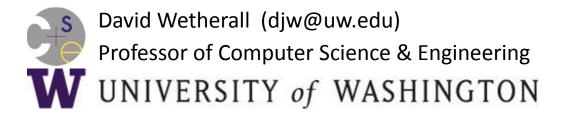
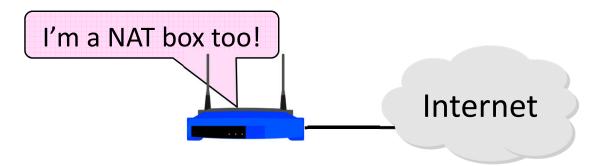
Computer Networks

Network Address Translation (§5.6.2)



Topic

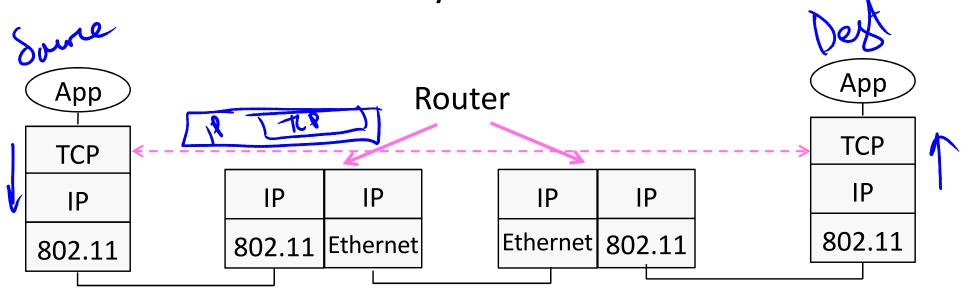
- What is NAT (Network Address Translation)? How does it work?
 - NAT is widely used at the edges of the network, e.g., homes



Layering Review

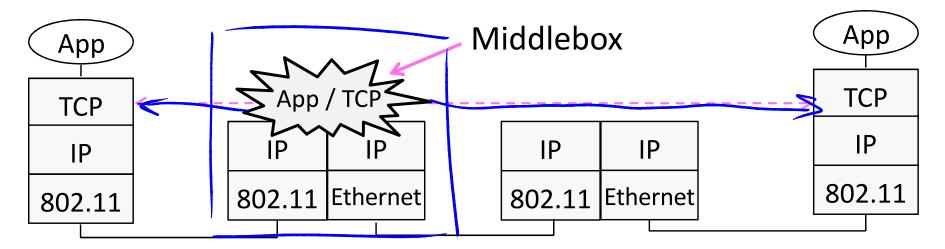
Remember how layering is meant to work?

- "Routers don't look beyond the IP header." Well,



Middleboxes

- Sit "inside the network" but perform "more than IP" processing on packets to add new functionality
 - NAT box, Firewall / Intrusion Detection System



Middleboxes (2)

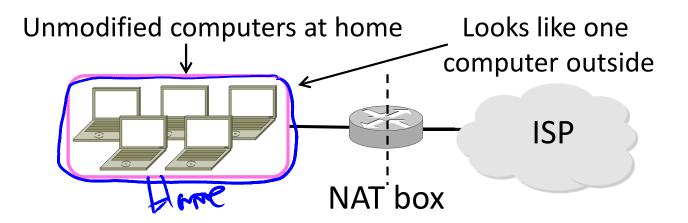
- Advantages
 - A possible rapid deployment path when there is no other option
 - Control over many hosts (IT)
- Disadvantages
 - Breaking layering interferes with connectivity; strange side effects
 - Poor vantage point for many tasks

NAT (Network Address Translation) Box

- NAT box connects an internal network to an external network
 - Many internal hosts are connected using few external addresses
 - Middlebox that "translates addresses"
- Motivated by IP address scarcity
 - Controversial at first, now accepted

NAT (2) 10.60.0/8 112.16600/6

- Common scenario: 142.16600/
 - Home computers use "private" IP addresses
 - NAT (in AP/firewall) connects home to ISP using a single external IP address



How NAT Works

Keeps an internal/external table

Typically uses IP address + TCP port

This is address and port translation

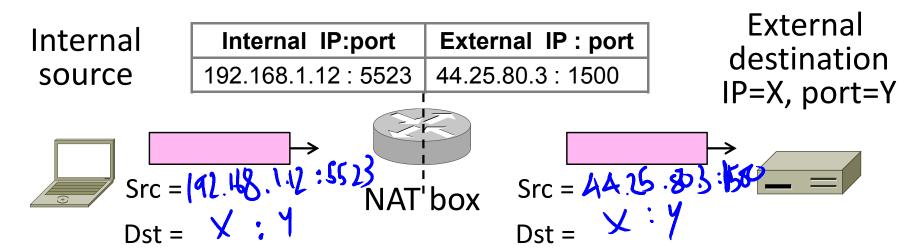
What host thinks What ISP thinks

	Internal IP:port	External IP : port	
_	192.168.1.12 : 5523	44.25.80.3 : 1500	
١	192.168.1.13 : 1 <u>234</u>	44.25.80.3 : 1501	ไงน้
	192.168.2.20 : 1234	44.25.80.3 1502	W

Need ports to make mapping 1-1 since there are fewer external IPs

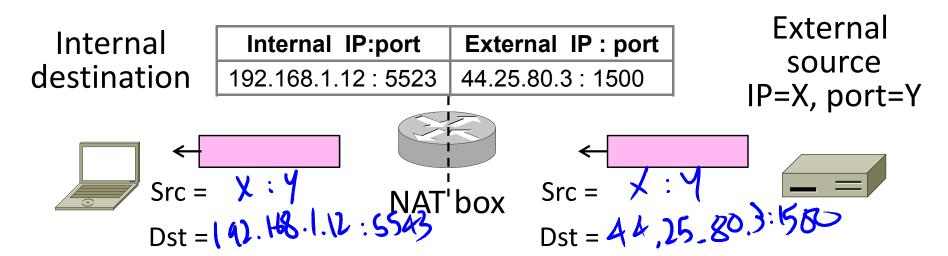
How NAT Works (2)

- Internal → External:
 - Look up and rewrite Source IP/port



How NAT Works (3)

- External → Internal
 - Look up and rewrite Destination IP/port

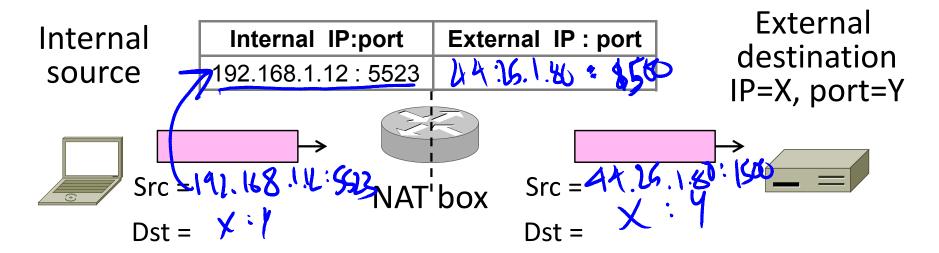


Computer Networks

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How NAT Works (4)

- Need to enter translations in the table for it to work
 - Create external name when host makes a TCP connection



NAT Downsides

- Connectivity has been broken!
 - Can only send incoming packets after an outgoing connection is set up
 - Difficult to run <u>servers</u> or peer-to-peer apps (Skype) at home
- Doesn't work so well when there are no connections (UDP apps)
- Breaks apps that unwisely expose their IP addresses (FTP)

NAT Upsides

- Relieves much IP address pressure
 - Many home hosts behind NATs
- **Easy to deploy**
 - Rapidly, and by you alone
- Useful functionality
 - Firewall, helps with privacy
- Kinks will get worked out eventually
 - "NAT Traversal" for incoming traffic

END

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