

DS-Lite (Dual-Stack Lite)

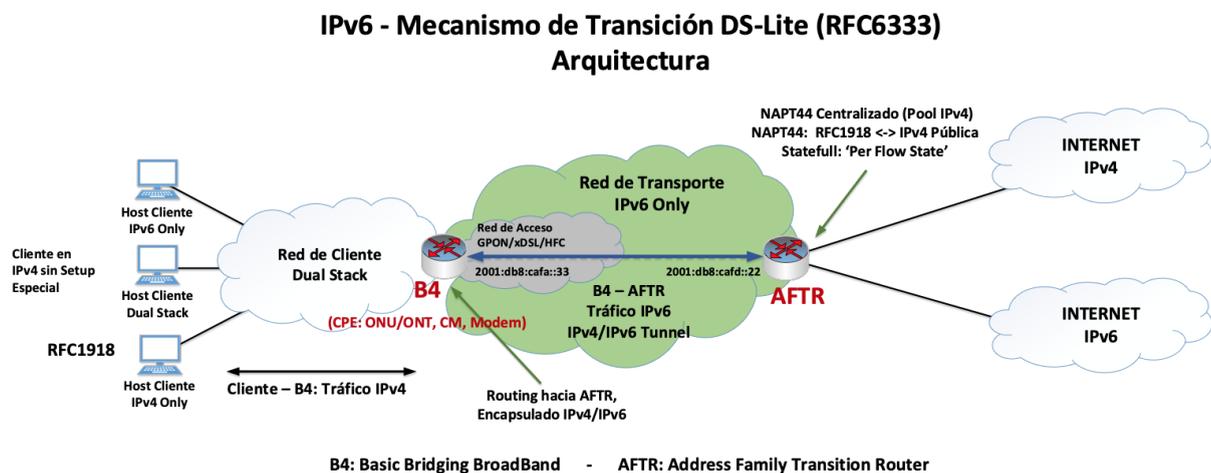
Overview

Standardized in IETF RFC 6333, the DS-Lite transition mechanism is designed to allow IPv4 clients to access the Internet by sharing a pool of public IPv4 addresses and an IPv6-only transport network at the ISP.

The functional components of DS-Lite are B4 (Basic Bridging BroadBand) and AFTR (Address Family Transition Router).

There are two key aspects in DS-Lite to allow IPv4 clients to connect to the Internet:

- Use of an IPv4-in-IPv6 tunneling mechanism between the B4 and the AFTR, and
- Use of NAPT44 (IPv4-IPv4 CGNAT) in the AFTR.



In DS-Lite, the NAPT44 process is centralized in the AFTR. According to the DS-Lite specification, no NAT process should be deployed in the B4 component. DS-Lite standardization focuses on Internet services for IPv4 over an IPv6-only transport network with an IPv4/IPv6 tunneling mechanism. Pure IPv6 services are completely decoupled and outside the scope of DS-Lite. In other words, IPv6 services and traffic operate natively in the operator's network. Given that the operator's network is IPv6-only, the network between all B4s and the AFTR has no addressing limitations and no additional overlapping techniques are required as they would in IPv4. The B4 function is located in the CPE. This CPE will have IPv4 on the LAN side towards IPv4 clients, with private RFC 1918 addressing for bridged or routed networks. Optionally, the CPE/B4 offers IPv4 clients the DHCPv4 service and DNS Proxy. DNS Proxy allows the CPE/B4 to receive DNS requests in IPv4 and resolve them using IPv6 on the operator's network. The WAN interface of the CPE/B4 is IPv6-only and allows communicating and routing IPv6 traffic towards the AFTR. The CPE/B4 encapsulates all IPv4 traffic using an IPv4/IPv6 tunnel and forwarding it to the AFTR (and vice versa). The CPE/B4

must be provided with the IPv6 address of the AFTR, which can be configured using a variety of methods including manual configuration or a variety of DHCPv6 options.

In turn, the AFTR function may be located in an edge router on the ISP's network. The AFTR must have at least two interfaces: a) an interface on the IPv6 side on the operator's network for communicating with all CPEs/B4s, and b) a WAN interface on the IPv4 Internet. The AFTR receives IPv6 traffic with encapsulated IPv4, decapsulates and extracts the IPv4 traffic from the tunnel, and then proceeds to perform stateful NAT44. For the stateful NAT44, the AFTR uses the pool of public IPv4 addresses assigned to the WAN interface (which must contain at least one IPv4 address). In DS-Lite, IPv4-in-IPv6 tunneling is deployed in accordance with RFC 2473 and RFC 4213. DS-Lite supports all types of unicast traffic but does not support multicast traffic. As for the IPv4 configuration of the IPv4/IPv6 tunnel between the B4 and the AFTR, DS-Lite defines the well-known 192.0.0.0/29 range, reserving 192.0.0.1 for the AFTR and 190.0.0.2 for the B4.

Technical Characteristics

DS-Lite allows IPv4 clients to access the Internet using a shared pool of public IPv4 addresses, performing stateful CGNAT NAT44 in the AFTR edge device, and offering IPv4 transport on an IPv4-in-IPv6 tunnel between the CPE/B4 and the AFTR over the operator's IPv6-only transport network. IPv6 traffic is handled natively.

DS-Lite works over an IPv6-only transport network (details). DS-Lite uses IPv6-only between the B4 and the AFTR. The use of IPv6-only in the transport network suggests greater efficiency and performance in the core network and L3 switching of the operator (ISP).

- **CPE/B4 provisioning:**
 - o AFTR's IPv6 address

- **AFTR provisioning:**
 - o Pool of public IPv4 addresses, with at least one public IPv4 address configured in the WAN interface used to connect to the Internet.

Advantages:

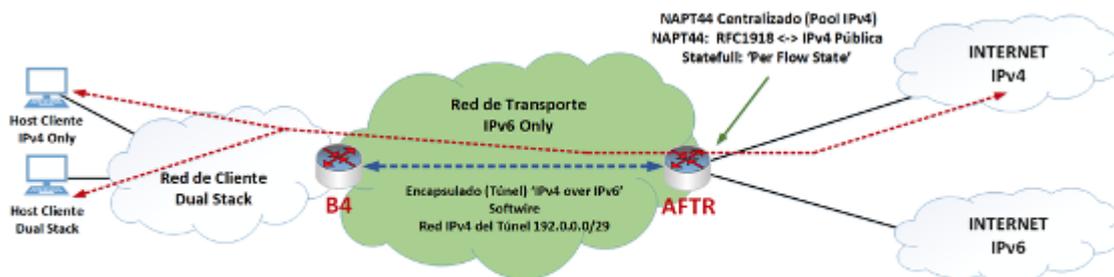
- o Does not require adaptations or modifications in dual-stack or IPv4-only customers.
- o IPv6-only transport network: high efficiency and performance, single protocol stack and management.
- o Promotes IPv6-only deployment in the ISP's transport network.

- o Because the transport network is IPv6-only, there are no limitations or need to overlap the addressing of thousands of CPEs/B4s.
- o Native IPv6 traffic is neither translated nor encapsulated.
- o Support for all protocol types using unicast traffic.
- o Automatic provisioning of B4 with DHCPv6 options.
- o Supported by the majority of CPEs.
- o Adaptations have no impact on the operator's IPv6 addressing.

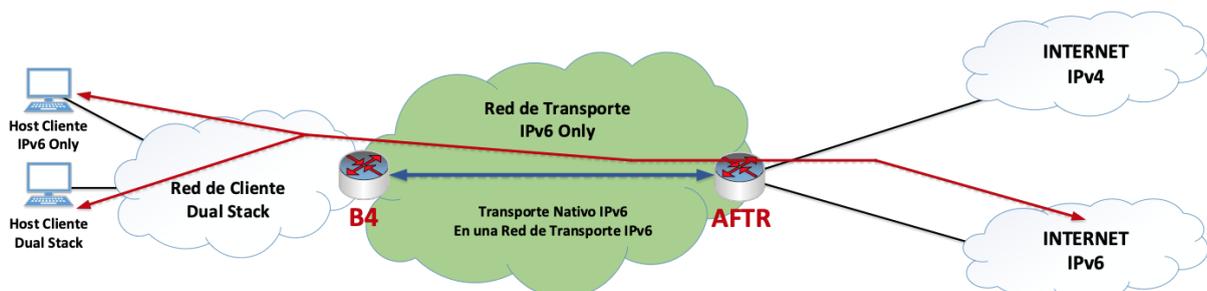
Disadvantages

- o Overhead in the transport network due to the IPv4/IPv6 tunnel encapsulation between B4 and AFTR.
- o Does not support multicast traffic.
- o The NAT44 function is centralized in the CGNAT/AFTR.
- o Does not solve the problem of IPv4 exhaustion.
- o Does not support IPv4 mesh networks layered over the ISP's transport network.
- o Not designed for mobile cellular networks.
- o IPv4/IPv6 encapsulation in the IPv6-only transport network adds some complexity to DPI in the operator's network.

Detailed architecture and diagram



Tráfico IPv4 en la Arquitectura 'Dual Stack Lite'



Tráfico IPv6 en la Arquitectura 'Dual Stack Lite'