CS 640 Introduction to Computer Networks

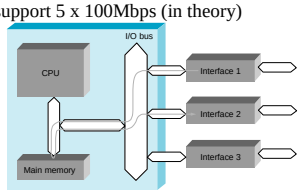
Lecture10

Today's lecture

- Implementing routers/switches
- Network address translation
- IPv6

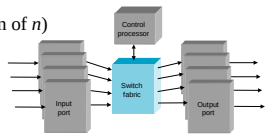
Workstation-based router

- Aggregate throughput (bandwidth)
  - 1/2 of the I/O bus bandwidth
  - capacity shared among all hosts connected to switch
  - ex: 1Gbps bus can support 5 x 100Mbps (in theory)
- Packets per second
  - must be able to switch small packets
  - 300,000 packets-per-second is achievable
  - e.g., 64-byte packets implies 155Mbps



Serious routers and switches

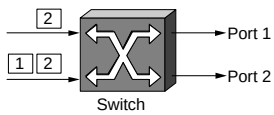
- Design Goals
  - throughput
  - scalability (a function of *n*)



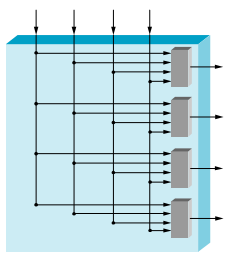
- Ports
  - forwarding decision (route lookup)
  - buffering (input and/or output)
- Fabric
  - as simple as possible
  - sometimes do buffering (internal)

Buffering

- Wherever contention is possible
  - input port (contend for fabric)
  - internal (contend for output port)
  - output port (contend for link)
- Head-of-Line Blocking (input buffering)



Fabric example: crossbar switches



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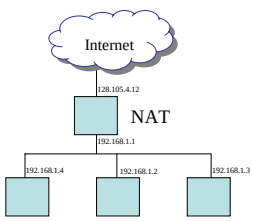
Network Address Translation

- Multiple clients access network through NAT box using single IP address
- **Advantages**:
  - Fewer IP addresses used (clients have private RFC 1918 addresses)
  - Outside hosts cannot connect to NATed clients
- **Disadvantages**:
  - Breaks end to end reachability
  - Outside hosts cannot connect to NATed clients
- Works by rewriting IP, TCP, and UDP headers

Network Address Translation

- Rewrites <hostaddr, port> to <extaddr, port> and back
- Source address, port of outgoing packet changed
- Destination address, port of incoming packet changed



NAT box maintains table with translations

Internal	External
192.168.1.4, 1336	128.105.4.12, 1330
192.168.1.3, 1455	128.105.4.12, 1331
192.168.1.2, 1336	128.105.4.12, 1332
192.168.1.2, 1771	128.105.4.12, 1333

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IP version 6

- Proposed successor of IPv4
- Uses 128 bit addresses

  - IP address includes 48 bit MAC address
  - Renumbering still necessary when network moves to different provider
- Simplifies header to allow more efficient packet processing at routers

IPv6 header