

464XLAT

Overview

This mechanism combines the use of stateful NAT64 with stateless NAT46. It is formally standardized in RFC6877 (2013). The provider-side translator (PLAT) implements stateful NAT64 and is located inside the ISP's core. A customer-side translator (CLAT) component is also defined, which may be located in the IPv6 client's CPE or network. Stateful NAT64 translation is defined in RFC6146 for the NAT64 transition mechanism. Stateless NAT46 translation is defined in RFC6145. In other words, RFC6877 (464XLAT) combines the use of RFC6146 and RFC6145. The stateful NAT64 process translates N:1, which allows stateful mapping of multiple IPv6 GUAs through a pool of public IPv4 addresses. This pool must contain at least one IPv4 address. On the other hand, the stateless NAT46 translation process is 1: 1 and maps a private IPv4 address (RFC1918) to an IPv6 GUA address. NAT46XLAT uses an IPv6-only transport network between the CLAT and the PLAT. An important feature of 464XLAT is that it does not use IPv4 encapsulation over IPv6, but rather translation with algorithmic mapping, both in NAT46 and NAT64.

Technical Characteristics

- 464XLAT is a transition mechanism especially designed for IPv6-only client networks and devices that also use an IPv6-only transport network. It is a new mechanism in the IPv6-only and NAT64/DNS64 series that allows solving particular situations that these mechanisms do not. Specifically, 464XLAT is an improvement of the NAT64 mechanism that allows solving requirements such as:
 - o The need for IPv6 clients and devices to establish connections to IPv4-only Internet servers, and to do so from a local IPv4 binding. In other words, applications that run in an IPv6-only client operating system and that only bind to an IPv4 socket on the client host will fail in NAT64 but will succeed in 464XLAT.
 - o Similarly, applications in which the client host uses literal IPv4 addresses or socket APIs will fail in the NAT64 mechanism but will succeed in 464XLAT.
- 464XLAT does not require the use of DNS64. Applications on the client host that wish to establish connections to IPv4 servers do not require synthesizing AAAA records from A records, as they will be able to establish connections directly from IPv4 using the CLAT on the client host. The client host may use either DNSv4 or DNSv6.
- This mechanism is based on algorithmic mapping translation and does not use IPv4 in IPv6 encapsulation techniques. Instead, for both NAT46 and NAT64,

464XLAT utilizes a translation technique that uses algorithmic mapping to map IPv4 addresses to the corresponding IPv6 addresses. RFC6052 (2010) defines the operational details of this algorithmic mapping. The table below (source: RFC6052, Section 2.2) illustrates the algorithmic mapping process for IPv4 to IPv6 translation (and vice versa).

IPv4-Embedded IPv6 Address Format											
PL	0 - 31	32-39	40-47	48-55	56-63	64-71	72-79	80-87	88-95	96-103	104-127
32	prefix	v4(32)				u	suffix				
40	prefix	v4(24)				u	v4(8)	suffix			
48	prefix	v4(16)				u	v4(16)	suffix			
56	prefix	v4(8)				u	v4(24)	suffix			
64	prefix					u	v4(32)				suffix
96	prefix (tipico: 64:ff9b::/96)								v4(32)		

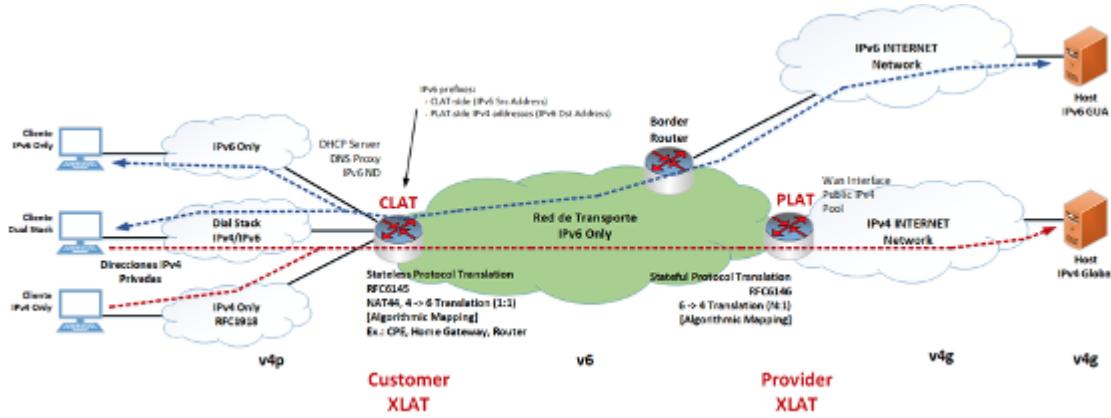
Examples of Algorithmic Mapping Translation

Example & Text Representation		
IPv6 Prefix	IPv4	IPv4-Embedded IPv6 Address
2001:db8::/32	192.168.2.33	2001:db8:c000:221::
2001:db8:100::/40	192.168.2.33	2001:db8:1c0:2:21::
2001:db8:122::/48	192.168.2.33	2001:db8:122:c000:2:2100::
2001:db8:122:300::/56	192.168.2.33	2001:db8:122:3c0:0:221::
2001:db8:122:344::/64	192.168.2.33	2001:db8:122:344:c0:2:2100::
2001:db8:db8:122:344::/96	192.168.2.33	2001:db8:122:344::192.0.2.33

While 464XLAT allows the use of any /32, /40, /48, /54, /64 or /96 translation prefix, the most commonly used is well-known prefix 64:ff9b::/96.

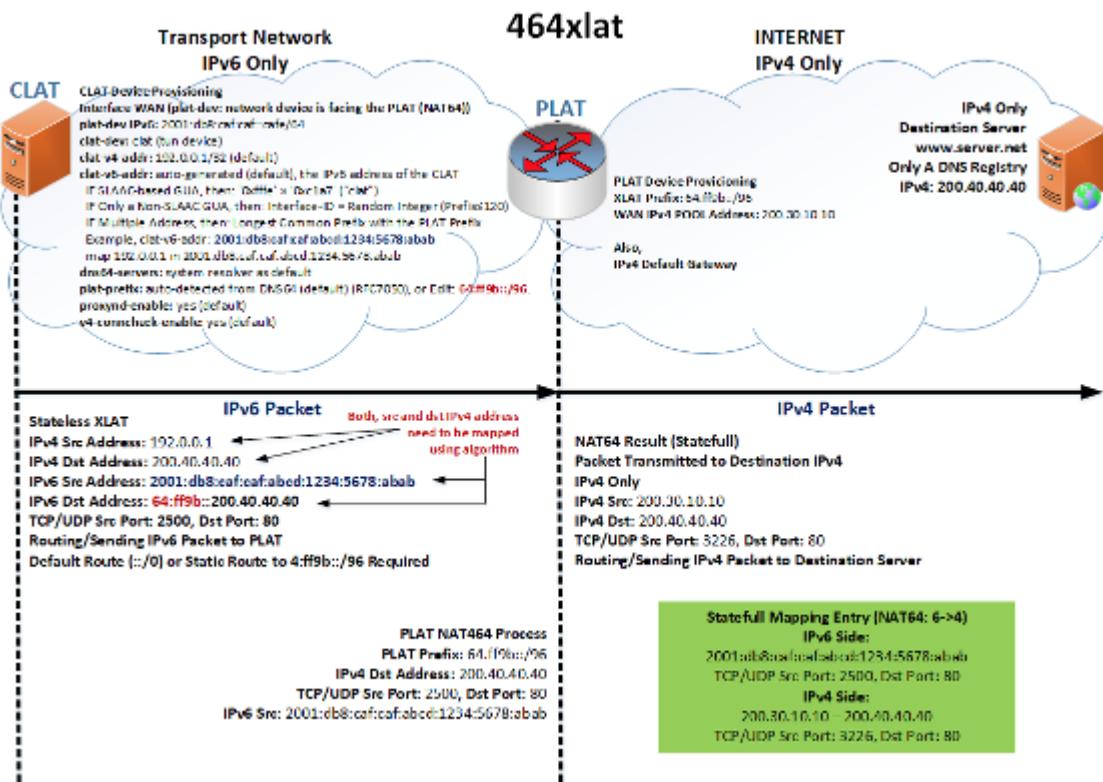
- 464XLAT works over an IPv6-only transport network. Like other mechanisms such as NAT64, IPv6-only, DS-Lite, Iw4o6 and others, 464XLAT uses IPv6-only between the CLAT and the PLAT. The use of IPv6-only in the transport network provides for greater efficiency and better performance in the core network and L3 switching of the operator (ISP), even more so because it does not use packet encapsulation. An IPv6-only transport network also allows the operator to deploy traffic engineering and QoS techniques to optimize traffic, service and network management.
- 464XLAT supports TCP, UDP and ICMP traffic. Like NAT64 and other translation-based mechanisms using algorithmic mapping, 464XLAT supports TCP, UDP and ICMP connections. 464XLAT fully matches the client-server service model and is designed for outbound connections from IPv6-only devices and hosts on the ISP's network. 464XLAT does not define a solution for incoming connections from the IPv4 Internet to IPv6-only hosts. In other words, 464XLAT does not fully match the peer-to-peer model on which the Internet is based.

- 464XLAT and different types of traffic: In 464XLAT, IPv4 traffic is resolved by the CLAT component on the client host. IPv6 traffic flows natively from the client host through the operator's IPv6-only network and does not necessarily flow through the PLAT.



- Advantages
 - Highly efficient stateless CLAT component.
 - Does not use encapsulation.
 - IPv6-only transport network: high efficiency and performance, single protocol stack and management.
 - Promotes the deployment of IPv6-only client devices and hosts.
 - Native IPv6 traffic is neither translated nor encapsulated.
 - Allows traffic engineering and QoS in the operator's network.
 - Matches the client-server model and allows outgoing connections from the IPv6-only side and from applications that require local binding in IPv4.
 - Does not require DNS64 and uses the same NAT64 as PLAT.
 - Allows load balancing through the simultaneous use of several PLATs and several translation prefix schemes.
 - Ideal for fixed telephony networks and IoT.
- Disadvantages
 - Does not resolve incoming connections from the IPv4 Internet.
 - Limited to TCP, UDP and ICMP.
 - Requires the installation of CLAT in the IPv6-only client or CPE.

464XLAT and Upstream Traffic



464XLAT and Downstream Traffic

