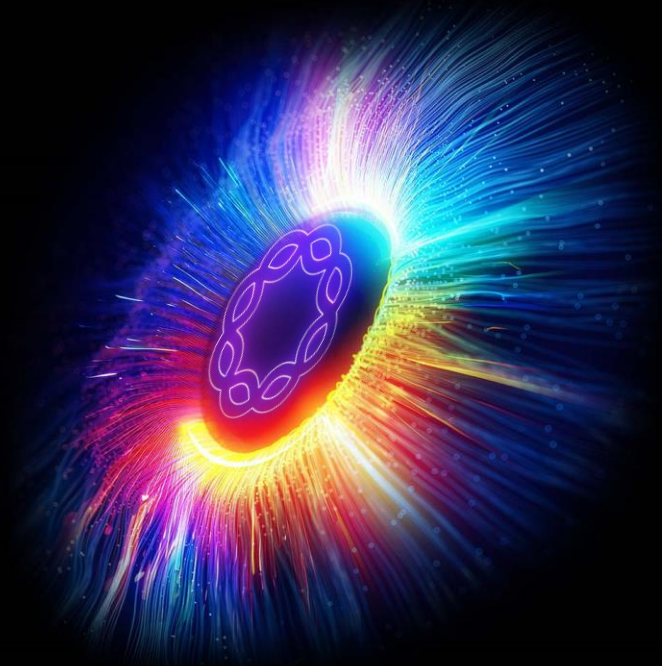


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Network Modernization

TDM to IP Migration

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Principal Solutions Architect

Ribbon Communications

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TDM – Why Is It Still Around?

- TDM Circuits are a shrinking product for most service providers, but not gone yet.
- What reasons do providers have to continue to support TDM?
 - Existing carrier voice trunks that currently cannot be migrated
 - Existing customer that cannot or will not change circuit physical interface
 - Customer with legacy PBX/Key System that requires TDM Interface



Why Make a Change - If It Ain't Broke, Don't Fix It, Right?

- Existing TDM equipment is EoL
 - Manufacturers no longer support equipment
 - Finding spares is difficult, eBay is not a strategy
 - Vendors not making “new” TDM equipment
 - Current circuits sparsely populated
- Leased TDM circuits are very expensive
- Trained TDM engineers retiring
- Antique EoL management systems
 - No longer being maintained

Similar Items

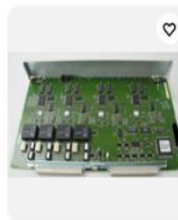
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Remote Access Server RCU PSU
Bundle 4203376L#AC
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feedback



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\$162.50
~~\$250.00~~ 35% off
Free 2-3 day shipping
 Top Rated Plus
Seller with 99.2% positive
feedback



TELLABS TITAN 5500 81.55196
T3C5DD0AAC TIME SLOT
INTERCHANGE

Pre-owned

\$227.50
~~\$350.00~~ 35% off
Free shipping
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feedback



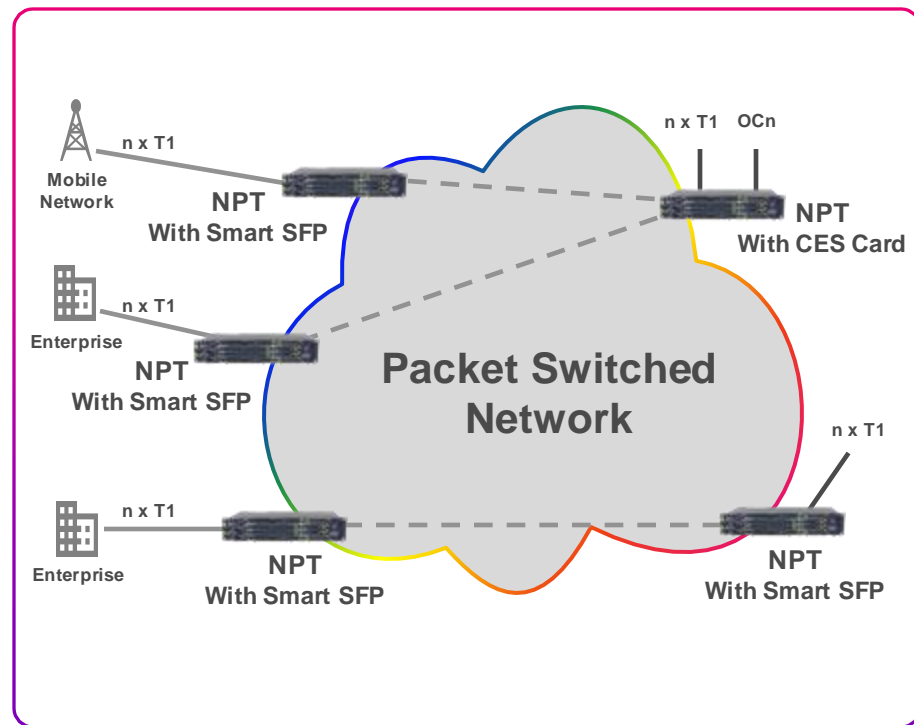
TELLABS 81.5517A TITAN-5500
DS3/I PORT MODULE
T3CIBBIAAF

New (Other)

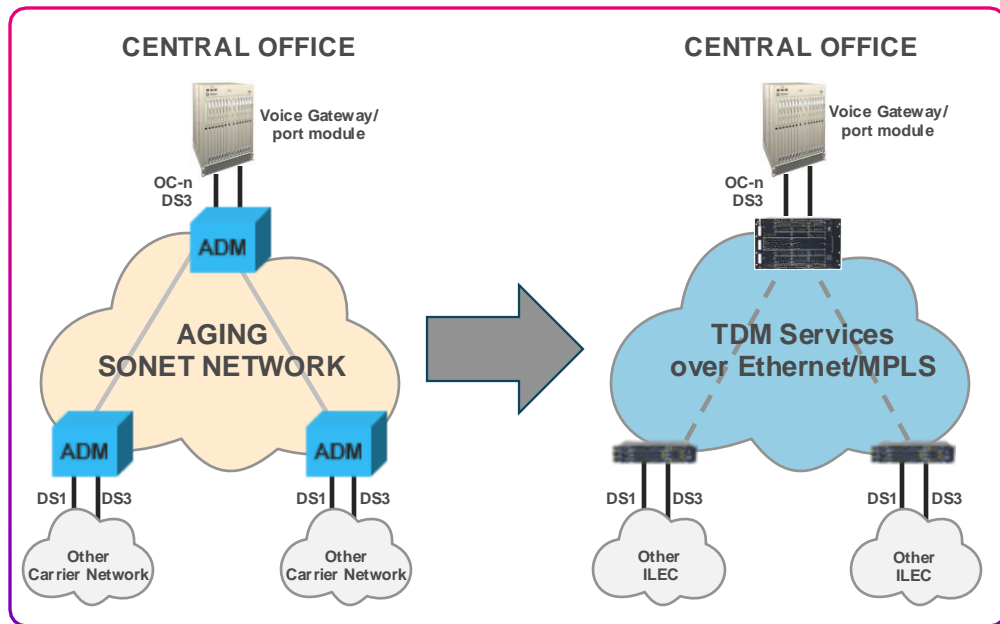
\$178.75
~~\$275.00~~ 35% off
Free shipping
 Top Rated Plus
Seller with 99.2% positive
feedback

Solution – Circuit Emulation

- Standardized protocols to support TDM on packet switched networks
 - Supports DS1, DS3, OC-n
 - RFC 4553: Structure Agnostic TDM over Packet (SAToP)
 - RFC 5086: Circuit Emulation Services over Packet Switched Networks (CESoPSN)
- Packetizes TDM payload, similar to VoIP telephone call (RTP)
- BITS/GPS timing, can be GM clock
- Sub-50ms switchover (like SONET)



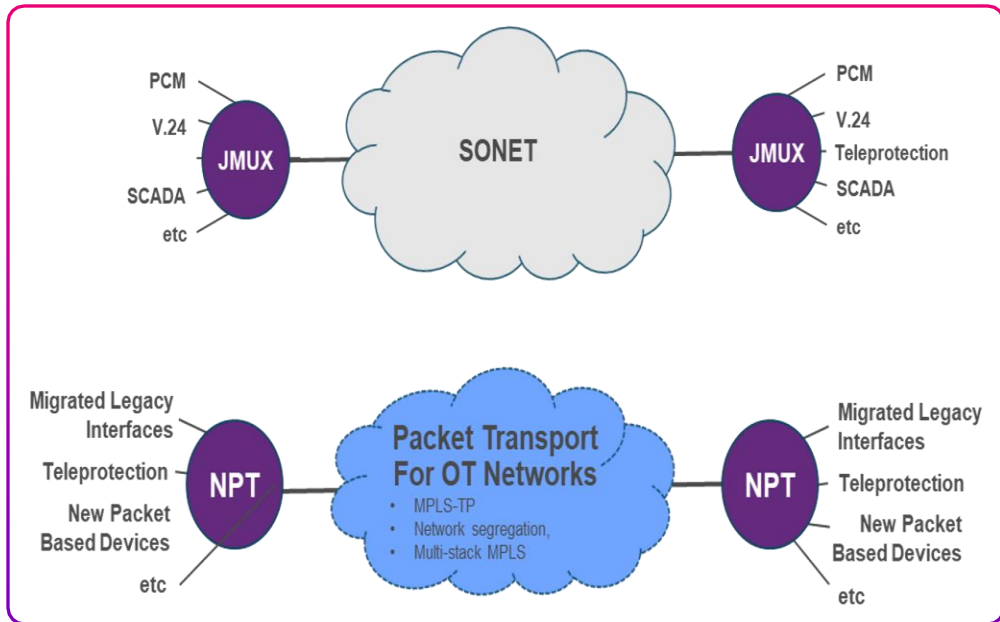
Common TDM Migration Applications: Voice Backhaul



Voice Backhaul

- Replace SONET EoL equipment
- Interconnecting Voice Switches
- Configure with SONET-like SLA
- Build as new network or augment existing MPLS/IP network
- Functions as network wide, distributed digital cross-connect

Common TDM Migration Applications: SCADA Backhaul



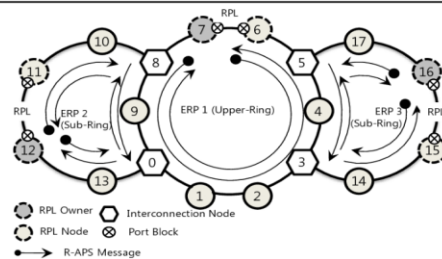
SCADA Backhaul

- Replaces SONET EoL equipment
- Interconnect SCADA devices to the Master/Controller
- Network performance will be similar, or better, than SONET network
- Introduce L2/L3 services

Multiple Methods For Connectivity in the Transport Underlay

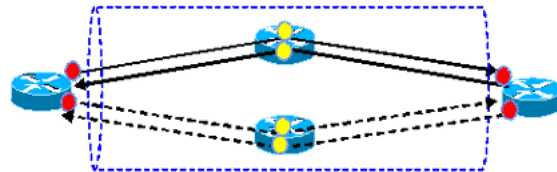
Layer 2 VLANs With G.8032 Ethernet Ring Protection

- Simple
- Good for small networks



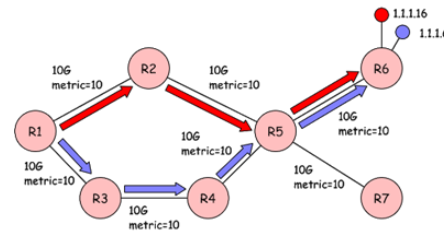
MPLS-TP or RSVP-TE With active and standby pseudowires

- Deterministic
- Network operator has full control of path



MPLS-LDP/SR-MPLS/TE With protection

- Dynamic routing
- Easiest with greenfield network



Technology Advantage: Distributed Digital Cross-connect

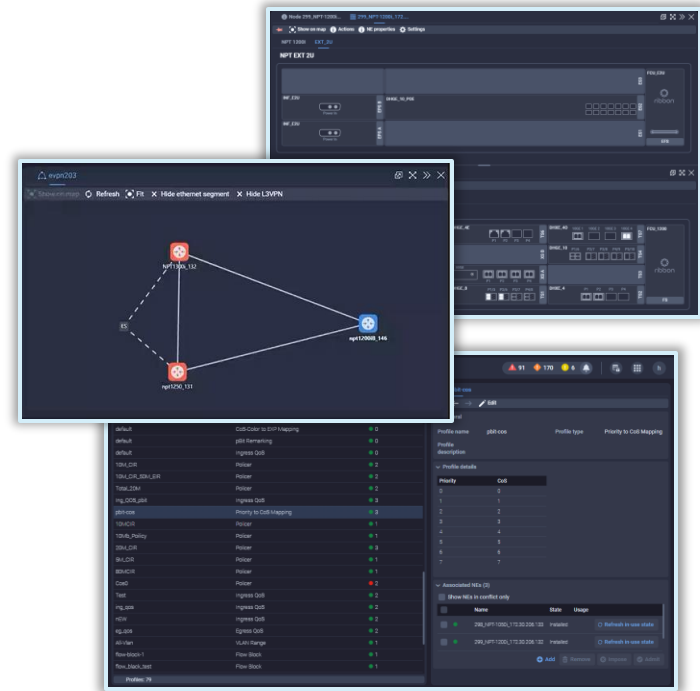
- Any to any circuit mapping, the cross-connect is just a packet stream
- DS1/T1s can be directly mapped from higher order VT1.5 mapped OC-X circuits to electrical DS1/T1 connections
- DS3 cards can trans-MUX DS1/T1s
- DS1/T1 interfaces can be terminated via an SFP pluggable
- SONET 1+1 protection with two CES paths
- Many transport options; LAN, Fiber, DWDM, L2VPN



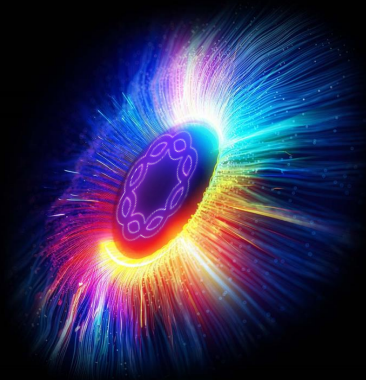
The Network Becomes a DCS with CES

CES Made Easy With Muse SDN Domain Controller

- **Automated Provisioning**
 - Point and click provisioning of CES services
 - Templates to simplify service design
- **Single pane of glass for everything**
 - Provisioning, Network Health, Alarms, Events, PM Counters, Statistics
- **NE Configuration**
 - Cards & ports, DCN, Policies & Profiles
 - Protocol Configurations, Timing & Synchronization
- **Topology Management**
 - FlexE, Ethernet, IP/MPLS, MPLS-TP, SR
 - All topologies; ring, star, mesh, chain, dual-homed
- **IP Service CRUD**
 - L2VPN, EVPN, L3VPN, Circuit Emulation



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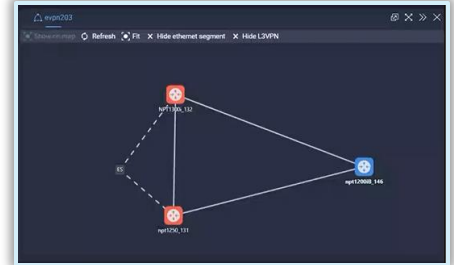
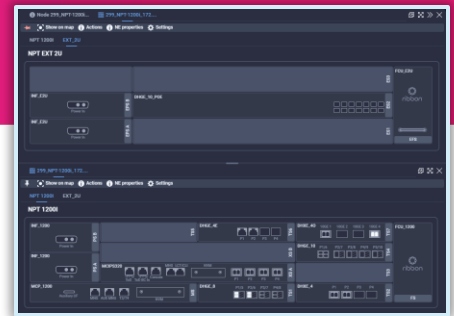
Making it Easy to Provision and Manage

- Ribbon Muse management platform can automate provisioning across the network
 - Point and click provisioning of CES services
 - Define underlay in a template, simplifying service design
- Muse provides single pane of glass for monitoring and managing network
 - Fault Management and Performance Monitoring
 - Network health monitoring tools
- Track existing TDM circuits (forthcoming)
- Mapping of emulated circuits to TDM endpoints



Muse Managing NPT Networks

- NPT NEs Configurations
 - Cards and port assignment, DCN configuration, Policies and Profiles
- Managing Topology
 - FlexE, Ethernet, IP/MPLS
- IP Service CRUD
 - L2VPN, EVPN, L3VPN, Circuit Emulation
- Fault Management and Performance Monitoring
 - Alarms, Events, PM Counters, Statistics
- The following are configured from EMS-NPT:
 - Protocols Configurations
 - Timing and Synchronization

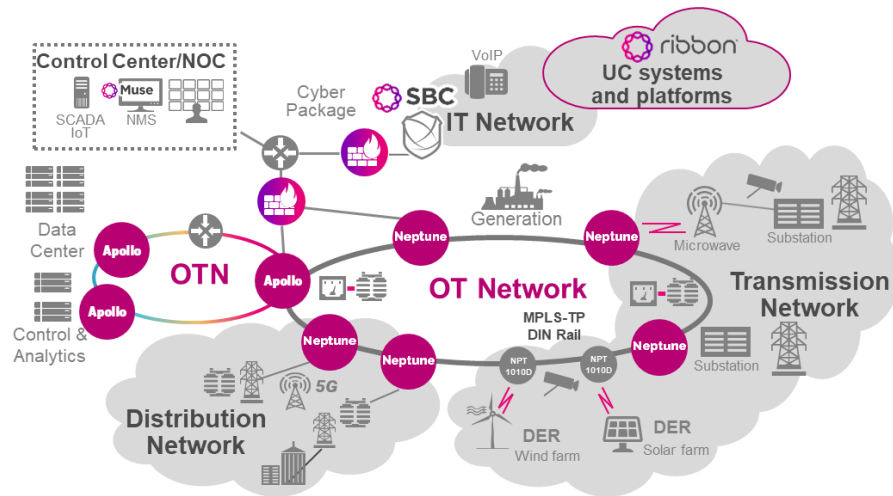
This screenshot shows the 'Policies and Profiles' configuration page in the Network Controller. It features a table of configurations and a detailed view of a specific profile.

Name	Type	# Profiles
default	Default	1
default	gdb Mapping	0
default	ingress QoS	0
default	egress QoS	0
default	Priority to CoS Mapping	0
default	QoS CoS	0
default	QoS Policy	0
default	QoS CoS	0
default	QoS CoS	0
default	QoS CoS	0
default	CoS	0
default	ingress QoS	0
default	egress QoS	0
default	Egress QoS	0
default	Flow Change	0
default	Flow Drop	0
default	Flow Drop	0

Priority	CoS
1	1
2	2
3	3
4	4
5	5
6	6
7	7

Ribbon Solutions

Service Provider Benefit	Ribbon Solution Features
Packet Transport Network architected for utility and service provider industry	Multi-stack MPLS simultaneously supports MPLS-TP, IP/MPLS-LDP, SR-MPLS/TE, RSVP-TE
Form factors optimized for utility and service providers	From DIN-rail, to fixed form factor, to modular redundant, temperature hardened form factors
Integrated solution for multi-services access aggregation	CES/MPLS-TP for SONET and multi-stack MPLS for packet services on integrated platform
Single, segregated network for IT/OT convergence	Use network slicing techniques to segregate network
Best use of IP/Optical network resources	Coherent routing supported by Muse multilayer management system
Improved operations lifecycle	Muse provides advanced tools for fault-free provisioning, rapid fault localization and fiber health
Supports continuous network evolution	Multi-stack MPLS supports seamless introduction of new routing technology



Applications	Interfaces
ICS/SCADA/ IIoT	V.35, X.21, RS-232/V.24, RS-449, V.36/V.11, Ethernet
Tele-protection	IEEE C37.94, E&M, G.703 CoDir, serial, E1/T1
Voice	Ethernet, E1/T1, FXO/FXS/E&M
Video	Ethernet with PoE+
SONET	STS-1, OC-12, OC-3, DS1, DS3
SDH	STM-1, STM-4