A+P Lite

How to Keep CGNs from Breaking the Internet

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Problem Statement

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

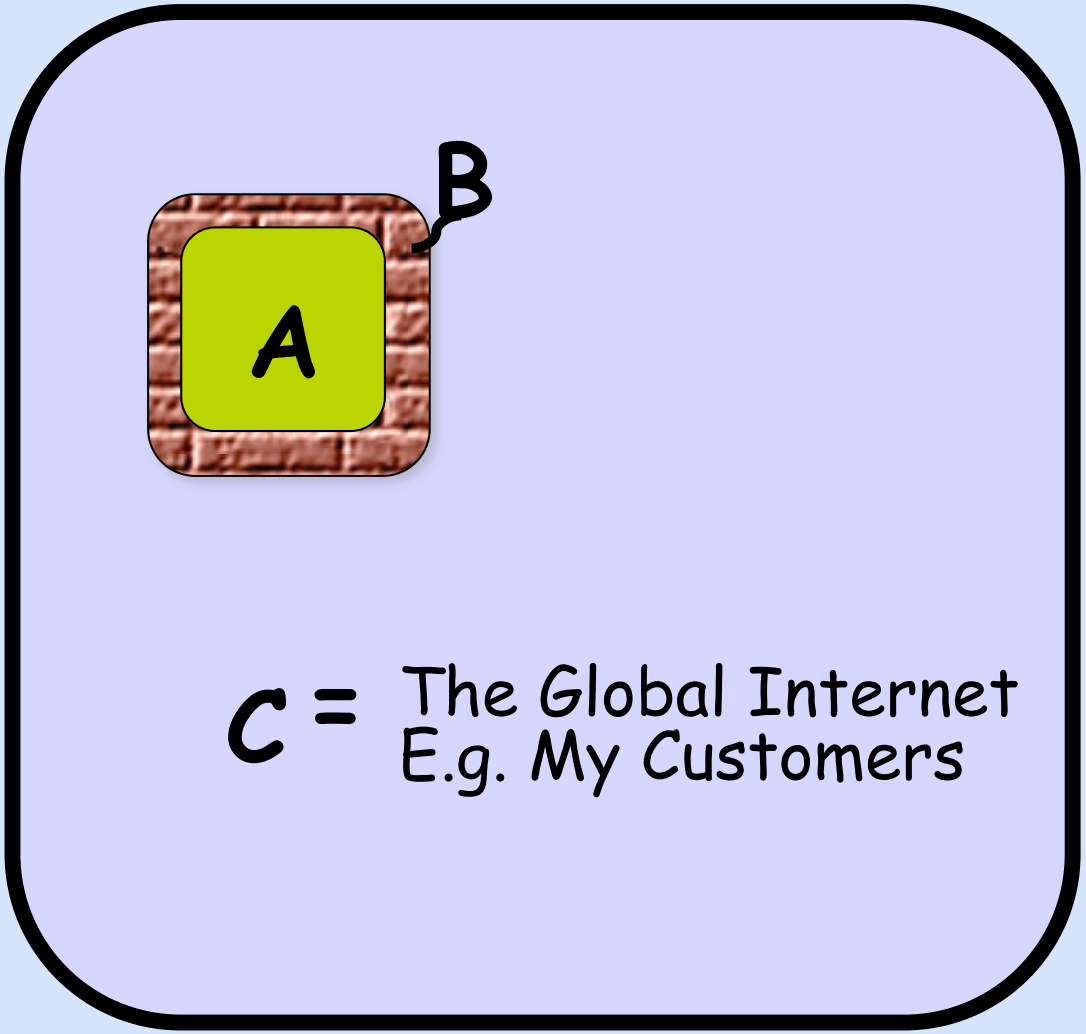
Large-Scale NAT (LSN)

- 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!

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

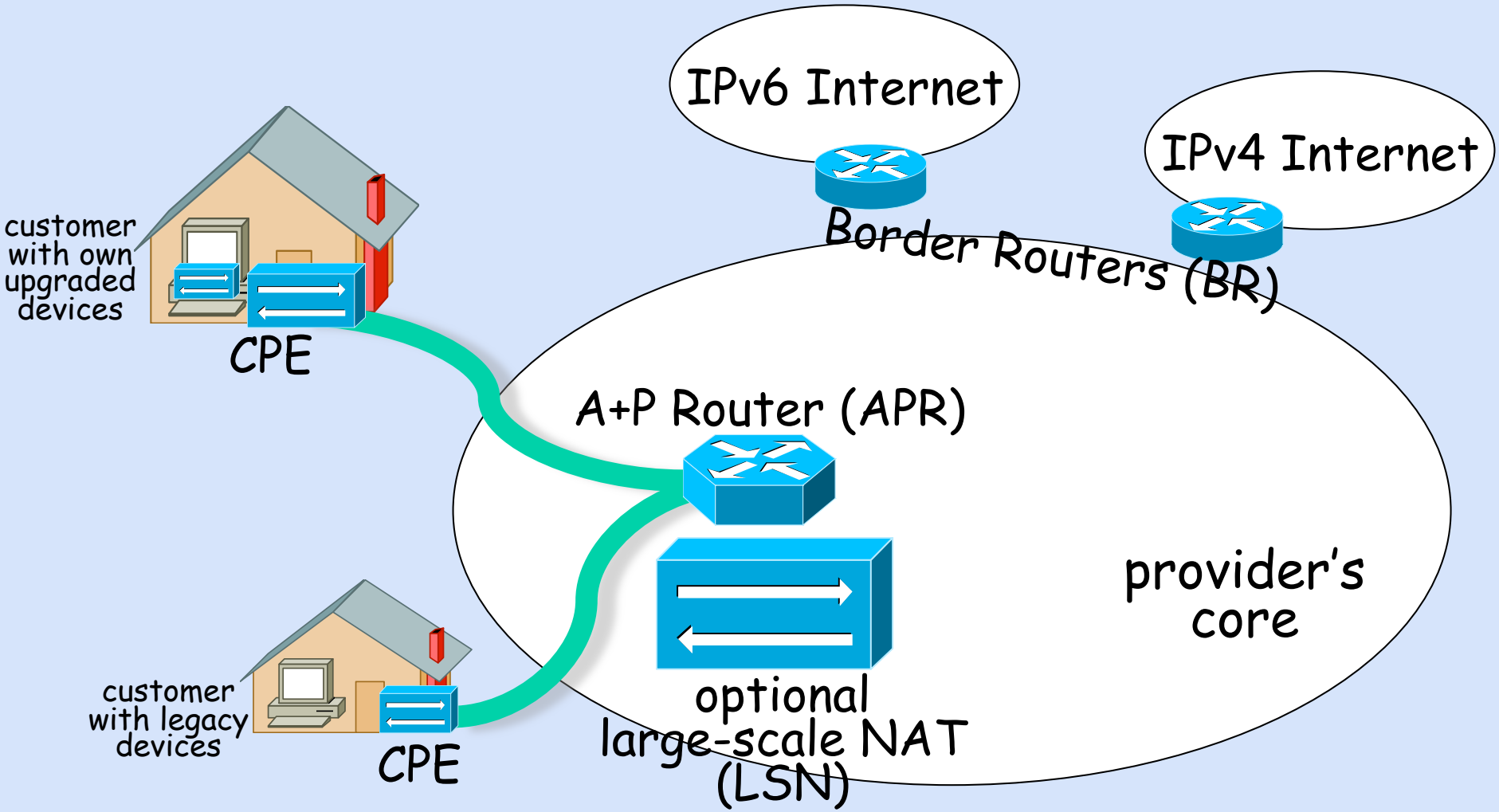
- Goal: required mechanism where **consumer can control their "fate".**

- "Steal" bits from Ports and use it for addressing. This is the same as LSN.
- But do it **at the User CPE**!
- Thus, extend end-to-end connectivity (at least for some ports) to end-user!

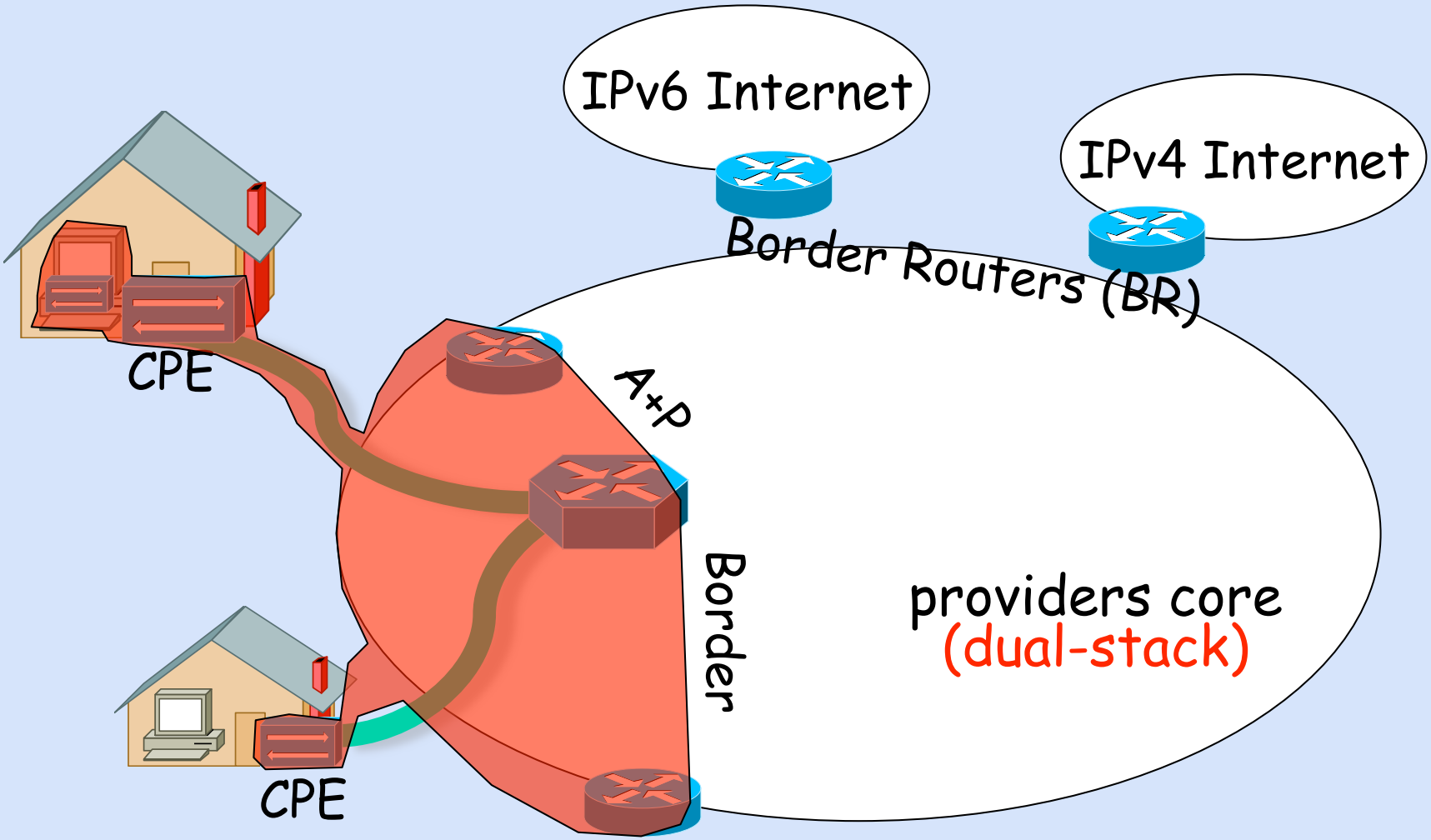
Same Port-Count Issues as LSN

- 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

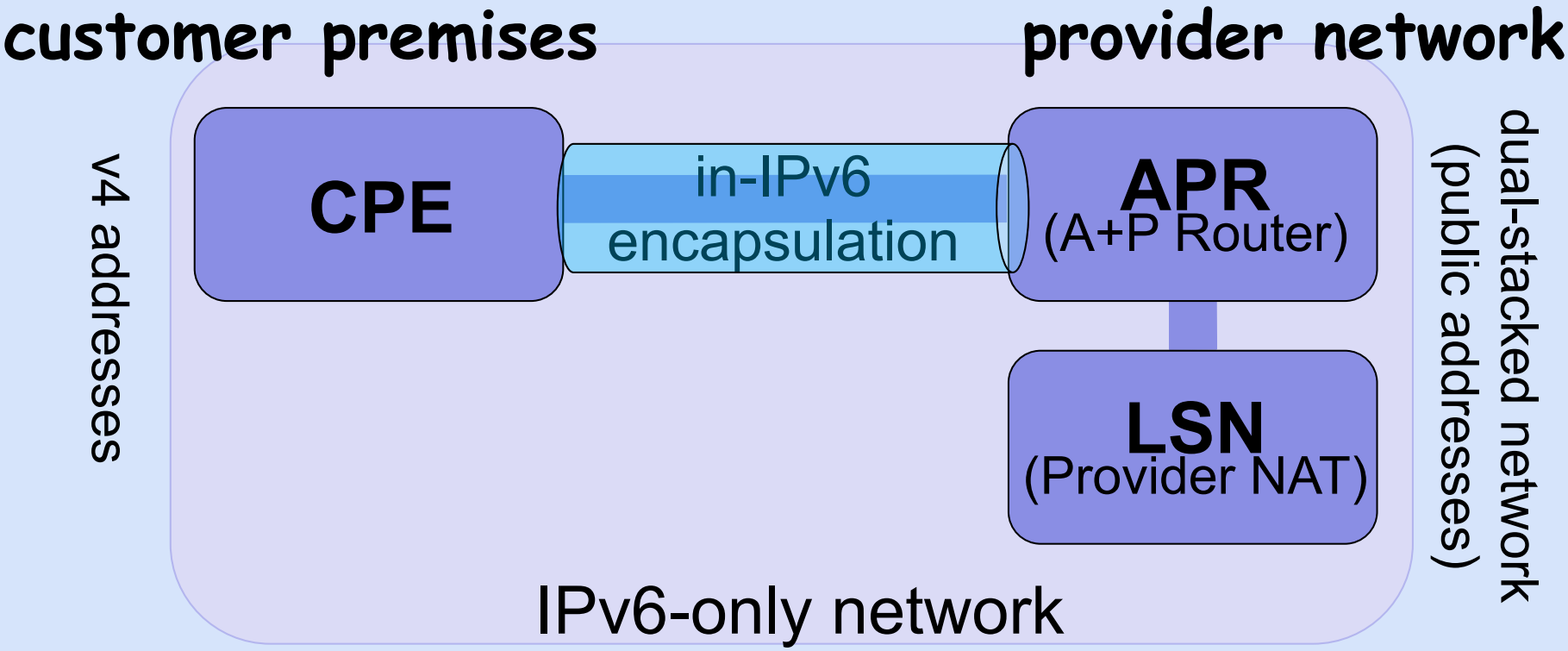
A+P Lite Terminology



A+P Subsystem

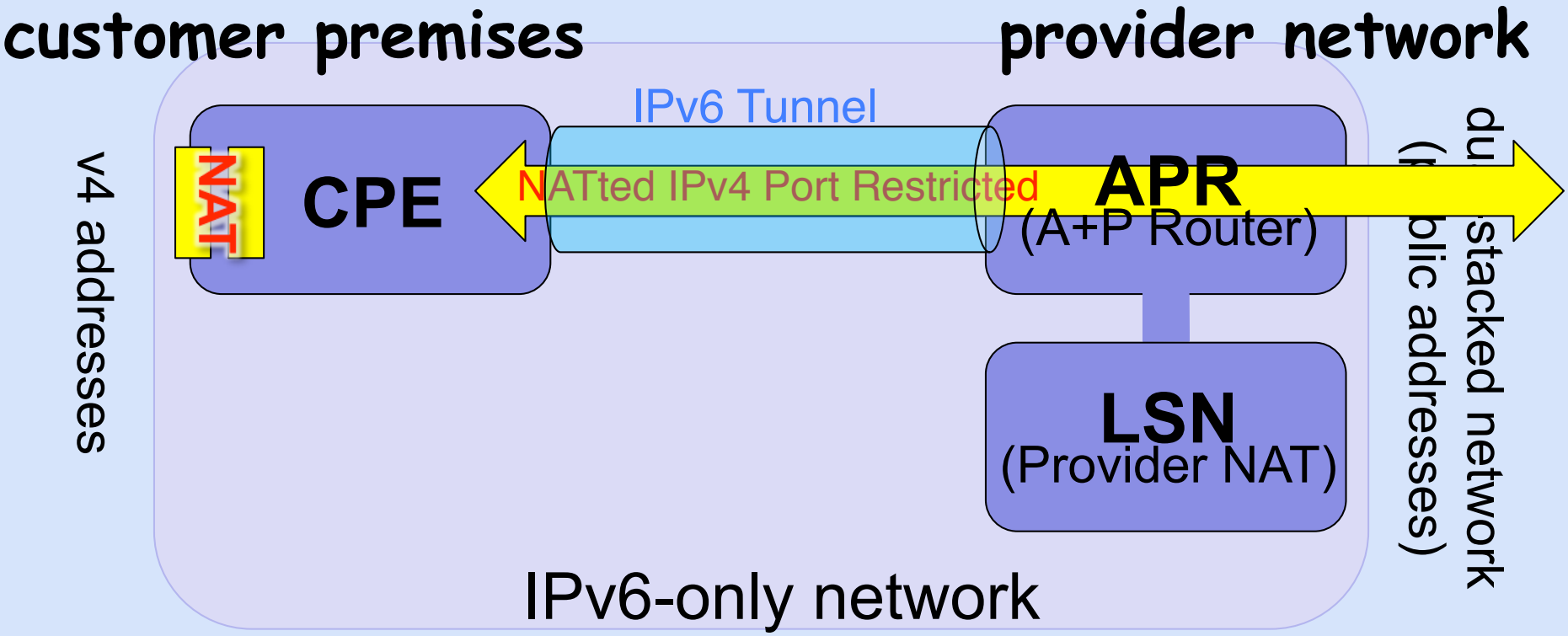


A+P Subsystem



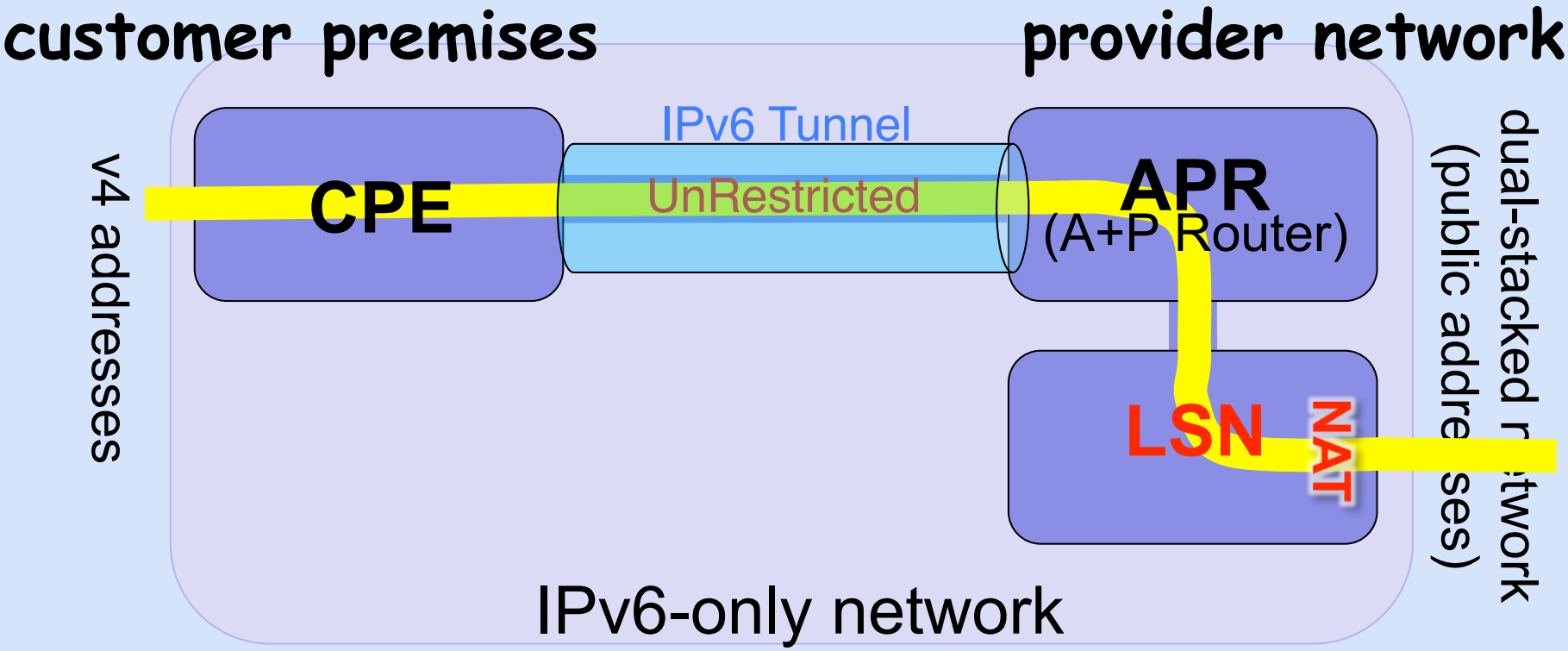
- "A+P pkts" are encapsulated in IPv6
- Could use other encapsulation

A+P-NAT at CPE



- Untranslated end-to-end to CPE
- CPE nats to connect legacy hosts.
- APR encap/decaps only (LSN bypassed) !

Out-of-port-range Pkts



- Normal DS-Lite, NAT done at LSN
- However, customer has choice where or how NATing is done!

Status

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

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

Open Questions

- Signaling mechanisms
- Port restrictions & agility
- Can CPE control port range(s)
- Assigned ports and IPv4 address
- Tunnel address of LSN

and your questions…