Routing

Routing

Routing Techniques

Static Versus Dynamic Routing

Routing Table for Classful Addressing

Routing Table for Classless Addressing

Next-hop routing

Routing table for host A

Destination	Route
Host B	R1, R2, Host B

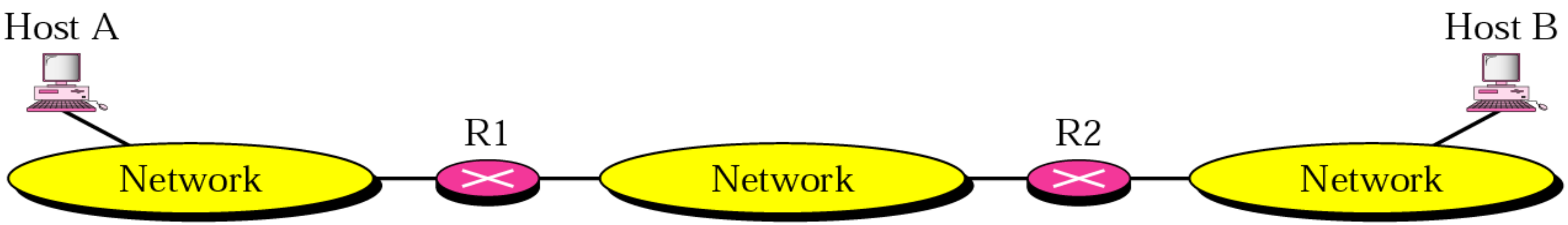
Routing table for R1

Destination	Route
Host B	R2, Host B

Routing table for R2

Destination	Route
Host B	Host B

a. Routing tables based on route



Routing table for host A

Destination	Next Hop
Host B	R1

Routing table for R1

Destination	Next Hop
Host B	R2

Routing table for R2

Destination	Next Hop
Host B	—

b. Routing tables based on next hop

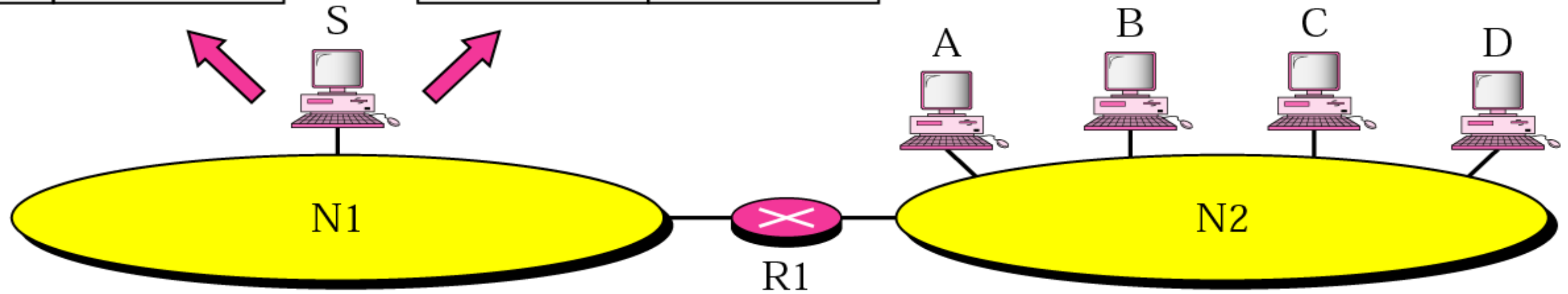
Network-specific routing

Routing table for host S based on host-specific routing

Destination	Next Hop
A	R1
B	R1
C	R1
D	R1

Routing table for host S based on network-specific routing

Destination	Next Hop
N2	R1



Host-specific routing

Routing table for host A

Destination	Next Hop
Host B	R3
N2	R1
N3	R3
......	......

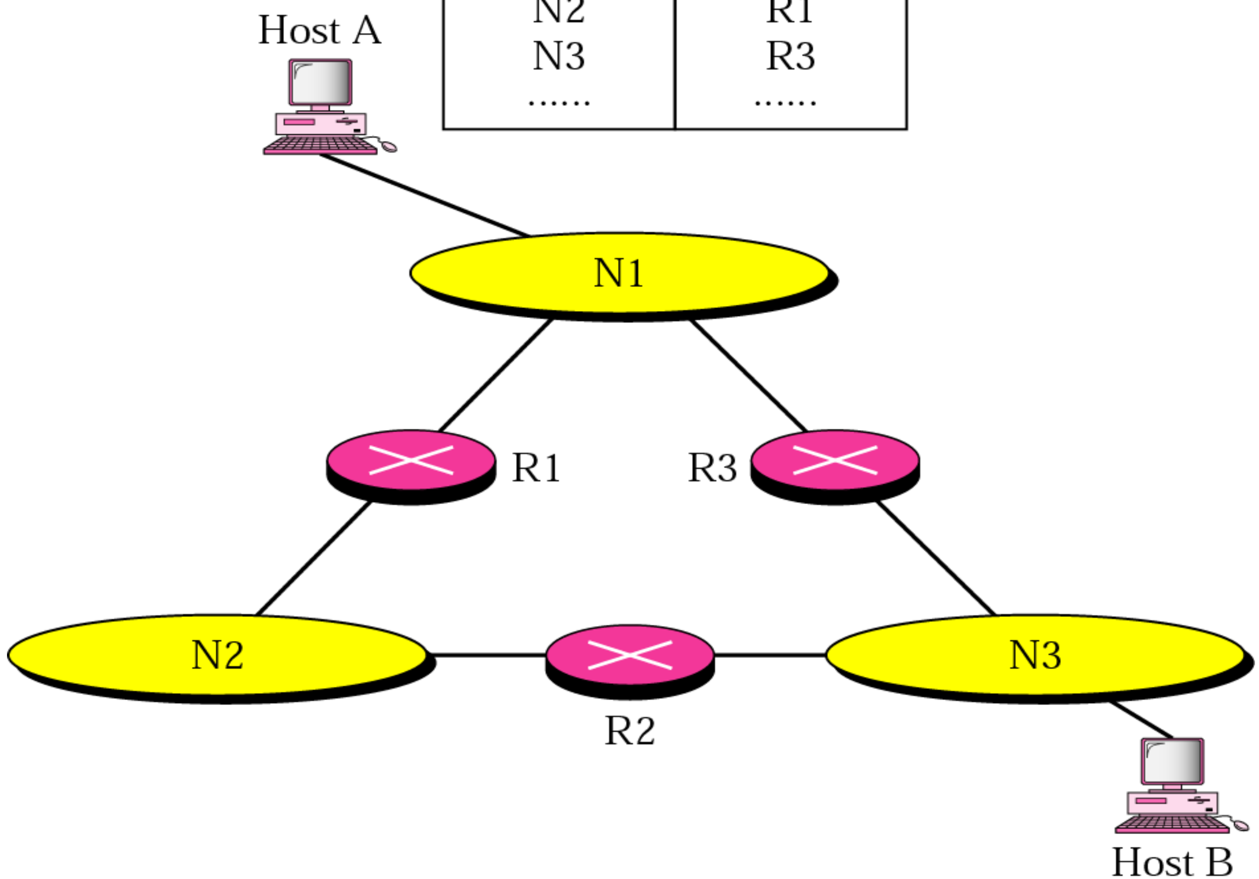


Figure 19.31 Default routing

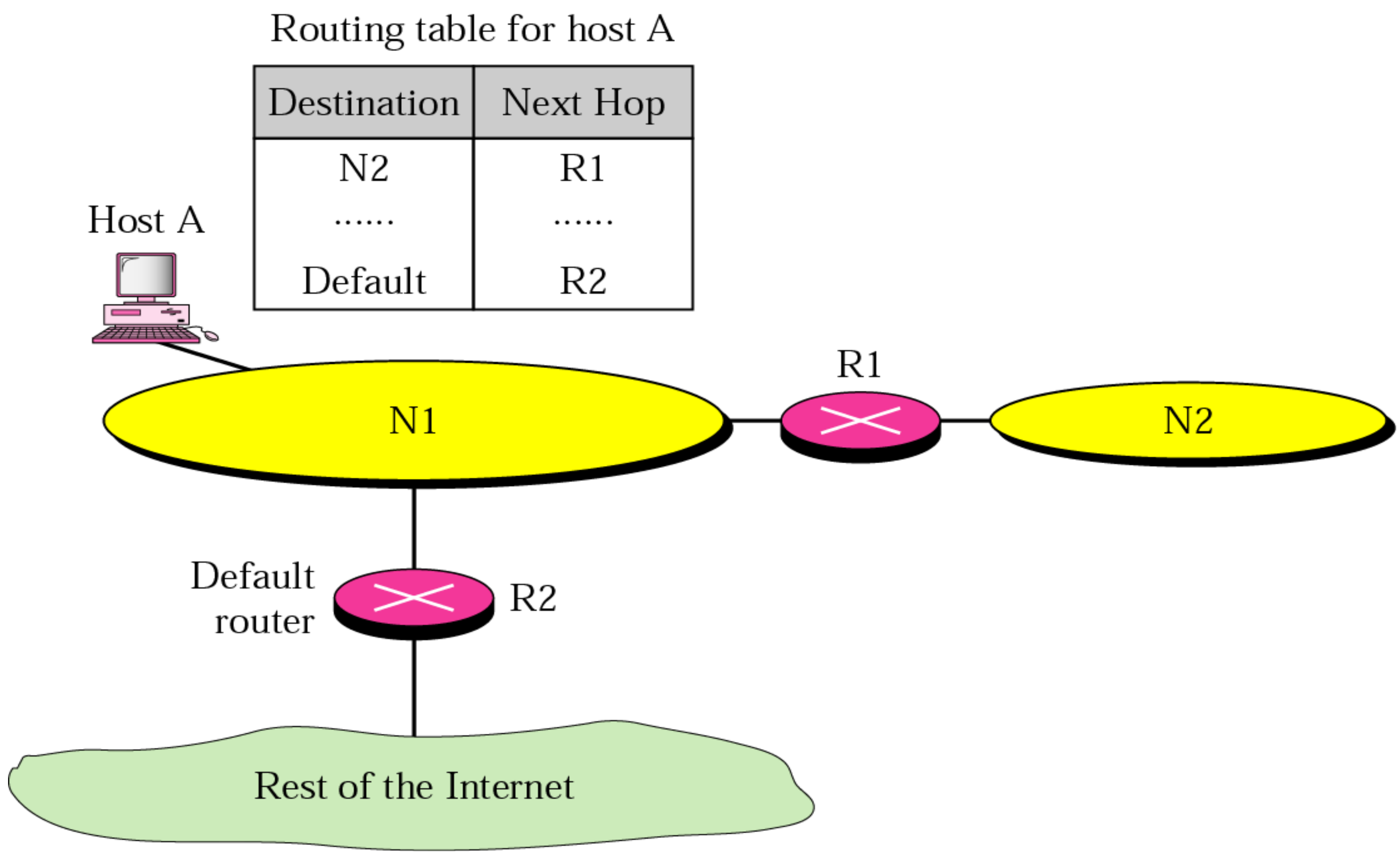
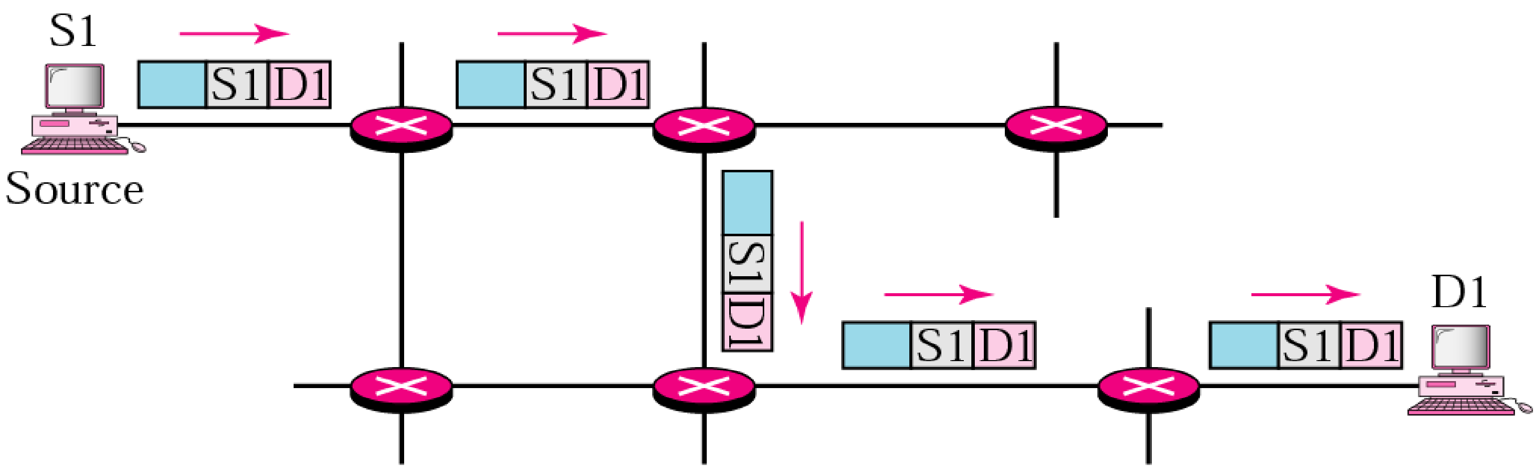


Figure 19.32 Classful addressing routing table

	Mask	Destination address	Next-hop address	Interface
	/8	14.0.0.0	118.45.23.8	m1
Host-specific →	/32	192.16.7.1	202.45.9.3	m0
	/24	193.14.5.0	84.78.4.12	m2
Default →	/0	/0	145.11.10.6	m0

Routing Protocols

Unicasting



Note:

In unicast routing, the router forwards the received packet through only one of its ports.

Distance Vector Routing

- Each router periodically shares its knowledge about the entire internet with its neighbours
  - Sharing the knowledge about the entire autonomous system
  - Sharing only with neighbours
  - Sharing at regular intervals

Routing Table

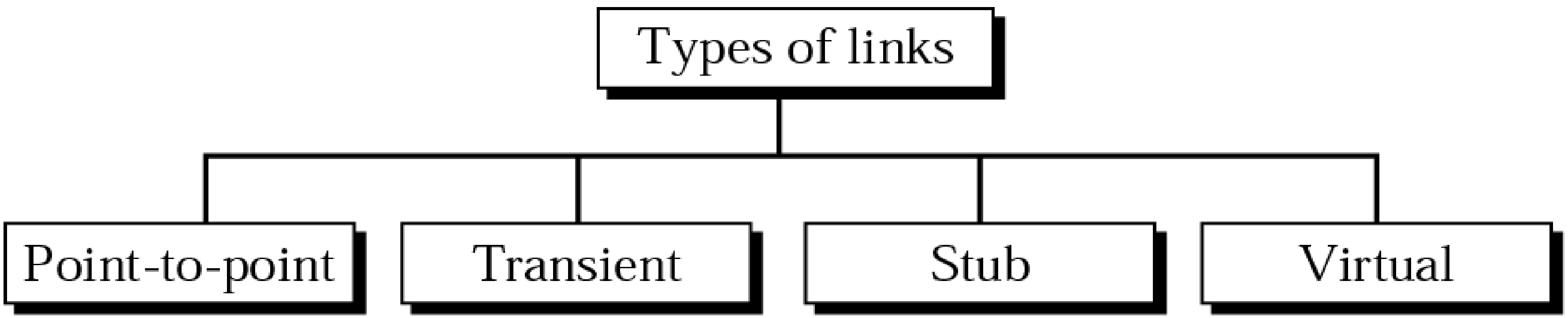
Every router keeps a routing table that has one entry for each destination network of which the router is aware

Destination	Hop Count	Next Router	Other information
163.5.0.0	7	172.6.23.4	
197.5.13.0	5	176.3.6.17	
189.45.0.0	4	200.5.1.6	
115.0.0.0	6	131.4.7.19	

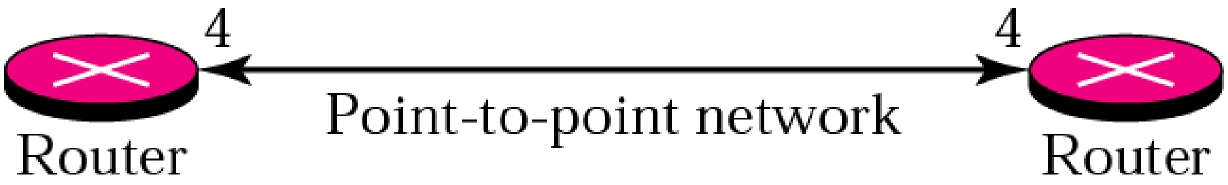
Link State Routing

- Process by which each router shares its knowledge about its neighbourhood with every router in the area
  - Sharing knowledge about the neighbourhood
  - Sharing with every other router – flooding
  - Sharing when there is a change – results in lower internet traffic than that required by distance vector routing

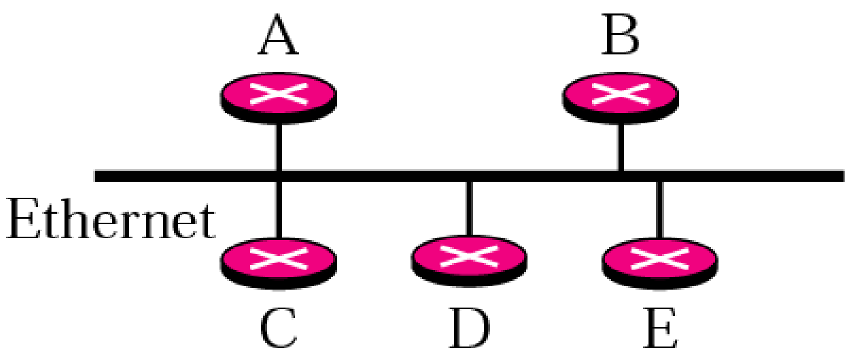
Types of links



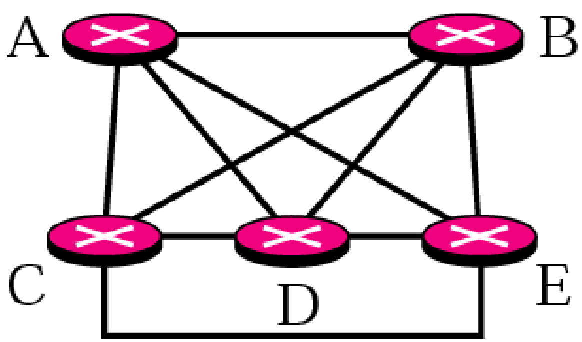
Point-to-point link



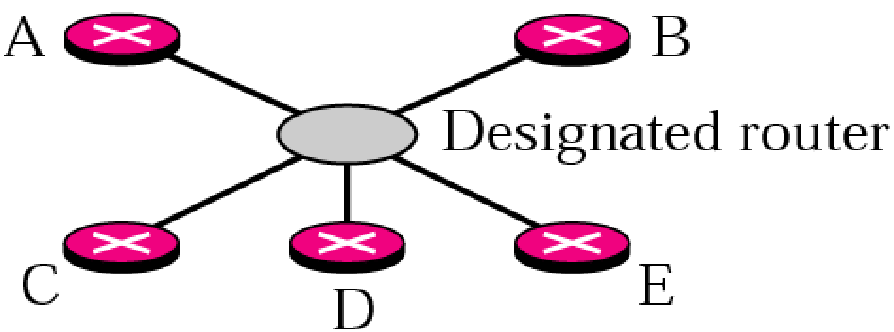
Transient link



a. Transient network

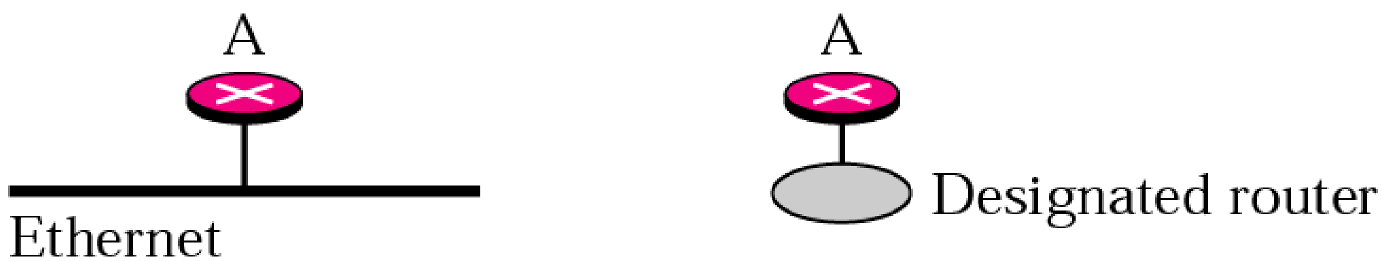


b. Unrealistic representation



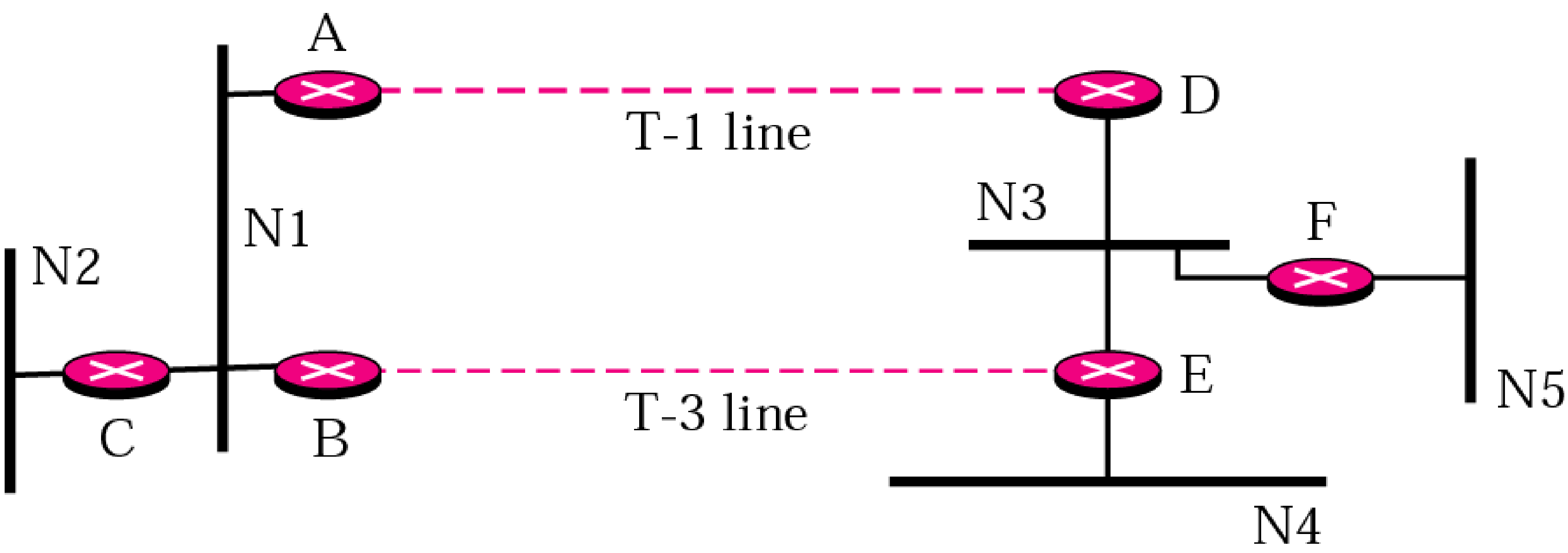
c. Realistic representation

Stub link

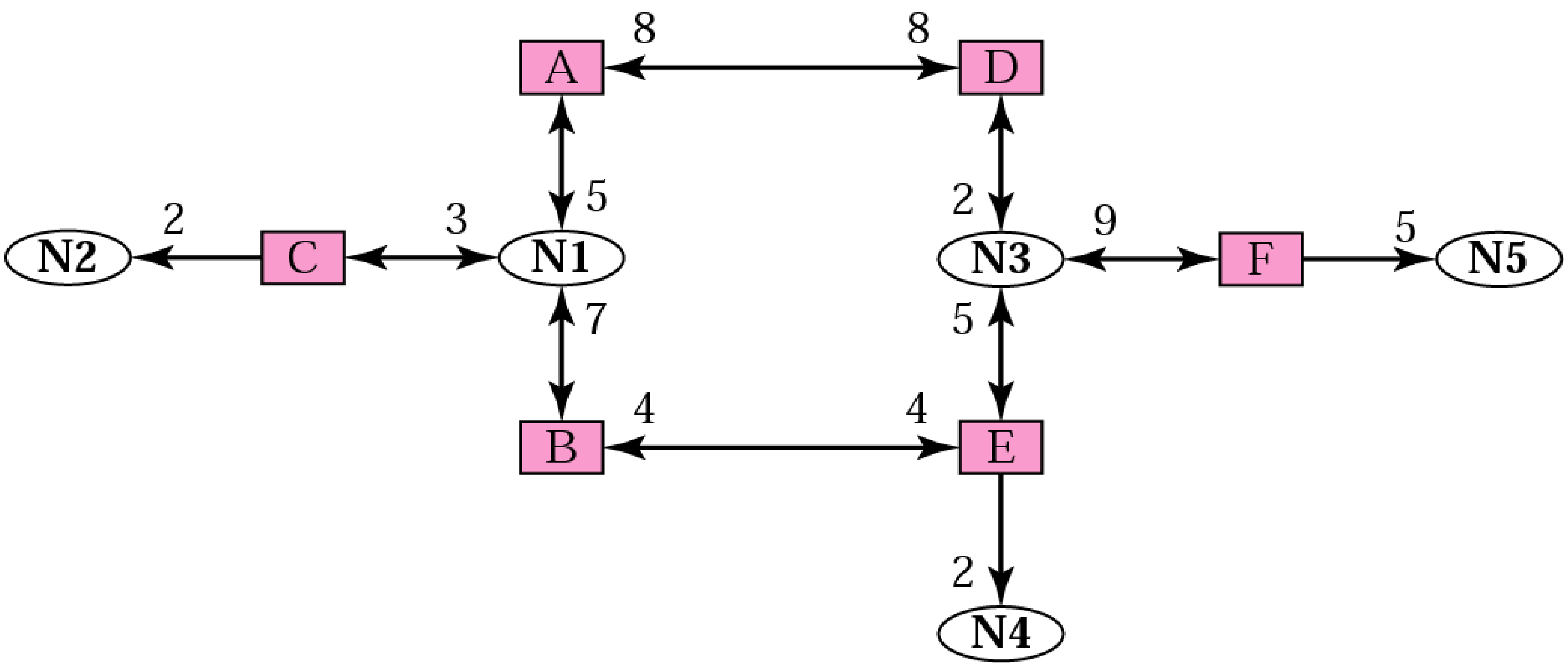


a. Stub network b. Representation

Example of an internet



Graphical representation of an internet

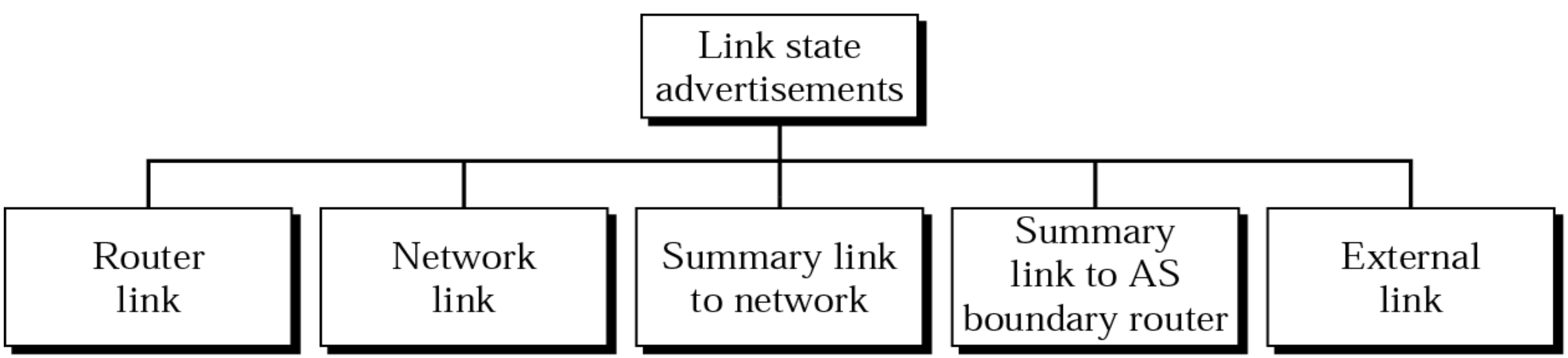


Types of LSAs

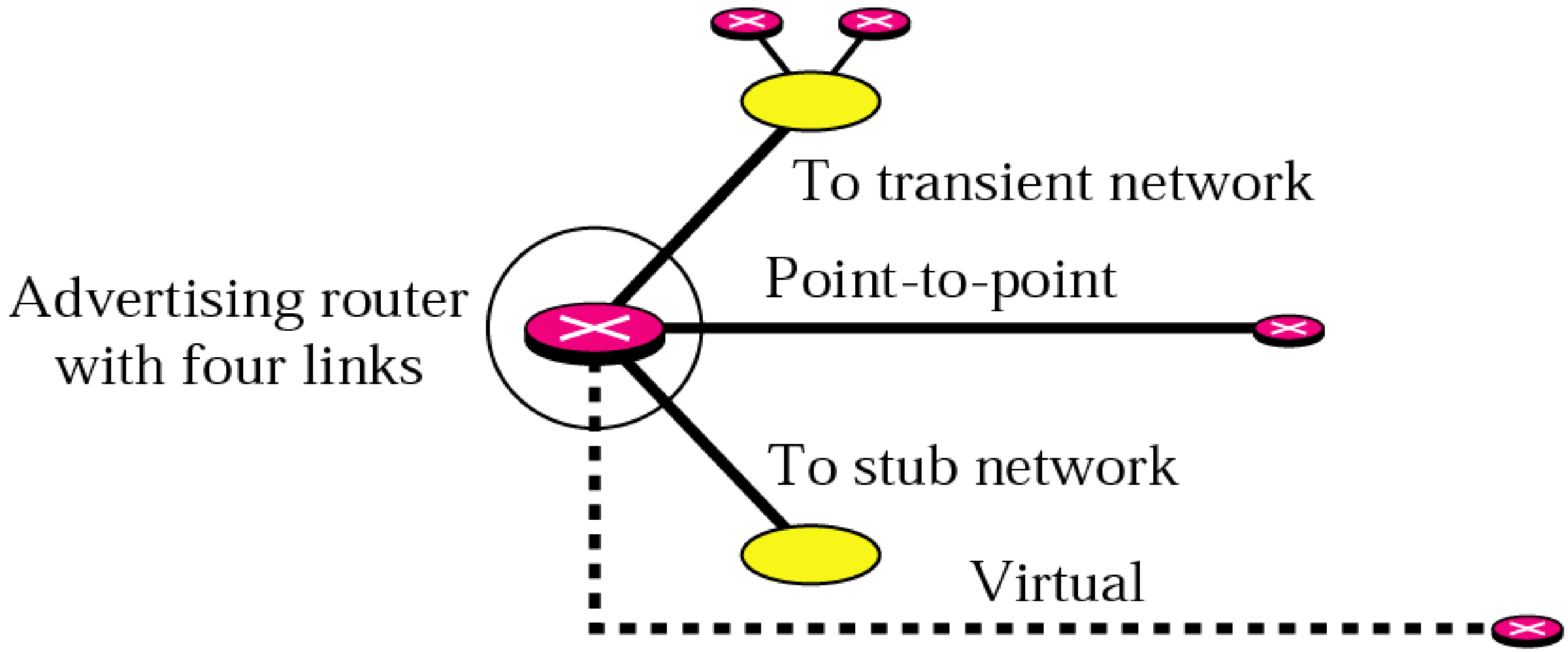
Link State Advertisements :

To share information about their neighbour each entity distributes link state advertisements (LSAs)

LSA announces the states of entity links

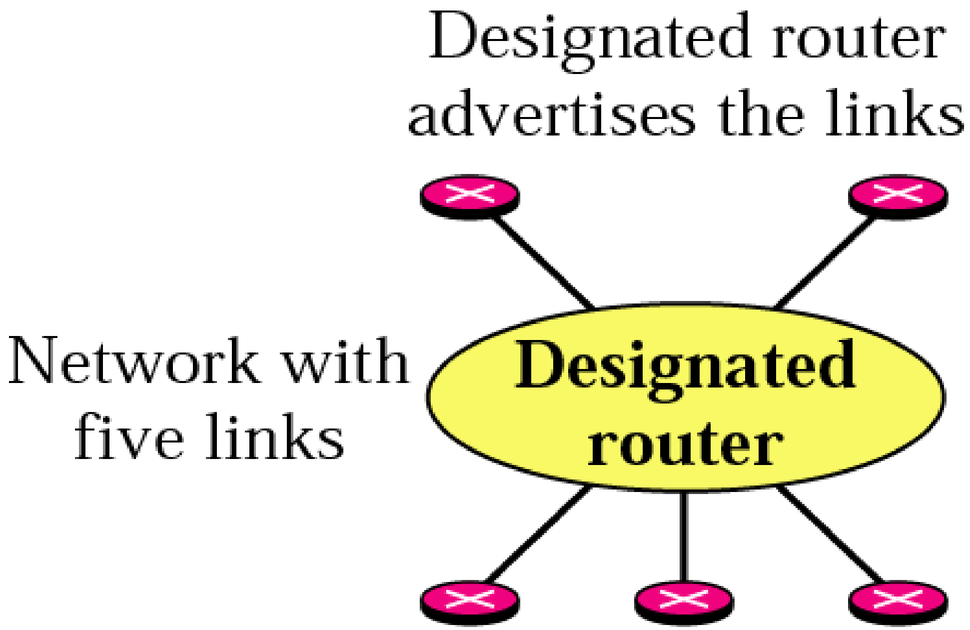


Router link

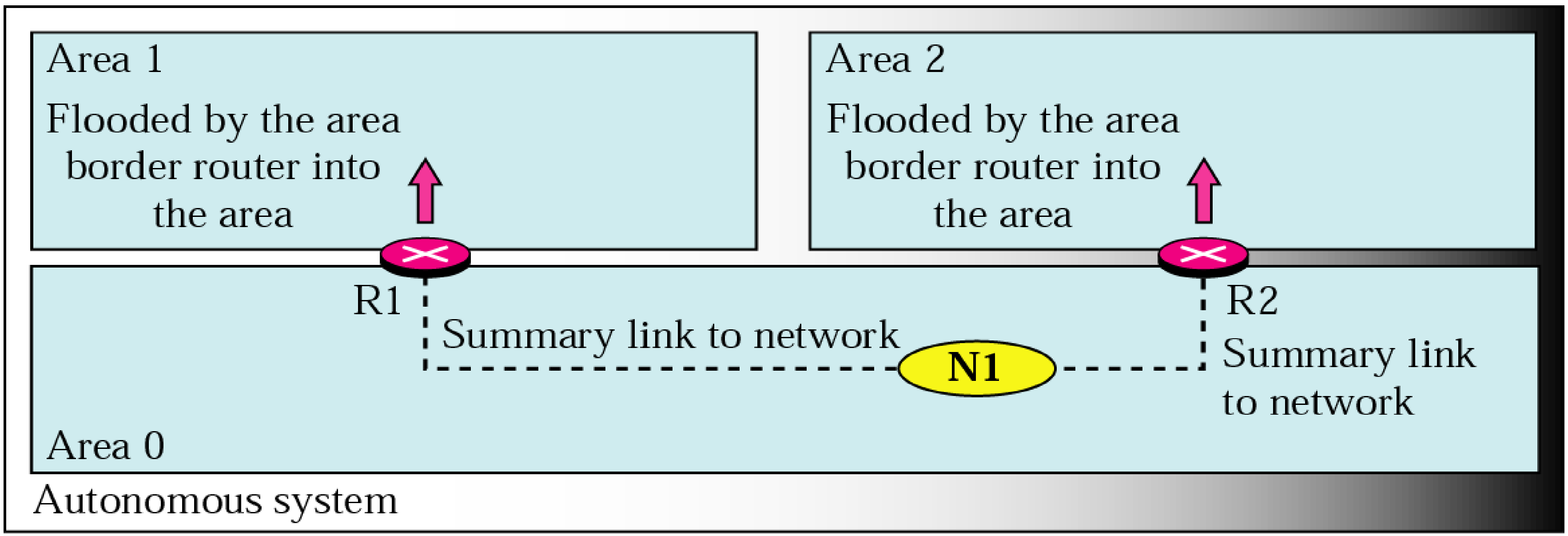


To transient network
Advertising router
with four links
Point-to-point
To stub network
Virtual

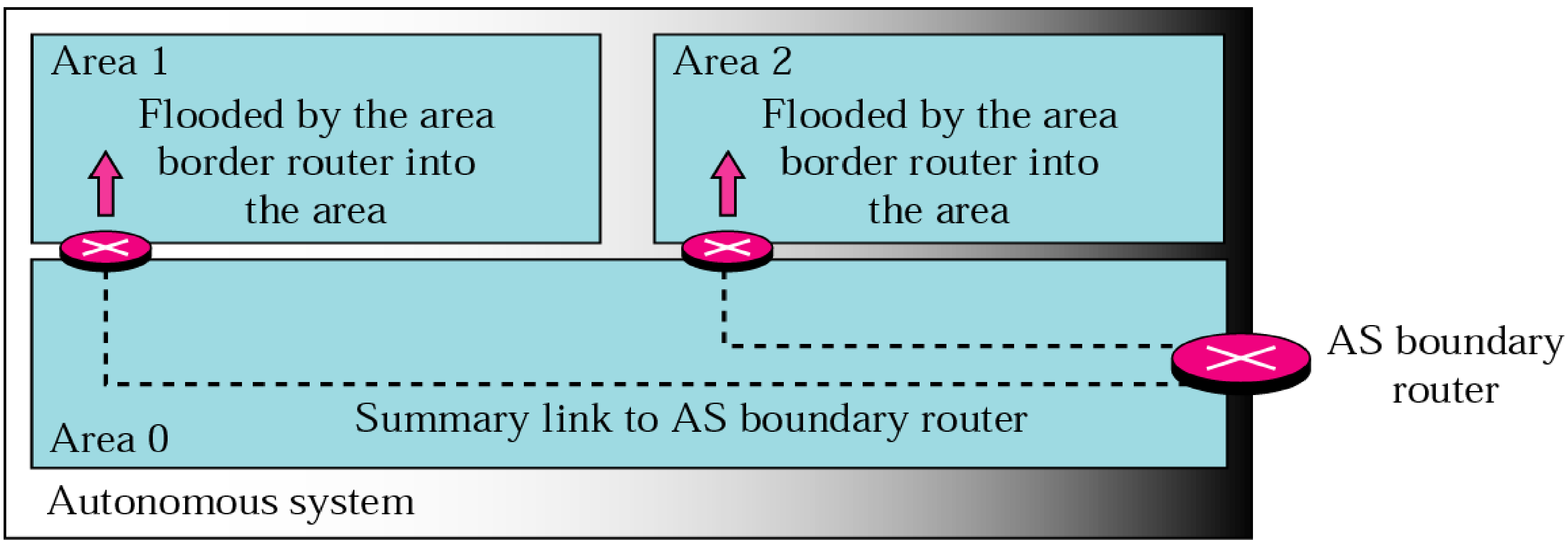
Network link



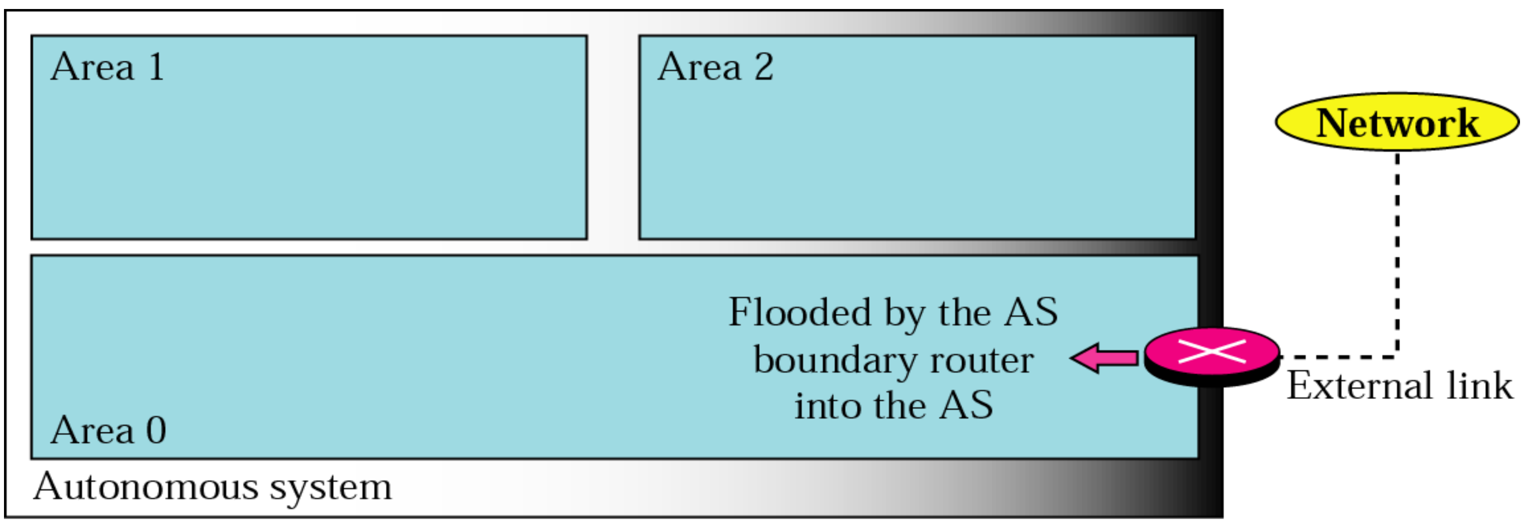
Summary link to network



Summary link to AS boundary router



External link



Link State Database

- Every router in an area receives the router link and network link LSAs from every other router and forms a link state database
- Every router in the same area has the same link state database
- Link state database – tabular representation of the topology of the internet inside an area – shows relationship between each router and its neighbours including the metrics

Note:

In OSPF, all routers have the same link state database.

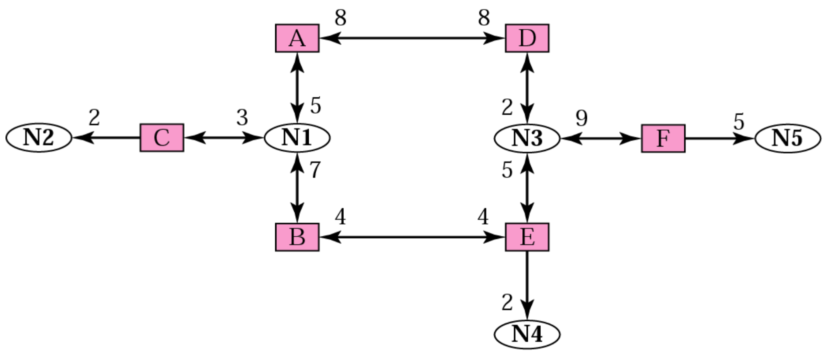
Dijkstra Algorithm

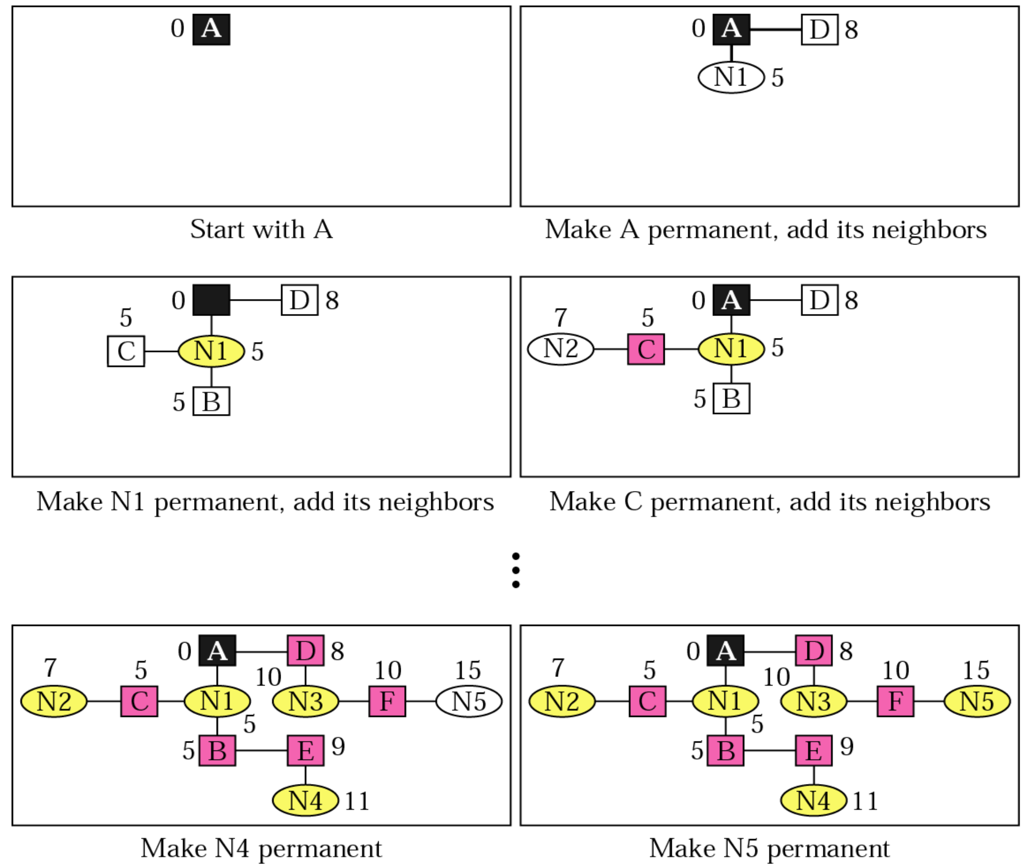
- To calculate routing table each router applies Dijkstra algorithm to its link state database
- Dijkstra algorithm calculates the shortest path between two points on a network using a graph made up of nodes and edges
- Algorithm divides the nodes into two sets: tentative and permanent. It chooses nodes, makes them tentative, examines them and if they pass the criteria, makes them permanent

Dijkstra Algorithm

1. Start with the local node (router): the root of the tree.
2. Assign a cost of 0 to this node and make it the first permanent node.
3. Examine each neighbor node of the node that was the last permanent node.
4. Assign a cumulative cost to each node and make it tentative.
5. Among the list of tentative nodes
    1. Find the node with the smallest cumulative cost and make it permanent.
    2. If a node can be reached from more than one direction
        1. Select the direction with the shortest cumulative cost.
6. Repeat steps 3 to 5 until every node becomes permanent.

Shortest-path calculation





Routing Table

- Each router uses the shortest-path tree method to construct its routing table
- Routing table shows cost of reaching each network in the area
- To find the cost of reaching networks outside of the area, routers use the summary link to network, the summary link to boundary router and the external link advertisements

Link state routing table for router A

Network	Cost	Next Router	Other Information
N1	5	C	
N2	7	D	
N3	10	B	
N4	11	D	
N5	15	C	