Post IPv4 “completion”

Making IPv6 deployable incrementally by making it backward compatible with IPv4.

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The Internet must support continued, un-interrupted growth regardless of IPv4 address availability

- DISCLAIMER:

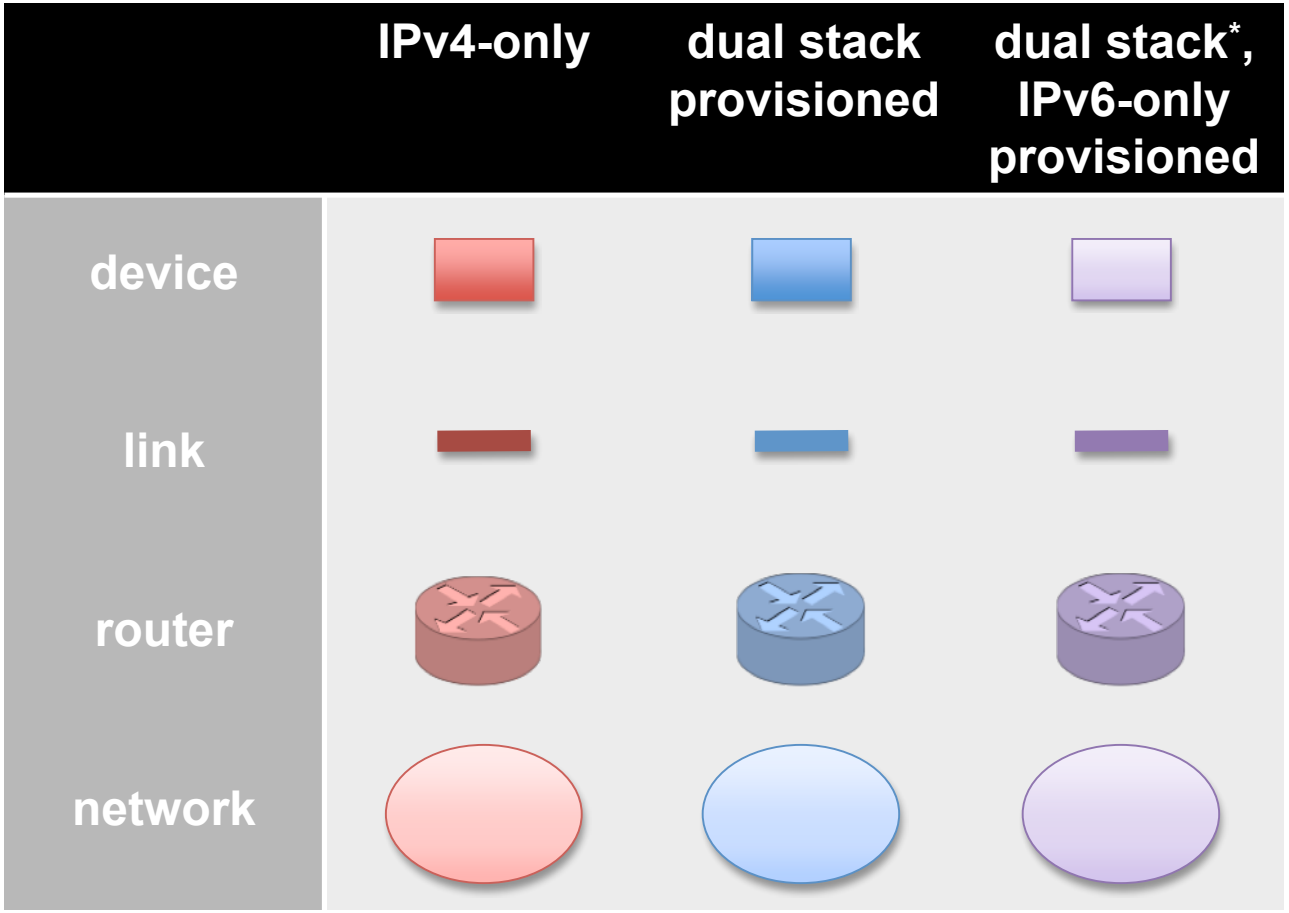
  Comcast has not made any decisions to deploy any of the following technologies.

Post IPv4 completion

- IPv4 resources alone will not provide a viable supply to the industry for the long term.

- The “Internet” edges will still be mostly IPv4:
  - Many hosts in the home (Win 9.x, XP,…) are IPv4-only.
    - They will not function in an IPv6 only environment.
    - Few of those hosts will upgrade to Windows Vista.
  - Content servers (web, Mail,…) hosted on the Internet by many different parties will take time to upgrade to

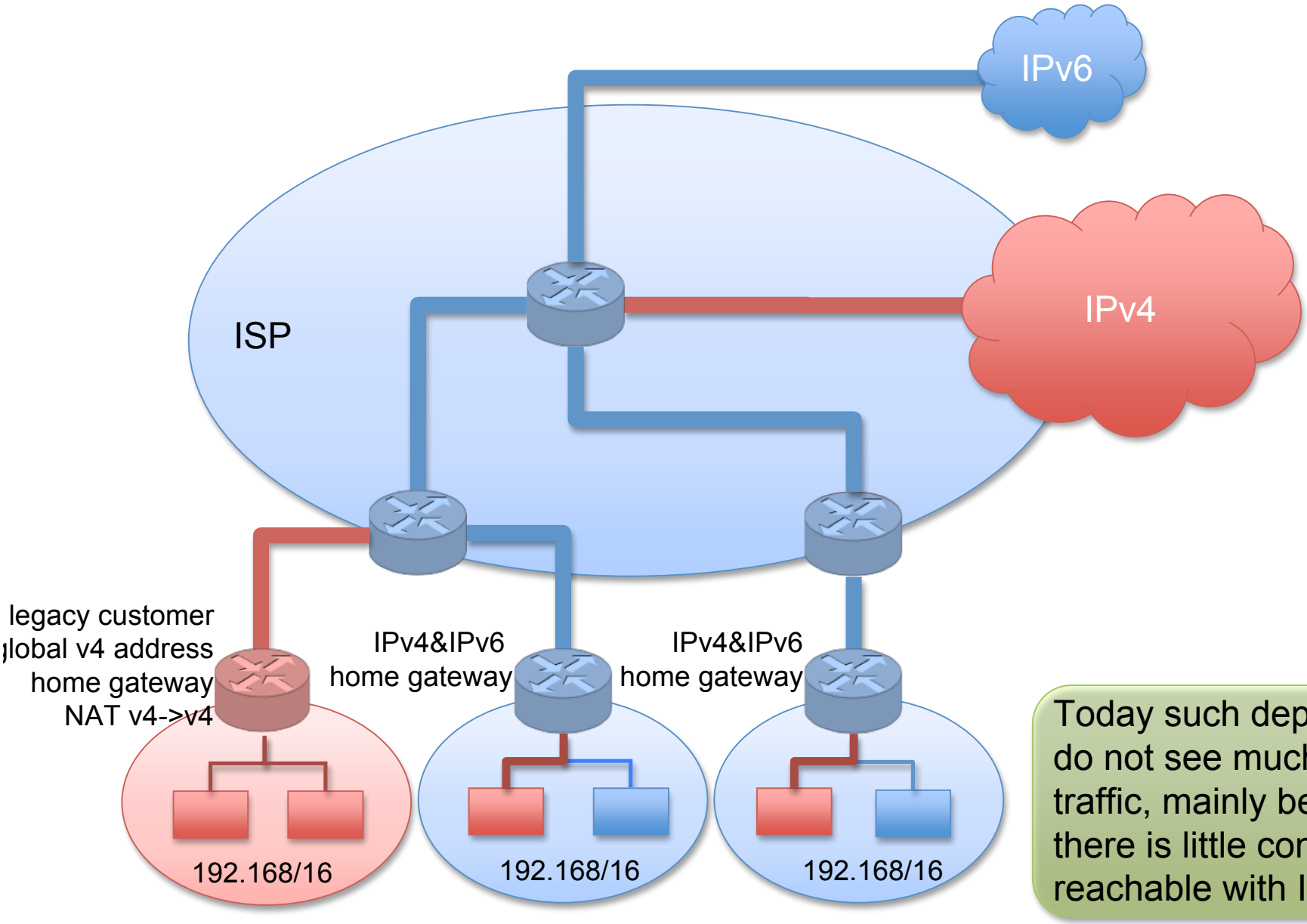
Provisioning color code



* devices with pure IPv6-only code are out of scope

Plan zero: dual-stack

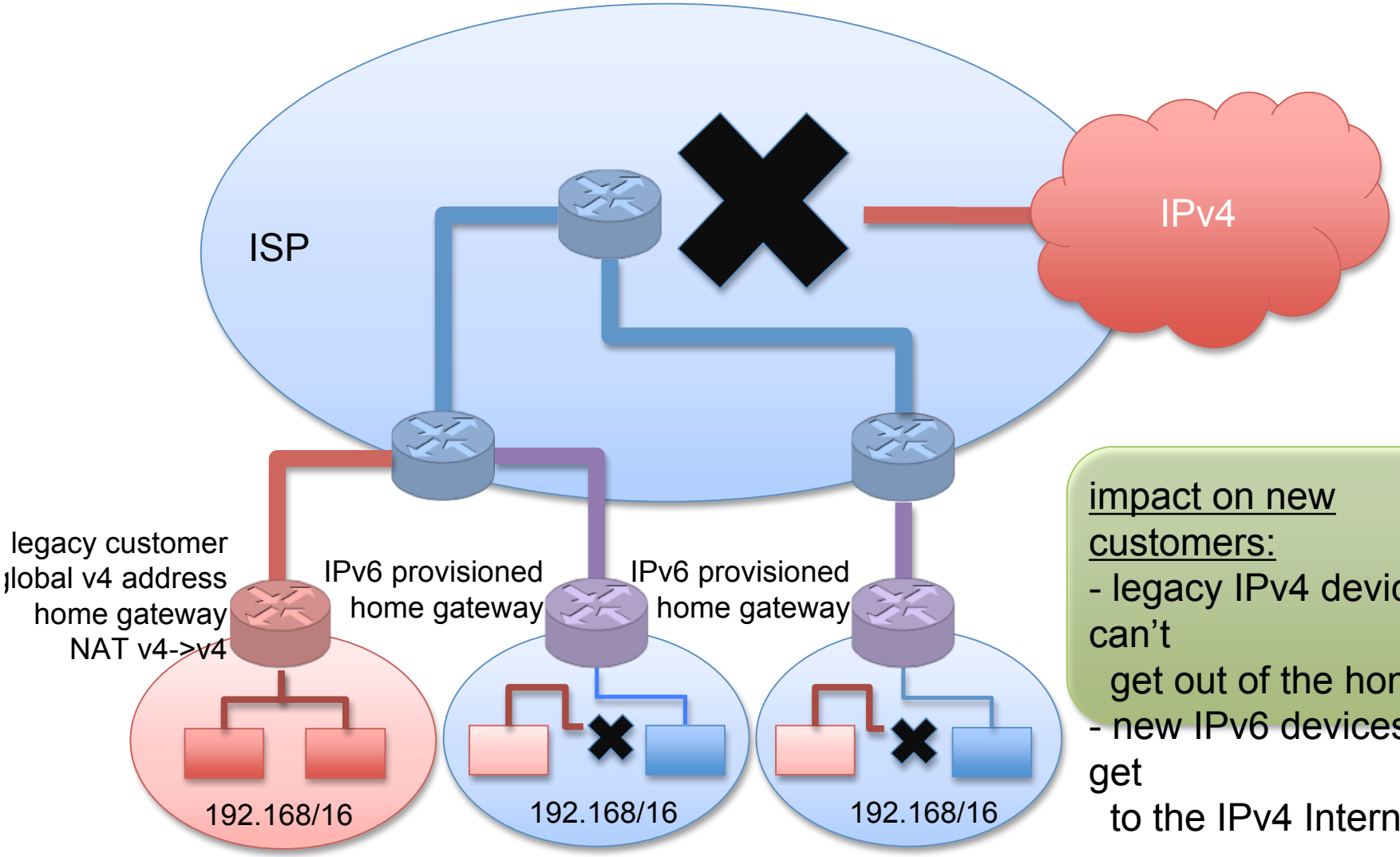
After IPv4 IANA completion, there will not be enough IPv4 addresses to sustain this model.



Today such deployments do not see much IPv6 traffic, mainly because there is little content reachable with IPv6.

Plan A: dual-stack core
new customers are provisioned
with IPv6-only but no IPv4 support

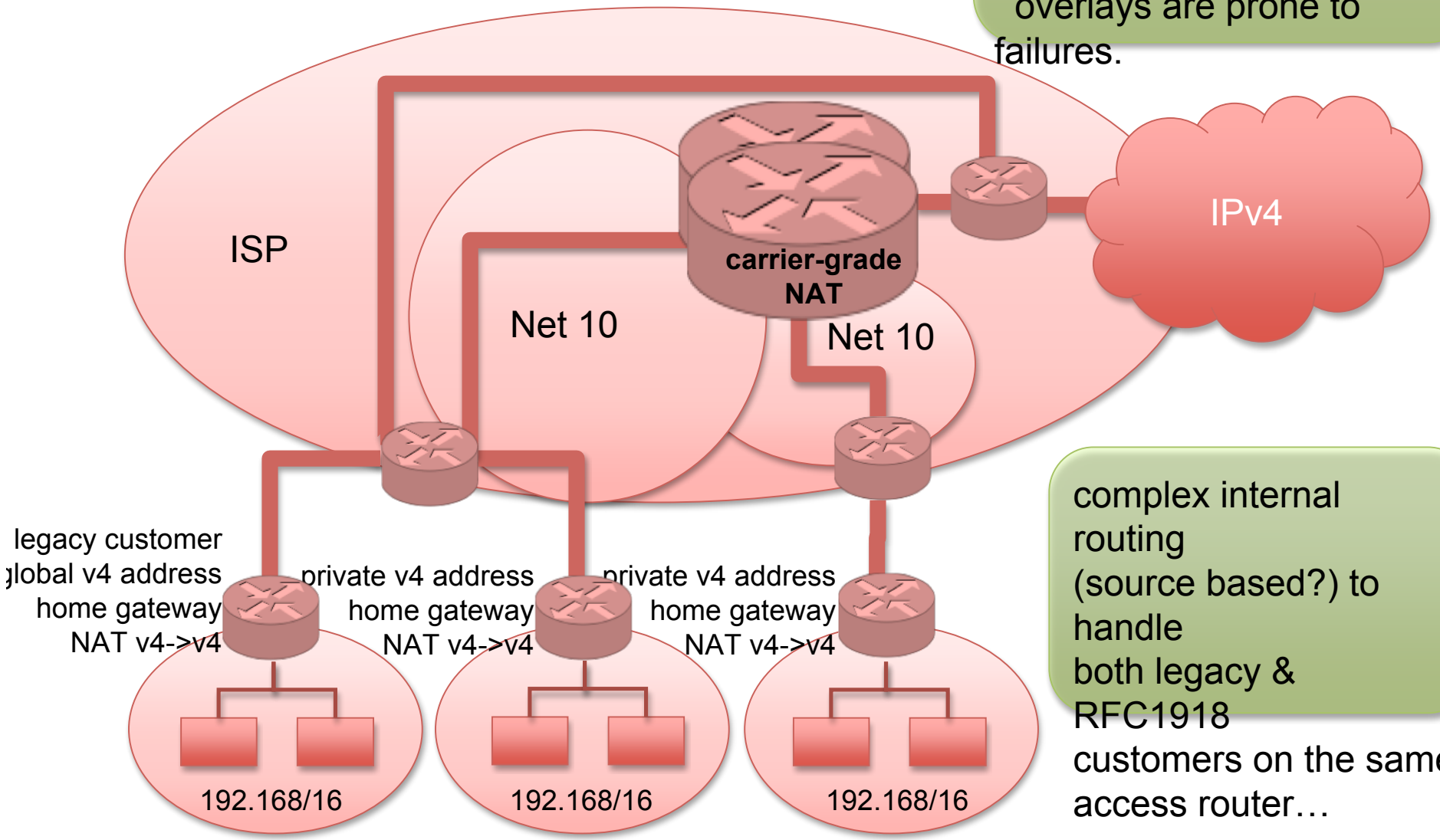
lots of broken paths…



impact on new customers:
- legacy IPv4 devices can't get out of the home.
- new IPv6 devices can't get to the IPv4 Internet.

Plan B: double NAT
new customers are provisioned with overlays of RFC1918

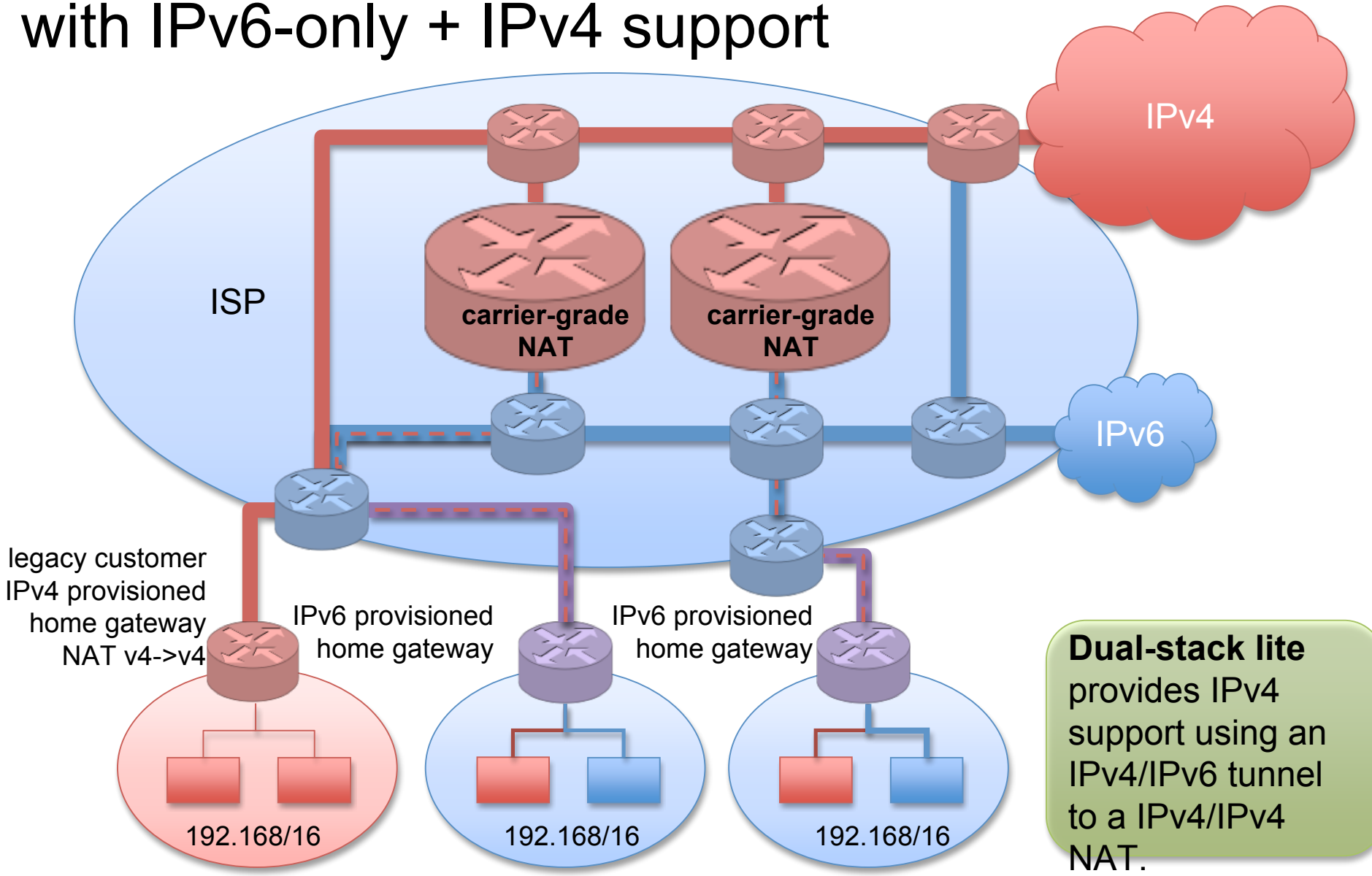
- two layers of NAT
- no evolution to IPv6
- network gets increasingly complex to operate.
- Intersections of Net 10 overlays are prone to failures.



complex internal routing (source based?) to handle both legacy & RFC1918 customers on the same access router…

Plan C: dual-stack lite
new customers are provisioned with IPv6-only + IPv4 support

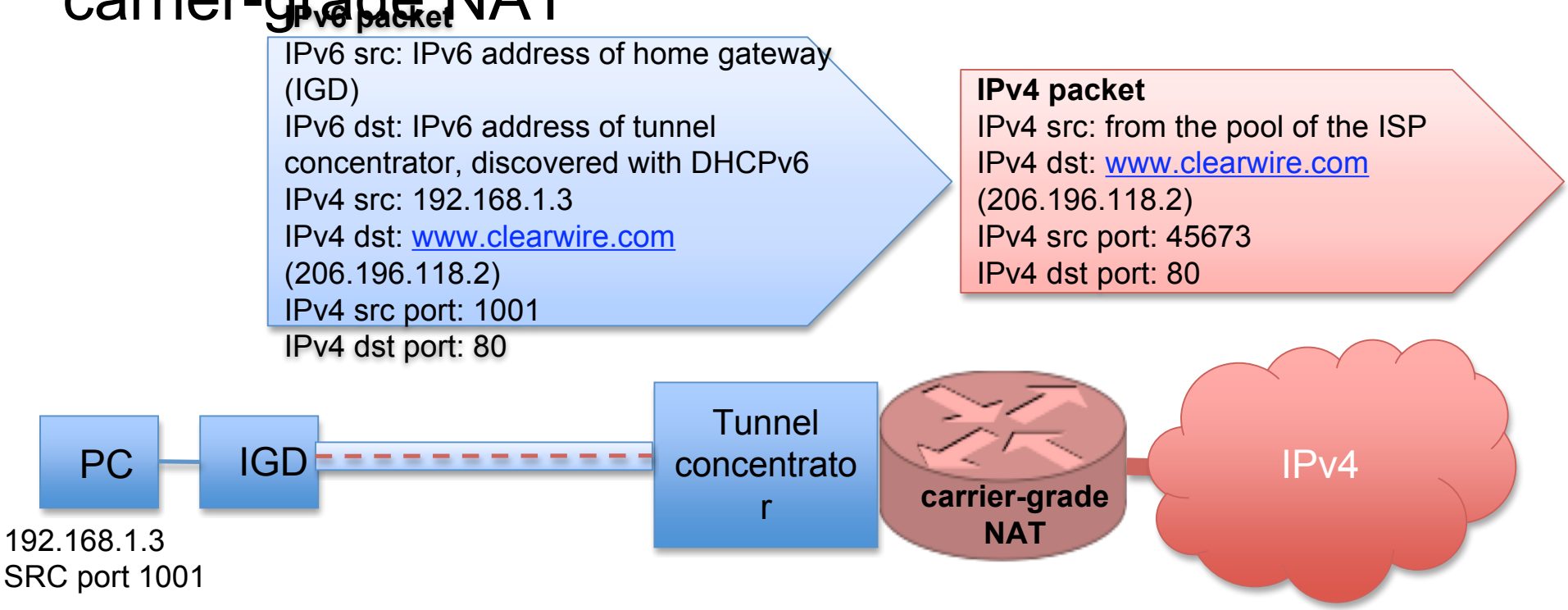
- simplifies network operation
- provides an upgrade path to IPv



Dual-stack lite provides IPv4 support using an IPv4/IPv6 tunnel to a IPv4/IPv4 NAT.

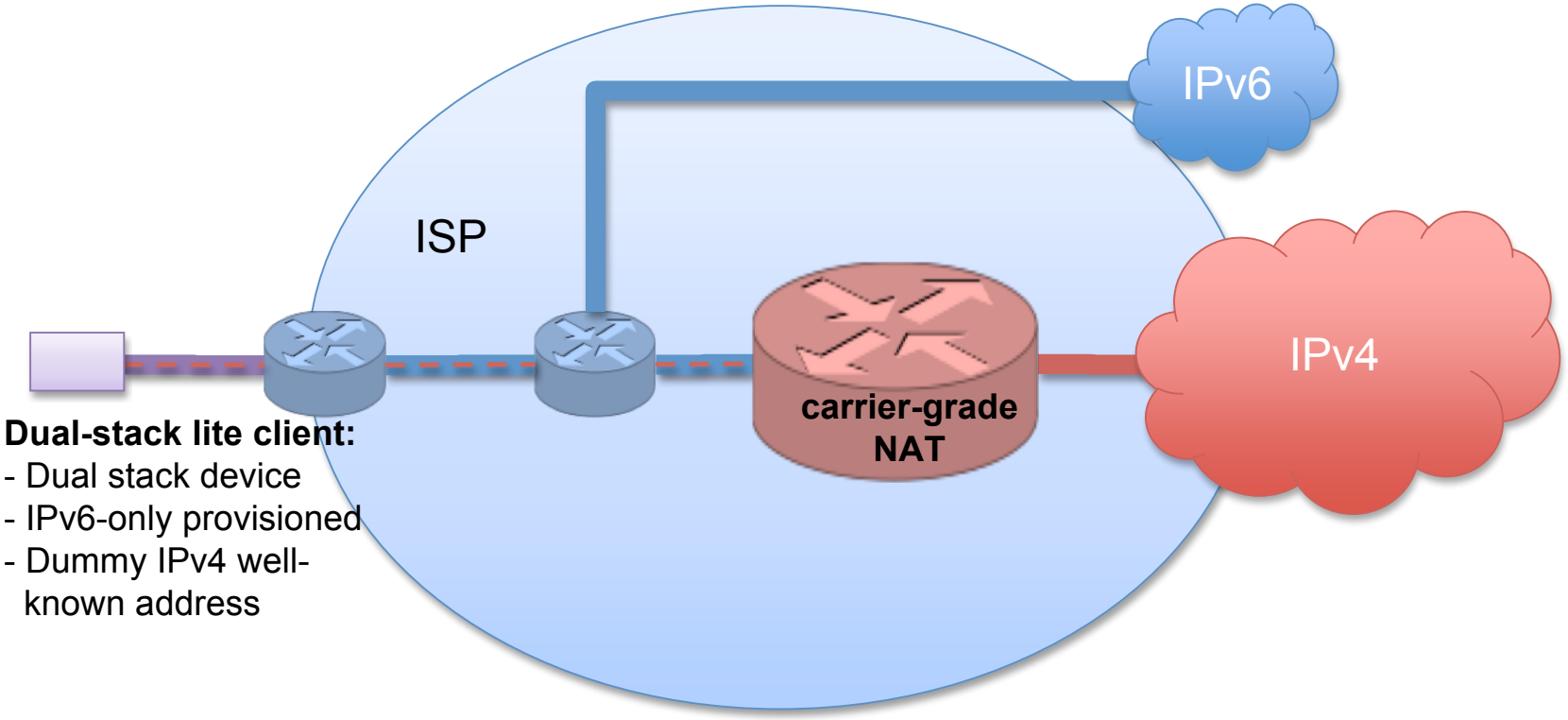
DS lite:

Dual-stack capable IGD are provisioned with IPv6-only + IPv4 support for the homer PC from a carrier-grade NAT



NAT binding
IN:
IPv6 src: IPv6 address of IGD + 192.168.1.3 + port1001
OUT:
IPv4 src address: from pool of the ISP + port: 45673

Plan C : New stand-alone devices are provisioned with IPv6-only + IPv4 support with dual-stack lite

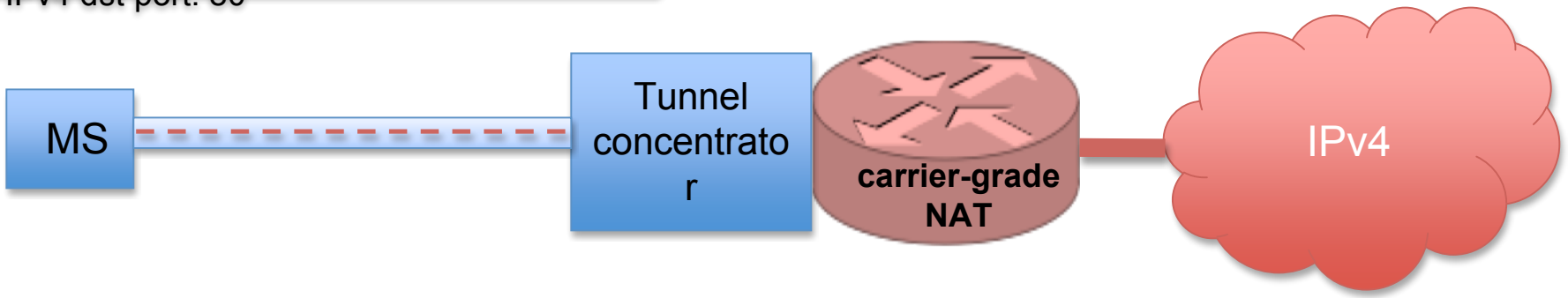


Stand-alone, dual-stack, IPv6-only provisioned devices
can use dual-stack lite to reach the IPv4 Internet.

DS lite:
Dual-stack capable end-nodes are provisioned with IPv6-only + IPv4 support from a carrier-grade NAT

IPv6 packet
IPv6 src: IPv6 address of end-node
IPv6 dst: IPv6 address of tunnel concentrator, discovered with DHCPv6
IPv4 src: well known IPv4 address: (IANA defined)
IPv4 dst: www.clearwire.com (206.196.118.2)
IPv4 src port: 1001
IPv4 dst port: 80

IPv4 packet
IPv4 src: from the pool of the ISP
IPv4 dst: www.clearwire.com (206.196.118.2)
IPv4 src port: 45673
IPv4 dst port: 80



NAT binding
IN:
IPv6 address of end node + well known IPv4 address of end-node (IANA defined) + port1001
OUT:
IPv4 src address: from pool of the ISP + port: 45673

Tunnel-based solution

- Running a tunnel between the end-node or the IGD and the CGN open the door to several new things, simply by pointing the tunnel to the right place:
  - Distribution & horizontal scaling of CGN
  - Use of 3rd party CGN (virtual ISP)
  - …

Open issue 1: ALGs

- CGN may or may not be the best place to implement ALGs
  - Bring some ideas from A+P
  - Enable the end-node or the IGD to perform the ALG function, by running a port mapping protocol with the CGN, eg NAT-PMP

- Things to avoid
  - Redefining & re-implementing DHCPv4
  - An inefficient port allocation scheme
    - Cookie-cutter approaches are less efficient than need-based allocations

Open Issue 2: Servers

- Apps that require running on a well-known port number
  - E.g. mail server at home
- May be dealt with using non-technical solutions
  - Maybe offering different tiers of services

Open Issue 3: UPnP

- Apps that insist on running on a well-known port number (or port range) using UPnP to signal the home gateway
  - Outbound: could be fixed by running a port translator on the IGD
  - Inbound: ???

Open Issue 3: Multicast

- Should we do anything about IPv4 multicast?
- If yes, what?

Is IP protocol translation needed in scenario 2.3 for IPv6 only network?

- Observations:
  - Except sensors, all IPv6 implementations today appear to be dual-stack capable, IPv4 & IPv6
  - The issue about dual-stack is not so much memory space in devices but the availability of the IPv4 addresses plus the cost of running a parallel IPv4 address space with separate routing & ACLs
  - DS-lite remove all those costs plus allows to run classic IPv4 apps on dual-stack nodes that are not provisioned with an IPv4 address