IPAM: Why a spreadsheet won't cut it for IPv6 address management

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Topics

- What is IP[v6] address management?
- IPv6 block allocation
- IPv6 host assignment
- Configuring DNS and DHCP
- The cost of spreadsheets
- How can IPAM help streamline my deployment?

IPv6 address management

- Manage IPv6 address space in the context of IPv4 network and routing topology
  - Hierarchical allocation of multiple IPv6 blocks/subnets
  - Subnet host and address pool tracking
  - DNS domain ←→ IP address space management
- Manage configuration of DHCP and DHCPv6 configurations in accordance with the address plan
- Manage configuration of DNS zones and host resource records in accordance with the address plan

Today with IPv4, many use spreadsheets to manage address space and text files, scripts or MMC for DNS/DHCP configuration

Spreadsheet heaven

	Regional Site	Sites
1		
2	**Regional Site**	**Sites**
3	Philadelphia	
4	Philadelphia	
5		Core Backbone Net
6		Philadelphia - Exec
7		Philadelphia - Finance
8		Philadelphia - Operations
9		Philadelphia - Technology
10		Philadelphia - Marketing
11		Philadelphia - R&D
12		
13	Norristown	
14		Norristown
15		Toronto
16		Nashua
17		Newark
18		Baltimore
19		Pittsburgh
20		Charlotte
21		Atlanta
22		Providence
23		Quincy
24		Albany
25		Manhatten
26		Norristown
27		Reston
28		Richmond
29		Charleston
30		Montgomery

Spreadsheet heaven

	Regional Site	Sites	Subnets
3	Philadelphia		**10.0.0.0/12**
4	Philadelphia		**10.0.0.0/16**
5		Core Backbone Net	10.3.0.0/26
6		Philadelphia - Exec	10.0.0.0/22
7		Philadelphia - Finance	10.0.4.0/22
8		Philadelphia - Operations	10.0.8.0/22
9		Philadelphia - Technology	10.0.12.0/22
10		Philadelphia - Marketing	10.0.16.0/22
11		Philadelphia - R&D	10.0.20.0/22
13	Norristown		**10.0.64.0/18**
14		Norristown	10.0.64.0/23
15		Toronto	10.0.66.0/23
16		Nashua	10.0.68.0/23
17		Newark	10.0.70.0/23
18		Baltimore	10.0.72.0/23
19		Pittsburgh	10.0.74.0/23
20		Charlotte	10.0.76.0/23
21		Atlanta	10.0.77.0/24
22		Providence	10.0.78.0/24
23		Quincy	10.0.79.0/24
24		Albany	10.0.80.0/24
25		Manhatten	10.0.81.0/24
26		Norristown	10.0.82.0/24
27		Reston	10.0.83.0/24
28		Richmond	10.0.84.0/24
29		Charleston	10.0.85.0/24
30		Montgomery	10.0.86.0/24

Spreadsheet heaven?

Regional Site	Sites	Infrastructure Nets	VoIP Nets	Wireless Nets
Philadelphia		**10.0.0.0/12**	**10.16.0.0/12**	**10.32.0.0/12**
Philadelphia		**10.0.0.0/16**	**10.16.0.0/16**	**10.32.0.0/16**
	Core Backbone Net	10.3.0.0/26		
	Philadelphia - Exec	10.0.0.0/22	10.16.0.0/22	10.32.0.0/22
	Philadelphia - Finance	10.0.4.0/22	10.16.4.0/22	10.32.4.0/22
	Philadelphia - Operations	10.0.8.0/22	10.16.8.0/22	10.32.8.0/22
	Philadelphia - Technology	10.0.12.0/22	10.16.12.0/22	10.32.12.0/22
	Philadelphia - Marketing	10.0.16.0/22	10.16.16.0/22	10.32.16.0/22
	Philadelphia - R&D	10.0.20.0/22	10.16.20.0/22	10.32.20.0/22
Norristown		**10.0.64.0/18**	**10.16.64.0/18**	**10.32.64.0/18**
	Norristown	10.0.64.0/23	10.16.64.0/23	10.32.64.0/23
	Toronto	10.0.66.0/23	10.16.66.0/23	10.32.66.0/23
	Nashua	10.0.68.0/23	10.16.68.0/23	10.32.68.0/23
	Newark	10.0.70.0/23	10.16.70.0/23	10.32.70.0/23
	Baltimore	10.0.72.0/23	10.16.72.0/23	10.32.72.0/23
	Pittsburgh	10.0.74.0/23	10.16.74.0/23	10.32.74.0/23
	Charlotte	10.0.76.0/23	10.16.76.0/23	10.32.76.0/23
	Atlanta	10.0.77.0/24	10.16.77.0/24	10.32.77.0/24
	Providence	10.0.78.0/24	10.16.78.0/24	10.32.78.0/24
	Quincy	10.0.79.0/24	10.16.79.0/24	10.32.79.0/24
	Albany	10.0.80.0/24	10.16.80.0/24	10.32.80.0/24
	Manhatten	10.0.81.0/24	10.16.81.0/24	10.32.81.0/24
	Norristown	10.0.82.0/24	10.16.82.0/24	10.32.82.0/24
	Reston	10.0.83.0/24	10.16.83.0/24	10.32.83.0/24
	Richmond	10.0.84.0/24	10.16.84.0/24	10.32.84.0/24
	Charleston	10.0.85.0/24	10.16.85.0/24	10.32.85.0/24
	Montgomery	10.0.86.0/24	10.16.86.0/24	10.32.86.0/24

Spreadsheet purgatory

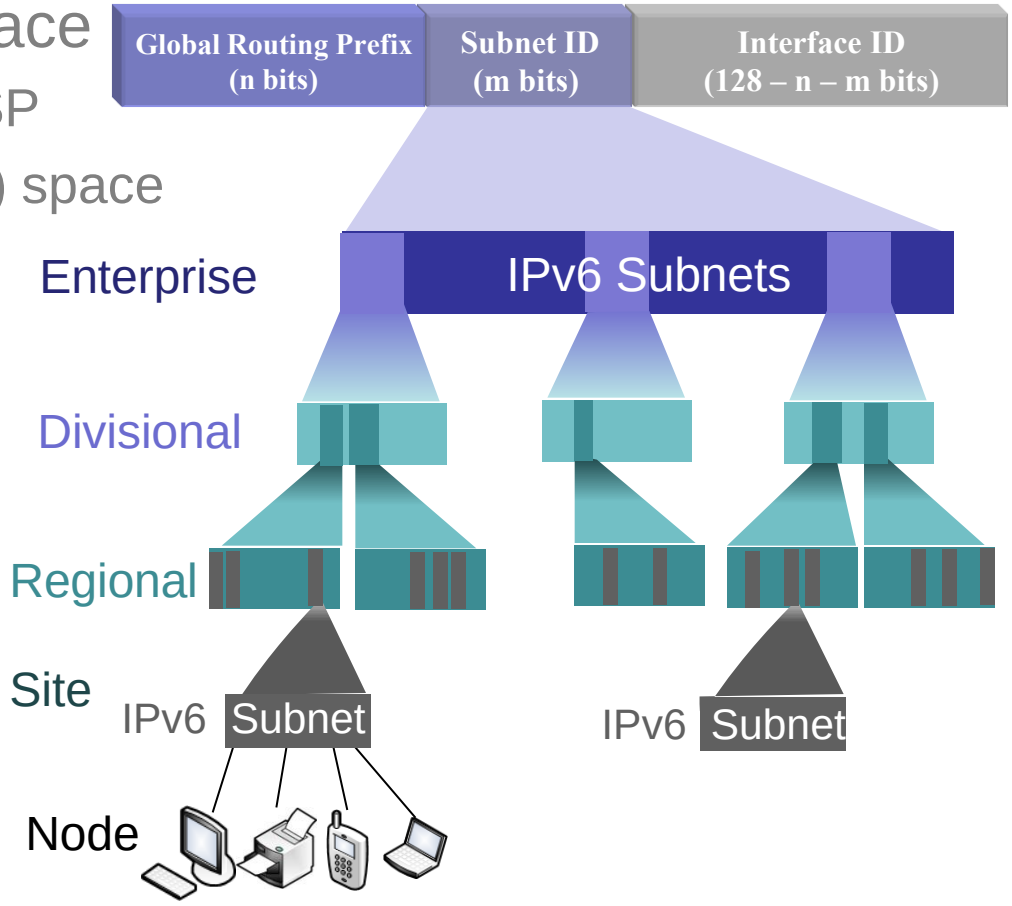
Regional Site	Sites	Infrastructure Nets	VoIP Nets	Wireless Nets	Public IPv6
Philadelphia		**10.0.0.0/12**	**10.16.0.0/12**	**10.32.0.0/12**	**2001:db8:4af0::/52**
Philadelphia		**10.0.0.0/16**	**10.16.0.0/16**	**10.32.0.0/16**	**2001:db8:4af0::/56**
	Core Backbone Net	10.3.0.0/26			2001:db8:4af0:0:8000::/64
	Philadelphia - Exec	10.0.0.0/22	10.16.0.0/22	10.32.0.0/22	2001:db8:4af0::/64
	Philadelphia - Finance	10.0.4.0/22	10.16.4.0/22	10.32.4.0/22	2001:db8:4af0:1::/64
	Philadelphia - Operations	10.0.8.0/22	10.16.8.0/22	10.32.8.0/22	2001:db8:4af0:2::/64
	Philadelphia - Technology	10.0.12.0/22	10.16.12.0/22	10.32.12.0/22	2001:db8:4af0:3::/64
	Philadelphia - Marketing	10.0.16.0/22	10.16.16.0/22	10.32.16.0/22	2001:db8:4af0:4::/64
	Philadelphia - R&D	10.0.20.0/22	10.16.20.0/22	10.32.20.0/22	2001:db8:4af0:5::/64
Norristown		**10.0.64.0/18**	**10.16.64.0/18**	**10.32.64.0/18**	**2001:db8:4af0:8000::/56**
	Norristown	10.0.64.0/23	10.16.64.0/23	10.32.64.0/23	2001:db8:4af0:8000::/64
	Toronto	10.0.66.0/23	10.16.66.0/23	10.32.66.0/23	2001:db8:4af0:8001::/64
	Nashua	10.0.68.0/23	10.16.68.0/23	10.32.68.0/23	2001:db8:4af0:8002::/64
	Newark	10.0.70.0/23	10.16.70.0/23	10.32.70.0/23	2001:db8:4af0:8003::/64
	Baltimore	10.0.72.0/23	10.16.72.0/23	10.32.72.0/23	2001:db8:4af0:8004::/64
	Pittsburgh	10.0.74.0/23	10.16.74.0/23	10.32.74.0/23	2001:db8:4af0:8005::/64
	Charlotte	10.0.76.0/23	10.16.76.0/23	10.32.76.0/23	2001:db8:4af0:8006::/64
	Atlanta	10.0.77.0/24	10.16.77.0/24	10.32.77.0/24	2001:db8:4af0:8007::/64
	Providence	10.0.78.0/24	10.16.78.0/24	10.32.78.0/24	2001:db8:4af0:8008::/64
	Quincy	10.0.79.0/24	10.16.79.0/24	10.32.79.0/24	2001:db8:4af0:8009::/64
	Albany	10.0.80.0/24	10.16.80.0/24	10.32.80.0/24	2001:db8:4af0:800a::/64
	Manhatten	10.0.81.0/24	10.16.81.0/24	10.32.81.0/24	2001:db8:4af0:800b::/64
	Norristown	10.0.82.0/24	10.16.82.0/24	10.32.82.0/24	2001:db8:4af0:800c::/64
	Reston	10.0.83.0/24	10.16.83.0/24	10.32.83.0/24	2001:db8:4af0:800d::/64
	Richmond	10.0.84.0/24	10.16.84.0/24	10.32.84.0/24	2001:db8:4af0:800e::/64
	Charleston	10.0.85.0/24	10.16.85.0/24	10.32.85.0/24	2001:db8:4af0:800f::/64
	Montgomery	10.0.86.0/24	10.16.86.0/24	10.32.86.0/24	2001:db8:4af0:8010::/64

Spreadsheet hell? – not yet!

Regional Site	Sites	Infrastructure Nets	VoIP Nets	Wireless Nets	Public IPv6	IPv6 ULA
Philadelphia		**10.0.0.0/12**	**10.16.0.0/12**	**10.32.0.0/12**	**2001:db8:4af0::/52**	**fd01:273e:90a::/52**
Philadelphia		**10.0.0.0/16**	**10.16.0.0/16**	**10.32.0.0/16**	**2001:db8:4af0::/56**	**fd01:273e:90a:8000::/52**
	Core Backbone Net	10.3.0.0/26			2001:db8:4af0:0:8000::/64	fd01:273e:90a:0:8000::/64
	Philadelphia - Exec	10.0.0.0/22	10.16.0.0/22	10.32.0.0/22	2001:db8:4af0::/64	fd01:273e:90a::/64
	Philadelphia - Finance	10.0.4.0/22	10.16.4.0/22	10.32.4.0/22	2001:db8:4af0:1::/64	fd01:273e:90a:1::/64
	Philadelphia - Operations	10.0.8.0/22	10.16.8.0/22	10.32.8.0/22	2001:db8:4af0:2::/64	fd01:273e:90a:2::/64
	Philadelphia - Technology	10.0.12.0/22	10.16.12.0/22	10.32.12.0/22	2001:db8:4af0:3::/64	fd01:273e:90a:3::/64
	Philadelphia - Marketing	10.0.16.0/22	10.16.16.0/22	10.32.16.0/22	2001:db8:4af0:4::/64	fd01:273e:90a:4::/64
	Philadelphia - R&D	10.0.20.0/22	10.16.20.0/22	10.32.20.0/22	2001:db8:4af0:5::/64	fd01:273e:90a:5::/64
Norristown		**10.0.64.0/18**	**10.16.64.0/18**	**10.32.64.0/18**	**2001:db8:4af0:8000::/56**	**fd01:273e:90a:8000::/56**
	Norristown	10.0.64.0/23	10.16.64.0/23	10.32.64.0/23	2001:db8:4af0:8000::/64	fd01:273e:90a:8000::/64
	Toronto	10.0.66.0/23	10.16.66.0/23	10.32.66.0/23	2001:db8:4af0:8001::/64	fd01:273e:90a:8001::/64
	Nashua	10.0.68.0/23	10.16.68.0/23	10.32.68.0/23	2001:db8:4af0:8002::/64	fd01:273e:90a:8002::/64
	Newark	10.0.70.0/23	10.16.70.0/23	10.32.70.0/23	2001:db8:4af0:8003::/64	fd01:273e:90a:8003::/64
	Baltimore	10.0.72.0/23	10.16.72.0/23	10.32.72.0/23	2001:db8:4af0:8004::/64	fd01:273e:90a:8004::/64
	Pittsburgh	10.0.74.0/23	10.16.74.0/23	10.32.74.0/23	2001:db8:4af0:8005::/64	fd01:273e:90a:8005::/64
	Charlotte	10.0.76.0/23	10.16.76.0/23	10.32.76.0/23	2001:db8:4af0:8006::/64	fd01:273e:90a:8006::/64
	Atlanta	10.0.77.0/24	10.16.77.0/24	10.32.77.0/24	2001:db8:4af0:8007::/64	fd01:273e:90a:8007::/64
	Providence	10.0.78.0/24	10.16.78.0/24	10.32.78.0/24	2001:db8:4af0:8008::/64	fd01:273e:90a:8008::/64
	Quincy	10.0.79.0/24	10.16.79.0/24	10.32.79.0/24	2001:db8:4af0:8009::/64	fd01:273e:90a:8009::/64
	Albany	10.0.80.0/24	10.16.80.0/24	10.32.80.0/24	2001:db8:4af0:800a::/64	fd01:273e:90a:800a::/64
	Manhatten	10.0.81.0/24	10.16.81.0/24	10.32.81.0/24	2001:db8:4af0:800b::/64	fd01:273e:90a:800b::/64
	Norristown	10.0.82.0/24	10.16.82.0/24	10.32.82.0/24	2001:db8:4af0:800c::/64	fd01:273e:90a:800c::/64
	Reston	10.0.83.0/24	10.16.83.0/24	10.32.83.0/24	2001:db8:4af0:800d::/64	fd01:273e:90a:800d::/64
	Richmond	10.0.84.0/24	10.16.84.0/24	10.32.84.0/24	2001:db8:4af0:800e::/64	fd01:273e:90a:800e::/64
	Charleston	10.0.85.0/24	10.16.85.0/24	10.32.85.0/24	2001:db8:4af0:800f::/64	fd01:273e:90a:800f::/64
	Montgomery	10.0.86.0/24	10.16.86.0/24	10.32.86.0/24	2001:db8:4af0:8010::/64	fd01:273e:90a:8010::/64

IPv6 address assignment

- Obtaining IPv6 address space
  - Regional Internet Registry/ISP
  - Unicast Local Address (ULA) space
- IPv6 address allocation
  - Hierarchical
  - Association with IPv4 space
- Node level
  - Address assignment policy
  - Autoconfiguration
  - DHCPv6 pools
  - DNS zones and resource records

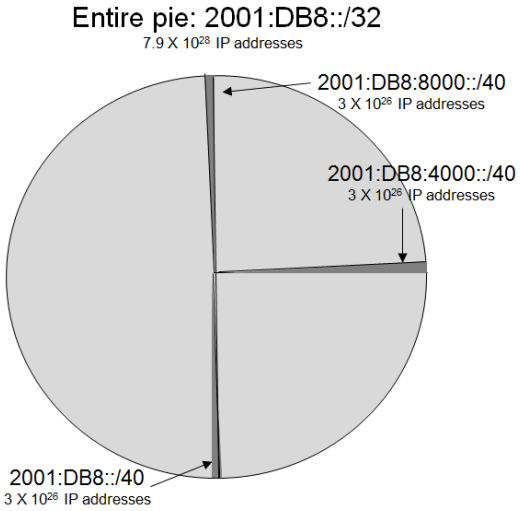


BT Diamond IP

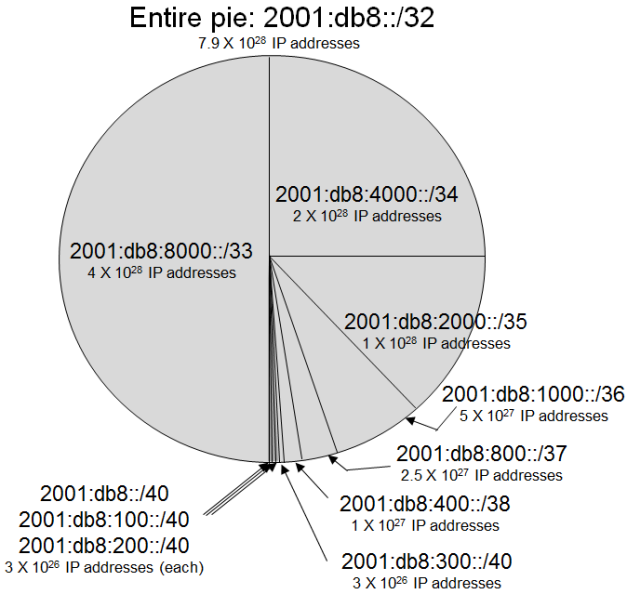
IPv6 address allocation

- Sparse (RFC 3531)
  - Allocate SubnetID counting right to left

  - 1000 0000, 0100 0000, 1100 0000 (80, 40, c0, 20, a0, …)
  - Top level allocations – “room for growth”



- Best fit
  - Allocate smallest available candidate block
  - Optimizes address allocation efficiency

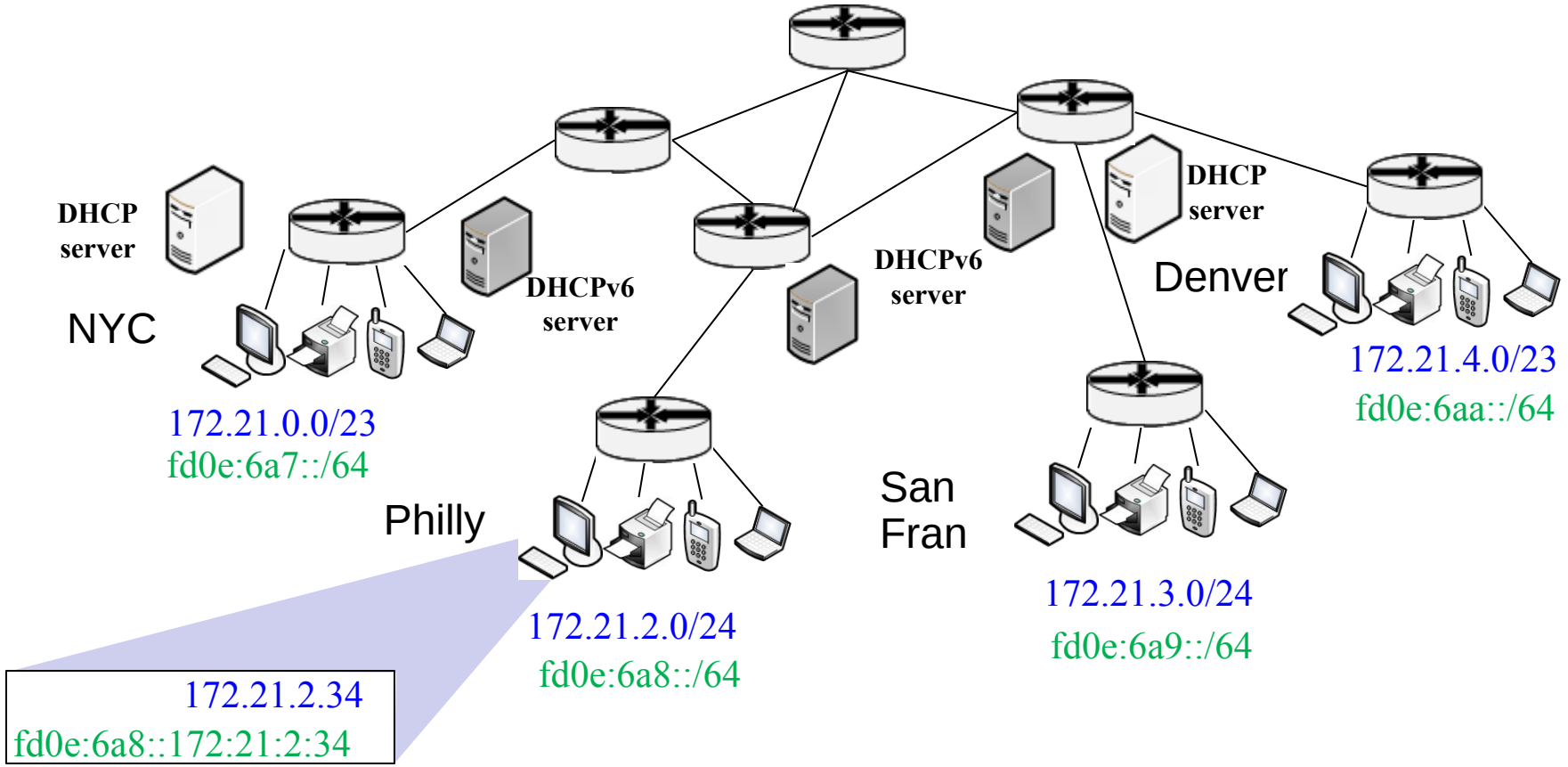


- Prefix delegation
  - DHCPv6 protocol to allocate prefixes

BT Diamond IP

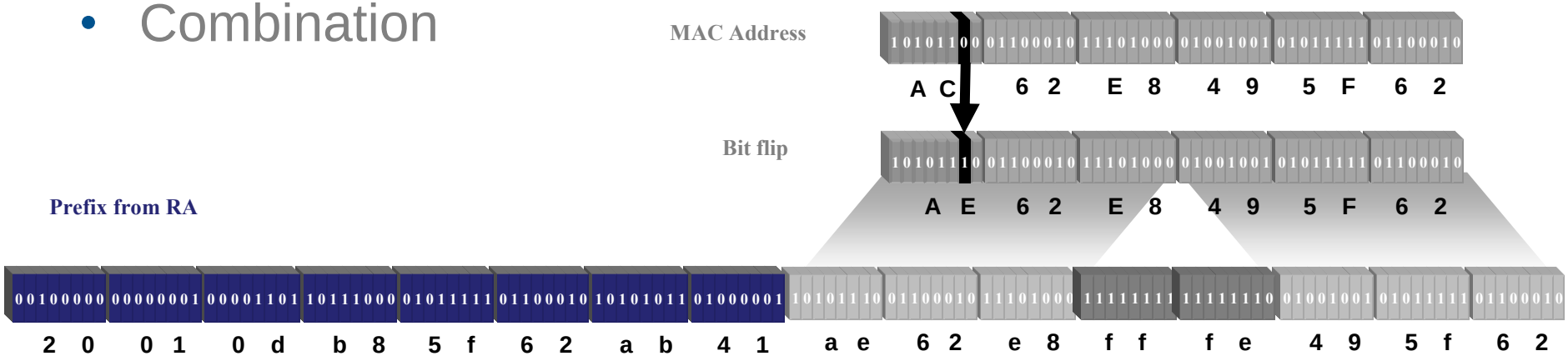
IPv4-IPv6 address association

- Trade-off correlation vs. privacy



Host IPv6 address assignment methods

- Static
  - Manually configure an IPv6 address
- DHCPv6 – “stateful”
  - Similar to DHCPv4
- SLAAC – Stateless address autoconfiguration
  - Prefix based on router advertisement
  - Interface ID derivation based on MAC
- Combination

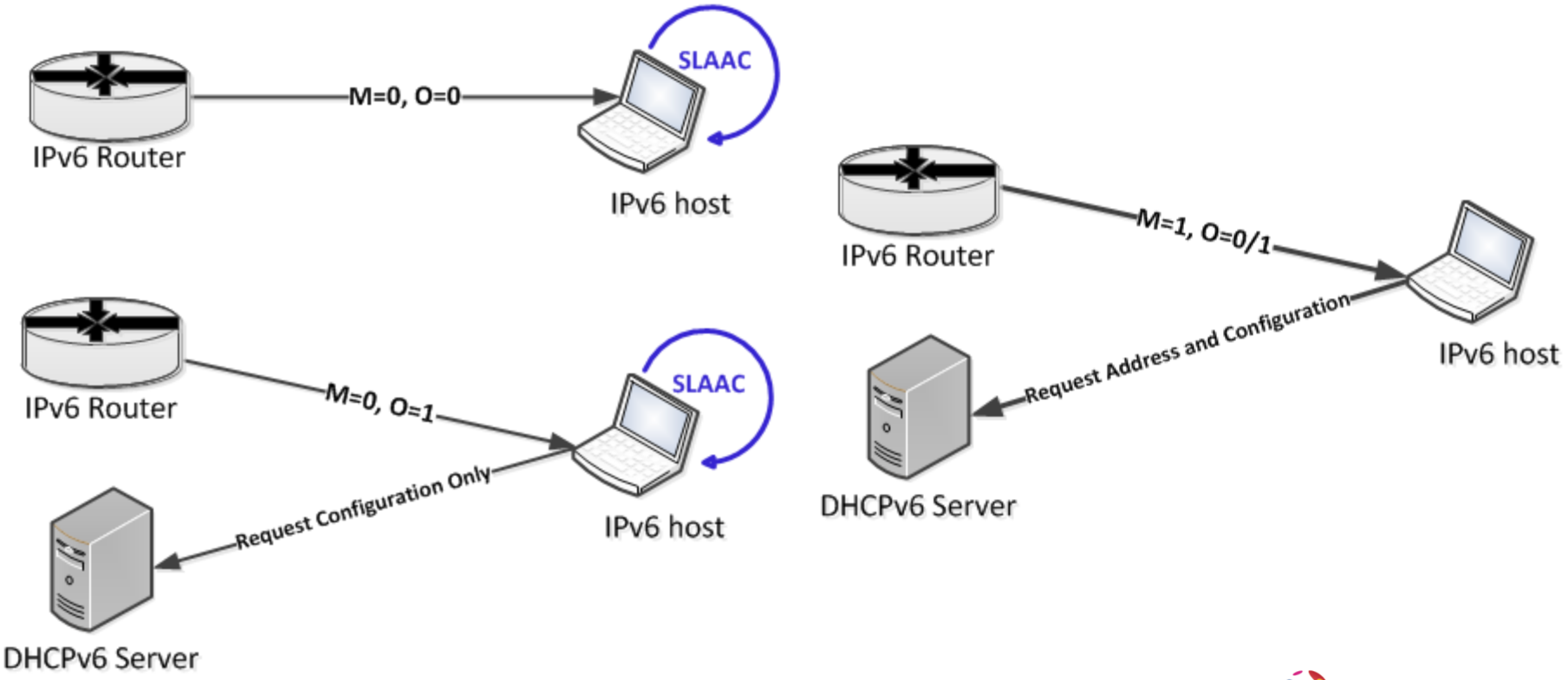


2001:db8:5f62:ab41:ae62:e8ff:fe49:5f62

BT Diamond IP

SLAAC availability via router advertisements

Flag	O=0	O=1
M=0	No DHCPv6	DHCPv6 for configuration information only
M=1	DHCPv6 for address and configuration information	DHCPv6 for address and configuration information



BT Diamond IP

DHCPv6 deployment considerations

- Potential capital requirement
  - DHCPv6 on separate server from IPv4 DHCP
- Address assignment policy
  - SLAAC
  - SLAAC with DHCPv6
  - DHCPv6 without SLAAC
- Address privacy vs. stability
  - Difficulty with “reserving” addresses in DHCPv6
- DHCP redundancy
  - Split scopes with preference option
  - Failover protocol in progress in IETF DHC WG

Back to the spreadsheet

Philadelphia - Operations				
VoIP Subnet:	10.16.8.0/22			
IP Address	**Hostname**	**Device Type**	**Assignment Method**	**Hardware Address**
10.16.8.1	phl-core01	Gateway/Router	Manual	C8-00-21-07-39-F1
10.16.8.2	phl-core02	Gateway/Router	Manual	C8-00-22-FE-A9-01
10.16.8.3	phl-hqops01	Switch	Manual	00-12-65-91-00-27
10.16.8.4	phl-hpops02	Switch	Manual	00-12-65-91-1E-B1
10.16.8.5			Reserved	
10.16.8.6			Reserved	
10.16.8.7			Reserved	
10.16.8.8	hqops-print01	Printer	M-DHCP	45-6A-01-00-0D-98
10.16.8.9	hqops-print02	Printer	M-DHCP	45-6A-01-20-3D-F0
10.16.8.10	hqops-print03	Printer	M-DHCP	45-6A-01-01-65-D1
10.16.8.11	hqops-print04	Printer	M-DHCP	45-6A-01-94-30-9E
10.16.8.12	hqops-print05	Printer	M-DHCP	45-6A-01-89-A2-0C
10.16.8.13	hqops-print06	Printer	M-DHCP	45-6A-01-0A-A9-8B
10.16.8.14	hqops-print07	Printer	M-DHCP	45-6A-01-49-01-FE
10.16.8.15	opsfile41	Server	Manual	
10.16.8.16	opsfile42	Server	Manual	
10.16.8.17	opsfile43	Server	Manual	
10.16.8.18	opsfile44	Server	Manual	
10.16.8.19	opsfile45	Server	Manual	
10.16.8.20	opsfile46	Server	Manual	
10.16.8.21-10.16.8.50			Reserved for servers 2012	
10.16.8.51-10.16.11.254		VoIP Phones	D-DHCP	

Insert IPv6 column

Philadelphia - Operations					
VoIP Subnet:	10.16.8.0/22	fd01:273e:90a:2::/64			
IPv4 Address	**IPv6 Address**	**Hostname**	**Device Type**	**Assignment Method**	**Hardware Address**
10.16.8.1	fd01:273e:90a:2:10:16:8:1	phl-core01	Gateway/Router	Manual	C8-00-21-07-39-F1
10.16.8.2	fd01:273e:90a:2:10:16:8:2	phl-core02	Gateway/Router	Manual	C8-00-22-FE-A9-01
10.16.8.3	fd01:273e:90a:2:10:16:8:3	phl-hqops01	Switch	Manual	00-12-65-91-00-27
10.16.8.4	fd01:273e:90a:2:10:16:8:4	phl-hpops02	Switch	Manual	00-12-65-91-1E-B1
10.16.8.5	fd01:273e:90a:2:10:16:8:5			Reserved	
10.16.8.6	fd01:273e:90a:2:10:16:8:6			Reserved	
10.16.8.7	fd01:273e:90a:2:10:16:8:7			Reserved	
10.16.8.8	fd01:273e:90a:2:10:16:8:8	hqops-print01	Printer	M-DHCP	45-6A-01-00-0D-98
10.16.8.9	fd01:273e:90a:2:10:16:8:9	hqops-print02	Printer	M-DHCP	45-6A-01-20-3D-F0
10.16.8.10	fd01:273e:90a:2:10:16:8:10	hqops-print03	Printer	M-DHCP	45-6A-01-01-65-D1
10.16.8.11	fd01:273e:90a:2:10:16:8:11	hqops-print04	Printer	M-DHCP	45-6A-01-94-30-9E
10.16.8.12	fd01:273e:90a:2:10:16:8:12	hqops-print05	Printer	M-DHCP	45-6A-01-89-A2-0C
10.16.8.13	fd01:273e:90a:2:10:16:8:13	hqops-print06	Printer	M-DHCP	45-6A-01-0A-A9-8B
10.16.8.14	fd01:273e:90a:2:10:16:8:14	hqops-print07	Printer	M-DHCP	45-6A-01-49-01-FE
10.16.8.15	fd01:273e:90a:2:10:16:8:15	opsfile41	Server	Manual	
10.16.8.16	fd01:273e:90a:2:10:16:8:16	opsfile42	Server	Manual	
10.16.8.17	fd01:273e:90a:2:10:16:8:17	opsfile43	Server	Manual	
10.16.8.18	fd01:273e:90a:2:10:16:8:18	opsfile44	Server	Manual	
10.16.8.19	fd01:273e:90a:2:10:16:8:19	opsfile45	Server	Manual	
10.16.8.20	fd01:273e:90a:2:10:16:8:20	opsfile46	Server	Manual	
10.16.8.21-10.16.8.50				Reserved for servers 2012	
10.16.8.51-10.16.11.254			VoIP Phones	D-DHCP	
	fd01:273e:90a:2:ffff::/80			DHCPv6 pool	

DHCP for IPv6 deployment considerations

- DHCPv6 policies
  - Subnets, prefixes, options
- DUID matching

```
default-lease-time 86400;
max-lease-time 432000;

subnet6 fd01:273e:90a:2::/64 {

   option dhcp6.preference 20;
   range6 fd01:273e:90a:2:ffff:: fd01:273e:90a:2:ffff:ffff:ffff:ffff;

     option dhcp6.name-servers fd01:273e:90a::1a;
     option dhcp6.domain-search "example.com";
     option dhcp6.sntp-servers fd01:273e:90a::19, fd01:273e:90a:8000::30e1;
     option dhcp6.info-refresh-time 43200;

   host hqops-print01 {
      host-identifier option
         dhcp6.client-id 00:01:00:01:4a:1f:ba:e3:45:6a:01:00:0d:98;
         fixed-address6 fd01:273e:90a:2:10:16:8:8;
   }

   host hqops-print02 {
      host-identifier option
         dhcp6.client-id 00:01:00:01:4a:1f:ba:e3:45:6a:01:20:3d:f0;
         fixed-address6 fd01:273e:90a:2:10:16:8:9;
   }

}

subnet6 fd01:273e:90a::/64 {

   option dhcp6.preference 10;
```

DNS association with the IPv6 address plan

- Forward domains
  - Commonly the same, e.g., btdiamondip.com
- Reverse domains
  - Zones required for DNS administrative delegation within network scope
  - ip6.arpa zone(s)
- Resource records
  - AAAA, PTR required for navigability to hosts
  - Publishing AAAA will encourage IPv6 connectivity
  - Other RRTypes – CNAME, DHCID, SRV, etc.

IPv6 DNS Resource Record Types

- AAAA = IPv6 address

  host.btdiamondip.com IN AAAA 2001:db8:b7::a8e1

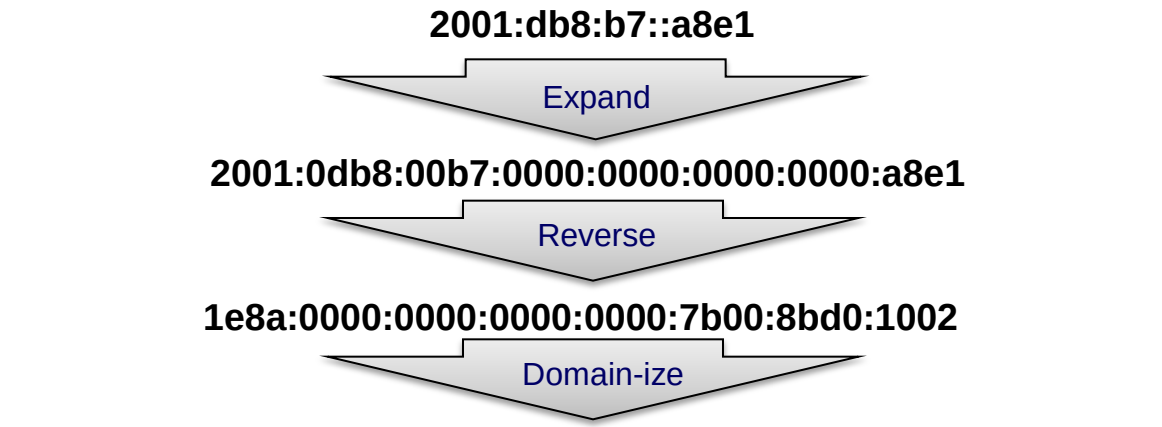
- PTR = pointer

  1.e.8.a.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.7.b.0.0.8.b.d.0.1.0.0.2.ip6.arpa.
  IN PTR host.btdiamondip.com

  Easier:

  $ORIGIN 0.0.0.0.7.b.0.0.8.b.d.0.1.0.0.2.ip6.arpa.

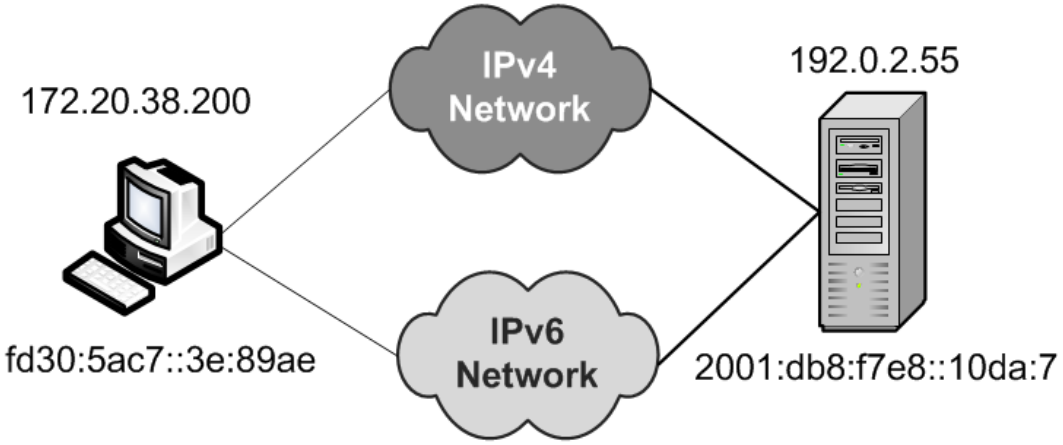
  1.e.8.a.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR host.btdiamondip.com



BT Diamond IP

Source and destination address selection

- RFC 3484 algorithm input:
  - Candidate source addresses - based on sending host's configured IPv4 and IPv6 addresses
  - Destination addresses – derived from DNS queries* for types A & AAAA (getaddrinfo() sockets call)



** Name resolution may alternatively be provided by hosts.txt file, other naming systems or NetBIOS lookups for Windows systems*

DNS implications of address selection

- Major host OSs will attempt to connect via IPv6 first
- Provision of AAAA records for a host will trigger querying dual-stack hosts to connect via IPv6 if possible
- Provision of A records for a host will provide an alternate connection address should IPv6 not be feasible
- Policy table best match will drive source-destination address selection

DNS for IPv6 deployment considerations

- Delegating reverse zones
- Managing PTRs in reverse zones
- Managing AAAA in forward zones

```
example.com.    IN  SOA ns1.example.com. admin.example.com. 2011121384  3600
800  43200  3600

            IN   NS   ns1.example.com.
            IN   NS   ns2.example.com.

phl-core01      IN    A      10.16.8.1
                IN    AAAA   fd01:273e:90a::10:16:8:1

phl-core02      IN    A      10.16.8.2
                IN    AAAA   fd01:273e:90a::10:16:8:2

phl-hqops01     IN    A      10.16.8.3
                IN    AAAA   fd01:273e:90a::10:16:

phl-hqops02     IN    A      10.16.8.4
                IN    AAAA   fd01:273e:90a::10:16:

opsfile41       IN    A      10.16.8.15
                IN    AAAA   fd01:273e:90a::10:16:

opsfile42       IN    A      10.16.8.16
                IN    AAAA   fd01:273e:90a::10:16:

opsfile43       IN    A      10.16.8.17
                IN    AAAA   fd01:273e:90a::10:16:

opsfile44       IN    A      10.16.8.18
                IN    AAAA   fd01:273e:90a::10:16:
```

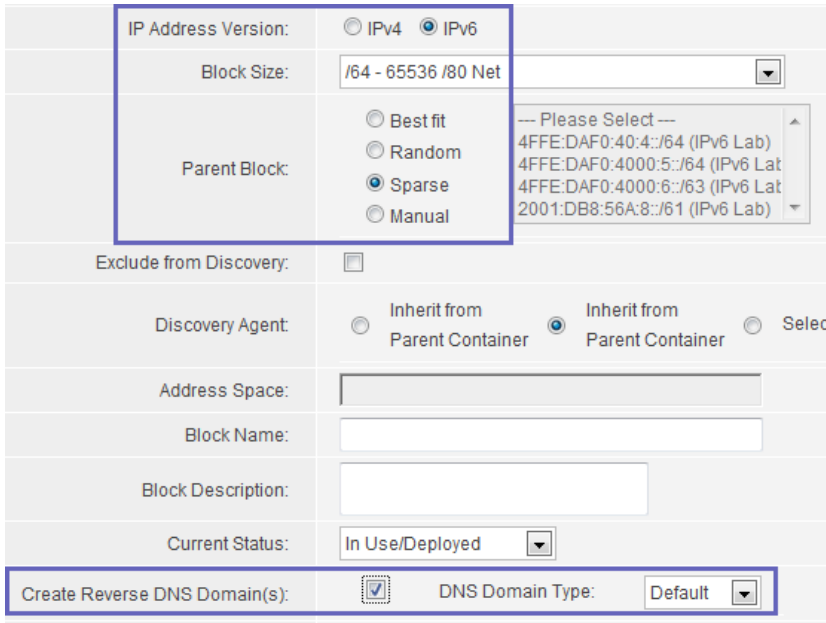
```
0.0.0.0.a.0.9.0.e.3.7.2.1.0.d.f.ip6.arpa.    IN  SOA ns1.example.com.
admin.example.com.  2011121384  3600  800  43200  3600

            IN   NS   ns1.example.com.
            IN   NS   ns2.example.com.

1.0.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   phl-core01.example.com.
2.0.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   phl-core02.example.com.
3.0.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   phl-hqops01.example.com.
4.0.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   phl-hqops02.example.com.

5.1.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   opsfile41.example.com.
6.1.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   opsfile42.example.com.
7.1.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   opsfile43.example.com.
8.1.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   opsfile44.example.com.
9.1.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   opsfile45.example.com.
0.2.0.0.8.0.0.0.6.1.0.0.0.0.1.0.0   IN   PTR   opsfile46.example.com.
```

The cost of spreadsheets

- Free?
- IPAM lifecycle
  - Block/subnet allocations, renumbering
  - Host address assignment
  - DHCP, DHCPv6 server configuration
    - Pools, prefixes, options, policies, client classing
  - DNS server configuration
    - Zones, resource records
- Cost of provisioning time, error detection & correction
  - Duplicate allocations and assignments
  - Miscorrelation spreadsheet ←→ DHCP/v6 server configuration
  - Miscorrelation spreadsheet ←→ DNS server configuration
- Cost of [mis-]management
  - Auditing IP space, accountability, multi-user, reporting

IPv6 address management

- IPv6 subnet allocation and host assignment via mouse clicks, not typing hex!
  - Automated ip6.arpa. domain creation
  - Automated IPv6 host assignment via templates
  - Track dual stack hosts
  - Automated AAAA/PTR record creation
  - Deployment of configurations to DHCP/DNS servers



General | Interfaces | **Resource Records** | Aliases | Ports

Add Resource Record

Select	Owner	Class	Type	TTL	Data	Domain/Zone
☐	fileserv-403	IN	AAAA		2001:db8:56a:1:0:0:0:a	eng.diamondip.com.
☐	fileserv-403	IN	A		172.16.8.201	eng.diamondip.com
☐	a.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.1.0.0.0.a.6.5.0.8.b.d.0.1.0.0.2.ip6.arpa.	IN	PTR		fileserv-403.eng.diamondip.com.	8.b.d.0.1.0.0.2.ip6.arpa
☐	201.8.16.172.in-addr.arpa.	IN	PTR		fileserv-403.eng.diamondip.com.	8.b.d.0.1.0.0.2.ip6.arpa

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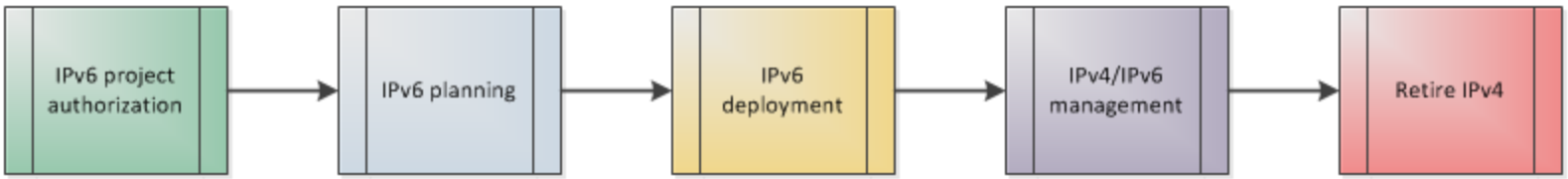
IPv6 deployment – High level process

- Deployment planning
  - Discovery, assessment, design
  - Timeline and budget
- Managing deployment
  - Resource allocation
  - Plan execution
- Post-deployment
  - Managing your IPv4-IPv6 network



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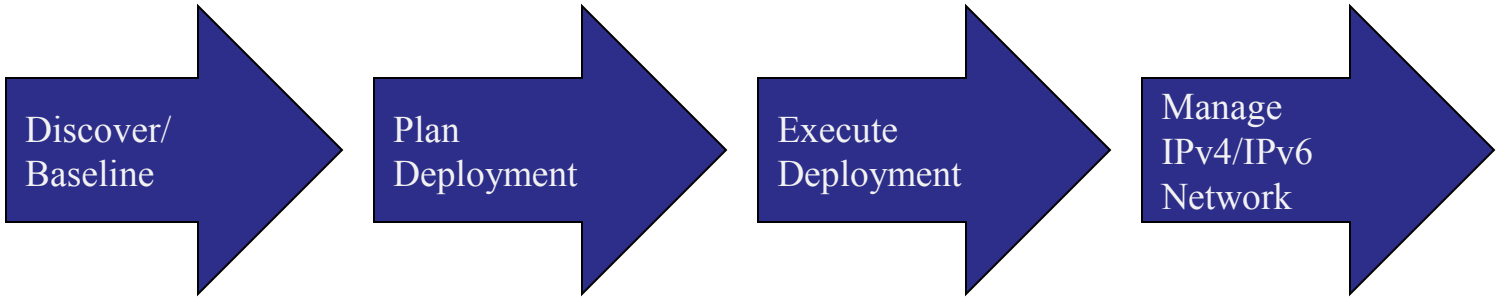
IPAM a critical ingredient to IPv6 deployment

- Baseline current IPv4 address allocations
  - Various discovery mechanism enable documentation and baselining of current IPv4 foundation on which to deploy IPv6
- Define IPv6 address plan
  - Logical containers and automated block allocation facilitate development of IPv6 address plan as overlay on IPv4 baseline
- Track your addressing plan during deployment
  - Use of block states enables pre-allocations then “in-production” states
- Manage IPv4-IPv6 space ongoing
  - Intuitive management of dual stack networks



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