

Διαχείριση Δικτύων Βασισμένων στο Λογισμικό 2025 (DIT306)

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3/4/2025

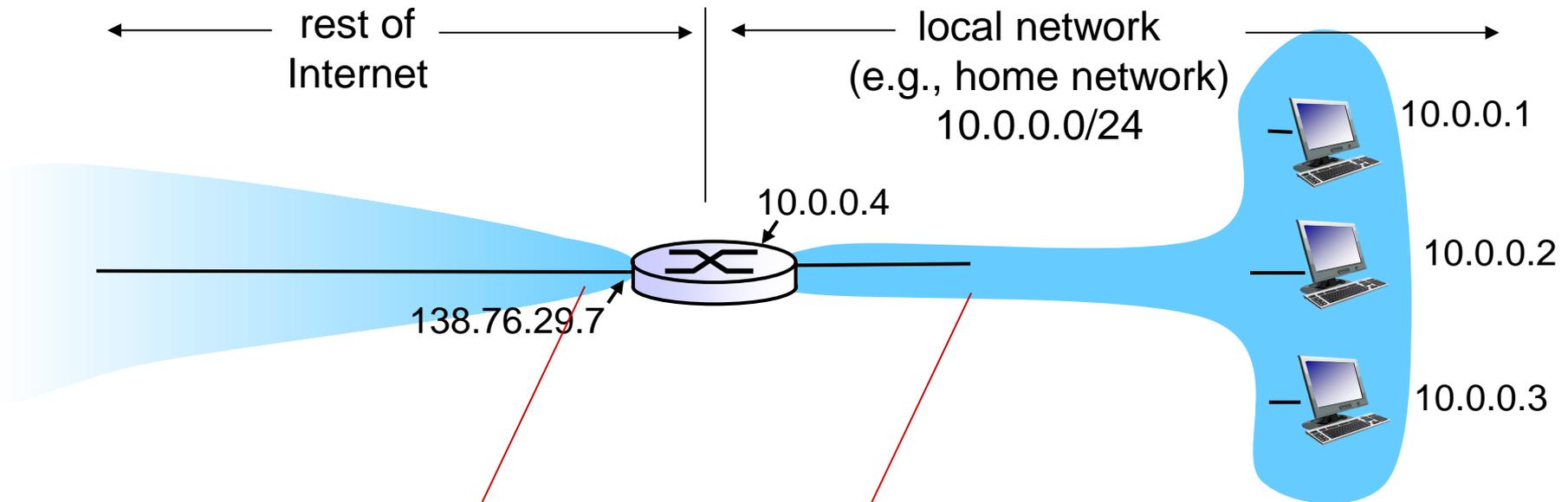
Chapter 4

Network Layer:

The Data Plane



NAT: network address translation



all datagrams *leaving* local network have *same* single source NAT IP address: 138.76.29.7, different source port numbers

datagrams with source or destination in this network have 10.0.0.0/24 address for source, destination (as usual)

NAT: network address translation

motivation: local network uses just one IP address as far as outside world is concerned:

- range of addresses not needed from ISP: just one IP address for all devices
- can change addresses of devices in local network without notifying outside world
- can change ISP without changing addresses of devices in local network
- devices inside local net not explicitly addressable, visible by outside world (a security plus)

NAT: network address translation

implementation: NAT router must:

- *outgoing datagrams: replace* (source IP address, port #) of every outgoing datagram to (NAT IP address, new port #)
... remote clients/servers will respond using (NAT IP address, new port #) as destination addr
- *remember (in NAT translation table)* every (source IP address, port #) to (NAT IP address, new port #) translation pair
- *incoming datagrams: replace* (NAT IP address, new port #) in dest fields of every incoming datagram with corresponding (source IP address, port #) stored in NAT table

NAT: network address translation

NAT translation table	
WAN side addr	LAN side addr
138.76.29.7, 5001	10.0.0.1, 3345
.....

1: host 10.0.0.1 sends datagram to 128.119.40.186, 80

S: 10.0.0.1, 3345
D: 128.119.40.186, 80

1

10.0.0.1

10.0.0.2

10.0.0.3

2: NAT router changes datagram source addr from 10.0.0.1, 3345 to 138.76.29.7, 5001, updates table

2

S: 138.76.29.7, 5001
D: 128.119.40.186, 80

138.76.29.7

S: 128.119.40.186, 80
D: 138.76.29.7, 5001

3

3: reply arrives
dest. address:
138.76.29.7, 5001

10.0.0.4

S: 128.119.40.186, 80
D: 10.0.0.1, 3345

4

4: NAT router changes datagram dest addr from 138.76.29.7, 5001 to 10.0.0.1, 3345

* Check out the online interactive exercises for more examples: http://gaia.cs.umass.edu/kurose_ross/interactive/

NAT: network address translation

- 16-bit port-number field:
 - 60,000 simultaneous connections with a single LAN-side address!
- NAT is controversial:
 - routers should only process up to layer 3
 - address shortage should be solved by IPv6