

9. ACTIVITY

9A. calculate whether destination address is local or remote using ip address.

➤ Determining if Network Hosts are Local or Remote (ANDing)

We spent time determining the valid ranges of addresses on a given subnet for a reason. Recall from our earlier look at TCP/IP communication that when a host wishes to communicate with another host, it must first determine whether the destination is local (on the same subnet) or remote (on a different subnet). In cases where hosts are local, they can communicate directly. In cases where the destination host is on a different network, the packets must be sent to a router, who will then forward them along on their journey to the destination network.

In order to determine whether a destination host is local or remote, a computer will perform a simple mathematical computation referred to as an AND operation. While the sending host does this operation internally, understanding what takes place is the key to understanding how an IP-based system knows whether to send packets directly to a host or to a router.

An AND operation is very simple – two binary digits are compared, and the based on their combination, a resultant value is formed. It is neither adding nor subtracting, so do not consider it as such. In the most simple terms, there are only three possibilities when ANDing two binary digits. The list below outlines these operations and their results.

$$0 \text{ AND } 0 = 0$$

$$0 \text{ AND } 1 = 0$$

$$1 \text{ AND } 1 = 1$$

Notice that when the binary digits 1 and 1 are ANDed, the result is 1, and that any other combination produces a result of 0.

The question now becomes how this is actually used. When a host wishes to figure out whether a destination host is local or remote, it goes through the following steps.

- The host takes its own IP address and ANDs it with its own subnet mask, producing a result.

- The host then takes the destination IP address and ANDs it with its own subnet mask, producing another result.
- Finally, the host compares the two results. In cases where the ANDing results are identical, it means that the hosts reside on the same subnet. In cases where the results are different, it means that the destination host is remote.

Consider this example. Computer A has an IP address of 192.168.62.14 with a subnet mask of 255.255.248.0. It wishes to communicate with host 192.168.65.1. In order to determine whether this destination is local or remote, it will go through the ANDing process. Its IP address and subnet mask are lined up in binary, and then vertically compared to find the AND result. The same is then done for the destination address, again using the subnet mask of the source host. This is illustrated in the figure below.

➤ **Figure: The ANDing process.**

Notice that when the resulting AND values are converted back to binary, it becomes clear that the two hosts are on different networks. Computer A is on subnet 192.168.56.0, while the destination host is on subnet 192.168.64.0, which means that Computer A will next be sending the data to a router. Without ANDing, determining local and remote hosts can be difficult. Once you're very familiar with subnetting and calculating ranges of addresses, recognizing local and remote hosts will become much more intuitive.

Whenever you're in doubt as to whether hosts are local or remote, use the ANDing process. You should also notice that the ANDing process always produces the subnet ID of a given host.

❖ How does a host determine whether the destination for a packet is a local or remote host?

When a host attempts to communicate with another device using TCP/IP, it performs a comparison process using the defined subnet mask and the destination IP address versus the subnet mask and its own IP address. The result of this comparison tells the computer whether the destination is a local host or a remote host.