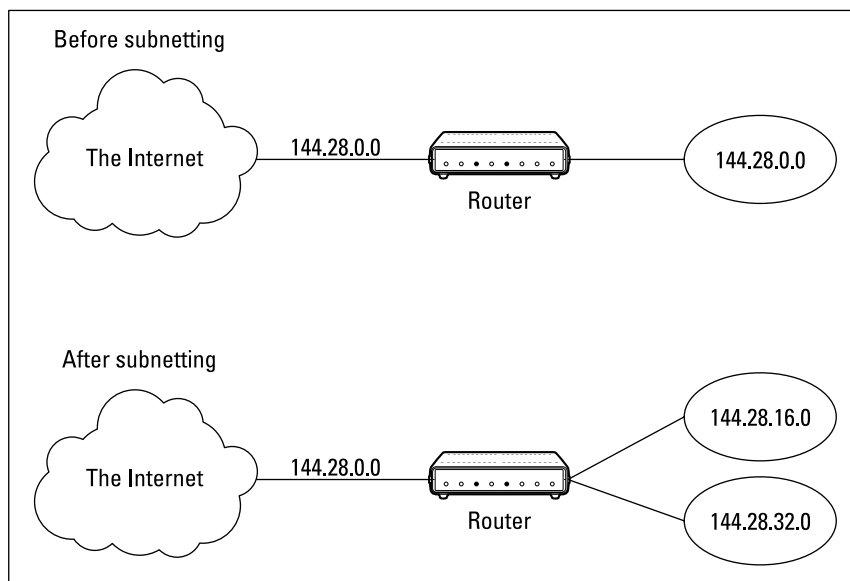FIGURE 6-1:
A network
before and after
subnetting.

Subnet masks

For subnetting to work, the router must be told which portion of the host ID to use for the subnet's network ID. This little sleight of hand is accomplished by using another 32-bit number, known as a *subnet mask.* Those IP address bits that represent the network ID are represented by a 1 in the mask, and those bits that represent the host ID appear as a 0 in the mask. As a result, a subnet mask always has a consecutive string of ones on the left, followed by a string of zeros.

For example, the subnet mask for the subnet, as shown in Figure 6-1, in which the network ID consists of the 16-bit network ID plus an additional 4-bit subnet ID, would look like this:

```
11111111 11111111 11110000 00000000
```

In other words, the first 20 bits are ones; the remaining 12 bits are zeros. Thus, the complete network ID is 20 bits in length, and the actual host ID portion of the subnetted address is 12 bits in length.

To determine the network ID of an IP address, the router must have both the IP address and the subnet mask. The router then performs a bitwise operation called a *logical AND* on the IP address to extract the network ID. To perform a logical AND, each bit in the IP address is compared to the corresponding bit in the subnet mask. If both bits are 1, the resulting bit in the network ID is set to 1. If either of the bits is 0, the resulting bit is set to 0.