CORIANT IS NOW PART OF INFINERA

mTera® Universal Transport Platform

Flexible, Scalable, & Future-Proof Transport for Metro, Regional, & Long Haul Networks

Network operators are facing a number of challenges including bandwidth growth driven by video, cloud, and data center interconnect and unpredictable traffic patterns. These trends are only likely to accelerate as mobile networks move to 5G. At the same time, network operators need to reduce operational costs including space and power consumption, migrate from legacy technologies such as SONET/SDH, and grow revenues by offering next-generation Ethernet services and new SDN-enabled services such as Network-as-a-Service and Bandwidth-on-Demand. They also need to maximize network and service availability cost effectively. The Coriant® mTera® Universal Transport Platform (UTP) helps network operators address these challenges by providing OTN, MPLS-TP, Carrier Ethernet, and SONET/SDH switching at the electrical layer with the option of an integrated DWDM layer based on ROADM-on-a-blade technology.

CONVERGING ELECTRICAL & OPTICAL SWITCHING IN A SINGLE PLATFORM

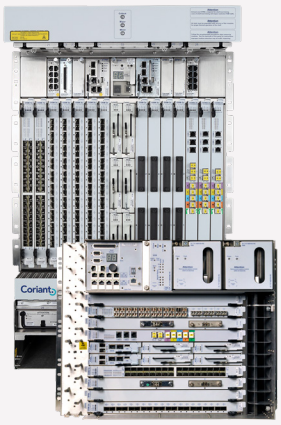
The mTera UTP is a flexible and scalable universal transport platform that can dynamically adapt to changing traffic patterns and address multiple use cases. This universal solution is available as both a 14-slot shelf and an 8-slot shelf. The 14-slot shelf supports a switching capacity of 2.8 Tbps (200G per slot) or 7 Tbps per shelf (500G per slot) depending on the selected fabrics. Paired 14-slot shelves can deliver 12 Tbps. The 8-slot mTera UTP offers 1.6 Tbps (200G per slot) or 4 Tbps (500G per slot) depending on the selected fabrics. The backplane of both mTera UTP shelves is capable of supporting 1 Tbps per slot and provides a path to even higher switching capacities in the future.

mTera UTP Shelf	mTera 8-slot Shelf	mTera 14-slot Shelf
Shelf Photo		
Full Size Slots	8	14
Height	10RU (23-inch rack) 12RU (ETSI or 19-inch rack)	19RU (single shelf) 38RU (paired mTera shelves)
Electrical Switching Capacity	1.6 Tbps (MFAB) or 4 Tbps (MFAB2)	2.8 Tbps (MFAB) or 7 Tbps (MFAB2) or 12 Tbps (MFAB2-M, paired shelves)

TABLE 1 — *Coriant mTera UTP Shelves*

BENEFITS OF THE CORIANT® MTERA® UTP

- **Future proof** your network with the ability to define any interface for OTN, MPLS-TP, or Carrier Ethernet switching, and scale up to 7 Tbps in a single shelf or 12 Tbps in a paired shelf configuration
- **Deliver** MEF CE 2.0 certified services leveraging mTera UTP scalable, feature-rich packet switching
- **Migrate** SONET/SDH to next-generation packet optical technologies including MPLS-TP, Carrier Ethernet, OTN, and up to 1.68 Tbps of STS-1/VC-4 switching
- **Minimize** OEO regens with 100G/150G/200G flexi-rate interfaces that can deliver over 5,000 km in terrestrial networks and over 12,000 km in submarine networks
- **Reduce** space, power, and operational costs with a converged packet optical solution leveraging compact, future-proof route and select ROADM-on-a-blade technology
- **Maximize** network and service availability with a wide range of mechanisms including Y-cable, SNC protection, Carrier Ethernet and MPLS-TP protection mechanisms, and ASON/GMPLS restoration



At the electrical layer, universal switching of OTN, packet, and SONET/SDH is supported by agnostic fabrics (MFAB, MFAB2, and MFAB2-M). The OSM modules support OTN, MPLS-TP including VPLS/H-VPLS, and Carrier Ethernet including VLAN cross-connect and Ethernet bridging. In addition, the OSM modules support interfaces ranging from GbE and STM-1/OC-3 to 100G/150G/200G flexi-rate. The SSM-2S module provides SONET/SDH switching with OTN and packet interworking. At the optical layer, the mTera UTP supports route and select ROADM-on-a-blade modules with colorless, directionless, and/or contentionless add/drop options.

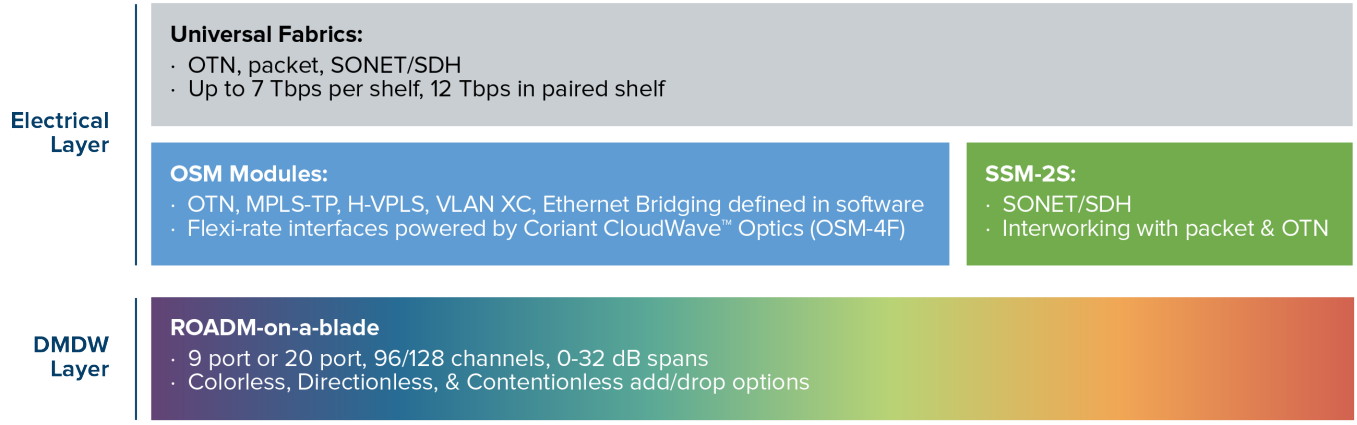


Figure 1: Coriant mTera UTP High Level Overview

These technologies enable the mTera UTP to address a wide range of metro and long haul use cases, including a primary use case, the efficient grooming of traffic onto high speed wavelengths to reduce network cost and improve spectral efficiency. The mTera UTP can be deployed as a standalone OTN switch, a standalone packet switch, a standalone SONET/SDH switch, or as a hybrid switch with OTN, packet, and/or SONET/SDH switching. In each of these four cases, the DWDM layer can be provided by the Coriant® 7100 Packet Optical Transport Solutions, Coriant® hiT 7300 Multi-Haul Transport Platform, or third-party DWDM equipment. Alternatively, with its optional ROADM-on-a-blade modules, the mTera UTP can provide a converged packet optical system with both electrical switching and DWDM.

ENABLING UNIVERSAL SWITCHING OF OTN, PACKET, & SONET/SDH

The agnostic cell-based fabrics of the mTera UTP support the universal switching of OTN, packet, and SONET/SDH at the electrical layer. The OSM modules provide the ability to select OTN, MPLS-TP including VPLS/H-VPLS, VLAN cross-connects, and Ethernet bridging for each interface or virtual interface. The SSM-2S module supports SONET/SDH switching and interworking to packet and OTN on the OSM modules.

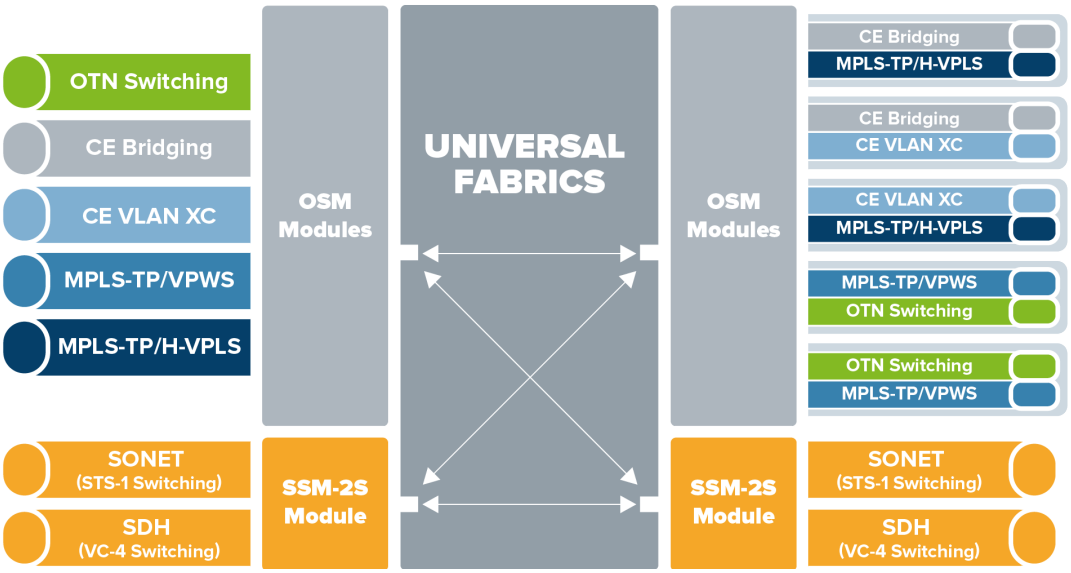


Figure 2: mTera Universal Switching

Module	Interfaces	Per Slot Capacity	Switching
OSM-1S	32 x SFP	40 Gbps	OTN, MPLS-TP (including VPLS/H-VPLS), VLAN XC, Bridging
OSM-2S	20 x SFP+	200 Gbps	OTN, MPLS-TP (including VPLS/H-VPLS), VLAN XC, Bridging
OSM-2C	2 x CFP	200 Gbps	OTN, MPLS-TP (including VPLS/H-VPLS), VLAN XC, Bridging
OSM-4S	40 x SFP+	400 Gbps	OTN, MPLS-TP (including VPLS/H-VPLS), VLAN XC, Bridging
OSM-4C	4 x CFP2-ACO	400 Gbps	OTN, MPLS-TP (including VPLS/H-VPLS), VLAN XC, Bridging
OSM-4F	2 x 100G/150G/200G	400 Gbps	OTN, MPLS-TP (including VPLS/H-VPLS), VLAN XC, Bridging
OSM-5C	5 x CFP2	500 Gbps	OTN, MPLS-TP (including VPLS/H-VPLS), VLAN XC, Bridging
SSM-2S	6 x SFP+, 24 x SFP	120 Gbps	SONET/SDH (with OTN/packet interworking)

TABLE 2 — *Coriant mTera Switching Interface Modules*

Fully Featured OTN Switching

The OSM modules can support ODUk (where k = 0, 1, 2, 2e, 3, 4, flex) switching with one (i.e., ODU2->ODU4) or two levels (i.e., ODU0->ODU2->ODU4) of ODU multiplexing. Performance monitoring features include OTUk section monitoring, ODUkP path monitoring, and delay measurement. SNC protection and Y-cable protection for Ethernet and SONET/SDH clients are also supported. Additional features include PRBS test and loopback, GCC in-band management, and in-service ODUflex resizing.

Comprehensive Packet Switching

The OSM modules support a wide range of packet switching protocols including MPLS-TP (including VPLS/H-VPLS) and Carrier Ethernet (VLAN cross-connect and Ethernet bridging) with a comprehensive packet feature set. Quality of Service (QoS) is ensured with classification based on port, MAC, or L2/2.5/3 header information, multiple queues per port and per VLAN/LSP, multi-level hierarchical scheduling and policing, and NMS-enabled CAC. Packet protection mechanisms include G.8032v2 Ethernet Ring Protection, G.8031 1:1 VLAN protection, G.8131 1:1 LSP protection, and 802.1AX Link Aggregation. Supported OAM features are Y.1731 and 802.1 CFM OAM, 802.3 Link OAM, IETF-based MPLS-TP LSP fault management, and RFC 2544/Y.1564 service activation testing. The OSM modules also offer Synchronous Ethernet support and in-band management VLANs. The mTera UTP is MEF CE 2.0 certified for 100G and services including E-Line (EPL and EVPL), E-LAN (EPLAN and EVPLAN), and E-Access.

Scalable SONET/SDH Switching with Packet/OTN Interworking

The mTera UTP SSM-2S module provides six OC-192/STM-64 SFP+ ports and twenty-four SFP ports for OC-3/OC-12/OC-48/STM-1/STM-4/STM-16. The module supports 120 Gbps of VC-4 switched SDH or STS-1 switched SONET. This enables native SONET/SDH switching of 1.68 Tbps in the 14-slot mTera and 960 Gbps in the 8-slot mTera. Additionally, the SSM-2S module supports SONET/SDH to OTN interworking and Ethernet over SONET/SDH (EoS) to packet interworking. Protection options include UPSR and 1+1 APS for SONET and SNC and 1+1 MSP for SDH. Synchronization is provided by the Stratum 3 clock in the Shelf Timing and Processor Modules (STPMs) with timing references coming from either the interface modules or T1/E1 interfaces in the Shelf Timing Interface Module (STIM) for the 14-slot mTera UTP or Shelf Input/Output Module (SIOM) for the 8-slot mTera.

Flexible Hybrid Switching

Hybrid operation enables OTN switching, different flavors of packet switching, and/or SONET/SDH switching to function simultaneously in the same shelf and even on the same cards and ports, thus saving CapEx and footprint. Hybrid operation also enables different switching types to share the same high speed line interfaces, thereby reducing interface costs and decreasing the number of wavelengths on the optical network. An additional hybrid use case is VLAN to ODUk mapping, aggregating sub-wavelength traffic from multiple locations onto a smaller number of high speed (100GE) client ports, which enables router slots and ports to be used more efficiently.

OFFERING FLEXI-RATE INTERFACES FOR LONG REACH AND SPECTRAL EFFICIENCY

The mTera UTP OSM-4F module provides two flexi-rate interfaces powered by Coriant CloudWave™ Optics technology that support 100G (QPSK), 150G (8QAM), and 200G (16QAM). Ideal for long haul applications, the flexi-rate interfaces enable reach of over 5,000 km in terrestrial networks and over 12,000 km in submarine networks. 200G (16QAM) support and super-channel support enable high spectral efficiency with over 25 Tbps per fiber pair. Additional Coriant CloudWave™ Optics benefits include low power consumption, robust performance under challenging fiber conditions, fast protection, comprehensive performance monitoring, and compatibility with existing networks including mixed 10G/100G networks and 50GHz fixed grid networks.

SUPPORTING OPTIONAL DWDM LAYER WITH INTEGRATED ROADM-ON-A-BLADE

The mTera UTP provides the option of converging electrical switching and DWDM with its ROADM-on-a-blade modules, the 9-port OADMRS-9 and the 20-port OADMRS-20. Based on a route and select architecture, these modules integrate twin Wavelength Selective Switches (WSSs), the input amplifier, the output amplifier, the Optical Supervisory Channel (OSC), and Optical Channel Monitoring (OCM) into a single module offering significant space and power savings. Both module versions support up to 128 channels for flexi-grid applications and 96 channels for fixed grid applications. The input amplifiers of both modules support 0 to 32 dB spans to simplify sparing.

Featuring Flexible Add/Drop Options Including CD and CDC

Supported ROADM add/drop options include colored/directional, colorless/directionless (CD), and colorless/directionless/contentionless (CDC). Colored/directional add/drop provides the most cost-effective option. However, drivers for CD and CDC include SDN and ASON/GMPLS-enabled restoration, SDN use cases such as network defragmentation and service assurance, and faster provisioning with preinstalled cards.

DELIVERING HIGH AVAILABILITY EQUIPMENT PROTECTION, ASON/GMPLS RESTORATION

The mTera UTP offers protection against single points of failure of its common equipment modules. Each module receives power from two independent external sources. The mTera UTP supports N:1 fabric redundancy (5:1 in the 14-slot shelf and 3:1 in the 8-slot shelf) that provides cost-effective protection against a fabric failure. Equipment protection includes the fans and the STPMs. At the network level in addition to OTN, packet, and SONET/SDH protection mechanisms, the mTera UTP supports ASON/GMPLS at both Layer 0 and Layer 1. Shared mesh restoration provides an option for cost-effective multi-failure resilience, while the ability to combine protection with restoration delivers multi-failure resiliency with fast (i.e., 50 ms) protection.

PROVIDING MANAGEABILITY THROUGH AN NMS AND SDN

Network management system (NMS) support is provided by the Coriant® Transport Network Management System (TNMS), an end-to-end management platform that enables operators to easily and cost effectively manage multi-layer, multi-domain, and multi-vendor networks. TNMS integrates into existing OSS environments and empowers a holistic approach to network and service management. SDN support is provided by the Coriant Transcend™ SDN Transport Controller that enables multi-layer control and network programmability via open interfaces to empower new applications such as Bandwidth-on-Demand, Network-as a Service, and SLA-aware service assurance.

TECHNICAL SPECIFICATIONS

mTera 14-slot Shelf

- 14 Full size universal slots: Slots 1 to 7 and 10 to 16
- Slots 8, 9, 17, 18, 19, and 20 - Switch Fabric Modules
- Fabric Options:
  - MFAB provides 2.8 Tbps (200G/slot) switching
  - MFAB2 provides 7 Tbps (500G/slot) switching
  - MFAB2-M provides 12 Tbps in paired 14-slot mTera UTP configurations
  - No fabrics required in all optical layer configurations
- Slots 24 and 25 - Shelf Timing and Processor Modules
- Slot 22 - Shelf Alarm Interface Module
- Slots 21 and 28 - Shelf Ethernet Interface Modules
- Slots 23 and 26 - Shelf Timing Interface Modules
- Four fan tray units (two fans per unit)
- Six power feeds (three redundant power feeds)
- -48VDC and -60VDC
- 19-inch ETSI and 23-inch NEBS racks:
  - Height: 844 mm (33.22 in)
  - Width: 97.5 mm (19.585 in)
  - Depth: 381 mm (15 in)
- Maximum power consumption:
  - Fully equipped with 200G modules: ~5840 W
  - Fully equipped with 400G/500G modules: ~7200 W
- Equipment Redundancy: Power feeds, fans, shelf controller, fabrics (5:1)

mTera 8-slot Shelf

- 8 Full size universal slots: Slots 1 to 4 and 7 to 10
- Slots 5, 6, 11, and 12 - Switch Fabric Modules
- Fabric Options:
  - MFAB provides 1.6 Tbps (200G/slot) switching
  - MFAB2 provides 4 Tbps (500G/slot) switching
- Slots 13 and 14 - Shelf Timing and Processor Modules
- Slot 5 - Shelf Input/Output Module (SIOM)
- Two fan tray units (four fans per unit)
- Four power feeds (two redundant power feeds)
- -48VDC and -60VDC, optional AC power supply
- Dimensions (horizontal deployment for 23-inch racks)
  - Height: 443 mm (17.44 in)
  - Width: 532 mm (20.94 in)
  - Depth: 381 mm (15 in)
- Dimensions (vertical deployment for ETSI and 19-inch racks)
  - Height: 532 mm (20.94 in)
  - Width: 443 mm (17.44 in)
  - Depth: 381 mm (15 in)
- Maximum Power Consumption
  - Fully equipped with 200G modules: ~3740 W
  - Fully equipped with 400G/500G modules: ~4800 W
- Equipment Redundancy: Power feeds, fans, shelf controller, fabrics (3:1)

Switching Interface Modules

- OSM-1S: 32 x Sub 10G SFP (GbE, STM-1/4/16, OC-3/12/48, OTU-1)
- OSM-2S: 20 x 10G SFP+ interfaces (STM-64, OC-192, 10GbE LAN and WAN, OTU2, OTU2e)
- OSM-2C: 2 x CFP interfaces with options including:
  - 100GbE, 40GbE, and OTU4 grey interfaces
  - OTU4 Coherent DWDM Line (PM-QPSK)
- OSM-4F: 2 x 200G/150G/100G flexi-rate interfaces
  - 100G: Coherent PM-QPSK
  - 150G: Coherent PM-8QAM
  - 200G: Coherent PM-16QAM
  - 100G Reach: Over 5,000 km (terrestrial) and over 12,000 km (submarine)
- OSM-4C: 4 x CFP2-ACO for 100G/OTU-4 Coherent PM-QPSK Line
- OSM-4S: 40 x 10G SFP+ (STM-64, OC-192, 10GbE LAN and WAN, OTU2, OTU2e)
- OSM-5C: 5 x 100G CFP2 (100GbE, OTU-4)
- SSM-2S: 6 x SFP+ (OC-192/STM-64) and 24 x SFP (OC-48/STM-16, OC-12/STM-4, OC-3/STM-1)

OTN Switching Features

- ODUk (where k = 0, 1, 2, 2e, 3, 4, flex)
- One or two levels of ODU multiplexing
- OTUk section monitoring and ODUkP path monitoring
- SNC protection
- Y-cable protection (Ethernet and SDH)
- Delay measurement
- Test signal generation and mapping
- In-band management (GCC0, GCC1, GCC2)
- In-service ODUflex resizing

Packet Switching Features

- Carrier Ethernet
  - MAC Bridging (802.1D)
  - VLAN Bridging (802.1Q)
  - Provider Bridging (802.1ad)
  - VLAN Cross-connect
  - Multiple Virtual Switches
  - VLAN Translation
  - L2CP Tunneling
- MPLS-TP
  - P2P, bidirectional, co-routed LSPs
  - Ethernet PW encapsulation (T-PE) and multi-segment PWs (S-PE)
  - LSP switching
  - IETF based LSP fault management
  - RFC 4115 and 2698 based policing
  - VPWS, VPLS, and H-VPLS
  - MEF6.1 compliant single and double rooted multi-point EVC
- Protection
  - G.8031 Ethernet 1:1 VLAN protection, also over LAG interfaces
  - G.8032v2 Ethernet ring protection
  - G.8131 based LSP 1:1 protection, also over LAG interfaces
  - 802.1AX Link Aggregation (1:N and Active/Standby)
  - RSTP/MSTP
- OAM
  - 802.1 CFM OAM, 802.3 Link OAM
  - Y.1731 OAM FM and PM
  - G.8113.2 PW and LSP OAM
  - RFC 2544/Y.1564 service activation
  - Port/VLAN/flow mirroring
  - PM on policers and shapers
- QoS and Traffic Management
  - Classification based on Port and MAC L2, L2.5, L3 headers

TECHNICAL SPECIFICATIONS

- 4 queues per VLAN/LSP, 8 queues per port
- RED, WRED, and tail drop, WFQ and strict priority
- Multi-level hierarchical scheduling and shaping (port, VLAN/LSP)
- P-bit manipulation (mark, override, regeneration)
- IEEE 802.3x flow control on access ports

• Other
- Synchronous Ethernet
- In-band management VLAN
- MEF CE 2.0 certified including 100G

SONET/SDH Switching Features
- VC-4 and STS-1 based switching (up to 1.68 Tbps)
- Protection: UPSR/SNC and 1+1 APS/MSP
- SONET/SDH to OTN interworking
- Ethernet over SONET/SDH with or without LCAS, interworking with mTera packet switching
- IP/DCC

Timing and Synchronization
- Synchronous Ethernet
- Stratum 3 Clock
- SSM support
- E1/T1 and 2048 kHz support

ROADM-on-a-blade/DWDM
- ROADM-on-a-blade modules integrating twin WSS, amplifiers, OSC, and per channel power monitoring
- 9-port OADMRS-9 and 20-port OADMRS-20
- Route and select ROADM architecture
- Input amplifier version for both modules support 0 dB to 32 dB spans
- Support of 96 channels (fixed grid) or up to 128 channels (flexi-grid)
- Add/Drop Options:
  - Colored/Directional Add/Drop
  - Colorless/Directionless Add/Drop
  - Colorless/Directionless/ Contentionless Add/Drop

ASON/GMPLS Control Plane
- Layer 0 (OCh) and Layer 1 (ODU and SONET/SDH) support
- Dynamic source routing and/or preplanned paths
- Constraint options include optical impairments, latency, cost, and Shared Risk Link Groups (SRLGs)
- Resiliency options include Protection (1+1), Restoration (1+R), Protection +Restoration (1+1+R)
- Advanced features include: Hierarchical Restoration, Restoration Priority, 2 Port Diverse, Reversion, In-service Call Modification

Management/SDN
- NMS: Coriant® Transport Network Management System (TNMS)
- SDN: Coriant Transcend™ SDN Transport Controller and Coriant Transcend™ SDN Hierarchical Controller
- Craft Station: Coriant 7191 LCT
- Management Protocols: TL1 (DWDM, OTN, SONET/SDH) and SNMP (Packet), SFTP (File Transfers), SSH, Radius
- Physical Management Interfaces (i.e., DCN, LCT):
  - 14-slot mTera: Shelf Ethernet Interface Module (SEIM) with 8 x 10/100BaseT (RJ45), up to 2 SEIM per shelf
  - 8-slot mTera: Shelf Input/Output Module (SIOM) with 8 x 10/100BaseT (RJ45)
- Zero Touch Provisioning Assist
- Syslog

Environmental Specifications
- ETSI ETS 300 019 Class 3.1, 1.1 and 2.2
- NEBS Level 3, FR-2063, GR-3028: Thermal Management, Central Office
- EU WEEE (Waste Electrical and Electronic Equipment)
- UL and CE Compliant
- VCCI Certified
- FCC Class A

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