National Institute of Technology Karnataka Surathkal
Department of Information Technology

IT 200 **Computer Communication and Networking**

Introduction

Dr. Geetha V

Assistant Professor

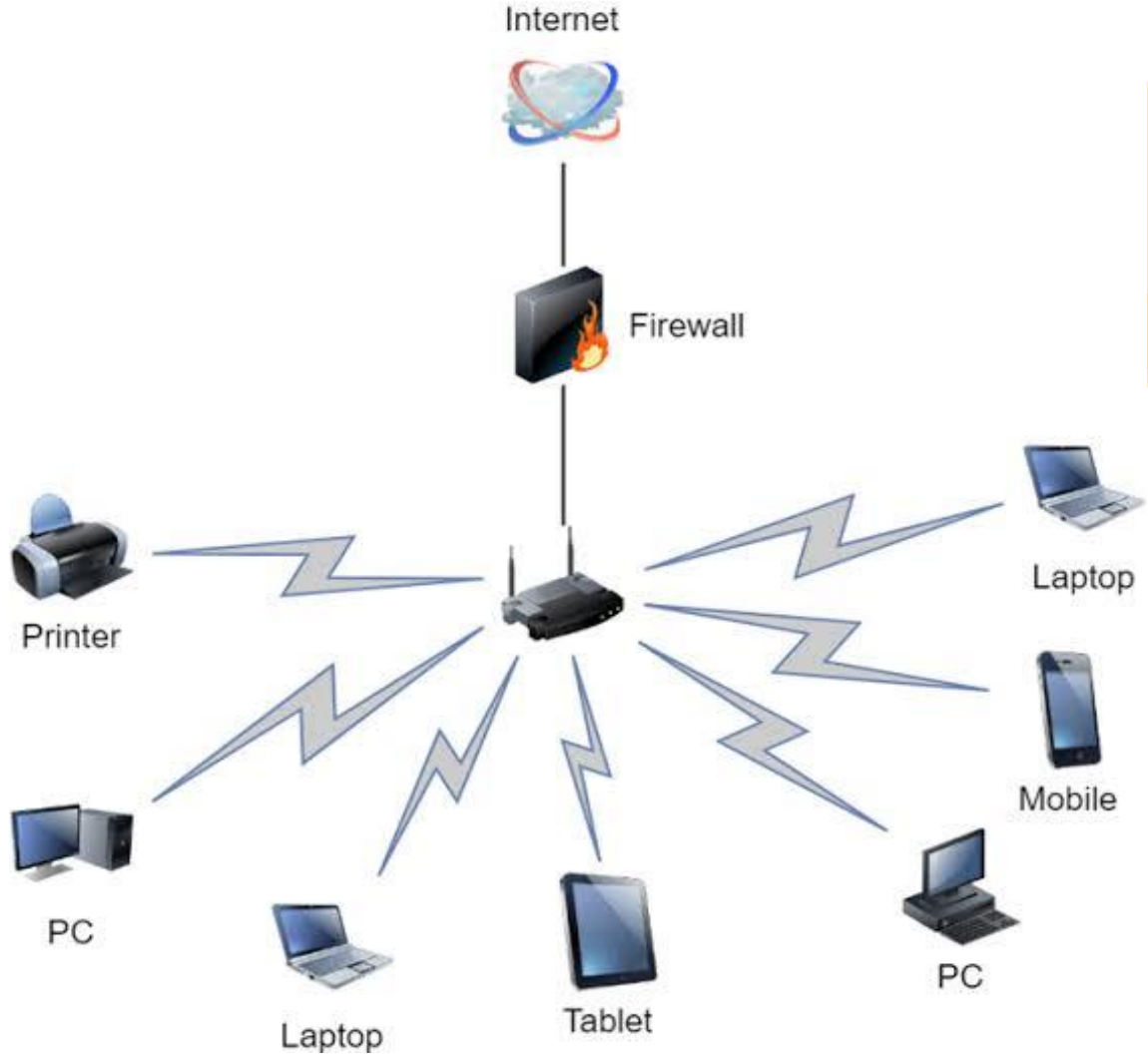
Dept of Information Technology

NITK Surathkal

Index

1. Introduction : Data Communication and Network

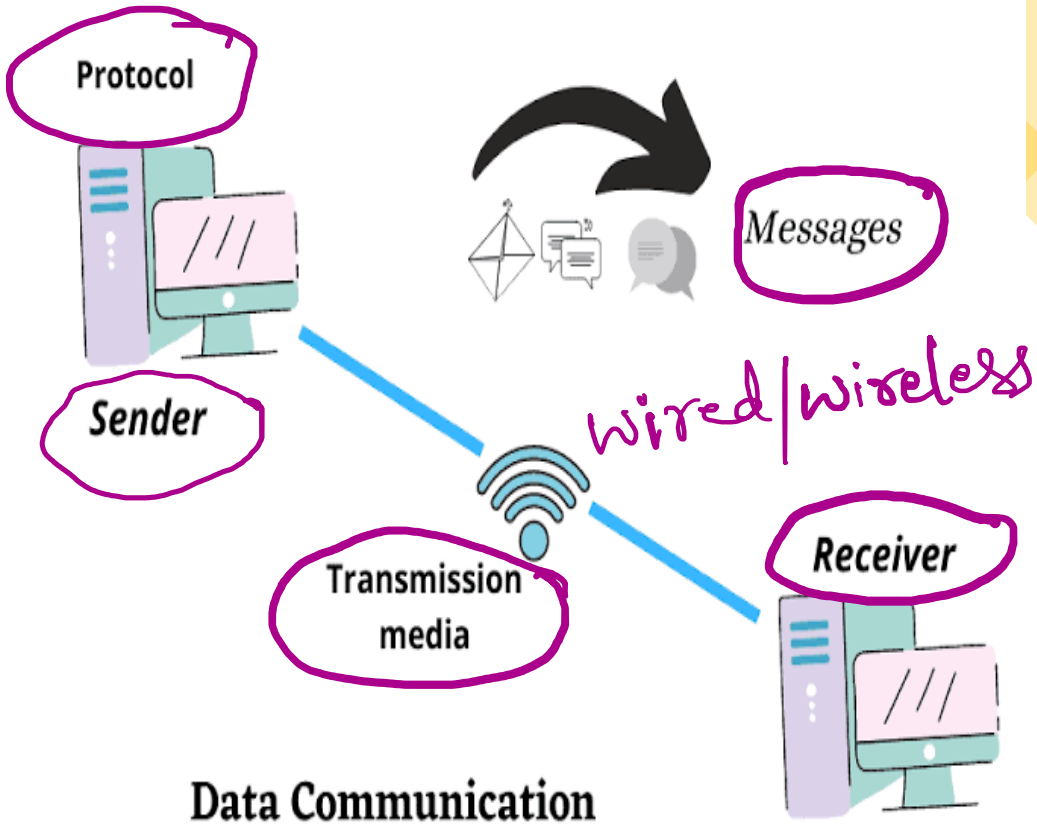
- Data can be any text, image, audio, video, and multimedia files.
- Communication is an act of sending or receiving data.
- Data communication refers to the exchange of data between two or more networked or connected devices. These devices must be capable of sending and receiving data over a communication medium.



1. Introduction : Data Communication and Network

Components of Data Communication

- Sender: device
- Receiver: Device
- Messages: text, audio, video, images etc
- Transmission Media: It is also called medium or link which is either wired or wireless. For example, a television cable, telephone cable, ethernet cable, satellite link, microwaves, etc.
- Protocol:: It is a set of rules that need to be followed by the communicating parties in order to have successful and reliable data communication. http, FTP



Data Communication

2. History of Data Communication

1940

SMALL STEP FOR MAN, GREAT LEAP FOR COMMUNICATIONS

With morse code, the telephone, and radio signals behind him, George Stibitz (pictured) took networking technology a great leap forward when he sent computing commands over a teletype machine from his model at Dartmouth College to his Complex Number Calculator in New York.

A •–	J •–––	S •••
B –•••	K –•–	T –
C –•–•	L •–••	U ••–
D –••	M ––	V •••–
E •	N –•	W •––
F ••–•	O –––	X –••–
G ––•	P •––•	Y –•––
H ••••	Q ––•–	Z ––••
I ••	R •–•	

Morse Code

HAPPY

•••• •– •––• •––•

–•––

2. History of Data Communication

Punched Cards

25 bits | second

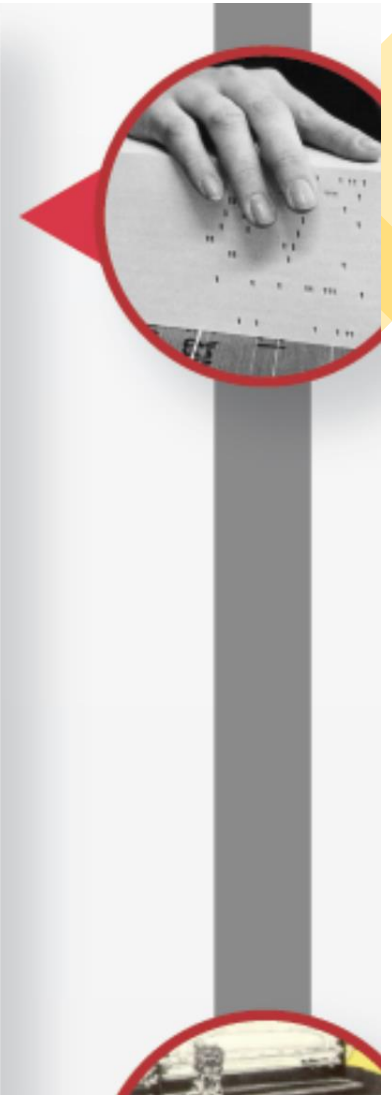
1943

TELETYPE COMPUTATION

Stibitz's successful telegraph prompted a new method of computation, which was quickly used for loop-based teleprinters and automated telegraphs. An IBM adaptation of this technology was able to transmit punched cards at a whopping 25 bits per second (bps).

SPEED CHECK

At 25bps, it would take approximately 15 ½ days to download the average 4MB song on iTunes.



2. History of Data Communication

1948

TELETYPE MODEMS TO SAGE

Telephone systems using early teletype communication modems were used to transmit multiple images across the United States to Semi-automatic Ground Environment (SAGE) computers. This increased the amount of data being transferred but also resulted in slower speeds at the receiving end.

Slower speed at Receiver why?

2. History of Data Communication

AT&T Modems

-110 bits/second

1958

AMERICAN TELEPHONE & TELEGRAPH BRINGS THE DIGITAL SUBSET

Speed was boosted by over 4 times, sending a new record of 110 bits per second through American Telephone and Telegraph (AT&T) computer modems, called Digital Subsets. These Digital Subsets linked SAGE computers across the United States and Canada.

SPEED CHECK

At 110bps, it would take approximately 3 ½ days to download the average 4MB song on iTunes.

2. History of Data Communication

1962

AT&T RELEASES BELL 103 DATA PHONE

The first civilian commercial computer modem, the Bell 103 Data Phone, allowed digital data to be transmitted over regular unconditioned telephone lines. These modems were extremely expensive and were not typically used for personal communications.

SPEED CHECK

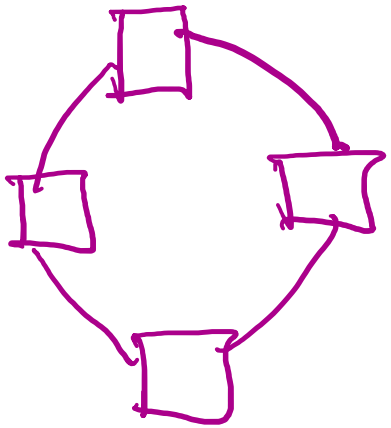
At 300bps, it would take approximately 1 day and 7 hours to download the average song on iTunes.

Digital data over telephone lines.

≈ 300 bits/second

2. History of Data Communication

Computer Network

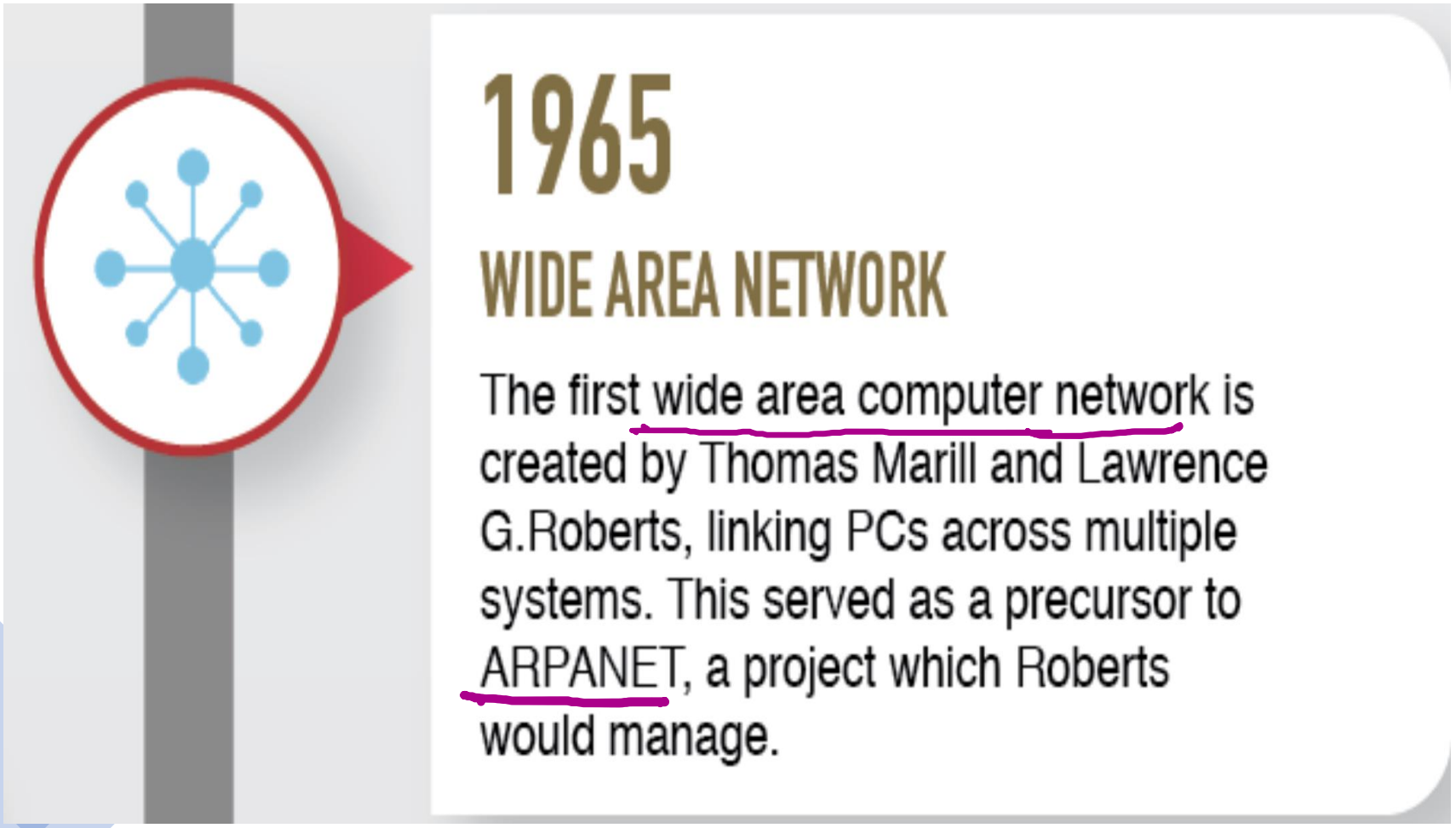


1962

INTERGALACTIC COMPUTER NETWORK

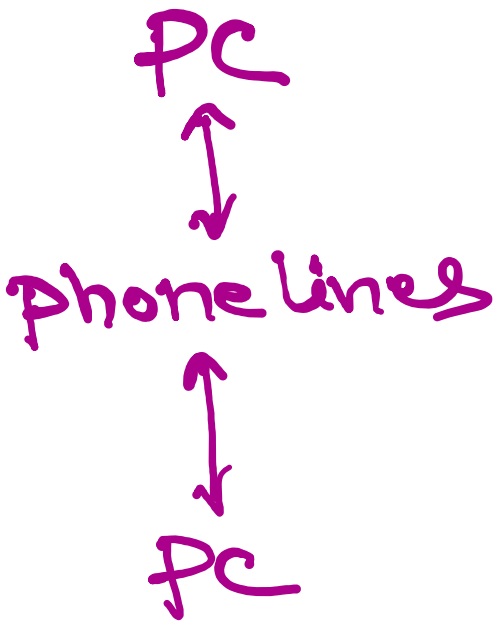
J.C.R. Licklider (pictured) leads the Advanced Research Projects Agency (ARPA) to create and link a network of computers across the world, effectively known as the Intergalactic Computer Network. This would allow data and programs to be shared by any of the connected computers.

2. History of Data Communication



WAN

2. History of Data Communication



1977

THE HAYES 80-130A

The first personal computer modem, the Hayes 80-130A, was designed by Dennis Hayes and Dale Heatherington. The device allowed computer users to connect directly to their phone lines to create a personal network, something never experienced before.

2. History of Data Communication

1981

THE HAYES SMARTMODEM

An improved iteration, the Hayes Smartmodem, is released. This device offered 300 bits per second speed in an affordable body. It also enabled users to perform new functions like initializing, hanging-up, and auto dialing. A 1200 bits per second version of the Hayes Smartmodem was released soon after.

SPEED CHECK

At 1200 bps, it would take approximately 7.76 hours to download the average song on iTunes.

Initially

300 bps

Cost effective

Later 1200 bps

2. History of Data Communication

IBM PC

PCI Modem

1200 bps to 28800 bps

MID 80s

MODEMS HIT THE FAST LANE

IBM PC clones dominated the PC market, leading to a new era of internal Industry Standard Architecture (ISA). Peripheral Component Interconnect (PCI) modem cards were designed for additional PC compatibility, extending WAN reach. This marked the era of Broadband Services.

Modems that enabled network communications came in a variety of shapes and sizes, and pushed bits per second way up, from 1200 to 4800, to 9600, 14400, 28800 and beyond.

SPEED CHECK

At 28800 bps, it would take approximately 19 minutes to download the average 4MB song

2. History of Data Communication

1989

THE WORLD WIDE WEB

Consumer demand for more visual imagery, a better web-browsing interface, and more online content prompted Sir Tim Berners-Lee (pictured) to create an Information Management proposal. This would eventually become the foundation for what we use today, the World Wide Web.

DID YOU KNOW?

Three of Timothy John Berners-Lee's fundamental technologies are still utilized today:
HyperText Markup Language (HTML)
Uniform Resource Identifier (URI)
Hypertext Transfer Protocol (HTTP)

www

2. History of Data Communication

MID 90s

LOWER COSTS AND FASTER SPEEDS

Home broadband entered the market in 1991, and people all over the world began accessing the Internet using Berners-Lee's World Wide Web. Prices for commercial PCI modems plunged and vendors began to ship out modems as standard components of PCs and laptops.

2. History of Data Communication

1996

THE 56K

Brent Townshend created the technology for the first 56K modem, a model which used a bitrate of 56.0/33.06 kilobytes per second, doubling the speed and power of previous modems. The 56K gained immediate popularity due to its price point. Local Area Networks (LANs) started becoming popular in commercial businesses.

SPEED CHECK

At 56,000 bps, it would take approximately 10 minutes to download the average 4MB song

56K modem

Local Area Network

2. History of Data Communication

Devices,

Technology,

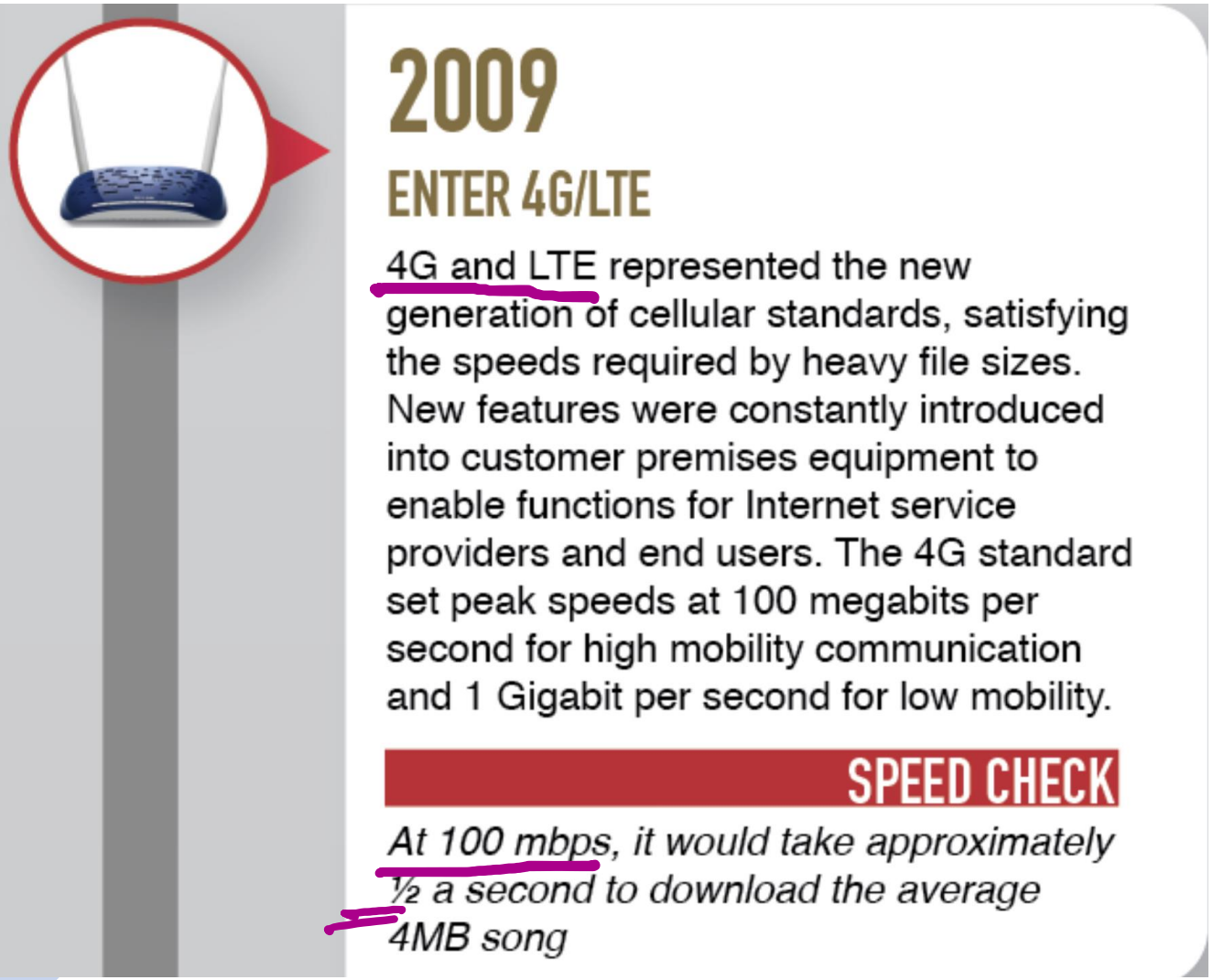
Cost effective.

MID 2000S

THE WIRELESS AGE MATURES

Broadband Internet services and wireless access networks quickly became mainstream technology due to the convenience and ease of access. Users no longer required two phone lines to connect to the Internet. File sizes for videos, video games, music, and pictures increased, and more vendors released hardware models that could connect wirelessly to user devices, like early iPhones and tablets.

2. History of Data Communication



2009

ENTER 4G/LTE

4G and LTE represented the new generation of cellular standards, satisfying the speeds required by heavy file sizes. New features were constantly introduced into customer premises equipment to enable functions for Internet service providers and end users. The 4G standard set peak speeds at 100 megabits per second for high mobility communication and 1 Gigabit per second for low mobility.

SPEED CHECK

At 100 mbps, it would take approximately ½ a second to download the average 4MB song

Cellular Standards

100 megabite/sec → high mobility

1 Gigabit → low mobility

2. History of Data Communication

2. History of Data Communication

Fiber optics

10 Gigabits/sec

2011–2014

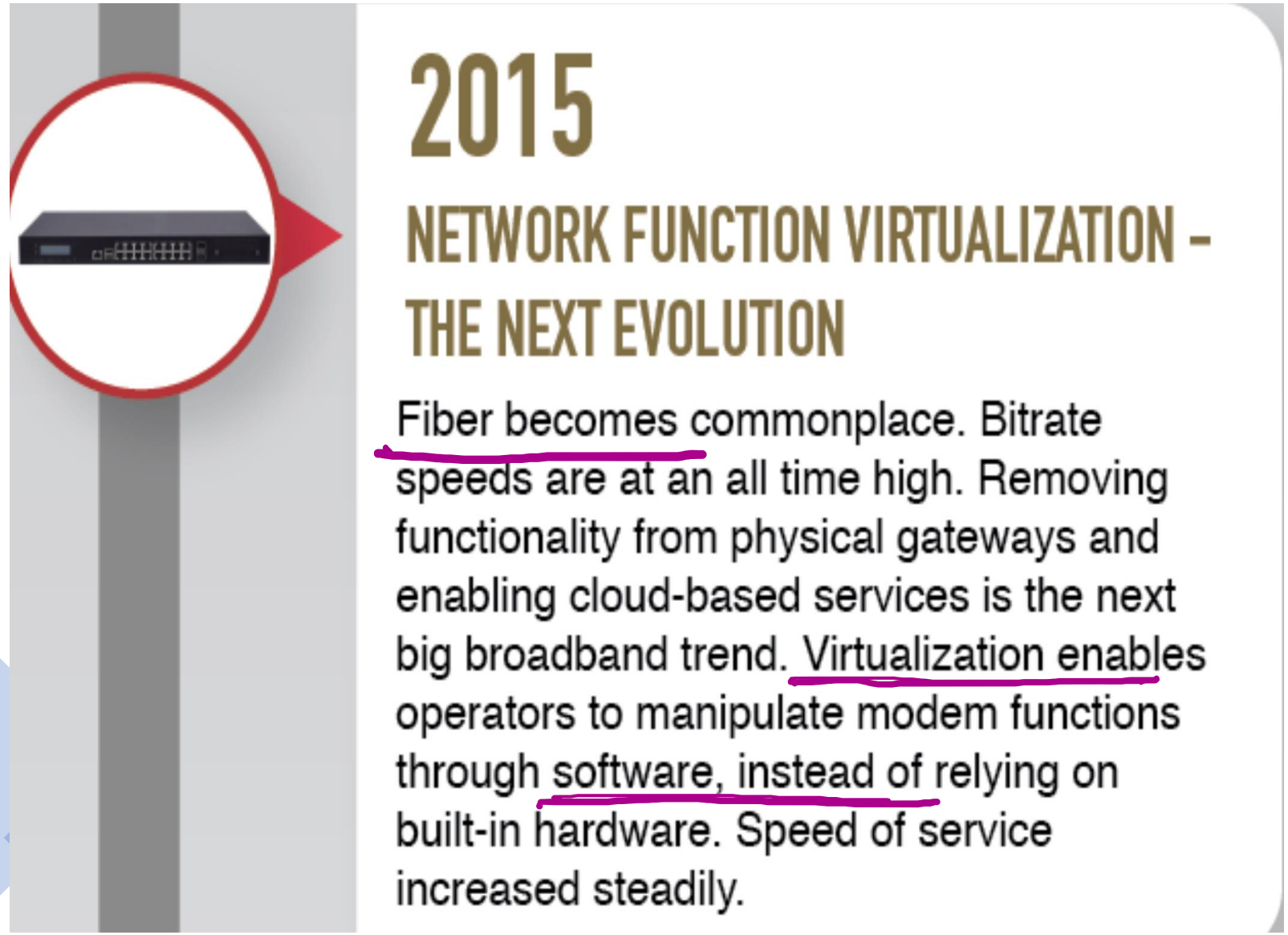
HOW FAST CAN WE GO?

4G is ubiquitous. Fiber optic communications gained popularity. Hardware manufacturers continued to develop new features within modems so that new services could be enjoyed by the end-user. 10 gigabits per second was tested while 1 gigabit lines were made available in the United Kingdom and United States.

SPEED CHECK

At 10gbps, it would take approximately the time it takes to blink your eyes and the song would be downloaded. The customer expectations have increased, changing this from a song to UHD HDR immersive 360 video.

2. History of Data Communication



2. History of Data Communication

Application Development

- Smart city
- IoT etc

2017 AND BEYOND

The fulcrum pivots from human triggered communications to AI triggered communications. Smart Cities and Smart Homes, the Internet of Everything (IoE), mobile communications, and evolving consumption habits increases spectrum utilization. Low frequency (sub 1Ghz) for IoT and millimeter wavelengths (60Ghz) for short distance. Ultra-low latency high bandwidth applications such as a smart car with collision avoidance or robotic medical procedures. The fifth generation (5G) opens new opportunities for humans and machines to communicate.

What will the future hold?
Only time will tell...

Thank You