1. Network Bandwidth Calculation for Link-State and Distance Vector Routing

Given:

- **Number of routers**: 180
- **Average connections per router**: 5
- **Update interval**: 120 milliseconds
- **Protocol assumptions**:
    - **Link-state routing**: Each router sends link-state packets (LSPs) to all routers in the network.
    - **Distance-vector routing**: Each router sends its distance vector to only directly connected neighbors.

Assumptions:

1. **Size of routing table entries**:
    - Assume each entry in a routing table (e.g., each route to a specific destination) takes 4 bytes.
    - Each router's LSP includes information about its direct links to its *5* neighbors.
2. **Size of link-state packets**:
    - Each LSP includes information about the router's identity (e.g., router ID, *4* bytes), sequence number (*4* bytes), and entries for its 5 neighbors (*5 * 4 = 20* bytes).
    - Total LSP size per router: *4+4+20=284 + 4 + 20 = 284+4+20=28* bytes.
3. **Size of distance-vector packets**:
    - Assume that each distance vector sent to a neighbor contains *180* entries, with each entry representing the cost to each destination router (*180 entries * 4 bytes = 720 bytes*).
    - Total DV packet size per router: *720 bytes*.

Link-State Routing Bandwidth Calculation

- Each router generates an LSP every 120 ms and floods it to the entire network.
- Since there are 180 routers, each router will receive 179 LSPs from other routers every 120 ms.
- Bandwidth used by link-state routing per 120 ms:
    - Bandwidth=Number of routers × LSP size × Number of updates per second
    - So, *180 × 28 bytes = 5040 bytes* every 120 ms.

Distance-Vector Routing Bandwidth Calculation

- Each router sends its distance vector (*720 bytes*) to its 5 neighbors every *120* ms.
- Bandwidth used by distance-vector routing per *120* ms:
    - Bandwidth=Number of routers×Neighbors per router×Distance vector size
    - So, *180×5×720=648,000 bytes* per 120 ms

Summary

- **Link-state bandwidth**: 5040 bytes every 120 ms.
- **Distance-vector bandwidth**: 648,000 bytes every 120 ms.

2. Flooding vs. Broadcast

Similarities:

- Both **flooding** and **broadcast** aim to deliver information to all nodes in a network.

Differences:

- **Flooding** does not limit the scope, so each node retransmits to all its neighbors until all nodes receive the message. This can cause excessive duplication and traffic.
- **Broadcasting** aims for efficiency by ensuring each node receives the message once, avoiding duplication where possible.

3. Split Horizon Limitation in Avoiding Count-to-Infinity Problem

Example Scenario: Consider routers A, B, and C connected in a linear configuration (A—B—C). Suppose the following initial distances:

Initial State:

Router	Destination	Distance
A	C	2
B	C	1

After Link Breaks Between B and C:

When the link between B and C fails, the tables evolve as follows:

Iteration 1:

1. B cannot reach C anymore, so B updates its table:
   - **B:** (C, ∞)
2. A still believes it can reach C through B and continues with (C, 2).

Iteration 2:

1. B now receives A's distance to C (2) and updates its table again:
   - **B:** (C, 3)

This process continues, increasing the distance between B and C at each iteration. Here, split horizon does not prevent B from updating its distance based on A's belief, leading to count-to-infinity.