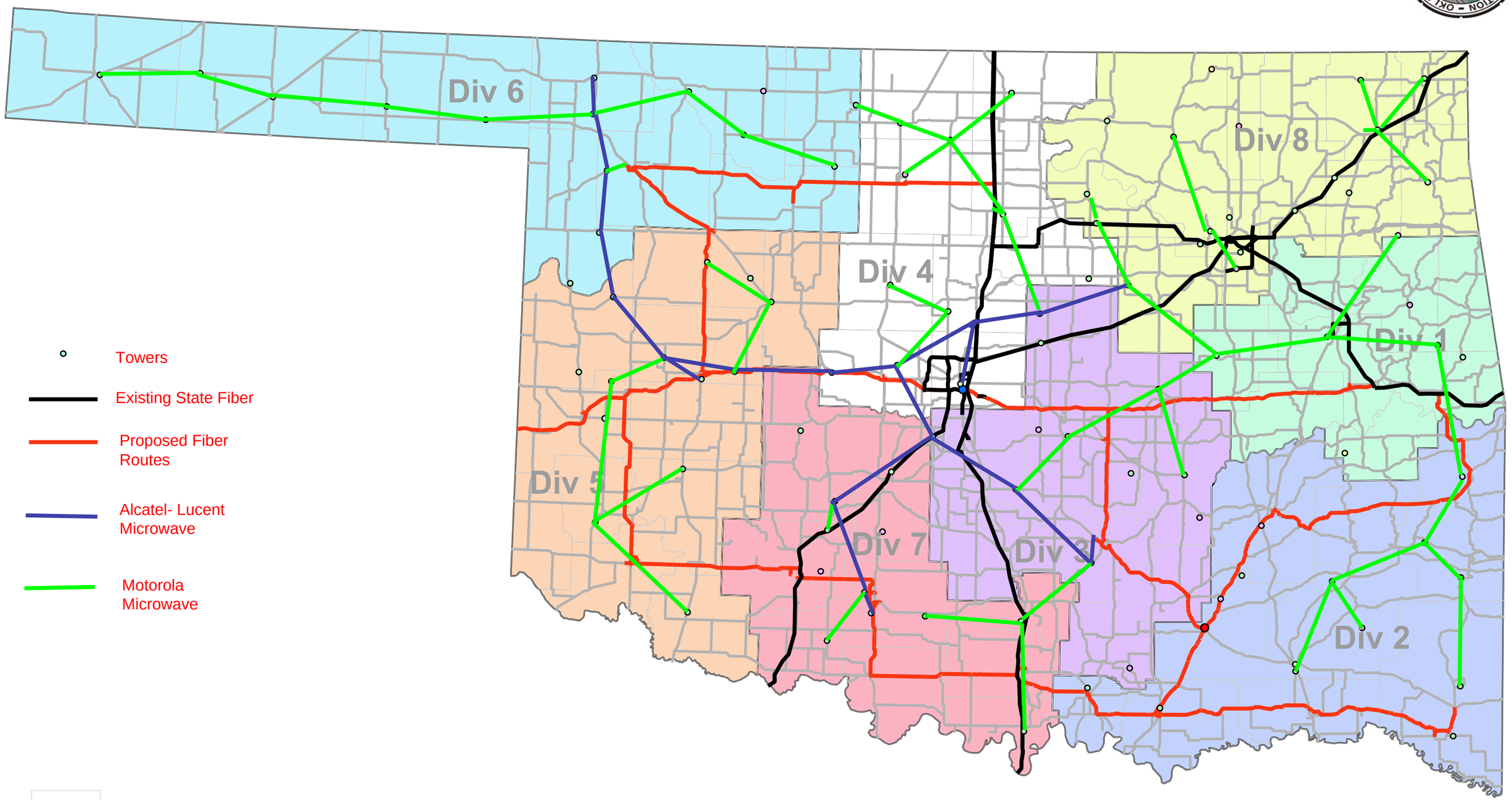
State of Oklahoma Microwave Fiber Map



Alcatel-Lucent MDR-8000

6 GHz DIGITAL RADIOS

OVERVIEW

The MDR-8X06 is Alcatel-Lucent's premier digital microwave radio for long-haul, point-to-point wireless communications. The flexible platform offers features designed to provide robust operation, while also reducing your total cost of ownership. With a common platform that supports virtually all frequency bands from 2-11 GHz, the MDR-8X06 operates in the lower and upper 6 GHz bands used by common carriers and private users in the United States and Canada, as well as upper 6 GHz frequencies used for television broadcast auxiliary service in the U.S. It also offers customers transmission capacity from 4-32 DS1s, 1-3 DS3s, OC-3, and 10/100/1000 Base-T Ethernet, with the ability to upgrade capacity simply by changing Capacity Keys™. Wayside capacity provides an additional DS1 per each DS3-equivalent available in the system.

Compact mechanical dimensions and low power consumption allow operators to place the MDR-8X06 in cramped spaces without sacrificing system performance and availability. This flexible and scalable architecture provides reliable wireless backbone communications for cellular operators, public safety agencies, railways, pipelines, utilities, local exchange carriers, television stations, and private enterprise.

COST-SAVING FEATURES

- Industry-high system gain
  - ¬ Allows longer paths, potentially avoid repeater sites
  - ¬ Allows smaller antennas
    - Lower purchase price
    - Reduces tower loading & rent
  - ¬ Improves path availability
- Common platform for all frequency bands & capacities
  - ¬ Simplifies training and maintenance
  - ¬ Minimizes spares
- In-service capacity upgrades
  - ¬ Graceful migration to higher capacities
  - ¬ No stranded investment
- Flexible Ethernet options
  - ¬ Provision bandwidth dynamically, as needed
  - ¬ Combined data throughput of 300 Mb/s using dual channel mode
  - ¬ Auto-sensing simplifies installation and turn-up
- Low power consumption
  - ¬ Reduces size of DC power plant and batteries
  - ¬ Reduces cost of HVAC
- Small size
  - ¬ Reduces amount of rack space needed

PERFORMANCE-ENHANCING FEATURES

- All-indoor operation
  - ¬ No tower-mounted electronics
  - ¬ Simplifies maintenance and troubleshooting
- Industry-leading receiver selectivity and interference rejection
  - ¬ Allows coordination in frequency congested areas
  - ¬ Speeds up licensing
- Full range of configurations
  - ¬ Nonstandby, hot-standby, space diversity, frequency diversity, quad diversity
  - ¬ Provides full equipment protection
  - ¬ Used to overcome poor path conditions
- Robust multipath countermeasures
  - ¬ Used to overcome propagation problems

MDR-8506 - Maximum System Gain

EQUIPMENT IDENTIFIER	MDR-8506-4	MDR-8506-8	MDR-8506-16
Frequency Band (GHz)	5.725 - 7.125	5.725 - 7.125	5.725 - 7.125
Emission Designator	2M50D7W	3M50D7W	N/A
RF Channel Bandwidth (MHz)	2.5	3.5	7.5
Capacity per RF Channel (DS1s)	4	8	16
Modulation Type (TCM)	32	32	32
Radio Data Rate (Mb/s)	6.18	12.4	24.7
System Gain (BER = 10^{-6}) @ 33 dBm (dB)*	119	116	113
Transmitter Power Output (dBm)	15	15	15
Optional Power Amplifier Outputs (dBm)	23, 29, 31, 33	23, 29, 31, 33	23, 29, 31, 33
Receiver Threshold (BER = 10^{-6}) (dBm)*	-86	-83	-80
Maximum RSL for 10^{-6} BER (dBm)*	-17	-17	-17
Dispersive Fade Margin for 10^{-3} BER (dB)	80	80	66
Threshold/Interference			
Cochannel (dB)	28	28	28
Adjacent Channel (dB)	-8	-8	-8

MDR-8706 - Maximum Spectral Efficiency

EQUIPMENT IDENTIFIER	MDR-8706-4	MDR-8706-8	MDR-8706-16
Frequency Band (GHz)	5.725 - 7.125	5.725 - 7.125	5.725 - 7.125
Emission Designator	1M25D7W	2M50D7W	5M00D7W
RF Channel Bandwidth (MHz)	1.25	2.5	5.0
Capacity per RF Channel (DS1s)	4	8	16
Modulation Type (TCM)	128	128	128
Radio Data Rate (Mb/s)	6.18	12.4	24.7
System Gain (BER = 10^{-6}) @ 33 dBm (dB)*	115	112	109
Transmitter Power Output (dBm)	15	15	15
Optional Power Amplifier Outputs (dBm)	23, 29, 31, 33	23, 29, 31, 33	23, 29, 31, 33
Receiver Threshold (BER = 10^{-6}) (dBm)*	-82	-79	-76
Maximum RSL for 10^{-6} BER (dBm)*	-17	-17	-17
Dispersive Fade Margin for 10^{-3} BER (dB)	80	80	66
Threshold/Interference			
Cochannel (dB)	34	34	34
Adjacent Channel (dB)	-8	-8	-8

MDR-8X06 - High Capacity

EQUIPMENT IDENTIFIER	MDR-8706-32	MDR-8606-45	MDR-8506-90	MDR-8606-135	MDR-8706s-155
Frequency Band (GHz)	5.725 - 7.125	5.725 - 7.125	5.725 - 7.125	5.725 - 7.125	5.725 - 7.125
Emission Designator	10M0D7W	10M0D7W	25M0D7W	30M0D7W	30M0D7W
RF Channel Bandwidth (MHz)	10	10	25	30	30
Capacity per RF Channel	32xDS1	1xDS3	2xDS3	3xDS3	3xSTS-1
DS1 Wayside Line Capacity	N/A	1xDS1	2xDS1	3xDS1	3xDS1
Modulation Type	128 TCM	64 QAM	32 TCM	64 QAM	128 TCM
Radio Data Rate (Mb/s)	58.996	46.3	92.5	138.8	160.2
System Gain (BER = 10^{-6}) @ 33 dBm (dB)*	107.5	108.5	108	103	103
Transmitter Power Output (dBm)	15	15	15	15	15
Optional Power Amplifier Outputs (dBm)**	23, 29, 31, 33	23, 29, 31, 33	23, 29, 31, 33	23, 29, 31, 33	23, 29, 31, 33
Receiver Threshold (BER = 10^{-6}) (dBm)*	-74.5	-75.5	-75	-70	-70
Maximum RSL for 10^{-6} BER (dBm)*	-17	-17	-17	-17	-17
Dispersive Fade Margin for 10^{-3} BER (dB)	64	67	56	53	49
Threshold/Interference					
Cochannel (dB)	34	34	28	34	34
Adjacent Channel (dB)	-8	-8	-8	-8	-8

MDR-8X06E - Ethernet Radios

EQUIPMENT IDENTIFIER	MDR-8506E-8	MDR-8706E-12	MDR-8706E-24	MDR-8706E-50	MDR-8706E-150
Ethernet Specifications					
Ethernet Forwarding Capacity	Up to 8 Mb/s	Up to 12 Mb/s	Up to 24 Mb/s	Up to 50 Mb/s	Up to 150 Mb/s
	14,585 pps	21,611 pps	44,448 pps	91,910 pps	278,848 pps
Ethernet Latency (S/F)	265-1270 µs	185-1180 µs	95-575 µs	194-425 µs	66-142 µs
RF Specifications					
Frequency Band (GHz)	5.725 - 7.125	5.725 - 7.125	5.725 - 7.125	5.725 - 7.125	5.725 - 7.125
Emission Designator	2M50D7W	2M50D7W	5M00D7W	10M0D7W	30M0D7W
RF Channel Bandwidth (MHz)	2.5	2.5	5	10	30
TDM Lines Capacity	5xDS1	8xDS1	16xDS1	32xDS1	32xDS1
Modulation Type (TCM)	32	128	128	128	128
Radio Data Rate (Mb/s)	9.093	13.135	26.27	58.996	176.994
System Gain (BER = 10^{-6}) @ 33 dBm (dB)*	118	112	109	107.5	103
Transmitter Power Output (dBm)	15	15	15	15	15
Optional Power Amplifier Outputs (dBm)	23, 29, 31, 33	23, 29, 31, 33	23, 29, 31, 33	23, 29, 31, 33	23, 29, 31, 33
Receiver Threshold (BER = 10^{-6}) (dBm)*	-85	-79	-76	-74.5	-70
Maximum RSL for 10^{-6} BER (dBm)*	-17	-17	-17	-17	-17
Dispersive Fade Margin for 10^{-3} BER (dB)	80	80	66	64	49
Threshold/Interference					
Cochannel (dB)	28	34	34	34	34
Adjacent Channel (dB)	-8	-8	-8	-8	-8

*Typical values as measured at the antenna port for nonstandby and hot-standby/space diversity configurations. Hot-standby configurations will have 1 dB less receiver threshold on the A side and 10 dB less receiver threshold on the B side.

**33 dBm transmit power available in the 5.925 – 6.425 GHz frequency band.

Note: These specifications are subject to change without notice.

TECHNICAL SUMMARY

Power Requirements

- Input voltage: +/- 20 V dc to +/- 60 V dc
- Typical power consumption per T/R @ 15 dBm:
  - ¬ MDR-8X06 (DS1): 69 Watts
  - ¬ MDR-8606 (DS3): 74 Watts
  - ¬ MDR-8706s (OC-3): 71 Watts
  - ¬ MDR-8X06E (Ethernet): 71 Watts

Mechanical Dimensions & Interfaces

- Size: 12.25 x 19.0 x 16.25 in.
- Weight (1+1): 70 lb.
- RF interface: SMA (female) - other RF interfaces available
- DS1 interface: 37 pin D-type
- DS3 interface: BNC 75 Ohm
- OC-3 interface: LC connector, 1310 nm
- Ethernet interface: RJ-45 standard data connector or optical SFP
- Wayside DS1 interface: Two 9 pin D-type (one TX, one RX)
- Orderwire handset interface: RJ-11 standard telephone handset jack
- Alarm/Management interfaces:
  - ¬ SNMP = RJ-48, 10 Base-T
  - ¬ USI = RS-232
  - ¬ MCS-11 = RS-422
  - ¬ TBOS = RS-485
  - ¬ Parallel = Form A relays

Environmental

- Ambient temperature:
  - ¬ Specification compliant: 0° to +50° C
  - ¬ Operating without failure: -20° to +65° C
  - ¬ Storage: -40° to +80° C
- Relative humidity: 5 to 95% noncondensing
- Altitude:
  - ¬ Operating: -350 to 16,500 ft.
  - ¬ Storage: -350 to 40,000 ft.

Note: These specifications are subject to change without notice.

ABOUT ALCATEL-LUCENT WIRELESS TRANSMISSION:

With more than 50 years of experience in wireless transmission, Alcatel-Lucent provides the solid foundation for your mission-critical network, and continually fosters visions for the future. As a pioneer in point-to-point microwave radios, Alcatel-Lucent has demonstrated leadership in wireless technology.

Our history of design innovation began when the former Collins Radio Company developed the first commercial microwave radios in the 1950s. Alcatel-Lucent maintains the Collins tradition, setting the industry standard for microwave communications all over the world with scalable, reliable, economical and readily deployable wireless backbone communications systems.

In the last five years, Alcatel-Lucent has installed more than 300,000 microwave radios in more than 150 countries. For more information, visit www.alcatel-lucent.com/microwave or call 1-800-ALCATEL.

www.alcatel-lucent.com

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Alcatel-Lucent 7450 ESS

ETHERNET SERVICE SWITCH | RELEASE 9.0

The Alcatel-Lucent 7450 Ethernet Service Switch (ESS) is a market-leading MPLS-enabled Carrier Ethernet platform dedicated to line-rate Ethernet service delivery at maximum scale. This high-performance platform provides Carrier Ethernet service aggregation with industry-leading throughput, densities, and reliability. Enabling a broad service mix and a graceful migration to a converged service environment, the 7450 ESS is the platform of choice to enable wide-scale Carrier Ethernet adoption, implementation, and transformation.

The Alcatel-Lucent 7450 ESS is the industry's most advanced MPLS-enabled Carrier Ethernet platform. With multi-terabit capacity, leading port densities, advanced MPLS capabilities, and best-in-class service attributes, all in a highly reliable and feature-rich platform, the 7450 ESS is a field-proven, highly scalable platform designed to support residential triple play services, business VPN services and mobile backhaul applications at the Carrier Ethernet service edge. The 7450 ESS integrates the scalability, resiliency and predictability of MPLS, along with the bandwidth and economics of Ethernet, to enable a metro-wide, converged packet aggregation infrastructure using Carrier Ethernet to deliver next-generation services.

With the flexibility to support both advanced Ethernet and IP services, the MEF-certified Alcatel-Lucent 7450 ESS allows customers to evolve their networks forward to create revenue-expansion opportunities while simultaneously protecting previous investments. Advanced Ethernet service delivery includes both point-to-point and any-to-any business VPN services, such as virtual private LAN services (VPLS) or Ethernet LAN (ELAN) services, Ethernet access to IP VPNs, virtual leased line (VLL) or Ethernet Line (E-Line) services, and Ethernet access to enhanced Internet services. As well, advanced IP services (either IPv4- or IPv6-based) including IP VPNs, Internet Access, IP multicast routing, and more can be offered via the 7450 ESS. Similar Ethernet or IP-based services may also be offered for the aggregation of residential triple play and mobile traffic over IP/MPLS infrastructures.

Supporting service speeds up to 100 Gb/s with advanced features fully enabled and no sacrifice in performance, the 7450 ESS delivers two terabits of capacity, enabling seamless evolution from 10 Gigabit Ethernet (10GigE) to 100GigE and widely scalable Carrier Ethernet metros. Additionally, with the industry's most advanced Provider Backbone Bridges/Virtual Private LAN Service (PBB/VPLS) implementation, customers have the flexibility to deploy either native Carrier Ethernet or MPLS-based services and functions in any combination.

Leveraging the carrier-optimized and highly fault-tolerant Service Router Operating System (SR OS) — a common element across the Alcatel-Lucent Service Router portfolio — the 7450 ESS provides advanced, highly flexible service-aware QoS, and a robust and feature-rich operations, administration and maintenance (OAM) toolkit to enable next-generation service delivery. For increased service intelligence, the 7450 ESS features a Multiservice Integrated Service Adapter (MS-ISA) to provide high-performance Layer 3 through Layer 7 application-specific processing, for the monetization and optimization of advanced residential triple play and business VPN services. This combination helps the 7450 ESS set a new market benchmark for the delivery of advanced services with predictable, differentiated service level agreements (SLAs). As one element of a broad data networking portfolio, the 7450 ESS can be deployed with Alcatel-Lucent's flagship 7750 Service Router and 7210 Service Access Switch families for end-to-end IP/MPLS networking solutions unmatched by the competition.

Features

Multi-terabit capacity

More end users per residential subscriber, emerging business applications extremely bursty in nature, and the wide proliferation of wireless devices using multimedia content — it all adds up to more bandwidth demand on the network and more capacity required. The Alcatel-Lucent 7450 ESS delivers multi-terabit switching capacity to meet these ever-increasing bandwidth requirements in Carrier Ethernet and IP/MPLS networking environments. Leveraging breakthrough in-house developed FP2 silicon, the 7450 ESS provides a migration path to multi-terabit system capacity with 100 Gb/s (full duplex) slots on existing systems — without a forklift upgrade. Supporting up to two terabits of throughput (half duplex) in one-third of a telco rack, the 7450 ESS enables providers to fully utilize its 100 Gb/s (full duplex) slot capacity with no tradeoff between terabit performance and service delivery.

Advanced Carrier Ethernet and IP services delivery

Designed as a service delivery platform, the 7450 ESS enables a broadly scalable service offering based upon MPLS-enabled Carrier Ethernet. Comprehensive Carrier Ethernet and IP/MPLS feature and protocol support allows a full complement of residential, business and mobile service applications across a range of topologies, from point-to-point to any-to-any, from fully meshed to ring-based. The 7450 ESS enables providers to flexibly offer any combination of Ethernet or IP-based services as individual network requirements dictate. With a market-leading PBB/VPLS solution, as well as support for BGP-based VPLS, service providers have a highly scalable Ethernet-based solution that can support hundreds of thousands of end users in a metro area with ease. The 7450 ESS also supports the ability to offer advanced IP services as well, leveraging service routing technology and capabilities from the 7750 SR platform. This helps protect investments and allows full asset utilization for existing Ethernet services, while creating revenue expansion opportunities via the ability to offer new IP services. The result is more choices and greater flexibility.

Additionally, service specialization capabilities can be offered using the integrated Alcatel-Lucent MS-ISA for the 7450 ESS platform. The MS-ISA supports a number of services including Application Assurance, leveraging deep packet inspection (DPI) technology to provide application-level traffic reporting and traffic management capabilities, and advanced video services (Fast Channel Change/Retransmission). With on-board high-performance Layer 3 to Layer 7 application-specific processing within the 7450 ESS platform, greater opportunity exists to capitalize on high-touch service opportunities and drive additional revenues.

High-density service aggregation

The 7450 ESS supplies a market-leading range of high-density, flexible Ethernet and SONET/SDH interface options, enabling cost-effective Carrier Ethernet service delivery and aggregation. With a full complement of 10M/100M/1GigE/10GigE interfaces with SFP/XFP/copper support (and including digital diagnostics monitoring support), the 7450 ESS can support up to 2880 GigE ports/rack or up to 360 10GigE ports/rack. Synchronous Ethernet (SyncE) support is also provided on MDA-XP interfaces. SONET/SDH MDAs are available to support legacy environments (OC-3c/STM-1c, OC12-c/STM-4c and OC-48c/STM-16c). Other interface options include a 10GigE MDA with integrated tunable DWDM optics and a high-scale MDA for residential applications. With the ability to mix-and-match interface types at the IOM level and/or between chassis, the 7450 ESS provides outstanding flexibility to fit any application.

Best-in-class availability

More than ever before, customers are demanding "always-on" services. High availability must go beyond simply implementing redundant hardware. In addition to redundant common equipment and line-card redundancy, the 7450 ESS provides an industry-leading and field-proven feature set that minimizes service disruption. Non-stop routing, non-stop services, stateful failover capabilities, in-service software upgrades (ISSU), and innovative multi-chassis LAG and Automatic Protection Switching (APS) enable the 7450 ESS to deliver superior service resiliency. Support for standards-based Ethernet APS (ITU-T G.8031 and G.8032 Ethernet) delivers carrier-grade reliability in point-to-point as well as ring topologies. Further, the 7450 ESS supports a wide variety of service assurance and availability monitoring tools across IP, MPLS, and Ethernet domains, including Fast Reroute, Graceful Restart Helper mode, MPLS-TE Graceful Shutdown, Bidirectional Forwarding Detection, and pseudowire redundancy, to name several. In short, with a comprehensive suite of high

availability features, the 7450 ESS is the industry's most reliable platform for offering non-stop Carrier Ethernet and IP/MPLS applications and services.

Proven end-to-end operating system

Alcatel-Lucent SR OS is a carrier-grade, highly fault-tolerant, and feature-rich operating system that operates across the entire Alcatel-Lucent Service Router portfolio. With a single operating system across the 7450 ESS and 7750 SR switch and router product families, operators can be assured of consistent service definitions and reliable operations and management when deploying Ethernet (VLL, VPLS), IP/MPLS (IP VPN), and/or mobile services and applications on an Alcatel-Lucent network.

Advanced, flexible Hierarchical QoS

With today's Ethernet and IP/MPLS traffic streams encompassing a variety of services consisting of video applications, voice, best-effort Internet access, and mission-critical business services, QoS becomes a critical element for delivering both best-effort and SLA-based services on a common platform. The Alcatel-Lucent 7450 ESS sets the standard with its advanced and highly flexible Hierarchical QoS implementation, providing hardware support for multi-tiered shaping and policing hierarchies. With service- and network-level queuing, granular shaping, policing, and marking of service traffic, and per-service guarantee capabilities, the 7450 ESS provides the tools to define and deliver the most stringent SLAs for high-value, differentiated services.

Robust service-aware management and OAM suite

Alcatel-Lucent provides a comprehensive element-, network-, and service-management solution for the 7450 ESS family. Tightly integrated with SR OS OAM tools, the 5620 Service Aware Manager (SAM) delivers comprehensive operations capabilities across network and service management domains, providing visibility into the network for small- and large-scale service deployments. Additionally, specialized management tools, including the 5650 Control Plane Assurance Manager (CPAM) and 5670 Reporting and Analysis Manager (RAM), work in conjunction with the 5620 SAM to streamline network operations and aid in the provisioning, fault management, and performance management of all advanced networking services.

This suite of management tools depends on the network elements themselves being appropriately instrumented to provide the required information, and the 7450 ESS supports extensive Ethernet OAM standards and capabilities. With support for ITU-T Y.1731 and IEEE 802.1ag, IEEE 802.3ah for first mile Ethernet OAM, Ethernet Local Management Interface (E-LMI), and the Alcatel-Lucent Service Assurance Agent, performance, connectivity, and fault monitoring is greatly simplified, so that even the most stringent SLAs can be met with confidence.

Benefits

Increased revenues with innovative, differentiated services

With market-leading PBB/VPLS and BGP VPLS implementations, Ethernet-based services using the Alcatel-Lucent 7450 ESS can be scaled to the highest levels — supporting more end users, more bandwidth, and more capacity, with no sacrifice in performance. The ability to provide IP-VPNs and other IP-based services allows revenue-expansion opportunities beyond Layer 2, Ethernet-only service environments. With an MS-ISA integrated into the 7450 ESS platform, opportunities can be capitalized on as they arise, whether it be short term, application-specific processing in a business service context, or a longer term video application in a residential service context. Lastly, with advanced Hierarchical QoS capabilities on the 7450 ESS, highly available and predictable services enable support of the highly stringent SLAs required to deliver advanced next-generation applications including video, IPTV, multimedia Internet, and premium business VPN services.

Ubiquitous services with massive scale and reach

The 7450 ESS provides a robust and proven MPLS-enabled Carrier Ethernet solution that allows Ethernet to be leveraged for its performance and economic benefits, while simultaneously leveraging IP/MPLS protocols and traffic engineering capabilities for efficient, reliable transport of any service or application and seamless integration with the IP/MPLS provider edge. This enables the consolidation of next-generation residential, business and mobile services on a single converged platform. VPLS/ELAN and VLL/E-Line services leverage MPLS to provide seamless Carrier Ethernet service reach over metro, national and international geographies. An innovative PBB/VPLS solution on the 7450 ESS platform enhances network and service scalability — both in terms of reach and MAC addressing — to support the expansion of Carrier Ethernet VPN services into new territories. Support for BGP-VPLS eases interworking and facilitates inter-provider communications.

High customer satisfaction with non-stop Carrier Ethernet

Broadband connectivity continues to grow exponentially, in wired as well as wireless environments. End users have voracious bandwidth appetites and little tolerance for services that are not always available. The high availability feature set of the 7450 ESS, including non-stop services, non-stop routing, ITU-T G.8031/G.8032 and FRR, enables a flawless quality of experience and promotes brand differentiation. All services (VLL, VPLS, enhanced Internet services) and applications are kept running and true stateful resiliency of IP routing and MPLS signaling protocols occurs during a control plane failure.

Dramatically improved return on investment (ROI)

With the flexibility of the 7450 ESS to enable a converged packet aggregation infrastructure using MPLS-enabled Carrier Ethernet for delivery of Ethernet- or IP-based services, networking is simplified and costs can be significantly

reduced. The 7450 ESS platform's multi-terabit system capacity with a proven "in-place" upgrade to 100 Gb/s (full duplex) per-slot capacity at highest levels of scalability provides unmatched investment protection. The interface density and variety, combined with high subscriber and service scale, allow for more subscribers per platform to further improve ROI without compromising performance and service quality.

Reduced operational costs with improved service assurance and service velocity

By enabling migration to a converged services environment — supporting the combination of wireline and wireless services on a 7450 ESS-based Carrier Ethernet metro network — operations and administration are simplified, because all services run over a platform with a consistent feature set, operational model, and management suite, while supporting the service scalability required. Legacy services and network domains can be decommissioned when practical, further simplifying overall network operations and expenditure. The tight integration of the 7450 ESS and 7750 SR operating system with the Alcatel-Lucent service and network management suite, including the 5620 SAM, 5650 CPAM, and the 5670 RAM, provides a unified operations solution that also reduces ongoing operational costs while enabling precise service-aware SLA control. Simplified service provisioning helps reduce mean-time-to-repair with rapid problem detection, isolation and prevention, and provides a fully integrated service-aware OAM tool kit for improved overall service availability.

Investment protection

Since its introduction, the 7450 ESS family has evolved with customer feature and scaling requirements. The 7450 ESS sophisticated and flexible hardware has a track record of allowing new features and enhancements to be introduced "in-place" in software, rather than through a rapid series of ever-changing hardware iterations. The award-winning FP2 network processing silicon ensures 7450 ESS platform capacity and service scale can continually evolve in step with customer requirements, providing an unprecedented level of investment protection.

Environmentally friendly

Alcatel-Lucent is committed to supplying environmentally friendly solutions. Pioneering advances in power efficiency are incorporated into the Alcatel-Lucent 7450 ESS product family, reducing the expense of both powering and cooling when comparing products with less advanced silicon technology. Combined with environmentally sensitive manufacturing processes, careful materials selection, and a view to sustainable product life cycle management, the 7450 ESS platform assists service providers in reducing their environmental impact while lowering operational costs.

Hardware overview

The Alcatel-Lucent 7450 ESS is available in five chassis — the 7450 ESS-12, ESS-7, ESS-6, ESS-6V, and ESS-1. With these five platform options, the 7450 ESS allows service providers, ILECs, multi-service operators, mobile operators, city carriers, application service providers, and industry and public sector (IPS) customers to build out cost-optimized, Carrier Ethernet infrastructures for a right-sized solution for any network environment. Each system offers leading throughput and density, as well as the ability to mix and match interface adapters, with exceptional portability across platforms. Table 1 provides a summary of the technical specifications for each platform within the family.

The Alcatel-Lucent 7450 ESS family supports a wide range of media and service adapters that are optimized to address different network and application requirements:

- *Input/Output Modules (IOMs)* – IOMs are supported on the 7450 ESS-12, 7450 ESS-7, and 7450 ESS-6/6V and are optimized for flexibility in deploying a variety of Carrier Ethernet- and IP-based applications. Each IOM supports up to two Media Dependent Adapters and can also be used to house Multi-Service Integrated Service Adapters. IOM3-XPs are the latest generation of IOMs featuring the Alcatel-Lucent FP2 network processing silicon.
- *Media Dependent Adapters (MDAs)* – MDAs are supported on all platforms and provide physical interface connectivity. MDAs are available in a variety of interface and density configurations. MDA-XPs are the latest generation of Ethernet MDAs and are notable for supporting the SyncE standard for the distribution of timing across Ethernet networks.
- *Integrated Media Modules (IMMs)* – IMMs are line cards providing integrated processing and physical interfaces on a single board. IMMs provide high-capacity, high-density Ethernet interfaces and are supported on the 7450 ESS-12, ESS-7, and ESS-6/6V platforms. IMMs also feature Alcatel-Lucent FP2 network processing silicon.
- *Multi-Service Integrated Service Adapters (MS-ISAs)* – MS-ISAs are resource modules that provide specialized processing and buffering for various applications. MS-ISAs are supported on the 7450 ESS-12, ESS-7 and ESS-6/6V platforms.

Refer to Tables 1 to 5 for further information regarding the different types of hardware, modules, and interfaces available for the 7450 ESS family.

Technical specifications

Table 1. Technical specifications for the Alcatel-Lucent 7450 ESS family

	7450 ESS-1	7450 ESS-6 AND 7450 ESS-6V	7450 ESS-7	7450 ESS-12
System throughput	• Switch fabric: Up to 40 Gb/s (half duplex) • MDA half-slot capacity: Up to 10 Gb/s (full duplex)	• Switch fabric: Up to 320 Gb/s (half duplex) • Slot capacity: Up to 40 Gb/s (full duplex)	• Switch fabric: Up to 1 Tb/s (half duplex) • Slot capacity: Up to 100 Gb/s (full duplex)	• Switch fabric: Up to 2 Tb/s (half duplex) • Slot capacity: Up to 100 Gb/s (full duplex)
IOM support	• One integrated IOM and SF/CPM	• IOM-20G • IOM3-XP • Up to 4 per chassis	• IOM-20G • IOM3-XP • Up to 5 per chassis	• IOM-20G • IOM3-XP • Up to 10 per chassis
Number of half-slot MDAs per chassis	• Up to 2 – Any mix of MDA or MDA-XP	• Up to 8 – Any mix of MDA or MDA-XP	• Up to 10 – Any mix of MDA or MDA-XP	• Up to 20 – Any mix of MDA or MDA-XP
Common equipment redundancy	• Power, fan	• SF/CPM, PEM-3, fan	• SF/CPM, PEM-3, fan	• SF/CPM, power entry module-3 (PEM-3), fan
Hot-swappable modules	• Integrated IOM and SF/CPM, MDAs and power	• SF/CPM, PEMs, fan, IOM, MDAs, MS-ISA	• SF/CPM, PEMs, fans, IOM, MDAs, MS-ISA	• SF/CPM, PEMs, fans, IOM, MDAs, MS-ISA
Dimensions	• Height: 6.7 cm (2.6 in.) • Width: 44.5 cm (17.5 in.) • Depth: 56.4 cm (22.2 in.)	ESS-6 dimensions: • Height: 35.56 cm (14 in.) • Width: 44.5 cm (17.5 in.) • Depth: 64.8 cm (25.6 in.) ESS-6V dimensions: • Height: 80 cm (31.5 in.) • Width: 46.5 cm (18.3 in.) • Depth: 45.5 cm (17.9 in.)	• Height: 35.56 cm (14 in.) • Width: 44.5 cm (17.5 in.) • Depth: 64.8 cm (25.5 in.)	• Height: 62.2 cm (24.5 in.) • Width: 44.5 cm (17.5 in.) • Depth: ¬ Without cable guides: 65.4 cm (25.75 in.) ¬ With cable guides: 76.5 cm (30.1 in.)
Weight	• 27.2 kg (60 lb) chassis weight	ESS-6: • Empty: 32.7 kg (72 lb) chassis weight with PEMS, two fan trays and air filters ESS-6V: • Empty: 54.4 kg (119.7 lb) chassis weight with PEMs, fan trays and air filters • Loaded: 89 kg (195.8 lb) approx.	• Empty: 27.2 kg (60 lb) chassis weight with two fan trays and air filters • Loaded: 70.5 kg (155 lb) approx.	• Empty: 33.1 kg (73 lb) chassis weight with two fan trays and air filters • Loaded: 152 kg (335 lb) approx.
Power	• 110 V AC or 220 V AC • -40 V DC to -72 V DC • 6 A to 10 A • 1+1 redundancy • AC available with external shelf	• -40 V DC to -72 V DC • 41 A to 75 A • 1+1 redundancy • AC options available	• -40 V DC to -72 V DC • 52 A to 93 A • 1+1 redundancy • AC options available	• -40 V DC to -72 V DC • 90 A to 162 A • 1+1 redundancy • AC options available
Cooling	• Side-to-side air flow	ESS-6: • Side-to-back air flow ESS-6V: • Front-bottom intake, rear top exhaust	• Side-to-back air flow	• Front-to-back air flow

Table 2. Alcatel-Lucent 7450 ESS MDA-XP and MDA support-by-chassis type

MDA TYPE	PORTS PER MDA	CONNECTOR TYPE	ESS-1	ESS-6/ESS-6V	ESS-7	ESS-12
ETHERNET MDA-XPs						
1000BASE	10/20	SFP	√	√	√	√
10/100/1000BASE-TX	20	RJ-45	√	√	√	√
10/100/1000BASE-TX	48	6 x mini RJ-21	–	√	√	√
10GBASE (LAN/WAN PHY)	1/2/4	XFP	√	√	√	√
ETHERNET MDAs						
100BASE-FX	20	SFP	√	√	√	√
10/100BASE-TX	60	5 x mini RJ-21	√	√	√	√
10GBASE/1000BASE (LAN PHY)	1+10	XFP/SFP	√	√	√	√
10GBASE (tunable optics)	1	LC	√	√	√	√
HIGH SCALE MDAs						
1000BASE	10	SFP	–	√	√	√
10GBASE	1	XFP	–	√	√	√
PoS MDAs						
OC-3c/STM-1c	16	SFP	√	√	√	√
OC-3c/OC-12c/STM-1c/STM-4c (multirate)	8/16	SFP	√	√	√	√
OC-48c/STM-16c	2/4	SFP	√	√	√	√
OTHER						
Versatile services module	N/A	N/A	√	√	√	√

Table 3. Alcatel-Lucent 7450 ESS IMM support-by-chassis type

IMM TYPE	PORTS PER IMM	CONNECTOR TYPE	ESS-1	ESS-6/ESS-6V	ESS-7	ESS-12
100GBASE	1	CFP	–	–	√	√
40GBASE	3	QSFP	–	–	√	√
10GBASE	12	SFP+	–	–	√	√
10GBASE	5/8	XFP	–	√	√	√
10/100/1000BASE	48	SFP	–	√	√	√
10/100/1000BASE	48	RJ-45	–	√	√	√

Table 4. ISA support-by-chassis type

ISA TYPE*	ESS-1	ESS-6/ESS-6V	ESS-7	ESS-12
Multiservice Integrated Services Adapter (MS-ISA)	–	√	√	√

* Consult the MS-ISA Data Sheet for details for application support on a given platform.

Table 5. 7750 SR MDAs supported within the 7450 ESS (when Advanced IP Services mode is enabled) by chassis type*

MDA TYPE	PORTS PER MDA	CONNECTOR TYPE	ESS-1	ESS-6/ESS-6V	ESS-7	ESS-12
PACKET OVER SONET/SDH MDA*						
OC-192c/STM-64c POS	1	Simplex SC	–	–	√	√
ANY SERVICE ANY PORT MDAs*						
Channelized DS3/E3 ASAP	4/12	1.0/2.3 connectors	–	–	√	√
Channelized OC-3/ STM-1 ASAP	4	SFP	–	–	√	√
Channelized OC-12/ STM-4 ASAP	1	SFP	–	–	√	√
CIRCUIT EMULATION SERVICE MDAs*						
Channelized OC-3/ STM-1 CES	1/4	SFP	–	–	- / √	√
Channelized OC-12/ STM-4 CES	1	SFP	–	–	√	√
ATM MDAs*						
OC-3c/STM-1c / OC-12c/ STM-4c (Multirate) ATM	4	SFP	–	–	√	√
OC-3c/STM-1c ATM	16	SFP	–	–	√	√

* Note that to operate these MDAs in a 7450 ESS chassis, Advanced IP Services mode is required

Safety standards and compliance agency certifications

Safety

- EN 60590-1
- IEC 60950-1 CB Scheme
- CSA/UL 60950-1 NRTL
- FDA CDRH 21-CFR 1040
- EN 60825-1
- EN 60825-1/2
- IEC 60825-1
- IEC 60825-2

EMC

- ICES-003 Class A
- FCC Part 15 Class A
- EN 300 386
- EN 55022
- EN 55024
- EN 61000-4-2
- EN 61000-4-3
- EN 61000-4-4
- EN 61000-4-5
- EN 61000-4-6
- EN 61000-4-11
- IEC CISPR22
- AS/NZS CISPR 22

Immunity

- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 61000-4-2 Electric Static Discharge
- EN 61000-4-3 Radiated Immunity
- EN 61000-4-4 EFT
- EN 61000-4-5 Surge
- EN 61000-4-6 Low Frequency Common
- EN 61000-4-11 Voltage Dips and Sags

Telecom

- Telcordia GR-253-CORE, Issue 3
- IEEE 802.3 (Gigabit Ethernet, Ethernet)
- ANSI T1.105.03
- ANSI T1.105.06
- ANSI T1.105.09
- ANSI T1.403 (DS1)
- ANSI T1.404 (DS3)
- ITU-T G.957
- ITU-T G.825
- ITU-T G.824
- ITU-T G.823
- ITU-T G.813
- ITU-T G.707
- ITU-T G.703

Environmental

- ETS 300 019-1-1, Storage Tests, Class 1.2
- ETS 300 019-1-2, Transportation Tests, Class 2.3
- ETS 300 019-1-3, Operational Tests, Class 3.2
- ETS 300 019-2-4, per A 1 Seismic

Environmental specifications

- Operating temperature: 0°C to 40°C (32°F to 104°F)
- Relative humidity: 15% to 85% (non-condensing)
- Operating altitude: Sea level to 3048 m (10,000 ft)

Electronic equipment devices

- WEEE
- RoHS
- R&TTE
- China CRoHS

Certifications

- Network Equipment Building System (NEBS) Level 3
  - ¬ Telcordia GR-63-CORE, Issue 4, June 2006
  - ¬ Telcordia GR-1089-CORE, Issue 3, March 2006
  - ¬ ATT-TP-76200
- CE

Alcatel·Lucent

Alcatel-Lucent 7750 SR

SERVICE ROUTER

Alcatel-Lucent 7750 SR multiservice edge routers have been designed from inception to deliver differentiated, high-performance, high availability services. With platform capacities ranging from 40 Gb/s to 2 Tb/s, specialized service-aware application processing, advanced quality of service (QoS), and a comprehensive range of Ethernet and multiservice interfaces and protocols, the 7750 SR provides industry-leading scale and intelligence to deliver residential, business, and wireless broadband IP services on a converged edge routing platform.

The Alcatel-Lucent 7750 Service Router (SR) portfolio is a suite of multiservice edge routers designed from inception to deliver high-performance, high availability routing with service-aware operations, administration, management, and provisioning. The 7750 SR integrates the scalability, resiliency, and predictability of MPLS along with the bandwidth and economics of Ethernet and a broad selection of legacy interfaces, to enable a converged network infrastructure for the delivery of next-generation services. The 7750 SR's advanced and comprehensive feature set enables it to be deployed as a Broadband Network Gateway (BNG) for residential services, as a Multiservice Edge (MSE) for Carrier Ethernet and IP VPN business services, as the aggregation router in mobile backhaul applications, or as a mobile packet core for 2G, 3G and LTE wireless networks. With support for service-enabled, high-density 10GigE and 100GigE interfaces, the 7750 SR is also well suited for core routing applications. Available in five chassis variants, the 7750 SR scales gracefully from 40 Gb/s to 2 Tb/s of capacity, providing cost-effective solutions to address the smallest to the largest network locations.

Features

Industry-leading FP2 silicon

At the heart of the Alcatel-Lucent 7750 SR is the Alcatel-Lucent award-winning FP2 network processing silicon. Clocking in at 100 Gb/s, the FP2 chipset enables line interfaces to scale to 100 Gb/s, while concurrently supporting processing-intensive edge routing and mobile gateway services without performance impact. Network processing silicon is an essential element in the quest for no compromise, high-speed, intelligent services that can adapt to customer requirements. Alcatel-Lucent has a proven track record as an innovator and industry leader in network processor silicon technology.

Proven end-to-end operating system

Alcatel-Lucent Service Router Operating System (SR OS) is a carrier-grade, highly fault-tolerant, and feature-rich operating system that operates across the entire Alcatel-Lucent Service Router portfolio. With a single operating system across all platforms, operators can be assured of consistent and reliable operations and management when deploying Ethernet (VLL, VPLS), IP/MPLS (IP VPN), legacy (ATM, TDM, POS), and/or mobile services and applications on an Alcatel-Lucent service router network.

Best-in-class high availability

High availability is more than just redundant hardware. In addition to redundant common equipment and line card redundancy, SR OS supports numerous features that minimize service disruption, such as, non-stop routing, stateful failover capabilities, in-service software upgrades (ISSU), and innovative multi-chassis features for service resiliency. Further, the 7750 SR supports service assurance and monitoring tools across IP, MPLS, and Ethernet domains. In short, with a comprehensive suite of high availability features, the 7750 SR is the industry's most reliable platform for offering non-stop applications and services.

Advanced Hierarchical QoS

With today's IP traffic streams including a range of services consisting of video applications, voice, best-effort Internet access, and mission-critical business services, QoS becomes a critical element for delivering both best-effort and SLA-based services on a common platform. The Alcatel-Lucent 7750 SR sets the standard with its advanced and highly flexible Hierarchical QoS implementation with hardware support for multi-tiered shaping and policing hierarchies. As it is designed as a service delivery platform, the 7750 SR provides the tools to define and deliver the most stringent SLAs for high-value, differentiated services.

Service routing specialization

Alcatel-Lucent recognizes that service providers need to be nimble and yet cost sensitive when introducing application-enabled services into the network. With service routing specialization, operators can add new services with higher-level processing requirements to the network wherever an Alcatel-Lucent 7750 SR is located, by simply adding an Integrated Services Adapter (ISA) or Integrated Services Module (ISM) to the node. Compared to using dedicated network elements to provide services, 7750 SR service adapters have tighter management integration, higher performance, higher scale, and consume less energy. They allow service providers to leverage the network design in deploying services where most cost effective, where most easily managed, and with appropriate scale. Applications supported include Application Assurance, which leverages deep packet inspection (DPI) technology to provide application-level traffic reporting and traffic management capabilities, advanced video services (Fast Channel Change/Retransmission or Ad Insertion), IPsec services, large scale Network Address Translation (NAT), and L2TP Network Server (LNS) services.

Service-aware management

The 7750 SR family is managed by the Alcatel-Lucent 5620 Service Aware Manager (SAM) for assured, simplified and integrated operations across both network and service management domains. 5620 SAM is designed to manage services and provides service-level visibility into the network for small- and large-scale service deployments. The Alcatel-Lucent management offering includes additional tools like the 5650 Control Plane Assurance Manager (CPAM) and 5670 Reporting and Analysis Manager (RAM) that work in conjunction with 5620 SAM and streamline network operations and aid in the provisioning and management of all connectivity and advanced networking services.

Benefits

Increased revenues with innovative, differentiated services

Support for advanced networking services allows service providers to capitalize on information embedded in the network to provide subscriber-centric Internet and connectivity services. Subscriber, service, and application awareness can be used to provide differential QoS treatment of higher-value traffic streams and manage the online experience. Guaranteeing a superior Quality of Experience (QoE) for certain applications and metering them separately for billing permits tiered pricing for different levels of service.

Reduced operational expense

By combining wireline and wireless services on a 7750 SR-based converged provider edge, network operations are simplified because all services run over a platform with consistent feature set, operational model, and management, while supporting the service scalability required to combine services. As legacy services are migrated to converged service networks, the legacy networks that carried the service can be decommissioned, further simplifying overall network operations and expenditure. In addition, the 7750 SR has numerous features for automated provisioning of subscribers and services based on service templates and interacting with other operational systems for authentication, authorization, and billing that all but eliminates the need for individual, manual service provisioning.

Investment protection

From its introduction, the 7750 SR family has evolved with customer feature and scaling requirements. The 7750 SR's sophisticated and flexible hardware has a track record of allowing new features and enhancements to be introduced "in-place" in software, rather than through a series of ever-changing hardware iterations. The award-winning FP2 network processing silicon ensures 7750 SR platform capacity and service scale can

continually evolve in step with customer requirements providing an unprecedented level of investment protection.

Environmentally friendly

Pioneering advances in power efficiency are incorporated into each member of the Alcatel-Lucent 7750 SR family reducing the expense of both powering and cooling when comparing products with less advanced silicon technology. Combined with environmentally sensitive manufacturing processes, careful materials selection, and a view to sustainable product life cycle management, the 7750 SR family assists service providers in reducing their environmental impact.

Hardware overview

The Alcatel-Lucent 7750 SR is available in five chassis types — the 7750 SR-12, SR-7, SR-c12, SR-c4, and SR-1. The 7750 SR-12 and SR-7 are offered in a mobile gateway configuration. Table 1 provides a summary of the technical specifications for each platform within the family.

The Alcatel-Lucent 7750 SR family supports a wide range of media and service adapters that are optimized to address different network and application requirements:

- *Input/Output Modules (IOMs)* – IOMs are supported on the 7750 SR-12 and 7750 SR-7 and are optimized for flexibility in deploying a variety of mobile, multiservice, and Ethernet-based applications. Each IOM supports up to two Media Dependent Adapters (MDAs) and can also be used to house Integrated Service Adapters (ISAs). IOM3-XPs are the latest generation of IOMs featuring the Alcatel-Lucent FP2 network processing silicon.
- *Media Dependent Adapters (MDAs)* – MDAs are supported on all platforms and provide physical interface connectivity. MDAs are available in a variety of interface and density configurations. MDA-XPs are the latest generation of Ethernet MDAs and are notable for supporting the Synchronous Ethernet (SyncE) standard for the distribution of timing across Ethernet networks.
- *Compact Media Adapters (CMAs)* – CMAs are interface adapters supporting lower speed services and port densities. CMAs are supported on the 7750 SR-c12 and SR-c4 platforms.
- *Integrated Media Modules (IMMs)* – IMMs are line cards providing integrated processing and physical interfaces on a single board. IMMs provide high-capacity, high-density Ethernet interfaces and are supported on the 7750 SR-12 and SR-7 platforms. IMMs feature the Alcatel-Lucent FP2 network processing silicon.
- *Integrated Service Adapters (ISAs)* – ISAs are resource blades that provide specialized processing and buffering for applications. ISAs are supported on the 7750 SR-12 and SR-7 platforms.
- *Integrated Service Modules (ISMs)* – ISMs are resource line cards that provide specialized processing and buffering for applications. ISMs are supported on the 7750 SR-12 and SR-7 platforms.

Refer to Tables 2 to 6 for further information regarding the different types of MDA, CMA, IMM, ISA, and ISM available for the 7750 SR family.

Table 1. Technical specifications for the Alcatel-Lucent 7750 SR family

	7750 SR-1	7750 SR-c4	7750 SR-c12	7750 SR-7	7750 SR-12
System throughput	Switch fabric: Up to 40 Gb/s (half duplex)	Switch fabric: Up to 90 Gb/s (half duplex)	Switch fabric: Up to 90 Gb/s (half duplex)	Switch fabric: Up to 1 Tb/s (half duplex) Slot capacity: Up to 100 Gb/s (full duplex)	Switch fabric: Up to 2 Tb/s (half duplex) Slot capacity: Up to 100 Gb/s (full duplex)
Built-in network interfaces	• 10/100BASE Management Ethernet RJ-45	• 2 x 10GBASE (LAN/ WAN PHY) XFP • 10/100BASE Management Ethernet RJ-45	• 10/100BASE Management Ethernet RJ-45	-	-
Number of MDAs per chassis	2	2	6	10	20
Number of CMAs per chassis	-	4	8 (plus 2 MDAs)	-	-
Number of IOM/IMM/ ISM per chassis	-	-	-	5	10
Common equipment redundancy	Power, fans	Power (PEMs), fans	CFM-XP, power (PEMs), fans	SF/CPM, power (PEMs), fans	SF/CPM, power (PEMs), fans
Hot-swappable modules	MDAs	MDAs, CMAs, PEMs, fans	CFM-XP, MDAs, CMAs, PEMs, fans	SF/CPM, IOMs, IMMs, ISMs, MDAs, ISAs, PEMs, fans	SF/CPM, IOMs, IMMs, ISMs, MDAs, ISAs, PEMs, fans
Dimensions	• Height: 6.6 cm (2.6 in.) • Width: 44.4 cm (17.5 in.) • Depth: 56.4 cm (22.2 in.)	• Height: 13.8 cm (5.4 in.) • Width: 44.5 cm (17.5 in.) • Depth: 47.0 cm (18.5 in.)	• Height: 22.2 cm (8.7 in.) • Width: 44.4 cm (17.5 in.) • Depth: with cable management: 60.0 cm (23.6 in.)	• Height: 35.5 cm (14 in.) • Width: 44.4 cm (17.5 in.) • Depth: 59.7 cm (25.5 in.)	• Height: 62.2 cm (24.5 in.) • Width: 44.4 cm (17.5 in.) • Depth: without cable: 64.5 cm (25.4 in.); with cable: 76.5 cm (30.1 in.)
Weight	• Empty: 12.3 kg (27 lb) • Loaded: 13.2 kg (29 lb) approx.	• Empty: 13.6 kg (30.0 lb) • Loaded: 22.5 kg (50 lb) approx.	• Empty: 16.4 kg (36.2 lb) • Loaded: 45.4 kg (100 lb) approx.	• Empty: 27.2 kg (60 lb) • Loaded: 70.5 kg (155 lb) approx.	• Empty: 33.1 kg (73 lb) • Loaded: 152 kg (335 lb) approx.
Power	• -40 V DC to -72 V DC • 110 V AC or 220 V AC • 6 A to 10 A • AC options available	• -40 V DC to -72 V DC • 100 V AC to 240 V AC	• -40 V DC to -72 V DC • 220 V AC to 240 V AC	• -40 V DC to -72 V DC • 52 A to 93 A • AC options available	• -40 V DC to -72 V DC • 90 A to 162 A • AC options available
Cooling	• Side-to-side air flow	• Side-to-side air flow	• Side-to-side air flow	• Side-to-back air flow	• Front-to-back air flow

Table 2. Alcatel-Lucent 7750 SR MDA, MDA-XP support-by-chassis type

MDA TYPE	PORTS PER MDA	CONNECTOR TYPE	SR-1	SR-c4	SR-c12	SR-7	SR-12	SR-7/SR-12 MOBILE GATEWAY
ETHERNET MDA-XPs								
1000BASE	10/20	SFP	√	√	√	√	√	√
10/100/1000BASE-TX	20	RJ-45	√	√	√	√	√	√
10/100/1000BASE-TX	48	6 x mini RJ-21	-	-	-	√	√	-
10GBASE (LAN/WAN PHY)	1/2/4	XFP	√	√ / √ / -	√ / √ / -	√	√	√
ETHERNET MDAs								
100BASE-FX	20	SFP	√	√	√	√	√	-
10/100BASE-TX	60	5 x mini RJ-21	√	√	√	√	√	-
10GBASE/1000BASE (LAN PHY)	1+10	XFP/SFP	√	-	-	√	√	-
10GBASE (tunable optics)	1	LC	√	-	-	√	√	-
HIGH SCALE MDAs								
1000BASE	10	SFP	-	-	-	√	√	-
10GBASE	1	XFP	-	-	-	√	√	-
POS MDAs								
OC-3c/STM-1c	8/16	SFP	√	√ / -	√ / -	√	√	-
OC-3c/STM-1c/OC-12c/ STM-4c (Multirate)	8/16	SFP	√	-	-	√	√	-
OC-48c/STM-16c	2/4	SFP	√	√ / -	√ / -	√	√	-
OC-192c/STM-64c	1	Simplex SC	√	-	-	√	√	-
ANY SERVICE ANY PORT (ASAP) MDAs*								
Chan. DS3/E3 ASAP	4/12	1.0/2.3 Connectors	-	√	√	√	√	-
Chan. OC-3/STM-1 ASAP	4	SFP	-	√	√	√	√	-
Chan. OC-12/STM-4 ASAP	1	SFP	-	√	√	√	√	-
CIRCUIT EMULATION SERVICE (CES) MDAs*								
Chan. OC-3/STM-1 CES	1/4	SFP	-	- / √	- / √	√	√	-
Chan. OC-12/STM-4 CES	1	SFP	-	√	√	√	√	-
ATM MDAs*								
ATM OC-3c/STM-1c/ OC-12c/STM-4c (Multirate)	4	SFP	√	√	√	√	√	-
ATM OC-3c/STM-1c	16	SFP	√	-	-	√	√	-
OTHER								
Versatile Service Module	N/A	N/A	√	-	-	√	√	-

Table 3. Alcatel-Lucent 7750 SR CMA support-by-chassis type

CMA TYPE	PORTS PER CMA	CONNECTOR TYPE	SR-c4	SR-c12
1000BASE	1/5	SFP	√	√
Chan. DS1/E1	8	RJ-48c	√	√
DS3/E3	4	1.0/2.3 Connectors	√	√
10/100BASE-TX	8	RJ-45	√	√
1000BASE	1	SFP	√	√
Chan. OC-3/STM-1 CES	1	SFP	√	√
OC-3c/STM-1c/OC-12c/STM-4c (Multirate)	2	SFP	√	√
ATM T1/E1 IMA	8	RJ-48c	√	√

Table 4. Alcatel-Lucent 7750 SR IMM support-by-chassis type

IMM TYPE	PORTS PER IMM	CONNECTOR TYPE	SR-7	SR-12	SR-7/SR-12 MOBILE GATEWAY
100GBASE	1	CFP	√	√	-
10GBASE	12	SFP+	√	√	-
10GBASE	4/5/8	XFP	√	√	- / √ / -
10/100/1000BASE	48	SFP	√	√	-
10/100/1000BASE	48	RJ-45	√	√	-

Table 5. ISA support-by-chassis type

ISA TYPE*	SR-1	SR-c4	SR-c12	SR-7	SR-12	SR-7/SR-12 MOBILE GATEWAY
Multiservice Integrated Services Adapter (MS-ISA)	-	-	-	√	√	-

* Consult the MS-ISA Data Sheet for details for application support on a given platform.

Table 6. ISM support-by-chassis type

ISA TYPE*	SR-1	SR-c4	SR-c12	SR-7	SR-12	SR-7/SR-12 MOBILE GATEWAY
Mobile Gateway Integrated Services Module (MG-ISM)	-	-	-	-	-	√

Technical specifications

Safety standards and compliance agency certifications

Safety

- EN 60590-1
- IEC 60950-1CB Scheme
- CSA/UL 60950-1 NRTL
- FDA CDRH 21-CFR 1040
- EN 60825-1
- EN 60825-1/2
- IEC 60825-1
- IEC 60825-2

EMC

- ICES-003 Class A
- FCC Part 15 Class A
- EN 300 386
- EN 55022
- EN 55024
- EN 61000-4-2
- EN 61000-4-3
- EN 61000-4-4
- EN 61000-4-5
- EN 61000-4-6
- EN 61000-4-11
- IEC CISPR22
- AS/NZS CISPR 22

Immunity

- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuations and Flicker
- EN 61000-4-2 Electric Static Discharge
- EN 61000-4-3 Radiated Immunity
- EN 61000-4-4 EFT
- EN 61000-4-5 Surge
- EN 61000-4-6 Low Frequency Common Immunity
- EN 61000-4-11 Voltage Dips and Sags

Telecom

- Telcordia GR-253-CORE, Issue 3
- IEEE 802.3 (Gigabit Ethernet, Ethernet)
- ANSI T1.105.03
- ANSI T1.105.06
- ANSI T1.105.09
- ANSI T1.403 (DS1)
- ANSI T1.404 (DS3)
- ITU-T G.957
- ITU-T G.825
- ITU-T G.824
- ITU-T G.823
- ITU-T G.813
- ITU-T G.707
- ITU-T G.703

Environmental

- ETS 300 019-1-1, Storage Tests, Class 1.2
- ETS 300 019-1-2, Transportation Tests, Class 2.3
- ETS 300 019-1-3, Operational Tests, Class 3.2
- ETS 300 019-2-4, pr A1 Seismic

Environmental specifications

- Operating temperature: 5°C to 40°C (32°F to 104°F)
- Operating relative humidity: 5% to 85%
- Maximum operating altitude: 4000 m (13,000 ft) at 30°C

Electronic equipment devices

- WEEE
- RoHS
- R&TTE
- China CRoHS

Certifications

- Network Equipment Building System (NEBS) Level 3
  - ¬ Telcordia GR-63-CORE, Issue 4, June 2006
  - ¬ Telcordia GR-1089-CORE, Issue 3, March 2006
  - ¬ ATT-TP-76200
- CE

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ALCATEL-LUCENT 7705 SERVICE AGGREGATION ROUTER

RELEASE 5.0

7705 SAR-18

7705 SAR-8

7705 SAR-M

7705 SAR-F

The Alcatel-Lucent 7705 Service Aggregation Router (SAR) portfolio delivers industry-leading IP/MPLS and pseudowire capabilities in compact platforms with the ability to reliably groom and aggregate multiple media, service and transport protocols onto an economical packet transport infrastructure.

The Alcatel-Lucent 7705 SAR portfolio is optimized for multiservice adaptation, aggregation and routing, especially onto a modern Ethernet and IP/MPLS infrastructure. Leveraging the powerful Service Router Operating System (SR OS) and the 5620 Service Aware Manager (SAM), the 7705 SAR is available in compact, low power-consumption platforms that deliver highly available services over resilient and flexible network topologies.

The 7705 SAR is well suited to the aggregation and backhaul of 2G, 3G and LTE mobile traffic, providing cost-effective scaling and the transformation to IP/MPLS networking. Business services modernization is supported in the transition from legacy to consolidated, packet-based operation. Hugely reduced equipment footprints are achievable with reduced energy costs. Industries, enterprises and government organizations can deploy with confidence, achieving reliable and resilient support of legacy and advanced services.

The Alcatel-Lucent 7705 SAR owes much of its development heritage to the Alcatel-Lucent Service Router (SR) product line. Sharing much of the market-leading feature set of that product line, the Alcatel-Lucent 7705 SAR brings a powerful, service-oriented capability to the RAN, specifically in form factors and at-price points that are particularly appropriate for cell sites and hub locations in addition to denser points of concentration. With end-to-end service management under the Alcatel-Lucent 5620 management portfolio, the Alcatel-Lucent 7705 SAR greatly augments the IP/MPLS RAN transport solution from Alcatel-Lucent.

Service aggregation and networking

To provide the most efficient transport solution, the Alcatel-Lucent 7705 SAR can employ pseudowire encapsulation methods to map services end to end. The use of pseudowires ensures that the key attributes of the service are maintained, while using a cost-effective packet environment to aggregate services. In addition to pseudowire transport, IP routing and forwarding and Virtual Private LAN Service (VPLS) are supported. Services such as Asynchronous Transfer Mode (ATM), inverse multiplexing over ATM (IMA), Ethernet, Frame Relay, HDLC and TDM traffic can be natively switched across the 7705 SAR.

Pseudowire Support includes:

- ATM/ IMA
- TDM: CESoPSN & SATOP
- Ethernet port/VLAN
- Frame Relay
- HDLC
- IP

The 7705 SAR product line supports Border Gateway Protocol (BGP)/ MPLS Virtual Private Networks (VPNs) to allow the separation of Layer 3 traffic between different groups of users or organizations. Virtual Private LAN Service (VPLS) is supported for the delivery of Layer 2 VPNs. Analog voice encoding and transport is available on the 7705 SAR-8 and the 7705 SAR-18. Voiceband analog traffic can be carried over a modern network infrastructure between two analog devices using either traditional T1/E1 network interfaces or over Ethernet or MLPPP interfaces.

Highly flexible network infrastructure options

The 7705 SAR supports a broad range of integrated media across fiber, copper and microwave for maximum deployment flexibility. Tunneling options include the use of MPLS, IP or GRE (Generic Routing Encapsulation) for aggregated traffic. When dynamic MPLS signaling is deployed, the end-to-end pseudowire is established using targeted label distribution protocol (T-LDP) and the MPLS tunnel using LDP. In addition to efficient LDP-based dynamic signaling, static provisioning of both the MPLS tunnel and the pseudowire is supported. GRE or IP tunneling allows low-cost, ubiquitous IP networks to be used

for backhauling; for example, for the transport of HSPA (High Speed Packet Access) off-loaded traffic using DSL access media.

Label switched routing

The 7705 SAR can be configured as either a Label Edge Router (LER) or a full Label Switched Router (LSR). Label Switched Paths (LSPs) can be signaled using either the Label Distribution Protocol (LDP) or the Resource Reservation Protocol with Traffic Engineering (RSVP-TE). The 7705 SAR brings a strong suite of traffic engineering and resiliency capabilities using functions such as Constraint-based Shortest Path First (CSPF) routing, Fast Reroute (FRR), primary and secondary LSPs and redundant pseudowires.

Quality of service and traffic management

It is critical to maintain the end-to-end quality of service (QoS) for packet traffic. Not all types of traffic have the same set of requirements. Voice traffic in particular requires low latency and jitter (latency variation) as well as low loss, whereas data traffic often has less stringent delay requirements but may be very sensitive to loss, as packet loss can seriously constrain application throughput. To offer the required treatment throughout the network, traffic flows with different requirements are identified at the access and marked in-line with the appropriate QoS metrics. Traffic classification and marking are carried out based on the following categories:

Traffic classification (Layer 1/Layer 2/ Layer 2.5 and/or Layer 3 header)

- Time slot/port
- Ethernet port/VLAN
- ATM service category (CBR/ rt-VBR/ nrt-VBR/UBR)
- ATM VC
- Ethernet 802.1p/VLAN
- IP DSCP/MPLS EXP

Marking

- Layer 2 (802.1p)
- Layer 2.5 (EXP) both for tunnel and PWE3
- Layer 3 (DiffServ)

The Alcatel-Lucent 7705 SAR utilizes extensive traffic management policies to ensure fairness with detailed classification and hierarchical scheduling including: minimum/maximum, queue type-based weighted round robin or strict priority and profiled scheduling, as well as multi-tier policing to differentiate and prioritize individual services and flows.

Operations, administration and maintenance

In order to ensure continuity of services, the Alcatel-Lucent 7705 SAR has a full set of operations, administration and maintenance (OAM) features including:

- LSP ping
- LSP traceroute
- Service distribution path (SDP) ping
  - ¬ Verifies, for example, tunnel connectivity and round-trip delay
- Virtual circuit connectivity verification (VCCV)
  - ¬ Verifies, for example, service level existence and round-trip time
  - ¬ Extends OAM to pseudowire services
- Ethernet OAM functions, for example
  - ¬ 802.3ah: Ethernet in the First Mile
  - ¬ 802.1ag: Connectivity Fault Management
  - ¬ Y.1731: Ethernet OAM mechanisms for fault management – mainly at a service level
- Service Assurance Agent (SAA)
  - ¬ Runs in background, periodically collecting network 'health' information from OAM mechanisms (such as VCCV) and monitoring for problems (such as SLA transgressions)

These features, when under the control of the Alcatel-Lucent 5620 management portfolio, ensure rapid fault detection as well as efficient troubleshooting. In particular, SLAs can be proactively monitored by the SAA. This powerful capability allows the specification of test suites, policies and schedules. The tests are then auto-created, and the results obtained are automatically compared to pre-defined SLA metrics. Any transgressions detected are automatically reported through the SAA to operations staff. An auto-discovery protocol is supported to allow rapid commissioning of remote devices.

Synchronization

Cell sites rely on the backhaul network to provide synchronous interfaces for the proper delivery of data. In addition, cell sites may rely on the network interfaces as stable references with which to derive radio frequencies and to ensure reliable subscriber handover between cell towers. Accurate synchronization is also important in wireline networks in maintaining network operational integrity; for example, avoiding data underflows and overflows and transmission 'slips.'

The Alcatel-Lucent 7705 SAR supports external reference timing, line timing, adaptive clock recovery (ACR) timing, synchronous Ethernet and also timing distribution using 1588v2. The 1588v2 Master Clock and Boundary Clock functions are also supported. The 7705 SAR-M supports Transparent Clock and Time of Day capability. Accuracy and high performance of timing over packet solutions, such as ACR and IEEE 1588v2, are accomplished by a combination of built-in architectural features, efficiently tuned algorithms and powerful QoS mechanisms to minimize the delay experienced by synchronization traffic. These capabilities are cornerstones of the design of the Alcatel-Lucent 7705 SAR. A built-in Stratum-3 clock is provided to assist in synchronization maintenance during unavailability of a primary source.

7705 SAR family chassis options

7705 SAR-F

The 7705 SAR-F is a fixed configuration version of the Service Aggregation Router packaged in a one-rack unit (1 RU) high form factor that supports up to 16 T1/E1 any-service-any-port (ASAP) ports. The ASAP ports can be configured to support ATM, ATM IMA, TDM and MLPPP. Six 10/100 Base-T auto-sensing Ethernet ports are provided, plus two extra ports supporting 10/100/1000 Base-TX with small form factor pluggable optics (SFPs). Network uplink connectivity options are: Ethernet, Fast Ethernet (FE), Gigabit Ethernet (GigE), n × T1/ E1 MLPPP or n × T1/E1 ATM IMA. Integrated DS3 point-to-point trunking is supported using a SFP device.

7705 SAR-M

The 7705 SAR-M is a series of high-performance one-rack unit (1 RU) high form factor Service Aggregation Routers that are orderable in four different configurations. All four variants of the SAR-M support four 10/100/1000 Base-TX with small form factor pluggable optics (SFP) plus three 10/100/1000 Base-T auto-sensing Ethernet ports.

The variable capabilities of the four variants are shown in the following list:

- Fan cooled with a module slot
- Fan cooled with a module slot, plus16 T1/E1s any-service-any-port (ASAP) ports
- Passively cooled with no module slot
- Passively cooled with no module slot, plus16 T1/E1s any service any port (ASAP) ports

The expansion module slot, provided on two of the 7705 SAR-M variants, can support one of the following plug-in modules:

- An integrated GPON ONT
- A DSL Combo Module (DCM) supporting four pairs of G.SHDSL, plus two pairs of ADSL2/2+/ VDSL2 with ATM/PTM bonding
- An xDSL module supporting up to eight pairs of PTM bonding over ADSL2/2+/VDSL2
- An integrated CWDM Optical Add-Drop Mux (OADM) module

The T1/E1 ASAP ports, provided on two of the 7705 SAR-M variants, can be configured to support ATM, ATM IMA, TDM and MLPPP.

Network uplink connectivity options are: Ethernet, Fast Ethernet (FE), Gigabit Ethernet (GigE), n × T1/ E1 MLPPP or n × T1/E1 ATM IMA, GPON, multi-pair bonded DSL or CWDM interworking via colored SFPs. Integrated DS3 point-to-point trunking is supported using a SFP device.

7705 SAR-8

The 7705 SAR-8 is a two-rack unit (2 RU) version of the 7705 SAR with industry-leading access density. The platform can be optionally configured with a redundant control and switch module and uplinks. The Alcatel-Lucent 7705 SAR-8 has eight slots; two slots are allocated for control and switch modules (CSMs), with the remaining six slots being available for user traffic adapter cards. The Alcatel-Lucent 7705 SAR-8 has a compact, modular architecture, constructed to allow flexible use of line adapter cards so operators can optimize the configuration to meet the specific requirements of a site. With the modular architecture comes additional resilience and flexibility. The platform can optionally support 1+1 fully redundant CSMs. This industry-leading, independently validated High Availability feature has been inherited from the Service Router product line and is a strong contributor to overall network uptime. Network uplink connectivity options are: Ethernet, FE, GigE, n × T1/ E1 MLPPP or n × T1/E1 ATM IMA. Integrated DS3 point-to-point trunking is supported using the 4-port DS3 adapter card. OC-3/ STM-1 trunking is supported using Packet over SONET/ SDH (POS) on the 4-port OC-3/STM-1 clear channel adapter card.

7705 SAR-18

The 7705 SAR-18 is a 10 RU version of the 7705 SAR with industry-leading scalability. The platform can be optionally configured with a redundant control and switch module and uplinks. The Alcatel-Lucent 7705 SAR-18 has 18 slots; two slots are allocated for control and switch modules (CSMs), with the remaining 16 slots being available for user traffic adapter cards. Twelve of the adapter card slots have full duplex 2.5 Gb/s connectivity to the switching fabric, while the remaining four slots have full duplex 10 Gb/s connectivity. The platform can optionally support 1+1 fully redundant CSMs for High Availability. The twelve 2.5 Gb/s adapter card slots support the same adapter cards as the 7705 SAR-8. Network connectivity options are: Ethernet, FE, GigE, n × T1/ E1 MLPPP or n × T1/E1 ATM IMA. Integrated DS3 point-to-point trunking is supported using the 4-port DS3 adapter card. OC-3/ STM-1 trunking is supported using POS on the 4-port OC-3/STM-1 clear channel adapter card.

7705 SAR adapter cards

Each of the six adapter card slots in the 7705 SAR-8, or the twelve 2.5 Gb/s adapter card slots in the right side of the 7705 SAR-18, can be used to house the following adapter card types:

- 4-port OC-3/STM-1 clear channel adapter card, supporting ATM and POS with ports configurable for SONET or SDH operation
- 2-port OC-3/STM-1 channelized adapter card, supporting ATM, ATM IMA, TDM and MLPPP with ports configurable for SONET or SDH operation
- 16-port ASAP T1/E1 adapter card supporting ATM, ATM IMA, TDM and multiclass MLPPP
- 32-port ASAP T1/E1 adapter card supporting ATM, ATM IMA, TDM and multiclass MLPPP
- 8-port Ethernet adapter card supporting six ports of auto-sensing 10/100 Base-TX ports, plus two extra ports supporting 10/100/1000 Ethernet with SFP optics
- 4-port DS3/E3 adapter card supporting clear channel PPP and ATM service (ATM on DS3 only)
- 6-port Ear and Mouth (E&M) adapter card supporting selectable µ-Law or A-Law encoding
- 12-port Serial Data Interface (SDI) card, which can be configured for RS232, V.35 or X.21 operation
- An auxiliary alarm card with 24 digital alarm inputs, 2 analog inputs and 8 output relays
- A range of CWDM passive optical adapter cards. Add/drop cards are available with selected wavelengths
- 8-port GigE adapter card supporting 10/100/1000 Mb/s Auto sensing
- Microwave Power Injector Card
- Packet Microwave Card with microwave-aware Ethernet ports
- Voice and Teleprotection adapter card supporting FXS/FXO voice and low-latency teleprotection

7705 SAR-18 x-adapter cards

The four 10 Gb/s slots in the left side of the 7705 SAR-18 can be used to house the following x-adapter card:

- 1-port 10Gb/s / 10-port 1Gb/s card, configurable to operate in one of the following modes:
  - ¬ 10-port 1GigE SFP
  - ¬ 1-port 10GigE SFP+

FEATURES AND BENEFITS

FEATURES	BENEFITS
Cost-effective migration from PDH-based backhaul to economical and flexible IP/MPLS-based aggregation and routing, leveraging Ethernet or ISP network services over a wide range of first mile media	Transition from PDH-based connectivity to modern Ethernet and/or IP-based networking infrastructures can greatly reduce recurring operating expenditures such as line lease costs.
Resiliency and redundancy including: One-for-one hitless control and switch module failover (7705 SAR-8 and 7705 SAR-18), synchronization redundancy, network uplink resiliency and redundancy of power feeds plus temperature hardening (7705 SAR-8, 7705 SAR-F and 7705 SAR-M)	Advanced resiliency features lead to improved network uptime, which can positively impact customer retention and allow critical services to be offered for increased revenue.
Powerful, service-aware OAM capabilities complemented by the Alcatel-Lucent 5620 management portfolio for GUI-based network and element configuration, provisioning, and fault and performance management	Rapid fault detection and powerful commissioning and troubleshooting tools can improve productivity of operations staff and reduce network downtime.
Dense adaptation of multiple converged services onto an efficient economical packet infrastructure	Multiprotocol and convergence capabilities (with flexible and granular QoS) reduce equipment instances needed to carry multiple traffic types. Compact, energy-efficient platforms reduce power and cooling costs.
Extends service routing IP/MPLS dynamic capabilities to the remote site, hubs and network edge in compact form factors with low power consumption	Modular, flexible architecture alleviates the burden of complex pre-engineering and future scenario planning. Compact, rugged form factors allow remote sites to be addressed.
Breadth of synchronization solutions with flexible operation, redundancy and independent validation of accuracy	Accurate synchronization allows cost-effective deployment over packet infrastructure and improves the user experience (for example, less data loss and minimal dropped calls in mobile applications).

TECHNICAL SPECIFICATIONS

Safety, EMC, environmental and telecom compliance

Safety

- UL/CSA 60950-1
- IEC/EN 60950-1
- AS/NZS 60950-1
- IEC/EN 60825-1 and 2 (LASER Safety)

EMC

- EN 55022 2006 (Class A)
- FCC Part 15 2008 (Class A)
- ICES-003 Issue 4 2004 (Class A)
- EN 300 386 V1.4.1
- AS/NZS CISPR 22: 2006 (Class A)
- Telcordia GR-1089 Issue 4
- RRL Notice No. 2008-38 (Class A)
- RRL Notice No. 2008-39

Telecom

- IC CS-03 Issue 9
- ACTA TIA-968-A
- AS/ACIF S016 (Australia/ New Zealand)
- ITU-T G.703
- ITU-T G.707
- ITU-T G.712
- ITU-T G.957
- ITU-T V.24/RS232
- ITU-T V.36
- ITU-T X.21

Power utility substation

- IEEE 1613 (fan required)
- IEC 61850-3 (hazardous substances exception; e.g., sea salt mist, oil)

Railway

- EN 50121-4

Network Equipment and Building Standards (NEBS)

- NEBS Levels 1 and 3
- Telcordia GR-63-CORE, Issue 3
- Telcordia GR-78-CORE, Issue 2
- Telcordia GR-1089, Issue 4
- ATT-TP-76200
- VZ.TPR.9305
- ANSI T1.315-2001

Environmental

- Telcordia GR-63-CORE, Issue 3
- ETSI EN 300 019-2-1 v2.1.2 (Class 1.2)
- ETSI EN 300 019-2-2 v2.1.2 (Class 2.3)
- ETSI EN 300 019-2-3 v2.2.2 (Class 3.2)
- ETSI 300 132-2 v2.2.1

• Directives

- EU Directive 1999/5/EC R&TTE
- EU Directive 2002/96/EC WEEE
- EU Directive 2002/95/EC RoHS
- China: Ministry of Information Industry order No. 39
- CroHS

Chassis-dependent specifications

(see Table 1)

Table 1. 7705 SAR chassis-dependent specifications

	7705 SAR F	7705 SAR M (4 VARIANTS)**	7705 SAR-8	7705 SAR-18
Capacity for adapter cards/modules per chassis	-/-	- / One expansion module slot capable of housing 7705 SAR-M specific modules**	6 adapter card slots	12 (2.5 Gb/s full duplex) adapter card slots + 4 (10 Gb/s full duplex) XMDA adapter card slots
Redundancy and resiliency	Synchronization, uplinks, MPLS tunnel, pseudowires, power feeds, cooling fans	Synchronization, uplinks, MPLS tunnel, pseudowires, power feeds, cooling fans*	Control, fabric, synchronization, uplinks, MPLS tunnel, pseudowires, power feeds, cooling fans	Control, fabric, synchronization, uplinks, MPLS tunnel, pseudowires, power feeds, cooling fans
Physical dimensions	• Height: 1 RU 4.45 cm (1.75 in.) • Depth: 25.4 cm (10 in.) • Width: 43.9 cm (17.3 in.) • Rack mountable in a 48.2-cm rack, 30-cm depth (standard 19-inch equipment rack, 12-inch depth)	• Height: 1 RU 4.4 cm (1.73 in.) • Depth: 24.1 cm (9.5 in.) • Width: 44.1 cm (17.4 in.) • Rack mountable in a 48.2-cm rack, 30-cm depth (standard 19-inch equipment rack, 12-inch depth)	• Height: 2 RU, 8.9 cm (3.5 in.) • Depth: 25.4 cm (10 in.) • Width: 43.9 cm (17.3 in.) • Rack mountable in a 48.2-cm rack, 30-cm depth (standard 19-inch equipment rack, 12-inch depth)	• Height: 10 RU, 44.5 cm (17.5 in.) • Depth: 30 cm (11.8 in.) • Width: 43.9 cm (17.3 in.) • Rack mountable in a 48.2-cm rack, 30-cm depth (standard 19-inch equipment rack, 12-inch depth)
Power	• Two feeds: -48/-60 V DC, or two feeds: +24 V DC • Third-party sourced AC power solutions available: 100 V AC – 240 V AC	• Two feeds: -48/-60 V DC, or two feeds: +24V DC • Third-party sourced AC power solutions available: 100 V AC – 240 V AC	• Two feeds: -48/-60 V DC, or two feeds: +24 V DC • Third-party sourced AC power solutions available: 100 V AC – 240 V AC	• Two feeds: -48/-60 V DC • Third-party sourced AC power solutions available: 100 V AC – 240 V AC
Cooling	Built-in five-fan array with redundancy	Built-in five-fan array with redundancy*	One tray of eight fans with redundancy	One tray of eight fans with redundancy
Operating environment	• Normal operating temperature range: -40°C to +65°C (-40°F to +149°F) sustained • Normal humidity: 5% to 95%, non-condensing	• Normal operating temperature range: -40°C to +65°C (-40°F to +149°F) sustained • Normal humidity: 5% to 95%, non-condensing	• Normal operating temperature range: -40°C to +65°C (-40°F to +149°F) sustained • Normal humidity: 5% to 85%, non-condensing • Short term (96 hours) extended humidity range: 5% to 95%, non-condensing	• Normal operating temperature range: -5°C to +45°C (23°F to 113°F) sustained, -5°C to +55°C (23°F to 131°F) extended (96 hours) • Normal humidity: 5% to 85%, non-condensing • Short term (96 hours) extended humidity range: 5% to 95%, non-condensing
Shipping and storage temperature	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)	-40°C to +70°C (-40°F to +158°F)

* Only 7705 SAR-M variants with active cooling have fans and fan redundancy. Passively cooled 7705 SAR-M variants have no fans.
** See Table 2, "7705 SAR-M chassis variants" for details on 7705 SAR-M chassis variants

There are four variants of the 7705 SAR-M. Each column denotes a different set of supported capabilities per 7705 SAR-M configuration.

Table 2. 7705 SAR-M chassis variants

ETHERNET PORTS	7 (4 10/100/1000 BASE TX WITH SFP + 3 10/100/1000 BASE-T)	7 (4 10/100/1000 BASE TX WITH SFP + 3 10/100/1000 BASE-T)	7 (4 10/100/1000 BASE TX WITH SFP + 3 10/100/1000 BASE-T)	7 (4 10/100/1000 BASE TX WITH SFP + 3 10/100/1000 BASE-T)
T1/E1 ports	16	0	16	0
Module slot support	Yes	Yes	No	No
Cooling	Active	Active	Passive	Passive

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Alcatel-Lucent 5620 SAM

SERVICE-AWARE MANAGER | RELEASE 9.0
TECHNICAL SPECIFICATIONS

Operating environment

The Alcatel-Lucent 5620 SAM, Release 9.0 operates on the following:

Main, database, auxiliary servers and clients:

- x86 or Intel-based platforms (HP® or Oracle® Sun® Servers only)
- Oracle® Solaris™ 10 Operating System

Databases:

- Oracle® Database 11g

Additional clients:

- Microsoft® Windows® 2000 / 2003 / XP® Professional / Vista™ Business and Ultimate (32-bit)
- Microsoft Windows 7 Professional (32-bit and 64-bit editions)

Note that hardware recommendations may vary depending on scale of deployment. Contact your Alcatel-Lucent representative for the 5620 SAM Planning Guide for hardware requirements and platform sizing recommendations.

Minimum hardware requirements for Alcatel-Lucent 5620 SAM, Release 9.0 running on a Oracle Solaris 10 platform

APPLICATION	X86 HP® OR ORACLE® SUN	ULTRASPARC III Cu & IIIi, IV, OR IV+
5620 SAM main server: • It is recommended that the 5620 SAM server be installed on a workstation separate from that of the 5620 SAM database for large-scale deployments	• 2 dual-core or 1 quad core CPUs • 12 GB RAM • 2 disk drives, minimum 73 GB each	• 2 dual-core or 1 quad core CPUs • 12 GB RAM • 2 disk drives, minimum 73 GB each
5620 SAM 3GPP Interface • North-bound Interface for mobile networks • Optional on main server	• 16 GB RAM (24 GB RAM required if 5620 SAM main server & database on same workstation)	N/A
5620 SAM database: • Includes Oracle® Database 11g • Stores network objects and configuration • 5620 SAM server can be installed on a workstation separate from that of the 5620 SAM database for large-scale deployments • RAID technologies are supported • SAN storage is supported with 4GB or faster optical connections with dedicated Fiber Channel connection between hosts and storage arrays	• 2 dual-core or 1 quad core CPUs • 8 GB RAM • 4 disk drives recommended, minimum 73 GB each (2 drives minimum)	• 2 CPUs, 1 GHz or higher • 8 GB RAM • 4 disk drives recommended, minimum 73 GB each (2 drives minimum)
5620 SAM auxiliary statistics collector server: • For 5620 SAM logToFile statistics • Dedicated server only required for large-scale deployments	• 2 dual-core or 1 quad core CPUs • 8 GB RAM • 4 disk drives, minimum 73 GB each	• 4 CPUs, 1.5 GHz or higher • 8 GB RAM • 4 disk drives, minimum 73 GB each
5620 SAM auxiliary call trace collector server: • For call trace and debug trace statistics • Dedicated server only required for large-scale deployments	• 2 dual-core or 1 quad core CPUs • 24 GB RAM • 8 disk drives, minimum 146 GB each	N/A

5620 SAM client: • GUI presentation front-end • Only one client should be installed per platform	• 1 CPU, 1 GHz or higher • 1 GB dedicated RAM • 1 GB available disk space • 1280 × 1024 display resolution	• 1 CPU, 1 GHz or higher • 1 GB dedicated RAM • 1 GB available disk space • 1280 × 1024 display resolution
5620 SAM client delegate and third- party remote display server: • Single client install for multiple GUIs for multiple users • Citrix is recommended third-party remote display software • X11 protocol and native X displays supported	• 4 CPU cores • 16 GB dedicated RAM • 1 GB available disk space For a maximum of 15 concurrent GUIs. Increased hardware specifications are required as number of concurrent GUIs increases.	• 4 CPU cores • 16 GB dedicated RAM • 1 GB available disk space For a maximum of 15 concurrent GUIs. Increased hardware specifications are required as number of concurrent GUIs increases.

Scalability

Item description	Release 9.0 R3 Scalability Numbers
Network Elements (NE), not including Generic Network Elements (GNE)	12,000
GNEs in addition to NE limit	2,000*
GNEs	18,000*
Media Dependent Adapter (MDA)	25,000
Services	2 Million
Service Access Point (SAP)	6 Million
LSPs	50,000
Simultaneous operational 5620 SAM GUI clients	150
Simultaneous operational 5620 SAM OSS clients (HTTP, JMS)	30
Outstanding alarm-list entries	50,000
Alarm History Duration (assuming Outstanding alarms limit reached each day)	1 month
Concurrent Standard or Light-weight OAM tests (per 10 minutes)	6,000
Concurrent Accounting-based OAM tests (per 10 min.)	50,000
Combined Accounting and Performance statistics (per 15 minutes)	10 Million (Accounting) 500,000 (Performance)

* Assuming 10 interfaces per GNE.

Note: To achieve the scalability numbers above, consult your Alcatel-Lucent representative for required hardware specifications. Some 5620 SAM Release 9.0 scalability numbers are planned to increase throughout the Release 9.0 R-load release cycle. Check the Alcatel-Lucent 5620 SAM product page to download the latest version of this document for the most up-to-date Release 9.0 scalability numbers.

Note: Please refer to the Alcatel-Lucent 5620 SAM Release Description (RD) for additional scalability limits for specific NEs, associated MDAs, and limitations with respect to items that can be maximized concurrently.

Device Support

Device Name	Device Release(s) supported from specified 5620 SAM Release 9.0 R load onward			
	9.0 R1 (available)	**9.0 R3 (available)**	**9.0 R5 (plan of intent)**	**9.0 R7 (pre commit)**
1830 Photonic Service Switch (PSS)	PSS-1: AHP 1.0, GBEH 2.5, MD4H 1.5; PSS-16/32: 2.5, 2.5.1	**PSS-1: GBEH 2.7, MD4H 1.7 PSS-4: 1.5 PSS-16/32: 3.5, 3.5.1, 3.5.2, 3.5.3**		**PSS-4/16/32: 3.6, 3.6.5 PSS-36: 3.6, 3.6.5**
5780 Dynamic Services Controller (DSC)	2.0, **3.0**	**4.0**		
7210 Service Access Switch (SAS) –E	1.0, 1.1, 2.0, **3.0 R2/R3/R4**		**3.0 R5, 4.0 R1**	
7210 Service Access Switch (SAS) –D	**3.0 R2/R3/R4**		**3.0 R5, 4.0 R1**	
7210 Service Access Switch (SAS) –M	1.1, 2.0, **3.0 R2/R3/R4**		**3.0 R5, 4.0 R1**	
7210 Service Access Switch (SAS) –X	2.0, **3.0 R2/R3/R4**		**3.0 R5, 4.0 R1**	
7250 Service Access Switch (SAS) ES and ESA	3.0			
7250 Service Access Switch (SAS) STD	2.0			
7450 Ethernet Service Switch (ESS)	6.0, 6.1, 7.0, 8.0, **9.0 R1**	**9.0 R3**	**9.0 R4**	
7701 Control Plane Assurance Appliance (CPAA)	**5.0 R1**		**5.0 R5**	
7705 Service Aggregation Router (SAR)	2.0, 2.1, 3.0, **4.0 R1**	**4.0 R2/R3/R4**		**5.0 R1/R2**
7705 Service Aggregation Router (SAR) -18/-8/-F	**4.0 R1**	**4.0 R2/R3/R4**		**5.0 R1/R2**
7705 Service Aggregation Router (SAR) -M			**4.0 R4**	**5.0 R1/R2 + Fanless**
7710 Service Router (SR)	6.0, 6.1, 7.0, 8.0, **9.0 R1**	**9.0 R3**	**9.0 R4**	
7750 Mobile Gateway (MG)	1.0, 2.0, **3.0 R1**	**3.0 R4**	**3.0 R6 or R7**	
7750 Service Router (SR)	6.0, 6.1, 7.0, 8.0, **9.0 R1**	**9.0 R3**	**9.0 R4**	
9400 AWY (NG digital PDH family)	**2.01.04*, 2.01.05*, 2.01.06***			
9412 eNodeB	LA 2.0, 3.0 TLA 2.1, **3.0**		**LA 4.0 TLA 4.0**	
9471 Wireless Mobility Manager (WMM)*	LM 2.0, 3.0	**LM 4.0.1**	**LM 4.0.0, 4.0.2**	
9500 Microwave Packet Radio (MPR)	**3.00.00** ETSI-only: 1.03.01, 1.04.00, 2.01.01 ANSI-only: 1.02.00, 2.02.00, 2.02.01		**3.01.00, 3.02.00**	
9500 Microwave Packet Radio e (MPR-e)	**3.00.00***		**3.01.00*, 3.02.00***	
9500 Microwave Services Switch (MSS)	**MSS-1c: 3.00.00* MSS-4/-8: 3.00.00**		**MSS-1c: 3.01.00* MSS-4/-8: 3.01.00**	
OmniSwitch 6250	6.6.2			
OmniSwitch 6400	6.3.4, 6.4.2, 6.4.3, **6.4.4 R01**			
OmniSwitch 6850 / 6850E	**6.4.4 R01** 6850 ANSI-only: 6.3.1, 6.4.2, 6.4.3			
OmniSwitch 6855	6.3.1, 6.3.4, 6.4.2, 6.4.3, **6.4.4 R01**			

OmniSwitch 6855 U24-X	6.4.3, **6.4.4 R01**			
OmniSwitch 6900			**7.2.1 R01**	**7.2.1 R02**
OmniSwitch 9000 / 9000E	6.4.2, 6.4.3, **6.4.4 R01** ANSI-only: 6.3.1, 6.3.4			
OmniSwitch 10K			**7.1.1 R01**	**7.2.1 R02**
Telco T5C 24G, 24GT, 24T, 24F and 48T variants	BiNOS 6.3.13, 6.5.2, 6.5.5			
Other Devices via Generic Network Elements (GNE)	SNMP v1 (discovery only), v2c and v3			

* Supported as GNE
** Supported for use as 3GPP MME

Note: Please contact your Alcatel-Lucent representative for the latest 5620 SAM Release 9.0 Release Description (RD) for final supported device releases, including minor release loads and specific features supported, as well as information on which specific 5620 SAM Release 9.0 R-loads device releases will be supported in. Information labeled as "plan of intent" or "pre-commit" or "pre-DR0" or "pre-DR1" are subject to change.