The evolution of IPv6 transition technologies

APIPv6TF, APNIC 35

Innovative solutions
for tomorrow's challenges

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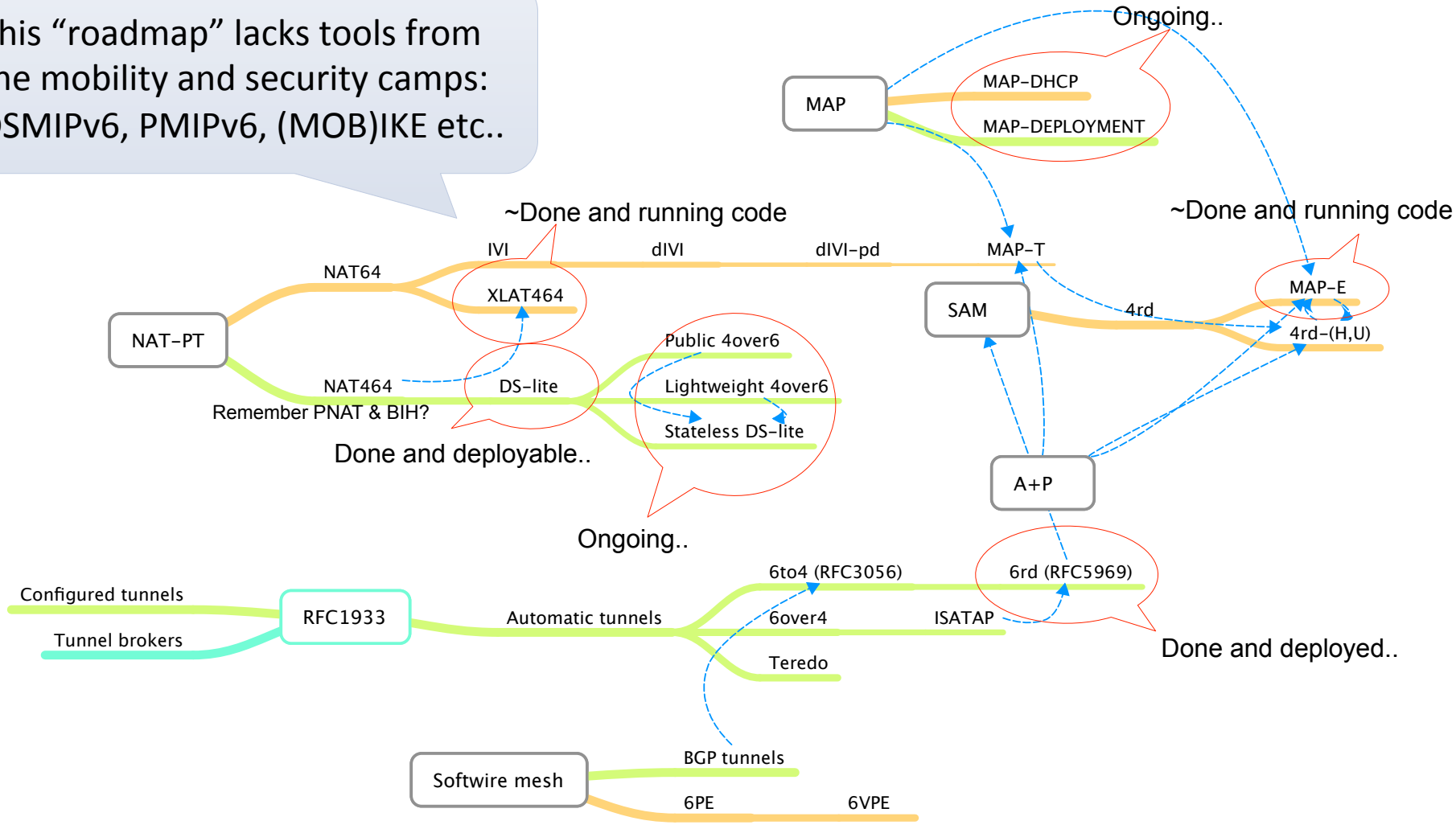
Overview

- IETF has worked on a plethora of IPv6 transition mechanisms.
- The activity is still ongoing trying to address different types on deployment scenarios.
- There is still need to provide IPv4 access and extend IPv4 lifetime when ISPs deploy IPv6 in their backbone.

- This presentation goes through **recent** IPv6 transition activities in IETF. We do not repeat the existing technologies..

Evolution of IPv6 transition technologies in IETF

This “roadmap” lacks tools from the mobility and security camps: DSMIPv6, PMIPv6, (MOB)IKE etc..

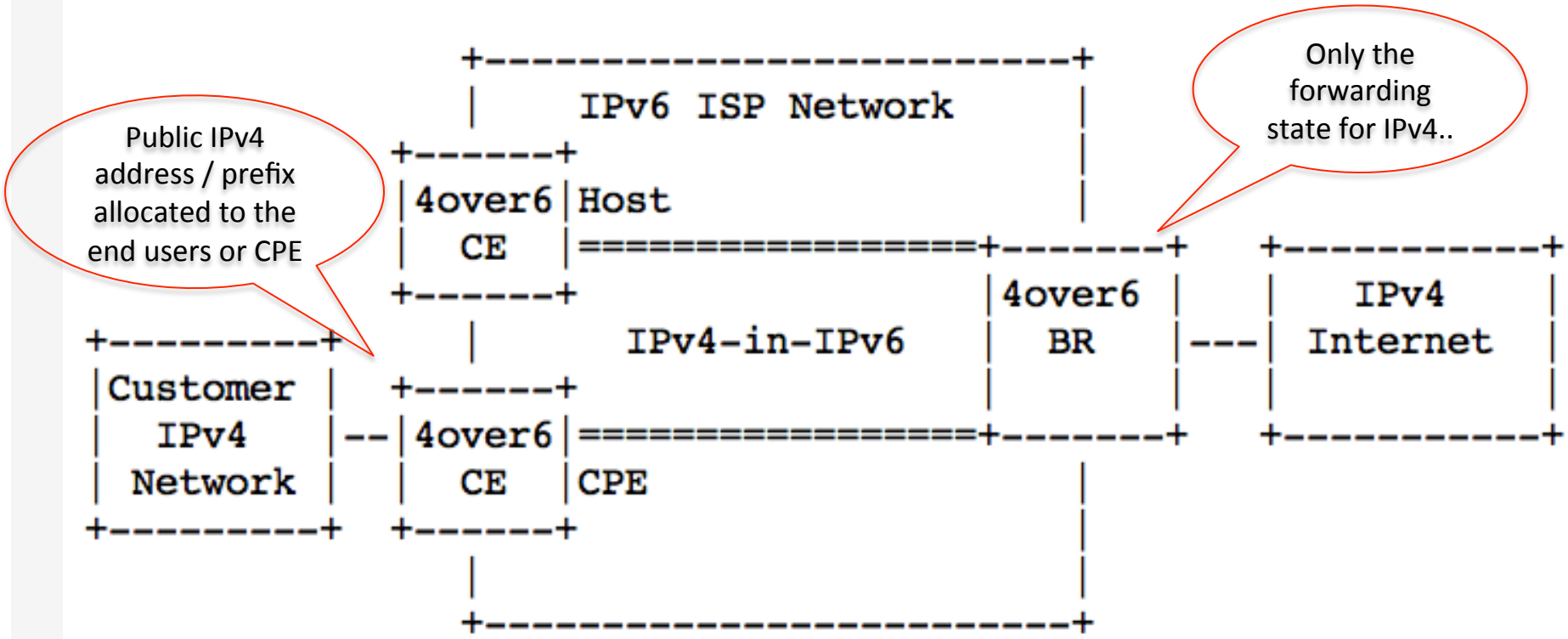


Original picture modified with the permission of Ole Troan

Common trends for recent work @ IETF

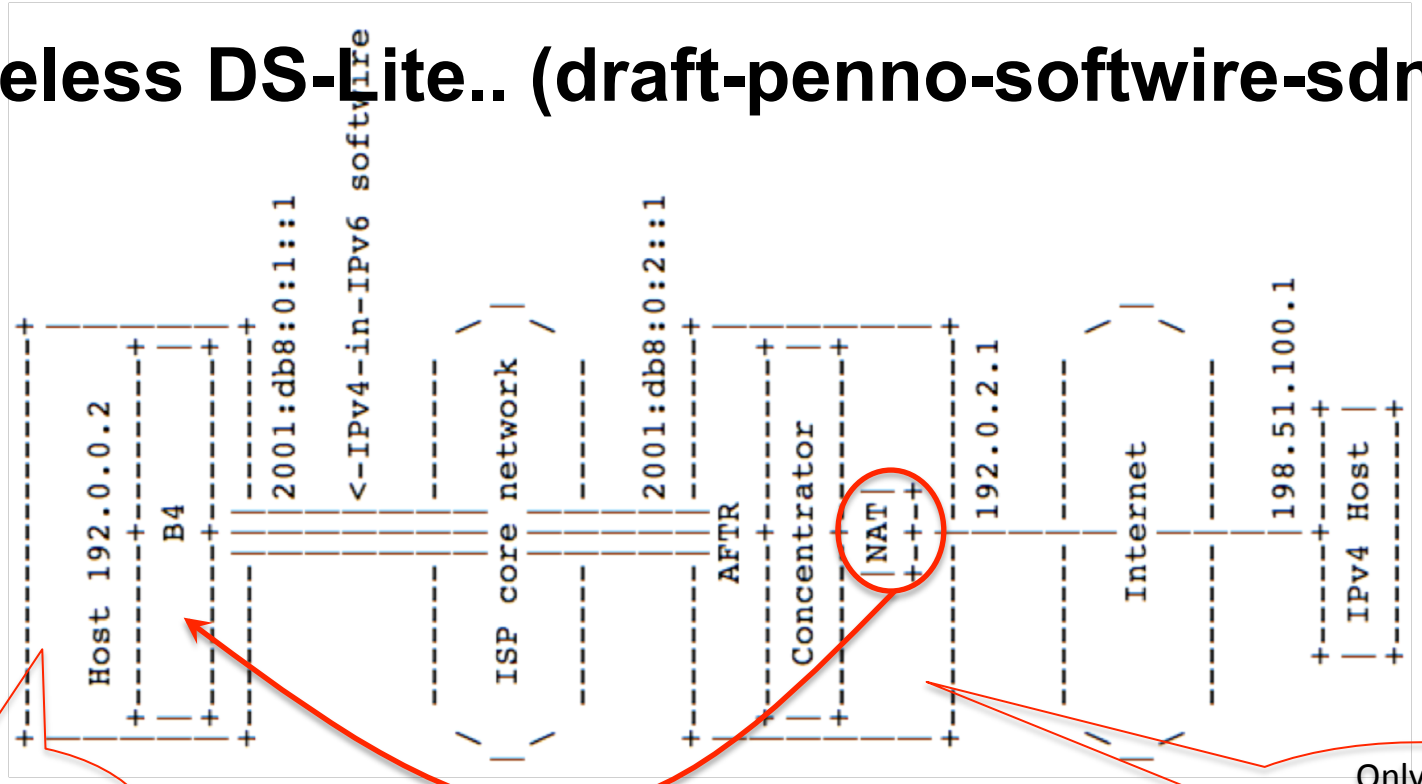
- Offer IPv4 end user service over IPv6(-only) ISP backbone.
- Assume dual-stack service for customers.
- IPv4 lifetime extension either using A+P or making end user IPv4 number “insignificant”.
- Push (NAT44) state at the customer edge.
- Keep the ISP core as stateless as possible (i.e., no NAT44 state in core). Per subscriber forwarding/binding state is OK since it is rather static; use anycast for reaching ISP border nodes if just technology allows it.
- Allow both mesh or hub & spoke modes of operation.
- Figure out the mechanisms for CPE provisioning and automated bootstrapping.. Oh.. someone is paying attention to operational aspects!

Public 4over6.. (draft-ietf-softwire-public-4over6)



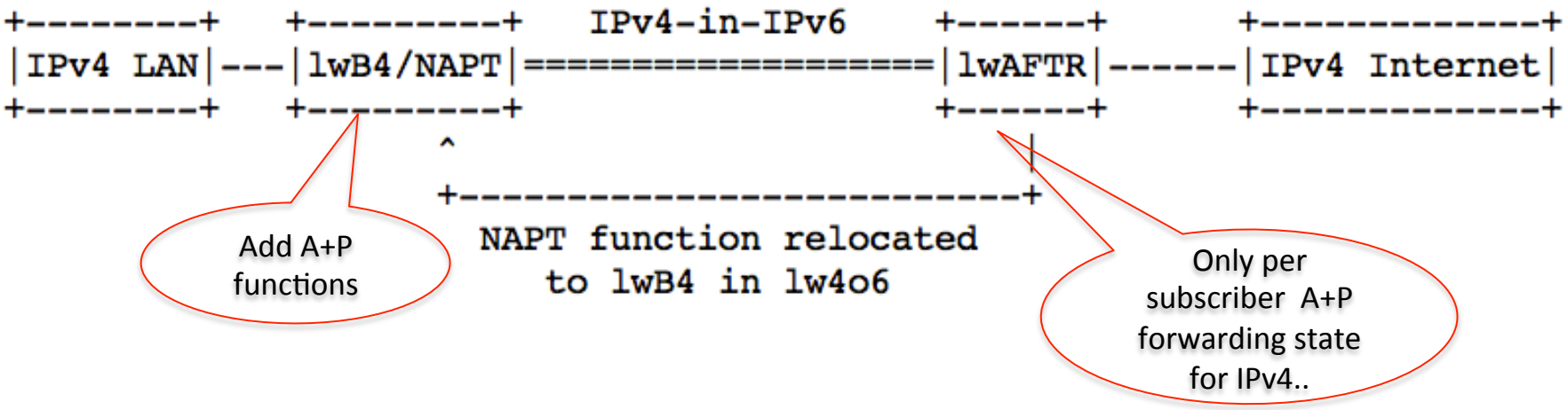
- Public 4over6 is a per-subscriber stateful, IPv4-over-IPv6 tunnel mechanism.
- The mechanism follows hub and spokes softwire model, and uses IPv4-over-IPv6 tunnel between end host or CPE and border relay (BR).
- The binding between the allocated IPv4 address and the end user's IPv6 address are maintained on the border relay for encapsulation usage.
- The BR also works as a DHCPv4 over IPv6 [I-D.ietf-dhc-dhcpv4-over-ipv6] server/relay for assigning public IPv4 address to 4over6 CEs.

Stateless DS-Lite.. (draft-penno-softwire-sdnat)



- The approach presented here is stateless in AFTR and deterministic. AFTR is stateless as NAT44 bindings are maintained on the CPE (B4 in “end host”). Good for logging.
- Per-subscriber mapping (IPv4 address + port range) to DS-Lite IPv6 tunnel in AFTR.
- ICMP port restricted message send when a source transmit a packet with a source port outside of the pre-authorized range. The ICMP message informs the source of the actual port range allocated.

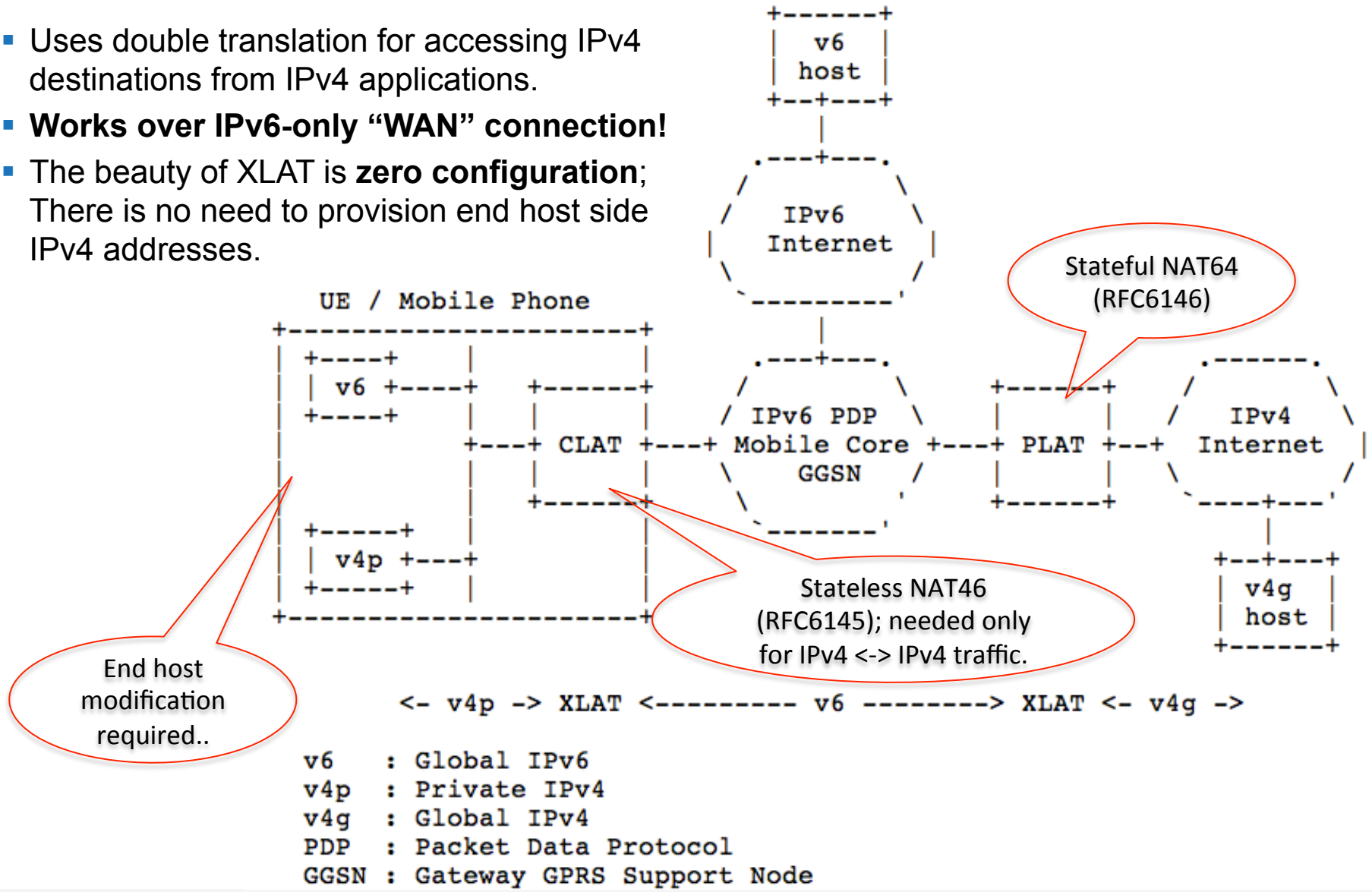
Lightweight 4over6.. (draft-cui-softwire-b4-translated-ds-lite)



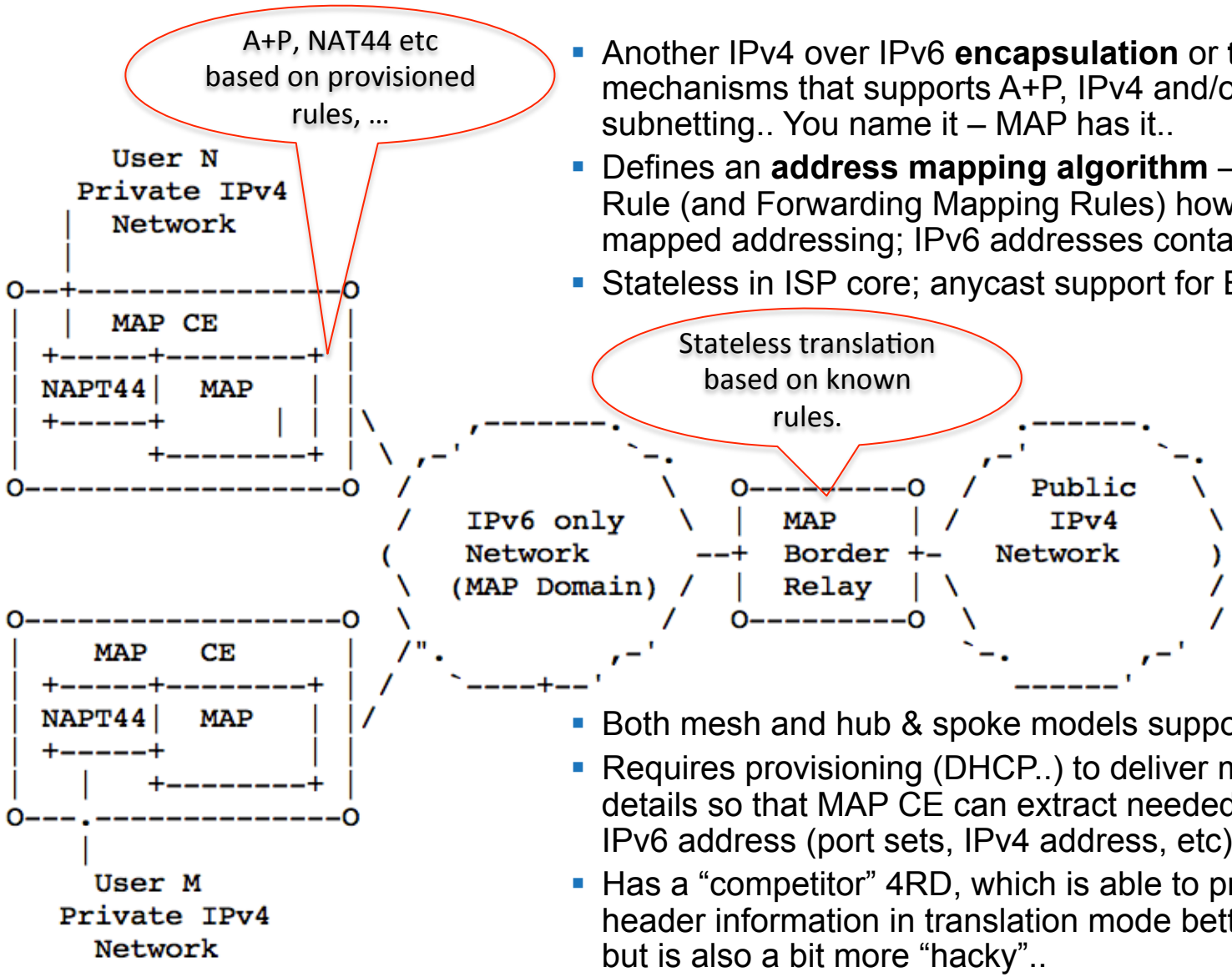
- It is quite similar to Stateless DS-Lite and Public 4over6..
- Lightweight 4over6 provides a solution for a hub-and-spoke softwire architecture only.
- An lwB4 is implemented on a dual-stack capable node, supports A+P (for sharing IPv4 address), implements NAT44 functionality.
- An lwAFTR is an IPv4-in-IPv6 tunnel endpoint and maintains per-subscriber A+P binding only and does not perform a NAT44 function.
- The provisioning system, which tells the lwB4 which IPv4 address and port set to use e.g. using DHCP, PCP or TR-69.

XLAT464.. (draft-ietf-v6ops-464xlat)

- Uses double translation for accessing IPv4 destinations from IPv4 applications.
- **Works over IPv6-only "WAN" connection!**
- The beauty of XLAT is **zero configuration**; There is no need to provision end host side IPv4 addresses.



MAP-E / -T (draft-ietf-softwire-map & -t)



- Another IPv4 over IPv6 **encapsulation** or **translation** mechanisms that supports A+P, IPv4 and/or IPv6 subnetting.. You name it – MAP has it..
- Defines an **address mapping algorithm** – Basic Mapping Rule (and Forwarding Mapping Rules) how to construct mapped addressing; IPv6 addresses contains all info.
- Stateless in ISP core; anycast support for BRs..

- Both mesh and hub & spoke models supported.
- Requires provisioning (DHCP..) to deliver mapping rule details so that MAP CE can extract needed parts from IPv6 address (port sets, IPv4 address, etc).
- Has a “competitor” 4RD, which is able to preserve some header information in translation mode better than MAP-T but is also a bit more “hacky”..

Summary

- There is no limit on engineering possibilities and innovation ;-)

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