chapter 1

Data Communications – An Introduction

CHAPTER OBJECTIVES

- Define data communications and its building blocks.
- Identify and describe three different types of data encoding.
- Describe the differences between analog and digital data.
- Describe the differences between analog transmission and digital transmission.
- Recognize the differences between parallel and serial transmission.

병렬전송 직렬전송

CHAPTER OBJECTIVES (cont'd)

- Identify and describe asynchronous and synchronous transmission.
  비동기식과 동기식 전송의 차이
- Define simplex, half-duplex, and full-duplex data transmission.
- Examine common data communications media options.
- Describe key data communications standards, standards organizations, and standards-making processes.
- Identify the layers of the OSI and TCP/IP models and describe their layered architectures.

DATA COMMUNICATIONS *DEFINED*

- It moves data from point A to point B. 가까울수도 멀 수도 있다
- It requires at least one communications medium. 전송매체
- Data must be formatted for transmission across the medium.
- High-tech hardware, software, and services are used.
- It's the transmission of encoded data and information in a medium-specific format between two or more nodes, people, businesses, or entities.

전송매체에 맞게 포멧된 데이터

두개 이상의 비지니스 사람들 노드 등 정보통신

BITS, BYTES, and DATA ENCODING

- To transfer human readable data, the data must be transmitted in a format that machines can understand. To do this, we use bits, bytes, and data encoding.

Bit – smallest unit of encoding in the binary number system.

Byte – 8 bits.

Data Encoding – the method by which data is represented in digital or binary format.

BITS, BYTES, and DATA ENCODING (cont'd)

Examples of data encoding include:

EBCDIC – the Extended Binary Coded Decimal Interchange Code. 미국애들이 만들어서 알파벳만 씀

ASCII – the American Standard Code for Information Interchange.

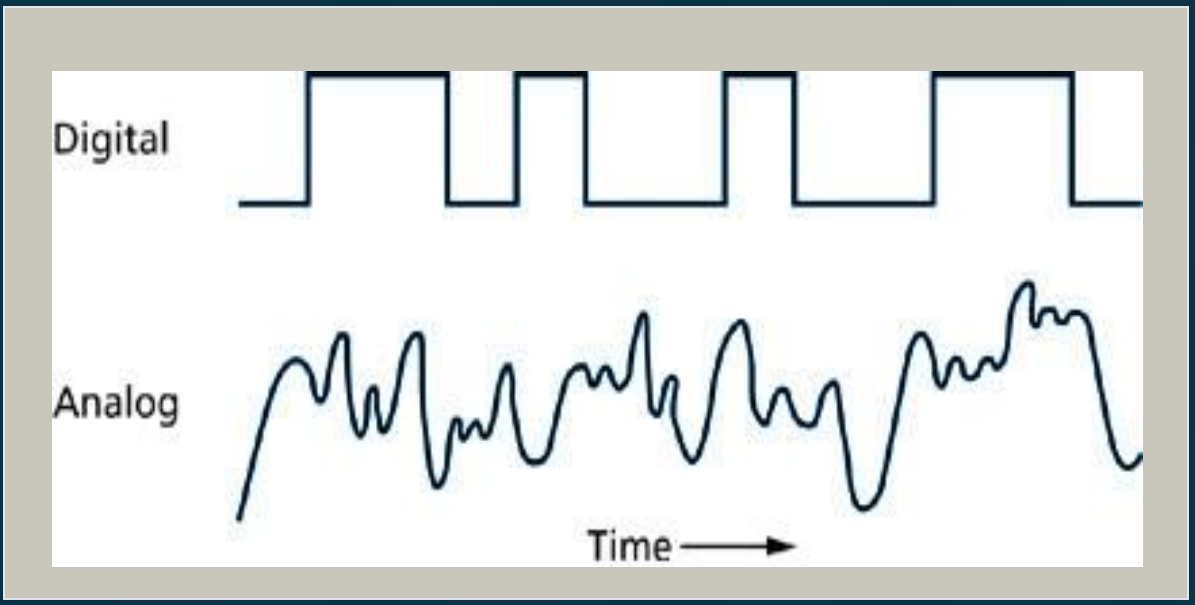
Unicode – surpasses the limitations of ASCII by employing more bits. 16bit 크기로 언어를 표시할 때 사용

DIGITAL and ANALOG DATA

- Analog data - is represented and reproduced by a continuously variable level of sound, light, electricity, or other input.

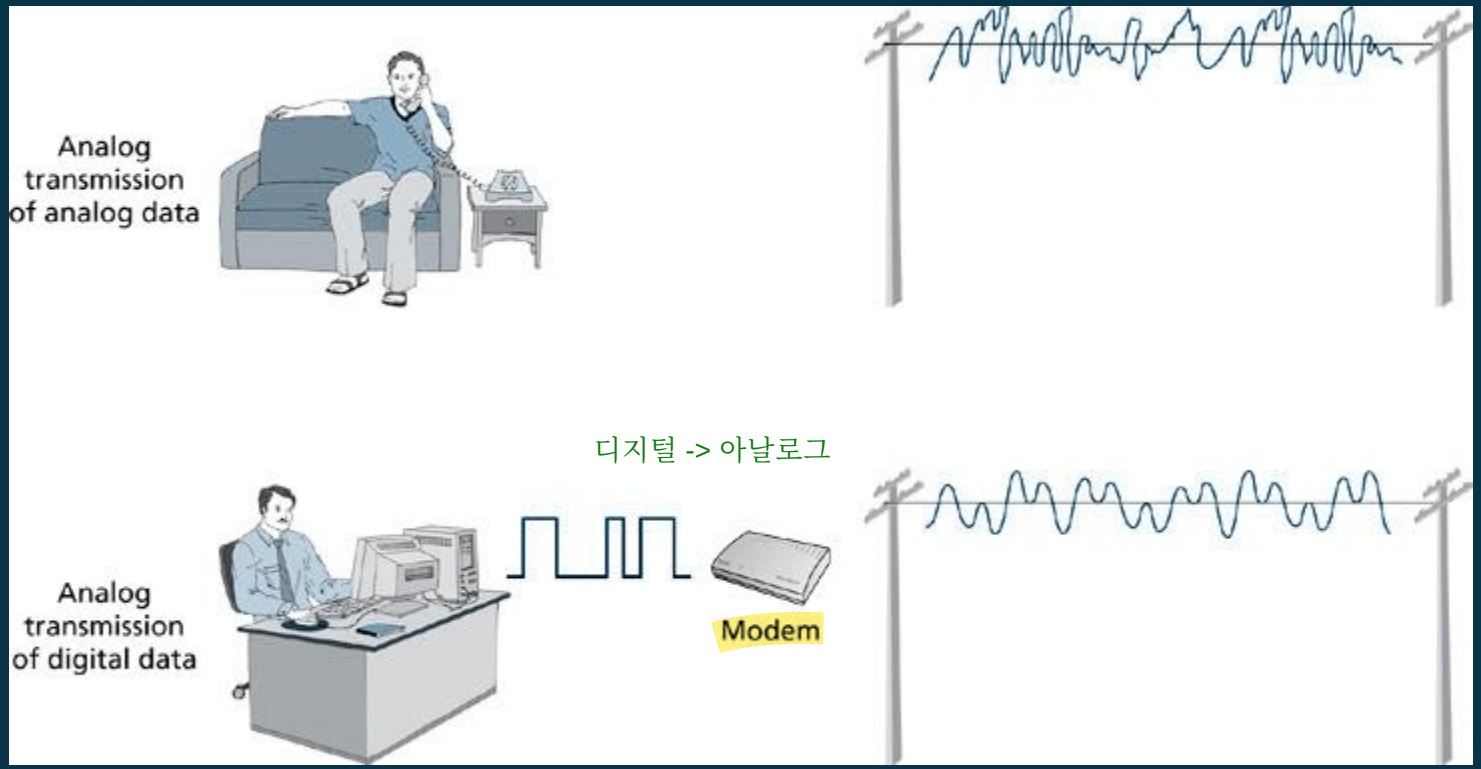
- Digital data – is represented and reproduced by discrete levels of sound, light, electricity, or other input.

Digital Transmission and Analog Transmission



디지털은 값이 0하고 1밖에 없지만 아날로그는 어떤 값이든 가질 수 있다

Analog Transmission of Analog Data versus Analog Transmission of Digital Data



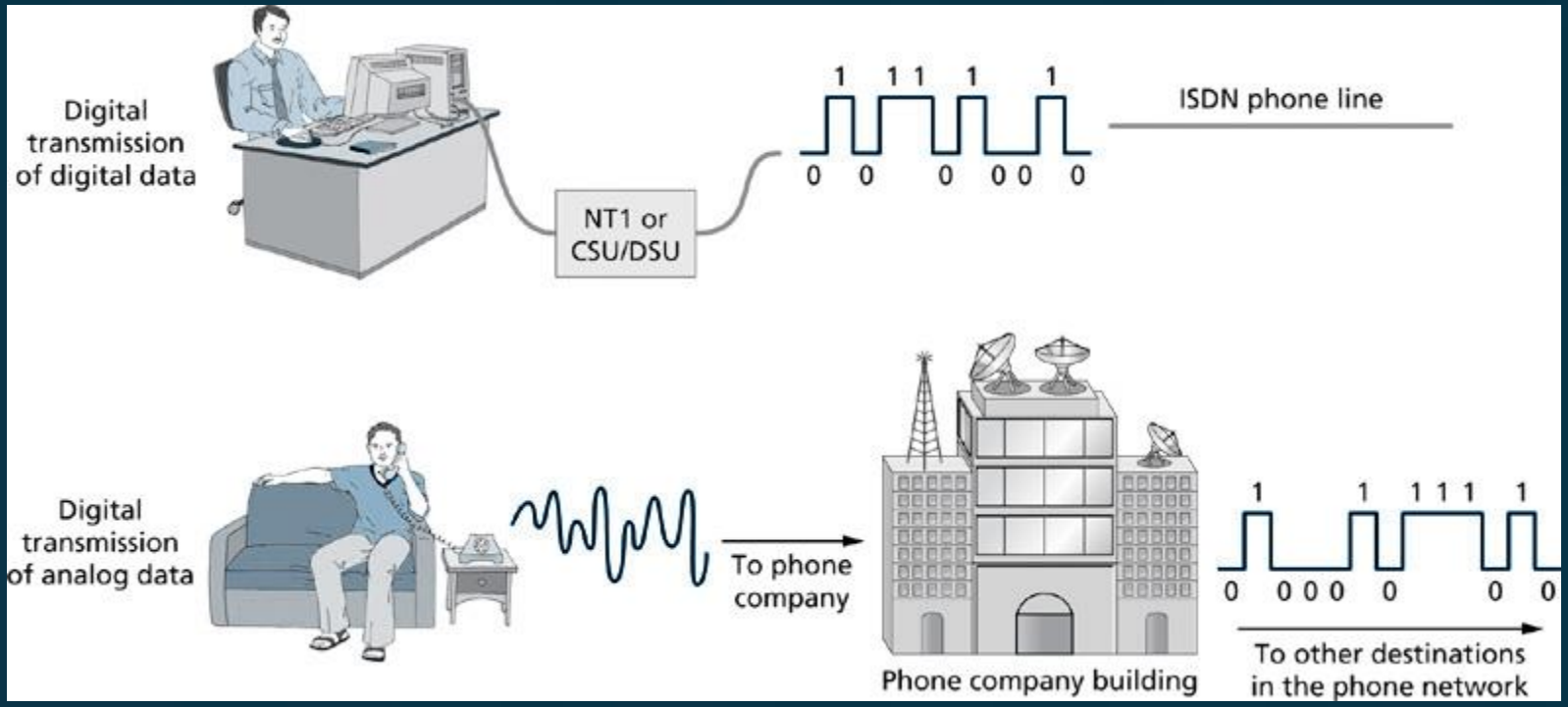
디지털 -> 아날로그

데이터를 전송할 때 손상된 데이터를 원상복구 하는 결과가 디지털이 아날로그보다 훨씬 좋다

0.8 0.2 이런식으로되면 1.0 0.0 으로 바꿔주면 복원이 아주 잘 된다

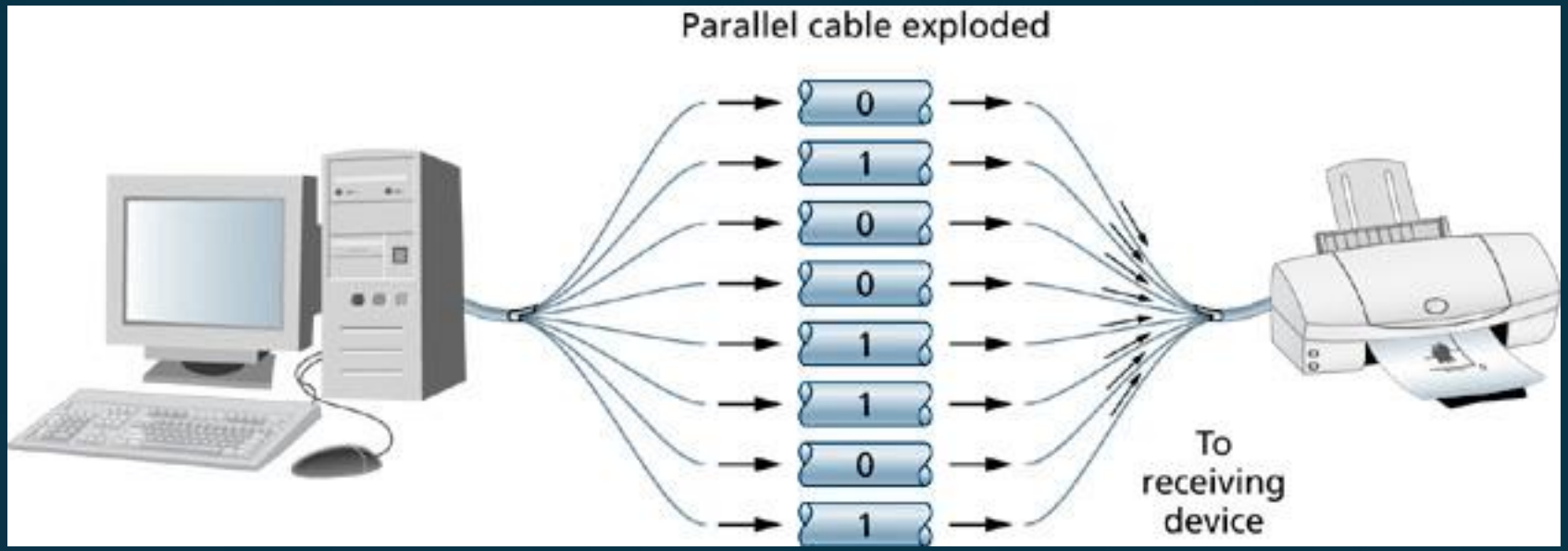
아날로그는 값을 모두 가지고 있어서 어렵다

Digital Transmission of Digital Data versus Digital Transmission of Analog Data

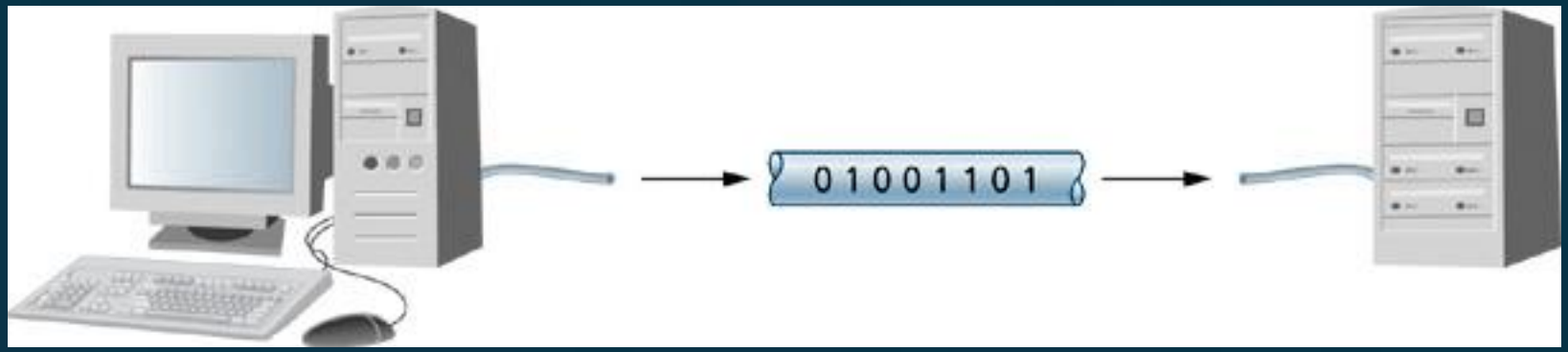


전화 -> 기지국 -> 전화받는 사람 근처 기지국 -> 전화받는 사람

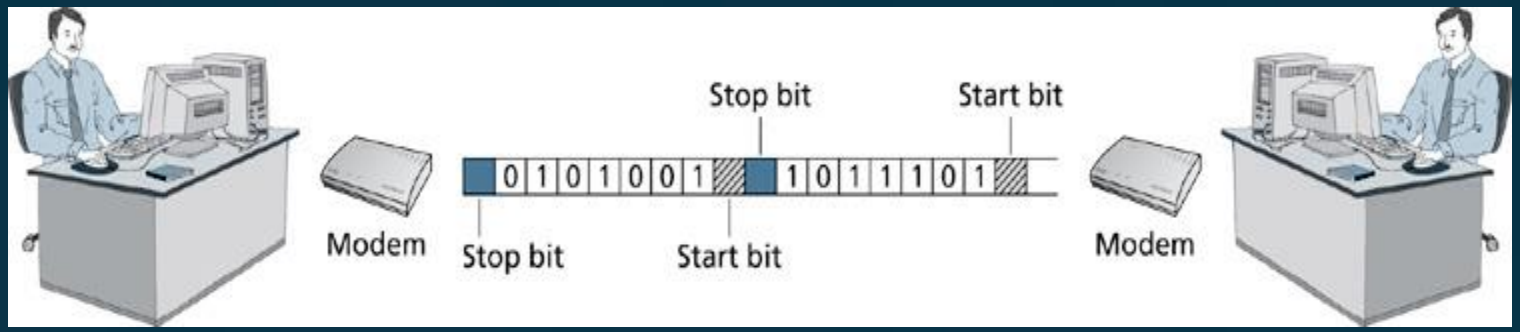
Parallel Transmission



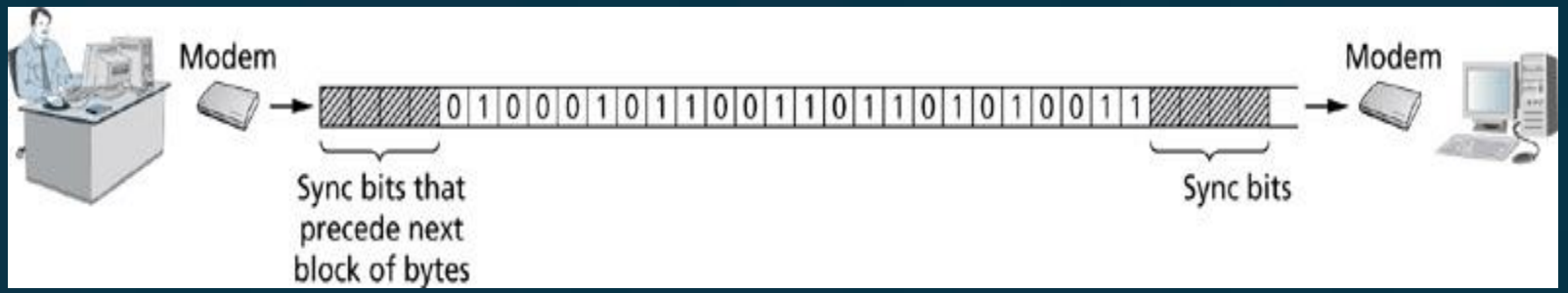
Serial Transmission



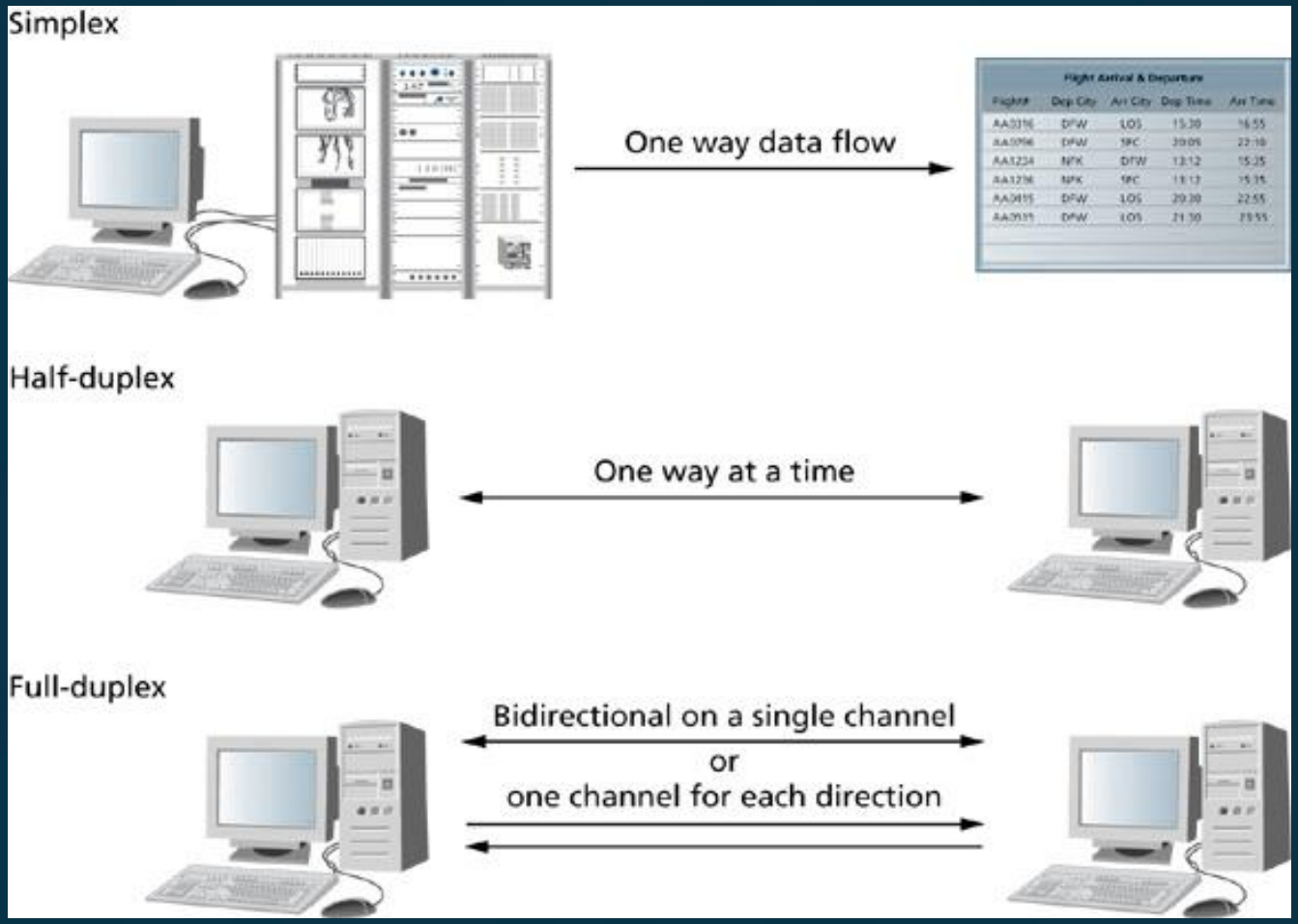
Asynchronous Transmission



Synchronous Transmission



Simplex, Half-Duplex, and Full-Duplex Transmission



DATA COMMUNICATIONS STANDARDS

- A standard is an accepted model or pattern.
- Standards are used extensively in data communications and networks.
- Standards provide a basic level of compatibility and interoperability among devices.
- Morse code and the Bell telephone are historical examples of standards.

DATA COMMUNICATIONS STANDARDS (cont'd)

- Many standards organizations develop and publish data communications standards.

ANSI – represents member companies in the pursuit of national standards.

IEEE – fosters the development and publication of electrical, computer, and control standards.

DATA COMMUNICATIONS STANDARDS (cont'd)

ITU – assists in the standardization of numerous data communications standards.

ISO – develops and publishes standards for data communications technologies as well as standards for non-technical products and services.

DATA COMMUNICATIONS MODELS

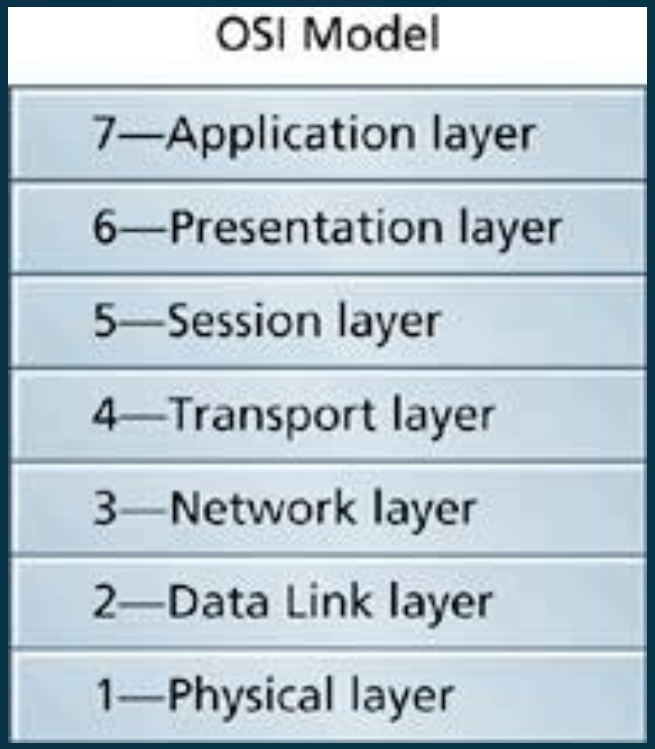
- Layered architectures and protocols provide the framework for two important data communications models.
- These models are the OSI model and the TCP/IP model.
- These models provide frameworks by which vendors can develop products that have compatibility and interoperability.

DATA COMMUNICATIONS MODELS (cont'd)

OSI Model – dates back to the late 1970s.

- It uses a 7-layer framework to define communications functions that assure compatible communications among devices or systems.
- Its layered architecture provides modularity to systems developers.
- Each layer provides a set of rules or protocols.

The OSI Reference Model



LAYERS OF THE OSI MODEL

Physical Layer

- It's also known as layer 1 of the OSI model.
- Defines the protocols that govern the physical connection and transmission of bits between devices.
- Defines the signaling method such as digital or analog.
- Specifies transmission characteristics such as asynchronous, synchronous, simplex, half-duplex, or full-duplex.
- Defines the data rate such as 10 Mbps, 100 Mbps, 1000 Mbps, etc.

LAYERS OF THE OSI MODEL (cont'd)

Data Link Layer

- Prepares data for the physical layer and provides services to the network layer that's above it.
- Organizes data bits into frames.
- Defines node addresses.
- Also defines how data bits access the transmission medium.
- Includes error detection and correction protocols.

LAYERS OF THE OSI MODEL (cont'd)

Network Layer

- Defines logical network and node addressing.
- Specifies creation of packets and sequencing of the packets.
- Prepares data for the data link layer and provides support services for the transport layer.
- Provides route discovery and determination of best route between separate networks.

LAYERS OF THE OSI MODEL (cont'd)

Transport Layer

- Receives messages from upper layers and segments those messages into smaller chunks.
- Provides connection-oriented data services.
- Provides end-to-end flow control.
- Identifies service addresses, or port numbers.

LAYERS OF THE OSI MODEL (cont'd)

Session Layer

- Is responsible for establishing, maintaining, synchronizing, and terminating communications between two devices.

LAYERS OF THE OSI MODEL (cont'd)

Presentation Layer

- Provides data transformation services, such as encoding – ASCII, EBCDIC, or Unicode.
- Can provide end-to-end encryption services within data transmissions.

LAYERS OF THE OSI MODEL (cont'd)

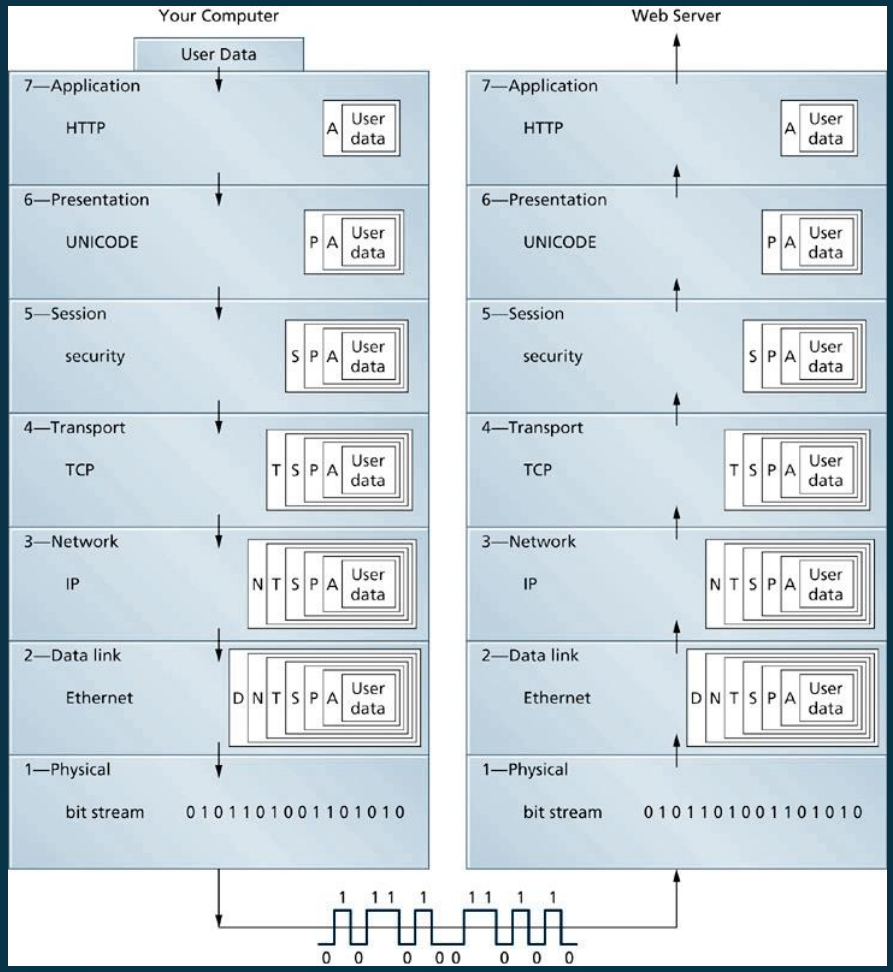
Application Layer

- Provides services such as file, print, and email services that support user applications.
- Remote access services exist in this layer.
- Collaborative computing services and service advertising mechanisms exist here.

DATA ENCAPSULATION IN A LAYERED ARCHITECTURE

- Data encapsulation is a process that adds an additional set of protocol information known as a header to a set of data bits for each layer in a layered architecture.
- Protocols at each layer provide a framework that describes how data communications should take place between similar processes, services, or functions running on two or more devices that are exchanging data.
- Protocols that function according to the rules that describe each layer facilitate the exchange of data between communicating devices.

Layered Approach to Data Encapsulation



THE TCP/IP MODEL

- Dates back to the early 1970s.
- Uses a layered architecture for defining communications functions between devices.
- It’s not a formal standard.
- Can be represented as either a 4-layer or 5-layer model.

The TCP/IP Model and the OSI Reference Model Compared

OSI Model	TCP/IP Model
7—Application layer	4—Process/Application layer
6—Presentation layer	
5—Session layer	
4—Transport layer	3—Host-to-Host layer
3—Network layer	2—Internet layer
2—Data Link layer	1—Network Access layer
1—Physical layer	