The Alcatel-Lucent 1660 Synchronous Multiplexer (SM) is the market-leading Synchronous Transfer Mode 64 (STM-64) multiservice provisioning platform (MSPP) for building next-generation multiservice Synchronous Digital Hierarchy (SDH) metro and regional transport networks. A single-shelf solution that integrates highly functional transport features, including SDH cross-connect and Coarse Wavelength Division Multiplexing (CWDM) add/drop functionality, the Alcatel-Lucent 1660 SM provides carrier-class, Layer 2 packet/cell switching functions, such as Ethernet, Multi-Protocol Label Switching (MPLS) and ATM. The Alcatel-Lucent 1660 SM supports Generalized MPLS (GMPLS), Ethernet Ring Protection (ERP), enhanced resiliency and flexible service interworking with intelligent optical core networks, such as those based on the Alcatel-Lucent 1678 Metro Core Connect (MCC).

With these capabilities, the Alcatel-Lucent 1660 SM addresses metro and regional applications, offering a multiservice transport platform that supports revenues from multiple broadband services, such as triple play, private line, Ethernet business services and mobile aggregation.

The Alcatel-Lucent 1660 SM is the metro-core component of the Alcatel-Lucent Optical Multi-Service Node (OMSN) product family, which also includes the Alcatel-Lucent 1662 Synchronous Multiplexer Compact (SMC), an STM-16 MSPP, and the Alcatel-Lucent 1650 SMC, an STM-4 MSPP. For offering capital and operating efficiencies, the Alcatel-Lucent OMSN products share many common features and modules.

Features

• Fully non-blocking redundant SDH matrix with:
  - 60 Gb/s (384 x 384 STM-1 equivalent) high-order (HO) throughput capacity
  - 40 Gb/s (256 x 256 STM-1 equivalent) low-order (LO) capacity

• SDH interfaces, with up to four STM-64 interfaces for double 10 Gb/s ring interconnection or Multiplex Section Protection (MSP) 1+1 configuration

• Rich-featured 10/100 Ethernet and Gigabit Ethernet (GE)

• ITU-T G.8032 v2 ERP

• E1 and E3/DS3

• MPLS-enabled Ethernet, ATM and digital video switching
• GMPLS control plane with:
  ¬ Automated discovery and provisioning of network resources
  ¬ Resiliency against multiple network failures
  ¬ Enhanced connectivity to GMPLS-enabled intelligent optical core networks
• Transport for IBM® Enterprise Systems Connection (ESCON®), IBM Fibre Connection (FC), and Fibre Channel (FCF)
• CWDM multiplexer/demultiplexer (MUX/DEMUX)
• Colored STM-16 for direct interworking with Dense WDM (DWDM) systems
• ITU-T G.8032v2 ERP

Benefits
• Supports high-capacity Plesiochronous Digital Hierarchy (PDH)/SDH service
• Provides GMPLS efficiency
  ¬ Fast service provisioning and reduced operating expenditures (OPEX)
  ¬ Capital expenditure (CAPEX) savings with a more fully monetized transport network
  ¬ Increased reliability
• Supports ITU-T G.8032 v2 ERP for 100 percent increase in Ethernet over SDH (EoS) bandwidth for protected services
• Supports SyncE derived from SDH synchronization supply unit (SSU) quality
• Aggregates broadband services
  ¬ Triple play
  ¬ Business Ethernet: MEF (former Metro Ethernet Forum) compliant virtual LAN (VLAN) and Virtual Private LAN Service (VPLS)
• Provides Third Generation (3G) mobile backhaul
• Offers highly reliable and manageable TDM and data services
• Delivers feature transparency and operational savings with Alcatel-Lucent OMSN common components

Technical specifications

Interfaces per board
• 63 x 2 Mbit/s: ISDN-PRA and retiming function
• 3 x 34/45 Mbit/s switchable
• 4 x 140 Mbit/s/STM-1 switchable
• 4 x STM-1: electrical, S-1.1, L-1.1, L-2.1
• 16 x STM-1 electrical/optical
• 4 x OC-3 with administrative unit (AU) 3/tributary unit (TU) 3 conversion
• 4 x STM-4: S-4.1, L-4.1, L-4.2
• 1 x STM-16: S-16.1, S-16.1, L-16.1, L-16.2
• 1 x L-16.2 colored optics DWDM
• 1 x L-16.2 colored optics CWDM
• 1 x STM-64: very short reach (VSR)/CI-64.1, S-64.2b S-64.2b
• P1L1 -2D2/JE2/JE3
• Integrated booster: +10 dB/ +15 dB/+17 dB
• 4 x any sub-lambda multiplexing function (four channels in 2.5G lambda); transparent Ethernet/FE, GE, STM 4, FC, ESCON, FICON, FDDI, digital video
• Digital Video Broadcasting (DVB) ASI blade
• Up to 14 x Ethernet 10/100Base-T per ISA blade
• Up to 8 x Ethernet 10/100Base-FX per ISA blade
• Up to 4 x GE Base-SX/LX per ISA blade

Connection
• 384 x 384 (HO)/256 x 256 (LO) STM-1 equivalent fully non-blocking SDH fabric in all configurations
• Unidirectional, bidirectional, drop-and-continue multicast, broadcast SDH connections
• Line and virtual container (VC) loopbacks
• Virtual concatenation (VCAT) and contiguous concatenation
• 1- or 2-channel CWDM optical add/drop multiplexer (OADM) function
• 8-channel CWDM MUX/DEMUX function
• Embedded ATM star, ring and mesh topologies
• Embedded Ethernet/MPLS star, ring and mesh topologies
• Embedded Ethernet/multiple-ring topologies

Equipment protection
• Matrix, control and synchronization EPS 1+1
• ISA-ATM switch EPS 1+1
• ISA-ES16 EPS 1+1
• DVB-ASI EPS 1+1
• 63 x 2 Mbit/s EPS n+1, maximum
  • n = 6
  • 3 x 34/45 Mbit/s EPS n+1, maximum
  • n = 15
  • 4 x STM-1e EPS n+1, maximum
  • n = 15
  • 16 x STM-1e EPS n+1, maximum
  • n = 15

GMPLS/ASON control plane
• Managed class of service (CoS): different levels of priority differentiated by priority mechanism
• SNCP ring closure
• TDM ring closure (2F)
• ASON/GMPLS-based multicast
• Type of path unidirectional/bidirectional
• Full portfolio of meshed service protection and restoration: SBR, GR and PRC
• Hitless reversion of nominal routes
• End-to-end management across different domains
• Maintenance support with:
  ¬ Manual routing of traffic
  ¬ Modification of nominal and current route
  ¬ Shutting down of links
  ¬ PM on path
  ¬ SNCP selector state retrieval and manual switchover and reversion
  ¬ In-service migration from classical centralized management to GMPLS/ASON
  ¬ In-service upgrade with active control plane
  ¬ Link in maintenance
  ¬ Node in maintenance
  ¬ Link shutting down state
• Traffic parameter modify, including SRLG, priority and cost
• Priority-based preemption
• Bridge and roll
• Full operator control of dynamic GMPLS networking
• OIF UNI (OIF-UNI 2.0), OIF E-NNI 1.0 and Enhanced OIF E-NNI 1.0

Network protection

Transport
• Linear single/dual-ended 1+1 APS at STM-1/4/16/64
• Linear dual-ended n+1 APS at STM-1/4/16
• SNCP/I, SNCP/N
• SNCP drop-and-continue plus insertion
• Multiplex Section – Shared Protection Ring (MS-SPRing) drop-and-continue plus insertion
• 2 fiber MS-SPRing at STM-16/64
• Collapsed single-node ring interconnection
• Collapsed dual-node ring interconnection

Packet
• Dual attach: packet-ring interconnection
• ITU-T G.8032 v2 ERP
Monitoring
- Performance monitoring according to ITU-T G.784, G.826, G.821
- Path overhead monitoring (POM) on all VCs
- Supervisory unequipped trail (SUT)
- Tandem connection monitoring (TCM)
- Ethernet performance monitoring counters
  - Port/aggregate/flow
  - Incoming/outgoing

Ethernet performance monitoring according to ITU-T G.784, G.826, G.821
- Path overhead monitoring (POM) on all VCs
- Supervisory unequipped trail (SUT)
- Tandem connection monitoring (TCM)
- Ethernet performance monitoring counters
  - Port/aggregate/flow
  - Incoming/outgoing

Synchronization
- Internal oscillator ±4.6 ppm
- Holdover drift ±0.37 ppm per day
- External sources: STM-n/2 Mb/s ports, 1 external 2 MHz/2 Mb/s output
- Priority and quality SSM synchronization algorithms
- SyncE for Alcatel-Lucent ISA-ES blades linked to SDH SSM

Data blades: ISA
ISA-ATM
- 600 Mb/s and 1.2 Gb/s cell switch with optional STM-1 access on board
- Equipment protection 1+1
- VPC/VCC switch/cross-connect
- Hard/soft PVC connections for PNNI
- Point-to-point/multipoint from E1 up to VC4-4c payloads
- Up to 252 ATM logical ports
- IMA support: maximum 126 groups/32 links
- Policing, shaping, congestion management

ISA-ES1
- 1 Gb/s throughput
- 155 Mb/s back-panel capacity
- 8 x Ethernet 10/100Base-T/FX
- GFP-F/LAPS, VCAT, LCAS
- LACP
- VC-12/VC-3/VC-4 terminations
- VC groups: maximum eight at 50/2/1
- Classification/forwarding
  - Per port
  - MAC DA: IEEE 802.3
  - C-VLAN/S-VLAN
  - IEEE 802.1p
  - DSCP/TOS
  - Ethertype
- Ethernet multicast: IGMP
- Ethernet OAM & CFM
- Q-in-Q: IEEE 802.1Q/ad
- QoS: IEEE 802.1p
  - CoS
    - Guaranteed
    - Regulated
    - Best-effort
  - STP/RSTP/MSTP/PVSTP: IEEE 802.1d/w/s
  - Congestion avoidance
  - ITU-T G.8032 v2 ERPs
  - Ethernet performance counters
    - Per port/aggregate/flow
    - Incoming/outgoing
    - Unicast
    - Multicast
    - Broadcast
  - E-Line, E-LAN, Ethernet aggregation services in accordance with MEF

ISA-ES4
- 2.5 Gb/s throughput
- 622 Mb/s back-panel capacity
- 1 x GE using SFP, 8 x Ethernet 10/100Base-T
- GFP-F/LAPS, VCAT, LCAS
- LACP
- VC-12/VC-3/VC-4 terminations
- VC groups: maximum 16 at 63/12/4
- Classification/forwarding
  - Per port
  - MAC DA: IEEE 802.3
  - C-VLAN/S-VLAN
  - IEEE 802.1p
  - DSCP/TOS
  - Ethertype
- MPLS label switching (pseudowire/tunnel)
- MPLS EXP bits
- Ethernet and MPLS multicast, IGMP
  - CoS
    - Guaranteed
    - Regulated
    - Best-effort up to eight CoS
  - Policing dual-rate token bucket, metering, marking, CIR/CBS, EIR/EBR, dropping (OOP)
  - Scheduling HOL, weighted-deficit round robin
  - Congestion-avoidance weighted random early detection (WRED) per queue
  - STP/RSTP/MSTP/PVSTP: IEEE 802.1d/w/s
  - ITU-T G.8032 v2 ERPs
  - Ethernet and MPLS performance counters
    - Per port/aggregate/flow
    - Incoming/outgoing
    - Unicast
    - Multicast
    - Broadcast
  - E-Line, E-LAN, Ethernet aggregation services in accordance with MEF

ISA-ES8
- 4.5 Gb/s throughput
- 2.5 Gb/s back-panel capacity
- 4 x GE (SFP), 14 x Ethernet 10/100Base-T, 7 x 10/100Base-FX
- GFP-F/LAPS, VCAT, LCAS
- LACP
- VC-12/VC-3/VC-4 terminations
- VC groups: maximum 64 at 63/12/8
- Classification/forwarding
  - Per port
  - MAC DA: IEEE 802.3
  - C-VLAN/S-VLAN
  - IEEE 802.1p
  - DSCP/TOS
  - Ethertype
- MPLS label switching (pseudowire/tunnel)
- MPLS EXP bits
- Ethernet and MPLS multicast, IGMP
  - CoS
    - Guaranteed
    - Regulated
    - Best-effort up to eight CoS
  - Policing dual-rate token bucket, metering, marking, CIR/CBS, EIR/EBR, dropping (OOP)
  - Scheduling HOL, weighted-deficit round robin
  - Congestion-avoidance weighted random early detection (WRED) per queue
  - STP/RSTP/MSTP/PVSTP: IEEE 802.1d/w/s
  - ITU-T G.8032 v2 ERPs
  - Ethernet and MPLS performance counters
    - Per port/aggregate/flow
    - Incoming/outgoing
    - Unicast
    - Multicast
    - Broadcast
  - E-Line, E-LAN, Ethernet aggregation services in accordance with MEF

ISA-ES16
- 4.5 Gb/s throughput
- 2.5 Gb/s back-panel capacity
- 4 x GE (SFP), 14 x Ethernet 10/100Base-T, 7 x 10/100Base-FX
- GFP-F/LAPS, VCAT, LCAS
- LACP
- VC-12/VC-3/VC-4 terminations
- VC groups: maximum 64 at 63/12/8
- Classification/forwarding
  - Per port
  - MAC DA: IEEE 802.3
  - C-VLAN/S-VLAN
  - IEEE 802.1p
  - DSCP/TOS
  - Ethertype
- MPLS label switching (pseudowire/tunnel)
- MPLS EXP bits
- Ethernet and MPLS multicast, IGMP
  - CoS
    - Guaranteed
    - Regulated
    - Best-effort up to eight CoS
  - Policing dual-rate token bucket, metering, marking, CIR/CBS, EIR/EBR, dropping (OOP)
  - Scheduling HOL, weighted-deficit round robin
  - Congestion-avoidance weighted random early detection (WRED) per queue
  - STP/RSTP/MSTP/PVSTP: IEEE 802.1d/w/s
  - ITU-T G.8032 v2 ERPs
  - Ethernet and MPLS performance counters
    - Per port/aggregate/flow
    - Incoming/outgoing
    - Unicast
    - Multicast
    - Broadcast
  - E-Line, E-LAN, Ethernet aggregation services in accordance with MEF

DVB-ASI
Unidirectional transparent transport
- CBR MPEG-n transport stream (TS)
  - Single program TS (SPTS)
  - Multiple program TS (MPTS)
  - TS rate: 1.5 Mb/s to maximum 100 Mb/s with C-12 or C-3 granularity

Physical specifications
Power
- Station battery: -48 V DC / -60 V DC
- Power consumption: 250 W (typical)
Dimensions

**Dimensions**

**Rack size**
- Height: 2.2 mm
- Width: 600 mm
- Depth: 300 mm

**Subrack size**
- Height: 650 mm
- Width: 482 mm
- Depth: 250 mm

Regulatory compliance

**Environmental**
- Operating conditions: ETS 300 019, class 3.2
- Storage conditions: ETS 300 019, class 1.2
- Transportation conditions: ETS 300 019, class 2.2
- ESD/EMC: ETS 300 386 "Telecommunications Center"

**Mechanical**
- Mechanical compatibility: ETSI ETS/E3, 59

Operational

**Operational**
- Alcatel-Lucent 1350 Optical Management System (OMS)
- CMISE craft terminal through TIA/EIA-232 at 38.4 kb/s
- Network management access through Q83 G.773 interface or Qecc G.784
- Protocol stack and information model: according to ITU-T G.774 and ETSI rec. ISO-OSI; IP and SNMP tunneling over OSI
- Local and remote software download
- Remote inventory
- Housekeeping: six inputs plus two outputs
- Auxiliary channels
  - EOW
  - 4 x 64 kb/s G.703
  - 4 x TIA/EIA-232
  - 4 x V.11
  - 2 x 2 Mb/s G.703

Standards

**Standards**
- Compliant with all the latest relevant ITU-T standards
  - G.7041
  - G.7042
  - G.707
- ETSI
- ITU-T G.8032 v2 ERP
- ATM Forum
- IETF
- IEEE
- MEF 9, MEF 14, MEF 21 certified