CSC 524

Computer Networks

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Lecture 7

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Agenda

1. IP protocol – Cont.
2. Transport Layer
3. Routing Algorithms
4. Congestion Control
5. Internet Protocol
6. Summary & Discussion

IP Protocol- Cont.

- NAT
- Internet Control Protocols
  - ICMP
  - ARP
  - DHCP

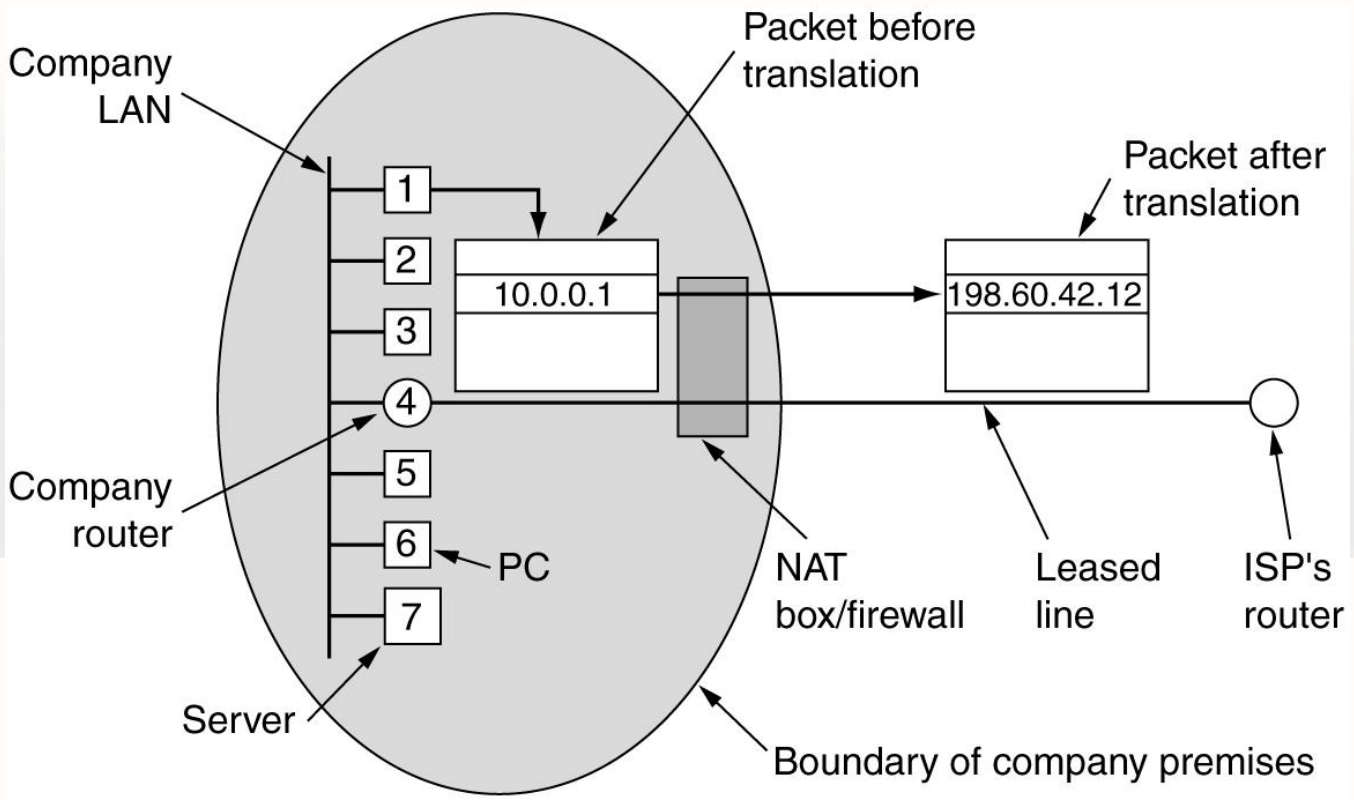
IP Protocol- Cont.

- NAT (Network Address Translation)
- IPs are limited !
- Cannot give each “Host” an IP address
- Solution ?
  - Internal Networks
  - Non-Routable IP address
    - 10.0.0.0 - 10.255.255.255/8 (16,777,216 hosts)
      172.16.0.0 - 172.31.255.255/12 (1,048,576 hosts)
      192.168.0.0 - 192.168.255.255/16 (65,536 hosts)
  - NATting !

IP Protocol- Cont.

- How does NAT work ?
- NAT box
  - Internal host (iHost) wants to communicate with External Host (eHost)
  - NAT box replace ip of iHost to be ip of NAT box and update the Translation Table (or packet)
  - Packet comes from eHost ? Check Table or packet
  - Reverse the translation

IP Protocol- Cont.



IP Protocol- Cont.

- Outgoing Packets
  - Whenever an outgoing packet enters the NAT box, the 10.x.y.z source address is replaced by the company's true IP address.
  - TCP Source port field is replaced by an index into the NAT box's 65,536-entry translation table.
  - This table entry contains the original IP address and the original source port.

IP Protocol- Cont.

- Incoming Packets
  - a packet arrives at the NAT box from the ISP
  - the Source port in the TCP header is extracted and used as an index into the NAT box's mapping table.
  - the internal IP address and original TCP Source port are extracted and inserted into the packet.
  - The packet is then passed to the company router for normal delivery using the 10.x.y.z address.

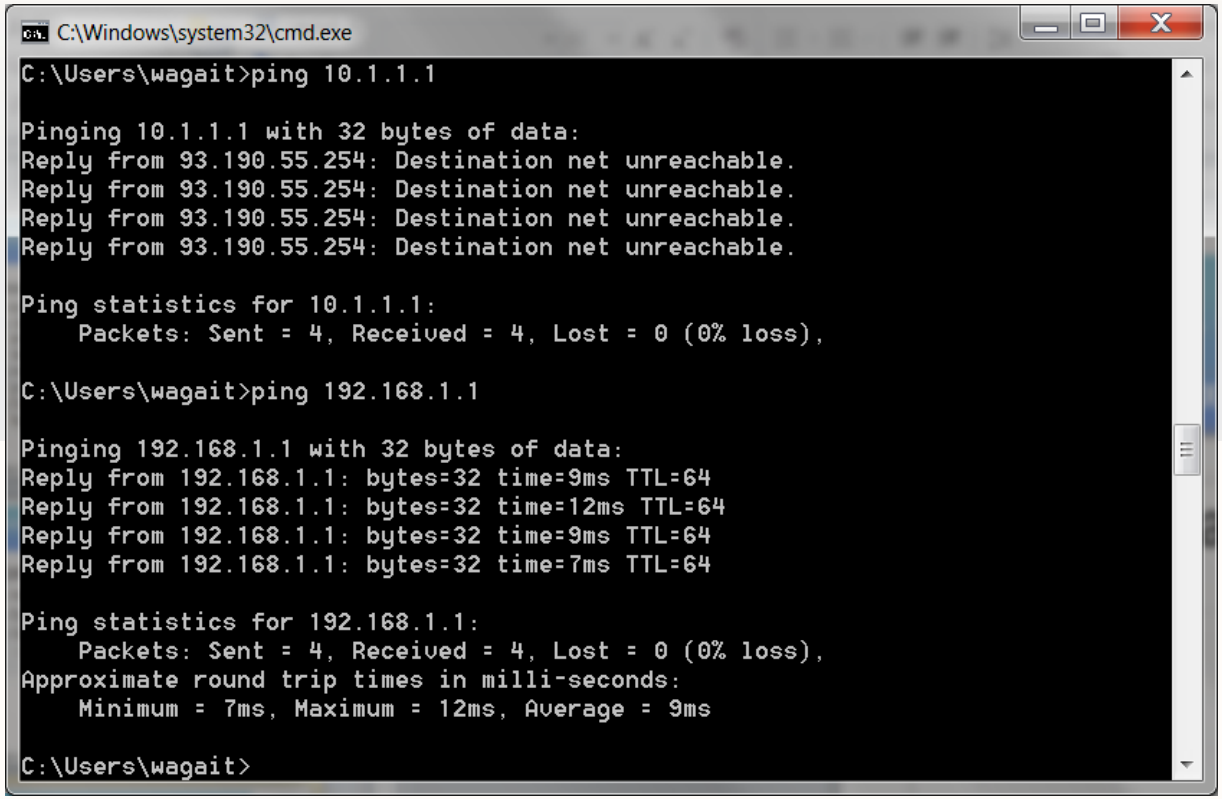
IP Protocol- Cont.

- ICMP
  - Internet Control Message Protocol
  - To handle unexpected errors
  - You know Ping ?
    - Utility that uses ICMP

Message type	Description
Destination unreachable	Packet could not be delivered
Time exceeded	Time to live field hit 0
Parameter problem	Invalid header field
Source quench	Choke packet
Redirect	Teach a router about geography
Echo request	Ask a machine if it is alive
Echo reply	Yes, I am alive
Timestamp request	Same as Echo request, but with timestamp
Timestamp reply	Same as Echo reply, but with timestamp

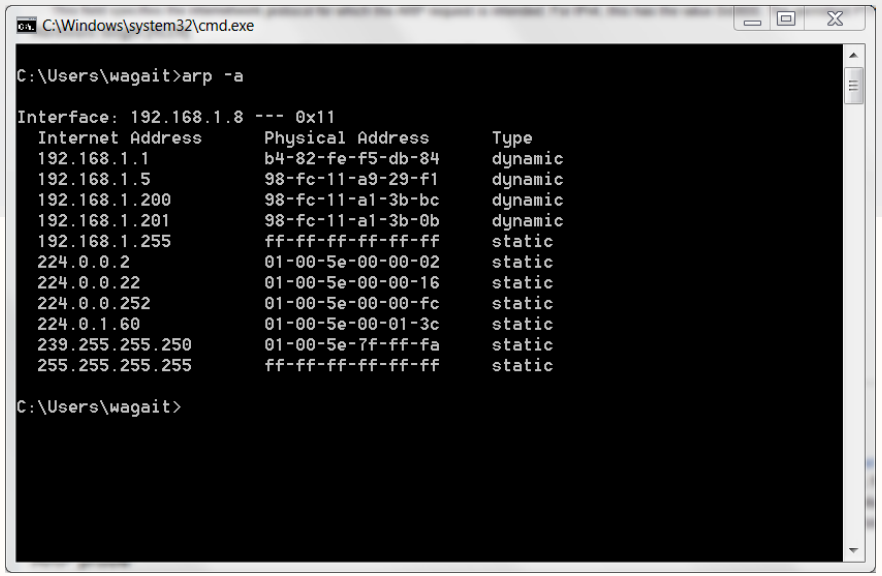
IP Protocol- Cont.

- 1983.. Why named PING ? ☺



IP Protocol- Cont.

- ARP (Address Resolution Protocol)
- Network layer is end-to-end layer !
- How do you determine Data Link Layer address ?



IP Protocol- Cont.

- DHCP (Dynamic Host Configuration Protocol)
- Telling each host the IP config. (gateway, ip address, DNS ..etc)

IP Protocol- Cont.

- Routing
  - Internal → OSPF
    - Open Shortest Path First
  - External → BGP
    - Border Gateway Protocol

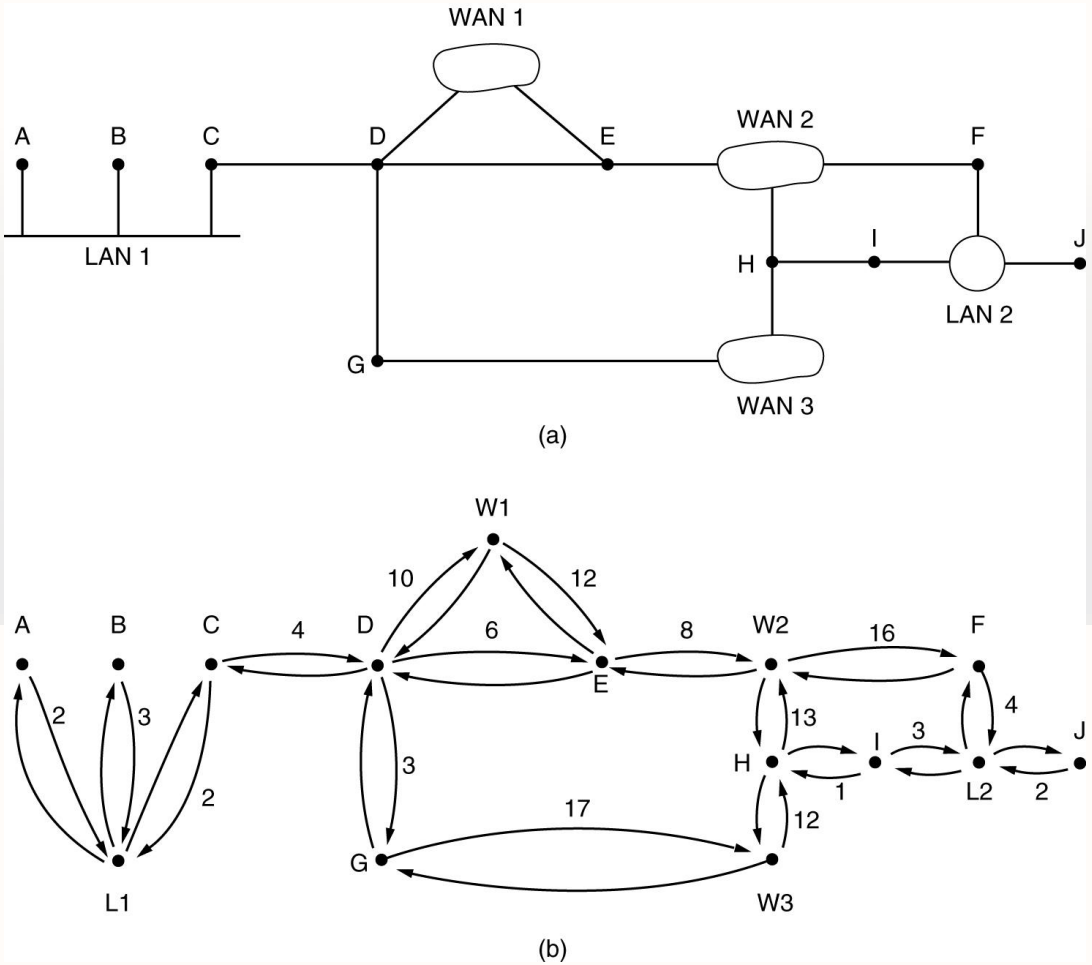
IP Protocol- Cont.

- OSPF
  - Internet Engineering Task Force (RFC2328)
- Requirements
  - published in the open literature, hence the "O"
  - support a variety of distance metrics, including physical distance, delay, and so on
  - dynamic algorithm
  - support routing based on type of service
  - load balancing, splitting the load over multiple lines
  - support for hierarchical systems (no single router knows the entire Internet topology)
  - security (cannot fool routers)
  -

IP Protocol- Cont.

- OSPF supports
  - Point-to-point lines between exactly two routers
  - Multiaccess networks with broadcasting (e.g., most LANs).
  - Multiaccess networks without broadcasting (e.g., most packet-switched WANs).

IP Protocol- Cont.



IP Protocol- Cont.

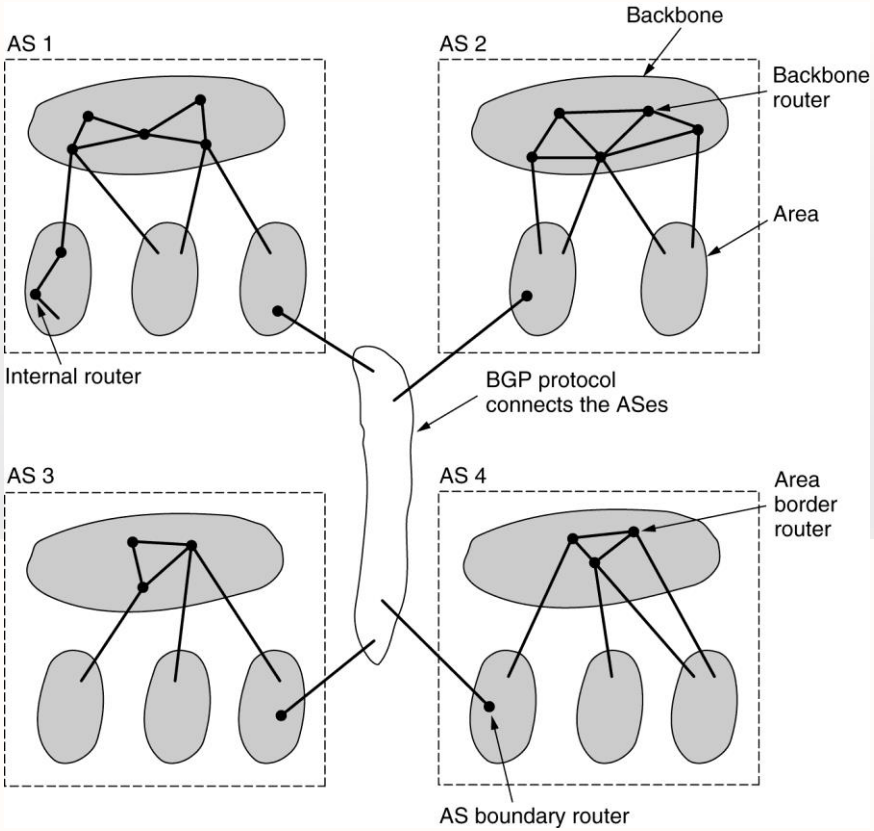
- networks, routers, and lines converted into a directed graph in which each arc is assigned a cost
- then computes the shortest path based on the weights on the arcs
- OSPF allows Large Autonomous Systems to be divided into numbered areas
  - area is a network or a set of contiguous networks

IP Protocol- Cont.

- backbone area, called area 0.
  - All areas are connected to the backbone
- Within an area
  - each router has the same link state database and runs the same shortest path algorithm
- 3 kinds of routes
  - intra-area: Shortest Path !!
  - Interarea: Source → backbone → destination
  - inter-AS

IP Protocol- Cont.

- 4 types of routers
  - Internal
  - Area Border
  - Backbone
  - AS Boundary
- Classes overlap



IP Protocol- Cont.

- BGP
  - Border Gateway Protocol
- Homework .. Self-read

THANK YOU!

Your Logo