ADDRESS ASSIGNMENT AND PRIVATE ADDRESSES
Outline

- Address assignment
- Private addresses
- Public and private intranet
- NAT: network address translation
ADDRESS ASSIGNMENT
Basic Principles

- Each IP address must be unique
- Centralized coordination
- IANA: Internet Assigned Numbers Authority
- Delegation
Further Delegation

→ Internet Service Provider (ISP)
→ IT Department
→ Departmental/lab IT manager

Cumbersome for each new subnet (LAN)
PRIVATE ADDRESSES
What's the Deal?

- Anyone can use them without requesting
- They will be duplicated
- They cannot be used across the Internet
- Only where they are for sure unique
What’s the Problem?

Routers forward packets along the shortest path

Packet from A to B
Private Addresses

- 10.0.0.0/8
- 1 class A prefix
- 172.16.0.0/16 - 172.31.0.0/16
- 16 class B prefixes
- 192.168.0.0/24 - 192.168.255.0/24
- 256 class C prefixes
Why Not Using Any Address Locally?

Destination concealment

Packet from A to B

Private network

Public host

Internet

Private host
PUBLIC AND PRIVATE INTRANET
Intranet

- Private IP network
- It belongs to an organization/company
- Private hosts
- Private addresses
- Public hosts
- Public addresses
Internet Communication with Private Address
Internet Communication from Private Intranet

→ Temporary use a public host

→ Temporary “change” IP address to a public one

→ It prolonged IPv4 life by 20 years
NETWORK ADDRESS TRANSLATION (NAT)
Internet Communication with NAT

Network Address Translation

Access router

Internet

Public Intranet

Private Intranet
Proxy vs. NAT

From: X

To: B
Applications

- Overlapping private address spaces
- Merge and acquisitions
- Extranets
- Federation of intranets
Address Expansion

- Multiple local (private) addresses on same global address
- Differentiate based on ports
## NAT Mapping Table

<table>
<thead>
<tr>
<th>Inside</th>
<th>Outside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Add</td>
</tr>
<tr>
<td>Port</td>
<td>Add</td>
</tr>
<tr>
<td>Add</td>
<td>Port</td>
</tr>
</tbody>
</table>

Inside

Outside

- Local
- Global

- Add
- Port
Sample Scenario

Internet

2.1.1.1
4.3.2.1

10.1.1.5
10.1.1.7
3.1.1.5
3.1.1.6
### NAT Mapping Table

<table>
<thead>
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</tr>
<tr>
<td>10.1.1.5</td>
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<tr>
<td>3.1.1.5</td>
<td>2345</td>
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<tr>
<td>2.1.1.1</td>
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</tr>
<tr>
<td>2.1.1.1</td>
<td>80</td>
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<tr>
<td>10.1.1.7</td>
<td>3456</td>
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<tr>
<td>3.1.1.6</td>
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</tr>
<tr>
<td>4.3.2.1</td>
<td>21</td>
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<tr>
<td>4.3.2.1</td>
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<tr>
<td>10.1.1.7</td>
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<td>3.1.1.5</td>
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<td>4.3.2.1</td>
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</tr>
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</tr>
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</table>
PAT: Port Address Translation

- AKA NAT overload
- Source port is mapped onto random unique port
- Problematic if specific port is needed
- IPSec, DNS
## Mapping Table with PAT support

<table>
<thead>
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<th>Local</th>
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<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Add</td>
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</tr>
<tr>
<td>10.1.1.7</td>
<td>4444</td>
<td>3.1.1.5</td>
<td>4444</td>
</tr>
<tr>
<td>10.1.1.5</td>
<td>4444</td>
<td>3.1.1.5</td>
<td>5555</td>
</tr>
</tbody>
</table>

**Internet**

<table>
<thead>
<tr>
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<td>80</td>
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</tr>
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</table>
Static NAT

- Dynamic NAT requires communication to be initiated from inside.
  - Fine for private clients.
- Public servers with private address?
- Manually inserted entries.
# NAT Table with Static Entry

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<td>10.1.1.7</td>
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</tr>
<tr>
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