Sun™ Quad FastEthernet™ PCI Adapter

Just the Facts

Sun microsystems

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Sun™ Quad FastEthernet™ Positioning

Why Use Quad FastEthernet?

The growing importance of LANs and the increasing demand for data in a variety of forms (text, digital images and voice) are fueling the need for high bandwidth networks. To continue supporting business operations, information systems (IS) managers have extended existing networks with the integration of Fast Ethernet to provide needed performance enhancement. Fast Ethernet offers a simple migration path from 10BASE-T Ethernet to 100 Mbps Fast Ethernet: existing customer networking infrastructure can be used for minimal cost and minimal service disruption.

100BASE-T Fast Ethernet preserves the widely used core UTP wiring infrastructure, while providing a seamless migration to higher-performance workstations and desktops. Quad FastEthernet provides the performance of 100BASE-T and the higher density of four independent ports. The combination of high performance and high density of ports provides IS managers and network administrators with scalable bandwidth and multi-homing options not available in other networking products.

What is Fast Ethernet?

Fast Ethernet, 100BASE-T, is an extension to the existing 10 Mbps 10BASE-T standard. It supports existing 10BASE-T networking protocols, media, and standards, making it cost effective and easy to deploy, and offering backward compatibility to the more than 170 million nodes in the Ethernet installed base world wide. Providing a tenfold increase in performance at less than half the cost makes Fast Ethernet a valuable resource to departments eager to protect their investment in Ethernet while delivering the performance required by power users and applications.

Sun has led the industry in the development and evangelism of Fast Ethernet technology. As a founding member of the Fast Ethernet Alliance, Sun has worked with other industry leaders to define Fast Ethernet specifications and standards and increase user awareness of the technology. Sun's Networking Computing Group chaired the IEEE 802.3u 100BASE-T group in writing the standard, which was approved in June 1995 and is now part of the IEEE 802.3 standard.

The Quad FastEthernet Product

Sun Microsystems introduces a low-cost, high-density 10/100 Mbps Fast Ethernet networking interface card: four high-performance 10/100 Mbps auto-negotiating ports in full or half duplex, all in a single PCI bus card slot. The Sun™ Quad FastEthernet™ (QFE) adapter provides the server and network with unprecedented performance in a single PCI bus interface card. QFE also provides trunking support, supplying the Sun customer up to 400 Mbps full duplex (800 Mbps theoretical) and load balancing across discrete links.

QFE provides four channels with independent MAC addresses for multi-homing configurations, or any combination of the four ports can use a single address when trunking is used. QFE trunking software delivers fat pipe performance that is transparent to the application layer by distributing the traffic across multiple Fast Ethernet links. When used with a trunking capable switch, QFE provides scalable bandwidth up to 400 Mbps full duplex to multimedia and other high network bandwidth applications, providing performance solutions to network bottlenecks.

QFE creates high-speed solutions, allowing multi-homing and trunking for dedicated bandwidth to servers and switching resources required by high-performance servers and desktops in the switched environments.

Positioning *(cont.)*

Key Messages

The key messages to remember about Sun's Quad FastEthernet are:

- **High speed/high density.** Sun's Quad FastEthernet network interface card is a low-cost, high-performance networking solution. It combines the performance of 100BASE-T with the high density of four ports per PCI bus slot.
- **Low cost.** Fast Ethernet is a low-cost alternative to more expensive high-performance networking technologies such as ATM, FDDI, and Gigabit Ethernet.
- **Trunking capable.** Trunking software supplies scalable aggregate "fat pipe" performance, with throughput up to 400 Mbps full duplex.
- **Network flexibility.** The multiple ports, each with its own MAC address, provide multi-homing options not available in other networking products. Any combination of the four ports can be used, providing additional configuration flexibility.
- **Investment protection.** Quad FastEthernet's four 10/100 Mbps auto-negotiating ports are compatible with both 10 Mbps and 100 Mbps networks. Existing 10BASE-T wiring infrastructure can be used, reducing overall costs.

Quad FastEthernet Features and Benefits

Sun's Quad FastEthernet networking interface card provides customers with the following benefits:

• Features	• Benefits
– 4 10/100BASE-T channels	– Provides high bandwidth
– Auto-negotiating 10/100 Mbps ports full/half duplex	– Compatible with both 10 Mbps and 100 Mbps Ethernet – Protects existing investment in 10 Mbps, eases migration to 100 Mbps
– Multiple IDs with local MAC IP storage	– Supports multi-homing – Provides network redundancy
– Trunking capabilities	– Provides 400 Mbps aggregate "fat pipe" performance in full duplex
– Single PCI bus network adapter	– Conserves PCI bus slots
– IEEE 802.3u Compliant	– Ensures compatibility and interoperability

Availability

- The Quad FastEthernet PCI Bus Adapter will be orderable starting on July 15, 1997.
- The product will be available in volume in August, 1997.

Target Markets

Customers targeted for the Quad FastEthernet fall into the following categories:

- Current SBus Quad Ethernet Controller (SQEC) customers and customers with multiple Ethernet interfaces who are moving to Sun PCI-based platforms.
- New customers who require additional bandwidth. The Quad FastEthernet network interface card supplies high performance bandwidth for up to four Ethernet connections.
- New and existing Sun customers in switched network environments where "fat pipe" trunking is a clear performance enhancement.
- New and existing Sun customers where network topology requires multi-homing capabilities.
- Customers with high-bandwidth applications, including real-time graphics and video, multimedia, imaging, and computer modeling.

Product Family Placement

Sun is offering three Fast Ethernet options for PCI-based Sun systems:

- SunSwift™ PCI Adapter

  Supports one 10/100 Mbps full/half duplex Ethernet connection and one fast/wide SCSI-2 connection. SunSwift is ideal for customers who wish to use as few PCI Bus slots as possible and require both Fast Ethernet and SCSI-2 connections.
- Sun FastEthernet™ PCI Adapter

  Supports one 10/100 Mbps full/half duplex Ethernet connection. Sun FastEthernet PCI adapter is a low cost alternative that provides a single Fast Ethernet connection.
- Sun Quad FastEthernet PCI Adapter

  Supports four 10/100 Mbps full- and/or half-duplex Ethernet connections on a single PCI card. The Sun Quad FastEthernet product is best suited for customers who need multiple network connections or who require the higher aggregate network bandwidth provided by four ports.

Networking at Sun

Sun's tagline, “The Network is the Computer™,” has become a reality as an increasing number of companies accept distributed or network computing. At the same time, existing networks have become bandwidth constrained due to the immense popularity of the Internet/Intranet, bandwidth hungry applications and extremely fast processors such as Sun's own UltraSPARC™.

Always a leader in networking, Sun has developed LAN/WAN interfaces including Fast Ethernet and ISDN and built them into Sun systems. ONC+™ and NFS™ are part of Solaris™ and available on every system. Federated Services, Common Open Software Environment (COSE), and NEO™ services continue to add strength to the Solaris distributed computing environment.

Sun supports high speed networking technologies including both ATM and Ethernet. By incorporating the appropriate combination of high-speed technologies, Sun customers reap the benefits of effective corporate networks.

Quad FastEthernet continues the Sun tradition of state-of-the-art networking products. QFE puts four Fast Ethernet channels on a single bus thus providing not only higher density but also saving precious bus slots. QFE provides a low-risk upgrade for customers requiring more bandwidth in the future.

Peripheral Component Interconnect (PCI)

As a leading supplier of powerful hardware systems for technical and commercial computing, Sun Microsystems is continually searching for innovative, reliable technologies that complement its high-performance platform designs. In looking to the future, and anticipating increased demands from users for more performance as well as more choice of system peripherals, Sun recognized the benefits of the emerging system bus option known as the Peripheral Component Interconnect (PCI) bus. While still committed to supporting SBus platforms and peripherals, Sun believes that the new PCI specification, version 2.1, is robust and powerful enough to increase the potential of Sun's desktop products, while adhering to important industry standards.

Why PCI?

PCI offers many of the same characteristics as SBus, and is an open standard that Sun has chosen to support for a variety of reasons:

- Open, economical, architecture-independent bus

  Because PCI is open, it is being adopted more quickly by both consumers and producers of computer hardware. As a result, the potential exists for a large number of platform-independent peripherals to be quickly supported, along with the resultant economies that come from a more competitive marketplace.

- PCI is fast

  The PCI bus architecture is designed to provide high performance, with its I/O performance a key differentiator from other bus architectures. Running at 33 MHz and 66 MHz, PCI offers configurations that meet a variety of developer and user needs.

- PCI is standardized

  PCI is a standard bus architecture that has been adopted by the volume personal computer industry. Because of its wide acceptance, PCI promises that compliant adapter cards will be available from more sources than ever before.

Sun believes the PCI bus design offers its customers the best of both worlds: a high-performance bus and an industry-standard design that promotes interoperability and widespread adoption.

Peripheral Component Interconnect (PCI) *(cont.)*

What is PCI?

PCI is a high-performance bus, used as an interconnect between highly integrated components and subsystems such as peripherals, add-on boards, and memory systems. On Sun™ systems, the processor, main memory, and graphics are connected through the high-performance Ultra™ Port Architecture (UPA) bus. The PCI host bridge is also connected to the UPA (see Figure 1). This design gives the I/O subsystems (such as network connections and I/O data transfers) independent paths to the system CPU and memory through the UPA bus, allowing for faster overall performance. A single Sun platform can support multiple PCI buses simultaneously, allowing for even greater expansion of the I/O subsystem and sustained data throughput.

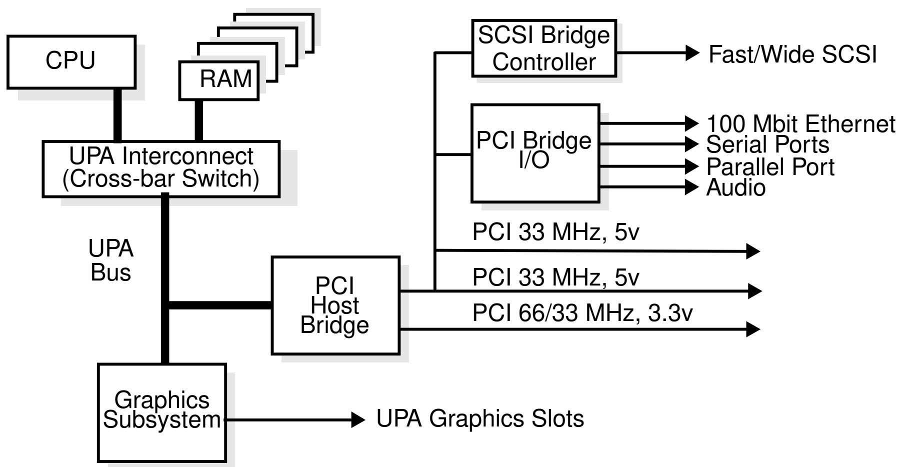

Figure 1. Typical PCI bus architecture implementation for a Sun™ Workstation™

The PCI bus design emerged from the PC industry in response to the need for greater performance for high-end graphics and I/O operations. It is a widely available industry standard bus design that meets Sun's requirements for delivering sustained, balanced performance to all parts of the computing system.

Unlike traditional bus architectures, PCI is not designed for a single system architecture. Rather, it can be adapted to run on architecturally different machines, such as Intel, PowerPC, and SPARC™. This platform independence helps maximize the number of readily available PCI peripherals and encourages the widespread adoption of the PCI design. Because of this, Sun believes PCI will become the predominant industry standard for high-end PCs and workstations in the coming years. Thus, future innovations in peripherals for multimedia, networking, and other applications will evolve on PCI-based I/O designs.

Peripheral Component Interconnect (PCI) *(cont.)*

Sun's PCI Hardware Implementation

The PCI bus is based on the industry-standard PCI specification version 2.1. Unlike many standards, the PCI specification is very broad, and covers everything from multiple form factors and voltages to connector types. Sun has chosen to implement some of the most popular options:

- Bus speeds/widths:
  - 33 MHz @ 32 or 64 bit
  - 66 MHZ @ 64 bit—the industry's first 66-MHz PCI bus
- Voltage:
  - 5V for PCI 33 MHz
  - 3.3V for PCI 66 MHz
- Form factor:
  - Short cards (7 inches)
  - Long cards (up to 12 inches)
- Low-power operation, Energy Star[SM] compliance

Transition from SBus to PCI

The SBus architecture continues to play an important role in Sun's desktop product strategy, and Sun offers both SBus and PCI-based systems and I/O options. As a result, current users of SBus systems and developers of SBus products can continue to rely on the technology that best suits their requirements.

For those new systems supporting the PCI bus, Sun has developed a line of PCI networking and I/O cards, and is working with third-party vendors to make available additional PCI products, ensuring that customers have a wide choice of platforms and I/O expansion options.

Fast Ethernet

With an existing installed base of more than 170 million Ethernet nodes worldwide, Ethernet is the world's most popular method of networking computers. However, the growing importance of LANs and increasing demand for data are fueling the need for higher bandwidth networks.

Increasing numbers of users, combined with bandwidth-hungry applications, are making network bottlenecks all too common. This need for higher bandwidth has spawned an intense interest in defining the next generation of networking technology. Fast Ethernet, a natural extension of the existing IEEE 802.3 Ethernet standard, stands out as the logical choice.

Fast Ethernet Technology

100 BASE-T Fast Ethernet consists of five component specifications: the Media Access Control (MAC) Layer, the Media Independent Interface (MII), and the three physical layers supporting the most widely used cabling types. Each of these components was designed to preserve compatibility with 10 Mbps Ethernet and existing installations.

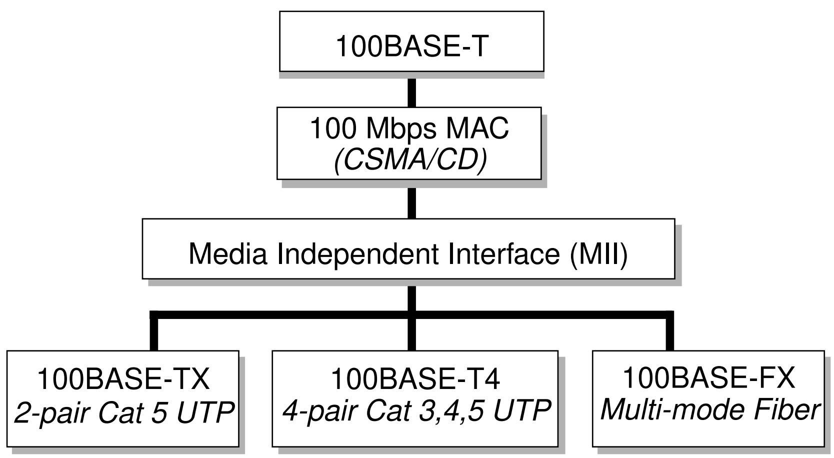

Figure 2. Fast Ethernet architecture allows scalable performance up to 100 Mbps

Fast Ethernet *(cont.)*

Fast Ethernet Features and Benefits

Fast Ethernet provides the following features and benefits:

Features	**Benefits**
– 100-Mbps network bandwidth	– Provides ten times the capacity of Ethernet
– Cost-effective migration to higher speed	– Minimizes cost of change, compared to ATM or FDDI
– ANSI 802.3u standard	– Ensures high level of interoperability with other vendors' products
– Extension of existing Ethernet standards	– Minimizes disruption and risk – Maximizes investment protection in expertise, existing applications, and wiring infrastructure

Fast Ethernet Key Facts

- Fast Ethernet is Ethernet, only faster
- A high-speed networking technology offering speeds of 100 Mbps
- Low-cost alternative to FDDI and ATM
- Backward-compatible protocols, media, and standards
- Easy migration to higher bandwidth

Fast Ethernet Tech Facts

- ANSI 802.3u-compliant
- 100-Mbps network bandwidth
- 2-pair Category 5 UTP wiring

Overview

The Sun™ Quad FastEthernet™(QFE) PCI Adapter is a half-size PCI card with a high performance PCI host interface and four 10/100 Mbps Ethernet ports, each using an RJ-45 connector.

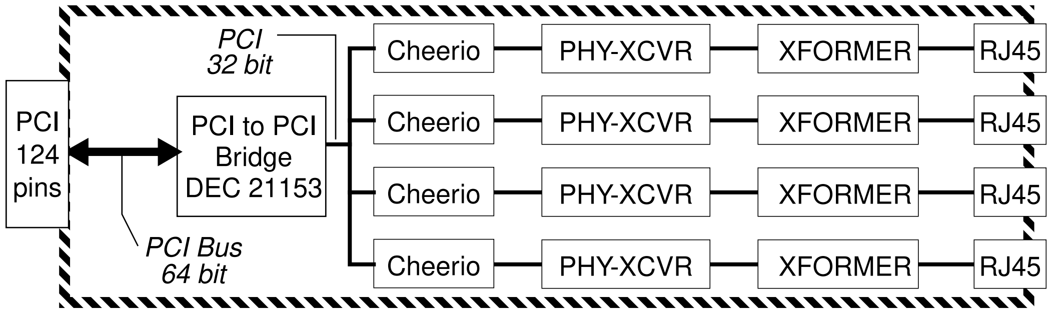

Figure 1. Quad FastEthernet system architecture.

Key Facts

- High speed and high density
- Full and/or half duplex
- Auto-negotiation capability supports both 10/100 Mbps
- Trunking support for “fat pipe” options
- Multi-homed hosts
- Low-cost alternative to high-speed technologies

Tech Facts

- Four 10/100 Mbps auto-negotiating Ethernet ports on a single PCI bus adapter card
- Trunking software supplies 400 Mbps full-duplex bandwidth (800 Mbps theoretical)
- Supports 10 Mbps (10BASE-T) or 100 Mbps (100BASE-T) Ethernet via RJ-45 connector
- For 10 Mbps, 2-pair Category 3 or better, UTP is supported; for 100 Mbps, 2-pair Category 5, UTP is required.
- Preserves Ethernet MAC and CSMA/CD layers
- Individual MAC addresses support multiple domain/IP networks
- Full packet buffering for transmit and receive packets (64 KB of memory for data)
- Link integrity LED for each channel

Integrating Quad FastEthernet into the Network

Sun's Quad FastEthernet can be implemented in the shared or switched environment by connecting to 10BASE-T or 100BASE-T Fast Ethernet switches or hubs. QFE interoperates with all hubs and switches that comply with the 10BASE-T and 100BASE-T standards.

Full-Duplex Ethernet and Trunking

Full-duplex is defined as the transmission of data in both directions at the same time. Ethernet was originally designed with a single-wire (coax) as the transmission medium and a bus topology. Transmission of data was half duplex: it could either be sent or received at any given time. The introduction of twisted-pair wiring—with separate wires for sending/receiving data—removed the half duplex restriction.

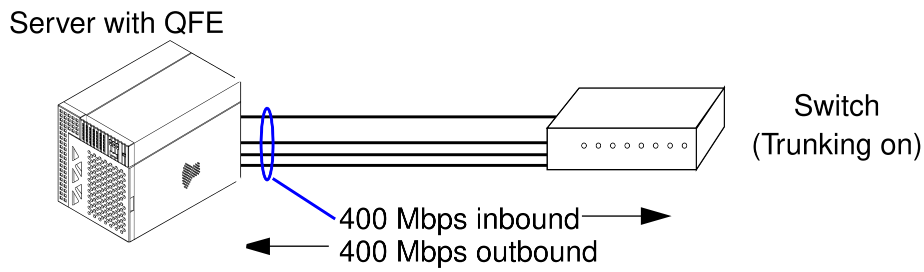

Figure 2. Server with Quad FastEthernet connected to Ethernet switch.

Full-duplex Ethernet requires twisted pair wiring and an Ethernet switch. The twisted-pair wiring medium includes two separate channels (wires) for sending and receiving data, and a switch ensures that collisions are eliminated between the two Ethernet stations (e.g., the server with QFE and the Ethernet switch). This allows data to be sent and received continuously.

When attached to an Ethernet switch, each port on the Quad FastEthernet can provide two 100 Mbps streams for simultaneous and continuous transmit and receive. This doubles the theoretical bandwidth for each port from 100 Mbps to 200 Mbps.

Trunking is defined as combining multiple links in parallel to form a single, high-speed, logical link. Trunking software (available August 1997) will allow the four 100 Mbps lines (full duplex) of the Quad FastEthernet to be "trunked" together to create one logical link with a theoretical transmission rate of 800 Mbps.

Full Integration Configuration

The four ports of the Quad FastEthernet NIC can be used independently. In this example, two ports are trunked together to provide 200 Mbps full duplex transmission to a trunking switch. A third port is used to connect to a legacy switch at 10 Mbps. The remaining port is used to connect at 10/100 Mbps to a router, providing access to the wide area network.

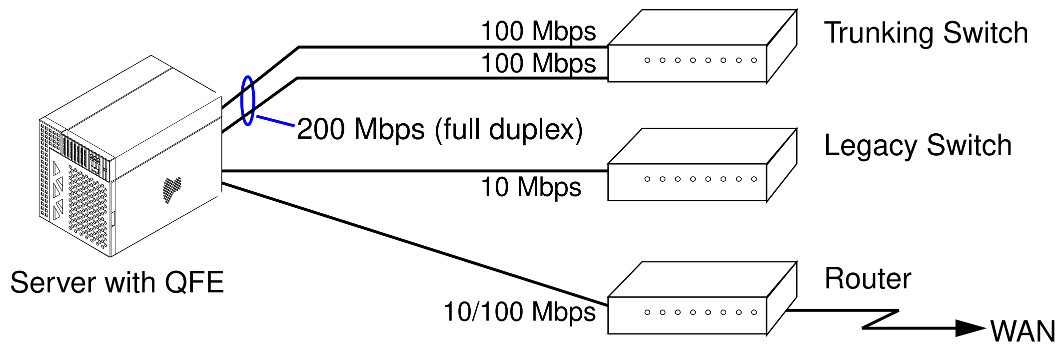

Figure 3. Example configuration for server with Quad FastEthernet.

System Requirements

- **Hardware requirements**
  - For systems running at 167 MHz, four CPUs per Quad FastEthernet PCI adapter card (one CPU per Fast Ethernet port) is recommended for maximum throughput
  - For systems running at 200 MHz, two CPUs per Quad FastEthernet PCI adapter card is recommended
  - For systems running at 30 MHz, one CPU per Quad FastEthernet PCI adapter card is recommended
- **Software requirements**
  - Solaris™ 2.5, Solaris 2.5.1 SHWP, and later releases
  - OpenBoot™ PROM release 3.0 or later
- **Supported platforms**
  - Ultra™ 450 workstation
  - Ultra™ Enterprise™ 450 workgroup server

Note: *The Quad FastEthernet PCI bus adapter is not supported on the Ultra 30 workstation.*

Interconnect

The Quad FastEthernet PCI adapter conforms to the following standards:

- 100-Mbps Ethernet conforms to 100BASE-T IEEE 802.3u standard
- 10-Mbps Ethernet conforms to 10BASE-T IEEE 802.3 standard

Ordering Information

Sun™ Quad FastEthernet™ PCI Adapter Card

Order Number	Title and Description
X1034A	Sun™ Quad FastEthernet™ PCI – Quad FastEthernet PCI adapter card, plus CD containing required drivers and QFE management software

Service and Support

SunSpectrum℠ is an innovative and flexible service offering that allows customers to choose the level of service best suited to their needs—ranging from mission-critical support for maximum solution availability to backup assistance for self-support customers. SunSpectrum provides a simple pricing structure in which a single fee covers support for an entire system, including related hardware and peripherals, the Solaris™ operating system software, and telephone support for Sun™ software packages. The majority of Sun's customers today take advantage of the SunSpectrum program, underscoring the value it represents. Customers should check with their local SunService℠ representative for program/feature variance and availability in their area.

FEATURE	**SUNSPECTRUM℠ PLATINUM℠** Mission-Critical Support	**SUNSPECTRUM℠ GOLD℠** Business-Critical Support	**SUNSPECTRUM℠ SILVER℠** Systems Support	**SUNSPECTRUM℠ BRONZE℠** Self Support
Systems Features				
Systems approach coverage	Yes	Yes	Yes	Yes
System availability guarantee	Customized	No	No	No
Account Support Features				
Service account management team	Yes	No	No	No
Personal technical account support	Yes	Yes	No	No
Account support plan	Yes	Yes	No	No
Software release planning	Yes	No	No	No
On-site account reviews	Monthly	Semi-annual	No	No
Site activity log	Yes	Yes	No	No
Coverage / Response Time				
Standard telephone coverage hours	7 day/24 hour	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday
Standard on-site coverage hours	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday	N/A
7 day/24 hour telephone coverage	Yes	Yes	Option	No
7 day/24 hour on-site coverage	Yes	Option	Option	N/A
Customer-defined priority setting	Yes	Yes	Yes	No
– Urgent (phone/on-site)	Live transfer/ 2 hour	Live transfer/ 4 hour	Live transfer/ 4 hour	4 hour / N/A
– Serious (phone/on-site)	Live transfer/ 4 hour	2 hour/next day	2 hour/next day	4 hour / N/A
– Not critical (phone/on-site)	Live transfer/ customer convenience	4 hour/ customer convenience	4 hour/ customer convenience	4 hour / N/A
Additional contacts	Option	Option	Option	Option

Service and Support *(cont.)*t

FEATURE	SUNSPECTRUM PLATINUM Mission-Critical Support	SUNSPECTRUM GOLD Business-Critical Support	SUNSPECTRUM SILVER Systems Support	SUNSPECTRUM BRONZE Self Support
Enhanced Support Features				
Mission-critical support team	Yes	Yes	No	No
Sun Vendor Integration Program (SunVIP™)	Yes	Yes	No	No
Software patch management assistance	Yes	No	No	No
Field change order (FCO) management assistance	Yes	No	No	No
Remote Systems Diagnostics				
Remote dial-in analysis	Yes	Yes	Yes	Yes
Remote systems monitoring	Yes	Yes	No	No
Remote predictive failure reporting	Yes	Yes	No	No
Software Enhancements and Maintenance Releases				
Solaris enhancement releases	Yes	Yes	Yes	Yes
Patches and maintenance releases	Yes	Yes	Yes	Yes
Sun unbundled software enhancements	Option	Option	Option	Option
Internet and CD-ROM Support Tools				
SunSolve™ license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier℠ service	Yes	Yes	Yes	Yes

Glossary

10BASE-T	10-Mbps Ethernet.
100BASE-T	100-Mbps Ethernet. See Fast Ethernet.
ANSI	American National Standards Institute.
ATM	Asynchronous Transfer Mode. A new high speed networking protocol.
COSE	Common Open Software Environment.
CSMA/CD	Carrier Sense Multiple Access with Collision Detection.
Fast Ethernet	IEEE standard for 100 Mbps Ethernet.
FDDI	Fiber Distributed Data Interface. A 100 Mbps fiber-optic LAN technology.
IEEE	Institute for Electrical and Electronic Engineers.
Internet	A global network of networks that connects all kinds of computers using the Internet protocol, enabling them to share services and communicate.
Intranet	The application of Internet technologies on internal corporate networks.
LAN	Local area network.
MAC	Media Access Control.
NFS™	Network File System.
NIC	Network Interface Card.
ONC+™	Open Network Computing.
PCI	Peripheral Component Interconnect.
QFE	Sun™ Quad FastEthernet™. Sun's 4-port 10/100 Mbps networking interface card.
SQEC	SBus Quad Ethernet Card. Sun's 4-port 10 Mbps networking interface card.
Router	A system that provides access among multiple networks.
UPA	Ultra™ Port Architecture.
UTP	Unshielded Twisted Pair.
WAN	Wide area network.