ALCATEL-LUCENT 7750 SR FOR RESIDENTIAL SERVICES IPv6 MIGRATION

ENABLING FLEXIBILITY IN ADDRESSING IPv4 ADDRESS EXHAUSTION IN RESIDENTIAL NETWORKS

- **The Alcatel-Lucent 7750 Service Router (SR) eases the migration to dual-stack IPv4/IPv6 residential services.**
- **IPv6 transition features promote an orderly and phased introduction of IPv6 into the services network.**
- **IPv4 continuity features extend the lifetime of an IPv4 address space.**

The Alcatel-Lucent 7750 SR facilitates both conservative and aggressive IPv6 migration strategies. To ease the migration to IPv6, the Alcatel-Lucent 7750 SR natively supports IPv6 and dual-stack IPv4/IPv6 residential services and also provides other features. IPv4 continuity features extend the lifetime of IPv4 addresses and allow service providers to parallelize deployment of IPv6 while mitigating IPv4 exhaustion issues, and IPv6 transition features allow IPv6 to be introduced in a controlled, phased manner, minimizing the impact on existing services.

OVERVIEW

To cope with IPv4 exhaustion, service providers basically have two strategies: IPv6 transition, where IPv6 is introduced into the network while maintaining IPv4 services and connectivity; and IPv4 continuity, where the aim is to use network address translation (NAT) techniques to manage IPv4 address exhaustion by over-loading IPv4 address usage. The Alcatel-Lucent 7750 SR supports several different flavors of large-scale NAT (LS-NAT) as well as different IPv6 transition techniques to introduce IPv6 into the network while maintaining continuity of IPv4 services.

IPv6 is gaining wider-scale deployment and acceptance; however, IPv4 services will still be needed for a long time. As a result, service providers will need to embrace dual-stack IPv4/IPv6 services. Alcatel-Lucent had the foresight to add support for dual-stack IPv4/IPv6 services to the Alcatel-Lucent 7750 SR because consumers will need to access both IPv4 and IPv6 servers for information, commerce and entertainment.

Alcatel·Lucent

COMPONENTS

LS-NAT, also referred to as carrier-grade NAT (CG-NAT), is a network-based network address and port translation (NAPT) function for IPv4 that is highly available, can scale to millions of simultaneous sessions, tracks customer connections, enforces per-subscriber session limits, and supports Lawful Intercept to allow law-enforcement action against individual subscribers. NAPT of an IPv4 address translated to another IPv4 address is referred to as NAT44 and allows the service provider to map multiple subscribers to a single IPv4 public address at the service provider's Internet gateway (see Figure 1).

Layer 2-aware NAT, with delimiter options for Internet Protocol over Ethernet (IPoE), Point-to-Point Protocol over Ethernet (PPPoE) and Layer 2 Tunneling Protocol (L2TP), is an IPv4 NAT solution developed by Alcatel-Lucent that allows many residential subscribers to use the same IP address by integrating a NAT/NAPT component into the Broadband Network Gateway (BNG) (see Figure 2). Because the BNG maintains subscriber context, the subscriber ID is used as a unique identifier for all NAT sessions.

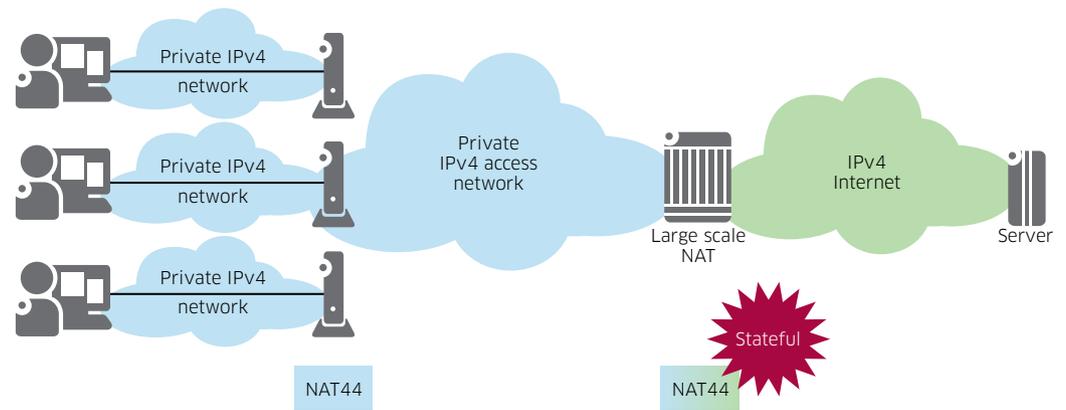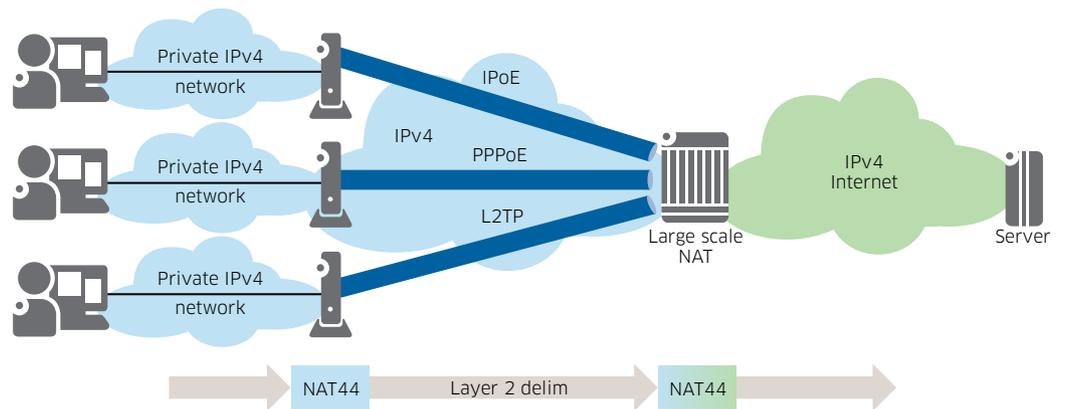**Figure 1. Large-scale NAT**

Figure 2. Layer 2-aware NAT

Subscriber-aware NAT is NAT for cases when the Alcatel-Lucent 7750 SR is acting as a standalone, centralized NAT behind BNGs that terminate subscribers (see Figure 3). The subscriber-aware NAT component acts as a RADIUS proxy to determine subscriber context for the NAT mappings.

Subscriber-aware NAT is similar in concept to Layer 2-aware NAT , but Subscriber-aware NAT allows for centralizing the NAT function because the NAT and BNG are in separate service routers, whereas with Layer 2-aware NAT, the NAT and BNG are in a single Alcatel-Lucent 7750 SR performing both functions.

Dual-Stack Lite (DS-Lite) allows IPv4 services to traverse an IPv6-only access network. DS-Lite defines a Basic Broadband Bridging (B4) element that resides in the customer home gateway and encapsulates IPv4 payload in IPv6 to be extracted by an Address Family Transition Router (AFTR) element in a service edge router such as the Alcatel-Lucent 7750 SR (see Figure 4). As the name implies, DS-Lite allows for dual-stack IPv4/IPv6 residential services by tunneling the IPv4 services through the IPv6-only access network, whereas IPv6 services are supported natively in the IPv6 access network.
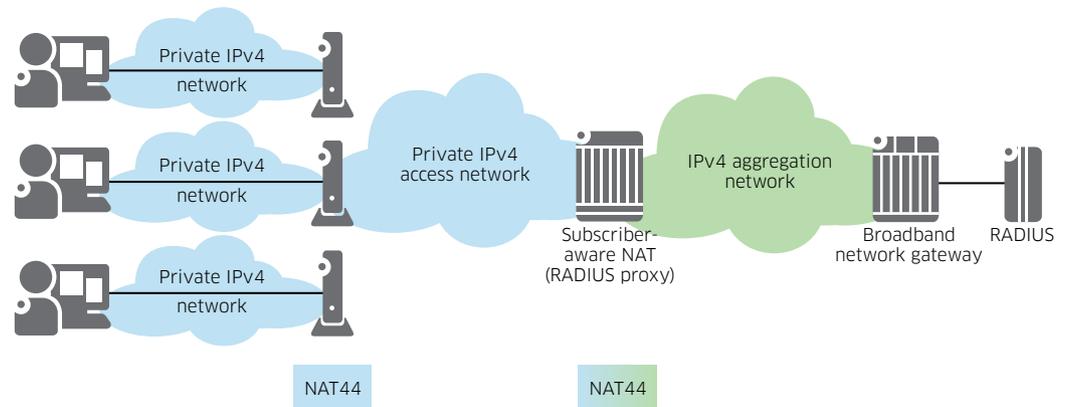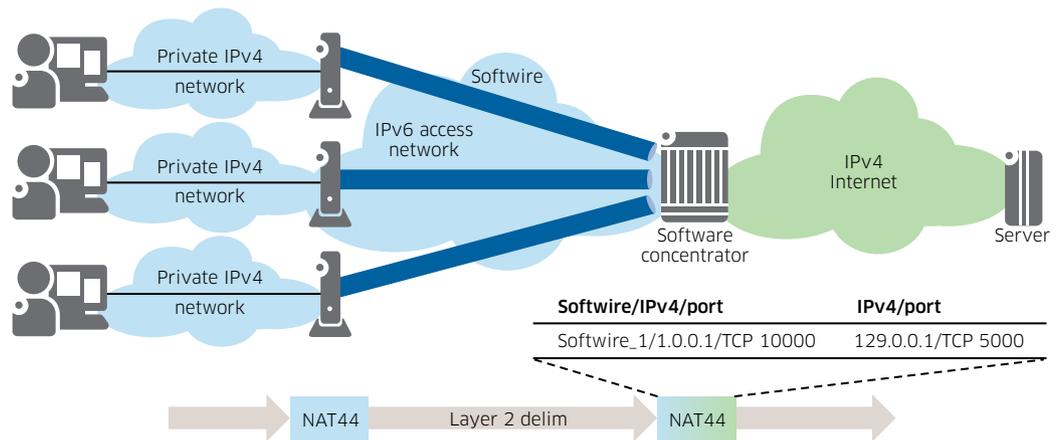
Figure 3. Subscriber-aware NAT

Figure 4. Dual-Stack Lite

Softwire/IPv4/port	IPv4/port
Softwire_1/1.0.0.1/TCP 10000	129.0.0.1/TCP 5000

NAT64 allows IPv6 hosts to communicate with IPv4 servers (see Figure 5). NAT64 requires a complementary Domain Name Server function (DNS64) to enable IPv6 clients to interoperate with IPv4 hosts. NAT64 can be a potential intermediate step in the v4-to-v6 evolution for a service provider to address the need to access IPv4 content when the access network is completely IPv6 capable.

Dual-stack IPv4/IPv6 BNG functionality is supported on the Alcatel-Lucent 7750 SR and allows subscribers to have access to both IPv4 and IPv6 servers. Alcatel-Lucent is a contributor to the Broadband Forum documents defining the transition to IPv6 residential broadband services (TR-177 and TR-187) for PPP, L2TP and IPoE. A dual-stack residential subscriber will have both IPv4 and IPv6 traffic within a single subscriber context and subscriber profile on the BNG.

Figure 5. NAT64/DNS64
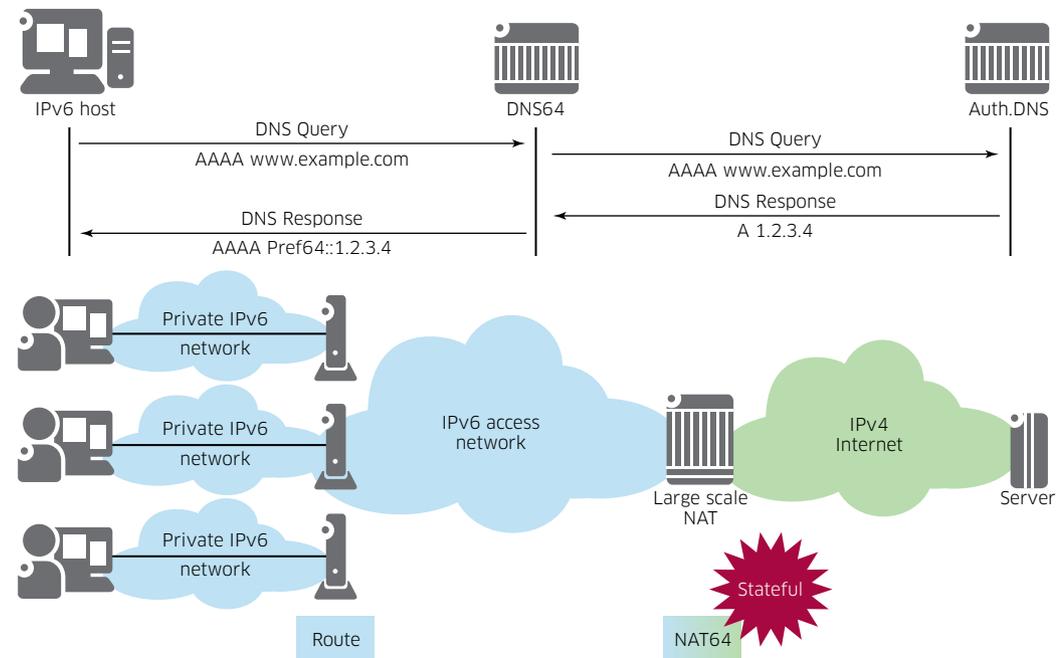
FEATURES

FEATURE	BENEFIT
Large-scale NAT (LS-NAT44)	Extends the life of IPv4 address space by allowing service providers to incorporate NAT with service provider scale
Layer 2-aware NAT	Integrated NAT and BNG functionality in a single router where the NAT is keyed to the subscriber identification, so all subscribers can use the same IP address
Subscriber-aware NAT	NAT in a standalone router that acts as a RADIUS proxy to correlate NAT mappings to subscribers terminated on separate BNGs
Port Control Protocol (PCP)	Emerging IETF protocol that allows a home gateway to communicate with a service provider NAT to facilitate incoming connections
NAT64	Allows an IPv6 client to communicate with an IPv4 server so IPv6 services can be introduced while maintaining IPv4 compatibility.
NAT redundancy	Enables NAT services to be deployed in redundant pairs, ensuring that NAT is highly available
DS-Lite AFTR	Allows the introduction of dual-stack IPv4/IPv6 services over an IPv6-only access network
IPv4/IPv6 dual-stack residential services	Ties together IPv4 and IPv6 services within a single subscriber context with a common policy for Quality of Service (QoS), accounting, and so on

THE 7750 SR ADVANTAGE

The Alcatel-Lucent 7750 SR is an integral part of the Alcatel-Lucent residential services delivery solution, which enables a cost-effective, graceful migration to IPv6 for residential services. With the 7750 SR, service providers gain the benefits of:

• A wide variety of IPv4 continuity and IPv6 transition tools and approaches to best fit the service provider's desired transition timeline and approach

• IPv6 transition mechanisms to introduce IPv6 and IPv6 services into the network while maintaining IPv4 interoperability

• Comprehensive IPv4, IPv6 and dual-stack IPv4/IPv6 BNG capabilities with concurrent support of full service routing features, for improved operational efficiency and reduced costs

LEARN MORE

In partnering with Alcatel-Lucent, service providers can now begin to "energize the edge" of their IP service networks by transforming standard IP edge routers into high-performance IP service routers through the addition of industry-leading capacity and scale, embedded application intelligence and the potential to support a vast selection of new network services. Only the Alcatel-Lucent 7750 SR has the breadth and depth to be a truly energized edge, and only the Alcatel-Lucent 7750 SR can deliver the real operational benefits of converging multiple IP applications and services onto a common high-performance IP services platform.

Visit the Alcatel-Lucent website for more information on the Alcatel-Lucent 7750 SR: **www.alcatel-lucent.com/7750sr**

Alcatel·Lucent