Al-Mustaqbal Univerity

College of Science

Intelligent Medical Systems Departement

Computer Networks - 3rd Class

جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

Lecture 6 and 7:
TCP/IP Protocol Suite, Addressing

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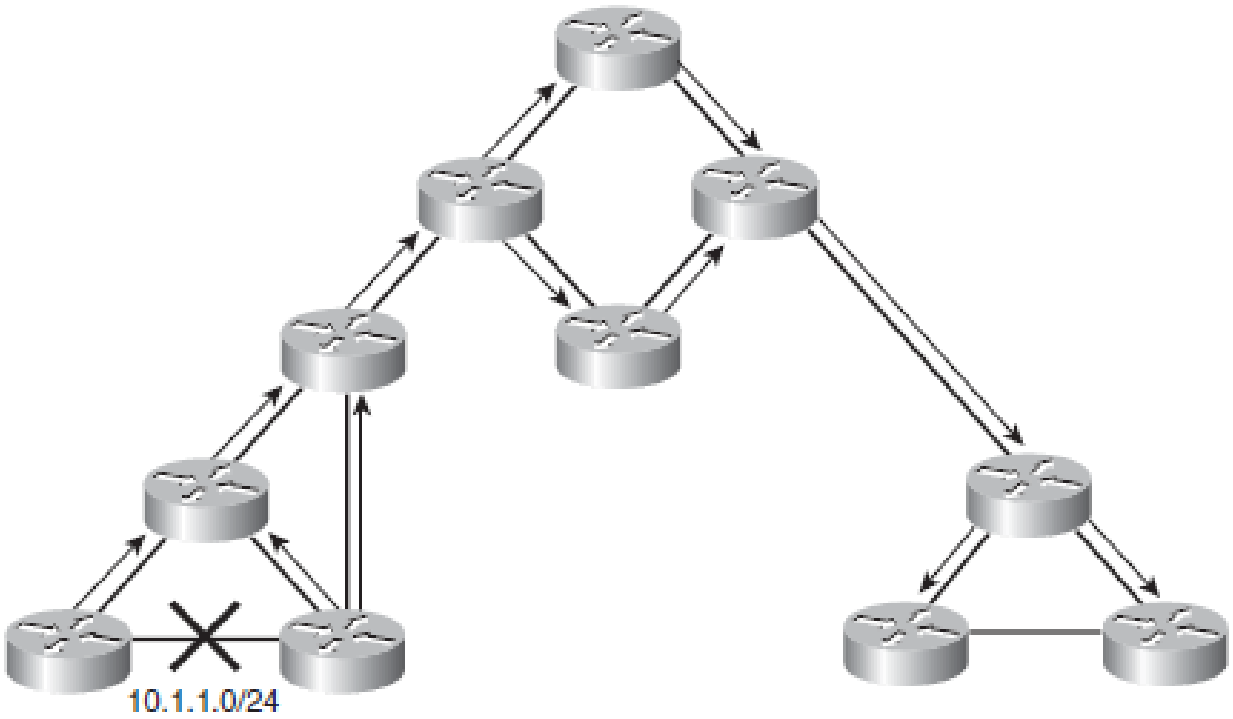
Impact of Poorly Designed IP Addressing

A poorly designed IP addressing scheme usually results in IP addresses that are randomly assigned on an as-needed basis. In this case, the IP addresses are most likely dispersed through the network with no thought as to whether they can be grouped or summarized. A poor design provides no opportunity for dividing the network into contiguous address areas, and therefore no means of implementing route summarization.

The next figure is a sample network with poorly designed IP addressing; it uses a dynamic routing protocol. Suppose that a link in the network is flapping (changing its state from UP to DOWN, and vice versa) ten times per minute. Because dynamic routing is used, the routers that detect the change send routing updates to their neighbors, those neighbors send it to their neighbors, and so on. Because aggregation is not possible, the routing update is propagated throughout the entire network, even if there is no need for a distant router to have detailed knowledge of that link.

Impact of Poorly Designed IP Addressing

A Poorly Designed IP Addressing Scheme Results in Excess Routing Traffic



Impact of Poorly Designed IP Addressing

Impacts of poorly designed IP addressing include the following:

- **Excess routing traffic consumes bandwidth**: When any route changes, routers send routing updates. Without summarization, more updates are sent, and the routing traffic consumes more bandwidth.

- **Increased routing table recalculation**: Routing updates require routing table recalculation, which affects the router's performance and ability to forward traffic.

- **Possibility of routing loops**: When too many routing changes prevent routers from converging with their neighbors, routing loops might occur, which might have global consequences for an organization.

Benefits of Route Aggregation

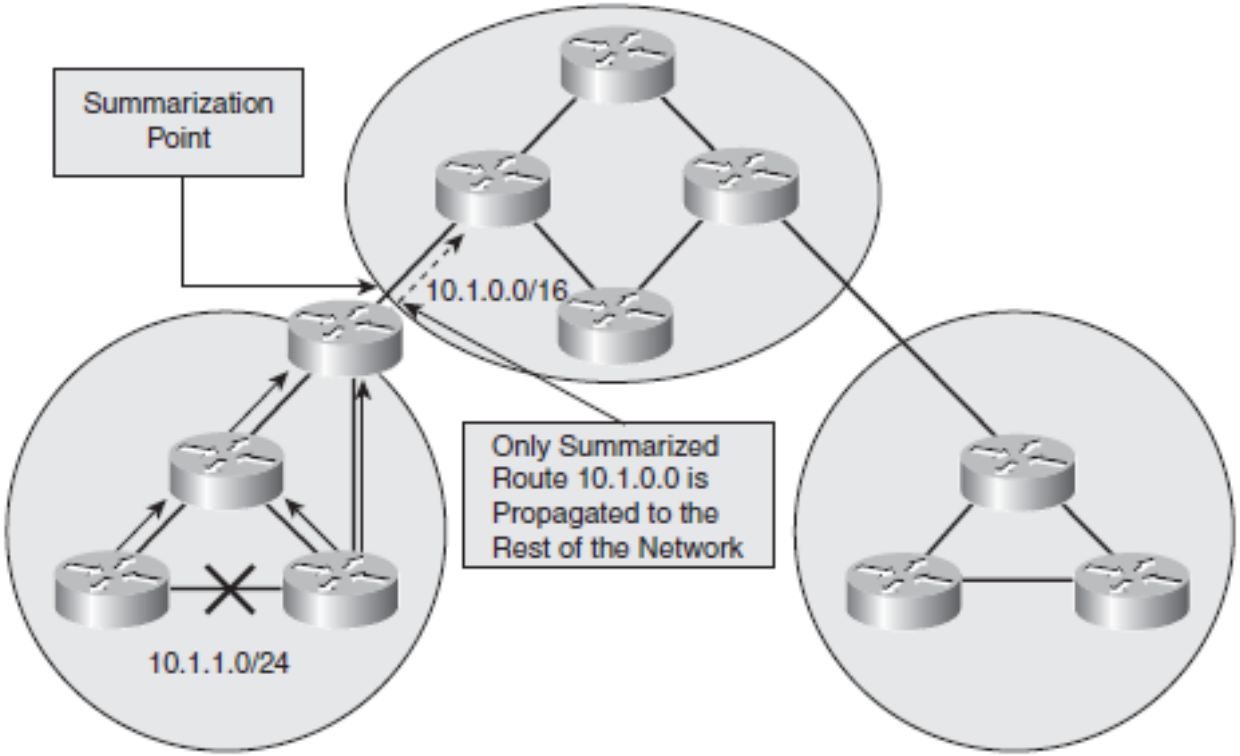
Implementing route aggregation on border routers between contiguously addressed areas controls routing table size.

The following figure shows an example of implementing route summarization (aggregation) on the area borders in a sample network. If a link within an area fails, routing updates are not propagated to the rest of the network, because only the summarized route is sent to the rest of the network, and it has not changed; the route information about the failed link stays within the area. This reduces bandwidth consumption related to routing overhead and relieves routers from unnecessary routing table recalculation.

Efficient aggregation of routing advertisements narrows the scope of routing update propagation and significantly decreases the cumulative frequency of routing updates.

Benefits of Route Aggregation

- *A Hierarchical IP Addressing Plan Results in Reduced Routing Traffic*



Fixed- and Variable-Length Subnet Masks

*Another consideration when designing the IP addressing hierarchy is the subnet mask to use either the same mask for the entire major network or different masks for different parts of the major network.

*Some routing protocols require FLSM; others allow VLSM.

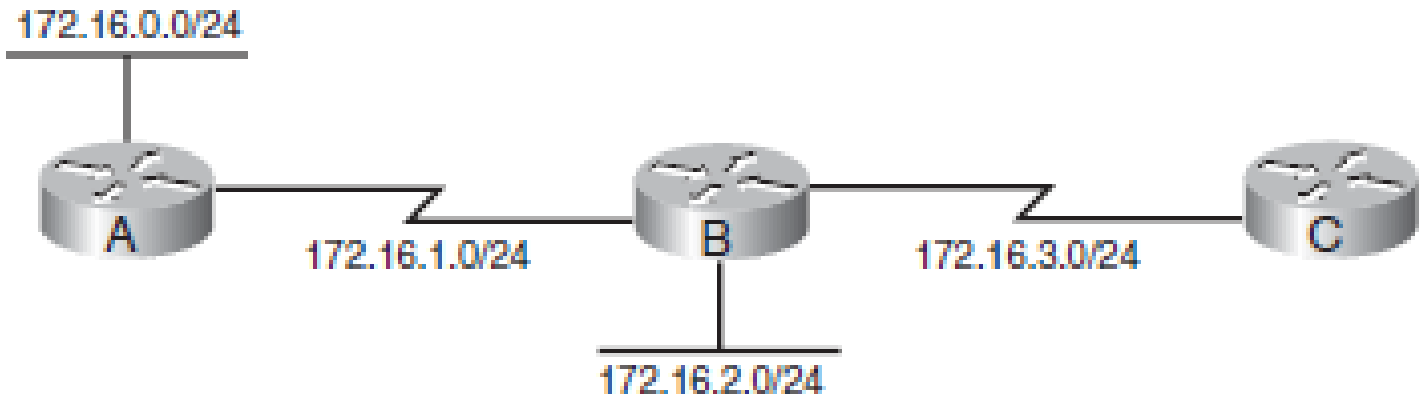
**A major network is a Class A, B, or C network.

**Fixed-Length Subnet Masking (FLSM) is when all subnet masks in a major network must be the same.

**Variable-Length Subnet Masking (VLSM) is when subnet masks within a major network can be different. In modern networks, VLSM should be used to conserve the IP addresses.

FLSM

FLSM requires that all subnets of a major network have the same subnet mask, which therefore results in less efficient address space allocation. For example, in the network shown in the following figure, network 172.16.0.0/16 is subnetted using FLSM. Each subnet is given a /24 mask. The network is composed of multiple LANs that are connected by point-to-point WAN links. Because FLSM is used, all subnets have the same subnet mask. This is inefficient, because even though only two addresses are needed on the point-to-point links, a /24 subnet mask with 254 available host addresses is used.

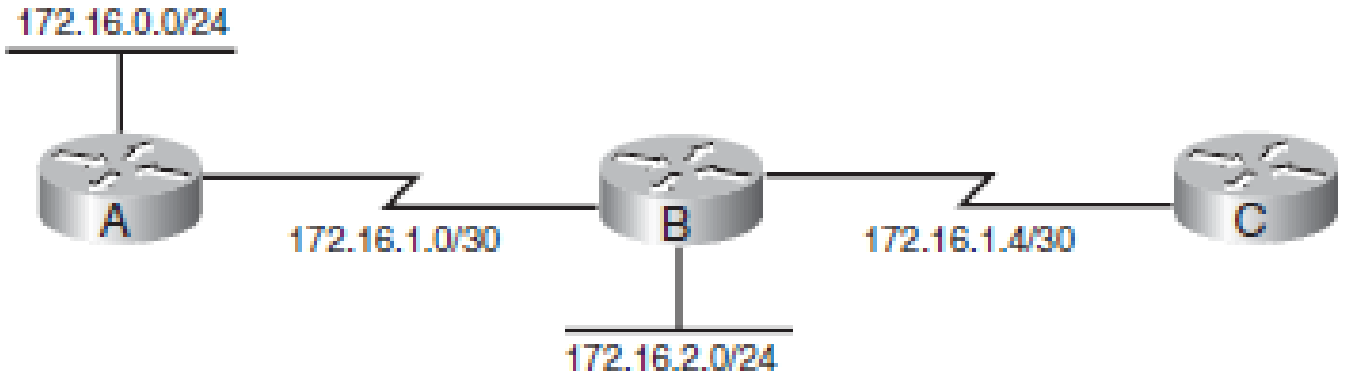


VLSM

VLSM makes it possible to subnet with different subnet masks and therefore results in more efficient address space allocation. VLSM also provides a greater capability to perform route summarization, because it allows more hierarchical levels within an addressing plan. VLSM requires prefix length information to be explicitly sent with each address advertised in a routing update.

VLSM

For example, in the network shown in the following figure, network 172.16.0.0/16 is subnetted using VLSM. The network is composed of multiple LANs that are connected by point-to-point WAN links. The point-to-point links have a subnet mask of /30, providing only two available host addresses, which is all that is needed on these links. The LANs have a subnet mask of /24 because they have more hosts that require addresses.



Routing Protocol Considerations

To use VLSM, the routing protocol in use must be classless.

Classful routing protocols permit only FLSM.

Classful Routing Protocols

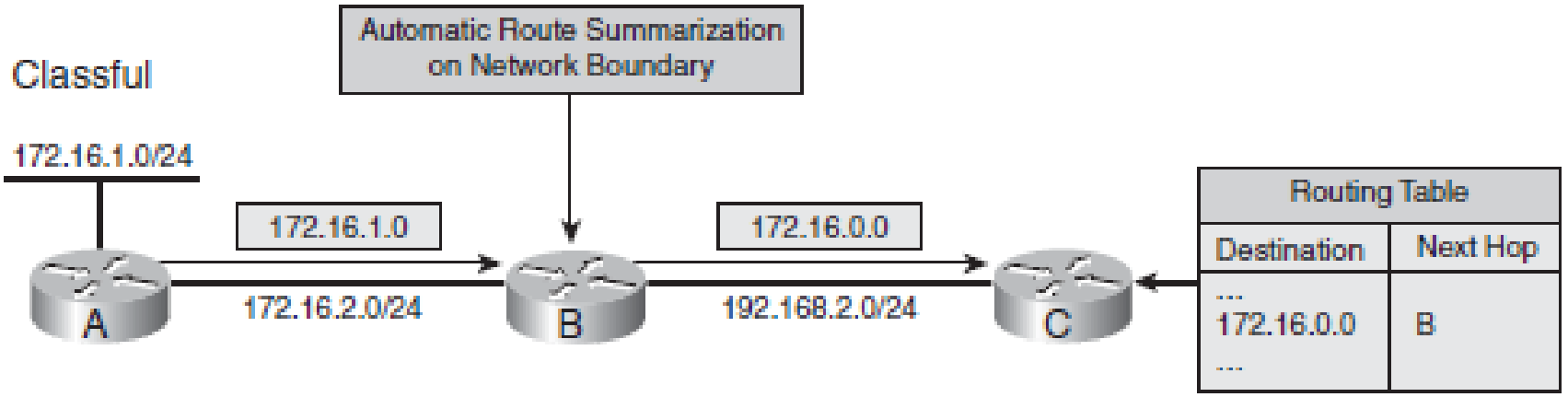
The following rules apply when classful routing protocols are used:

- The routing updates do not include subnet masks.
- When a routing update is received and the routing information is about one of the following:

— Routes within the same major network as configured on the receiving interface, the subnet mask configured on the receiving interface is assumed to apply to the received routes also. Therefore, the mask must be the same for all subnets of a major network. In other words, subnetting must be done with FLSM.

— Routes in a different major network than configured on the receiving interface, the default major network mask is assumed to apply to the received routes. Therefore, automatic route summarization is performed across major network (Class A, B, or C) boundaries, and subnetted networks must be contiguous.

Classful Routing Protocols



Classful Routing Protocols

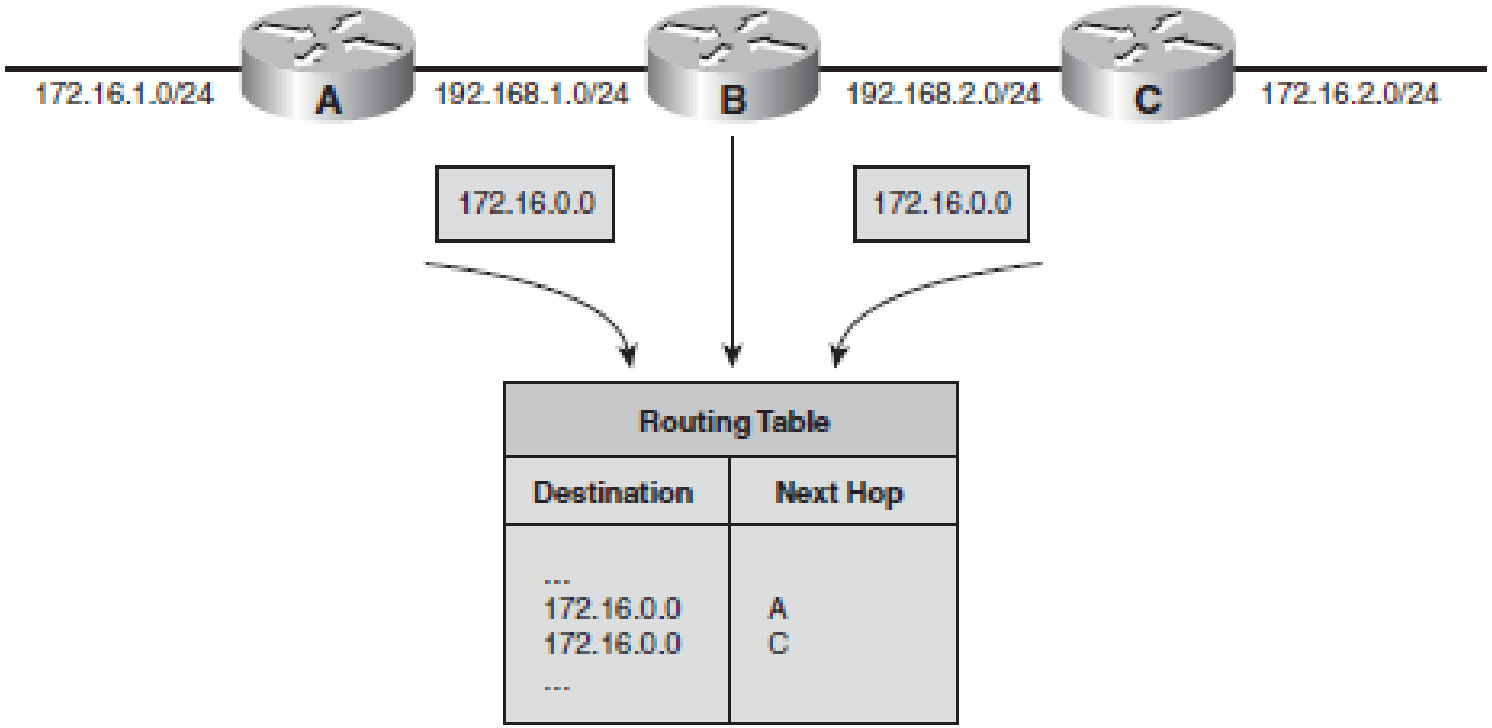
The following figure illustrates a sample network with a discontiguous 172.16.0.0 network that runs a classful routing protocol. Routers A and C automatically summarize across the major network boundary, so both send routing information about 172.16.0.0 rather than the individual subnets (172.16.1.0/24 and 172.16.2.0/24).

Consequently, Router B receives two entries for the major network 172.16.0.0, and it puts both entries into its routing table. Router B therefore might make incorrect routing decisions.

Because of these constraints, classful routing is not often used in modern networks. Routing Information Protocol (RIP) version 1 (RIPv1) is an example of a classful routing protocol.

Classful Routing Protocols

Classful Routing Protocols Do Not Send the Subnet Mask in the Routing Update



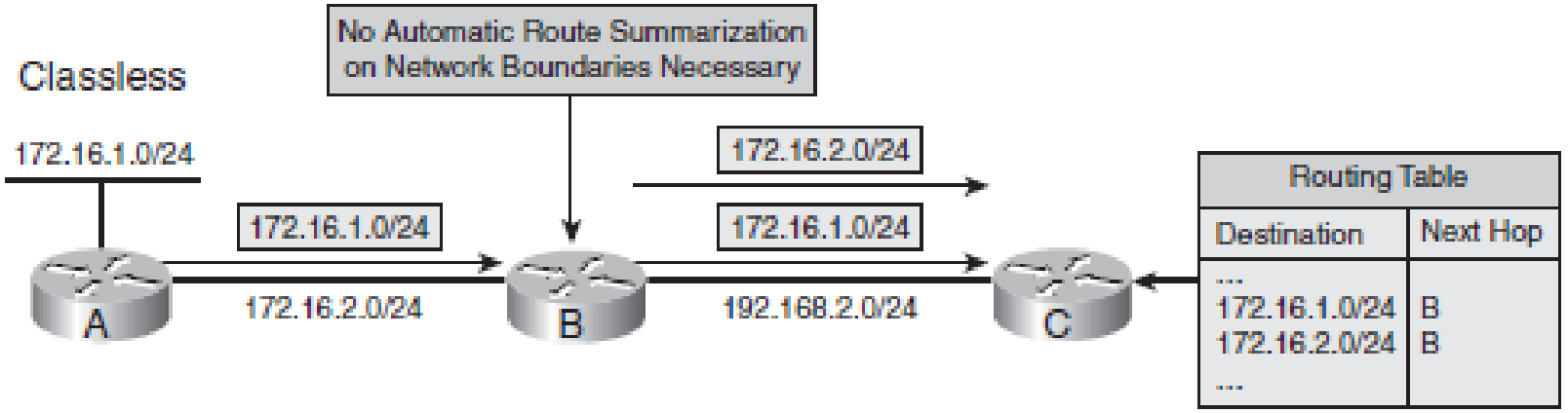
Classless Routing Protocols

The following rules apply when classless routing protocols are used:

- The routing updates include subnet masks.
- VLSM is supported.
- Automatic route summarization at the major network boundary is not required, and route summarization can be manually configured.
- Subnetted networks can be discontiguous.

Consequently, all modern networks should use classless routing. Examples of classless routing protocols include RIP version 2 (RIPv2), Enhanced Interior Gateway Routing Protocol (EIGRP), and Border Gateway Protocol (BGP).

Classless Routing Protocols



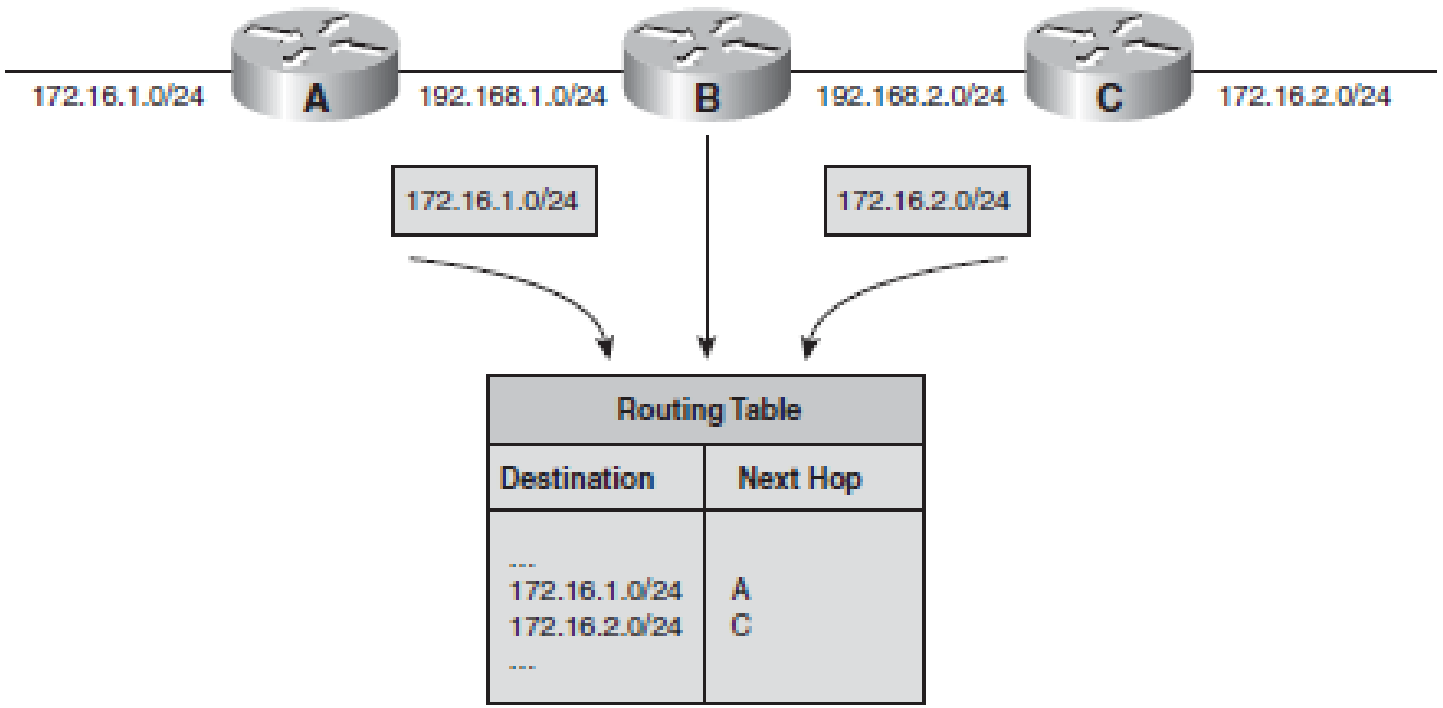
Classless Routing Protocols

The following figure illustrates how discontiguous networks are handled by a classless routing protocol.

Within this network, the classless routing protocol is running that does not automatically summarize at the network boundary. In this example, Router B learns about both subnetworks 172.16.1.0/24 and 172.16.2.0/24, one from each interface; routing is performed correctly.

Classless Routing Protocols

Classless Routing Protocols Send the Subnet Mask in the Routing Update



Assessment

1- With classful routing, routing updates _ _ _ _ carry the subnet mask.

2- With classless routing, routing updates _ _ _ _carry the subnet mask.

A- Do

B- Do not

Thank you