



IT203N

Data Communication and Networking



Overview of Data Communication and Networking

Week 1



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Introduction

- **Telecommunications** – “Refers to the electronic transmission of any type of electronic information ... encompasses telephone communications, the transmission of television signals, data communication of all forms, electronic mail, facsimile transmission, and so on.”
- **Data Communication** is the movement of encoded information from one point to another by means of electrical or optical transmission systems. Such systems often are called data communication networks.



Benefit of Data Communication and Networking

- Collect data from remote points and transmit that data to a central point, vice versa.
- Facilitate more efficient use of central computers.
- Improve day-to-day control of business by providing faster information flow.
- Provide message switching services to allow terminals to talk to one another.
- Offer better and timely interchange of data among users.
- Bring power of computers closer to users.



Uses of Data Communication

- Source data entry and collection
- Real-time interactive network
- Remote Job entry (RJE) data collection
- Information Retrieval
- Conversational timesharing
- Message switching
- Real-time data acquisition and process control.
- Interprocessor data exchange

Uses of Data Communication

Data Communication Usage Modes	Example of Applications	Typical Characteristics of Transactions
Source data entry and collection	Sales status data Inventory control Payroll data gathering	Transaction collected several times per day or week; direct response message not issued for every transaction.
Real-time interactive network	Point-of-sales system Airline reservations Electronic data interchange	Transactions arrive frequently (every few seconds) and demand response within a few seconds.
Remote Job Entry (RJE) data collection	Remote high speed reading and printing Local access to distant computer power	Transactions usually batched and required processing times ranging from minutes to hours. Input and output for each transaction may take seconds or minutes.

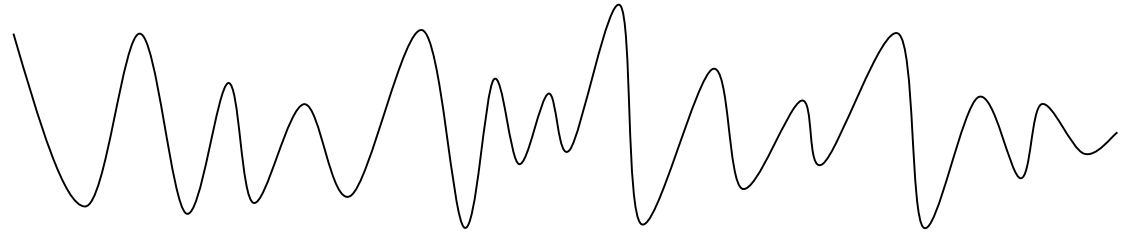
Uses of Data Communication

Data Communication Usage Modes	Example of Applications	Typical Characteristics of Transactions
Information retrieval	Credit checking Bank account status Insurance policy status Law enforcement Government social services Hospital information systems	Relatively low character volume per input transaction, response required within seconds. Output message lengths usually short but might vary widely with some types of applications.
Conversational timesharing	General problem solving Engineering design calculations Text editing	Conversational response required within a few seconds.
Message switching	Company mail delivery and memo distribution	Delivery time requirements range from minutes to hours.

Uses of Data Communication

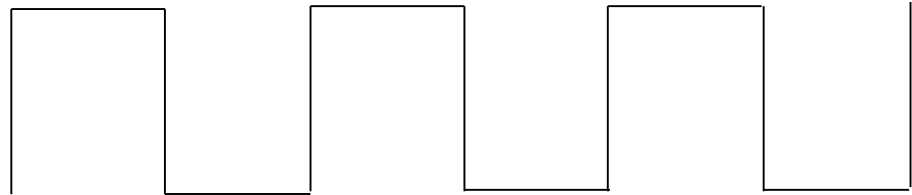
Data Communication Usage Modes	Example of Applications	Typical Characteristics of Transactions
Real-time data acquisition and process control	Numerical control of machine tools Remote meter and gauge reading	Remote sensors continuously sampled and monitored at widely varying time intervals.
Interprocessor data exchange	Processor, program, and file-sharing applications of all types	Infrequent burst arrivals consisting of large data blocks requiring transmission to another CPU, usually within micro-seconds.

Signals



■ Analog

- Varies continuously within a range of values. Examples are telephone, radio and television signals.
- Usually represented as amplitude, phase or frequency.



■ Digital

- Data with sequence of voltage pulses.
- Normally it involves two discrete voltage for binary 0s and 1s.

Character Codes

- A character is a symbol that has a common, constant meaning.
- It might be the letter A or B, a number such as 1 or 2, or special symbols such as ? or &.
- Characters are represented by groups of bits that are **binary zeros** (0) and **ones** (1).
- These groups of bits are called a **coding scheme** (or code).
- A byte is a group of consecutive bits that are treated as a unit or character.
- Could be 5, 6, 6, 7, 8 or 9 bits depending on the codes and error checking used. (Some groups use this to represent a character).



Types of Character Codes

- ASCII (American Standard Code for Information Interchange)
- EBCDIC (Extended Binary Coded Decimal Interchange Code)
- BCD (Binary Coded Decimal) and Baudot Code

ASCII

- Developed by the American National Standard Institute (ANSI).
- Usually 7 bit code (128 characters) and one parity (for error checking on individual character).
- 8-bit version also exist (256 characters i.e. extended ASCII) for graphics and foreign languages applications.
- Widely used in data communication and processing.

ASCII

Decimal Value	Binary Value	Hexadecimal Value	ASCII Character	ASCII Meaning
0	0000 0000	0	NUL	Null
1	0000 0001	1	SOH	Start of Heading
2	0000 0010	2	STX	Start of text
3	0000 0011	3	ETX	End of Text
4	0000 0100	4	EOT	End of transmission
5	0000 0101	5	ENQ	Enquiry
6	0000 0110	6	ACK	Acknowledge
7	0000 0111	7	BEL	Bell
8	0000 1000	8	BS	Backspace
9	0000 1001	9	HT	Horizontal tab
10	0000 1010	A	LF	Line Feed
11	0000 1011	B	VT	Vertical tab
12	0000 1100	C	FF	Form Feed
13	0000 1101	D	CR	Carriage return
14	0000 1110	E	SO	Shift out
15	0000 1111	F	SI	Shift in
16	0001 0000	10	DLE	Data link escape

EBCDIC

- Developed by IBM for data processing (1 start, 8 data, 1 parity, 1 stop in asynch 11 bits sync 9 bits).
- 8 bits code i.e. 256 characters (alphabet, numerals, and special characters) possible.
- If parity is implemented, a ninth bit will be used.

EBCDIC

Special characters	EBCDIC
<	01001011
(01001100
+	01001101
/	01001110
&	01010000
:	01111011
#	01111011
@	01111100
'	01111101
=	01111110
"	01111111
,	01101011
%	01101100
-	01101101
>	01101110

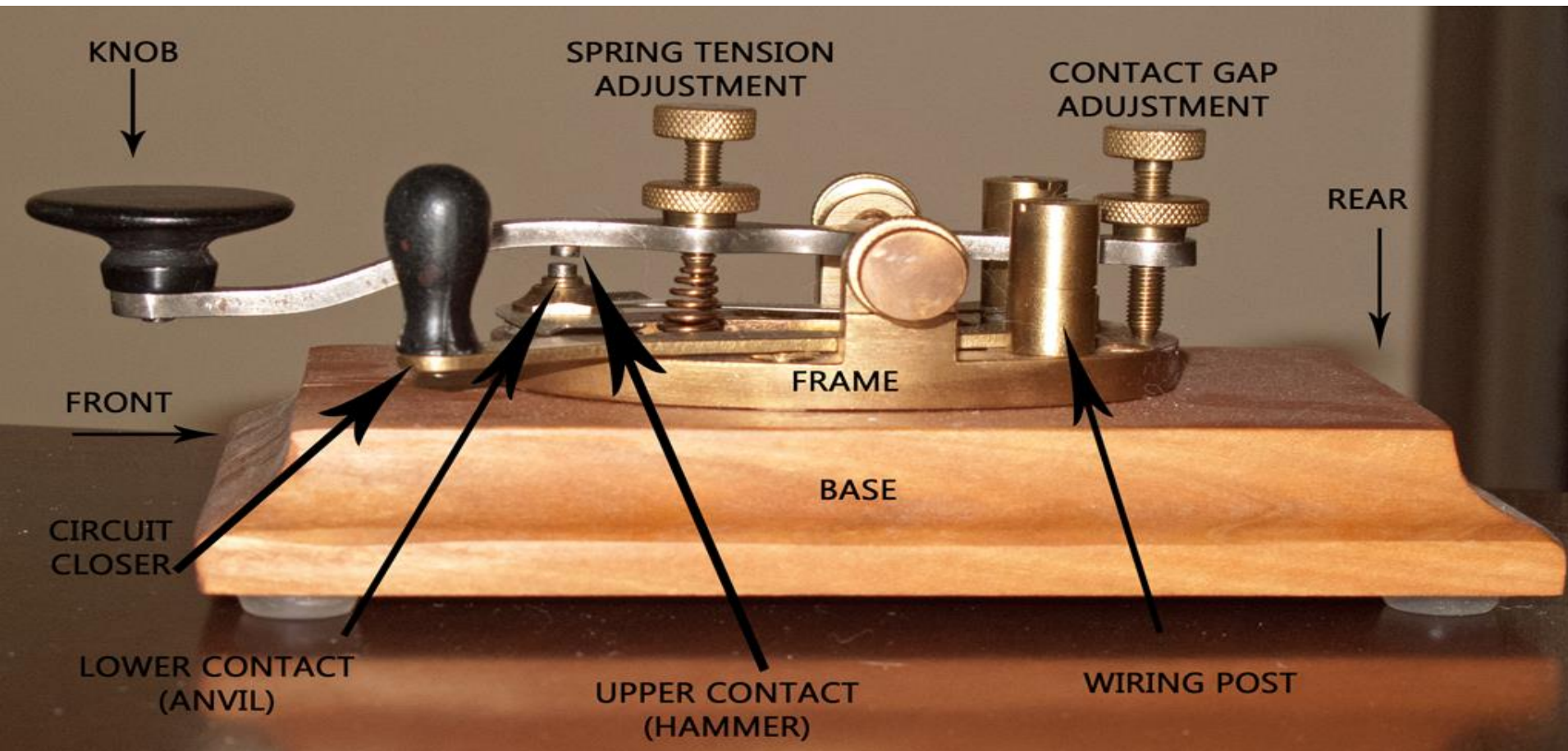
Contd..

Alphabetic	EBCDIC
A	11000001
B	11000010
C	11000011
D	11000100
E	11000101
F	11000110
G	11000111
H	11001000
I	11001001
J	11010001
K	11010010
L	11010011
M	11010100
N	11010101
O	11010110
P	11010111

Baudot Code

- 5 bit code derived from telegraphy.
- Used in International Telex network (called Telex code, telegraph code). Speed is 150 bits per second or less.
- Uses “shift” character to increase character set to 58 character combinations.
- Different collating sequences for letters and numbers e.g. 1 is higher than 9; A is higher than Z.

Baudot Code



Baudot Code

LETTERS FIGURES		A	B	C	D <small>WHO ARE YOU</small>	E	F	G	H	I	J <small>BELL</small>	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	CARRIAGE RETUN	LINE FEED	LETTERS	FIGURES	SPACE	ALL-SPACE NOT IN USE
CODE ELEMENTS	1	●	●		●	●	●				●	●						●	●	●		●		●	●	●	●			●	●		
	2	● ○		● ○				● ○		● ○	● ○	● ○	● ○				● ○	● ○	● ○		● ○		● ○	● ○	● ○		● ○			● ○	● ○	● ○	
	3		○	● ○	○	○	● ○		○	● ○		● ○	○	○	○	○	○	● ○	● ○	○	○	○	● ○	● ○	○	○	○	○	○		○	○	○
	4		●	●	●		●	●			●	●		●	●	●				●			●	●	●	●		●		●	●		
	5		●						●	●				●	●	●	●	●			●			●	●	●	●	●				●	●

● INDICATES A MARK ELEMENT (A HOLE PUNCHED IN THE TAPE)

○ INDICATES POSITION OF A SPROCKET HOLE IN THE TAPE

The International Telegraph Alphabet

Modulation

- Modulation is the technique of modifying the form of an electrical signal so that the signal can carry **intelligent information** on a communication medium.
- Modem (**m**odulator-**d**emodulator)
- One of the basic components of a network.
- It takes the binary electrical pulses received from the microcomputer or terminal and convert or modulates the signal so it can be transmitted.
- Perform either analog modulation or digital modulation.



Data Communication Hardware

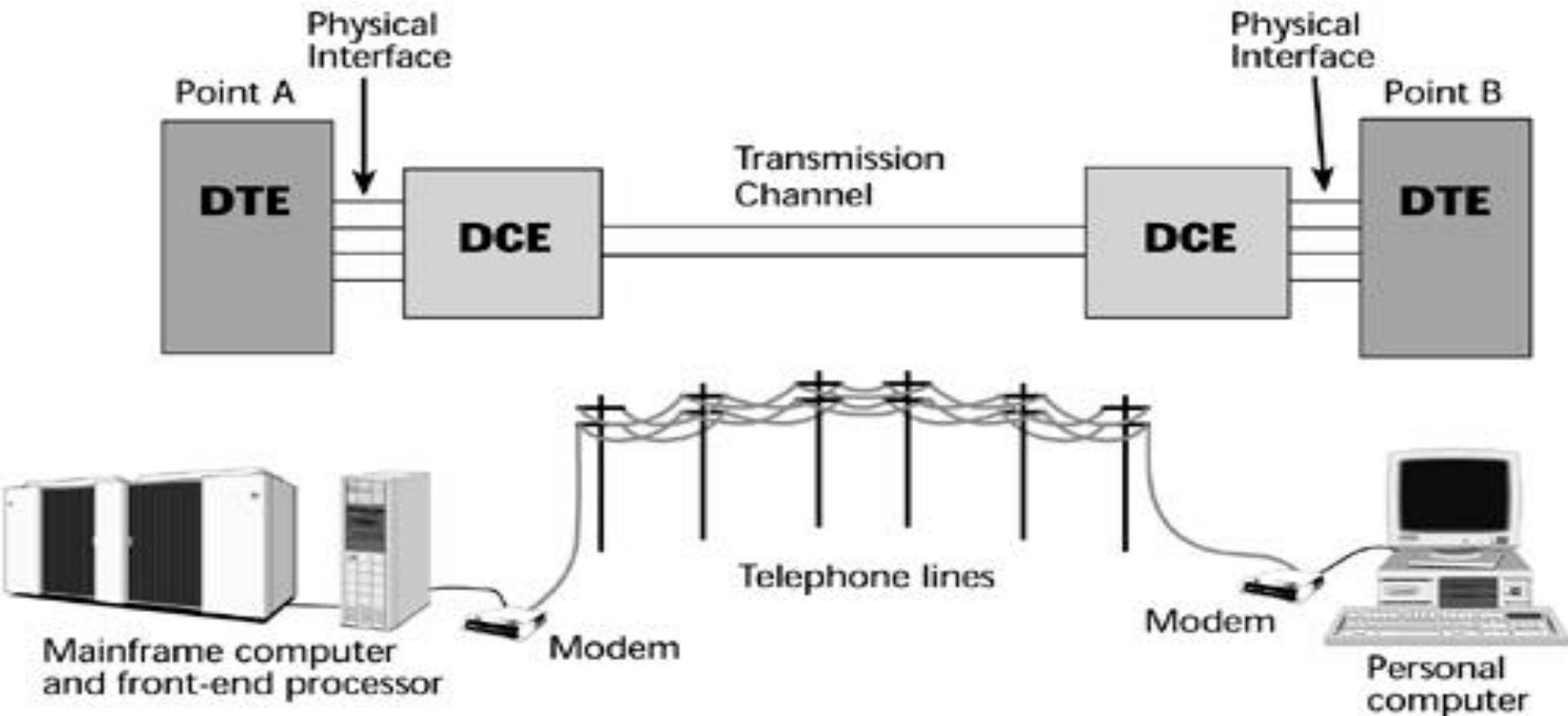
- Basic hardware needed for a functioning network includes the host computer, the front end processor, modems, and terminal.
- Other hardware that makes a network run faster, more efficiently and more secure include multiplexers, controllers, protocol converters, encryption devices and line adapters.



Data Communication Hardware

- **DCE:** Data Communication Equipment. It is used to connect computer terminals through the medium. Example: Modems, transponders etc.
- **DTE:** Data Terminal Equipment. Terminal for inter-connection of computer equipment. Eg; terminals, concentrators etc.

Data Communication Hardware





Networks and Communication

- A computer network is an interconnected collection of autonomous computers.
- In a distributed or parallel computer system (as discussed in the previous section), the existence of multiple computers is transparent to the user (but not the programmer).
- In a computer network, the existence of other computers is explicit.



Components of a Network

- Server or host (mainframe)
- Client (terminal)
- Circuit (cable, modem)



Server or Host

- Stores data or software that can be accessed by the clients.
- Several servers may work together to support the business applications.



Client

- Input-output hardware device at the user's end of a communication circuit.
- Provides users with access to the network and the data and software on the server.



Circuit

- Pathway through which the messages travel.
- Typically a copper wire, fiber optic cable and wireless transmission.



Network and Communication

- Three scales of network are often identified:
 - **LAN** : Local area network cover rooms and buildings.
 - **MAN** : Metropolitan area network cover cities.
 - **WAN** : Wide area network cover countries, continents and the world.



Summary

- Types of Character codes – ASCII, EBCDIC, BCD
- The functions of DTE and DCE
- Components of a network – server, client and circuit

Tutorial 【50%】 ~ (1)

1. Define the terms below: 【4%】
 - a. Telecommunication
 - b. Data Communication
 - c. Modulation
 - d. Modem
2. Identify and describe **THREE (3)** types of character codes. 【9%】

Tutorial 【50%】 ~ (2)

3. State the full term of LAN, MAN and WAN as well as explain them. 【6%】
4. Interpret any **THREE (3)** uses of data communication with example. 【9%】
5. List and explain **TWO (2)** types of data communication hardware. 【4%】

Tutorial 【50%】 ~ (3)

6. Determine **THREE (3)** benefits of data communication networks. 【3%】
7. Analyse the differences between analogue signal and digital signal. 【6%】
8. Elaborate **THREE (3)** components of a network with instance. 【9%】