

Dual-Stack lite: a scalable CGN story

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IPv4 reality check: completion of allocation is real



After completion:

**Existing IPv4 addresses will not stop working.
Current networks will still operate.**

IPv6 reality check: the IPv4 long tail

- Post IPv4 allocation completion:
 - Many hosts in the home (eg Win 95/98/2000/XP, Playstations, consumer electronic devices) are IPv4-only.
 - They will not function in an IPv6-only environment.
 - Few of those hosts can and will upgrade to IPv6.
 - Content servers (web, email,...) hosted on the Internet by many different parties will take time to upgrade to support IPv6.

Dealing with both realities: a two prong approach

① Embrace IPv6

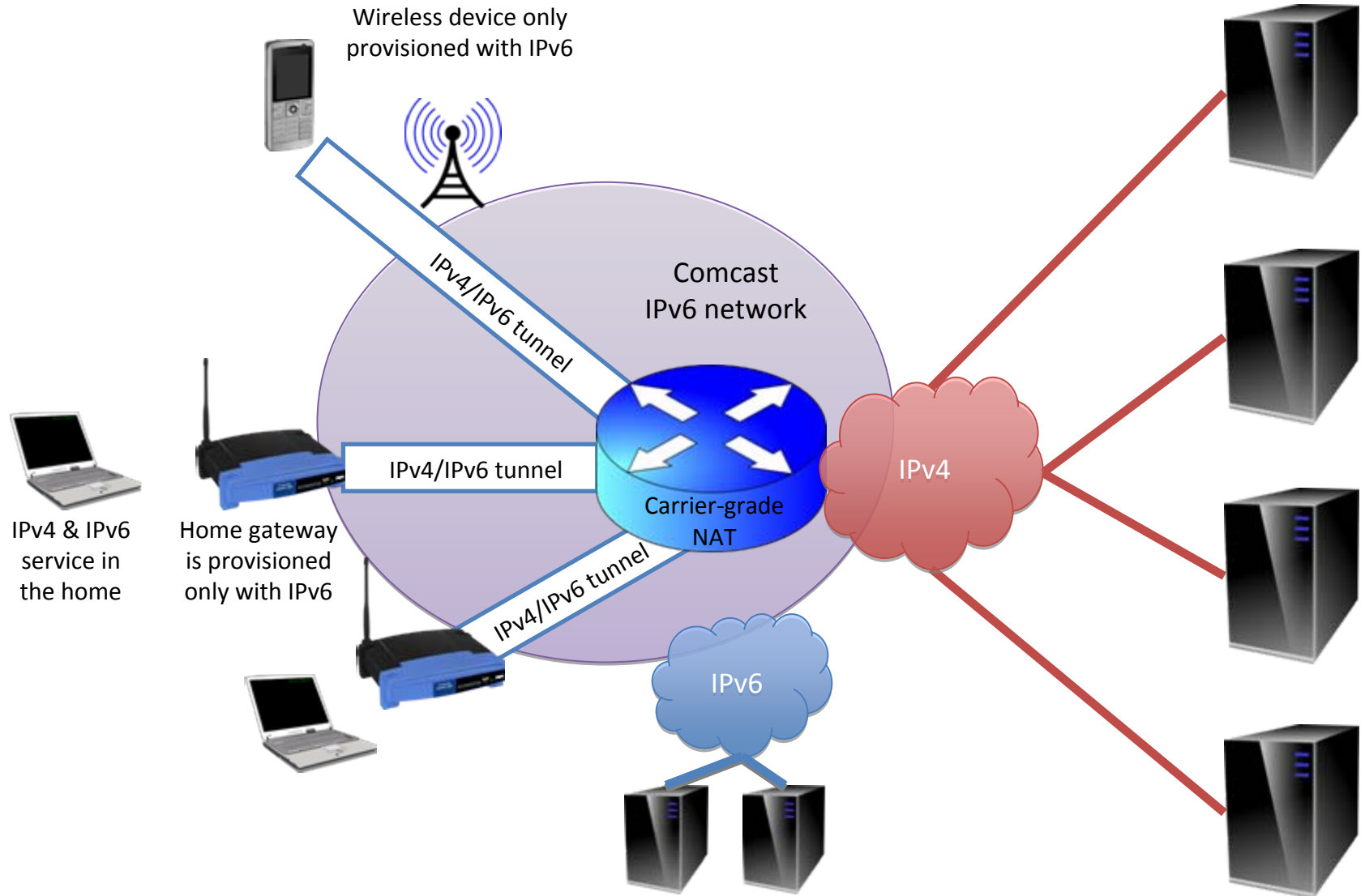
- Move as many devices/services to IPv6 as possible to lower dependency on IPv4 addresses

② Build an IPv6 transition bridge for the IPv4 long tail

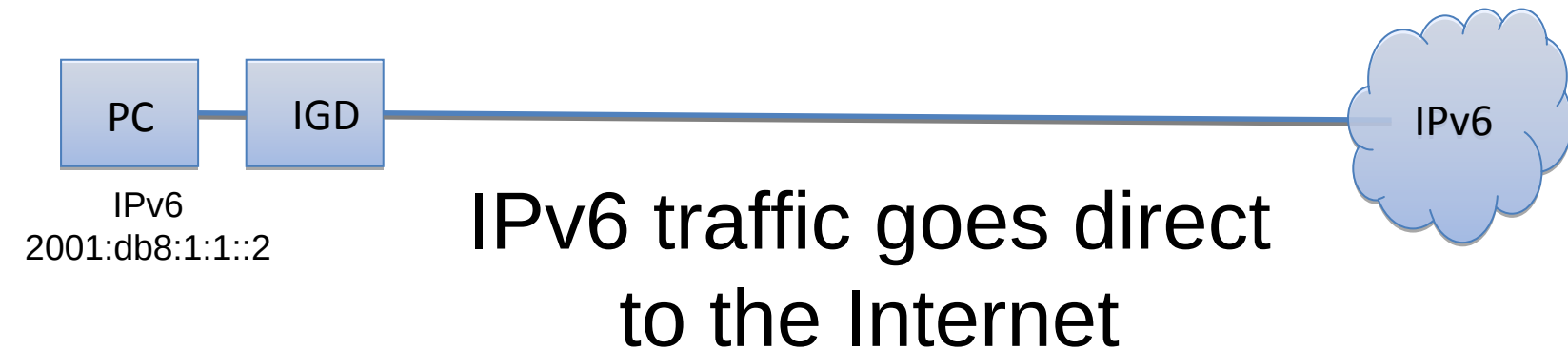
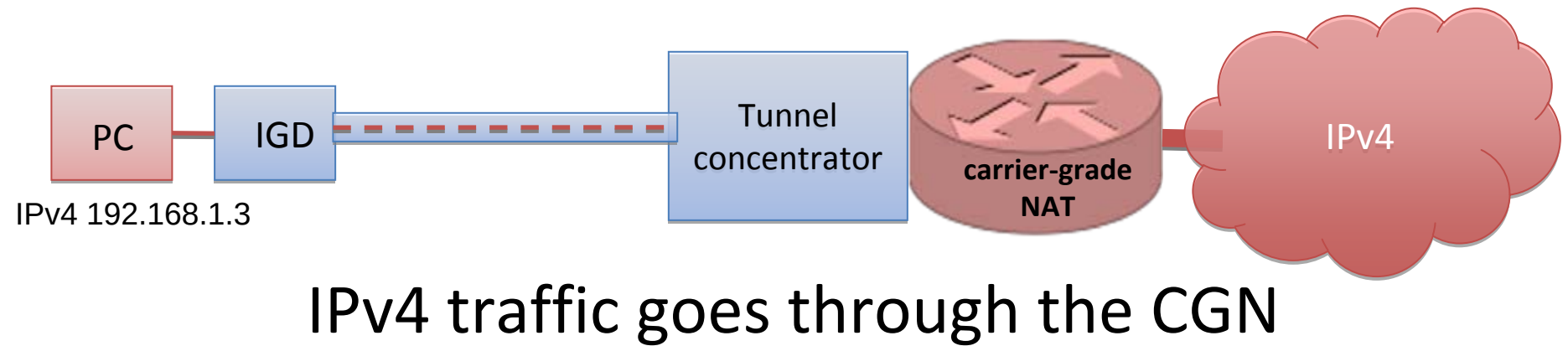
- Goal:
 - Provide IPv4 service without providing a dedicated IPv4 address
- Technology:
 - Leverage IPv6 access infrastructure
 - Provide only IPv6 addresses to endpoint
 - Share IPv4 addresses in the access networks
 - DS-lite: IPv4/IPv6 tunnel + provider NAT

IPv6 Transition Bridge

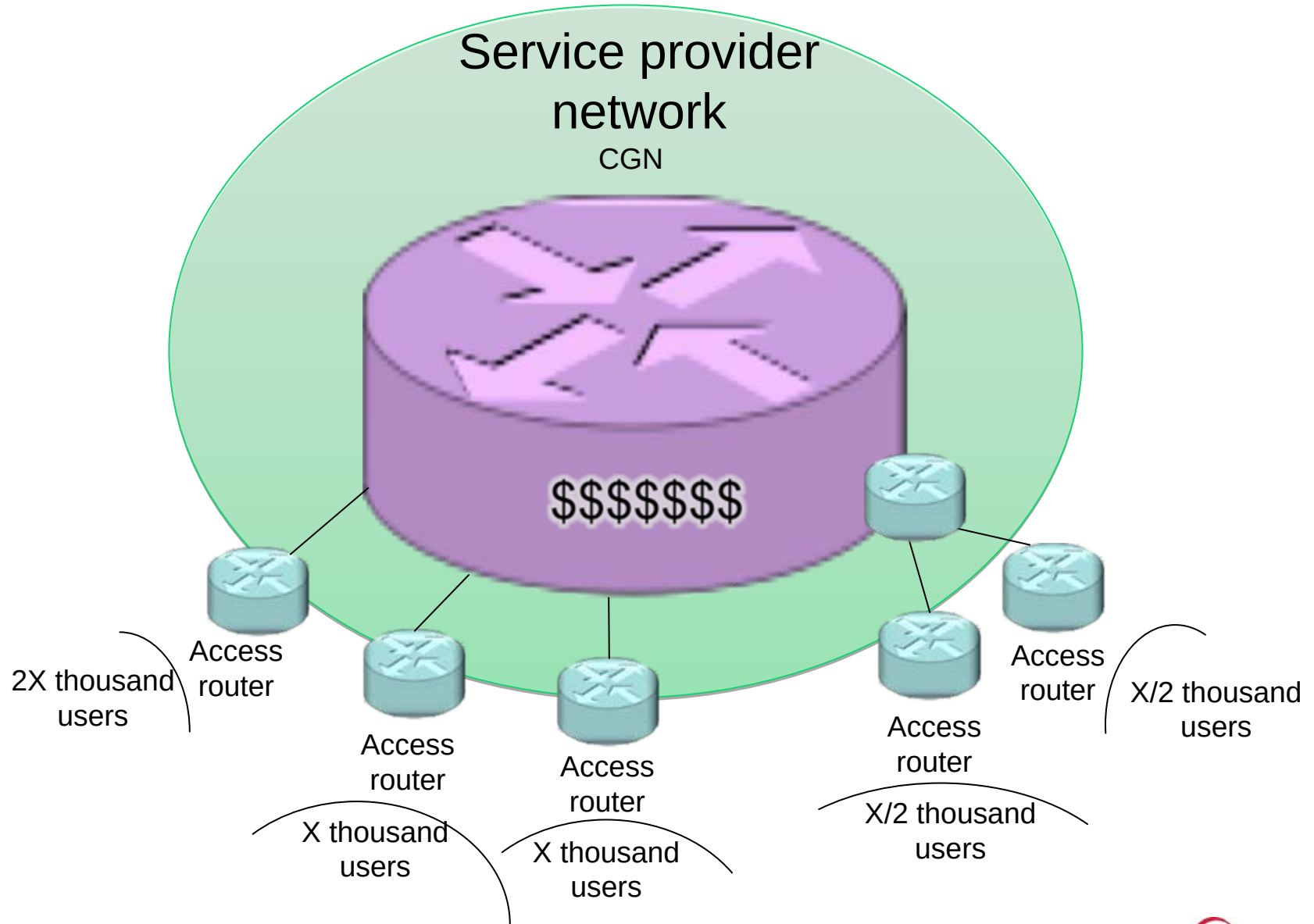
Sharing IPv4 addresses among new customers with DS-lite



Migrating Internet traffic to native IPv6 reduces stress on the CGN

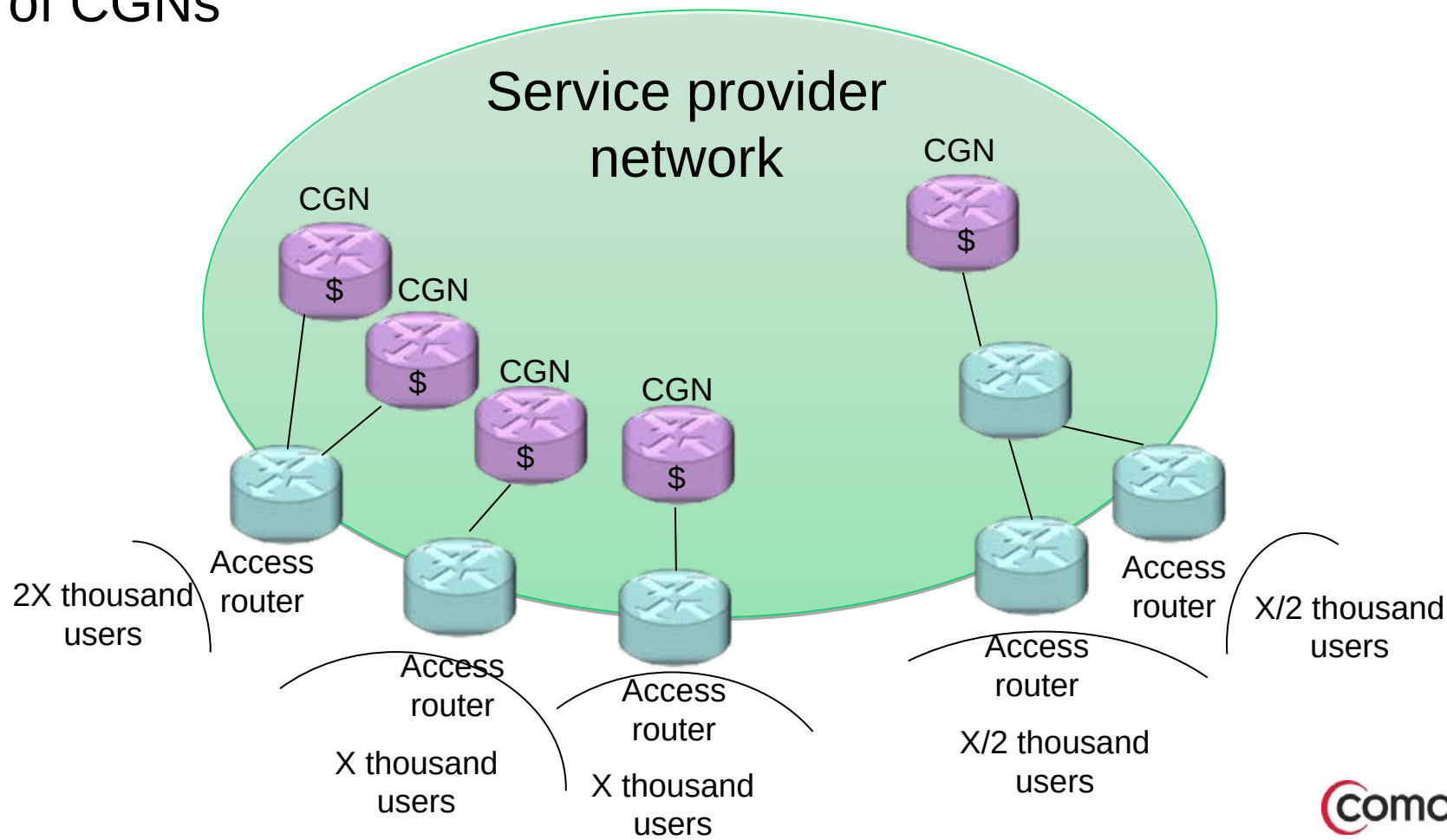


Avoiding the Mega CGNs



Horizontal scaling with DS-lite

- Uses DHCPv6 option to configure tunnel end-point
- Sends the traffic to as many CGNs as necessary
- Provides flexibility in network design and enable 'soft-wiring' of CGNs



IPv4 port distribution

- Measurements:
 - Average #ports/customer < 10 (per transport protocol)
 - Peak #ports/customer > 100? > 1000? > 5000?
- Do not dimension for peaks, but for average!
 - No cookie cutter approach
 - Large dynamic pool of ports shared by many customers
- Customers want to choose their own applications
 - CGN MUST not interfere with applications, eg avoid ALGs,...
 - Need to support incoming connections
 - Small static pool of reserved ports under the control of customers

Port forwarding & A+P extensions

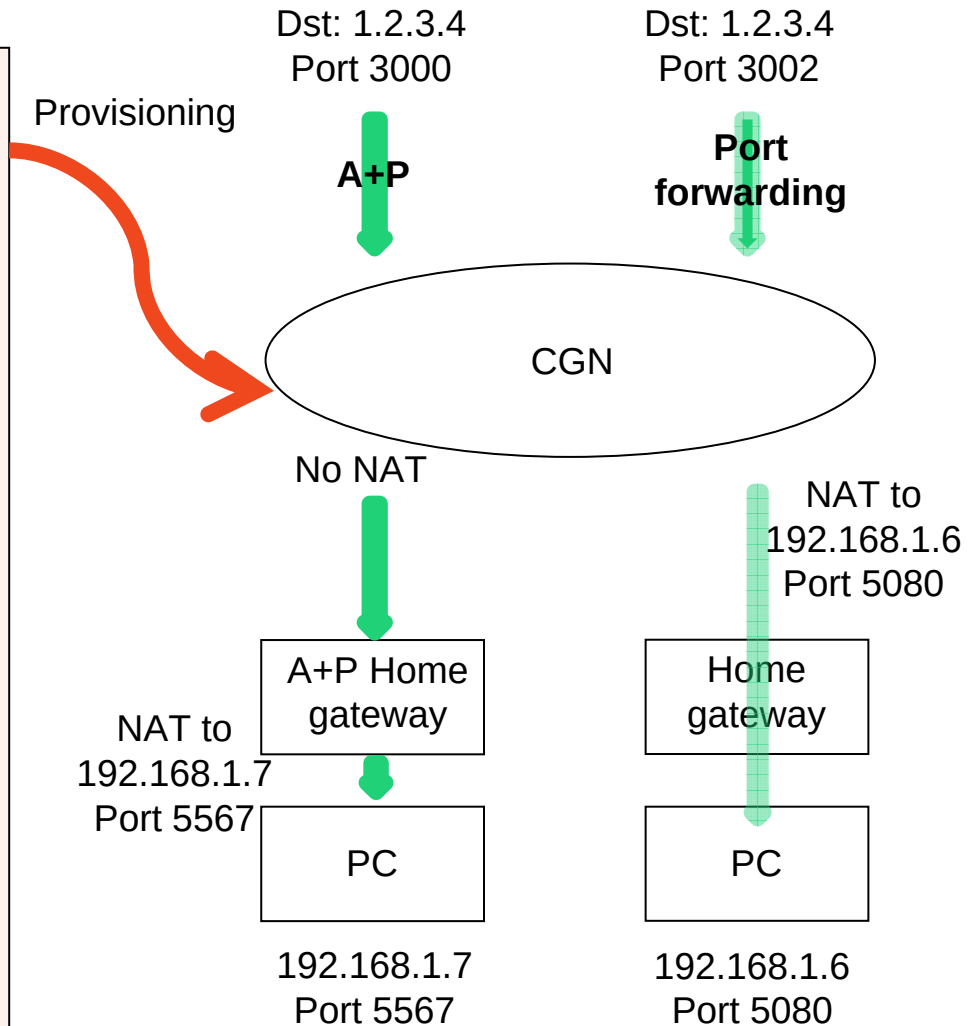
ISP portal

Address & port control tab

User: X

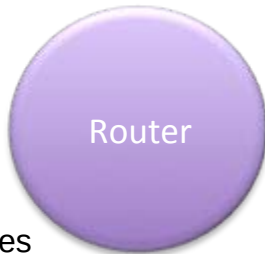
External IPv4 address: 1.2.3.4

Port	A+P	Port forwarding	Internal IP	Port
3000	☒	☐		
3001	☐	☒	192.168.1.5	80
3002	☐	☒	192.168.1.6	5080
3003	☒	☐		
3004	☒	☐		
...				



Comcast DS-lite demo

CORE



2001:240:63f:1::1/64
202.32.249.89/29

Static routes

2001:240:63f:ff00::/56 via 2001:240:63f:1::2
202.32.249.92/32 via 202.32.249.91

2001:240:63f:1::2/64
202.32.249.91/29

DUAL STACK LITE

DHCPv6 Provisioning

- IPv6 address of home GW
- /64 DHCPv6 prefix delegation
- DNS server IPv6 address
- CGN IPv6 address

IPv6 router
DHCPv6/DNS
server

DS-lite
CGN

202.32.249.92
IPv4 NAT pool

Color code

IPv6

Dual-
Stack

IPv4

DHCPv6

Switch
2001:240:63f:ff00::/64

DHCPv6

Home GW 1

IPv4/IPv6
DS-lite tunnel

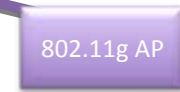
IPv4/IPv6
DS-lite tunnel

Home GW 2



...

PC 3



2001:240:63f:ff11::/64

192.168.1.0/24

SSID: ds-lite1



SSID: ds-lite2



...

PC 7

2001:240:63f:ff12::/64

192.168.1.0/24