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IPv6 Subnetting

Your organization receives 2001:db8:abba::/48 from an ISP. (/48 prefix gives you 2^{80} bits in the usable pool)

Remember that subnets are /64, point-to-point links are /127, and loopbacks use /128.

This leaves one block of hex digits (2^{16}) for subnetting.

Defining the Site ID

In order to allow for proper route aggregation and summarization you should define **Site ID**s that you can use at each location (e.g. office, data center, geographic region), and possibly sub-Site ID's.

Subnetting will vary according to business needs; when possible, you can break things down along the nibble boundary to make the notation process in hexadecimal simpler. This gives you the following options:

Option A

2 bits for sites plus 2 bits for sub-sites (first nibble), the remaining three nibbles for subnets (2^{12}) – resulting in 4 sites, each containing 4 sub-sites, each of which has 4096 subnets.

Option B

4 bits (nibble) for sites, plus 4 bits (nibble) for sub-sites and the remaining 8 bits (byte) for subnets – resulting in 16 sites, each containing 16 sub-sites, each of which has 256 subnets.

Option C

4 bits (nibble) for sites, 8 bits (byte) for sub-sites, and the remaining 4 bits for subnets – resulting in 16 sites, each containing 256 sub-sites, each of which has 16 subnets.

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Case Study

- medium sized business
- bureaus and data centers in Canada (12), Europe (25), and the Middle East (14)
    - Canada: Toronto (4), Montreal (2), Winnipeg (2), Vancouver (2), St.John (2)
    - Europe: London (4), Paris (4), Berlin (2), Reykjavík (1), Monaco (2), Barcelona (2), Uppsala (2), Kiev (2), Amsterdam (2), Luxembourg (2), Naples (2)
    - Middle East: Jerusalem (4), Be'er Sheva (4), Osaka (2), Shanghai (2), Manila (2)
- assigned 2001:db8:abba:0:/48
- use Site ID's at the continent level, and sub-sites for countries
    - use four continental aggregates (with number of countries), Africa (57), Asia (44), The Americas & Oceana (49), Europe (47)

1. The sites that we are currently assigning IPv6 to are:

   Asia (44)
   The Americas & Oceania (49)
   Europe (47)

2. Number of bits for the Site ID's, sub-site (level II), sub-site (level III), and subnets (subnetting on the nibble boundary is not ideal in this case):

   4 bits for Site ID's
   8 bits for sub-sites:
   a) 4 bits for sub-site (level II)
   b) 4 bits for sub-site (level III)
   Remaining 4 bits subnets

3. Assign site prefixes (continents):

   1) Asia ==> 2001:db8:abba:1000::/52

   2) The Americas & Oceania ==> 2001:db8:abba:2000::/52

   3) Europe ==> 2001:db8:abba:3000::/52

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4. Assign sub-site (level II – countries):

1) Asia:

Israel ==> 2001:db8:abba:1100::/56

Japan ==> 2001:db8:abba:1200::/56

China ==> 2001:db8:abba:1300::/56

Philippines ==> 2001:db8:abba:1400::/56

2) The Americas & Oceania:

Canada ==> 2001:db8:abba:2100::/56

3) Europe:

England ==> 2001:db8:abba:3100::/56

France ==> 2001:db8:abba:3200::/56

Germany ==> 2001:db8:abba:3300::/56

Iceland ==> 2001:db8:abba:3400::/56

Spain ==> 2001:db8:abba:3500::/56

Sweden ==> 2001:db8:abba:3600::/56

Ukraine ==> 2001:db8:abba:3700::/56

Netherlands ==> 2001:db8:abba:3800::/56

Luxembourg ==> 2001:db8:abba:3900::/56

Italy ==> 2001:db8:abba:3a00::/56

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5. Assign sub-sub-site (level III – cities):

1) Asia:

Jerusalem ==> 2001:db8:abba:1110::/60 |
| Israel
Be’er Sheva ==> 2001:db8:abba:1120::/60 |

Osaka ==> 2001:db8:abba:1210::/60

Shanghai ==> 2001:db8:abba:1310::/60

Manila ==> 2001:db8:abba:1410::/60

2) The Americas & Oceania:

Toronto ==> 2001:db8:abba:2110::/60 |

Montreal ==> 2001:db8:abba:2120::/60 |

Winnipeg ==> 2001:db8:abba:2130::/60 | Canada

Vancouver ==> 2001:db8:abba:2140::/60 |

St.John ==> 2001:db8:abba:2150::/60 |

2) Europe:

London ==> 2001:db8:abba:3110::/60

Paris ==> 2001:db8:abba:3210::/60 |
| France
Monaco ==> 2001:db8:abba:3220::/60 |

Berlin ==> 2001:db8:abba:3310::/60

Reykjavik ==> 2001:db8:abba:3410::/60

Barcelona ==> 2001:db8:abba:3510::/60

Uppsala ==> 2001:db8:abba:3610::/60

Kiev ==> 2001:db8:abba:3710::/60

Amsterdam ==> 2001:db8:abba:3810::/60

Luxembourg ==> 2001:db8:abba:3910::/60

Naples ==> 2001:db8:abba:3a10::/60

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6. Assign the subnets for (some) of the cities:

Shanghai:
2001:db8:abba:1310::/64
2001:db8:abba:1311::/64
2001:db8:abba:1312::/64

Kiev:
2001:db8:abba:3710::/64
2001:db8:abba:3711::/64
2001:db8:abba:3712::/64

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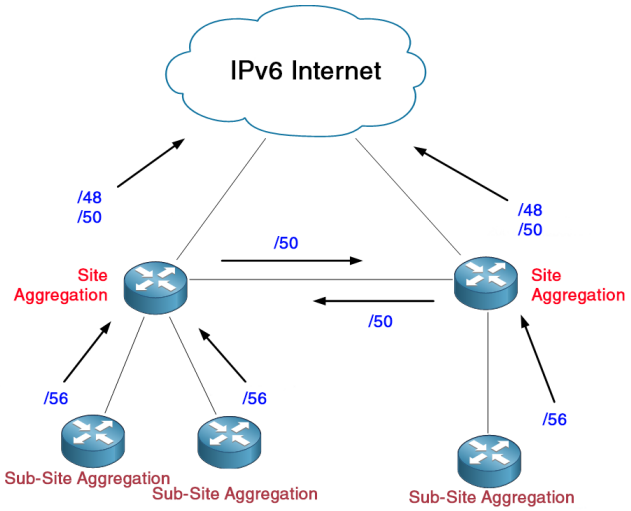
Routing

The /64 subnets will advertise themselves upstream to routers, as will the /62 prefixes. Each of the sub-sites will advertise their /56 prefix up to an aggregation router.

Each aggregation router will be connected to the IPv6 Internet and announce both the enterprise wide /48 and the site /50, as well as advertising their own /50. This provides redundant connectivity via the internet and allows the internet to use longest match to reach the site directly.



Requirements

The decision regarding subnetting simply aligns the subnetting with the specific business goals and requirements. There are no requirements regarding the site and sub-site or even how these are broken down. These examples are provided simply as illustrations.