HP Server Automation

Enterprise Edition

Software Version: 10.0

Overview and Architecture

Document Release Date: June 13, 2013
Software Release Date: June 2013

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Product Editions

There are two editions of HP Server Automation:

- HP Server Automation (SA) is the Enterprise Edition of Server Automation. For information about Server Automation, see the SA Release Notes and the SA User Guide: Server Automation.
- HP Server Automation Virtual Appliance (SAVA) is the Standard Edition of Server Automation. For more information about what SAVA includes, see the SAVA Release Notes and the SAVA at a Glance Guide.

Contents

1 Introduction to HP Server Automation

Overview of HP Server Automation (SA)

This section provides a description of basic HP Server Automation (SA) features and architecture. If you want a more detailed look at SA, read SA Architecture In Depth on page 13.

SA is data center automation software that centralizes and streamlines many data center functions and automates critical areas of your data center's server management:

- **Server Discovery**

  SA scans your network for servers that it does not yet manage and displays them in an agentless server list. You then bring these servers under SA management by installing an SA Agent on each server. After the servers are under SA management, you can perform management tasks on them, including the following:

- **Operating System Provisioning**

  SA OS Provisioning enables you to provision bare metal and virtual servers with a preconfigured operating system and bring them into the SA Managed Server Pool, after which SA can centrally manage the newly provisioned servers.

- **Operating System Patching**

  SA provides an automated, centralized, and flexible method of applying the required operating system patches for Windows, Linux, and Solaris-based managed servers. You can compare required patches against operating system vendor approved lists. You can customize the patching process to omit patches that are incompatible with a server's environment.

- **Software Provisioning**

  After a server is part of the managed server pool, you can install and configure software applications using templates called Software Policies. A software policy specifies the software to be installed, the configurations to be applied, and the scripts to be run during installation. Software policies allow you to establish a baseline configuration for your servers which you can then enforce using SA's Software Compliance feature. For example, you can install an baseline version of an Apache server on all or a subset of your SA managed servers.

- **Audit and Compliance**

  SA Audit and Remediation allows you to define server configuration policies to help you ensure that your SA managed servers meet your policy standards. When servers are found to be out of compliance—not configured the way you want them to be—you can remediate them (force them into compliance). You can base your compliance policy on a snapshot of a base server that you have configured as you want all servers to be configured.

SA's audit trail data helps you establish strict accountability in your data center environment—an increasingly urgent topic in the age of Sarbanes-Oxley Act, the Gramm-Leach-Bliley Act (GLB Act), and the Health Information Portability and Accountability Act (HIPAA).

- **Application Configuration**

  You can design application configuration templates and push those configurations to all SA managed servers. For example, if you have an Apache web server, you might want to ensure that its configuration files are standardized on all servers on which it is deployed. Application configuration allows you to do that. For more information, see the *SA User Guide: Application Configuration*.

- **Application Deployment**

  Using SA Application Deployment, you can quickly and easily move your complex, custom, multi-tier applications from the development team to the quality assurance team for testing, to preproduction, staging and finally to production. For more information, see the *SA User Guide: Application Deployment Manager*.

- **Software Compliance**

  SA's Software Policy Compliance Scan determines whether a Managed Server's software configuration is compliant with the specifications in the software policies attached to that server.

- **Reporting**

  SA provides an extensive set of comprehensive and configurable reports that you can use to present data about the state of your managed servers for various audiences.

SA allows you to make changes more safely and consistently, because you can model and validate changes before you actually commit the changes to a managed server. SA also provides methods to ensure that modifications you plan for your managed servers work on the first time because they have been tested before being applied, thereby reducing downtime.

SA Configurations

A simple SA installation consists of an SA Core, its components, and an Oracle database hosted on single server. More advanced installations can add Secondary Cores (cores that supplement a Primary SA Core and enhance its server management capacity), SA Satellites (similar to an SA Core but smaller and with more limited capabilities used for data centers/branches with limited requirements/resources), and Multimaster Mesh, which allows two separate SA Core installations to communicate and co-manage servers. For more information see Chapter 3, Advanced SA Architecture.

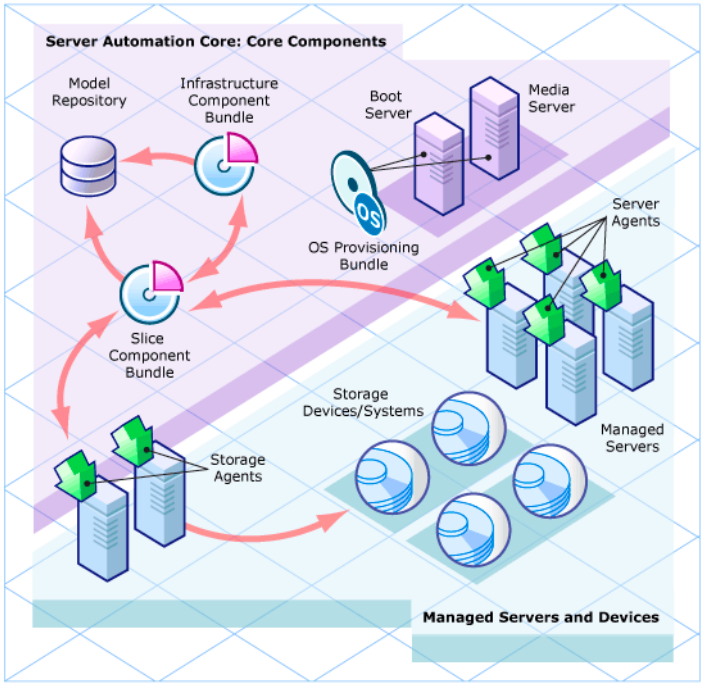
SA supports customer installation in eight specific configurations. These configurations are listed in the *SA Standard/Advanced Installation Guide*. Other configurations are not supported for customer installation and require HP Professional Services.

A Simple SA Configuration

SA installs a number of components that provide its server management capabilities. If you have no need to customize your SA installation, you can choose a SA Single-Host installation. If you need to customize your core installation; for example, distribute SA Core Components to different servers for performance reasons, you will need to use HP Professional Services or certified HP consultants.

Figure 1 shows the simplest SA installation for a single data center/facility. It consists of all SA components installed on a single host managing servers on a single network.

Figure 1 A Simple SA Installation



The Oracle Database

All SA installations require an Oracle database that is configured specifically for SA and is used by an SA component called the Model repository (see Model Repository on page 28) to store information about your network, storage devices, managed servers and the operating systems and applications installed on them, and so on. This database is provided as part of the SA installation, or you can use an existing Oracle installation that has been configured for use with SA (see Appendix A: "Oracle Setup for the Model Repository" in the *SA Standard / Advanced Installation Guide*.

Accessing SA Features

There are two ways you typically access SA functions:

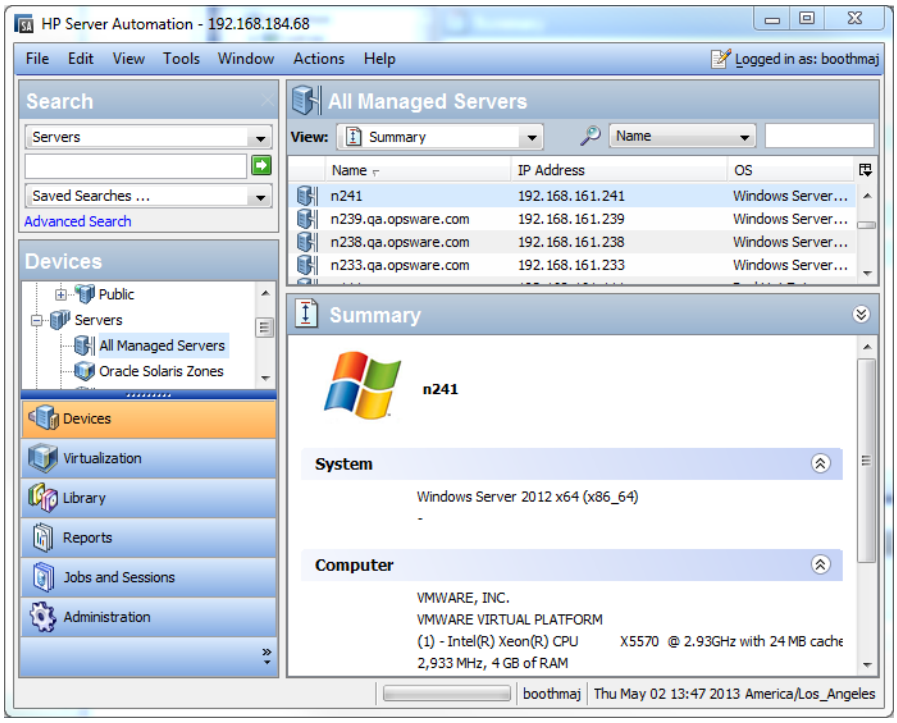
SA Client

SA Client is a Windows application that you install after SA is installed. It provides an interface to SA functions.

To install the SA Client, you must download and install the SA Launcher by opening the login page to your core and clicking on the "Download Hewlett-Packard Launcher" link (see the *User Guide: Server Automation*).

Figure 2 shows the SA Client main screen. You can find more detailed information about the SA Client in the User Guide: Server Automation.

Figure 2 The SA Client Main Screen



SA Web Client

The SA Web Client is deprecated. Certain SA functions are still provided through the SA Web Client; however, you should use the SA Client when possible.

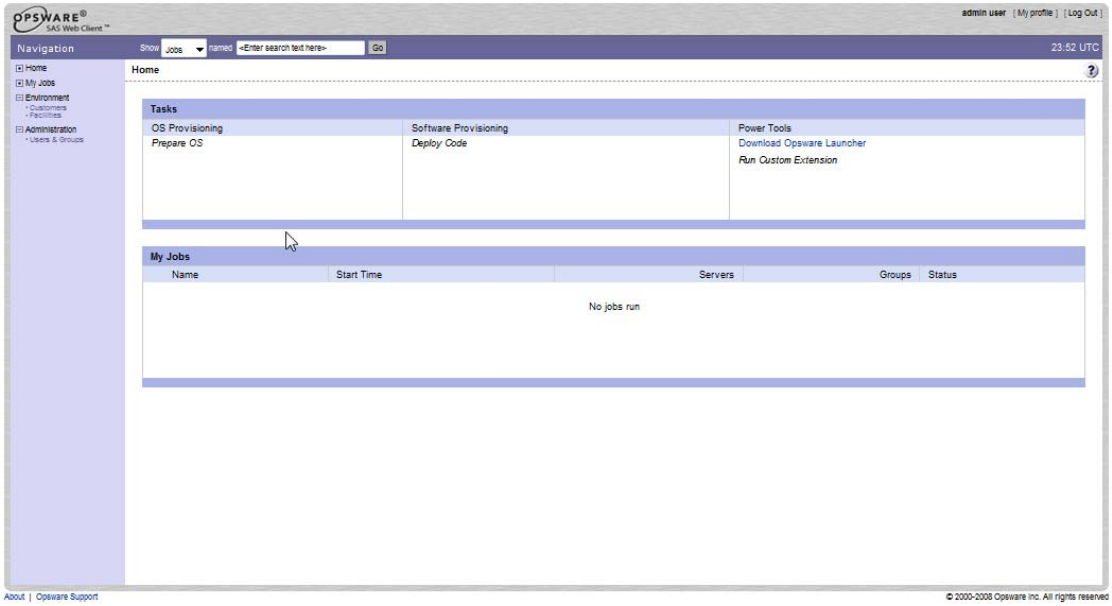
The web-based user interface to SA through which you manage your servers. Instructions for starting the SA Web Client in your browser are in the *User Guide: Server Automation*. After you start the SA Web Client, you can download and install the SA Client Launcher executable from the Tasks pane.

The SA Web Client provides:

- **Tasks**
  - Download the SA Client executable
  - Run Distributed Scripts
  - Run Custom Extensions
- **My Jobs**: details of the jobs that you have run, jobs that are currently in progress, or jobs that you have scheduled to run
- **My Customers**: information about customers associated with the SA Core.

Figure 3 shows the SA Web Client home page.

Figure 3 The SA Web Client Home Page



Sample Use Cases and Tutorials

Chapter 2, Overview of SA Features, provides an overview of using SA features. HP also provides interactive tutorials in the *SA Getting Started* guide that walk you through performing certain tasks like installing an operating system on a server, creating a software policy, applying Windows/Solaris patches, and more. The SA Client also provides interactive tutorials accessible through the online help.

SA Architecture In Depth

If you plan to use any installation other than the Simple SA Installation because you need to take advantage of SA's advanced component layout and customization capabilities, see Chapter 3, Advanced SA Architecture.

2 Overview of SA Features

Server Automation (SA) automates data center processes, replacing ad hoc, error-prone, manual processes. For example, by using OS Provisioning, you can set standards for different types of servers and automatically provision the servers, saving time and ensuring that operating system builds are consistent.

You can establish patch polices to install and maintain patches for supported operating systems running on managed servers in your IT environment.

By using Compliance, you have visibility across your managed servers to see which servers are out of compliance. You can then remediate noncompliant servers to bring them back into compliance, based on the policies you created.

SA provides the following capabilities:

- Operating System Provisioning
- Application Deployment
- Script Execution
- Agentless Server Discovery and Agent Installation
- Device Explorer
- Virtual Server Management
- Server Automation Visualizer (SAV)
- Storage Visibility and Automation
- Audit and Remediation
- Compliance in the SA Client
- Reports
- Software Management
- Patch Management for Windows
- Patch Management for HP-UX
- Patch Management for UNIX
- Patch Management for Solaris
- Application Configuration Management
- Global Shell

SA supports cross-platform environments and is designed to automate both new and existing data center environments.

Operating System Provisioning

SA OS Provisioning provides the ability to provision operating system baselines onto bare metal and virtual servers quickly, consistently, and with minimal manual intervention. Bare metal and virtual server OS provisioning is a key part of the overall process of getting a server into production.

Benefits of SA OS Provisioning include:

- **Integration with other SA functionality**

  Because SA OS Provisioning is integrated with the suite of SA automation capabilities, including patch management, software management, and distributed script execution, hand-offs between IT groups are seamless. SA ensures that all IT groups are working with a shared understanding of the current state of the environment, which is an essential element of delivering high-quality operations and reliable change management.

- **Update server baselines without re-imaging**

  Unlike many other OS provisioning solutions, systems provisioned with SA can be easily changed after provisioning to adapt to new requirements. The key to this benefit is the SA use of templates and an installation-based approach to provisioning.

- **Flexible architecture designed to work in many environments**

  SA OS Provisioning supports many different types of servers, networks, security architectures, and operational processes. SA works well in CD (Linux provisioning) or network-boot environments (both DHCP and non-DHCP environments), with scheduled or on-demand workflows, and across a large variety of hardware models. This flexibility ensures that you can provision operating systems to suit your organization's needs.

SA automates the entire process of provisioning a comprehensive server baseline, which typically consists of the following tasks:

- Preparing the hardware for OS installation using an OS installation profile (required only for OS Sequences).
- Creating OS Build Plans or OS Sequences that define a server build policy, including application policies, patch policies, device groups, and remediation policies.
- Installing a base operating system and default OS configuration using an OS Build Plan or OS Sequence.
- Applying the latest set of OS patches. The exact list depends on the applications running on the server.
- Executing pre-installation or post-installation scripts that configure the system with values such as a root password.

Application Deployment

With Application Deployment, you can manage and deploy your custom software applications to target servers in your data centers. With Application Deployment, you can:

- Model your application components such as code, scripts, configuration files, and tiers such as application servers, web servers, and databases.
- Manage multiple concurrent releases and versions of your applications.
- Deploy, roll back, and undeploy your applications on target servers.

- Model your target servers that are running the tiers required by your applications. These target servers are managed servers in Server Automation.
- Provide clear, concise communication between software application developers, Quality Assurance and testing, systems administrators, and other operations personnel.
- Model and implement life cycles from application development to QA to preproduction to staging to production. You can customize SA to match your enterprise life cycle.

For complete information, see the *SA User Guide: Application Deployment Manager*.

Script Execution

SA Script Execution enables you to share and run ad-hoc or saved scripts across an entire farm of SA-managed servers.

By executing scripts with SA instead of manually, administrators benefit from:

- Parallel script execution across many UNIX and/or Windows servers, saving time and ensuring consistency.
- Role-based access control, ensuring only authorized administrators can execute scripts on hosts to which they have access.
- The ability to control access to scripts by storing them in private or in public libraries.
- The ability to see and download script output one server at a time or in a consolidated report, which captures output from all servers in a single place.
- The ability for scripts to be mass-customized. Administrators can access information in SA about the environment and the state of servers. This is critical to ensuring that the right scripts are executed on the right servers.
- A comprehensive audit trail that reports who, what, when, and where a particular script was executed.

Because Script Execution is an integrated part of SA, administrators can take advantage of unique benefits when compared to standalone script execution tools:

- Using known system state and configuration information to customize script execution, users can tailor each script by referencing and accessing the rich store of information in SA, such as the customer or business that owns the server, whether the server is a staging or production server, which facility the server is located in, and custom name-value pairs.
- By sharing scripts without compromised security, users can share scripts with each other without compromising security because SA maintains strict controls on who can execute scripts on which servers and generates a comprehensive audit trail of script execution.

Agentless Server Discovery and Agent Installation

Agentless server discovery and agent installation allows you to deploy Server Agents to a large number of servers in your facility and place them under SA management.

You can perform the following tasks:

- Scan your network for agentless servers.
- Select servers for SA Agent installation.
- Select a communication tool and provide user/password combinations.
- Choose agent installation options and deploy agents.

Device Explorer

The Device Explorer lets you view information about servers in your managed environment.

From the Server Explorer, you can perform the following tasks:

- Create a server snapshot, perform a server audit, audit application configurations, create a package, and open a remote terminal session on a remote server.
- Browse a server's file system, registry, hardware inventory, software and patch lists, and services.
- Browse SA information such as properties, configurable applications, and even server history.

From the Groups Browser, you can perform the following tasks:

- Audit system information, take a server snapshot, and configure applications.
- View and access group members (servers and other groups).
- View group summary and history information.

Virtual Server Management

Virtual Server management enables you to provision and manage virtual servers. Using the SA Client, you can perform the following tasks:

- View both hypervisor and virtual servers and their relationships in the SA Client, so you can find out the hypervisors that are hosting your virtual machines and local zones.
- View virtual servers and their relationship in the Server Automation Visualizer (SAV).
- Provision hypervisors
- Provision VMware and Microsoft virtual machines (VMs) using OS Build Plans.
- Provision Oracle Solaris zones using OS Sequences.
- Create, start, stop, modify, and remove Oracle Solaris local zones.
- Perform power control operations on VMs and zones, such as power on, power off, reset, shutdown guest, and pause.
- Modify and delete VMs and zones.
- Clone VMs.
- Convert VMs to VM templates
- Deploy VMs from VM templates.
- Delete VM templates.
- Deploy agents on agentless virtual servers using the Agent Discovery and Deployment.
- Search for virtual servers in your data center using the Search tool.
- Create dynamic Device Groups based on virtual server characteristics (zones or VMs).

Server Automation Visualizer (SAV)

Server Automation Visualizer (SAV) is designed to help you optimally understand and manage the operational architecture and behavior of distributed business applications in your IT environment. Since these applications are complex collections of services that typically run across many servers, as well as network and storage devices, it can become increasingly difficult to understand (or remember) what is connected to what, where performance problems originate, how to troubleshoot and resolve problems, and what result would occur if you make a change in your environment.

SAV helps you see (visualize) this type of information through physical and logical drawings.

Storage Visibility and Automation

Storage Visibility and Automation offers storage management capabilities by enabling end-to-end visibility and management of the entire storage supply chain. Storage Visibility and Automation helps server administrators day-to-day tasks by providing tools that increase cost savings through application storage, dependency and visibility, storage audits, storage capacity and utilization trending, and scripting and automation. See the Storage Visibility and Automation User's Guide for more information.

Audit and Remediation

Audit and Remediation allows you to identify which objects you want checked, where you want to check for them, and when you want to check them in your IT environment.

- *Audit policies* define what to check—such as files, directories, configuration values, and so on.
- *Audits* define where to check—such as servers and server groups.
- *Audit schedules* define when to check—such as one time or as a recurring job.

These capabilities help you understand how to make your managed server environment compliant and how to keep your servers compliant. In SA, you can define server configuration policies to ensure that servers in your facilities meet policy standards. When servers are found to be *out of compliance*—not configured the way you want them to be—you can remediate them to comply with your organization's standards.

Using the SA Client, you can audit server configuration values based on a live server or a server snapshot, based on your own custom values, or based on pre-configured audit policies. You can also take server configuration snapshots to capture the current state of a system, so that you can compare other servers against a known baseline.

Audit policies allow you to define company or industry-wide compliance and security standards, which can then be used inside of audits, snapshot specifications, and other audit policies. Referencing audit policies in your audits or snapshot specifications helps verify that you are up to date with the latest compliance definitions in your organization.

Compliance in the SA Client

In the SA Client, the Compliance view allows you to see the overall compliance levels for all servers and groups of servers in your facility. From this view, which is commonly known as the *compliance dashboard*, you can remediate servers that are *out of compliance*. You can view compliance for an individual server, multiple servers, groups of servers, or for all servers under SA management.

The compliance dashboard displays the results of all compliance statuses on servers or groups of servers for audits, audit policies, software policies, patch policies, and application configurations. A server's compliance status is based on a *compliance policy*. A compliance policy defines unique server configuration settings or values to ensure that your IT environment is configured as it should be.

A compliance policy is typically created and defined by a *policy setter*. In some environments, a system administrator might be required to create an ad-hoc policy. The policy setter creates compliance policies and then attaches them to servers to ensure that servers are compliant with your organization's standards and policies.

For example, a policy setter can create a software policy that defines a standard set of patches and packages that must be installed on a server. The policy setter can also define the manner in which certain application files must be configured on a server. A server or group of servers is considered *compliant* if its configuration matches the rules, defined by the policy setter, in the compliance policy.

The compliance dashboard allows you to determine whether the server's actual installed software, packages, patches, and configuration files settings match the configuration defined in the *software policy*. The Compliance view allows you to view compliance for groups of servers, showing a compliance status rollup for all members and sub-group members of a group. From the Compliance view, you can discover servers and groups of servers that are *out of compliance* and then remediate any problems.

Reports

SA Reports provide comprehensive, real-time information about managed servers, network devices, software, patches, customers, facilities, operating systems, compliance policies, and users and security in your environment. These reports are presented in graphical and tabular format, and are actionable—where you can perform appropriate actions on objects, such as a policy or an audit, within the report. These reports are also exportable to your local file system (in `.html` and `.xls` formats) to facilitate use within your organization.

Software Management

SA Software Management provides a powerful mechanism to model software by using software policies and to automate the process of deploying software and configuring applications on a server in a single step. In addition, SA Software Management provides a structure to organize your software resources in folders and define security permissions around them. SA Software Management allows you to verify the compliance status of a server and remediate non-compliant servers.

SA Software Management provides the following capabilities:

- Creating an organizational structure for software
- Defining security boundaries for folders
- Defining a model-based approach to manage the IT environment in your organization

- Enabling sharing of software resources among user groups
- Deploying and configuring applications simultaneously
- Deploying multiple application instances on one server
- Establishing a software deployment process
- Verifying compliance status of servers to software policies
- Generating reports
- Comprehensively searching for software resources and servers

Patch Management for Windows

Patch Management for Windows enables you to identify, install, and remove Microsoft® Windows patches, and maintain a high level of security across managed servers in your organization. You can identify and install patches that protect against security vulnerabilities for the following Windows operating systems:

- Windows 2000, Service Pack 4
- Windows Server 2003
- Windows Server 2003 x64
- Windows Server 2008
- Windows Server 2008 x64
- Windows Server 2008 R2 x64
- Windows XP x86, Service Pack 2 and higher

See the *Server Automation Compatibility Matrix* for more information.

Because Windows patches are often released to address security threats, an organization must be able to roll out patches quickly, before systems are compromised. However, at the same time, patches themselves can cause serious problems, from performance degradation to server failures.

While patch management allows you to react quickly to newly discovered threats, it also provides support for strict testing and standardization of patch installation. And, if patches cause problems, even after being tested and approved, Windows patch management allows you to uninstall the patches in a safe and standardized way.

Patch Management for HP-UX

SA automates HP-UX Patch Management by enabling you to:

- Define HP-UX software policies that provide a model-based approach to managing your HP-UX servers. Server Automation enables you to create a model of your IT environment using HP-UX software policies. These software policies specify patches and scripts that can be installed on the managed servers.
- Install HP-UX patches and patch bundles on your managed servers.
- Establish a patch installation process.
- Schedule the stages of patch management: analysis, download, and installation. You can also set up email notification for each stage and associate a ticket ID for each job.
- Verify the compliance status of servers, based on software policies.

- Display the Compliance view to see whether servers are configured according to the software policy and to remediate non-compliant servers.
- Search for software resources and servers.
- Use the SA Library to search for HP-UX packages, patches, and software policies using powerful and flexible search criteria, such as availability, architecture, operating system, reboot options, version, and so on. You can also search for HP-UX software policies by name, folder name, availability, and operating system.
- View patch dependencies and patch applicability analysis while previewing patch installation.

Patch Management for Solaris

Patch Management for Solaris enables you to identify, install, and remove Solaris patches, and maintain a high level of security across managed servers in your organization. You can identify and install patches that protect against security vulnerabilities.

SA automates Solaris patching by enabling you to:

- Determine which patches your managed servers need.
- Create Solaris patch policies.
- Download Solaris patches, patch clusters, and patch bundles, and then store them, and related vendor information, in the SA Library.
- Resolve all dependent patches for Solaris patches.
- Install Solaris patches and patch clusters on managed servers.
- Install Solaris patches in single-user mode.
- Install patches by Oracle Solaris zones.
- Establish a patch installation process.
- Verify the compliance status of servers with patch policies.
- Search for software resources and servers.

Patch Management for UNIX

Patch Management for UNIX enables you to identify, install, and remove patches, to maintain a high level of security across managed servers in your organization. Using the SA Client, you can identify and install patches that protect against security vulnerabilities for AIX operating systems.

SA allows you to react quickly to newly discovered security threats and also provides support for strict testing and standardization of patch installation. If patches cause problems after being tested and approved, SA allows you to uninstall the patches in a safe and standardized way.

SA stores patch information in the SA Library that includes detailed information about every server under management, the patches and software installed on the servers, and the patches and software available for installation. You can use this data to determine the severity of your exposure to a newly discovered threats, and to help assess the benefits of rolling out a patch versus the costs in downtime and testing requirements.

By automating the patching procedure, SA can reduce the amount of downtime required for patching. SA also allows you to schedule patch activity, so that patching occurs during off-peak hours.

Patch Management for UNIX provides the following capabilities that enable you to browse patches by a certain operating system, schedule patch downloads and installations, set up email notifications, preview a patch installation, use software policies and remediation to install and uninstall patches, and export patch information to a reusable file format:

- The SA Library where patches are stored and organized in their formats
- A database that includes information on every patch that has been applied
- Customized scripts that can be run before and after a patch is installed
- Advanced search abilities that identify servers that require patching
- Auditing abilities that enable security personnel to track the deployment of important patches

Application Configuration Management

Application Configuration Management (ACM) allows you to create templates so you can modify and manage application configurations associated with server applications. ACM enables you to manage, update, and modify those configurations from a central location, ensuring that applications in your facility are accurately and consistently configured.

Using ACM, you can perform the following tasks:

- Manage configurations based on files and objects, such as Windows registry, IIS metabase, WebSphere, COM+, and more.
- Preview configuration changes before applying them.
- Edit and push configuration changes to individual servers or server groups.
- Use information in the SA data model to set configuration values.
- Manage configurations of any application by building configuration templates.
- Audit the Application Configurations on a server to determine if any of the configuration files on the server are out of sync with the values stored in your templates.

Global Shell

The SA Global Shell enables you to manage servers by using a command-line interface. You can remotely perform the following tasks:

- Complete routine maintenance tasks on managed servers.
- Troubleshoot, identify, and remediate problems on managed servers.

The Global Shell consists of a file system and a command-line interface to that file system for managing servers in SA. The file system is known as the SA Global File System (OGFS). All object types in the OGFS (such as servers, customers, and facilities) are represented as directory structures in this file system.

The SA Global Shell also manages user permissions for accessing the file system, Windows Registry, and Windows Services objects on managed servers.

3 Advanced SA Architecture

This section is intended for those users who want a more in-depth understanding of SA architecture because they intend to customize the layout of their SA cores, create a Multimaster Mesh, require a remote database installation, and so on. You will learn about the SA Core and its Core Components and the relationship between the core, Server Agents, and Satellites.

The SA Core

An *SA Core* is a set of *Core Components* that work together to allow you to discover servers on your network, add those servers to a Managed Server Pool, and then provision, configure, patch, monitor, audit, and maintain those servers from a centralized SA Client interface. The SA Client provides a single interface to all the information and management capabilities of SA.

The servers that the Core Components are installed on are called *Core Servers*. Core Components, even if distributed to multiple hosts are still considered part of a single SA Core.

Core Components can all be installed on a single host or distributed across several hosts, however, the typical SA installation uses *Core Component bundling* which installs certain components together on the same server for performance and maintainability purposes. See SA Core Component Bundling on page 27 for more information about component bundling.

In order to communicate and perform certain server management activities, SA installs *Server Agents* on each Managed Server and communicates with the Managed Servers through Gateways that are part of the SA Core Components. Server Agents also perform certain actions on Managed Servers as directed by user input from the SA Client or SA Web Client.

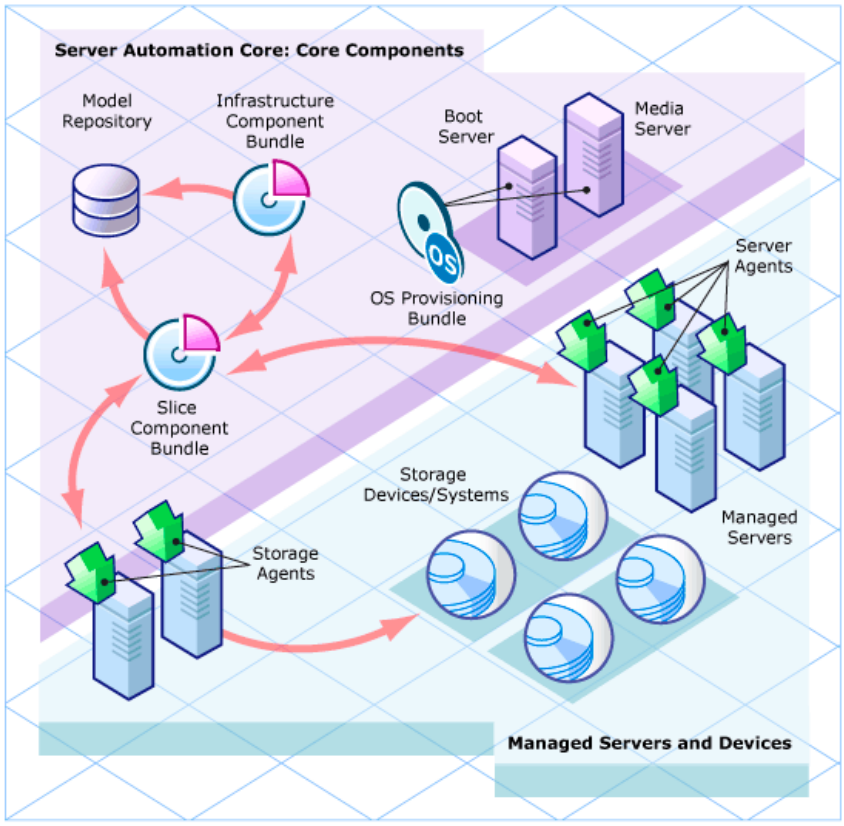
A Simple Single Host Installation

Figure 4 shows a simplified representation of an SA Core installed on a single host with all Managed Servers in the same facility, typically the First Core of a Multimaster Mesh. Many installations consist of multiple cores in different facilities. See SA Topologies on page 36.

In the figure, a single *Core Server* hosts all the SA Core Components that allow SA to discover and store information about the location and configuration of all the servers on a network as well as components that perform monitoring, auditing, provisioning and maintenance tasks, and more.

The SA Core Components are the Model Repository and the Infrastructure, Slice and OS provisioning component bundles. On the Managed Server side, SA Agents are installed on all managed servers and storage devices. The agents communicate with the core through gateways and also perform certain tasks as directed by core-side users, for example, OS provisioning, running audits and reports, and so on.

Figure 4 An *SA* Core and Agents



SA Server Agents

An SA Server Agent is intelligent software that is installed on all servers that you want SA to manage. After an agent is installed on an agentless server, the agent register the server with the SA Core which then adds that server to its pool of Managed Servers. The SA Agent also receives user initiated commands from the Core and takes the appropriate action on the server it is installed on, such as software installation and removal, software and hardware configuration, server status reporting, auditing, and so on.

You can install SA Agents on servers in the following ways:

- You can use the SA Agent Deployment Tool (ADT) to discover the servers on your network that do not have SA Server Agents installed (agentless servers) and install agents on those servers. For more information about ADT, see the *SA User Guide: Server Automation*.
- You can use SA OS Provisioning to provision an operating system to a bare-bones server — an SA Server Agent is installed with the operating system. See the *SA User Guide: OS Provisioning*.
- You can copy the SA Server Agent binary to the server and install it manually. See the *SA User Guide: Server Automation*.

During agent registration, SA assigns each server a unique ID (the Machine ID (MID)) and stores this ID in the Model Repository. Servers can also be uniquely identified by their MAC Address (the network interface card's unique hexadecimal hardware identifier, which is used as the device's physical address on the network).

The Core Components

The Core Components are the heart of the SA Core, making it possible to monitor and manage servers. When you retrieve vital information about network servers, provision servers, apply patches, take servers on and off line, configure and audit servers, and more, this interaction is controlled by the Core Components.

The following section describes the SA Core Components and interfaces. For detailed information about how the SA Components work together to manage your servers, see the *SA Administration Guide*.

SA Core Component Bundling

Certain SA Core Components are *bundled* together and must be installed as a *unit* during a Typical Installation. It is possible, if necessary, to break certain components (such as the Repository Store, OS Provisioning Media Server, OS Provisioning Boot Server, among others) out of a bundle to install them on a different host by performing a Custom installation. However, more complex installations like distributed core components require the services of HP Professional Services or HP certified consultants and are not supported for customer installation.

Table 1 shows the SA component bundles and their constituent components. Note that the Slice Component bundle can have multiple installed instances which aids in workload balancing.

SA Core Component bundling provides the following benefits:

- Added simplicity and robustness for multi-server deployments
- Scaling capability: you can install additional Slice Component bundles for horizontal scaling
- Improved high availability
- Load balancing between slices when multiple instances installed

For more information about SA Core Component architecture and interaction, see the SA *Architectural Diagrams* document provided with the SA documentation set (also downloadable from HP Self Solve).

Table 1 shows how SA Core Components are bundled.

Table 1 Component Distribution

Model Repository	Infrastructure Components	OS Provisioning Components	Slice Components #1	Slice Components #x
One per core	One per core	Typically one per core	One per core	Multiple per core
Model Repository	Management Gateway Primary Data Access Engine Model Repository Multimaster Component Software Repository Store (can be located on another host)	Media Server Boot Server	Core Gateway/ Agent Gateway Command Center Global File System Web Services Data Access Engine Secondary Data Access Engine Build Manager Command Engine Software Repository HP Live Network (HPLN) DCML Exchange Tool (DET) Tsunami Memcache	Core Gateway/ Agent Gateway Command Center Global File System Web Services Data Access Engine Secondary Data Access Engine Build Manager Command Engine Software Repository HP Live Network (HPLN) DCML Exchange Tool (DET) Tsunami Memcache

The *Boot Agent* is unrelated to Server Agents and operates as part of OS Provisioning.

Model Repository

The Model Repository requires either the SA-supplied Oracle database or an existing Oracle installation that meets SA database requirements. For more information about these requirements see the *SA Standard/Advanced Installation Guide* or the document *Oracle Setup for the Model Repository.*

The Model Repository is a standalone component and is not bundled with other Core Components. All SA components work from or update a data model maintained for all SA Managed Servers. The Model Repository stores the following information:

- An inventory of all servers under SA management.
- An inventory of the hardware associated with these servers, including memory, CPUs, storage capacity, and so on.
- Information about managed server configuration.

- An inventory of the operating systems, system software, and applications installed on managed servers.
- An inventory of OS Provisioning operating system installation media (the media itself is stored in the OS Provisioning Media Server).
- An inventory of software available for installation and the software policies that control how the software is configured and installed. The software installation media itself is stored in the Software Repository.
- Authentication and security information.

The Core Component Bundles

Infrastructure Component Bundle

- **Primary Data Access Engine**

  The Data Access Engine provides an XML-RPC interface to the Model Repository that simplifies interaction with various clients, such as the SA Web Client, system data collection, and monitoring agents on servers. The Data Access Engine installed with the Infrastructure Component bundle is designated the *Primary* Data Access Engine. The Data Access Engine installed with the Slice Component bundle(s) is designated the *Secondary* Data Access Engine.

  Because interactions with the Model Repository go through the Data Access Engine, clients are less impacted by changes to the Model Repository's schema. The Data Access Engine allows functionality to be added to SA without requiring system-wide changes.

- **Management Gateway**

  Manages communication with other SA Cores and Satellites.

- **Model Repository Multimaster Component**

  The Model Repository Multimaster Component is installed with the Infrastructure Component bundle. A Multimaster Mesh, by definition, has multiple core installations and the Model Repository Multimaster Component synchronizes the data in the Model Repositories for all cores in the Mesh, propagating changes made in one repository to the other repositories.

  Each Model Repository Multimaster Component consists of a Sender and a Receiver. The Sender (Outbound Model Repository Multimaster Component) polls the Model Repository and sends unpublished transactions to other Model Repositories. The Receiver (Inbound Model Repository Multimaster Component) accepts the transactions from other Model Repositories and applies them to the local Model Repository.

As of SA 7.80, TIBCO Rendezvous was replaced by the SA Bus. The SA Bus is a set of libraries that provide certified messaging services.

- **Software Repository Store**

  The Software Repository Store component can be installed on any server hosting an Infrastructure Component bundle. As of SA 9.0, the Software Repository is part of the Slice Component bundle and the Software Repository Store component has been introduced to handle NFS exports to Slice Component bundle hosts.

  If you choose not to install the Software Repository Store, you must manually configure a NAS (filer) to allow Slice Component bundle servers access to the file system.

Slice Component Bundle

- **Command Engine**

  Part of the Slice Component bundle. The Command Engine is a system for running distributed programs across many servers (typically through SA Server Agents). Command Engine scripts are written in Python and run on the Command Engine server. Command Engine scripts can issue commands to Server Agents. These calls are delivered in a secure manner and are auditable by using data stored in the Model Repository.

  Because you can have multiple Slice Component bundles, and therefore multiple Command Engines, horizontal scaling is greatly enhanced. Multiple Command Engine instances can share the load of command delivery and script execution by taking advantage of the load balancing mechanism provided by multiple Slice Component bundles. Failover and high availability are also improved. For example, when a Command Engine instance tries to delegate a command to another node in the cluster and that node is down, it fails over to the next node.

  SA can use Command Engine scripts to implement functionality.

- **Software Repository**

  Part of the Slice Component bundle. This component is a repository in which the binaries/packages/source for software/application provisioning and remediation is uploaded and stored. A related component is the Software Repository Store which is installed with the Infrastructure Component bundle and handles NFS exports to Slice Component bundle hosts.

  SA supports mirroring of the Software Repository. You can control which Software Repositories in the mesh are designated as mirrors and control the frequency of mirroring jobs by modifying configuration parameters in the SA Web Client. Mirroring does not affect Satellite Software Repository caches.

  Software Repository mirroring can require large amounts of available disk space. During Standard and Advanced installation, you are given the opportunity to turn off mirroring which is on by default.

  For more information about configuring Software Repository mirroring, see the *SA Administration Guide*.

  For information about how to upload software packages to the SA Library, see the *SA User Guide: Software Management*.

- **Core Gateway/Agent Gateway**

  The Core Gateway communicates directly with Agent Gateways passing requests and responses to and from Core Components.

- **Command Center**

  The Command Center (OCC) is the Core Component that underlies the SA Web Client. The OCC includes an HTTPS proxy server and an application server. You access the OCC only through the SA Web Client.

- **DCML Exchange Tool**:

  The DCML Exchange Tool is installed with each Slice Component bundle and facilitates the import and export of SA content. See the *SA Content Utilities Guide*.

- **Global File System**

  The Global File System (OGFS) is installed with each Slice Component Bundle and provides the central execution environment for SA.

The OGFS runs on one or more physical servers; customers can scale SA execution capacity by simply adding additional Slice Component bundles in a core.

The OGFS runs SA built-in components — as well as customer-written programs — within a virtual file system that presents the SA data model, SA actions, and managed servers as virtual files and directories.

This unique feature of SA allows users of the Global Shell and Automation Platform Extensions (APX) to query SA data and manage servers from any scripting or programming language. Since the OGFS filters all data, actions, and managed server access through the SA security model, programs running in the OGFS are secure by default.

- **Web Services Data Access Engine**

  The Web Services Data Access Engine provides a public-object abstraction layer to the Model Repository and provides increased performance to other SA Core Components. This object abstraction can be accessed through a Simple Object Access Protocol (SOAP) API, through third-party integration components, or by a binary protocol of SA components such as the SA Web Client.

- **Secondary Data Access Engine**

  The Data Access Engine provides an XML-RPC interface to the Model Repository that simplifies interaction with various clients, such as the SA Web Client, system data collection, and monitoring agents on servers. The Data Access Engine installed with the Infrastructure Component bundle is designated the *Primary* Data Access Engine. The Data Access Engine installed with the Slice Component bundle(s) is designated the *Secondary* Data Access Engine.

  Because interactions with the Model Repository go through the Data Access Engine, clients are less impacted by changes to the Model Repository's schema. The Data Access Engine allows functionality to be added to SA without requiring system-wide changes.

- **Build Manager**

  Although the Build Manager is part of SA OS Provisioning, it is installed as part of the Slice Component bundle. The Build Manager facilitates communications between OS Build Agents and the Command Engine. It accepts OS Provisioning commands from the Command Engine. It provides a runtime environment for the platform-specific build scripts to perform OS Provisioning procedures.

- **HP Live Network (HPLN)**

  HP Live Network delivers content updates for Server Automation (SA), Network Automation (NA), Client Automation (CA), Operations Orchestration (OO) and Service Automation Reporter (SAR). The HP Live Network (HPLN) provides customers with security and compliance policies to help maximize your return on investment in SA, NA, and CA, and to leverage the extensible automation platforms to deliver new automation capabilities on an ongoing basis.

  HPLN is installed as part of the Slice Component bundle during SA Core installation.

- **Tsunami**

  An object store download accelerator that boosts remediation performance and scalability for any agents that communicate directly with a Linux-based SA Core.

  Performance and scalability are improved in two key areas:

  — *RPM Remediation Analysis* – Fetching package headers during an RPM dependency analysis/preview is considerably faster than in previous SA releases.

— *Remediation Package Staging* – Unit downloads to managed hosts from the Software Repository is considerably faster than in previous SA releases and can use 10GbE networking.

- **memcache**

  An in-memory caching layer that works with the Tsunami component to support remediation and scalability enhancements for agents that communicate directly with a Linux-based SA Core.

OS Provisioning Components Bundle

- **Boot Server**

  The Boot Server is part of SA OS Provisioning. It supports network booting of Sun and x86 systems with inetboot and PXE, respectively. The processes used to provide this support include the Internet Software Consortium DHCP server, Sun Solaris TFTP, and NFS.

- **Media Server**

  The Media Server is part of SA OS Provisioning. It is responsible for providing network access to the vendor-supplied media used during OS Provisioning. The processes used to provide this support include the Samba SMB server and Sun Solaris/Linux NFS. You copy and upload your valid operating system installation media to the Media Server.

OS Build Agent: The OS Build Agent is part of OS Provisioning. It runs during the pre-provisioning (network boot) process and is responsible for registering a server with the SA Core through the Build Manager and guiding the OS installation process.

Satellite Installations

- **Software Repository Cache**

  A Software Repository Cache contains local copies of the contents of a Core's Software Repository (or of another Satellite). Having a local copy of the Software Repository can improve performance and decrease network traffic when you install or update software on a Satellite's Managed Servers.

- **Satellite Agent Gateway**

  The Satellite Agent Gateway handles communications between the Satellite and the Core through the Core's Management Gateway.

SA Interfaces

Automation Platform Extensions

APXs provide a framework that allows anyone familiar with script-based programming tools such as shell scripts, Python, Perl, and PHP, to extend the functionality of SA and create applications that are tightly integrated into SA. For more information, see the *SA Platform Developer Guide*.

SA Command Line Interface (SA CLI)

The SA CLI is a command line interface you can use to upload packages into the Software Repository, and to perform batch commands, run scripts, and many other SA operations. For more information, see the *SA User Guide: Server Automation*

DCML Exchange Tool (DET)

A utility that enables users to export almost all server management content from any SA Core and import it into any other SA Core. For more information, see the *SA Content Utilities Guide*.

ISM (Intelligent Software Modules) Development Kit

A development kit that consists of command-line tools and libraries for creating, building, and uploading ISMs. An ISM is a set of files and directories that include application bits, installation scripts, and control scripts. For more information, see the *SA Content Utilities Guide*.

SA APIs

A set of APIs and a command-line interface (CLI) that facilitate the integration and extension of SA. This platform allows other IT systems — such as existing monitoring, trouble ticketing, billing, and virtualization technology — to exchange information with SA. This broadens the scope of how IT can use SA to achieve operational goals. For more information, see the *SA Platform Developer Guide*.

SA Gateways

SA Gateways manage communication between Managed Servers and a SA Core, between multiple cores (Multimaster Mesh), and between Satellite installations and an SA Core. Multimaster installations are discussed in Multimaster Mesh (Multiple Cores) on page 36 and Satellite installations are discussed in SA Satellites on page 40.

There are several types of gateways:

- **Management Gateway**

  This gateway manages communication between SA Cores and between SA Cores and Satellites.

- **Core Gateway/Agent Gateway**

  These gateways work together to facilitate communication between the SA Core and SA Agents on managed servers.

- **Satellite Gateway**

  This gateway communicates with the SA Core through the Management Gateway or the Core Gateway depending on your configuration.

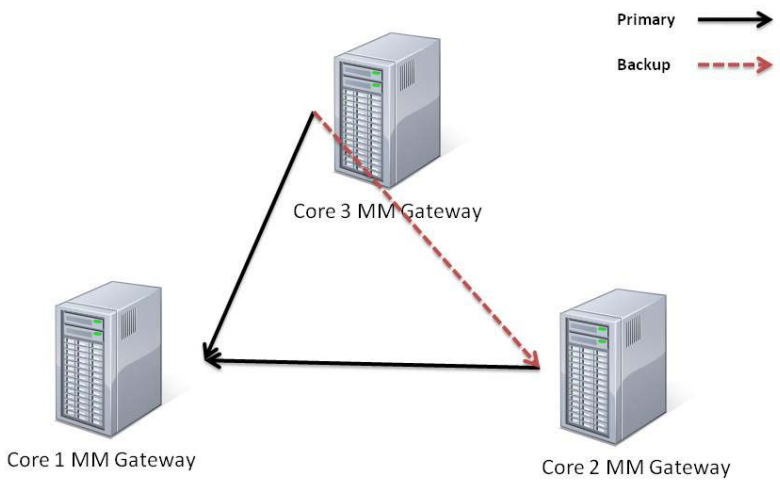
Multimaster Master Gateway Backup Routes

By default, installation of a third or subsequent core in a Multimaster Mesh automatically creates a backup route to the Second Core providing a primary route to the First Core and a backup route to the Second Core. SA creates the Gateway backup routes automatically during installation, you are not required to provide any configuration information, however, if SA cannot create the backup routes, you will see a message to that effect and may need to contact HP Technical Support to manually configure Gateway backup routes.

Gateway backup routes are created only during fresh installations of SA 9.0, not during upgrades. If you are upgrading to SA 9.0 from an earlier version, the upgrade will not create gateway backup routes. You must create backup routes manually. Contact your HP Technical Support representative for more information.

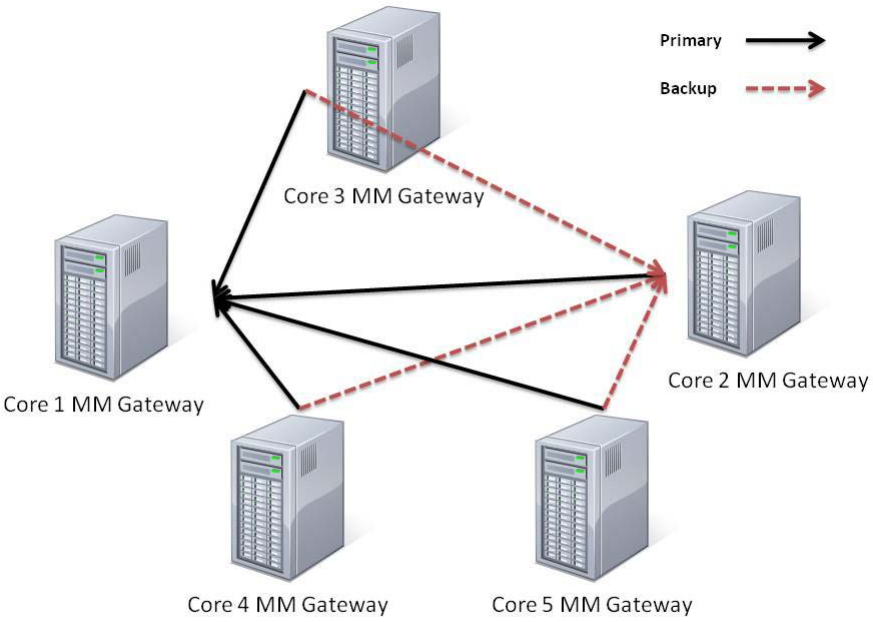
For example, for a three core or more mesh, all Multimaster traffic is routed by default through the First Core's Master Gateway. However, the Second Core's Master Gateway is now designated by default as the backup Master Gateway should the First Core's Master Gateway fail. All additional subsequent core's Master Gateways added to the mesh will be designated as a backups in the order of installation. On installation, the third and subsequent cores will by default have two tunnels. The first tunnel communicates with the First Core's Master Gateway, the second tunnel with the second core in the mesh. See Figure 5.

Figure 5 Mesh with Three Cores and a Single Backup Route



A mesh with multiple Master Gateways will also have redundant backup routes. See Figure 6.

Figure 6 Five Core Mesh with Multiple Backup Routes



Upon failure of a Master Gateway, the backup route will automatically be used for Multimaster Mesh traffic by default. When the failed Master Gateway is brought back on line, mesh traffic will automatically be routed through that gateway again.

SA Topologies

You must decide what SA topology fits your facility's needs. This section provides some background on the SA topologies to help you make that decision

Single Host Core

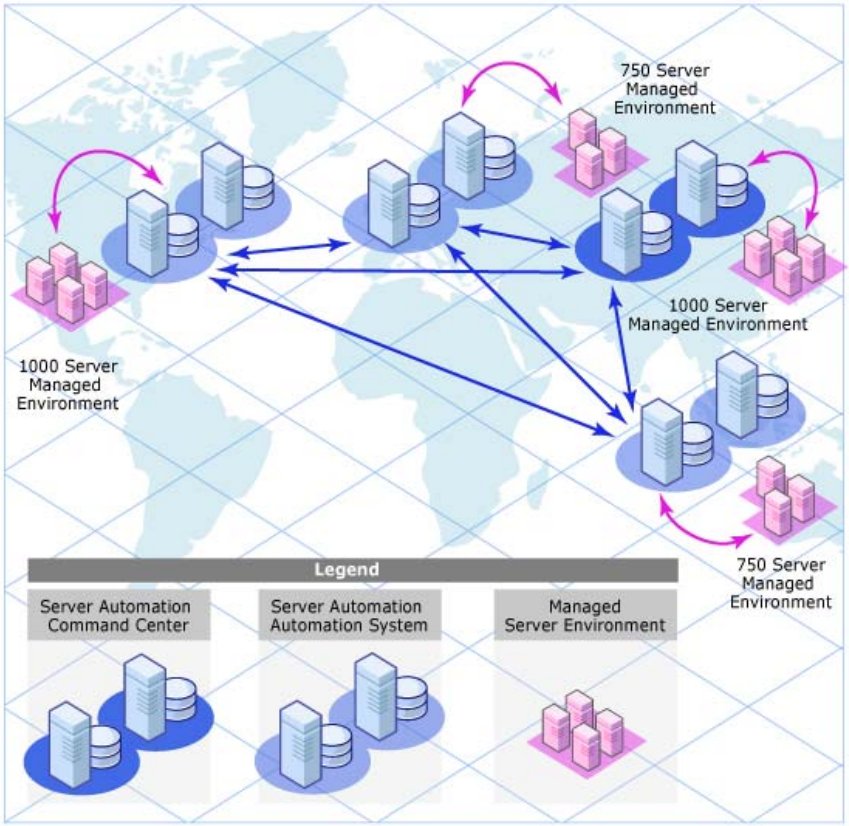
The simplest topology is a Single Host Core (formerly a Standalone Core) that manages servers in a single facility.

A Single Host Core is best for a small network of servers contained in a single facility. Although a Single Host Core does not communicate with other SA Cores, it has all the components required to do so and can be easily converted into a core that is part of a Multimaster Mesh.

Multimaster Mesh (Multiple Cores)

To manage servers in more than one facility, you install a Multimaster Mesh of SA Cores or a combination of SA Cores and Satellites.

Figure 7 Multimaster Topology



A *Multimaster Mesh* is a set of two or more SA Cores that communicate with each other through Management Gateways and can perform synchronization of the data about the Managed Servers contained in their respective Model Repositories. Changes to the data in any Model Repository in a Multimaster Mesh are broadcast to all other Model repositories in the Mesh and synchronized.

The SA Core Component that propagates and synchronizes changes from each Model Repository to all other Model Repositories is called the Model Repository Multimaster Component and is part of the Infrastructure Component bundle. This replication capability allows you to store and maintain a "blueprint" of software and environment characteristics for each facility making it easy to rebuild your infrastructure. It also provides the ability to easily provision additional capacity, distribute updates, and share software builds, templates and dependencies across multiple facilities.

A Multimaster Mesh can also include Satellite installations.

Servers can be managed from any facility with an installed SA Core using the SA Web Client or the SA Client.

Benefits of Multimaster Mesh

An Multimaster Mesh offers the following benefits among others:

- **Centralized Administration** — the Managed Servers in a Multimaster Mesh can be centrally administered from any facility that is managed by an SA Core that is part of the mesh. Administration is not locked into a single location or even restricted geographically.
- **Redundancy** — Synchronized (replicated) data management between facilities provides redundancy. For example, if an SA Core in one facility in a mesh is damaged, other cores in the Multimaster Mesh contain synchronized copies of the managed server data that can be used to restore the damaged core's Model Repository to a last known good state. In addition, while a damaged core is unavailable, other cores in the mesh can continue functioning without interruption.

  Replication also provides the ability to close down or add a facility while other facilities in the mesh continue operations without interruption.
- **Performance Scalability** — In a Multimaster Mesh, only multimaster database synchronizations are transmitted over the network reducing network bandwidth load.
- **Geographic Independence** — Cores can continue to manage servers during network interruptions regardless of location.

Facilities and Realms

SA Gateways use two constructs that facilitate routing network traffic and eliminate the possibility of IP address conflicts:

Facilities

A *Facility* is a construct that typically represents a collection of servers that a single SA core manages through the data about the managed environment stored in its Model Repository. A facility typically represents a specific geographical location, such as Sunnyvale, San Francisco, or New York, or, commonly, a specific data center.

A Facility is a permissions boundary within SA, that is, a user's permissions in one Facility do not carry over to another. Every Managed Server is assigned to a single facility. When a device initially registers with the SA Core, it is assigned to the facility associated with the gateway through which it is registering.

For example, Admin A works in Sunnyvale and is in charge of maintaining server patches. In a Facility framework, Admin A is bound to the Sunnyvale Facility as a user. When Admin A views servers, only those servers that are also bound to the Sunnyvale Facility are displayed. He will not see servers for any other Facility.

There are two types of facilities

- **Core Facilities**

  There is one Core Facility for every SA Core installation.

- **Satellite Facilities**

  A default Facility created when you install a Satellite.

Realms

Realms are a SA construct that allow SA to manage servers on different networks in the same Facility without fear of IP address conflicts. A realm is a unique identifier, appended to the IP address of a device in a Facility's network, that allows SA Gateways to uniquely identify devices on different networks in a Multimaster Mesh that may have conflicting IP addresses.

A Realm is a logical entity that defines an IP namespace *within which* all Managed Server IP addresses must be unique. However, servers that are assigned to *different Realms* can have duplicate IP addresses and still be uniquely identified within SA by their Realm membership.

Realms are interconnected by gateways in what can be described as a *gateway mesh* — a single interconnected network of SA Gateways.

When you create and name a new Facility during installation, a *default* Realm is also created with the same name as the Facility. For example, when you create the Facility, *Datacenter*, the installation also creates a Realm named *Datacenter*. Subsequent Realms in that facility could be named *Datacenter001*, *Datacenter002*, and so on. Managed servers in each realm are uniquely identified by the combination of the Realm name and the IP address.

Multimaster Mesh Topology Examples

Figure 8 shows a Multimaster Mesh with cores installed in two separate facilities, San Francisco and Los Angeles. Each facility's core has a Model Repository that contains data about the Managed Servers in both facilities. That data is constantly synchronized (replicated) between both Facilities' Model Repositories. The cores communicate through their respective Management Gateways.

Communication from the Managed Servers in the Los Angeles facility to the San Francisco core travels through the Los Angeles Agent Gateway to the Core Gateway, then to the Los Angeles Management Gateway which then communicates with the San Francisco core through the San Francisco Management Gateway and Core Gateway.

Figure 8 Multimaster Mesh with Two Cores

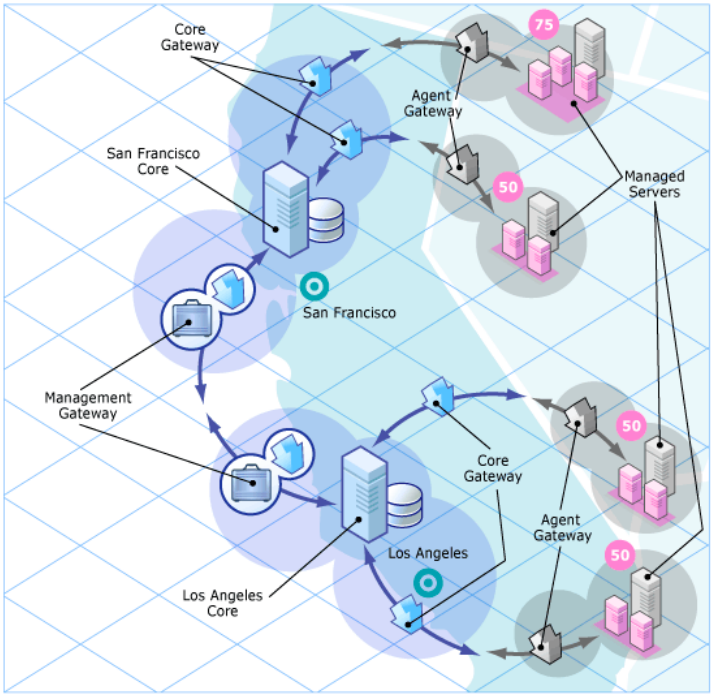
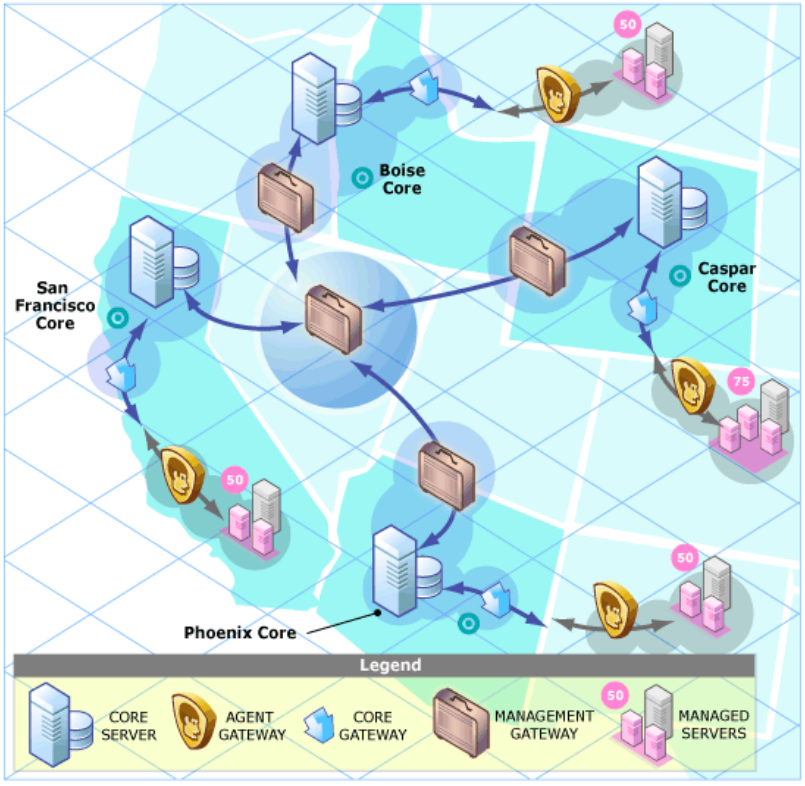


Figure 9 shows a Multimaster Mesh with four cores. This Mesh topology is called a *Star Formation* with the San Francisco core at the center of the Mesh. The SA Installer configures a Multimaster Mesh in a star topology with backup gateway routes by default.

Figure 9 Multimaster Mesh with Four Cores



SA Satellites

A Satellite installation can be a solution for remote sites that do not have a large enough number of potentially Managed Servers to justify a full SA Core installation. A Satellite installation allows you to install only the minimum necessary Core Components on the Satellite host which then accesses the Primary Core's database and other services through an SA Gateway connection.

A Satellite installation can also relieve bandwidth problems for remote sites that may be connected to a primary facility through a limited network connection. You can cap a Satellite's use of network bandwidth to a specified bit rate limit. This allows you to ensure that Satellite network traffic will not interfere with your other critical systems network bandwidth requirements on the same pipe.

A Satellite installation typically consists of, at minimum, a Satellite Gateway and a Software Repository Cache and still allows you to fully manage servers at a remote facility. The Software Repository Cache contains local copies of software packages to be installed on Managed Servers in the Satellite while the Satellite Gateway handles communication with the Primary Core.

You can optionally install the OS Provisioning Boot Server and Media Server on the Satellite host to support remote OS Provisioning. Installing other components on the Satellite host is not supported.

Satellite Topology Examples

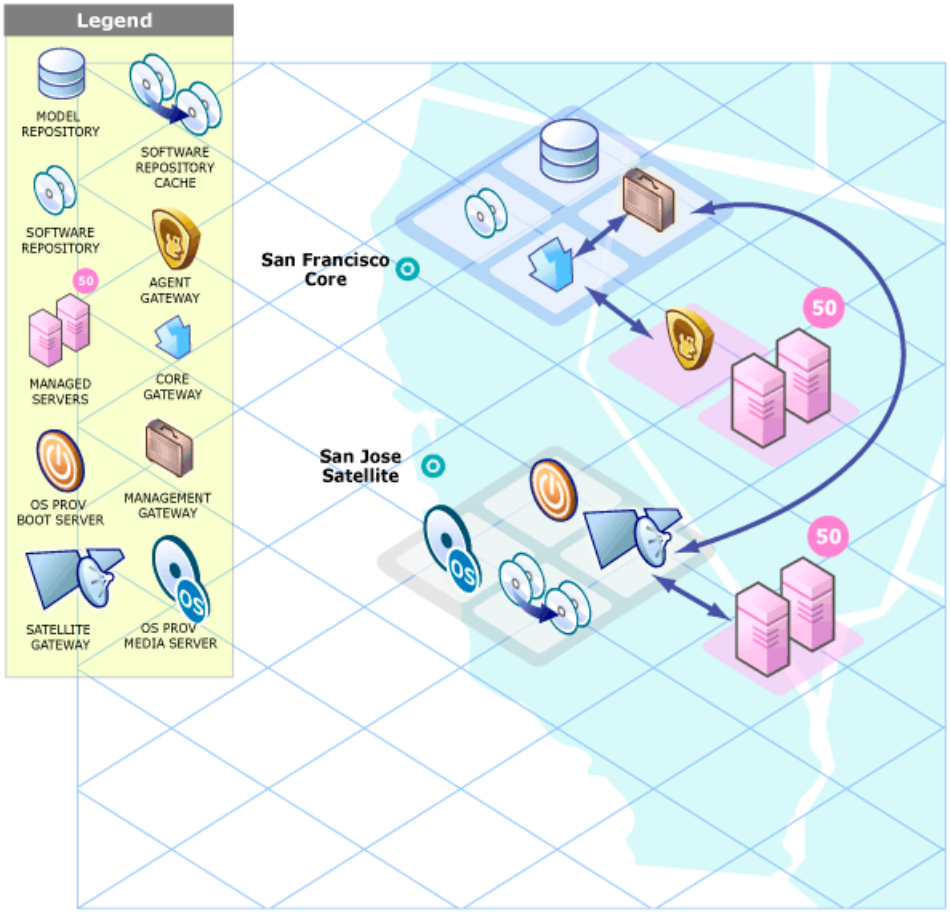
A Simple Single Core to Satellite Link

Figure 10 shows a single Satellite linked to a Single Core. In this example, the main facility is in San Francisco, and a smaller remote facility is in San Jose.

The San Francisco Single Core consists of several components, including the Software Repository, the Model Repository, an Agent gateway and a Management Gateway. For simplicity, this figure does not show all required Core Components, such as the Command Engine.

The San Jose Satellite consists of a Software Repository Cache, an Satellite Gateway, and an optional OS Provisioning Boot server and Media Server.

Figure 10 Satellite with the Single Core



The San Jose Satellite's Software Repository Cache contains local copies of software packages to be installed on Managed Servers in that facility.

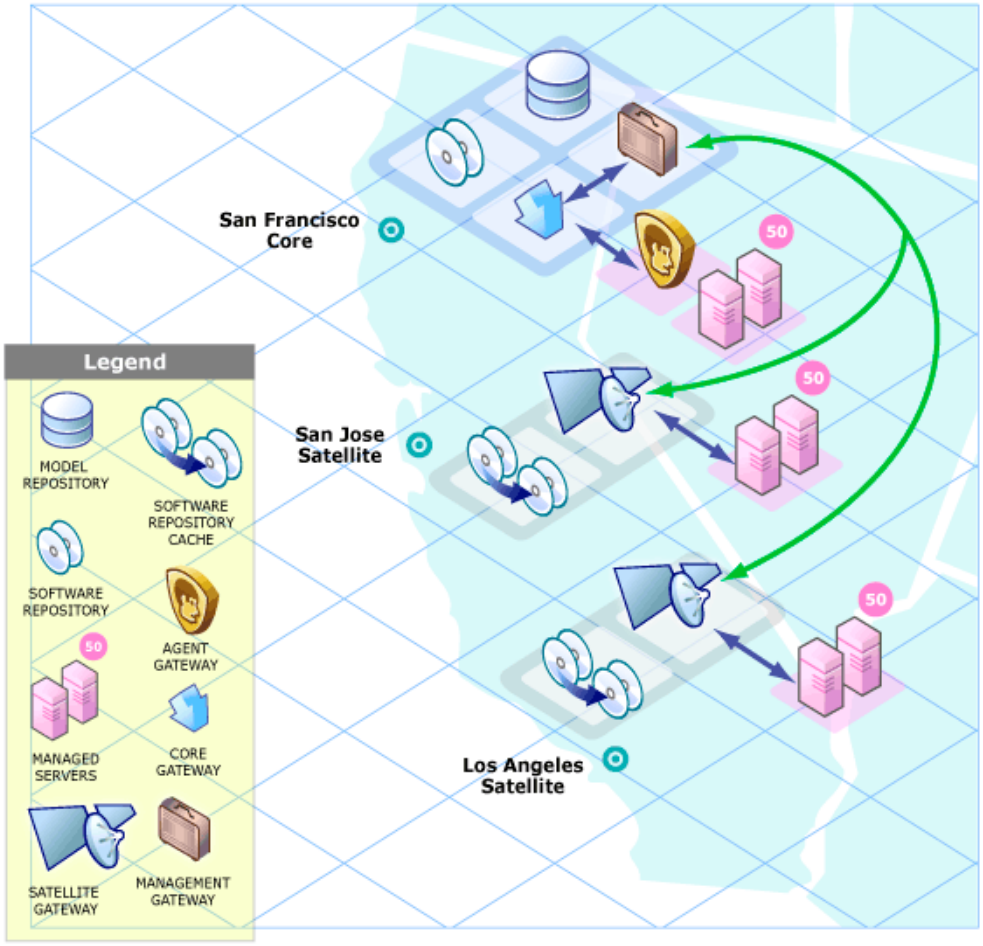
The Server Agents installed on managed servers at the San Jose facility connect to the San Francisco core through the San Jose Satellite Gateway which communicates with the San Francisco Management Gateway, then through the San Francisco Core gateway, ultimately, with the required Core Components.

Return communication reverses that path. The Server Agents installed on managed servers in the San Francisco facility communicate with the Core Components through the San Francisco facility's Agent and Core Gateways.

A Two Satellite to Single Core Link

Figure 11 shows two Satellites linked to a Single Core. In this example, San Francisco is the main facility, Sunnyvale and San Jose are Satellite facilities.

Figure 11 Two Satellites with a Single Core

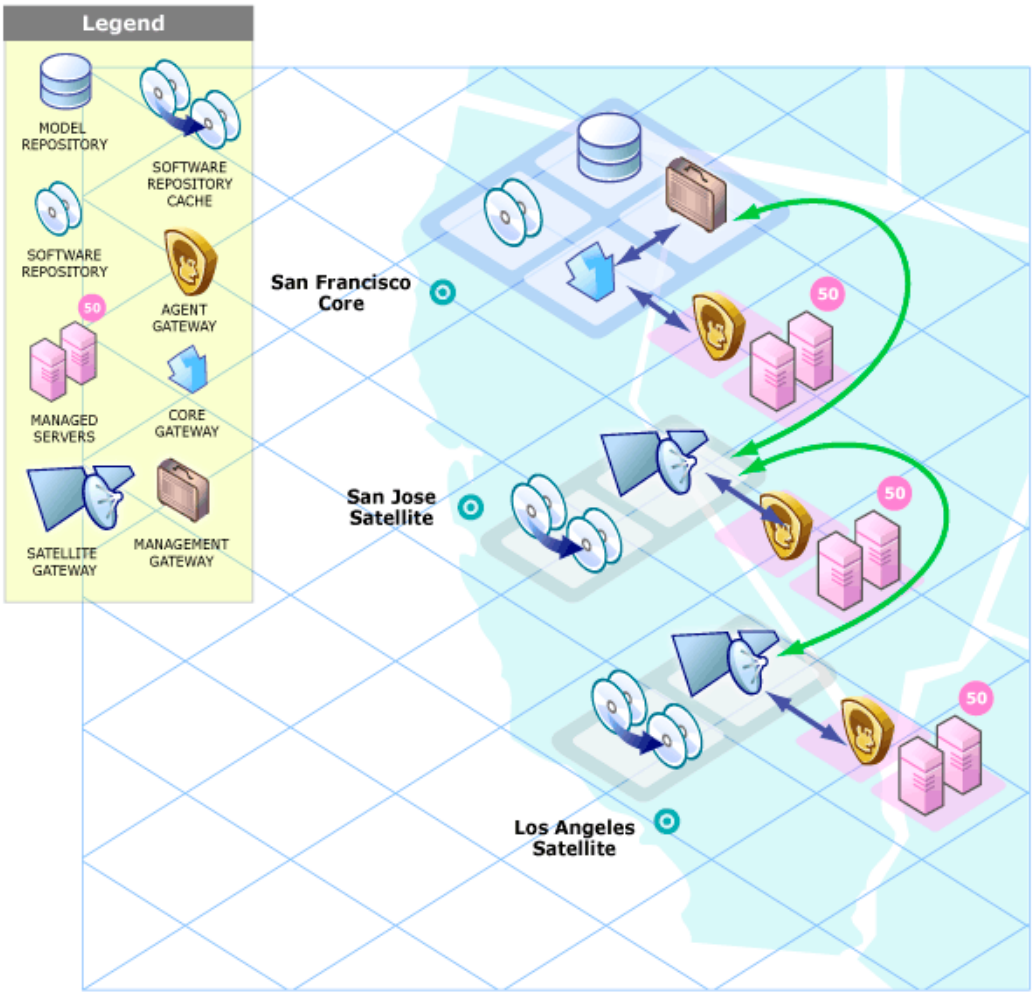


A Cascading Satellite Link

Figure 12 shows cascading Satellites, a topology in which Satellite Gateways are connected in a *chain*. This topology enables you to create a hierarchy of Software Repository Caches. Note that, the Satellite Gateways in this topology must belong to different SA Realms.

When tasked to install a package on a managed server in the Los Angeles facility, SA first checks to see if the package resides in the Software Repository Cache in Los Angeles. If the package is not in Los Angeles, then SA checks the Software Repository Cache in San Jose. Finally, if the package is not in San Jose, SA goes to the Software Repository in the San Francisco core. For more information, see “Satellite Software Repository Cache Management” in the *SA Administration Guide*.

Figure 12 Cascading Satellites with a Single Core



Satellites in a Multimaster Mesh

Figure 13 shows the San Jose Satellite connected to two SA Cores in a Multimaster Mesh.

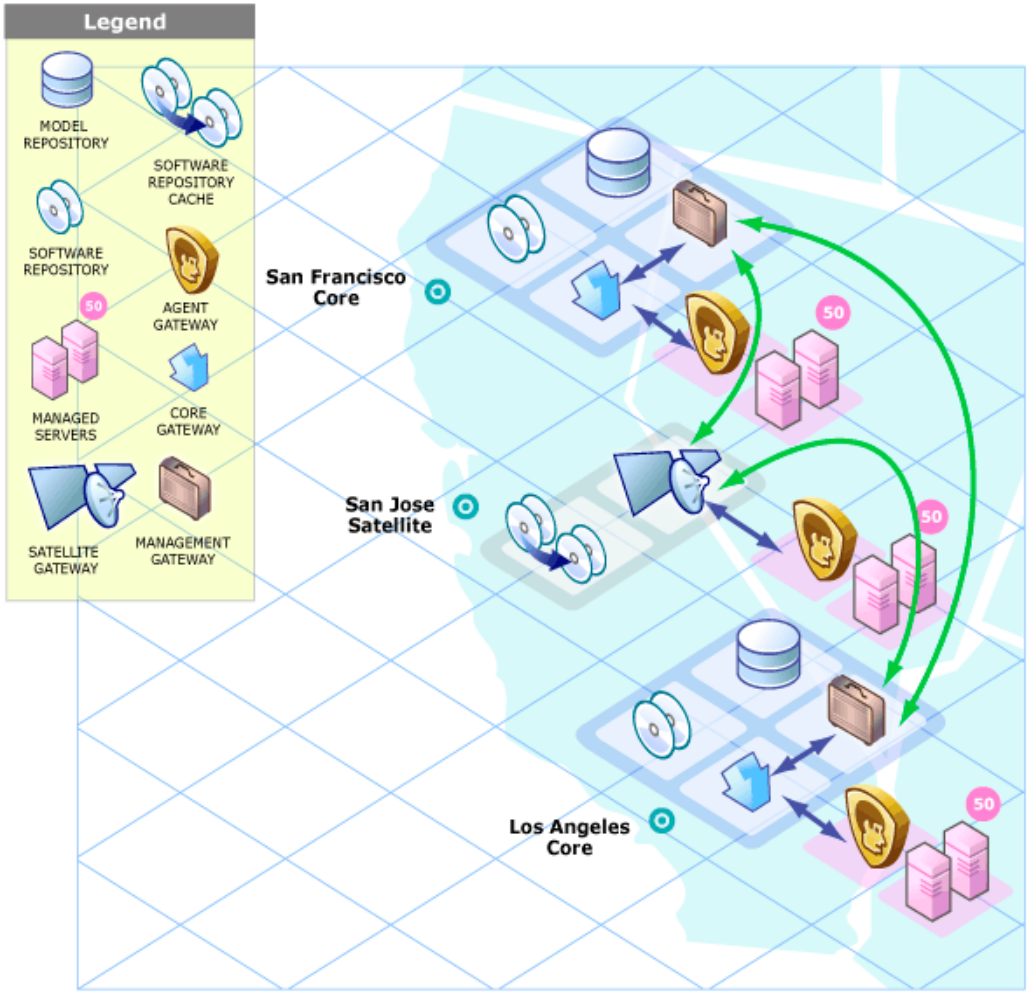
Even when communication is possible to both Los Angeles and San Francisco, the Management Gateway chooses the route with the lowest cost (in Figure 13, the San Francisco route). You control cost evaluation using a parameter specified during Gateway installation. System designers can specify rules governing which SA Gateway routes to use to minimize network connectivity costs.

Using the same example environment in a failover scenario, during normal operations, the servers in the San Jose Satellite are managed by the San Francisco Core. Note, however, that the San Francisco and the Los Angeles Cores are directly connected through their Management Gateways.

If the connection between the San Jose Satellite and the San Francisco Core fails, the San Jose Satellite Gateway can immediately move communications from San Francisco to the Los Angeles core, allowing that core to maintain management of the San Jose servers. The Los

Angeles Core will have up-to-date information about the San Jose site because the San Francisco Core's Model Repository data will have been replicated to the Los Angeles Model Repository as a part of normal SA operations.

Figure 13 Satellite in a Multimaster Mesh



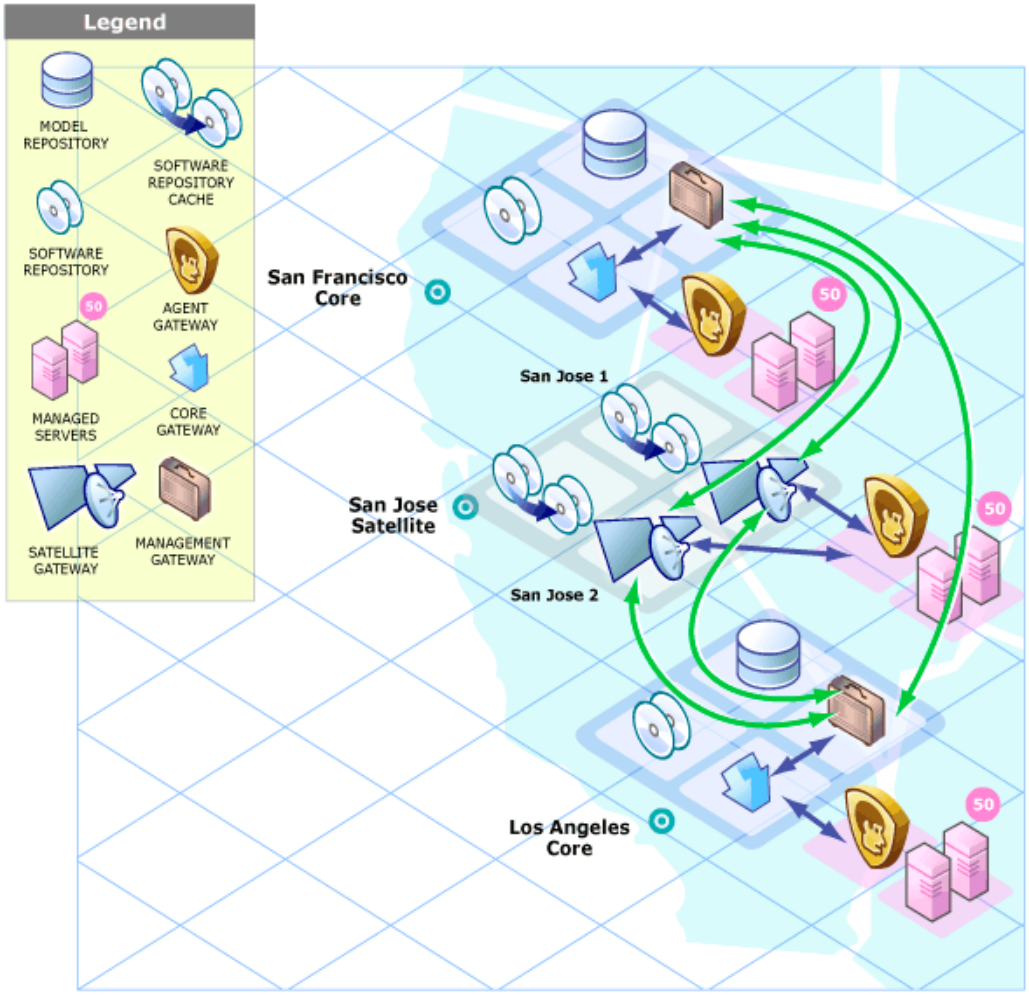
Satellite With Multiple Gateways in a Multimaster Mesh

Figure 14 shows a topology that provides failover capability in two ways. First, the San Jose Satellites 1 and 2 have Gateway connections to both the San Francisco and Los Angeles Management Gateways. If the Los Angeles core becomes unavailable, the San Francisco core can still manage the servers in the San Jose Satellite.

Second, the Agents installed on the Managed Servers in the San Jose Facility point to both of the Satellite's Agent Gateways. SA Agents automatically load balance over the available Agent Gateways and therefore can communicate directly with either the San Francisco or Los Angeles cores.

If one Gateway becomes unavailable, the Agents that are using the unavailable gateway as their primary gateway will automatically failover to using the secondary gateway. During routine agent-to-core communication, SA Agents will discover new gateways added to (or removed from) the Satellite.

Figure 14 Satellite With Multiple Gateways in a Multimaster Mesh

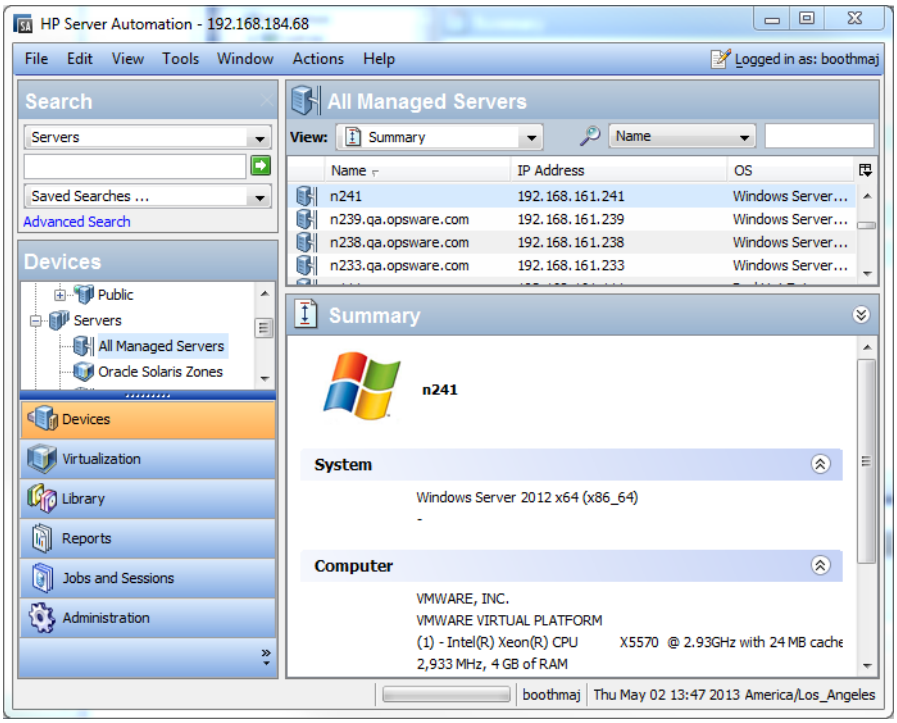


SA Interfaces and Tools

Depending on the type of operation you need to perform with SA, you select the appropriate user interface.

- **SA Client**: Figure 15 shows the SA Client main page:

Figure 15 The SA Client Main Page



- **SA Command Line Interface (SA CLI)**: A command line interface that you can use to access many SA functions to perform bulk operations or repetitive tasks on multiple servers. In SA, the command-line environment consists of the Global Shell (OGSH), the Global File System (OGFS), and SA Command-line Interface (SA CLI) methods. For more information, see the *SA Platform Developer Guide*.
- **DCML Exchange Tool (DET)**: A utility that exports almost all server management content from one SA Core and imports it into another core. SA also provides pre-packaged server management content appropriate for new installations that can be imported into an SA Core using DET after initial setup. See the *SA Content Utilities Guide* for information about using this utility.
- **Intelligent Software Module Development Kit (IDK)**: A development kit that allows administrators to deliver stable and consistent software builds and manage change in complex data center environments. The IDK consists of command-line tools and libraries for creating, building, and uploading intelligent software modules (ISMs). An ISM is a set of files and directories that include packages, installation scripts, control scripts, and so on. See the *SA Content Utilities Guide* for information about using the IDK Development Kit.

- **SA APIs**: A set of APIs and a command-line interface (SA CLI) that facilitate the integration and extension of SA. This platform allows other IT systems — such as existing monitoring, trouble ticketing, billing, and virtualization technology — to exchange information with SA. This broadens the scope of how IT can use SA to achieve operational goals. For more information, see the *SA Platform Developer Guide*.
- **Automation Platform Extensions (APXs)**: APXs provide a framework that allows anyone familiar with script-based programming tools such as shell scripts, Python, Perl, and PHP, to extend the functionality of SA and create applications that are tightly integrated into SA. SA provides two types of APXs:
  - **Program APXs** (also called *Script APXs*) run in the Global File System (OGFS) and can use all of the OGFS functionality
  - **Web APXs**: allow you to create a web-based application, where either an Apache 2.x process or a CGI/PHP script is called using GET or POST URL.

  For more information about APXs, see the *SA Platform Developer Guide*.

SA Product Options

SA provides a set of options that enable automation of many IT processes, including:

- OS Provisioning
- Software Management
- Application Configuration Management
- Patch Management for Windows
- Patch Management for UNIX
- Patch Management for Solaris
- Audit and Remediation
- Virtual Server Management
- Service Automation Visualizer (SAV)
- Storage Visibility and Automation
- Reports

All SA options support cross-platform environments and are designed to automate both new and existing data center environments.

OS Provisioning

OS Provisioning provides you with the ability to install (or *provision*) pre-configured operating systems on servers in your facility, ensuring that each server in your facility has a standardized, default operating system configuration that you control. For detailed information about OS Provisioning, see the *SA User Guide: OS Provisioning*.

SA OS Provisioning supports:

- Windows, Solaris, and Linux.
- Network or CD/DVD-based installations.

- Separation of duties between data center staff and systems administrators.
- A model-based approach — in which you create a *standard build* in SA which can then be installed on many systems.

OS Provisioning integrates with your operating system vendors' native installation technology, specifically:

- Windows setup answer files: `unattend.txt, unattend.xml, sysprep.inf`
- Red Hat Kickstart
- SuSE YaST (Yet another Setup Tool)
- Solaris Jumpstart
- WINPE/WIN-BCOM/UNDI

You can provision an operating system on:

- A server in SA's agentless server pool that does not have an operating system installed (*bare metal sever*)
- A virtual server
- A server in SA's *unmanaged server pool* with an installed operating system
- A server in SA's *managed server pool* with an installed operating system (*reprovisioning*)

You can perform OS Provisioning functions from both the SA Client and the SA Web Client.

SA automates the following operating system installation tasks:

- Preparing hardware for operating system installation using configuration specifications contained in an OS Installation Profile.
- Defining OS Build Plans which are a list of tasks to be performed on a server before and after operating system installation. OS Build Plans are more powerful than and can be used in place of OS Sequences.
- Defining OS Sequences which are a list of tasks to be performed on a server during installation. OS Sequences can include application, patch, and remediation policies. SA recommends that you use the more flexible OS Build Plans.
- Installing a baseline operating system and default operating system configuration.
- Applying the latest set of operating system patches after the operating system has been installed.
- Installing system agents and utilities such as SSH, PC Anywhere, backup agents, monitoring agents, or anti-virus software.
- Installing widely-shared system software such as Java Virtual Machines.

Software Management

SA Software Management provides a powerful mechanism to model software by using software policies and to automate the process of deploying software and configuring applications on a server in a single step. In addition, SA Software Management provides a structure to organize your software resources in folders and define security permissions around them. SA Software Management allows you to verify the compliance status of a server and remediate non-compliant servers.

SA Software Management provides the following functionality:

- Creating an organizational structure for software

- Defining security boundaries for folders
- Defining a model-based approach to manage the IT environment in your organization
- Enabling sharing of software resources among user groups
- Deploying and configure applications simultaneously
- Deploying multiple application instances on one server
- Establishing a software deployment process
- Verifying compliance status of servers to software policies
- Generating reports
- Comprehensively searching for software resources and servers

Application Configuration Management

Application Configuration Management (ACM) allows you to create templates so you can modify and manage application configurations associated with server applications. ACM enables you to manage, update, and modify those configurations from a central location, ensuring that applications in your facility are accurately and consistently configured.

Using ACM, you can perform the following tasks:

- Manage configurations based on files and objects, such as Windows registry, IIS metabase, WebSphere, COM+, and more.
- Preview configuration changes before applying them.
- Edit and push configuration changes to individual servers or server groups.
- Use information in the SA data model to set configuration values.
- Manage configurations of any application by building configuration templates.
- Audit the Application Configurations on a server to determine if any of the configuration files on the server are out of sync with the values stored in your templates.

Patch Management for Windows

SA Patch Management for Windows enables you to identify, install, and remove Microsoft® Windows patches and maintain a high level of security across managed servers in your organization. With SA Client user interface, you can identify and install patches that support security vulnerabilities for the Windows 2000, Windows Server 2003, Windows Server 2008 and Windows Server 2008 R2 x64 operating systems. These patches include Service Packs, Update Rollups, and hotfixes.

Patch Management for UNIX

SA Patch Management for UNIX enables you to identify, install, and remove UNIX patches to maintain a high level of security across managed servers in your organization. With the SA Client, you can identify and install patches that support security vulnerabilities for the AIX, HP-UX, Linux, and Solaris operating systems.

Patch Management for Solaris

HP Server Automation patch management for Solaris allows you to automate the process of installing and uninstalling Solaris patches and patch clusters on Sun Solaris using patch policies. In addition, SA analyzes the dependency, supersedence, and applicability relationships between patches in the policy and displays an updated and ordered list of patches that should be installed on the server. This feature allows you to verify the compliance status of a server and remediate non-compliant servers and automatically download the Solaris patches into SA and organize them into patch policies.

Patch Management for HP-UX

SA automates HP-UX patch management by enabling you to:

- Define HP-UX software policies that provide a model-based approach to managing your HP-UX servers. Server Automation enables you to create a model of your IT environment using HP-UX software policies. These software policies specify patches and scripts that can be installed on the managed servers.
- Install HP-UX patches and patch bundles on your managed servers.
- Establish a patch installation process.
- Schedule the stages of patch management: analysis, download, and installation. You can also set up email notification for each stage and associate a ticket ID for each job.
- Verify the compliance status of servers, based on software policies.
- Display the Compliance view to see whether servers are configured according to the software policy and to remediate non-compliant servers.
- Search for software resources and servers.
- Use the Library to search for HP-UX packages, patches, and software policies using powerful and flexible search criteria, such as availability, architecture, operating system, reboot options, version, and so on. You can also search for HP-UX software policies by name, folder name, availability, and operating system.
- View patch dependencies and patch applicability analysis while previewing patch installation.

Audit and Remediation

SA Audit and Remediation allows you to define server configuration policies and make sure that servers in your facilities meet those policy standards. When servers are found to be 'out of compliance' (not configured the way you want them to be), you can remediate the differing server configurations.

With Audit and Remediation, you can audit a server configuration values based upon a live server (or server snapshot), or based upon your own custom values, perform server comparisons against a baseline, and create custom audit policies that define company or industry server configuration compliance standards, and which can be used inside of audits, snapshot specifications, and audit policies.

Using Audit and Remediation, you can perform the following tasks:

- Compare servers or snapshots to reference servers or snapshots
- Create audits for repeated use

- Create audit policies that define compliance and security standards for your organization
- Associate audits with individual servers or dynamic server groups
- Remediate problems at multiple levels, including files, directories, patches, registry keys, and packages

Virtual Server Management

Virtual Server management enables you to provision and manage virtual servers. Using the SA Client, you can perform the following tasks:

- View both hypervisor and virtual servers and their relationships in the SA Client, so you can find out the hypervisors that are hosting your virtual machines and local zones.
- View virtual servers and their relationship in the HP Server Automation Visualizer (SAV).
- Provision hypervisors
- Provision VMware and Microsoft virtual machines (VMs) using OS Build Plans.
- Provision Oracle Solaris zones using OS Sequences.
- Create, start, stop, modify, and remove Oracle Solaris local zones.
- Perform power control operations on VMs and zones, such as power on, power off, reset, shutdown guest, and pause.
- Modify and delete VMs and zones.
- Clone VMs.
- Convert VMs to VM templates
- Deploy VMs from VM templates.
- Delete VM templates.
- Deploy agents on agentless virtual servers using the Agent Discovery and Deployment.
- Search for virtual servers in your data center using the Search tool.
- Create dynamic Device Groups based on virtual server characteristics (zones or VMs).

Service Automation Visualizer (SAV)

Service Automation Visualizer (SAV) is designed to help you optimally understand and manage the operational architecture and behavior of distributed business applications in your IT environment. Since these applications are complex collections of services that typically run across many servers, as well as network and storage devices, it can become increasingly difficult to understand (or remember) what is connected to what, where performance problems originate, how to troubleshoot and resolve problems, and what result would occur if you make a change in your environment.

SAV helps you see (visualize) this type of information through physical and logical drawings.

Storage Visibility and Automation

Storage Visibility and Automation offers storage management capabilities by enabling end-to-end visibility and management of the entire storage supply chain. Storage Visibility and Automation helps server administrators day-to-day tasks by providing tools that increase cost savings through application storage, dependency and visibility, storage audits, storage capacity and utilization trending, and scripting and automation. See the Storage Visibility and Automation User's Guide for more information.

Deploy Applications

With the Application Deployment tool you can create, test and deploy multi-tiered custom applications using your software development life cycle. For example, you can move applications from the development team to the quality assurance team for testing. Once testing is complete you can move the application to other phases such as preproduction, staging and finally to production. The Application Deployment tool reduces the complex communications necessary to deploy applications by providing a single point of access where everyone involved can view or enter data that is relevant to them and to their role. For more information, see the *SA User Guide: Application Deployment Manager*.

Reports

SA Reports provide comprehensive, real-time information about managed servers, network devices, software, patches, customers, facilities, operating systems, compliance policies, and users and security in your environment. These reports are presented in graphical and tabular format, and are actionable—where you can perform appropriate actions on objects, such as a policy or an audit, within the report. These reports are also exportable to your local file system (in `.html` and `.xls` formats) to facilitate use within your organization.

SA Utilities

SA also provides utilities that assist with typical data center automation tasks.

Script Execution

The built-in SA Script Execution capability enables you to share and run ad-hoc or saved scripts across an entire farm of SA-managed servers.

Executing scripts with SA instead of manually, has the following advantages:

- Parallel script execution across many UNIX and/or Windows servers, saving time and ensuring consistency.
- Role-based access control, ensuring only authorized administrators can execute scripts on hosts to which they have access.
- The ability to control access to scripts by storing them in private or in public libraries.
- The ability to see and download script output one server at a time or in a consolidated report, which captures output from all servers in a single place.

- The ability for scripts to be mass-customized. Administrators can access information in SA about the environment and the state of servers. This is critical to ensuring that the right scripts are executed on the right servers.
- A comprehensive audit trail that reports who, what, when, and where a particular script was executed.
- Using known system state and configuration information to customize script execution, you can tailor each script by referencing and accessing the information in SA, such as the customer or business that owns the server, whether the server is a staging or production server, which facility the server is located in, and custom name-value pairs.
- You can share scripts with others without compromising security because SA maintains strict controls on who can execute scripts on which servers and generates a comprehensive audit trail of script execution.

Discover Agentless Servers and Install a Server Agent

SA can discover your agentless servers and install the server agent to bring them under SA management. You can:

- Scan your network for agentless servers.
- Select agentless servers and install the agent.
- Select a communication tool and provide user and password combinations.
- Choose server agent installation options.

Device Explorer

The Device Explorer lets you view information about servers in your SA managed environment. The Device Explorer consists of:

The *Server Explorer*:

- Create a server snapshot, perform a server audit, audit application configurations, create a package, and open a remote terminal session on a remote server.
- Browse a server's file system, registry, hardware inventory, software and patch lists, and services.
- Browse SA information such as properties, configurable applications, and even server history.

The *Groups Browser*:

- Audit system information, take a server snapshot, and configure applications.
- View and access group members (servers and other groups).
- View group summary and history information.

Compliance View

The Compliance Dashboard allows you to view the overall compliance levels for all the devices in your facility and helps you to remediate compliance problems. The Compliance Dashboard displays compliance tests for software policies, application configurations, audits, patches,

and duplex status. Each of these compliance tests is based upon an SA policy (user- or system-defined) which define a unique set of server or device configuration settings or values that ensure that your IT environment is configured the way you want it to be.

Global Shell

The Global Shell enables you to manage servers by using a command-line interface. You can remotely perform the following tasks:

- Complete routine maintenance tasks on managed servers.
- Troubleshoot, identify, and remediate problems on managed servers.

Global Shell consists of a file system and a command-line interface to that file system for managing servers in SA. The file system is known as the SA Global File System (OGFS). All object types in the OGFS (such as servers, customers, and facilities) are represented as directory structures in this file system.

The Global Shell also manages user permissions for accessing the file system, Windows Registry, and Windows Services objects on managed servers.

Network Automation (NA) Integration

Network Automation (NA) Integration enables you to closely examine detailed information about managed servers and the network devices connected to them so that you can determine how they are related and then, subsequently, coordinate and implement those changes. NA supports integration with SA so that you can perform actions on device groups, such as combine event history, determine compliance, and identify duplex mismatches across servers and network devices in your environment.

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