

# Subnet Masking and Addressing

PIX Firewall commands let you use subnet masking for commands that accept network masks, including the **aaa**, **access-list**, **access-group**, **alias**, **conduit**, **debug**, **global**, **ip address**, **nat**, **outbound**, **route**, **static**, **telnet**, and **tunnel** commands. This appendix lists information by subnet mask and identifies which masks are for networks, hosts, and broadcast addresses.

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**Note** In some networks, broadcasts are also sent on the network address.

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This appendix includes the following sections:

- Uses for Subnet Information
- Addresses in the .128 Mask
- Addresses in the .192 Mask
- Addresses in the .224 Mask
- Addresses in the .240 Mask
- Addresses in the .248 Mask
- Addresses in the .252 Mask

The subnet masks are also identified by the number of bits in the mask. Table D-1 lists subnet masks by the number of bits in the network ID.

**Table D-1**      **Masks Listed by Number of Bits**

Network ID Bits	Host ID Bits	Subnet	Example Notation	# of Subnets	# of Hosts on Each Subnet
24	8	.0	192.168.1.1/24	1	254
25	7	.128	192.168.1.1/25	2	126
26	6	.192	192.168.1.1/26	4	62
27	5	.224	192.168.1.1/27	8	30
28	4	.240	192.168.1.1/28	16	14
29	3	.248	192.168.1.1/29	32	6
30	2	.252	192.168.1.1/30	64	2

The .255 mask indicates a single host in a network.

## Uses for Subnet Information

Use subnet information to ensure that your host addresses are in the same subnet and that you are not accidentally using a network or broadcast address for a host.

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**Note** In the sections that follow, the network address provides a way to reference all the addresses in a subnet, which you can use in the **global**, **outbound**, and **static** commands. For example, you can use the following net **static** statement to map global addresses 192.168.1.65 through 192.168.1.126 to local addresses 192.168.2.65 through 192.168.2.126:

**static (dmz1,dmz2) 192.168.1.64 192.168.2.64 netmask 255.255.255.192.**

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This section includes the following topics:

- When NAT is Disabled
- With Limited IP Addresses

### When NAT is Disabled

Subnet mask information is especially valuable when you have disabled Network Address Translation (NAT) using the **nat 0** command. PIX Firewall requires that IP addresses on each interface be in different subnets.

However all the hosts on a PIX Firewall interface between the PIX Firewall and the router must be in the same subnet as well. For example, if you have an address such as 204.31.17.0 and you are not using NAT, you could use the 255.255.255.192 subnet mask for all three interfaces and use addresses 204.31.17.1 through 204.31.17.62 for the outside interface, 204.31.17.65 through 204.31.17.126 for the perimeter interface, and 204.31.17.129 through 204.31.17.190 for the inside interface.

### With Limited IP Addresses

Another use for subnet mask information is for network planning when an Internet service provider (ISP) gives you a limited number of IP addresses and requires you to use a specific subnet mask. Use the information in this appendix to ensure that the outside addresses you choose are in the subnet for the appropriate subnet mask.

For example, if your ISP assigns you 204.31.17.176 with a subnet mask of .240, you can see in Table D-5, Subnet Number 12 for the .240 mask, that hosts can have IP addresses of 204.31.17.177 through 204.31.17.190. Because this only yields 14 hosts, you will probably use one for your router, another for the outside interface of the PIX Firewall, one for a static for a web server, if you have it, one for a static for your mail server, and the remaining 10 for global addresses. One of these addresses should be a PAT (Port Address Translation) address so that you do not run out of global addresses.

## Addresses in the .128 Mask

Table D-2 lists valid addresses for the .128 subnet mask. This mask permits up to 2 subnets with enough host addresses for 126 hosts per subnet.

**Table D-2 .128 Network Mask Addresses**

Subnet Number	Network Address	Starting Host Address	Ending Host Address	Broadcast Address
1	.0	.1	.126	.127
2	.128	.129	.254	.255

## Addresses in the .192 Mask

Table D-3 lists valid addresses for the .192 subnet mask. This mask permits up to 4 subnets with enough host addresses for 62 hosts per subnet.

**Table D-3 .192 Network Mask Addresses**

Subnet Number	Network Address	Starting Host Address	Ending Host Address	Broadcast Address
1	.0	.1	.62	.63
2	.64	.65	.126	.127
3	.128	.129	.190	.191
4	.192	.193	.254	.255

## Addresses in the .224 Mask

Table D-4 lists valid addresses for the .224 subnet mask. This mask permits up to 8 subnets with enough host addresses for 30 hosts per subnet.

**Table D-4 .224 Network Mask Addresses**

Subnet Number	Network Address	Starting Host Address	Ending Host Address	Broadcast Address
1	.0	.1	.30	.31
2	.32	.33	.62	.63
3	.64	.65	.94	.95
4	.96	.97	.126	.127
5	.128	.129	.158	.159
6	.160	.161	.190	.191
7	.192	.193	.222	.223
8	.224	.225	.254	.255

# Addresses in the .240 Mask

Table D-5 lists valid addresses for the .240 subnet mask. This mask permits up to 16 subnets with enough host addresses for 14 hosts per subnet.

**Table D-5      .240 Network Mask Addresses**

Subnet Number	Network Address	Starting Host Address	Ending Host Address	Broadcast Address
1	.0	.1	.14	.15
2	.16	.17	.30	.31
3	.32	.33	.46	.47
4	.48	.49	.62	.63
5	.64	.65	.78	.79
6	.80	.81	.94	.95
7	.96	.97	.110	.111
8	.112	.113	.126	.127
9	.128	.129	.142	.143
10	.144	.145	.158	.159
11	.160	.161	.174	.175
12	.176	.177	.190	.191
13	.192	.193	.206	.207
14	.208	.209	.222	.223
15	.224	.225	.238	.239
16	.240	.241	.254	.255

## Addresses in the .248 Mask

Table D-6 lists valid addresses for the .248 subnet mask. This mask permits up to 32 subnets with enough host addresses for 6 hosts per subnet.

**Table D-6 .248 Network Mask Addresses**

Subnet Number	Network Address	Starting Host Address	Ending Host Address	Broadcast Address
1	.0	.1	.6	.7
2	.8	.9	.14	.15
3	.16	.17	.22	.23
4	.24	.25	.30	.31
5	.32	.33	.38	.39
6	.40	.41	.46	.47
7	.48	.49	.54	.55
8	.56	.57	.62	.63
9	.64	.65	.70	.71
10	.72	.73	.78	.79
11	.80	.81	.86	.87
12	.88	.89	.94	.95
13	.96	.97	.102	.103
14	.104	.105	.110	.111
15	.112	.113	.118	.119
16	.120	.121	.126	.127
17	.128	.129	.134	.135
18	.136	.137	.142	.143
19	.144	.145	.150	.151
20	.152	.153	.158	.159
21	.160	.161	.166	.167
22	.168	.169	.174	.175
23	.176	.177	.182	.183
24	.184	.185	.190	.191
25	.192	.193	.198	.199
26	.200	.201	.206	.207
27	.208	.209	.214	.215
28	.216	.217	.222	.223
29	.224	.225	.230	.231
30	.232	.233	.238	.239
31	.240	.241	.246	.247
32	.248	.249	.254	.255

## Addresses in the .252 Mask

Table D-7 lists valid addresses for the .252 subnet mask. This mask permits up to 64 subnets with enough host addresses for 2 hosts per subnet.

**Table D-7 .252 Network Mask Addresses**

Subnet Number	Network Address	Starting Host Address	Ending Host Address	Broadcast Address
1	.0	.1	.2	.3
2	.4	.5	.6	.7
3	.8	.9	.10	.11
4	.12	.13	.14	.15
5	.16	.17	.18	.19
6	.20	.21	.22	.23
7	.24	.25	.26	.27
8	.28	.29	.30	.31
9	.32	.33	.34	.35
10	.36	.37	.38	.39
11	.40	.41	.42	.43
12	.44	.45	.46	.47
13	.48	.49	.50	.51
14	.52	.53	.54	.55
15	.56	.57	.58	.59
16	.60	.61	.62	.63
17	.64	.65	.66	.67
18	.68	.69	.70	.71
19	.72	.73	.74	.75
20	.76	.77	.78	.79
21	.80	.81	.82	.83
22	.84	.85	.86	.87
23	.88	.89	.90	.91
24	.92	.93	.94	.95
25	.96	.97	.98	.99
26	.100	.101	.102	.103
27	.104	.105	.106	.107
28	.108	.109	.110	.111
29	.112	.113	.114	.115
30	.116	.117	.118	.119
31	.120	.121	.122	.123
32	.124	.125	.126	.127
33	.128	.129	.130	.131
34	.132	.133	.134	.135

**Table D-7      .252 Network Mask Addresses (Continued)**

<b>Subnet Number</b>	<b>Network Address</b>	<b>Starting Host Address</b>	<b>Ending Host Address</b>	<b>Broadcast Address</b>
35	.136	.137	.138	.139
36	.140	.141	.142	.143
37	.144	.145	.146	.147
38	.148	.149	.150	.151
39	.152	.153	.154	.155
40	.156	.157	.158	.159
41	.160	.161	.162	.163
42	.164	.165	.166	.167
43	.168	.169	.170	.171
44	.172	.173	.174	.175
45	.176	.177	.178	.179
46	.180	.181	.182	.183
47	.184	.185	.186	.187
48	.188	.189	.190	.191
49	.192	.193	.194	.195
50	.196	.197	.198	.199
51	.200	.201	.202	.203
52	.204	.205	.206	.207
53	.208	.209	.210	.211
54	.212	.213	.214	.215
55	.216	.217	.218	.219
56	.220	.221	.222	.223
57	.224	.225	.226	.227
58	.228	.229	.230	.231
59	.232	.233	.234	.235
60	.236	.237	.238	.239
61	.240	.241	.242	.243
62	.244	.245	.246	.247
63	.248	.249	.250	.251
64	.252	.253	.254	.255

