Jaringan Komunikasi Data

E-Learning

Presents:

Introduction and Network Models

Minggu 1

Outline

- Introduction
- Jaringan Komunikasi dan Data
- Model Jaringan

Introduction

How Networks Impact Our Daily Life

Online Interest Groups

Online Gaming

Online Entertainment

Online Shopping

Onboard Data Networks

Instant Messaging

The way we play is supported by services delivered by the data network.

Networks support the way we learn …

Virtual Classrooms

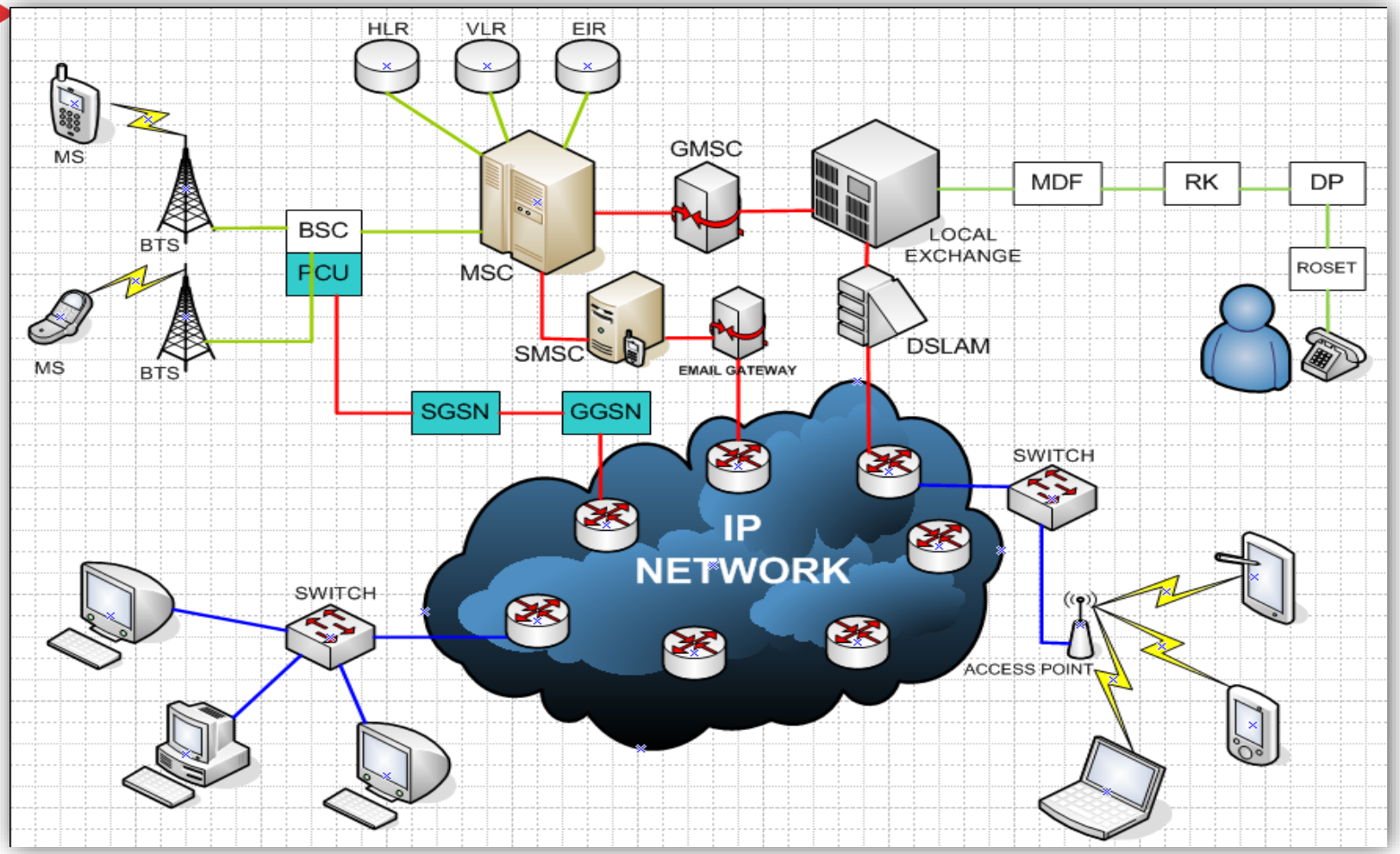
Collaborative Learning Spaces

On-demand Video

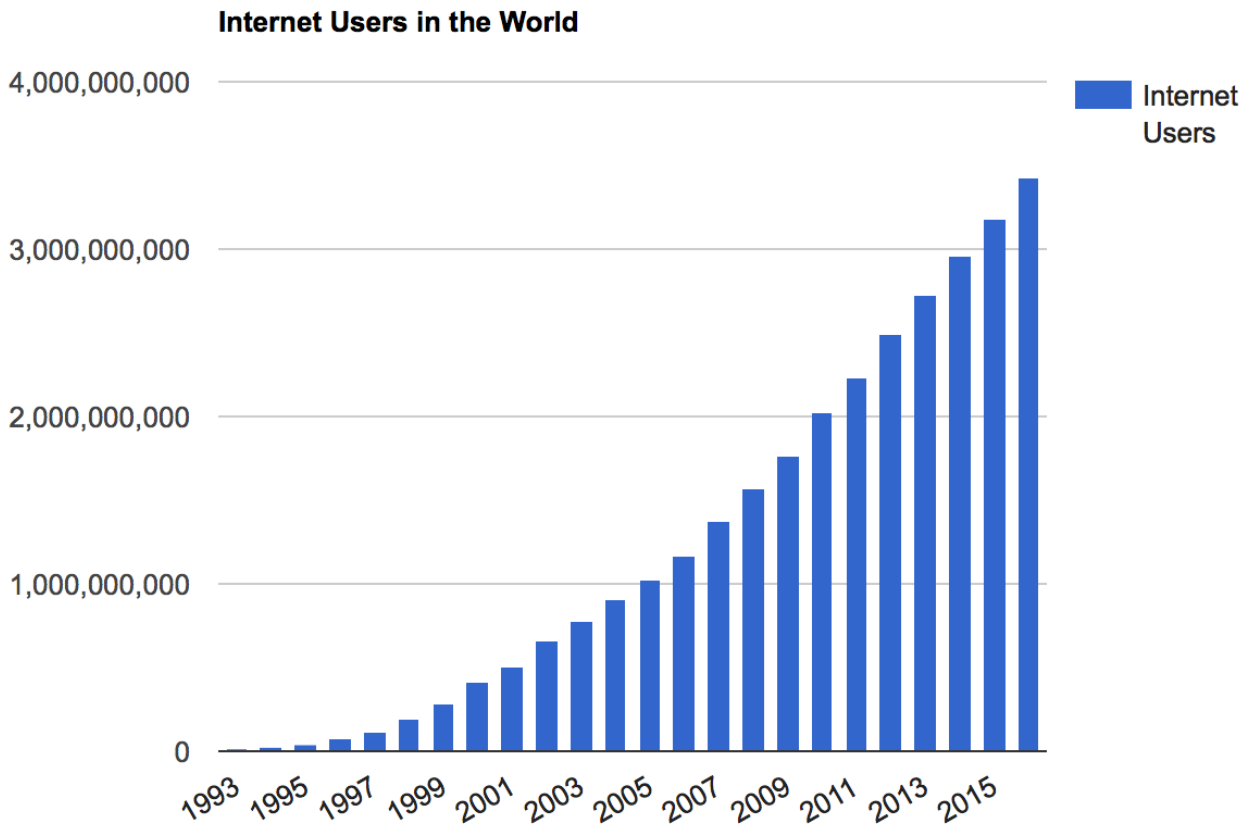
Mobile Learning

Video Conference

Network Growth



Internet Users Growth in The World



Source: www.internetlivestats.com

Internet Users by Country

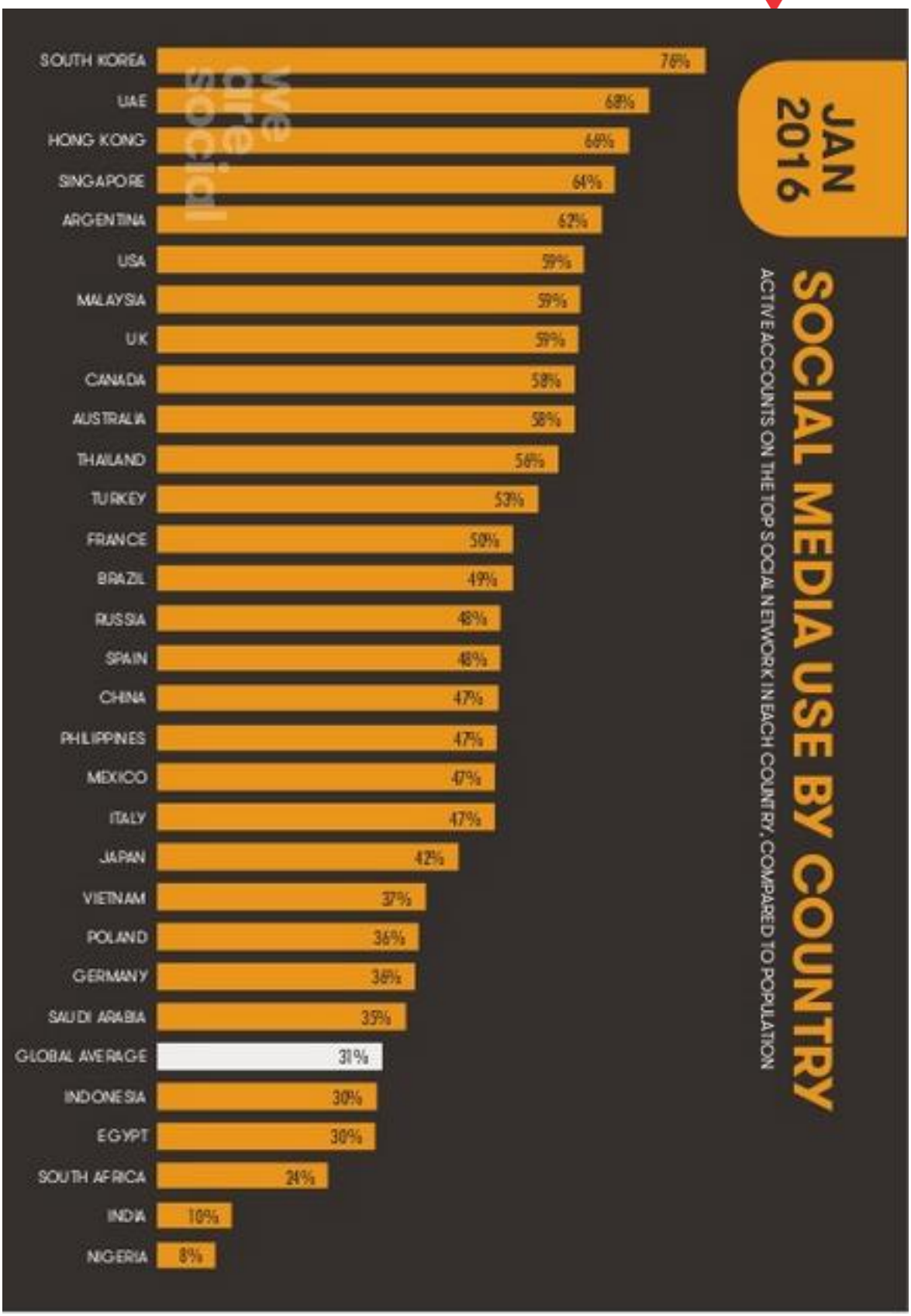
Internet Users by Country (2016)

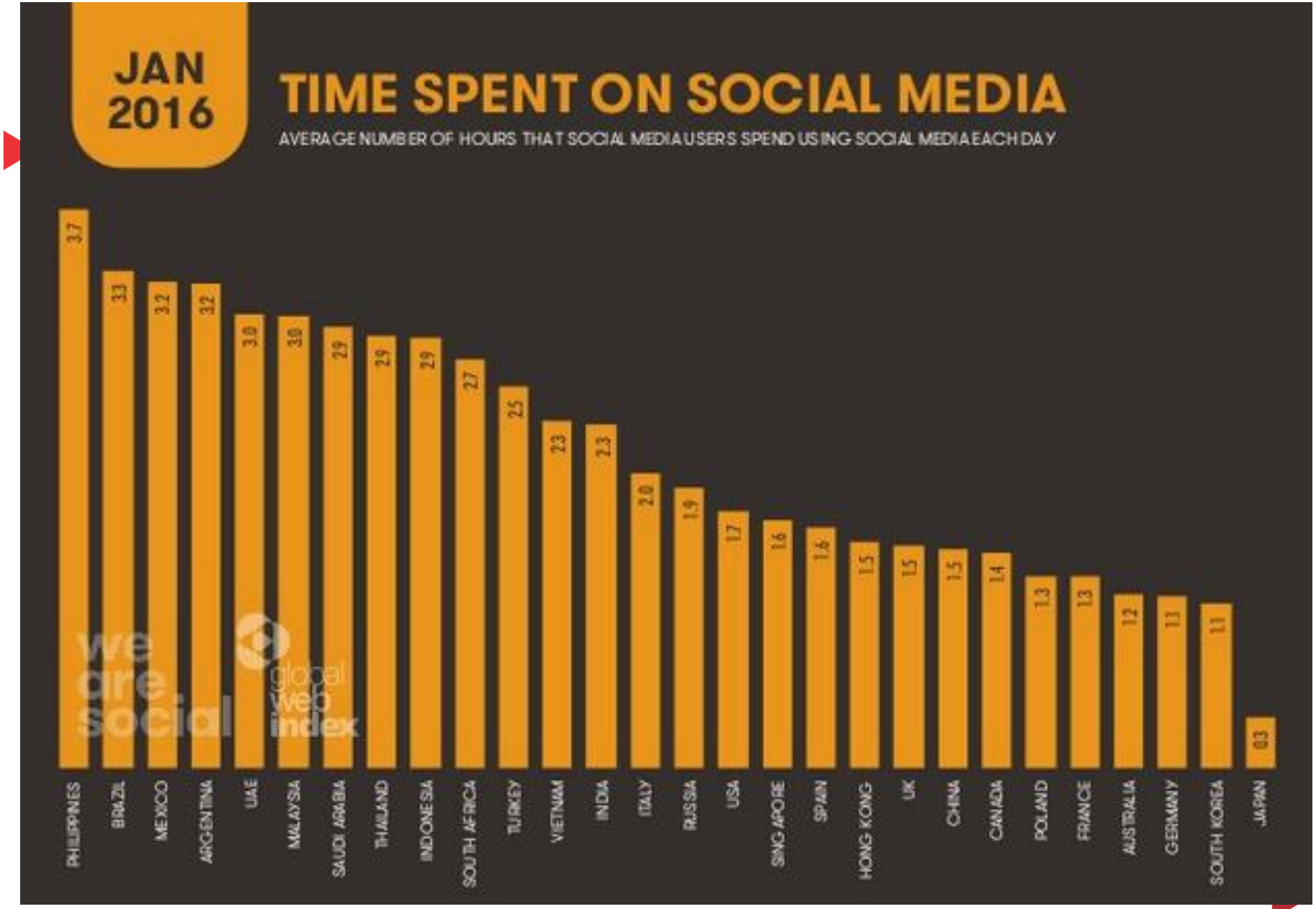
See also: 2015 Estimate and 2014 Finalized

#	Country	Internet Users (2016)	Penetration (% of Pop)	Population (2016)	Non-Users (internetless)	Users 1 Year Change (%)	Internet Users 1 Year Change	Population 1 Y Change
1	China	721,434,547	52.2 %	1,382,323,332	660,888,785	2.2 %	15,520,515	0.46 %
2	India	462,124,989	34.8 %	1,326,801,576	864,676,587	30.5 %	108,010,242	1.2 %
3	U.S.	286,942,362	88.5 %	324,118,787	37,176,425	1.1 %	3,229,955	0.73 %
4	Brazil	139,111,185	66.4 %	209,567,920	70,456,735	5.1 %	6,753,879	0.83 %
5	Japan	115,111,595	91.1 %	126,323,715	11,212,120	0.1 %	117,385	-0.2 %
6	Russia	102,258,256	71.3 %	143,439,832	41,181,576	0.3 %	330,067	-0.01 %
7	Nigeria	86,219,965	46.1 %	186,987,563	100,767,598	5 %	4,124,967	2.63 %
8	Germany	71,016,605	88 %	80,682,351	9,665,746	0.6 %	447,557	-0.01 %
9	U.K.	60,273,385	92.6 %	65,111,143	4,837,758	0.9 %	555,411	0.61 %
10	Mexico	58,016,997	45.1 %	128,632,004	70,615,007	2.1 %	1,182,988	1.27 %
11	France	55,860,330	86.4 %	64,668,129	8,807,799	1.4 %	758,852	0.42 %
12	Indonesia	53,236,719	20.4 %	260,581,100	207,344,381	6.5 %	3,232,544	1.17 %
13	Viet Nam	49,063,762	52 %	94,444,200	45,380,438	3.3 %	1,564,346	1.07 %
14	Turkey	46,196,720	58 %	79,622,062	33,425,342	5.1 %	2,242,750	1.22 %
15	Philippines	44,478,808	43.5 %	102,250,133	57,771,325	4.4 %	1,855,574	1.54 %

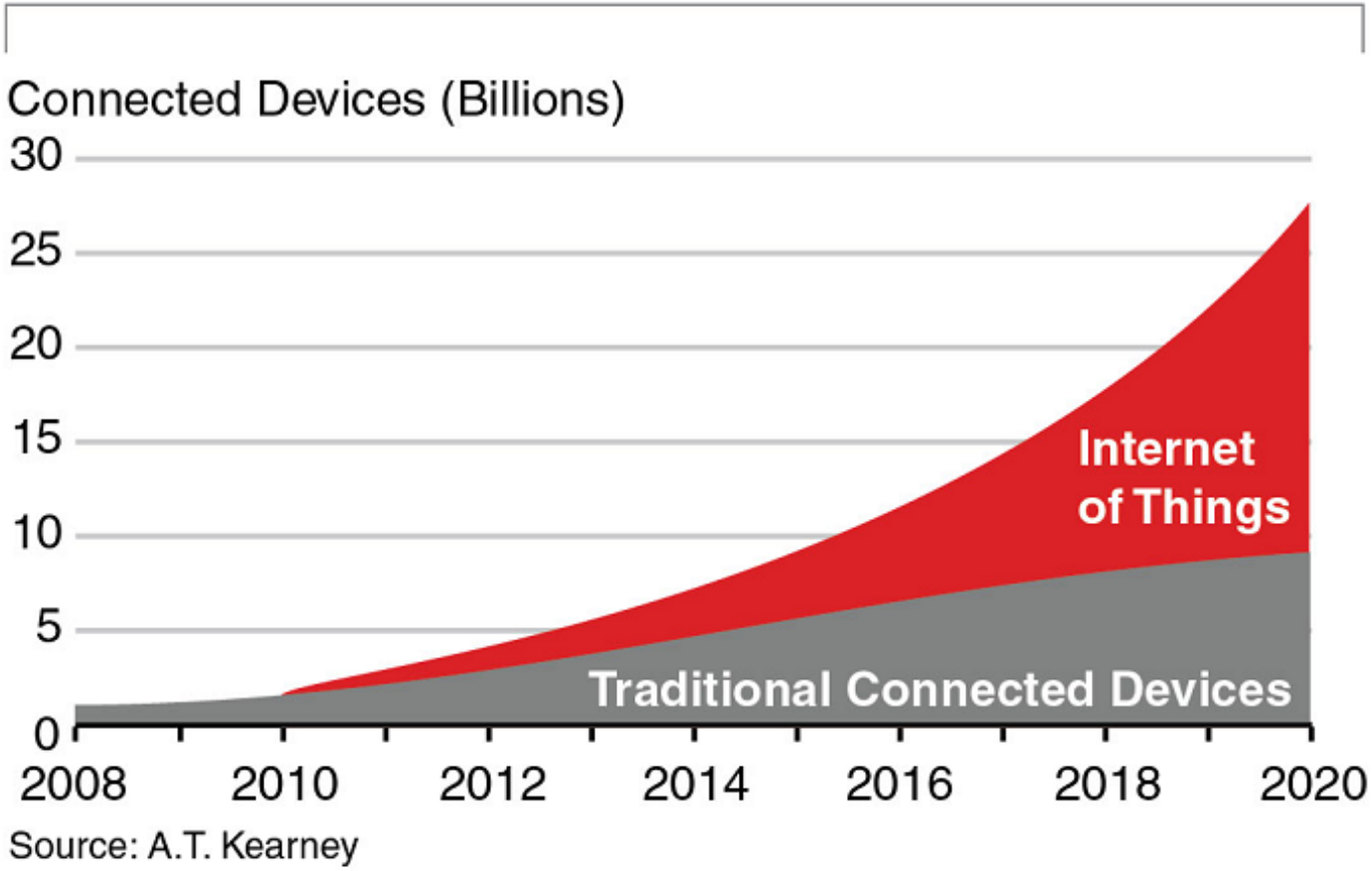
Source: www.internetlivestats.com

JAN 2016
ACTIVE E-COMMERCE SHOPPERS
PERCENTAGE OF THE NATIONAL POPULATION WHO BOUGHT SOMETHING ONLINE IN THE PAST MONTH [SURVEY-BASED]
we are social
global web index
UK 77%
GERMANY 74%
SOUTH KOREA 72%
USA 68%
FRANCE 64%
UAE 62%
AUSTRALIA 62%
CANADA 60%
SPAIN 57%
SINGAPORE 57%
HONG KONG 57%
JAPAN 55%
ARGENTINA 53%
POLAND 53%
MALAYSIA 50%
ITALY 48%
RUSSIA 48%
TURKEY 45%
BRAZIL 44%
CHINA 44%
THAILAND 44%
SAUDI ARABIA 41%
VIETNAM 37%
MEXICO 31%
PHILIPPINES 29%
INDONESIA 27%
SOUTH AFRICA 27%
INDIA 25%


JAN 2016
SOCIAL MEDIA USE BY COUNTRY
ACTIVE ACCOUNTS ON THE TOP SOCIAL NETWORK IN EACH COUNTRY, COMPARED TO POPULATION
SOUTH KOREA 76%
UAE 69%
HONG KONG 68%
SINGAPORE 64%
ARGENTINA 62%
USA 59%
MALAYSIA 59%
UK 59%
CANADA 58%
AUSTRALIA 58%
THAILAND 56%
TURKEY 53%
FRANCE 50%
BRAZIL 49%
RUSSIA 48%
SPAIN 48%
CHINA 47%
PHILIPPINES 47%
MEXICO 47%
ITALY 47%
JAPAN 42%
VIETNAM 37%
POLAND 36%
GERMANY 36%
SAUDI ARABIA 35%
GLOBAL AVERAGE 31%
INDONESIA 30%
EGYPT 30%
SOUTH AFRICA 24%
INDIA 10%
NIGERIA 8%


JAN 2016
TIME SPENT ON SOCIAL MEDIA
AVERAGE NUMBER OF HOURS THAT SOCIAL MEDIA USERS SPEND USING SOCIAL MEDIA EACH DAY
we are social
global web index
PHILIPPINES 3.7
BRAZIL 3.3
MEXICO 3.2
ARGENTINA 3.2
UAE 3.0
MALAYSIA 3.0
SAUDI ARABIA 2.9
THAILAND 2.9
INDONESIA 2.9
SOUTH AFRICA 2.7
TURKEY 2.5
VIETNAM 2.3
INDIA 2.3
ITALY 2.0
RUSSIA 1.9
USA 1.7
SING APORE 1.6
SPAIN 1.6
HONG KONG 1.5
UK 1.5
CHINA 1.5
CANADA 1.4
POLAND 1.3
FRANCE 1.3
AUSTRALIA 1.2
GERMANY 1.1
SOUTH KOREA 1.1
JAPAN 0.3

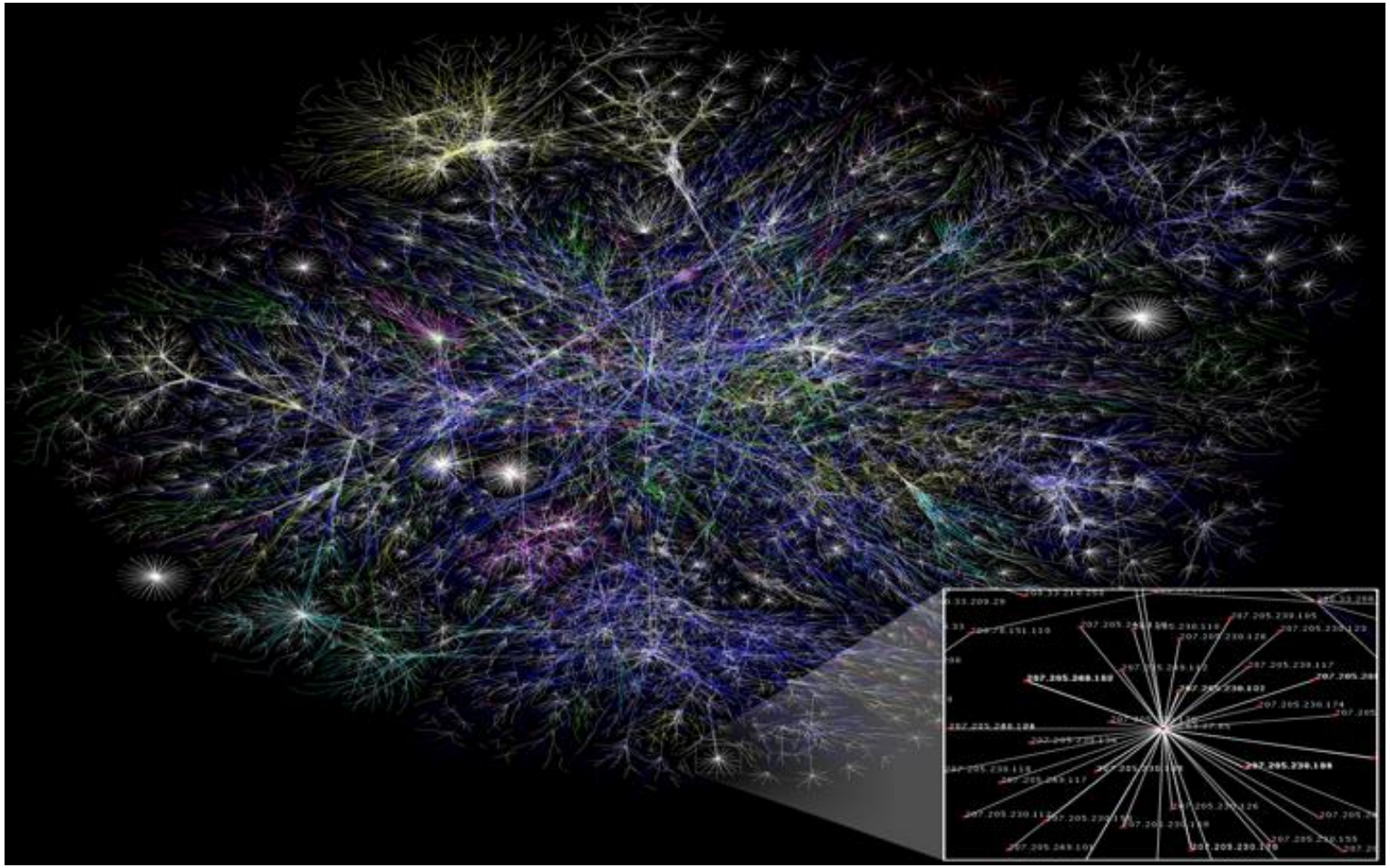
Estimated Worldwide Growth of Traditional Connected Devices and IoT

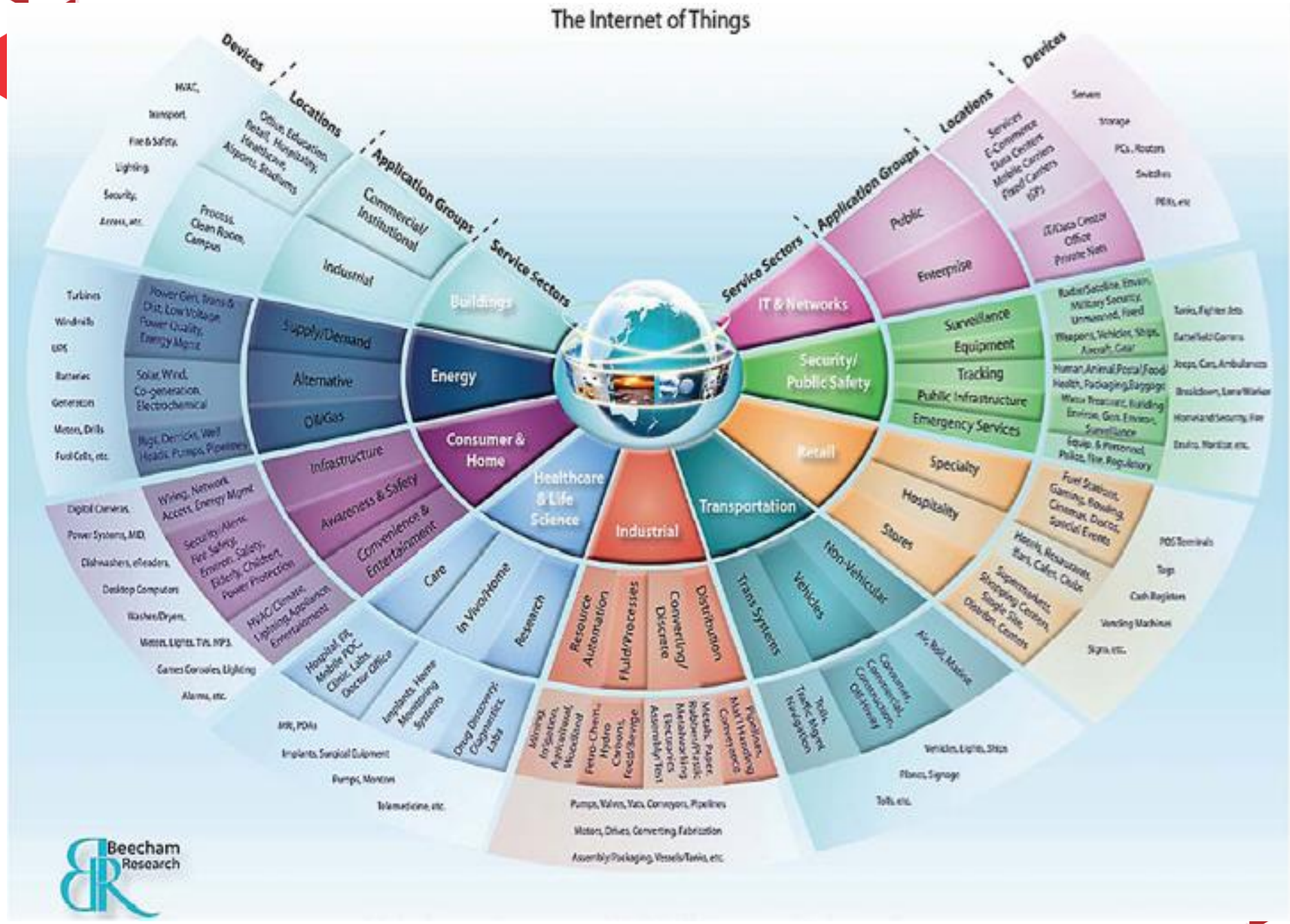


Source: A.T. Kearney

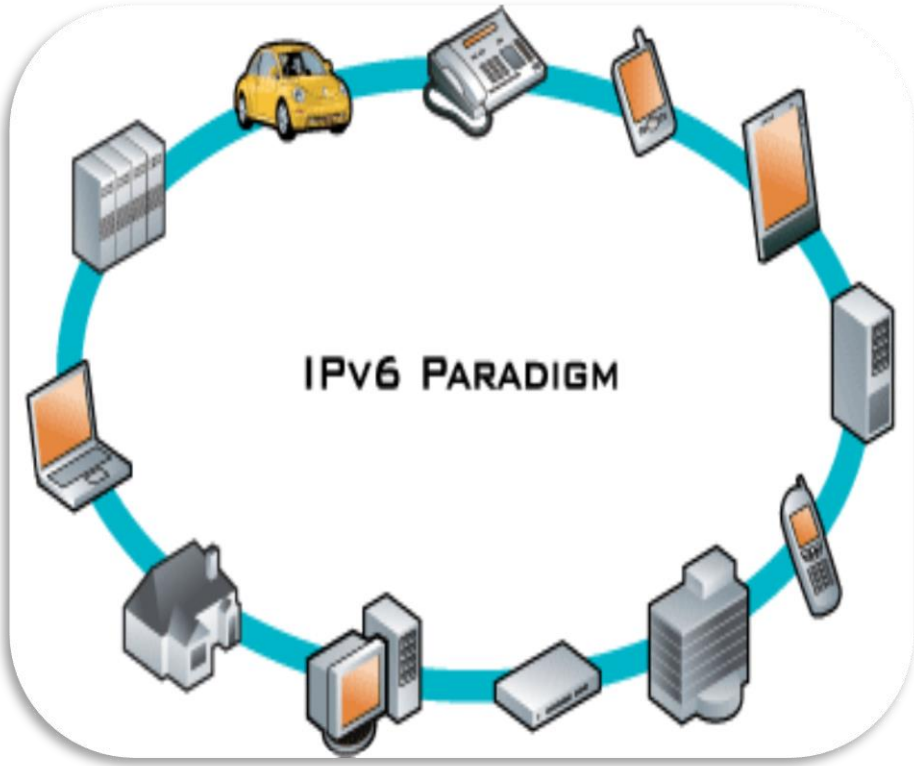
IoT ripples through advanced industries.

Data Growth

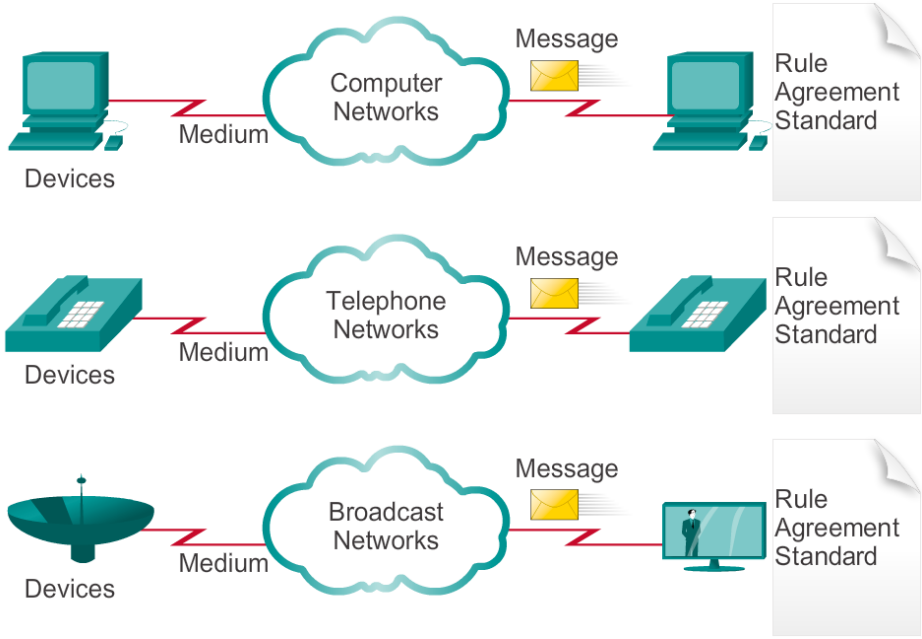



The Internet of Things
Devices
Locations
Application Groups
Service Sectors
HVAC,
Transport
Fire & Safety
Lighting
Security,
Access, etc.
Office, Education, Retail, Hospitality, Healthcare, Airports, Stadiums
Process, Clean Room, Campus
Commercial/ Institutional
Industrial
Buildings
Turbines
Windmills
UPS
Batteries
Generators
Motors, Drills
Fuel Cells, etc.
Power Gen, Trans & Dist, Low Voltage, Power Quality, Energy Mgmt
Solar, Wind, Co-generation, Electrochemical
Rigs, Derricks, Well Heads, Pumps, Pipelines
Supply/Demand
Alternative
Oil/Gas
Energy
Digital Cameras
Power Systems, MID
Dishwashers, eReaders,
Desktop Computers
Washer/Dryers
Motors, Lights, TVs, MP3,
Games Consoles, Lighting
Alarms, etc.
Wiring, Network Access, Energy Mgmt
Security, Alarms, Fire Safety, Environ. Safety, Elderly, Children, Power Protection
HVAC, Climate, Lighting, Appliances, Entertainment
Infrastructure
Awareness & Safety
Convenience & Entertainment
Consumer & Home
MRI, PDAs
Implants, Surgical Equipment
Pumps, Monitors
Telemedicine, etc.
Hospital ER, Mobile POC, Clinic, Labs, Doctor Office
Implants, Home Monitoring Systems
Drug Discovery, Diagnostics, Labs
Care
In Vivo/Home
Research
Healthcare & Life Science
Pumps, Valves, Vats, Conveyors, Pipelines
Motors, Drives, Converting, Fabrication
Assembly, Packaging, Vessels/Tanks, etc.
Mining, Irrigation, Agricultural, Woodland
Ferro-Chem, Hydro Carbons, Food/Beverage
Metals, Paper, Rubber/Plastic, Metallurgical, Electronics, Assembly, Test
Pipelines, Multi Handling, Conveyance
Resource Automation
Fluid/Processes
Converting/ Discrete
Distribution
Industrial
Toll, Traffic Mgmt, Navigation
Comms, Commercial, Construction, Off-Highway
Air, Rail, Marine
Vehicles, Lights, Ships
Planes, Signage
Tolls, etc.
Trans Systems
Vehicles
Non-Vehicular
Transportation
Servers
Storage
PCs, Routers
Switches
PERs, etc
Services
E-Commerce
Data Centers
Mobile Carriers
Fixed Carriers
ISPs
IT/Data Center Office
Private Nets
Public
Enterprise
IT & Networks
Surveillance
Equipment
Tracking
Public Infrastructure
Emergency Services
Security/ Public Safety
Radar/Satellite, Environ. Military Security, Unmanned, Fixed
Weapons, Vehicles, Ships, Aircraft, Gear
Human, Animal, Postal/Food, Health, Packaging, Baggage
Water Treatment, Building, Environ, Geo, Environ. Surveillance
Equip. & Personnel, Police, Fire, Regulatory
Tanks, Fighter Jets
Battle Tech/ Comms
Jeeps, Cars, Ambulances
Breakdown, Lane Marker
Homeland Security, Fire
Enviro, Hardcat etc.
Specialty
Hospitality
Stores
Retail
Fuel Stations, Gaming, Vending, Cinemas, Docks, Special Events
Hotels, Restaurants, Bars, Cafes, Clubs
Supermarkets, Shopping Centers, Single Sites, Distribution, Cinemas
POS Terminals
Tags
Cash Registers
Vending Machines
Signs, etc.
Beecham Research

IPv4 IPv6



Data Networking Role, Components, and Challenges



Various elements make up a network :

- ***Devices***: These are used to communicate with one another
- ***Medium***: This is how the devices are connected together
- ***Messages***: Information that travels over the medium
- ***Rules***: Governs how messages flow across network

Network Architecture - Reliable Networks

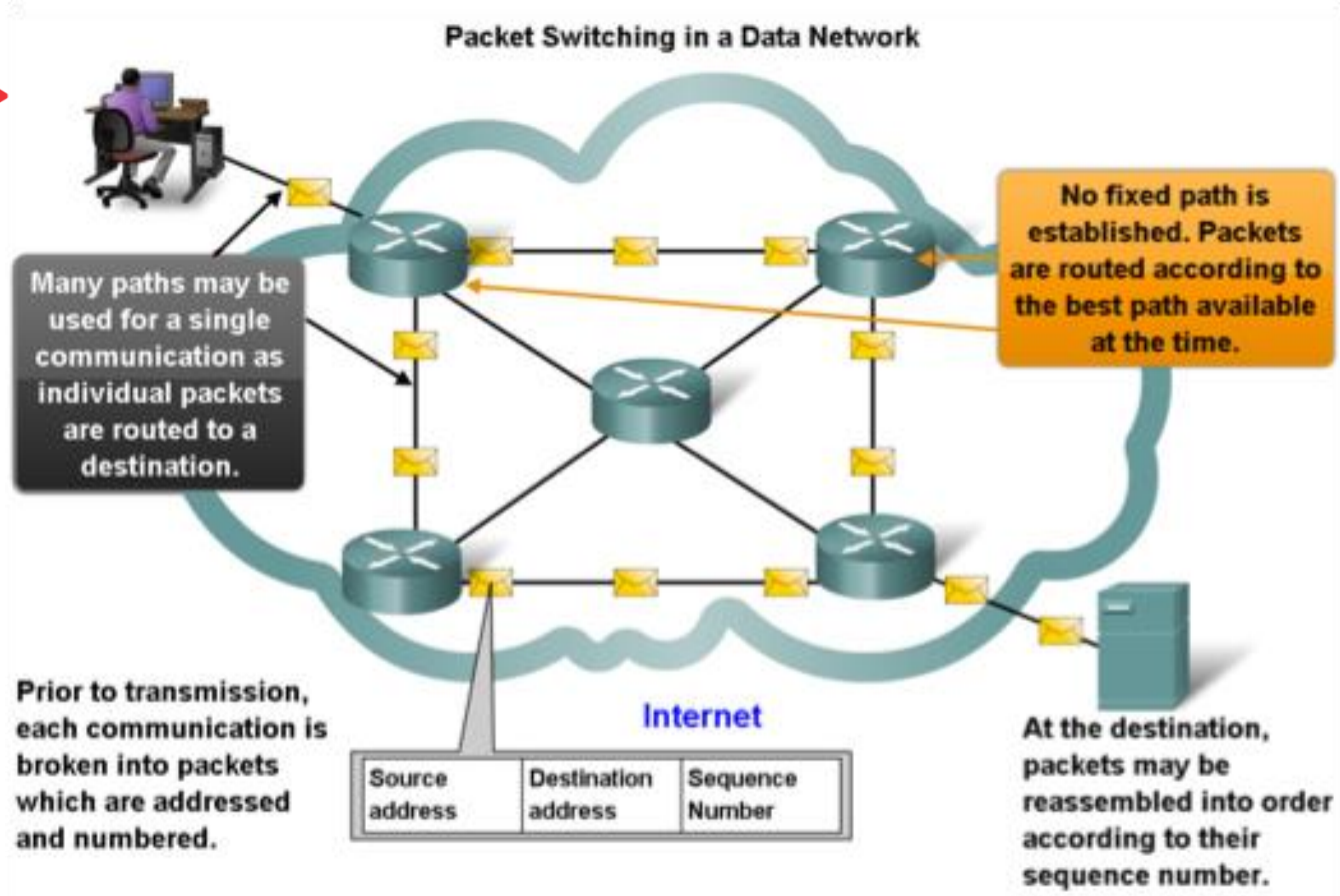
Empat karakteristik dasar yang harus dipenuhi agar suatu infrastruktur jaringan bisa dikatakan baik (memenuhi kebutuhan pengguna):

- ***Fault Tolerance***
- ***Scalability***
- ***Quality of Service (QoS)***
- ***Security***

Fault Tolerance (Toleransi Kesalahan)

Sebuah jaringan 'fault tolerant' merupakan salah satu metode yang digunakan untuk mengurangi dampak kerusakan hardware atau software dan dapat pulih dengan cepat ketika terjadi masalah.

Packet switching dapat meningkatkan ketahanan dan fault tolerance dari arsitektur internet.

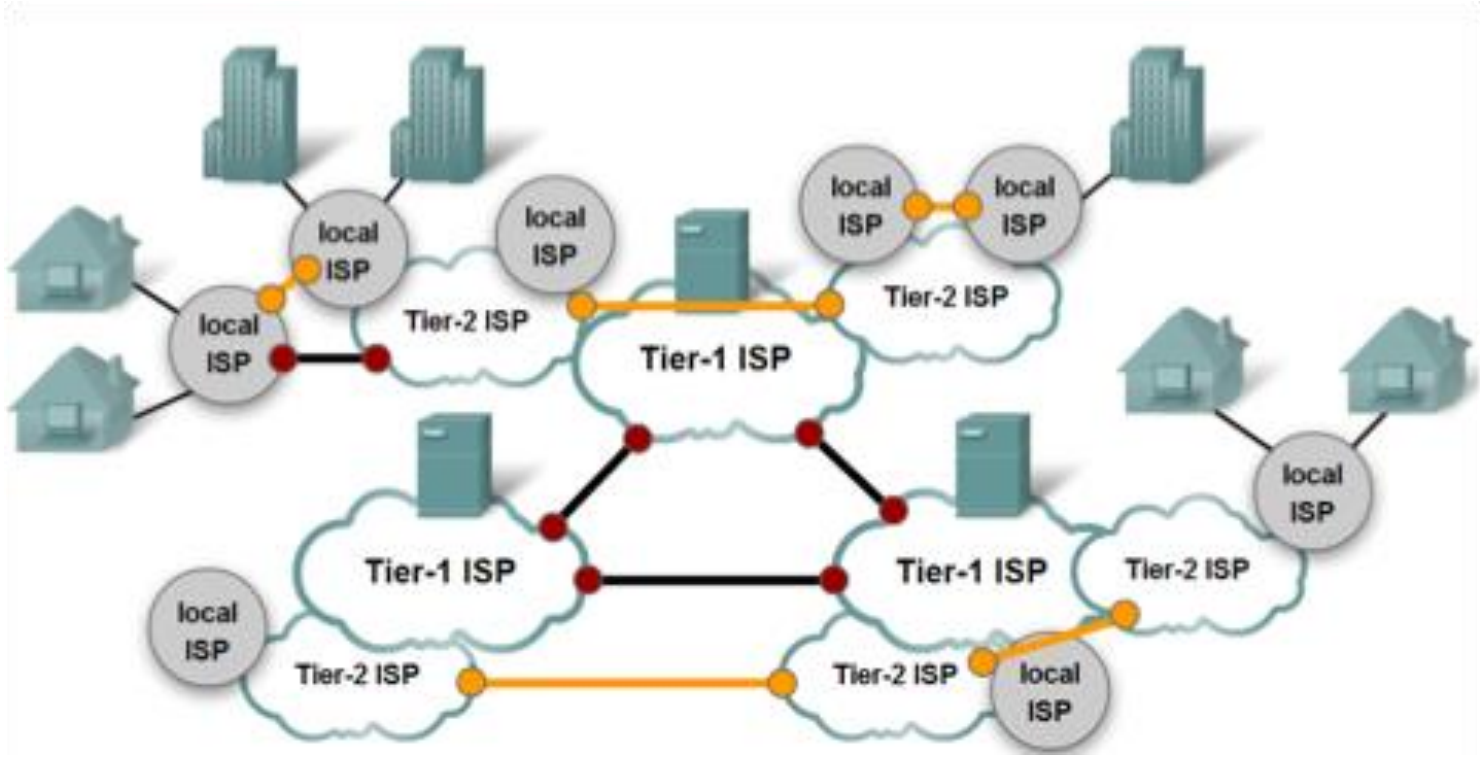

Packet Switching in a Data Network
Many paths may be used for a single communication as individual packets are routed to a destination.
No fixed path is established. Packets are routed according to the best path available at the time.
Internet
Prior to transmission, each communication is broken into packets which are addressed and numbered.
Source address
Destination address
Sequence Number
At the destination, packets may be reassembled into order according to their sequence number.

Scalability

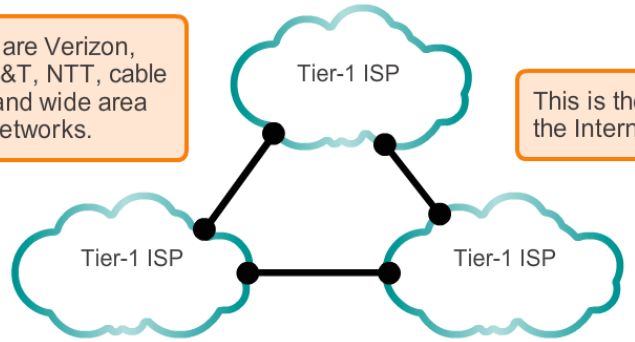
Jaringan bersifat *scalable,* artinya mampu beradaptasi dengan cepat untuk mendukung pengguna baru tanpa mengganggu atau mempengaruhi kinerja jaringan dan layanan yang lama.

Karakteristik internet yang dapat membantu memenuhi user demand:

- Hierarchical
- Common standards
- Common protocols


local ISP
local ISP
local ISP
local ISP
local ISP
local ISP
local ISP
Tier-2 ISP
Tier-2 ISP
Tier-2 ISP
Tier-1 ISP
Tier-1 ISP
Tier-1 ISP
Tier-2 ISP
Tier-2 ISP
Tier-2 ISP
local ISP
local ISP

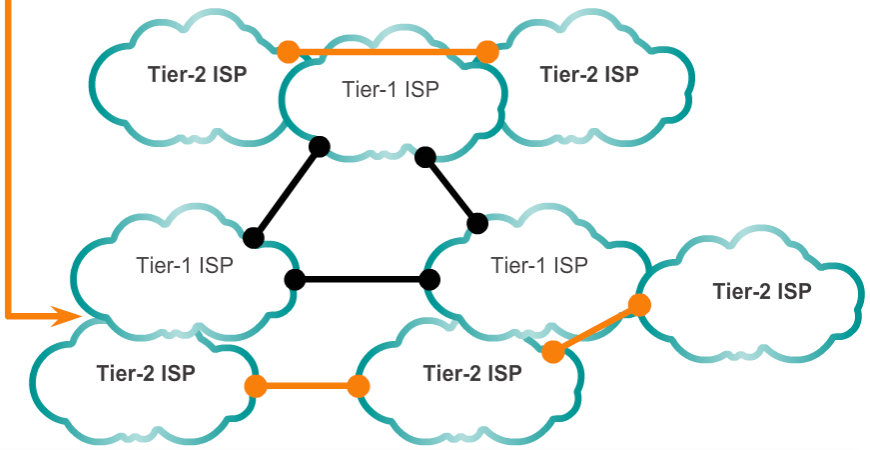
Examples are Verizon, Sprint, AT&T, NTT, cable systems, and wide area wireless networks.



This is the backbone of the Internet.

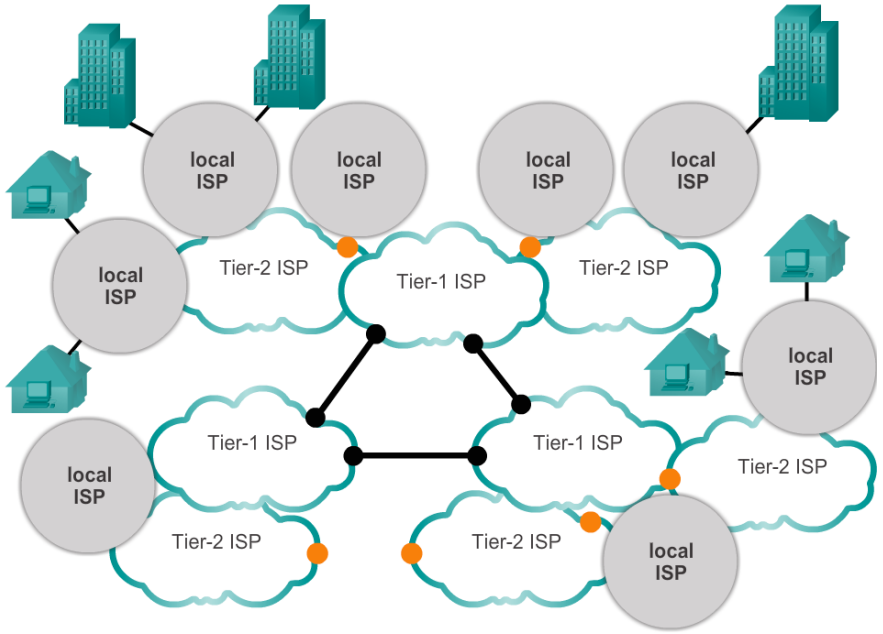
At the center of the Internet, Tier-1 ISPs provide national and international connections. These ISPs treat each other as equals.

The point where ISPs interconnect is often called a border.



Tier-2 ISPs are smaller and often provide regional service. Tier-2 ISPs usually pay Tier-1 ISPs for connectivity to rest of the Internet.

Peer connections between networks at the same level provide direct connections, bypassing longer routes and preventing congestion on the backbone.



Tier-3 ISPs are the local providers of service directly to end users. Tier-3 ISPs are usually connected to Tier 2 ISPs and pay Tier 2 providers for Internet access.

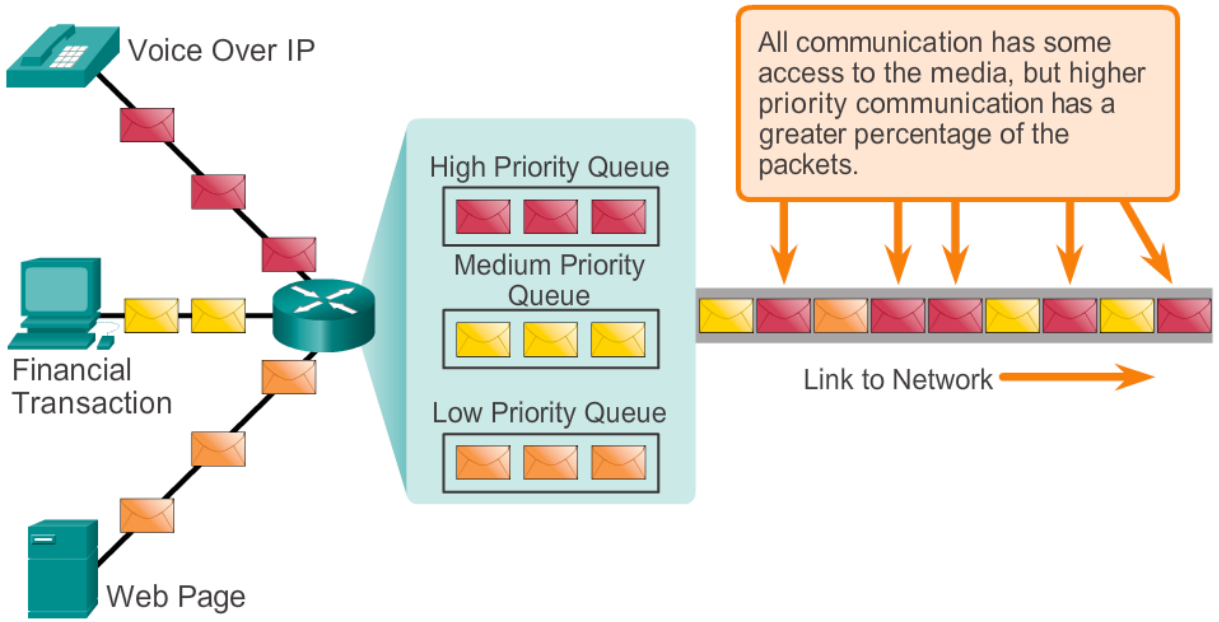
Quality of Services (QoS)

Jaringan membutuhkan mekanisme untuk mengatur lalu lintas jaringan yang macet.

Bandwidth jaringan adalah ukuran kapasitas jaringan. Dengan kata lain, berapa banyak informasi yang dapat dikirim dalam jumlah waktu tertentu? Bandwidth jaringan diukur dalam jumlah bit yang dapat ditransmisikan dalam satu detik, atau bit per detik (bps).

Ketika komunikasi simultan dicoba di seluruh jaringan, permintaan bandwidth jaringan dapat melebihi ketersediaannya, menciptakan kemacetan jaringan (network congestion).

Using Queues to Prioritize Communication



Queuing according to data type enables voice data to have priority over transaction data, which has priority over web data.

Security

- Ada dua tipe keamanan jaringan:

  network infrastructure security dan **information security**

  Tindakan dasar pengamanan jaringan

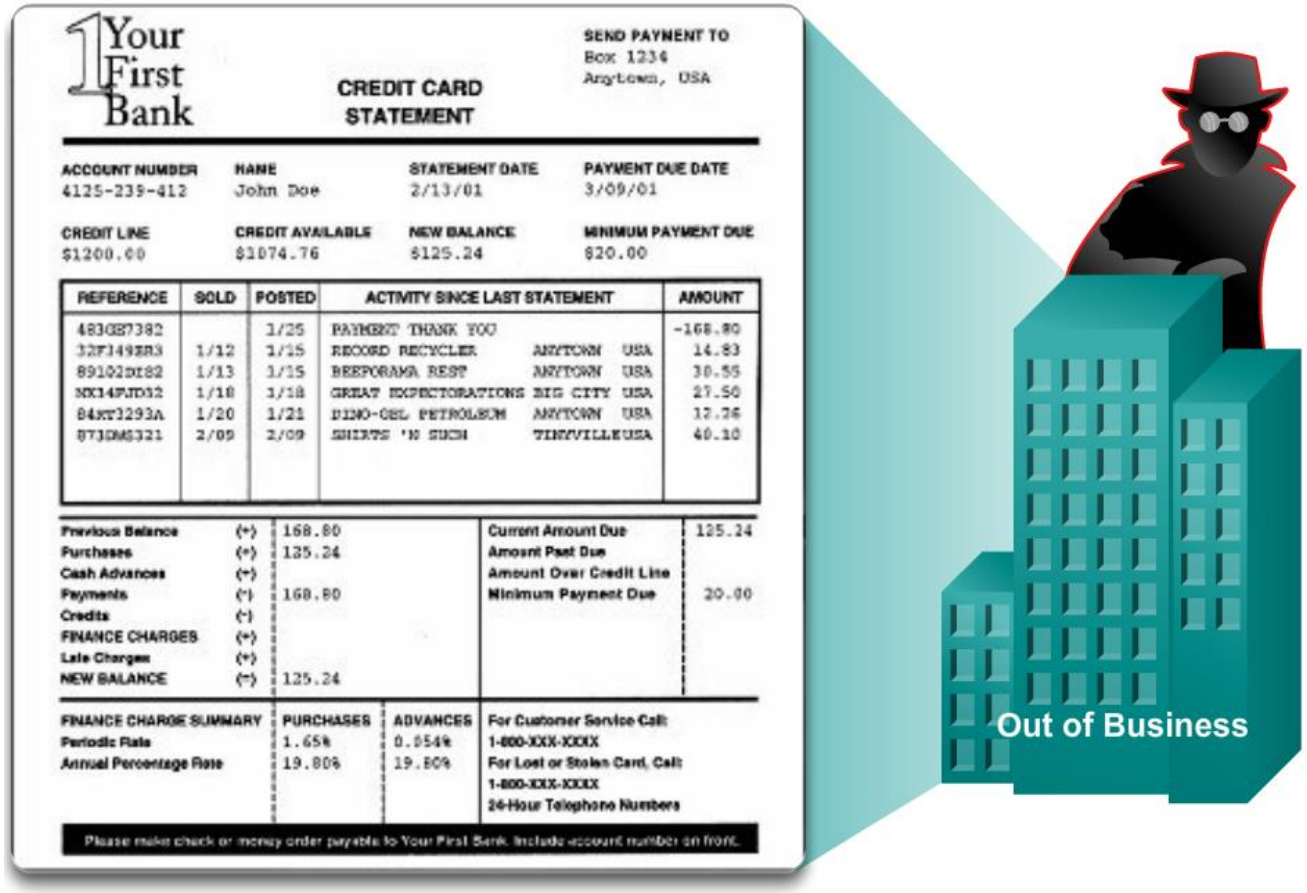
  Memastikan **confidentiality** (kerahasiaan) dengan penggunaan
  - Autentikasi user
  - Enkripsi data

  Mempertahkan **integrity** dengan penggunaan
  - Digital signatures

  Memastikan **availability** (ketersediaan) dengan penggunaan
  - Firewalls
  - Redundant network architecture
  - Network and hardware without a single point of failure

Security is Important for How We Use a Network

Unauthorized Transactions



Unauthorized use of our communications data can have severe consequences.

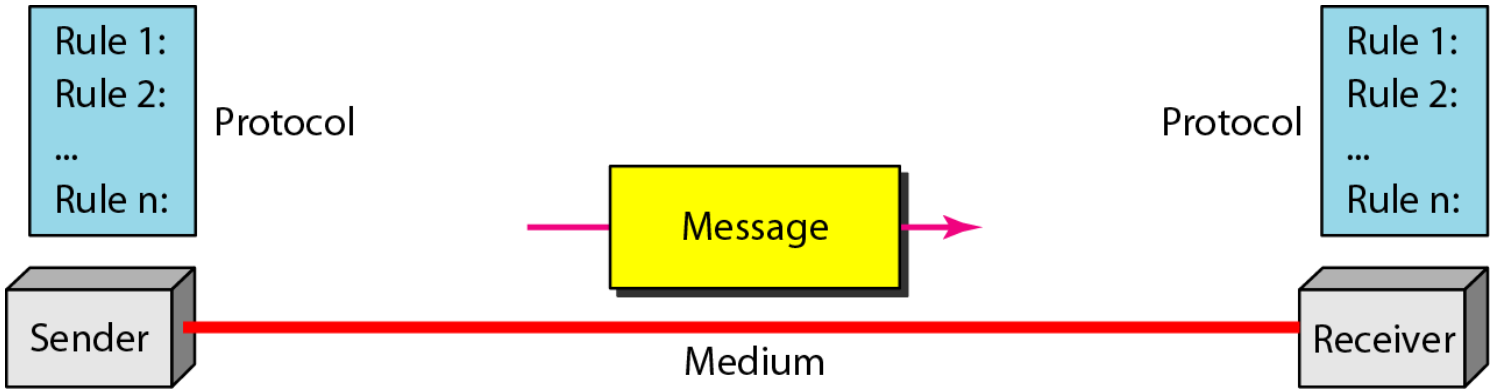
Jaringan Komunikasi dan Data

Komunikasi Data

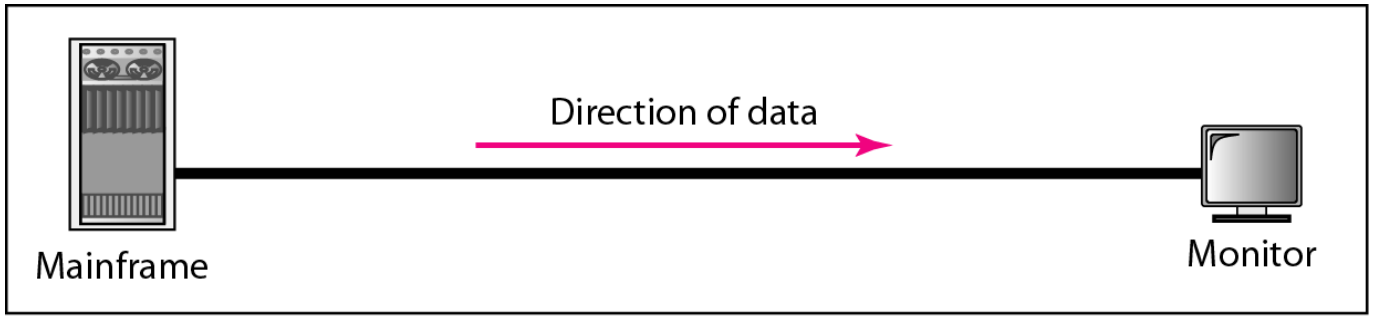
Istilah telekomunikasi berarti komunikasi pada jarak jauh. Data mengacu pada informasi yang disajikan dalam bentuk apapun yang disepakati oleh pembuat dan pengguna data.

Komunikasi data adalah pertukaran data antara dua perangkat melalui berbagai bentuk media transmisi, misalnya wire cable.

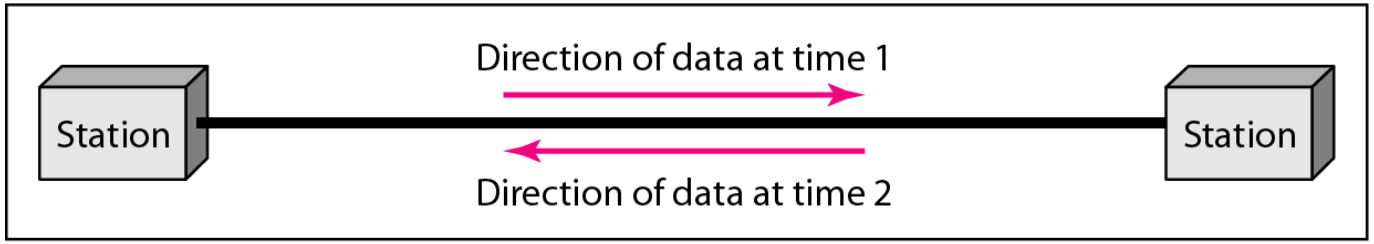
Sistem Komunikasi Data



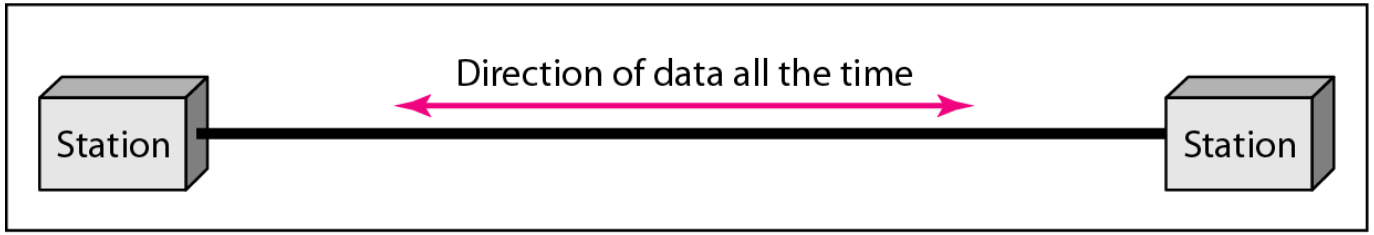
Data flow (simplex, half-duplex, and full-duplex)



a. Simplex



b. Half-duplex



c. Full-duplex

Jaringan

Jaringan adalah seperangkat alat (node) yang terhubung oleh link komunikasi. Node dapat berupa komputer, printer, atau perangkat lain yang mampu mengirim dan/atau menerima data yang dihasilkan oleh node lain di jaringan. Link dapat berupa kabel, udara, serat optik, atau media apa pun yang dapat mengangkut informasi pembawa sinyal.

Network Criteria

- Performance
  - Depends on Network Elements
  - Measured in terms of Delay and Throughput
- Reliability
  - Failure rate of network components
  - Measured in terms of availability/robustness
- Security
  - Data protection against corruption/loss of data due to:
    - Errors
    - Malicious users

Physical Structures

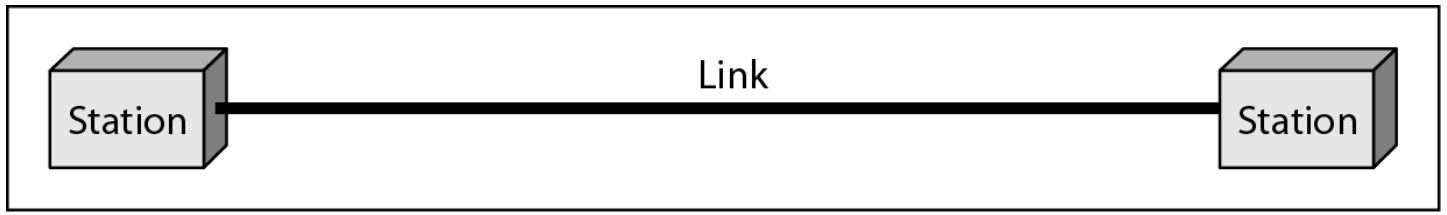
Type of Connection

- Point to Point - single transmitter and receiver
- Multipoint - multiple recipients of single transmission

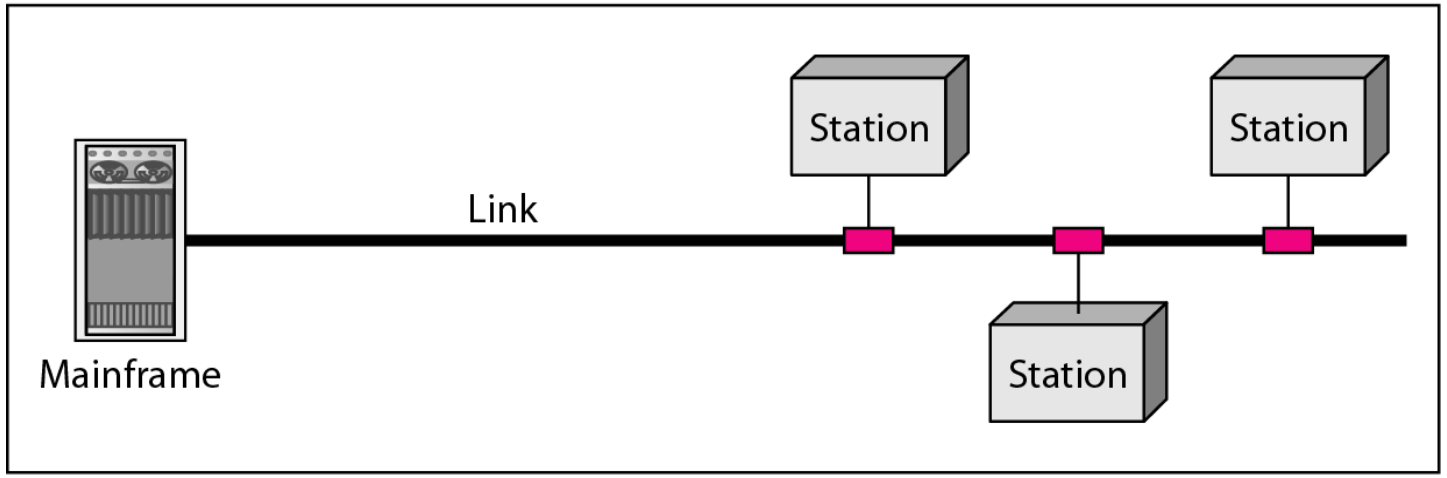
Physical Topology

- Connection of devices
- Type of transmission - unicast, multicast, broadcast

Types of connections: point-to-point and multipoint

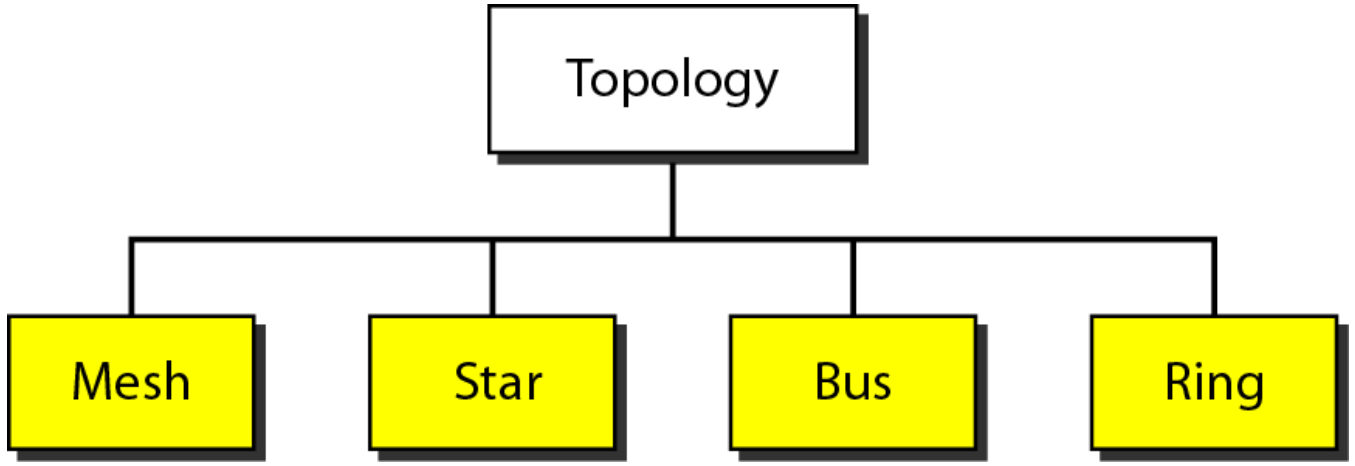


a. Point-to-point

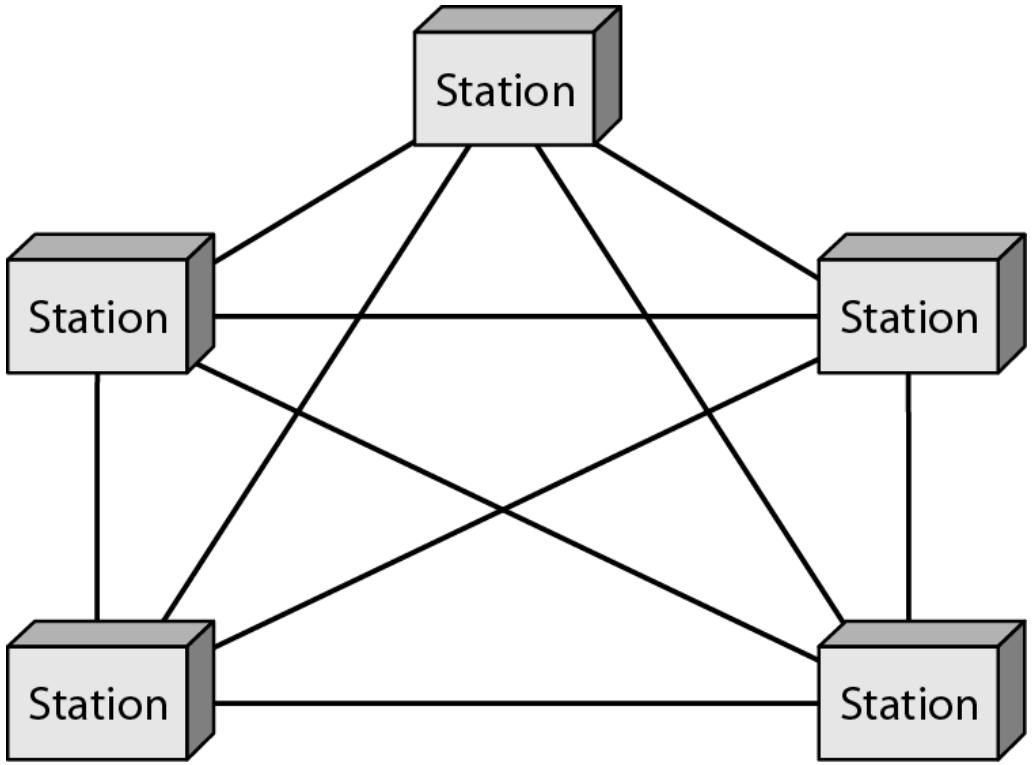


b. Multipoint

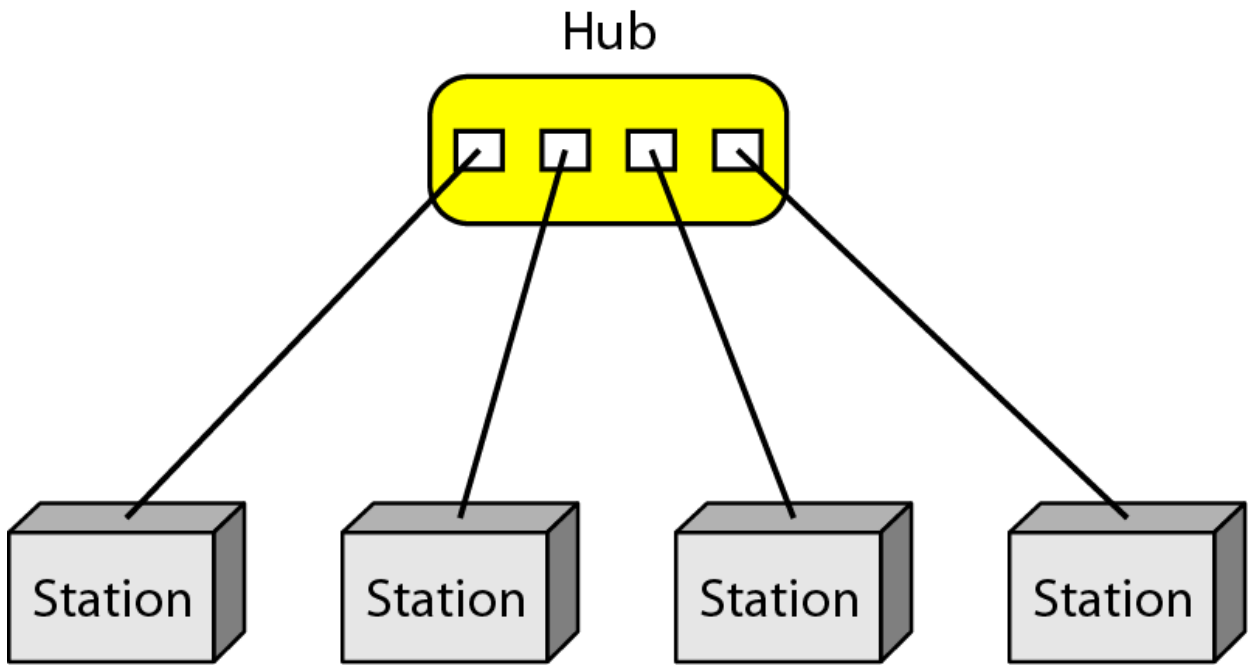
Categories of topology



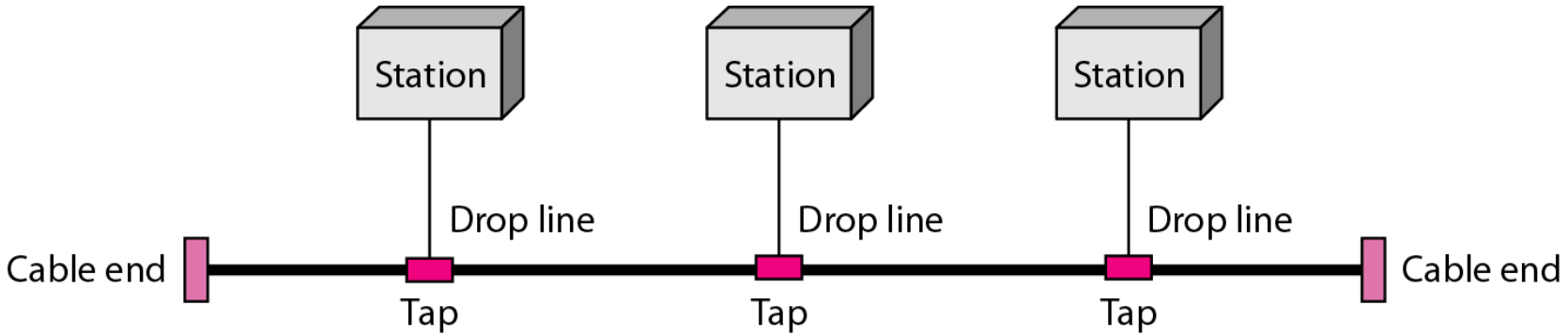
A fully connected **mesh** topology (five devices)



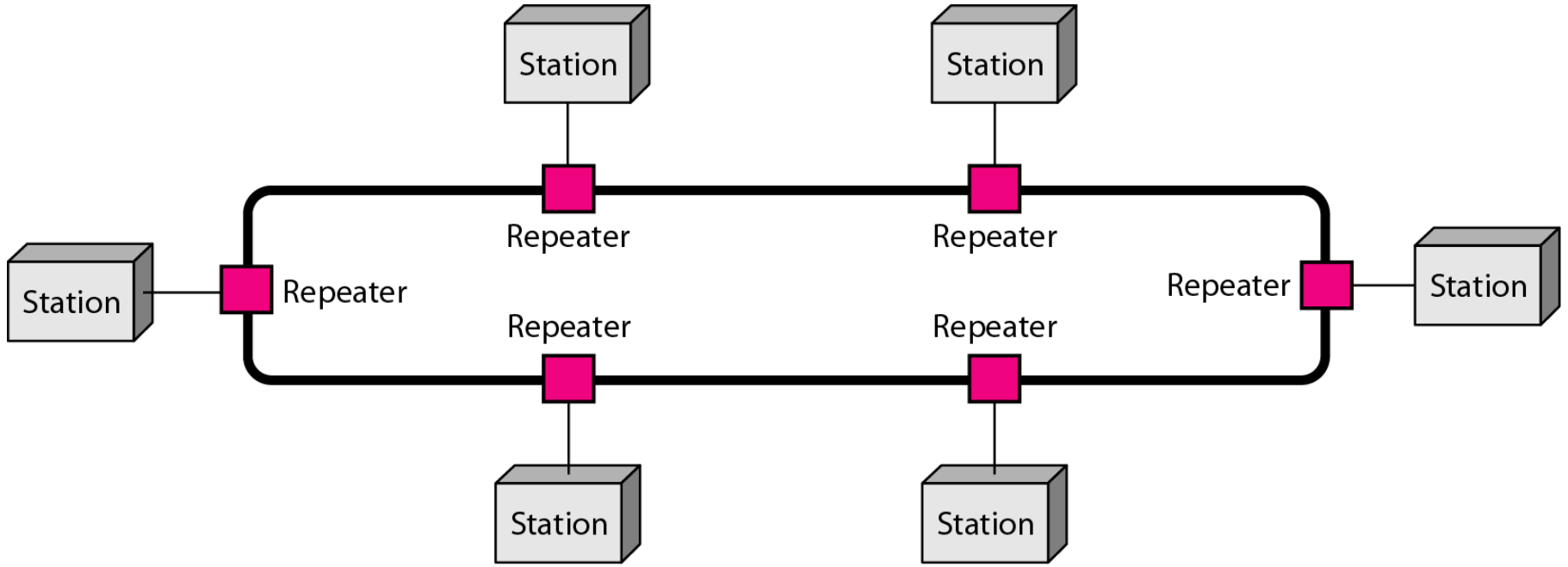
A **star** topology connecting four stations



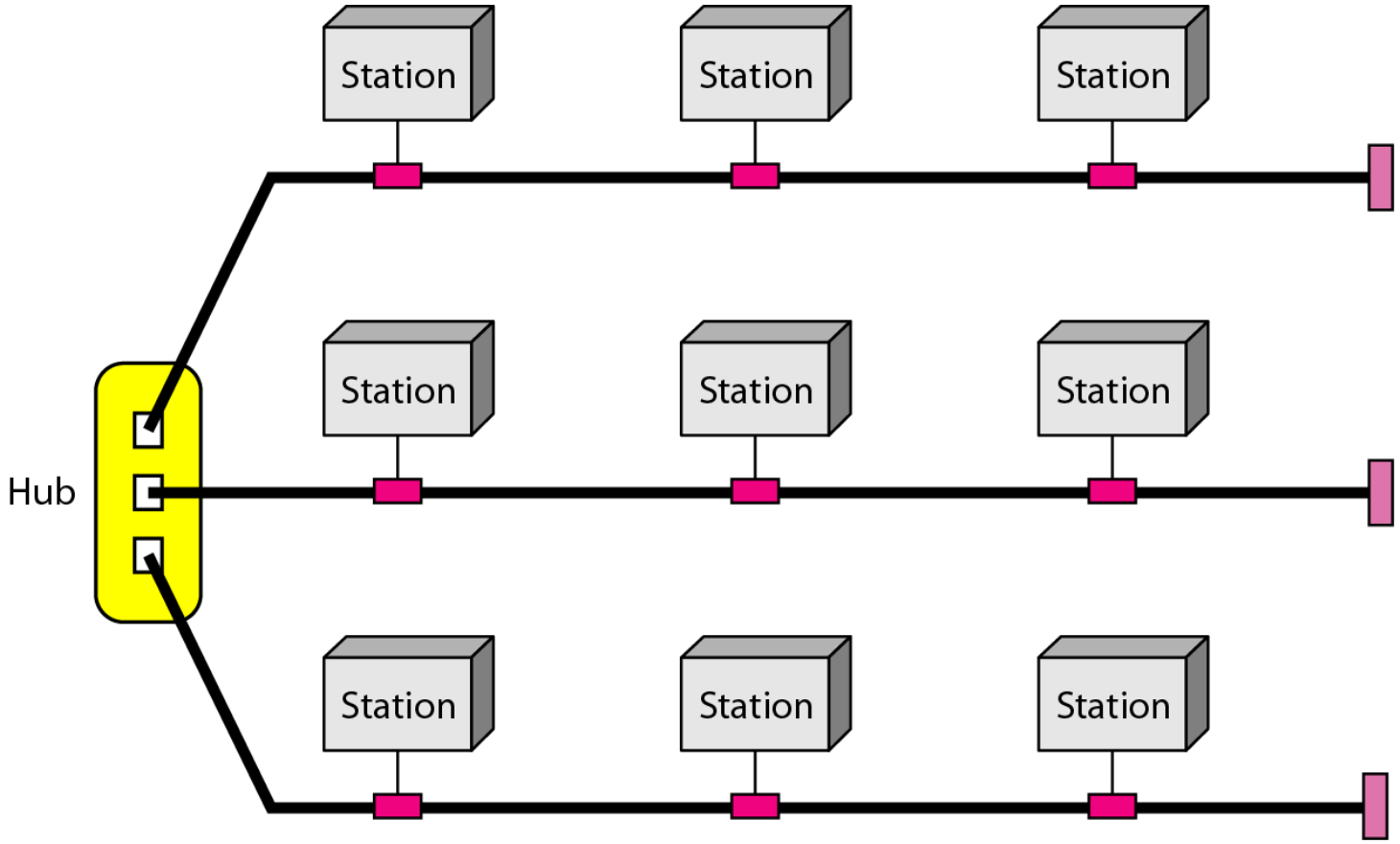
A **bus** topology connecting three stations



A **ring** topology connecting six stations



A **hybrid** topology: a star backbone with three bus networks



Kategori Jaringan

Local Area Networks (LANs)

- Short distances
- Designed to provide local interconnectivity

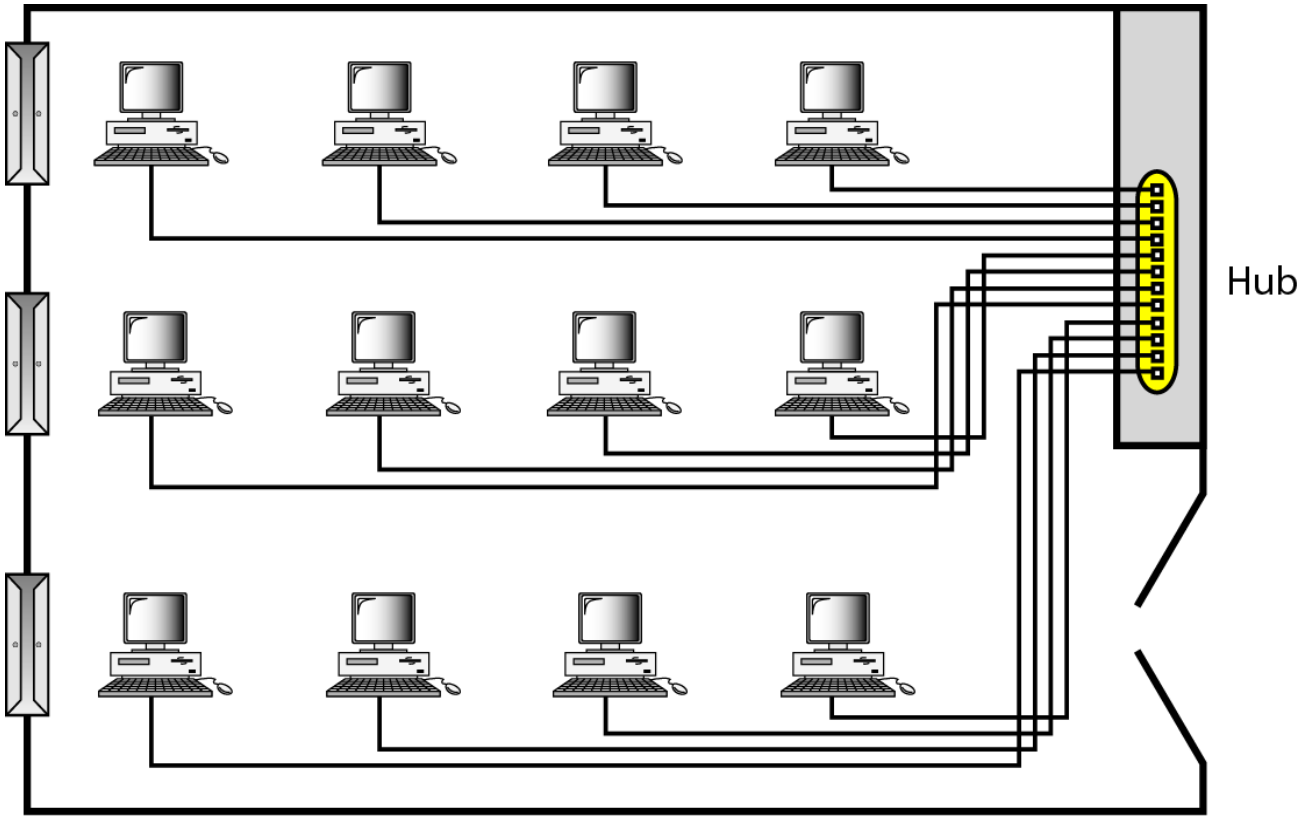
Wide Area Networks (WANs)

- Long distances
- Provide connectivity over large areas

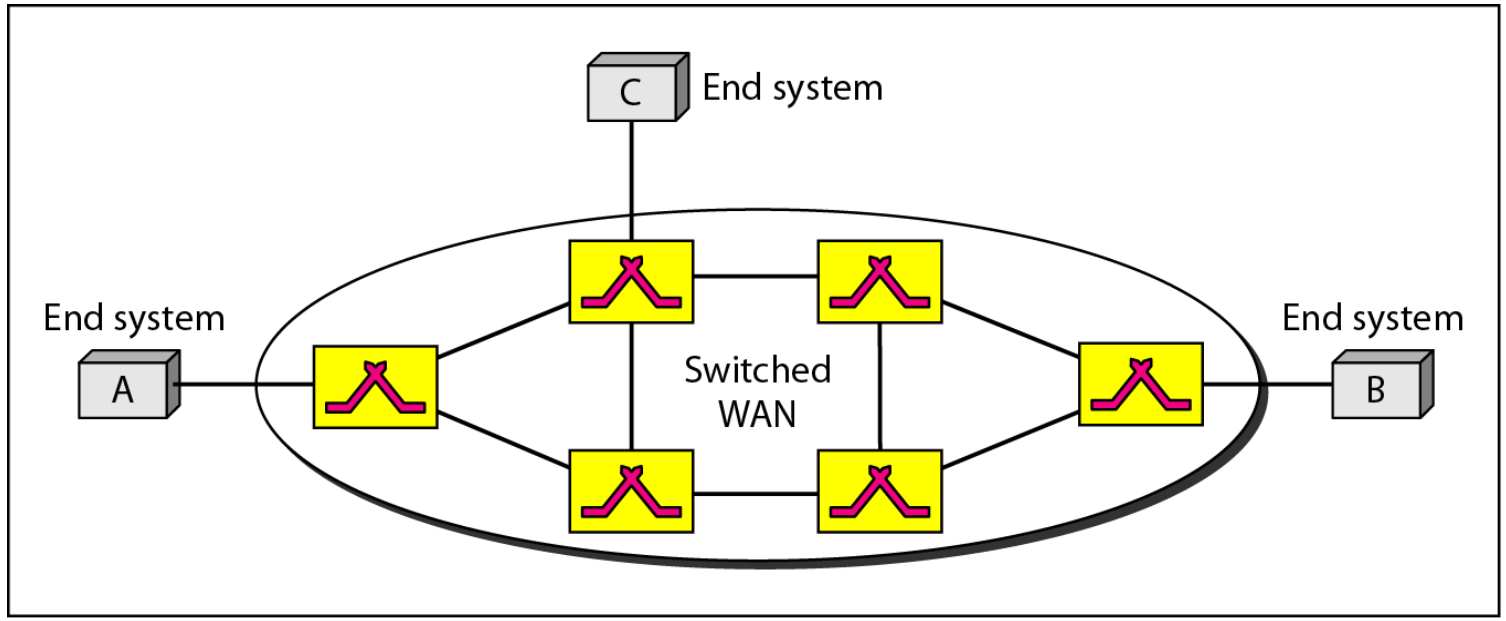
Metropolitan Area Networks (MANs)

- Provide connectivity over areas such as a city, a campus

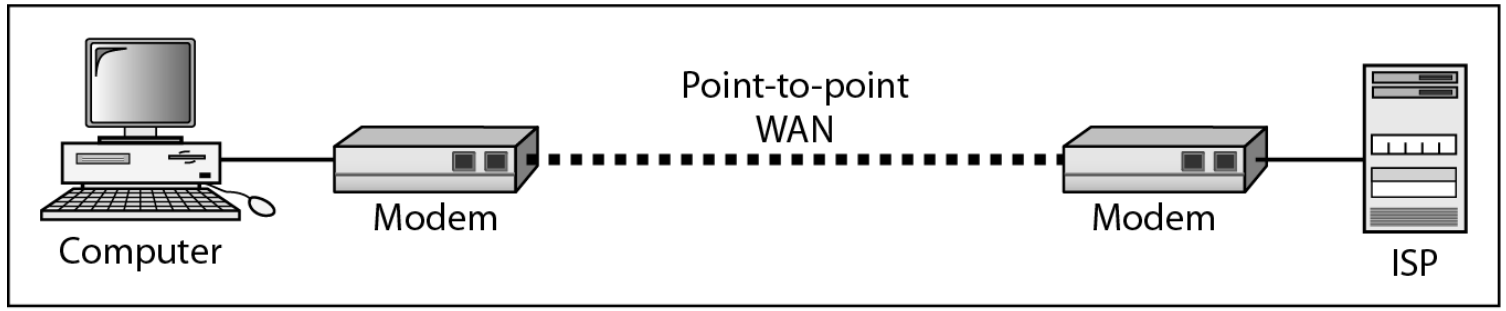
An isolated **LAN** connecting 12 computers to a hub in a closet



WANs: a switched WAN and a point-to-point WAN

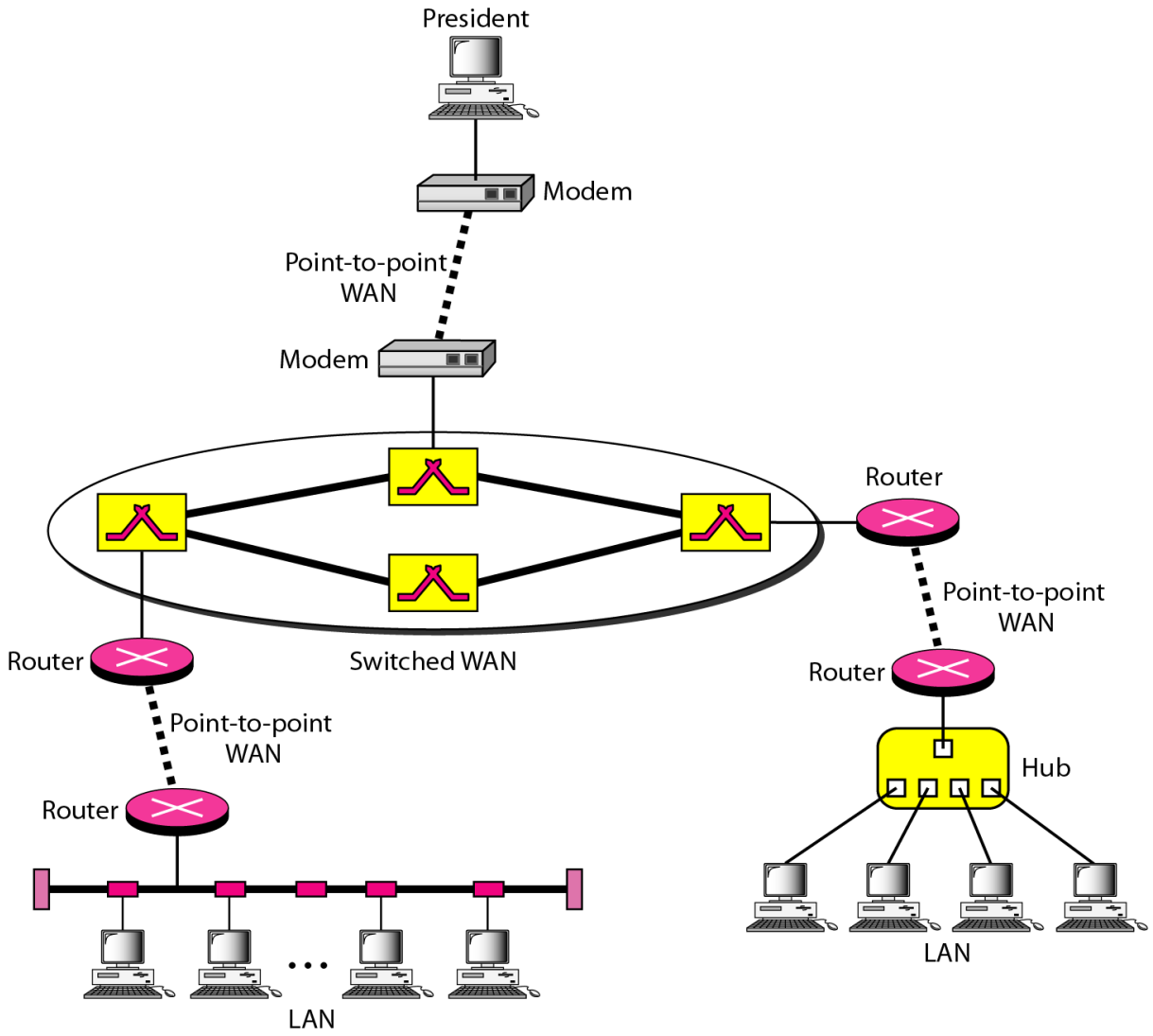


a. Switched WAN



b. Point-to-point WAN

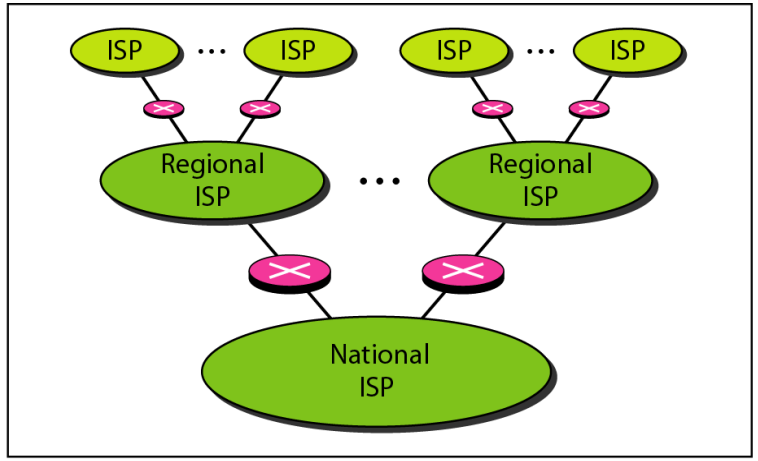
A heterogeneous network made of four WANs and two LANs



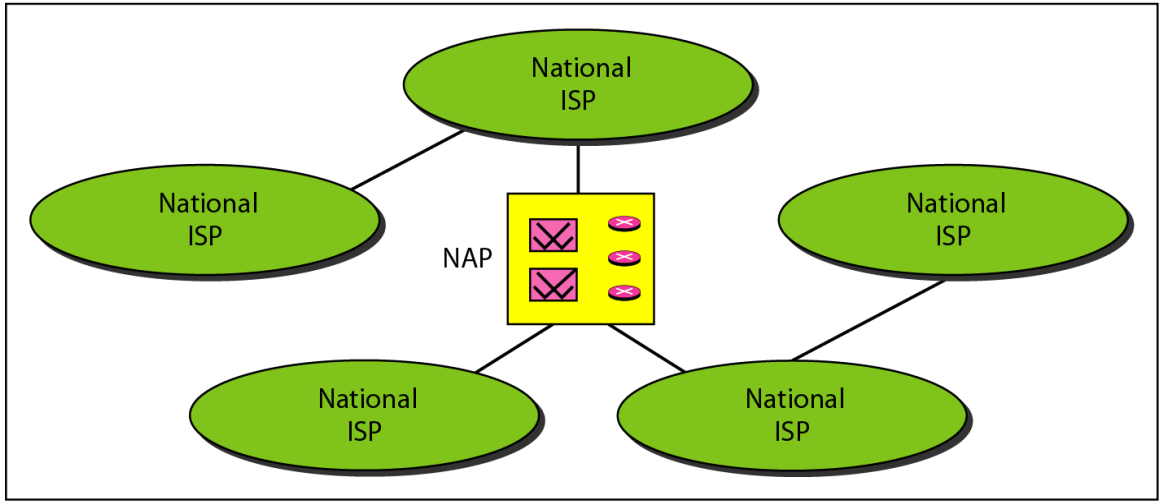
Internet

Internet telah merevolusi banyak aspek kehidupan kita sehari-hari, mempengaruhi cara kita melakukan bisnis serta cara kita menghabiskan waktu luang. Internet adalah sistem komunikasi yang telah membawa banyak informasi ke ujung jari kita dan mengaturnya untuk kita gunakan.

Hierarchical organization of the Internet



a. Structure of a national ISP



b. Interconnection of national ISPs

Protokol

Protokol identik dengan aturan.
Protokol terdiri dari seperangkat aturan yang mengatur komunikasi data, yang menentukan apa yang dikomunikasikan, bagaimana dikomunikasikan dan kapan dikomunikasikan.
Elemen-elemen kunci dari protokol adalah syntax, semantics, dan timing.

Elements of a Protocol

Syntax

- Structure or format of the data
- Indicates how to read the bits - field delineation

Semantics

- Interprets the meaning of the bits
- Knows which fields define what action

Timing

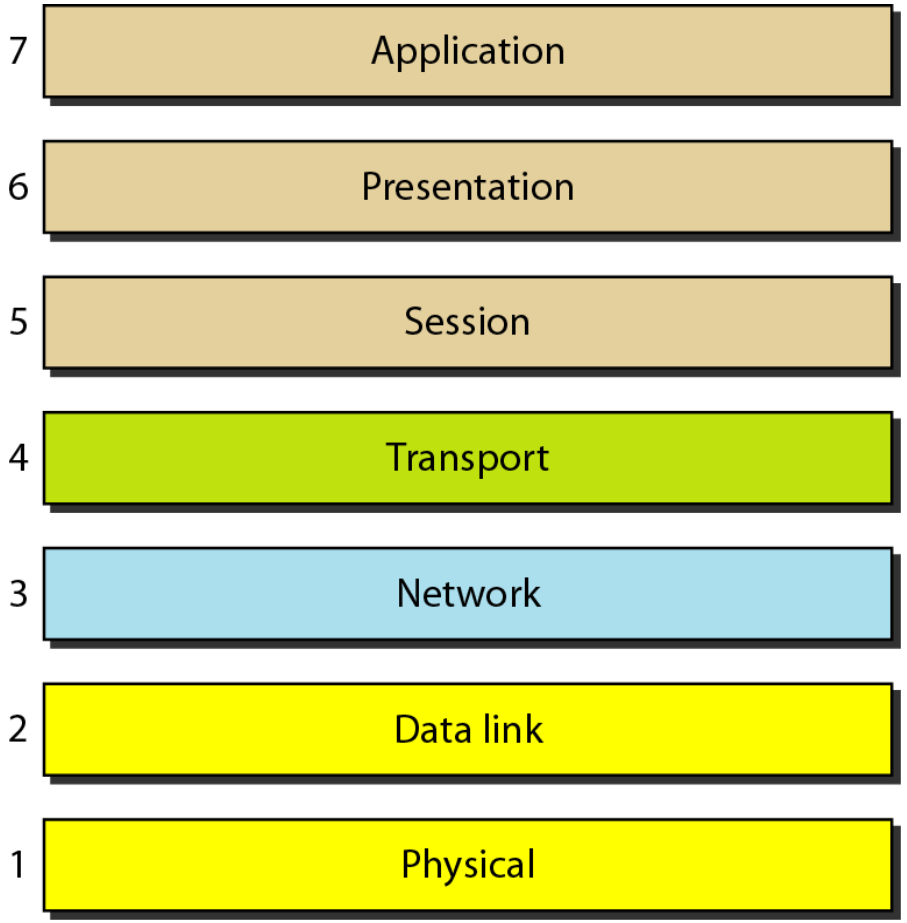
- When data should be sent and what
- Speed at which data should be sent or speed at which it is being received.

Model Jaringan

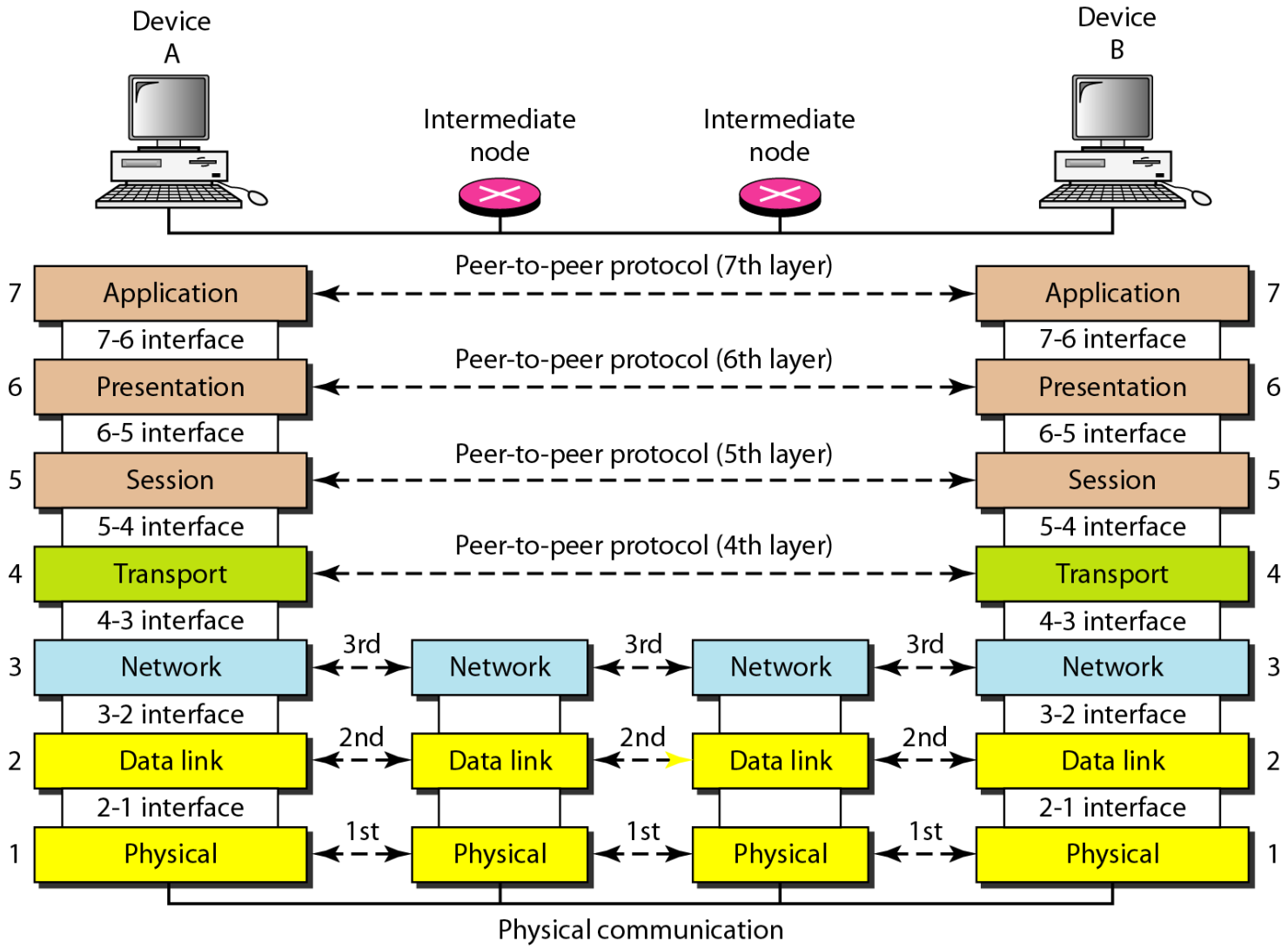
Model OSI

Didirikan pada tahun 1947, *International Standards Organization* (ISO) adalah badan multinasional yang didedikasikan untuk perjanjian seluruh dunia mengenai standar internasional. Standar ISO yang mencakup semua aspek komunikasi jaringan adalah model *Open Systems Interconnection* (OSI), pertama kali diperkenalkan pada akhir 1970-an.

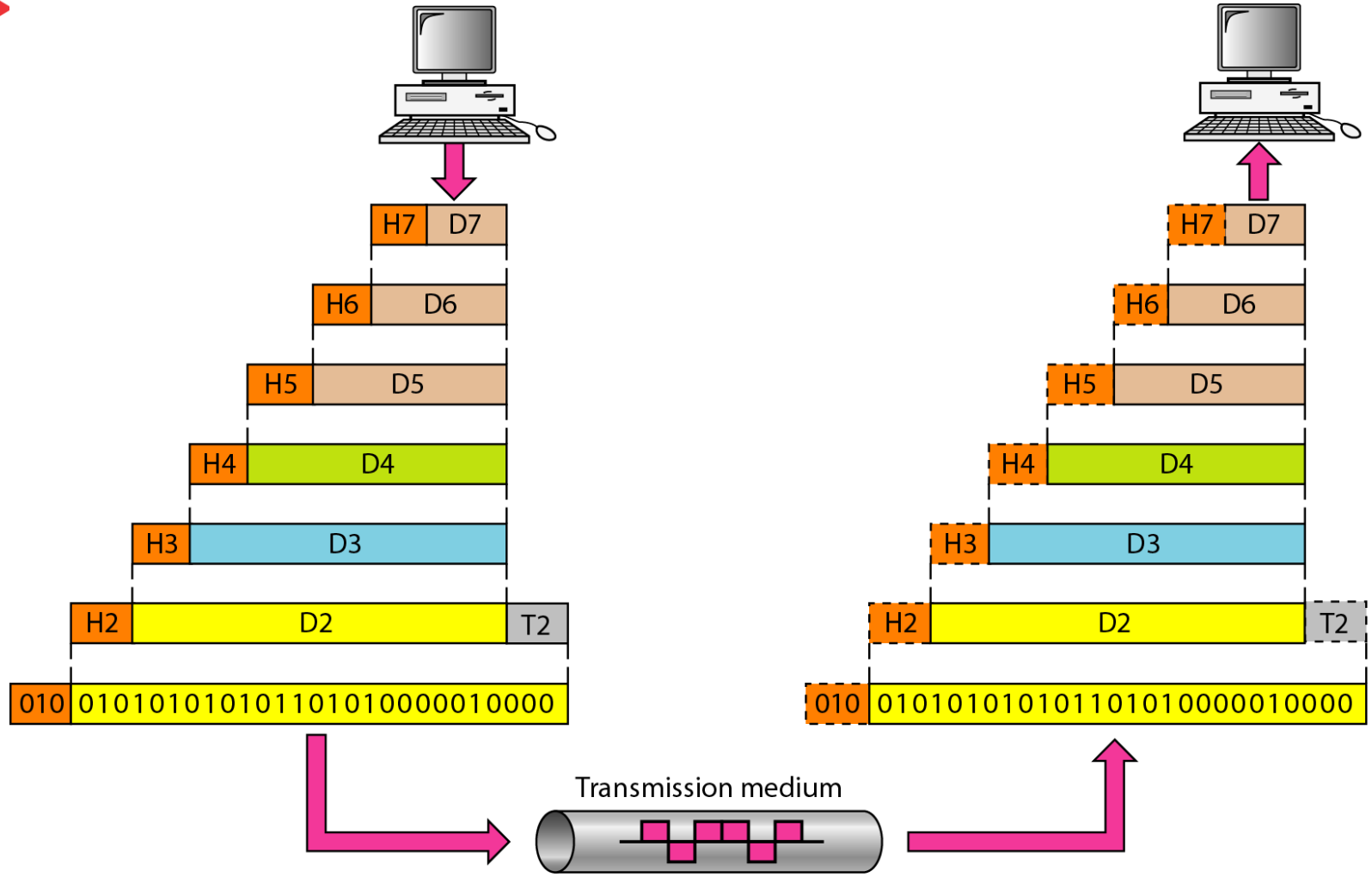
Tujuh layer model OSI



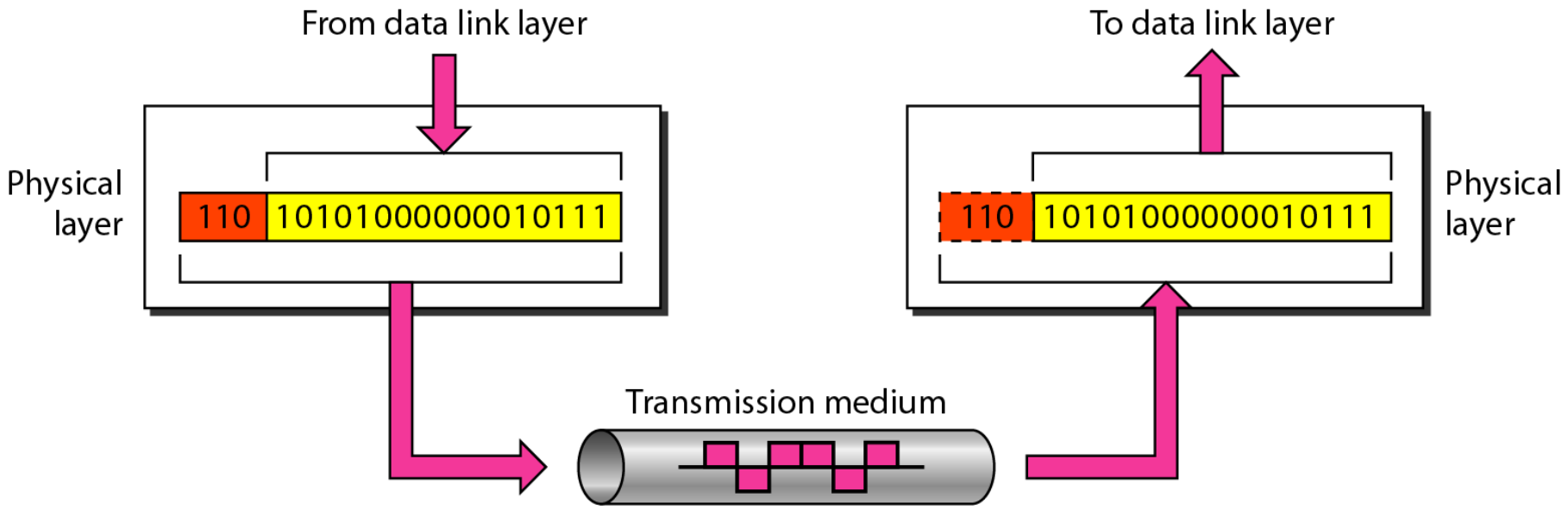
Interaksi antara layer pada model OSI



Pertukaran menggunakan model OSI

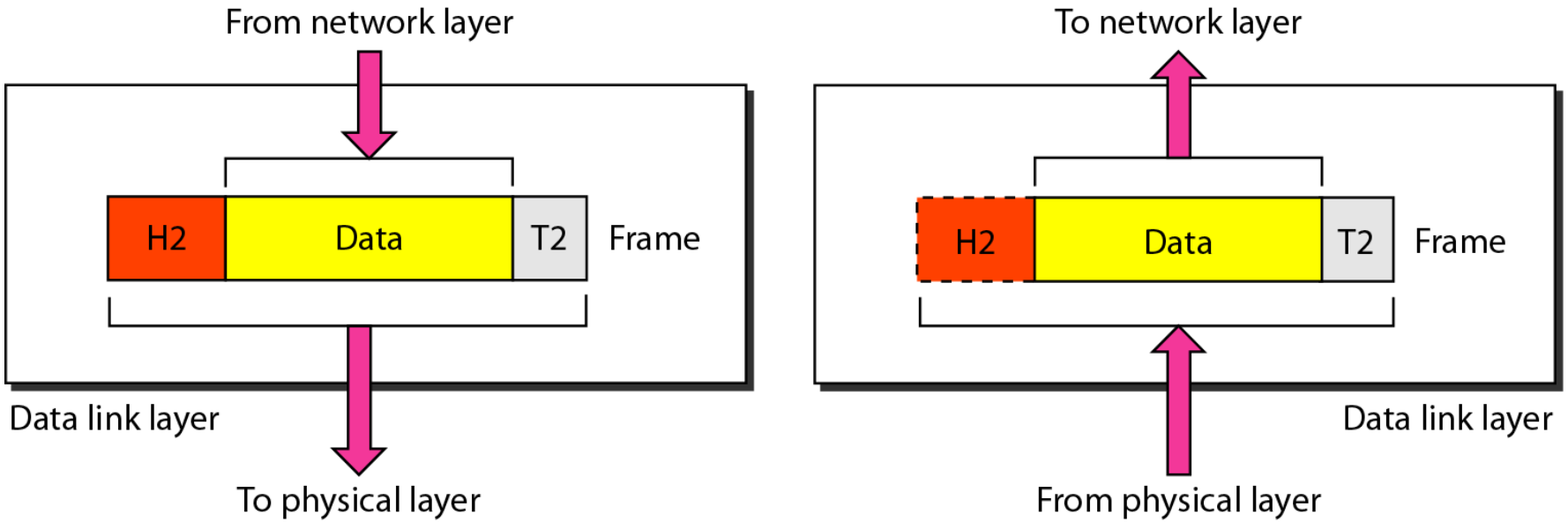


1 - Physical layer



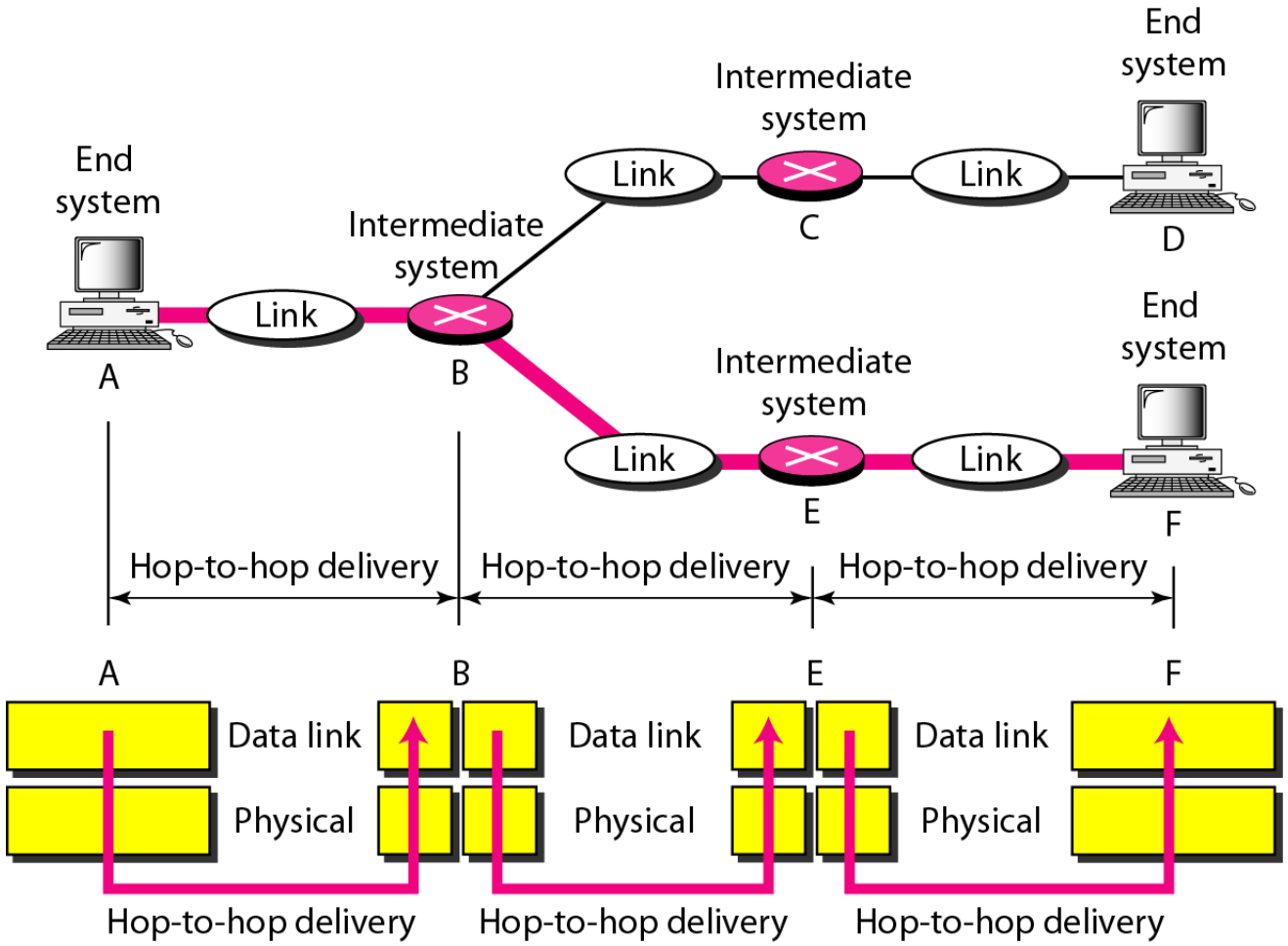
The physical layer is responsible for movements of individual bits from one hop (node) to the next.

2 - Data link layer

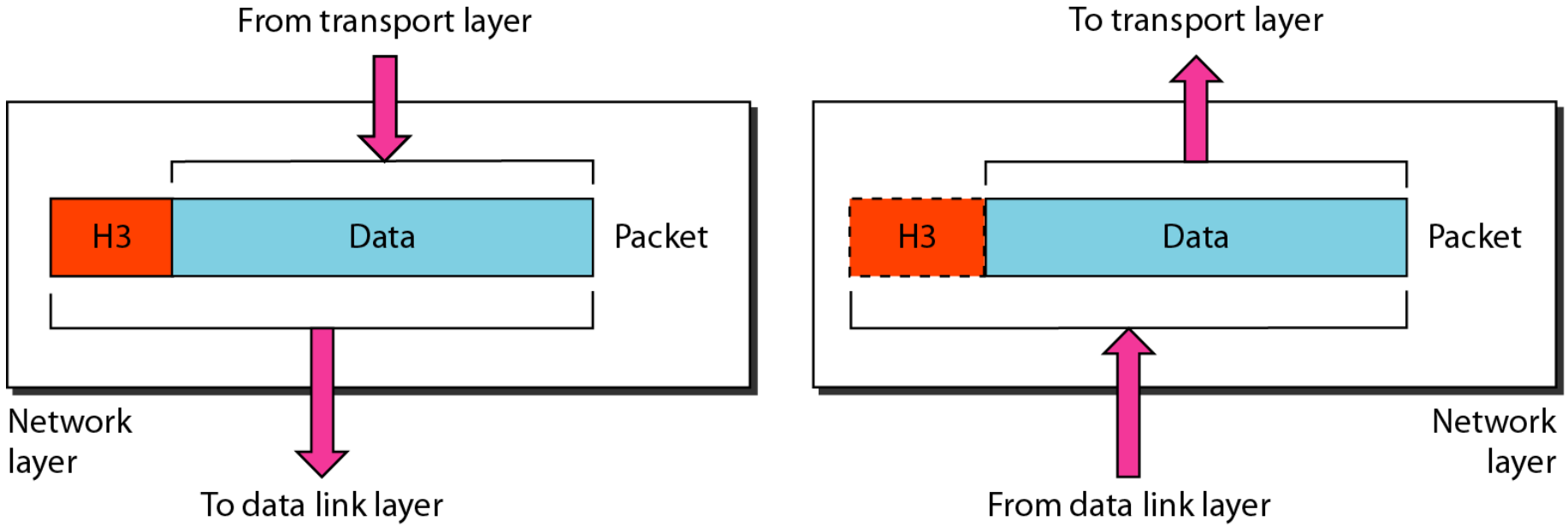


The data link layer is responsible for moving frames from one hop (node) to the next.

Hop-to-hop delivery

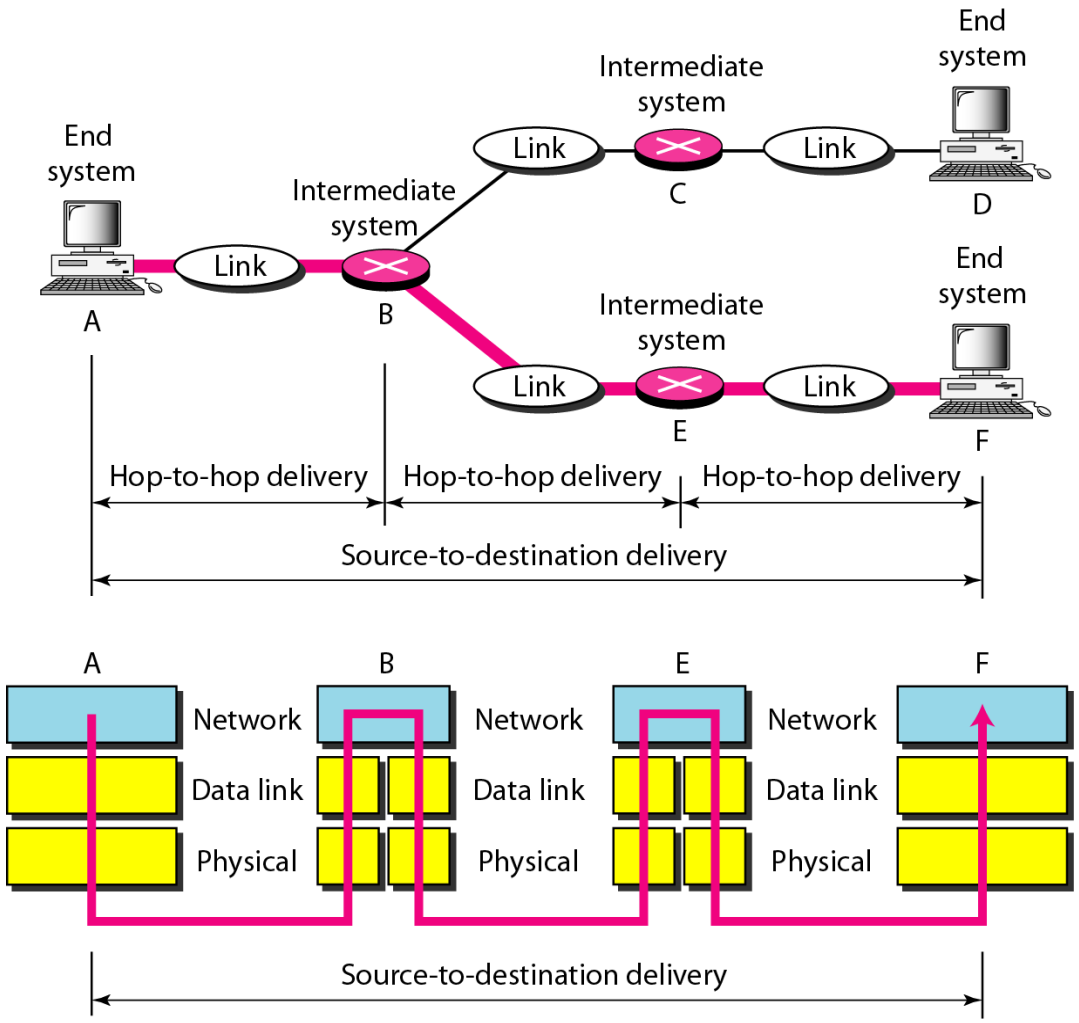


3 - Network layer

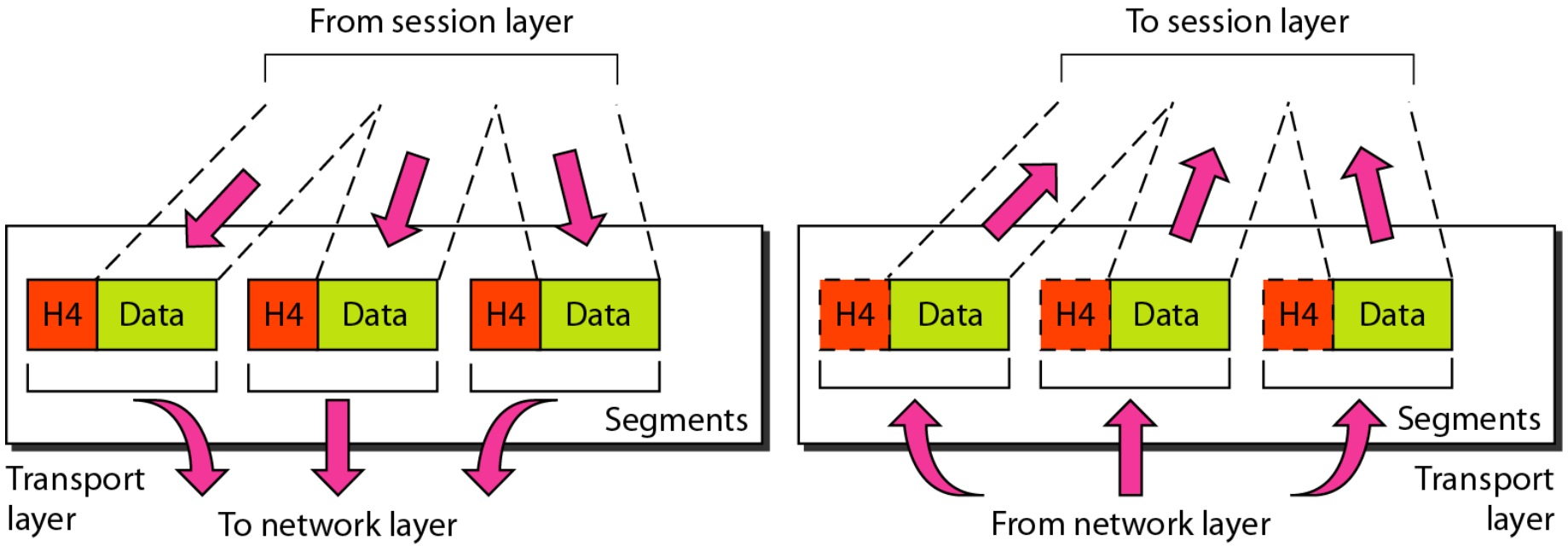


The network layer is responsible for the delivery of individual packets from the source host to the destination host.

Source-to-destination delivery

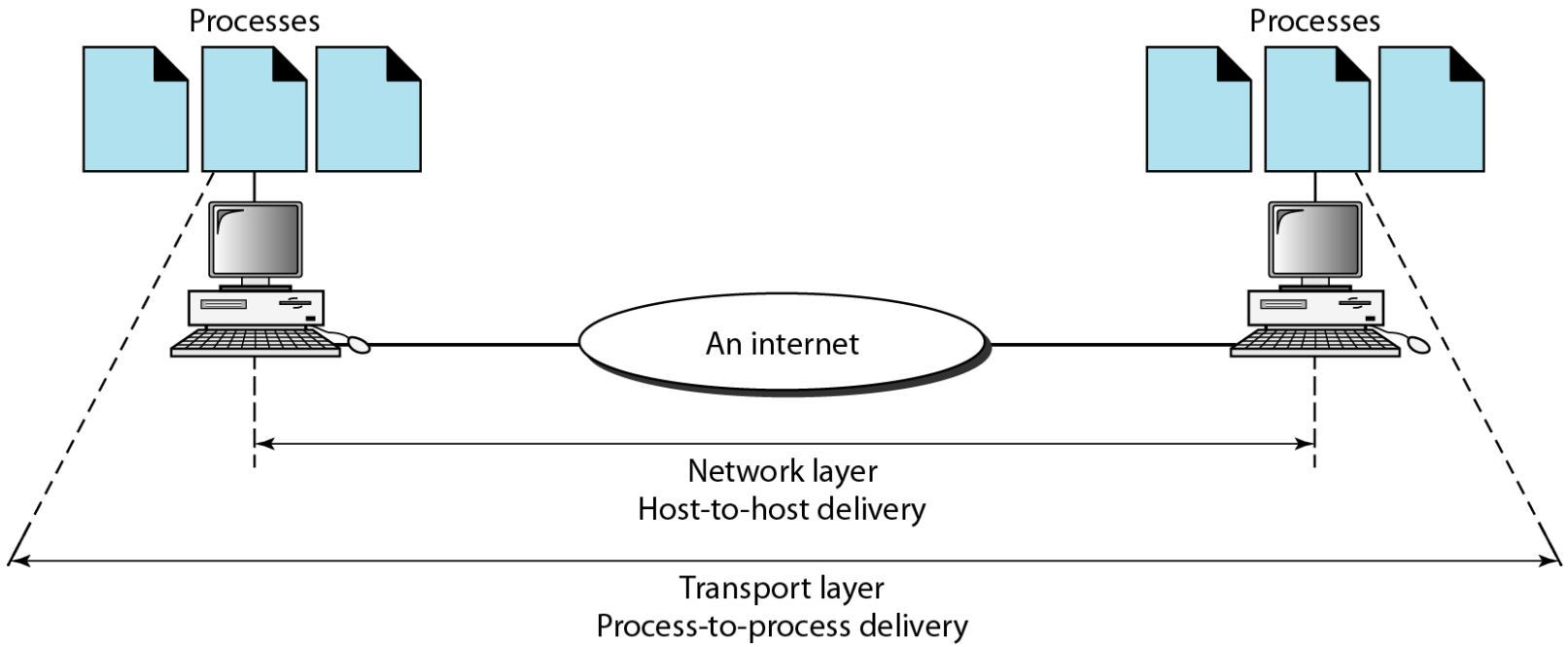


4 - Transport layer

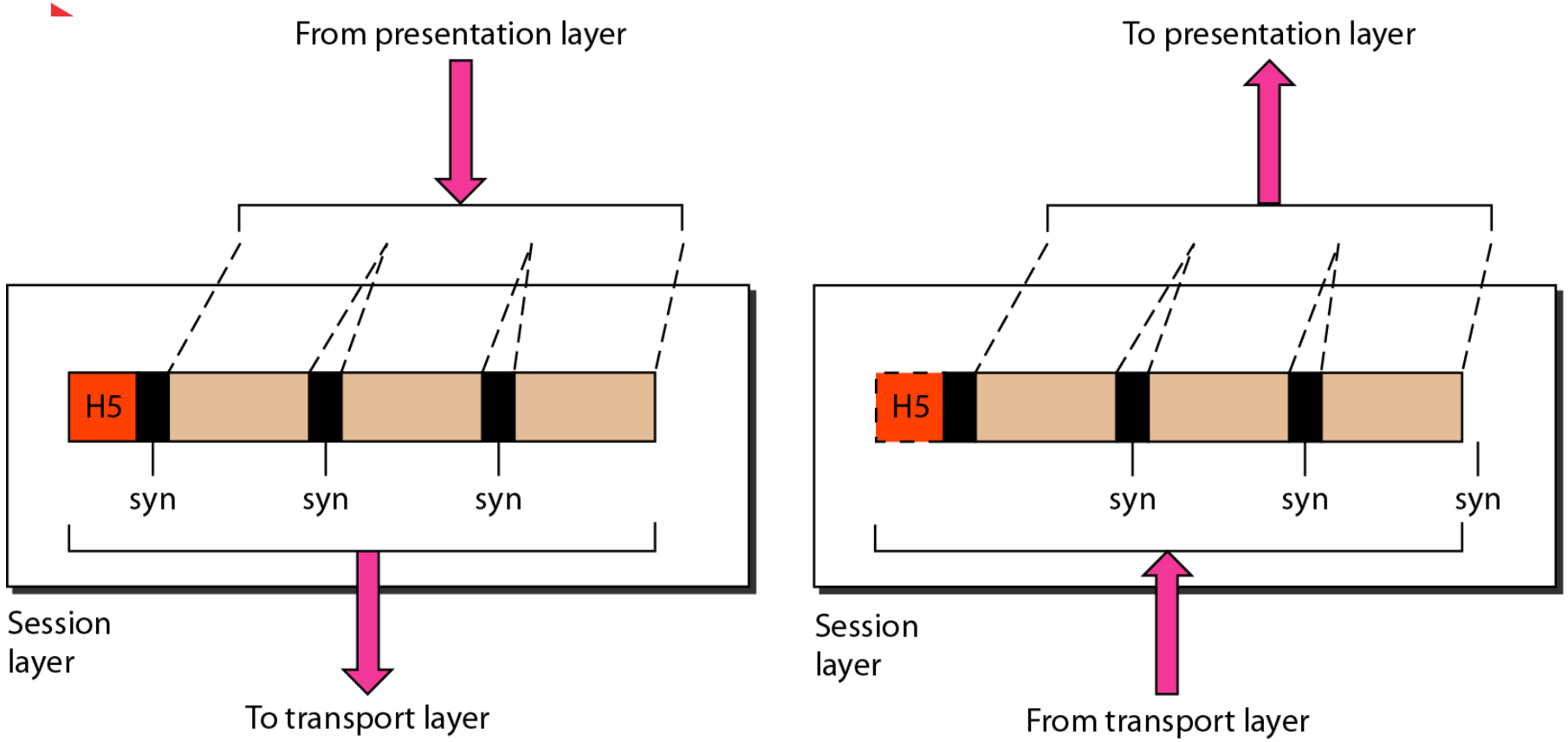


The transport layer is responsible for the delivery of a message from one process to another.

Reliable process-to-process delivery of a message

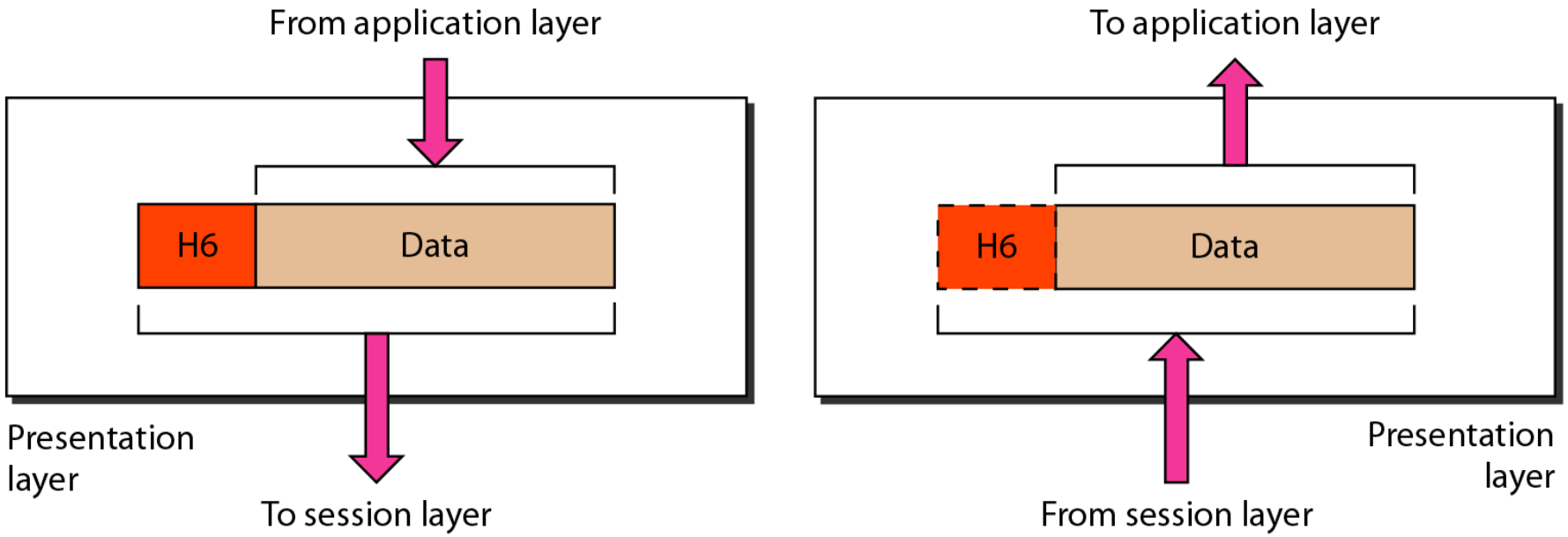


5 - Session layer



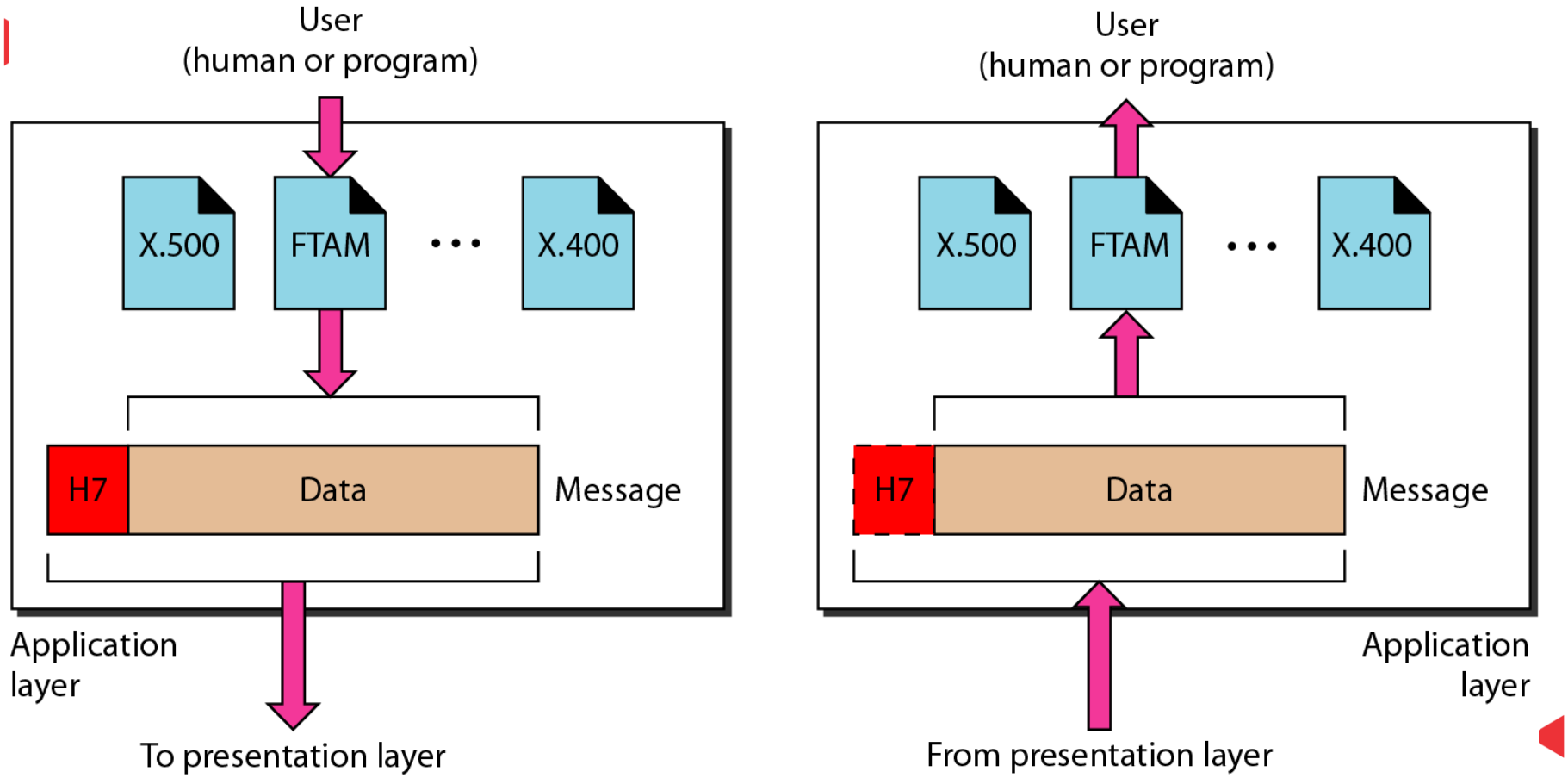
The session layer is responsible for dialog control and synchronization.

6 - Presentation layer



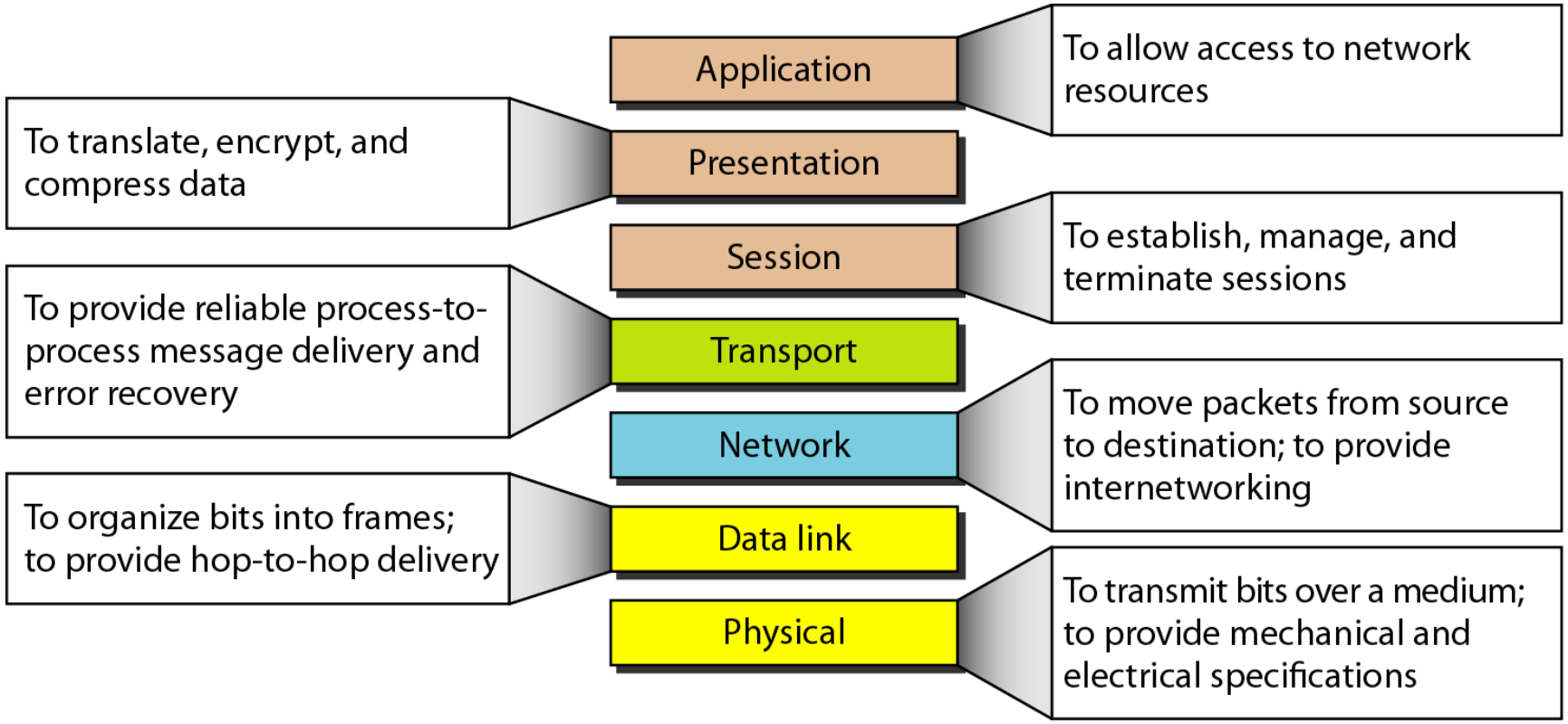
The presentation layer is responsible for translation, compression, and encryption.

7 - Application layer



The application layer is responsible for providing services to the user.

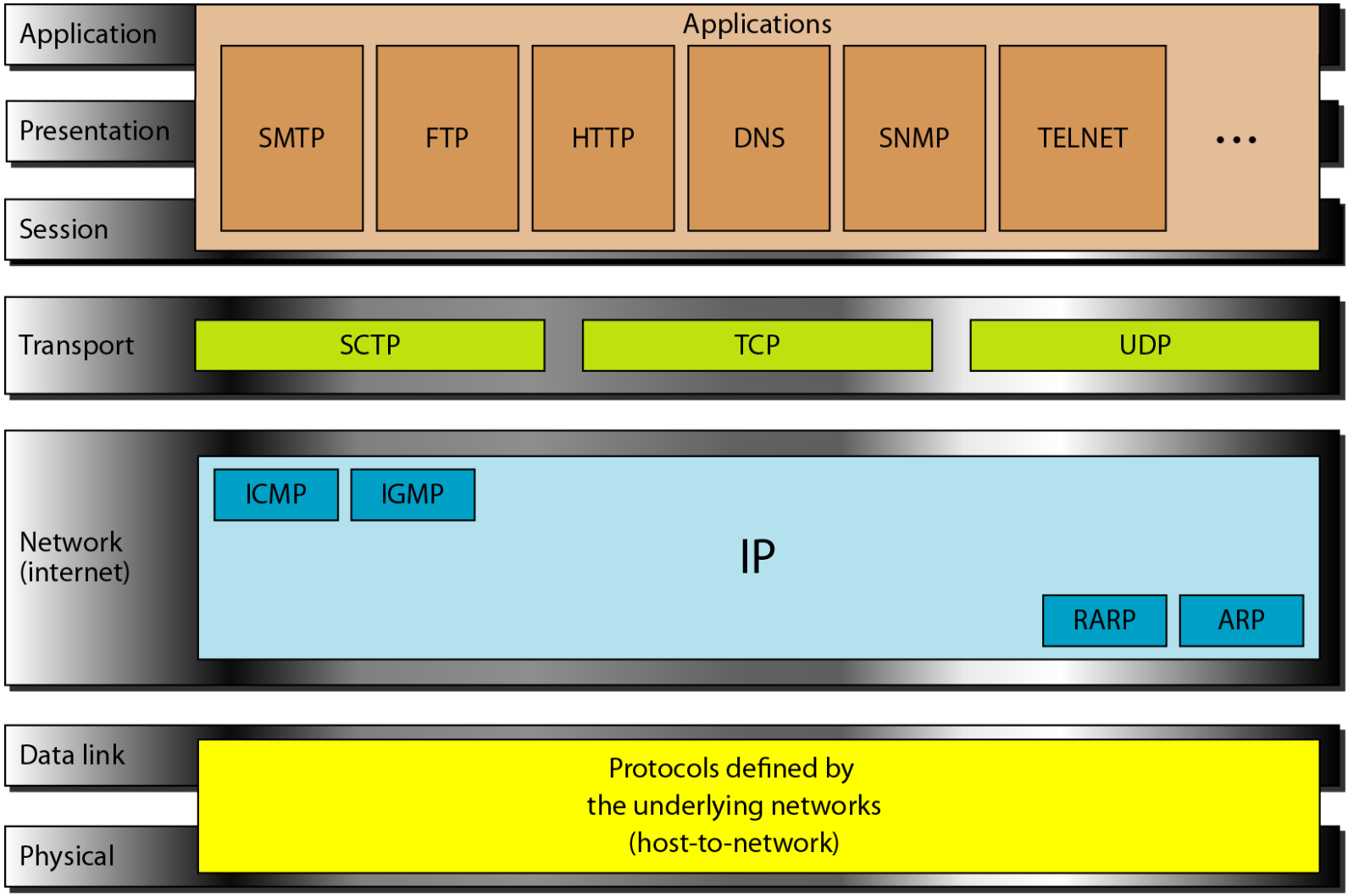
Summary of layers



TCP/IP Protocol Suite

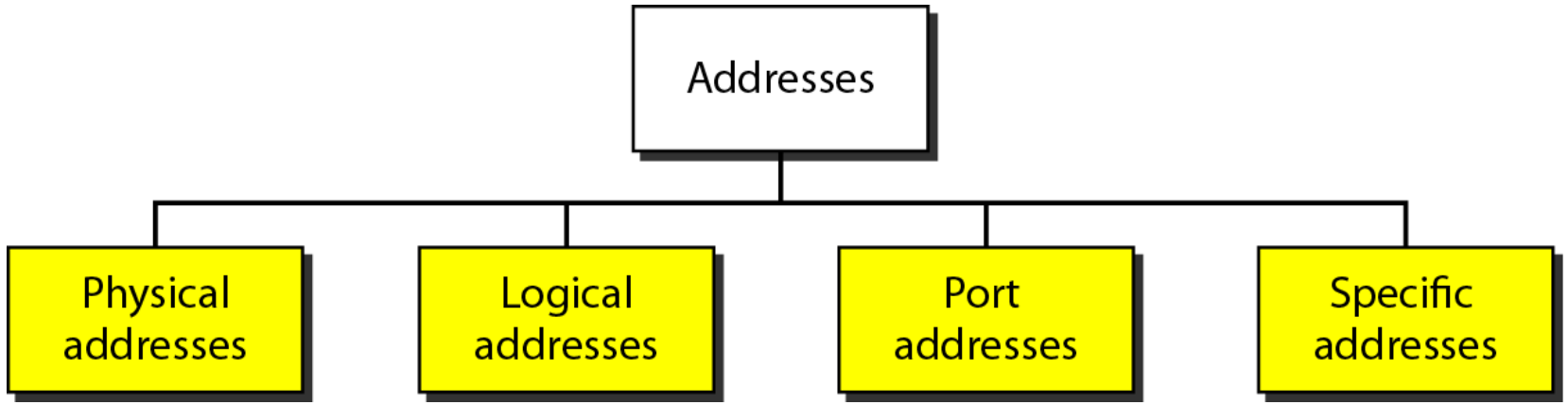
Layer pada TCP/IP protocol suite tidak sama persis dengan layer pada model OSI. Pada dasarnya, TCP/IP memiliki empat layer: host-to-network, internet, transport, dan application. Namun, saat dibandingkan dengan OSI, dapat dikatakan bahwa TCP/IP memiliki lima layer: physical, data link, network, transport, dan application.

TCP/IP and OSI model

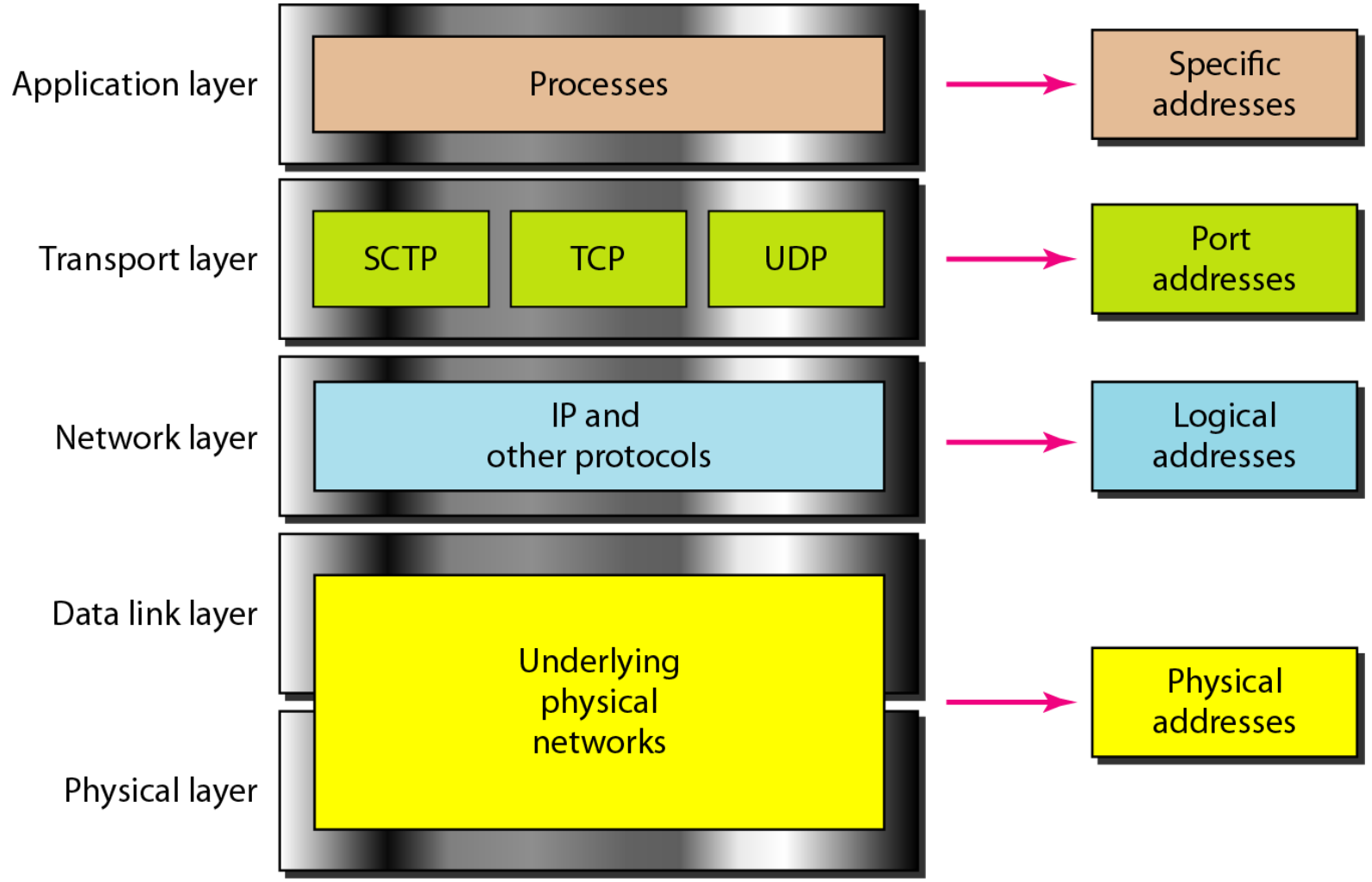


Addressing

Four levels of addresses are used in an internet employing the TCP/IP protocols: physical, logical, port, and specific.



Relationship of layers and addresses in TCP/IP



References

- *Data Communications and Networking*, 5th Edition, Behrouz A. Forouzan, McGraw Hill, 2013
- *Data and Computer Communications*, 10th Edition, William Stallings, Pearson Education, 2014
- *Computer Networking: A Top Down Approach*, 7th Global Edition, James F. Kurose & Keith W. Ross, Pearson Education, 2017

External Links

- http://www.akxl.org/ComputerNetworksArchitecture/characteristicsofnetworkarchitectures.htm
- https://www.paloaltonetworks.com/cyberpedia/what-is-quality-of-service-qos
- https://www.studytonight.com/computer-networks/complete-osi-model
- https://idcloudhost.com/perbedaan-osi-layer-dengan-tcp-layer/