High-performance client/server applications and interactive multimedia services are just some of the styles of computing growing in popularity in the 1990s, placing new demands on the networks that support them.

This document examines how network switches are evolving to meet these challenges and how Digital is leading the way with innovative new switching products.

SWITCHING TECHNOLOGY

Switching is a cost-effective way for organizations to meet the network performance demands of their users and applications. For example, network managers can incorporate switches into a LAN to increase network throughput without altering network links. In this way, switches help preserve network investments as requirements evolve.

The technology behind most of today’s network switches is either ‘cut-through’ or ‘store-and-forward.’ These switching algorithms govern how switches pass data packets across a network. Store-and-forward switches process the data packets passing through them, validating that they have accurately received the bits comprising the packets. A store-and-forward switch waits to receive an entire packet off the network link, verifies that it has received the data without error, processes its destination address and only then forwards the packet to the appropriate network.

The key advantage of store-and-forward switches is that their use guarantees the integrity of the packets passing through. The store-and-forward switch detects bad or incomplete ("runt") packets and does not propagate them to other networks. IEEE 802.1-compliant store-and-forward devices provide additional levels of functionality. For example, these full-function devices can also support redundant paths to ensure network availability and can connect dissimilar networks, such as Token Ring and FDDI — distinctive benefits in today’s hybrid networking environments.

Cut-through switches, on the other hand, do not attempt to validate the data in the packets passing through them. A cut-through switch begins retransmitting a packet as soon as it reads its destination address — even before it has received the entire packet.
Because cut-through switches evaluate only the destination address on each packet passing through, their latency, the delay before a packet is transmitted, is typically very low.
SWITCHING METHODS FOR ETHERNET AND FDDI

The effectiveness of cut-through and store-and-forward switching methods varies with the network technologies on which they are deployed.

Ethernet is a collision-oriented approach to transmitting data on a network. If two stations attempt to transmit on an Ethernet network at the same time, a collision occurs; collisions result in "runt" packets. Runts do not contain any useful or complete user data.

When cut-through switches are used to switch Ethernet traffic, runt packets are propagated since the switch only examines the destination address of the packet. As these runt packets traverse the network, they cause more collisions . . . producing even more runts. This chain reaction can quickly cripple a network and dramatically reduce the throughput of real user data. In short, cut-through switches can be ineffective in Ethernet networks because they tend to flood networks with runt packets, not real data.

In contrast, store-and-forward switches are often a much better choice for Ethernet networks because they can detect and reject runt packets.

FDDI networks are based on a timed-token passing dual ring scheme. Because collisions do not occur in these networks, cut-through switching can be used effectively to improve network performance.

DIGITAL’S SWITCHING STRATEGY

Digital implements both cut-through and store-and-forward switches to offer customers a choice when selecting the "best" switch for their requirements.

Digital’s switching strategy is to:

- deliver a full range of high performance switching products — across desktops, departments and enterprise network backbones
- implement store-and-forward and cut-through switches to ensure that customers have the network building blocks they need
- offer high performance switching engines across key networking technologies - such as Ethernet, FDDI, and ATM
- build standards-based switching platforms ensuring data integrity and interoperability
- integrate switching, routing and hub functionality to offer a graceful migration path to ATM
• provide a single, easy-to-use graphical SNMP management application on multiple platforms
Digital’s leadership in switching technology has evolved from the company’s twenty plus years of network experience and numerous technical contributions in product innovation and standards development, including: the invention of peer-to-peer networking; the co-development of Ethernet; and the development of the Spanning Tree algorithm, used in bridges and IEEE 802.1-compliant devices. Digital was the first company to develop and manufacture a true store-and-forward device, the LAN Bridge 100.

Digital also has more than six years experience with high-performance switch-based networking for both FDDI and ATM networks. This includes GIGASwitch/FDDI, the industry’s fastest FDDI switch. GIGASwitch/FDDI was recently named *Data Communications* 1994 ‘Hot Product of the Year’ and won *R&D Magazine’s* "R&D 100" award for technological leadership.

**DIGITAL’S SWITCHING PRODUCT FAMILY**

Digital’s switching product strategy brings the benefits of high-performance switching to a range of network applications on a variety of levels — the desktop, the department and the enterprise.

Digital’s switches can connect multiple, high-performance personal computers, workstations and servers on a single LAN, as well as interconnect multiple desktop and departmental LANs into a high-performance corporate backbone. Digital combines data integrity with high performance to bring industry-leading price/performance to its switching family.

![Figure 1. Digital’s switching product family.](image-url)

**LOW-COST, HIGH-PERFORMANCE DESKTOP SWITCHING.** The PEswitch 900TX meets the needs of bandwidth-hungry desktops. This true store-and-forward switch expands available bandwidth through dedicated Ethernet switching at desktop prices. The PEswitch 900TX provides excellent performance and low latency. The unit also provides robust, high-performance network connections that maintain packet integrity,
while delivering full IEEE-compliant 802.1 Ethernet-to-FDDI translation and IP fragmentation.

The PEswitch 900TX permits a choice of upgrades for desktop performance connections at a cost that is significantly lower than other high-speed technologies. This approach minimizes user disruption, changes to cabling infrastructure and replacement costs of new system adapters, drivers and software.
**HIGH-PERFORMANCE SWITCHING BETWEEN DEPARTMENTS.** The new DECswitch 900 products are full-performance, store-and-forward switches for inter-LAN connectivity. They optimize network bandwidth and manage traffic by providing high-performance switching from multiple Ethernet LANs to Ethernet or FDDI backbones.

The DECswitch 900EF is an Ethernet-to-FDDI switch; it offers six Ethernet ports and one FDDI port. The DECswitch 900EE, with six Ethernet ports, offers the best price/performance of any Ethernet-to-Ethernet store-and-forward switch on the market today. These switches provide full-speed, full-function filtering and forwarding and offer a simple, firmware upgrade capability to router functionality, when downline-loaded from DOS, UNIX or VMS systems.

The DECswitch 900 products combine ‘full-speed’ switching with standards-based, true ‘store-and-forward’ functionality, ensuring data integrity as well as high performance.

**SCALEABLE SWITCH CONFIGURATIONS.** Digital has integrated the new PEswitch 900TX and the DECswitch 900 products into its leadership DEChub 900 MultiSwitch architecture — a 3+ Gb/s technology independent backplane that supports integration of Ethernet, Token Ring, FDDI, ATM and other high performance network technologies. These are the only switches on the market today that can operate and be managed both as a standalone switch or as modules within the DEChub 900 MultiSwitch without modifications or additional cost. This offers unmatched configuration flexibility and provides a "no-cost" migration path to powerful switch-based enterprise networks.

**HIGH-PERFORMANCE ENTERPRISE SWITCHING.** Digital’s award-winning GIGAswitch/FDDI, as well as the GIGAswitch/ATM, deliver the high throughput and low latency demanded in high-performance backbone networks. GIGAswitch systems implement a patented, highly parallel switch design, supporting multiple simultaneous connections between ports. This crossbar switching technology helps to make these switches among the fastest available.

The 3.6 Gb/s power of the GIGAswitch/FDDI makes it the industry's fastest FDDI switch, performing, according to *R&D Magazine*, “more than six times better than its nearest competitor.” GIGAswitch/ATM, a 10.4 Gb/s ATM small switch, reflects Digital’s leadership in ATM technology, and is the only ATM switch that ensures network stability through a patented, no-loss traffic management feature, known as FLOWmaster flow control.

**MULTI-PLATFORM NETWORK MANAGEMENT.** Digital products enable customers to manage all of their high-performance switches through HUBwatch, a graphical SNMP-based management platform that is easy to use and install. HUBwatch provides a comprehensive set of switch management functions using simple "point and click" commands both in-band and out-of-band management.
HUBwatch is available on a choice of popular PC and workstation platforms, such as Windows, OpenVMS, HP OpenView for Windows and POLYCENTER/Netview.
SUMMARY

The emerging styles of computing in the 1990s demand reliable, high performance networks. These new switches demonstrate Digital’s continued leadership in meeting these evolving needs.

Digital’s family of switching products offer extremely high performance, and guaranteed data integrity at an aggressive price. As customers’ networking needs evolve, their networks can grow with them, scaling up from work group solutions to high-speed enterprise-wide computing infrastructures.

Digital Equipment Corporation is the world's leader in open client/server solutions from personal computing to integrated worldwide information systems. Digital's scaleable Alpha AXP platforms, storage, networking, software and services, together with industry-focused solutions from business partners, help organizations compete and win in today's global marketplace.

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