Jaringan Komputer

Perkenalan Jaringan Komputer dan Komunikasi data

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1

Objectives

- Mampu menjelaskan terminilogy dasar di jaringan komputer
- Mampu menyebutkan komponen-komponen dalam jaringan komputer
- Mampu menggambarkan layout network dasar
- Memahami internet dan protocol
- Memahami akses network dan media

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2

Pendahuluan

- **Siapa hari ini yang tidak menggunakan jaringan ?**
- Mass transit, interstate highways, 24-hour bankers, grocery stores, cable television, cell phones, businesses and schools, and retail outlets support some form of computer network

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Istilah umum dalam Jaringan

- **Computer network** – an interconnection of computers and computing equipment using either wires or radio waves over small or large geographic areas
- **Local area network** – networks that are small in geographic size spanning a room, floor, building, or campus
- **Metropolitan area network** – networks that serve an area of 1 to 30 miles, approximately the size of a typical city

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4

Istilah umum dalam Jaringan

- **Wide area network –** a large network that encompasses parts of states, multiple states, countries, and the world
- **Personal area network –** a network of a few meters, between wireless devices such as PDAs, laptops, and similar devices
- **Voice network –** a network that transmits only telephone signals (almost extinct)
- **Data network –** a network that transmits voice and computer data (replacing voice networks)

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Istilah umum dalam Jaringan

- **Data communications** – the transfer of digital or analog data using digital or analog signals
- **Telecommunications** – the study of telephones and the systems that transmit telephone signals (becoming simply data communications)
- **Network management** – the design, installation, and support of a network, including its hardware and software
- **Network cloud** – a network (local or remote) that contains software, applications, and/or data

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Big Picture Network

- Jaringan disusun dari berbagai macam peralatan, including:
  - Workstations (computers, tablets, wireless phones, etc)
  - Servers
  - Network hubs and switches
  - Routers (LAN to WAN and WAN to WAN)
  - Telephone switching gear

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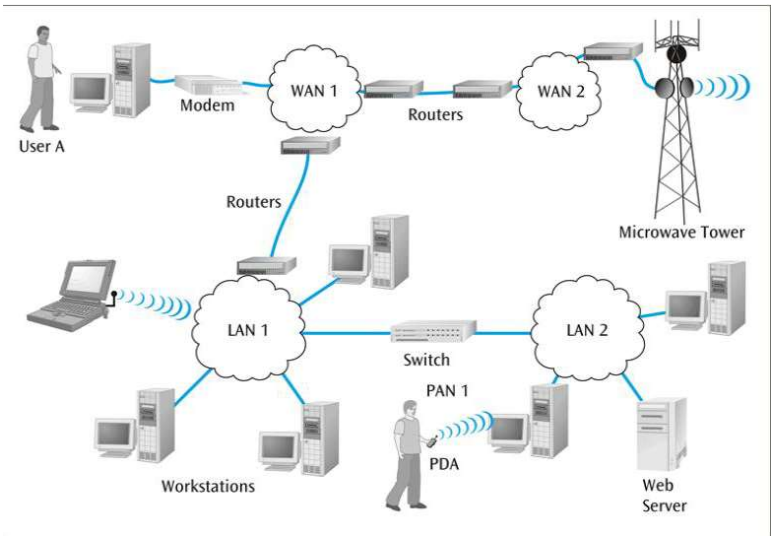
7

Big Pictures Network



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Layout Komunikasi Jaringan

- *Microcomputer-to-local area network*
- *Microcomputer-to-Internet*
- *Local area network-to-local area network*
- *Personal area network-to-workstation*
- *Local area network-to-metropolitan area network*
- *Local area network-to-wide area network*
- *Sensor-to-local area network*
- *Satellite and microwave*
- *Cell phones*
- *Computer terminal / microcomputer-to-mainframe*

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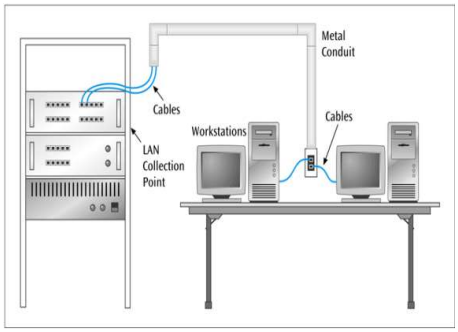
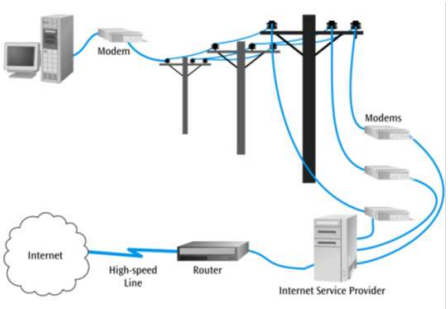
9



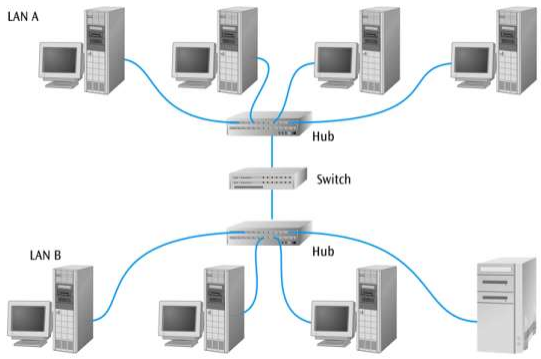
Microcomputer-to-local area network

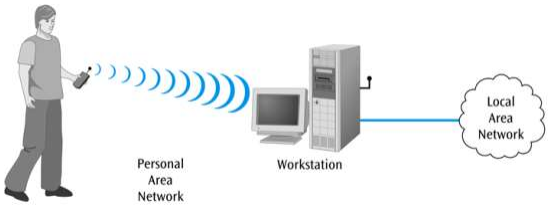
Microcomputer-to-Internet



10

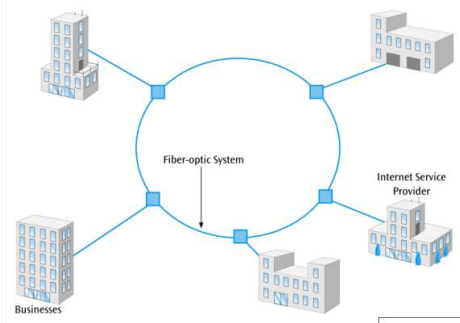
LAN to LAN

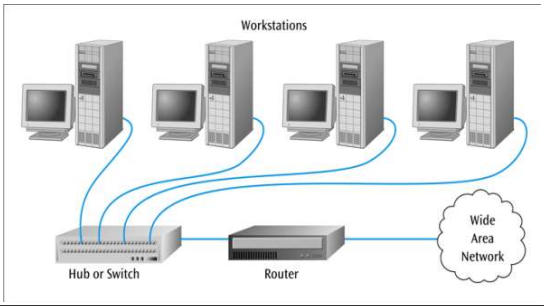




11

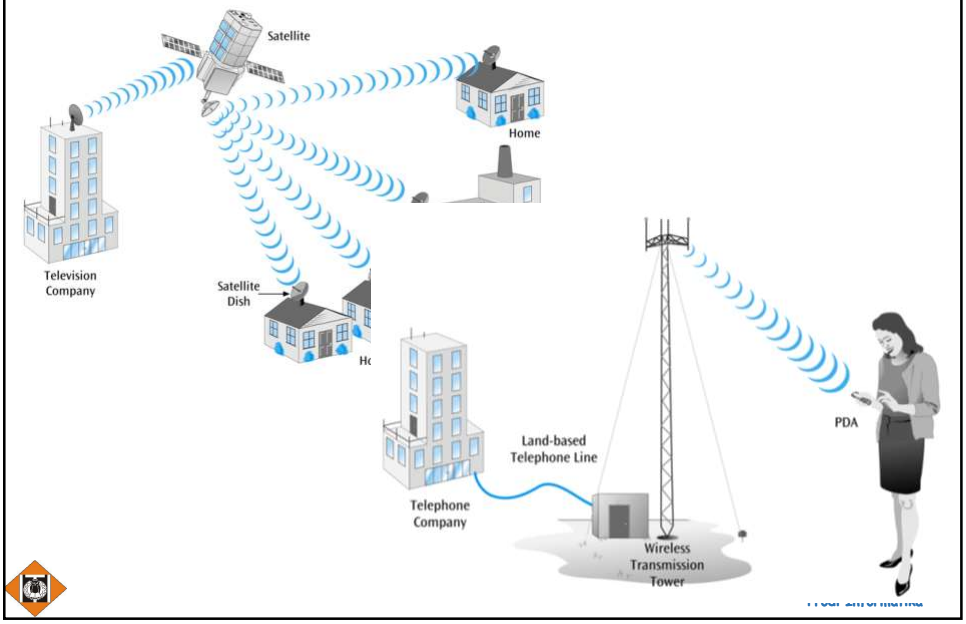
LAN to MAN & LAN to WAN





12

Satellite & Microwave, Cellphone



13

Network Architectures

- **Model referensi** yang mengambarkan layer hardware dan software yang dibutuahkan untuk mengirimkan data antara dua titik atau banyak peralatan/aplikasi untuk saling terhubung
- **Model referensi** diperlukan untuk meningkatkan kemungkinan komponen berbeda dari pabrikan berbeda untuk berkomunikasi
- Dua Model dipelajari: TCP/IP protocol dan OSI model

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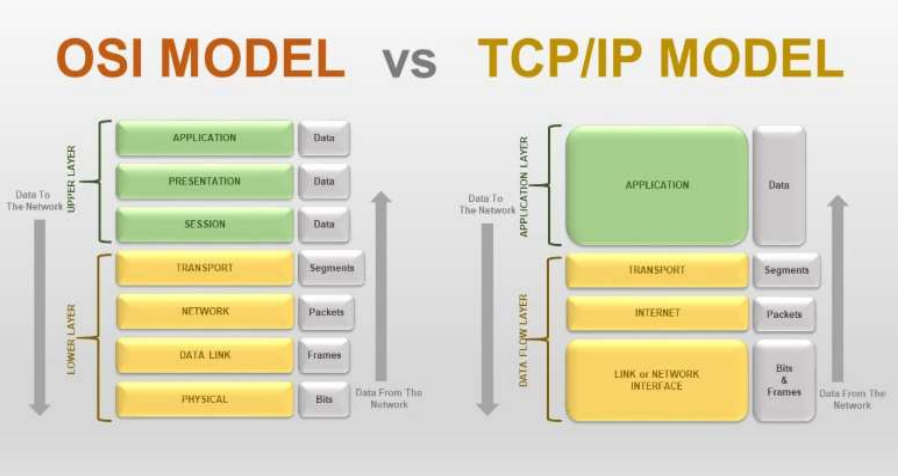
14

Referensi Model



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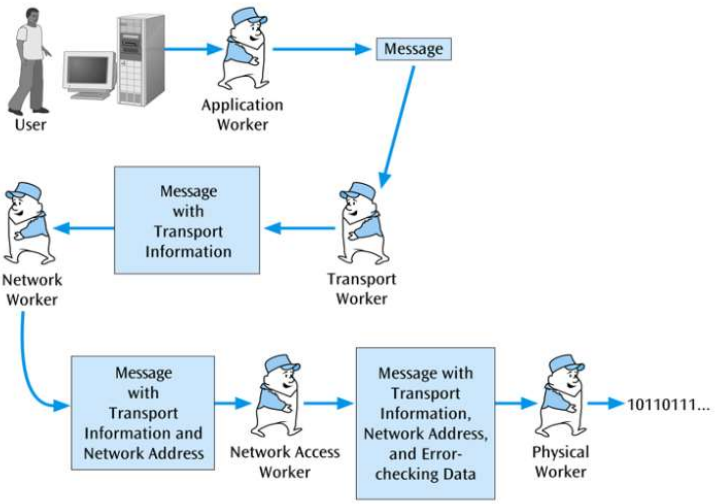
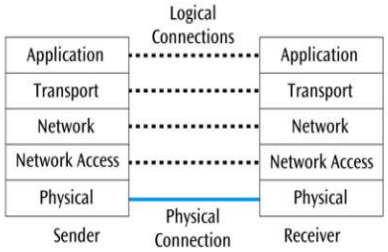


16

Logical & Physical Connection

- A logical connection is one that exists only in the software, while a physical connection is one that exists in the hardware
- Note that in a network architecture, only the lowest layer contains the physical connection, while all higher layers contain logical connections



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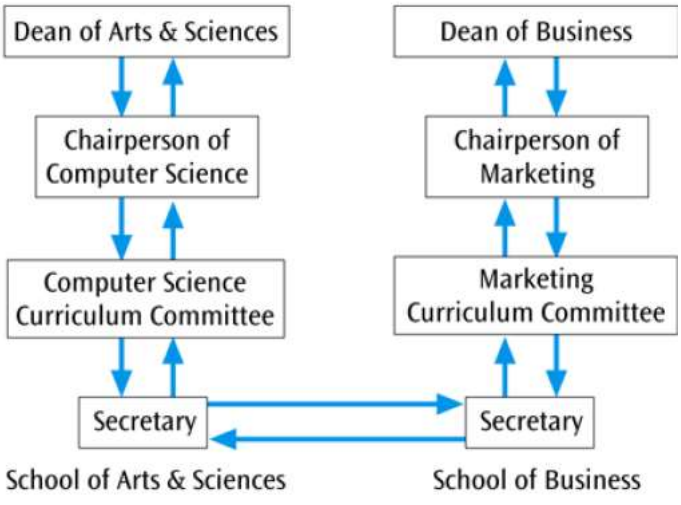
17



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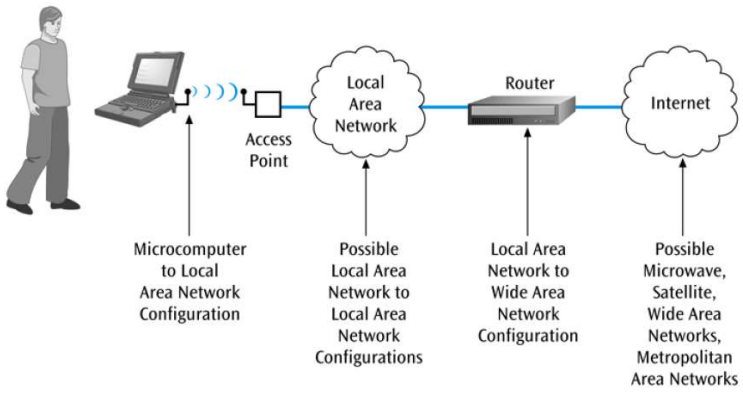
18

Network Layout in Action



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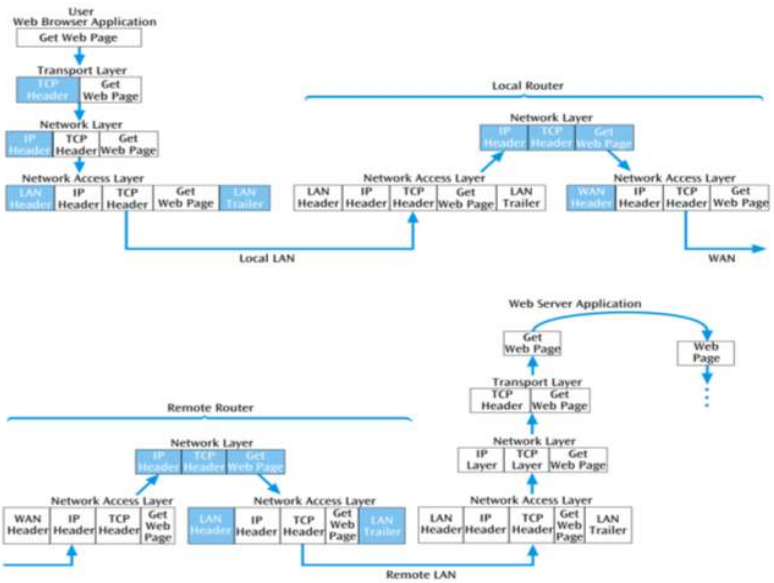
19

Network in Action



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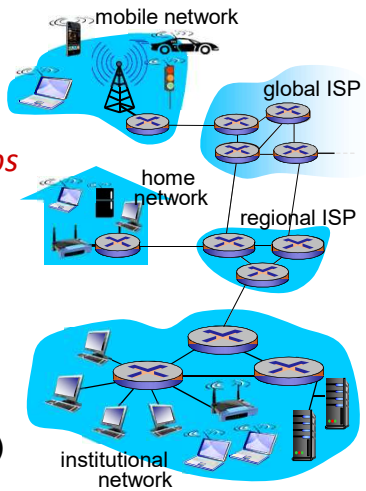
20

Introduction to Internet !

21

What's the Internet: "nuts and bolts" view

- Milyaran peralatan komputer:
  - *hosts = end systems*
  - running *network apps*
- *communication links*
  - fiber, copper, radio, satellite
  - transmission rate: *bandwidth*
- *packet switches:* forward packets (chunks of data)
  - *routers* and *switches*



22

"Fun" Internet-connected devices

IP picture frame
http://www.ceiva.com/

Web-enabled toaster + weather forecaster

Tweet-a-watt: monitor energy use

Internet refrigerator

Slingbox: watch, control cable TV remotely

sensorized, bed mattress

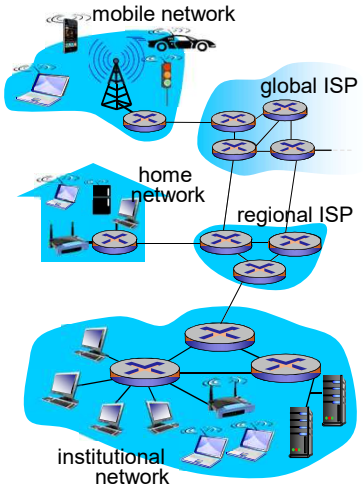
Internet phones

Introduction 1-23

23

What's the Internet: "nuts and bolts" view

- *Internet:* "network of networks"
  - Interconnected ISPs
- *protocols* control sending, receiving of messages
  - e.g., TCP, IP, HTTP, Skype, 802.11
- *Internet standards*
  - RFC: Request for comments
  - IETF: Internet Engineering Task Force

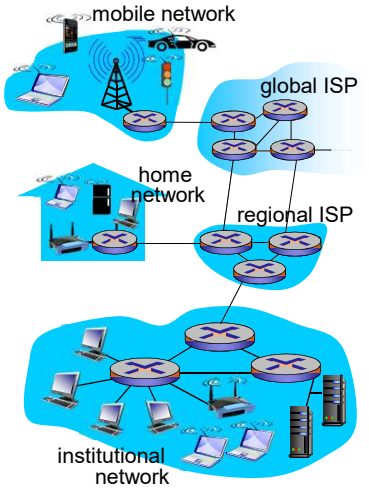


Introduction 1-24

24

What's the Internet: a service view

- *infrastructure that provides services to applications:*
  - Web, VoIP, email, games, e-commerce, social nets, …
- *provides programming interface to apps*
  - hooks that allow sending and receiving app programs to "connect" to Internet
  - provides service options, analogous to postal service



What's a protocol?

human protocols:

- "what's the time?"
- "I have a question"
- introductions

… specific messages sent

… specific actions taken when messages received, or other events

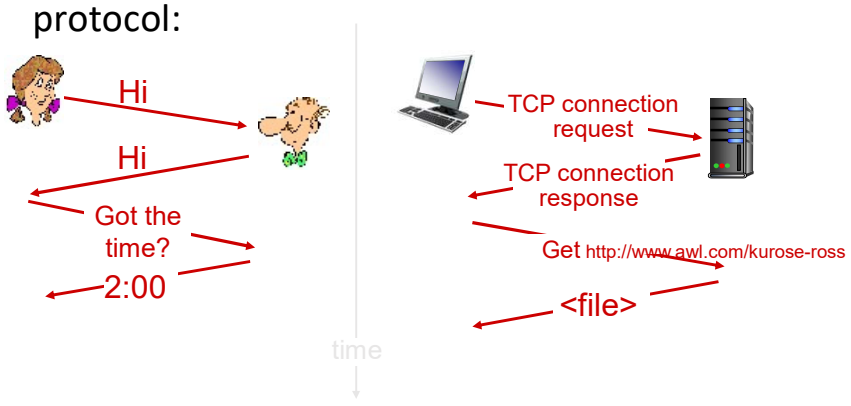
network protocols:

- machines rather than humans
- all communication activity in Internet governed by protocols

protocols define format, order of messages sent and received among network entities, and actions taken on message transmission, receipt

What's a protocol?

a human protocol and a computer network protocol:

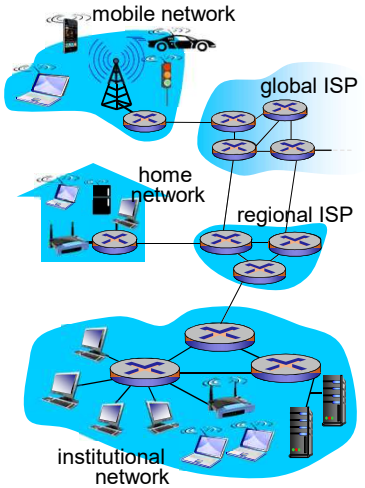


Q: other human protocols?

27

A closer look at network structure:

- *network edge:*
  - hosts: clients and servers
  - servers often in data centers
- *access networks, physical media:* wired, wireless communication links
- *network core:*
  - interconnected routers
  - network of networks



28

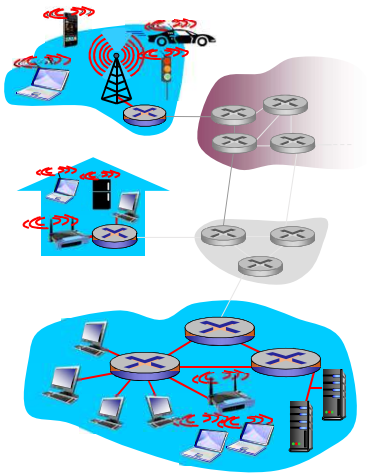
Access networks and physical media

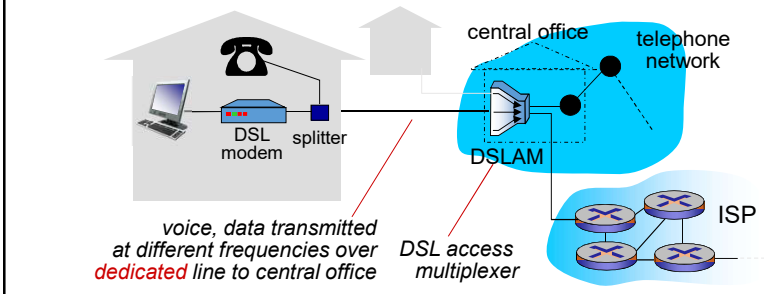
Q: How to connect end systems to edge router?

- residential access nets
- institutional access networks (school, company)
- mobile access networks

keep in mind:

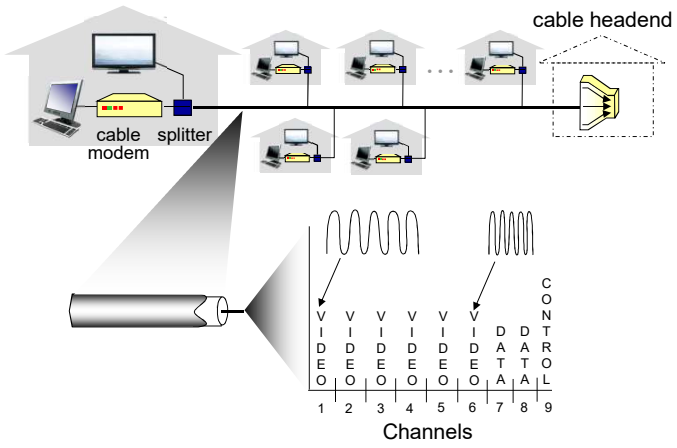
- bandwidth (bits per second) of access network?
- shared or dedicated?





- use *existing* telephone line to central office DSLAM
  - data over DSL phone line goes to Internet
  - voice over DSL phone line goes to telephone net
- < 2.5 Mbps upstream transmission rate (typically < 1 Mbps)
- < 24 Mbps downstream transmission rate (typically < 10 Mbps)

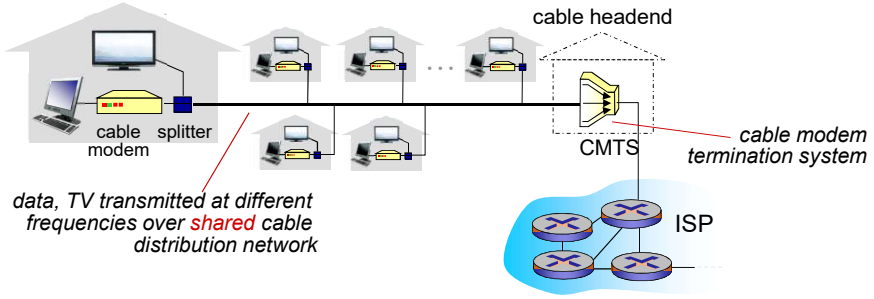
Access network: cable network



frequency division multiplexing: different channels transmitted in different frequency bands

31

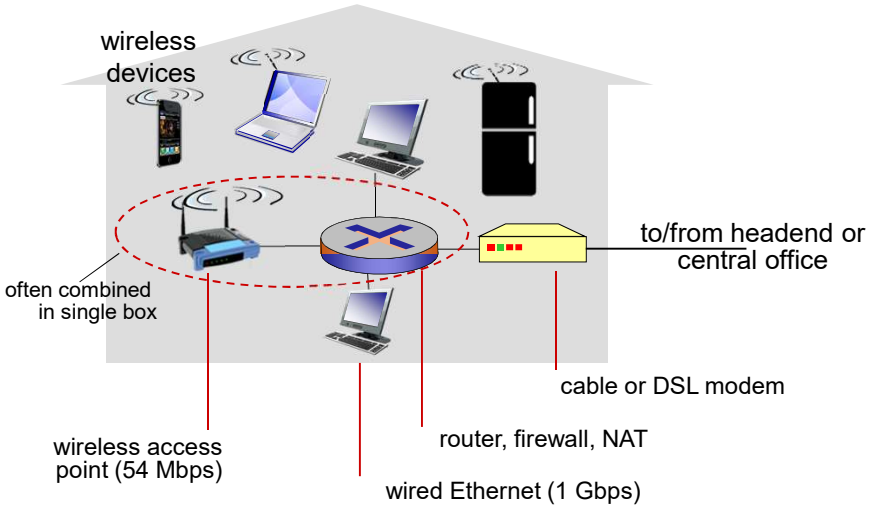
Access network: cable network



- HFC: hybrid fiber coax
  - asymmetric: up to 30Mbps downstream transmission rate, 2 Mbps upstream transmission rate
- network of cable, fiber attaches homes to ISP router
  - homes *share access network* to cable headend
  - unlike DSL, which has dedicated access to central office

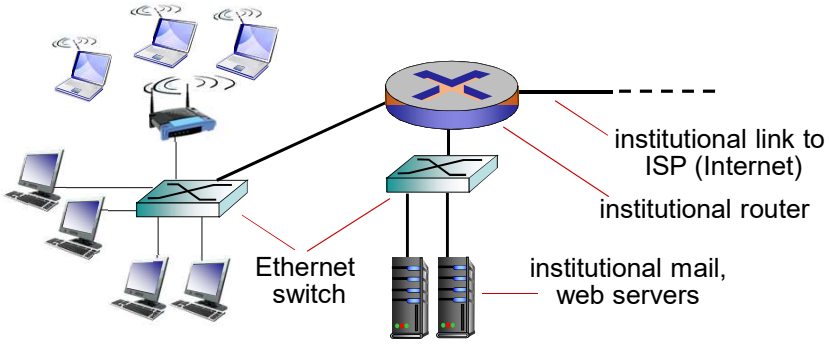
32

Access network: home network



33

Enterprise access networks (Ethernet)



- typically used in companies, universities, etc.
- 10 Mbps, 100Mbps, 1Gbps, 10Gbps transmission rates
- today, end systems typically connect into Ethernet switch

34

Wireless access networks

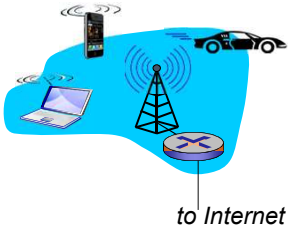
- shared *wireless* access network connects end system to router
  - via base station aka "access point"

wireless LANs:

- within building (100 ft.)
- 802.11b/g/n (WiFi): 11, 54, 450 Mbps transmission rate

wide-area wireless access

- provided by telco (cellular) operator, 10's km
- between 1 and 10 Mbps
- 3G, 4G: LTE

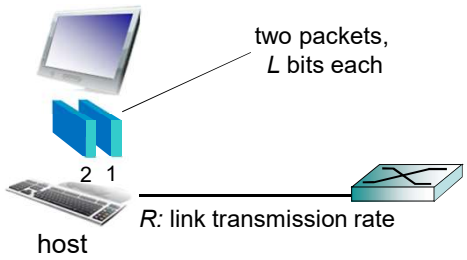


35

Host: sends *packets* of data

host sending function:

- takes application message
- breaks into smaller chunks, known as *packets*, of length *L* bits
- transmits packet into access network at *transmission rate R*
  - link transmission rate, aka link *capacity, aka link bandwidth*



$$\text{packet transmission delay} = \text{time needed to transmit } L\text{-bit packet into link} = \frac{L \text{ (bits)}}{R \text{ (bits/sec)}}$$

36

Physical media

- bit: propagates between transmitter/receiver pairs
- physical link: what lies between transmitter & receiver
- guided media:
  - signals propagate in solid media: copper, fiber, coax
- unguided media:
  - signals propagate freely, e.g., radio

twisted pair (TP)

- two insulated copper wires
  - Category 5: 100 Mbps, 1 Gbps Ethernet
  - Category 6: 10Gbps

37

Physical media: coax, fiber

coaxial cable:

- two concentric copper conductors
- bidirectional
- broadband:
  - multiple channels on cable
  - HFC

fiber optic cable:

- glass fiber carrying light pulses, each pulse a bit
- high-speed operation:
  - high-speed point-to-point transmission (e.g., 10's-100's Gbps transmission rate)
- low error rate:
  - repeaters spaced far apart
  - immune to electromagnetic noise

38

Physical media: radio

- signal carried in electromagnetic spectrum
- no physical "wire"
- bidirectional
- propagation environment effects:
  - reflection
  - obstruction by objects
  - interference

radio link types:

- terrestrial microwave
  - e.g. up to 45 Mbps channels
- LAN (e.g., WiFi)
  - 54 Mbps
- wide-area (e.g., cellular)
  - 4G cellular: ~ 10 Mbps
- satellite
  - Kbps to 45Mbps channel (or multiple smaller channels)
  - 270 msec end-end delay
  - geosynchronous versus low altitude