**Redundant connections (kết nối dự phòng).**

**I. What is rebundant connection?**

Redundant connections involve establishing multiple connection paths between network devices (like switches, routers, servers) instead of relying on a single path. The goal is to ensure that if one connection fails, others remain active, allowing the network to continue operating without interruption

**II. Why are Redundant Connections Needed?**

- High Availability: In critical networks, connection failures can cause significant damage. Redundancy minimizes downtime and ensures that services remain accessible.

- Fault Tolerance: If a cable is cut, a device malfunctions, or a port fails, redundant connections automatically take over, maintaining network operation.

- Load Balancing: In some cases, redundant connections can distribute network traffic across multiple paths, improving performance.

**iii. Common Forms of Redundant Connections:**

- Switch Redundancy: Using multiple cables to connect switches, creating alternate paths.

- Server Redundancy: Connecting servers to multiple switches or network interface cards (NICs) to ensure accessibility if a connection fails.

- Router Redundancy: Using multiple links between routers to maintain connectivity with other networks if a link fails.

- Internet Redundancy: Using multiple internet connections from different Internet Service Providers (ISPs).

IV. **The Problem with Redundant Connections:**

**- Loops:** As discussed earlier, redundant connections can create Layer 2 loops, leading to broadcast storms and other issues.

**- Complexity:** Managing and configuring redundant connections can be complex, especially in large networks.

**V. Solutions:**

**- Spanning Tree Protocol (STP):** STP is the primary solution for preventing loops in networks with redundant connections.

**- Link Aggregation (LAG):** LAG combines multiple physical links into a single logical link, increasing bandwidth and reliability.

**VII. Important of Redundacy:**

- The Importance of Redundancy: It emphasizes that redundancy is crucial for building resilient networks. Redundancy eliminates single points of failure, ensuring that network services remain available even if a component fails.

- The Difference Between Physical and Logical Redundancy: It highlights that while physical redundancy (adding extra cables and devices) is necessary, logical redundancy (ensuring that data paths are managed correctly) is equally important.

- The Problem of Layer 2 Loops: It explains that redundant paths in Ethernet networks can lead to Layer 2 loops, which can disrupt network operations.

- The Consequences of Loops: It describes the negative effects of loops, specifically the continuous propagation of Ethernet frames, which can overwhelm the network.

- The Need for Loop Prevention: It implicitly sets the stage for the introduction of solutions like the Spanning Tree Protocol (STP), which is briefly mentioned as a way to address the issue of loops.

- The requirement of a loop free topology: It stresses the fact that Ethernet Lans need a loop free topology, and that there must only be one path between two devices.