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Coriant® mTera ROADM

Compact, Flexible, and Future-proof Route and Select ROADM-on-a-Blade

The demand for more bandwidth and greater agility has been driving network operators to deploy ROADM-based optical transport with integrated electrical switching. At the same time, ROADM technology has evolved to address the requirements for higher wavelength speeds, increased add/drop flexibility and scalability, improved spectral efficiency, extended reach, and reduced power and footprint. Complementing its universal switching of packet, OTN, and SONET/SDH, the Coriant® mTera® Universal Transport Platform (UTP) optical layer based on a route and select ROADM-on-a-blade architecture can be deployed as part of a converged platform or as a disaggregated next-generation DWDM layer.

REDUCE CAPEX AND OPEX WITH CONVERGED ELECTRICAL AND OPTICAL SWITCHING

The mTera UTP provides the option to converge both electrical switching and optical switching in a single platform. At the electrical layer, the mTera UTP supports the universal switching of OTN, MPLS-TP including VPLS/H-VPLS, VLAN cross-connects, Ethernet bridging, and SONET/SDH. The mTera UTP optical layer modules include route and select ROADM-on-a-blade, colorless/directionless (CD) modules, a colorless/directionless/contentionless (CDC) module, a Raman amplifier, an EDFA amplifier for optical line amplifier (OLA) applications, and an Optical Time Domain Reflectometer (OTDR) pluggable. These optical layer modules are supported in both the 14-slot mTera shelf and the 8-slot mTera shelf. ROADM systems can be deployed in a single shelf, or to maximize availability, ROADM degrees and add/drop modules can be distributed over multiple shelves. The mTera UTP optical layer modules can be deployed with electrical switching in the same shelf, or they can be deployed in optical-only shelves that avoid the cost and power consumption of the electrical switching fabrics.

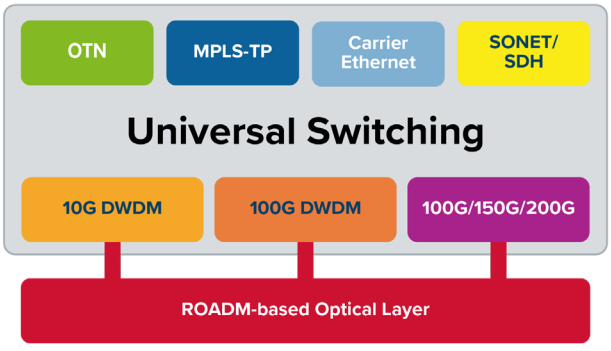

Figure 1: Coriant® mTera® UTP Converged Electrical Optical Switching

BENEFITS OF THE CORIANT® MTERA ROADM

- **Future-proof** your optical network with support for cost-efficient higher baud rate wavelengths and spectrally-efficient super-channels
- **Scale** your optical network with up to 20 ROADM ports and up to 128 channels per degree
- **Minimize** footprint with single slot ROADM-on-a-blade modules integrating twin WSS, input and output amplifiers, OSC, OCM, and OTDR filter
- **Maximize** network availability with restoration enhanced by CD and CDC add/drop options, and with integrated OTDR for quickly locating fiber cuts
- **Address** both metro and long haul applications with support for Coriant® 7100-compatible metro link control, Coriant® hiT 7300-compatible long haul link control, and hybrid EDFA/ Raman
- **Reduce** CapEx and OpEx by converging electrical and optical switching in a single platform

OADM-96-RS9 and OADM-96-RS20-DLC

The benefits of deploying the mTera UTP optical layer as part of a converged platform include power consumption reductions of up to 40% and footprint reductions of over 30%. A converged platform can further reduce OpEx with fewer network elements to install, manage, troubleshoot, and maintain, simplified OSS integration and end-to-end network management, guaranteed interoperability, and a single vendor relationship to manage. CapEx savings of up to 25% are made possible by sharing common equipment and by eliminating transponders and short-reach interconnects.

PREPARE FOR THE FUTURE WITH ROUTE AND SELECT ROADM

The mTera UTP optical layer is based on a route and select ROADM architecture with Wavelength Selective Switches (WSS) at both the ingress and egress in contrast to the traditional broadcast and select architecture, which has a splitter at the ingress and WSS at the egress, as shown in Figure 2. Route and select ROADM can scale to support larger numbers of ROADM ports, as ingress splitter loss is no longer an issue. This enables ROADM nodes with more than eight degrees and provides more scalability for CD and CDC add/drop. Route and select ROADM also offers improved performance for >100G wavelengths leveraging high order modulation and/or higher baud rates by eliminating leakage from non-selected channels at the egress in addition to eliminating ingress splitter loss. Route and select can also improve performance in long haul applications with the ability to use the WSS to control the per channel power levels at both the ingress and egress.

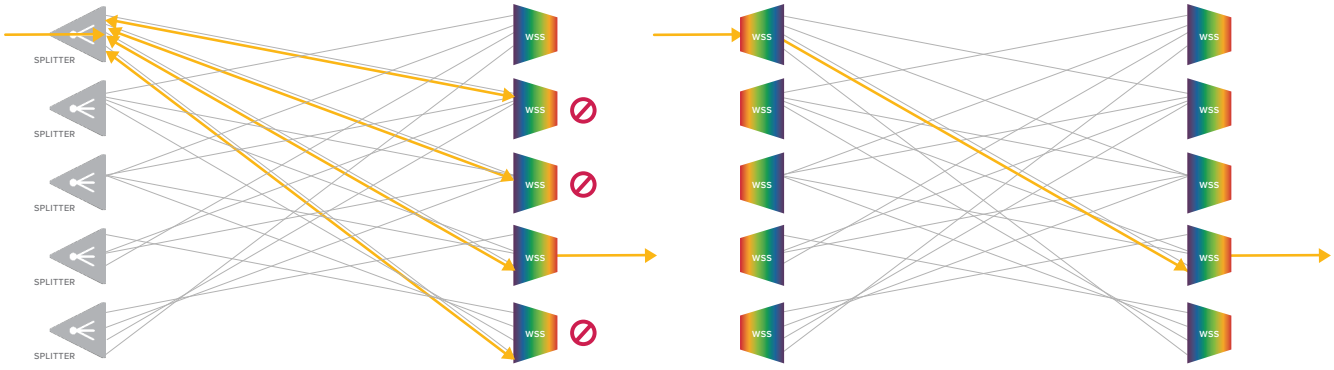

Figure 2: Route and Select Architecture

MINIMIZE FOOTPRINT WITH 9 PORT AND 20 PORT ROADM-ON-A-BLADE MODULES

The mTera UTP leverages ROADM-on-a-blade modules to minimize footprint and power consumption. These modules integrate twin WSS, the input amplifier, the output amplifier, the Optical Supervisory Channel (OSC), the Optical Channel Monitor (OCM), and an OTDR filter into a single module. They support flexi-grid enabling applications including high baud rate wavelengths that minimize cost per bit, and super-channels for increased spectral efficiency and/or reach, with a maximum of 128 channels. 50 GHz fixed grid is also supported with 88 channels for compatibility with the Coriant® 7100 Packet Optical Transport Platform or 96 channels to maximize channel count and to provide compatibility with the Coriant® hiT 7300 Multi-Haul Transport Platform. The input amplifiers support 0 dB to 32 dB spans to simplify sparing. The amplifiers also support automatic gain setting by the metro or long haul link control, and Automatic Power Shutdown (APSD). ROADM modules can be fully meshed or, to save ports in scenarios that do not require any-to-any wavelength connectivity, partially meshed.

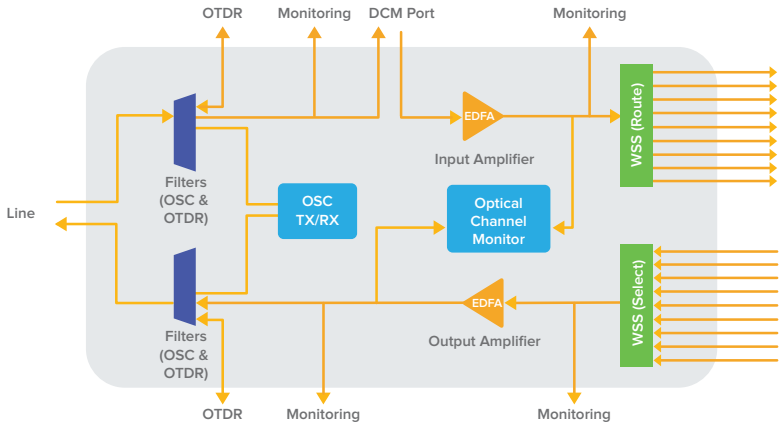

Figure 3: ROADM-on-a-blade Architecture

Two ROADM-on-a-blade module options are available. Optimized for nodes with fewer degrees, the OADM-96-RS9 is a 9-port route and select ROADM-on-a-blade based on twin 1x9 WSS. Optimized for applications requiring a larger number of degrees and CD and CDC add/drop scalability, the OADM-96-RS20-DLC is a 20-port route and select ROADM-on-a-blade based on twin 1x20 WSS. Both the OADM-96-RS9 and OADM-96-RS20-DLC have DCM ports for mixed coherent/non-coherent applications.

CHOOSE FROM COLORED/DIRECTIONAL, CD, AND CDC ADD/DROP

The mTera ROADM solution provides flexible add drop options including colored/directional, colorless/directionless (CD), and colorless/directionless/contentionless (CDC). In terms of grid structures, the colored/directional option supports a 50 GHz grid while the CD and the CDC options support both fixed grid and flexi-grid. And while colored/directional add/drop provides the most cost-effective option, drivers for CD and CDC add/drop include restoration, network defragmentation, service assurance, and faster provisioning with preinstalled cards.

COST-EFFECTIVE COLORED/DIRECTIONAL ADD/DROP WITH THE OMD48

The mTera UTP supports colored/directional add/drop with the 1RU OMD48 patch panels. The OMD48-S (Standard) supports the add/drop of channels 1–48, while the OMD48-O (Offset) supports channels 49–96. The OMD48s are based on a 50 GHz AWG filter with an offset filter to block the channels being sent to the other OMD48, thus avoiding the need for an interleaver/de-interleaver in the ROADM-on-a-blade. Starting with only a single OMD48 patch panel, it is possible to add/drop 48 wavelengths, then in the case of future traffic expansion, a second OMD48 patch panel can be added to support add/drop of the full 96 wavelengths, thereby enabling a pay-as-you-grow option.

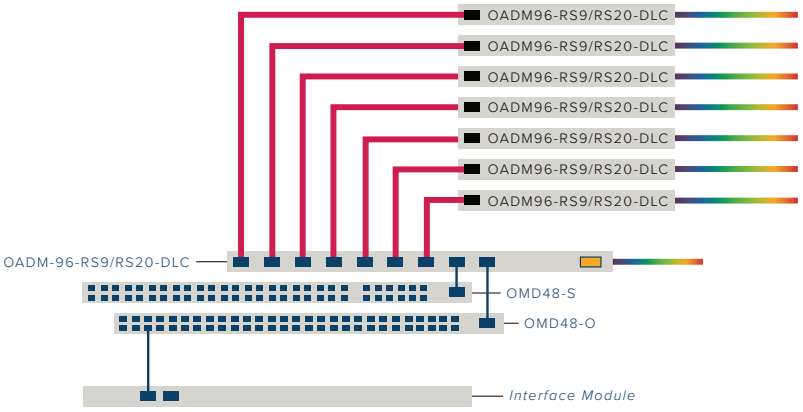

Figure 4: Colored/Directional 50 GHz Add/Drop with OMD48s

SCALABLE COLORLESS/DIRECTIONLESS ADD/DROP WITH THE CD-20 AND CX-12C

The mTera UTP provides the option of CD add/drop with support for both fixed grid and flexi-grid grid structures. The CD-20 houses a twin 20 port WSS with the ability to use these ports for either express ports to ROADM degrees or for coherent or non-coherent add/drop. Supported configurations include 8 directions plus 12 add/drops and 4 directions plus 16 add/drops. Each add/drop port can be used for a single coherent or non-coherent add/drop, or with a CX-12C splitter/combiner for twelve coherent add/drops. Based on the OFP1 form factor of the Coriant® Pluggable Optical Layer, the CX-12C can be housed in any OFP1 slot including one of the three OFP1 slots in the OFP1CC module and the single OFP1 slot in the CD-20. With CX-12Cs, a single CD-20 can support 192 coherent add/drops to four directions or support 144 coherent add/drops to eight directions. More CD add/drops can be supported with additional CD-20s.

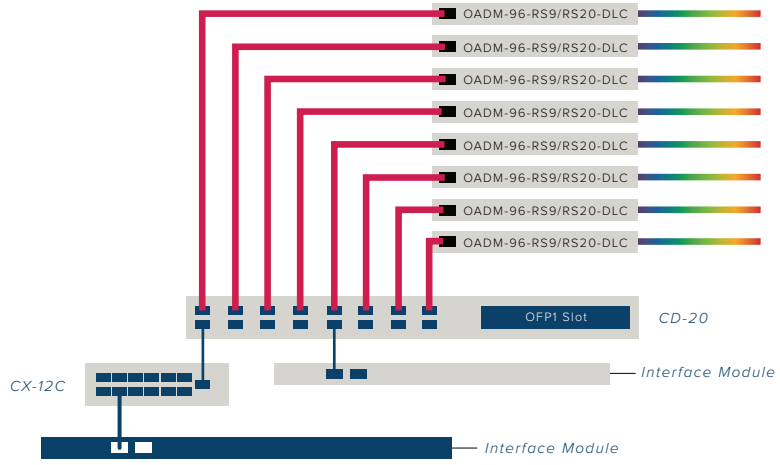

Figure 5: CD Flexi-grid Add/Drop with the CD-20 and the CX-12C

FLEXIBLE COLORLESS, DIRECTIONLESS, AND CONTENTIONLESS ADD/DROP WITH THE CDC8D6

CDC provides the ultimate add/drop flexibility with contentionless adding the ability to have the same wavelength on different add/drop ports on the same add/drop unit. The mTera UTP provides the option of CDC add/drop with support for both fixed grid and flexi-grid structures, leveraging the CDC8D6 with the OADM-96-RS9 or OADM-96-RS20-DLC. Based on "low port count" multicast switch (MCS) technology, the CDC8D6 provides a cost-effective CDC solution by eliminating the amplifiers required in "high port count" CDC architectures. Each CDC8D6 provides six coherent add/drops and eight directions. Based on the OFP1 form factor of the Pluggable Optical Layer, the CDC8D6 can be housed in any OFP1 slot including one of the three OFP1 slots in the OFP1CC module.

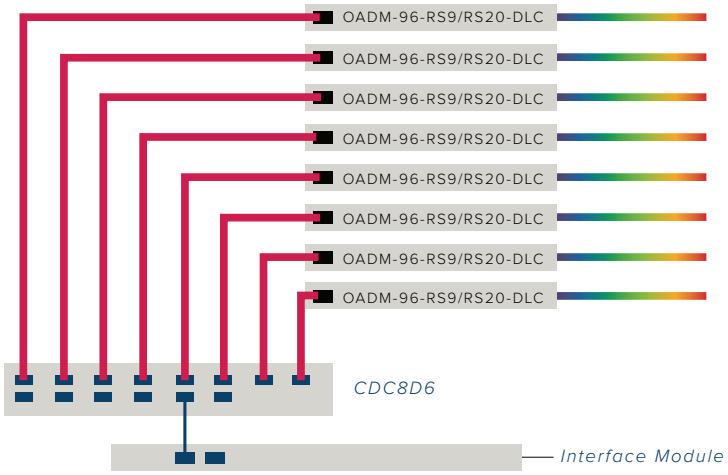

Figure 6: CDC Flexi-grid Add/Drop with the CDC8D6

QUICKLY LOCATE FIBER CUTS WITH INTEGRATED OTDR

Based on the OFP1 form factor of the Pluggable Optical Layer, the O1OTDR supports both in-service and out-of-service OTDR on up to 16 fibers (i.e., 8 bi-directional degrees) and can be used on EDFA-only spans as well as hybrid EDFA/Raman spans. It supports measurements with resolution down to as little as 1 meter over distances of approximately 100 km, with the graphical display of OTDR data supported in both the Coriant Transcend™ Software Suite and from a standalone OTDR viewer. In order to support in-service operation, it operates at 1625 nm in the L band and therefore requires a filter to separate this from the C band, which is used for the DWDM channels. This filter is provided in the mTera UTP's ROADM-on-a-blade modules and the standalone EDFA module, thus avoiding the need for an external filter.

EXTEND REACH WITH AN OLA-OPTIMIZED EDFA AND HYBRID EDFA/RAMAN AMPLIFICATION

A single slot EDFA amplifier with integrated OSC and OTDR filter supporting 0–32 dB spans is also available for OLA applications. A single slot counter-propagating Raman amplifier is also available. This Raman amplifier is used with the EDFA amplifier module or the integrated EDFA input amplifier of ROADM-on-a-blade modules to enable hybrid EDFA/Raman amplification, extending wavelength reach with lower noise for a given span loss and enabling a maximum span loss of 42 dB. The Raman amplifier can be optimized for any fiber type including SSMF, LEAF, ULL, TWRS, and TWC. It also provides a single slot to house OFP1 pluggables such as the O1OTDR.

ADDRESS BOTH METRO AND LONG HAUL WITH FLEXIBLE LINK CONTROL OPTIONS

Optical link control sets the power levels of the optical channels at each stage of their journey across the networks and the gain of the amplifiers. The mTera UTP ROADM layer supports both a metro link control and a long haul link control. Optimized for operational simplicity and fast service provisioning the mTera UTP metro link control is inherited from and fully compatible with the 7100 Series. Optimized to maximize reach under even the most challenging fiber conditions, the mTera UTP's long haul link control is inherited from and fully compatible with the hiT 7300. With the ability to support both link controls simultaneously, the mTera UTP can provide an optical gateway between a 7100 Series metro and a hiT 7300 long haul network providing the ability to express wavelength from the metro to the long haul network without the need for OEO regeneration, as shown in Figure 7.

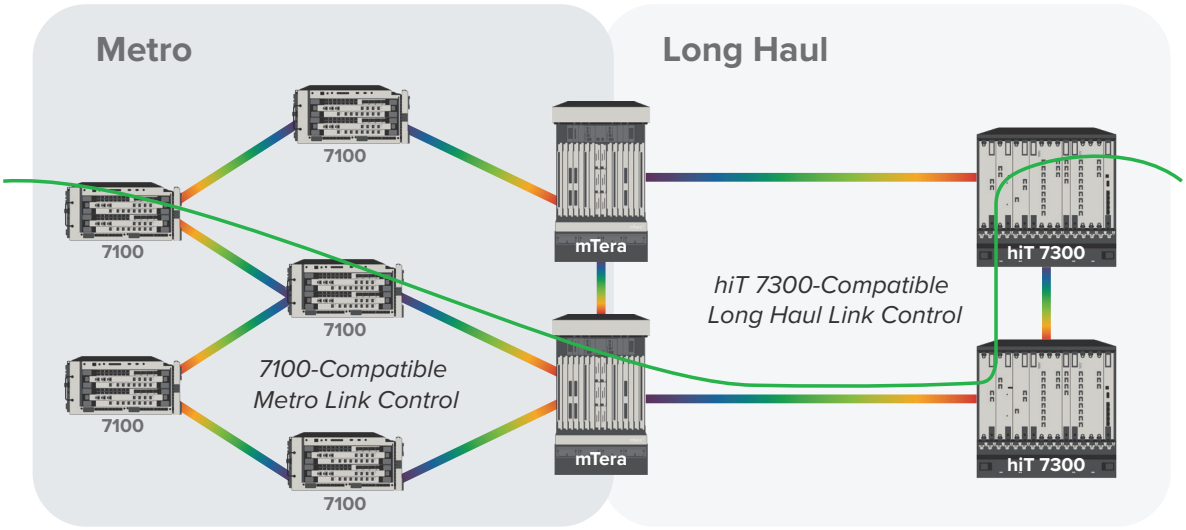

Figure 7: mTera UTP Gateway Application with Metro and Long Haul Link Controls

TECHNICAL SPECIFICATIONS

Route and Select ROADM-on-a-Blades

- Occupies 1 slot in the 14-slot or 8-slot mTera shelf
- Single integrated card includes: Twin WSS, Input Amplifier, Output Amplifier, OSC, OCM, OTDR Filter
- Twin WSS: 1x9 (RS9), 1x20 (RS20)
- Full Mesh or Partial Mesh
- Spans: 0–32 dB (minus DCM loss); longer spans with Raman Amplifier
- 50 GHz Fixed Grid (88 or 96 Channels), Flexi-grid (up to 128 Channels)
- Link Control: Metro (Coriant® 7100-compatible) and Long Haul (Coriant® hiT 7300-compatible)
- Automatic Power Shutdown (APSD)

Connectors	OADM-96-RS9	OADM-96-RS20-DLC
Dual LC for Express or Add/Drop	9	20
Dual LC for Line	1	1
Dual LC for DCM	1	1
Dual LC for Monitoring	2	2
Dual LC for OTDR	1	1
RJ-45 for Inventory of Passive Devices (OMD48s, DCMs; 1-wire protocol)	3	3

Colored/Directional Add/Drop (OMD48)

- Mux/Demux for Colored/Directional Add/Drop
- Channels 1–48 on OMD48-S (Standard)
- Channels 49–96 on OMD48-O (Offset)
- RJ-45 for inventory communications to OADM-96-RSx (1-wire protocol)
- Height: 43.18 mm (1RU)
- Width: 439.17 mm
- Depth: 166.62 mm

Colorless/Directionless Add/Drop (CD-20)

- Occupies 1 slot in the 14-slot or 8-slot mTera shelf
- 20 Port Twin WSS; supported configurations include:
  - 8 degrees + 12 add/drops
  - 4 degrees + 16 add/drops
- Coherent and Non-Coherent Add/Drop
- One OFP1 sub-slot (for CX-12C)

TECHNICAL SPECIFICATIONS CONTINUED

Colorless/Directionless Expansion (CX-12C)
- 12:1 Splitter/Combiner
- Coherent-only expansion – uses 1 add/drop port on CD-20 for 12 coherent colorless add/drops
- OFP1 Pluggable Form Factor
- Housed in OFP1CC, OFP1 slot in CD-20, or OFP1 slot in Raman Amplifier

CDC Add/Drop (CD8D6)
- Colorless, Directionless, and Contentionless based on Multicast Switch (MCS) technology
- 6 add/drops and 8 directions
- 14 x dual LC connectors
- OFP1 Pluggable Form Factor
- Housed in OFP1CC, OFP1 slot in CD-20, or OFP1 slot in Raman Amplifier

Standalone EDFA Amplifier (MLAIC1)
- Standalone EDFA for OLA/OLR applications
- Occupies 1 slot in the 14-slot or 8-slot mTera shelf
- Single integrated card includes: EDFA Amplifier, OSC, OTDR Filter
- Spans: 0–32 dB (minus DCM loss); longer spans with Raman Amplifier
- 50 GHz Fixed Grid (88 or 96 Channels), Flexi-grid (up to 128 Channels)
- Link Control: Metro (Coriant® 7100-compatible) and Long Haul (Coriant® hiT 7300-compatible)
- Automatic Power Shutdown (APSD)
- DCM ports for mixed coherent/non-coherent applications

Raman Amplifier (MRMNCPA)
- Counter-Propagating Raman Amplifier
- Occupies 1 slot in the 14-slot or 8-slot mTera shelf
- Enables hybrid EDFA/Raman amplification OADM-96-RSx and MLAIC1: Up to 42 dB spans
- Support for any fiber type: SSMF, LEAF, ULL, TWRS, TWC
- One OFP1 sub-slot

OTDR (O1OTDR)
- Optical Time Domain Reflectometer at 1625 nm
- In-service and out-of-service operation
- 16 Ports (8 bi-directional degrees)
- 0 to 100 km; Accuracy to 1 m
- OFP1 form factor
- Housed in OFP1CC, OFP1 slot in CD-20, or OFP1 slot in Raman Amplifier

OFP1 Carrier Card (OFP1CC)
- Occupies 1 slot in the 14-slot or 8-slot mTera shelf
- Carrier Module for OFP1 pluggables (O1OTDR, CX-12C, CDC8D6)
- Three OFP1 slots

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