

Using Smart Cards With the Sun Ray™ 1 Enterprise Appliance

A Customer Brief



THE NETWORK IS THE COMPUTER™

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Part No. 8xx-xxxx-xx
September 1999, Revision 01

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Using Smart Cards With the Sun Ray™ 1 Enterprise Appliance

Sun Ray 1 Enterprise Appliance Overview

Sun Ray™ 1 enterprise appliances are simple, low-cost devices that require no desktop administration and are targeted at workgroup environments. These appliances are centrally managed by, and draw their computing resources from, the Sun Ray 1 enterprise server software which runs on all Sun's enterprise and workgroup servers. Underlying this architecture is Hot Desk technology, which enables "Hot Desking" — the ability for users to instantly access their sessions from any Sun Ray 1 enterprise appliance in the workgroup.

The Sun Ray Hot Desk architecture is a computing model, initially targeted at the workgroup, where all user state is centralized on the server and linked, by a dedicated interconnect, to a simple zero administration appliance on the desktop. This model delivers a wide array of computational services to a local community of users, through a new partitioning of system functionality. Hot Desk technology enables use of a true, low-cost appliance on the desktop. At the same time it delivers the full power and performance of a server to the desktop, through centralization and the sharing of resources.

With Sun's Hot Desk technology, everything that previously ran on the user's own desktop, including the window system and user applications, now runs in a session on a server. In addition, users can access multiple platforms — Solaris™ Operating Environment, Microsoft Windows NT 4.0 TSE via Citrix MetaFrame™, 3270 and 5250 mainframe applications, and other UNIX® applications — from a single desktop.

The Sun Ray enterprise system delivers lower total cost of ownership, centralized management and access to existing applications with no loss of functionality or performance.

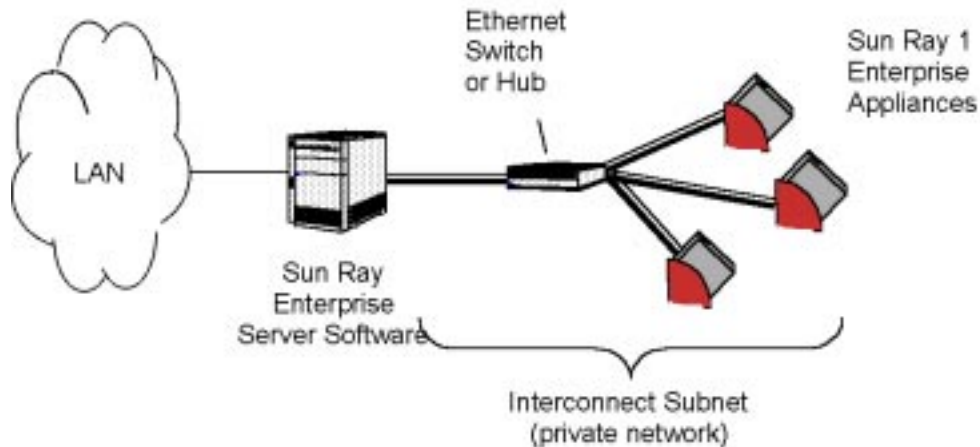
The Sun Ray 1 Hot Desk Architecture is the first step towards a model of computing where client sessions are maintained on the server and instantly available from any device, anytime, anywhere. Because there is no state on the desktop, User sessions and environments not tied to physical hardware units, thereby enabling “Hot Deskling,” the ability to instantly access your session from any appliance within the workgroup.

In addition, a smart card reader in the Sun Ray enterprise appliance provides users with instant access to their user environment, and prevents data loss if a client appliance fails. Once a user has logged in, subsequently inserting an optional smart card into the standard smart card reader brings up the user’s workspace, including applications, profiles, and work in progress — these appear instantly and securely on the Sun Ray 1 enterprise appliance. The capability provided at first customer shipment is simple session mobility. Over time it is expected that general mobility , authentication, and other card-based applications will be more fully integrated with the Sun Ray enterprise system.

Sun Ray 1 Enterprise System

The Sun Ray 1 enterprise system consists of a Solaris server running the Sun Ray enterprise server software, Sun Ray 1 enterprise appliances, and a dedicated interconnect subnet which ties the server and the appliances together. The Sun Ray enterprise server software is installed on a server running the Solaris 2.6 or Solaris 7 Operating Environment. With the Sun Ray enterprise server software, an end user

has access to all Solaris applications, including those based on Java™ technology as well as a variety of X-Windows applications. With third-party emulators, legacy applications, including mainframe and Windows NT, are also available.



Sun Ray 1 Enterprise Appliance

The Sun Ray 1 enterprise appliance delivers server-class performance to the desktop, complemented by a rich, multimedia environment. The key features of the units include the following:

- 24-bit, 2D accelerated graphics at up to 1280x1024 resolution at 85 Hz
- Multichannel audio input and output capabilities: The Sun Ray 1 enterprise appliance can connect with other audio equipment to record and play back sound at all common sample rates from 8 kHz to 48 kHz. Devices such as tape decks, external powered speakers, and power amplifiers can be connected at any Sun Ray 1 enterprise appliance.
- Composite video input: The video in (composite) connector accepts video signals supplied by standard VCRs, camcorders, videodisc players, or video cameras. Stereo audio can be supplied through the line-in port. NTSC M and PAL B/G/I standards are supported. Also, a SunCamera™ II video camera can be connected through this port.
- ISO-7816 compliant smart card reader
- Four powered USB ports which support hot-pluggable peripherals

The Sun Ray 1 enterprise appliance acts as a frame buffer on the client-side of the Sun Ray enterprise system network (interconnect-network). Applications are run on the server and render their output to a virtual frame buffer. The Sun Ray enterprise server software formats and sends the rendered output to the appropriate appliance, where it is interpreted and displayed.

Sun Ray 1 enterprise appliances are identical, with the exception of the Ethernet address. If an appliance fails, it can be quickly replaced with another appliance. Sun Ray 1 enterprise appliance IP addresses are dynamically allocated. IP address allocation is managed by the Dynamic Host Configuration Protocol (DHCP).

Sun Ray 1 Enterprise Appliance Smart Card

The built-in smart card reader provides a specific function in the Sun Ray 1 enterprise appliance. This enhances the user experience by providing session mobility through the unique “Hot Desk” technology. Using a smart card, users can quickly and easily move between Sun Ray 1 enterprise appliance clients. Their session will instantly appear, including all open applications and work-in-progress, at any Sun Ray 1 enterprise appliance once their smart card is inserted into the reader.

The first release of the Sun Ray 1 enterprise appliance supports only a specific smart card: the Schlumberger MicroPayflex. For more information on this card, including how to order and customize smart cards for the Sun Ray enterprise system, refer to Section IV: Ordering and Customizing Smart Cards.

The session mobility functionality provided by the smart card supported by Sun in this first product release is expected to be available in future versions of the Sun Ray 1 enterprise appliance. However, future versions of the Sun Ray enterprise system should be capable of additional smart card functionality, and third-party vendors should be able to write Open Card Framework (OCF) compliant applications which use this smart card. Sun will facilitate the third-party market for Sun Ray 1 enterprise appliance smart cards and applications through its support of OCF and the publishing of test suites for this environment. Because smart cards can be programmed for new functionality, cards purchased for use in Sun Ray 1 enterprise appliances today will be capable of new functionality at a later time. However, it is possible that the requirements for new smart card application may exceed the capacity of existing smart cards.

Using the Sun Ray 1 Enterprise Appliance Smart Card

Administration Overview

The concept of a Sun Ray 1 enterprise appliance user is different from the concept of the traditional UNIX platform user. The Sun Ray 1 enterprise appliance user is identified by a token. The token is usually a smart card ID, but it can also be an appliance's built-in ID. Successful validation of the token gives the user access to an X-Windows session. The initial session begins with a standard dtlogin screen, which requires the user to log in with a UNIX platform username and password before being presented with the user's normal desktop windowing environment. Note that there is no formal connection between a Sun Ray 1 enterprise appliance user and a standard UNIX platform user account — a Sun Ray 1 enterprise appliance user can log in as any UNIX platform account for which the user has a user name and password.

If the user started a Sun Ray 1 enterprise appliance session with a smart card, the user can remove the smart card and insert it in any other enterprise appliance connected to the same Sun Ray server. The user's session "follows" the user, providing the user with instantaneous access to the user's window environment, including current applications, from multiple appliances.

Policy and the Authentication Manager

The amount of Sun Ray 1 enterprise appliance user administration functionality that is available depends on the organization's current authentication policy. The default policy allows all cards and all appliances access without any registration, so the administration database is not consulted or updated with regards to users. Smart card users can still take their sessions from appliance to appliance, but the cards are not named or tracked.

There are two unique system functions that control user access on the Sun Ray 1 enterprise system — the Authentication Manager and the Session Manager. The Authentication Manager's main task is to implement the chosen policies for identifying and authenticating tokens at Sun Ray 1 enterprise appliances. The Authentication Manager is also responsible for verifying user identities and for implementing site access policies.

When an end user first accesses the system, the enterprise appliance takes a token and uses it to present credentials to the Authentication Manager to request access. If the user inserts a smart card, the smart card's type and ID are used as the token. If the user is not using a smart card, the enterprise appliance's built-in type and ID (the unit's Ethernet address) are supplied as the token.

The Authentication Manager uses predefined pluggable components called authentication modules to implement various site-selectable authentication policies. The site administrator can select a combination of the different modules and their options to implement a policy tailored to the site's needs. The modules are:

- **ZeroAdmin** – Any type of token is accepted. Users are automatically passed through to the dtlogin screen.
- **Registered** – The token is only accepted if the token has been registered in the Sun Ray 1 enterprise system administration database and the token is enabled. If the token does not meet these conditions, it is rejected. If accepted, the user is passed through to the dtlogin screen.

Once the user is presented with the dtlogin screen, the Authentication Manager has successfully completed its tasks.

Users can be registered in two ways:

- **Central Registration** – One or more site administrators are responsible for assigning smart cards and/or enterprise appliances to authorized users and registering users' tokens in the Sun Ray 1 enterprise system administration database.
- **Self-Registration** – Users are allowed to register themselves in the Sun Ray 1 enterprise system administration database. If this mode is enabled and the Authentication Manager is presented with a token that is not registered, the user is prompted with a registration screen that is similar to the information a site administrator would fill out.

If an authentication policy involving registered users or appliances is enabled, the Sun Ray 1 enterprise system administration database is consulted before allowing a specific user or appliance (depending on the policy) access to a session. Sun Ray 1 enterprise appliance users can be created, modified, and deleted centrally by an administrator using the Sun Ray 1 enterprise system administration application.

Sun Ray 1 enterprise appliance users can also be created by the users themselves if the current authentication policy has enabled self-registration. Tokens can be added to a user — for example, if a user's card has been left at home and the user needs access to the current session. Tokens can also be removed from a user — for example, if a user's card has been lost or damaged. Tokens can also be enabled or disabled as needed. User statistics, including lists of users, current logins, and individual user properties are also available.

The Session Manager

The Session Manager controls a group of services. The session is associated with an end user via an authentication token. A service is any application that can directly connect to the Sun Ray 1 enterprise appliance, such as audio, video, X servers, and device control of the appliance. The Session Manager keeps track of sessions and services by mapping services to sessions, and binding and unbinding related services to or from a specific appliance.

The Session Manager is active only when the state of the session changes, or if other services are added. When an end user's token is no longer mapped to an appliance (for example, when a card is removed), the Session Manager disconnects the services from the appliance, but the services remain active on the server. For example, programs attached to the X server continue to run, although their output is not visible. If the Authentication Manager quits, the Session Manager disconnects all the sessions authorized by it. All the sessions that were attached will have to be re-authenticated. The services are disconnected, but still active. If the Session Manager is disrupted, it automatically restarts. Each service contacts the Session Manager and requests being added back to a particular session.

Administering Tokens

Administrators have a wide range of control in managing tokens in a Sun Ray enterprise computing environment. Using either a command line or Web interface, administrators can:

- Add, delete, enable or disable tokens to a single user
- Obtain the token ID from a token reader
- Edit the token properties of a single user



FIGURE 1 Sun Ray Administrative Software Edit Properties Page

Using only the command line — which can be useful for bulk operations — administrators can:

- Add, delete, enable or disable tokens to multiple users
- Edit the properties of multiple users

Sun Ray 1 Enterprise Appliance Smart Cards Deployment Scenarios

The integration of smart cards into the Sun Ray 1 enterprise system architecture greatly increases the overall functionality of the system. As shipped, smart cards provide the capability for transparent session mobility — a user can insert a smart card into the reader and be presented instantly with a desktop as it was in their last session, at any machine in the Sun Ray 1 enterprise server domain. Individual user environment, access privileges, and applications are all enabled and instantly presented at any Sun Ray 1 enterprise appliance by inserting a smart card into the standard card reader. Centralized administration can manage users, assign and revoke access and privileges, and provide a foundation for future smart card functionality in the Sun Ray 1 enterprise system environment.

A number of scenarios illustrate how smart cards can reduce costs and create new applications:

Training Platform

The Sun Ray 1 enterprise appliance is the ideal platform for self-paced training. Classroom attendees are instantly identified, and they can pick up exactly where they left off by merely inserting their smart card into the reader. Any of the Sun Ray 1 enterprise appliances are capable of delivering any of the training modules — no need to create separate PC configurations, such as technical, advanced, or sales stations. With the Sun Ray 1 enterprise system, any available appliance can be used by any student with virtually no waiting for session resumption. Special administration clients are not required, either. Administrators, instructors and operators can interrupt any session to check status, apply modifications, or enable new permissions, with students resuming their training module (session) upon insertion of their smart card.

Depending on the training policy and environment, students may either self-register their smart cards or be authenticated against a central database.

Sun Ray 1 enterprise appliances are equipped for a training environment with full multimedia capabilities, including multi-channel audio input and output and video input jacks. High-resolution, true-color displays with accelerated 2-D graphics maximize the learning experience. Administration is minimized because all applications and user parameters are loaded and stored at a central server — no client configuration is allowed.

University/Education Environment

The Sun Ray 1 enterprise system delivers the transparent session mobility required in the university environment. Students can use appliances in labs, libraries, and dorm rooms without waiting for login delays typically associated with a browser-based environment. Whenever and wherever they insert their smart card, lab notes, research links, and in-process emails will appear on their desktop, exactly as they were from the previous session. Using more customized integration, universities will soon create a “do-everything” card featuring personal identification and dormitory security, banking, and a wide range of stored value functions for the purchase of food, books, photocopying and vending services as well as class registration. Hybrid smart cards, which include magnetic stripes and bar codes, can provide door access to dorms and libraries. And by printing or laminating a picture onto the card, these cards can provide identification between humans.

Mobile Employees

Office mobility is the key to improved productivity in many industries and professions — finance, healthcare and customer service, to name a few. Workers in the financial industry often require strict control over what information they can and cannot see, and Sun Ray 1 enterprise appliance smart cards enable strict access controls and user authentication. Typically, it’s not feasible for healthcare workers to carry around portable computing devices, yet they need secure access to patient information as well as their own files. Smart card-enabled sessions provide new levels of accessibility and security from any Sun Ray 1 enterprise appliance.

Many of today’s customer service centers are accessible 24 hours per day, seven days a week. Each call center technician needs access to tremendous computing resources, including databases of information, integrated telephony, access to the Internet and corporate intranets, and in many cases the ability to run the product environment. Multiple technicians, including front-line and second-level technicians, can use a single Sun Ray 1 enterprise appliance by simply inserting their smart card into the reader. They are presented with their desktop as they left it. Plus the same system can be used by many shifts, with virtually no downtime in the changeover.

As the smart card market expands, Sun Ray 1 enterprise smart card functionality will increase to meet market requirements. Sun is working with other suppliers, manufacturers, developers, and vendors in the OpenCard Consortium to create an open, flexible environment for smart cards.

Ordering and Customizing Smart Cards

At first customer shipment (Q3 1999) the Sun Ray 1 enterprise appliance provides support for one type of smart card — the MicroPayflex — as supplied by Schlumberger. The Sun Ray 1 enterprise appliance platform ships with documentation on the use of this card, as well as administering users with it.

The smart card shipped with the unit in the first release delivers only session mobility functionality. While the smart card can be programmed with other capabilities, these are not supported in the first release of the Sun Ray 1 enterprise appliance environment. Additional functionality supporting the OCF framework will be available at a later release. A developer's toolkit is expected early in calendar year 2000.

Smart cards which can be used with the Sun Ray 1 enterprise appliance can be obtained directly from Sun Microsystems or from Schlumberger Limited.

Solaris™ Ready Program

Users and ISVs can order smart cards that work with Sun Ray 1 enterprise appliances through the Solaris™ Ready program. Cards bearing Sun artwork may be ordered through Sun's electronic storefront — the SunStoreSM program (<http://sunstore.sun.com/>). Additional physical customization, such as laminating a picture or logo onto the card, is not available on cards ordered through the SunStore program. Additional smart card vendors are being added to the Solaris Ready program, to provide a breadth of solutions for Sun Ray 1 enterprise appliance users and developers.

Schlumberger

Administrators or developers who want to order large numbers of cards may want to order directly from Schlumberger. Cards ordered from this supplier can be plain (blank) or customized through Schlumberger partners and distributors. This customization can include the printing of custom logos and unique pictures on each card.

ISV and Smart Card Vendors

There are a number of vendors and organizations that provide information and services for smart card users:

- Sun Microsystems - java.sun.com/products/javacard/
- Schlumberger - www.slb.com/smartcards/ or www.cardstore.slb.com/
- OpenCard Consortium - www.opencard.org
- JavaCard Forum - www.javacardforum.org/
- Java Card™ Information - java.sun.com/products/javacard/index.html
- SunStore site - sunstore.sun.com/

Summary

The Sun Ray enterprise system provides an exciting new information appliance, designed to deliver the power of a server to a desktop. The smart card component enables new flexibility, control, and functionality for users, administrators, and developers. Today, smart cards deployed with Sun Ray 1 enterprise appliances enable significantly lower TCO, enhanced user mobility within the workgroup, and greater application availability and performance. This will result in new ways of delivering existing applications, as well as new types of applications. Using smart cards with the Sun Ray 1 enterprise appliances means that users can have “anytime, anywhere” access to their information.

Appendix: Smart Card Market Overview

The impact of the Internet on everyday life is growing more significant every day. Just as telephones were the cornerstone of business at the beginning of the century, Internet technology is the foundation for electronic commerce. With the distributed nature of electronic commerce, security and mobility are the fundamental requirements for authenticated access and secure transactions. Smart cards provide security without limiting mobility.

Smart cards may look similar to cards containing magnetic-stripes or bar codes, but they are very different. In general, smart cards have some sort of integrated circuitry embedded in them, but this circuitry can be implemented in three different ways: as a simple memory card, a hardwired logic card, or a microprocessor card. The Sun Ray 1 enterprise appliance uses a card with a microprocessor, giving it the ability to read and store secure information, and execute programs based on the information in the card. Smart cards can be used as a login mechanism — as they can be used on the Sun Ray 1 enterprise appliance — expanding security options for enterprise computing environments. Smart cards can be manufactured as hybrid cards — with bar codes and magnetic stripes — so they can co-exist with current magnetic stripe readers.

Smart Card Market

The market for smart cards is large and growing fast. While there are less than one billion cards in existence today, Dataquest estimates that by 2001 over 3 billion will be in use. Growth will be fueled by electronic commerce and the need to provide secure access to computer networks.

- Mitsubishi Bank in Tokyo will use smart cards for 24-hour Internet banking. Along with the customer's PIN, the card will contain certificate and private key information.
- The US government expects all its employees to carry multipurpose smart cards by the end of 1999, according to Jack Radzikowski, chief of federal financial systems for the Office of Management and Budget. Federal employees will use the chip cards for building access, business expenses, and Internet services. (Office of Management and Budget, 202-395-3080)

Other innovative uses of smart cards include tracking expenses and equipment usage, health care information, and drivers' licenses.

Standards

There are hundreds of smart card pilot programs in existence around the world, but users may not take a card from one scheme or country and use it in another. In order to accelerate the widespread acceptance of multiple-application smart card technology, standards for interoperability — compatibility between cards, card-reading devices, and applications — must be achieved.

Standards are required to help ensure that cards and card-accepting devices are built to uniform specifications. This enables cards manufactured and issued by one industry sector in one part of the world to be accepted by a device in another part of the world. These cards and devices may support many different types of industries so that, for example, payment cards may be accepted in card-accepting devices at gas stations.

The International Organization for Standardization (ISO) has developed standards for smart cards. Specific industries are now developing proprietary versions of these ISO standards to support their own particular smart card applications. The goal is to provide uniform standards for smart cards that will allow interoperability of cards among a wide array of industries.

Any technology with broad appeal will have a wealth of new standards. Below are a few of the key standards:

Horizontal Standards — Used by All Smart Card Applications

- ISO 7816 – Describes the lowest-level interface to a smart card, where data bytes are transferred between card reader and card.
- PC/SC – Personal Computer/Smart Card – The standard for communicating with smart cards connected to Microsoft Windows systems.
- OCF – OpenCard Framework – An all Java™ technology-based interface for communicating with smart cards from a Java technology-based environment. OCF will soon allow developers to write to OCF and perform the translation, overcoming the need to write to PC/SC. It is intended the Sun Ray 1 enterprise system will support OCF later in 1999.
- Java Card technology – The Java Card application programming interface (API) enables Java technology to run on smart cards and other devices with limited memory. The Java Card API allows applications that are written for one smart card platform enabled with Java Card technology to run on any other such platform. Java Card technology offers several unique benefits, such as:
 - Platform Independence – Java Card technology applets that comply with the Java Card API specification will run on cards developed using the Java Card Application Environment (JCAE) - allowing developers to use the same Java Card technology applet to run on different vendors' cards.

- **Multi-Application Capability** – Multiple applications can run on a single card. In the Java programming language, the inherent design around small, downloadable code elements makes it easy to securely run multiple applications on a single card.
- **Post-Issuance of Applications** – The installation of applications after the card has been issued provides card issuers with the ability to dynamically respond to their customers' changing needs. For example, if a customer decides to change the frequent flyer program associated with the card, the card issuer can make this change without having to issue a new card.
- **Flexibility** – The Object-Oriented methodology of the Java Card technology provides flexibility in programming smart cards.
- **Compatibility with Existing Smart Card Standards** - The Java Card API is compatible with formal international standards, such as ISO7816, and industry-specific standards, such as, Europay/Master Card Visa (EMV).

Vertical Standards — Specific to an Industry or Application

- **Mondex** – Digital cash that uses smart cards only. The Mondex approach does not allow cash to exist outside of the card.
- **VisaCash** – Debit card that keeps track of the cards on the server.
- **MPCOS-EMV** – General-purpose card that allows the implementation of proprietary currency or tokens.

OpenCard Consortium

Twelve key industry players, including IBM, Sun, Netscape, VISA, Schlumberger, Bull, Gemplus and many others endorsed the new OpenCard Framework, which allows Java technology-based smart cards to inter-operate with different smart-card readers. Consortium members support the open architecture that enables issuers to add applications to existing cards after they have been issued, while maintaining security “firewalls” between applications. For example, Visa’s multiple application card plans call for a card to include a combination of Visa-developed credit, debit and stored-value functions along with member Java technology-based cardlets such as loyalty programs, local transit applications or drivers license programs.



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