Port Restricted IP Address Assignment

draft-bajko-v6ops-port-restricted-ipaddr-assign

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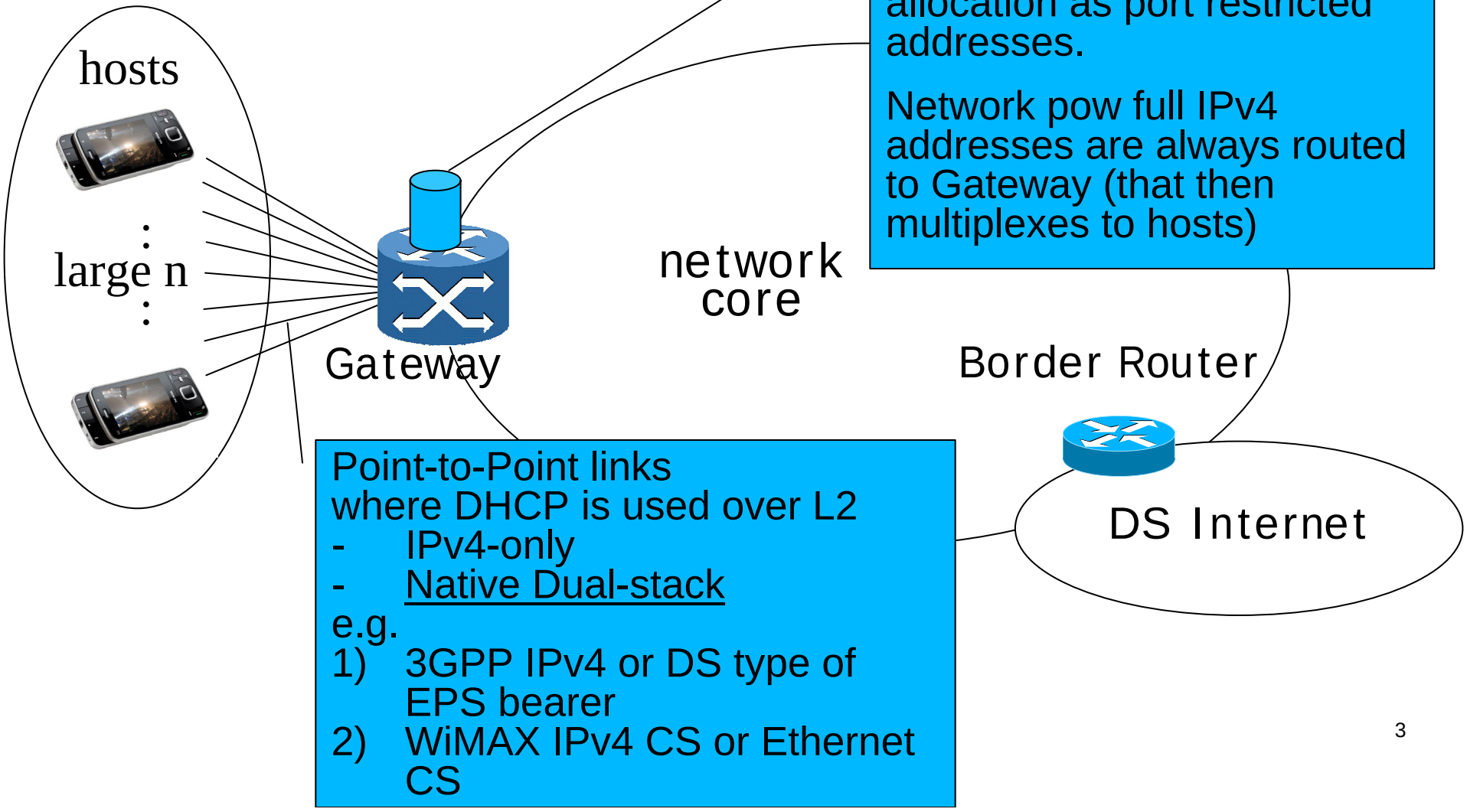
Softwires WG meeting @ IETF#73

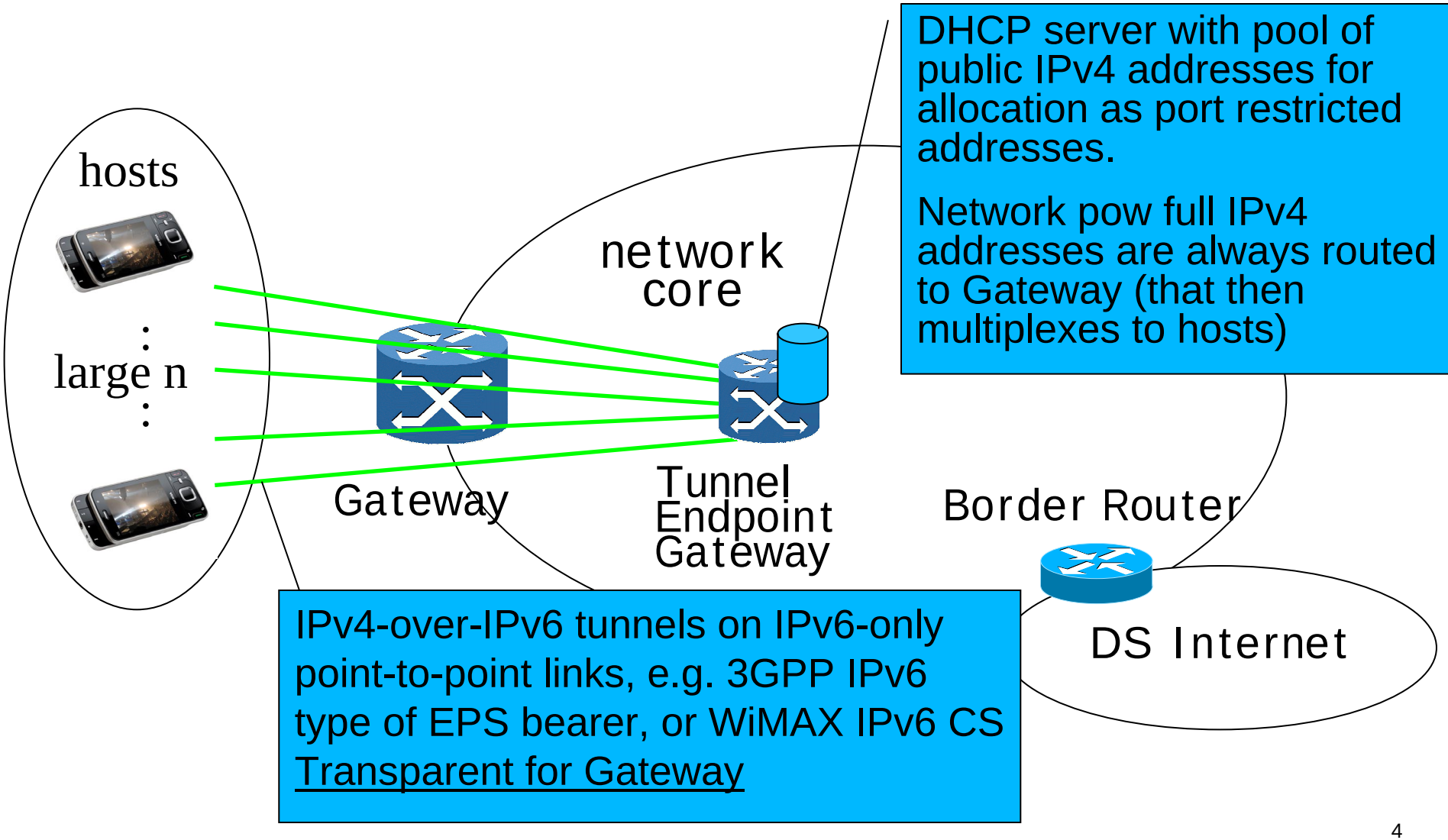
Intended usage scenarios

- **Managed and tightly controlled networks**
  - Generally for networks where host support for specific features can be mandated – e.g. via requirements or certification
  - Cellular networks in particular, where large number of hosts need simple IPv4 connectivity for few applications and which are increasingly always-on IP connected
- Intended to be mainly used **on point-to-point**
  - **Physical access links (L2)**: e.g. 3GPP IPv4 EPS bearer, WMF IPv4 CS
  - **IPv4-over-IPv6 tunneled access links (L3)**:
    - Over: IPv6 clouds, IPv6 PPP, IPv6 EPS bearer, etc.
- Usage to be restricted to avoid interference with current internet connectivity practices
- On demand allocation at DHCP request time

Physical point-to-point links with or w/o IPv6



Tunneled point-to-point IPv4-over-IPv6 links



About gateway functionality

- Gateway has a pool of public IPv4 addresses
- Gateway can also act as a NAT for legacy hosts (CGN)
- Gateway allocates port-restricted IPv4 addresses and multiplexes based on ports
- Same stands for both first hop Gateway and Tunnel Endpoint Gateway
- Gateway handles fragments (multiplexing needs the port information)

Gateway multiplexing tables

- For physical link scenario

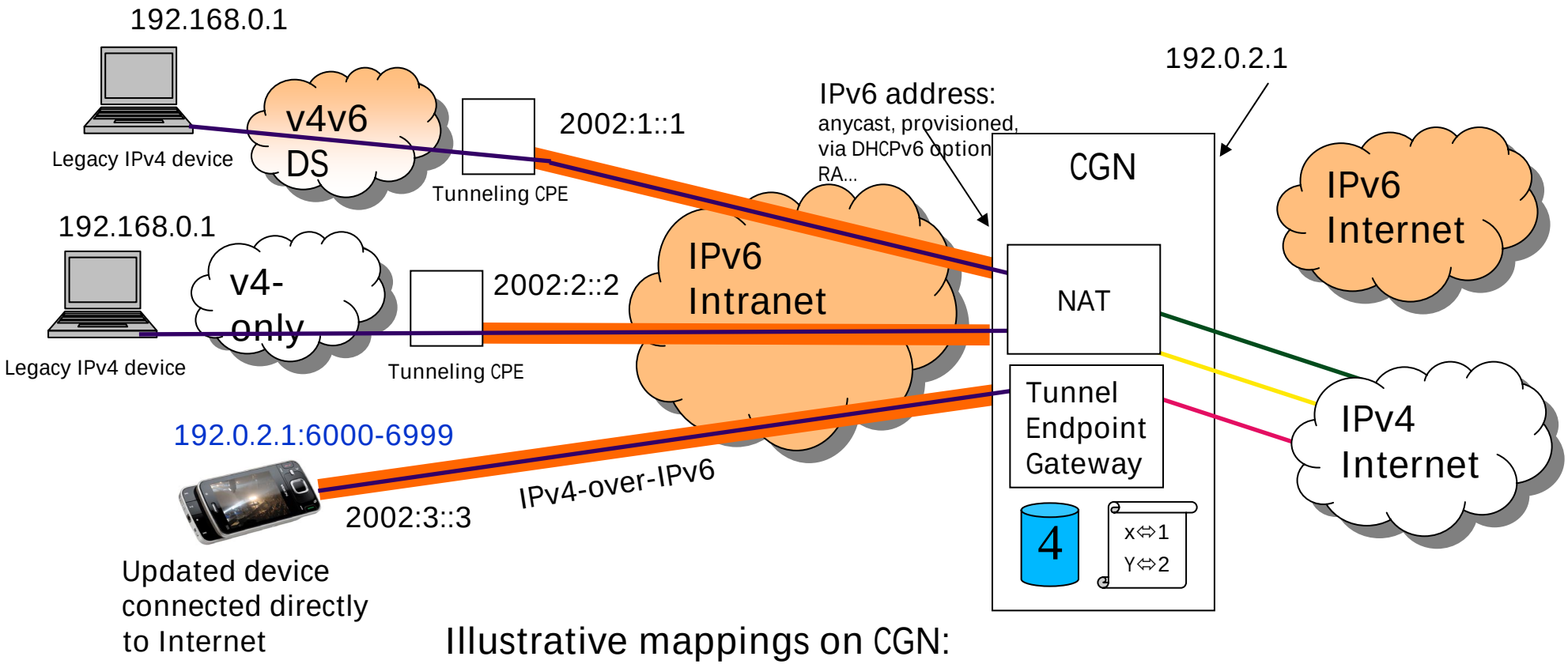
Point-to-point link	Public address + port range
Link 1	129.0.0.1 / 5000-5999
Link 2	129.0.0.1 / 6000-6999

- For IPv4-over-IPv6 tunneled link scenario with DS-Lite

Point-to-point tunnel	Public address + port (range)
Softwire 1/10.0.0.1/TCP 10000	129.0.0.1 / TCP 5000
Softwire 2	129.0.0.1 / 6000-6999

  - The same table for both translation and tunnel multiplexing

CGN allocating port-restricted IPv4 addresses in DS-Lite environment



Illustrative mappings on CGN:

Internal	External
(2002:1::1 * 192.168.0.1:5555)	⇔ 192.0.2.1:1234
(2002:2::2 * 192.168.0.1:5555)	⇔ 192.0.2.1:1235
(2002:3::3)	⇔ 192.0.2.1:6000-6999

Port-restricted IPv4 addresses and DS-Lite coexistence

- DS-Lite CGN to support port-restricted IPv4 address allocation
  - Enables benefits for modified hosts (NAT-less functionality)
  - Decreases CGN load
  - Enables more customer control if NAT is in host/CPE instead of CGN
- Port multiplexing efficiency as a configurable parameter:
  - When 0 ports are configured available for static reservation by hosts => CGN-only functionality
  - When 64k ports configured available for static reservation => basically dynamic IPv4-over-IPv6 tunneling solution
- If the allocated port-range for hosts is very small, hosts could utilize port-restricted addresses and CGN in parallel:
  - Class of applications would utilize CGN, e.g. HTTP applications with significant but short-lived port usage
  - Class of always-on applications could utilize port-restricted IP addresses to avoid NAT keep-alives and for P2P communication (e.g. VoIP)

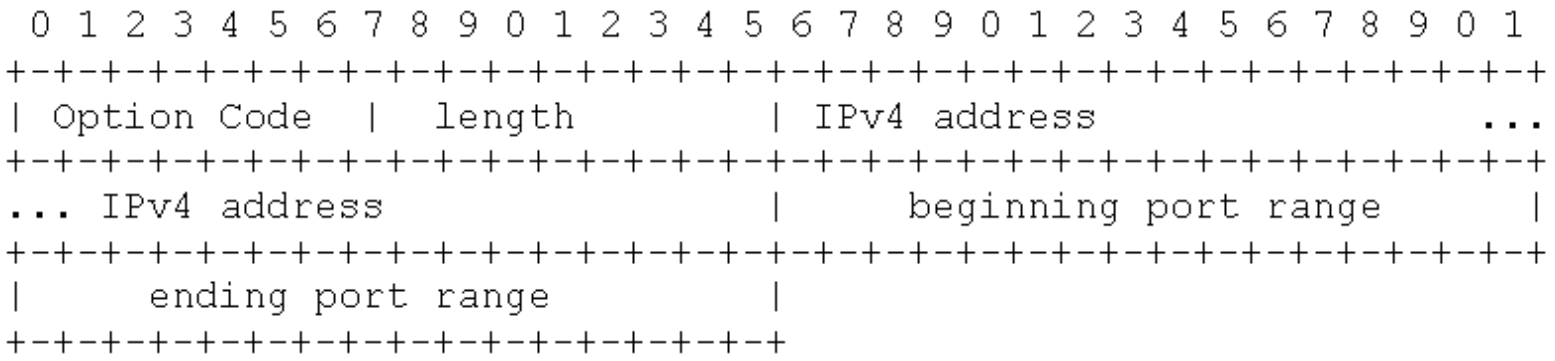
NAT in a Host

- Port-Restricted IP address can be hidden from the users/applications by implementing an internal NAT
  - Looks just the same as NAT in CPE or CGN
- Provides a distributed NAT functionality, with the NAT functionality moved from the network to the end host

+ **Allows of local optimizations for NAT traversal**
+ **Continued support for NAT control protocols**

Host and Network behavior

- Host includes new DHCP option (**OPTION-IPv4-RPR**) to indicate capability for port-restricted IP addresses
- *On reception* of OPTION-IPv4-RPR DHCP server may offer **OPTION-IPv4-OPR** and set ‘yiaddr’ as ‘0.0.0.0’ to ensure client does not configure full IP address:



- *On absence* of OPTION-IPv4-RPR server shall allocate full public/private IP address, or as last resort force OPTION-IPv4-OPR for client

Next steps

- Analyze issues with protocols not using port numbers, such as certain ICMP messages
  - *Some firewalls disallow ICMP passage already today, so what is the damage caused by not supporting messages such as ICMP echo as messages such as ICMP errors would continue to work?*
- Discuss topic on *behave* and *softwires* WGs
- Seek synergies with other proposals such as Dual-Stack Lite