Lecture 1 :- Network protocols

Application Layer Protocols

1. **HTTP (HyperText Transfer Protocol)**:
    - Client-server protocol.
    - Uses **1 connection** for communication.
2. **FTP (File Transfer Protocol)**:
    - Client-server protocol.
    - Uses **2 connections**: one for control commands and another for data transfer.
3. **SMTP (Simple Mail Transfer Protocol)**:
    - Used to **send emails**.
4. **IMAP (Internet Message Access Protocol)**:
    - Used to **read and access emails**.
5. **WebSocket**:
    - **Two-way communication** protocol (not peer-to-peer).
    - Primarily used for real-time messaging.
6. **WebRTC (Web Real-Time Communication)**:
    - **Peer-to-peer protocol** for direct media and data streaming.

Transport Layer Protocols

1. **TCP (Transmission Control Protocol)**:
    - Ensures **order is maintained**.
    - Reliable, with acknowledgment.
2. **UDP (User Datagram Protocol)**:
    - Sends data **in parallel** without maintaining order.
    - **Faster** but does not provide acknowledgment.

Lecture 2 :- CAP Theorem

CAP Theorem states that in a distributed system, it is impossible to achieve **Consistency (C)**, **Availability (A)**, and **Partition Tolerance (P)** simultaneously.

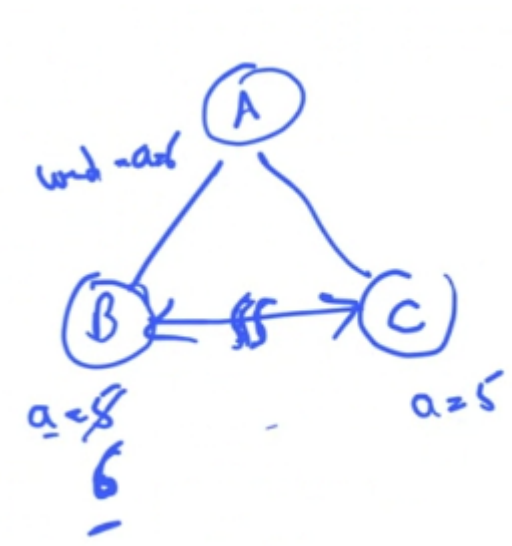
Key Concepts:

1. **Consistency**:
    - After a successful write to any node, all nodes should return the updated value on read.
    - Example: If Node A updates a value from 5 to 6, Nodes B and C must also return 6 after the write.
2. **Availability**:
    - All nodes must respond to queries, even if some nodes hold outdated data.
    - Example: If Node A updates the value to 6, Nodes B and C may still return 5 but must respond.

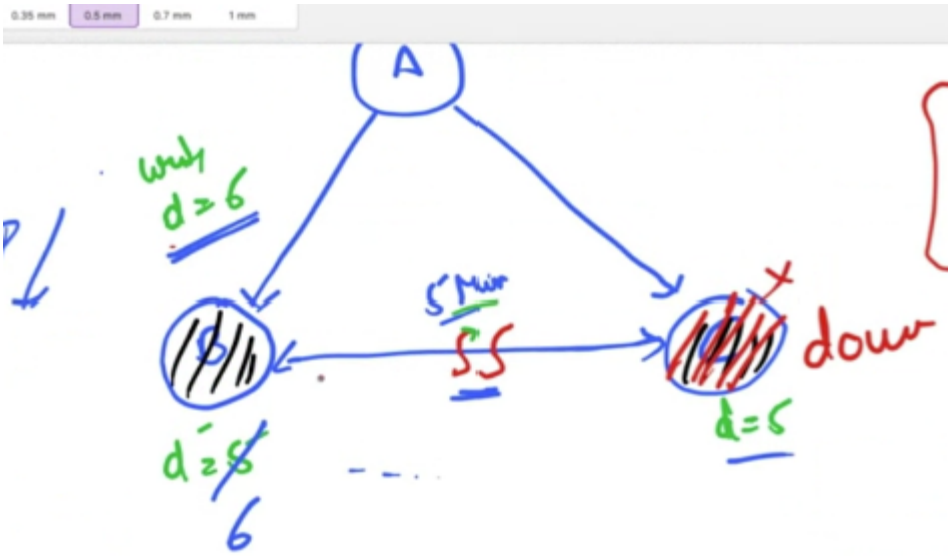
3. **Partition Tolerance**:
    - The system continues to operate despite network partition (system breakage).
    - Example: If Node A and Node B lose connection to Node C, Nodes A and B still handle requests independently.

CAP Trade-offs:

- **CA (Consistency + Availability)**: No Partition Tolerance.
  Example: All nodes return the updated value, but the system fails during partition.
- **CP (Consistency + Partition Tolerance)**: No Availability.
  Example: During partition, only the consistent nodes respond, some nodes are unavailable.
- **AP (Availability + Partition Tolerance)**: No Consistency.
  Example: During partition, all nodes respond, but some may return outdated values.



AP :-



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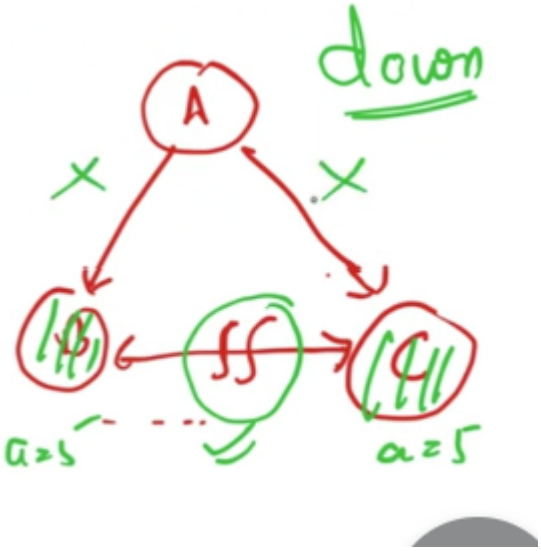

CA:-