

A+P Lite

How to Keep CGNs from Breaking the Internet

2010.03.02 / Kuala Lumpur

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Problem Statement

Broadband (cable/DSL) and wireless (GSM/3G) providers will not have enough IPv4 space to give a unique IPv4 address to each CPE or terminal so that every consumer has usable IPv4 connectivity.

Large-Scale NAT (LSN)

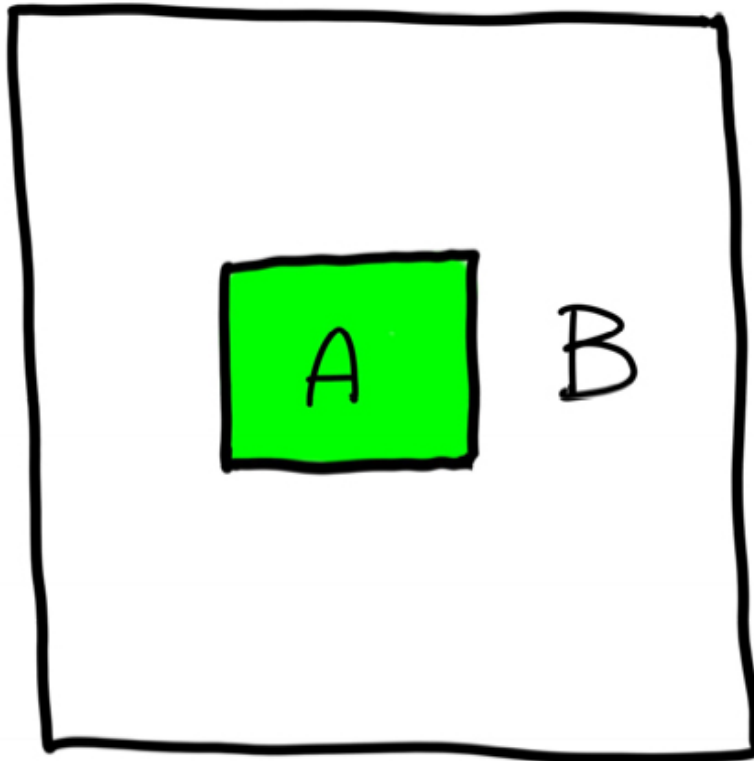
- LSN (formerly CGN) are NATs in the core of the provider's network
- NATs did not scale to Carrier Grade, no big surprise
- Customer Premises Equipment (CPE) has 4to4 NAT and the core re-NATs 4to4, "double nat" == double trouble.

LSN Breaks the Net

- This cause problems for the carrier, but also for the whole internet, as these captive customers can not use new protocols
- NAT in middle of net has all of the problems of a smart core, the Telco model
- Walled gardens here we go!

I Googled "Walled Garden"

Walled Gardens Explained:

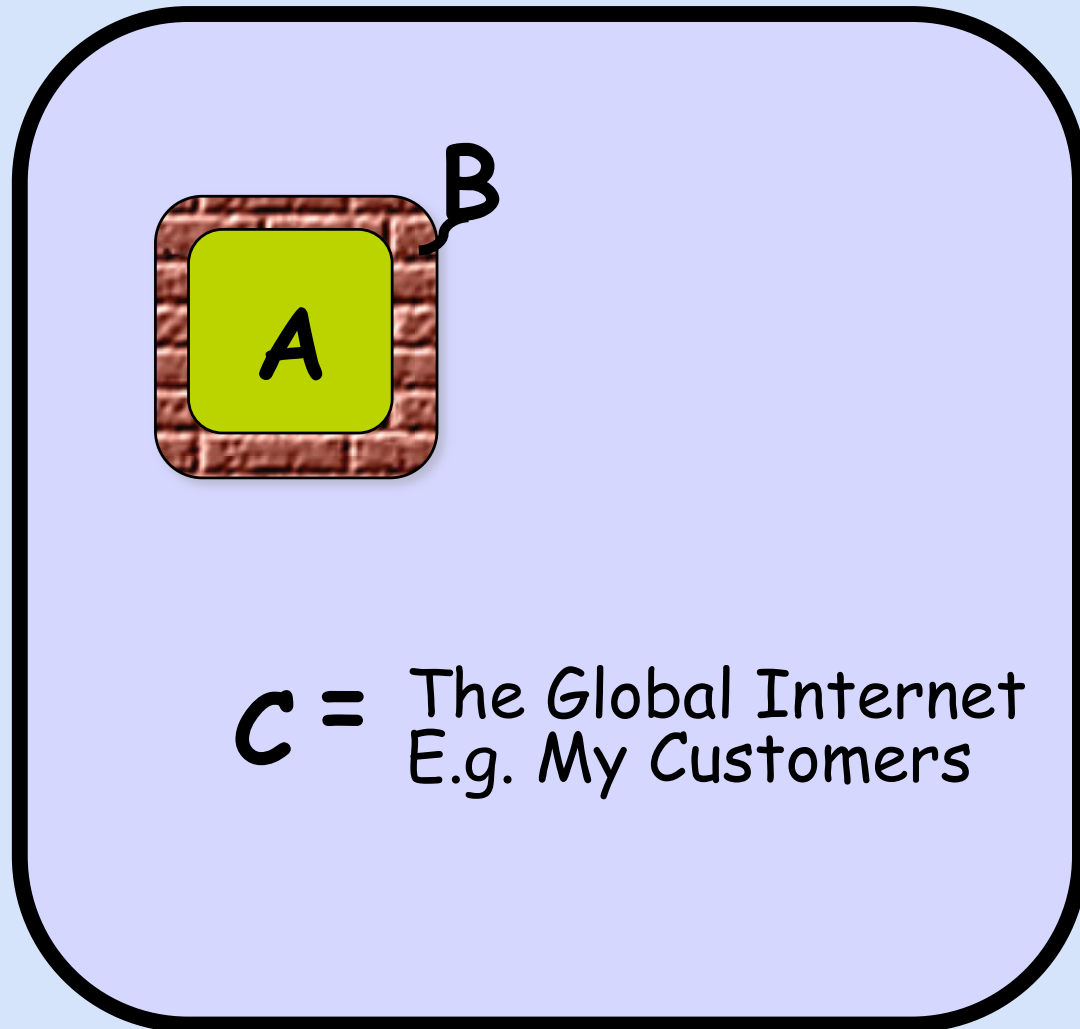


A: Everyone here makes money.

B: Everyone here can go ~~fuck~~ themselves.

@hugh

Walled Garden



- A: Isolated, exploited, & restricted
- B: Owner here makes money
- C: Everyone here can go fsck themselves

Captive Users

- This is the business model of User as Consumer
- Internet becomes Television
- Media is Controlled (DRM)
- Protocol innovation Stops
- RFC 1918 is totally deployed
- Google ads & Amazon frames will not all display!

This
Does Not
Have to
Happen

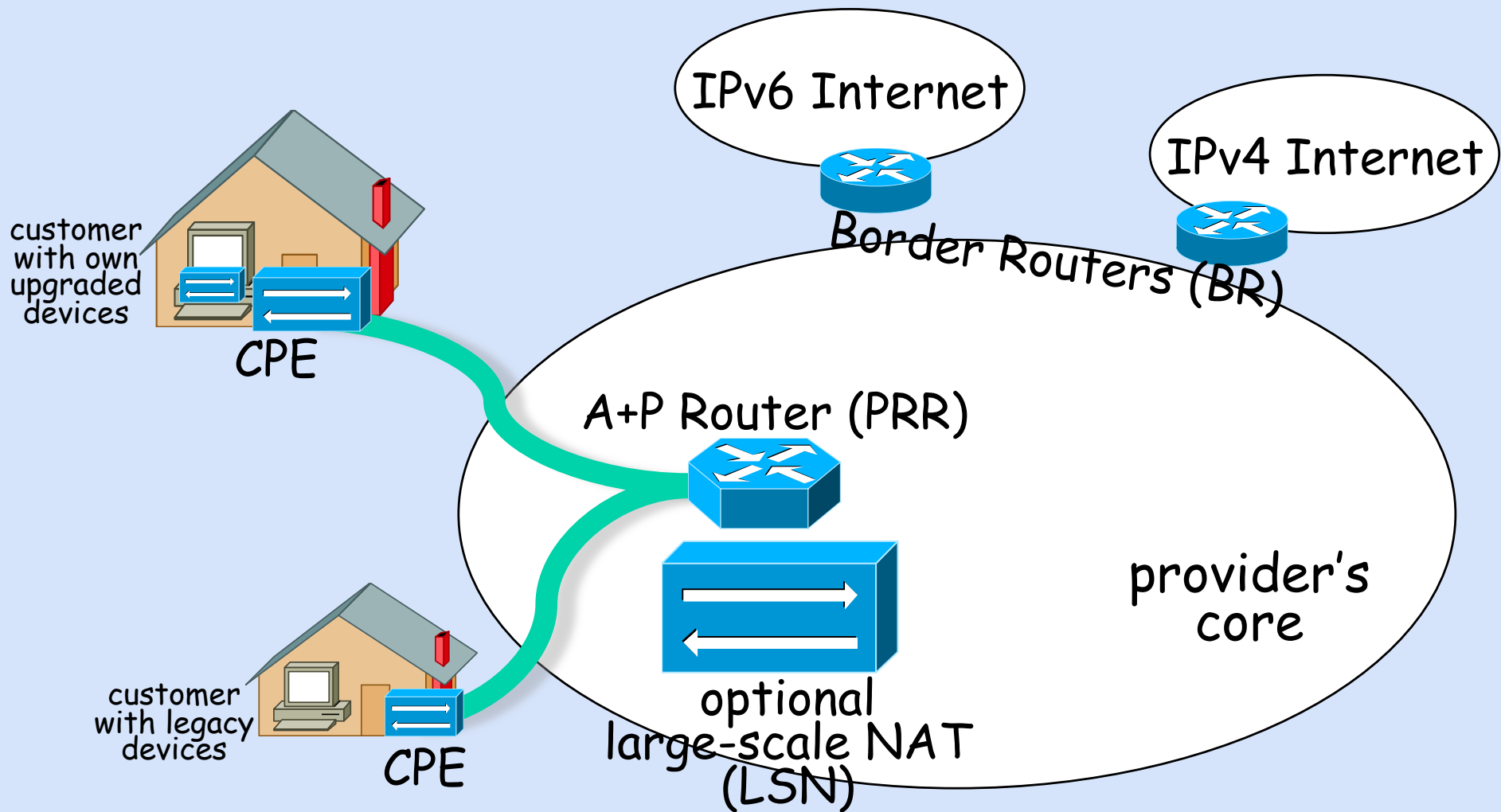
Keep the Power of
Choice in the Hands of
the Users!

Allow the NAT
to be "flexible"

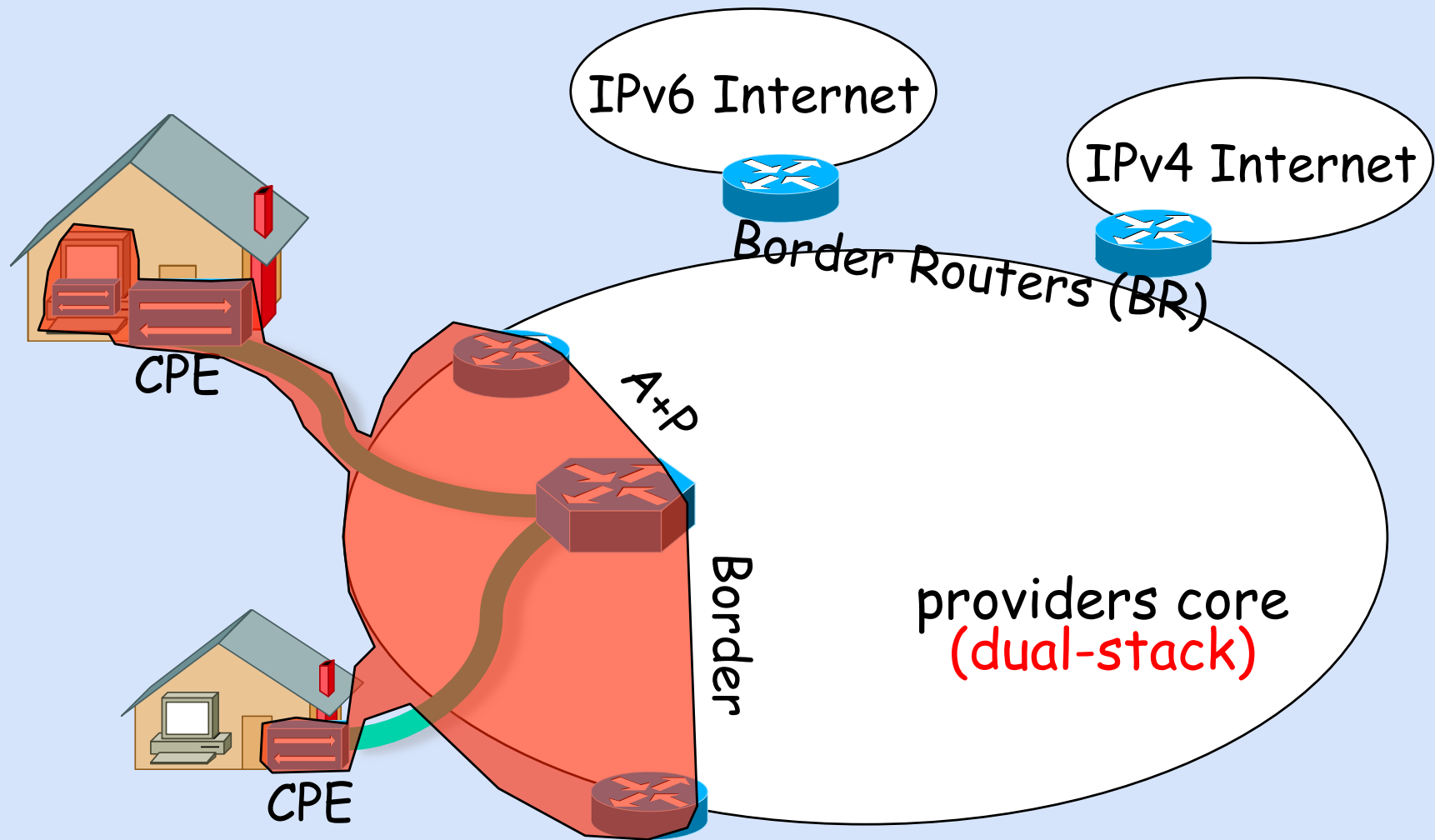
A+P in One Slide

- Goal: mechanism required that **customer can control their "fate"**.
- "Steal" bits from Ports and use it for addressing. Same as LSN.
- But do it at the **User CPE!**
- Thus, extend end-to-end connectivity (at least for some ports) to end-user!

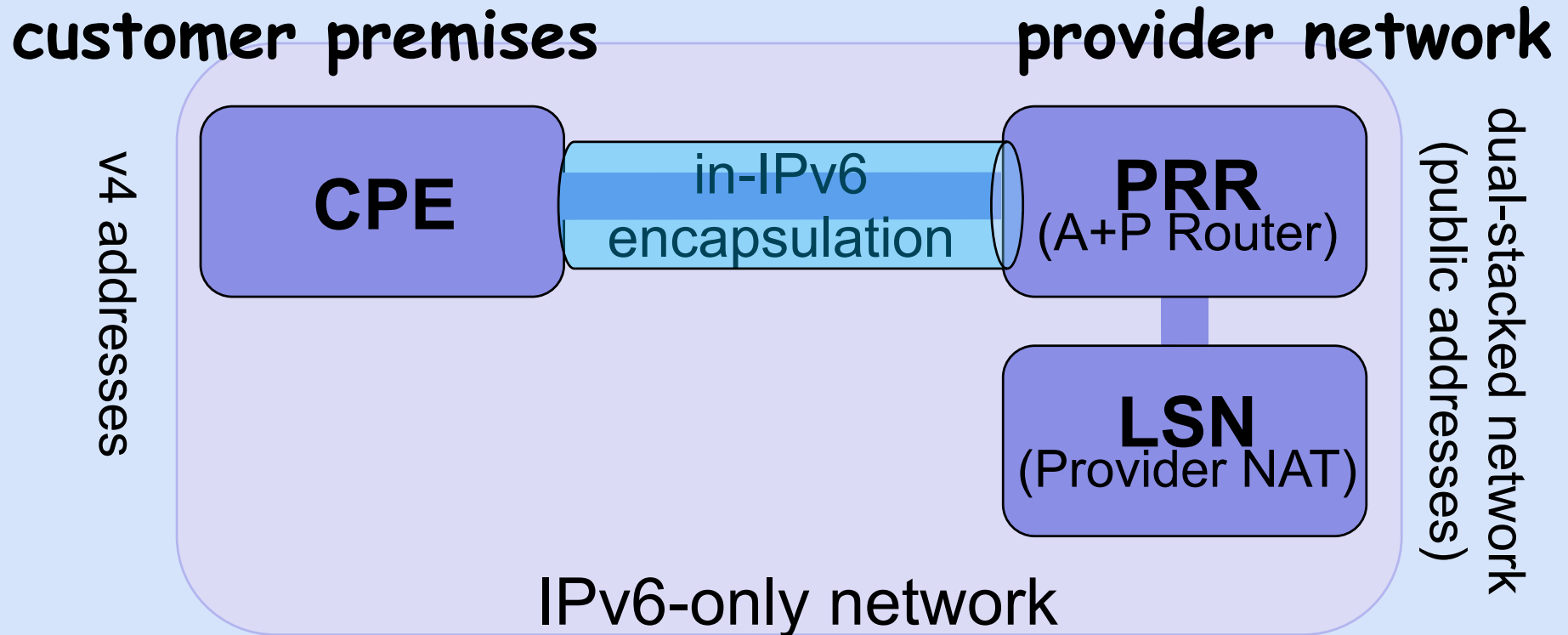
A+P Lite Terminology



A+P Subsystem

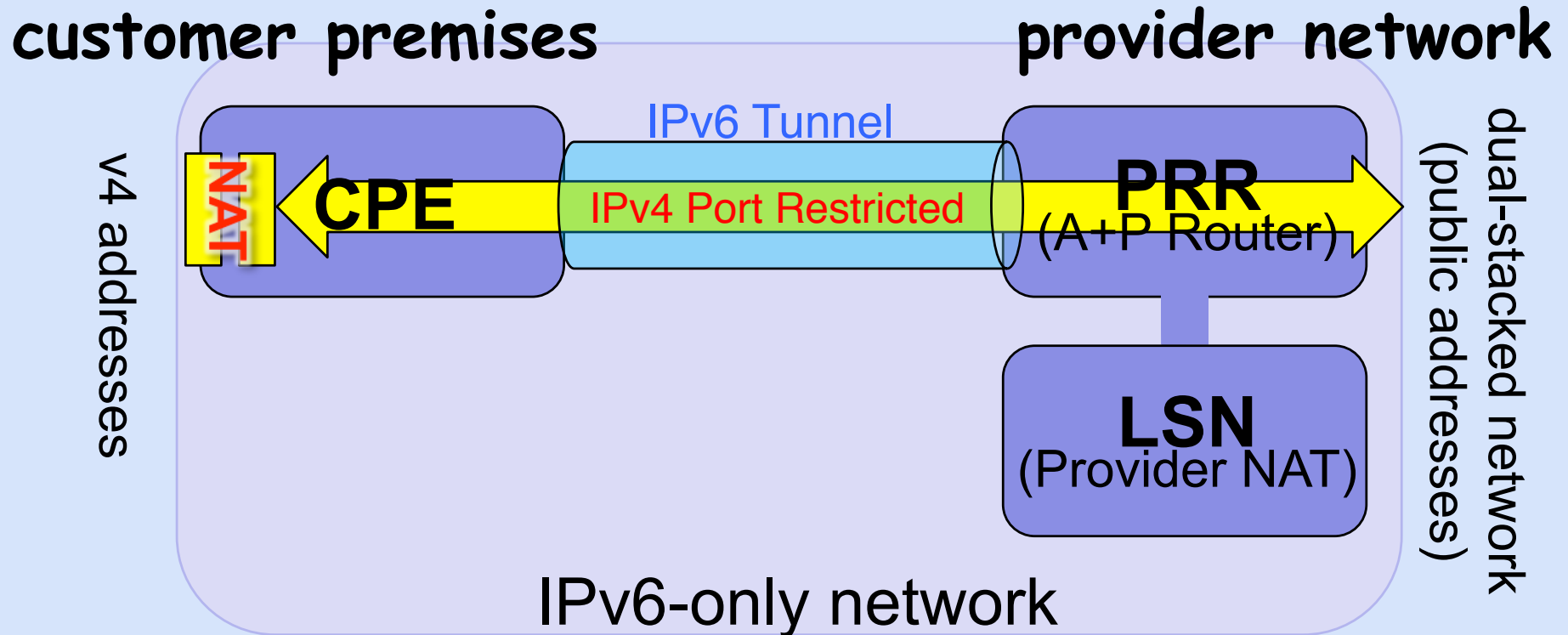


A+P With DS-Lite

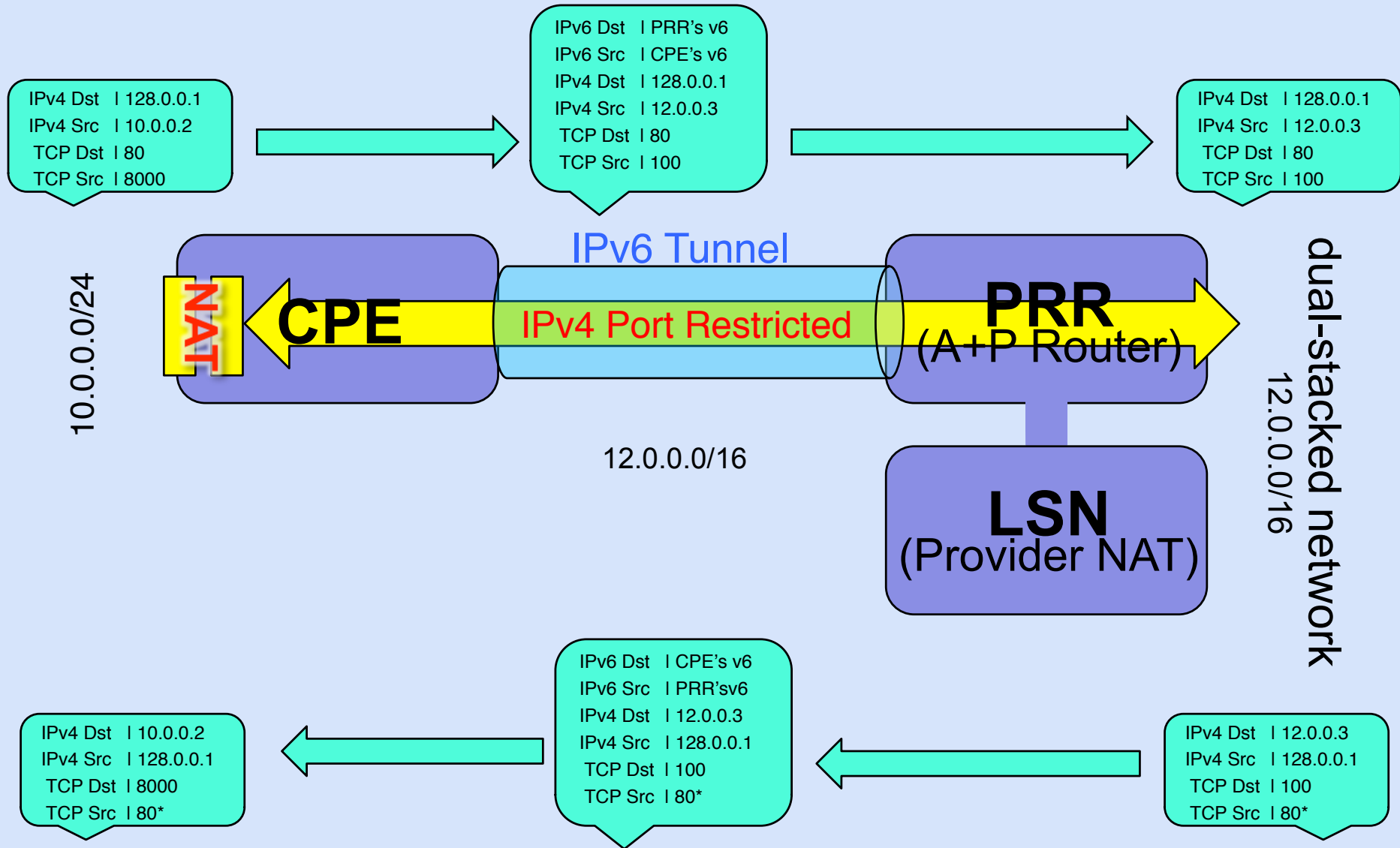


- "A+P pkts" are encapsulated in IPv6
- Could use other encapsulation

A+P-NAT at CPE

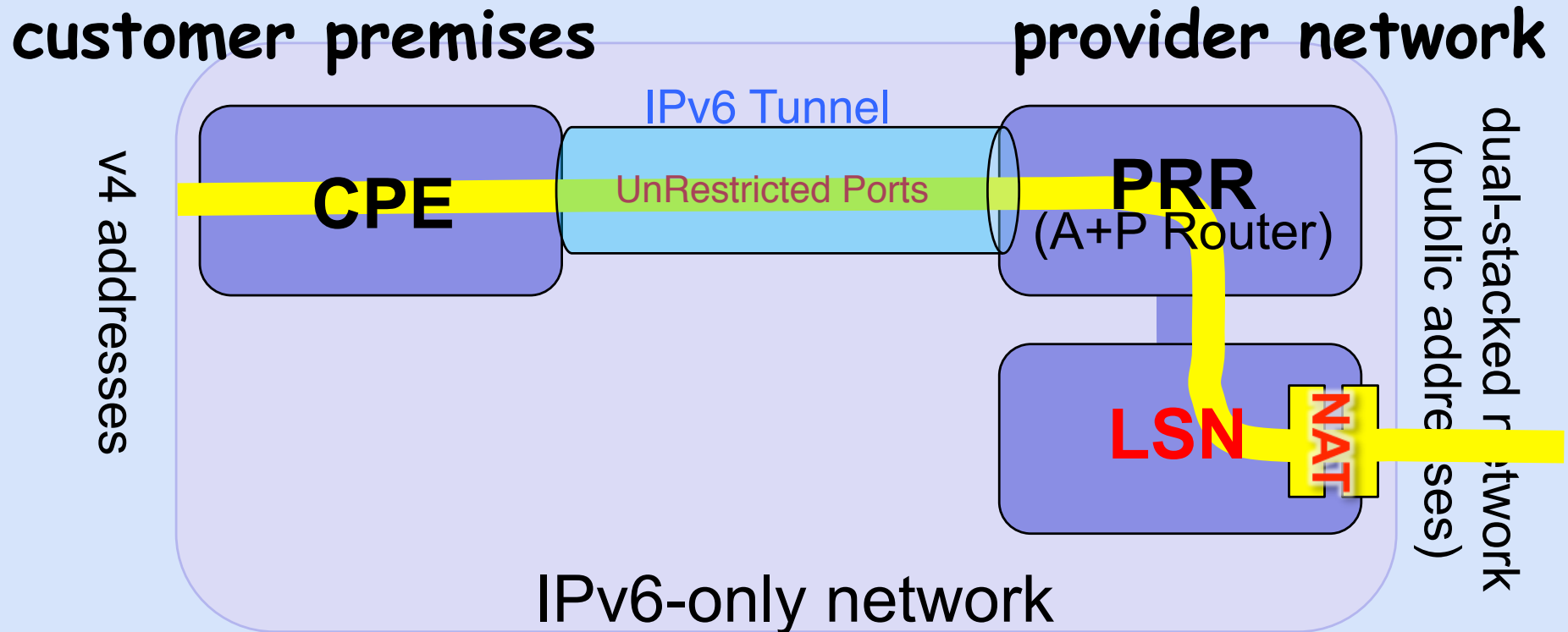


- Un-NATted end-to-end to CPE
- CPE NATs to connect to IPv4 hosts
- APR encap/decaps only (LSN bypassed)!

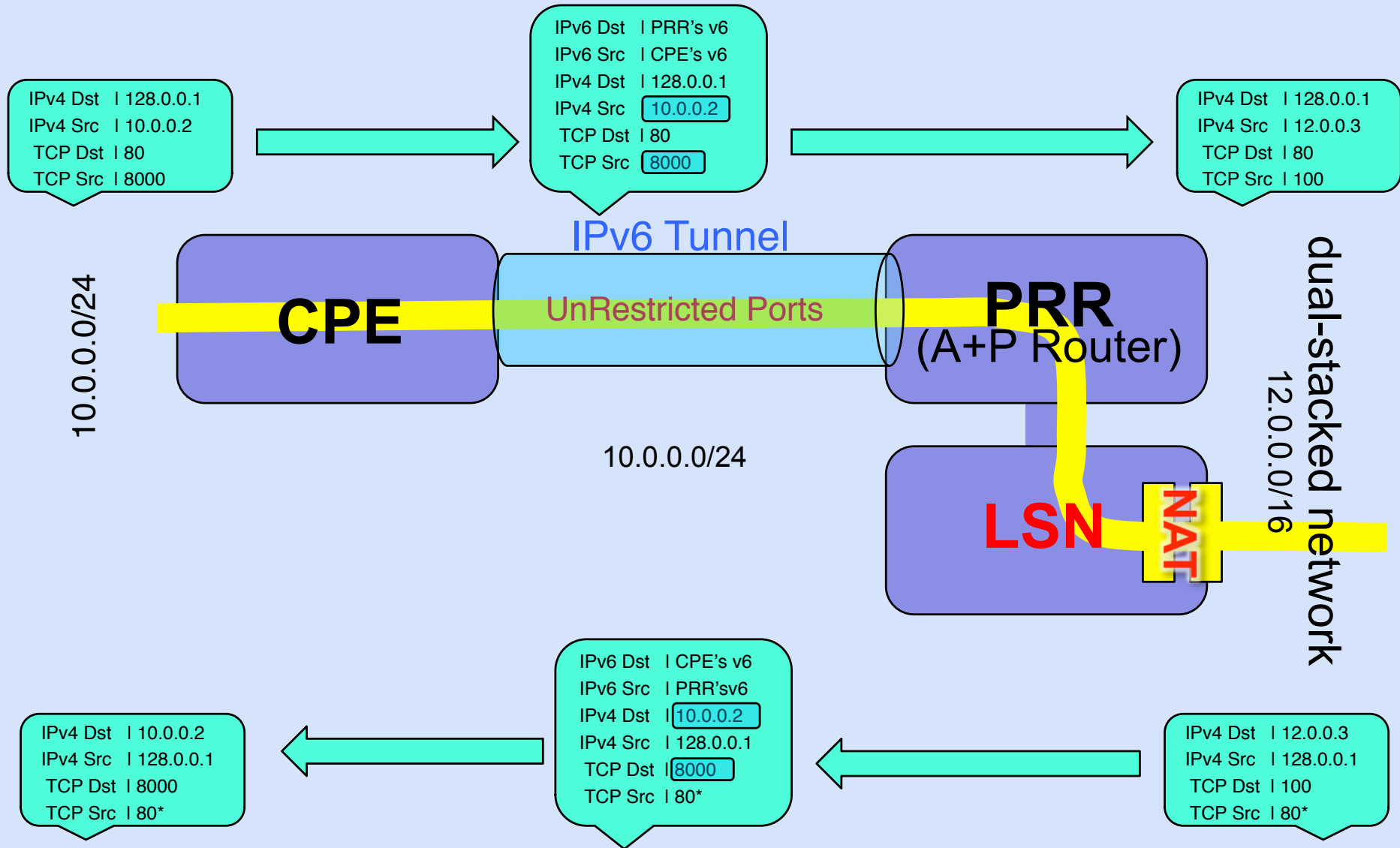


80* - web sites usually port shift the replies

DS-Lite NAT at LSN



- Legacy-style DS-Lite, NAT done at LSN
- However, customer could have chosen where NAT is done!



80* - web sites usually port shift the replies

Same Port-Count Issues as LSN

- Trade-off between port efficiency and signaling
- Measurement studies show port-use per residential customer ~100, peaking at ~700
- We are out of addresses, so we share and this is the consequence. No magic

Separable Functions

- **Encaps / Decaps**
 - "Softwire" (transport pkts from/to CPE)
 - End-user has control over some *untranslated* ports end-to-end
- **NAT**
 - Inevitable to connect legacy devices
 - But: flexible of where NATing is done

Status

Router vendors are currently prototyping this functionality so that we can learn more through actual deployment exercises vs specification by committee

Open Questions

- **Signaling mechanisms**
- **Port restrictions & agility**
- **Assigned ports and IPv4 address**
- **Tunnel address of LSN**

and your questions...