

HOW NETWORKS WORK

FOURTH
EDITION



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PC network

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and how it all
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4th Edition

Frank J. Derfler, Jr., and Les Freed

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and Patricia Douglas**

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How Networks Work, 4th Edition

By Frank J. Derfler, Jr., and Les Reed

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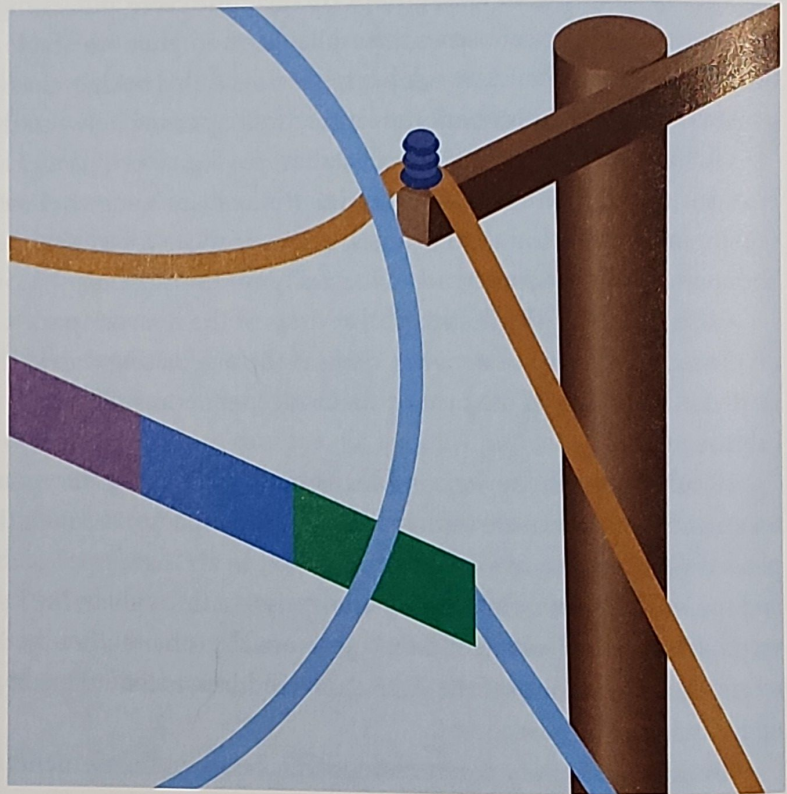
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CHAPTER

22

Repeaters, Bridges, Routers, and Switches



JUST as manufacturing plants have mail rooms and shipping docks, local area networks have specified places—called *portals*—where the local and long-distance services meet. Portal devices—repeaters, bridges, and routers—extend and segment the local area network's high-speed cable, and each device offers a different degree of discrimination and data handling capability.

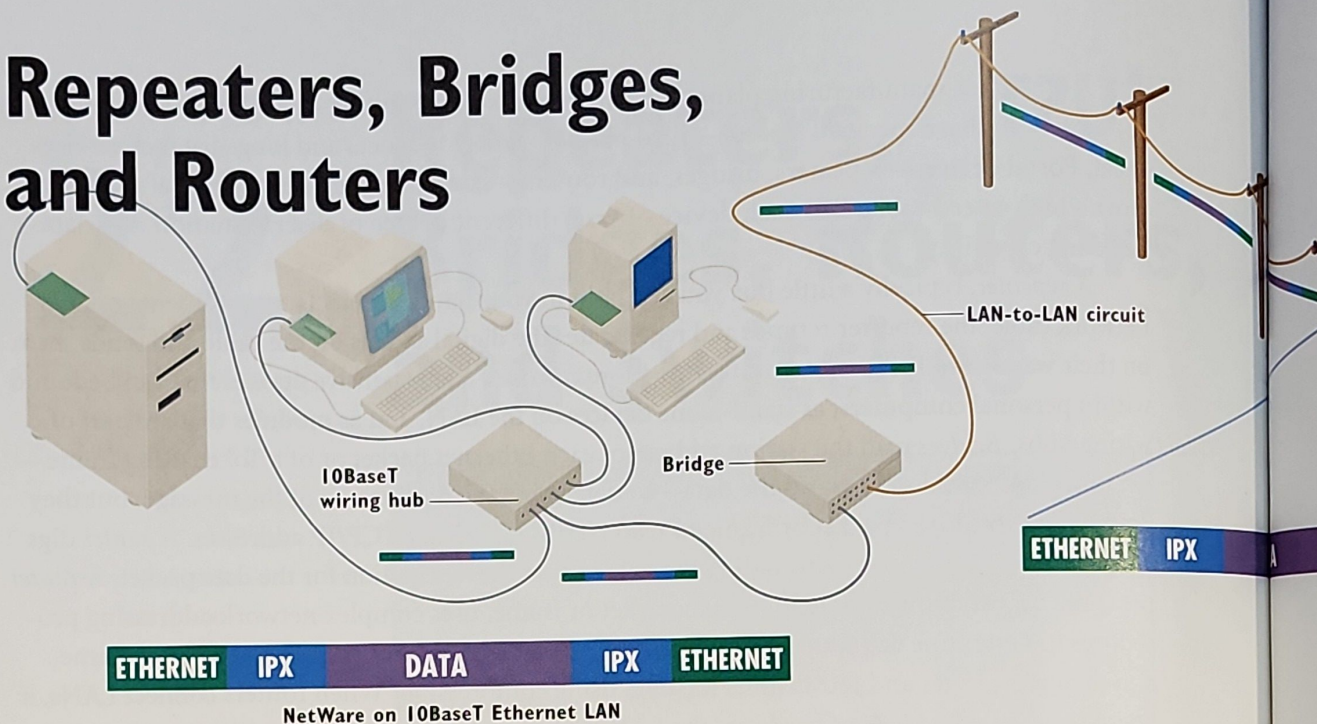
A *repeater*, typically a little box you can hold in your hand, connects two segments of your network cable; the repeater retimes and regenerates the digital signals on the cable and sends them on their way again. Bridges and routers are more complex and expensive devices that can be found within personal computers, as stand-alone devices on the LAN, and as modules that are part of wiring hubs. *Bridges* read the station address of each Ethernet packet or of a Token-Ring frame—the outermost envelope around the data—to determine the destination of the message, but they do not look inside the packet or frame to read NetBIOS, IPX, or TCP/IP addresses. A *router* digs deeper into the envelopes surrounding the data to find the destination for the data packet. A *router* reads the information contained in each packet or frame, uses complex network addressing procedures to determine the appropriate network destination, discards the outer packet or frame, and then repackages and retransmits the data using compression. When routers connect LANs, it doesn't matter what kinds of hardware the LAN segments use and, because multiprotocol routers are available, the LAN segments don't even have to use the same network communications protocols. Because they don't pass, or even handle, every packet or frame, routers act as a safety barrier between network segments. Data packets with errors simply don't make it through the router.

Routers strip off the outer layers of Ethernet or Token-Ring data before they send a packet from one LAN to the other, so they reduce the total number of bits going across the inter-LAN communications link. The remote router at the receiving end repackages the data into a packet or frame appropriate for its LAN segment. This allows routers to send the information across the inter-LAN circuit more efficiently than bridges do, and you can use less costly long-distance circuits.

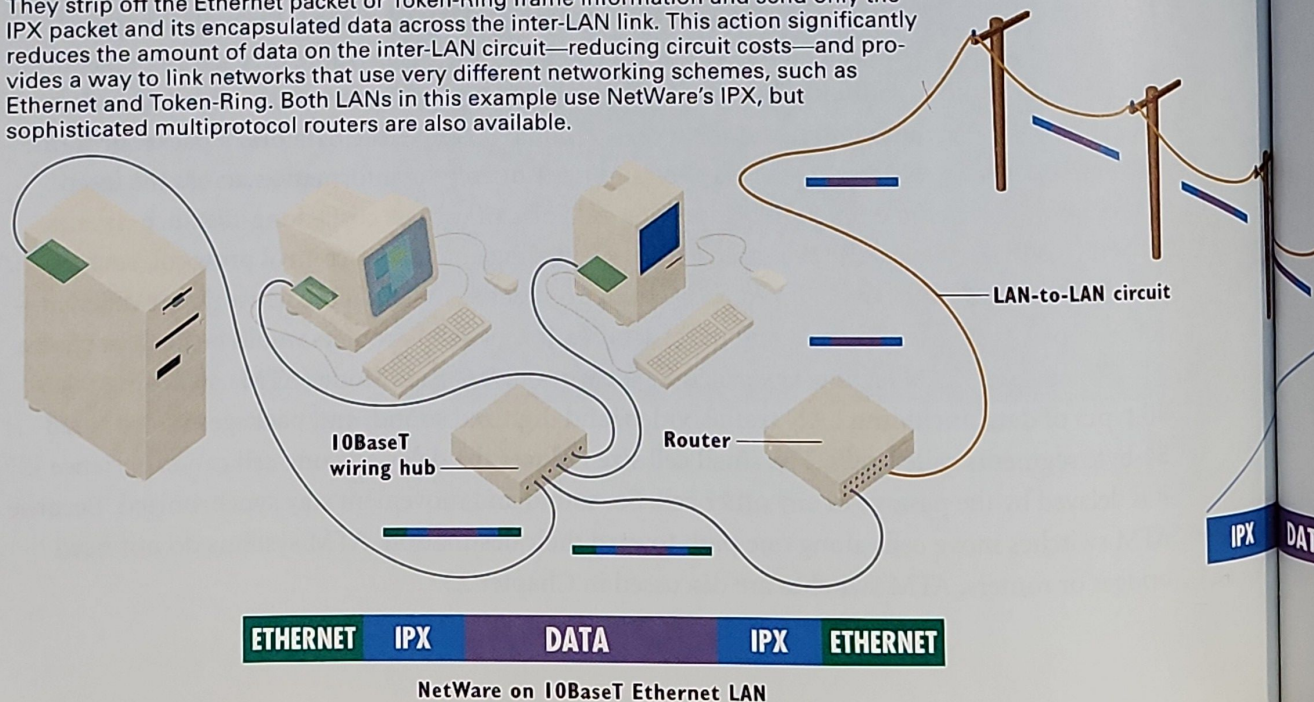
If the two networks use the same network signaling and access-control protocol, such as Ethernet, the networks can be linked with a bridge on each LAN. But if the networks are different—for example, if one uses Ethernet and the other uses Token-Ring—routers would be the best choice.

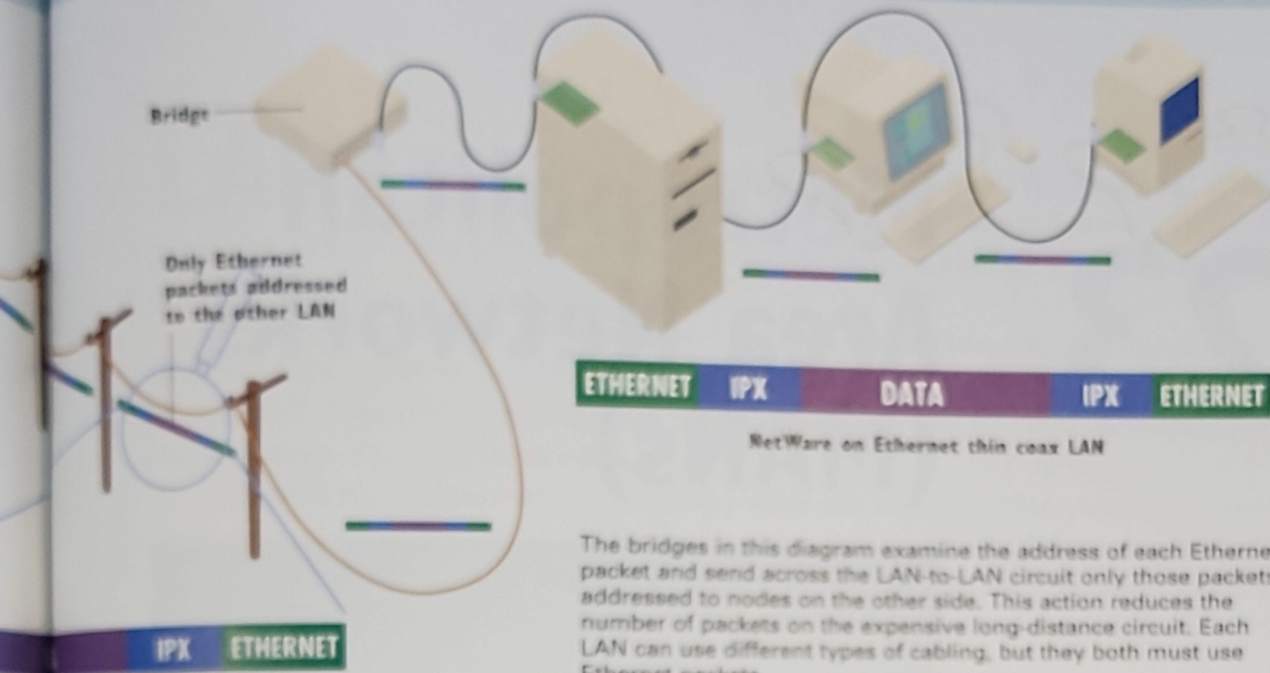
A new inter-LAN technology called Asynchronous Transfer Mode (ATM) switching takes all types of data, including LAN traffic, video, and digitized sound, and packages it into small 54-byte segments called *cells*. The small cell size reduces the delay any one cell can experience if it is delayed by the passage of any other cell. So, sound and movement stay synchronized. Because ATM switches move cells along one path toward their destination, ATM systems do not need bridges or routers. ATM switches are discussed in Chapter 25.

Repeaters, Bridges, and Routers



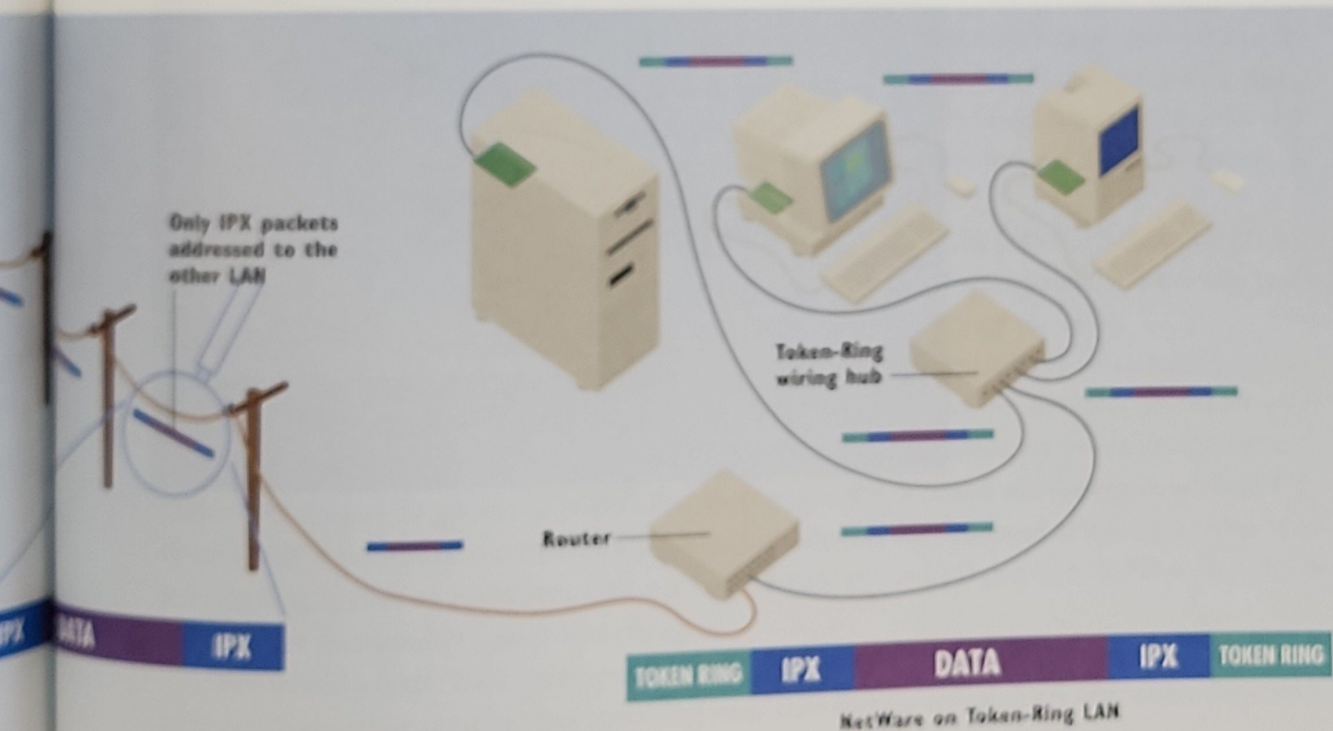
The routers examine the destination address contained in the NetWare IPX protocol. They strip off the Ethernet packet or Token-Ring frame information and send only the IPX packet and its encapsulated data across the inter-LAN link. This action significantly reduces the amount of data on the inter-LAN circuit—reducing circuit costs—and provides a way to link networks that use very different networking schemes, such as Ethernet and Token-Ring. Both LANs in this example use NetWare's IPX, but sophisticated multiprotocol routers are also available.





NetWare on Ethernet thin coax LAN

The bridges in this diagram examine the address of each Ethernet packet and send across the LAN-to-LAN circuit only those packets addressed to nodes on the other side. This action reduces the number of packets on the expensive long-distance circuit. Each LAN can use different types of cabling, but they both must use Ethernet packets.



NetWare on Token-Ring LAN