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The role of MDA in the Control and Management plane of Metro Networks

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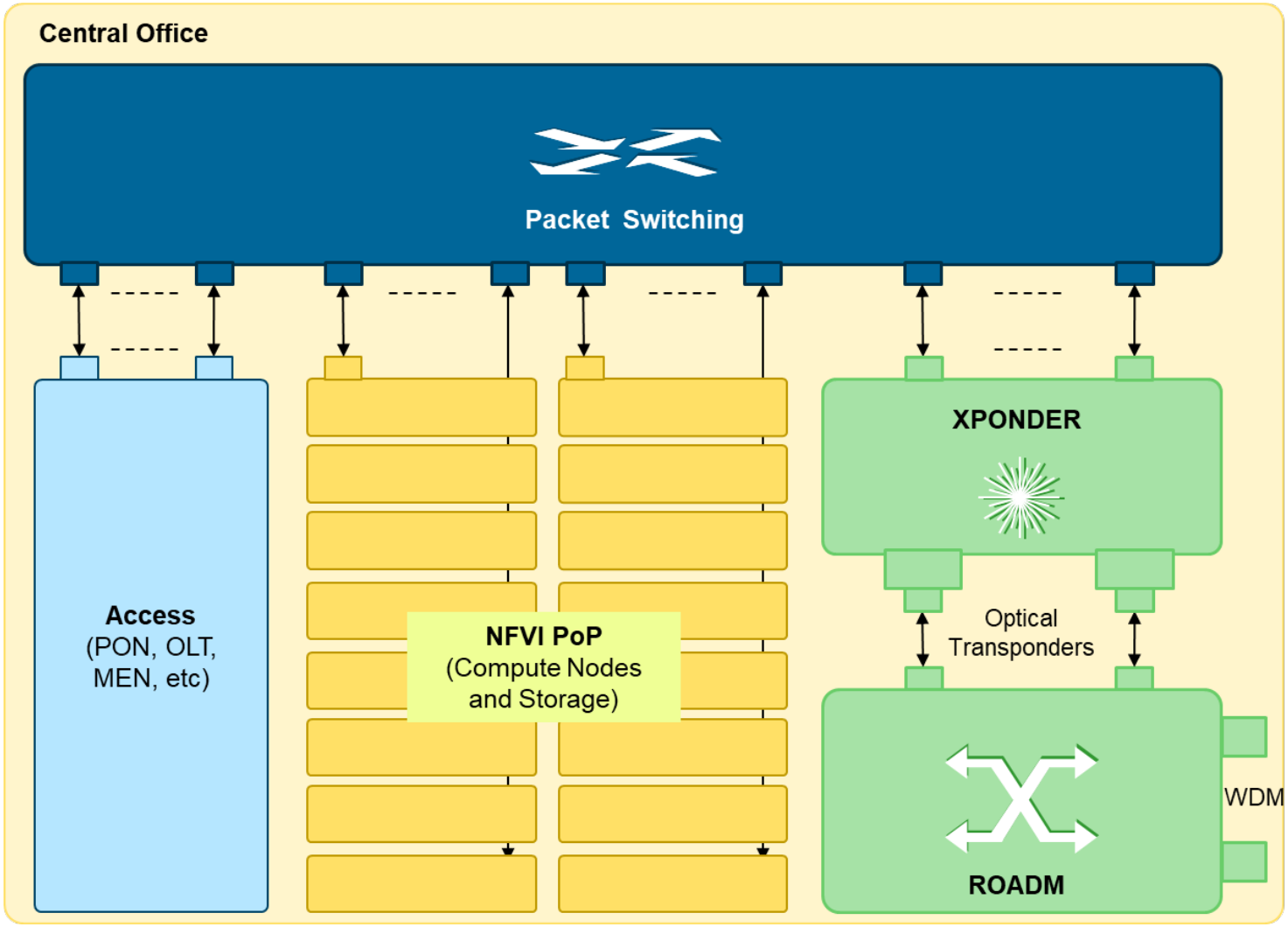
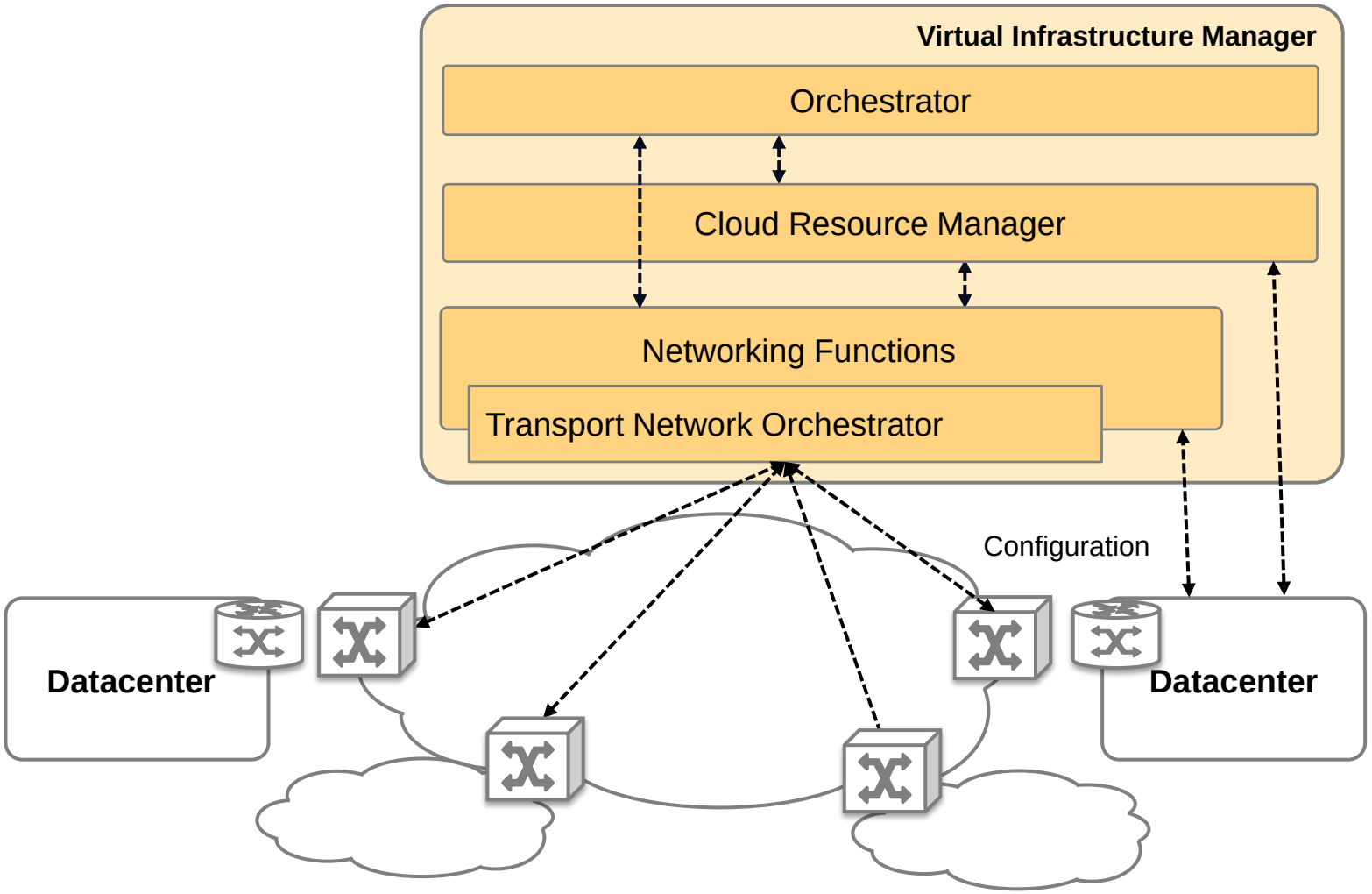
Central Office Architecture

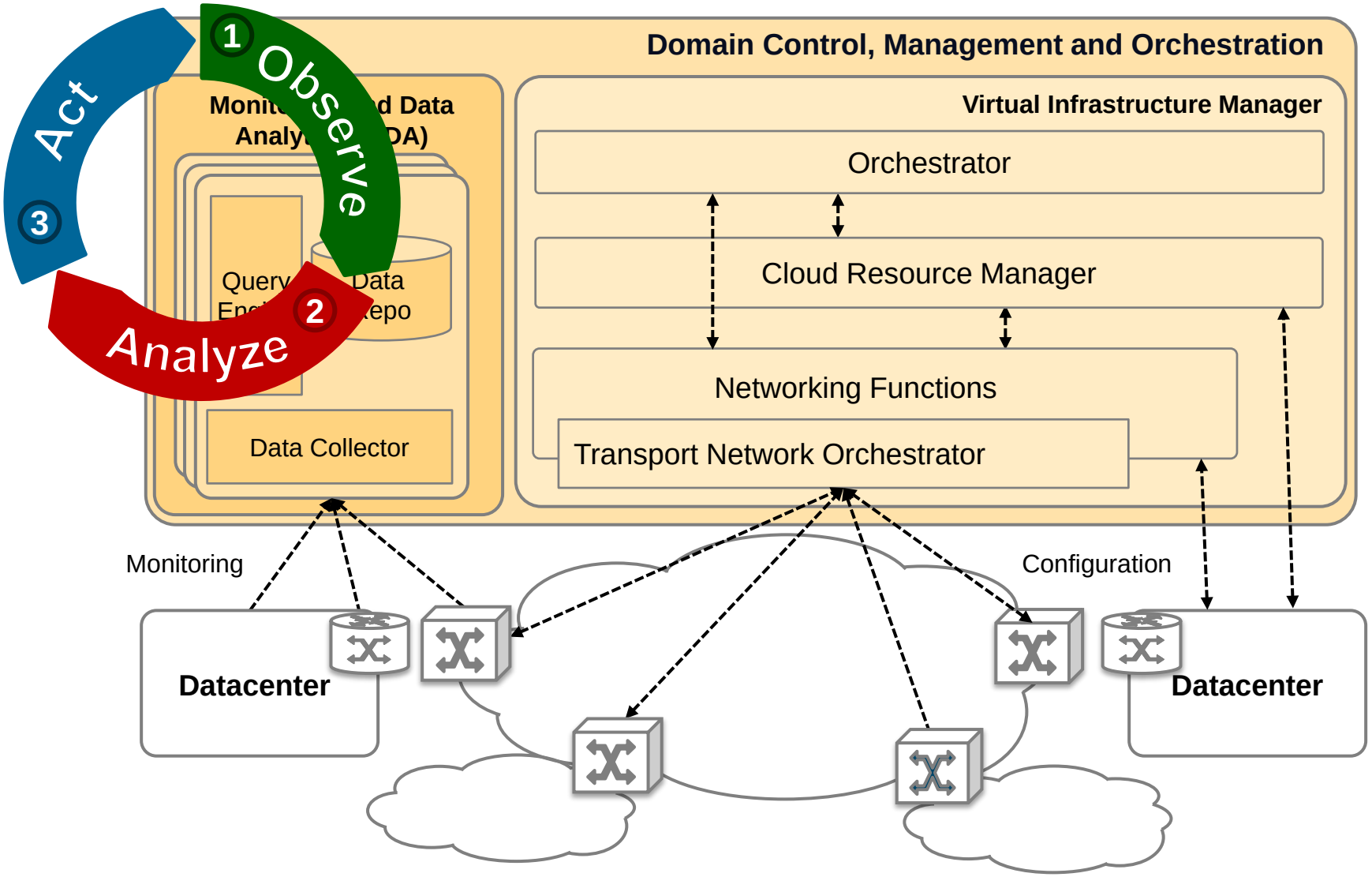


L. Velasco et al., "Building Autonomic Optical Whitebox-based Networks," IEEE/OSA JLT, 2018.

Orchestrating the Telecom Cloud

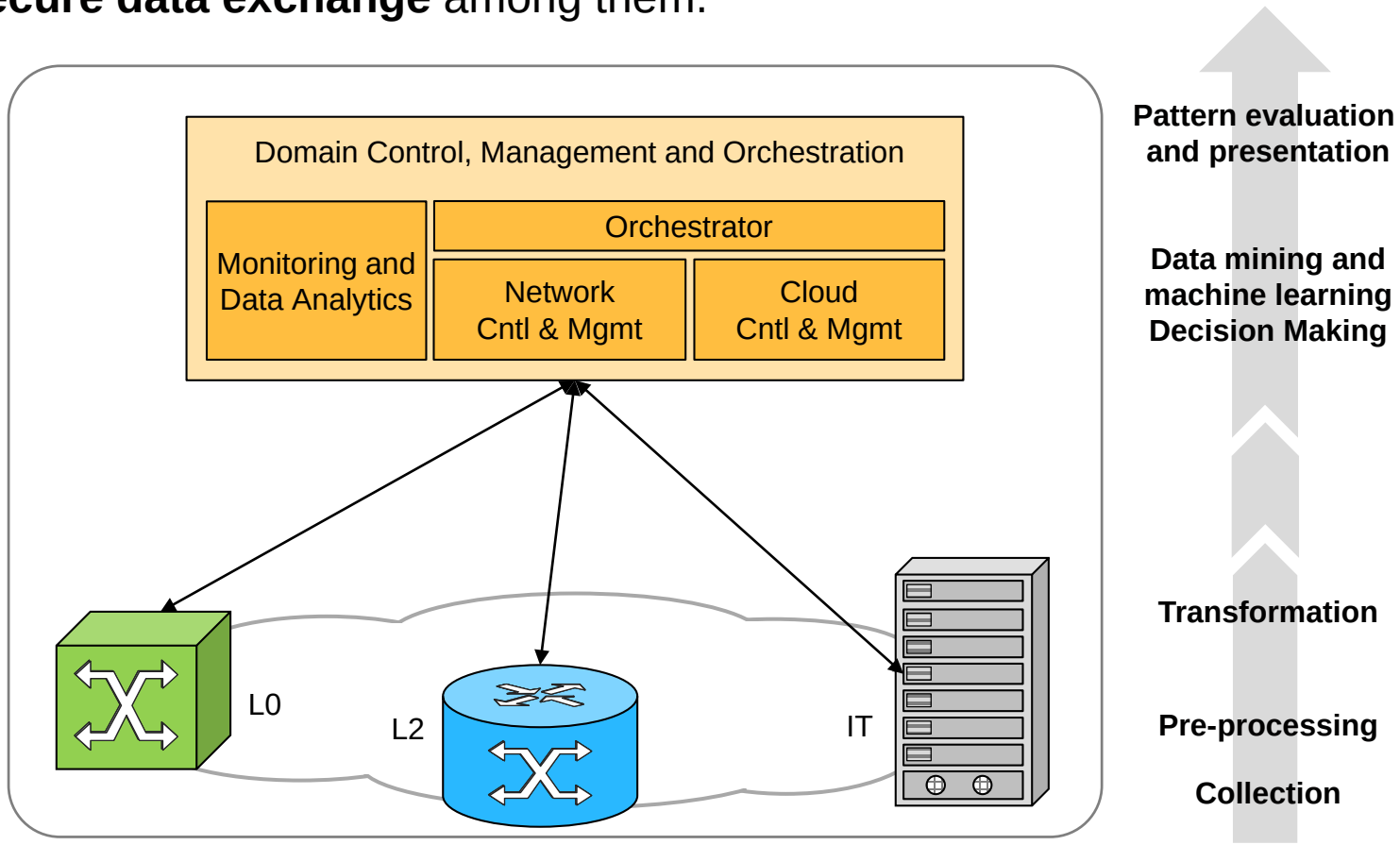


Applying Control Loops

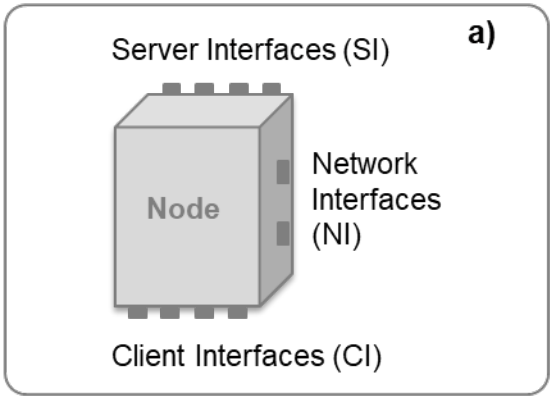


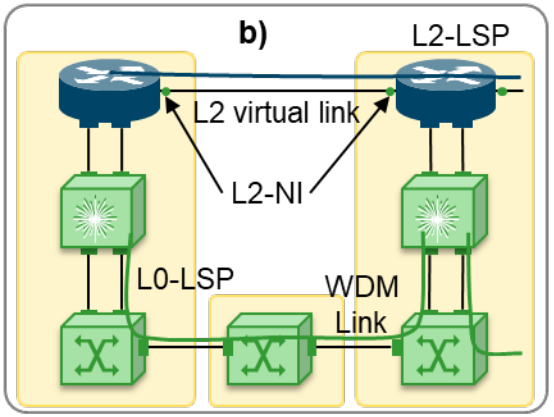
Architecture Overview

- **Single** monitoring and data analytics architecture for the whole infrastructure
- The MDA **connects virtualized components** together and enables **secure data exchange** among them.



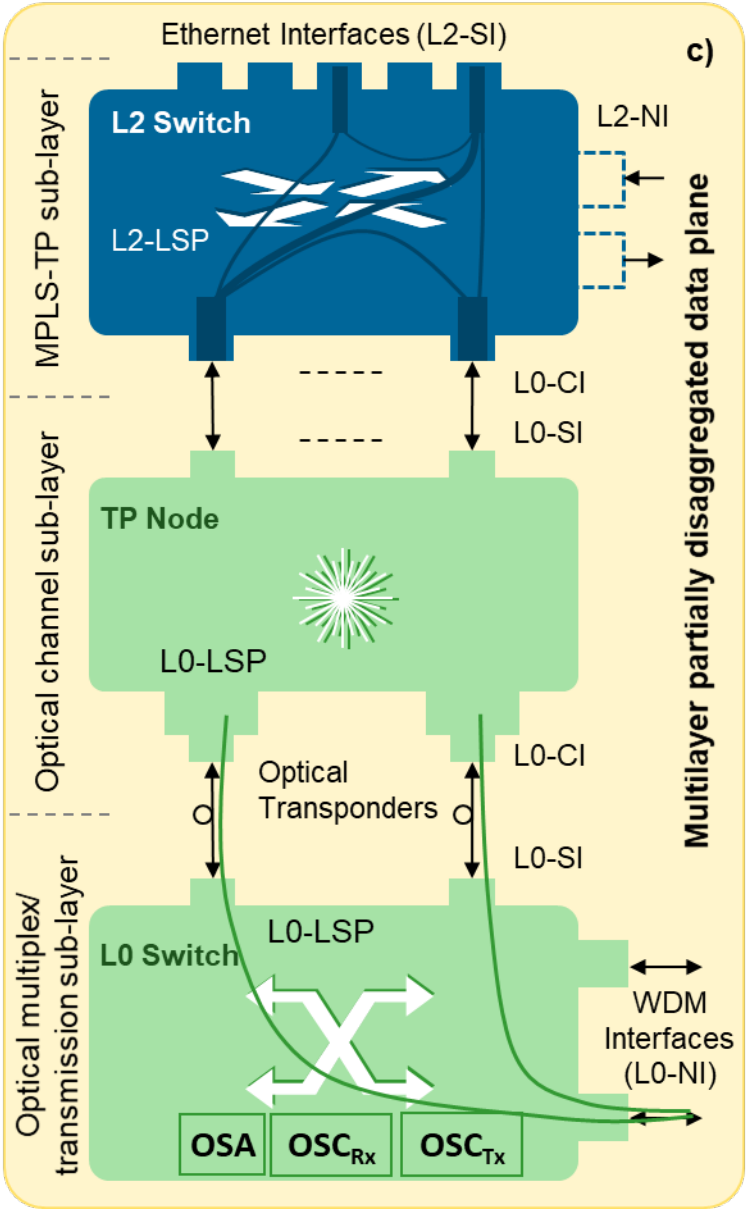
Observation Points





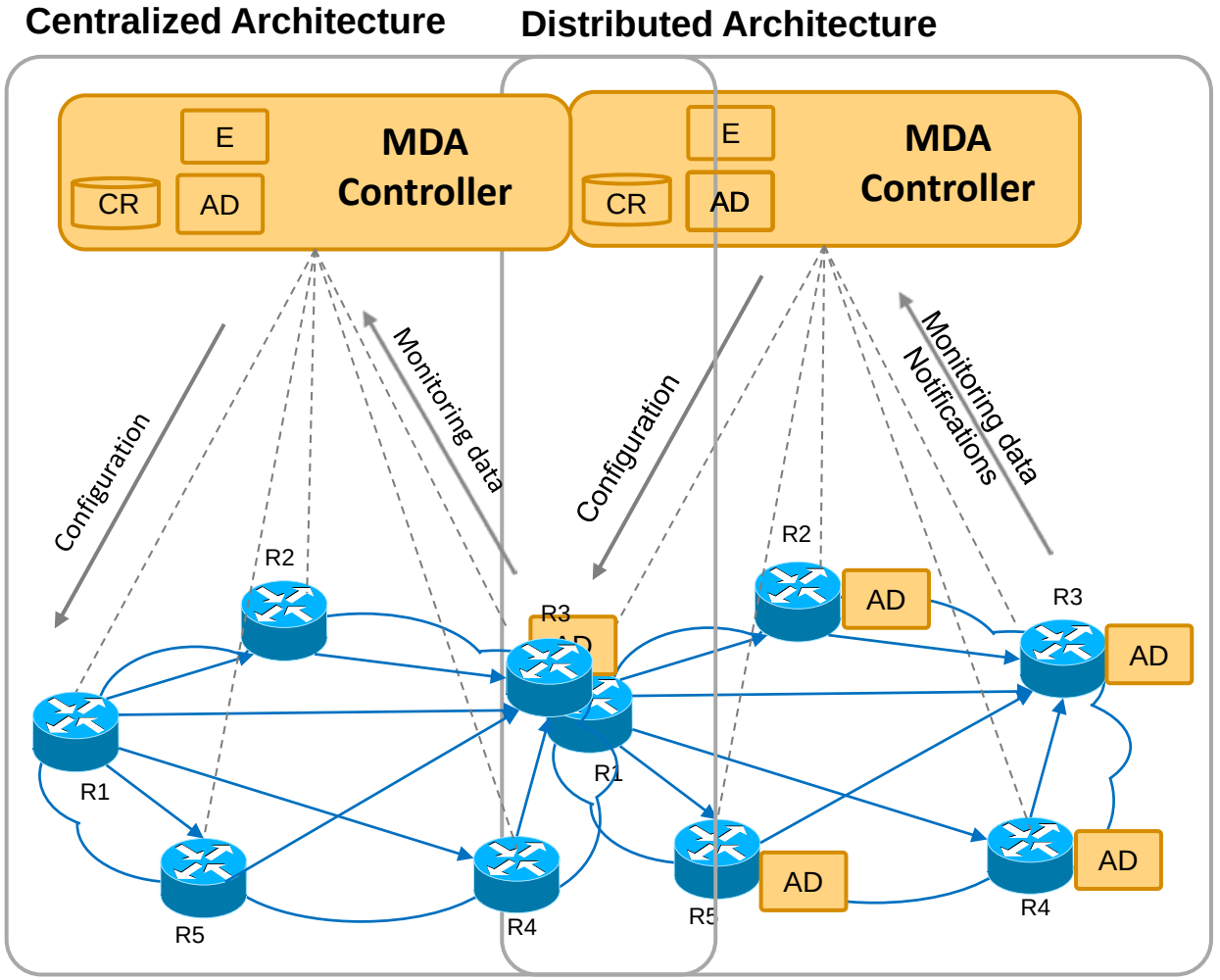
Monitorable components and data measured d)

1. L2-SI: Ethernet aggregated traffic
2. L2-NI: L2 aggregated traffic
3. L0-CI: Average optical power
4. L0-SI: Average optical power
5. L0-NI: Average optical power
6. L2-LSP: L2-LSP traffic
7. L0-LSP: L0-LSP BER and opt. power



L. Velasco et al., "Building Autonomic Optical Whitebox-based Networks," IEEE/OSA JLT, 2018.

Bringing Data Analytics to the Network Nodes



A. P. Vela et al., "Distributing Data Analytics for Efficient Multiple Traffic Anomalies Detection," *Elsevier Computer Communications*, 2017.

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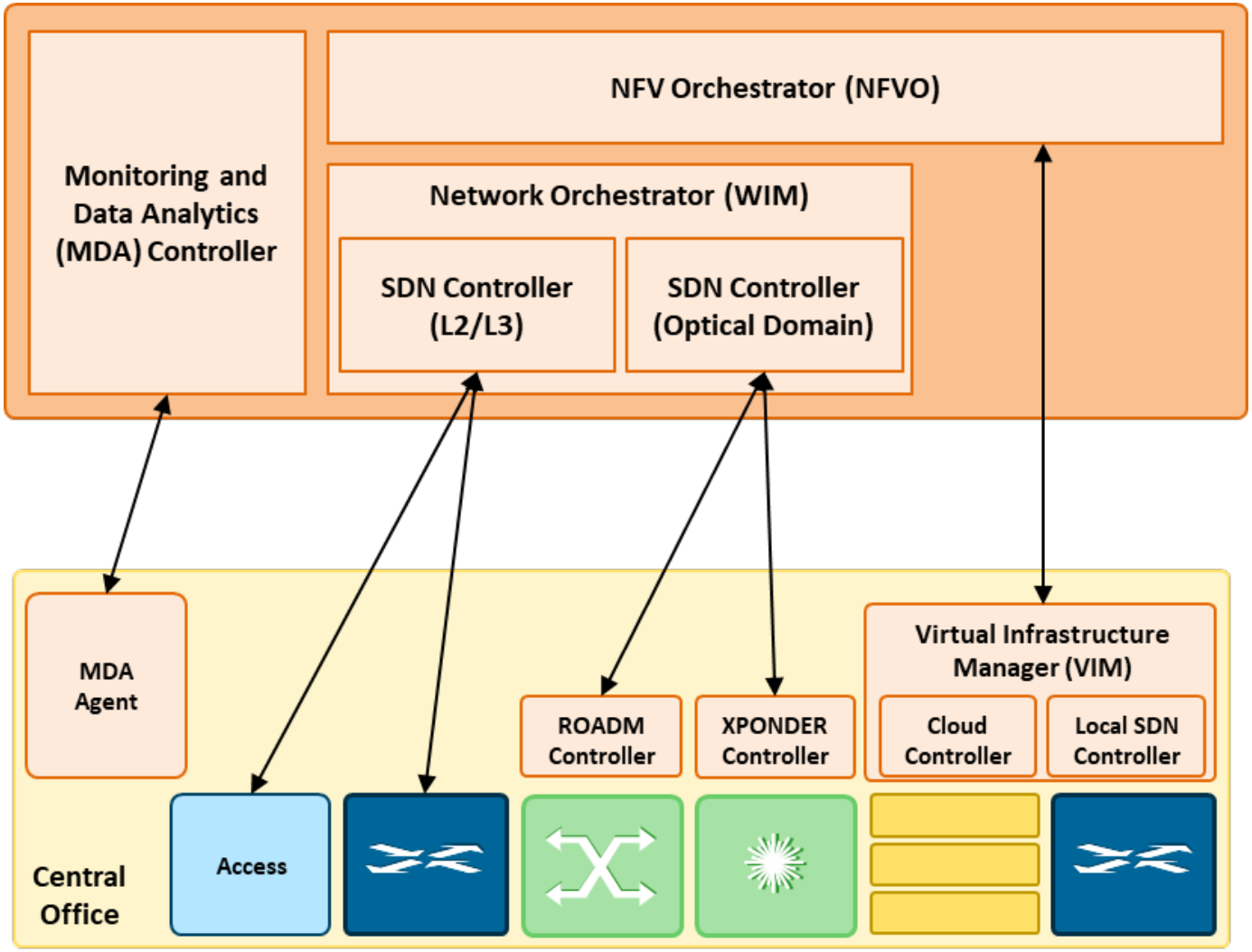
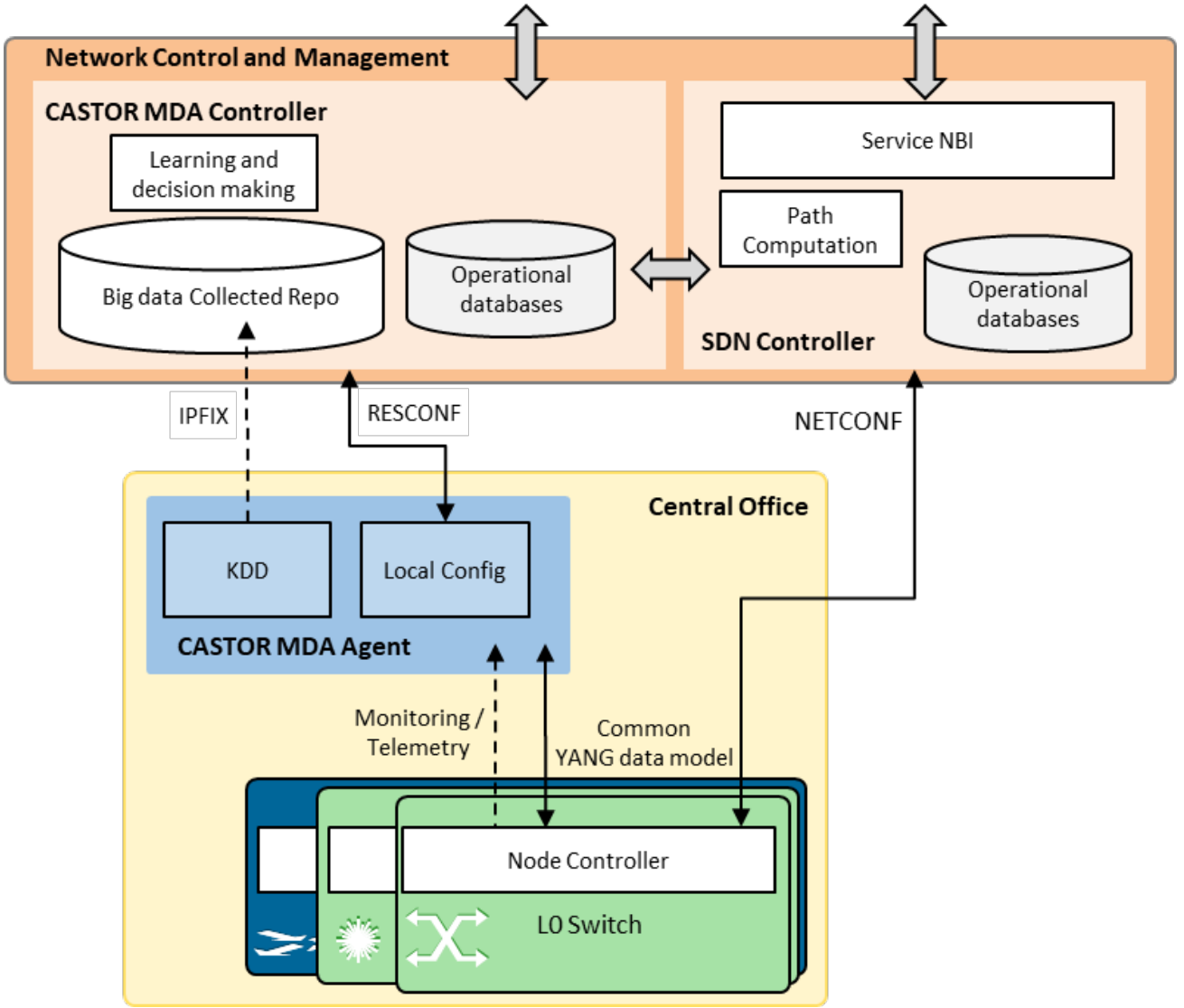
MDA and COM Architecture

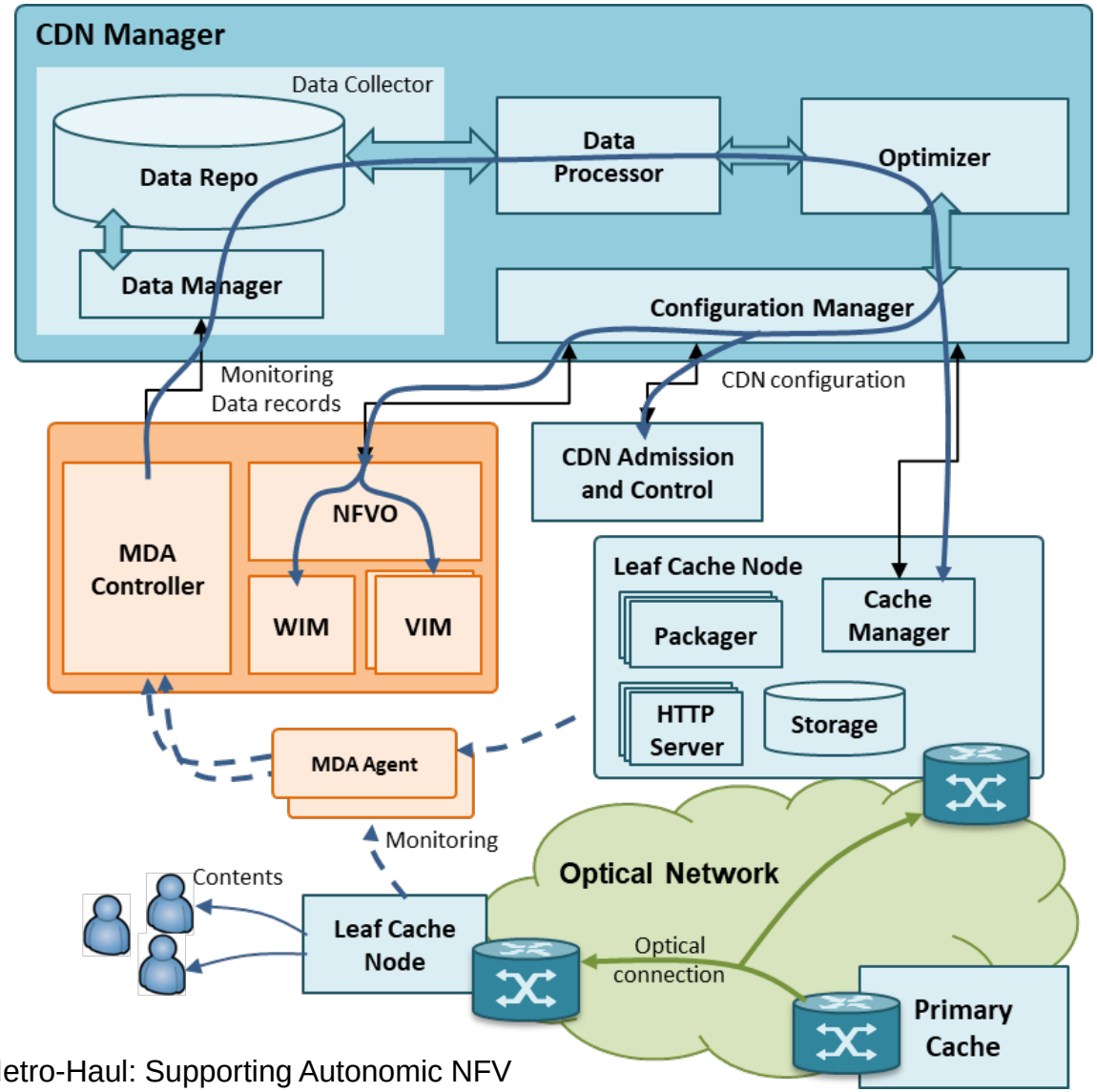
Conceptual COM Architecture



Architecture and Interfaces

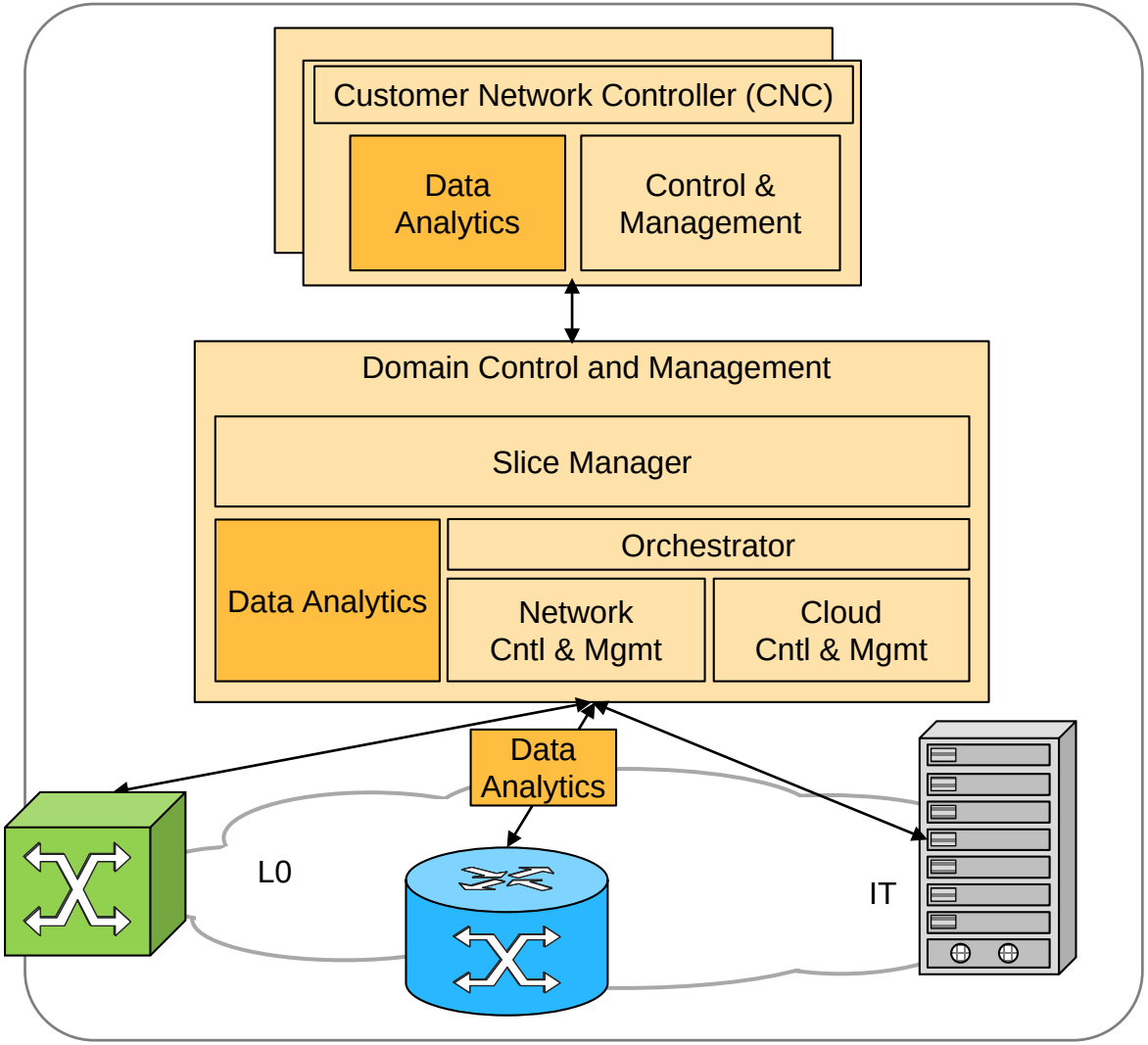


NFV Support



R. Casellas et al., "Metro-Haul: Supporting Autonomic NFV Services over Disaggregated Optical Networks," EuCnC, 2018.

Network Slicing Support



Pattern evaluation and presentation

Data mining and machine learning Decision Making

Network Slices

Pattern evaluation and presentation

Data mining and machine learning Decision Making

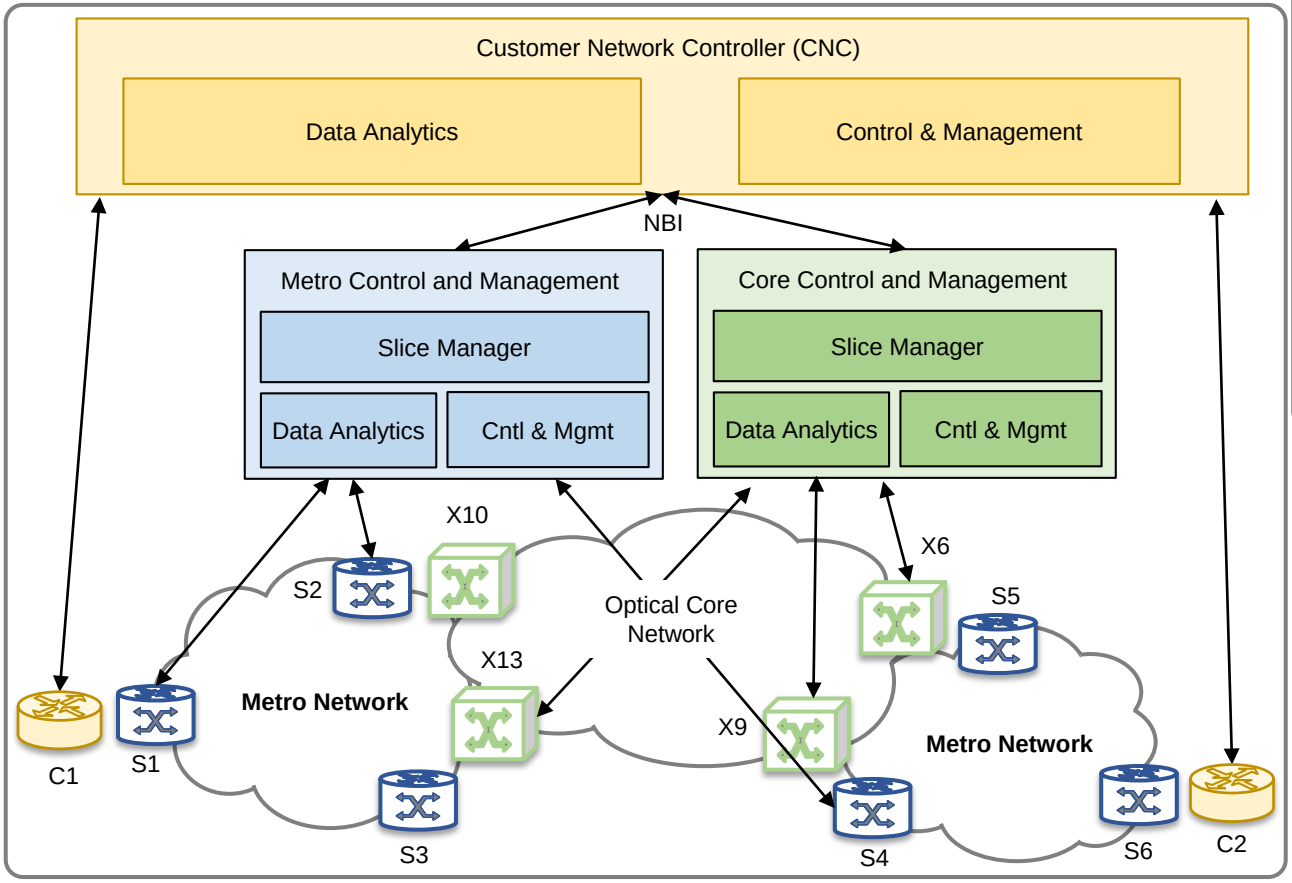
Operator Resources

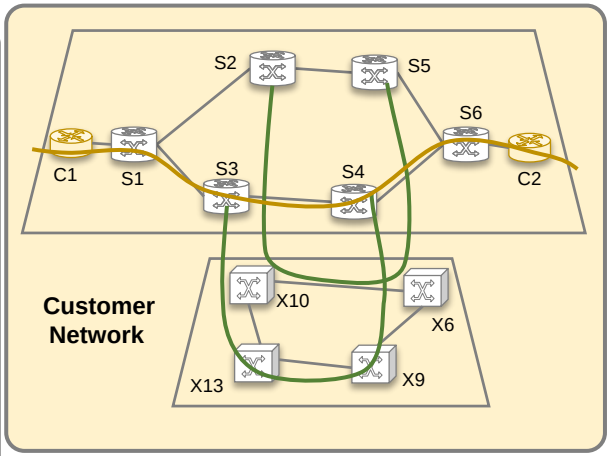
Transformation Decision Making

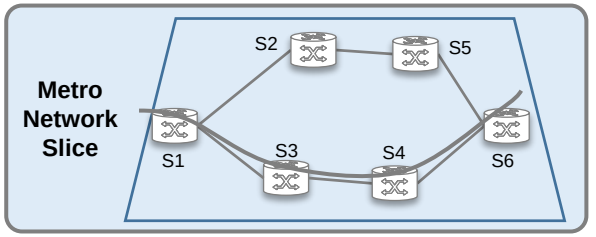
Pre-processing

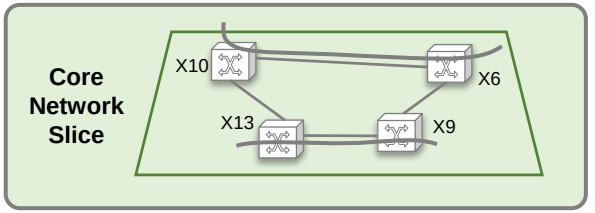
Collection

Example of Network Slicing



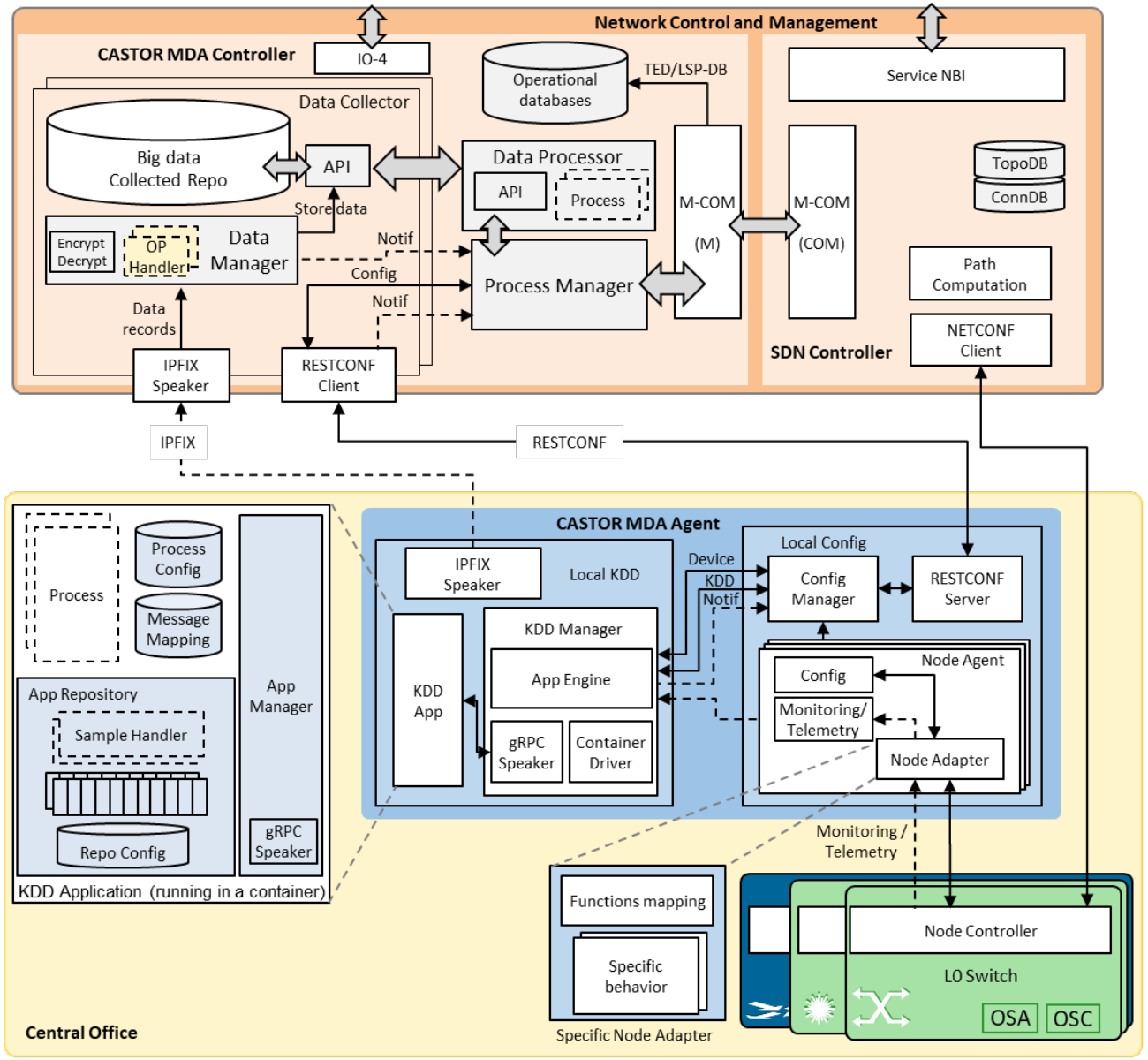






L. Velasco, et al., "An Architecture to Support Autonomic Slice Networking [Invited]," *IEEE/OSA JLT*, 2018.

Architecture



Ll. Gifre et al., “Autonomic Disaggregated Multilayer Networking,” in IEEE/OSA JOCN, 2018.

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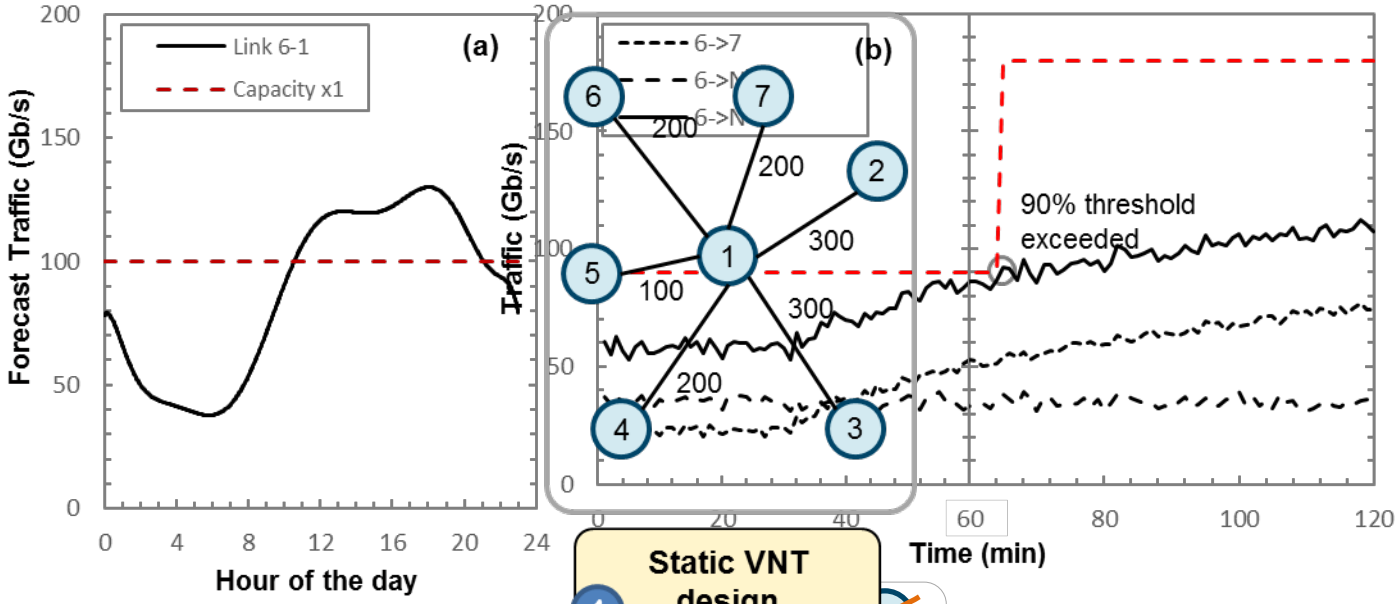
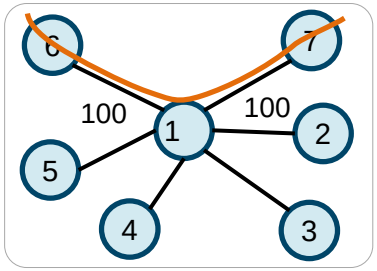
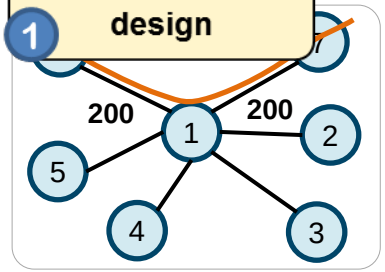
Sample Applications

VNT Design and Reconfiguration Options

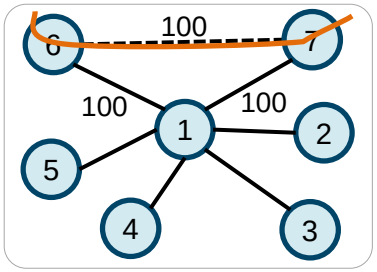


Current VNT





1 **Static VNT design**

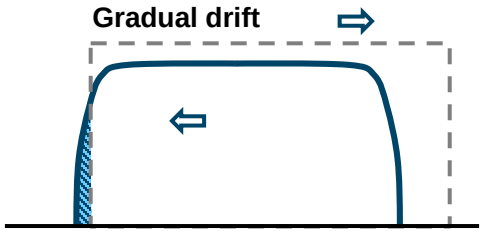


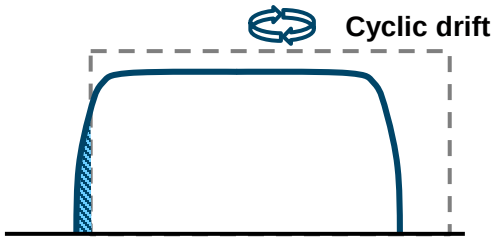
2 **Threshold-based reconfiguration**

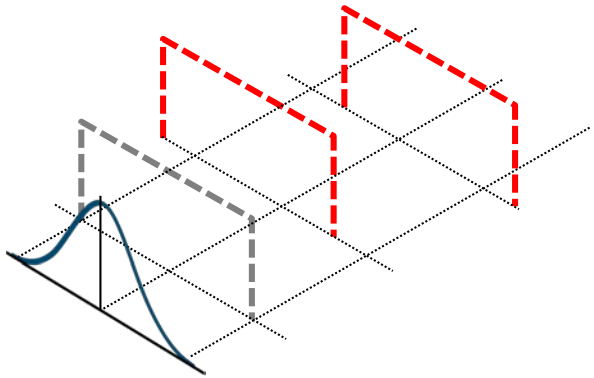
3 **Reconfiguration based on OD traffic prediction**

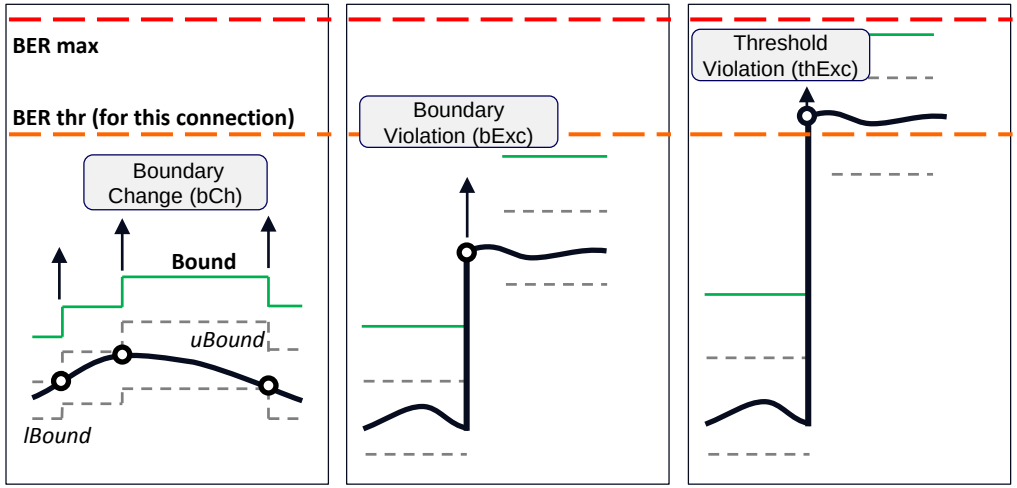
F. Morales et al., "Virtual Network Topology Adaptability based on Data Analytics for Traffic Prediction," *IEEE/OSA JOCN*, 2017.

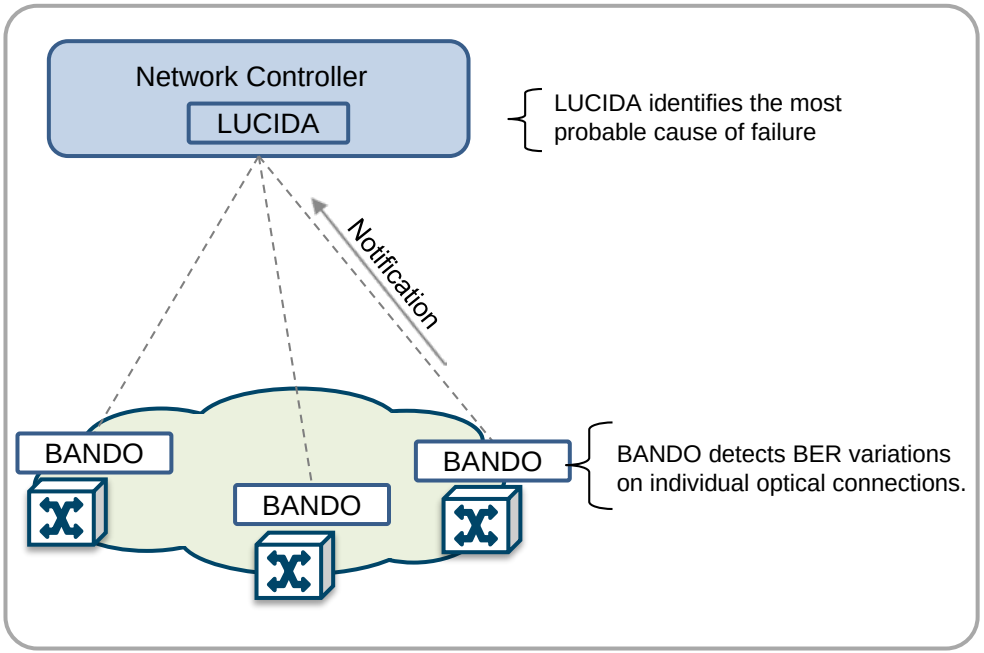
BER Degradation Detection and Failure Identification





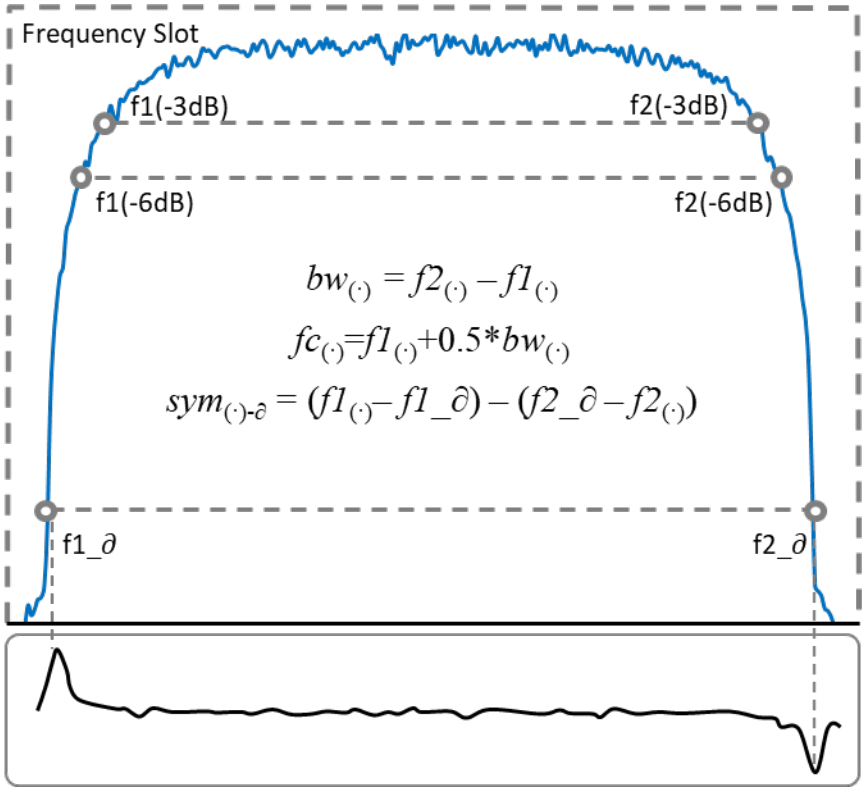


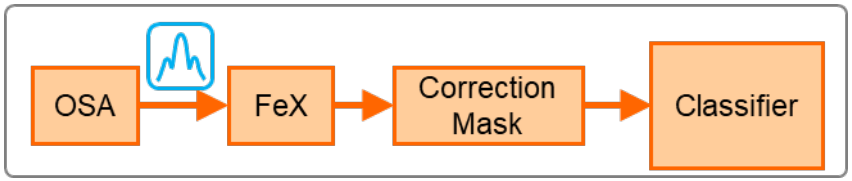


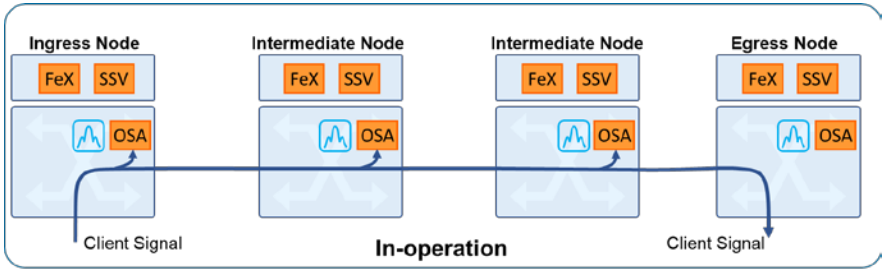


A. P. Vela, et al. “BER Degradation Detection and Failure Identification in Elastic Optical Networks," IEEE JLT, 2017.

Analyzing the optical spectrum

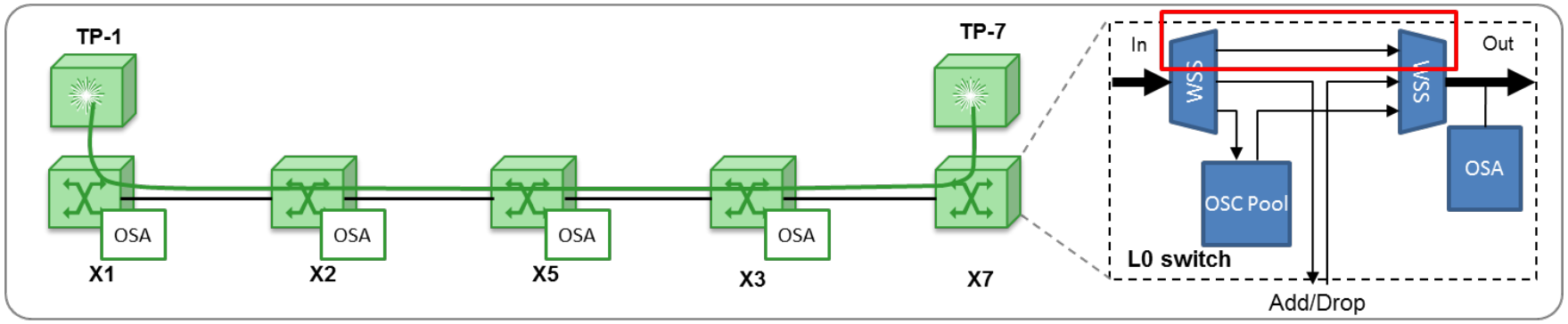


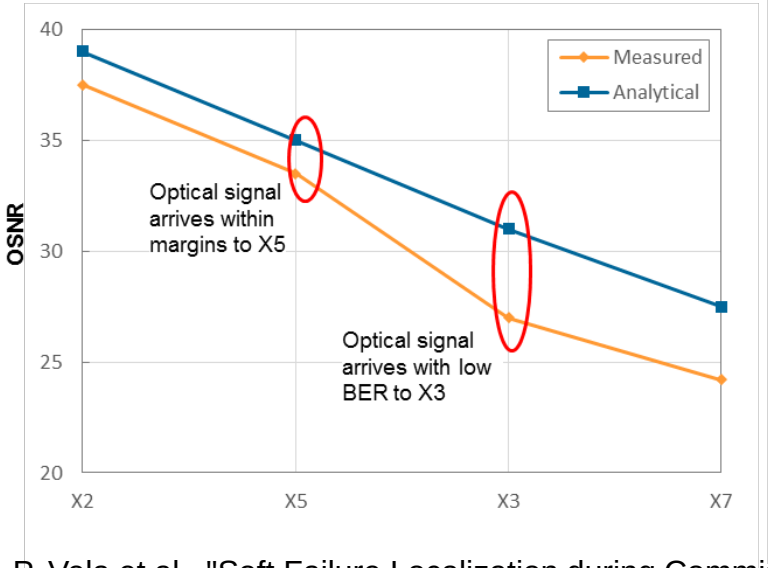


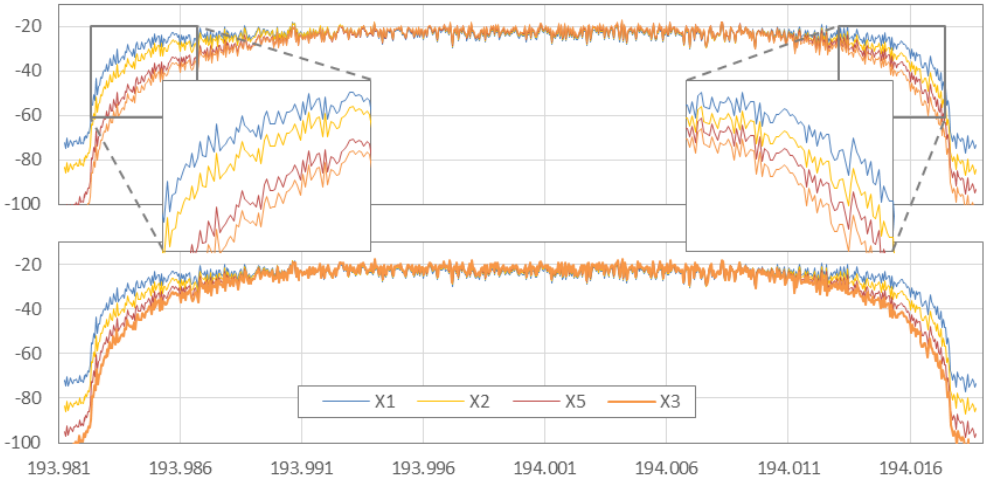


A. P. Vela et al., "Soft Failure Localization during Commissioning Testing and Lightpath Operation [Invited]," *IEEE/OSA JOCN*, 2018.

Failure Localization

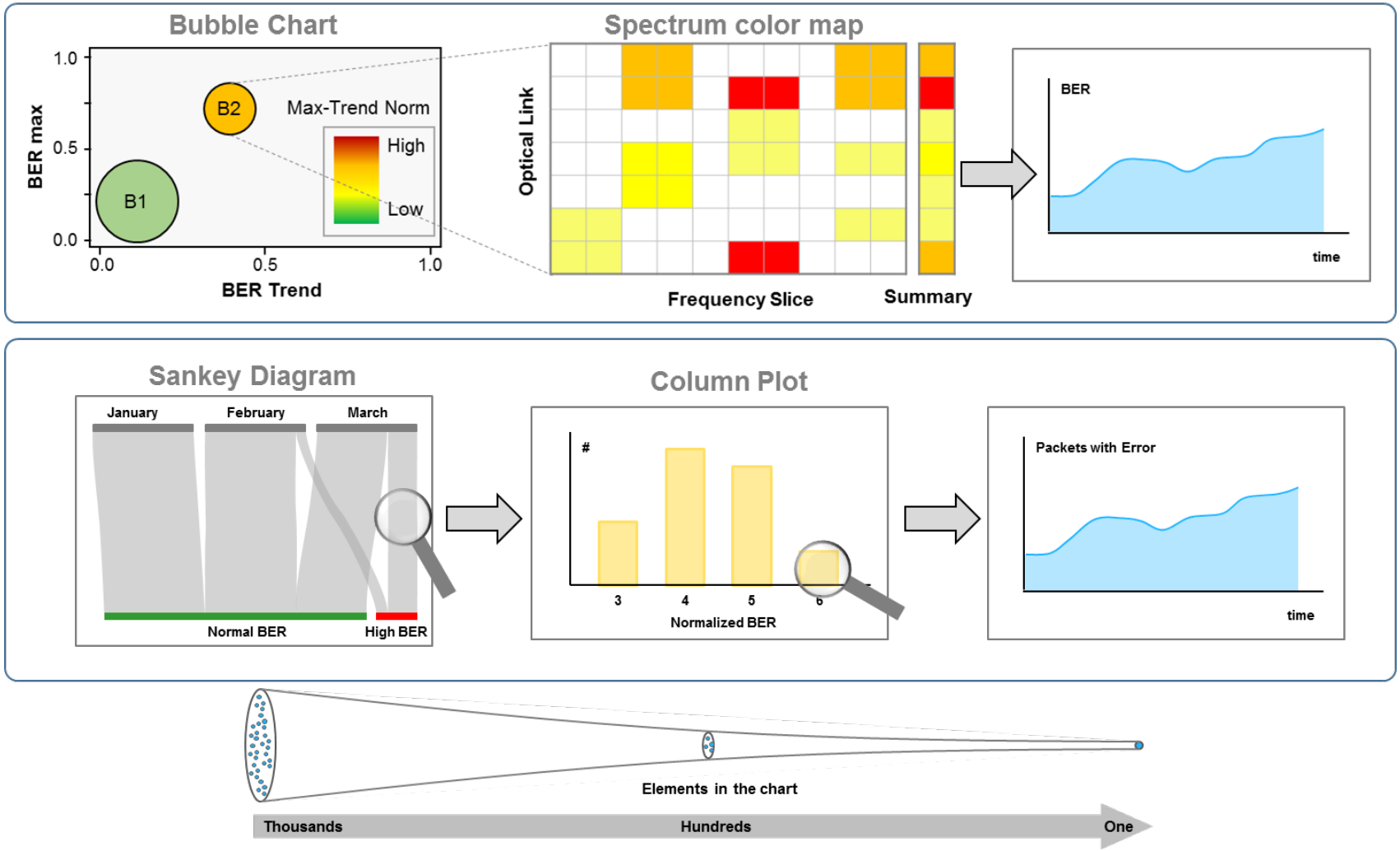






A. P. Vela et al., "Soft Failure Localization during Commissioning Testing and Lightpath Operation [Invited]," *IEEE/OSA JOCN*, 2018.

Task-oriented Visualization



A. P. Vela et al., "Applying Data Visualization for Failure Localization," in Proc. OFC, 2018.

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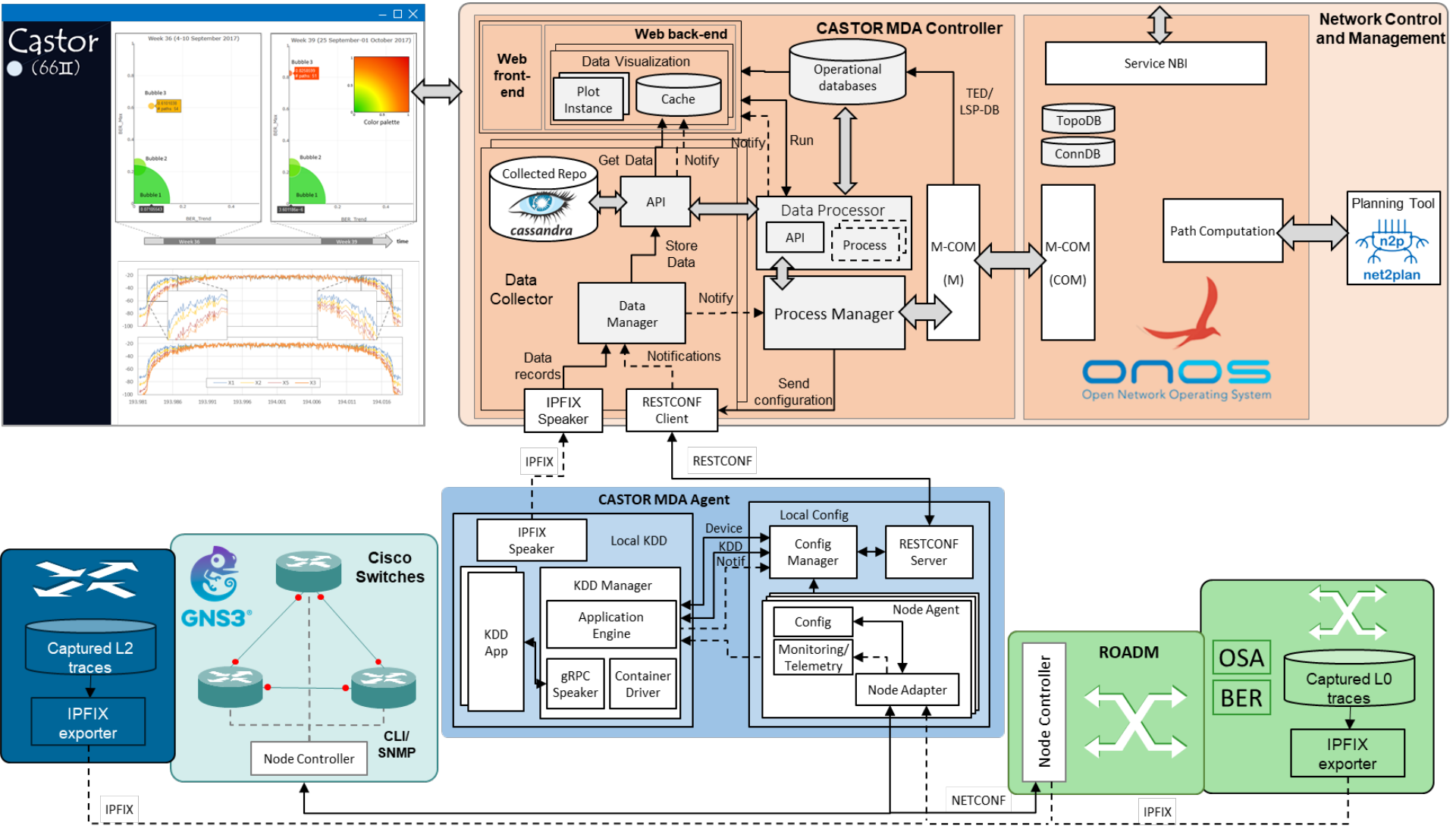
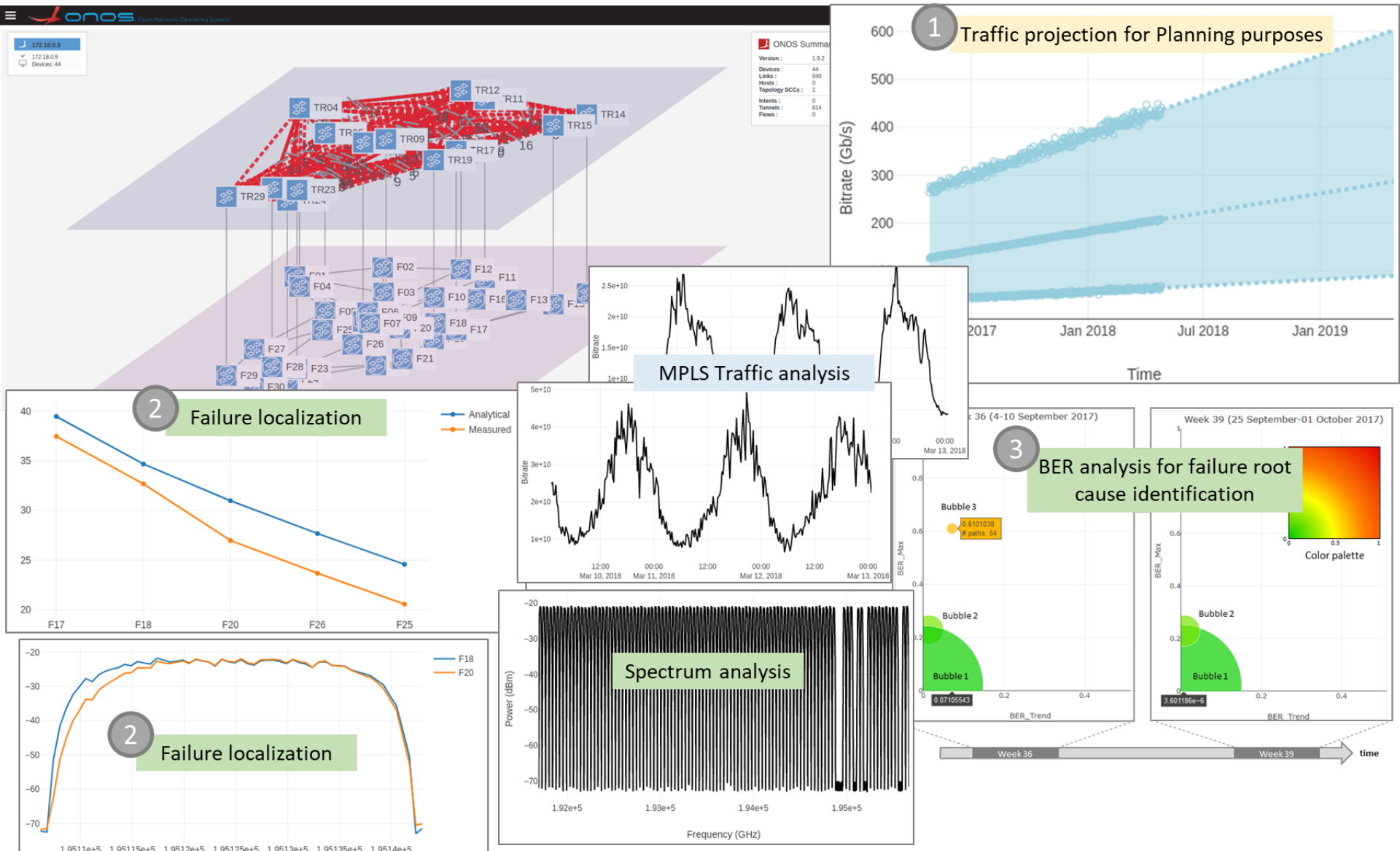
H2020 Metro Haul

Demonstration

Demo Set-up


Castor (66II)
Web front-end
Web back-end
Data Visualization
Plot Instance
Cache
CASTOR MDA Controller
Operational databases
TED/ LSP-DB
Service NBI
Network Control and Management
TopoDB
ConnDB
Notify
Run
Get Data
Notify
Collected Repo
cassandra
API
Data Processor
API
Process
M-COM (M)
M-COM (COM)
Path Computation
Planning Tool
n2p
net2plan
Store Data
Data Collector
Data Manager
Notify
Process Manager
Data records
Notifications
Send configuration
IPFIX Speaker
RESTCONF Client
ONOS
Open Network Operating System
IPFIX
RESTCONF
CASTOR MDA Agent
IPFIX Speaker
Local KDD
Device
KDD
Notif
Local Config
Config Manager
RESTCONF Server
KDD Manager
Application Engine
KDD App
gRPC Speaker
Container Driver
Node Agent
Config
Monitoring/ Telemetry
Node Adapter
Captured L2 traces
IPFIX exporter
GNS3
Cisco Switches
Node Controller
CLI/ SNMP
ROADM
Node Controller
OSA
BER
Captured L0 traces
IPFIX exporter
IPFIX
NETCONF
IPFIX

Examples


1
Traffic projection for Planning purposes
Bitrate (Gb/s)
Time
Jan 2018
Jul 2018
Jan 2019
MPLS Traffic analysis
2
Failure localization
Analytical
Measured
3
BER analysis for failure root cause identification
Bubble 1
Bubble 2
Bubble 3
Color palette
Week 36
Week 39
time
Spectrum analysis
Power (dBm)
Frequency (GHz)
2
Failure localization

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Thank you!

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