CTS2134
Introduction to Networking

Module 05.5 – 05.8
Network Implementation

NAT Facts

NAT (Network Address Translation) allows you to connect a private network to the Internet without obtaining registered addresses for every host. Private addresses are translated to the public address of the NAT router.

- Hosts on the private network share the IP address of the NAT router, or a pool of addresses assigned for the network.
- The NAT router maps port numbers to private IP addresses. Responses to Internet requests include the port number appended by the NAT router. This allows the NAT router to forward responses back to the correct private host.

NAT Facts

Virtually all NAT routers perform port address translation, so they are really performing **PAT** (Port address translation).

- NAT supports a limit of 5,000 concurrent connections.
- NAT provides some security for the private network because it translates or hides the private addresses.
- A NAT router can act as a limited-function DHCP server, assigning addresses to private hosts.
- A NAT router can forward DNS requests to the Internet.

NAT implementation

Dynamic NAT

•Dynamic NAT automatically maps internal IP addresses with a dynamic port assignment. On the NAT device, the internal device is identified by the public IP address and the dynamic port number.

•Dynamic NAT allows internal (private) hosts to contact external (public) hosts but not vice versa.

•External hosts cannot initiate communications with internal hosts.

NAT implementation

SNAT (Static Network Address Translation)

•Static NAT maps an internal IP address to a static port assignment. Static NAT is typically used allow a server on the private network (such as a Web server) available on the Internet.

•External hosts contact the internal server using the public IP address and the static port. Using a static mapping allows external hosts to contact internal hosts.

NAT Addressing

NAT assigns IP addresses on the private network in several predefined private address ranges. These address ranges are guaranteed to not be in use on the Internet and do not need to be registered.

The private IPv4 address ranges are:

- **10.0.0.1 to 10.255.255.254**
- **172.16.0.1 to 172.31.255.254**
- **192.168.0.1 to 192.168.255.254**

The Internet Assigned Numbers Authority (IANA) is responsible for allocating IP addresses used on the Internet. IANA is operated by the Internet Corporation for Assigned Names and Numbers (ICANN)

IPv6 Facts

The IPv6 address is a 128-bit binary number. Such as: 5BC:FA77:4898:DAFC:200C:FBBC:A007:8973

- 32 hexadecimal numbers, organized into 8 quartets, separated by colons.
- Each quartet is represented as a hexadecimal number between 0 and FFFF.
- Leading zeros can be omitted in each section
- Addresses with consecutive zeros can be expressed by substituting a double-colon for the group of zeros. For example:
  - FEC0:0:0:0:78CD:1283:F398:23AB
  - FEC0::78CD:1283:F398:23AB (concise form)
- If an address has more than one consecutive location where one or more quartets are all zeros, only one location can be abbreviated. For example, FEC2:0:0:0:78CA:0:0:23AB could be abbreviated as: FEC2::78CA:0:0:23AB or FEC2:0:0:0:78CA::23AB

IPv6 Facts

IPv6 adds the following features which are not included in IPv4:

- Auto-configuration
- Built-in Quality of Service
- Built-in Security Features
- Source Intelligent Routing

Multicast Facts

Multicasting creates logical groups of hosts

Without multicast groups, messages that must be sent to a specific group could only use the following:

- With unicasting, messages are sent to a specific host address and must create a separate packet for each destination device.
- With broadcasting, a single packet is sent to the broadcast address and is processed by all hosts. However, using broadcasting for sending data to a group would mean that all hosts, and not just group members, would receive the packet.

Multicast Facts

The Internet Group Management Protocol (IGMP) is used to identify group members and to forward multicast packets onto the segments where group members reside.

- Routers do not keep track of individual hosts that are members of a group, rather they simply compile a list of groups on the subnet that have at least one member.
- A router sends out a host membership query. This query is addressed to the IP address of 224.0.0.1.
- Hosts that are members of any group respond with a list of the groups to which the host belongs. Each group is identified with a multicast IP address in the range of 224.0.0.0 to 239.255.255.255.

VoIP Facts

Voice over IP (**VoIP**) is a protocol optimized for the transmission of voice (telephone calls) through a packet switched network. VoIP routes phone calls through an IP network, such as the Internet, instead of through the public telephone system (PSTN). However, VoIP solutions are typically integrated with the PSTN to allow VoIP customers to call any phone on the PSTN, and to allow phones on the PSTN to call phones connected to the VoIP network.

VoIP uses regular IP datagrams for sending voice data over a network.

VoIP Facts

VoIP networks have advantages:

- Administration is simplified because you maintain a single network for both data and voice instead of using a separate infrastructure for voice-only traffic.
- Costs for sending voice over an IP infrastructure are typically lower than long-distance costs over the PSTN.
- Adding additional phone lines is easier and cheaper than adding lines through the PSTN.
- Because packets are regular IP packets, encryption can be easily added to VoIP