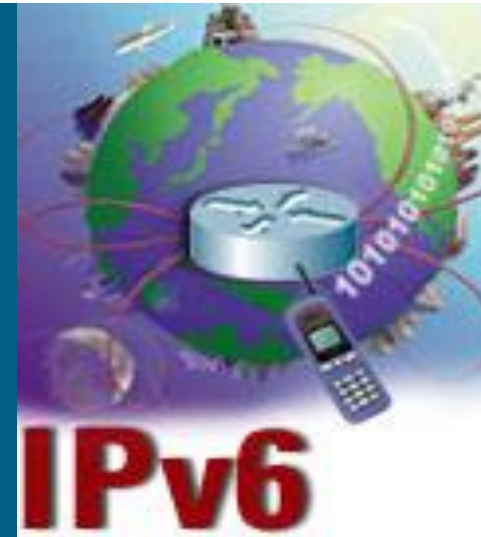




346: A **3**-step Strategy for migrating from IPv4 to IPv6



Pablo Mollinger

Systems Engineer

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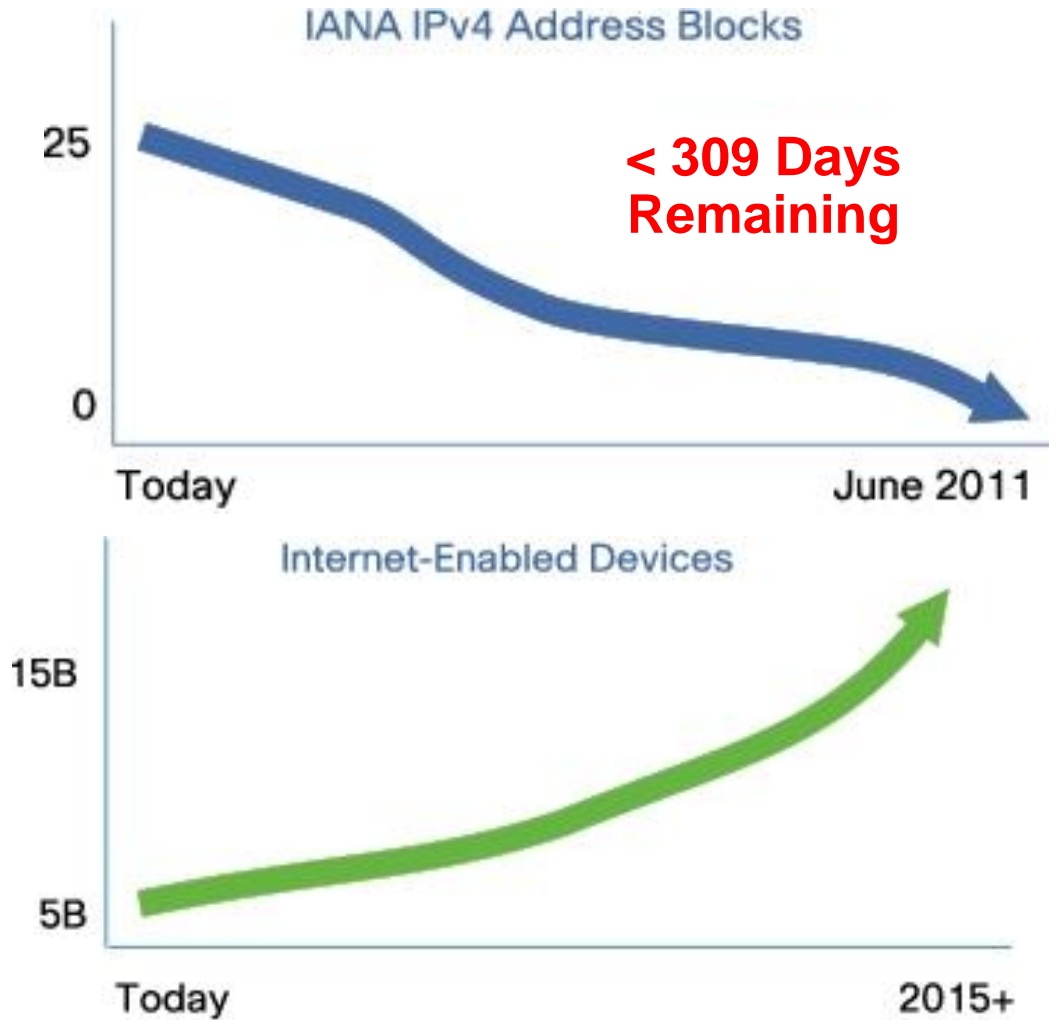
Cisco Chile

A Rationale for IPv6 Adoption



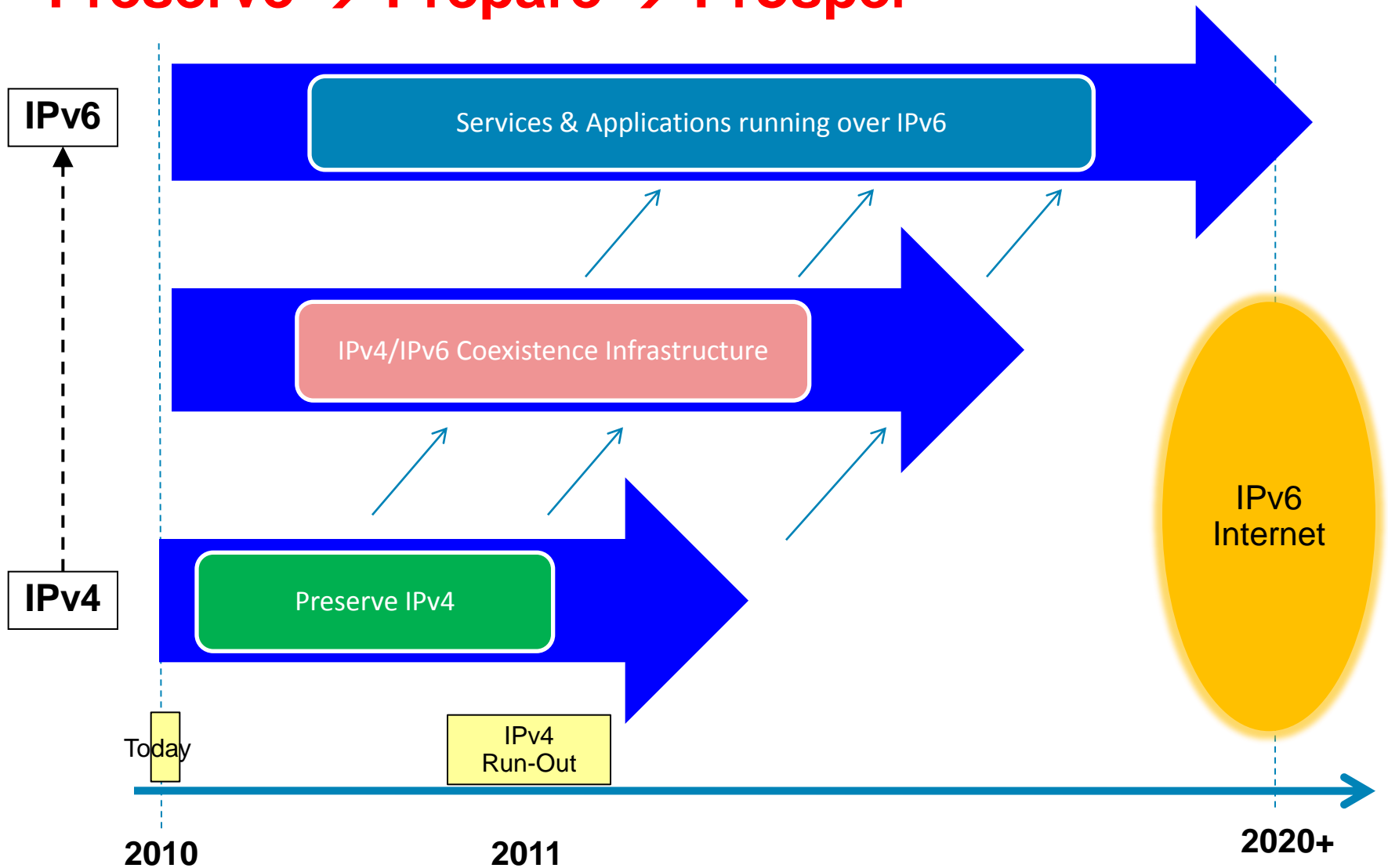
- Native IPv6 Internet is years and years away
- IPv4 Run-Out is here now
- Entering a period of IPv4/IPv6 Coexistence
- Legacy (IPv4) and new (IPv6) apps and services can only function over an IPv4/IPv6 Coexistence Infrastructure
- Thus we need tools, methods, products and solutions that
 - Help address IPv4 run-out NOW
 - Offer incremental means to build out IPv4/IPv6 coexistence infrastructure
- Not one size fits all

IPv4 Exhaustion



“346”: A 3 Tier Transition Framework for Moving from IPv4 to IPv6

Preserve → Prepare → Prosper



Introducing the **Cisco Carrier-Grade IPv6 Solution**

Built upon carrier-scale address **translation** and protocol **tunneling** capabilities

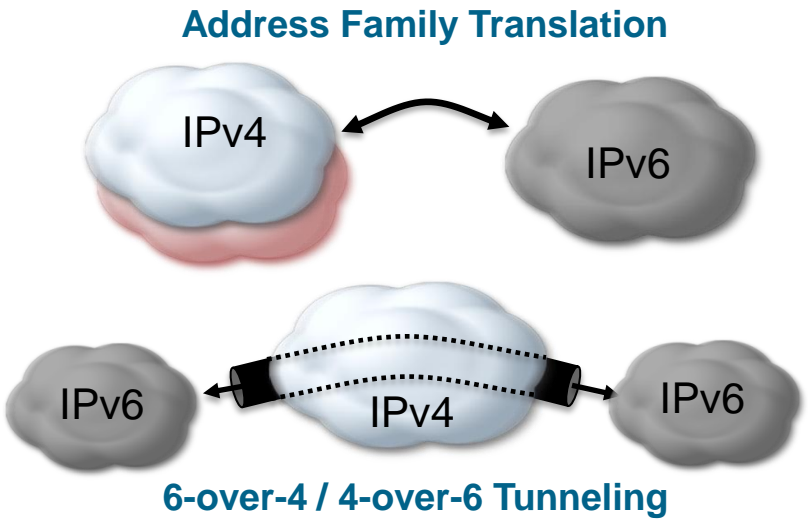
Preserve

By extending Private IP into the IP-NGN for continued growth



Prepare

By enabling interoperable IPv4 / IPv6 services over your existing IP-NGN infrastructure



346 Technology Buckets

CGv6

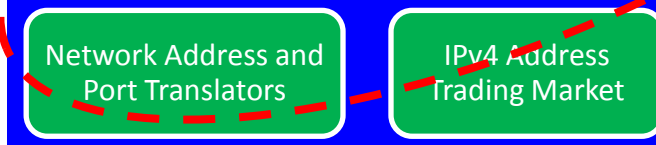
Services over IPv6



IPv4/IPv6 Coexistence Infrastructure



Preserve IPv4



Today

IPv4 Run-Out



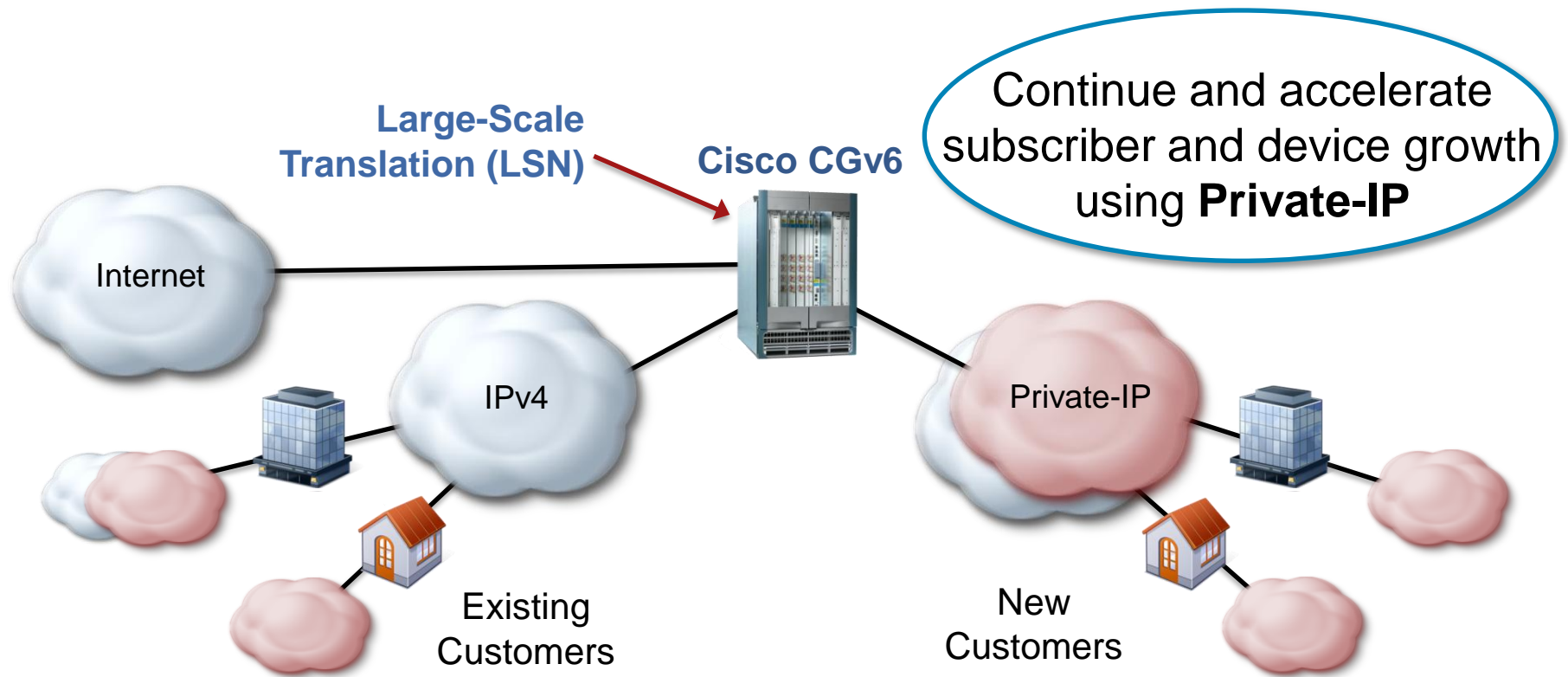
2010

2011

2020+

Preserve

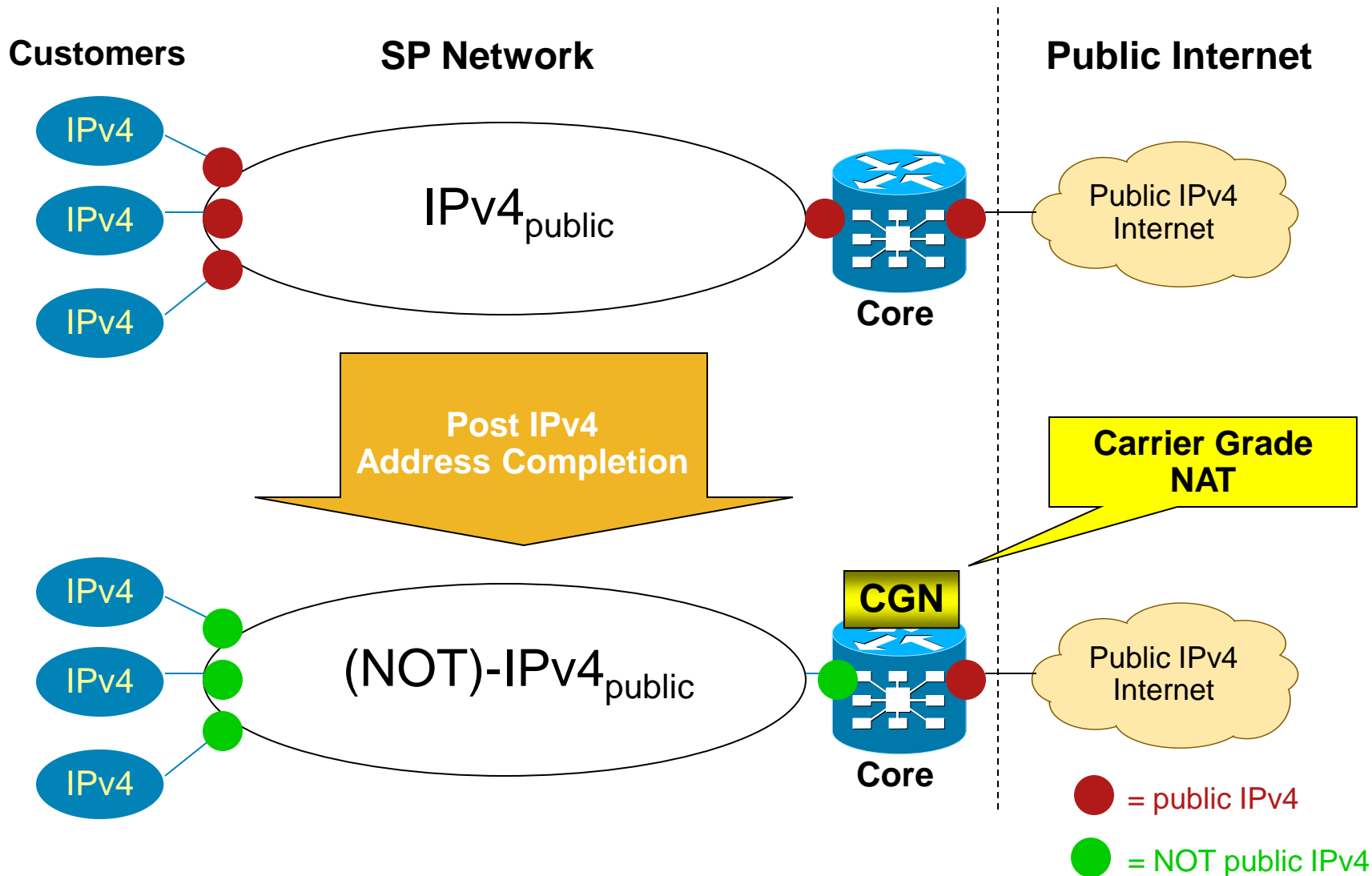
IPv4 infrastructure, assets, and service offerings



Today

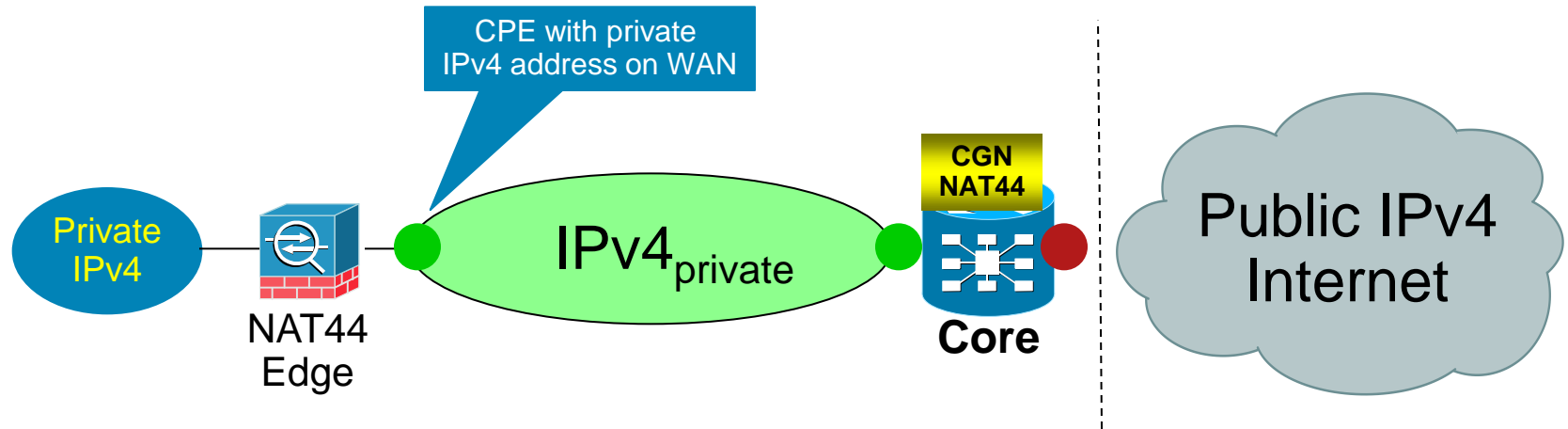
With Cisco CG6

One Strategy for Dealing with the IPv4 Address Run-Out Problem



CGN – Double NAT44

● = public IPv4
● = private IPv4

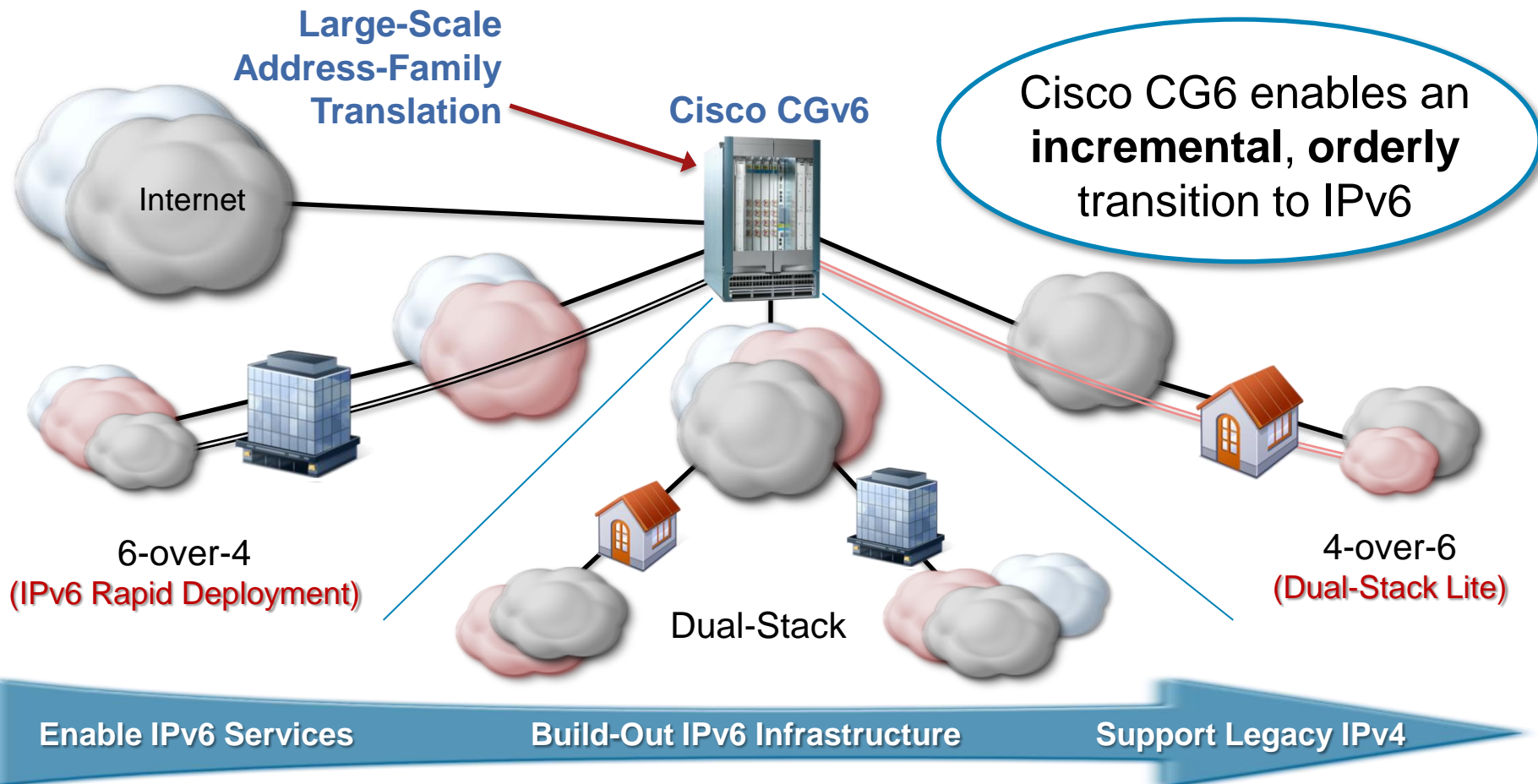


- CGN does NAT44 or O(large number) of private IPv4 end-points
- No need for IPv6 anywhere
- Challenges related to scale, performance, logging, subscriber interaction, etc.

NAT 444 Re-Enables Subscriber Growth

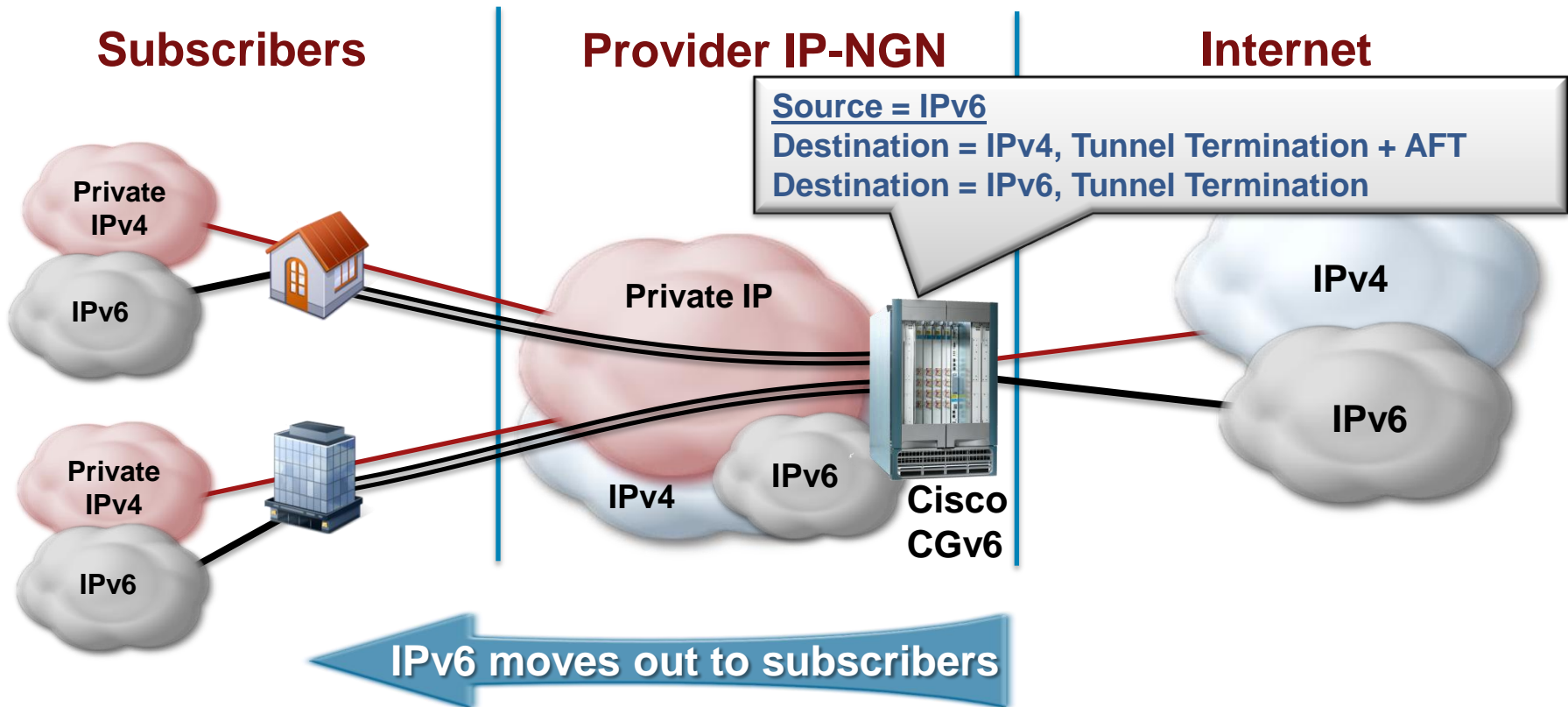
Prepare

To support IPv6 devices, services, and innovation



Prepare, with 6rd (6-over-4)

Subscriber IPv6 traffic is **tunneled** over IPv4 to gateways within the IP-NGN while IPv6 grows

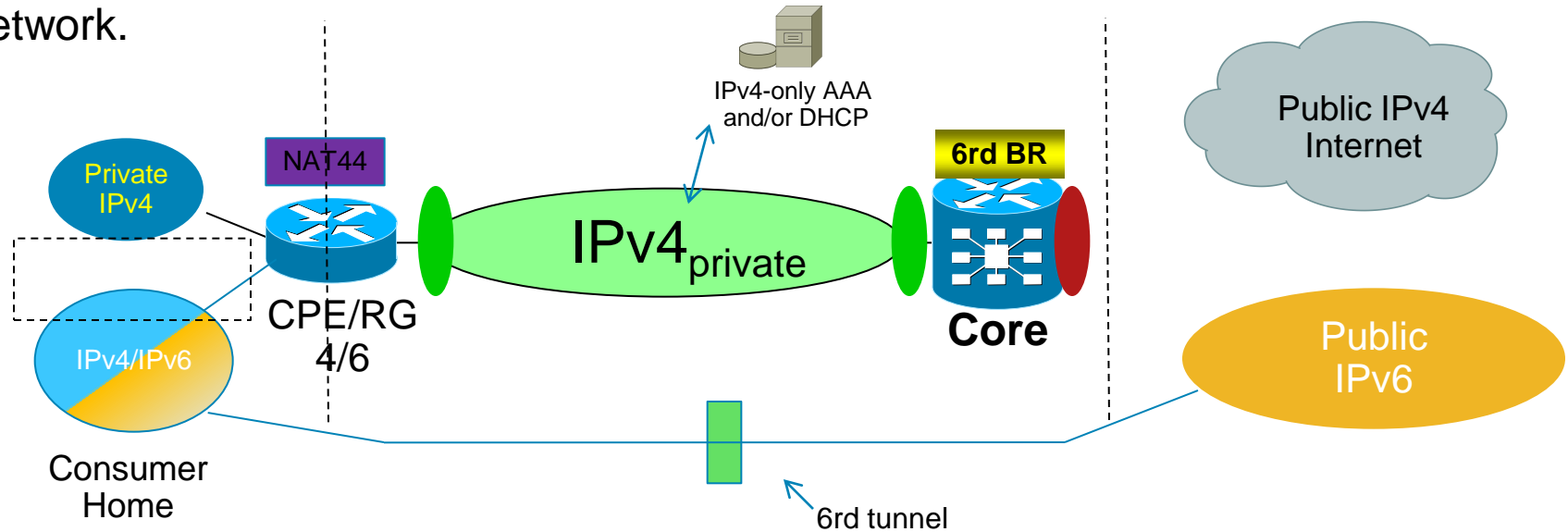


IPv6 Rapid Deployment (6rd) defines such a 6-over-4 model

6rd – IPv6 Rapid Development

● = public IPv4
● = private IPv4

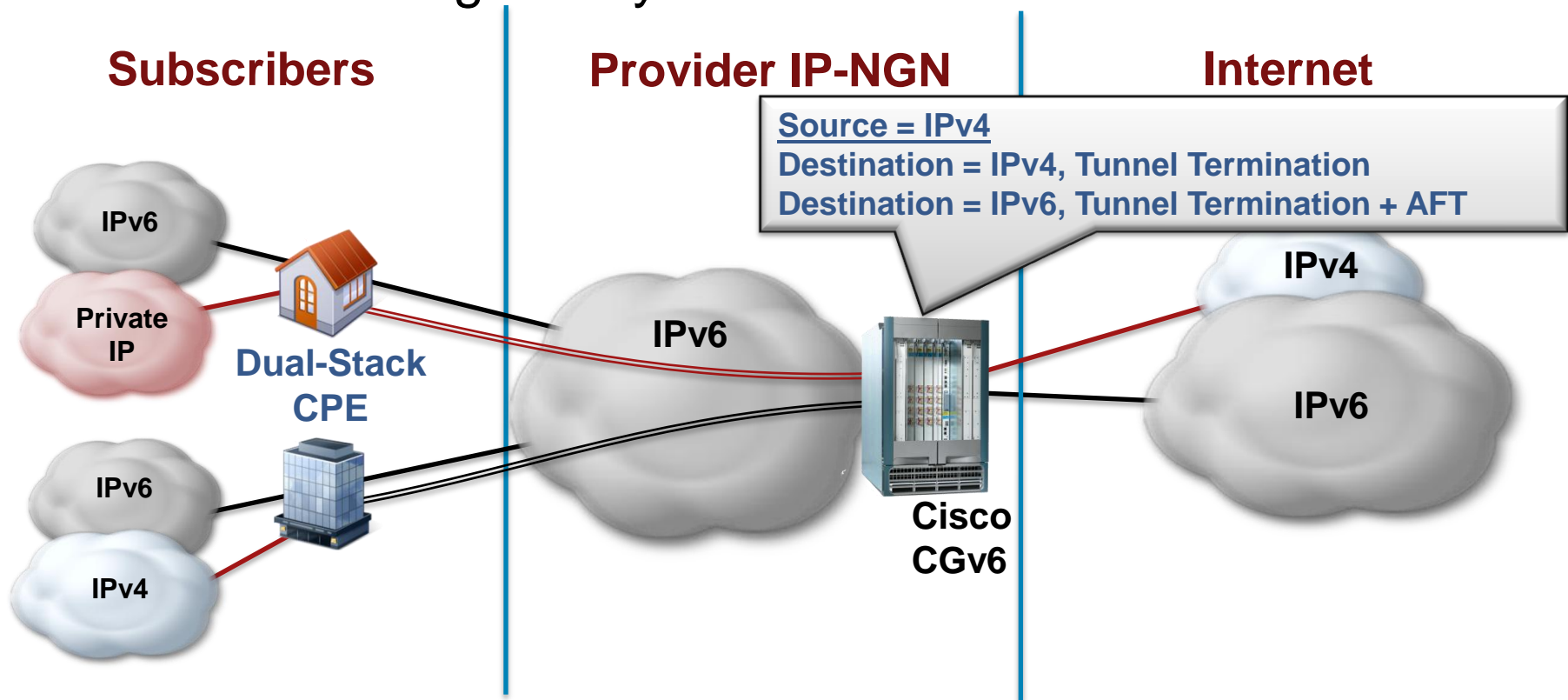
6rd specifies a protocol mechanism to deploy IPv6 to sites via a Service Provider's IPv4 network.



- No change to IPv4-based access infrastructure
- It builds on 6to4 [RFC3056], with the key differentiator that it utilizes an SP's own IPv6 address prefix rather than 2002::/16
- IPv6 address is derived from ISP IPv6 prefix and CPE IPv4 address; RG and CGN perform automatic IPv6/IPv4 encap/decap
- Simple, stateless, automatic IPv6-in-IPv4 encap and decap function on CPE/RG
- draft-ietf-softwire-ipv6-6rd and draft-despres-6rd-03.txt

Prepare, with DS-Lite (4-over-6)

Remaining subscriber IPv4 traffic is **tunneled** over IPv6 to gateways within the IP-NGN

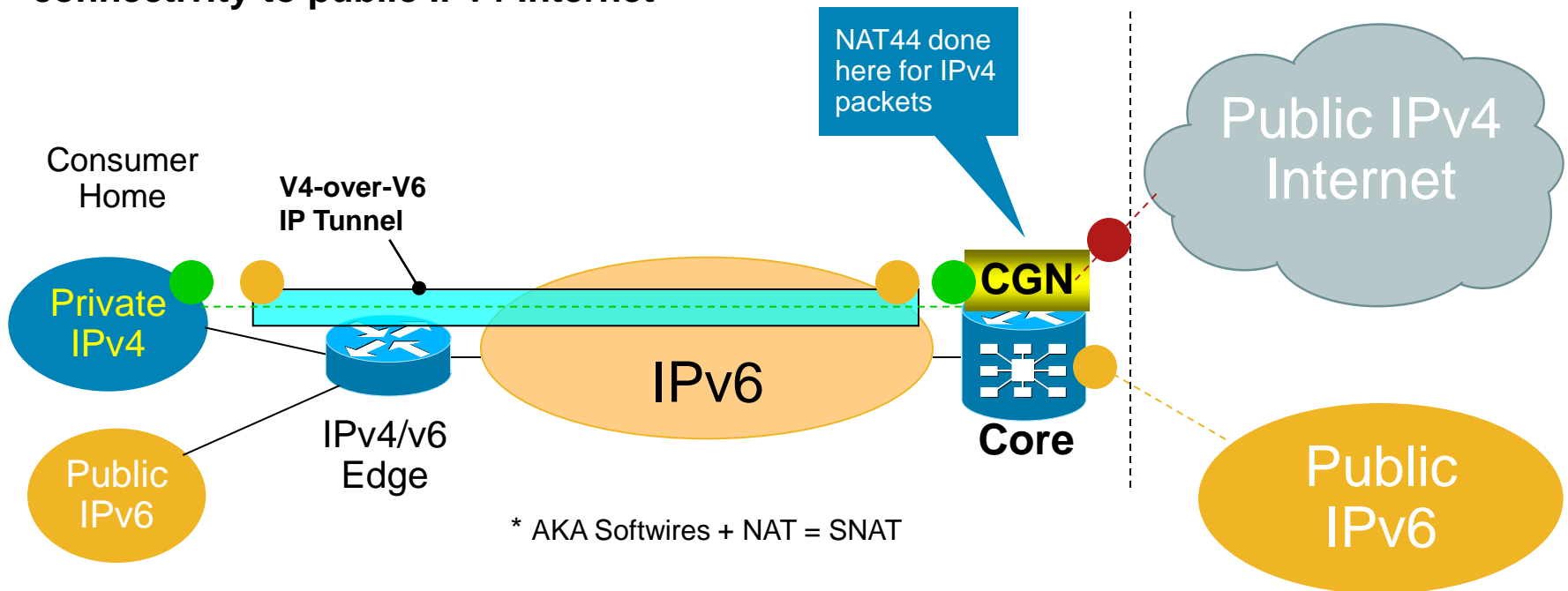


Dual-Stack Lite (DS-Lite) defines such a 4-over-6 model

Dual-Stack Lite*

Employs softwire 4over6 tunnels plus CGN-NAT44 to support private IPv4 connectivity to public IPv4 Internet

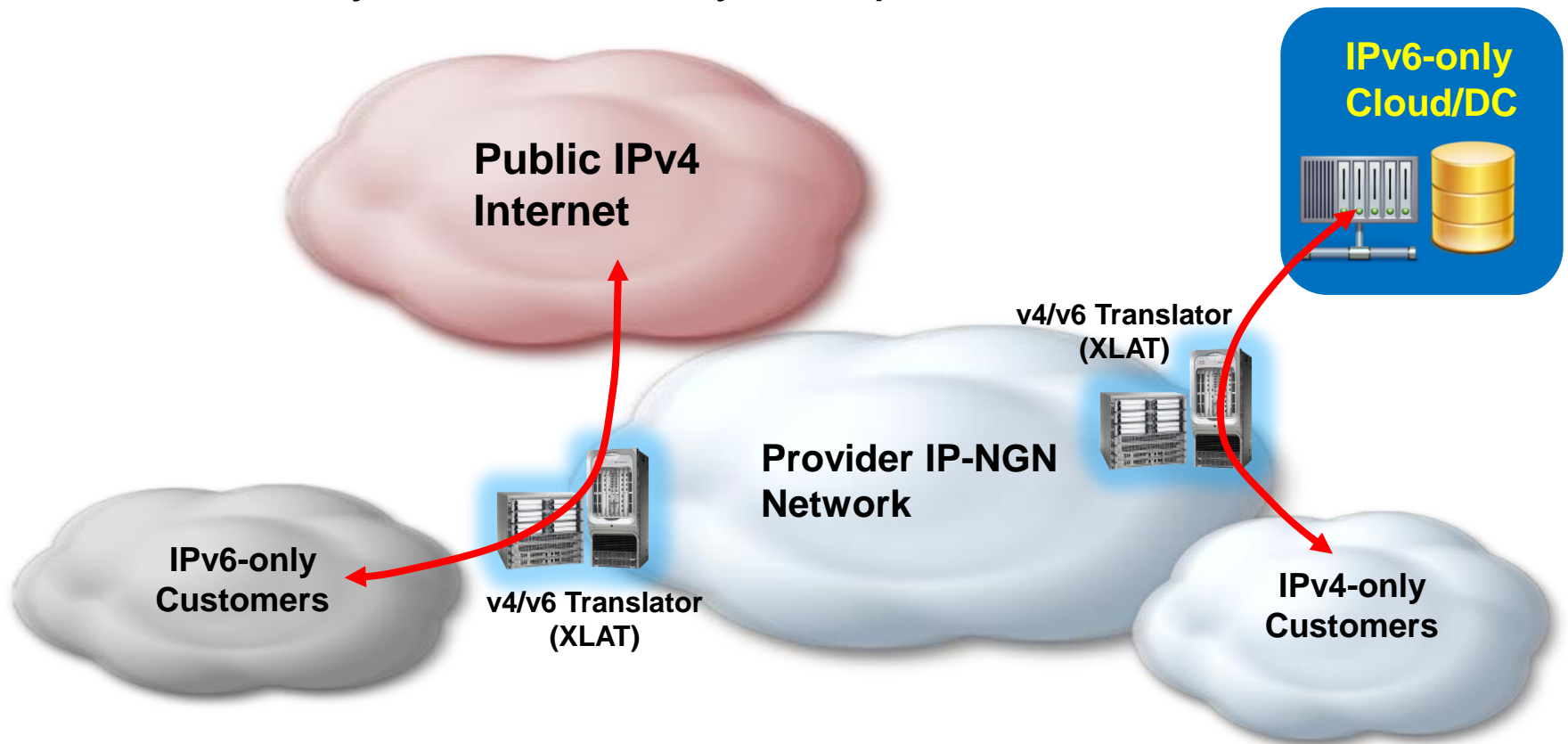
- = public IPv4
- = private IPv4
- = public IPv6



- Employs softwire 4over6 tunnels plus CGN-NAT44 to support private IPv4 connectivity to public IPv4 Internet
- IPv6 hosts use native IPv6 routing to public IPv6 Internet
- Challenge is laying out IPv6 access network
- [draft-ietf-softwire-dual-stack-lite](#)

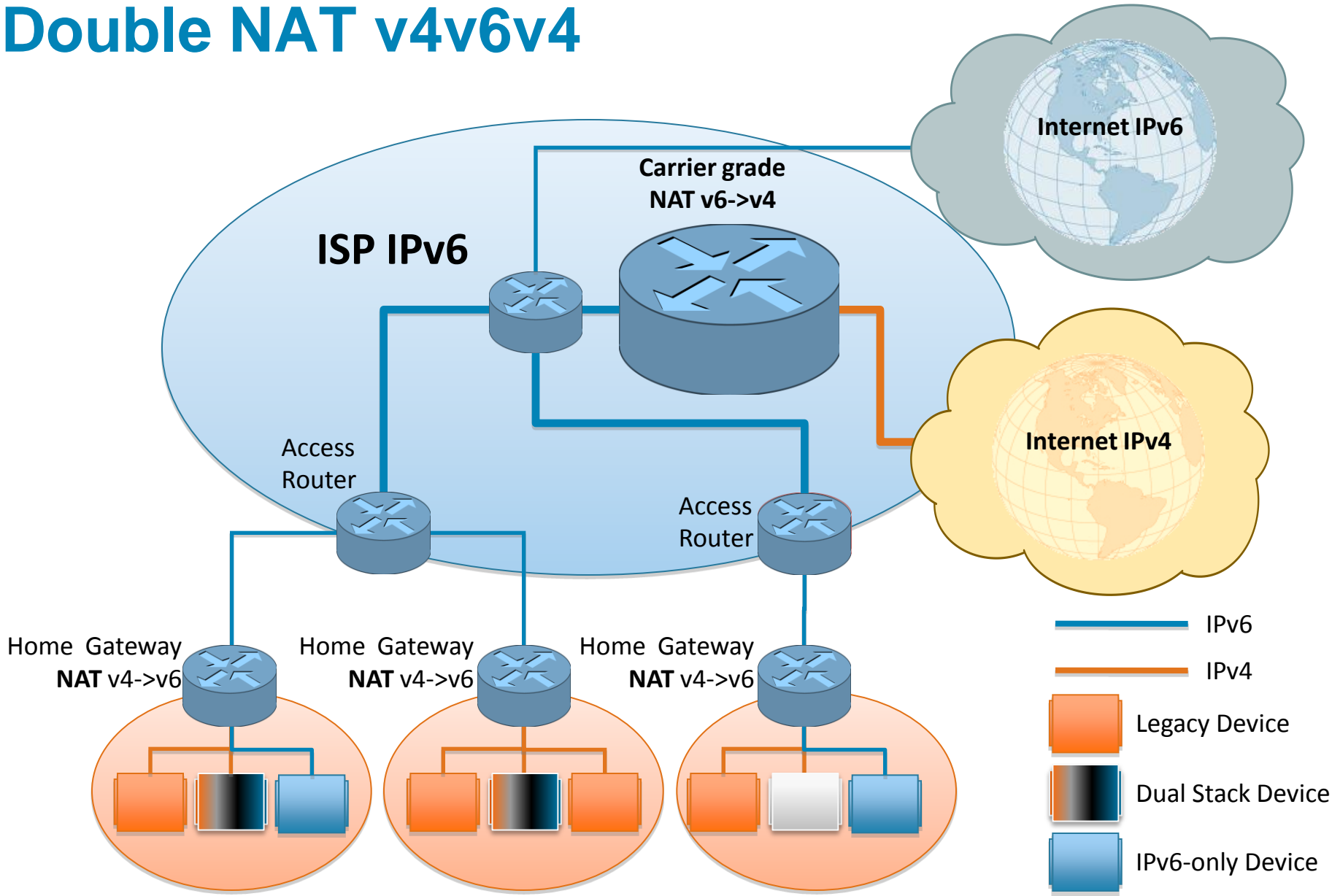
Prepare: IPv4/IPv6 Translation

Enables Bi-directional session connectivity between IPv6-only and IPv4-only end-points

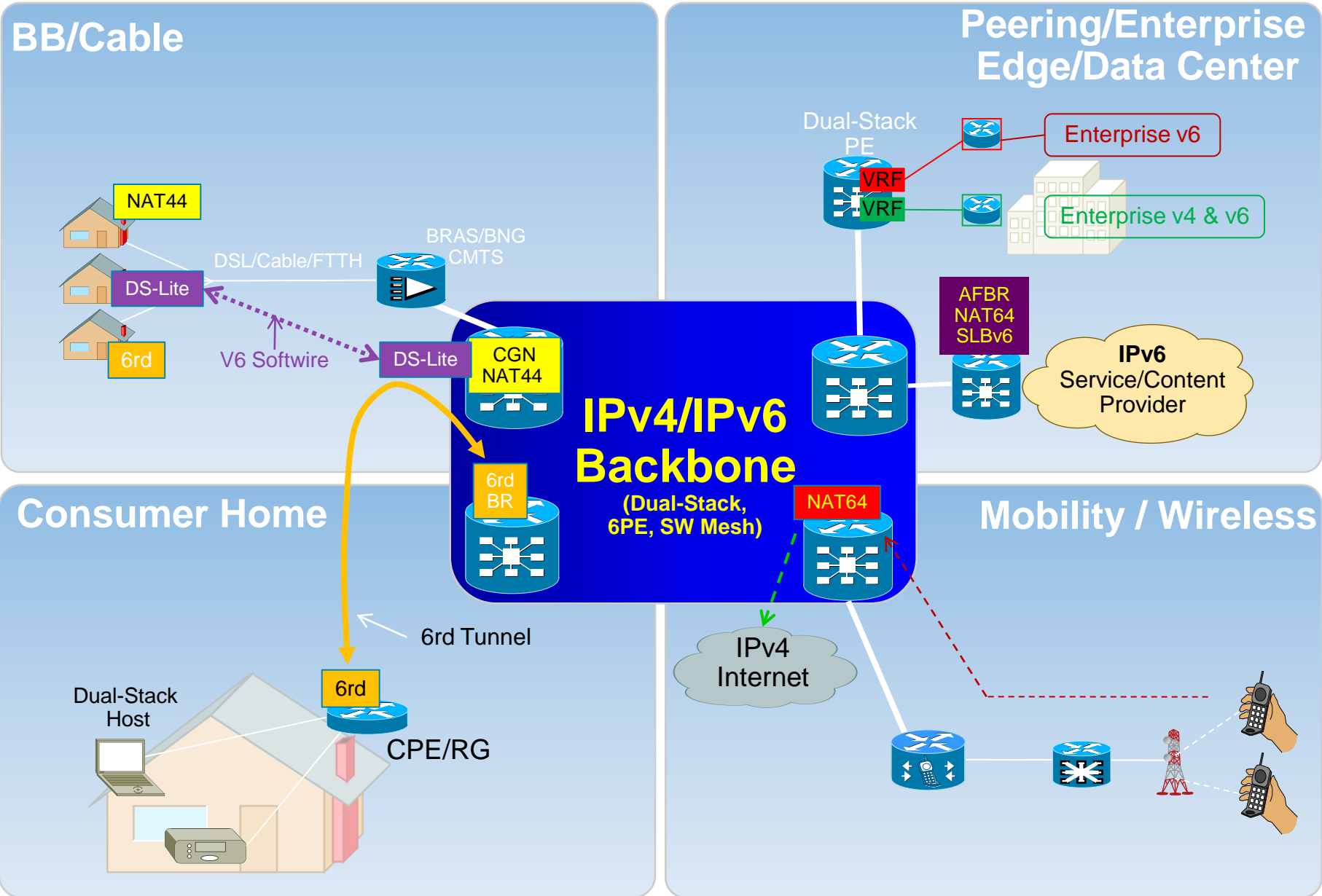


Interoperability between new IPv6 applications & services with Existing IPv4-only customers

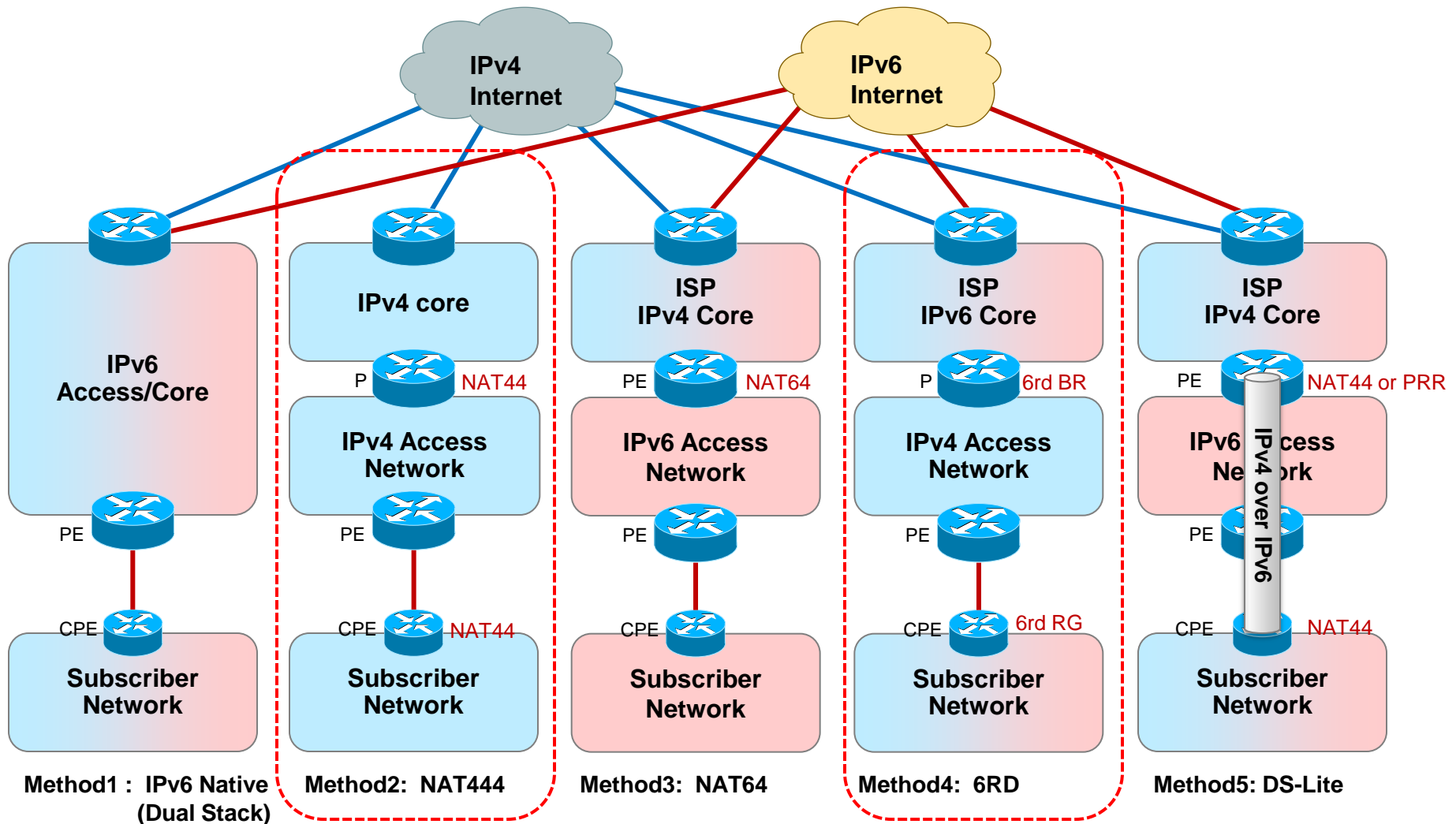
Double NAT v4v6v4



Backbone-First IPv6 Transition Strategy



IPv4 and IPv6 Co-existence



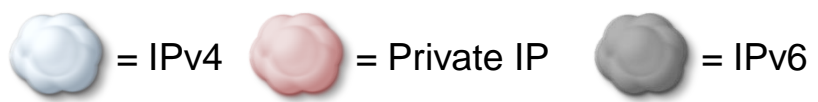
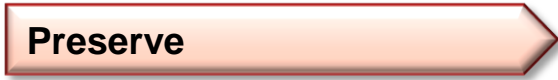
IPv4 Exhaust Technologies Summary

	Method 1 Dual Stack	Method 2 NAT444	Method 3 NAT64	Method 4 6RD	Method 5 DS-Lite
IPv4 Depletion Countermeasures	No	Yes	Yes	No (must be combined with other method)	Yes
Scalability	Depends on the number of IPv4 addresses	Yes (IPv6 support is needed)	Yes	Yes	Yes
IPv6 Support	Yes	No (must be combined with other method)	Yes	Yes	Yes
Coexistence with IPv6	Yes	Yes (must be combined with other method)	Yes	Yes	Yes
Operational complexity	Low	High	Moderate	Low	Moderate
Troubleshooting complexity	Low	Moderate	Moderate	Moderate	High
IPv4 NAT when connecting to server scalability concerns	No	Yes	Yes	No	Yes
IPv6 NAT when connecting to server scalability concerns	No	Yes (If you use NAT46)	No	No	No
CPE Changes	IPv6 Support	No	Yes	Yes	Yes
Protocol conversion in CPE (AFT)	No	No	No	Yes	No
PE Side NAT	No	Yes	No	No	Yes
SP Protocol conversion (AFT)	No	No	Yes	Yes	No
Phase-in (for the existing IPv4 infrastructure)	Entire transition will be long	Most readily available	IPv6 access network is required	Can be easy	IPv6 access network is required

- Any deployment of IPv6 is a countermeasure for IPv4 exhaustion
- DS-Lite is sort of a countermeasure against IPv4 depletion, but it's main focus is for IPv4 address exhaustion in the providers access network

Enabling an Orderly, Incremental Transition

Boundless service opportunities with Smart Grid, Connected Cities, Mobile Video, Cloud Computing



Smart Grid Opportunity:
110 million households
in US alone



