Alcatel-Lucent 1626 Light Manager

RELEASE 6.1

The Alcatel-Lucent 1626 Light Manager (LM) is a global 10G/40G multi-reach Dense Wavelength Division Multiplexing (DWDM) platform for regional, long-haul terrestrial and unrepeatered submarine applications. As new multimedia services fuel huge bandwidth growth and time-to-service becomes key to business success, capacity, flexibility and ease of operations are driving the requirements for next-generation regional and backbone photonic networks. The combination of networking flexibility, operational efficiency, traffic scalability and optical performance makes the Alcatel-Lucent 1626 LM the ideal platform to support profitable transport network growth.

Zero Touch Photonics – flexible, automated, easy to operate

The Alcatel-Lucent 1626 LM helps service providers lower the overall cost per transported bit in the core of the network by implementing Alcatel-Lucent Zero Touch Photonics technology. Its unique multi-degree Tunable and Reconfigurable Optical Add-Drop Multiplexer (T&ROADM) architecture supports photonic switching, enabling fast and easy turnup or reconfiguration of wavelength services from end to end. This functionality ensures operations access to any wavelength anywhere in the network, regardless of the traffic forecast, and provides full network traffic reconfiguration without on-site intervention.

The Alcatel-Lucent 1626 LM delivers any mix of 10G and 40G wavelength services on any given fiber in the network. In addition, next-generation polarization division multiplexing binary phase-shift keying (PDM-BPSK) coherent modulation allows for 40G wavelengths at the largest optical reach and with full compatibility with neighbor 10G optical channels. This capability enables service providers to profitably grow their capacity by leveraging their existing 10G assets without compromise, both in terms of backward compatibility and future scalability.

Sophisticated design tools and self-tuning features simplify, optimize and accelerate planning for new networks or upgrades. These tools fully automate network installation, provisioning and commissioning, while unparalleled optical performance is guaranteed for the most stringent long reach applications. The Alcatel-Lucent 1626 LM also supports Generalized Multi-Protocol Label Switching (GMPLS) to further enhance network flexibility and improve resiliency with photonic restoration.

The Alcatel-Lucent 1626 LM is fully managed by the Alcatel-Lucent 1350 Optical Management System (OMS), providing a range of operations support applications for the entire network life cycle, from planning and design to provisioning. The Alcatel-Lucent 1626 LM enables flexible photonic networking for protected or unprotected linear, ring and meshed network topologies. Supporting the ITU-T Optical Transport Network (OTN) suite of standards, the Alcatel-Lucent 1626 LM enables end-to-end management of backbone photonic networks for simplified, zero-touch operations.

Key features and benefits

- *Photonic switching* – fast and easy service turn-up
  - ¬ T&ROADM: Wavelength Selective Switch (WSS)-based wavelength routing and tunable filter architecture
  - ¬ Any client to any wavelength to any direction
  - ¬ Flexible optical add/drop options with T&ROADM, ROADM and Fixed OADM
  - ¬ Multi-degree node support from two-degree to nine-degree connectivity
  - ¬ Supports linear, ring and mesh topologies
- *High capacity at 10G and 40G* – scalability without compromise
  - ¬ Up to 96 channels at 10 Gb/s and up to 80 channels at 40 Gb/s in the C-band
  - ¬ Any 10G/40G mix supported
  - ¬ Up to 15 channels at 40G in a rack, using PDM-BPSK coherent detection
- *Automation* – fast and easy network life-cycle management
  - ¬ Graphical design tools for accelerated administration from plan to commission
  - ¬ Integrated with network management for 360-degree operations
  - ¬ Self-tuning optical performance, automatic power and line adjustment
  - ¬ Supports TL1 interface
- *Extended reach* – optimal performance
  - ¬ 3500 km unregenerated transmission at 10 Gb/s using pure Erbium Doped Fiber Amplifiers (EDFAs)
  - ¬ >1600 km unregenerated transmission at 40 Gb/s using pure EDFAs
  - ¬ >400 km unrepeatered transmission at 10 Gb/s
  - ¬ >2500 km using 40G coherent detection
- GMPLS control plane
  - ¬ Automated discovery of network resources (links, paths and switches)
  - ¬ Resilience against multiple network failures
  - ¬ Coordination with other GMPLS-enabled networks for fast service provisioning and OPEX reductions
  - ¬ Increased efficiency, yielding CAPEX savings and a more fully monetized transport network
- *Extensive interface options* – reliable service delivery
  - ¬ Support a variety of Ethernet and SONET/SDH client interfaces
  - ¬ Transparent concentrators
  - ¬ 1+1 channel protection
  - ¬ Optical Multiplex Section Protection (OMSP)

Technical specifications

Network applications

- Point-to-point DWDM terminal multiplexer
- Long-haul and ultra long-haul unrepeatered applications
- Ring-based transport networks
- Multipoint-to-multipoint networks with wavelength add/drop requirements
- Mesh-based optical network protection

Client interfaces

- SONET/SDH
  - ¬ OC-768/STM-256: ITU-T G.693 VSR2000-3R2, -3R3, -3R5
  - ¬ OC-192/STM-64: VSR, S-64.2
  - ¬ OC-48/STM-16: I-16.1, S-16.1, L-16.2, L-16.1
- Ethernet
  - ¬ 1000Base-SX, 1000Base-LX, 1000Base-ZX
  - ¬ 10GigE LAN PHY LR, 10GigE LAN PHY ER, 10GigE LAN PHY SR
- 10 Gb/s, 40 Gb/s UNI and NNI ITU-T G.709 interfaces

WDM interfaces

- Bit rate: 10.709 Gb/s, 11.096 Gb/s and 43.018 Gb/s
- Supported modulation formats at 10 Gb/s (direct transponders and concentrators/muxponders):
  - ¬ Non-return-to-zero (NRZ)
- Supported modulation formats at 40 Gb/s (direct transponders and concentrators/muxponders):
  - ¬ Differential phase-shift keying (DPSK)
  - ¬ Partial DPSK (P-DPSK)
  - ¬ PDM-BPSK
- ITU-T G.709 direct transponders and concentrators/muxponders
- Optical amplifiers: 17 dBm, 20 dBm and 23 dBm output power

- Chromatic dispersion compensation techniques:
  - ¬ Line dispersion compensation
  - ¬ Per-band dispersion compensation
- Tunable dispersion compensation module (TDCM) integrated in 10Gb/s transponder and in DPSK and P-DPSK 40Gb/s transponders
- Resilient up to 30 ps of polarization mode dispersion (PMD) thanks to 40G coherent modulation
- Linear chromatic dispersion tolerance @ 10 Gb/s: ±700 ps/nm
- Linear chromatic dispersion tolerance @ 40 Gb/s:
  - ¬ ±150 ps/nm with phase-shaped binary transmission (PSBT) modulation
  - ¬ ±500 ps/nm with DPSK and P-DPSK modulation
  - ¬ ±42,000 ps/nm with PDM-BPSK modulation

Transparent concentration

- 4 × 2.5 Gb/s ITU-T G.709 concentrator
- 4 × 10 Gb/s concentrator (supports any combination of the following rates):
  - ¬ ODU2 ITU-T G.709
  - ¬ 10GigE LAN PHY
  - ¬ 10GigE WAN PHY
  - ¬ Clear channel (any signal with 9.95 Gb/s bit rate)
- 2 × GigE concentration into 2.5 Gb/s
- 9 × GigE concentration into 10 Gb/s

GMPLS/ASON control plane

- Automatic topology discovery
- Autodiscovery of services and resources
- WDM-optimized path computation
- Unconstrained wavelength path setup
  - ¬ Routing over a feasible path
  - ¬ Routing with regeneration definition
- Wavelength path rerouting with wavelength path conversion
- Restoration
  - ¬ Source-based restoration
  - ¬ Protection restoration combined
- Nominal route
- Operator control over connection parameters
- Shutting down of links

Optical performance

- 3500 km unregenerated transmission at 10 Gb/s with pure EDFAs
- 1600 km unregenerated transmission at 40 Gb/s with pure EDFAs
- 400 km unrepeatered transmission at 10 Gb/s
- >2500 km using 40G coherent detection
- Fiber transmission support over all single-mode fibers: ITU-T G.652, G.653, G.654, G.655 and G.656 (SMF, DSF, LEAF, TeraLight, TrueWave)

Multi-degree T&ROADM and ROADM

- WSS-based technology
- Multi-degree node support (up to nine degrees)
- Multi-directional add/drop
- Tunable mux/demux for network traffic reconfiguration without on-site intervention

FEC

- 10 Gb/s
  - ¬ Enhanced FEC (EFEC) with 8.5 dB coding gain (7% overhead)
- 40 Gb/s
  - ¬ Ultra FEC (UFEC) with 7.4 dB net coding gain (7% overhead)
  - ¬ EFEC with 8.5 dB coding gain (7% overhead)

Optical connectors

- General practice: MU/SPC
- Plug-in modules: LC connectors
  - ¬ On the 4 × 2.5 Gb/s concentrator: Small Form Factor Pluggable (SFP)
  - ¬ On the 4 × 10 Gb/s concentrator: Extended Form Factor Pluggable (XFP)
  - ¬ On the 10 Gb/s universal transponder
  - ¬ On the 9 × GigE concentrator
- Dispersion compensating modules: MU/SPC

Optical Supervisory Channel (OSC)

- Wavelength: 1510 nm
- Bit rate: 4 Mb/s

Housekeeping

- Eight inputs/outputs per board

Data communication channels

- Up to four 64 kb/s data channels
- 2 Mb/s data channels

Optical safety

- Automatic power shutdown procedure and automatic restart of optical amplifiers

Protection

- 1+1 OCH protection (transponder protection)
- OMSP protection (line protection)
- GMPLS restoration

Operations automation

- Equipment commissioning
- Path routing and reservation
- Optical path creation and optical tuning
- Path restoration

Management

- Alcatel-Lucent 1350 Optical OMS
- Network management interface: TL1
- Zero-installation craft (ZIC) terminal
- Network management access: 10 Mb/s Ethernet interface with RJ-45 and BNC connectors
- Craft interface: 38.4 kb/s serial TIA/EIA-232 interface with DB-9 connector

Physical specifications and power requirements

- Rack dimensions:
  - ¬ Height: 2200 mm (86.6 in.)
  - ¬ Width: 600 mm (23.6 in.)
  - ¬ Depth: 300 mm (11.8 in.)
- Shelf dimensions (with front cover):
  - ¬ Height: 466 mm (18.3 in.)
  - ¬ Width: 532 mm (20.9 in.)
  - ¬ Depth: 288 mm (11.3 in.)
- Flexible slot shelf:
  - ¬ Slot heights: 354 mm, 265 mm and 73 mm (13.9 in., 10.4 in. and 2.9 in.)
  - ¬ Slot widths: 20 mm and 25 mm (0.79 in. and 0.98 in.)
- Board depth: 213 mm (8.39 in.)
- Wall mounting
- Voltage: 48/60 V DC

Operating environment

- Operating temperature: -5°C to +45°C (41°F to 113°F)
- Humidity: 5% to 95%
- EMI: EN 300 386 V1.3.1
- Shock/vibration: Zone 4 earthquake

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