ADDRESS
ASSIGNMENT
AND PRIVATE
ADDRESSES
Outline

→ Address assignment
→ Private addresses
→ Public and private intranet
→ NAT: network address translation
Basic Principles

⇒ Each IP address must be unique

⇒ Centralized coordination
  ⇒ IANA: Internet Assigned Numbers Authority

⇒ Delegation
Registries

- ARIN
- RIPE NCC
- AfriNIC
- LACNIC
- APNIC
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
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
PUBLIC
AND PRIVATE
INTRANET
Intranet

→ Private IP network
   → It belongs to an organization/company

→ Private hosts
   → Private addresses

→ Public hosts
   → Public addresses
Intranet

Public addresses

Internet

Public addresses

Private Intranet

Private 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
Internet Communication with Proxy Server

www.netscire.it

HTTP proxy (web proxy)

Private Intranet

Public Intranet

index.htm

ftp.studioreti.it

index.htm

FTP proxy

A

B

C
NETWORK ADDRESS TRANSLATION (NAT)
Internet Communication with NAT

Network Address Translation

Access router

Internet

Public Intranet

Private Intranet

NAT functionality
Operation

From: A
To: B

From: B
To: A

From: B
To: X

From: X
To: B

X, Y, Z

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

Diagram showing the concept of inside and outside networks with NAT mapping.
Sample Scenario

Internet

10.1.1.5
10.1.1.7
3.1.1.5
3.1.1.6
2.1.1.1
4.3.2.1
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</tr>
<tr>
<td>10.1.1.7</td>
<td>4444</td>
</tr>
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<td></td>
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## A Critical Situation

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**Internet**

`10.1.1.7`  `3.1.1.5`

`2.1.1.1`
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>
<tr>
<th>Local</th>
<th>Port</th>
<th>Global</th>
<th>Port</th>
<th>Local</th>
<th>Port</th>
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<th>Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1.1.7</td>
<td>4444</td>
<td>3.1.1.5</td>
<td>4444</td>
<td>2.1.1.1</td>
<td>80</td>
<td>2.1.1.1</td>
<td>80</td>
</tr>
<tr>
<td>10.1.1.5</td>
<td>4444</td>
<td>3.1.1.5</td>
<td>5555</td>
<td>2.1.1.1</td>
<td>80</td>
<td>2.1.1.1</td>
<td>80</td>
</tr>
</tbody>
</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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</tr>
<tr>
<td>10.1.1.8</td>
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