Network Address Translation

Running out of IP Addresses
• There are only
  – 2,113,928,964 class A addresses
  – 1,073,577,988 class B addresses
  – 532,676,608 class C addresses
  – 3,720,183,560 total possible addresses
• Far fewer address are actually available. Each domain does not use all of its available addresses.
• More than half of the class B domains have fewer than 50 hosts.

Hiding Network Configuration
• Most network owners do not want hackers checking their network configuration.
• It is relatively easy to write a program to “ping” every possible address in a domain.
• Many network administrators do not want just anybody connecting to their computers from the Internet.

Network Address Translation (NAT)
• A NAT router sits between the Internet and a private network.
Changing Addresses

• The NAT router has a single internet address. This is the address that the rest of the world sees.

• Computers within the private intranet have addresses that are never used outside of the private intranet.

Mapping Addresses and Ports

• When a computer within the private intranet creates a connection to an Internet site, the NAT router changes the address and port.

• The packet on the Internet has the NAT routers IP address as the source.

• The NAT keeps a table mapping the Internet addresses and ports to private address and ports.

Translation

• The only address seen on the Internet is the NAT router’s IP address. Remote systems do not know this is a translated address.

Multiple Computer Mapping

• What happens if two computer on the private intranet want to connect to the same Internet host?

• The NAT router will change the port numbers that appear on the Internet.

• The NAT mapping tables include the port number and the remote Internet address.
Mapping Example

- Imagine two computers, 10.0.0.1 and 10.0.0.2 use port 30000 to connect to the same web server at 128.10.19.20

NAT mapping table

<table>
<thead>
<tr>
<th>Direction</th>
<th>Fields</th>
<th>Old Value</th>
<th>New Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>out</td>
<td>IP SRC:TCP SRC</td>
<td>10.0.0.1:30000</td>
<td>128.10.19.20:40001</td>
</tr>
<tr>
<td>out</td>
<td>IP SRC:TCP SRC</td>
<td>10.0.0.2:30000</td>
<td>128.10.19.20:40002</td>
</tr>
<tr>
<td>in</td>
<td>IP DEST:TCP DEST</td>
<td>128.10.19.20:40001</td>
<td>10.0.0.1:30000</td>
</tr>
<tr>
<td>in</td>
<td>IP DEST:TCP DEST</td>
<td>128.10.19.20:40002</td>
<td>10.0.0.2:30000</td>
</tr>
</tbody>
</table>

Connections from the Internet

- Since individual computers on the private intranet do not have distinct Internet addresses, remote Internet sites cannot connect to them.
- If you have two web servers on the private intranet, they will be inaccessible from the Internet.
- Typically all incoming Internet connections are passed to one specific computer on the private intranet.

Private IP Addresses

- Certain IP addresses are reserved for the use of Intranets.
- The addresses 192.168/16, 172.16/12, and 10/8 should never appear on the Internet.

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