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Data Communication CS601 Lecture No 32

Lecture Prepared By

Muhammad Abid Ali

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CS601 Lecture No 32 Topic 186 to 190

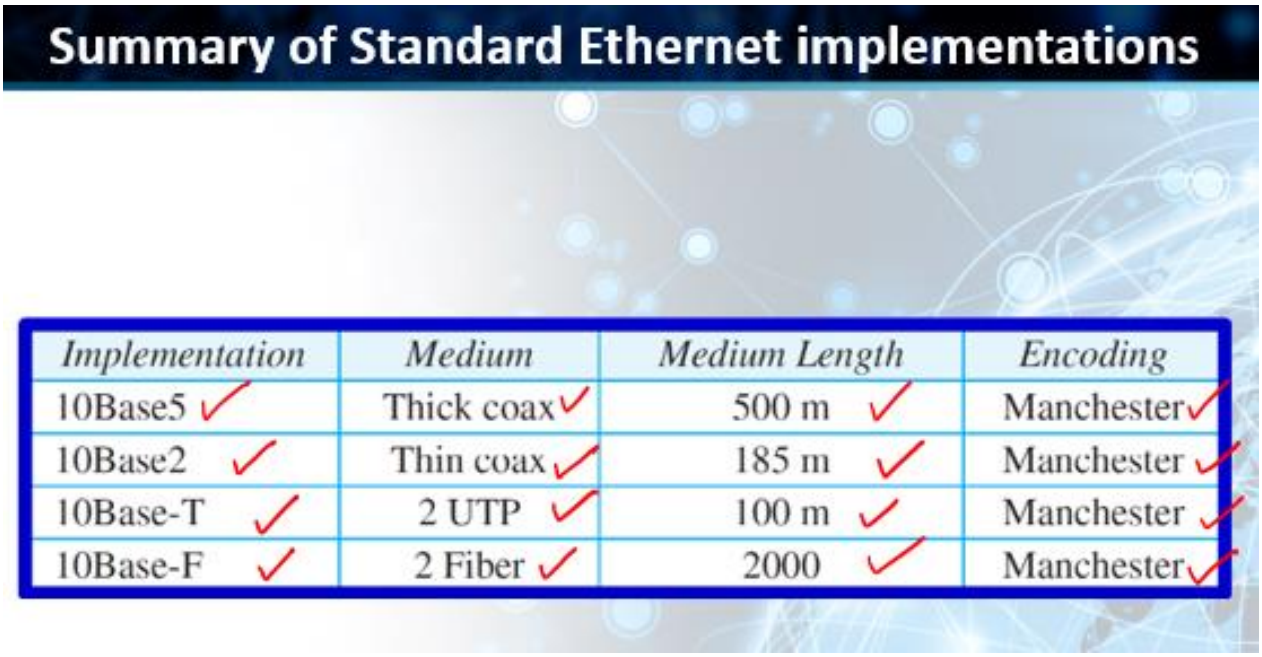
Implementation of Standard Ethernet

- **The Standard Ethernet defined several implementations, but only four of them became popular during the 1980s**

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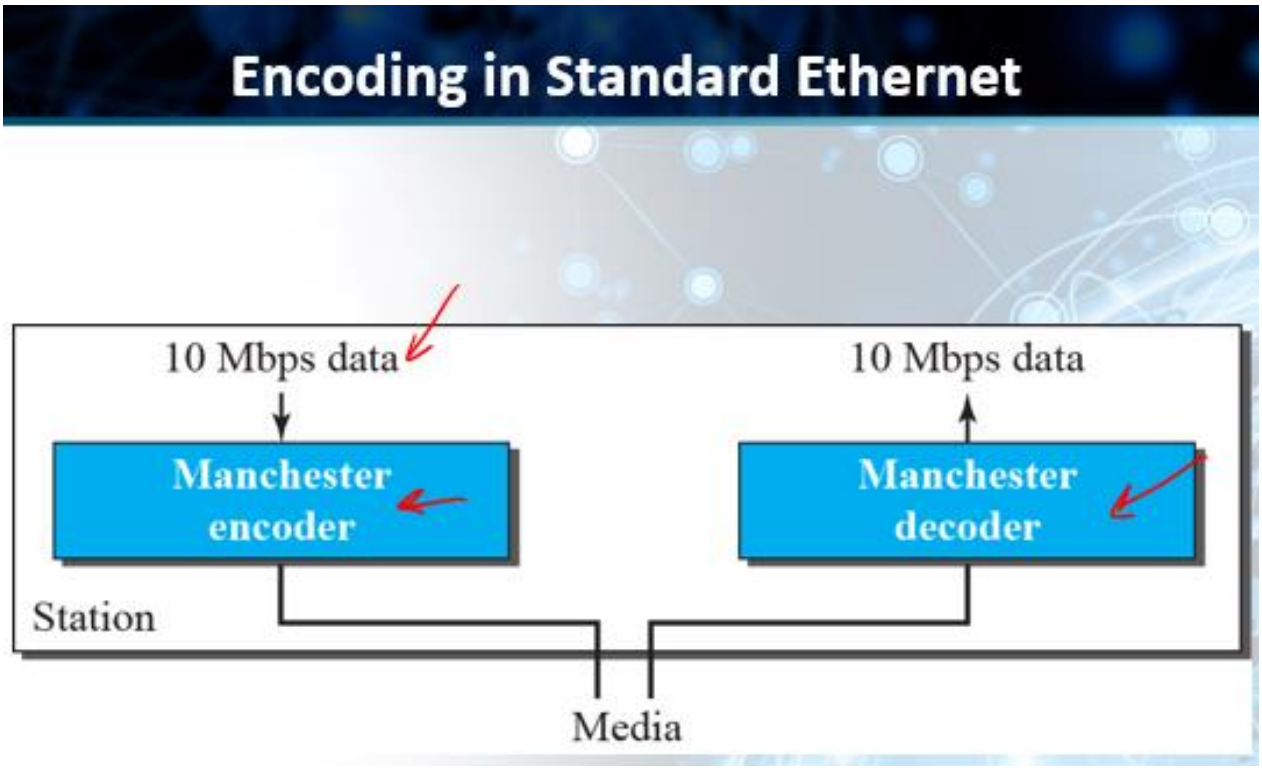


Encoding in Standard Ethernet

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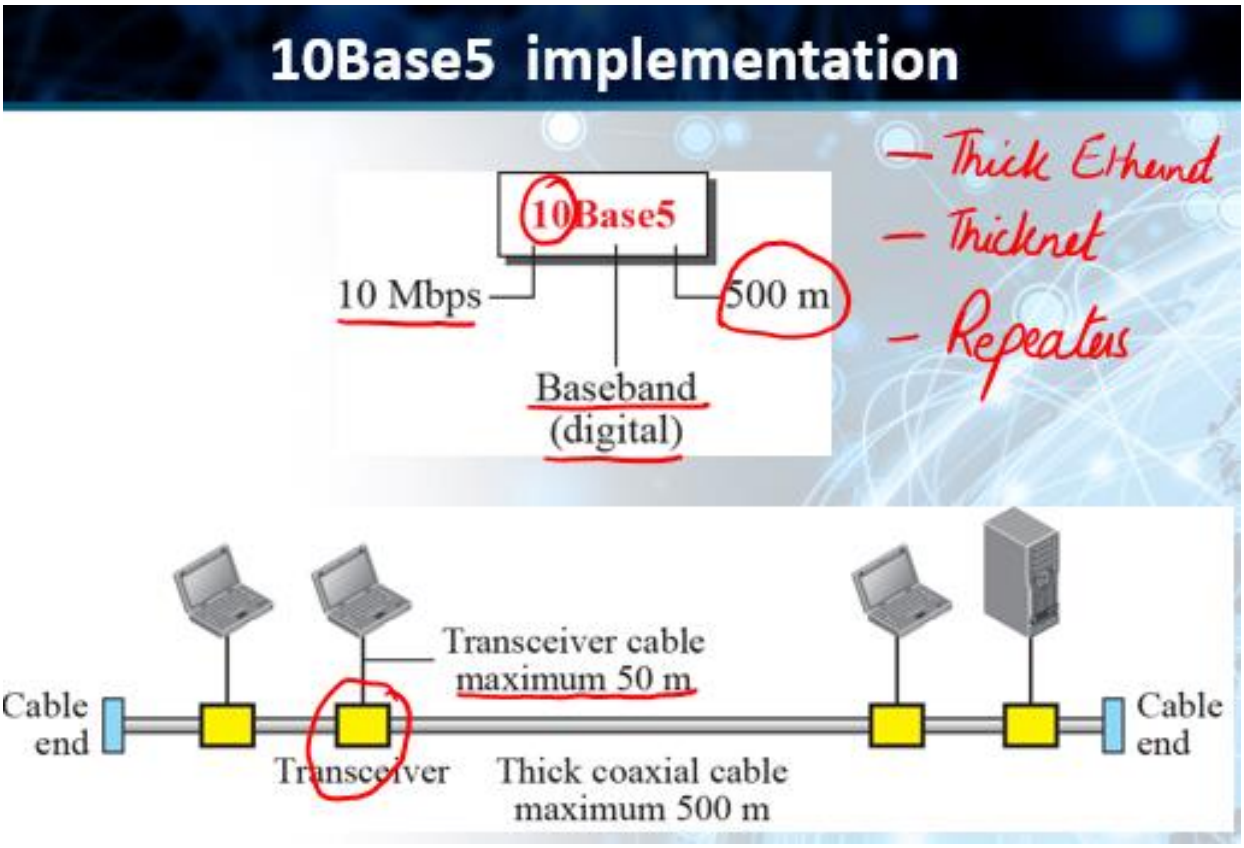
What is meant by Manchester encoding?

In data transmission, Manchester encoding is a form of digital encoding in which data bits are represented by transitions from one logical state to the other. This is different from the more common method of encoding, in which a bit is represented by either a high state such as +5 volts or a low state such as 0 volts.

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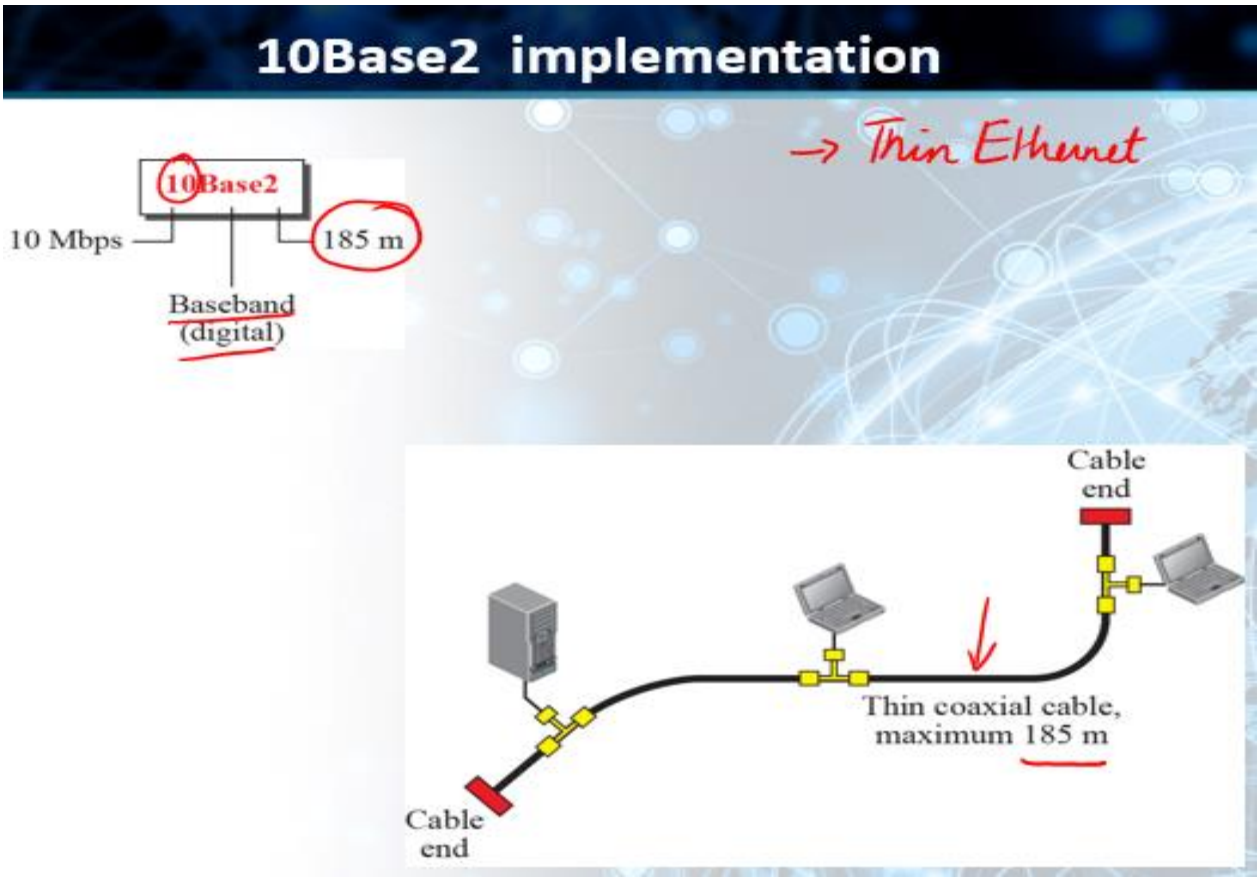
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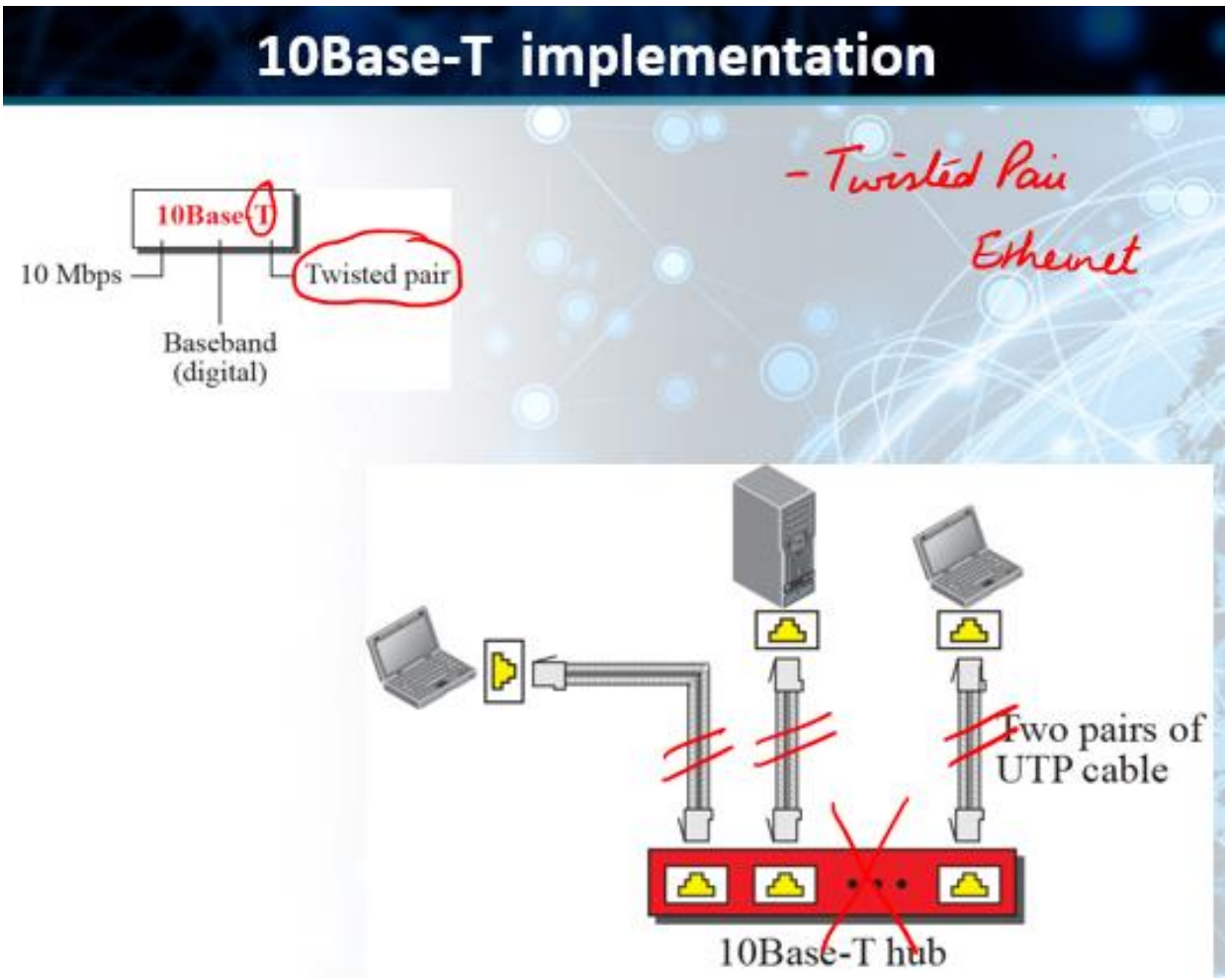
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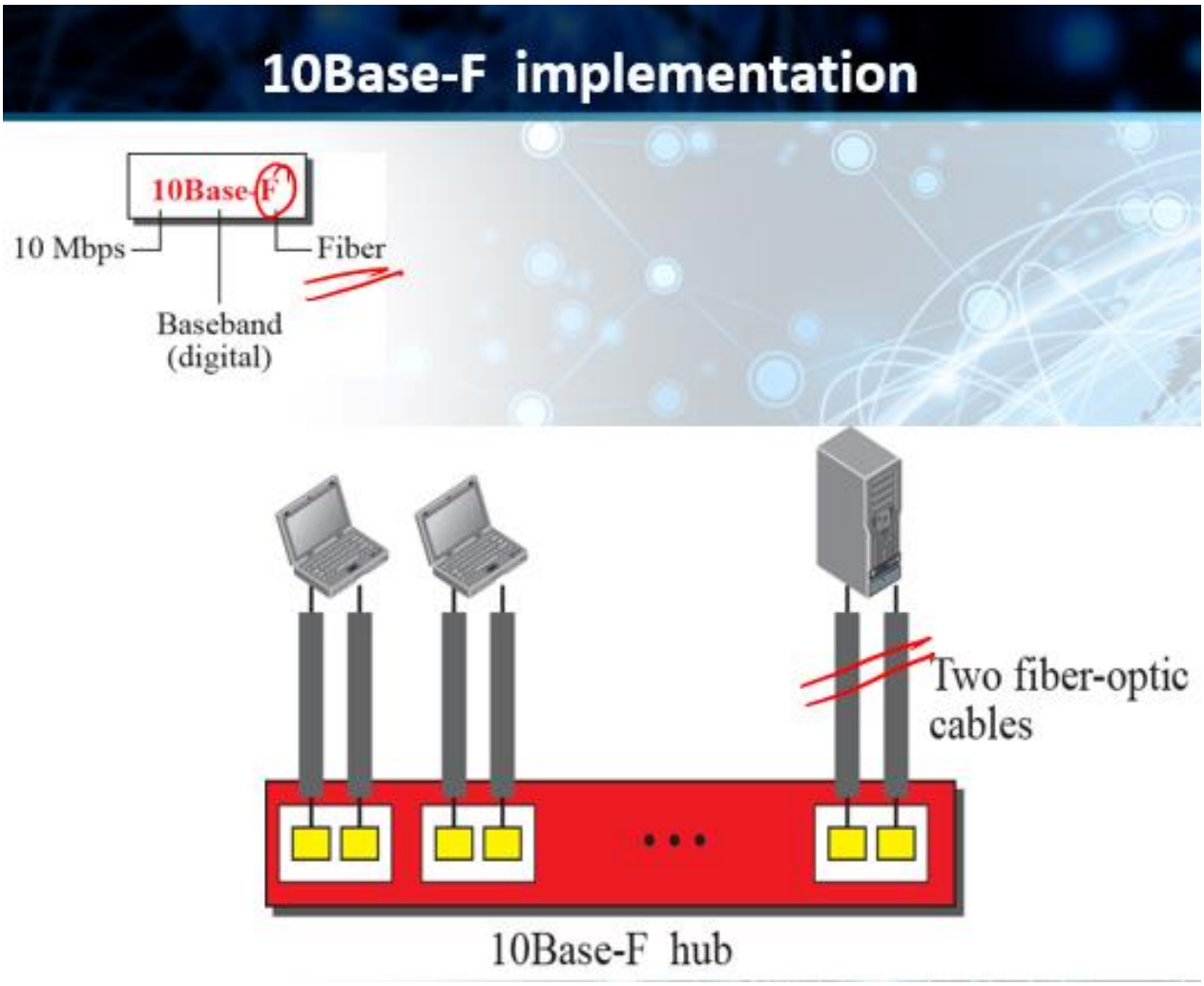
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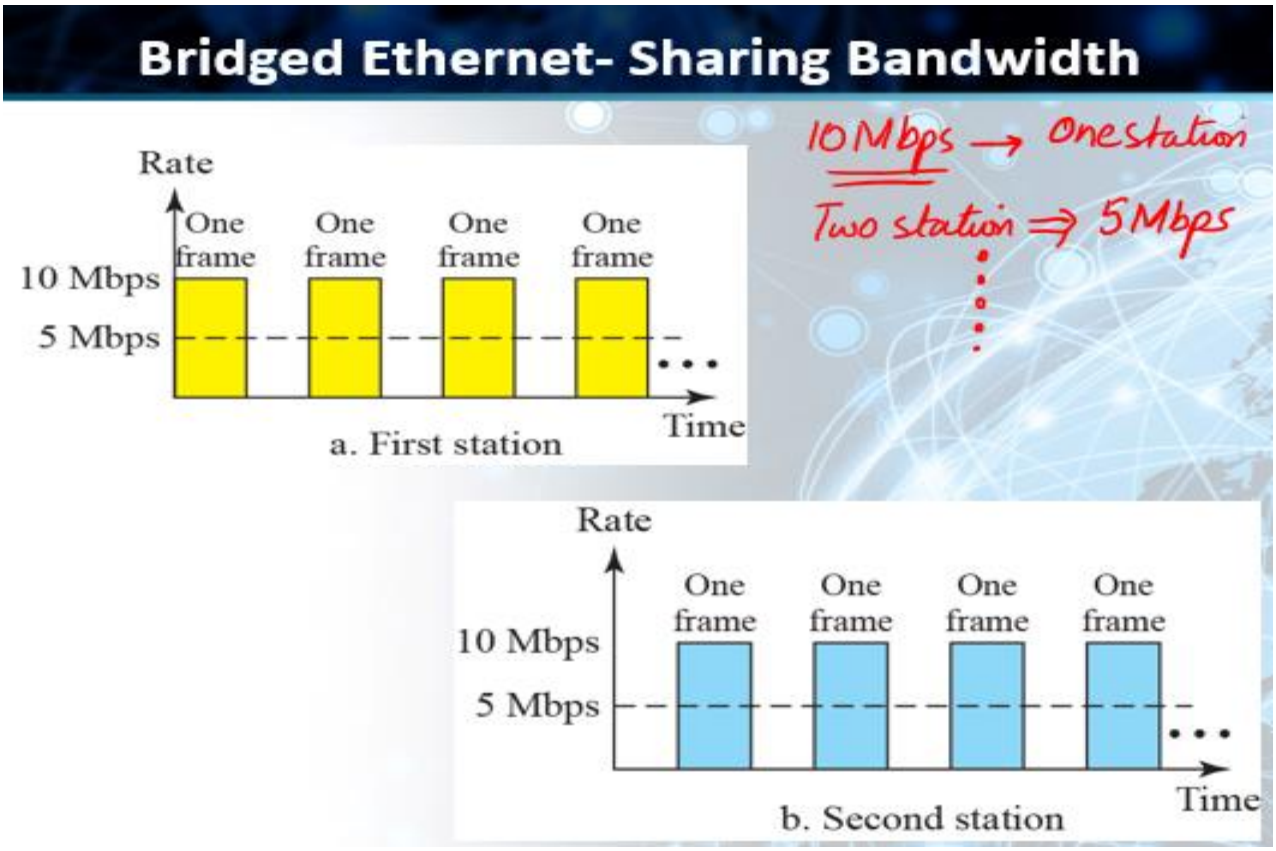
Changes in the Standard

- **The changes that occurred to the 10-Mbps Standard Ethernet opened the road to the evolution of the Ethernet to become compatible with other high-data-rate LANs**
  - ✓ **Bridged Ethernet**
  - ✓ **Switched Ethernet**
  - ✓ **Full-Duplex Ethernet**

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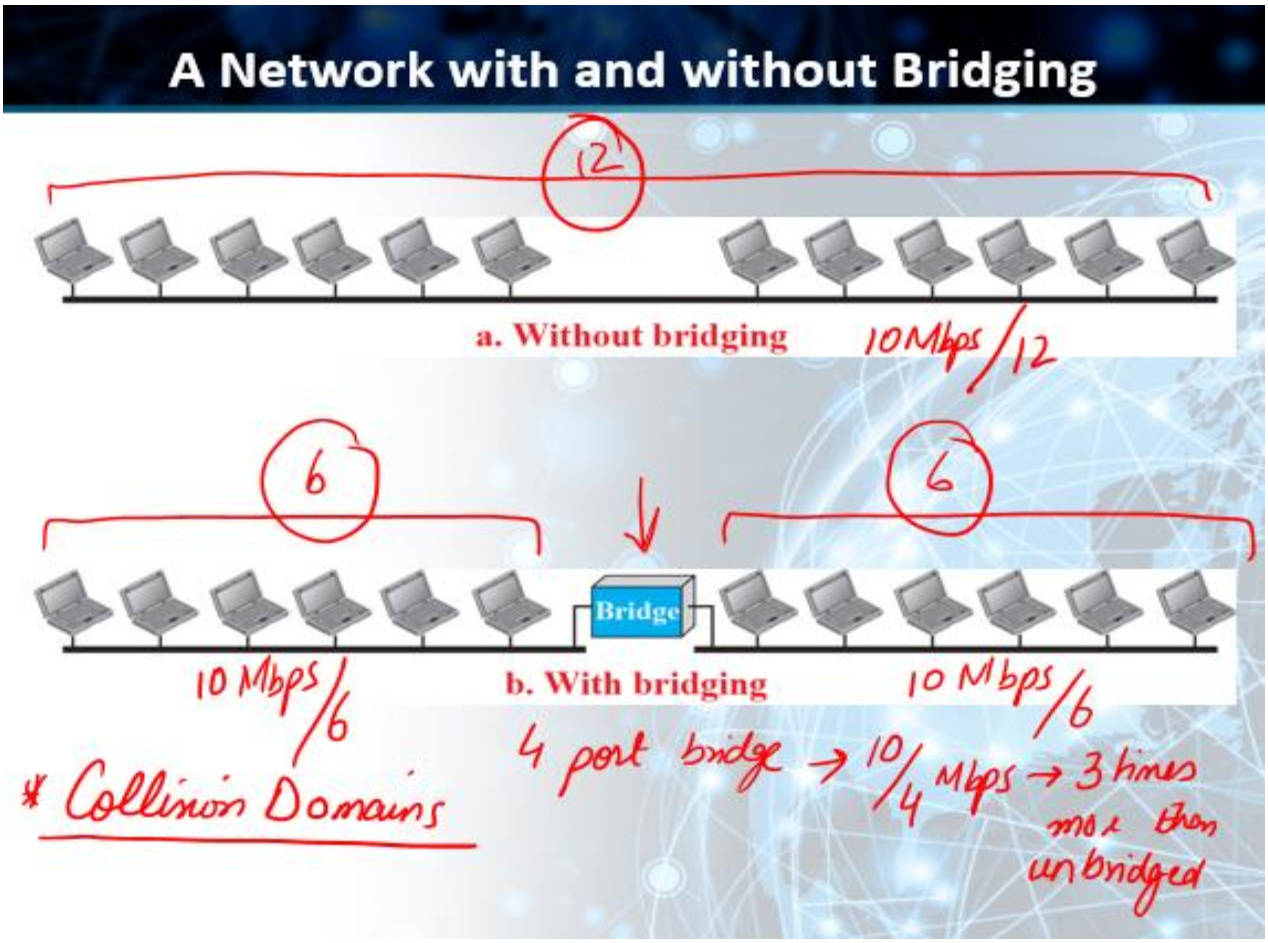
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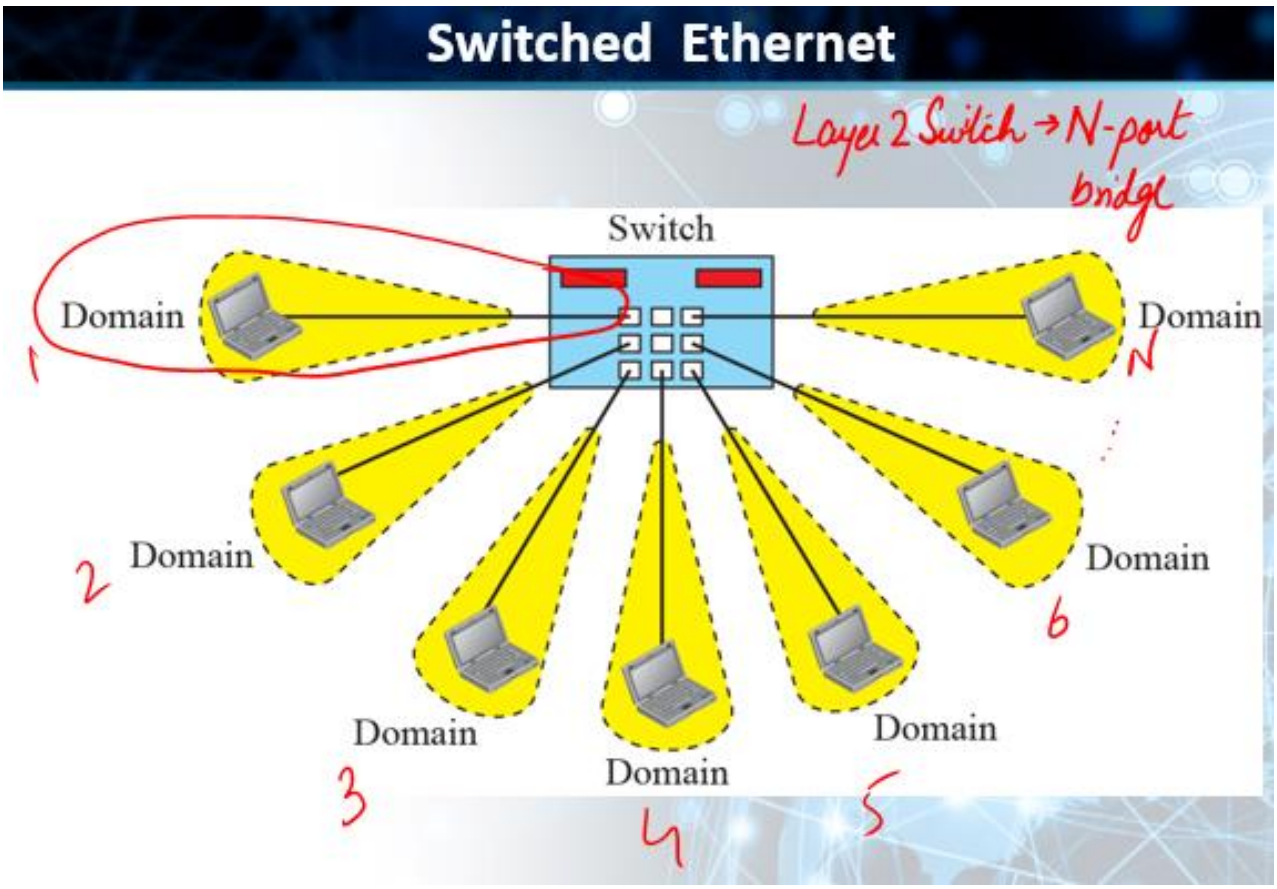
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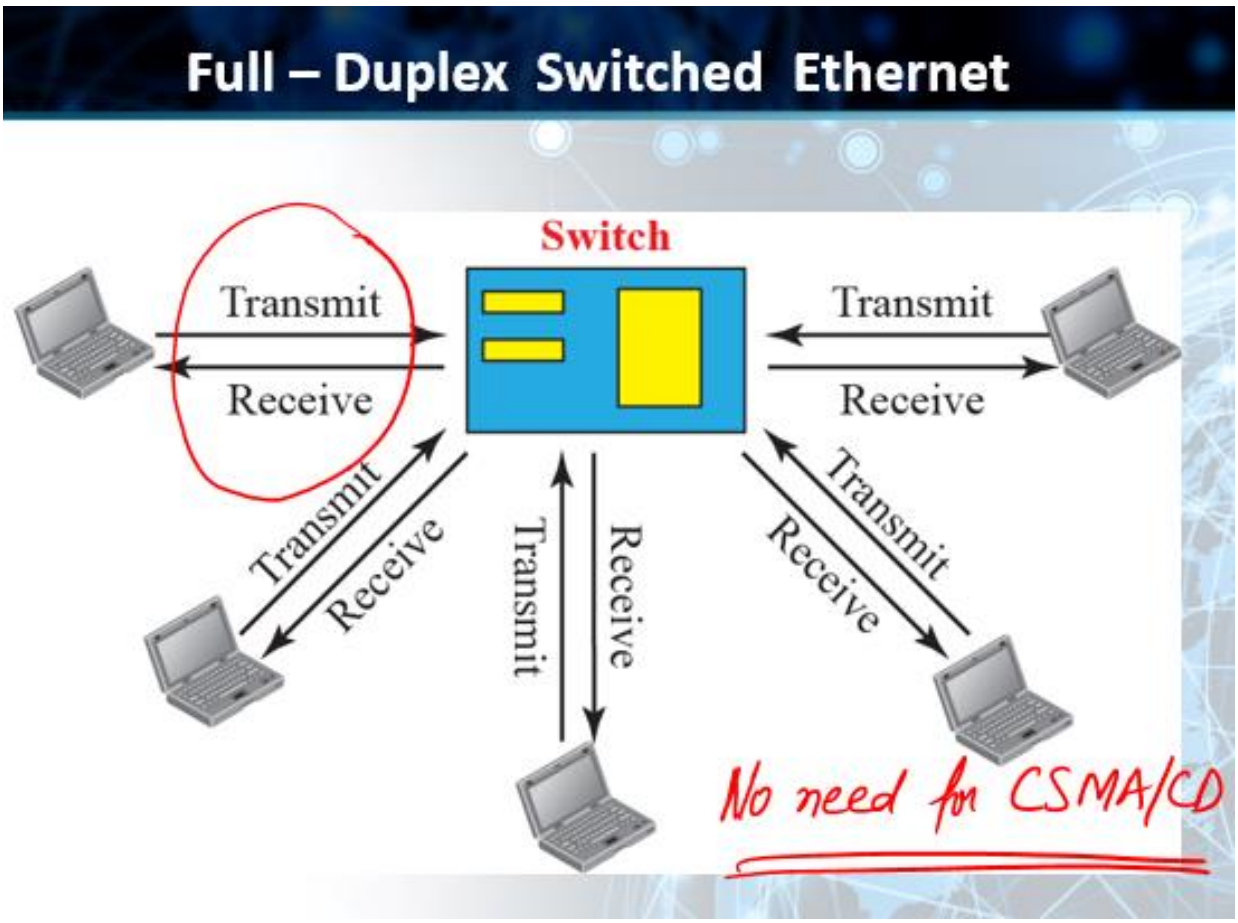
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Fast Ethernet

- **In the 1990s, Ethernet made a big jump by increasing the transmission rate to 100 Mbps, and the new generation was called the Fast Ethernet**
- **To make it compatible with the Standard Ethernet, the MAC sublayer was left unchanged**
- **But the features of the Standard Ethernet that depend on the transmission rate, had to be changed**
- **Goals of Fast Ethernet:**
    - **Upgrade data rate to 100Mbps**

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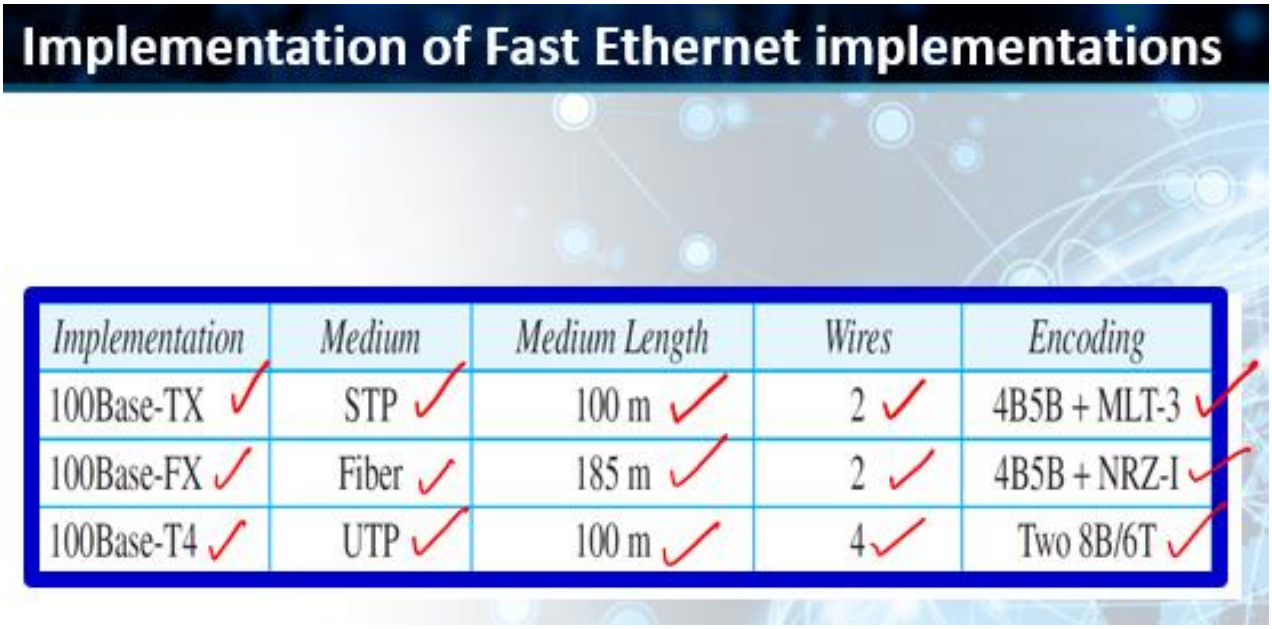
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- **Make it compatible with Standard Ethernet**
- **Keep same 48-bit address**
- **Keep same frame format**

Physical Layer

- **To be able to handle a 100 Mbps data rate, several changes need to be made at the physical layer**

Implementation of Fast Ethernet implementations



Implementation	Medium	Medium Length	Wires	Encoding
100Base-TX	STP	100 m	2	4B5B + MLT-3
100Base-FX	Fiber	185 m	2	4B5B + NRZ-I
100Base-T4	UTP	100 m	4	Two 8B/6T

Gigabit Ethernet

- **Need for an even higher data rate resulted in the design of IEEE Standard 802.3z Gigabit Ethernet Protocol (1000 Mbps)**
- **The goals of the Gigabit Ethernet were:**
  - **Upgrade the data rate to 1 Gbps**

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- **Make it compatible with standard or Fast Ethernet**
- **Use same 48-bit address**
- **Use the same frame format**
- **Keep same minimum and maximum frame lengths**

MAC Sub-layer

- **A main consideration in the evolution of Ethernet was to keep the MAC sublayer untouched**
- **To achieve a data rate of 1 Gbps, this was no longer possible**
- **Gigabit Ethernet has two distinctive approaches for medium access:**
  - ✓ **Half-duplex**
  - ✓ **Full-duplex**

Physical Layer

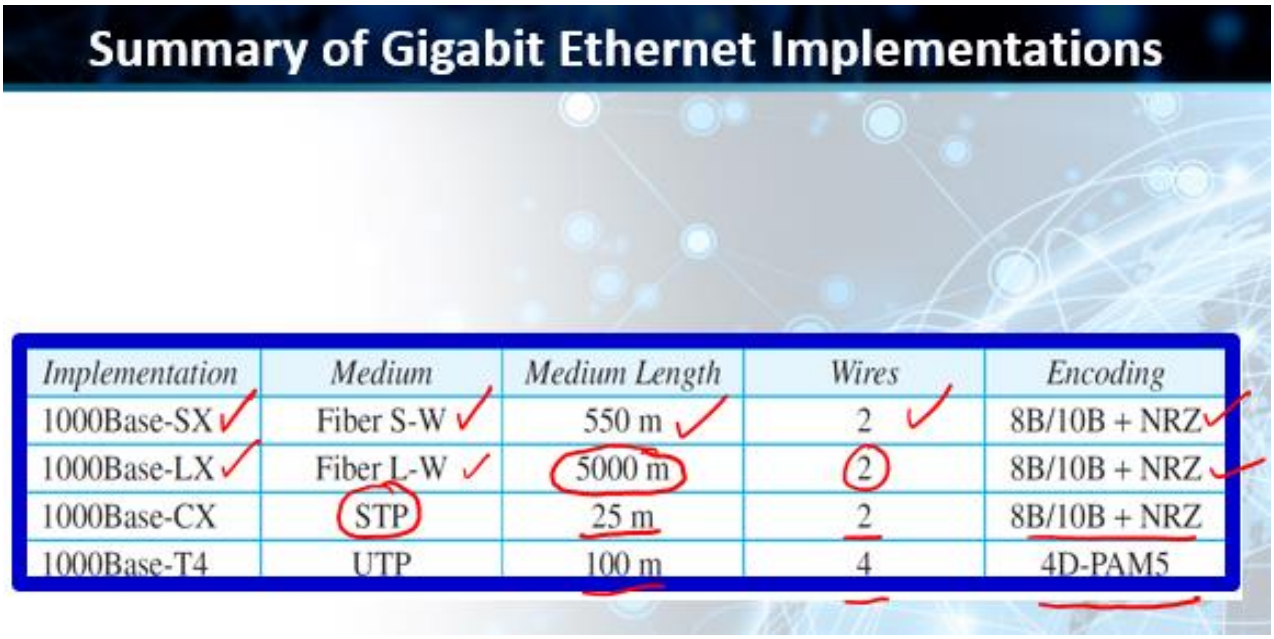
- **The physical layer in Gigabit Ethernet is more complicated than that in Standard or Fast Ethernet**
- **We briefly discuss some features of this layer:**

Summary of Gigabit Ethernet Implementations

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Implementation	Medium	Medium Length	Wires	Encoding
1000Base-SX	Fiber S-W	550 m	2	8B/10B + NRZ
1000Base-LX	Fiber L-W	5000 m	2	8B/10B + NRZ
1000Base-CX	STP	25 m	2	8B/10B + NRZ
1000Base-T4	UTP	100 m	4	4D-PAM5

10-gigabit Ethernet

- **The idea is to extend the technology, the data rate, and the coverage distance so that the Ethernet can be used in LANs and MANs (metropolitan area network)**
- **The IEEE committee created 10 Gigabit Ethernet and called it Standard 802.3ae**

Implementation

- **10 Gigabit Ethernet operates only in full-duplex mode, which means there is no need for contention; CSMA/CD is not used in 10 Gigabit Ethernet**
- **Four implementations are most common:**

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Implementation

Implementation	*Medium*	*Medium Length*	*Number of wires*	*Encoding*
10GBase-SR	Fiber 850 nm	300 m	2	64B66B
10GBase-LR	Fiber 1310 nm	10 Km	2	64B66B
10GBase-EW	Fiber 1350 nm	40 Km	2	SONET
10GBase-X4	Fiber 1310 nm	300 m to 10 Km	2	8B10B