

APPLICATION NOTE

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# Supporting the Service Routing Needs of Smaller Operators

The Alcatel-Lucent 7750 SR-c12 and 7750 SR-c4



## Abstract

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Alcatel-Lucent is at the forefront of delivering innovative and leading-edge IP/MPLS and carrier Ethernet products to service providers around the world. A key part of the market success and leadership of the Alcatel-Lucent Service Router (SR) portfolio is based on Alcatel-Lucent “Service Routing” — a unique combination of service and application-level intelligence combined with highly integrated and scalable hardware, software, and service management. Over the past several years, Alcatel-Lucent has established service routing as the industry foundation for defining the IP services edge. This paper discusses how Alcatel-Lucent has further extended the reach of service routing to address not only the needs of large, high-scale network and service deployments, but also the needs of smaller operators that require powerful service routing capabilities in platforms optimized for smaller scale and more cost-effective deployments.

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## 1. Introduction

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Explosive growth in video traffic and sophisticated consumer and business IP services are challenging service providers of all types and sizes to find ways of scaling and optimizing their network infrastructure. This requires far more than adding additional network capacity and bandwidth. It also includes important requirements of reducing the transport cost-per-bit while supporting sophisticated high-touch service handling capabilities needed for extreme quality and reliable service delivery.

Over the past several years, Alcatel-Lucent's research and development activity has centered on helping service providers profitably achieve these goals. One of the most powerful and innovative advancements came in March of 2008 with the introduction of our FP2 network processor silicon. FP2 is the industry's first 100 Gb/s fully programmable network processor, combining highly scalable packet processing, advanced traffic management, and high-touch service capabilities in a single device.

In leveraging FP2, Alcatel-Lucent was the first to be shipping 50 Gb/s cards in mid-2008 and will extend this to 100 Gb/s cards in the mid-2010 time frame. In addition to higher interface speeds, FP2 provides the tremendous queuing density, advanced QoS, and powerful processing needed for intensive services handling and routing at the network edge without performance impact — something that other vendors have yet to achieve.

The FP2's advanced and highly scalable technology is not just for the benefit of large-scale service providers. Alcatel-Lucent recognizes that smaller scale national, regional, and competitive operators face a similar set of network optimization challenges — how to deliver high-touch, low-cost-per-bit transport of advanced IP services while continuing to also support legacy subscribers and services. The remainder of this paper discusses how Alcatel-Lucent has extended our FP2 and service routing technology into two new platforms, the 7750 SR-c12 and 7750 SR-c4, to support the specific needs of smaller operators without compromising features, reliability, or performance.

## 2. Supporting the needs of smaller operators – The Alcatel-Lucent 7750 SR-c12 and 7750 SR-c4

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The Alcatel-Lucent 7750 SR-c12 and 7750 SR-c4 are the two newest members of the 7750 SR portfolio. Both products are carrier-grade IP/MPLS routers optimized to meet the needs of smaller operators without compromising scale or performance. By dimensioning these platforms for smaller-scale deployments while also incorporating Alcatel-Lucent's advanced service routing technology, the 7750 SR-c12 and SR-c4 deliver an advanced and highly versatile set of capabilities that make them an ideal choice for the business, service and networking needs of smaller operators.

Highlights of the key service routing capabilities which have been extended from our high-end 7750 Service Router to the 7750 SR-c12 and SR-c4 include:

- *Our award-winning FP2 network processing silicon* – The Alcatel-Lucent FP2 is a fully programmable, 100 Gb/s network processor combining highly scalable packet processing, advanced traffic management, and high-touch service capabilities. Supporting interface speeds of up to 100 Gb/s in our high-end routers, the FP2 provides tremendous queuing density and advanced QoS for service scale combined with the powerful processing support needed for handling intensive edge-network services and applications. The FP2 is innovative, powerful, and a key foundation of the SR portfolio.
- *The Alcatel-Lucent Service Router Operating System (SR OS)* – SR OS is a carrier-grade, highly fault-tolerant, and feature-rich operating system providing common service operation across the entire Alcatel-Lucent service router portfolio. The SR OS architecture provides the foundation for enabling sustainable, high-scale service routing, reliability, and development life-cycle sustainability. Deployed in over 350 networks around the world, operators can be assured of consistent and robust service delivery with reliable operations and management for all deployed equipment and services.

- *The Alcatel-Lucent 5620 Service Aware Manager (SAM)* – The 5620 SAM takes service providers far beyond the traditional boundaries of stand-alone element management systems. By integrating element, network, and service-level management into a common platform, the 5620 SAM enables unified, end-to-end management of IP/MPLS and Carrier Ethernet networks and services to help operators quickly gain the speed and efficiencies that they need. A robust set of management tools including automated provisioning, advanced trouble-shooting, and flexible reporting capabilities reduce complexity, minimize resource time, and provide a high degree of end-to-end network and service assurance. Operators can further enhance the 5620 SAM's management capabilities with the Alcatel-Lucent 5650 Control Plane Assurance Manager (CPAM) to greatly simplify the management of complex IP control plane functions. Custom service portals and pre-certified OSS partner applications enable rapid integration with existing OSS/BSS environments.
- *Common service router interface modules* – The 7750 SR-c12 and SR-c4 leverage a common set of 7750 SR multiservice interface modules that deliver a wide and flexible array of interface types, port densities, and service deployment options.

## 2.1 At a glance: The Alcatel-Lucent 7750 SR-c12



Alcatel-Lucent 7750 SR-c12

The 7750 SR-c12 is a 90 Gb/s (half-duplex) carrier-grade IP/MPLS router optimized for the high-performance routing and service-delivery needs of smaller operators. The SR-c12 is 5 RUs in height and leverages Alcatel-Lucent's award-winning FP2 network processor to provide advanced features, performance, and services with extreme quality delivery. The SR-c12 supports up to 12 subscriber interface slots that can be flexibly configured with up to eight Compact Media Adapters (CMAs), up to six Media Dependent Adapters (MDAs), or a combination of the two. CMAs are

optimized to deliver a range of lower-speed interfaces, a critical requirement of smaller scale operators, while MDAs deliver higher-capacity, higher-density interfaces. The combination of CMAs and MDAs provide operators with a high degree of optimization and flexibility for meeting the full range of service deployment needs.

The 7750 SR-c12 also supports a complete set of Layer 2 and Layer 3 IP/MPLS routing capabilities. These include Virtual Private Wire Service (VPWS or "pseudowire"), Virtual Private LAN Service (VPLS), and IP Virtual Private Network (IP VPN) services. Pseudowire services can be used to support the continuity of legacy services, including Frame Relay, TDM, and ATM over the IP/MPLS network.

Other feature highlights of the SR-c12 include:

- AC and DC power options
- Full NEBS Level 3 compliance
- Redundant common equipment (power, switch fabric modules, fans) complemented with an industry-best high availability feature set, including non-stop routing and non-stop services. All modules also support in-service insertion and removal
- In-Service Software Upgrade (ISSU) based on non-stop services and non-stop routing
- 10Gigabit Ethernet (10GigE) support, ideal for ring-based deployments and/or for higher-capacity network uplink requirements
- A wide range of multiservice interface cards enabling a fully converged multiservice edge. Port speeds range from channelized DS1/E1 up to 10GigE. Support for Packet over SONET/SDH (PoS), ATM, Circuit Emulation Services (CES), and Any Service Over Any Port (ASAP) cards address service and bandwidth requirements up to OC-48c/STM-16c

- Advanced hierarchical QoS (H-QoS) with high-density queuing and up to eight priority classes. H-QoS enables scalable and high-quality delivery of all applications and services with strict SLA enforcement
- Support for high performance multicast and native IPv6 in hardware
- Synchronous Ethernet for reliable distribution of network timing directly over Ethernet circuits
- Service mirroring and lawful intercept support
- Optimized size and lower power consumption for reduced floor space, lower operational costs, lower carbon footprint, and a greener environment

## 2.2 At a glance: The Alcatel-Lucent 7750 SR-c4



Alcatel-Lucent 7750 SR-c4

The 7750-SR-c4 is available beginning in mid-2010. Like its 7750 SR-c12 companion, the Alcatel-Lucent 7750 SR-c4 is a carrier-grade, 90 Gb/s (half-duplex) multiservice router optimized in scale and dimension for smaller network deployment needs. At just slightly over 3 RUs in height, the SR-c4 is more compact in size while also leveraging Alcatel-Lucent's award-winning FP2 network processor.

The SR-c4 supports up to four subscriber interface slots

which can be flexibly configured with up to four Compact Media Adapters (CMAs), up to two Media Dependent Adapters (MDAs), or a combination of the two.

As with the SR-c12, the SR-c4 also delivers a common and extensive set of multiservice capabilities through a full suite of Layer 2 and Layer 3 IP/MPLS service delivery capabilities. Pseudowire service is available for supporting the continuity of legacy services including Frame Relay, TDM, and ATM.

Other feature highlights of the SR-c4 include:

- AC and DC power options
- Full NEBS Level 3 compliance
- Front accessibility for all interfaces
- Redundant power supplies with all modules supporting in-service insertion and removal. Support for 1+1 redundancy or dual-homed redundancy is also provided, as required
- Two built-in 10Gigabit Ethernet (10GigE) ports, ideal for ring-based deployments and/or for higher-capacity network uplink requirements
- A wide range of multiservice interface cards (common to those supported on the 7750 SR-c12 above) with speeds ranging from channelized DS1/E1 up to 10GigE
- Multi-protocol adaptation and interworking support including frame relay, ATM, Packet over Sonet (PoS), and Circuit Emulation
- Advanced hierarchical QoS with high-density queuing and up to eight priority classes for scalable delivery of all applications and services with strict SLA enforcement
- High performance multicast and native IPv6 in hardware
- Synchronous Ethernet support for reliable distribution of network timing directly over Ethernet circuits
- Built-in BITS interface
- Service mirroring and lawful intercept support
- Optimized size and lower power consumption for reduced floor space, lower operational costs, lower carbon footprint, and a greener environment

### 3. Applications and benefits – Enhancing the business value for smaller operators

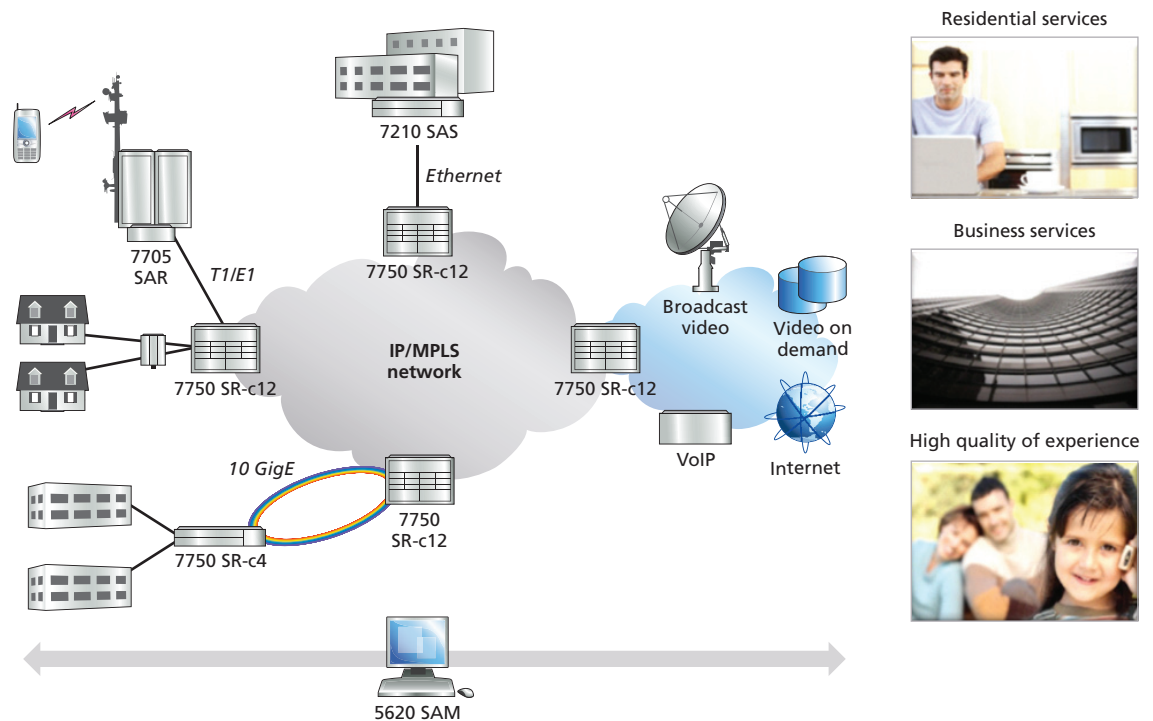
The unique features and service routing capabilities of the 7750 SR-c12 and SR-c4 enable smaller operators to optimize their networks for new multimedia IP services as well as support the continuity of legacy services over a common IP/MPLS network. They can also play a key role in helping operators become more profitable by reducing network capital and operational costs while enabling the delivery of premium business, residential, and Internet services.

Following are some of the key applications of the 7750 SR-c12 and SR-c4 and how they can help smaller operators meet their overall business, network, and service delivery needs.

#### 3.1 Enabling the converged multiservice edge

As illustrated in Figure 1, a key and powerful application of the 7750 SR-c12 and SR-c4 are their ability to deliver a more cost-effective, fully converged multiservice IP/MPLS network while meeting the full range of features, performance, and scale required for long-term growth in today's market. By deploying optimized service routers at the network edge, operators have the power and flexibility to aggregate traffic from traditional legacy voice and data networks while simultaneously supporting the needs of more sophisticated and higher bandwidth IP multimedia services. Over time, legacy networks can be phased out and replaced with all-IP based services to maximize total return on investment.

Figure 1. Converged multiservice edge network



#### 3.2 Expanding service portfolio and revenues

Deploying the 7750 SR-c12 and SR-c4 at the network edge also provides a tremendous opportunity for operators to expand the scope and breadth of their service offering. As discussed earlier, both of these platforms have the inherent performance, scalability, and multiservice feature capabilities to unlock new IP-based services for both business and residential customers. Service portfolio expansion can include adding new features and capabilities to an existing service or introducing an entirely

new service. For example, a basic high-speed internet service could be upgraded to a premium Internet and video service offering by leveraging Ethernet access, high-performance multicast, and advanced QoS capabilities. Further expansion to a full triple play service offering is also supported. Another example is the introduction of new business-Ethernet services based on Layer 2 VPLS and/or Layer 3 IP VPN offerings with advanced QoS and reliability assurances. These and many other IP services can readily be supported using the SR-c12 and SR-4 to help operators increase revenues, expand their customer base, and differentiate their offerings.

### **3.3 Delivering premium services with high customer satisfaction and SLA assurance**

With current and future IP traffic consisting of a multitude of services — including video, voice, best-effort Internet, and mission-critical business services — QoS becomes a critical element for delivering SLA-based and best-effort services with high reliability. The 7750 SR-c12 and SR-c4 support an advanced and highly scalable hierarchical-QoS implementation capable of supporting the most demanding edge service delivery environments while enforcing stringent subscriber and service-aware SLAs for high-value service-delivery assurance. Integrated service monitoring and measurement tools in the 5620 SAM also play an important role in ensuring a high degree of SLA assurance and reliability. The benefits of these advanced traffic prioritization and SLA monitoring and enforcement capabilities enable operators to deliver a superior Quality of Experience to customers, gain a sustainable competitive advantage, further differentiate their service offering, and promote long-term customer loyalty.

### **3.4 Reducing operational cost and complexity**

The Alcatel-Lucent 5620 SAM is a unified management system that delivers assured, simplified and integrated operations across the element, network, and service management domains. Unlike stand-alone element managers, the 5620 SAM provides a comprehensive portfolio of service-aware management tools and applications that are critical for helping smaller operators implement lean and scalable operations processes. The results are lower operational costs and an even more positive customer experience. With more than 200 deployments, including some of the world's largest and most advanced networks, the 5620 SAM is a proven and optimized solution encompassing all aspects of the service deployment and management life cycle process.

### **3.5 Meeting energy efficiency goals**

Reducing energy consumption is a key requirement for Alcatel-Lucent and a focus of all operators and businesses around the world. The 7750 SR-c12 and SR-c4 can play an important role in helping smaller operators meet their environmental objectives. Their smaller size and dimensioning require less power, rack space, and cooling needs while still delivering the high performance, scale, and features required for today's multiservice edge networks. Combined with environmentally sensitive manufacturing processes, careful environmental materials selection, and a focus on sustainable product life cycle management, the Alcatel-Lucent SR portfolio can help operators meet their environmental goals and enable them to offer assurances to their end-customers that the services they purchase are environmentally friendly.

## **4. Summary and conclusions**

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A key challenge for today's smaller operators is finding ways to cost-effectively optimize and scale their networks for delivering new IP multimedia services while also supporting the continuity of legacy networks and services. Addressing these challenges requires more than increasing network bandwidth. It also requires optimizing the network with more intelligence, reducing the transport cost-per-bit, gaining better network operational efficiencies, and enabling differentiated, value-added services for increased revenues. These challenges are critical parts of the business equation for all operators and are vital for long term growth and profitability.

The Alcatel-Lucent 7750 SR-c12 and 7750 SR-c4 were designed with the specific needs of smaller operators in mind. By extending Alcatel-Lucent's advanced service routing capabilities into platforms that are scaled and optimized for smaller network needs, the 7750 SR-c12 and SR-c4 help operators address critical new market demands and opportunities and provide a long-term strategic solution to their business, network and service requirements.

Since 2004, Alcatel-Lucent has shipped more than 35,000 IP/MPLS service routers to over 280 service providers in over 100 countries around the world. Our continuous innovations in service routing technology, such as our 100 Gb/s FP2 network processor silicon and unique approach to service management with the 5620 SAM, result in continuous investment protection and very high levels of service value and differentiation for operators as they look to profitably expand their business. The 7750 SR-c12 and SR-c4 are yet another proof point of how Alcatel-Lucent continues to be at the forefront of delivering leading-edge products and solutions for operators around the world.

## 5. Further reading

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- For Alcatel-Lucent 7750 Service Router product information, visit our 7750 SR website at <http://www.alcatel-lucent.com/wps/portal/Products>
- For information on Alcatel-Lucent industry-wide solutions, visit our Solutions website at <http://www.alcatel-lucent.com/wps/portal/Solutions>

## 6. Abbreviations

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|       |                                    |
|-------|------------------------------------|
| ASAP  | Any Service Over Any Port          |
| CES   | Circuit Emulation Services         |
| CMA   | Compact Media Adapter              |
| H-QoS | Hierarchical Quality of Service    |
| LAN   | Local Area Network                 |
| MDA   | Media Dependent Adapter            |
| MPLS  | Multi-Protocol Label Switching     |
| NEBS  | Network Equipment Building Service |
| PoS   | Packet over SONET/SDH              |
| QoE   | Quality of Experience              |
| QoS   | Quality of Service                 |
| RU    | Rack Unit                          |
| SAM   | Service Aware Manager              |
| SLA   | Service Level Agreement            |
| SR    | Service Router                     |
| SR OS | Service Router Operating System    |
| VPLS  | Virtual Private LAN Service        |
| VPWS  | Virtual Private Wire Service       |
| VPN   | Virtual Private Network            |

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