# Address Space Allocation

This document describes the IP address plan we will use for this set of workshop exercises.

Wherever possible the plan tries to replicate real life as closely as possible.

The IPv4 address space used in these exercises is from subnets of 100.64.0.0/10 which is an [IPv4 Shared Address](https://tools.ietf.org/html/rfc6598) block. **It must not be routed on the Internet.**

Note that 2001:DB8::/32 is the [IPv6 Documentation Address](https://tools.ietf.org/html/rfc3849) block. **It must not be routed on the Internet.**

And finally note that the 2001:10::/28 address block has been listed in the [IANA special registry](http://www.iana.org/assignments/iana-ipv6-special-registry/iana-ipv6-special-registry.xhtml) for future use. **It must not be routed on the Internet.**

**If using these labs as inspiration for your own infrastructure design, please replace all instances of private, documentation, and unassigned address space with your own address blocks.**

## End-Site networks

If they are not a Regional Internet Registry member, end-site networks typically will receive a public IPv6 /48 and a very small public IPv4 block from their network operator.

We will use an IPv4 /24 for these exercises, reflecting the fact that in reality an end-site organisation will use a large private block like a /16 internally, NATed out into a small public IPv4 block like the /24 we are using here.

| Group | Public IPv4 | IPv6 | ASN |
|---|---|---|---|
| 1 | 100.68.1.0/24 | 2001:DB8:1::/48 | 10 |
| 2 | 100.68.2.0/24 | 2001:DB8:2::/48 | 20 |
| 3 | 100.68.3.0/24 | 2001:DB8:3::/48 | 30 |
| 4 | 100.68.4.0/24 | 2001:DB8:4::/48 | 40 |
| 5 | 100.68.5.0/24 | 2001:DB8:5::/48 | 50 |
| 6 | 100.68.6.0/24 | 2001:DB8:6::/48 | 60 |

*The list will continue in the same pattern if there are more groups.*

Each group will then further partition their space as follows:

| IPv4 | IPv6 | Description |
|---|---|---|
| 100.68.X.0/24 | 2001:DB8:X::/48 | Group address block |
| 100.68.X.0/26 | 2001:DB8:X:0000::/50 | Infrastructure space |
| 100.68.X.0/28 | 2001:DB8:X:0000::/64 | Router loopbacks |
| 100.68.X.16/28 | 2001:DB8:X:0010::/60 | Point-to-point links |
| 100.68.X.64/26 | 2001:DB8:X:4000::/50 | End user space 1 |

| IPv4 | IPv6 | Description |
|---|---|---|
| 100.68.X.128/26 | 2001:DB8:X:8000::/50 | End user space 2 |
| 100.68.X.192/26 | 2001:DB8:X:C000::/50 | End user space 3 |

Where X is your group number (1,2,3...).

Prefixes for point-to-point links will be of length /30 for IPv4 and /127 for IPv6 (we will adopt the recommendations of [RFC6164](https://tools.ietf.org/html/rfc6164) for IPv6 inter-router links where we reserve a /64 for the link but subnet it as a /127):

| IPv4 | IPv6 | Description |
|---|---|---|
| 100.68.X.16/30 | 2001:DB8:X:10::/127 | P2P CX ↔ BX |
| 100.68.X.20/30 | 2001:DB8:X:11::/127 | P2P CX ↔ PX |
| 100.68.X.24/30 | 2001:DB8:X:12::/127 | P2P CX ↔ AX |

Router loopback address subnet masks will be /32 for IPv4 and /128 for IPv6:

| IPv4 | IPv6 | Description |
|---|---|---|
| 100.68.X.1/32 | 2001:DB8:X::1/128 | BX Loopback |
| 100.68.X.2/32 | 2001:DB8:X::2/128 | CX Loopback |
| 100.68.X.3/32 | 2001:DB8:X::3/128 | PX Loopback |
| 100.68.X.4/32 | 2001:DB8:X::4/128 | AX Loopback |

Note that the convention used here assigns the beginning of the IPv4 and IPv6 address space for use for infrastructure. This is generally a matter of choice: some network operators use the beginning of the space, others use the end of the space.

# Transit Providers

Commercial network operators receive at minimum an IPv6 /32 from their regional internet registry. IPv4 allocations can range upwards from /22. We will use an IPv4 /16 for our exercises.

| Transit Provider | IPv4 | IPv6 | ASN |
|---|---|---|---|
| 1 | 100.121.0.0/16 | 2001:18::/32 | 121 |
| 2 | 100.122.0.0/16 | 2001:19::/32 | 122 |

The point-to-point link addresses from Transit Providers 1 and 2 to the End-sites are listed next. Note that the Transit Providers will get the low address, and the end-site gets the high address in the subnet.

| Group | IPv4 | IPv6 |
|---|---|---|
| 1 | 100.121.1.0/30 | 2001:18:0:10::/127 |
| 2 | 100.121.1.4/30 | 2001:18:0:11::/127 |
| 3 | 100.121.1.8/30 | 2001:18:0:12::/127 |
| 4 | 100.122.1.0/30 | 2001:19:0:10::/127 |
| 5 | 100.122.1.4/30 | 2001:19:0:11::/127 |
| 6 | 100.122.1.8/30 | 2001:19:0:12::/127 |

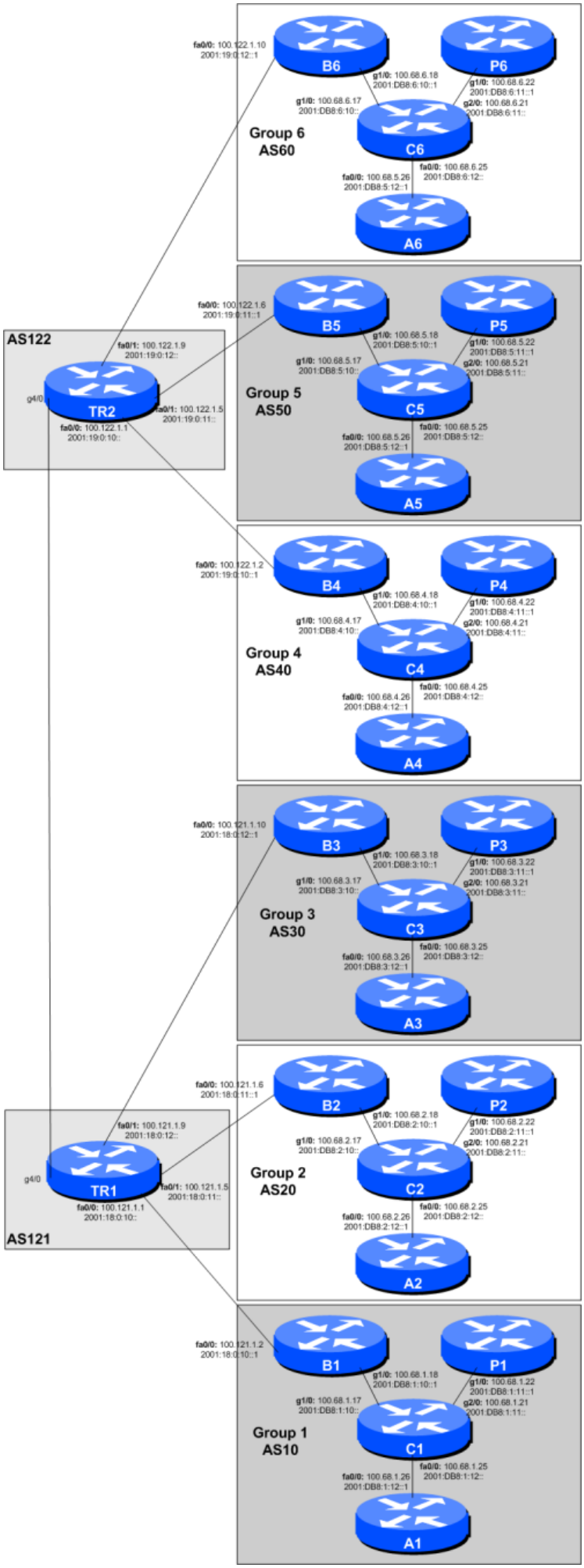
**Note:** The numbering started at the second /24 for the IPv4 point-to-point links to “end customers”. The first /24 is kept for number infrastructure within the ISP, for example: loopbacks, internal point-to-point links, etc. The same applies to IPv6, where the first sixteen /64s were kept for loopbacks (the first /64) and internal point-to-point links (the next fifteen /64s).

The address for the point to point link between Regional ISP 1 and Regional ISP 2 is given in this table:

| **Link** | **IPv4** | **IPv6** |
|---|---|---|
| Transit 1 to Transit 2 | 100.121.0.0/30 | 2001:18:0:0::/127 |

# Diagram

The following diagram shows the address plan as implemented in the lab topology.


Group 6
AS60
B6
P6
C6
A6
fa0/0: 100.122.1.10
2001:19:0:12::1
g1/0: 100.68.6.18
2001:DB8:6:10::1
g1/0: 100.68.6.17
2001:DB8:6:10::
g1/0: 100.68.6.22
2001:DB8:6:11::1
g2/0: 100.68.6.21
2001:DB8:6:11::
fa0/0: 100.68.6.25
2001:DB8:6:12::
fa0/0: 100.68.5.26
2001:DB8:5:12::1
Group 5
AS50
B5
P5
C5
A5
fa0/0: 100.122.1.6
2001:19:0:11::1
g1/0: 100.68.5.18
2001:DB8:5:10::1
g1/0: 100.68.5.17
2001:DB8:5:10::
g1/0: 100.68.5.22
2001:DB8:5:11::1
g2/0: 100.68.5.21
2001:DB8:5:11::
fa0/0: 100.68.5.25
2001:DB8:5:12::
fa0/0: 100.68.5.26
2001:DB8:5:12::1
AS122
TR2
g4/0
fa0/1: 100.122.1.9
2001:19:0:12::
fa0/1: 100.122.1.5
2001:19:0:11::
fa0/0: 100.122.1.1
2001:19:0:10::
Group 4
AS40
B4
P4
C4
A4
fa0/0: 100.122.1.2
2001:19:0:10::1
g1/0: 100.68.4.18
2001:DB8:4:10::1
g1/0: 100.68.4.17
2001:DB8:4:10::
g1/0: 100.68.4.22
2001:DB8:4:11::1
g2/0: 100.68.4.21
2001:DB8:4:11::
fa0/0: 100.68.4.25
2001:DB8:4:12::
fa0/0: 100.68.4.26
2001:DB8:4:12::1
Group 3
AS30
B3
P3
C3
A3
fa0/0: 100.121.1.10
2001:18:0:12::1
g1/0: 100.68.3.18
2001:DB8:3:10::1
g1/0: 100.68.3.17
2001:DB8:3:10::
g1/0: 100.68.3.22
2001:DB8:3:11::1
g2/0: 100.68.3.21
2001:DB8:3:11::
fa0/0: 100.68.3.25
2001:DB8:3:12::
fa0/0: 100.68.3.26
2001:DB8:3:12::1
Group 2
AS20
B2
P2
C2
A2
fa0/0: 100.121.1.6
2001:18:0:11::1
g1/0: 100.68.2.18
2001:DB8:2:10::1
g1/0: 100.68.2.17
2001:DB8:2:10::
g1/0: 100.68.2.22
2001:DB8:2:11::1
g2/0: 100.68.2.21
2001:DB8:2:11::
fa0/0: 100.68.2.25
2001:DB8:2:12::
fa0/0: 100.68.2.26
2001:DB8:2:12::1
AS121
TR1
g4/0
fa0/1: 100.121.1.9
2001:18:0:12::
fa0/1: 100.121.1.5
2001:18:0:11::
fa0/0: 100.121.1.1
2001:18:0:10::
Group 1
AS10
B1
P1
C1
A1
fa0/0: 100.121.1.2
2001:18:0:10::1
g1/0: 100.68.1.18
2001:DB8:1:10::1
g1/0: 100.68.1.17
2001:DB8:1:10::
g1/0: 100.68.1.22
2001:DB8:1:11::1
g2/0: 100.68.1.21
2001:DB8:1:11::
fa0/0: 100.68.1.25
2001:DB8:1:12::
fa0/0: 100.68.1.26
2001:DB8:1:12::1

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