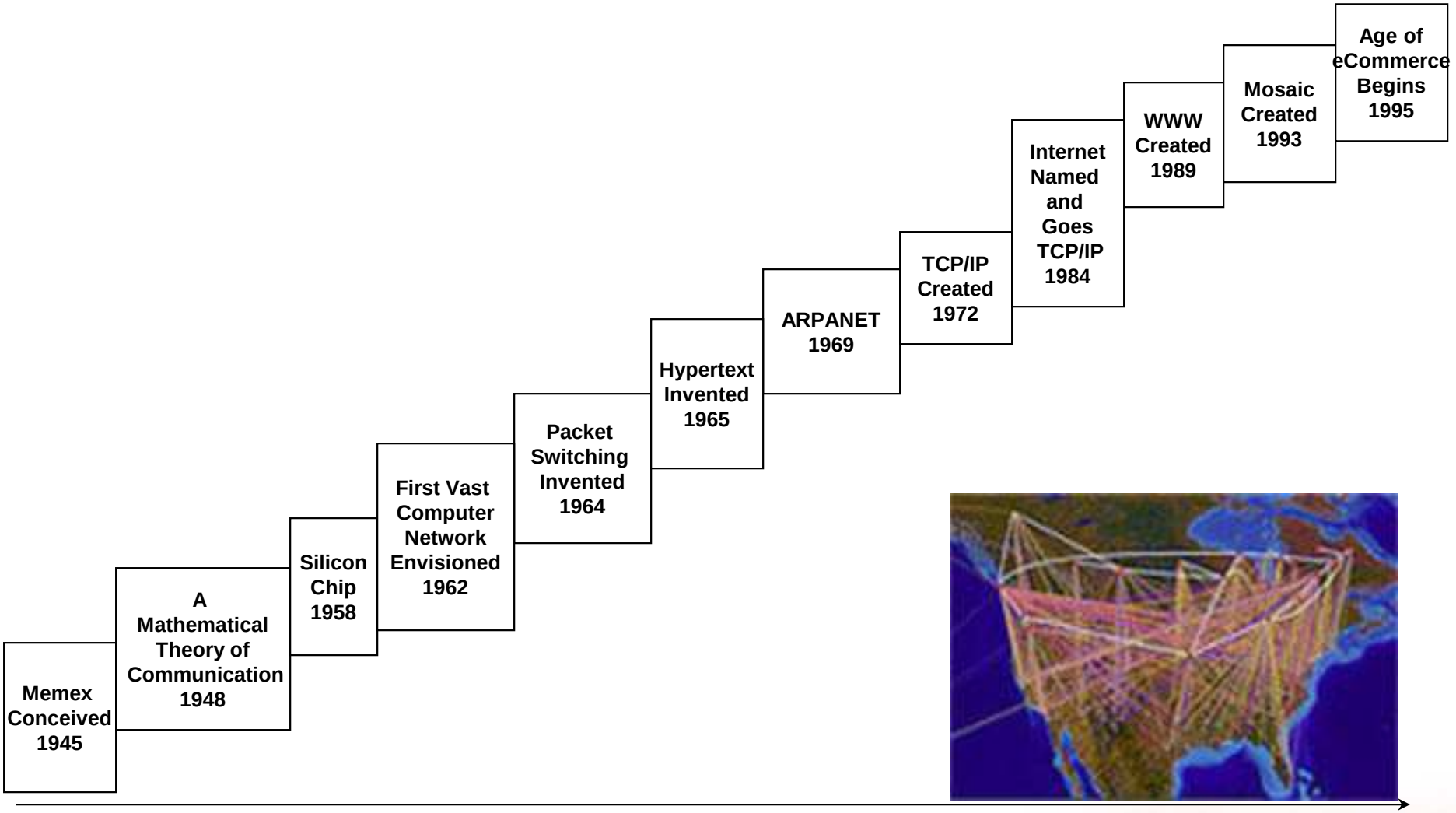
Topics

- Challenges and Key Requirements
- Overlay and Topology Abstraction
- Centralized Traffic engineering
- SDN implementation with OpenFlow 1.3
- Summary

A Brief Summary of the Evolution of the Internet



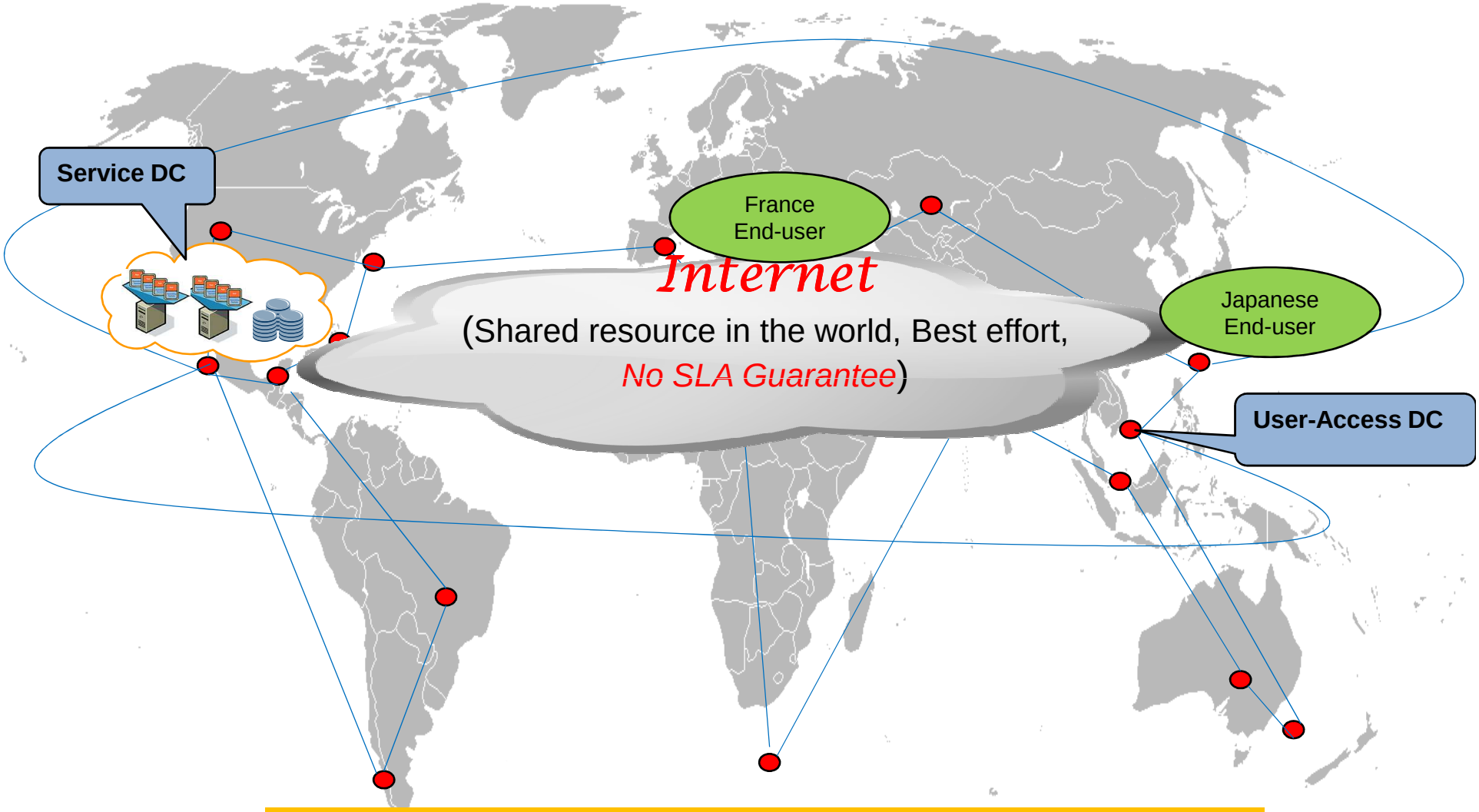
DC and Cloud Service Challenges

- Seamless Service Delivery
- Data Integrity, Security and Response times
- Mobility and Interconnectivity
- Traffic modeling
- Integration (physical devices, content, orchestration)
- Data Transport
- Service Delivery

DC and Cloud Services Attributes

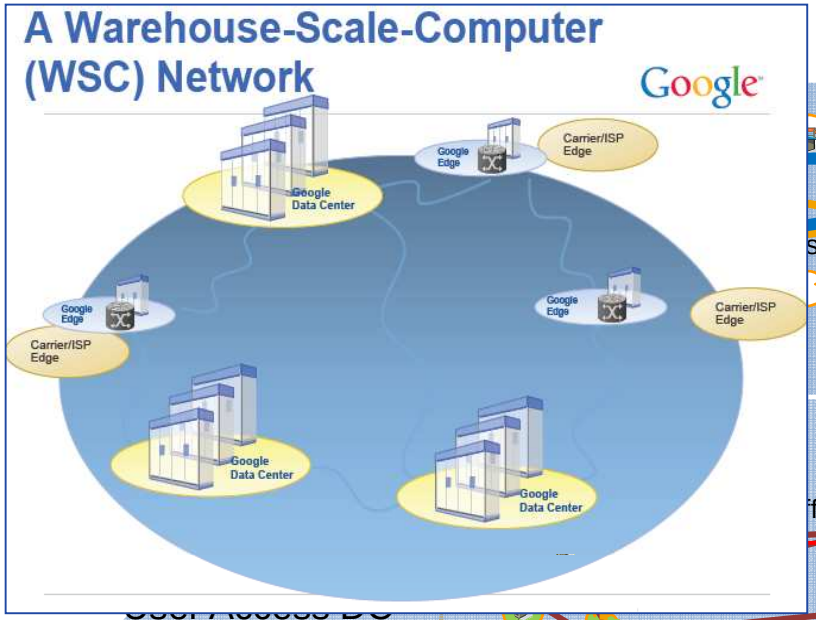
- Computing
  - Leasing out computing resources
  - Off loading of computing needs
  - On demand allocation of computing resources
- Storage
  - Storage space
  - Hosting services
  - Data protection and redundancy
- Network
  - Network services
  - Service based network services
  - Virtualization and Security

Content Provider Backbone architecture



CP backbone connect its UserAccess-DC and Service-DC.

Dedicated DCI for Content Providers



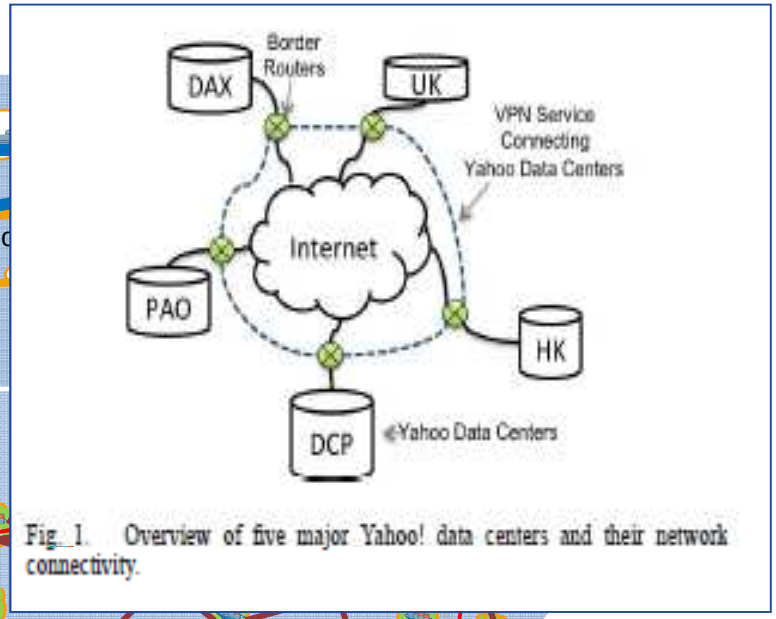
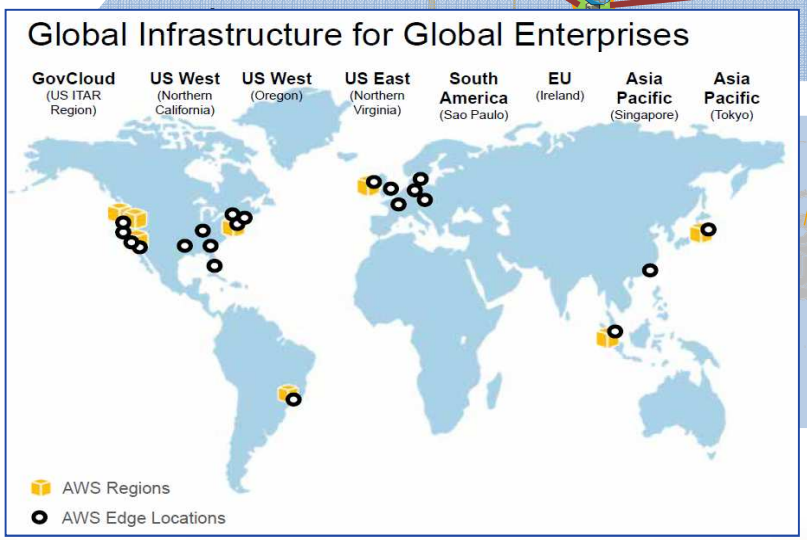
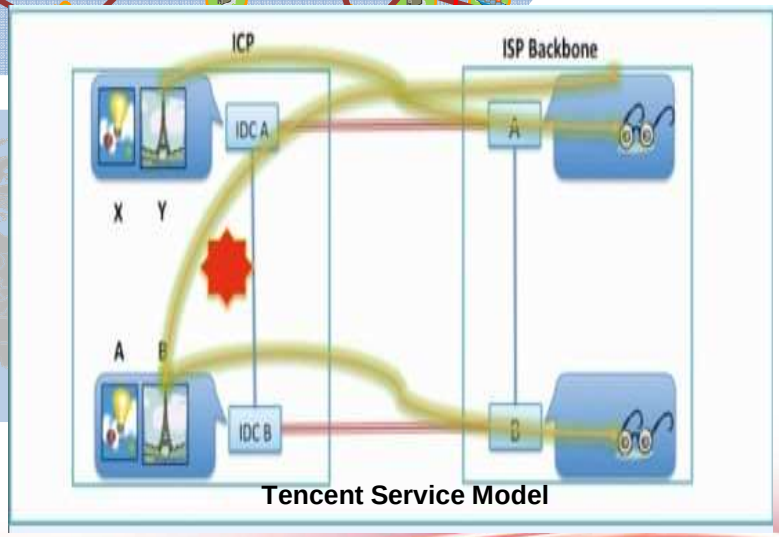


Fig. 1. Overview of five major Yahoo! data centers and their network connectivity.

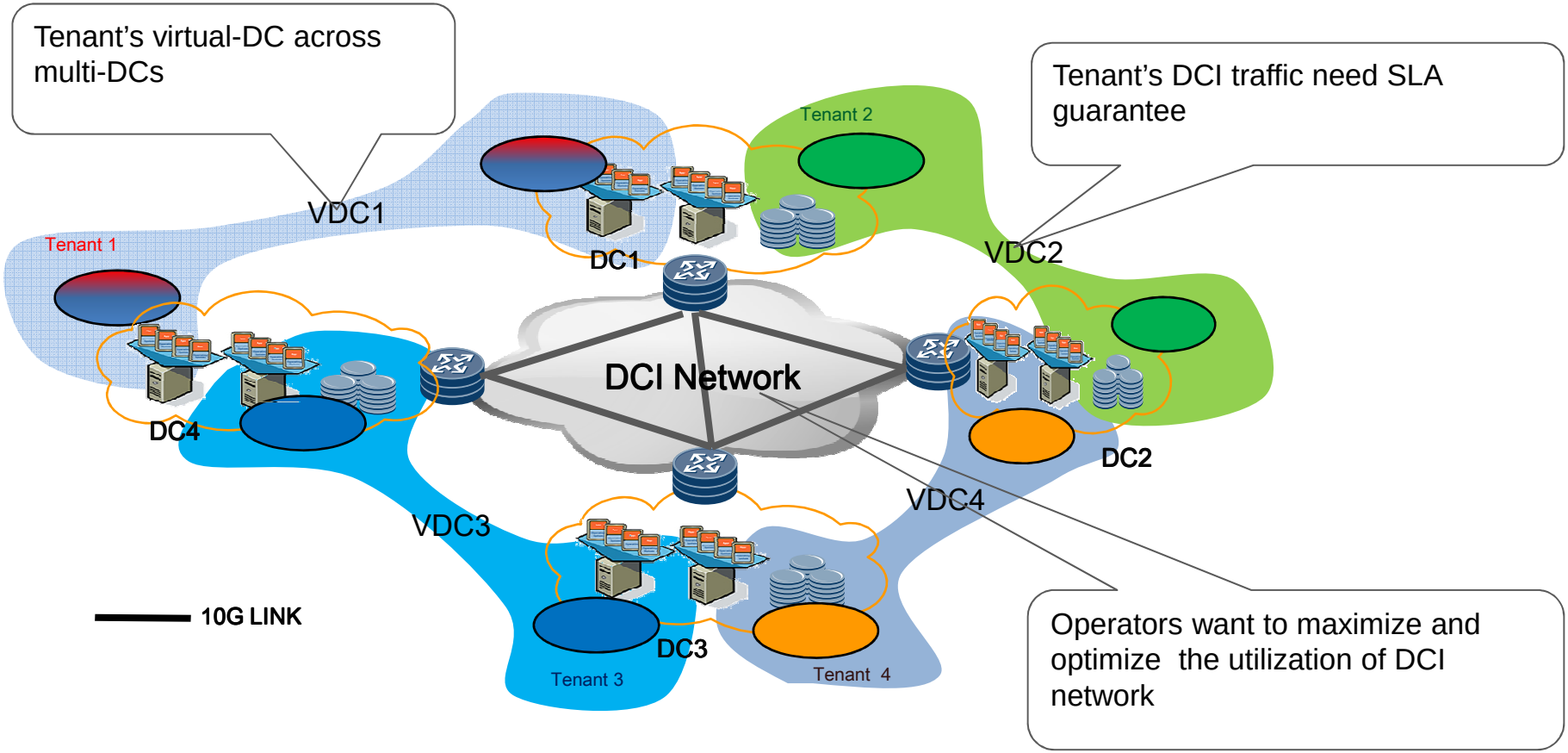




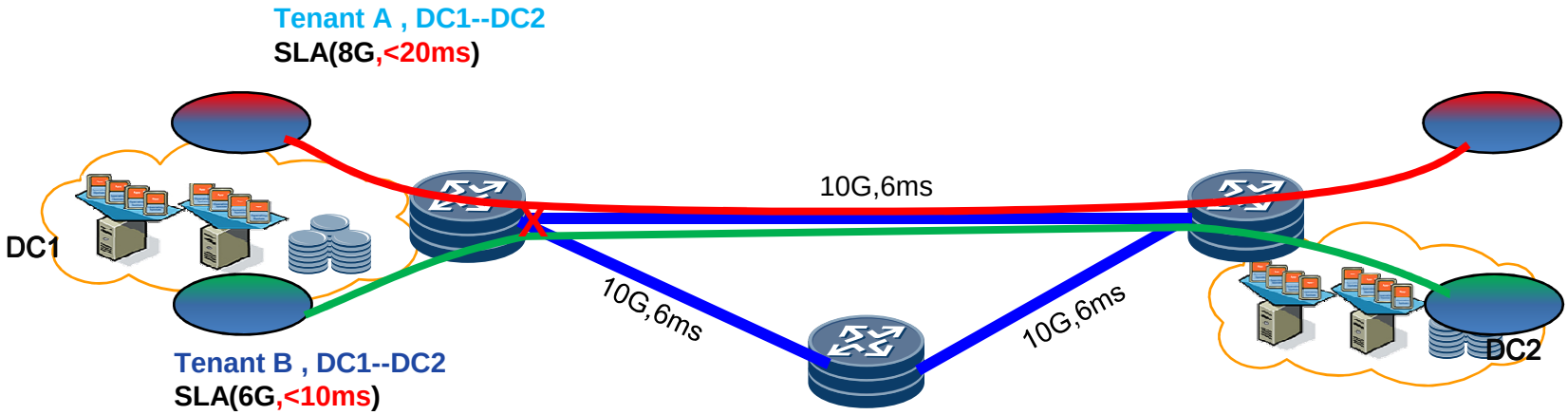
Tencent Service Model

HUAWEI

Key Requirements for DCI Network

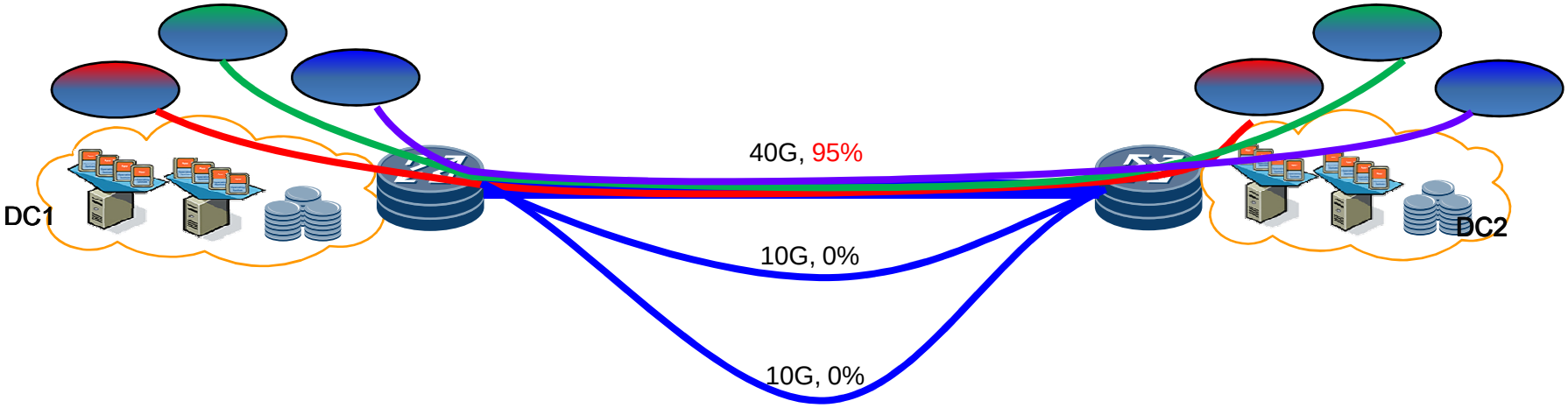


Resource Conflict in Multi-Tenancy



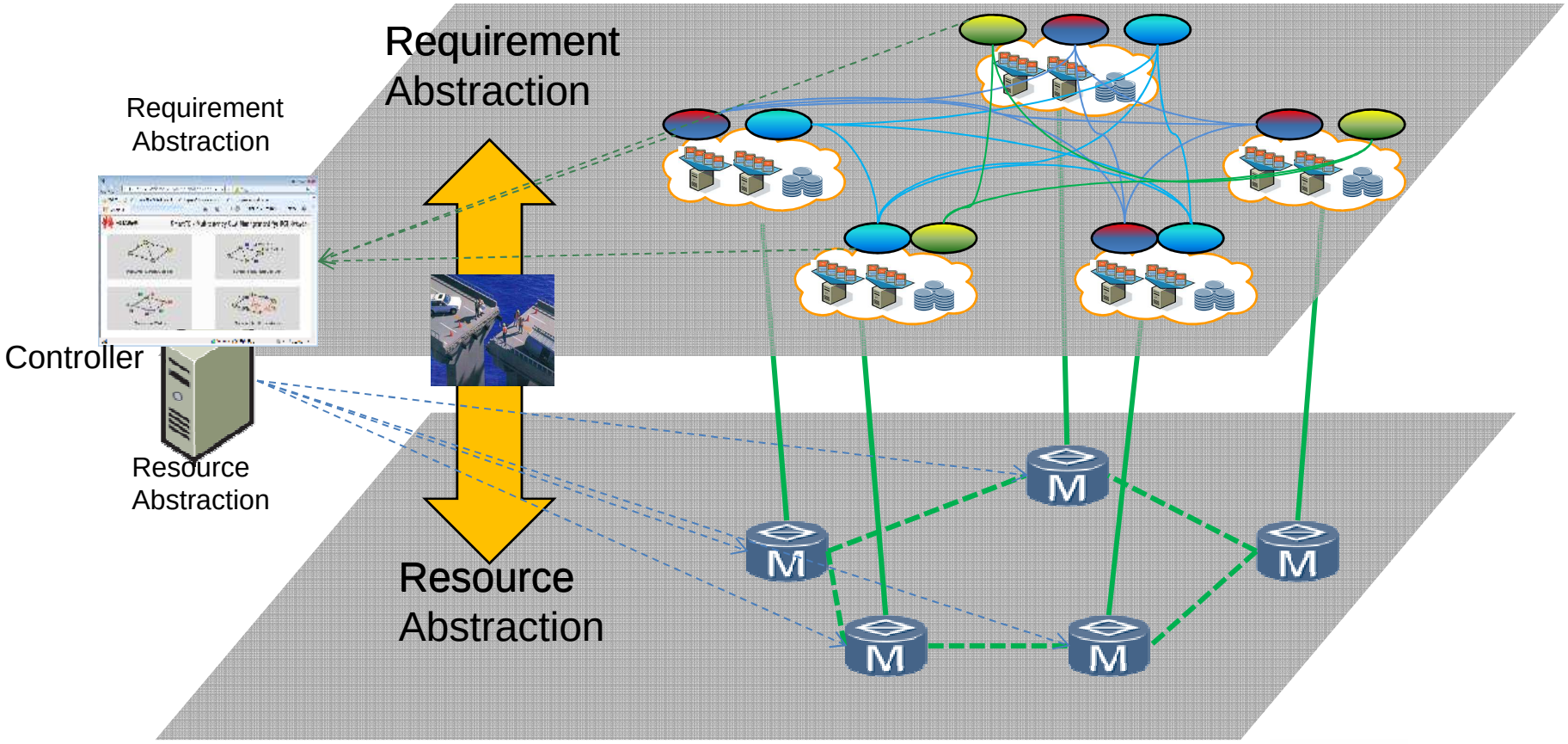
- Tenant A is first user, it uses shortest path
- Tenant B is next user, only one path can meet its SLA, but there is not enough BW
- Reason? - Lack of global SLA information for effective Traffic Engineering

Unbalanced usage of network resources

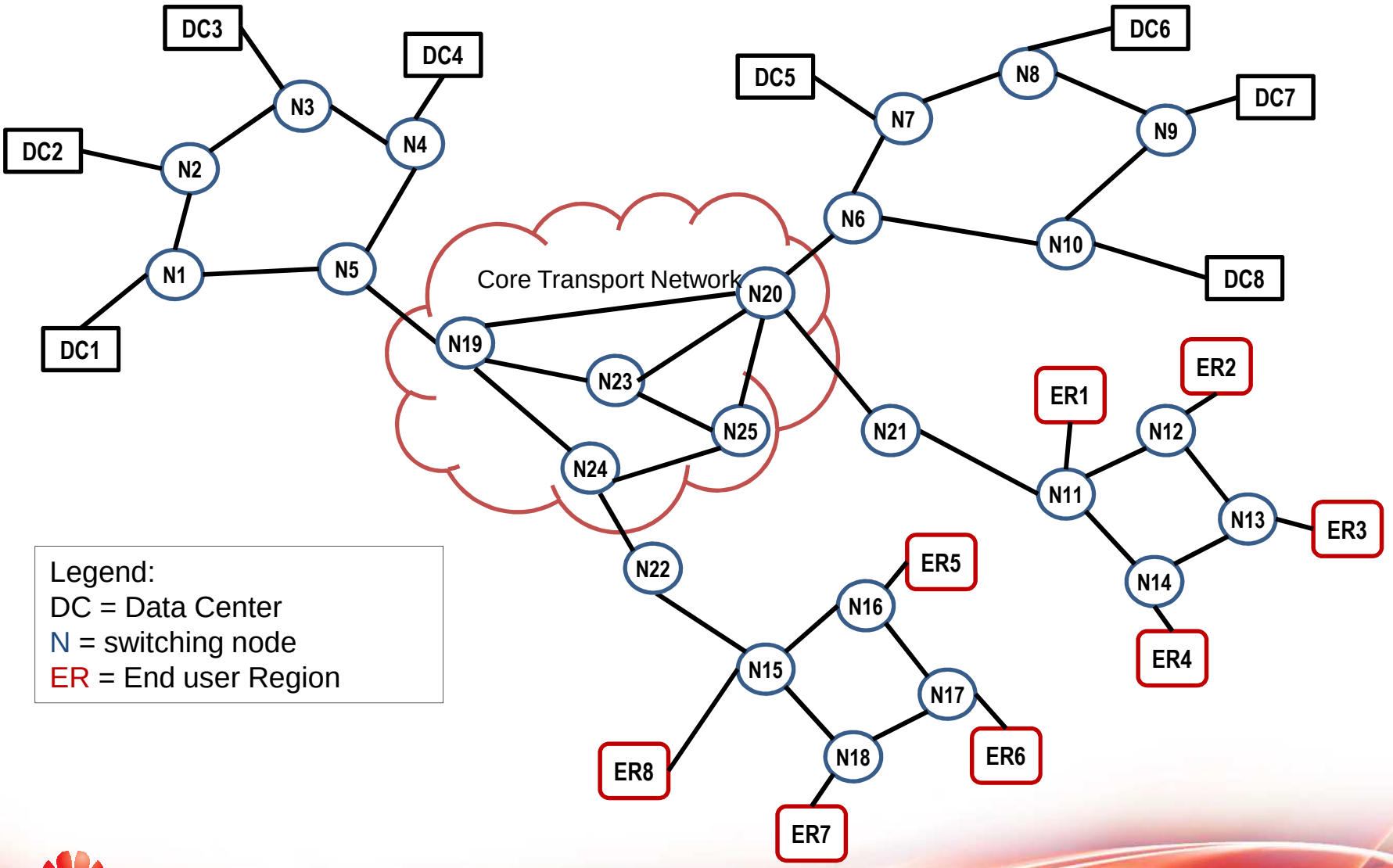


- Without global traffic information, some hot links always reach its threshold
- Legacy asset(low speed port) cannot be used effectively
- Reason? - Lack of global view of network and fine flow management capability

What causes these challenges

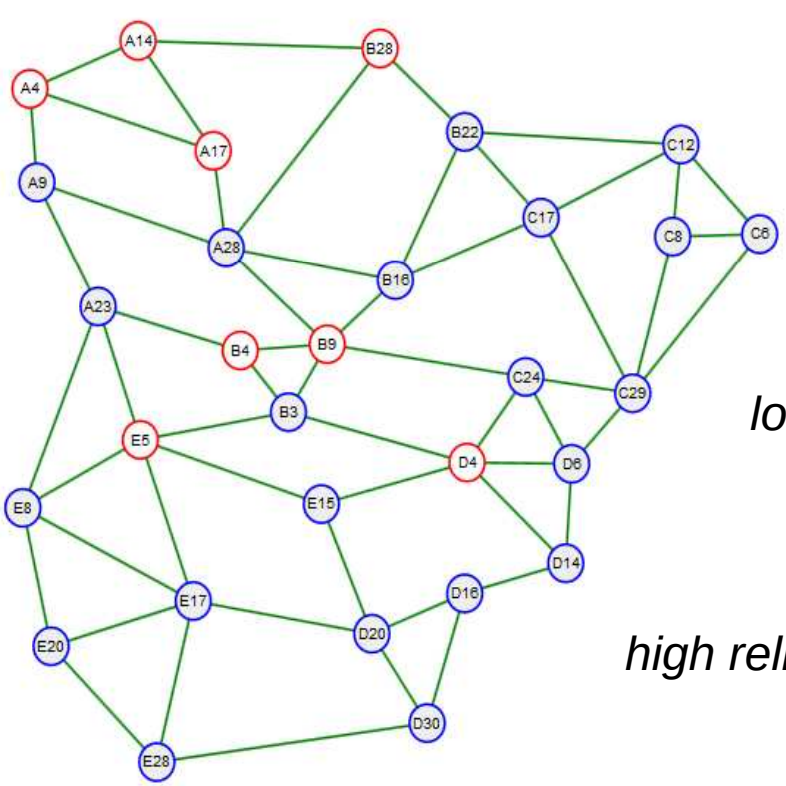


Example Transport Network Physical Topology



Service Specific Topology Reduction

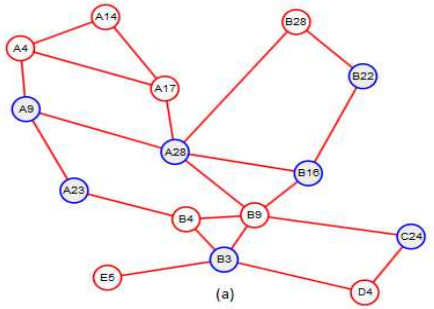
Communicating Nodes:
("A4","B9"), ("A14", "B4"), ("B28","E5"), and ("A17","D4").

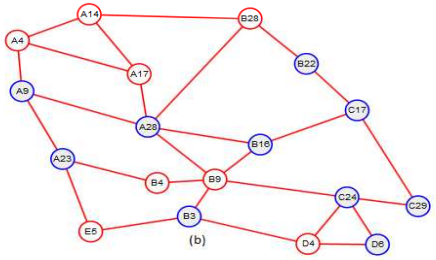


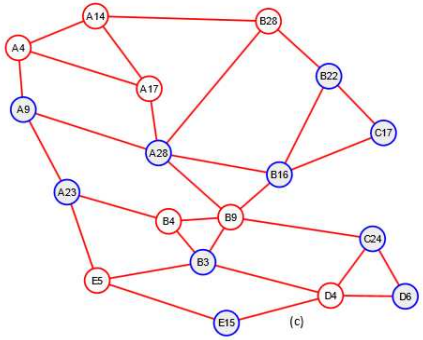
lowest latency

lowest cost

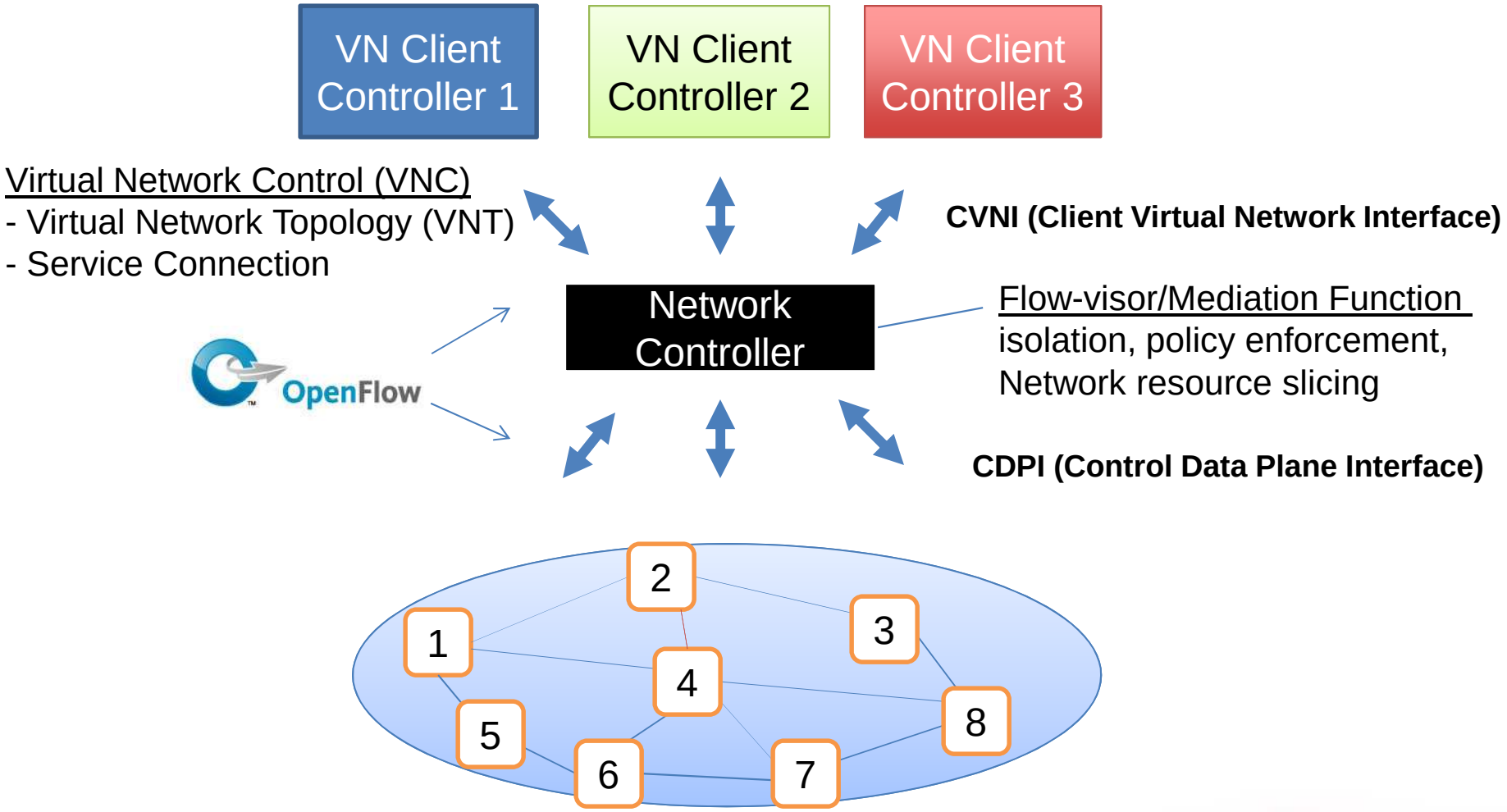
high reliability



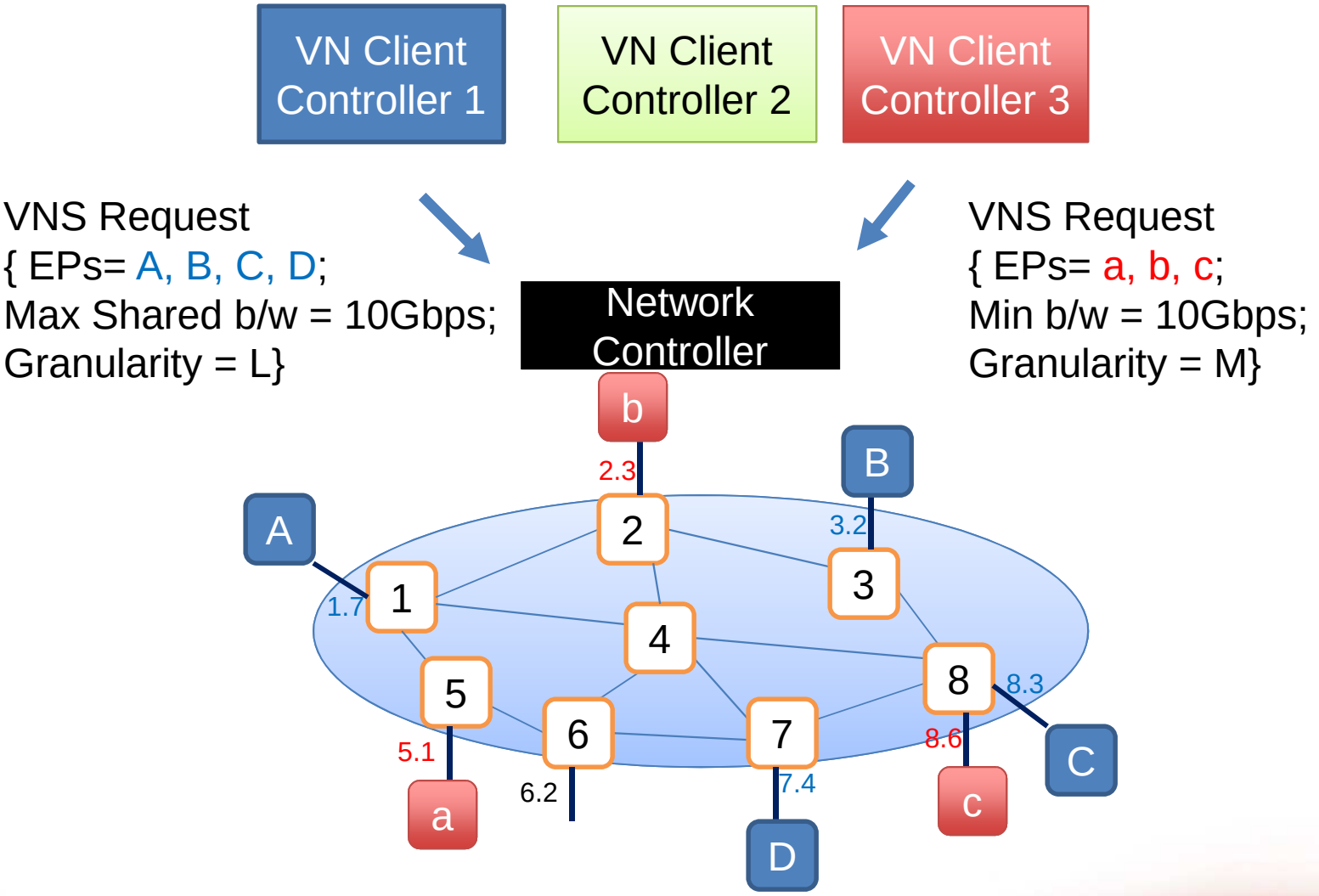




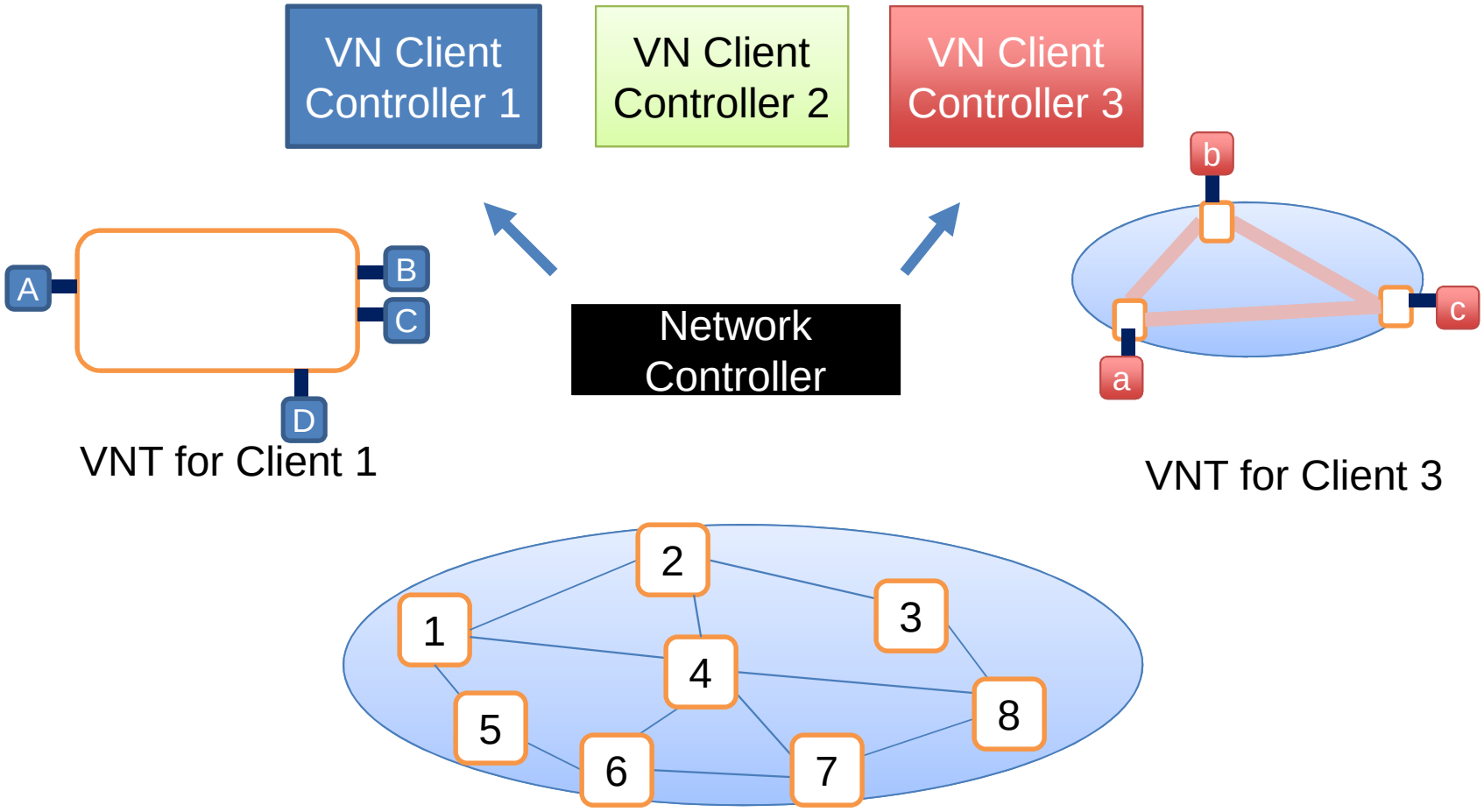
Network Architecture



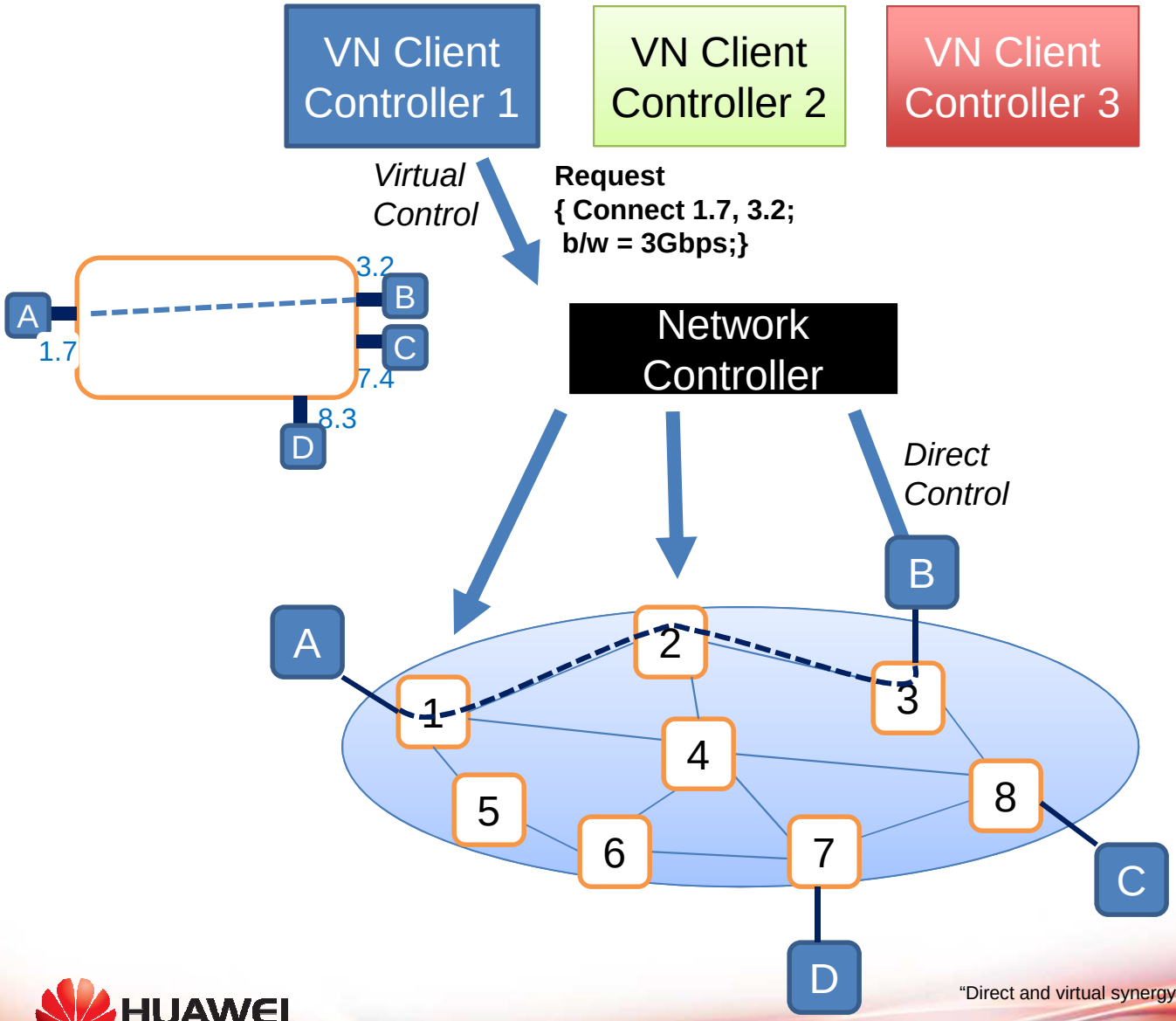
Virtual Network Service Request



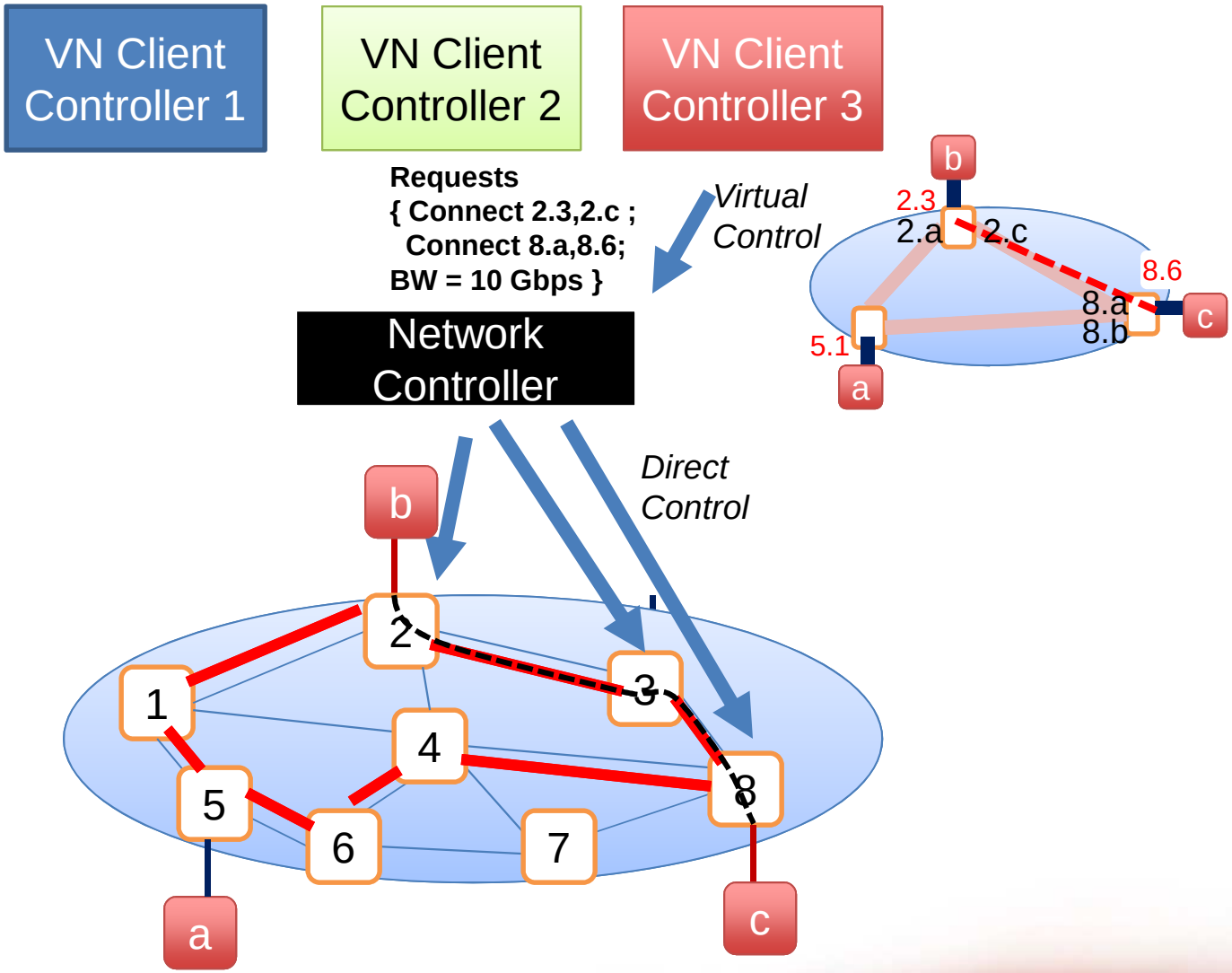
Virtual Network Service Reply



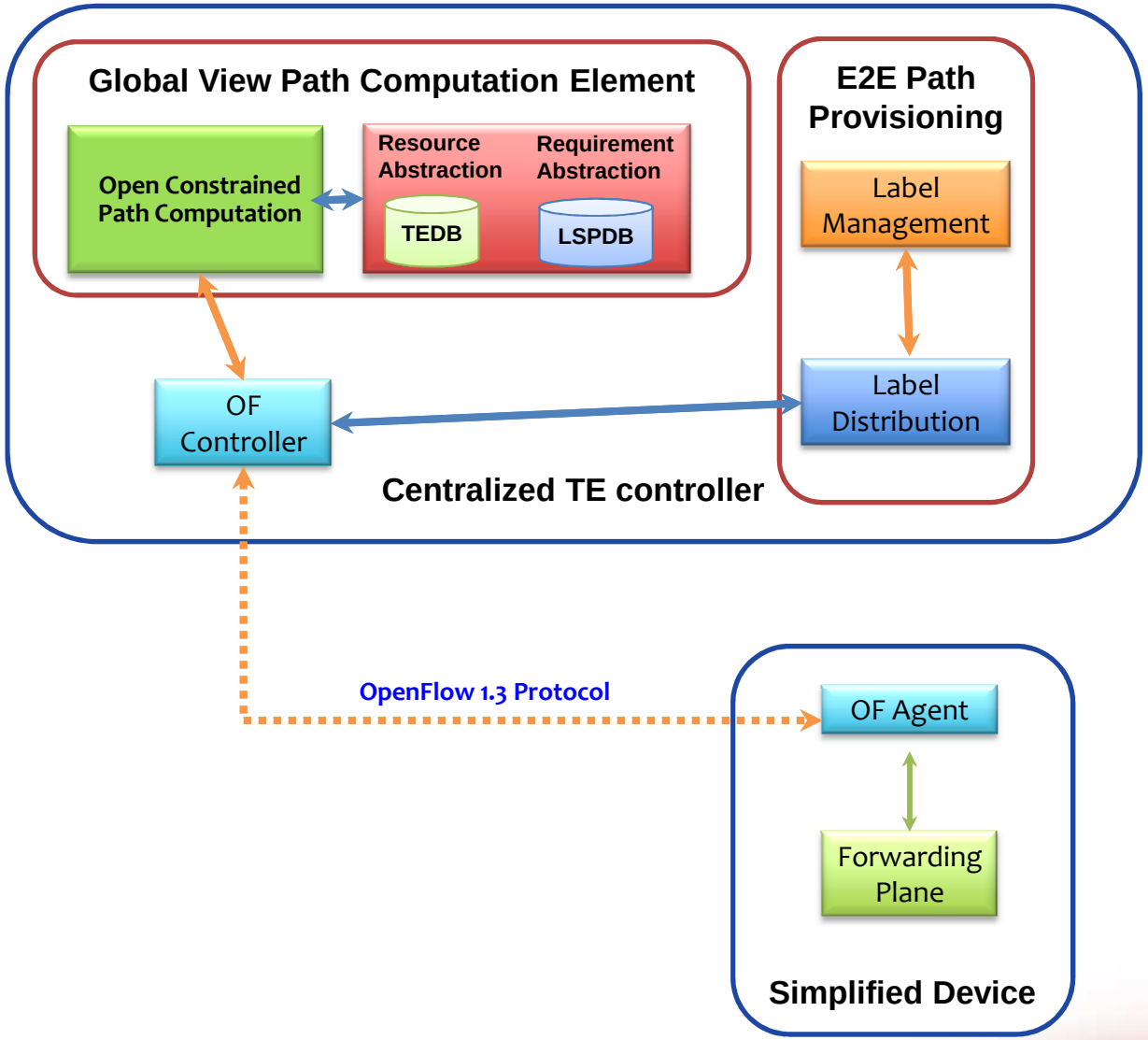
Service Connection Request



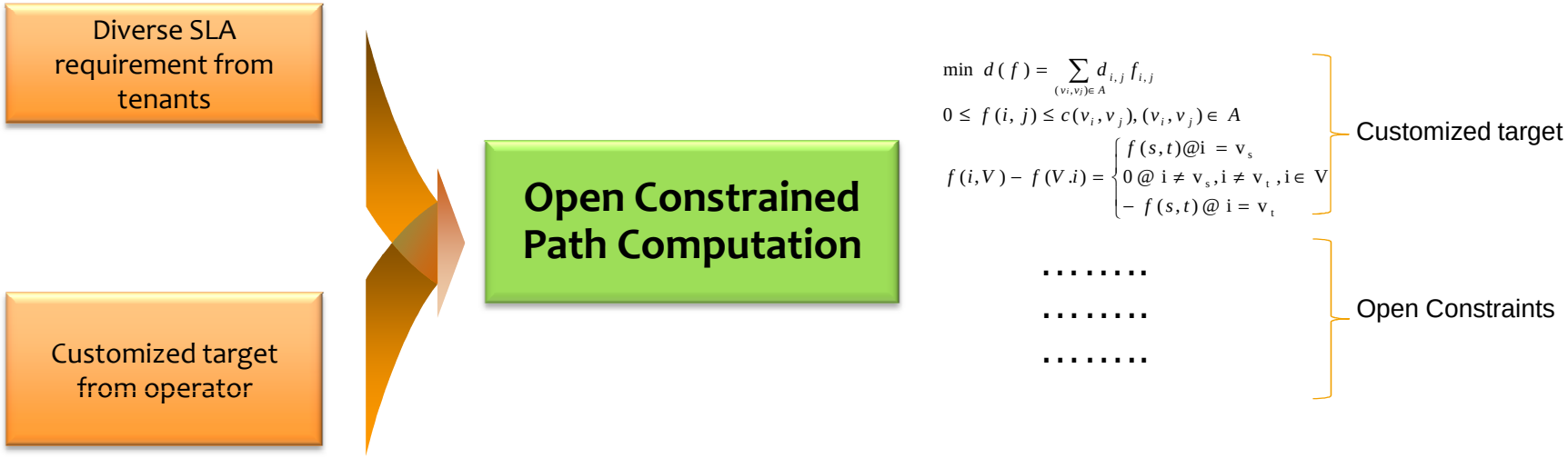
Service Connection Request



Centralized TE

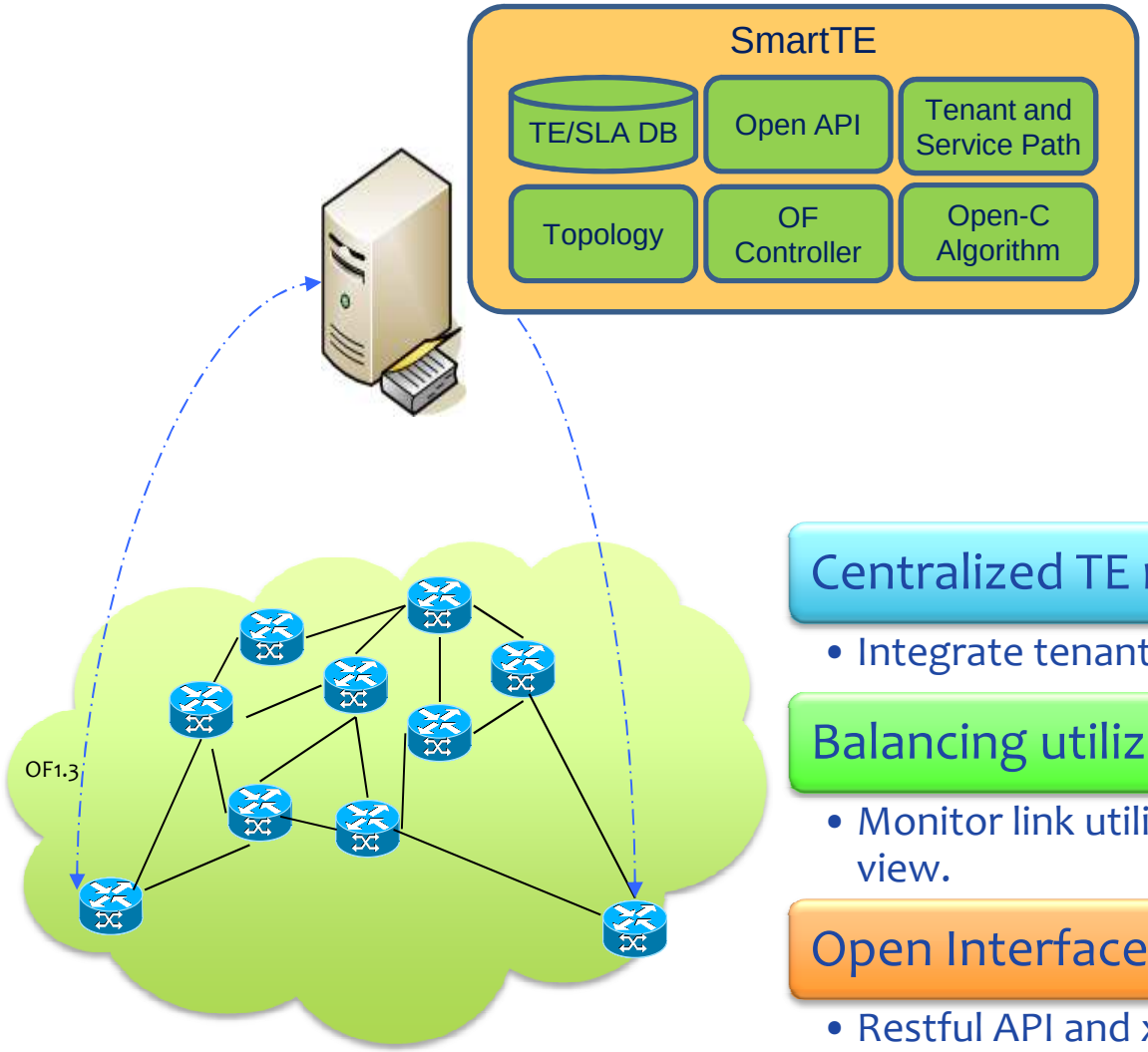


Open Constrained Path computation



Open capability is not only in Function but also in Algorithm

Centralized TE for DC multi-tenants SLA management



Centralized TE manage Multitenants SLA

- Integrate tenant and service path management.

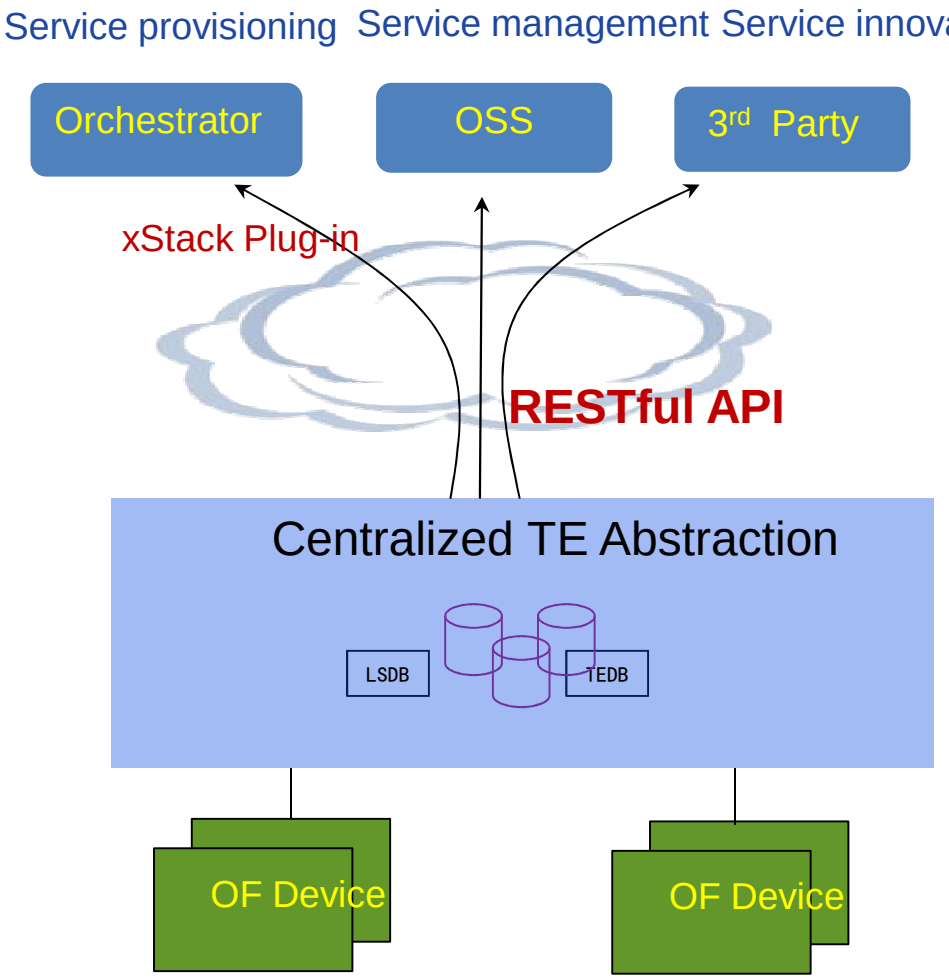
Balancing utilization of whole network

- Monitor link utilization and balance form global view.

Open Interface for easy integration

- Restful API and xStack plug-in make it easily integrated.

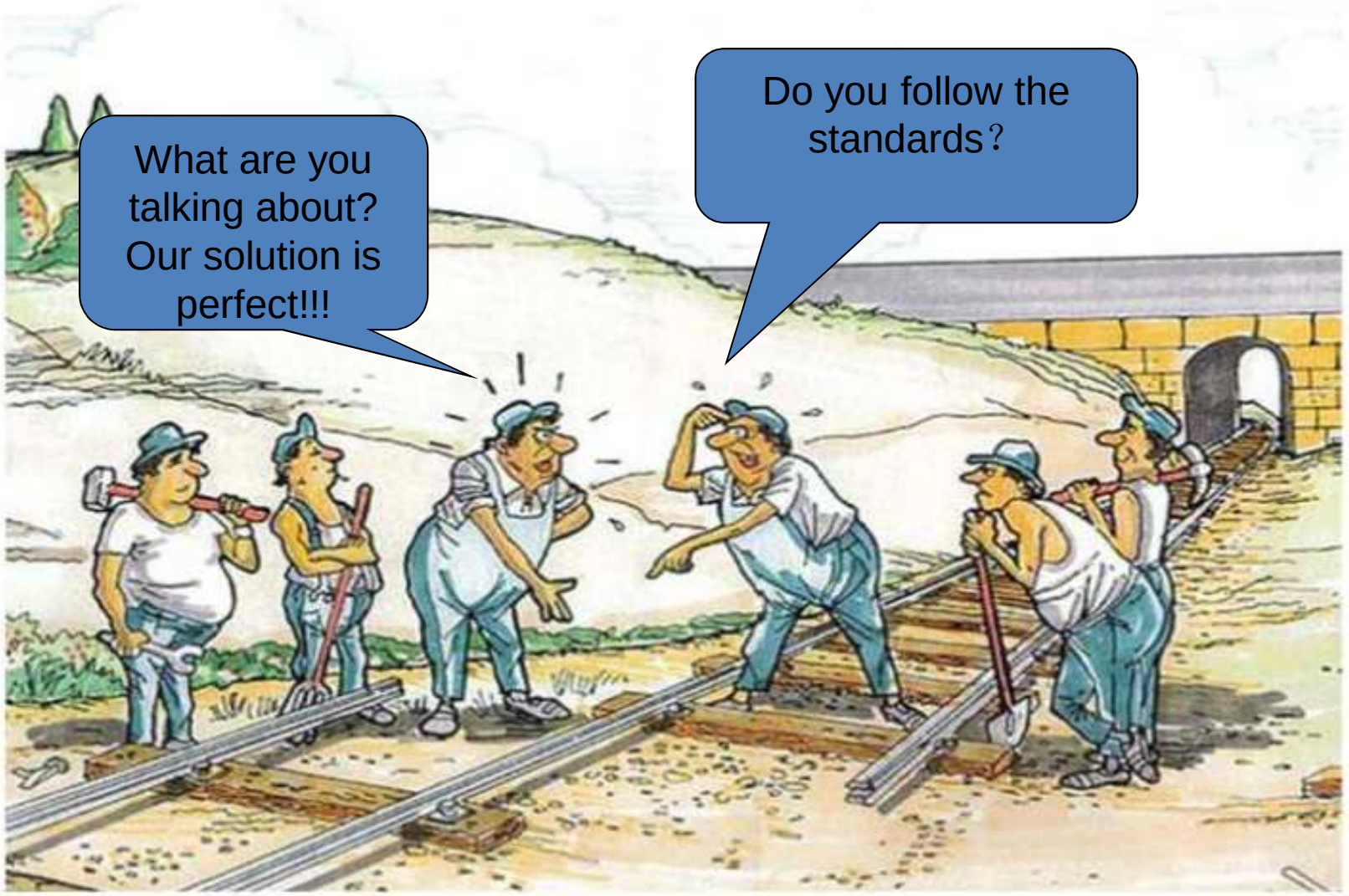
Open API of Centralized TE Controller



Abstraction of TE Controller:

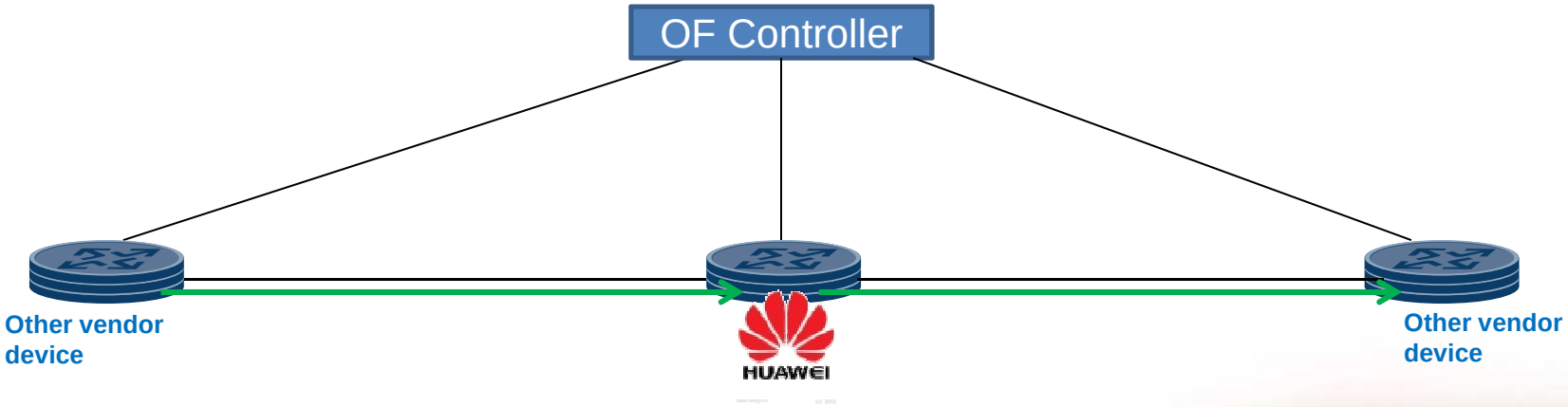
- **Resource Management**
  - **Topology Query**
  - **Resource Query**
- **Tenant Management**
  - **Create/Delete Tenant**
    - **Add/Del tenant's site**
    - **Add/Del tenant's SLA path**
    - **Tenent Mobility**
  - **Global SLA Path Management**

Interoperability and Compliance

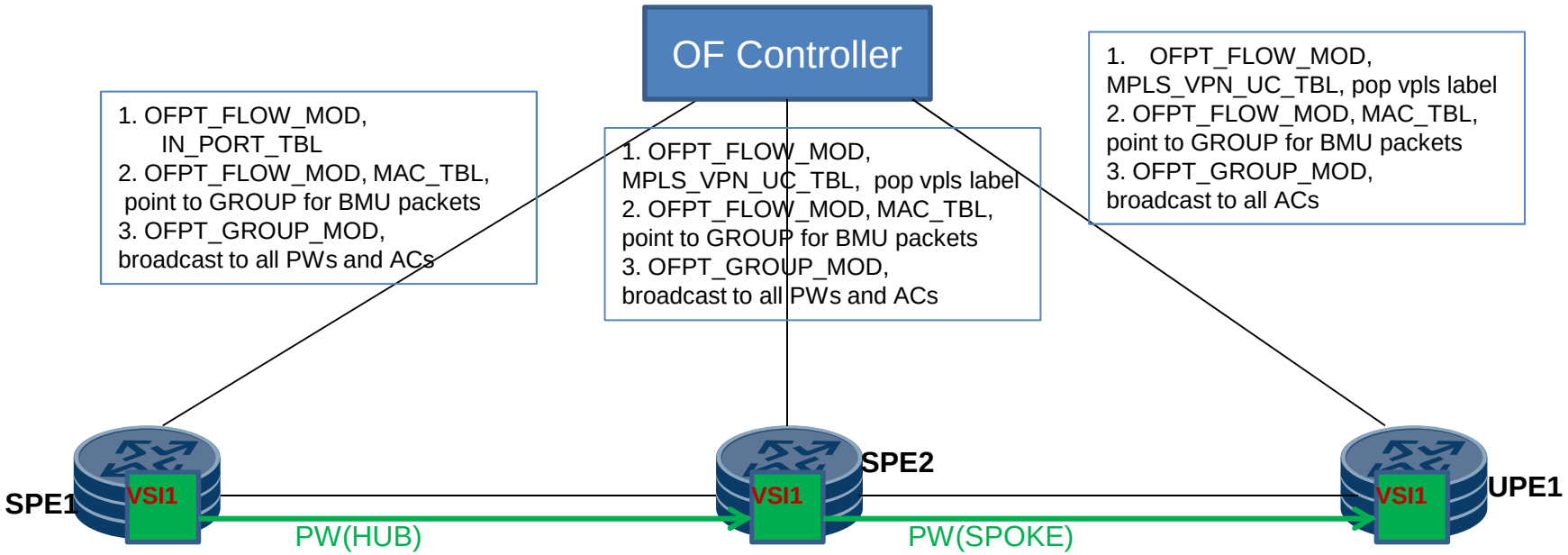


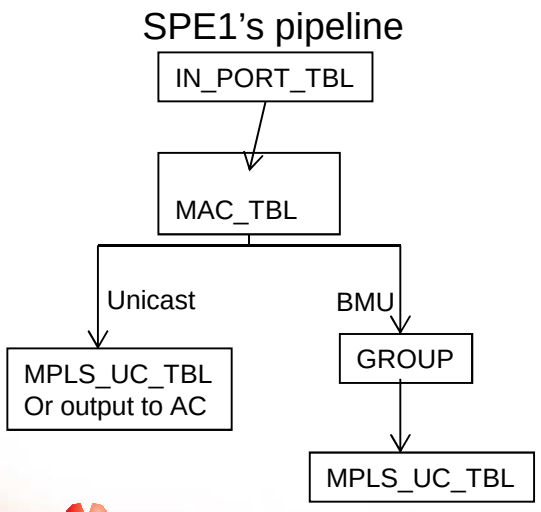
Interoperability challenges

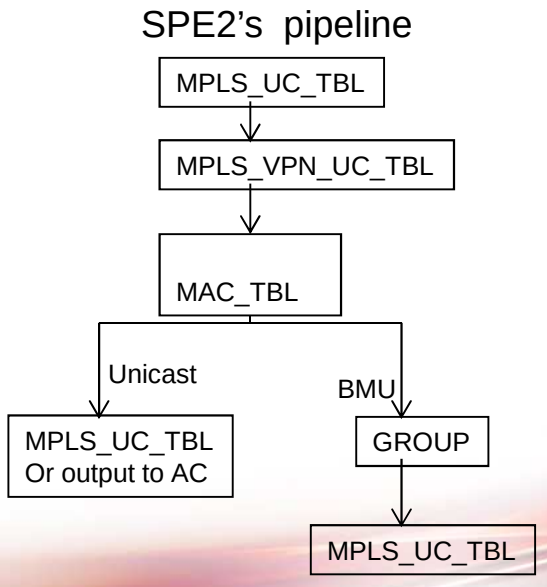
- How to guarantee controller can establish a E2E service use different vendor's OpenFlow Device?
- One vendor implements service using 5 match tables, other vendors maybe use 3 or 8 match tables. How to guarantee interoperability in these environments?
- ONF establishes Forwarding Abstraction WG to solve this problem.
- FAWG define TTP(Table Typing Pattern) for each service by OpenFlow.
- Demonstrated VPLS and TE TTP design and proposing to FAWG for discussion.

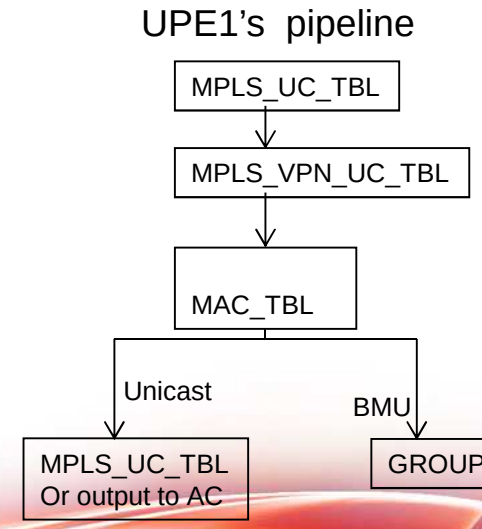


Example - Implementation in OpenFlow 1.3

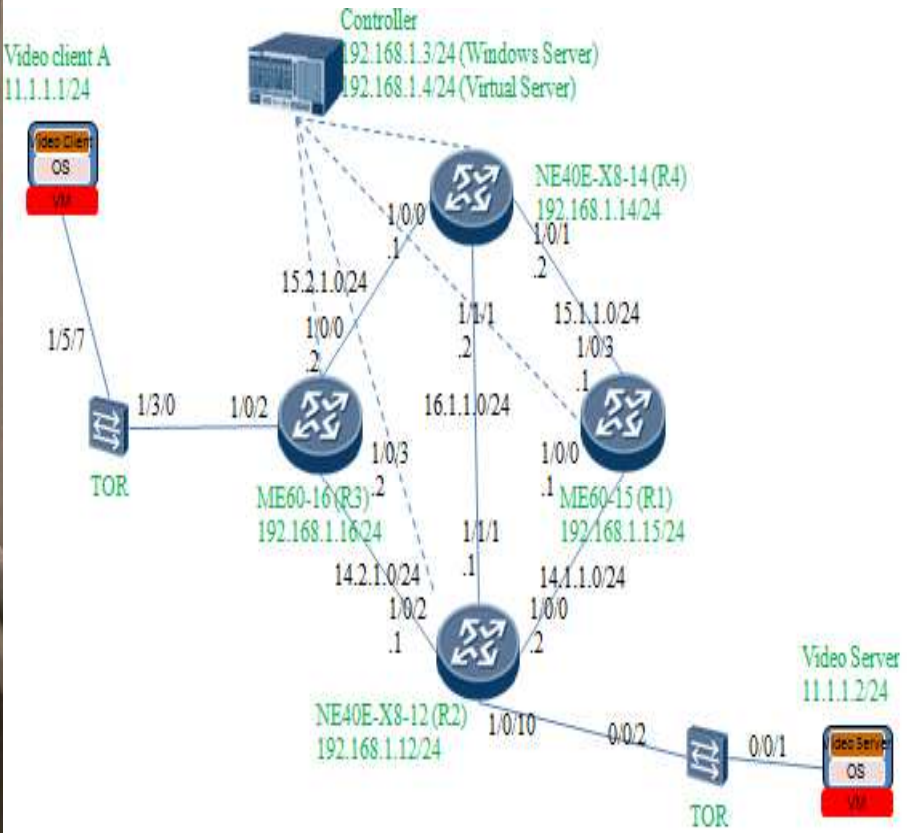






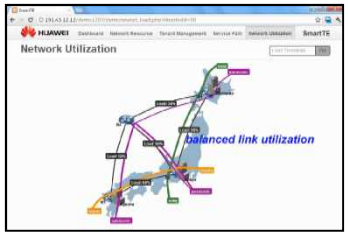


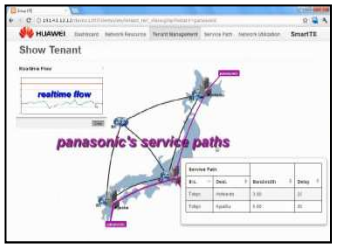
DCI Demo Details



OpenFlow 1.3 PE SDN Controller

The Framework of SDN For DC--SmartTE





SP Portal

Tenant Portal

Orchestrations (OpenStack/CloudStack)

Plugin/Restful API

SmartTE

TE/SLA DB | Open API | Open-C Algorithm

Topology | OF Controller | Tenant and Service Path

OpenFlow1.3

DC Controller

OF Agent

NE40E

Benefits

- Centralized TE management for tenant data path with global view
- Auto Provisioning of tenant's VPN/Bandwidth services
- Visualization of DC resources and tenant data path
- Real time monitoring of tenant traffic and network utilization
- Open Interface to integrate with Orchestrator/OSS/NMS
- Built on Open Standards

Thank You