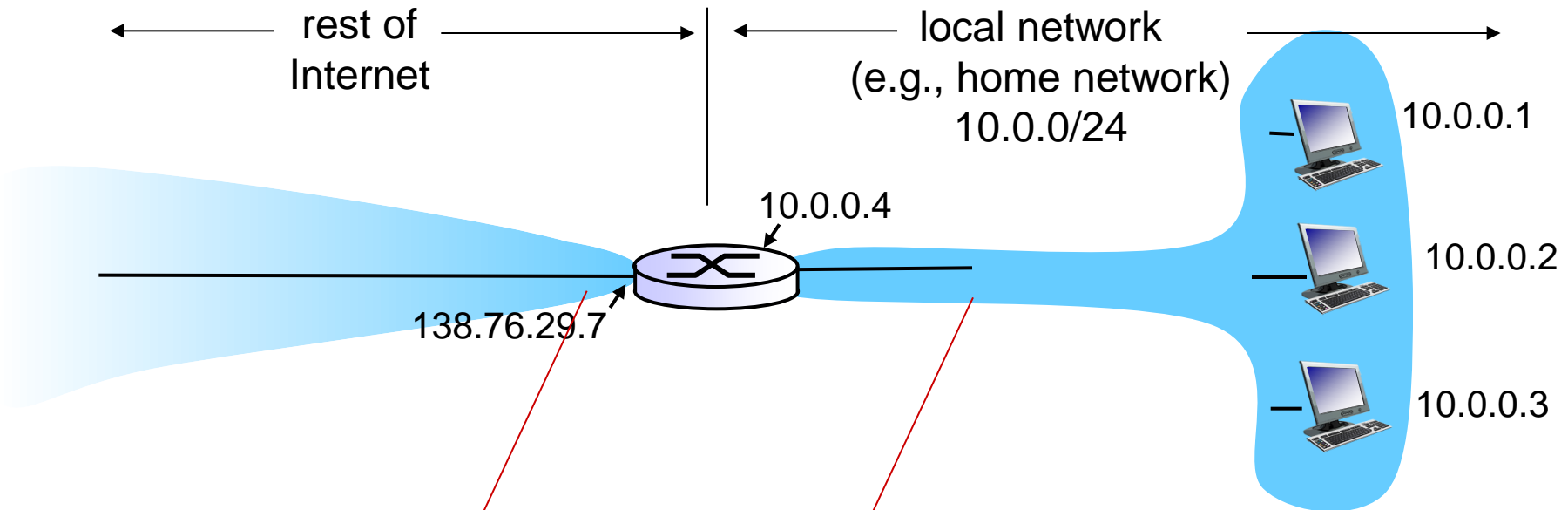


# NAT: network address translation

**Layer 3 protocol**, διότι ναι μεν διαβάζει τους Source/Destinations Port # 's (Layer 4), αλλάζει όμως τις διευθύνσεις IP (Layer 3). Το NAT καταργείται με την έλευση του IPv6.



*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 10.0.0/24 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:

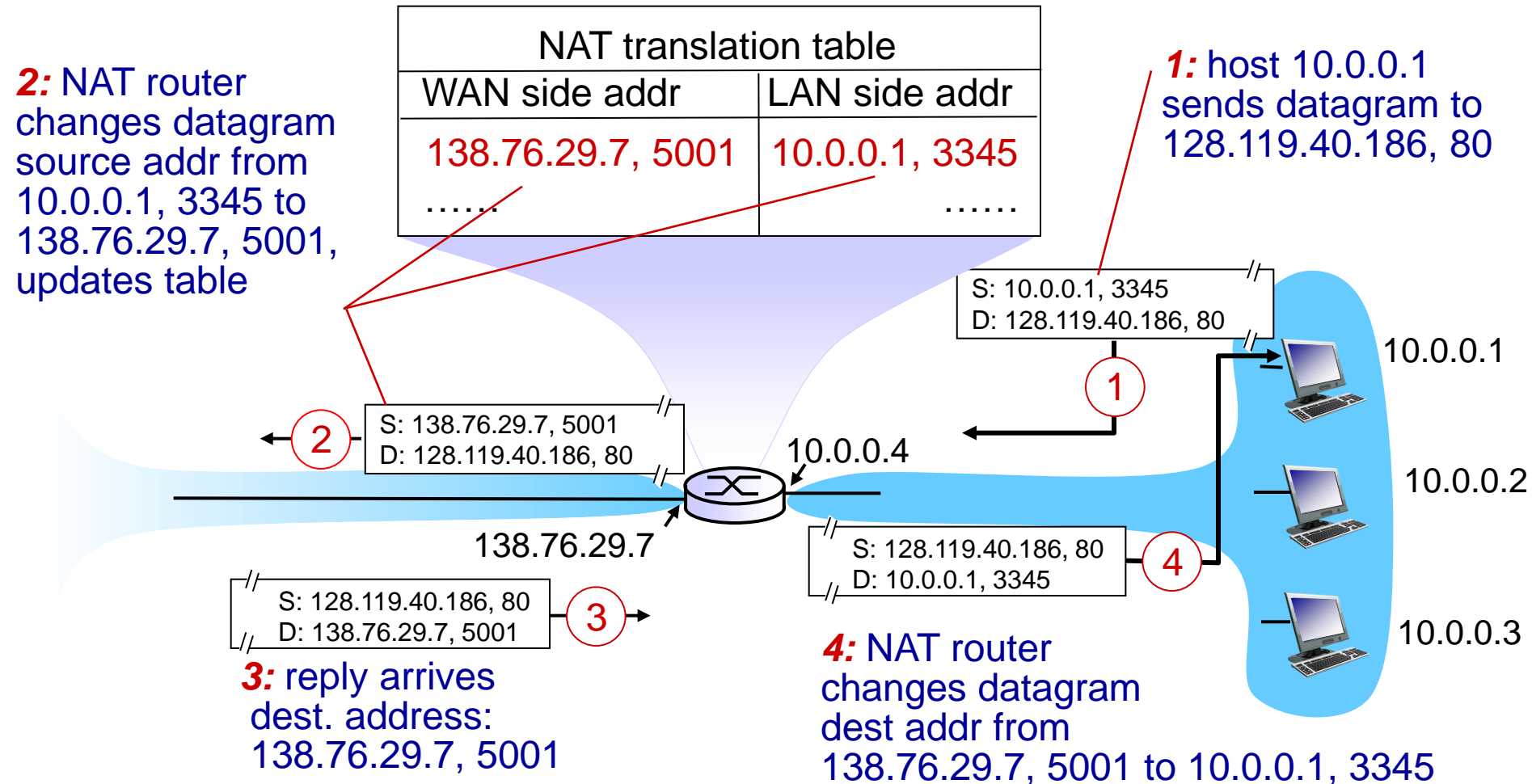
- range of addresses not needed from ISP: just one IP address for all devices
- can change addresses of devices in local network without notifying outside world
- can change ISP without changing addresses of devices in local network
- devices inside local net not explicitly addressable, visible by outside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

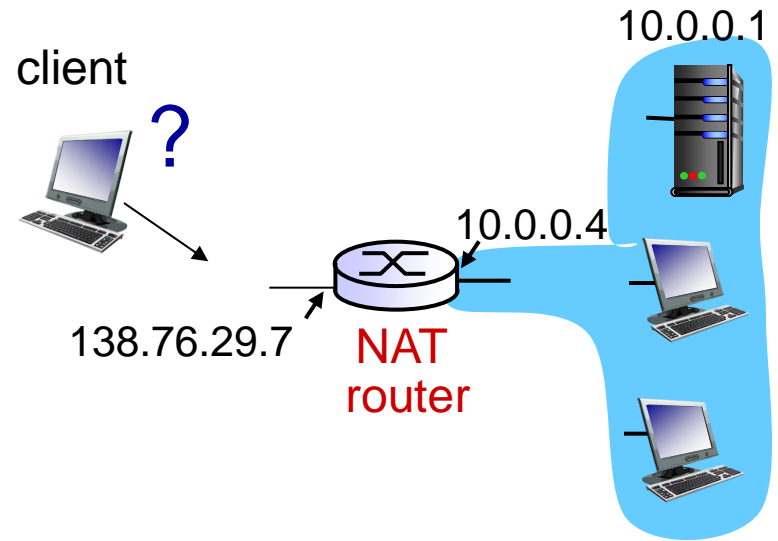


# NAT: network address translation

- ❖ 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
  - violates end-to-end argument
    - NAT possibility must be taken into account by app designers, e.g., P2P applications
  - address shortage should instead be solved by IPv6

# NAT traversal problem

- ❖ client wants to connect to server with address 10.0.0.1
  - server address 10.0.0.1 local to LAN (client can't use it as destination addr)
  - only one externally visible NATed address: 138.76.29.7
- ❖ **solution 1:** statically configure NAT to forward incoming connection requests at given port to server
  - e.g., (138.76.29.7, port 2500) always forwarded to 10.0.0.1 port 2500

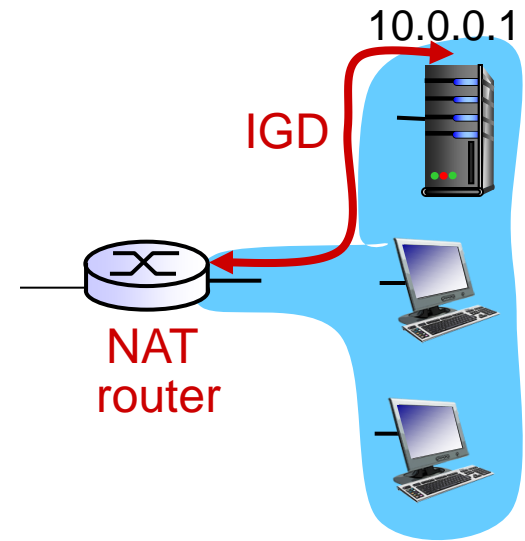


# NAT traversal problem

❖ *solution 2*: Universal Plug and Play (UPnP) Internet Gateway Device (IGD) Protocol. Allows NATed host to:

- ❖ learn public IP address (138.76.29.7)
- ❖ add/remove port mappings (with lease times)

i.e., automate static NAT port map configuration



# NAT traversal problem

- ❖ **solution 3:** relaying (used in Skype)
  - NATed client establishes connection to relay
  - external client connects to relay
  - relay bridges packets between to connections

