

## Task

2024

Given the 5 topologies:

1. bus
2. ring
3. 2-D grid
4. star
5. mesh

with the number of nodes  $N=16$  determine which topology has the *smallest latency* and which one the *largest bandwidth*?

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### 1. Bus Topology

- Latency: High. Since all nodes share a single communication line, data travels sequentially. Collisions can occur, especially with 16 nodes, leading to delays.
- Bandwidth: Low to moderate. All nodes share the same bandwidth, and only one transmission can occur at a time.

### 2. Ring Topology

- Latency: Moderate to high. Data must pass through intermediate nodes to reach the destination, leading to delays proportional to the number of hops.
- Bandwidth: Moderate. Like the bus, each node shares the same medium, but there are no collisions.

### 3. 2-D Grid Topology

- Latency: Moderate. Data must navigate through the grid, which can require several hops depending on the distance between nodes.
- Bandwidth: Moderate. Multiple communication paths are available, but congestion can happen if many nodes are trying to communicate simultaneously.

#### **4. Star Topology**

- Latency: Low. Since each node connects directly to a central hub, the latency is minimized. The hub directs traffic without needing multiple hops.
- Bandwidth: High. The central hub handles communication, providing higher overall bandwidth as long as the hub can manage the load.

#### **5. Mesh Topology**

- Latency: Very low. Since each node is directly connected to others, data can travel via the shortest path without needing intermediary nodes.
- Bandwidth: Very high. Each node has dedicated connections to other nodes, providing multiple parallel communication paths and high bandwidth.

#### **Conclusion**

- Smallest Latency: Mesh topology (direct connections between nodes reduce delays).
- Largest Bandwidth: Mesh topology (multiple simultaneous connections allow for the highest data throughput).