Chapter 01 Introduction

Nguyễn Đăng Quang

E-mail: quang.ngdang@outlook.com

Contents

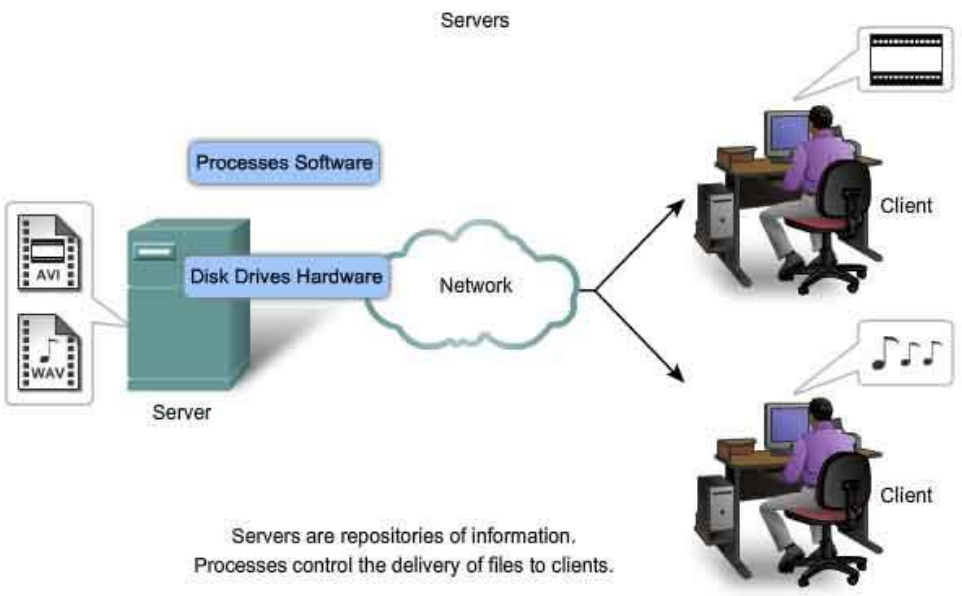
- Uses of Computer Network
- Network Hardware
- Network Software
- Reference Models
- Example of Networks
- Network Standardization
- IEEE 802 Project

Uses of Computer Network

- Business applications
- Home applications
- Mobile Users
- Social Issues

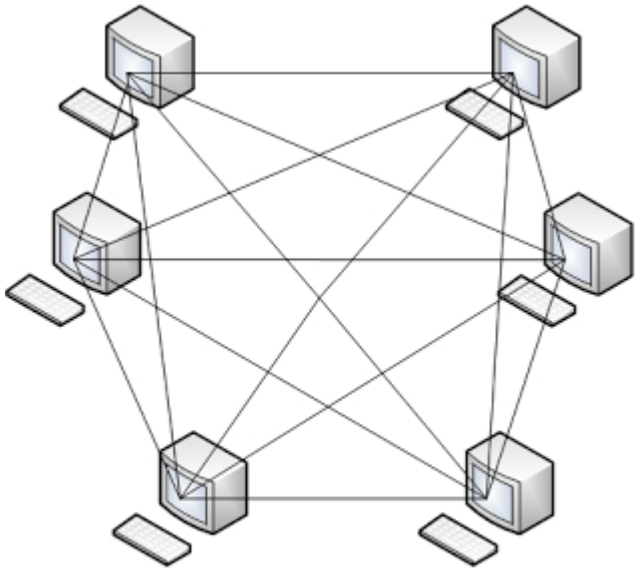
Business applications

- Resource sharing
  - Physical Devices
  - Information
- Client-Server models
  - Web application
- IP Telephony (VoIP)
- Desktop sharing
- E-Commerce



Home applications

- Word processing
- E-mail
- Peer-to-peer communication
  - Bit Torrent, uTorrent
- Instant messaging
- Social Network
  - Facebook
  - Twitter
  - Wiki
- IPTV



A peer-to-peer network.

Mobile Users

- Fixed Wireless
  - WIFI Access Point
- Mobile Wireless
  - 2G, 3G, 4G
- Mobile phones, Smart Phones
- GPS
- NFC (Near Field Communication)

Social Issues

- Mail
  - Junk mail
- Web
  - Cookies
  - Profiling Users
  - Phishing
  - Botnet

Network Hardware

- Transmission Technologies
- Network size

Transmission Technologies

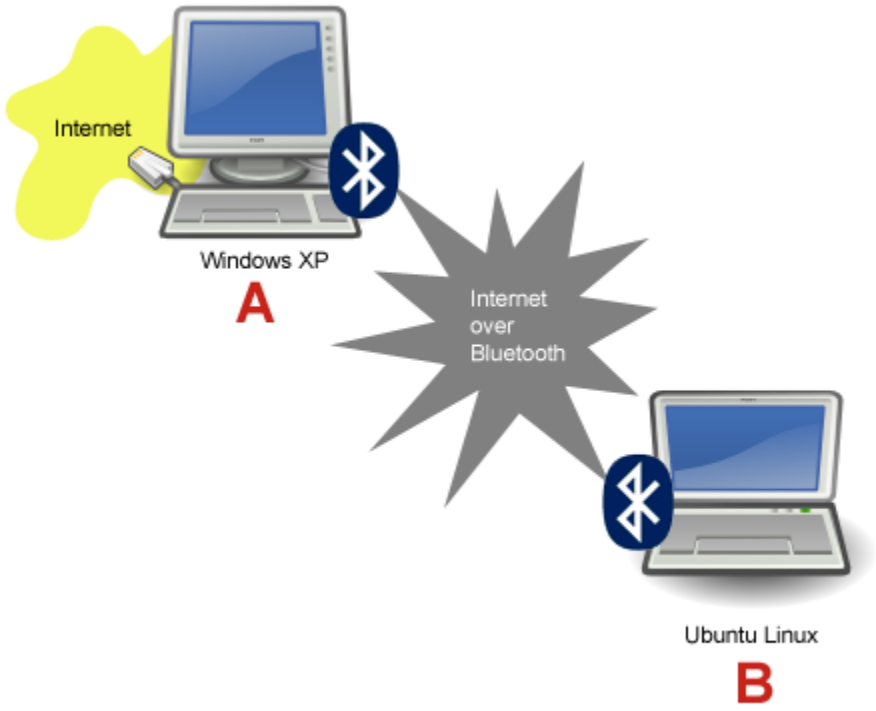
- Broadcast Links
  - MultiCast
- Point-to-Point Links

Network Scale

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

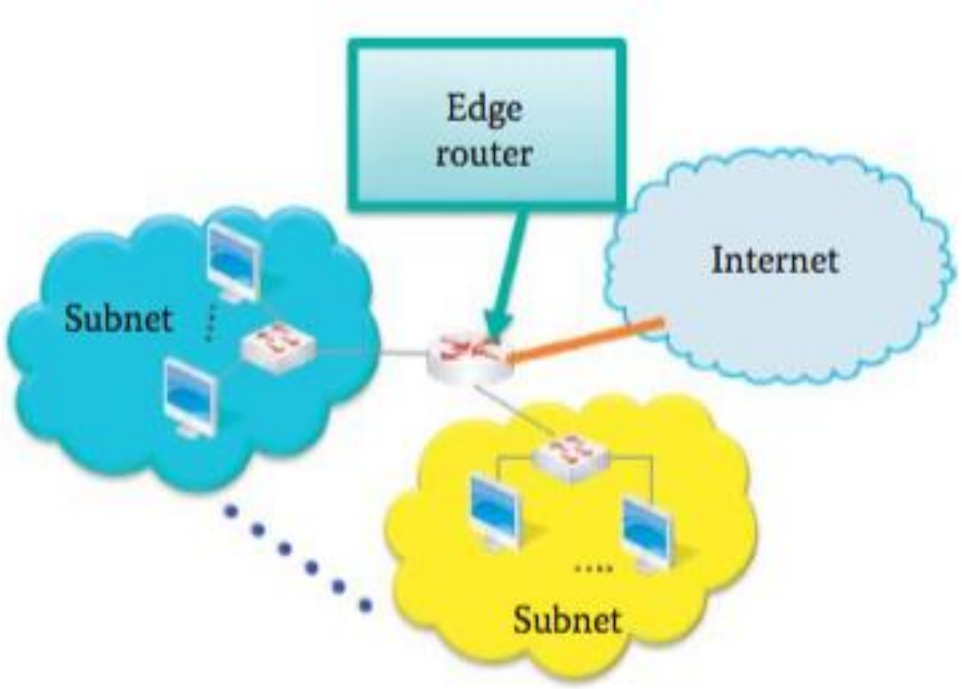
PAN Personal Area Network

- Bluetooth (IEEE 802.15)
- RFID



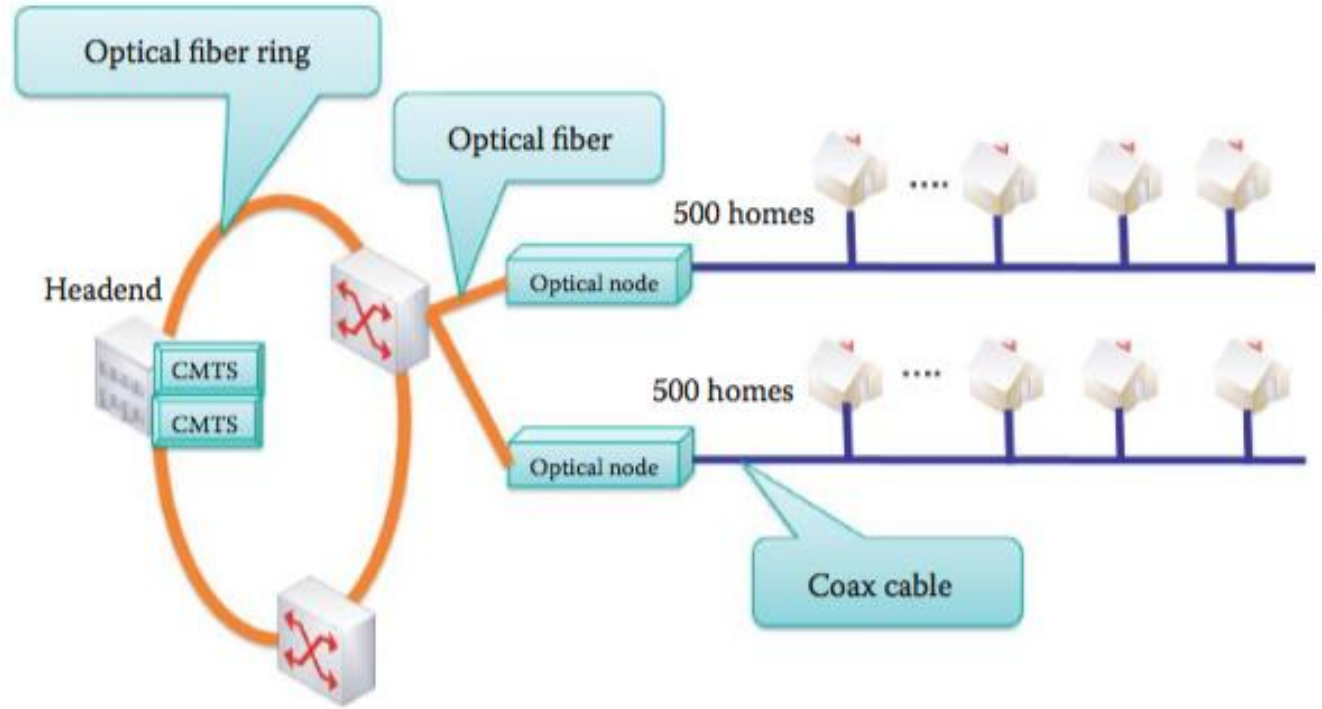
LAN – Local Area Network

- Enterprise Network
- Wireless (IEEE 802.11)
- Ethernet (IEEE 802.3)
  - Switched Ethernet
  - VLAN
- Power-line network



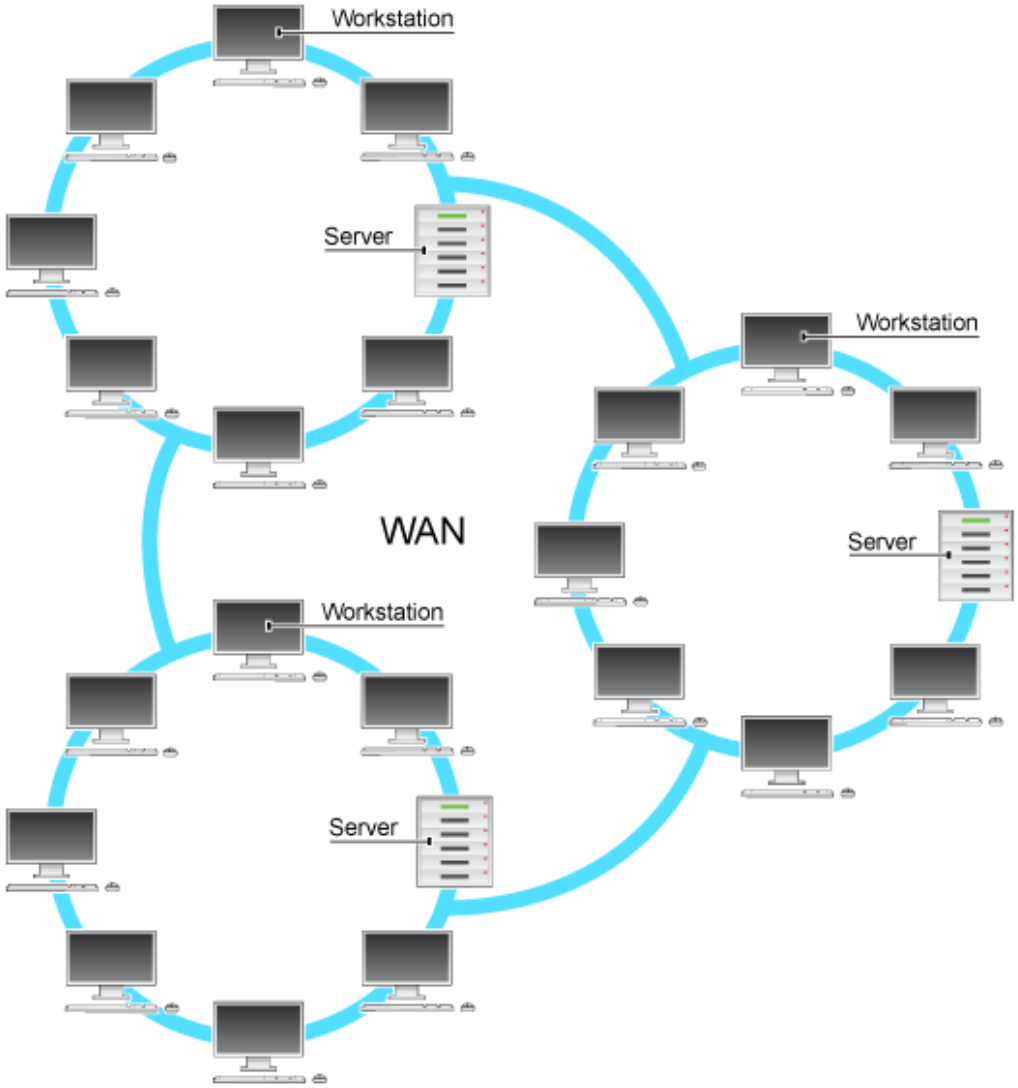
MAN – Metropolitan Area Network

- TV Cable Network
- WiMAX (IEEE 802.16)



WAN – Wide Area Network

- Router
- Subnets
- ISPs



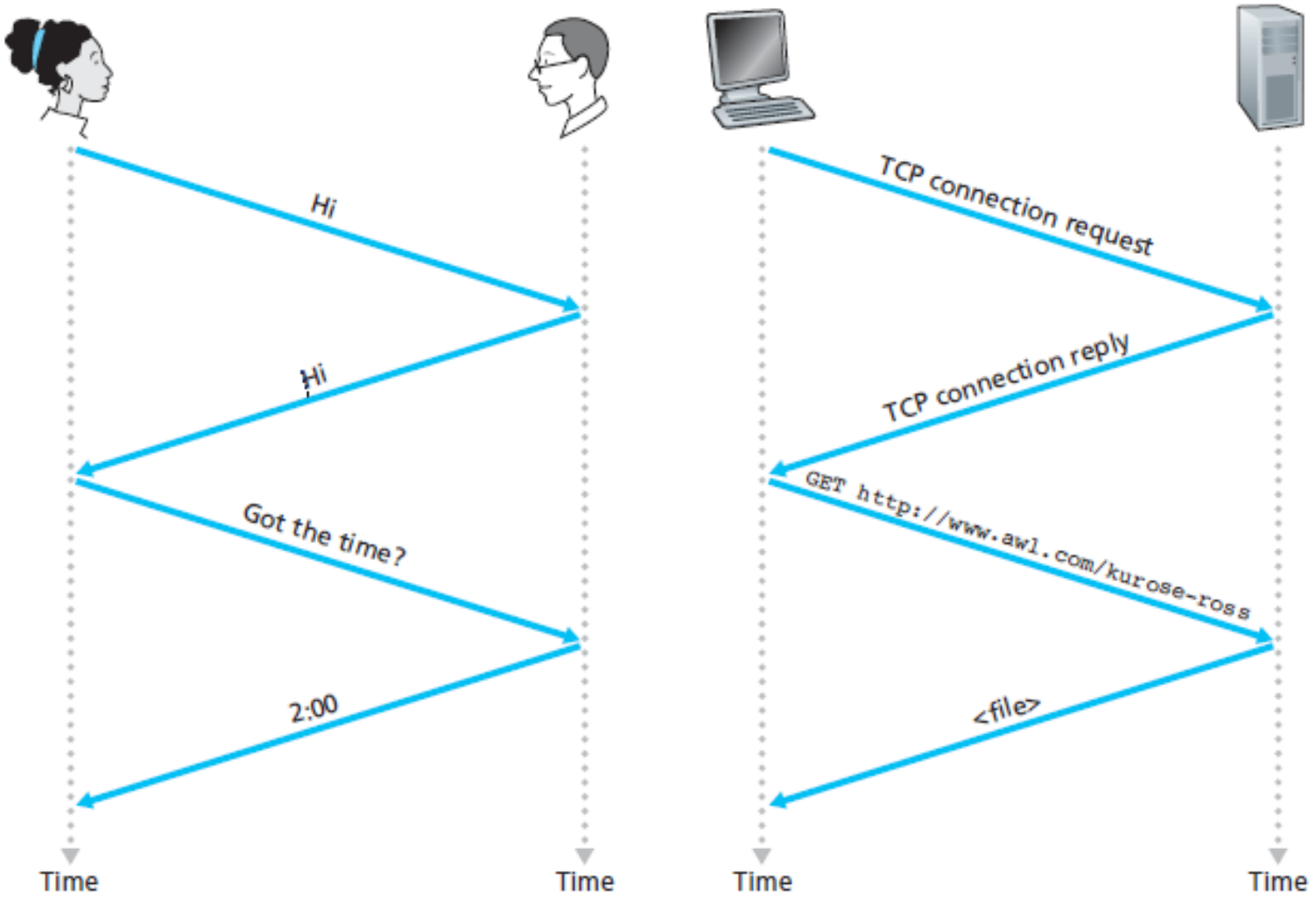
Network software

- Protocols/Protocol Stack
- Design Issues
- Connection-Oriented vs. Connectionless

Protocol

- A **protocol** defines the format and the order of messages exchanged between two or more communicating entities, as well as the actions taken on the transmission and/or receipt of a message or other event

Protocol


Hi
Hi
Got the time?
2:00
Time
Time
TCP connection request
TCP connection reply
GET http://www.awl.com/kurose-ross
<file>
Time
Time

Design issues for layers

- Error detection/correction
- Routing
- Addressing/Naming
- Flow Control
- Quality of Service (QoS)

Connection-Oriented vs. Connectionless

- Connection-Oriented:
  - Establish connection
  - Use the connection
  - Release the connection

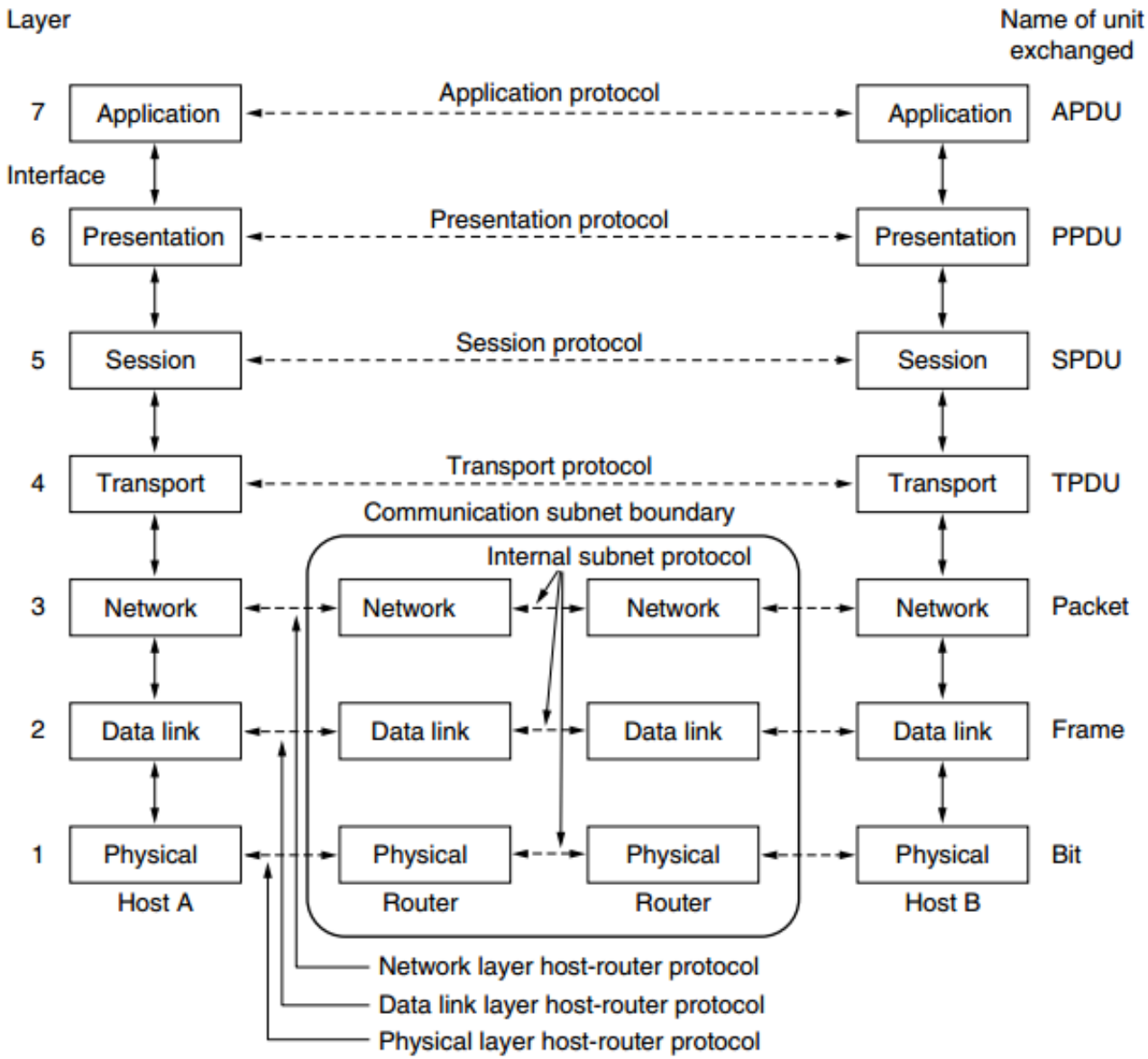
  Reliable service
- Connectionless
  - Not Establish connection
  - Datagram service = Telegram

  Unreliable service

Reference Models

- OSI Reference Model
- TCP/IP Reference Model

The OSI Reference Model



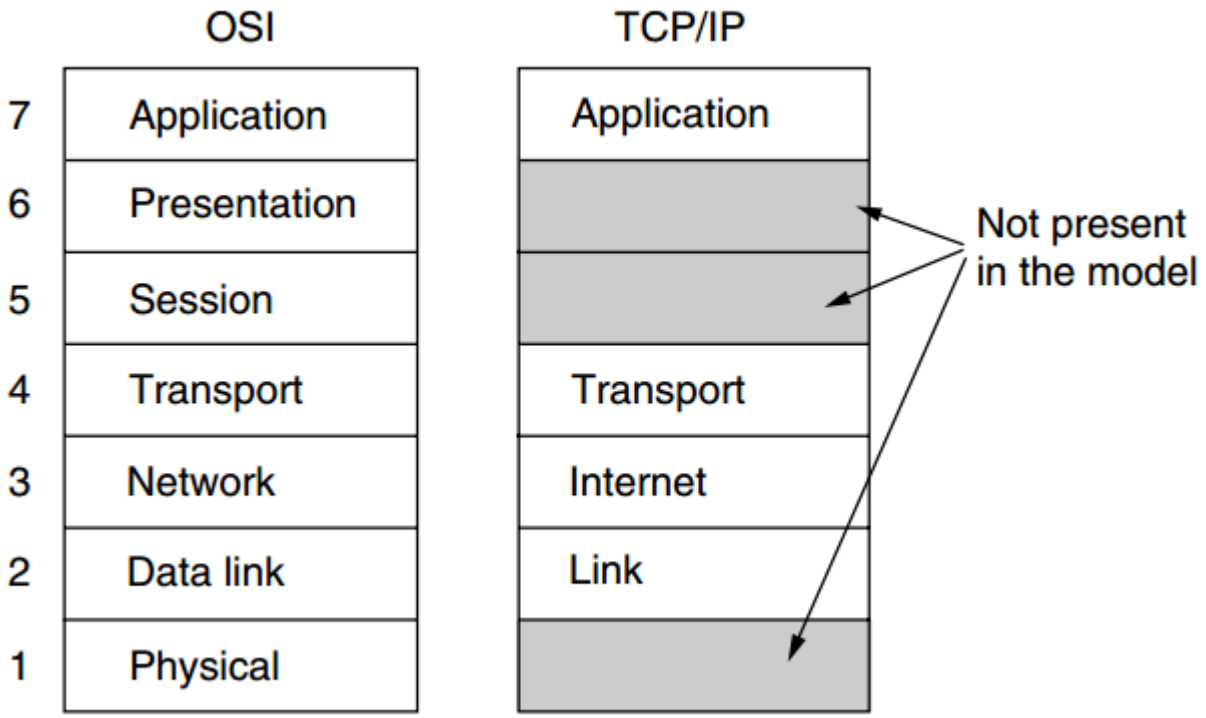
OSI Reference Model

- Physical Layer: Transmitting raw bits
- Data Link Layer:
  - Data is broken up in **frames**
  - How to transmit using shared channel → Media Access Control (MAC)
- Network Layer:
  - Addressing
  - Routing
  - Handling congestion
- Transport Layer
  - An Error-free point-to-point channel that delivers messages or bytes in the order they are sent.

OSI Reference Model

- Session Layer:
  - Establish connection,
  - Manage connection,
  - Disconnect
- Presentation Layer:
  - The lower layers, which are mostly concerned with moving bits around
  - This layer is concerned with Syntax & Semantic of information transmitted
- Application

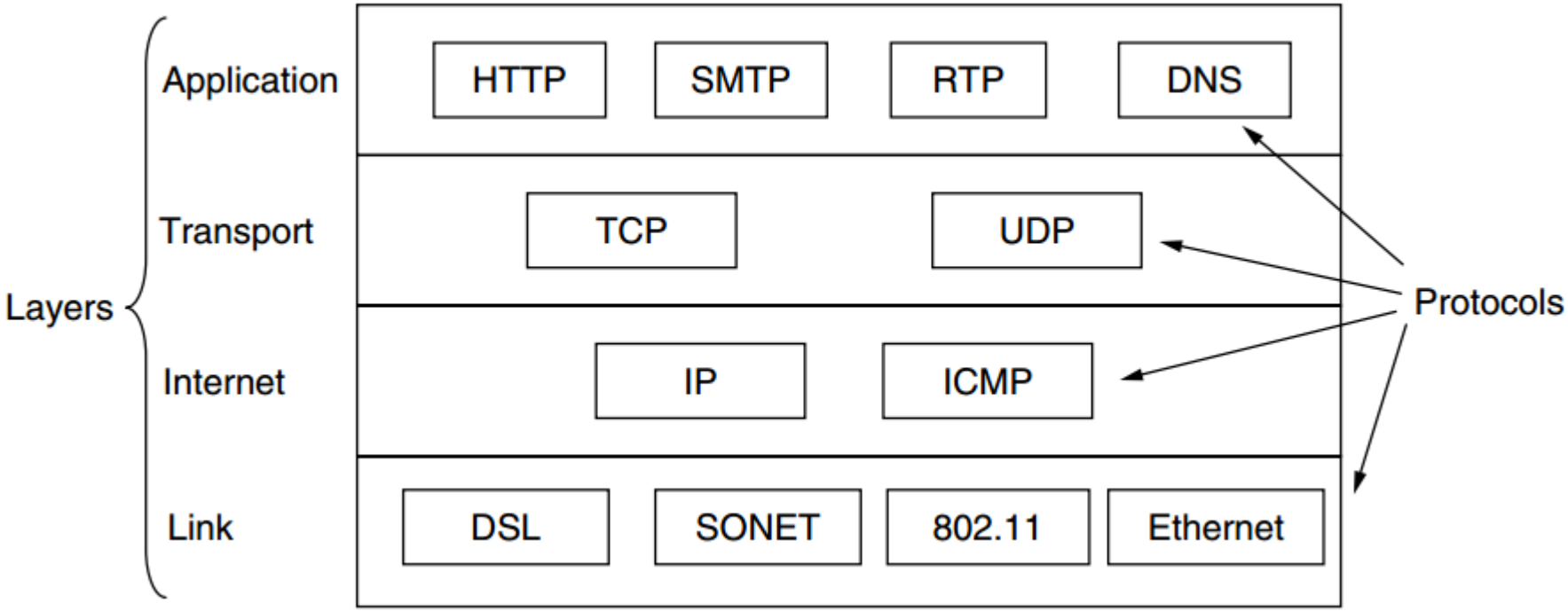
TCP/IP Reference Model



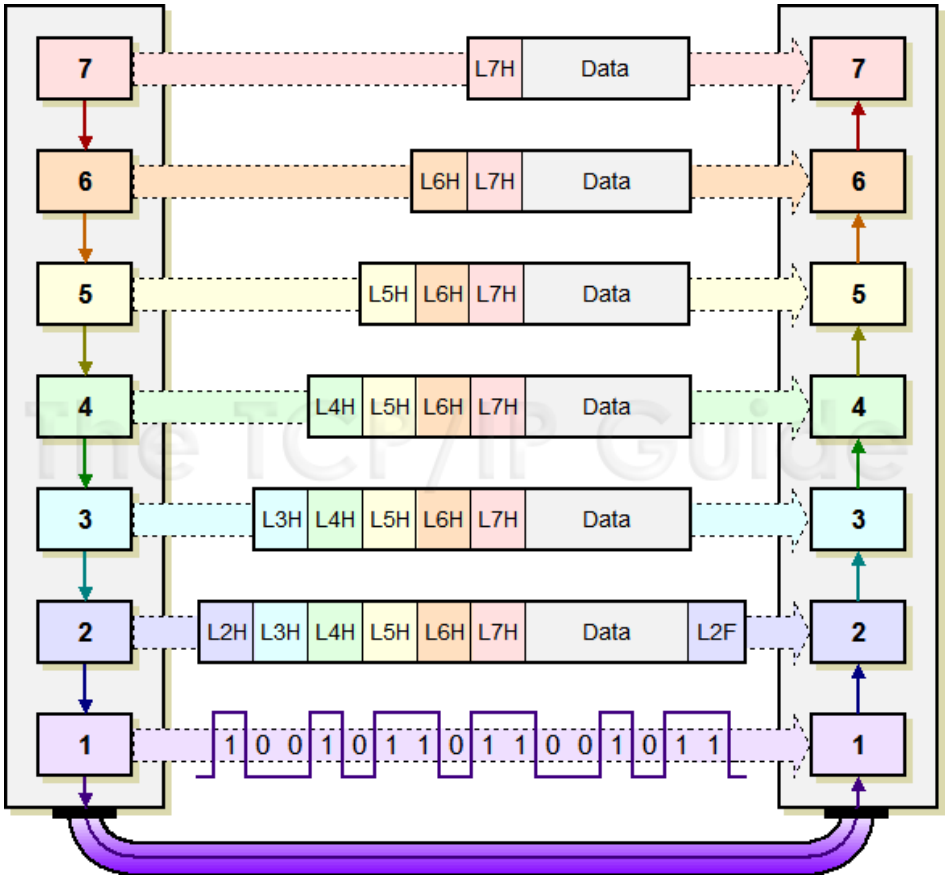
TCP/IP Reference Model

- Link Layer:
  - Serial line
  - Classic Ethernet
- Internet Layer
  - IP Packet
  - ICMP Packet
- Transport Layer
  - TCP – reliable connection – oriented protocol
  - UDP – unreliable connectionless protocol
- Application Layer

TCP/IP Reference Model



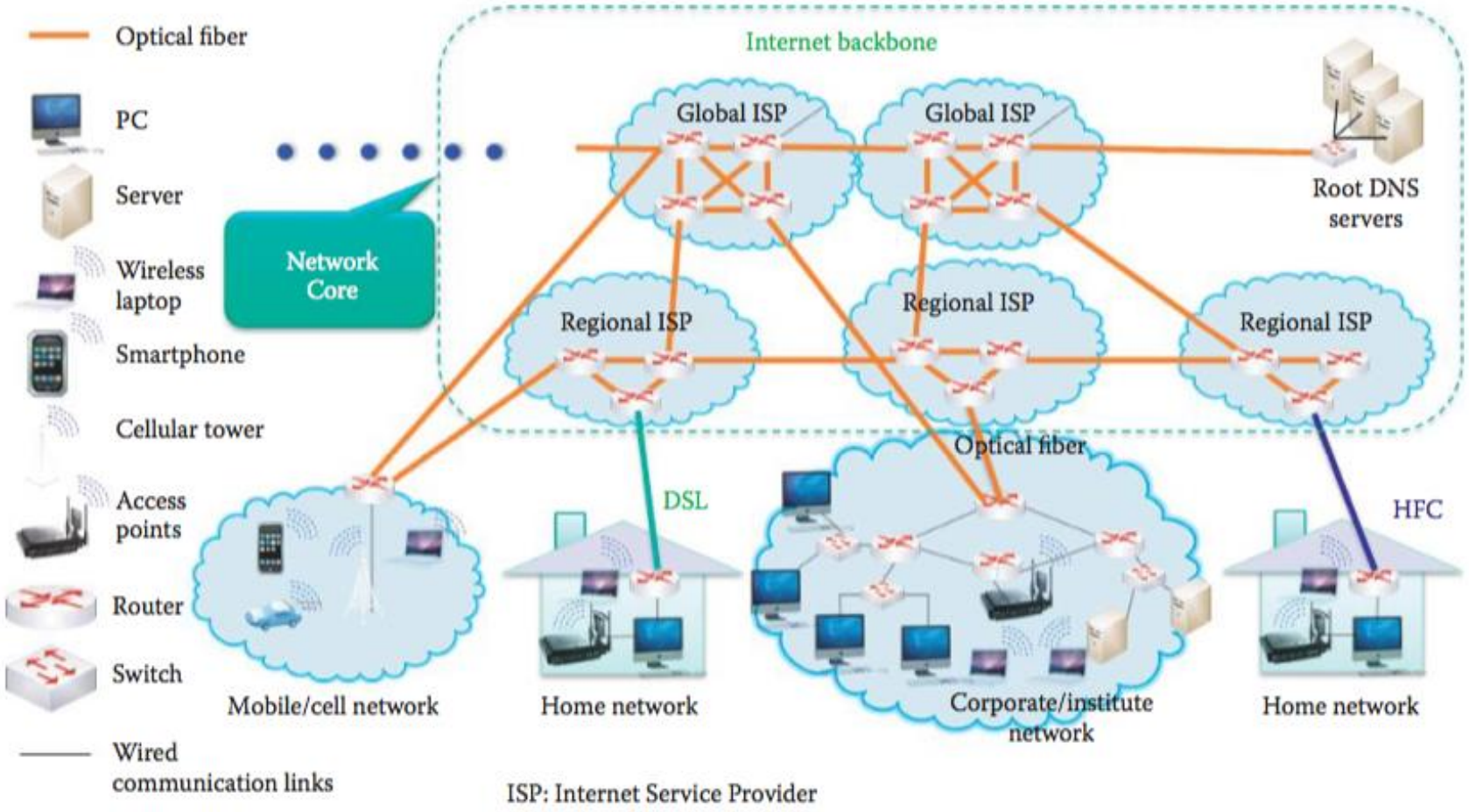
Packet Transmission



Example Network

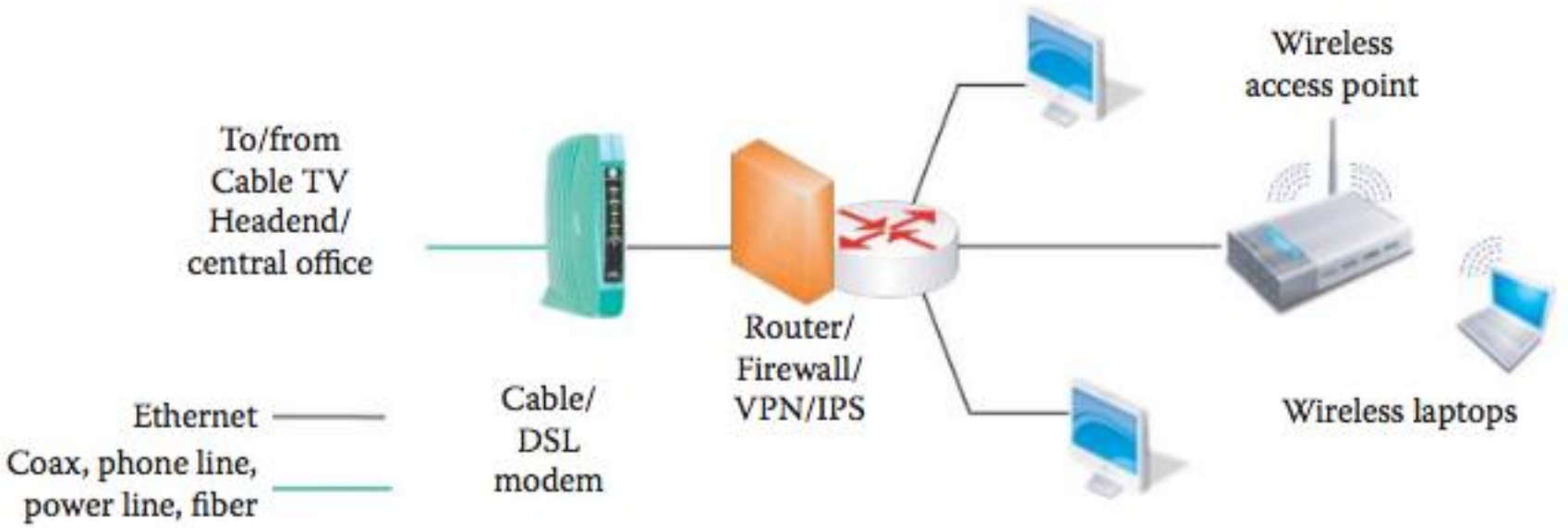
- The Internet
- Network edge
- Core network
- Access network

The Internet



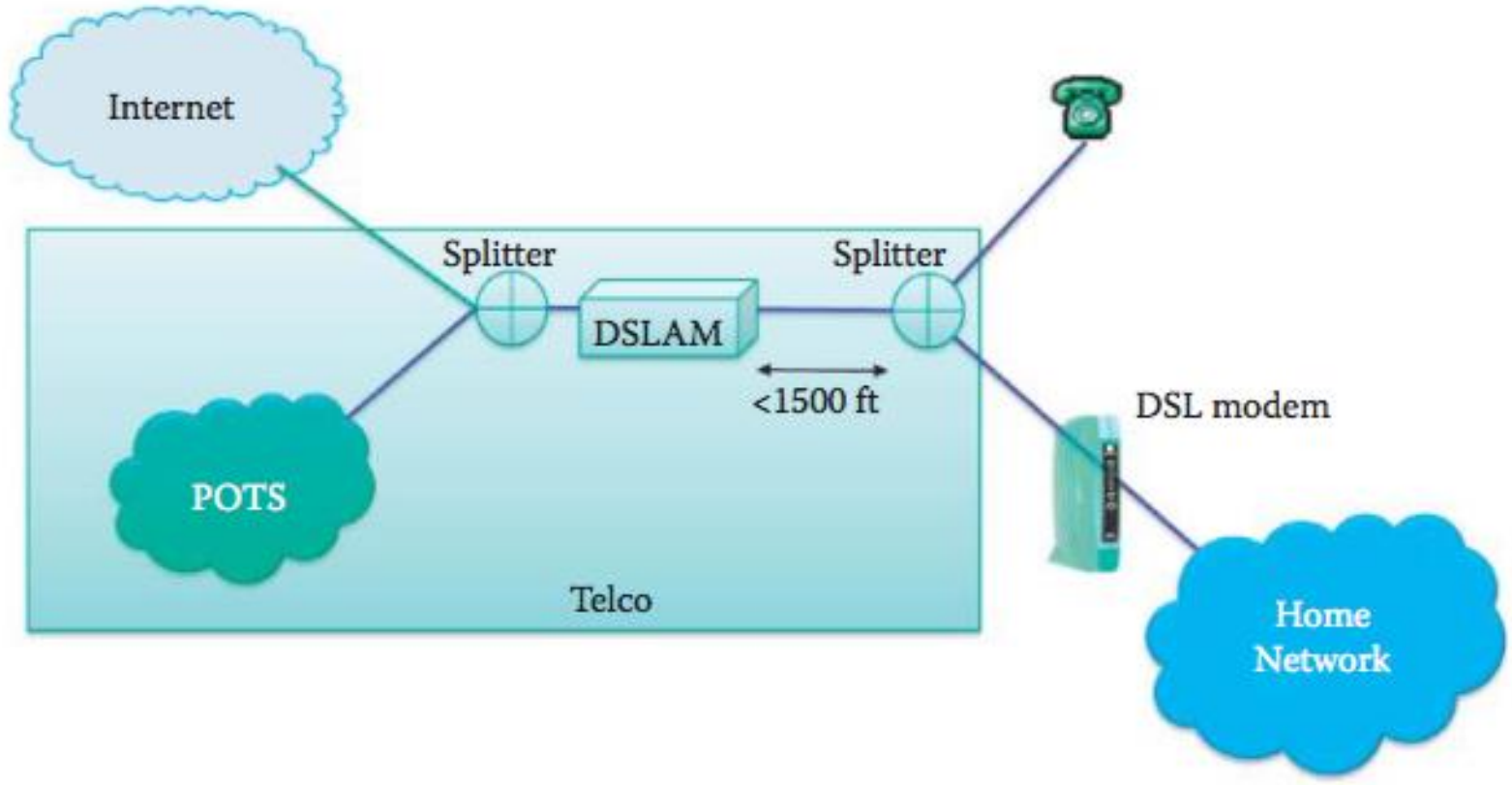
Access Networks

- **Residential access networks,** connecting a home end system into the network.



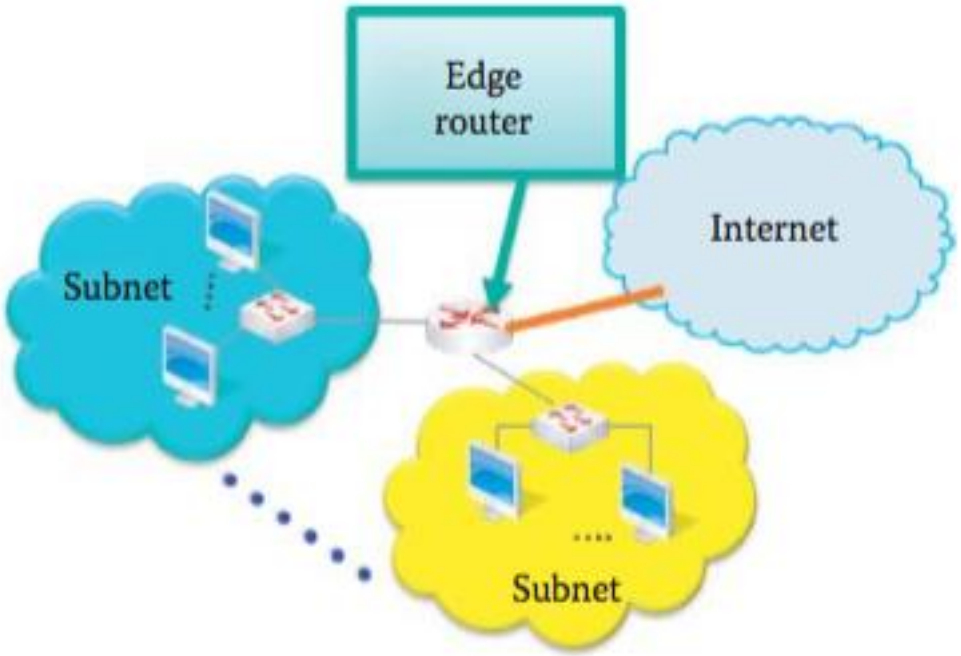
Access Networks

- **Home networks**, connecting a home end system into the network.



Access Networks

- **Institutional access networks,** connecting an end system in a business or educational institution into the network
- **Mobile access networks,** connecting a mobile end system into the network



Network Standardization

- In Telecommunication World
- In International Standard World

In Telecommunication World

- ITU (International Telecommunication Union)
  - ITU-T/CCITT (Telecommunications Standardization Sector): concerns with telephone and data communication systems.
  - ITU-R (Radiocommunications Sector): coordinating the use by competing interest groups of radio frequencies worldwide.
  - ITU-D (Development Sector): promotes the development of information and communication technologies

In International Standard World

- ISO
- NIST (National Institute of Standards and Technology)
- IEEE (Institute of Electrical and Electronics Engineers)
  - IEEE's 802 – IEEE 802.x
    - IEEE 802.3
    - IEEE 802.11

In the Internet Standards World

Internet

- IAB (Internet Architecture Board)
  - IRTF (Internet Research Task Force): Research Community – Long-term Research
  - IETF(Internet Engineering Task Force): Short-term engineering issues
- RFCs (Request For Comments)

Web

- W3C (World Wide Web Consortium)

Project 802

- Students research and make presentation

Project 802

1. The 802 Project Model
2. The 802 Specifications
3. Enhancement to the OSI Model
4. The 802 Categories

The 802 Project Model

- An IEEE's project → build up a LAN standard,
- Named for the year and month it began (1980, February),
- Defined network standards for the physical components of a network (NIC and cabling), that are accounted for in the physical and data-link layers of the OSI reference model.

The 802 specifications

Set standard for

- Network interface cards (NICs),
- Local area network (LAN) components,
- Components used to create twisted-pair and coaxial cable networks.

The 802 specifications define the ways NICs access and transfer data over physical media. These include connecting, maintaining, and disconnecting network devices

Enhancements to the OSI Model

- The physical layer and the data-link layer, define how multiple computers can use the network simultaneously without interfering with each other
- The 802 standards committee divided the data-link layer into two sublayers:
- **Logical Link Control (LLC)** Establishing and terminating links, controlling frame traffic, sequencing frames, and acknowledging frames
- **Media Access Control (MAC)** Managing media access, delimiting frames, checking frame errors, and recognizing frame addresses

IEEE 802 Categories

Specification	Description
802.1	Sets Internetworking standards related to network management.
802.1D	Interconnect multiple LAN segments (STP)
802.1q	VLAN
802.2	Defines the general standard for the data-link layer. The IEEE divides this layer into two sub-layers: the LLC and MAC layers. The MAC layer varies with different network types and is defined by standard IEEE 802.3
802.3	Defines the MAC layer for bus networks that use Carrier-Sense Multiple Access with Collision Detection (CSMA/CD). This is the Ethernet Standard.
802.4	Defines the MAC layer for bus networks that use a token-passing mechanism (Token Bus LAN).
802.5	Defines the MAC layer for token ring networks (Token Ring LAN).

IEEE 802 Categories

Specification	Description
802.6	Sets standards for metropolitan area networks (MANs). MANs are usually characterized by very-high-speed connections using fiber-optic cables or other digital media.
802.11	Defines wireless network standards
802.15	Defines wireless personal area networks (WPAN)
802.15.1	Bluetooth
802.16	Defines broadband wireless standards (WiMAX)

Video

- http://tinyurl.com/lr5dnpo