Chapter 15

Multicasting and Multicast Routing Protocols

Objectives

Upon completion you will be able to:

- *Differentiate between a unicast, multicast, and broadcast message*
- *Know the many applications of multicasting*
- *Understand multicast link state routing and MOSPF*
- *Understand multicast link state routing and DVMRP*
- *Understand the Core-Based Tree Protocol*
- *Understand the Protocol Independent Multicast Protocols*
- *Understand the MBONE concept*

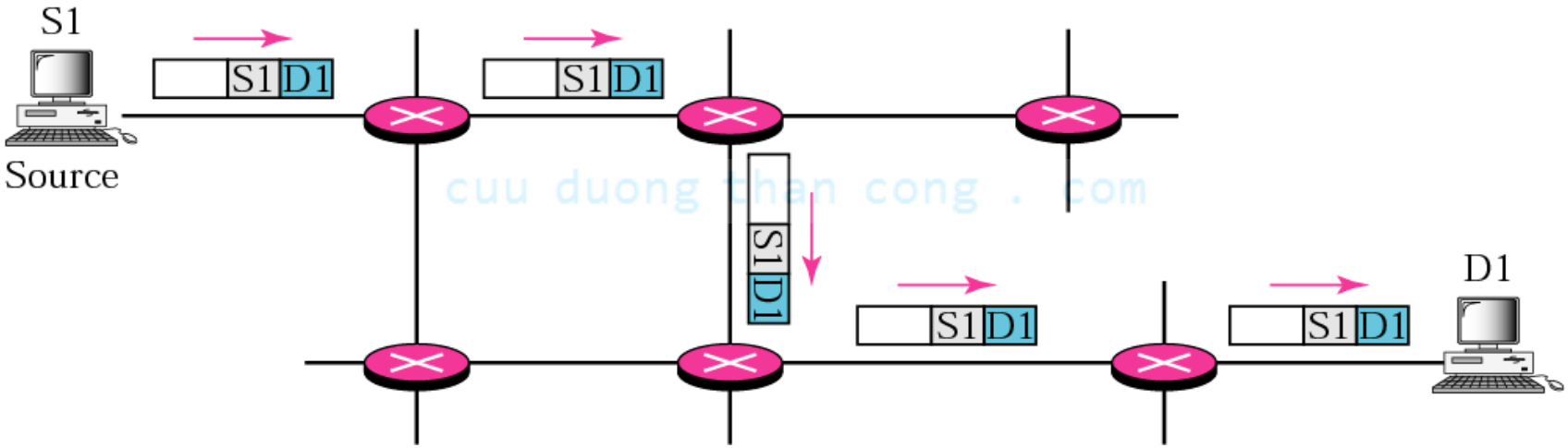
15.1 UNICAST, MULTICAST, AND BROADCAST

A message can be unicast, multicast, or broadcast. Let us clarify these terms as they relate to the Internet.

The topics discussed in this section include:

Unicasting
Multicasting
Broadcasting
Multicasting versus Multiple Unicasting

Figure 15.1 *Unicasting*

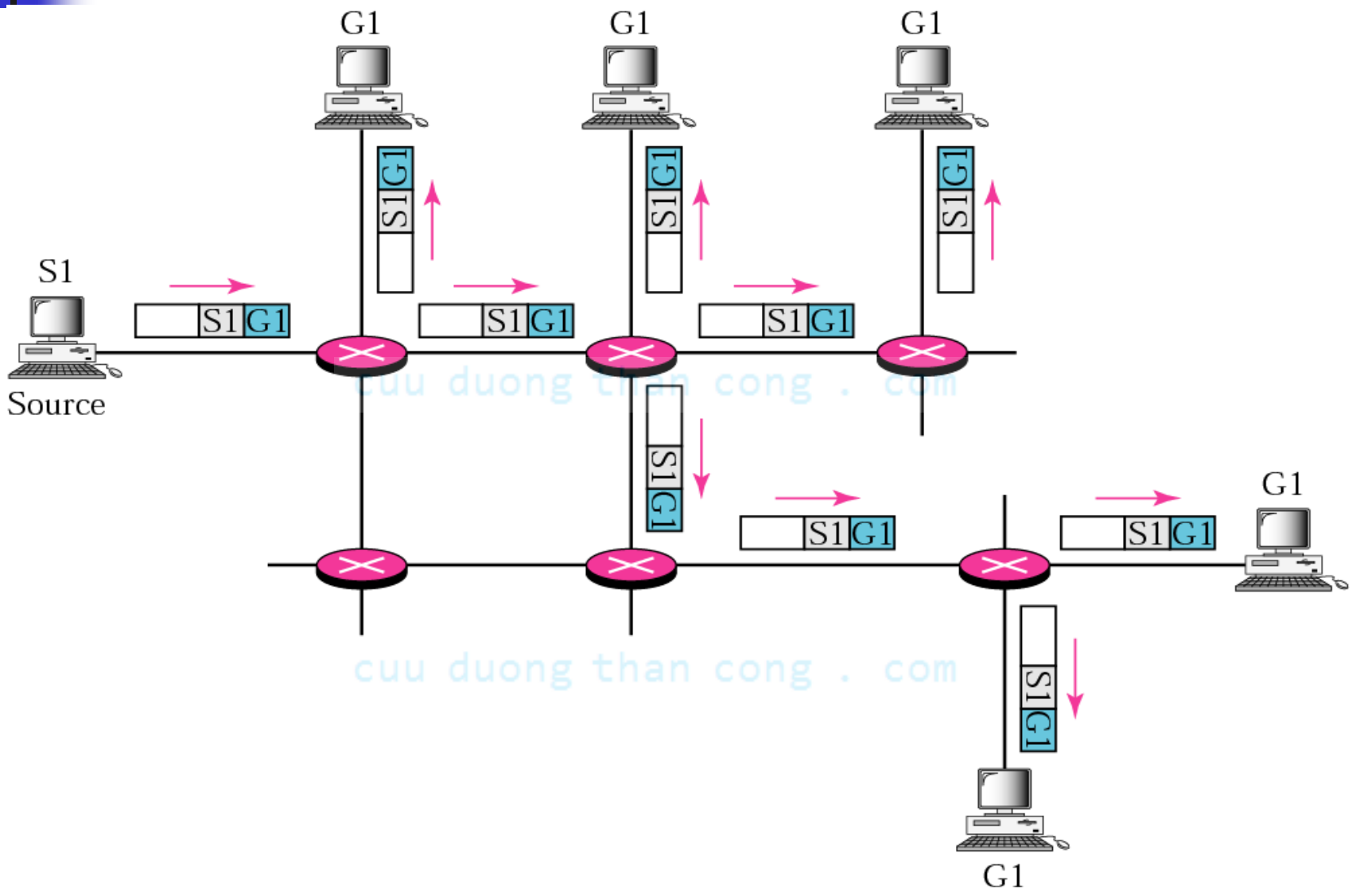


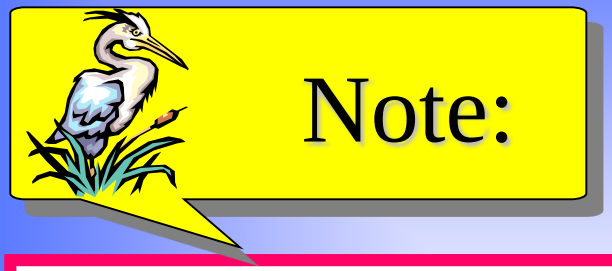
cuu duong than cong . com

Note:

In unicasting, the router forwards the received packet through only one of its interfaces.

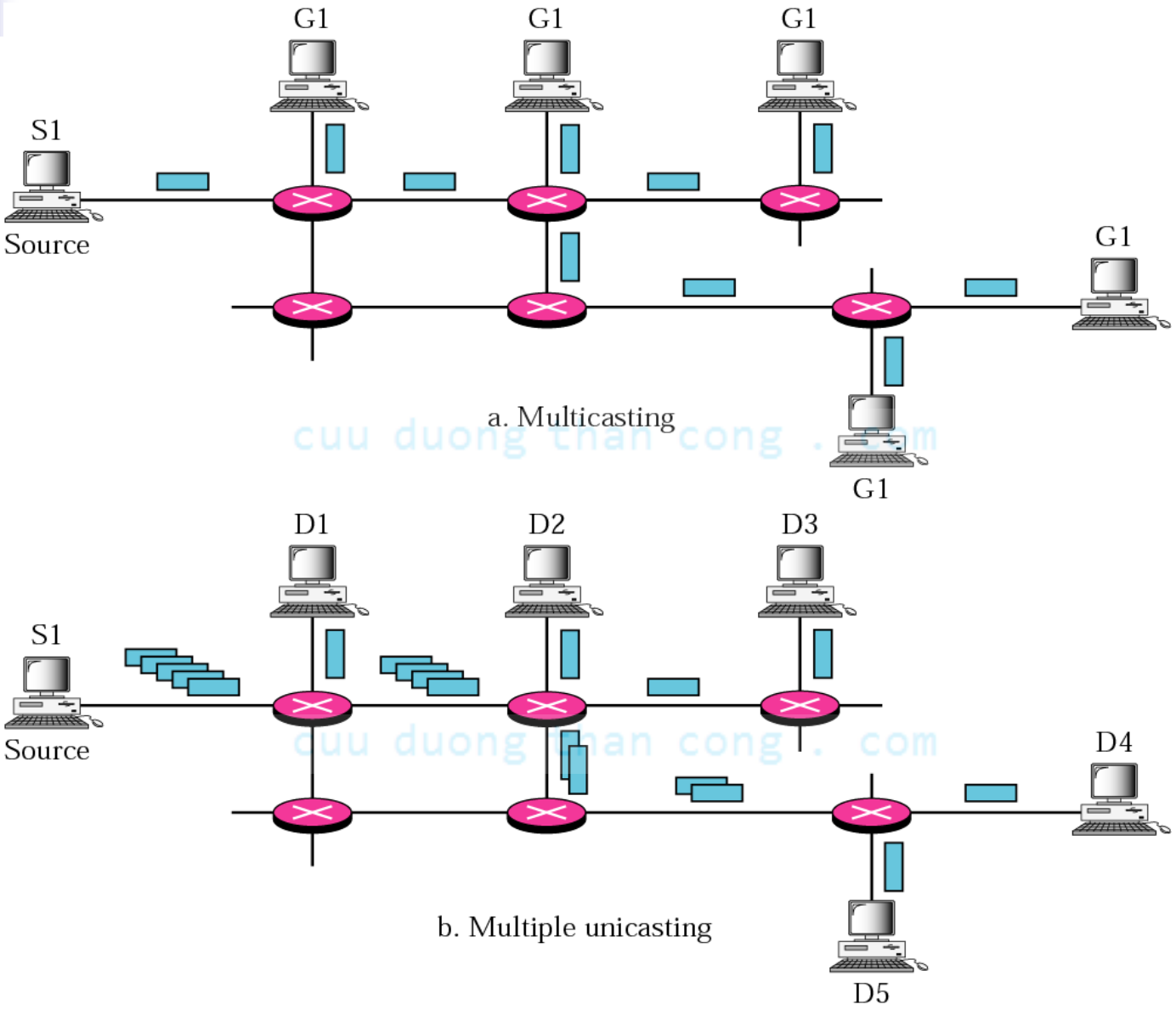
Figure 15.2 *Multicasting*





In multicasting, the router may forward the received packet through several of its interfaces.

Figure 15.3 *Multicasting versus multiple unicasting*



Note:

Emulation of multicasting through multiple unicasting is not efficient and may create long delays, particularly with a large group.

15.2 MULTICAST APPLICATIONS

Multicasting has many applications today such as access to distributed databases, information dissemination, teleconferencing, and distance learning.

The topics discussed in this section include:

Access to Distributed Databases
Information Dissemination
Dissemination of News
Teleconferencing
Distance Learning

15.3 MULTICAST ROUTING

In this section, we first discuss the idea of optimal routing, common in all multicast protocols. We then give an overview of multicast routing protocols.

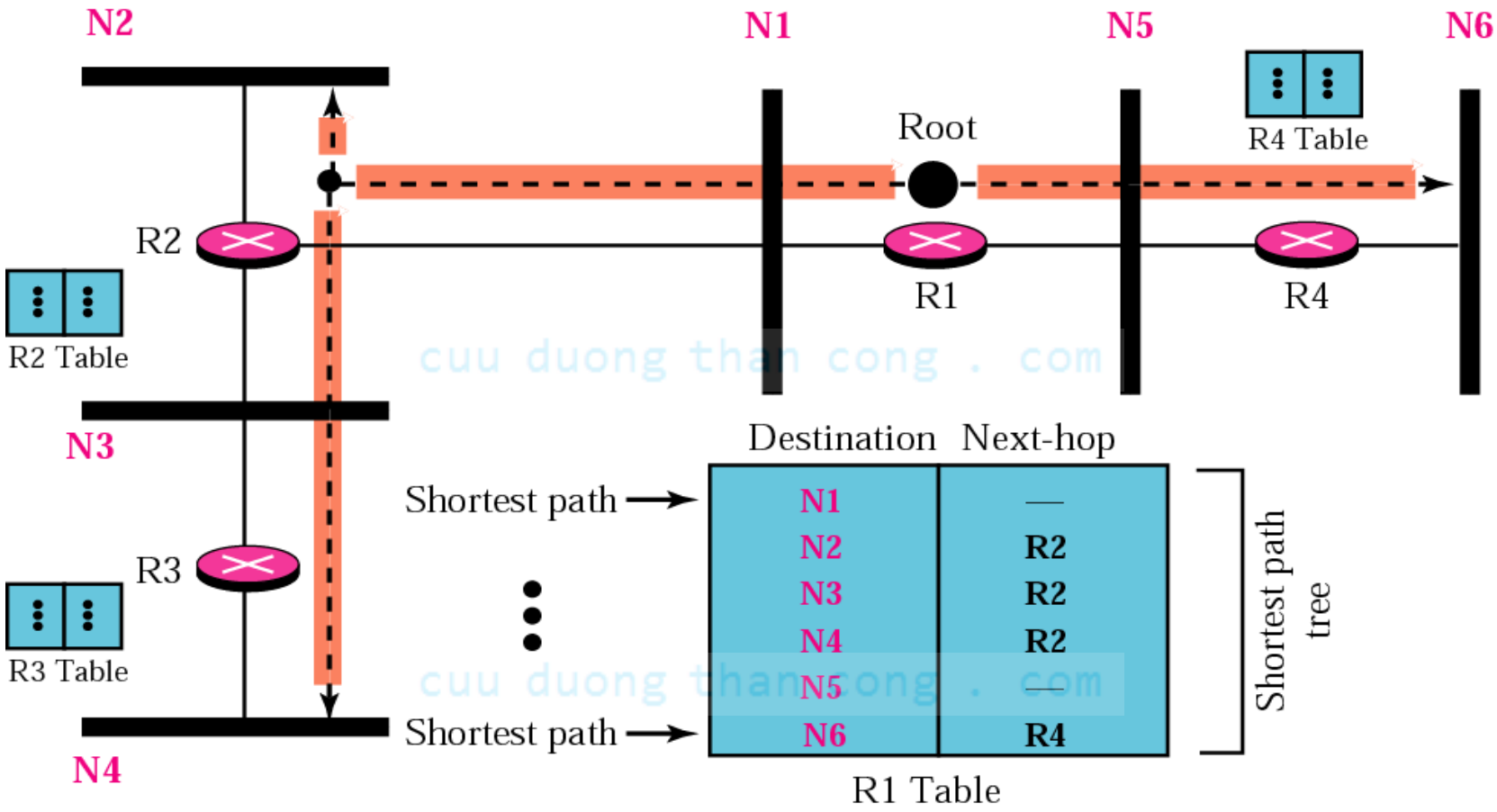
The topics discussed in this section include:

Optimal Routing: Shortest Path Trees
Routing Protocols

Note:

In unicast routing, each router in the domain has a table that defines a shortest path tree to possible destinations.

Figure 15.4 *Shortest path tree in unicast routing*



Note:

In multicast routing, each involved router needs to construct a shortest path tree for each group.

Note:

In the source-based tree approach, each router needs to have one shortest path tree for each group.

Figure 15.5 *Source-based tree approach*

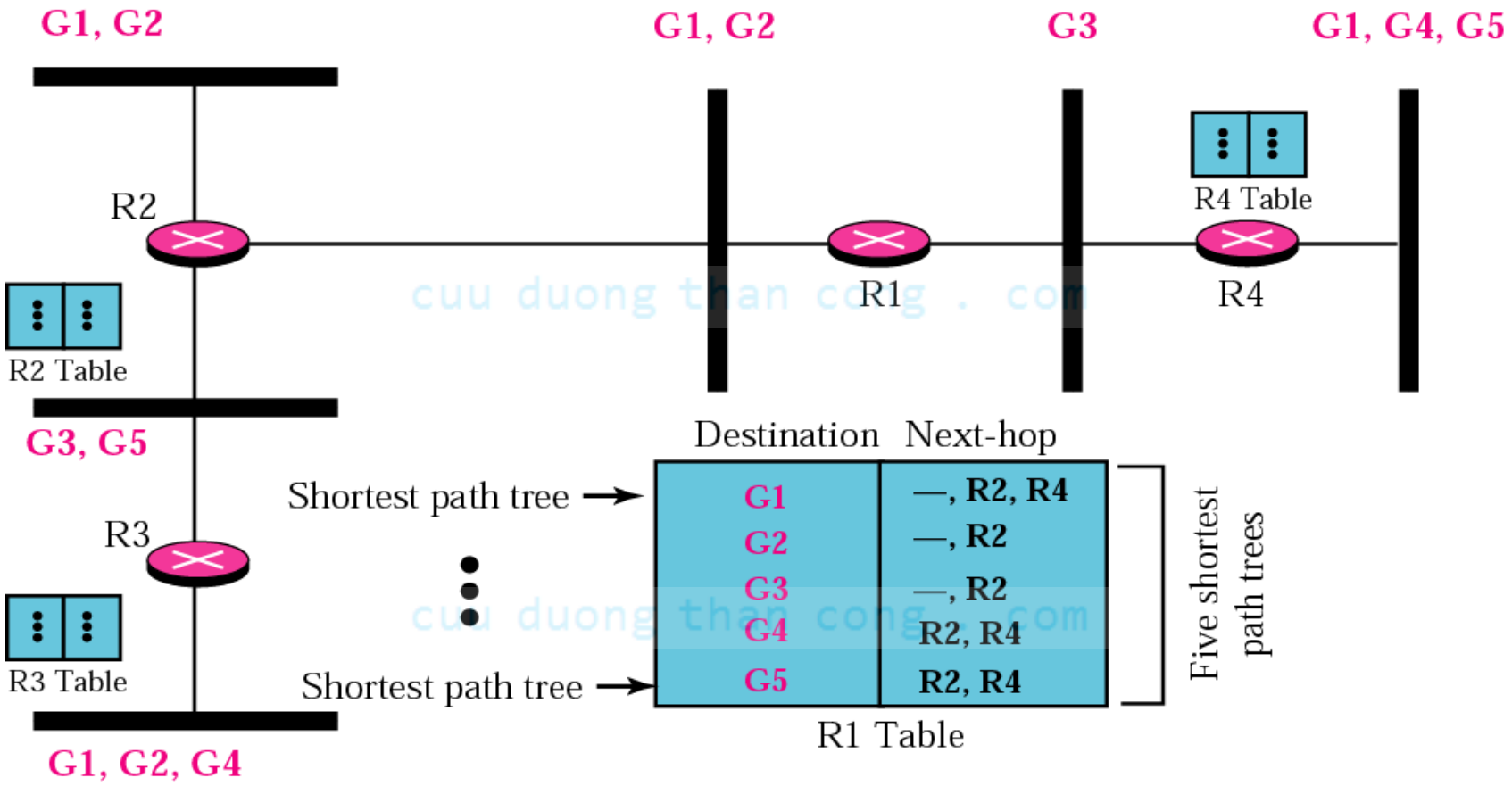
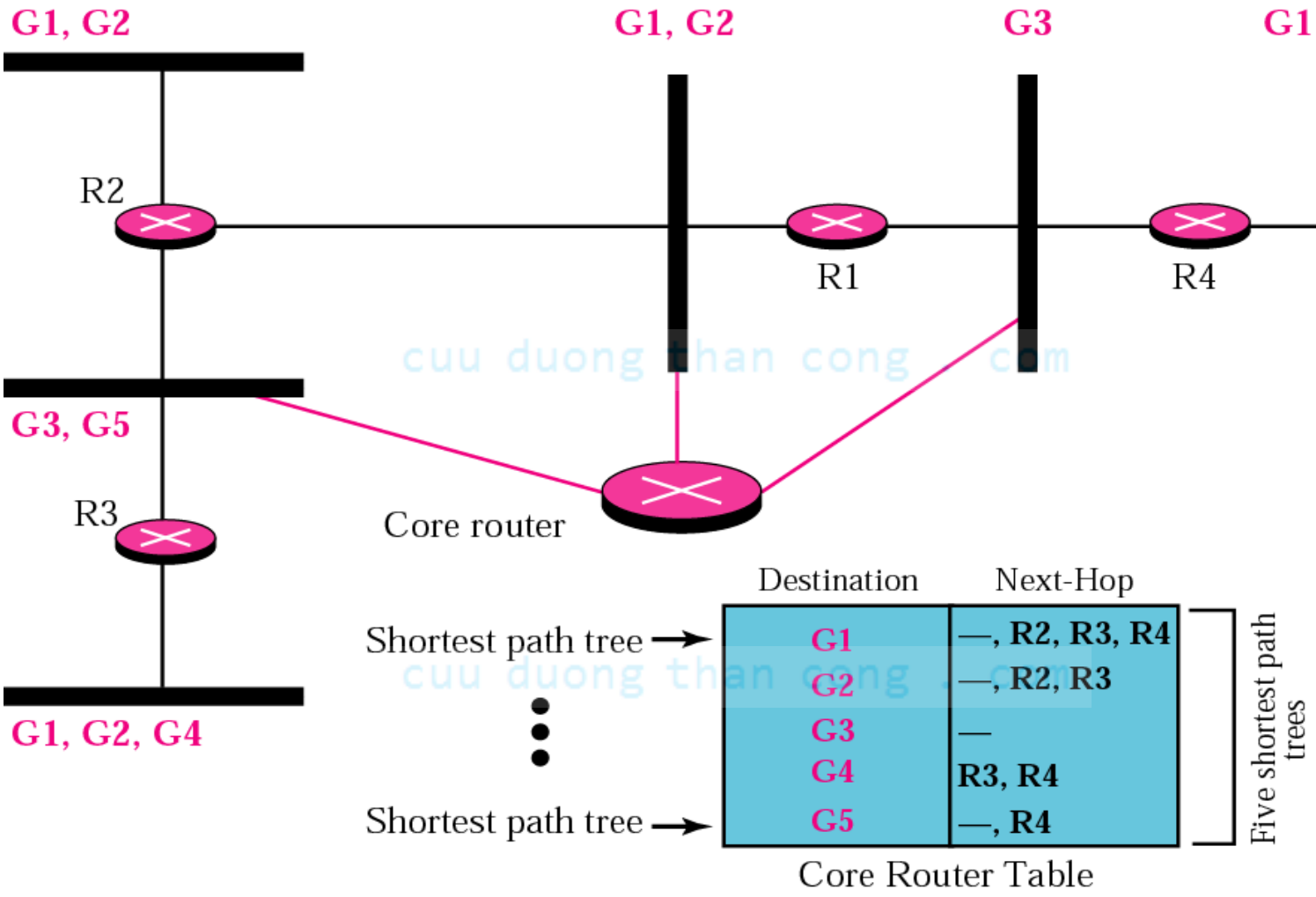


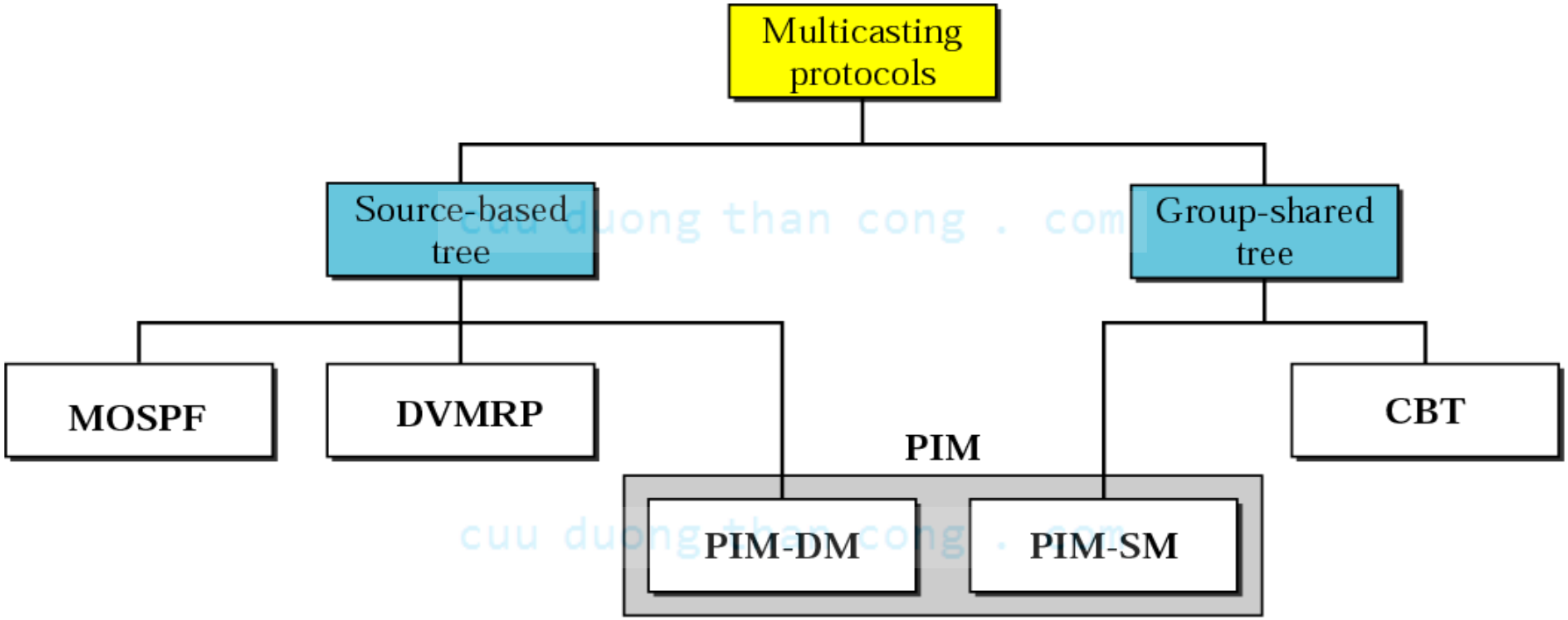
Figure 15.6 *Group-shared tree approach*



Note:

In the group-shared tree approach, only the core router, which has a shortest path tree for each group, is involved in multicasting.

Figure 15.7 *Taxonomy of common multicast protocols*

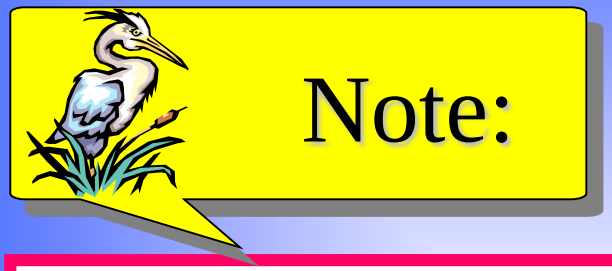


15.4 MULTICAST LINK STATE ROUTING: MOSPF

In this section, we briefly discuss multicast link state routing and its implementation in the Internet, MOSPF.

The topics discussed in this section include:

Multicast Link State Routing
MOSPF



Multicast link state routing uses the source-based tree approach.

15.5 MULTICAST DISTANCE VECTOR: DVMRP

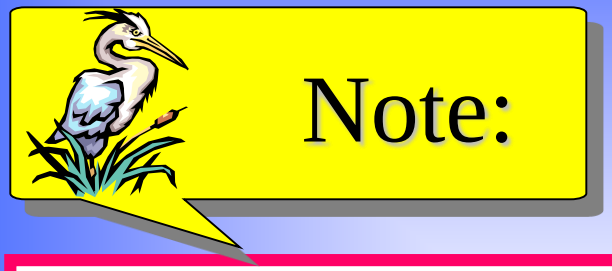
In this section, we briefly discuss multicast distance vector routing and its implementation in the Internet, DVMRP.

The topics discussed in this section include:

Multicast Distance Vector Routing
DVMRP

Note:

Flooding broadcasts packets, but creates loops in the systems.



RPF eliminates the loop in the flooding process.

Figure 15.8 *RPF*

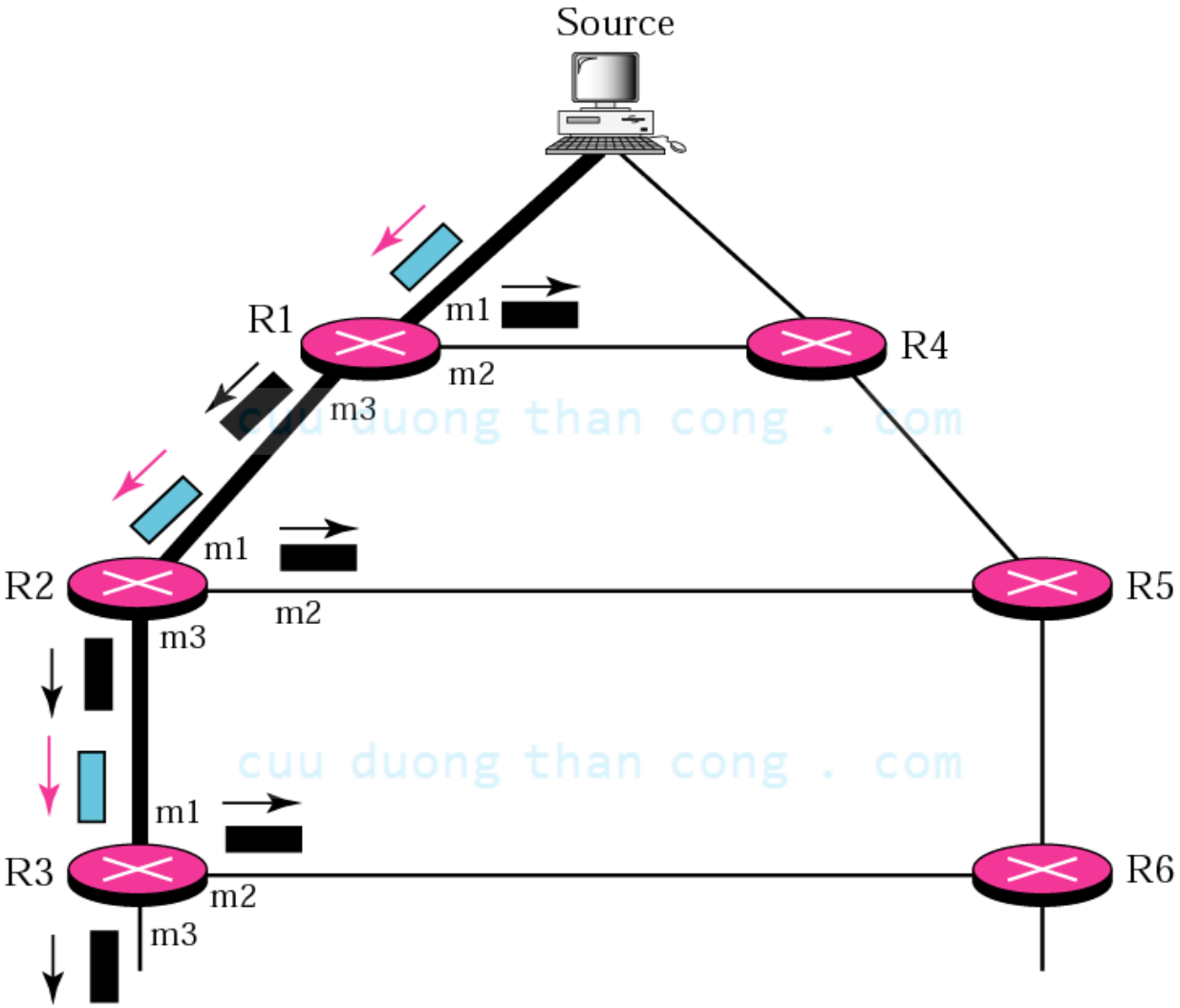


Figure 15.9 *Problem with RPF*

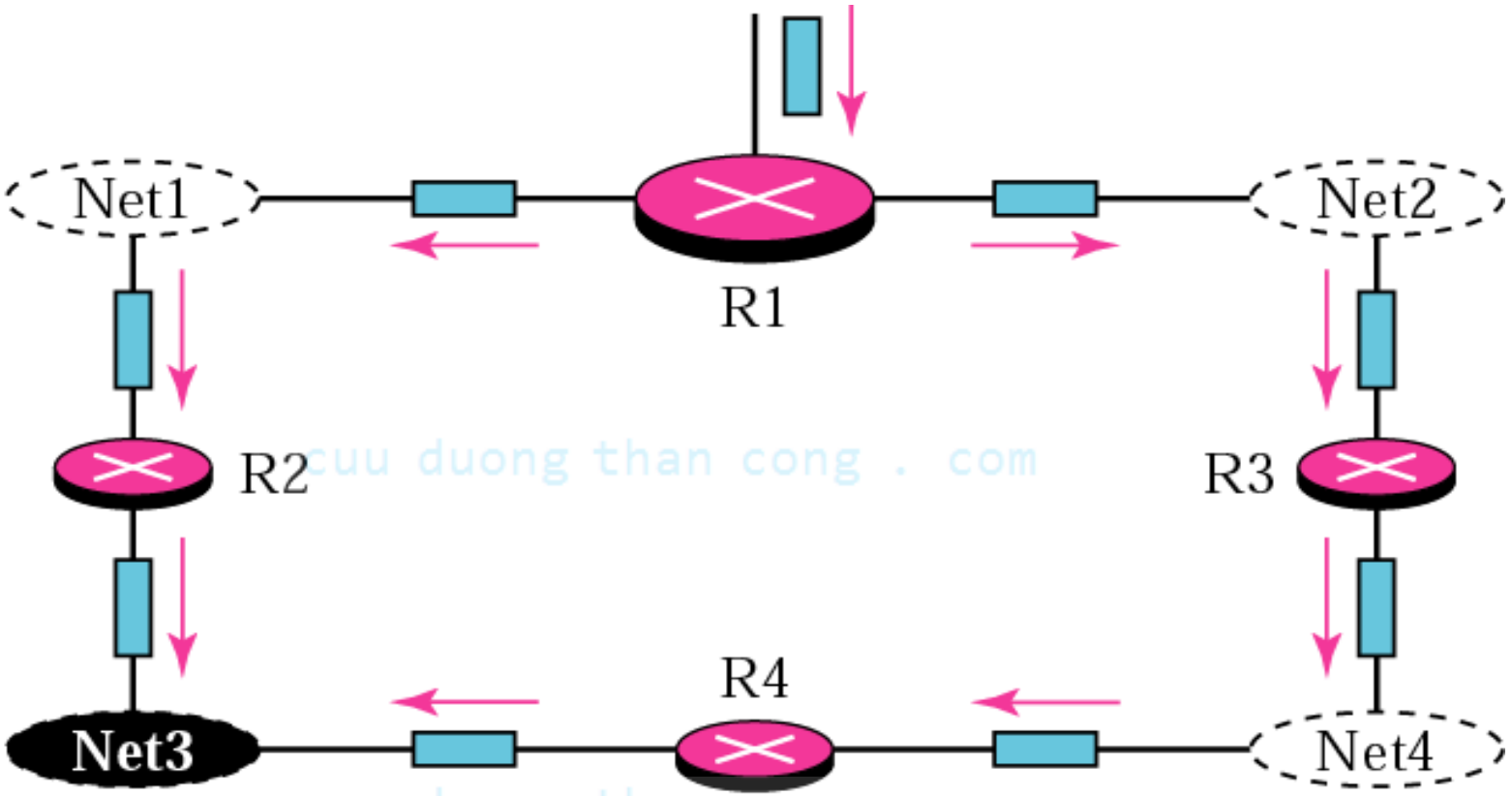
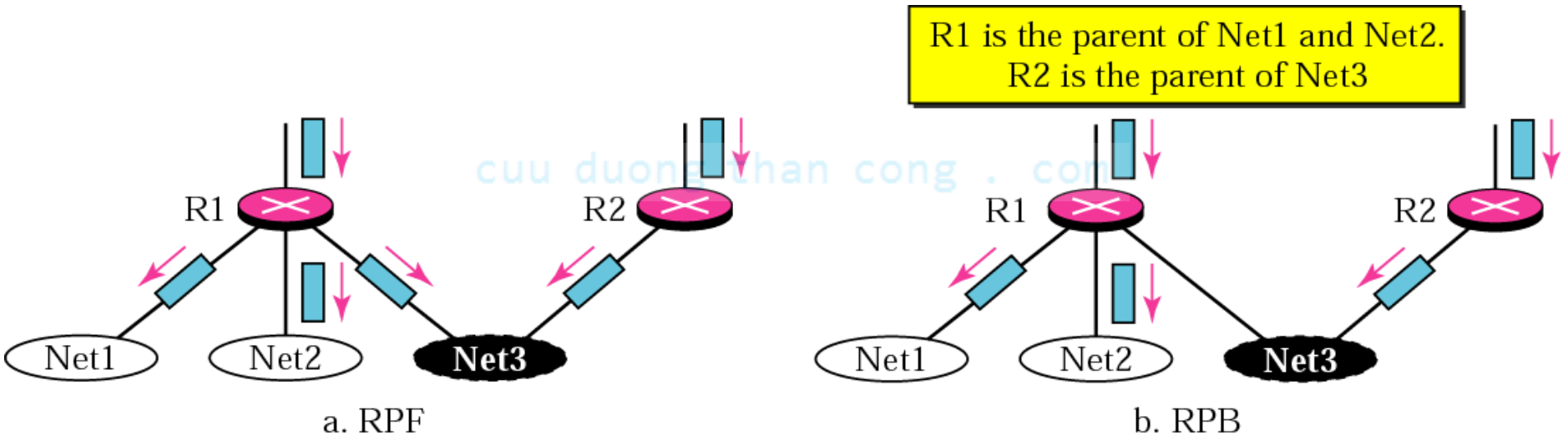


Figure 15.10 *RPF versus RPB*

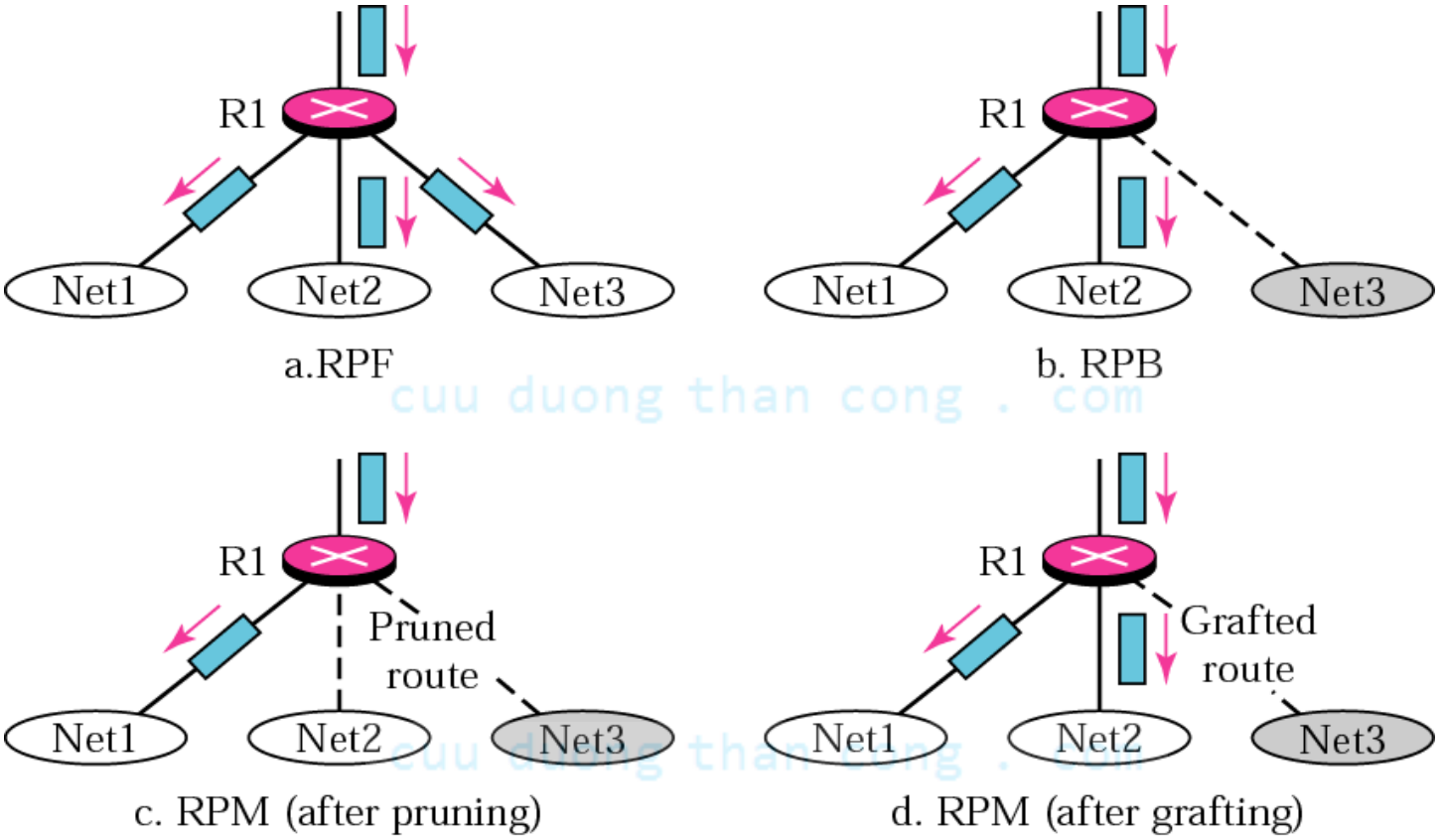


Note:

RPB creates a shortest path broadcast tree from the source to each destination.

It guarantees that each destination receives one and only one copy of the packet.

Figure 15.11 *RPF, RPB, and RPM*



Note:

RPM adds pruning and grafting to RPB to create a multicast shortest path tree that supports dynamic membership changes.

15.6 CBT

The Core-Based Tree (CBT) protocol is a group-shared protocol that uses a core as the root of the tree. The autonomous system is divided into regions and a core (center router or rendezvous router) is chosen for each region.

The topics discussed in this section include:

Formation of the Tree
Sending Multicast Packets
Selecting the Rendezvous Router

Figure 15.12 *Group-shared tree with rendezvous router*

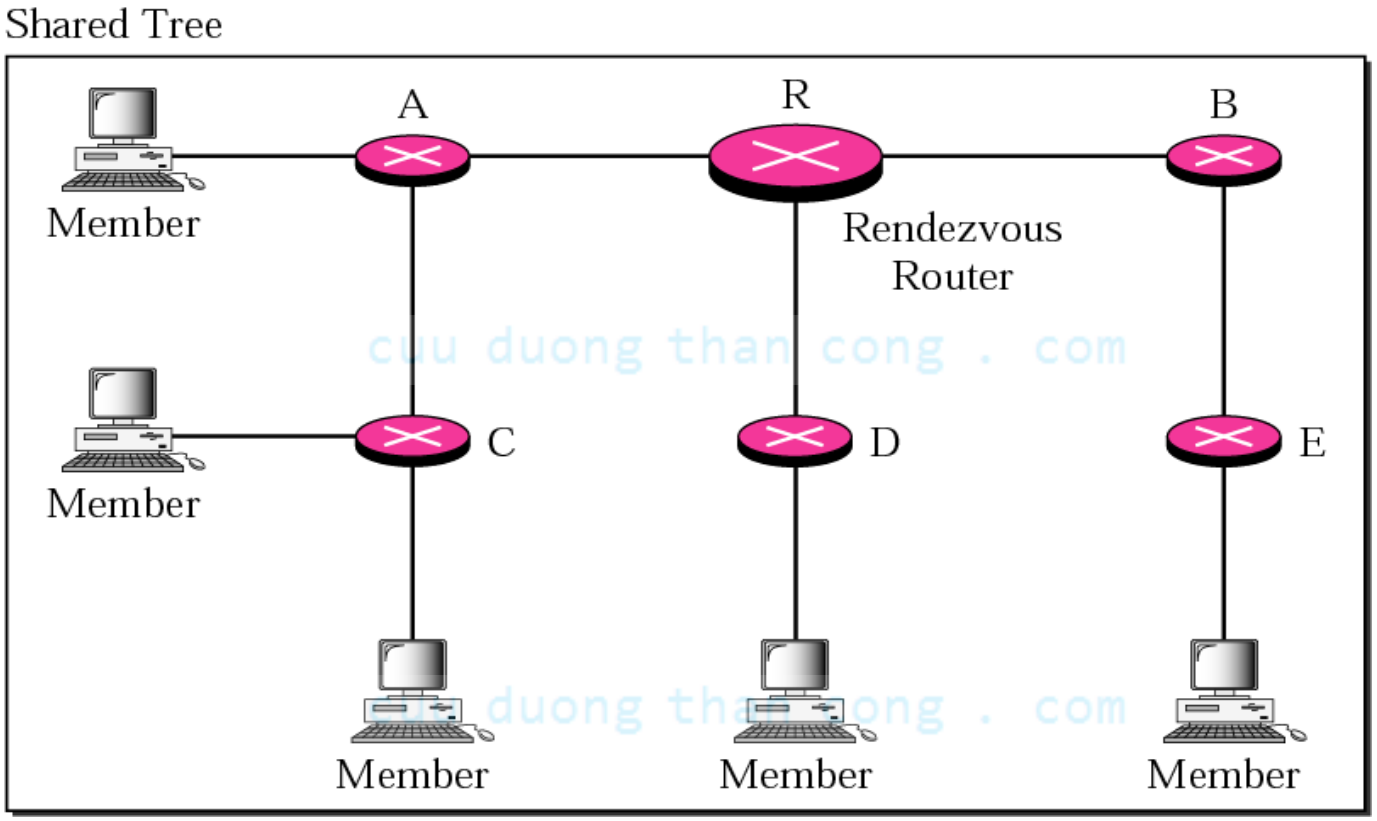
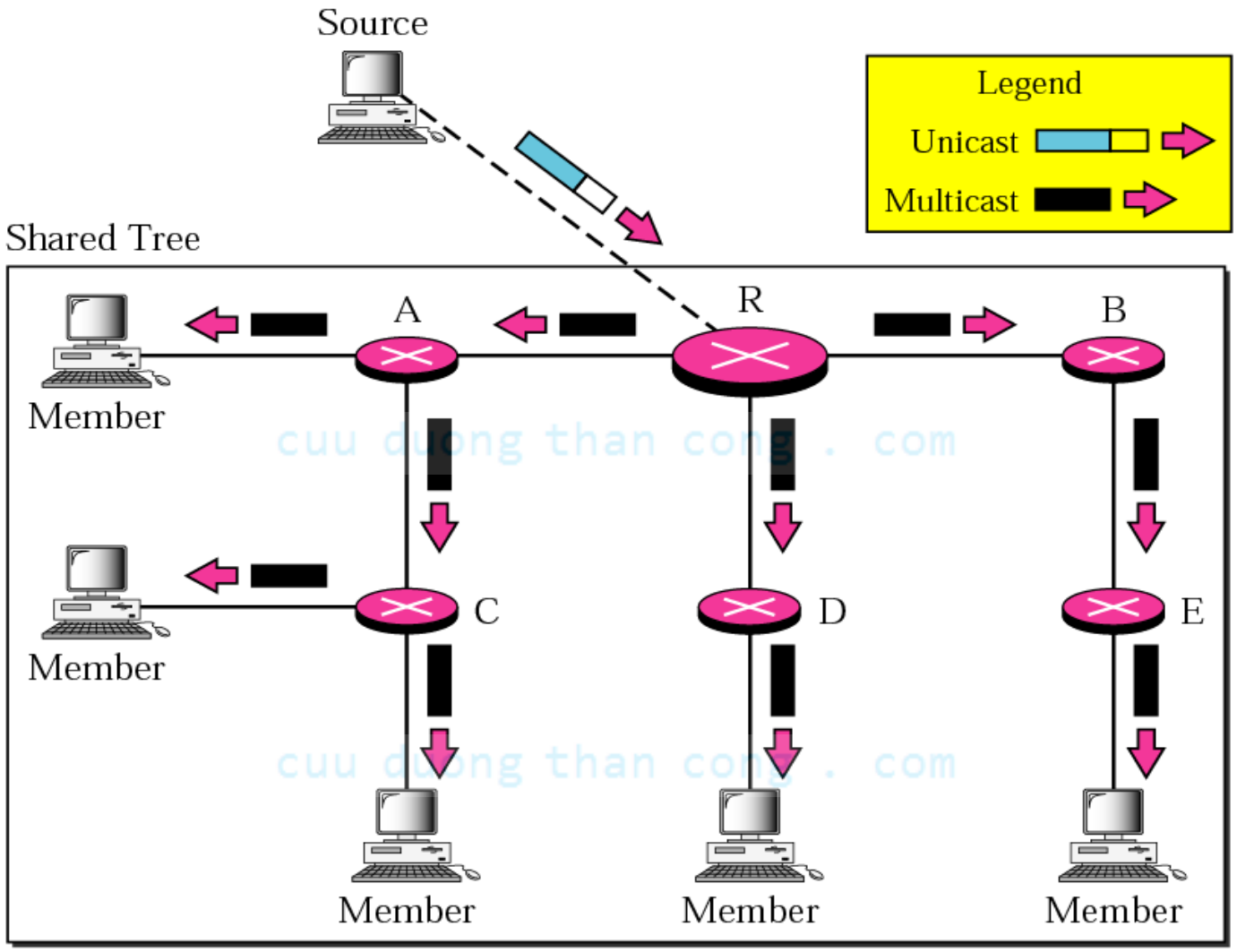
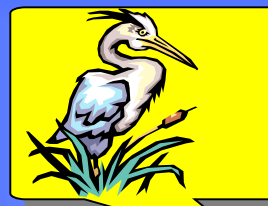


Figure 15.13 *Sending a multicast packet to the rendezvous router*





Note:

In CBT, the source sends the multicast packet (encapsulated in a unicast packet) to the core router.

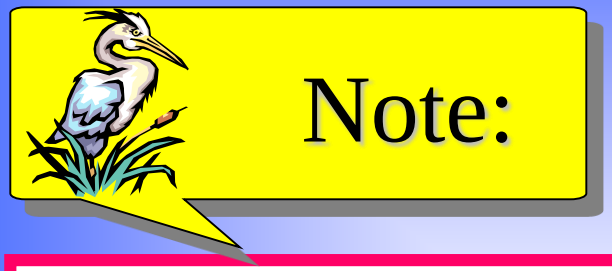
The core router decapsulates the packet and forwards it to all interested interfaces.

15.7 PIM

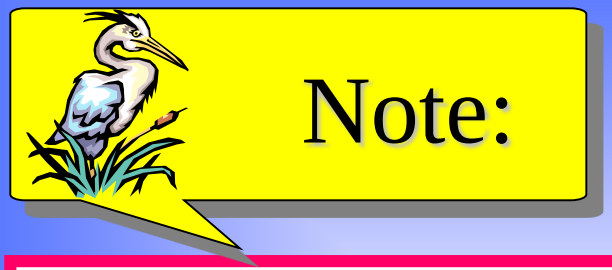
Protocol Independent Multicast (PIM) is the name given to two independent multicast routing protocols: Protocol Independent Multicast, Dense Mode (PIM-DM) and Protocol Independent Multicast, Sparse Mode (PIM-SM).

The topics discussed in this section include:

PIM-DM
PIM-SM



PIM-DM is used in a dense multicast environment, such as a LAN.

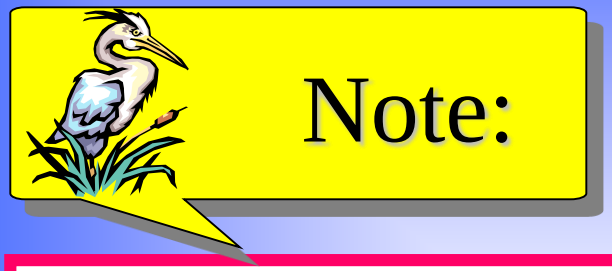


PIM-DM uses RPF and pruning/grafting strategies to handle multicasting.

However, it is independent from the underlying unicast protocol.

Note:

PIM-SM is used in a sparse multicast environment such as a WAN.



PIM-SM is similar to CBT but uses a simpler procedure.

15.8 MBONE

A multicast router may not find another multicast router in the neighborhood to forward the multicast packet. A solution for this problem is tunneling. We make a multicast backbone (MBONE) out of these isolated routers using the concept of tunneling.

Figure 15.14 *Logical tunneling*

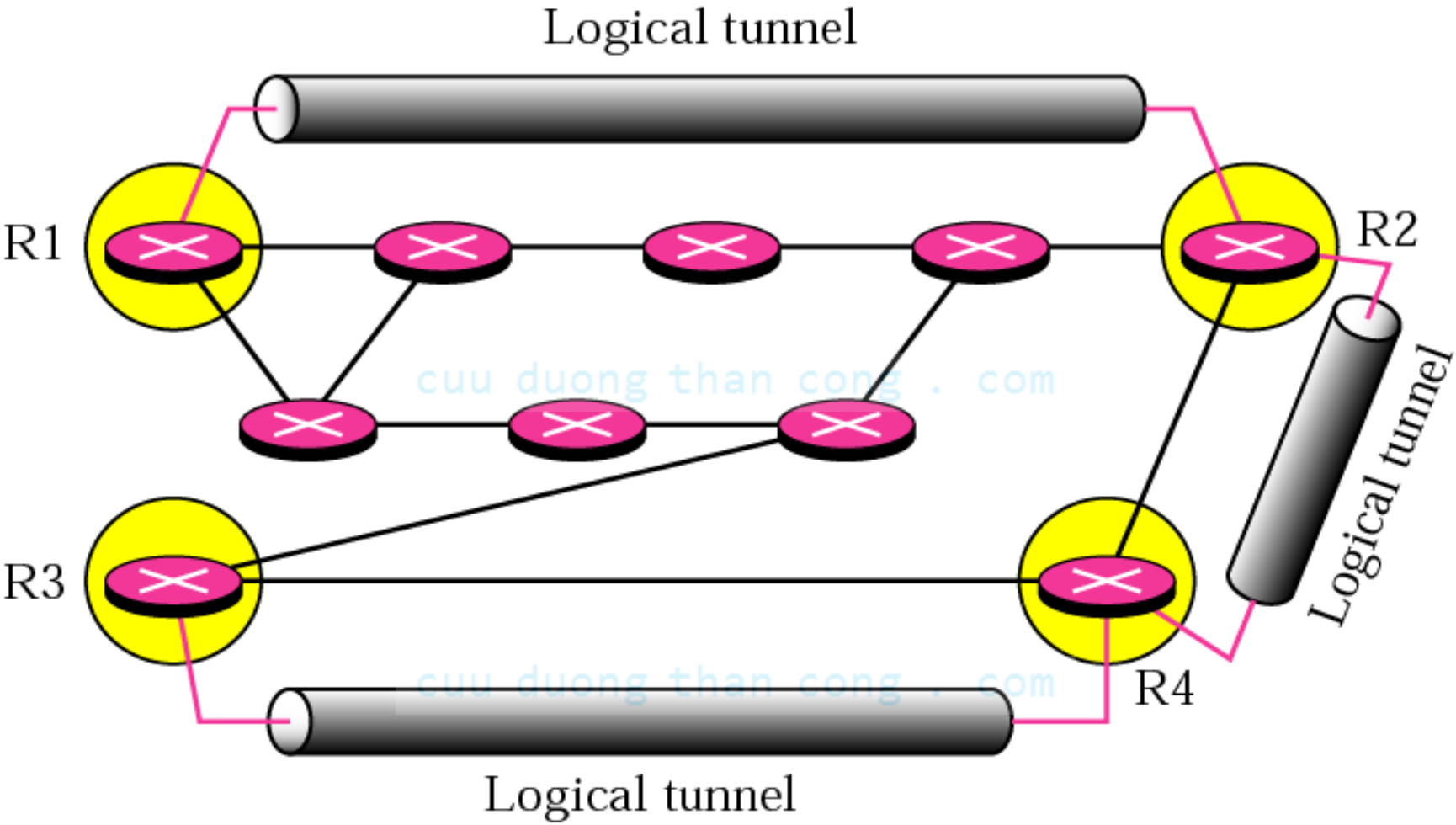


Figure 15.15 *MBONE*