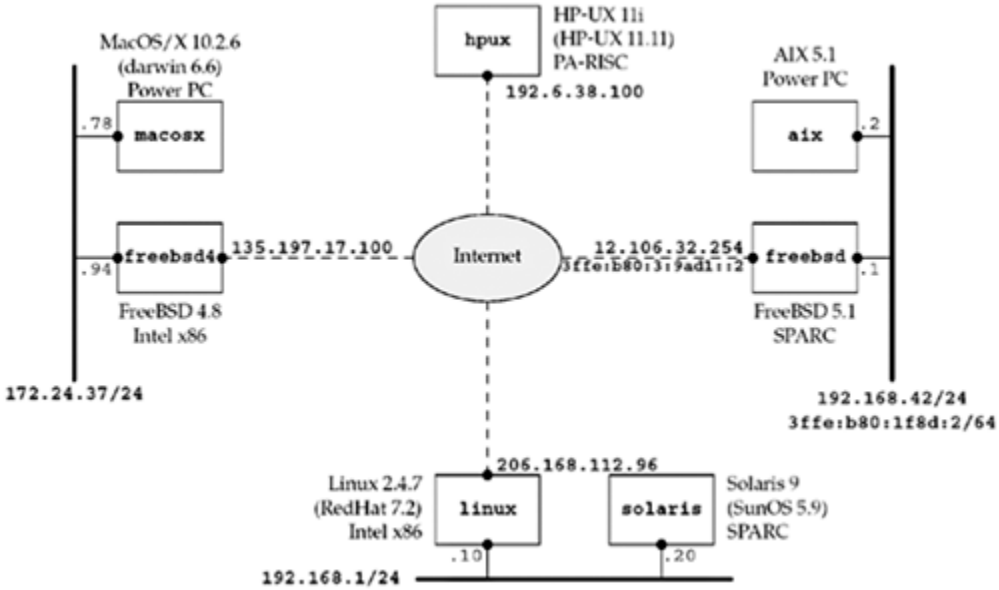
1.9 Test Networks and Hosts

Figure 1.16 shows the various networks and hosts used in the examples throughout the text. For each host, we show the OS and the type of hardware (since some of the operating systems run on more than one type of hardware). The name within each box is the hostname that appears in the text.

The topology shown in Figure 1.16 is interesting for the sake of our examples, but the machines are largely spread out across the Internet and the physical topology becomes less interesting in practice. Instead, virtual private networks (VPNs) or secure shell (SSH) connections provide connectivity between these machines regardless of where they live physically.

Figure 1.16. Networks and hosts used for most examples in the text.



The notation "/24" indicates the number of consecutive bits starting from the leftmost bit of the address used to identify the network and subnet. Section A.4 will talk about the */n* notation used today to designate subnet boundaries.

> The real name of the Sun OS is SunOS 5.x and not Solaris 2.x, but everyone refers to it as Solaris, the name given to the sum of the OS and other software bundled with the base OS.

Discovering Network Topology

We show the network topology in Figure 1.16 for the hosts used for the examples throughout this text, but you may need to know your own network topology to run the examples and exercises on your own network. Although there are no current Unix standards with regard to network configuration and administration, two basic commands are provided by most Unix systems and can be used to discover some details of a network: `netstat` and `ifconfig`. Check the manual (man) pages for these commands on your system to see the details on the information that is output. Also be aware that some vendors place these commands in an administrative directory, such as `/sbin` or `/usr/sbin`, instead of the normal `/usr/bin`, and these directories might not be in your normal shell search path (`PATH`).

1. `netstat -i` provides information on the interfaces. We also specify the `-n` flag to print numeric addresses, instead of trying to find names for the networks. This shows us the interfaces and their names.

```
linux % netstat -ni
Kernel Interface table
Iface   MTU Met    RX-OK RX-ERR RX-DRP RX-OVR    TX-OK TX-ERR TX-DRP TX-OVR Flg
eth0   1500   0 49211085      0      0      0 40540958      0      0      0 BMRU
lo    16436   0 98613572      0      0      0 98613572      0      0      0 LRU
```

The loopback interface is called `lo` and the Ethernet is called `eth0`. The next example shows a host with IPv6 support.

```
freebsd % netstat -ni
Name    Mtu Network       Address              Ipkts Ierrs    Opkts Oerrs  Coll
```

```
hme0   1500 <Link#1>      08:00:20:a7:68:6b 29100435    35 46561488     0     0
hme0   1500 12.106.32/24  12.106.32.254     28746630     - 46617260     -     -
hme0   1500 fe80:1::a00:20ff:fea7:686b/64
                         fe80:1::a00:20ff:fea7:686b
                                                0     -        0     -     -
hme0   1500 3ffe:b80:1f8d:1::1/64
                         3ffe:b80:1f8d:1::1     0     -        0     -     -
hme1   1500 <Link#2>      08:00:20:a7:68:6b    51092     0    31537     0     0
hme1   1500 fe80:2::a00:20ff:fea7:686b/64
                         fe80:2::a00:20ff:fea7:686b
                                                0     -       90     -     -
hme1   1500 192.168.42    192.168.42.1         43584     -    24173     -     -
hme1   1500 3ffe:b80:1f8d:2::1/64
                         3ffe:b80:1f8d:2::1     78     -        8     -     -
lo0   16384 <Link#6>                          10198     0    10198     0     0
lo0   16384 ::1/128       ::1                    10     -       10     -     -
lo0   16384 fe80:6::1/64  fe80:6::1               0     -        0     -     -
lo0   16384 127           127.0.0.1           10167     -    10167     -     -
gif0   1280 <Link#8>                             6     0        5     0     0
gif0   1280 3ffe:b80:3:9ad1::2/128
                         3ffe:b80:3:9ad1::2     0     -        0     -     -
gif0   1280 fe80:8::a00:20ff:fea7:686b/64
                         fe80:8::a00:20ff:fea7:686b
                                                0     -        0     -     -
```

2. `netstat -r` shows the routing table, which is another way to determine the interfaces. We normally specify the `-n` flag to print numeric addresses. This also shows the IP address of the default router.

```
freebad % netstat -nr
Routing tables

Internet:
Destination        Gateway            Flags    Refs       Use  Netif Expire
default            12.106.32.1        UGSc       10      6877   hme0
12.106.32/24       link#1             UC          3         0   hme0
12.106.32.1        00:b0:8e:92:2c:00  UHLW        9         7   hme0   1187
12.106.32.253      08:00:20:b8:f7:e0  UHLW        0         1   hme0    140
12.106.32.254      08:00:20:a7:6e:6b  UHLW        0         2    lo0
127.0.0.1          127.0.0.1          UH          1     10167    lo0
192.168.42         link#2             UC          2         0   hme1
192.168.42.1       08:00:20:a7:68:6b  UHLW        0        11    lo0
192.168.42.2       00:04:ac:17:bf:38  UHLW        2     24108   hme1    210

Internet6:
Destination                       Gateway                       Flags      Netif Expire
::/96                             ::1                           UGRSc       lo0 =>
default                           3ffe:b80:3:9ad1::1            UGSc       gif0
::1                               ::1                           UH          lo0
::ffff:0.0.0.0/96                 ::1                           UGRSc       lo0
3ffe:b80:3:9adl::1                3ffe:b80:3:9adl::2            UH         gif0
3ffe:b80:3:9adl::2                link#8                        UHL         lo0
3ffe:b80:1f8d::/48                lo0                           USc         lo0
3ffe:b80:1f8d:1::/64              link#1                        UC         hme0
3ffe:b80:1f8d:1::1                08:00:20:a7:68:6b             UHL         lo0
3ffe:b80:1f8d:2::/64              link#2                        UC         hme1
3ffe:b80:1f8d:2::1                08:00:20:a7:68:6b             UHL         lo0
3ffe:b80:1f8d:2:204:acff:fe17:bf38 00:04:ac:17:bf:38            UHLW       hme1
fe80::/10                         ::1                           UGRSc       lo0
fe80::%hme0/64                    link#1                        UC         hme0
fe80::a00:20ff:fea7:686b%hme0     08:00:20:a7:68:6b             UHL         lo0
fe80::%hme1/64                    link#2                        UC         hme1
fe80::a00:20ff:fea7:686b%hme1     08:00:20:a7:68:6b             UHL         lo0
fe80::%lo0/64                     fe80::1%lo0                   Uc          lo0
fe80::1%lo0                       link#6                        UHL         lo0
fe80::%gif0/64                    link#8                        UC         gif0
fe80::a00:20ff:fea7:686b%gif0     link#8                        UC          lo0
ff01::/32                         ::1                           U           lo0
ff02::/16                         ::1                           UGRS        lo0
ff02::%hme0/32                    link#1                        UC         hme0
ff02::%hme1/32                    link#2                        UC         hme1
ff02::%lo0/32                     ::1                           UC          lo0
ff02::%gif0/32                    link#8                        UC         gif0
```

3. Given the interface names, we execute `ifconfig` to obtain the details for each interface.

```
linux % ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:C0:9F:06:B0:E1
          inet addr:206.168.112.96  Bcast:206.168.112.127  Mask:255.255.255.128
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:49214397 errors:0 dropped:0 overruns:0 frame:0
          TX packets:40543799 errors:0 dropped:0 overruns:0 carrier:0
```

```
          collisions:0 txqueuelen:100
          RX bytes:1098069974 (1047.2 Mb)  TX bytes:3360546472 (3204.8 Mb)
          Interrupt:11 Base address:0x6000
```

This shows the IP address, subnet mask, and broadcast address. The `MULTICAST` flag is often an indication that the host supports multicasting. Some implementations provide a `-a` flag, which prints information on all configured interfaces.

4. One way to find the IP address of many hosts on the local network is to `ping` the broadcast address (which we found in the previous step).

```
linux % ping -b 206.168.112.127
WARNING: pinging broadcast address
PING 206.168.112.127 (206.168.112.127) from 206.168.112.96 : 56(84) bytes of data.
64 bytes from 206.168.112.96: icmp_seq=0 ttl=255 time=241 usec
64 bytes from 206.168.112.40: icmp_seq=0 ttl=255 time=2.566 msec (DUP!)
64 bytes from 206.168.112.118: icmp_seq=0 ttl=255 time=2.973 msec (DUP!)
64 bytes from 206.168.112.14: icmp_seq=0 ttl=255 time=3.089 msec (DUP!)
64 bytes from 206.168.112.126: icmp_seq=0 ttl=255 time=3.200 msec (DUP!)
64 bytes from 206.168.112.71: icmp_seq=0 ttl=255 time=3.311 msec (DUP!)
64 bytes from 206.168.112.31: icmp_seq=0 ttl=64 time=3.541 msec (DUP!)
64 bytes from 206.168.112.7: icmp_seq=0 ttl=255 time=3.636 msec (DUP!)
...
```