BITS Pilani
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Introduction

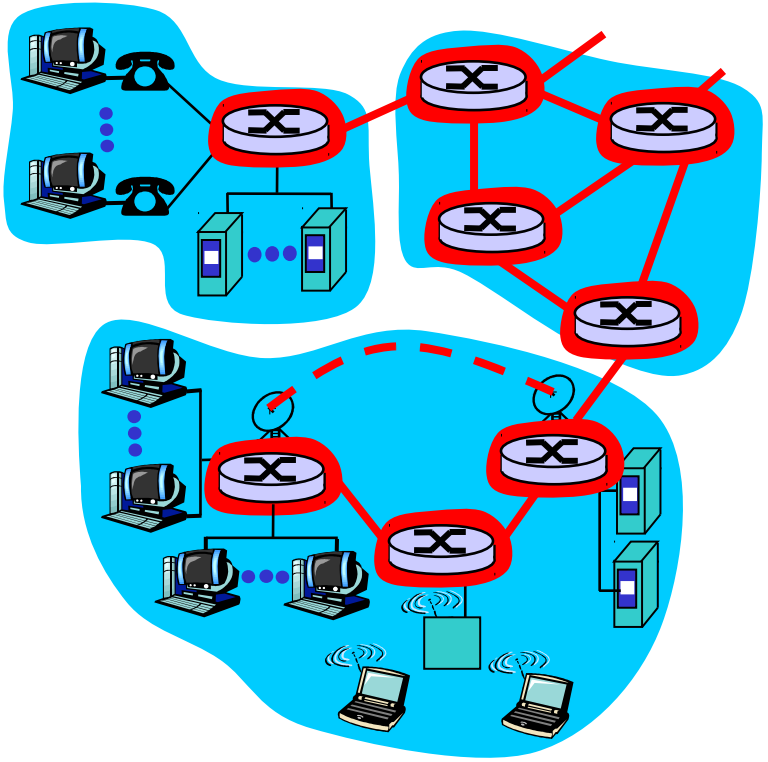
Network Core

Mesh of interconnected routers

Fundamental question: how is data transferred through net?

circuit switching: dedicated circuit per call: telephone net

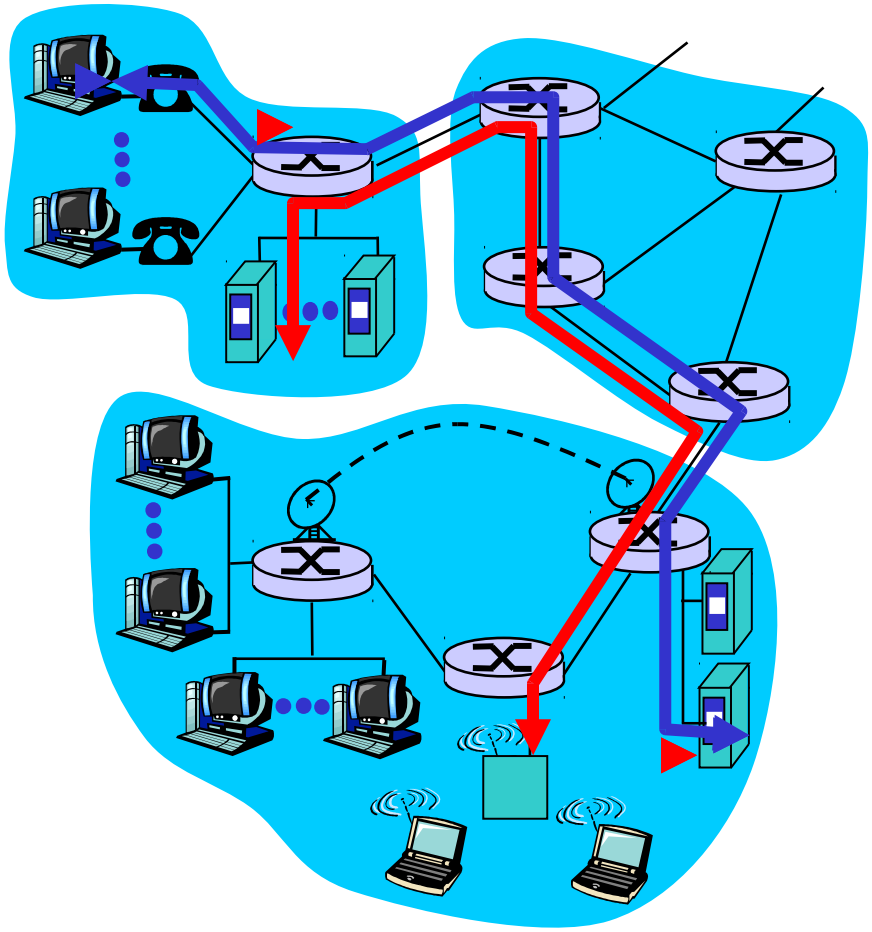
packet-switching: data sent thru net in discrete “chunks”



Circuit Switching

End-end resources reserved for "call"

- link bandwidth, switch capacity
- dedicated resources: no sharing
- circuit-like (guaranteed) performance
- call setup required



Circuit Switching

innovate achieve lead

Network resources (e.g., bandwidth) divided into “pieces”

Pieces allocated to calls

Resource piece *idle* if not used by owning call *(no sharing)*

Dividing link bandwidth into “pieces”

-frequency division

-time division

Packet Switching

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Each end-end data stream divided into *packets*

user A, B packets *share* network resources

each packet uses full link bandwidth

resources used *as needed*

Resource contention:

Aggregate resource demand can exceed amount available.

Congestion: packets queue, wait for link use

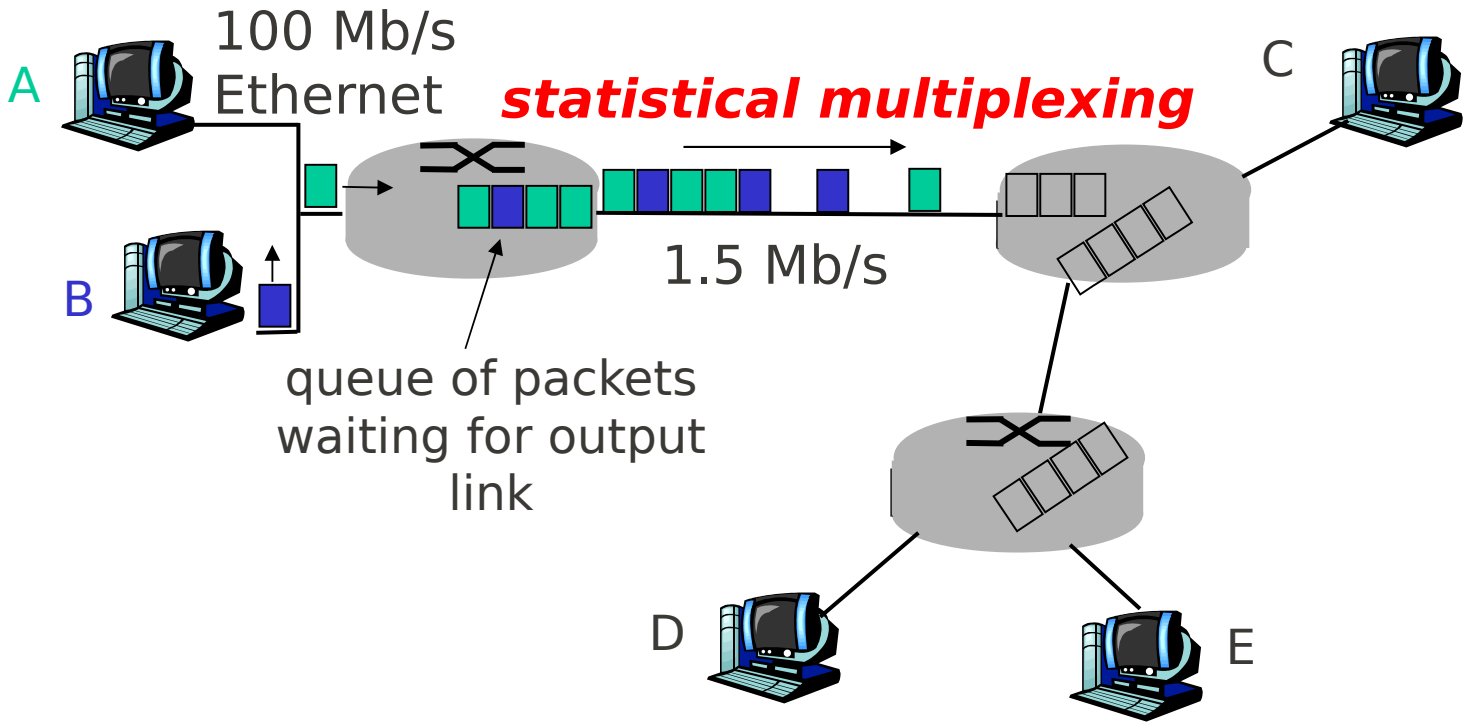
Store and forward: packets move one hop at a time

-Node receives complete packet before forwarding

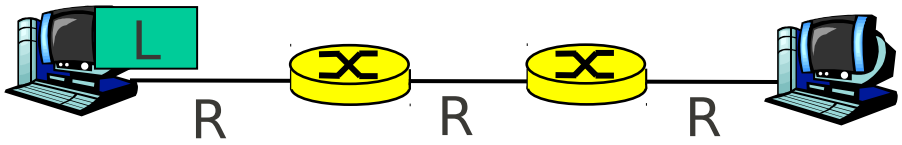
Packet Switching

innovate achieve lead

Sequence of A & B packets does not have fixed pattern, shared on demand *statistical multiplexing*.



Packet Switching



- Takes L/R seconds to transmit (push out) packet of L bits on to link or R bps
- Entire packet must arrive at router before it can be transmitted on next link: *store and forward*
- delay = 3L/R (assuming zero propagation delay)

Example:

- L = 7.5 Mbits
- R = 1.5 Mbps

Delay ??

Access networks and physical media

How to connect end systems to edge router?

residential access nets

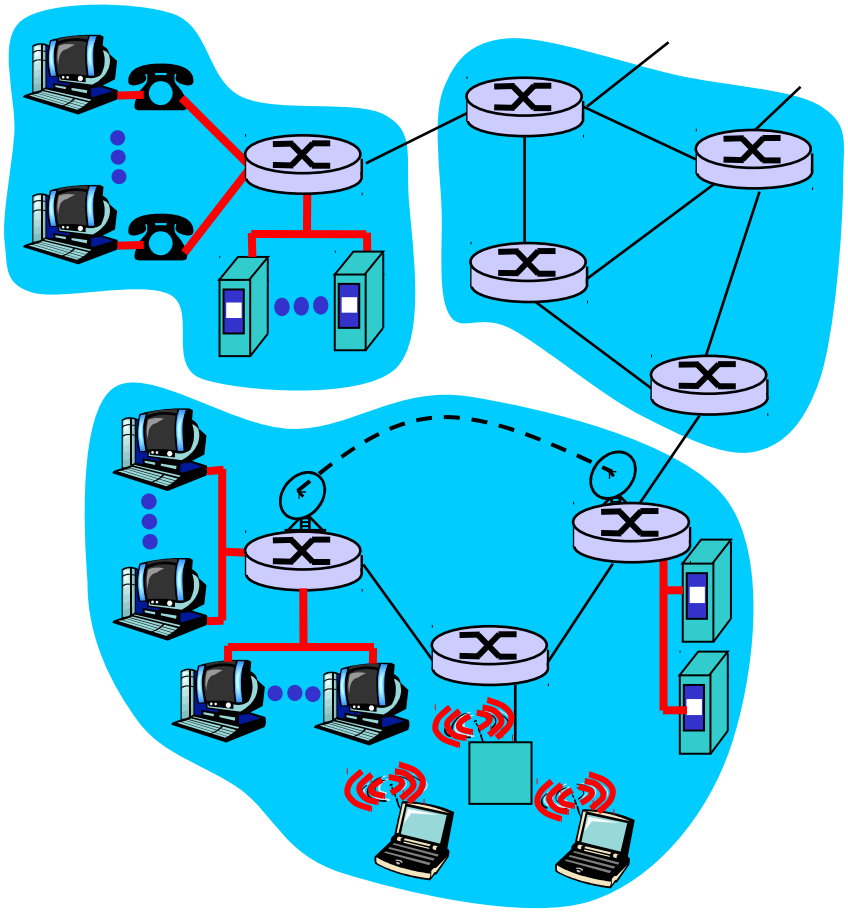
institutional access networks (school, company)

mobile access networks

Keep in mind:

bandwidth (bits per second) of access network?

shared or dedicated?



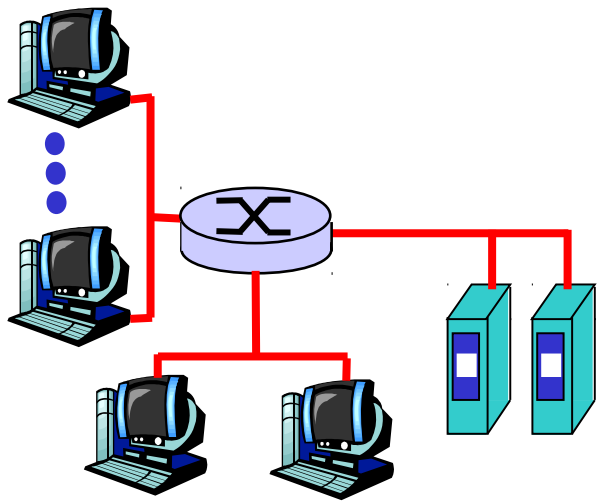
Local area networks

company/univ local area network (LAN) connects end system to edge router

Ethernet:

shared or dedicated link connects end system and router

10 Mbs, 100Mbps, Gigabit Ethernet



A closer look

network edge:

-applications and hosts

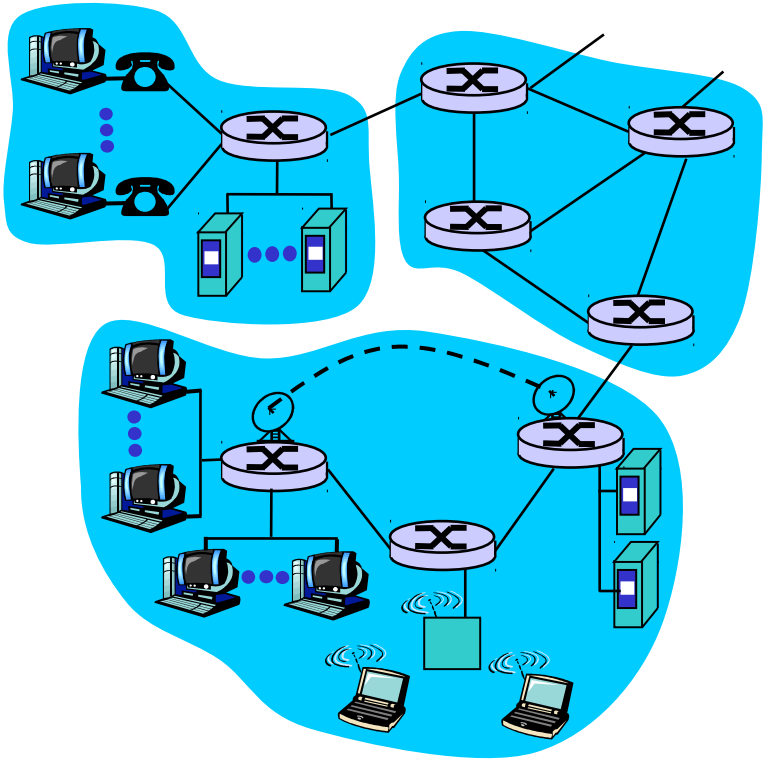
network core:

-routers

-network of networks

access networks, physical media:

-communication links



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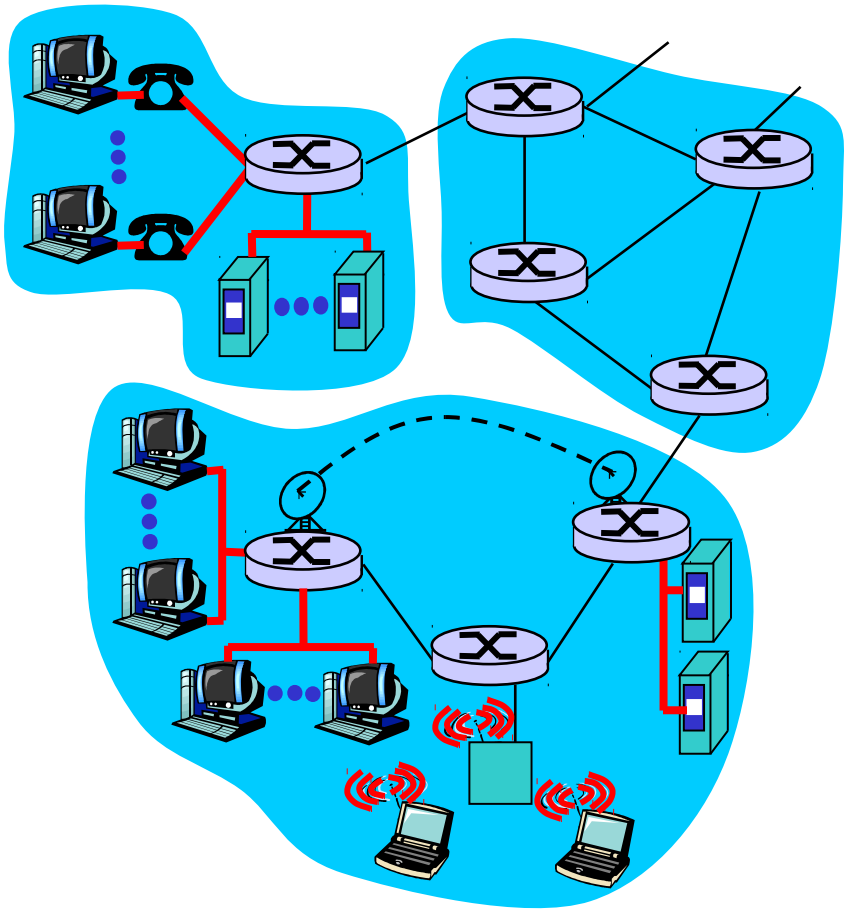

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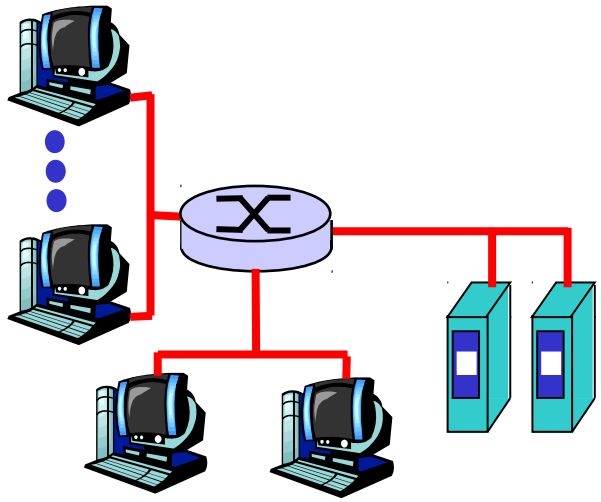


Wireless access networks

- shared *wireless* access network connects end system to router

  - via base station aka “access point”

- wireless LANs:

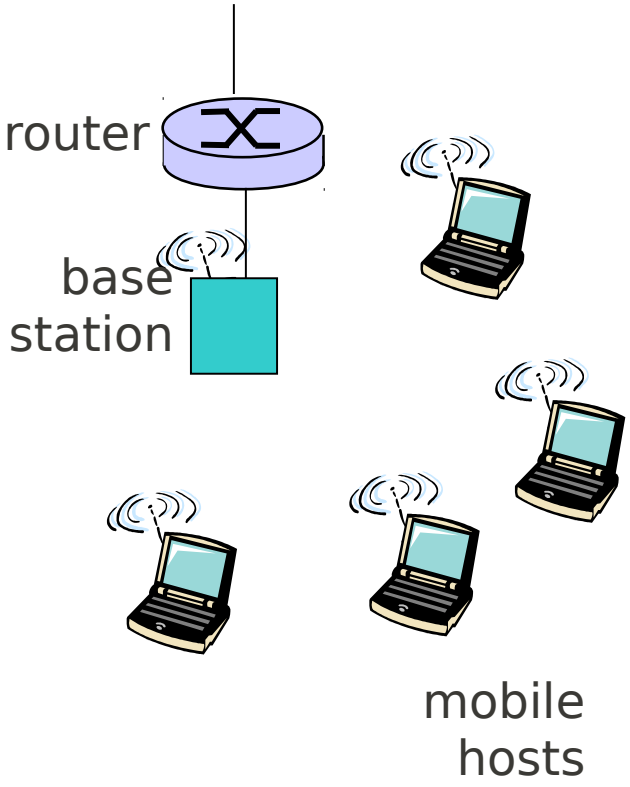
  - 802.11b/g (WiFi): 11 or 54 Mbps

- wider-area wireless access

  - provided by telco operator

  - 3G ~ 384 kbps

  - GPRS in Europe/US



Home networks

Typical home network components:

ADSL or cable modem

router/firewall/NAT

Ethernet

wireless access point