

TELEMETRY ENTERPRISE SWITCHED NETWORKING

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ABSTRACT

The success of the client/server paradigm for modern networked telemetry systems continues to stress the LAN that carries data generated from the acquisition front ends to the display workstations and the file servers on the LAN. As the number of LAN-attached devices such as Loral's System 500 Model 550 (Loral 550) telemetry front end, workstations, and file servers grows beyond two, the Ethernet LAN collision rates increase and the throughput slows down. At what point the network performance declines is a function of the specific application bandwidth demands required. This paper describes a new method for boosting LAN performance by providing Ethernet switching and protocol filtering. The performance of the LAN is critical to the performance of the complete telemetry enterprise architecture.

KEYWORDS

Enterprise, Switched Networking

INTRODUCTION

Ethernet or 802.3 uses a carrier sense multiple access with collision detection (CSMA/CD) access method. This method has a built-in random back-off polynomial that is engaged every time two or more devices try to access the Ethernet LAN at the same time. This built in LAN multiple access capability is very powerful. But as a network becomes more loaded, the efficiency of the network declines. Studies have shown that as a network with many users exceeds 30% usage, the network performance slows down drastically. The amount of time wasted trying to get onto the LAN increases in a nonlinear fashion. The symptoms can be non-deterministic and very frustrating in a real-time data acquisition application. This slow down of the Ethernet LAN has caused many to invest in expensive higher-speed technology like FDDI and ATM.

In today's telemetry applications, the Loral 550 telemetry front end is used in both the command and control link as well as in the normal telemetry downlink. Customer demands for faster, larger networks have influenced the design of an Ethernet performance booster. The Loral Test & Information Systems (LTIS) ProSwitch-T can, for most applications, provide the needed Ethernet LAN bandwidth and performance without investing in higher-speed LAN technology. A new class of connectivity devices called protocol switches combines the wire-speed traffic handling capacity of Ethernet switches with many of the protocol handling features usually associated with routers. Protocol switches can be used to link multi-protocol LANs and control unwanted traffic and broadcasts, without compromising the wire-speed performance demands of client/server architectures. Wide area links to the Internet or to remote sites are provided with IP-based firewall protection.

With the ability to connect many data acquisition front ends such as the Loral 550, each with the capability to drive many Ethernet outputs, the real-time demands for the network have increased beyond the capability of shared Ethernet. Switched Ethernet can extend the capability of Ethernet by providing dedicated 10M segments or collision domains for each data source such as a Loral 550. For segments that have less traffic demands, hundreds of workstations can be connected via a hub to each port on the switch. Switched Ethernet is becoming the dominant topology for the LAN industry. Loral's ProSwitch-T is thus a telemetry-optimized Ethernet Switch.

Figure 1 shows a typical network without a switch. Since all LAN-attached devices share the same collision domain, network performance is slowed down.

Figure 2 shows how the ProSwitch-T can be used in a high-performance telemetry application. Ethernet data from each Loral 550 is sent to the switch in a collision-free environment. The ProSwitch-T learns the source and destination media access control (MAC) addresses and forwards the packet to only the port that it has learned has the correct LAN-attached destination device.

The rest of the ports are not burdened with the unneeded traffic and therefore are free to operate with less collisions and higher efficiency within the 10M Ethernet standard. Custom filters can be easily setup that allow individual data sources or destinations to be passed or blocked from data access. This capability allows the flow of data to be controlled in a secure telemetry enterprise environment.

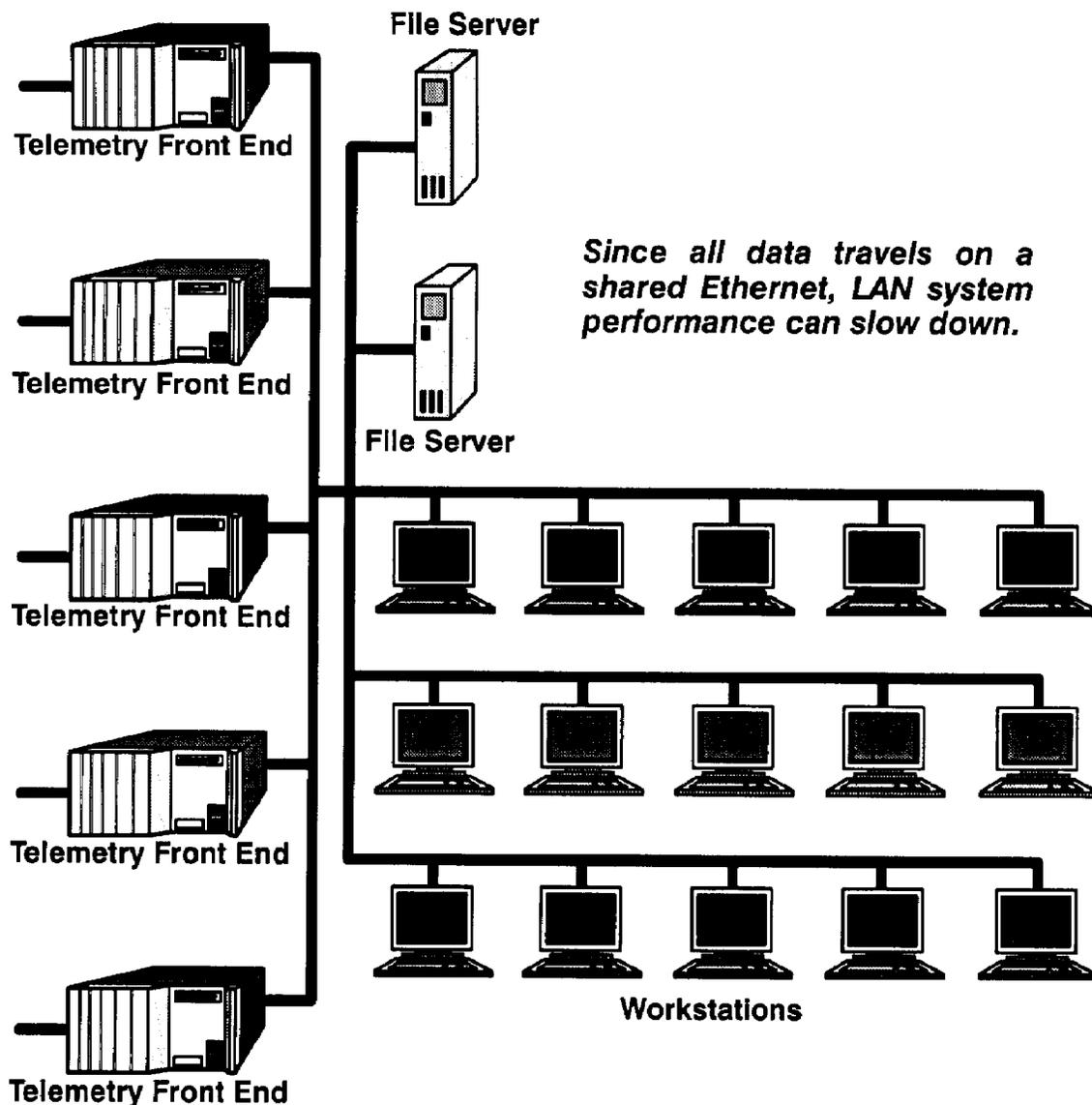


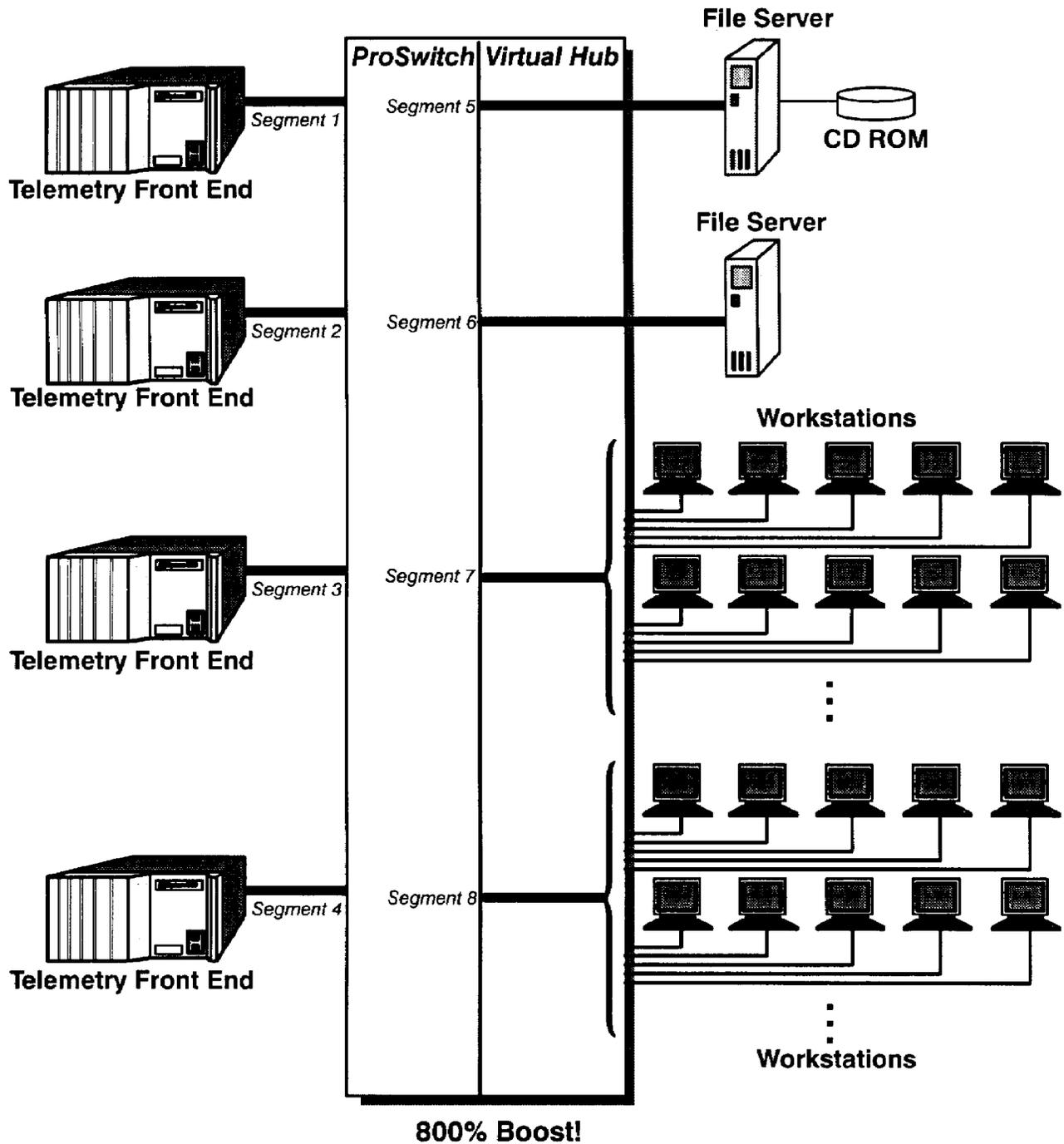
Figure 1. Telemetry Enterprise with Shared Ethernet

TELEMETRY WORKGROUPS

As shown in Figure 3, the ProSwitch-T allows users to control data sharing by creating switch groups or separate LANs. This feature allows different Loral 550s and workstations to be isolated from other groups for testing or security purposes. Reconfiguration is as simple as selecting a color from the switch group palette.

PROTOCOL MANAGEMENT

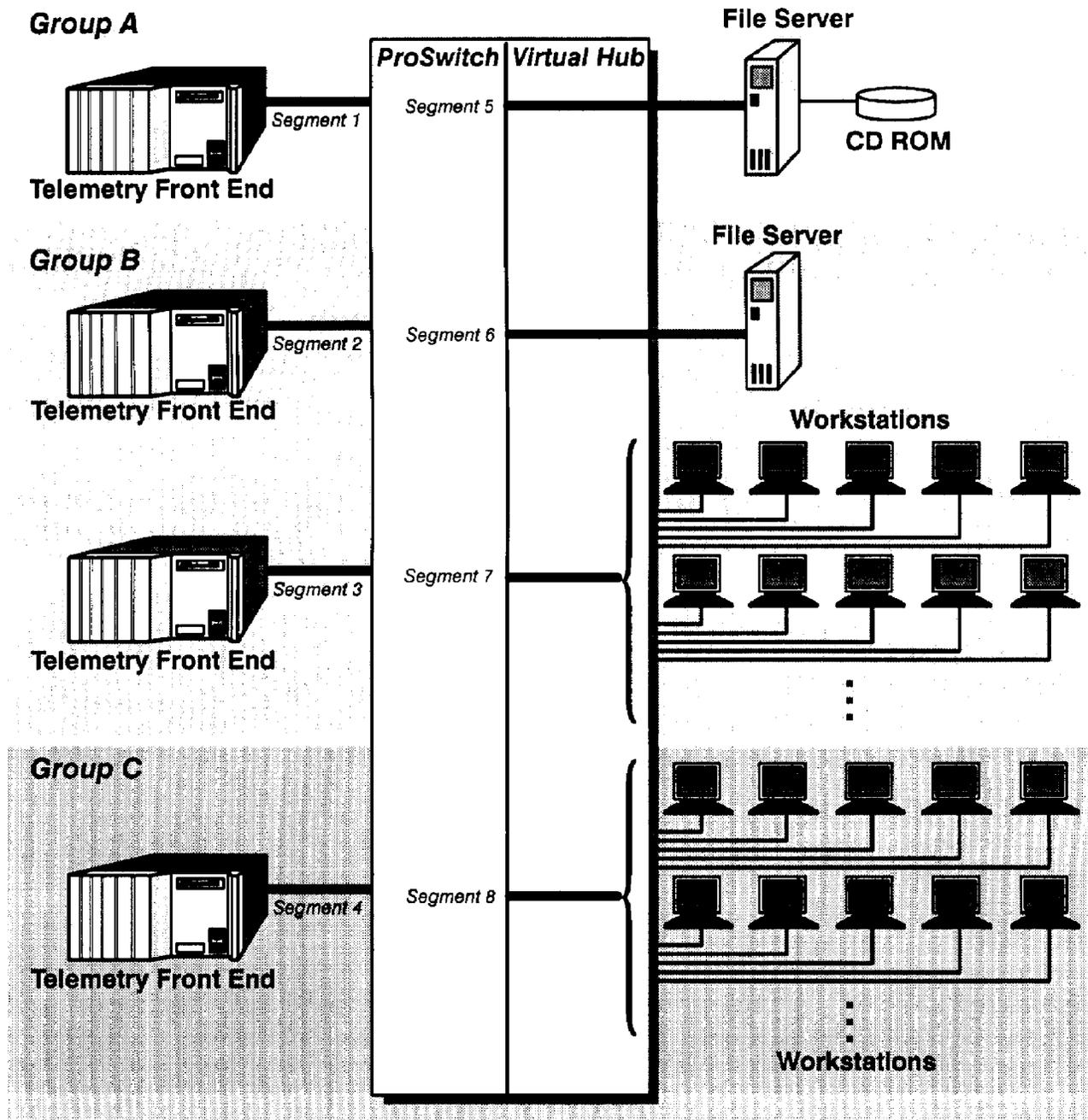
Once the telemetry network system has been boosted by ProSwitch-T segmentation, other improvements can be made. Protocol switches combine the high performance associated with Ethernet switches and many of the higher-level protocol handling



Benefits

- ◆ Full 10 MB bandwidth for telemetry front ends and file servers
- ◆ Network improvement by 800%
- ◆ Drastically lowered collisions means faster throughput
- ◆ Screen updates faster
- ◆ Storage times faster
- ◆ FEP configuration time reduced
- ◆ Multimedia applications faster
- ◆ No bottlenecks
- ◆ Intelligent data flow
- ◆ Data flow control

Figure 2. Telemetry Enterprise with Switched Ethernet



Benefits

- ◆ Data from different groups is not comingled
- ◆ Workgroups can be formed that keep LAN data within the work-group
- ◆ Data is secure
- ◆ Easy to configure for different test conditions
- ◆ Allows LAN network changes without affecting ongoing testing

Figure 3. Telemetry Enterprise with Switched Ethernet and Telemetry Workgroups A, B, and C Formed

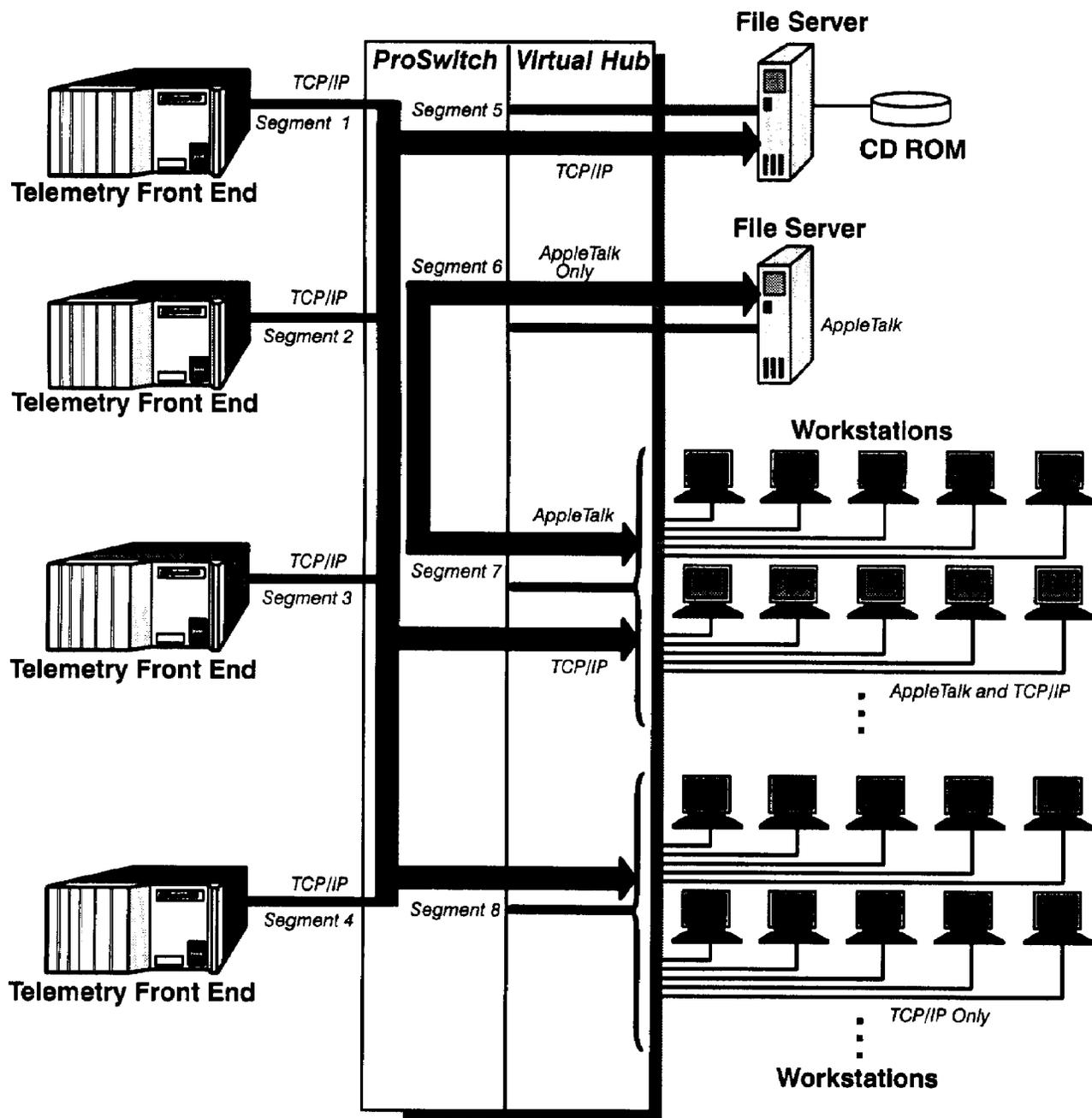
functions of routers. In telemetry enterprise network applications, a protocol switch can be used to provide high-speed segmentation of the Ethernet LANs while providing a secure protocol-based firewall between workgroups employing different protocols (see Figure 4).

For multi-protocol environments, the ProSwitch-T can be used to block or pass different protocols on a port-by-port basis. Some of the protocols supported are TCP/IP, IPX, DECnet, and AppleTalk. Loral's ProSwitch-T is the first true protocol switch. It combines high-speed LAN interconnection with protocol-based traffic handling and broadcast control. In addition, an easy-to-use point-and-click graphical user interface allows users to quickly configure firewalls and segmentation without laboriously entering routing tables.

The ProSwitch-T can be installed in "plug and play" learning mode, then "tuned" with protocol filters and broadcast groups over time to meet increasing network demands. Point-and-click IP routing on the wide area network (WAN) port offers a cost-effective link to the Internet or other enterprise networks with the added security of IP-based firewalls. The ProSwitch-T increases LAN performance up to 800% while eliminating the need for routers in many applications. Another subtle yet powerful feature is the ability of the ProSwitch-T to create broadcast domains that limit the multicast and broadcasts used by different LAN protocols to within operator-selected domains. This process can also free switch segments from unneeded broadcast activity.

WAN LINK

The WAN port can be used for both remote connections to other sites or for Internet connectivity. The explosive growth of the Internet and other enterprise wide area networks has created a corresponding need for connectivity and security. In the past, the only choice was a costly and complex router, implemented either as a standalone machine or in software within a workstation. The ProSwitch-T provides an integral IP router link for connection to IP wide area nets. Traffic from any of the switch segments can be routed to the WAN link. Traffic is permitted to and from the wide area connection on a segment-by-segment basis using Serial Link Interface Protocol (SLIP) and Point-to-Point Protocol (PPP). These IP routing functions are accessed via the ProSwitch-T's user-friendly point-and-click graphical network management interface, allowing even routing newcomers to build effective firewalls. Figure 5 shows how multiple sites can be linked using the WAN port with one central management console. Since the ProSwitch-T supports Simple Network Management Protocol (SNMP) Version 1 and Version 2, the MIB variables can be shared with

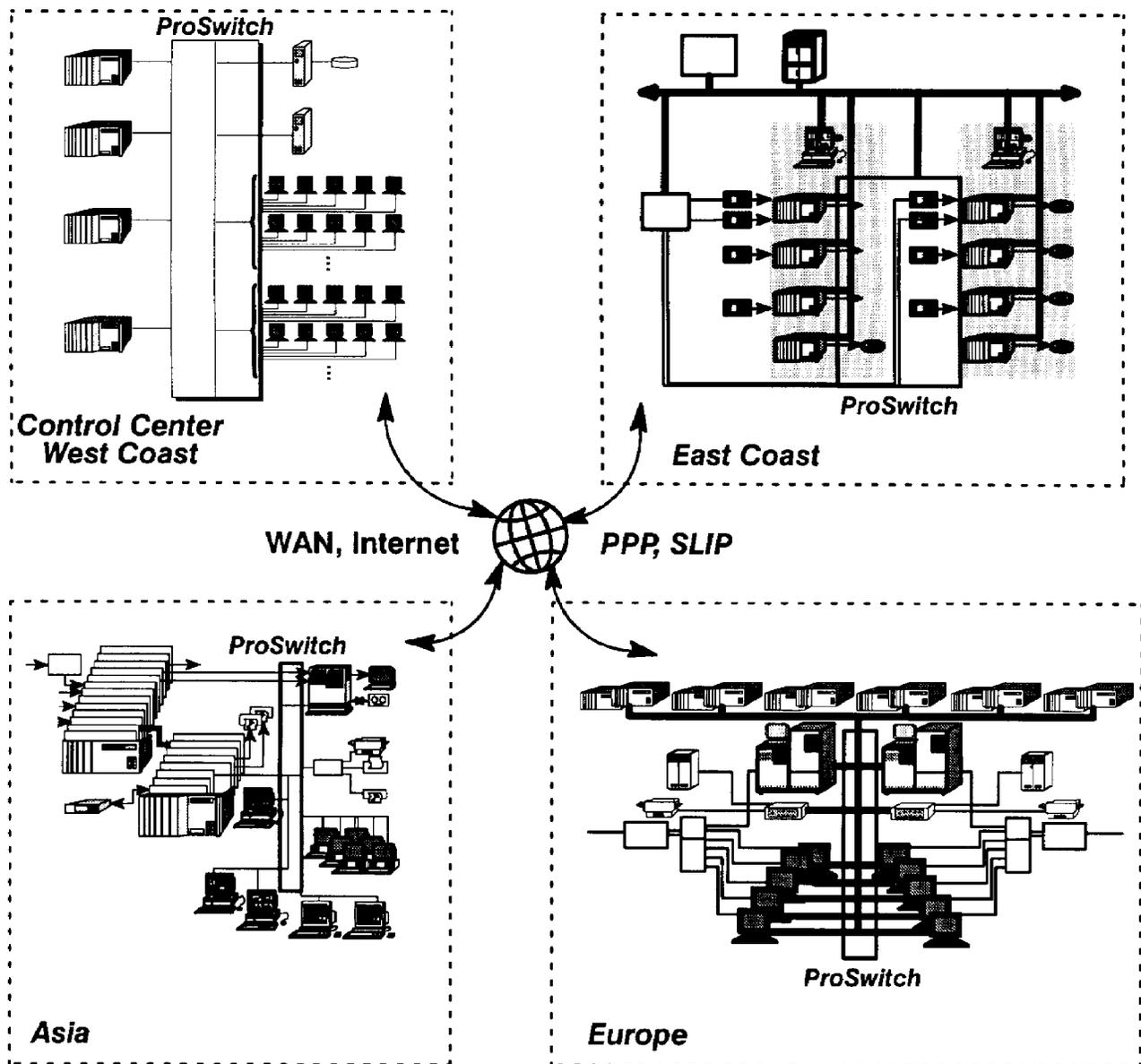


AppleTalk data from Segment 7 is allowed only to pass to Segment 6, thus sparing all other non-AppleTalk segments the burden of unwanted LAN traffic. TCP/IP from Segment 7 is allowed to pass freely to all ports except 6, since it contains an AppleTalk server.

Benefits

- ◆ Control which protocols go where
- ◆ Mixed protocol environments can be optimized
- ◆ Point-and-click protocol filters

Figure 4. Telemetry Enterprise with Protocol Filters



Benefits

- ◆ Connect multiple sites
- ◆ Central control
- ◆ Internet SLIP/PPP
- ◆ ATM (future)
- ◆ TCP/IP
- ◆ SNMP V1, V2 secure

Figure 5. Telemetry Enterprise with WAN Connections Between Sites

other network management software programs like HP's OpenView and Sun's SunNet Manager.

VIRTUAL HUB

The ProSwitch-T has an optional 64-port 10Base-T hub through which ports can be logically reassigned to different switch segments. This allows network load balancing and telemetry workgroup creation with an easy point-and-click graphical user interface. The virtual hub can be thought of as a programmable patch panel that merges data from the different LAN 10Base-T sources into the switch port that has been selected. A typical application might distribute the load so that each Loral 550 was logically allocated a separate switch segment and the rest of the hub ports contained an equal distribution of the workstations. The file servers would also be given a dedicated switch segment. In typical multimedia and 3-D software applications requiring wideband connections (tens of megabits) for mere milliseconds, a dedicated switch segment is essential since traditional technologies have been pushed to their limits. The process of allocating hub ports to switch segments is as simple as moving a graphical representation of the hub ports into a graphical representation of the switch port selected — all accomplished using a mouse.

CONCLUSION

Telemetry systems have become part of the mainstream movement into the client/server and distributed computing arena. Such applications as CAD/CAM, engineering development, imaging, visualization/modeling, data communications, and multimedia are part of today's telemetry requirements and are all high LAN traffic generators as data is moved and shared peer to peer or client to server. With real-time data acquisition added to the above applications, telemetry networking demands can exceed a shared Ethernet LAN.

Loral's protocol switch, ProSwitch-T, was developed to segment and boost Ethernet bandwidth by 800% and provide the key protocol handling capabilities needed to optimize operation of a networked telemetry system.

REFERENCES

Henderson, Byron, "Understanding Protocol Switching," May 1994.