Extended IPv6 Addressing for Encoding Port Range

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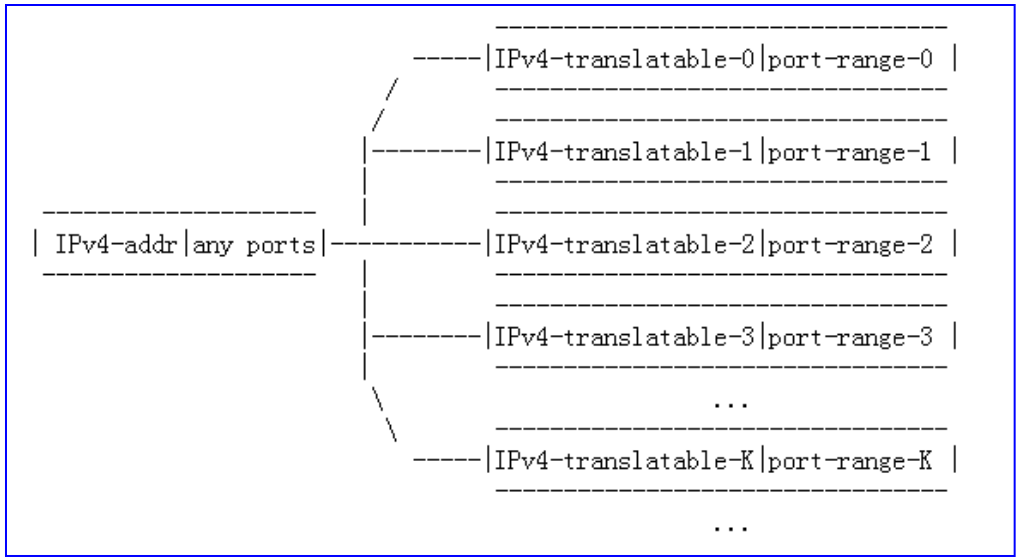
RFC6052
draft-ietf-behave-address-format

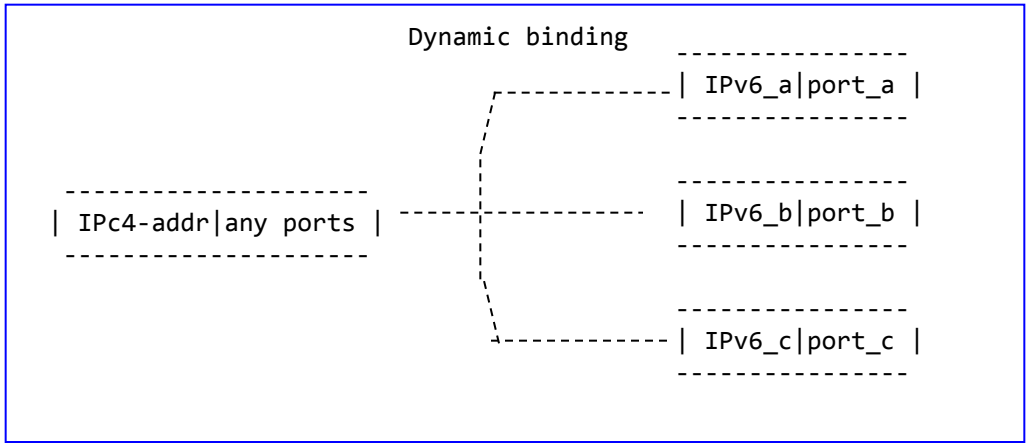
- 4.1. Choice of Suffix
  - There have been proposals to complement stateless translation with a port-range feature. Instead of mapping an IPv4 address to exactly one IPv6 prefix, the options would allow several IPv6 nodes to share an IPv4 address, with each node managing a different range of ports. If a port range extension is needed, it could be defined later, using bits currently reserved as null in the suffix.

Port-range

Stateless



Stateful



Idea

- Embed port range parameter in the IPv6 address
  - to inform the port mapping device that the port range is somehow limited
- Parameters related to port range
  - The sharing ratio
  - The index
- Using 16 bits
  - 4 bits for sharing ratio
  - 12 bits for index

Extended address format

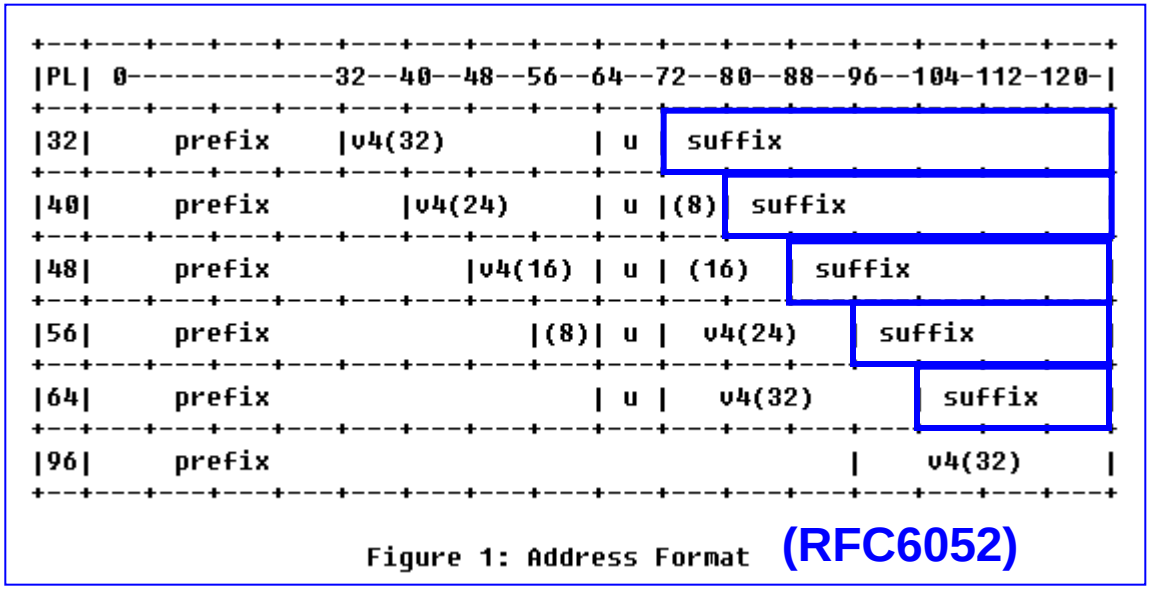


Figure 1: Address Format **(RFC6052)**

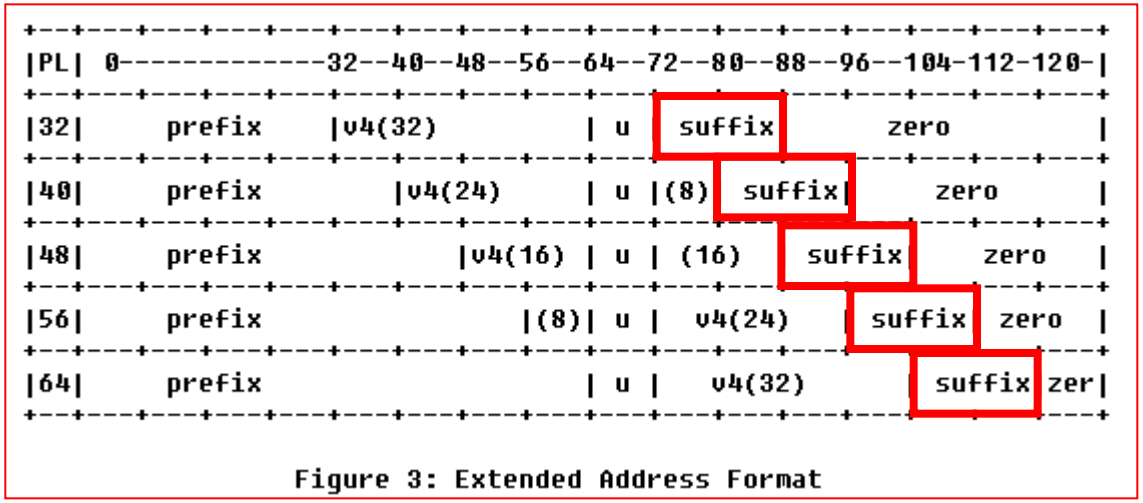


Figure 3: Extended Address Format

Suffix

ratio	suffix range	# of Ports
1	0000 - 0000	65,536
2	1000 - 1001	32,768
4	2000 - 2003	16,384
8	3000 - 3007	8,192
16	4000 - 400f	4,096
32	5000 - 501f	2,048
64	6000 - 603f	1,024
128	7000 - 707f	512
256	8000 - 80ff	256
512	9000 - 91ff	128
1,024	a000 - a3ff	64
2,048	b000 - b7ff	32
4,096	c000 - cfff	16

Figure 4: Suffix for Port Range Encoding

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Modulus operator

- Given K (K=0, 1, ..., N-1), the allowed port number (P) are
  - P=j*N + K, where j=0, 1, ..., (65536-N)/N.

- Given P, the IPv6 node index (K) is
  - K=(P%N) (% is the Modulus Operator).

Example

IPv4= 58.200.192.10
Prefix= 2001:da9:a4a6::/48
Ratio=64
Index=30

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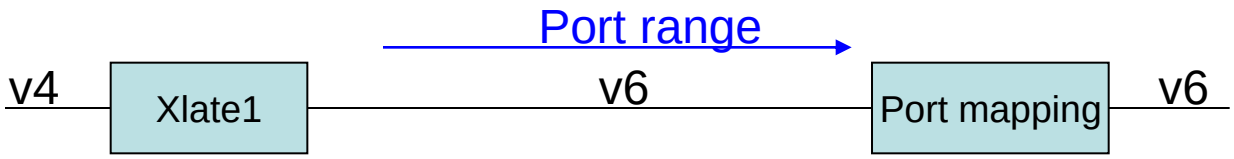
IPv4-translatable= 2001:da9:a4a6:3ac8:c0:a00::/88

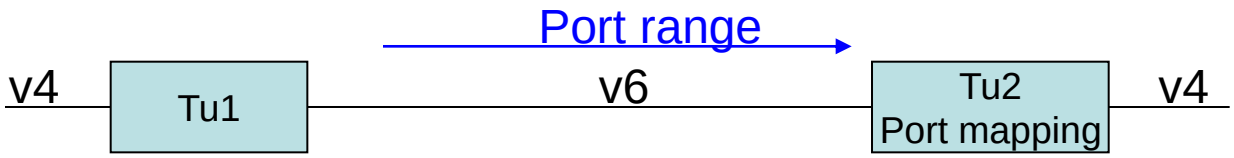
Address format extension
IPv4-translatable.ext= 2001:da9:a4a6:3ac8:c0:a60:1e00::/104

Applicability (1)

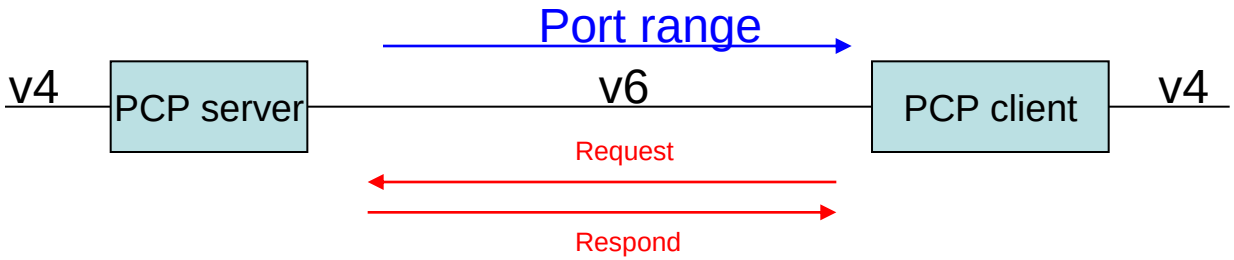
- Translation



- Tunneling

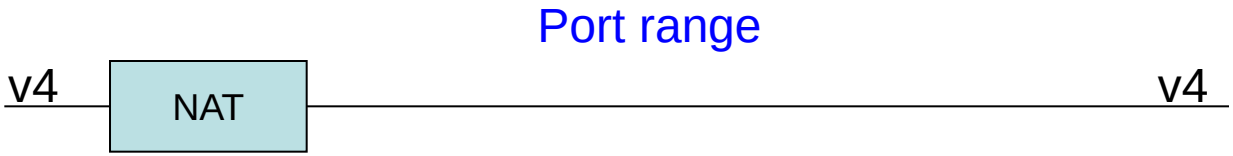


- PCP



Applicability (2)

- Minimize port logging requirements in large-scale NAT



Log
IPv6 (prefix…IPv4…Port range)