

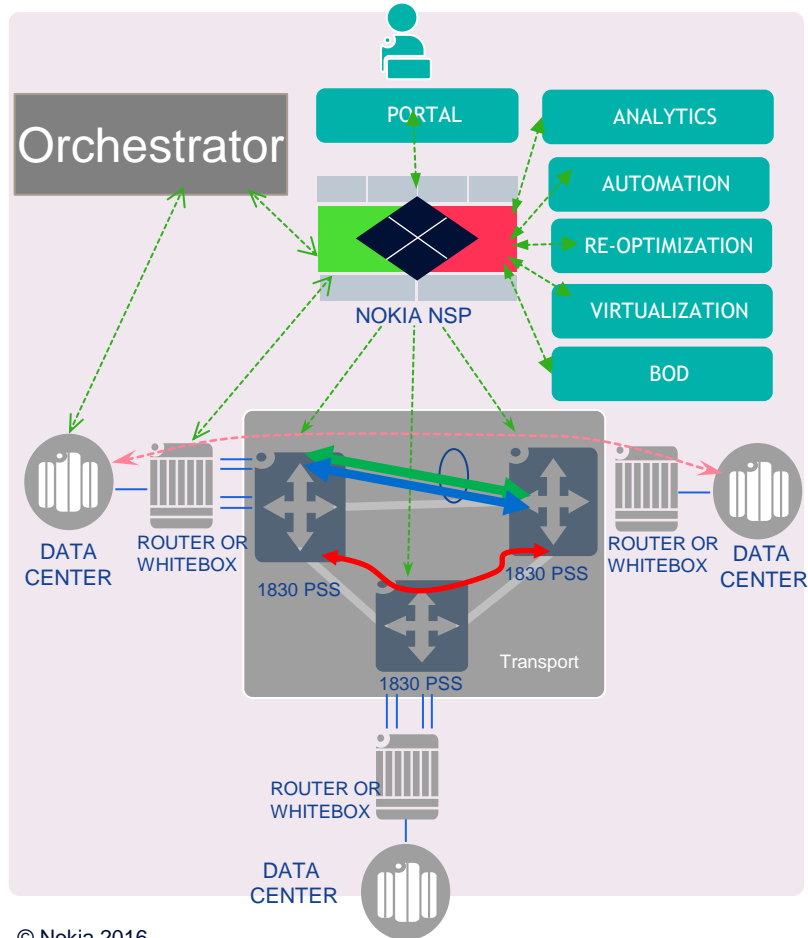
NOKIA

Transport SDN

Lubo Tancevski

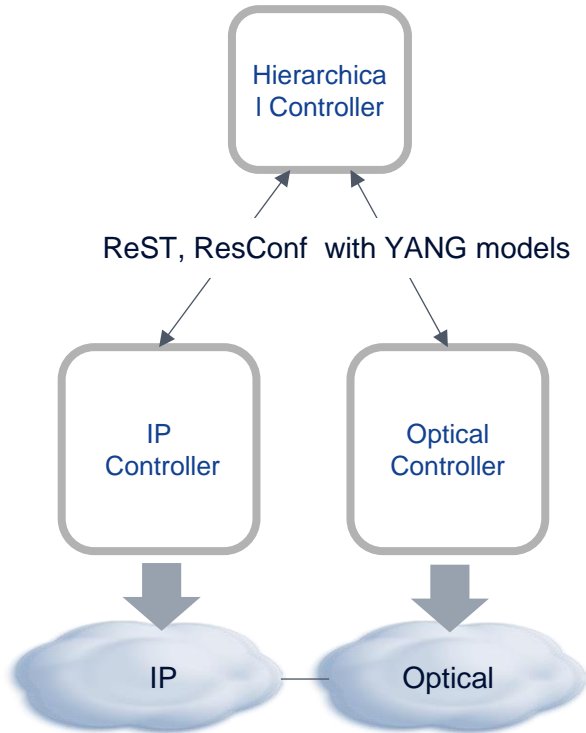
Director, Transport SDN Solutions

TRANSPORT SDN SOLUTION



- DYNAMIC Optical Layer Enablement
 - BoD/Bandwidth scheduling/calendaring
 - Re-sizing, elastic LAG, FlexE
- MULTI-DOMAIN (LAYER L0-L3 AND VENDOR) operation
 - IP/Optical Integration
 - Open Optical Layer
- RE-OPTIMIZATION
 - On-line and off-line; partial and global
 - Flexigrid specific; defragmentation
- NETWORK Virtualization
 - Multi-tenancy
 - Hierarchical slicing (retail, wholesale)
 - Enabler for new revenue generating services
- AUTOMATION (Network and Service)
 - Policy-based operation
 - Auto-discovery, auto-configuration, troubleshooting
- ANALYTICS engine
 - Alarms, KPIs, stats; expected network behavior, thresholding, anomaly detection

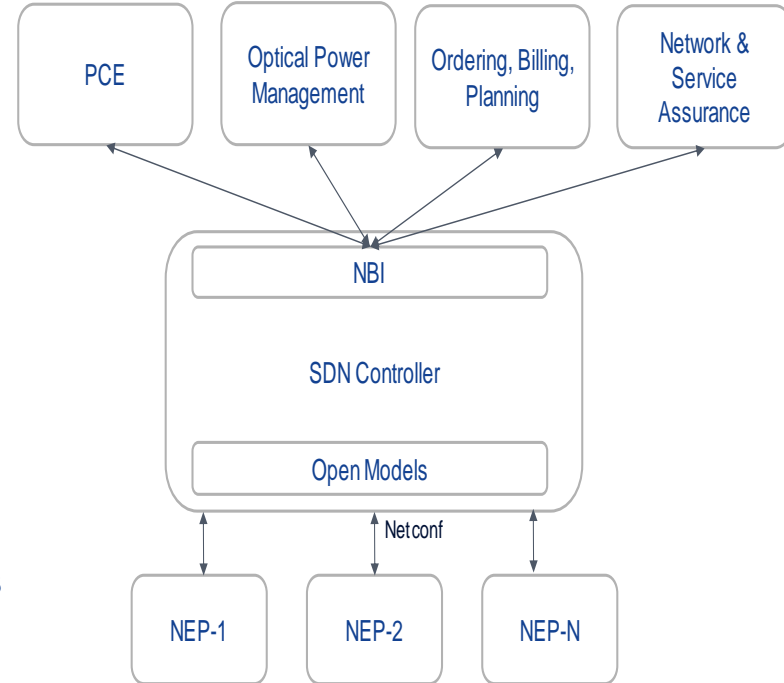
IP/OPTICAL INTEGRATION



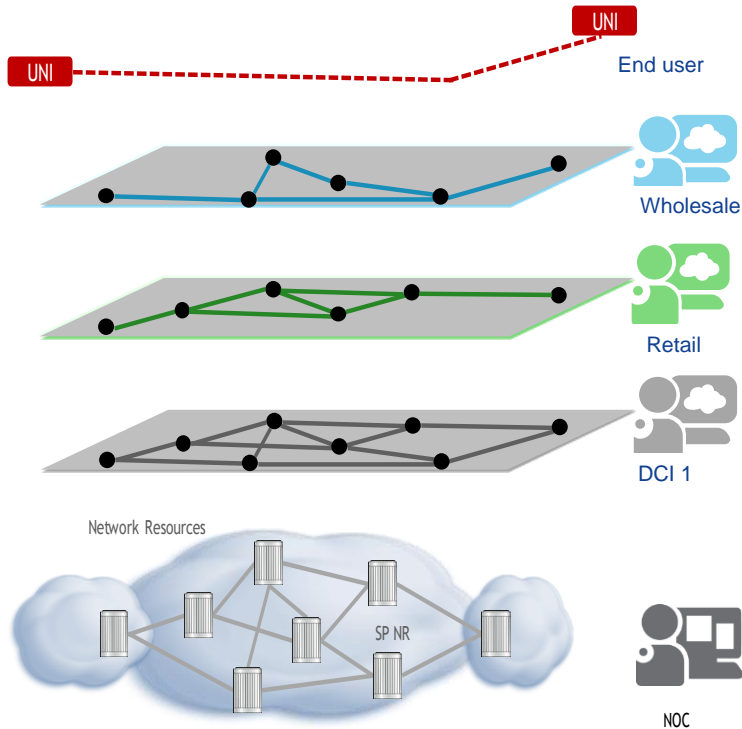
- Hierarchical Controller with domain controllers
- REST/RESTConf northbound interface with YANG Models
 - Topology abstraction
 - IETF drafts (ACTN, I2RS) and T-API ONF models for topology and other NBI functions
- Use Cases
 - IP/Optical Network Visualization
 - Transport SRLG deduction
 - Protection/Restoration (router port, line port, node)
 - Maintenance Intervals
 - Multi-layer path computation
 - Multi-layer concurrent optimization
- SDN is seen as an enabler to finally achieve IP/Optical
- Considerable investment and several interops (OIF, Telefonica...)

OPEN OPTICAL LAYER

- Simplifies multivendor deployment with potential disaggregation
- Single Controller manages different vendor domains or different vendor components in one domain
- YANG models for equipment config and telemetry; Netconf interfaces
 - For L0 and L1 devices (ROADMs, Terminal devices)
 - OpenConfig, OpenROADM, ONF, ITU-T models
- Open Line Systems and Open ROADM deployments
- Impact on the Control and management layer
 - Fulfillment, assurance, power management, commissioning and provisioning, monitoring...
- Several initiatives at network operators and developments at Open projects
 - ONOS, ODL

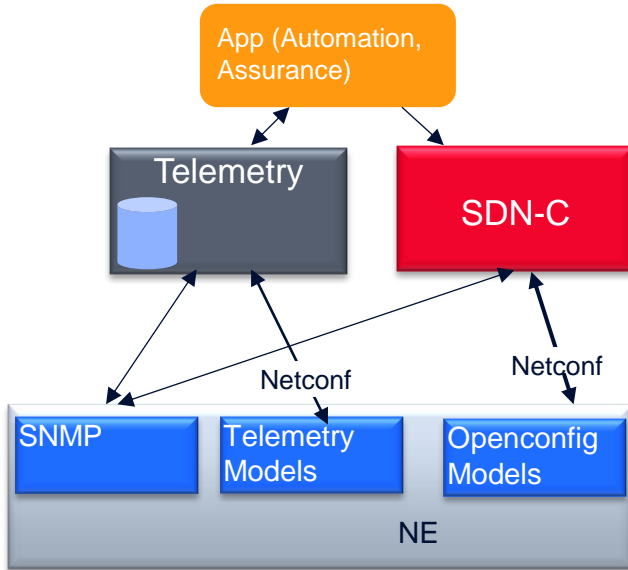


NETWORK VIRTUALIZATION



- Common Platform to monetize network infrastructure by maximizing efficiencies between units
- Allows for introduction of new business models and new revenue generating services
- Virtual Network Service or Slicing
 - external, internal tenants
 - TE slices (real-time/non real time apps)
- TaaS and NaaS
- Dynamic set-up, resizing, monitoring and policing of slice
 - Fully segregated slices, various constraints
- Portal for allocating virtual resources and self-service set-up over a virtualized infrastructure

AUTOMATION AND ANALYTICS



Rely on mechanism for stats collection

- Telemetry, traps
- Common database with assurance functionalities

Automation

- Allows for operation with minimum human intervention
- Perf monitoring (BER, load, latency)
- Trigger to SDN-C to perform certain operations (re-size, re-route...)
- Auto-discovery of neighbors
- Troubleshooting

Analytics

- Allows to run networks more optimally
- Historic analysis
- Prediction
- What/if analysis

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