# Sun Ray™ Thin Client Family

# Just the Facts

## Copyrights



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Sun Ray 1g

Sun Ray 170

**Figure 1.** Sun Ray™ ultra thin clients

## Introduction

Total cost of ownership (TCO) and security are both high priorities in today's workgroup and enterprise environments. With a renewed emphasis on TCO, rather than just on acquisition costs, managers actively seek methods and technology to help reduce costs associated with desktop administration and maintenance. Despite the need to reduce expenditures, savings cannot be traded for a loss of functionality, performance, or availability.

The Sun Ray™ thin client family utilizes Hot Desk technology, which enables "Hot Desking," the ability for users to instantly access their sessions from any Sun Ray thin client. Sun Ray thin clients require no desktop administration (there is nothing to upgrade on a Sun Ray thin client) and are targeted at workgroup environments.

With Sun Ray Hot Desk technology, all user state is centralized on the server and linked by an interconnect fabric of standard Ethernet cables and switches, either physically dedicated or implemented with a VLAN. The result is a desktop environment that is "stateless", which leads to TCO and security benefits.

The Sun Ray Hot Desk architecture is composed of:

- The Sun Ray thin client
- The Sun Ray server software

Benefits for the IT manager are centralized administration, stability, and security. Benefits for users are performance, a rich user environment, and an "always on, always available" desktop resource.

## Feature Summary

Sun introduces a new release of the Sun Ray Server Software 3.1 (SRSS 3.1). The enhanced software allows customers to deploy cross-platform (Linux/Solaris -SPARC & x86), expanded peripheral support and low bandwidth capability. Along with Solaris platform support, Sun Ray Server Software 3.1 is supported on the following Linux platforms: Java Desktop System, release 2, Red Hat Advanced Server 3 (32-bit) and SuSe SLES 8 (32-bit). Customers seeking to expand their Solaris 10 environments on the desktop on either SPARC or x86 servers, now have the ability to use Sun Ray ultra-thin clients. They will gain the large and growing application sets that take advantage of the key new features in Solaris 10.

Features include:

- **Operating System Choices**

  Sun Ray Server Software version 3.1 includes support for the Solaris 10 with Java Desktop System on either SPARC or X86 based servers. It also includes support for Linux (RedHat Advanced Server 3, SuSe SLES 8 and Java Desktop System release 2) operating systems.

- **Regional Hot Desking**

  Sun Ray Server Software version 3.1 extends the ability of users to access a virtual desktop session across failover groups. Users can now access the same session as they roam from office to office (across town or across the country).

- **Audio**

  This feature enhances audio optimizations for third party VoIP softphone applications in a LAN (100Mbps) environment.

- **Security**

  Security enhancements to the Web-based Adminstration Tool enabling tracking of which users made modifications of the Sun Ray server configuration.

- **Expanded Peripheral Support**

  Expanded Peripheral capabilities and control. The Sun Ray 170 serial ports are activated. Additionally, centralized adminstration control over the USB ports, internal smart card reader and serial ports can be globally enabled or disabled (except for keyboard and mouse traffic) by the system adminstrator.

- **XKB Xserver Extension Support**

  This extension is required for applications that create on-screen keyboards. The presence of the extension is controlled through new options to the utxconfig command.

- **Network Enhancements**

  Enhancements have been made in the Sun Ray Server Software version 3.1 to the networking configuration options for Sun Ray clients (DNS services for networking parameters).

- **Token Reader Administration**

  Token reader administration can now be done from any server in a fail over group to which the administrator and the token reader are connected. For sites that don't allow remote administration via the administration GUI, token reader administration can now be done from any server in the group.

- **Bandwidth Optimization**

  Sun Ray Server software version 3 further optimized the bandwidth usage for server/client communications. These enhancements improve the performance of Sun Ray thin clients deployed on a shared LAN environment.

- **Low Bandwidth capability**

  This feature in SRSS3 made it possible to provide options for existing customers to extend installations for work-from-home and remote/serverless offices via a 300Kpbs (DSL, Cable) connection for a single Sun Ray client through a VPN router.

- **LAN deployment capability**

  This feature enables Sun Ray thin clients to be deployed in a LAN environment by using the Sun Ray server as the DHCP server for all client devices on the subnet, by connecting the Sun Ray servers directly to every subnet and by utilizing a BOOTP relay agnt that can be directed toa Sun Ray Server.

- **Smart Card support**

  Sun Ray Server Software 3 provided a PC/SC Muscle Smartcard API used by applications for Smart Card communication. Sun Ray thin clients works with ISO 7816 compliant Smart Cards that use the T=0 and T=1 protocol.

- **Privacy Mode**

  Administrators may “turn on” the privacy mode function that encrypts traffic between the Sun Ray Server and the Sun Ray thin client regardless of the network. This feature uses the 128 bit ARCFOUR software encryption to encrypt data traffic between the Sun Ray thin client and the Sun Ray server. The general USB data and multimedia data are not protected. A Diffie-Hellman key exchange is performed upon session origination and repeated throughout the session.

- **Packet reporting tool**

  With "utcapture," a packet loss measurement tool, and guidelines from the new Advanced Administration Guide, system administrators can reconfigure their routers/switches to meet the necessary QoS level for Sun Ray thin clients and improve network performance.

- **Controlled access mode**

  Sun Ray thin clients can be configured to launch and restart applications automatically, without a user login. In addition, system administrators can control or limit which applications users are able to access.

- **SNMP monitoring**

  Customers can use either Sun Management Center software or compliant third-party management frameworks (such as Tivoli) to monitor the Sun Ray environment.

- **Enhanced session management**

  This feature provides the ability to display, locate, terminate, and suspend user sessions.

- **Expanded USB and Mass Storage devices support**

  Provides support fot a wide range of peripherals via the LibUSB API and support for a set of mass storage devices on Solaris OS. Refer to `http://www.sun.com/io_technologies/sunray/index.html` for a list of Sun Ray verified third-party peripherals.

## Sun Ray Thin Client Overview

Although thin client computing has been discussed and attempted for many years, Sun Ray is the first implementation to offer both workstation-like user functionality and sufficient speed and reliability to be suitable for mission-critical applications. The latest generation of Sun Ray Server Software now supports many USB peripheral devices, LAN and low bandwidth WAN deployments. Originally developed on Sun's Solaris Operating System, Sun Ray Server Software is now also supported on three Linux variants:

RedHat Enterprise Linux Advanced Server 8, SuSe Linux Enterprise Server 8 and Sun Java Desktop System 2.

The Sun Ray Hot Desk architecture consists of two components: the Sun Ray thin client and the Sun Ray server software. The interconnect between thin client and server is an unmanaged, switched Ethernet connection using standard network components (switches or hubs) and standard Cat 5 wiring.

The Sun Ray thin client is a simple, low-cost thin client that requires no desktop administration, is centrally managed, and provides an exceptional user experience. Unlike Microsoft Windows-based terminals and PCs, Sun Ray thin clients do not need to be upgraded when new applications are introduced or more computing power is required. They also provide a unique smart card interface that allows users to instant access to their sessions from any Sun Ray thin client beyond a single Sun Ray server failover group. The Sun Ray thin client is well suited for enterprise environments including call centers, training and education, government, financial services, and ERP.

Sun Ray thin clients are centrally managed by the Sun Ray server software, which runs on Sun Fire SPARC and X86 intel/opteron servers. Underlying this architecture is the Hot Desk technology, which enables "Hot Desking," the ability for users to instantly access their sessions from any Sun Ray thin client. This provides the following benefits for the system administrator:

- Provides user authentication and user session management
- Enhances security
- Helps reduce the complexity and administration of the IT environment

## Key Messages

The Sun Ray thin client allows Sun to aggressively enter the enterprise desktop market with a truly compelling product that provides the customer with many powerful features.

- **Simple, low-cost thin client**
  - Sun Ray thin clients do not require any administration at the desktop.
  - Sun Ray thin clients do not need to be upgraded to take advantage of new applications or functionality.
  - There is no software (OS or application) installed or embedded on Sun Ray thin clients.
- **Centralized administration and control**
  - Sun Ray thin client systems provide centralized management of applications and services at the desktop by using the power, reliability, and scalability of Sun Fire SPARC™ servers running the Solaris Operating system. or Sun Fire X86 servers running Linux or Solaris x86 Operating system.
  - Application clients and other service producers run unchanged on the server and render their output to a virtual frame buffer. The output is transmitted, using an Ethernet connection, to an attached Sun Ray thin client. All input (keystrokes, mouse clicks, and so on) are transmitted back to the server.
- **Exceptional user experience**
  - Sun Ray thin client systems have an exceptionally simple user interface with instant access to a unique user session from anywhere in the server group.
  - All-in-one thin clients conserve desktop space.
  - The Hot Desk technology provides excellent performance.

- The Sun Ray thin client provides access to the Solaris Operating System, Linux and Java applications, as well as access to other flavors of UNIX®, 3270 front ends, and Microsoft Windows in conjunction with technology from various third-party software vendors.

## Sun Ray Architecture Components and Terminology

### The components of the Sun Ray architecture which are actually deployed:

- The Sun Ray thin client.
- One or more Sun Fire servers running the Solaris or Linux Operating System.
- The Sun Ray Server Software running on each server
- The components of the interconnect (Ethernet switch, Cat 5 wiring)
- Optional Interoperability software to access Microsoft applications.

### Elements of the Sun Ray Architecture

- **Sun Ray ultra thin client**
  - A stateless, zero-administration, simple, low cost clients with no moving parts, and no local operating system. It displays the user sessions from a centrally managed dedicated server running Sun Ray Server Software.
- **Sun Ray server software**
  - The server-based software is used to manage, administer, and provide the screen display for any Sun Ray thin client on the network.
  - Its main components are:
    - Authentication Manager
    - Group Manager
    - Session Manager
    - Administration Tool

### Hot Desk Technology

- "Hot Desk", "Hot Desking" or “Session Mobility” refers to the ability of the user to access their sessions instantly from any Hot Desk-enabled thin client in the server group. Hot Desking is enabled by Hot Desk technology, the technology underlying the Sun Ray Hot Desk architecture.
- Key elements:
  - A fast and efficient interface used to communicate between server and thin client
  - Smart card technology
  - Server software which instantly maps users' sessions to thin clients

### The Interconnect/ Network

- The interconnect is the connection between the Sun Ray server and any Sun Ray thin client.
- The first generation Sun Ray server software versions 1.0, 1.1, and 1.2 requires Cat 5 wiring and 10/100 BASE-T switched Ethernet. With Sun Ray server software 1.3, a VLAN can be implemented. With Sun Ray Server Software 3.1, a LAN and WAN deployment can be implemented using DHCP and direct connection to every subnet and utilizing a BOOTP relay agent.

### Interoperability Software

- The following software can be used to link the Sun Ray thin client to multiple platform/environments (these have to be purchased separately, in addition to the Sun Ray Server Software):
  - Secure Global Desktop Enterprise Edition from Tarantella
  - Citrix MetaFrame XP for Windows
  - ThinSoft Winconnect-S
  - Netraverse Win4Lin
  - HOB JWTLink products
  - Third-party mainframe connectivity products
    1. Rdesktop
    2. Ericom software

## Product Family Placement

<table>
<tr><th>Product Requirement</th><th>Solution Type</th><th>Applications</th><th>Suggested Platform</th></tr>
<tr><td>• Accelerated 3-D graphics (MCAD/MCAE)<br>• Exceptional performance<br>• Can stand alone</td><td>Workstation/PC</td><td rowspan="2"> 
</td><td>Sun ™ workstation<br>Java Desktop System<br>PC</td></tr>
<tr><td>• Excellent performance (2-D)<br>• RAS<br>• Low TCO<br>• High Security<br>• Simplified Administration<br>• Mobility with Security</td><td>Technical Thin Client</td><td>Sun Ray thin client</td></tr>
</table>

### Sun Workstations

The power desktop is optimized to provide solutions for the technical desktop such as CASE, MCAD, and technical/scientific applications for standalone environments. Ultra workstations are designed to provide exceptional application performance, even in environments with demanding applications such as 3-D graphics that require hardware-based graphics acceleration.

Unlike the Sun Ray thin client, Sun workstations require local system administration.

### JDS – Java Desktop System

Java Desktop System delivers the best of open source software with the technical innovation of Sun to offer an affordable, comprehensive, fully integrated desktop client environment with administration and developer tools and an enterprise-ready support offering that lovers business costs, reduces complexities of desktop management and provides a secure computing environment. JDS is based on Linux operating System.

## Product History and Availability

- The Sun Ray 1 thin client and the Sun Ray Server Software, version 1.0, were released in August 1999.
- The Sun Ray server software version 1.1 was released in April 2000.
- Two new members of the Sun Ray thin client family were introduced in July 2000:
  - The Sun Ray 100 thin client, an "all-in-one" product with the Sun Ray technology embedded in a 17-inch CRT
  - The Sun Ray 150 thin client, with the Sun Ray technology embedded into an LCD flat panel (15-inch TFT) display
- The Sun Ray Server Software version 1.2 was introduced in November 2000.
- The Sun Ray Server Software version 1.3 was introduced in August 2001.
- The Sun Ray Server Software version 2.0 was introduced in January 2003.
- The new Sun Ray Server Software version 3 introduced in November 2004.
- The new Sun Ray Server Software version 3.1 to be introduced in September 2005.
- The new member of the Sun Ray thin client family introduced in November 2004
  - The Sun Ray 170 thin client, with the Sun Ray technology embedded into an LCD flat panel (17-inch TFT) display (with video-in, 2 serial ports, dual sided smart card reader).

## Target Markets

The Sun Ray thin client is designed for users who require simplified deployment and low-cost administration, high performance, low TCO, and convenient RAS features. Although the Sun Ray thin client will have a broad applicability within a wide variety of environments over time, the product is currently focused on the following markets.

Target markets include:

Government - Secure Desktop Applications.

Technical - Electronic Design Automation (EDA).

Finance - Retail Branch Banking, Trader Desktops.

Healthcare - Hospitals, healthcare networks.

Customer Relationship Management (CRM) - Call Centers.

Education - K-12 and Universities and Research Institutions.

| Key Markets and Uses | Key Selling Points |
|---|---|
| **Customer Relationship Management Solutions**<br>• Call centers<br>• Help desks<br>• Sales support | • Based on Solaris and Linux Operating System — helps minimize downtime, which is critical to this 24x7 environment<br>• Centrally managed — zero client administration<br>• Users tied to sessions, not desktops — shifts can share desktops<br>• A simple, low-cost, thin client — an excellent fit for budget-constrained organizations<br>• All-in-one units reduce desktop footprint. |
| **Government**<br>• Command and control desktops<br>• Administrative desktops | • User tied to a session, not to a desktop — allows user mobility among command and control stations; allows for high desktop-system utilization; one thin client can be used for multiple shifts.<br>• Trusted Solaris for EAL4 certified solutions.<br>• No desktop administration — perfect for administrative desktops<br>• A simple, "plug and work" thin client — devices are easily torn down and set up, only the server is configured; perfect for field mobility units<br>• Centrally managed — reduces desktop upgrade and management costs/issues<br>• Utilizes strengths of the Solaris Operating System — provides the RAS features required for tactical situations<br>• Inexpensive thin client — well-suited for government to use as an upgrade for older terminal-based networks |
| **Electronic Design Automation (EDA)**<br>• Compute farm users<br>• EDA users<br>• Engineering managers<br>• Design Engineers<br>• EDA ISV training centers | • Greater data and process integrity<br>– Increased security for intellectual property<br>– Synchronized design data ensured<br>– Improved process flow<br>• Increased design staff productivity<br>– Significant reduction in engineer downtime<br>– Increases efficiency and fosters team interaction of engineers, resulting in quicker problem solving<br>– More pleasant working environment with multi-head 24” monitor support @ 1920x1200 resolution on Sun Ray™ 1g client.<br>– Execute more design jobs<br>• Reduced cost of running and owning desktop environment<br>– Decrease in amount of initial and ongoing desktop administration<br>– Easier planning and budgeting<br>– Lower cost of adding new seats<br>– Elimination of enforced centralization<br>– Reduction in time spent on doing backups<br>– Reduction in desktop power consumption |

| Key Markets and Uses | Key Selling Points |
|---|---|
| **ERP**<br>• Financial<br>• Manufacturing<br>• Human resources | • A "plug and work" thin client — desktop maintenance is eliminated; thin clients can simply be replaced<br>• Centrally managed — allows more effective sharing of under-utilized computing resources (memory and CPU)<br>• No state or data on desktop — allows centralized control, quality, and backup of data; no local data to lose or to keep "in sync" with the central repository<br>• Users tied to sessions, not desktops — gives supervisors the ability to be mobile within the workgroup<br>• User state maintained on server — provides protected, dedicated environment for ERP; users cannot introduce viruses, change session configuration settings, or run unauthorized software |
| **Finance**<br>• Back office<br>• Administration<br>• Trading operations | • Supports multiple environments — allows access to multiple platforms without needing more than one system in the work space<br>• With the choice of Solaris & Linux Operating Systems — delivers the power and reliability that financial institutions demand. Java Branch Controller solution:<br>1. remote management features<br>2. Java based teller applications<br>3. Trader Desktop can use multihead 24” monitor displays<br>• Applications deployed on server — allows for more frequent upgrades without disturbing the desktop; users can stay up with the latest technology.<br>• Small footprint — saves desk space in this market, where desk space is at a premium |
| **Education**<br>• K-12 education<br>• Library automation<br>• University academic/research<br>• Campus automation | • Zero client administration — teachers and librarians do not need to become system administrators<br>• Centrally managed — lowers administration costs for this resource-constrained industry<br>• No fan — quiet for libraries<br>• Users tied to sessions, not desktops — allows desktops to be shared by multiple users, while at the same time providing instant access to individual sessions<br>• Applications deployed on server — well-positioned for service provider-based educational portals |

Target users for the Sun Ray thin client include the following:

- **The call center desktop**

  The call center market is close to three million seats in 2000 and is expanding at a rate greater than 25 percent per year. Businesses are expanding and modifying their call centers to improve customer service and sell new services. This expansion has put more focus on reducing the cost of the desktop of the call center operator. Typically, these operators like the multiservice access that the Sun Ray thin client system provides, in addition to zero desktop maintenance costs. This along with the ability to share desktops and still preserve the user session make the Sun Ray thin client a compelling solution. The ability to leverage existing applications reduces the sales cycle for the Sun Ray thin client system and Sun has a large installed base of servers in the Telco call center which is the initial target.

- **Education**

  The educational market finds the following Sun Ray thin client features especially compelling:

  – Low TCO — low purchase cost and zero administration on the desktop

  – Smart card capability

  – Multimedia presentation of instructional content — video (television) capability

- Access to instructional content on multiple platforms
- Reliability and scalability

The Sun Ray thin client is appropriate for all levels of educational and library services including university and academic research, K-12 education, and library automation.

**University academic/research**

This is a traditional Sun market. As student access to the Internet increases, the need for a low-cost, low-maintenance access device that can be shared by multiple users, and provides the individuality of a traditional PC is very important. The Sun Ray thin client provides both of these features. The university market is 5 million units and is increasing 20 percent a year.

**K-12 education**

The education market offers a breakout opportunity for Sun Ray thin clients. Today there is no satisfactory client solution for the K-12 market — PC and Macintosh systems are used by default. Sun Ray thin client solves two problems: it is more economical than PCs, and it removes the need to train teachers in PC administration and repair.

In addition, in the K-12 educational market, content delivery is moving to an Internet service provider (ISP) model. The service provider delivers services over the Internet through portals to the schools. Because its Solaris Operating System underpinnings provide browser and Java technology capability, the Sun Ray thin client can become a key element in the next wave of educational computing which will be based on service providers on the Internet.

- **The ERP desktop**

  Sun has an increasing presence on the server side in this rapidly expanding market (2 million seats increasing at 33 percent according to AMR). Strategically, Sun Ray thin client has the potential to be very important in these accounts by populating the desktop, which is now dominated by Microsoft Windows and Intel processor-based PCs. With Sun Ray thin client, Sun has the ability to extend its reach from the server room to the desktop in a aggressive way.

- **The secure desktop**

  With no data, no applications, and no operating system, the Sun Ray thin client provides significant security benefits. Data is an asset and, as such, is best protected in a central location: the server. If a Sun Ray thin client is removed from the desktop, no data can go with it. In addition, the use of Trusted Solaris™ software provides a role-based, multilevel secure environment.

- **The technical desktop**

  The Sun Ray thin client is entirely suitable for the technical desktop in areas such as EDA/software development. Users who require 3D imaging/graphics acceleration should use a workstation. For EDA/software development, success stories are available.

## For further success stories go to: http://wwws.sun.com/sunray/success.html

# Selling Highlights

## Market Value Proposition

If an organization is looking for the best desktop client solution to optimize productivity, then Sun Ray Server Software is the right choice because it delivers substantial return on investment (ROI), coexists with existing back-end infrastructure (Microsoft Windows, Mainframe, etc.), offers multiplatform support (Solaris and Linux), and virtually eliminates client virus treats.

With the Sun Ray Building Blocks promotion you get the necessary hardware and software to deploy a Sun Ray thin client environment.

This environment will reduce the cost and complexity in maintaining desktops, improve the security of your infrastructure, and provide campus/facility wide mobility allowing a session to follow you with the included Sun Ray smart card hot desking feature.

These bundles deliver powerful mission critical desktop and server solution for PC prices.

Sun Ray™ thin clients provide the following value for Sun's customers:

- Security: With no data, no applications, and no operating system, the Sun Ray thin client provides a secure desktop environment. With the addition of Trusted Solaris™ software for multilevel security, the Sun Ray thin client becomes "ultra-secure."
- The centralization of administration of all desktop applications and resources on the Sun Ray server enables a significant reduction in administration effort and application cost for the enterprise.
- The zero-administration desktop significantly reduces the total cost of ownership and increases employee productivity by reducing downtime. If a Sun Ray thin client fails, it can be easily replaced by another thin client without the user losing their computational state (applications and data).
- The Hot Desk technology brings Sun's core strengths of highly reliable, scalable, and available servers to the desktop, thereby increasing employee productivity.
- The Hot Desk architecture allows for a more efficient allocation of network resources such as CPU, memory and storage, ultimately lowering the total cost of ownership per capita in the enterprise.
- The Sun Ray thin client offers a rich user experience including Hot Desking, the power of the server on the desktop, and access to all your applications (UNIX®, NT, 3270/5250), plus multimedia capabilities.
- The all-in-one thin client form factor saves valuable desktop space. The Sun Ray 170 thin client offers alternative (VESA-compliant) mounting possibilities, such as on a wall, swivel arm, or mount. In addition, the Sun Ray 170 also comes with 2 serial ports in the client.

## Applications and Solutions

Applications that support SPARC™ platform/Solaris, Solaris x86 or Linux Operating System run unmodified with Sun Ray thin clients. The recommended configuration is having Sun Ray server software on the Sun Ray server, and having the applications on separate application servers. Using third-party software applications from Tarantella, Citrix, Ericom etc will allow you to run Windows, Mainframe, AS400 applications.

## Sun Ray Technology

Sun Ray™ thin clients implement the Sun Ray architecture, the next logical step in an evolutionary process towards more economical and secure computing environments. This new approach removes everything from the desktop except the resources needed for the human interface — input from the keyboard, mouse, and voice or output to the display and audio (see the figure below). All computing is performed on one or more centralized, shared machines. Everything that previously ran on the user's own desktop — window system, user applications, mail clients, and so on — runs in a session on the server. The Sun Ray thin client display provides a composite view of all currently active applications, with input/output between the user and the servers carried over a simple, interconnection fabric.

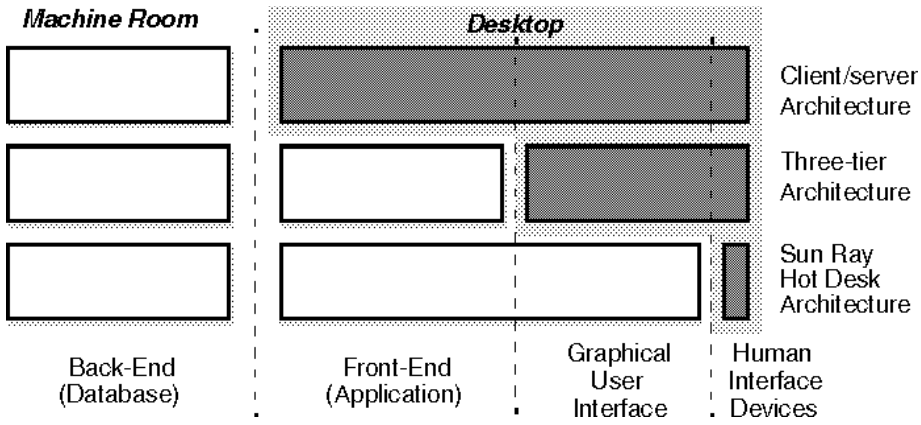



**Figure 2.** Sun's Hot Desk technology repartitions the functionality between the desktop and the machine room, leaving only the human interface thin client on the client desktop

Because applications execute independently, this architecture allows a user to access their unique session from any Sun Ray thin client within the server group. By redirecting input and output, a user's session environment can be moved from one Sun Ray desktop to another instantaneously.

The Hot Desk architecture provides substantial new opportunities for the creation of advanced applications based on Java™ technology, Internet, or collaboration technologies; however, this architecture can be realized without making changes to most existing applications. The vast majority of applications that run on the Solaris™ or Linux Operating system today will run unchanged on the Sun Ray thin client by using third-party software for Windows. The Sun Ray thin client is able to do this through virtual device drivers for X11, which emulate the usual target devices (such as a frame buffer) and send/receive low-level commands to and from the desktop devices in support of the desired user interaction.

This system architecture offers many advantages, perhaps the greatest of which is the ability to take advantage of the statistical multiplexing opportunities provided by the highly bursty and low duty-cycle resource demands of the majority of users. By centralizing and sharing the system's computational resources, significant cost savings can be achieved, which typically provides users with higher levels of performance. Given the nature of the gains that can be obtained through sharing of resources, it becomes

possible to add redundancy back into the computational facility for high reliability (for example, through mirroring and hot-standby techniques) at a lower overall cost.

The Sun Ray architecture focuses on the delivery of services to users, and decouples the delivery of these services from the application component. This architecture shifts the focal point from the desktop to the machine room computing complex. This server-centric world view plays to Sun's existing strengths: the ability to support large numbers of independent users over a high-performance network connection. All of the server technology being developed today in support of the RAS objectives can be used to provide a more robust system based on the principles of the Sun Ray architecture.

To the greatest extent possible, the Sun Ray architecture attempts to eliminate the need for thin client administration, as opposed to creating new administration tools or simply centralizing the tasks. The Sun Ray thin client consists of little more than a keyboard, mouse, and display. There are no user-accessible or alterable resources on the desktop. Also, as the thin client is not a network peer, the network administration stops at the Sun Ray server. The "last mile" of interconnect is substantially administration free.

The fact that no user state exists on the desktop means that Sun Ray thin clients are completely interchangeable and that the failure modes of user computations are independent of the desktop. Also, for this reason, there will be virtually no reason to modify or upgrade the Sun Ray thin client, regardless of what kind of application a user might wish to perform. Once the Sun Ray thin client is capable of meeting the input/output requirements set by the limits of human perception, a faster processor or more memory does not provide any perceptible benefit to the user.

The lack of hard drive user state on the desktop has the additional benefit of allowing an impressive degree of mobility. This feature allows users to gain complete and total access to the computational services being executed on their behalf by the server complex, without regard to the exact physical location of the user.

## Smart Card Technology

The Sun Ray desktop unit includes a built-in smart card reader that conforms to the ISO-7816 standard. Smart cards are the size of an ID badge or credit card. Sites using compatible smart cards are able to deploy and integrate them, if desired, with the Sun Ray thin client security system. The Sun Ray thin client's default authentication policy does not require a smart card, however; smart cards are not shipped with the product. Smart cards are available separately from Sun in packs of 25, either with Sun artwork or as blank white cards suitable for overprinting.

## Sun Servers and Solaris Operating System

Because computation takes place on servers, Sun Ray performance is a function of server performance. And with Sun Fire servers running the Solaris Operating System, Sun Ray thin client users can get all of the performance and scalability they need.

Sun's Sun Fire Servers are a leader in the industry in offering some of the most powerful, scalable, and reliable systems available today. Sun's family of servers provide scalable, symmetric multiprocessing capabilities, featuring from one to 64 high-performance UltraSPARC™ processors, up to 64 GB of physical memory, and up to 20 TB of disk storage, providing ample performance for peak demands as well as virtually unlimited growth. For the highest levels of availability, Sun servers also support clustering technology that can raise availability to levels over 99.99 percent. Sun Ray thin clients can be used with any Sun server (a minimum of two CPUs is recommended).

The power of Sun's servers is further enhanced by the Solaris Operating System, a premiere environment for enterprise network computing. Designed with the needs of enterprises in mind, the Solaris Operating

Environment features full 64-bit processing, mainframe-class reliability, superior scalability, and unprecedented performance. The Solaris Operating System has significant enhancements to support multi-user environments, and is uniquely suited to Sun Ray's new generation of time sharing.

## Low-Cost, High-Bandwidth Switched Networking

The Sun Ray thin client protocol no longer requires a dedicated connection between the desktop and server. Sun Ray Server Software 3.1 ensures a defined quality of service in terms of latency, bandwidth, and congestion-induced loss on the link. This version has brought significant bandwidth enhancements where you can run Sun Ray client at the end of a DSL or a Cable line with no local server. The bandwidth requirements is as low as 300kpbs. Such implementation reduces costs and maintenance. No higher level services such as NIS, NFS, LDAP, or SMTP are required, and no complex network management is necessary.

## Sun™ Management Center Software

Sun™ Management Center software may be very helpful to administrators who need to monitor and maintain the health of a Sun Ray server.

For enterprise computing environments where ease of management, application availability, optimal performance, and scalability are crucial, Sun Management Center software provides all the system management capabilities an administrator could ask for, including the ability to:

- Manage hundreds of Sun systems from any platform with an easy-to-use Java technology interface
- Simplify management of Sun environment to lower service-level costs
- Provide remote online control and "no-cease" management to streamline deployment of new features and reconfiguration of existing ones
- Provide predictive failure analysis to warn of problems before they occur
- Monitor application health through comprehensive process monitoring and log file scanning features
- Control management for remote dynamic reconfiguration and auditing securely
- Perform real-time performance monitoring and optional centralized data storage and performance analysis, including historical trend analysis

The following five areas of the Sun Ray solution can be monitored via Sun Management Center software:

- Sun Ray System — Sun Ray server and load info.
- Sun Ray Services — Sun Ray daemons on a Sun Ray server
- Failover group — Sun Ray servers in a failover group
- Interconnect — Interfaces on a Sun Ray server
- Desktops — Sun Ray thin clients connected to a Sun Ray server

## Sun Ray™ Thin Client System Overview

The Sun Ray™ thin client system consists of three components: the Sun Ray thin client, the Sun Ray server software, and the Sun Ray interconnect. The Sun Ray interconnect fabric (physically dedicated or shared network) is an unmanaged, point-to-point connection over a switched Ethernet network.

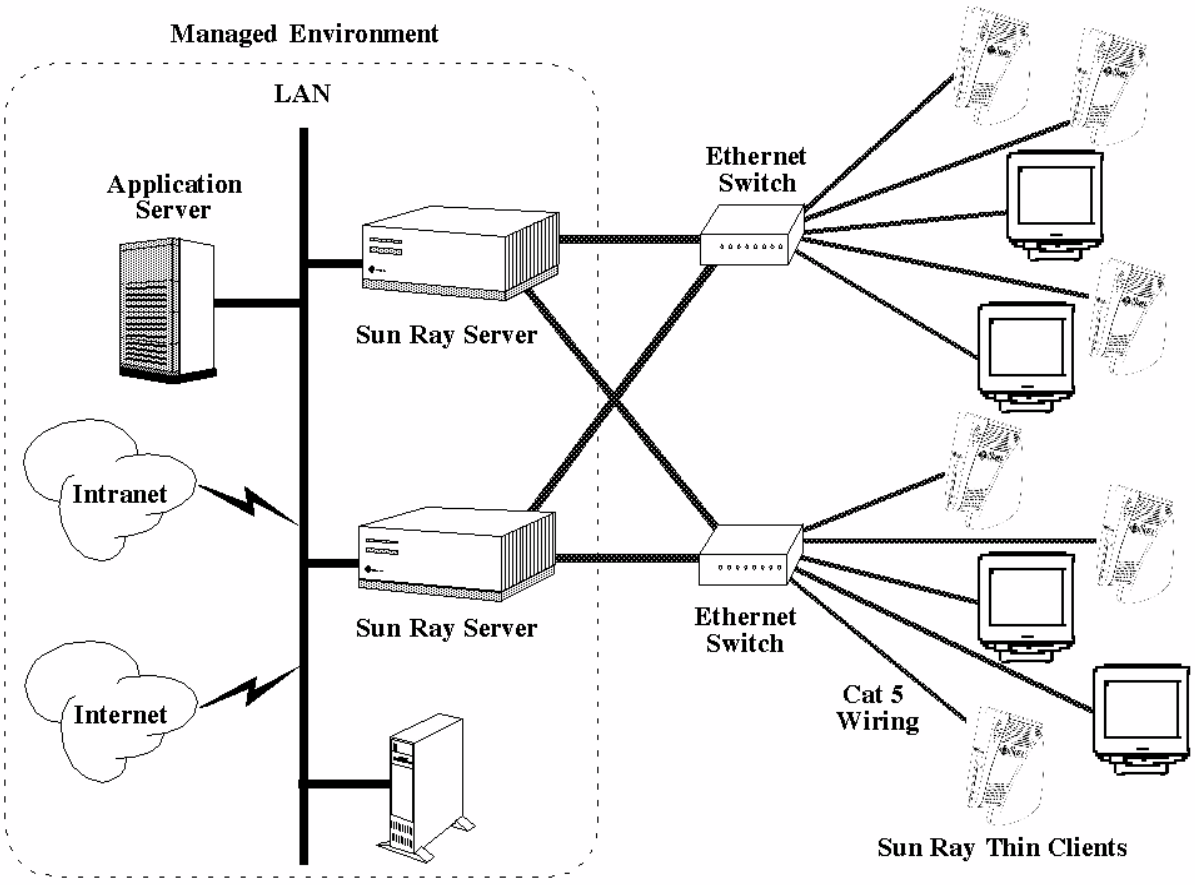



**Figure 3.** High-level diagram of Sun Ray thin client architecture in a server grouping configuration enabling load distribution and failover (Sun Ray 1 thin clients shown here)

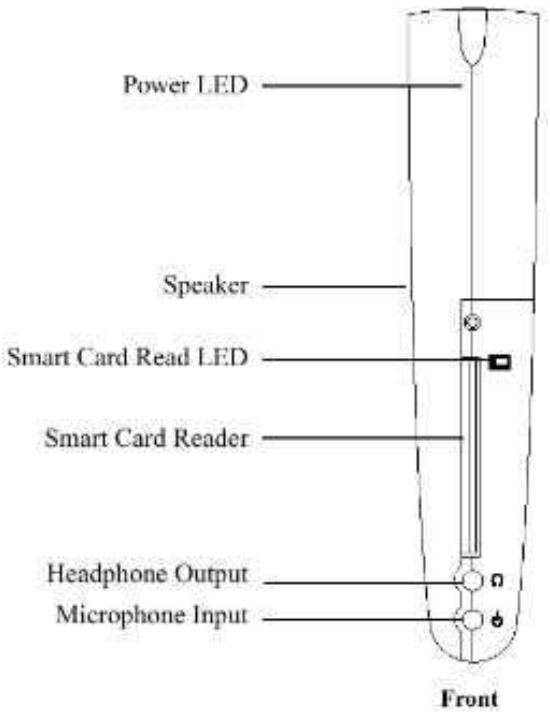
| Features | Benefits |
|---|---|
| • No computation performed on the Sun Ray thin client — all processing is done on the server | • No application or performance limitations due to lack of desktop resources<br>• The Sun Ray thin client never needs upgrading |
| • No state on the Sun Ray thin client | • No loss of work if desktop dies<br>• User sessions and environments not tied to physical hardware units<br>• Security |
| • Stateless, "plug-and-work" thin client | • Virtually eliminates time and cost required to install and maintain the desktop<br>• No desktop upgrades are required to take advantage of new applications |
| • Platform independent | • Can run Solaris™ Operating system software Linux Operating system software (JDS, RedHat, Suse), Java™ software, and multimedia applications<br>• Can access Microsoft Windows 4.0 or Windows 2000 using a variety of third-party products<br>• Existing applications can run without porting or rewriting |
| • Low Bandwidth/ WAN support | • Provides options for existing customers to extend installations for work-from-home and remote offices via a 300Kbps connection for a single Sun Ray client. |
| • Optional smart card allows "Hot Desking" | • Users who have to move around or share desktops can still get instant access to their own unique session<br>• Users access their sessions instantly and securely from any Sun Ray thin client in the server group |
| • No administration or maintenance needed on the desktop | • Significantly lowers cost and complexity of adding resources, upgrading, or adding new software |
| • Leverages shared server resources | • Every user gets server-class performance, at a significantly lower cost than putting comparable resources on every desktop |
| • Leverages Sun's server RAS strengths | • Helps reduce likelihood of system failure or lost productivity |
| • High-speed, dedicated interconnect between server and thin clients | • Reduces the number of managed network nodes<br>• Delivers excellent quality of service |
| • Minimal footprint | • Saves desktop space |

| Features | Benefits |
| --- | --- |
| • VESA mount compliant (Sun Ray 170 thin clients only) | • Allows various mounting options, including: wall and arm |

## The Sun Ray 1g Thin Client

The Sun Ray 1g thin client is a simple, low-cost thin client for workgroup environments. The thin client requires a USB keyboard and USB mouse, and connects to any of a number of Sun monitors or standard SVGA monitors. The thin client includes a total of four USB ports. The Sun Ray 1g doesn't have the PAL/NTSC Video-In port anymore. Below shows front and back view of Sun Ray 1g thin client.

**Figure 4.** Front view of the Sun Ray 1g thin client




Back view of the Sun Ray 1g thin client

**Note: The PAL/NTSC Video-In port is no longer available and has been taken out in Sun Ray 1g. Also the monitor connector on Sun Ray 1g is a DVI connector.**

Dimensions and Weight:

Width - 102mm (4in.)

Depth - 280mm (11in.)

Height - 306mm (12in.)

Weight – 1.8kg (3.9lb.)

Graphics: 24-bit, up to 1920x1200 resolution @ 75Hz

## The Sun Ray 170 Thin Client

The Sun Ray 170 thin client is an "all-in-one" thin client for workgroup environments, that embeds the Sun Ray thin client features into a 17-inch TFT flat-panel display format. The thin client requires a USB keyboard and USB mouse. The thin client includes four USB ports and 2 serial ports.

Front Panel of the Sun Ray 170 Thin Client

SOURCE button: Push the 'Source', to Select the Video signal.

AUTO button: Use this button for auto adjustment.

MENU button: Opens the Display Menu.

Adjust buttons: Adjust items in the menu.

Brightness button: When OSD is not on the screen, push the button to adjust brightness.

Enter button: Moves to the sub menu.

Power LED: Illuminates when the appliance is powered on.

Smart card reader: Accepts a valid smart card.

Smart card LED: Illuminates when a smart card is inserted.

Right Panel and Left Panel views and Speaker on base on Sun Ray 170 Thin Client

SIDE PANELS – Right & Left Panel & base COMPONENTS

Right:

Headphone connection terminal (IN)

Microphone connection terminal (OUT)

USB ports

Video OUT

Video IN (VGA) Allows to connect external display to a PC or laptop.

Left:

Audio OUT

Audio IN

Base: Speaker on base

Sun Ray 170 Rear Panel

REAR PANEL COMPONENTS

Serial ports (COM 1/COM 2)

USB ports

Ethernet Network port

DC Power connector

Dimensions and Weight:

Height – 406.8mm (14.8in.)

Width – 376.7mm (8.3in.)

Depth – 211.4mm (16in.)

Weight – 6.3kg (13.9lb.)

Graphics: 24-bit, 1280x1024 resolution @ 60Hz.

## Sun Ray Server Software (SRSS)

The server associated with Sun Ray thin clients provides all the computation, software, state information, and administration. The Sun Ray server software provides the software packages that communicate with and manage the Sun Ray thin clients. Users can access other services on the network through the server running the Sun Ray server software. SRSS 3.1 is supported on Solaris, Solaris 10 x86 and Linux (JDSr2, Redhat AS3 and SuSE SLES 8), It also provides customers with support for a wider range of peripherals via the LibUSB API and support for a set of mass storage devices (currently only on the Solaris OS).

The Sun Ray thin client system provides high performance and full functionality on the desktop. Possible exceptions to this may occur when users run applications that require intimate connection to the processor/memory subsystem (such as some high-performance graphics applications) or that continuously consume all of a system's processing resources (such as long-running simulations).

How many Sun Ray thin client system users can a server support? The critical resources are CPU, network, and physical memory (including swap memory). The limits of a system's scalability depend on the capacity of each resource in isolation, the demand on those resources made by the applications, the platform providing the services, and the number of active users on the system at one time.

Nominally, 10 active users per CPU (servers with a minimum of two CPU's are recommended) can be accomodated. This is assumes only email, browsing (non-video), and office productivity on the Sun Ray server. In some cases a higher client to CPU ratio can be achieved, and in cases where more applications are place in the Sun Ray server, the ratio is lower than 10 clients per CPU.

# Sun Ray™ 1g Thin Client

## Enclosure Features

The Sun Ray™ 1g thin client design includes a free-standing, vertical enclosure optimized for desktop use. Its features include the following:

- The mother board and power supply are enclosed together in a non-serviceable unit
- Convection cooling — no fan requirements

## Dimensions and Weight (Unit with Base)

| Specification | U.S. | Metric |
|---|---|---|
| **Height** | 12.0 ± 0.2 inches | 306 ± 5 mm |
| **Width** | 4.0 ± 0.2 inches | 102 ± 5 mm |
| **Depth** | 11.0 ± 0.2 inches | 280 ± 5 mm |
| **Weight** | 3.9 ± 0.5 lb. | 1.8 ± 0.2 kg |

## Power Requirements

| | |
|---|---|
| **AC Power** | • 100 to 240 V (autoranging power supply)<br>• 50 to 60 Hz<br>• 0.5 A<br>• 30 Watts max. (<20 typical) |

## Acoustic Noise

| | |
|---|---|
| **Acoustic Noise Emissions (declared in accordance with ISO 9296)** | |
| • Declared Sound Power, $L_{WAd}$ (1B = 10 dB) | • 3 B (operating and idling) |
| • Declared Sound Pressure, Operator Position $L_{pAm}$ | • 25 dBA (operating and idling) |

## Environment

| | |
|---|---|
| **Temperature**<br>(in accordance with IEC-60068-2-1, 68-2-2) | |
| • Operating | • 32 to 95° F (0 to 35° C) |
| • Nonoperating | • -4 to 140° F (-20 to 60° C) |
| **Humidity (noncondensing, in accordance with IEC-60068-2-3, 68-2-56)** | |
| • Operating | • 5 to 93% RH, 35 C (95 F) wet bulb max. |
| • Nonoperating | • 5 to 93% RH, 35 C (95 F) wet bulb max. |
| **Altitude (in accordance with IEC-60068-2-13)** | |
| • Operating | • 3,200 meters (10,500 feet) max. |
| • Nonoperating | • 12,500 meters (41,000 feet) max. |
| **Shock (in accordance with IEC-60068-2-27)** | |
| • Operating | • 5G maximum, 11 msec. half-sine |
| • Nonoperating | • 30G maximum, 11 msec. half-sine |
| **Vibration (in accordance with IEC-60068-2-64)** | |
| • Operating | • 0.0001 $G^2$/Hz maximum random, 5 to 500 Hz (0.22 Grms) |
| • Nonoperating | • 0.001 $G^2$/Hz maximum random, 5 to 500 Hz (0.70 Grms) |

## Compliance

| System Regulation | Specifications |
|---|---|
| **Safety** | Complies with the Low Voltage Directive 73/23/EEC based upon type examination certification to the following standards:<br>• EN60950/IEC950<br>• EN60950 with all countries deviations |
| **FCC Class B** | • Part 15 compliance, operation subject to the following two conditions:<br>– This device may not cause harmful interference<br>– This device must accept any interference received, including interference that may cause undesired operation |
| **EMC Directive 89/336/EEC** | • EN55022/CISPR22 (1985), Class B<br>• EN55024<br>– IEC801-2 (1991), 4 kV (Direct), 8 kV (Air)<br>– IEC801-3 (1984), 3 V/m<br>– IEC801-4 (1988), 1.0 kV Power Lines, 0.5 kV Signal Lines<br>• EN61000-3-2/IEC1000-3-2 (1994), Pass |
| **Industry Canada Class B Notice (Avis Industrie Canada, Classe B)** | • Complies with Canadian ICES-003 (NMB-003) |
| **Product Label** | • CE Mark: Complies with all requirements |

## Display Modes

- HD-15 standard PC connector
- Scan rates supported
  - 640 x 480 @ 85 Hz
  - 800 x 600 @ 85 Hz
  - 1024 x 768 @ 60 Hz or 75 Hz
  - 1152 x 900 @ 66 Hz* or 76 Hz*
  - 1280 x 1024 @ 60 Hz, 66 Hz, 75 Hz, 76 Hz, or 85 Hz*
  - 1920x1200 @ 75 Hz

    * These scan rates force composite sync. All others use VESA sync.
- DDC-2B support
- No support for sense pins

## Requirements and Configuration

## Software Requirements

Sun Ray Server Software (SRSS) 3.1 is designed to run on the following operating systems with SPARC servers:

* Solaris 8 02/02 or greater
* Solaris 9 12/03 or greater
* Solaris 10 3/05 or greater
* Trusted Solaris/SPARC 8 PSR3 or greater

SRSS 3.1 is also designed to run on the following operating systems with x86 servers:

* Solaris 10 3/05 or greater
* Java Desktop System, Release 2 on x86
* Red Hat Enterprise Linux Advanced Server 3 on x86
  (32-bit only, not x86-64)
* SuSe Linux Enterprise Server 8 Service Pack 3 on x86
  (32-bit only, not x86-64)

-LICENSING REQUIREMENTS:

Sun Ray Server Software 3.1 requires a right to use license for each Desktop Unit (Sun Ray client). Sun Ray Server Software can be installed on as many servers, with any supported operating system, as needed to support the number of licensed clients.

Customers can choose from the following perpetual license packages:

- single seat

- 20 seat

- 100 seat

(Note: The Site license is no longer offered. For customers that have existing Site licenses that would like to upgrade should purchase the appropriate Site License service contract.)

## Sun Ray 1g Thin Client Configuration

Sun Ray 1g thin clients require a Sun Type 6 USB keyboard and USB mouse. There is only one configuration of the desktop unit. There are no CPU, memory, storage, or other options. The product provides hardware support for audio and video, and four USB ports for connection of local peripherals. Implementation of these capabilities is provided through the Sun Ray server software and downloadable firmware. Additional peripheral and mass storage support is added in Sun Ray server software 3.1.

Monitors must be purchased separately. The Sun Ray 1g thin client is compatible with the currently shipping 17-inch and 21-inch Sun monitors. The 18-inch flat panel display and a limited number of Sun legacy monitors are also supported. Industry-standard DVI/I connector supports Sun's monitors, included HD15 adapter and standard VGA compatible monitors.

The Sun Ray 1g thin client system as shipped is smart card ready. Customers who have compatible smart cards may to use them (smart cards are not included with the Sun Ray 1g thin client). The default authentication for the Sun Ray 1g thin client system does not require a smart card, and smart cards are currently not included with the Sun Ray 1g thin client. Specifications for compatible smart cards, and information on where to obtain them can be found on the Sun Ray thin clients web page at `http://www.sun.com/sunray`

| Feature | Sun Ray 1g Thin Client Specification |
|---|---|
| **Enclosure** | • Slimline desktop box |
| **CPU** | • 100-MHz SPARC IIep |
| **Memory** | • 8 MB on board |
| **Graphics/Resolution** | • 24 bit, 2-D accelerated, Up to 1920x1200 resolution @ 75Hz |
| **Input/Output**<br>– Ethernet<br>– Input Devices | • 4 USB, powered; 2 needed for keyboard and mouse<br>• 100BASE-T, 10BASE-T<br>• Type 6 USB keyboard<br>• USB mouse<br>• SunMicrophone™ II (optional)<br>• Third-party analog camera (optional, no I/O card required) |

| Feature | Sun Ray 1g Thin Client Specification |
|---|---|
| – Audio | • 16-bit stereo audio in/out, microphone, headphone |
| **EnergyStar** | • Compliant |
| **Smart Card Reader** | • ISO-7816-1 compliant |

# Sun Ray 170 Thin Client

## Enclosure Features

The Sun Ray 170 thin client design includes a free-standing fully integrated 17-inch TFT and LCD flat panel display optimized for desktop use. Its features includes VESA mount compatibility and can be mounted on the wall or on a bracket with a moveable arm.

## Dimensions and Weight

| Specification | U.S. | Metric |
|---|---|---|
| **Height** | 16.0 ± 0.2 inches | 406.8 ± 5 mm |
| **Width** | 14.8 ± 0.2 inches | 376.7 ± 5 mm |
| **Depth** | 8.3 ± 0.2 inches | 211.4 ± 5 mm |
| **Weight** | 13.9 ± 0.5 lb. | 6.3 ± 0.2 kg |

## Power Requirements

| | |
|---|---|
| **AC Power** | • 100 to 240 VAC (autoranging power supply)<br>• 47 to 63 Hz<br>• 1.8 A<br>• 63 Watts AC max. (40W AC typical) |

## Acoustic Noise

| | |
|---|---|
| **Acoustic Noise Emissions (declared in accordance with ISO 9296)** | |
| • Declared Sound Power, $L_{WAd}$ (1B = 10 dB) | • <3.08 B (operating and idling) |
| • Declared Sound Pressure, Operator Position $L_{pAm}$ | • <28dBA (operating and idling) |

### Environment

| | |
|---|---|
| **Temperature**<br>(in accordance with IEC-60068-2-1, 68-2-2) | |
| • Operating | • 32 to 95° F (0 to 35° C) |
| • Nonoperating | • -4 to 140° F (-20 to 60° C) |
| **Humidity (noncondensing, in accordance with IEC-60068-2-3, 68-2-56)** | |
| • Operating | • 5% to 93% RH, 35 C (95 F) |
| • Nonoperating | • 5% to 93% RH, 35 C (95 F). |
| **Altitude (in accordance with IEC-60068-2-13)** | |
| • Operating | • 3km (10,000 feet) max. |
| • Nonoperating | • 12km (39,000 feet) max. |

### Compliance

| System Regulation | Specifications |
|---|---|
| **Safety** | UL 1950/CSA C22.2, No.950; CE Mark: EN 60950;CB Scheme: IEC 950, w/Nordic Deviations to EMKO-TSE (74-SEC) |
| **Ergonomics** | GS Mark: EN 29241-3, -7, -8(ISO 9241-3, -7, -8); EKI 59-98 and EKI 60-98; ISO 13406 ; BildsharbV A3, A5, A15, and A17; TCO 99 |
| **EMC** | EN55022 Class B; FCC CFR Title 47, Part 15, Subpart B, Class B; ICES-003 Class B; VCCI Class B; EN55024:1998 (CISPR24:1997) |
| **Product Label** | Power Management: EPA Ennergy Star Compliant; TCO 99 Compliant |

## Display Modes

24-bit graphics – 17-inch TFT & LCD flat panel display with 1280 x 1024 @ 60 Hz

## Sun Ray 170 Thin Client Configuration

The Sun Ray 170 thin client requires a Sun Type 6 USB keyboard and USB mouse. There is only one configuration of the desktop unit. There are no CPU, memory, storage, or other options. The product provides hardware support for audio and video, four USB ports for connection of local peripherals and also includes 2 serial ports. Implementation of these capabilities is provided through the Sun Ray server software and downloadable firmware. Additional peripheral support is included in Sun Ray server software 3.1.

The Sun Ray 170 thin client system as shipped is smart card ready. Customers who have compatible smart cards can use them (smart cards are not included with the Sun Ray 170 thin client). However, the default authentication for the Sun Ray 170 thin client system does not require a smart card, and smart cards are currently not included with the Sun Ray 170 thin client. Specifications for compatible smart cards, and information on where to obtain them can be found on the Sun Ray thin clients web page at http://www.sun.com/sunray

| Feature | Sun Ray 170 Thin Client Specification |
|---|---|
| **Display** | • 17.0-inch AM-TFT-LCD flat panel<br>• Fixed 1280x1024@75Hz maximum resolution |
| **Enclosure** | • All-in-one design<br>• VESA mounting features for kiosk, cabinet, wall, and bracket with moveable arm |
| **CPU** | • 100-MHz SPARC IIep |
| **Memory** | • 8 MB on board |
| **Graphics** | • 24 bit, 2-D accelerated |
| – Graphics/resolution | • 1280x1024 @ 75Hz |
| **Input/Output** | • 4 USB, powered; 2 needed for keyboard and mouse, 2 serial ports |
| – Ethernet | • 100BASE-T (RJ-45) |
| – Input Devices | • Type 6 USB keyboard<br>• USB mouse<br>• SunMicrophone II (optional) |
| – Audio | • 16-bit stereo audio in/out, microphone, headphone |
| – Composite Video In | • NTSC/PAL |
| **EnergyStar** | • Compliant |
| **Smart Card Reader** | • ISO-7816-1 compliant |

## Server Sizing and Configuration

This section covers the issues involved in determining the configuration of the server that hosts the Sun Ray server software. These sizing recommendations are intended to provide workstation class performance to the Sun Ray thin client user under normal, not peak, operating conditions, with less than 100-ms response times for most operations.

The sizing and configuration guidelines provided here also apply to servers that are members of a Sun Ray server group. However, the sizing must take into consideration the potential number of uses each server may need to support when one server in the group fails, and the sessions it was supporting are restarted on the remaining servers.

A general rule is that each server in a Sun Ray server group must be able to support its own portion of the total set of Sun Ray thin client users, plus some portion of the users from among the other members of the Sun Ray server group should a system become unavailable. Sun Ray servers load balance the new sessions so that there is an even distribution based on each individual system's load.

Example 3 servers, 150 users:

- Servers A, B, C each normally support 50 users each
- Each server sized for 75 users, so that any 2 servers can support the entire user population of 150

### Server Requirements

- SPARC server running Solaris Operating System or X86 Server running Solaris x86, JDSr2, Rehat 8 AS or Suse Linux Operating System. The operating system version is dependant on SRSS version; check the SRSS release notes.

### Recommended Minimum Configuration

- At least two CPUs
- At least two disk spindles for swap space
- 256-MB RAM

### CPU Sizing

A typical application uses 2 to 5 percent of a 450-MHz CPU. The user has additional processes beyond the main application that must be considered, but typically this is negligable.

In this example, the user has two main applications each with a 2 percent usage profile. The rest of the user's environment adds another 1 percent. So this user's usage profile consumes 5 percent of a 450-MHz CPU.

Example

- 100 users with 60% activity level = 60 users
- 60 users x 5% = 300% ( 3 CPUs @ 100% each) + 10% for OS = 310%
- A minimum of four CPUs is required to run this server.

Faster CPUs/systems provide increased performance in proportion to the increase in speed. In the example above, two 900-MHz CPUs should be appropriate for the load.

## Memory Sizing

The following are the general memory sizing rules for most applications, excluding applications with large memory footprints or resident data requirements (such as CAD):

- Allot 64 MB for kernel, system shared libraries, and shared application memory
- Add 40 MB per active user.

Example
- 25 active users x 40 MB + 64 MB (OS and shared) = 1064 MB

## Swap Sizing

Virtual memory should be sized large enough to hold the entire X session for every Sun Ray thin client user (not just currently active users). In addition, the user should provide space for anonymous memory and temporary storage required by the operating environment and many applications.

- A typical application suite footprint will be 40 to 100 MB
- Size virtual memory for all users, not just active users
- Determine the amount of swap by subtracting the amount of RAM configured on the system from the virtual memory requirement
- Add 500 MB to 1 GB of swap space for core dumps and temporary storage
- Spread swap over as many spindles as possible, with a general rule of one swap spindle per CPU configured in the server

Swap is used extensively by the Sun Ray server software to effectively share physical memory among users. Active users get their sessions paged into memory when they restart their sessions, and inactive users are paged out as memory is required to support other active users. To maintain the levels of performance expected by most users, it is important to have sufficient I/O bandwidth to the disk subsystem to make the paging in and out of user sessions occur quickly.

Example
- 50 users with 50% activity levels = 50 users x 50 MB = 2.5-GB virtual memory
- 2.5-GB virtual memory - 1064-MB RAM = 1.5-GB swap
- 1.5-GB swap + 500 MB (tmp) = 2-GB swap
- 2 CPU system needs swap spread across two disk spindles

## Other Services

Be sure to add in resource requirements for any additional services and applications that will be running on the same server that is hosting the Sun Ray server software.

## Load Balancing and Failover

With the Sun Ray server software, users have the option of dividing up their Sun Ray thin clients among several servers in a Sun Ray server group. This expands the number of Sun Ray thin clients that can participate in a single Hot Desking environment. With Sun Ray server grouping, a user can insert their smart card into a Sun Ray thin client connected to any one of the servers in the server group, and the group manager can locate a user's session if it exists on any of the servers in the group.

Multiple servers can improve the availability for a workgroup by providing an automated failover capability. If one Sun Ray server fails, sessions can automatically be started on the remaining servers in the Sun Ray server group. The only disadvantages of multiple servers is that they increase the administration load over a single server.

The Sun Ray enterprise software load-balancing feature can help normalizing peak loads, because loads can be spread and balanced over more resources. However, the Sun Ray load balancing feature provides static load balancing, so that once a session is created on a given server, it will never be automatically moved to another server. The session must be shut down (either by explicit user action or by a server failure) before it can be re-established on another server.

If loads are split across multiple servers, use servers with multiple processors. According to queuing theory, having a single run queue with multiple processors to service the queue is much more effective at reducing queue time (and response time) than having more queues with one CPU serving each queue. Aim for at least two to four CPUs per server when splitting loads across multiple servers.

A group configuration requires one of the servers to act as the primary for the SRSS datastore. In such a configuration, if the “primary” server is unavailable, then the datastore is also unavailable for updates. A simple solution to this problem is to architect a deployment where a small workstation-class server is used to house the datastore and is configured as the primary server for the group, but without the responsibilities of managing user sessions.

## Server Selection

When selecting a server to host the Sun Ray server software, do not pick a server that requires 80 percent or more of its maximum capacity just to support the average load for the intended workgroup. Pick a server that has capacity for expansion of system resources to accommodate tuning the system for higher than expected peak loads, failover of sessions from other servers in a Sun Ray server group, adding users, or adding applications.

## Sun Ray™ Server Software

Sun Ray™ server software is the set of software packages that are required to allow a SPARC™ server running the Solaris™ Operating Systems or a X86 server running Solaris 10 or Linux Operating System to manage a set of Sun Ray thin clients.

There are two unique system services that are central to the function of a Sun Ray server. The first of these is the Authentication Manager, which is responsible for identifying and authenticating an individual who accesses a Sun Ray thin client. The other service is the Session Manager. The Session Manager's primary function is maintaining the mapping of users (as identified by the Authentication Manager) to user sessions running on the Sun Ray server, and the binding and unbinding of related services to and from specific Sun Ray thin clients.

Sun Ray server software includes:

- Solaris Operating System window system code
  - Virtual device driver integration into Sun X server
  - Support for 8-bit visuals
  - Cut and paste between subsessions
- Sun Ray server software
  - Authentication Manager
  - Group Manager
  - Session Manager
  - System administration tools

### Authentication Manager

The Authentication Manager's principal duty is to implement the chosen policies for authenticating users' desktop units. When a user is successfully authenticated, this software maps the individual to a specific abstraction maintained by the system and notifies the Session Manager of the new connection. Similarly, the Authentication Manager notifies the Session Manager of disconnection events as they occur.

The Sun Ray system invokes the Authentication Manager each time a user at a Sun Ray desktop attempts to access the system. The Authentication Manager can be replicated on multiple servers, providing the increased performance and reliability needed by larger workgroups.

The Authentication Manager provides an extensible framework that permits the creation of arbitrary authentication policies, without requiring any modification to the desktop unit. Administrators may modify these policies or create new ones, providing a flexible security solution that can be tailored to meet an organization's specific needs. Two authentication policies are defined with the Sun Ray system:

- **Zero administration (default policy)**

  The default policy, in effect when a Sun Ray system is initially installed, requires no administration. Smart cards are optional, but fully supported. If smart cards are used, the serial number from the card

is used as a unique, identifying token number; otherwise the MAC address of the desktop unit is used as the default.

The first time a token number is sent (that is, the first time a smart card is inserted or a desktop unit is powered on), the Sun Ray system will prompt for a Solaris Operating System login name and password. When a user successfully logs in, the Authentication Manager notifies the Session Manager and creates a new session associated with this token.

Although smart cards are optional, they act as a "bookmark" for a particular session and enable easy mobility. During an active session, a smart card can be removed from one desktop and inserted into a different desktop. The Authentication Manager uses the token number of the smart card to map the user to their currently active session, and work can continue uninterrupted; all applications are still running and the user environment is recreated exactly as it was left. If smart cards are not used, a user needs to log out of one desktop and then log in to another (which is identical to workstation environments today). Sun Ray thin client users can still use any desktop, but a smart card is required to automatically reconnect to an active session.

- **Registered**

  The registered authentication policy affords a higher level of security, as all tokens must be registered before they can be used to create a Sun Ray session. Specific users (smart cards) or desktops may be assigned specific sessions, and may be denied access through the Administration Tools. For example, administrators can assign known smart cards to CDE desktop sessions, while other users logging in from a Sun Ray desktop can be assigned a session with a limited web browser instead.

  Administrators can choose a distributed or a centralized registration policy. With a distributed policy, users accessing the system with a new token number are sent to a registration screen to complete self-registration before being authenticated. A centralized policy provides greater security, as the registration program runs only at a single location, such as a badging station or site security officer's station. As with the zero administration policy, any user would also need a Solaris Operating System login and password to complete the Sun Ray authentication process.

Additional authentication policies are planned for later releases. When this occurs, administrators will be able to extend the provided authentication policies. For example, if increased security is needed, a challenge/response policy can be combined with the registered authentication policy. In addition to requiring a Solaris Operating System login name and password, users would need to enter a valid, registered smart card and complete a full challenge/response transaction to be successfully authenticated.

## Session Manager

The Session Manager manages all running user sessions. A user session consists of one or more subsessions, with each subsession encompassing one or more applications running on a particular server (see the figure below). For example, one subsession might contain a word processor and a spreadsheet application running on a Microsoft Windows server. Another subsession might contain software development tools, a document editor, and a custom application running on a Solaris Operating System server.

Although a user may have multiple subsessions, only one is active at any given time. Users can switch between subsessions, create new subsessions, and delete existing subsessions. Cutting and pasting data between subsessions — including those running on different platforms — is also supported.

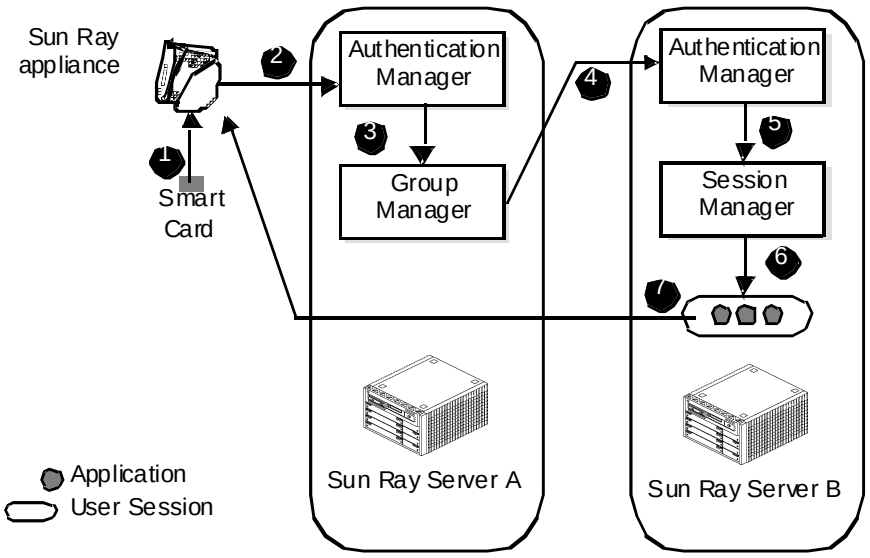



**Figure 9.** A user session consists of one or more subsessions, each encompassing one or more applications running on one or more host systems

When the Session Manager is informed of a user connection event by the Authentication Manager, it notifies the applications within the currently active subsession to perform all input/output operations with the indicated Sun Ray desktop unit. Similarly, when a disconnect event occurs, the Session Manager signals all applications in the currently active subsession to cease I/O with the desktop unit and enter a quiescent state.

As with the Authentication Manager, the Session Manager must be active at all times for the Sun Ray system to function properly. Like the Authentication Manager, the Session Manager can be distributed to multiple servers for load-balancing and higher availability.

## Administration Tools

Every effort has been made to reduce the administrative burden for Sun Ray systems. For example, reasonable defaults are provided so that most systems will function correctly after system installation without additional configuration. However, some administration is still required. Sun Ray thin client administration software includes tools for managing the chosen authentication policy, modifying user privileges, altering desktop device settings, and monitoring the state of the service producing machines.

All Sun Ray administration tools are accessible through browser-based graphical user interfaces (GUIs) and command line interfaces. C-language interfaces are also available for use in automating routine administration tasks with scripts.

Administrative data is stored in the Sun Java System Directory Server and Sun Java System Web Server software is used to provide GUI access.

## Peripheral Device Support

Sun Ray thin client users have two ways to access peripherals: they can access network peripherals that are accessible through the Sun Ray servers (just like any other Solaris Operating System user), or they can use local peripherals connected directly to a desktop unit. Local peripherals attach through either the

universal serial bus (USB) ports on the desktop unit (all Sun Ray software versions), or through USB to parallel or USB to serial adapters (Sun Ray server software (SRSS) 1.2 and later versions). The device driver for these peripherals residing on the servers. From the Sun Ray thin client initial release, Sun has provided USB drivers for the keyboard and mouse. Post-SRSS 1.2, support is enabled for printer-class devices and selected USB to serial adapters. SRSS 3.1 includes support for USB peripherals and mass storage devices. More information can be found at
**http://www.sun.com/io_technologies/sunray/index.html**

Merely plugging a peripheral into a desktop unit does not automatically imply that it will be available for use — the administrator must first set a policy that enables its use by that desktop. This approach provides system administrators with a high degree of control over which types of devices can be added to particular desktops.

# Ordering Information

## Sun Ray™ 1g Thin Client Part Numbers

The Sun Ray™ 1g thin client product includes the thin client (a free-standing, vertical unit), plastic base, and documentation. A country kit (which includes the keyboard, mouse, and power cords) must be ordered separately.

| Order Number | Title and Description |
|---|---|
| **BAE-110-00** | Sun Ray 1g thin client, keyboardless |

## Sun Ray 170 Thin Client Part Numbers

The Sun Ray 170 thin client product includes the thin client (all-in-one with 17-inch flat panel), plastic base, and documentation. A country kit (which includes the keyboard, mouse, and power cords) must be ordered separately.

| Order Number | Title and Description |
|---|---|
| **BAE-400-00** | Sun Ray 170 thin client, all-in-one 17-inch flat panel, keyboardless |

## Licensing

A per client right to use licenses for Sun Ray server software may now be purchased as a single seat RTU or in packs of 20 or 100. The software license is no longer restricted to any one server. These licenses are not software enforced. The customer may place the Sun Ray server software on any combination of servers that support the Sun Ray thin clients for which they have purchased RTU licenses.

# Sun Ray Server Software 3.1 RTU Part Numbers

The Sun Ray server software kit includes CD, Installation Guide, and Product Notes. It includes the right to use the software on a single Solaris™ Operating System/SPARC™ or x86 intel/Opetron processor server. The license has no limitations on the number of Sun Ray thin clients that may be connected to a single server.

## Physical RTU – New License Only

| Order Number & Price | Title and Description |
|---|---|
| **CECI9-310-992S**<br>**$99.00** | Sun Ray Server Software 3.1 **SINGLE SEAT** RTU. Allows use of 1 Sun Ray thin client on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECX9-310-992S**<br>**$1,780.00** | Sun Ray Server Software 3.1 **20 SEAT** RTU. Allows use of 20 Sun Ray thin clients on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECC9-310-992S**<br>**$7,900.00** | Sun Ray Server Software 3.1 **100 SEAT** RTU. Allows use of 100 Sun Ray thin clients on any combination of servers on any OS. Media kit and Sofware download sold separately. |

# Sun Ray Server Software 3.1 Media Kit Part Numbers

## Physical Media

| Part Number & Price | Description |
|---|---|
| **CEC9L-310C99MS** **$35.00** | Media Kit Sun Ray Server Software 3.1 Linux |
| **CEC9S-310C99MS** **$35.00** | Media Kit Sun Ray Server Software 3.1 Solaris OS |

## Electronic Media

| Part Number & Price | Description |
|---|---|
| **CEC9L-310C99BS** **$0.00** | Electronic Software Distribution Sun Ray Server Software 3.1 Linux |
| **CEC9S-310C99BS** **$0.00** | Electronic Software Distribution Sun Ray Server Software 3.1 Solaris OS |

## Electronic Software Distribution Only

| Part Number & Price | Description |
|---|---|
| **CECI9-310-99HS** **$99** | Electronic Software Distribution Sun Ray Server Software 3.1 **SINGLE SEAT** RTU. Allows use of 1 Sun Ray thin client on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECX9-310-99HS** **$1,780** | Electronic Software Distribution Sun Ray Server Software 3.1 **20 SEAT** RTU. Allows use of 20 Sun Ray thin clients on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECC9-310-99HS** **$7,900** | Electronic Software Distribution Sun Ray Server Software 3.1 **100 SEAT** RTU. Allows use of 100 Sun Ray thin clients on any combination of servers on any OS. Media kit and Sofware download sold separately. |

## Sun Ray + Monitor Bundles

| | Description |
|---|---|
| **BAE-110-7197-01** | Sun Ray 1G/24" flat panel display Building Block Includes one Sun Ray 1G ultra- thin client with one Sun 24" flat panel display (max resolution 1920 x 1200). Type 6 USB country kit not included. |
| **BAE-110-7198-01** | Sun Ray 1G with 19" flat panel display Building Block Includes one Sun Ray 1G ultra- thin client with one Sun 19" flat panel display (1280 x 1024 resolution). Type 6 USB country kit not included. |

## Required X-Options

One country kit is required for each Sun Ray thin client.

| Order Number | Title and Description |
|---|---|
| **X3531A** | Type 6 country kits for U.S./universal/Canada with USB interface |
| **X3532A** | International Type 6 country kits French with USB interface |
| **X3533A** | International Type 6 country kits German with USB interface |
| **X3534A** | International Type 6 country kits Swiss-French with USB interface |
| **X3535A** | International Type 6 country kits Swiss-German with USB interface |
| **X3536A** | International Type 6 country kits Swedish with USB interface |
| **X3537A** | International Type 6 country kits U.K. with USB interface |
| **X3538A** | Type 6 country kits for U.S. UNIX/UNIX Universal/European UNIX power cordless with USB interface |
| **X3539A** | Japanese UNIX Type 6 country kit with USB interface |
| **X3554A** | International Type 6 country kits Taiwanese with USB interface |
| **X3555A** | International Type 6 country kits Korean with USB interface |
| **X3558A** | International Type 6 country kits U.K. UNIX with USB interface |
| **X3559A** | International Type 6 country kits European UNIX with USB interface |
| **X3560A** | International Type 6 country kits Norwegian with USB interface |
| **X3561A** | International Type 6 country kits Portuguese with USB interface |
| **X3562A** | International Type 6 country kits Spanish with USB interface |
| **X3563A** | International Type 6 country kits Danish with USB interface |
| **X3564A** | International Type 6 country kits Italian with USB interface |
| **X3565A** | International Type 6 country kits Dutch with USB interface |
| **X3566A** | International Type 6 country kits Australian with USB interface |
| **X3567A** | International Type 6 country kits Finnish with USB interface |
| **X3568A** | European Universal Type 6 country kits with USB interface |
| **X3582A** | International Type 6 country kits Chinese with USB interface |
| **X3583A** | International Type 6 country kits European UNIX with USB interface (power cordless) |

## Sun Ray Smart Cards

Smart cards are sold in packages of 25, either with or without artwork.

| Order Number | Title and Description |
|---|---|
| **X1403A** | Payflex smart cards with Sun artwork, pack of 25 |
| **X1404A** | Payflex smart cards, white, no artwork, pack of 25 |

## Monitor Options

| Order Number | Description |
|---|---|
| **X7147A** | **17-inch Entry Color Monitor**<br>17-inch Flat Display CRT Monitor, 16" diagonal viewable area, 0.24-mm dot pitch, 1280x1024 @ 75/76Hz, captive video cable with HD15-pin connector, Universal Power Supply, DDC1/2B, VESA DPMS, TCO'99, WW agency compliance, Standard version |
| **X7198A** | **19-inch TFT LCD Color Monitor,**<br>19-inch TFT LCD Color Monitor, (CRT equivalent size 21.85-inches), Super IPS technology, 350:1 contrast ratio, 230 cd/m2 luminance, 88 degree viewing angle, 1280x1024@60 Hz, 2* HD15 analog and DVI-D ditial video inputs, 2* HD15 to HD15 and DVI-D to DVI-D cables, height rotation & tilt adjustments, Internal universal power supply, Energy Star and TCO'03 WW Agency compliances, Sun ID enclosure, Sun logo and color |
| **X7199A** | **21-inch Color Monitor**<br>21-inch Flat Shadow Mask CRT Monitor,20" diagonal viewable area, Dot pitch: 0.20 mm Horz., 0.27 mm Vert. Max. res.: 2048x1536@75Hz Recommended res: 1600x1200@75Hz, Inputs: two, HD-15 and 5x BNC connectors,cables: HD15M/HD15M 1.8 meters and HD15M/BNC 2 meters, Universal Power Supply,VESA DPMS, TCO'99, WW agency compliance, Sun logo & color, Standard version |
| **X7197A** | **24.1-inch TFT LCD Color Monitor**<br>24.1-inch TFT LCD Color Monitor (27 inch CRT equivalent), PVA wide viewing angle, 1920x1200@60 Hz, digital DVI interface, DVI-D video cable, HD15 interface and HD15 video cable, S-video and C-video interfaces, 4-port USB hub, DVI-D, HD15, and HD15-13W3 video input cables included, Digital OSD controls, Universal Power Supply, VESA DPMS, TCO'99, WW agency compliances, Sun ID enclosure, Sun logo and color |
| **Note:** *Many PC monitors work with the Sun Ray 1g thin client, but there is no certification.* | |

# Sun Ray Server Software 3.1 Service Part Numbers

| Order Number | Title and Description |
|---|---|
| **CECI9-99HS-1PR** | Sun Ray Server Software, 1 seat perpetual RTU per Desktop Unit (DTU). Annual Premium Support |
| **CECI9-99HS-1ST** | Sun Ray Server Software, 1 seat perpetual RTU per Desktop Unit (DTU). Annual Standard Support |
| **CECI9-99HS-3PR** | Sun Ray Server Software, 1 seat perpetual RTU per Desktop Unit (DTU). 3 Years Premium Support |
| **CECI9-99HS-3ST** | Sun Ray Server Software, 1 seat perpetual RTU per Desktop Unit (DTU). 3 Years Standard Support |
| **CECX9-99HS-1PR** | Sun Ray Server Software, 20 seat perpetual RTU per Desktop Unit (DTU). Annual Premium Support |
| **CECX9-99HS-1ST** | Sun Ray Server Software, 20 seat perpetual RTU per Desktop Unit (DTU). Annual Standard Support |
| **CECX9-99HS-3PR** | Sun Ray Server Software, 20 seat perpetual RTU per Desktop Unit (DTU). 3 Years Premium Support |
| **CECC9-99HS-3ST** | Sun Ray Server Software, 100 seat perpetual RTU per Desktop Unit (DTU). 3 Years Standard Support |
| **CECS9-99HS-1PR** | Sun Ray Server Software, Site License. Allows use of an unlimited number of Sun Ray thin clients on any combination of servers, on any OS, at a single geographical location. Annual Premium Support |
| **CECS9-99HS-1ST** | Sun Ray Server Software, Site License. Allows use of an unlimited number of Sun Ray thin clients on any combination of servers, on any OS, at a single geographical location. Annual Standard Support |
| **CECS9-99HS-3PR** | Sun Ray Server Software, Site License. Allows use of an unlimited number of Sun Ray thin clients on any combination of servers, on any OS, at a single geographical location. 3 Years Premium Support |

| Order Number | Title and Description |
|---|---|
| **CECS9-99HS-3ST** | Sun Ray Server Software, Site License. Allows use of an unlimited number of Sun Ray thin clients on any combination of servers, on any OS, at a single geographical location. 3 Years Standard Support |
| **CECC9-99HS-1PR** | Sun Ray Server Software, 100 seat perpetual RTU per Desktop Unit (DTU). Annual Premium Support |
| **CECC9-99HS-1ST** | Sun Ray Server Software, 100 seat perpetual RTU per Desktop Unit (DTU). Annual Standard Support |
| **CECC9-99HS-3PR** | Sun Ray Server Software, 100 seat perpetual RTU per Desktop Unit (DTU). 3 Years Premium Support |
| **CECC9-99HS-3ST** | Sun Ray Server Software, 100 seat perpetual RTU per Desktop Unit (DTU). 3 Years Standard Support |
| **CEC9S-C99BS-1M** | Sun Ray Server Software, Solaris SPARC. 1 Year Electronic Software Distribution |
| **CEC9S-C99BS-3M** | Sun Ray Server Software, Solaris SPARC. 3 Years Electronic Software Distribution |
| **CEC9S-C99MS-3MED** | Sun Ray Server Software, Solaris SPARC, Media Kit, 128bit encryption. 3 Years Additional Media |
| **CEC9S-C99MS-MEDIA** | Sun Ray Server Software, Solaris SPARC, Media Kit, 128bit encryption. Additional Media |
| **CEC9L-C99BS-1M** | Sun Ray Server Software, Linux. 1 Year Electronic Software Distribution |
| **CEC9L-C99BS-3M** | Sun Ray Server Software, Linux, media kit, 128bit encrycption. 3 Years Electronic Software Distribution |
| **CEC9L-C99MS-3MED** | Sun Ray Server Software, Linux, Media Kit, 128bit encryption. 3 Years Additional Media |
| **CEC9L-C99MS-MEDIA** | Sun Ray Server Software, Linux, Media Kit, 128bit encryption. Additional Media |

## Warranty

The Sun Ray 1g thin client has a 5-year return-to-Sun warranty.

The Sun Ray 170 thin clients come with a 3-year, return-to-Sun warranty, which includes complete unit repair or replacement within 15 days, worldwide.

No warranty is available on smart cards.

# Glossary

| | |
|---|---|
| 100BASE-T | Also known as Fast Ethernet, the IEEE standard for 100-Mbit Ethernet. |
| Hot Desk architecture | A computing implementation initially targeted at the workgroup, where all user state is centralized on the server and linked by an interconnect (physically dedicated or implemented with a VLAN) to a simple, zero-administration thin client on the desktop. The main elements of this architecture are:<br>– The Sun Ray™ thin client<br>– The Sun Ray server software<br>– Hot Desk technology (it can also include connectivity software and additional tools) |
| Hot Desk technology | The technology underlying the Sun Ray Hot Desk architecture. "Hot Desk" or "Hot Desking" refers to the ability of the user to access their sessions instantly from any Hot Desk-enabled thin client in the server group. Hot Desking is enabled by Hot Desk technology. Key elements:<br>– A fast and efficient interface used to communicate between server and thin client<br>– Smart card technology<br>– Server software which instantly maps users' sessions to thin clients |
| ISO7816 | International standard for smart cards. |
| PCI | Peripheral component interconnect. A industry-standard for connecting peripherals such as disk drives, tapes drives, and other devices used in the PCs. |
| Stateless | While other PCs and thin clients perform at least rendering at the desktop, Sun Ray thin clients are stateless, meaning they have no locally resident data, applications, or operating system. In the Sun Ray architecture, only pixel data is sent to the client. |
| Sun Ray thin client | A stateless, zero-administration, "plug-and-work" device that is centrally managed by, and is dedicated to display user sessions from a server running Sun Ray server software. |
| Sun Ray server software | The server-based software used to manage, administer, and provide the screen display for any Sun Ray thin client on the network.<br>Its main components are:<br>– Authentication Manager<br>– Group Manager<br>– Session Manager<br>– Administration Tool |

| | |
|---|---|
| Sun Ray system | The components of the Sun Ray Hot Desk architecture which are actually deployed:<br>– The Sun Ray thin client<br>– A SPARC™ server running the Solaris™ 2.6, 7, or 8 Operating Environment (or later) or X86 server running JDSr2, RedHat 8 or Suse Operating System<br>– The Sun Ray server software<br>The components of the interconnect (Ethernet switch, Cat 5 wiring) |
| TCO | Total cost of ownership. A term used to describe all the entire cost of owning and running computers, including purchase price, maintenance contracts, system administration support, need for upgrades, downtime, and inability to integrate with legacy hardware and software. |
| Thin client | A trimmed-down system, running only very basic software with applications residing on the network server. Low administration. |
| USB | Universal serial bus. A bus that provides support for a number of different types of peripherals such as keyboards and mice. |

# Materials Abstract

All materials will be available on SunWIN except where noted otherwise.

| Collateral | Description | Purpose | Distribution | Token # or COMAC Order # |
|---|---|---|---|---|
| **Product Literature** | | | | |
| – *Microsoft Interoperability* | – *A highlevel 'brochure' that addresses, by product family, Sun's ability to interoperate with Microsoft today.* | Sales Tool | SunWin | 439758 |
| – *Sun Ray Flash Demo CD* | *Sun Ray Thin Clients Overview CD* | | Java Cart | PE295-3 |
| **Presentations** | | | | |
| – *Sun Ray Customer Presentation (Sun Ray 170, SRSS 3* | Presentation | Sales Tool | SunWIN | 426183 |
| – *Sun Ray Desktop Solutions How to Sell Guide* | Presentation | Sales Tool | SunWIN | 405748 |
| – *Secure Network Access Platform (SNAP) Infrastructure Solution* | Partner Sales Presentation | Sales Tool | SunWIN | 401941 |
| – *Secure Network Access Platform (SNAP) Infrastructure Solution* | Techical Presentation | Sales Tool | SunWIN | 401942 |
| – *Sun Infrastructure Solution for Secure Network Access Platform (SNAP)* | Customer Sales Presentation | Sales Tool | SunWIN | 401940 |
| **White Papers and Technical Briefs** | | | | |
| – *Sun Ray Overview and Technical Brief* | Read how the current generation of Sun Ray thin clients and server software offers functionality, speed and reliability for mission-critical applications. | Training Sales Tool | SunWIN, Reseller Web | 378210 |
| – *Sun Ray Ultra-Thin Clients Deployment Options* | Whitepaper describing various options and scenarios of deploying Sun Ray thin clients. | Sales Tool | SunWIN | 440103 |
| – *Sun Ray Ultra Thin Clients Competitive Analysts* | Document describing differences between Sun Ray Ultra thin clients and Wyse, HP & Neoware | Sales Tool | SunWin | 449803 |

| Collateral | Description | Purpose | Distribution | Token # or COMAC Order # |
|---|---|---|---|---|
| – *Secure Network Access Platform (SNAP) Infrastructure Solution* | The technical white paper describes SNAP as well as it's major components. Further detail on design, implementation, sizing, tuning and optimization can be found in the Reference Architecture Document | Sales Tool | SunWin | 0 |

| Collateral | Description | Purpose | Distribution | Token # or COMAC Order # |
|---|---|---|---|---|
| **Data Sheets** | | | | |
| – *Sun Ray Product Line* | Data sheet | Sales Tool | SunWIN | 427362 |
| – *Sun Infrastructure Solution for Secure Network Access Platform* | Data sheet | Sales Tool | SunWIN | 423496 |
| – *Secure Network Access Platform (SNAP) Infrastructure Solution* | Data sheet | Sales Tool | SunWIN | 401936 |
| – *Sun Ray Ultra-Thin Clients in Technical Computing* | Data sheet | Sales Tool | SunWIN | 396722 |

| Collateral | Description | Purpose | Distribution | Token # or COMAC Order # |
|---|---|---|---|---|
| **Success Story Brochures** | | | | |
| – *Danish Technical University* | Success story | Sales Tool | SunWIN, Reseller Web | 116201, FE1192-1 |
| – *Las Vegas Sun* | Success Slides | Sales Tool | SunWin | 427719 |
| – *Space and Naval Warfare Systems Command (SPAWAR)* | Success story | Sales Tool | SunWin | 423474 |
| – *Canadian Forces College (CFC)* | Success story | Sales Tool | SunWin | 412904 |
| – *Carrefour de Sante de Jonquiere* | Success story | Sales Tool | SunWin | 412908 |
| – *Mountain View Elementary School* | Success story | Sales Tool | SunWin | 406221 |
| – *Dow Corning Success Story* | Success story | Sales Tool | SunWin | 403583 |
| – *Joint Intelligence Center of the Pacific (JICPAC)* | Sun Infrastructure Solution Success story | Sales Tool | SunWin | 402703 |
| – *US Navy - SPAWAR* | Sun Infrastructure Solution Success Story | Sales Tool | SunWin | 402162 |
| – *The Trusted Solaris Operating System with Sun Ray Ultra-Thin Client (SNAP)* | Sun Infrastructure Solution for Secure Network Access Platforms (SNAP) Success story | Sales Tool | SunWin | 403176 |
| – *Desktop Computing Solution Improves Patient Care and Reduces Costs* | Success story | Sales Tool | SunWin | 402142 |
| – *Desktop Computing Solution Reduces TCO by $350,000* | Customer Reference | Sales Tool | SunWin | 402144 |
| – *Sun Microsystems' Processor and Network Products Group* | Reference/Success Story | Sales Tool | SunWin | 396166 |
| **Case Studies** | | | | |
| – *SunRay at Home Solution* | *A Sun IT Project Case Study* | Sales Tool | SunWIN | 441067 |
| – *Sun Technology an Important Educational Tool in Georgia Schools* | Case study | Sales Tool | SunWIN, Reseller Web | 116188, FE1191-0 |
| – *Sun Helps University Educate New Generations of Engineers* | Case study | Sales Tool | SunWIN, Reseller Web | 116201 FE1192-0 |
| – *Sun Ray 1 Thin Client Links Pennsylvania Libraries* | Case study | Sales Tool | SunWIN, Reseller Web | 116203, FE1193-0 |
| – *Bledsoe Community Medical Center Success Story* | Case study | Sales Tool | SunWIN, Reseller Web | 124760 |

| Collateral | Description | Purpose | Distribution | Token # or COMAC Order # |
|---|---|---|---|---|
| – *National Australia Bank Gets Thin* | Case study | Sales Tool | SunWIN, Reseller Web | 120195, HE372-0 |
| – *University of California at Berkeley - Sun Ray in computer Science Labs* | Case study | Sales Tool | SunWIN, Reseller Web | 122896, FE1379-0 |
| **Miscellaneous Collateral** | | | | |
| – *The Total Economic Impact of Deploying Sun Ray Thin-Clients* | Independent study research by Forrester Research, Inc. | Sales Tool | SunWin | 410024 |
| – *Sun Ray Thin Client Competitive Beat Sheet* | Competitive One Pager that helps sales teams understand and compete in the thin client market. | Sales Tool | SunWin | 394502 |
| | | | | |
| **External Web Sites** | | | | |
| – *Sun Ray Thin Client Site* | `http://www.sun.com/sunray` | | | |
| **Smart Card Reference Sites** | | | | |
| – *Java™ Smart Card Framework* | `http://www.opencard.org/` | | | |
| – *Docs Available for Purchase* | `http://www.iso.org/iso/en/CatalogueListPage.CatalogueList?ICS1=35&ICS2=240&ICS3=15` | | | |
| – *Microsoft PC/SC Platform* | `http://www.pcscworkgroup.com/` | | | |

**Information on Sun Ray whitepapers and case studies is also available at :**

**http://www.sun.com/sunray/whitepapers.html**

**http://www.sun.com/sunray/success.html**

# Sun Ray Server 3.1 FAQ

Q. What is Sun Ray technology and how does it work?

Think of the Sun Ray ultra-thin clients as telephones, and Sun Ray Software as a PBX. Plug the Sun Ray clients into a configured network and they deliver a personalized compute desktop to the user (as a telephone configured with the PBX delivers a dial-tone and directs calls to a specific telephone).

Since the Sun Ray technology centralizes everything, users can use a smart card to "hot desk," moving their computing desktop with them as they move from Sun Ray client to Sun Ray client. Like forwarding a phone from one phone to another, in the middle of a conversation.

Q. What business benefits does Sun Ray technology provide?

First, Sun Ray deployments have provided customers up to 76% Return on Investment vs. other desktop alternatives. See the Forrester Research Total Economic Impact Study for more information (Download the Study http://www.sun.com/sunray/whitepapers/SunRay_Final_040504.pdf).

Second, Sun Ray technology eliminates desktop upgrade fatigue, the never-ending cycle of new PCs. Complex PCs and other "thin clients" have a local OS and local applications, which require different amounts of memory (RAM), CPU power (Mhz/Ghz), operating system patch levels, application patch levels which get you, the customer, caught in a never-ending cycle of application upgrades that then force new memory or CPU hardware upgrades on the desktop client.

Sun Ray technology frees your organization from desktop upgrade fatigue by centralizing your desktop computing on Sun Ray servers. A desktop application upgrade, memory performance upgrade or OS upgrade is as simple as upgrading a few servers. All Sun Ray clients will have instant access to the upgrades made on the servers.

Third, protecting your critical business information is vital to your success. Sun Ray technology virtually eliminates the risk of desktop virus infections and can help protect corporate intellectual property with a more secure desktop solution.

Q. Isn't a Sun Ray just an X Terminal?

No, the X server (desktop side) of X still resides on the Sun Ray Server. X Terminals require local processor and memory that can effect performance. Sun Ray is a much thinner protocol designed to ensure excellent performance and never require an upgrade on the desktop.

Q.How is the Sun Ray thin client different form other thin clients?

Other thin clients like X Terminals and Windows Based Terminals contain a local operating system and protocol client SW. These clients require some maintainance and must be managed as individual hosts. The Sun Ray thin client requires zero management.

Q. What types of USB devices may be used with Sun Ray Server Software?

Customers can use a variety of USB devices:
-USB flash disks (Solaris OS only)
-USB memory sticks (Solaris OS only)
-USB flatbed scanners
-USB digital cameras
-USB zip drives (Solaris OS only)
-USB external hard drives (Solaris OS only)
-USB-Serial/Parallel adapters
-USB printers
-USB keypads
-USB bar code scanners
-USB magnetic stripe readers
-USB HID class touch screen interfaces
-USB Keyboards and Mice

Q. Is there a new set of documentation for Sun Ray Server Software 3.1?

Yes. Please look for the new Sun Ray Server Software Installation Guide, Administration Guide, and Product Release Notes in the "Docs" directory of the software or on the Sun Ray web site (http://wwws.sun.com/sunray/docs.html).

You will also find helpful whitepapers and how-to guides at the following web site:
http://wwws.sun.com/sunray/whitepapers.html

Q.Can a single Sun Ray client within a workgroup be configured for Controlled Access Mode?

Controlled Access Mode can be designated for either all the Sun Ray clients in a workgroup or none of them.

Q. What do Sun Ray users need to do in order to use Non-Smart Card Mobility?

Instead of inserting smart cards, users would type their user names and passwords to log in. Instead of removing smart cards, users could enter the "utdetach" command or press a customizable hot key.

Q. Can Non-Smart Card Mobility be deactivated?

Yes, it can be turned off. A system administrator must deliberately enable mobile sessions for users without smart cards.

Q.Exactly what does SunMC monitor via the Sun Ray Server Software SNMP Monitoring feature?

The following 5 areas can be monitored (note: Only for the Solaris OS):
Sun Ray System - Sun Ray server & load info.

Sun Ray Services - Sun Ray daemons on a Sun Ray server.
Failover Group - Sun Ray servers in a failover group.
Interconnect - Interfaces on a Sun Ray server.
Desktops - Sun Ray clients connected to a Sun Ray server.

Q. What types of alarms does SunMC generate to alert the system administrator to a Sun Ray problem?

There are 3 alarm categories: critical (red), alert (yellow), and caution (blue). Any of these alarms could be used to notify the system administrator that the Sun Ray server is running out of DHCP addresses, for example.

Q. Are customers who have HP OpenView VPO, Tivoli TMS, or CA Unicenter able to take advantage of the SNMP Monitoring feature?

Yes, an interoperability interface exists between each of these management frameworks and SunMC. HP provides the interface between HP OpenView VPO and SunMC. Sun provides the interfaces between SunMC & Tivoli TMS and SunMC & CA Unicenter.

Q.Can smart cards be used with Controlled Access Mode?

Yes, Controlled Access Mode can be used with or without smart cards.

Q. In Controlled Access Mode, what options are available for the selected applications?

The system administrator can mark the applications:
- Critical. The application launches automatically and restarts upon exit.
- Menu. The application launches from the menu only.
- Default. The application launches automatically and from the menu but does not restart upon exit.

Q. How does SunMC communicate Sun Ray alerts to system administrators?

Alarms can be communicated via email or, if system administrators prefer an alternative method such as pager, they can customize their own alarm action script.

Q. Does SRSS support Java Cards?

A.Sun Ray Server Software has always supported the use of Java Cards to
perform Hot Desking. Now, with SRSS 3.1 and the new Java Card Framework, external applications that interact with a Java Card may be accessed through the Sun Ray Smart Card Terminal (Reader). These applications may provide for a strong authentication login, PKCS#11, S/MIME digital signature message signing and encryption and more.

Q. Does SRSS 3.1 support US government Common Access Cards?

Yes, CAC cards may be used to hot desk sessions, and with the addition of third party middleware, may be used for authentication and cryptograhpic services. The PC/SC bypass (a Sun Ray Server Software add-on) enables users to use 2 factor authentication with CAC cards to Microsoft Windows applications like Outlook.

Q. Does SRSS 3.1 support Trusted Solaris?

Yes, SRSS 3.1 supports Trusted Solaris 8.

Q. When would I not want to use encrytion in the privacy mode?

If your network topology is secure, encrypting may not be necessary. Encryption does add some processor load, which is usually very small, but could make a performance impact when running graphically intensive applications. Administrators may choose to turn off this feature if desired.

Q. How do I take advantage of adaptive bandwidth to support single clients deployed via DSL or Cable modems?

Simply installing or upgrading to Sun Ray Server Software 3.1 will provide the the bandwidth enhancements.

The changes to the rendering protocol are adaptive, and when bandwidth is constrained it will use aggressive compression techniques, when not constrained it will leverage the available bandwidth.

The upstream protocol (for keyboard and mouse) is more robust and will handle packet loss better. Additionally, there are more flexible DHCP options and a DNS client to allow you to deploy Sun Ray clients with a DSL or Cable modem connection from within NAT firewalls.

See the Sun Ray Server Software Adminstrator Guide and the Shared Networking Blue Print (http://www.sun.com/blueprints/0204/817-5490.pdf) for more information.

Q. If a Sun Ray Server fails, does that mean that all the Sun Ray thin clients are unavailable until the server is repaired or replaced?

No, Sun Ray Servers may be placed in "groups" so that users may hot desk between Sun Ray Servers, and so that if a Sun Ray Server fails, the Sun Ray thin client can immediately and automatically attach to the next least loaded server.

Q.Can multiple keyboards or USB HID devices that look like keyboards be used simultaneoulsly with Sun Ray thin clients?

Yes,

Any USB HID device including keyboards, mice, wedge type magnetic card readers, barcode scanners, and tablet devices may be used with Sun Ray. They must all have matching country codes to ensure that any key

mapping is consistent. The USB HID specification is a standard, so there is no list of "approved" or "supported" devices.

Q. How can Sun Ray users/administrators save monitor resolution settings across SunRay sessions ?

Administrators can use the new Persistent Settings feature to configure initial session resolutions for DTU's on a token-at-DTU basis, a per-DTU basis or a global per-server basis.

Users can use enhanced versions of existing utilities to configure initial settings on a token+DTU basis for tokens that are unique to that user.

Q.Are there any functional differences between SRSS 3.1 on the Solaris OS
and Linux?

Yes. The following features are only available on the Solaris version of SRSS 3.1:

1) Controlled Access Mode
2) Non-Smart Card Mobility
3) PIN based Smart Card Authentication
4) Direct Playback of the YUV-encoded video stream
5) Mass Storage
6) Sun Ray Software Specific SNMP Monitoring Agents

Q.Can I run a mixed failover group with the Solaris OS and Linux?

No.

Q.How can I use a USB flash drive? Once the Mass Storage capabilities have been enabled by the Sun Ray Administrator.

To access the drive:
1) Plug your USB storage device into a USB port on the Sun Ray DTU.
2) Look for your files mounted in */tmp/SUNWut/mnt/*<username>

To remove the drive:
1) Close all references to files and directories in the mount point.
2) Use the new command line tool, utdiskadm to prepare your device for removal:

/opt/SUNWut/bin/utdiskadm -r disk1
(unmount filesystems before unplugging device)

3) Unplug the device.

Q. What file systems are supported with the new Mass Storage support?

Both UFS and PCFS are supported.

Note:
FAT partitions and UFS slice names have "sn" suffixed to them to

denote traditional SunOS slices.
(for example: disk1s0, disk1s6)

disk1s2 is the backup slice (full disk, similar to c3t0d0s2 in /dev/dsk)

Q. Can I hot desk with a mounted USB mass storage device (a USB flash drive or zip drive)?

No, you cannot maintain access to a storage device during hot desking. Additionally, if you use Non-Smart Card Mobility (NSCM) and leave a session idle long enough to activate screen lock, you will also lose access to the attached device.

Either of these situations can result in data corruption and possibly device malfunction. Remember to unmount and unplug the device before hot desking or separating your NSCM session.

Q. Why doesn't the Sun Ray Server Software Administration GUI work?

To use the Web Administration GUI you need to have a web server installed on the Sun Ray server. A web server is not installed with Sun Ray Server Software 3.1.

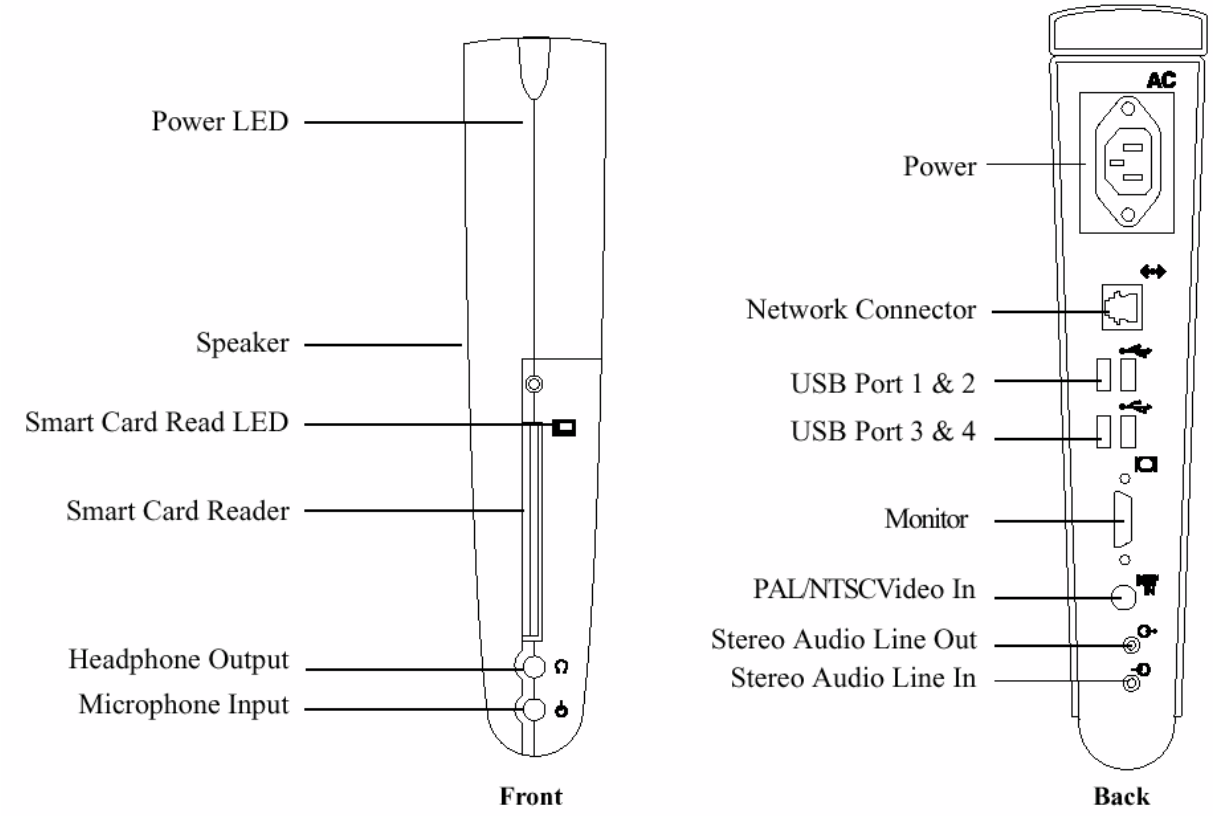
## EOL - Sun Ray 100 & Sun Ray 150

### EOL – November 2004

Sun Ray 100

Sun Ray 150

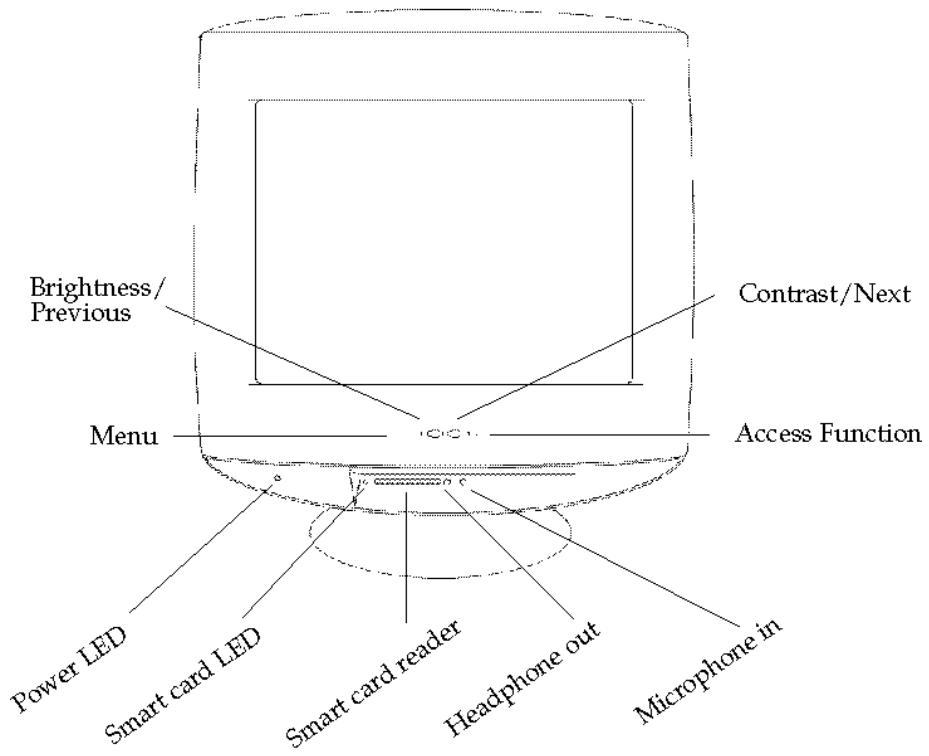
**Front & Back view of the Sun Ray 1 thin client**




**Note: Sun Ray 1 thin client is replaced with Sun Ray 1g thin client.**

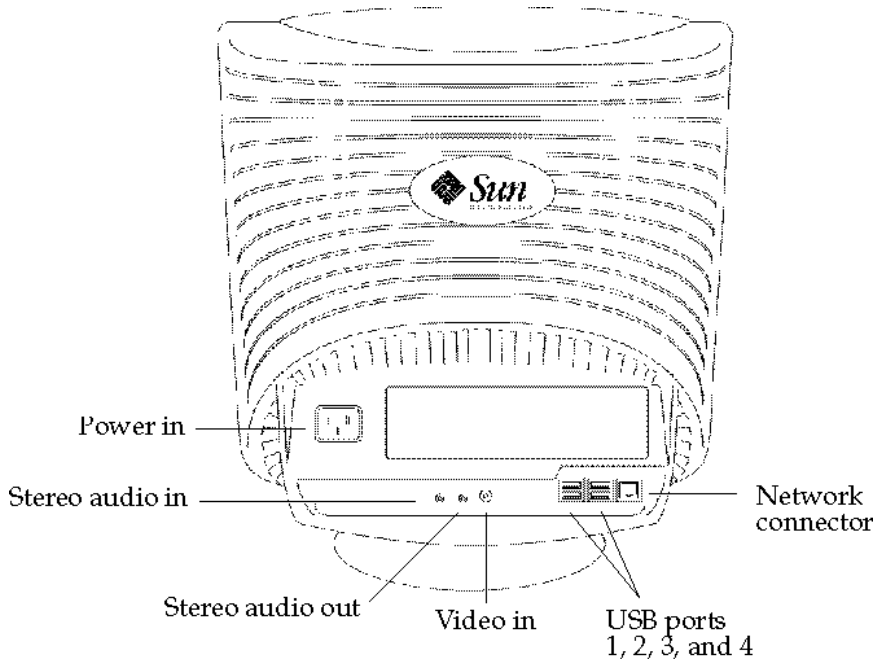
## The Sun Ray 100 Thin Client

The Sun Ray 100 thin client is an "all-in-one" desktop thin client for workgroup environments, the embeds the Sun Ray thin client features into a 17-inch CRT monitor format. The thin client requires a USB keyboard and USB mouse.




Front view of the Sun Ray 100 thin client

1. Menu button — Opens the Display menu
2. Brightness/Previous button — Can be used to adjust brightness, or to move to the previous selection in the Display menu
3. Contrast/Next button — Can be used to adjust the contrast, or to move to the next selection in the Display menu
4. Access function button — Accesses functions and submenus in the Display menu
5. Power LED — Illuminates when the thin client is powered on
6. Smart card LED — Illuminates when a smart card is inserted
7. Smart card reader — Accepts a valid smart card
8. Headphone outlet — Designed to work with low impedance stereo headphones
9. Microphone input — Adjust microphone volume through software



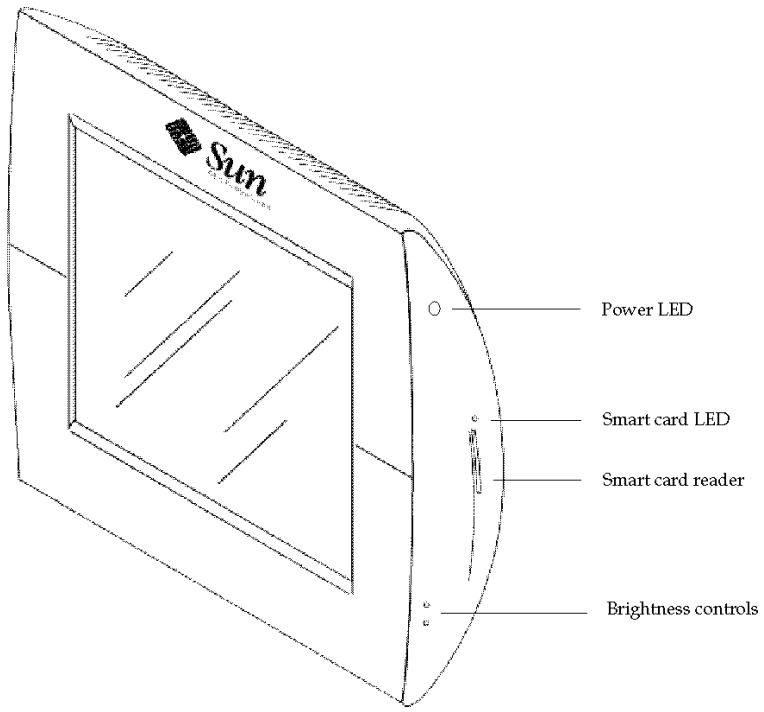

Back view of the Sun Ray 100 thin client

The Sun Ray 100 thin client is an "all-in-one" desktop thin client for workgroup environments, the embeds the Sun Ray thin client features into a 17-inch CRT monitor format. The thin client requires a USB keyboard and USB mouse.

1. Power In — Connect the power cord to this receptacle
2. Stereo audio signal line-in 1/8-inch (3.5-mm) stereo mini-plug — Input from an audio input device
3. Stereo audio signal line-out 1/8-inch (3.5-mm) stereo mini-plug — Output to an audio device
4. Video in — Input for a device that provides a composite video signal
5. USB ports 1, 2, 3, and 4 — Standard USB ports for peripherals
6. Network connector — 100BASE-T Ethernet cable receptacle (RJ-45)

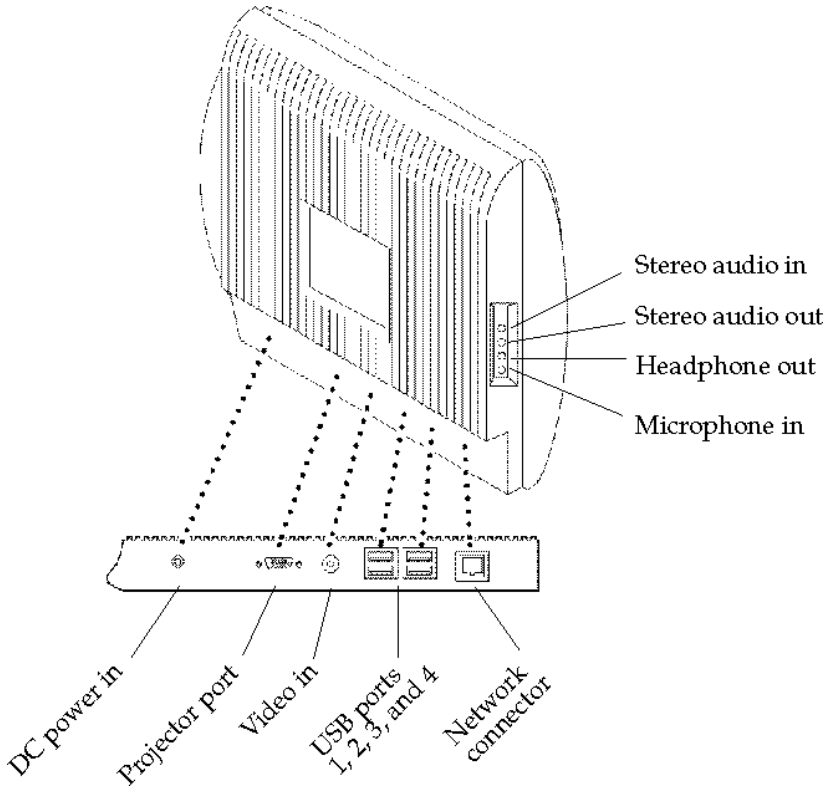
## The Sun Ray 150 Thin Client

The Sun Ray 150 thin client is an "all-in-one" thin client for workgroup environments, that embeds the Sun Ray thin client features into a 15-inch TFT flat-panel display format. The thin client requires a USB keyboard and USB mouse.




Front view of the Sun Ray 150 thin client

1. Power LED — Illuminates when the thin client is powered on
2. Smart card LED — Illuminates when a smart card is inserted
3. Smart card reader — Accepts a valid smart card
4. Brightness controls — Adjust screen brightness up or down




Back view of the Sun Ray 150 thin client

1. Power (DC power in) — Connect the power cord to this receptacle
2. Projector port — Connect an external projection display device to this port for conferences or demos

   **Note:** *The projector port is not for attaching an additional monitor to create a "dual head" Sun Ray thin client. If a standard CRT monitor is attached to this port, the CRT screen image may be corrupted due to incompatible display modes.*
3. Video in — Input for a device that provides a composite video signal
4. USB ports 1, 2, 3, and 4 — Standard USB ports for peripherals
5. Network connector — 100BASE-T Ethernet cable receptacle (RJ-45)
6. Stereo audio signal line-in 1/8-inch (3.5-mm) stereo mini-plug — Input from an audio input device
7. Stereo audio signal line-out 1/8-inch (3.5-mm) stereo mini-plug — Output to an audio device
8. Headphone output — Designed to work with low-impedance stereo headphones
9. Microphone input — Adjust microphone volume through software

This thin client offers the customer the opportunity to attach a Kensington-type security device on the panel cabinet. The Kensington slot is located on the back (vertical) surface of the LCD.

## Sun Ray Bundles - EOL

| Part Number & Price | Description |
|---|---|
| **BAE-110-V210-20A**<br><br>**$13,999.00** | Bundle of 20 Sun Ray 1G ultra-thin clients and one Sun Fire V210 server (2 x 1.34 Ghz, 2 GB Memory), includes two 2x512GB DIMM x-options (for total memory of 4GB), Sun Ray Server Software 3 media kit and one Sun Ray Server Software 20 seat license, one package of 25 smart cards. Country kits sold separately. |
| **BAE-400-V210-20**<br><br>**$28,499.00** | Bundle of 20 Sun Ray 170 ultra-thin clients and one Sun Fire V210 server (2 x 1.34 Ghz, 2 GB Memory), includes two 2x512GB DIMM x-options (for total memory of 4GB), Sun Ray Server Software 3 media kit and one Sun Ray Server Software 20 seat license, one package of 25 smart cards. Country kits sold separately. |
| **BAE-110-V20Z-20**<br><br>**$13,999.00** | Sun Ray 1G/V20Z and Java Desktop System Building Block: Bundle of 20 Sun Ray 1G ultra-thin clients and one Sun Fire V20Z server (2 x CPU, 2 GB), includes two 2 x 512 DIMM options for 4GB total memory, Sun Ray Server Software 3 media kit and one 20 seat license, one package of 25 smart cards, Java Desktop System, Release 2 media kit and 20 desktop licenses. Country kits sold separately. |
| **BAE-400-V20Z-20**<br><br>**$28,499.00** | Sun Ray 170/V20Z and Java Desktop System Building Block: Bundle of 20 Sun Ray 170 ultra-thin clients and one Sun Fire V20Z server (2 x CPU, 2 GB), includes two 2 x 512 DIMM options for 4GB total memory, Sun Ray Server Software 3 media kit and one 20 seat license, one package of 25 smart cards, Java Desktop System, Release 2 media kit and 20 desktop licenses. Country kits sold separately. |

# Sun Ray Server Software 3 RTU Part Numbers - EOL

The Sun Ray server software kit includes CD, Installation Guide, and Product Notes. It includes the right to use the software on a single Solaris™ Operating System/SPARC™ processor server. The license has no limitations on the number of Sun Ray thin clients that may be connected to a single server.

## Physical RTU – New License Only

| Order Number & Price | Title and Description |
|---|---|
| **CECI9-300-992S**<br><br>**$99.00** | Sun Ray Server Software 3 RTU, **SINGLE SEAT ONLY**. Allows use of 1 Sun Ray thin client on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECX9-300-992S**<br><br>**$1,780.00** | Sun Ray Server Software 3 RTU, **20 SEAT PACK.** Allows use of 20 Sun Ray thin clients on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECC9-300-992S**<br><br>**$7,900.00** | Sun Ray Server Software 3 RTU, **100 SEAT PACK.** Allows use of 100 Sun Ray thin clients on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECS9-300-992S**<br><br>**$39,500.00** | Sun Ray Server Software 3 RTU, **Site License**. Allows use of an unlimited number of Sun Ray thin clients on any combination of servers, on any OS, at a single geographical location. Media kit and Sofware download sold separately. |

# Sun Ray Server Software 3 Media Kit Part Numbers - EOL

## Physical Media

| Part Number & Price | Description |
|---|---|
| **CEC9L-300C99MS**<br>**$35.00** | Media Kit Sun Ray Server Software 3 Linux |
| **CEC9S-300C99MS**<br>**$35.00** | Media Kit Sun Ray Server Software 3 Solaris OS |

## Electronic Media

| Part Number & Price | Description |
|---|---|
| **CEC9L-300C99BS**<br>**$0.00** | Electronic Software Distribution Sun Ray Server Software 3 Linux |
| **CEC9S-300C99BS**<br>**$0.00** | Electronic Software Distribution Sun Ray Server Software 3 Solaris OS |

## Electronic Software Distribution Only

| Part Number & Price | Description |
|---|---|
| **CECI9-300-9LHS**<br>**$99** | Electronic Software Distribution Sun Store ONLY Sun Ray Server Software 3 RTU, **SINGLE SEAT ONLY**. Allows use of 1 Sun Ray thin client on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECX9-300-9LHS**<br>**$1,780** | Electronic Software Distribution Sun Store ONLY Sun Ray Server Software 3 RTU, **20 SEAT PACK**. Allows use of 20 Sun Ray thin clients on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECC9-300-9LHS**<br>**$7,900** | Electronic Software Distribution Sun Store ONLY Sun Ray Server Software 3 RTU, **100 SEAT PACK**. Allows use of 100 Sun Ray thin clients on any combination of servers on any OS. Media kit and Sofware download sold separately. |
| **CECS9-300-9LHS**<br>**$39,500** | Electronic Software Distribution Sun Store ONLY Sun Ray Server Software 3 RTU, **Site License**. Allows use of an **unlimited** number of Sun Ray thin clients on any combination of servers, on any OS, at a single geographical location. Media kit and Sofware download sold separately. |