CHAPTER 1

Introduction to the Catalyst 2600

Demand for network bandwidth continues to grow, driven by the increasing number of systems used in network-intensive applications. LAN segmentation has been the prevalent method for addressing these demands and has been further popularized by trends toward server centralization. However, the implementation costs of LAN segmentation, as well as the real performance characteristics of conventional network components, have served to limit the growth of some Token Ring networks. Alternative technologies for addressing bandwidth demands present other inhibitors, usually relating to costs. *Token Ring switching* provides users with an easy, cost-effective technique for addressing these demands.

The Catalyst 2600 is a Token Ring switch that provides high-speed forwarding of frames among the shared or dedicated segments attached to each of its ports.

This chapter provides information on the following:

- Ease of Integration
- Improve Performance
- Flexible Network Configurations
- Ease of Customization, Management, and Maintenance
- Physical Characteristics
- Sample Implementations of the Catalyst 2600

For more information about Token Ring switching, refer to the appendix "Understanding Token Ring Switching."

Ease of Integration

The Catalyst 2600 can be easily integrated into your existing network, as it is transparent to high-level protocols and provides:

- A fully-functional default configuration that will accommodate many current network configurations. This configuration can be easily customized via console configuration.
- Automatic learning of network configuration.
- Automatic sensing and configuring of ports. The Catalyst 2600 will automatically sense the type of Token Ring connection being employed on each of its ports, whether the connection is:
  - To a shared-media segment (via a Token Ring concentrator), to a dedicated-media segment (directly to a Token Ring LAN station), or to another Token Ring switch. Proper polarity for the connection is automatically determined. Therefore, no special cross-over cables are

required for Token Ring stations on dedicated-media segments or for switch-to-switch connections; these connections use the same cabling used to connect the Catalyst 2600 port to shared media segments.

— Operating at 4 Mbps or at 16 Mbps

— Operating in half-duplex (HDX) or full-duplex (FDX) mode. The Catalyst 2600 will automatically configure each port to operate at the highest level of capability possible.

If desired, this auto-sense/auto-configure capability of the Catalyst 2600 can be overridden by explicit console configuration.

- A factory-assigned station, or MAC, address. The Catalyst 2600 can also be configured with an IP address.

Improve Performance

Integration of a Catalyst 2600 in your Token Ring network can relieve network stress and improve performance. The architecture of the Catalyst 2600 centers around the AXIS bus, a 512 Mbps switching fabric through which all switched ports communicate. To avoid the congestion problems that can occur when multiple ports communicate with a single port, each port has 512 KB of buffering, fairness algorithms, and split-buffer schemes.

To address the needs of delay-sensitive data, such as multimedia, this switching fabric contains two data queues. Frames assigned a priority of 5, 6, or 7, such as audio transmissions, are sent to the high-priority queue and given forwarding preference. Frames assigned a priority of 4 or lower are processed through the normal-priority queue.

To provide increased bandwidth, you can use the Catalyst 2600 to create multiple, concurrent paths among connected segments, each path supporting the full,16-Mbps Token Ring bandwidth. With a parallel internal design optimized for performance, the Catalyst 2600 can forward Token Ring frames between each of the pairs of ports simultaneously and at media speeds.

In addition, you can select from three modes of operation for each port on the Catalyst 2600. In *cut-through mode*, the Catalyst 2600 begins forwarding frames as they are received; it does not wait to receive the entire packet before forwarding. This provides the benefits of dedicated-media, high-speed switching. *Store-and-forward mode* offers more error isolation between the segments, as the Catalyst 2600 waits until the entire frame is received and checked for errors before forwarding. *Adaptive cut-through mode* optimizes performance by alternating between cut-through and store-and-forward modes based on user-specified thresholds.

Flexible Network Configurations

The Catalyst 2600 can forward Token Ring frames among multiple shared or dedicated Token Ring LAN segments. Each of the Token Ring ports on the switch can be connected to a port on any external Token Ring hub or concentrator using a customer-supplied cable. Alternatively, a Token Ring port on the Catalyst 2600 can be connected directly to an HDX- or FDX-Token Ring LAN station without an intervening Token Ring concentrator or hub.

Similar to a transparent bridge, the Catalyst 2600 can forward frames based on MAC address lookup. If you have source-route bridges in your network, the Catalyst 2600 can learn the location of your source-route bridges and forward frames based on the routing information field. This dual frame forwarding technique is called *source-route switching*. For more information about source-route switching, refer to the section “Source-Route Switching” in the appendix “Understanding Token Ring Switching.”

While the Catalyst 2600 provides 16 ports, configurations larger than 16 Token Ring LAN segments can be constructed by:

- Adding multiport Universal Feature Cards (UFCs). The Catalyst 2600 contains two Universal Feature Slots that can accommodate optional, field-installable, UFCs that provide additional connections.
- Connecting Catalyst 2600 switches together using any of the ports on each switch, to form a TokenChannel. *TokenChannels* are two to four parallel links that connect Catalyst 2600 switches. TokenChannels provide capacity between the two Catalyst 2600 switches of up to 64 Mbps in HDX mode and up to 128 Mbps if all ports in the TokenChannel are operating in FDX mode.

To help ensure network availability, you can configure redundant (backup) paths in the switch topology. To avoid loops, the Catalyst 2600 allows you to configure spanning-tree parameters. In a spanning tree, a redundant loop is only enabled if the primary path fails.

Ease of Customization, Management, and Maintenance

The Catalyst 2600 provides a series of configuration and management panels which you can access via a console or Telnet connection. Configuration parameters are stored in nonvolatile random-access memory (NVRAM).

Although the Catalyst 2600 provides a fully-functional default configuration, you may want to alter or add to this configuration to suit your specific needs. For example:

- The virtual LAN (VLAN) feature allows you to partition a single Catalyst 2600 into multiple domains. For each domain that you establish, you can configure IP parameters, Simple Network Management Protocol (SNMP) parameters, and spanning-tree parameters. VLANs are useful for reducing intersegment traffic. Also, because the Catalyst 2600 does not forward data between VLANs, this feature can be used to restrict access between segments.
- The Catalyst 2600 can support a maximum of 1790 active Token Ring MAC addresses per port, but no more than 10,000 for each Catalyst 2600. The address tables have user-configurable aging parameters that can be set by port or for the entire Catalyst 2600. The Catalyst 2600 can be configured to clear space in the address tables when a configurable threshold is exceeded.
- To provide greater control of network flow, the Catalyst 2600 provides an address filtering feature that allows you to specify up to 100 source or destination MAC addresses to be selectively filtered at the port of entry into the Catalyst 2600.

To aid in network management, the Catalyst 2600 also maintains status information and a variety of statistics. Status information is available for each port and for each TokenChannel, if defined. Statistics are kept by port, by domain, and for the switch as a whole.

The Catalyst 2600 also contains an SNMP Management Information Base (MIB) II compliant management agent that will allow a customer-supplied SNMP-based network management system (such as CiscoView) to remotely monitor and control the Catalyst 2600.

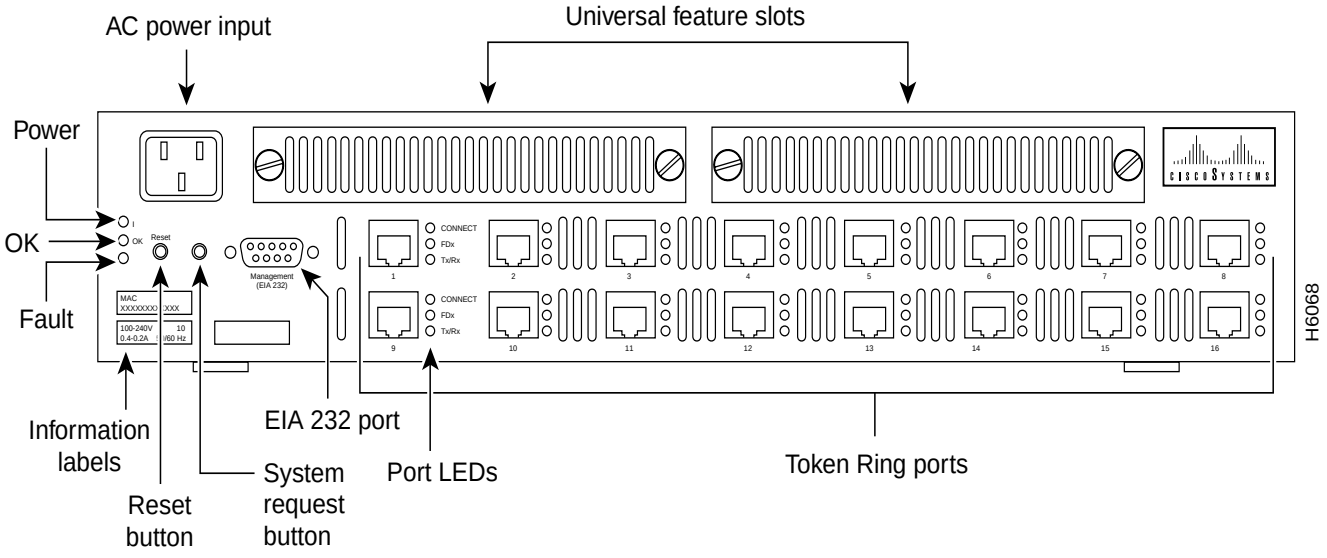
In addition, the Catalyst 2600 provides Switched Port Analyzer support, which allows you to monitor traffic on any of the Token Ring ports using a customer-supplied monitoring device such as the Network General Sniffer.

Should you need to upgrade the Catalyst 2600 software, upgrades to the functional code can be effected through the same serial port used for configuration. The code can be downloaded from a customer-supplied programmable workstation using the Xmodem protocol. Code upgrades can also be accomplished using TFTP.

Physical Characteristics

Figure 1-1 shows the front of the Catalyst 2600.

Figure 1-1 Locations of LEDs, Switches, and Connectors



EIA 232 PORT

This 9-pin, male, management port functions as a DTE port.

This port enables attachment of a terminal or terminal emulator that is used to customize the switch's configuration, monitor switch activity and status, and test the switch. Console access can be either local, by direct attachment to the EIA 232 port, or remote, through a modem connection.

The EIA 232 port automatically detects the baud rate of the terminal to which it is attached.

Token Ring Ports

The base unit of the Catalyst 2600 has 16, shielded RJ-45 connectors for Token Ring connection. As previously explained, these ports allow half-duplex (HDX) or full-duplex (FDX) connections to other switches, hubs, or end nodes. They support the IBM Cabling System via 150-ohm, shielded twisted-pair (150-ohm STP) or 100- or 120-ohm twisted-pair via Category 3, 4, or 5 cables.

Universal Feature Slots

The Catalyst 2600 contains two Universal Feature Slots (see Figure 1-1) that accommodate optional, field-installable, Universal Feature Cards (UFCs) that provide additional connections. Installation and configuration instructions are included with each feature card.

Reset Button

The Catalyst 2600 has a Reset button that is located on the front panel of the switch. Pressing the Reset button resets the hardware and software and clears all tables and memory, including the address tables. Pressing the Reset button does not clear those values stored in non-volatile random access memory (NVRAM).

System Request Button

This unlabeled button, on the front panel next to the Reset button, causes the System Request Menu to appear on the console attached to the serial port. The System Request Menu contains options for downloading new software, resetting the switch, and clearing NVRAM.

Caution This function should be used only at the direction of service personnel. The button is recessed to prevent accidental activation.

Status and Activity Indicators

The Catalyst 2600 has LEDs that indicate the status and activity of the base switch and the ports. There are three LEDs associated with the base switch: power, operation, and fault. There are three LEDs associated with each of the 16 ports: connection, duplex, transmit/receive.

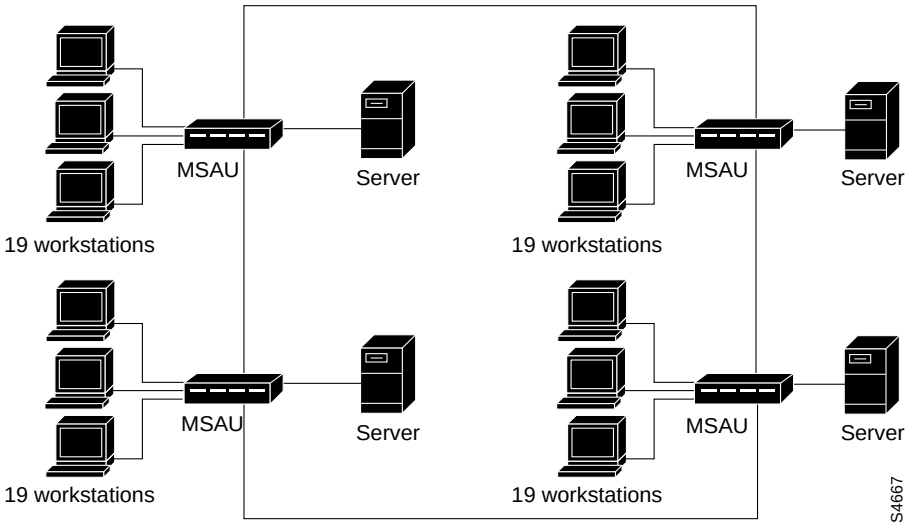
Sample Implementations of the Catalyst 2600

There are many applications of the Catalyst 2600. This section describes two scenarios that benefit from the addition of a Catalyst 2600: one for a single LAN segment, and one for multiple segments.

Improving Performance for a Single Segment

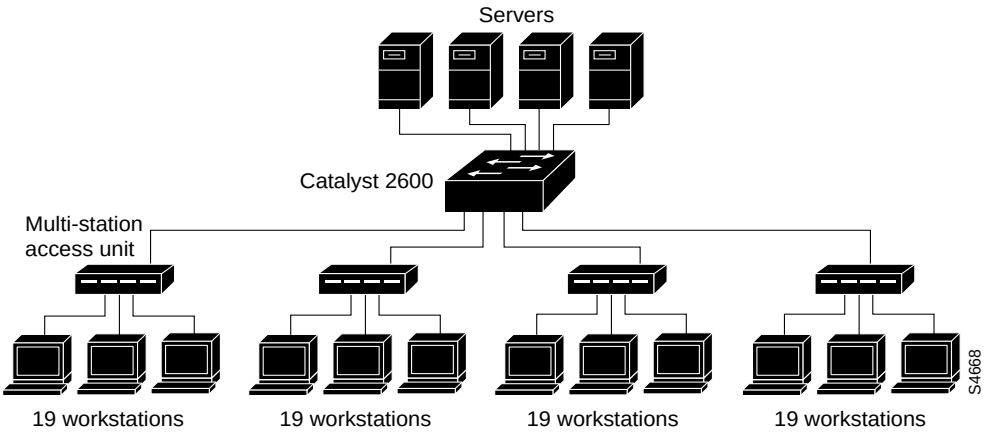
The Catalyst 2600 allows you to make incremental changes in your network to address both immediate and long-range performance challenges. For example, Sam works for a growing company and maintains a Token Ring LAN of 80 stations including 4 servers. All of the stations are attached to access units located in a single wiring closet. The LAN is beginning to experience performance problems as a result of increased traffic. The configuration of the LAN is similar to the one pictured in Figure 1-2.

Figure 1-2 Network without the Catalyst 2600



Then, Sam installs a Catalyst 2600. First, Sam divides the LAN into 4 segments (removing the ring-in and ring-out cables that link the access units). One port from each access unit is connected to a port on the Catalyst 2600 via a patch cable. Then, the four servers are removed from the access units to which they have been attached and their cables moved to four ports on the Catalyst 2600. Sam's LAN now looks like the one pictured in Figure 1-3.

Figure 1-3 Network with a Catalyst 2600



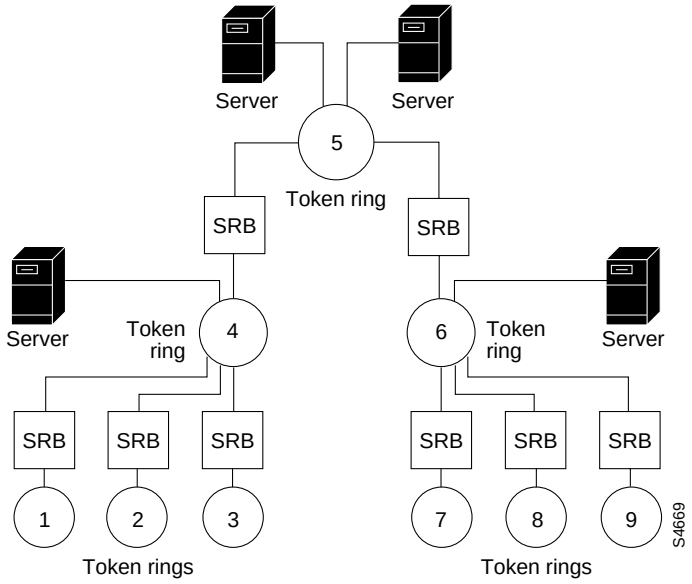
Each group of 19 users attached to an access unit now shares a dedicated, 16-Mbps path to any server. Each server has a dedicated, 16-Mbps path upon which to service requests. The addition of the Catalyst 2600 has increased the network capacity fourfold.

Improving Performance for Multiple Segments

Some large, multisegment, hierarchical, Token Ring networks experience congestion at the campus backbone level. Although this congestion can often be relieved by converting the backbone to a higher speed, shared-media protocol or by installing additional bridges or dual backbones to eliminate bottlenecks, the dedicated media offered by the Catalyst 2600 might be longer-lived or more economical if you foresee using higher demand applications or moving to an ATM WAN. Let's look at an example.

Chris works for a growing company. She maintains a multisegment network that is experiencing congestion at the backbone level and the users are experiencing server access problems. The network is a three-level, hierarchical, campus network like the one pictured in Figure 1-4.

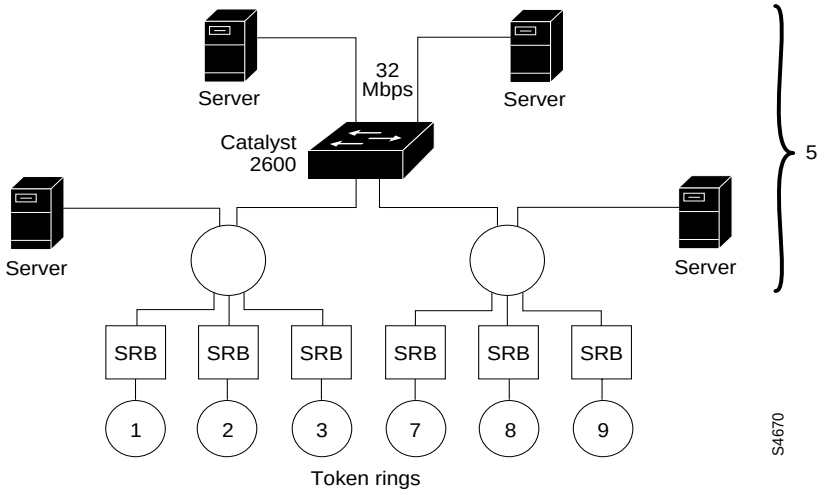
Figure 1-4 Network without a Catalyst 2600



To relieve the backbone congestion, Chris replaces the campus backbone and the attached source-route bridges with a Catalyst 2600.

Next, Chris addresses the performance problems with the servers that were attached to the backbone. The usual mode of operation for a Token Ring adapter is half-duplex. Therefore, the servers can either send or receive information with one other segment attached to the switch. Chris equips the servers with full-duplex adapters and attaches them as single-station segments (as shown in Figure 1-3). This enables the servers to send and receive data simultaneously over a dedicated path. The capacity of each server is now 32 Mbps per port.

Figure 1-5 Network with a Catalyst 2600



Because all of the ports on the Catalyst 2600 have the same ring number, LAN segments 4, 5, and 6 (shown in Figure 1-4) now have the same segment number (shown as segment 5 in Figure 1-5). This solution:

- Reduces the number of pieces of equipment that must be maintained.
- Reduces the latency between an end station and a server by reducing the number of bridges that a frame must traverse.
- Allows Chris to add more servers without impacting performance, by attaching the servers directly to the Catalyst 2600.