WELCOME
CONTENT

• SDN: CONCEPTS AND VALUES
• T-SDN DEMONSTRATION
TODAY’S MANs/WANs ARE NOT OPTIMIZED FOR CLOUD

Network service innovation, delivery, & optimization are:
• Complex
• Slow
• Inefficient

Fragmented/limited network visibility and control impacts efficiency, agility & user experience
SDN SERVICE EVOLUTION: ABSTRACTION & POLICY-BASED PROVISIONING

Rapid service definition using simplified “business language”

“Premium VPN” is:
- “Optical encryption”
- “10G bandwidth”
- “xxx latency”
- “yyy L1/L2/L3 VPN”

Policy list

Dynamically-triggered auto-provisioning

OSS / Apps / NFV

APIs

Map CPE1 on VPN1 to “Premium VPN” and ensure 10ms latency

1

Network controller

Policy based provisioning

Resource discovery & control

Network Element

CPE1

I’m online. Start my service.
ALCATEL-LUCENT SDN FRAMEWORK

**Application API** exposes network services to be consumed by applications
- Separates the description of network connectivity from its implementation
- Programmatic RESTful northbound interface capable of providing abstracted view of the network

**Open Network APIs** use to communicate network configuration
- Direct to Network Elements or indirect via Network Controllers
- OpenFlow (1.4+) is the target to achieve Open interface; Netconf/YANG starting

**1830 PSS Differentiators:**
- Integrated L0/L1 switching (Photonic/OTN)
- CDC-F ROADM architecture with Zero-touch Photonics
- Packet integration (with IPD SR-OS assets)
- Comprehensive multi-layer SDN solution

SINGLE FRAMEWORK ACROSS IP AND OPTICAL; INTRA- AND INTER-DC COORDINATION
WAN SERVICE CONTROLLER – A DETAILED LOOK

- **Service manager**
  - Presents simplified views of network topology and services to IT layer

- **Resource manager**
  - Dynamically binds services to IP/Optical transport based on real-time state of network

- **Multi-layer PCE**
  - Creates IP and optical paths through network

- **ALTO**
  - Returns best path/resource selection based on specified constraints

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**ReST APIs**

- Service Manager
- Multi-Layer PCE
- Resource Manager
- ALTO
- Provisioning Manager
- Topology Manager

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**OSS / Portal**

- Applications

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**BGP FlowSpec, OpenFlow, PCEP, Nefconf/YANG, Vendor EMS...**
ROLE OF TRANSPORT SDN

Private

Enterprise Transport
• Internal enterprise network
• Data Center Interconnect
• Usually interfaces with Eth. or FC switch; also to router
• Multi-protocol support
• Operational efficiency and to a lesser degree service acceleration

Metro

Services and Router Interconnect
• Providing connectivity to end-customers or between routers
• Data Center Interconnect; retail and wholesale
• L0, L1 and L2 service
• Multi-protocol (Eth, FC, IB)
• Service acceleration and operational efficiency

Core

Router Interconnect
• Provides connectivity to routers
• Wholesale
• IP/Optical Integration
• Ethernet clients
• GMPLS UNI and L1VPN
• Operational efficiency and multi-layer TE
TRANSPORT EQUIPMENT CAPABILITIES FOR SDN

The Agile Optical Network

- Wavelength routing with tunable optics
- Colorless (tunable) optical transponders
- DC and CDC ROADM
- FlexGrid, adaptive rate modulation
- Packet-optical integration, switching
- Monitoring probes and statistics to enable event correlation & multi-layer analysis
- Programmable, open interfaces

AGILE, SOFTWARE DEFINED NETWORKING REQUIRES AGILE, SOFTWARE-DEFINED TRANSPORT
# TRANSPORT SDN MAIN BENEFITS

## Abstraction
- Simplifies OSS Interface
- *Substantially reduces or eliminates changes in OSS-I*
- Enables multi-vendor network equipment support
- Network slicing

## Open
- Uses standardized network interfaces and object models (OF, PCEP, Netconf/YANG)
- No vendor equipment lock-in

## Global View
- View across multiple domains
- View across multiple layers
- Optimally maps service traffic to tunnels
- Path optimization
- Optimize network capacity

## Service Acceleration
- Programmable
- Able to change network behavior on the fly
- Enables easy modification of existing and introduction of new services

## Automation
- Enabled by policy-driven configuration
- Enables real time provisioning
MAIN BENEFIT: SERVICE AND TENANT SLICING

- Multi-tenant slicing
- Assignment of network slices per tenant
- Visible in admin view and tenant view
- Tenant view allowing tenant to set up a service

- Per Service slicing according to service attributes for faster turn up
  - Encryption service @10G containing network endpoints with encryption capability
  - Bandwidth service @100G
  - Latency Optimized services (path, FEC…)
  - Protected/unprotected service
MAIN BENEFIT: SERVICE ACCELERATION

- **Data Center Interconnection**: Facilitates dynamic operation
  - Workload migration (maintenance, disaster)
  - Scheduled bandwidth (backups)
  - Cloud bursting (peak hours, scheduled)
  - Storage and DR/BC applications

- **Enterprise Services**: Allows enterprises to manage their virtualized slice in accordance with policy-based abstractions and abstracted view of the slice
  - Dynamic connectivity set-up
  - Dynamic service re-sizing
  - Scheduled services
MAIN BENEFIT: GLOBAL VIEW

- SDN separates control from data plane and centralizes control functions
- Enables global view of the network
  - Multi-domain, multi-layer, multi-technology
  - Topology, resource, reachability
  - Service demands, fulfillment, tracking
  - Statistics and correlation
  - Optimization and TE
- Enabler for IP/Optical Integration
  - Complements existing technologies (UNI, OTN)
  - Provides efficient multi-layer operation
**SDN MODES OF OPERATION: PUSH AND PULL**

**PUSH MODEL**

- Top-Down Provisioning through Portal
- Define policy for every new service...
- ...and use only once
- Service set-up through a portal with all service parameters
- Set-up each time a service is requested
- Suitable for less dynamic and/or application-customized services

**PULL MODEL**

- Policy-Driven (Pull) provisioning with Nuage Network Resource Controller (NRC)
- Define policy once...
- ...and use many times
- Policy parameters defined only once and applied automatically to each new service
- Fully automatic service instantiation utilizing event-driven triggers (e.g. client port status transition)
- Suitable for fully-automated tasks (switchover), scheduled and repetitive tasks (backup), and dynamic activities (VM creation)
DATA CENTER INTERCONNECT SERVICES

Support for wide array of storage services to match customer needs
1830 PSS Attributes
• Full support for relevant protocols and certifications
• Variety of interfaces at different rates, low latency and high security
• Packet-Optical Integration
• SDN Connectivity Management and Dynamic Capacity
• Service Assurance

LOW LATENCY SERVICE

Provide the lowest latency service for financials
1830 PSS Attributes
• Latency optimized cards
• Configurable FEC/No-FEC
• SDN-enabled Latency abstraction and e2e Latency computation
• Service Assurance with Latency monitoring

MANAGED ENCRYPTED SERVICE

Enable encrypted connectivity to customers while allowing customers to manage their own security
1830 PSS Attributes:
• Integrated AES256 encryption
• Key Management Tool
• Optical Intrusion Detection (OID)
• Hardened operation
• FIPS/CC certifications
• Service Acceleration with SDN
TAAS EXAMPLE: DATA CENTER CONSOLIDATION

- Maintenance scheduled in DC-A and workload needs to move to DC-B and DC-C
  - Additional bandwidth needed between DC-A and DC-B, and between DC-A and DC-C
- Policies for workload migration programmed
- Triggers instantiation of services, and through the WSC instantiation of additional bandwidth
- Requirement for low latency (to support synchronous replication, DR/BC)
  - Latency-based path computation; latency optimized transponders
- Requirement for encrypted transport (to address security)
  - Bulk-rate, protocol agnostic encryption at L1; intruder detection; FIPS operation
- Requirement for scheduled operation (to accommodate periodic backups)
NAAS: PUTTING ABSTRACTION & POLICIES TO WORK

- Operator assignment of multi-tenanted virtualized resources: service and network parameters

- Tenant self-service portal: service creation through abstracted view

- Rapid service definition: creation of service policies (IP & Optical)
DYNAMIC AND OPTIMISED RESOURCES UTILIZATION

- New paradigm of dynamic and elastic connections requires elastic physical layer as well
- SW agent control of the physical layer parameters
- Modulation/Symbol-rate, SD-FEC, Flexgrid, CDC ROADM
- Example: SDN Controller transponder with adaptive modulation
  - Transponder mode: 100GE client -> 100G line over longer distances using DP-QPSK
  - Muxponder mode: 2x100GE client -> 200G line over shorter distances using DP-16QAM
- Application:
  - Change of modulation to accommodate different connection requests (100G over long haul; 200G over metro)
  - Change of modulation to accommodate degradation of physical quality of service (200G to 100G)

260SCX2 FIRST COMMERCIALY AVAILABLE RATE-ADAPTIVE 200G CARD
CONTENT

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DEMO CASE #1: MULTI-TENANT SERVICE MANAGEMENT
DEMO CASE #2: DYNAMIC BANDWIDTH ALLOCATION

Applications
- use monitor results
- use thresholds
- implements hold-off times to avoid flapping

Application: Bandwidth Supervisor

Link usage monitor

T-SDN Controller

Config

2x 10GE

Data Center Application Server

7750 SR

1830 PSS

11QPEN4

11QPEN4

7750 SR

1830 PSS

11QPEN4

11QPEN4

Data Center Application Server

1830 PSS

Pull Model
DEMO CASE #3: DYNAMIC BANDWIDTH ALLOCATION W/POLICY DB

Applications
- use monitor results
- implements hold-off times to avoid flapping
Thank you!