CSMA/CD

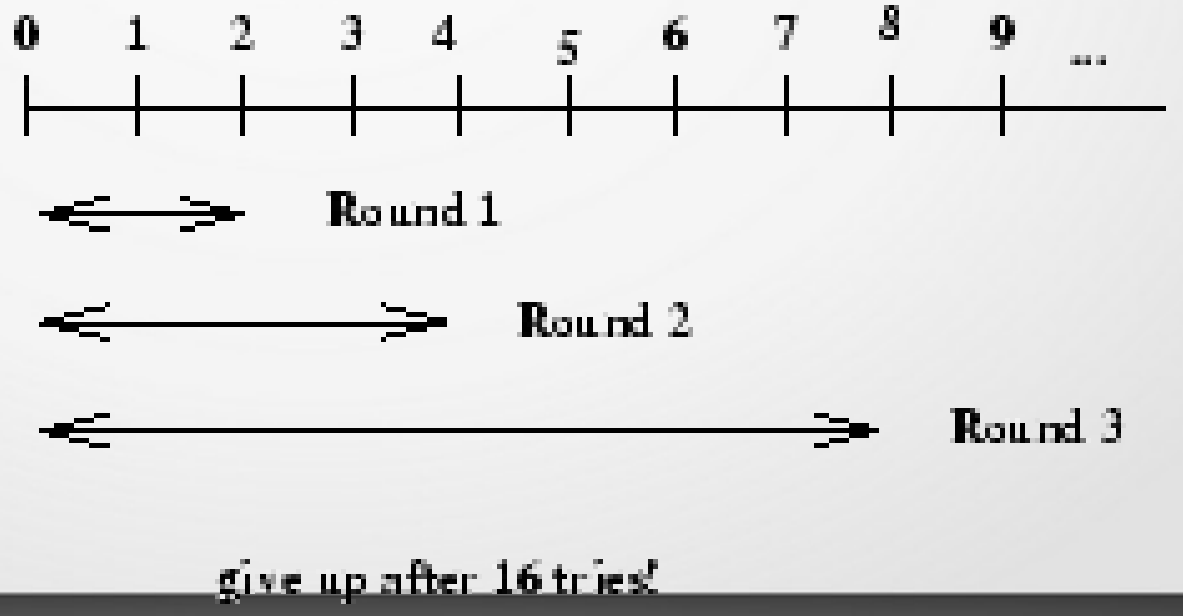
- Carrier Sense Multiple Access with Collision Detection
- Multiple host can access the Ethernet bus at a time through their transceiver and determine for the absence/presence of a carrier wave on the bus.
- If a host wants to send the data , first check the cable is ideal or not **-sensing**
- It defines how network devices respond when two devices attempt to use a data channel simultaneously and encounter a data collision.
- The CSMA/CD rules define how long the device should wait if a collision occurs. The medium is often used by multiple data nodes, so each data node receives transmissions from each of the other nodes on the medium.

CSMA/CD - Binary Exponential back-off Policy

- The Ethernet standard specifies a binary exponential back-off policy, where in a sender waits for a random time after a first collision, twice a long if retransmission also results into collision, four times as long if the retransmission also results in a collision and so on.
- Wi-Fi as an example. Two Wi-Fi stations A and B want to send data to C at the same time. When two stations access the channel at the same time, we say that it's a collision. Stations whose packets have just collided will initiate a backoff procedure. Every station maintains a **number** called **Contention Window (CW).** The station will choose a random value within this window. This value, which is really the number of idle transmission slots that the station has to wait, is called the **Backoff Period**. During this period, these stations (A and B) cannot transmit.

CSMA/CD - Binary Exponential back-off Policy

- The essence of BEB is that the backoff period is randomly selected within the CW. Each station will potentially have a different waiting time. They can't transmit until the backoff period has passed. Moreover, when another station gains access, backoff timer is paused. It's resumed only when the channel becomes idle again as determined by Distributed Interframe Space (DIFS).
- With every collision, the station will double its CW. This is why the prefix "binary exponential" is used. It's common to have minimum and maximum values for CW.

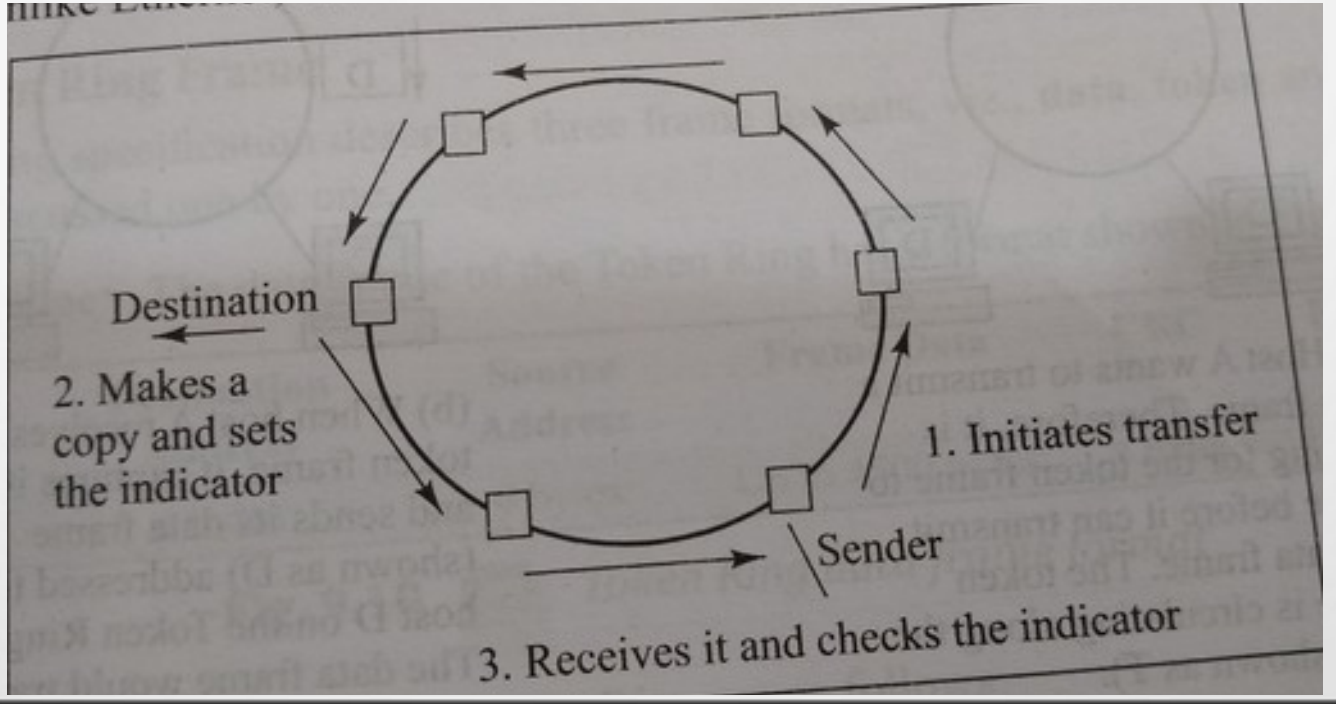


Token Ring

- The Token ring network is based on the ring topology.
- The most broadly deployed token ring protocols were IBM's, released in the mid-1980s, and the standardized version of it known as IEEE 802.5, which appeared in the late 1980s known as IBM Token ring.
- The IEEE standard version provides for data transfer rates of 4, 16 or 100 Mbps
- A token ring network employ a mechanism called **token passing.**
- All host on token ring share the same physical medium just as host on Ethernet, so we need MAC.
- **In token ring all the hosts are arranged to form a circular ring.**
- When a host on the ring wants to transmit data it cannot send it immediately. It must wait for permission for data transmission it is guaranteed tht no other host would be allowed to transmit data at the same time.
- The sending computer transmits a frame which travel across the ring. Host checks the destination address and if it is not meant for it, it forwards.

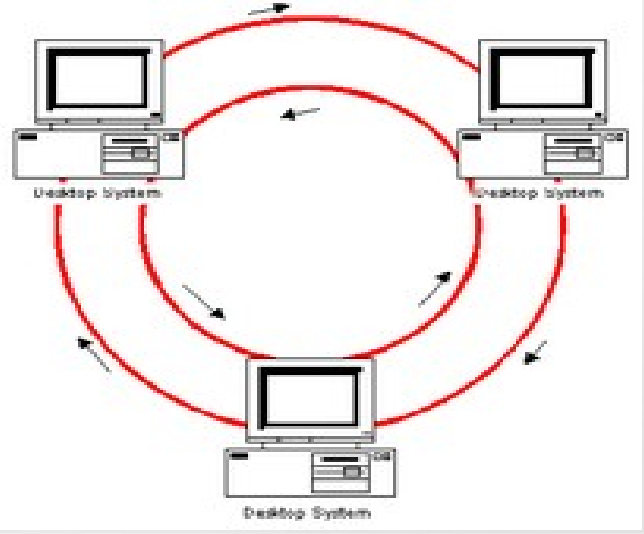
Token Ring

- At destination node, before it transmits the frame, hosts checks the CRC to ensure that there are no errors and then only accepts the frame.but also changes a flag bit in the frame to indicate the receipt of a correct frame.
- When it comes it back to sender after covering the entire ring. The sender checks the flag bit to verify the frame was received by the destination successfully.



FDDI

- The **Fiber Distributed Data Interface(FDDI)** network architecture is a LAN protocol standardized by ANSI and other organizations.
- It supports data transmission rates upto 100mbps, and it is alternative to Ethernet and Token Ring.
- FDDI was developed using **optical fiber** as the transmission medium because only optical fiber could support data rates upto 100 mbps. But even copper wires can support such rates and such version is called **Copper Distributed Data Interface** (**CDDI)**.
- FDDI uses glass fibers for data transmission and encodes data in form of pulses of light.



FDDI

- **Properties of FDDI:**
- **Token Passing for Media Access Control:**
  - Like token ring, FDDI also uses the concept of a token frame.
  - FDDI also has a ring-like structure where network medium starts from a computer passes through all hosts in the network and ends back at the original host.
- **Self-healing mechanism:**
  - The hardware in FDDI provides mechanism for detecting and problems on its own.

FDDI

- **Operations of FDDI:**
- FDDI operates exactly like **Token Ring,** with one difference. Token Ring uses a single wire through all the hosts whereas FDDI uses **two.**
- **FDDI hardware uses two independent rings to connect to every host.**

Normally, **FDDI** uses only one ring for transmission. The NIC(network interface card) of each host examines all the frames that circulate, compare the destination address.

- It keeps copy of the frame only if the two addresses match, else it simply forwards. What is the need of second ring?

FDDI

- **Self-healing mechanism:**
- The self-healing mechanism of FDDI network is possible by the second ring. When a network error occurs or host is down, the NIC of a host realizes that it cannot communicate with its neighbouring host.
- In such case, the NIC uses the second ring, which is used as a backup for such failures.
- This is called **loopback.**
- Whenever the first ring fails, or a host on the ring fails, the second ring is used to create another closed loop.