MAP - Mapping of Address and Port

The purpose of Mapping of Address and Port (MAP) transition mechanisms is to enable communication of IPv4 clients by using an IPv6-only transport network to connect to the IPv4 Internet and mapping IPv4 addresses and ports (TCP and UDP) over IPv6.

There are two forms of MAP:

- **MAP-E**, defined in RFC7597 (2015) and based on the encapsulation of IPv4 over IPv6 and mapping of IPv4 addresses and ports to IPv6 and vice versa.
- **MAP-T**, defined in RFC7599 (2015) and based on the translation of IPv4 addresses and ports to IPv6 and vice versa.

MAP has the following functional components:

- **MAP CE (Customer Edge)**: located on the customer side in the CPE.
- **MAP BR (Border Relay)**: located in the customer's network, at the edge of the IPv4 Internet.

Technical Characteristics

Both MAP-T and MAP-E have the following technical characteristics:

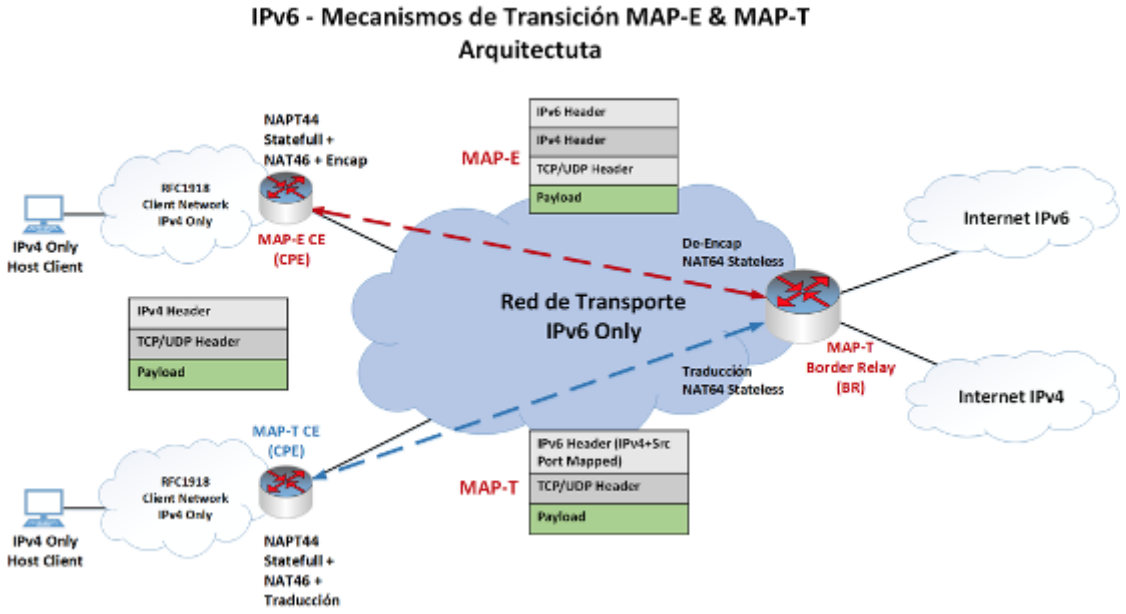
- Use of IPv6 as the transport network between MAP CEs (CPE) and MAP BRs.
- Mechanism to support IPv4aaS from IPv4 customer networks to the IPv4 Internet using IPv6 transport.
- Deployment of NAPT44/Stateful and NAT46/Stateless in MAP CEs and NAT64/Stateless in MAP BRs.
- Their operation is based on the mapping of IPv4 addresses and ports (TCP and UDP) to IPv6 addresses.
- Support for Unicast but not Multicast traffic.
- Support for DHCPv6 options for the provisioning of MAP (RFC7598).
- Both mechanisms perform NAPT44 (RFC2633) in MAP CE before the IPv4+Port mapping.
- MAP BR can connect multiple MAP Domains to the IPv4 Internet.
- The mapping algorithm, defined in Section 5 of RFC7597, is the same for both MAP-E and MAP-T. The algorithm allows mapping an IPv4 destination address and, optionally, a destination TCP/UDP port to an IPv6 address.
- There are two types of mapping rules:
    - a) Basic Mapping Rule (BMR) - mandatory
    - b) Forwarding Mapping Rule (FMR) - optional
- Both mapping rules share the same parameters:
    - Rule IPv6 prefix, including prefix length
    - Rule IPv4 prefix, including prefix length

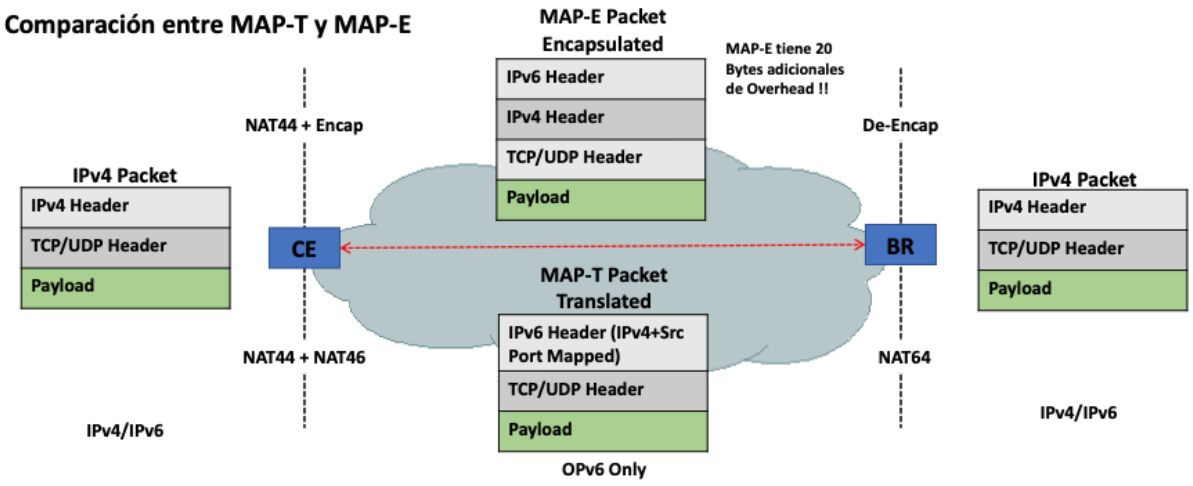
- Rule EA-Bit, in bits

· IPv4 address sharing, using Port Set/Range.

· Support for both mesh and hub-and-spoke topologies for both IPv4 as well as for IPv4 in the operator's network.

MAP-E employs IPv4 in IPv6 encapsulation between MAP CE and MAP BR. MAP-T maintains the functional structure of MAP-E but does not use encapsulation; instead, it uses 4>>6 translation in CE and 6>>4 in BR. MAP-T has the advantage of eliminating the overhead that MAP-E introduces.





Advantages:

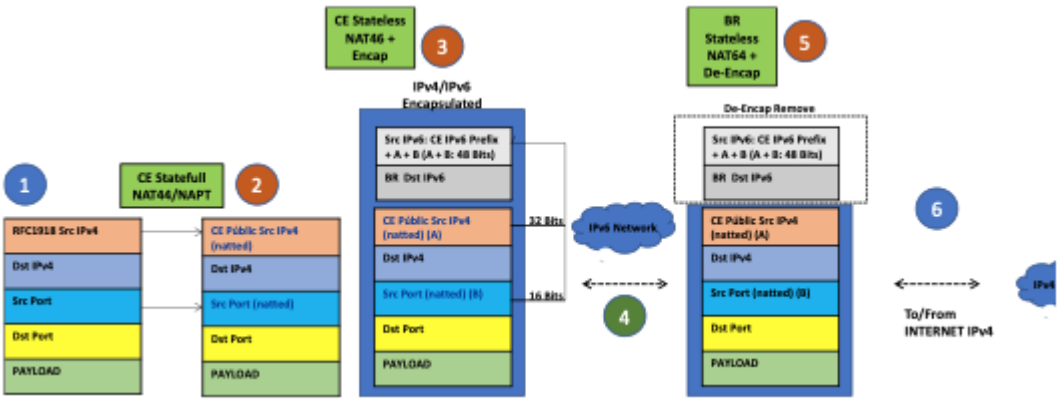
- Does not require adaptations or modifications in dual-stack or IPv4-only customers.
- IPv6-only transport network: high efficiency and performance, single protocol stack and management.
- Promotes IPv6-only deployment in the ISP's transport network.
- Because the transport network is IPv6-only, there are no limitations or need to overlap the addressing of thousands of CPEs.
- Native IPv6 traffic is neither translated nor encapsulated.
- Automatic provisioning of MAP CE with DHCPv6 options.
- Adaptations have no impact on the operator's IPv6 addressing.
- Does not require CGNAT.
- Better performance than DS-Lite, as NAPT is distributed.

Disadvantages

- In the case of MAP-E, encapsulation overhead in the transport network.
- Does not support multicast traffic.
- May require CPE update to support MAP CE.
- Does not solve the problem of IPv4 exhaustion.
- Neither MAP-T nor MAP-E were designed for mobile cellular networks.
- In the case of MAP-E, IPv4/IPv6 encapsulation in the IPv6-only transport network adds some complexity to DPI in the operator's network.

Detailed Architecture and Diagram

MAP-E Process



MAP-T Process

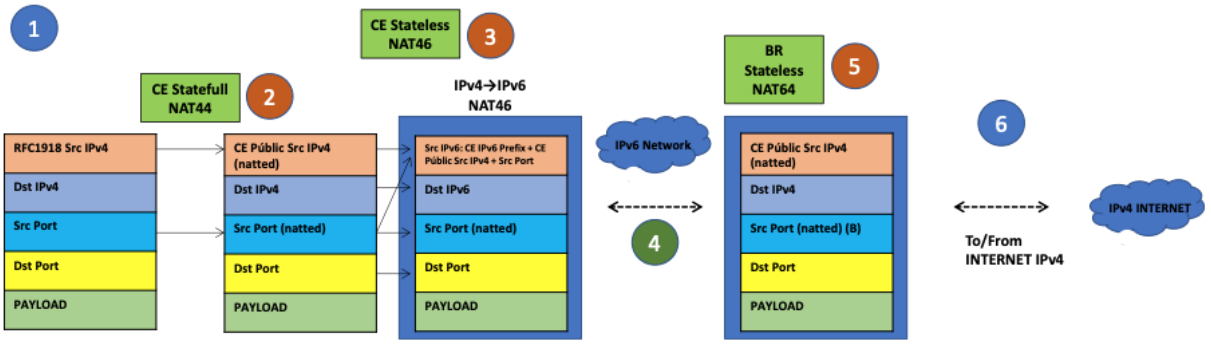


Figure showing an example of MAP-T