

Joonas Lehtimäki

Implementing Infrastructure Spacewalk into Company

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<p>The aim of this thesis was to create Spacewalk Linux management software. Capgemini Finland ordered this software to optimize the working processes for Linux systems. The main goal was to successfully install and configure Spacewalk so it could be used as the main management software for Linux operating systems. The thesis goes through the planning, installation, configuration and deployment phases of Spacewalk.</p> <p>In general management software help administrators to work on multiple systems at a time. Administrators can schedule maintenance tasks, for example updates or scripts. Spacewalk saves the time and effort of each administrator and therefore saves costs.</p> <p>Giving features that Capgemini had specified was an important part of this thesis. These features were RBAC, configuration file management, update deployment and automated installations. Some of the features were hard to implement because of Capgemini's high security standards and processes. All features were documented with instructions on how to use them.</p> <p>The result of the project was a functional Spacewalk software with all the required features and documentation. Spacewalk is now embedded in the Capgemini infrastructure and being used as the main Linux management software.</p>	
Keywords	Spacewalk, Linux, Management

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<p>Insinööriyön aiheena oli tehdä Spacewalk Linux hallinta sovellus. Capgemini Suomi tilasi kyseisen sovelluksen optimoidakseen Linux palvelinten työprosessin. Tavoitteena oli asentaa ja konfiguroida Spacewalk, jotta sitä pystyttäisiin käyttämään Linux hallinta sovelluksena. Insinööriyössä käsitellään Spacewalkin suunnittelu, asennus, konfigurointi ja käyttöönotto vaiheet.</p> <p>Hallintasovellukset auttavat ylläpitäjiä hallitsemaan useita palvelimia samanaikaisesti. Ylläpitäjät voivat ajoittaa palvelimille ylläpitotehtäviä kuten päivityksiä tai skriptejä. Spacewalk tulee säästämään jokaisen ylläpitäjän aikaa ja vaivaa ja näin ollen myös yrityksen kustannuksia.</p> <p>Insinööriyön tärkeä osa-alue oli toimittaa Capgemini Suomelle sen vaatimat Linux hallintasovellus ominaisuudet. Nämä ominaisuudet ovat RBAC, konfiguraatio tiedostojen hallinta, päivitysten toimittaminen ja automaattiset asennukset. Capgeminin korkeiden tietoturva-vaatimusten vuoksi, osa ominaisuuksista oli haastavampia toteuttaa. Kaikki hallintasovellus ominaisuudet dokumentoitiin.</p> <p>Projektin lopputulos oli toimiva Spacewalk ohjelma kaikilla vaadituilla ominaisuuksilla ja dokumenttien tuottaminen. Spacewalk on implementoitu Capgemini Suomen ympäristöön ja sitä käytetään Linuxin päähallintasovelluksena.</p>	
<p>Avainsanat</p>	<p>Spacewalk, Linux, Management</p>

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Abbreviations

SLES	SUSE Linux Enterprise Server, Linux operating system developed by SUSE.
RBAC	Role Based Access Control, approach to restricting system control for authorized users.
PXE	Pre-boot Execution Environment, environment to boot computers using network interface.
DHCP	Dynamic Host Configuration Protocol, network protocol that is used to configure devices connected to network.
RDP	Remote Desktop Protocol, protocol developed by Microsoft which is used to connect another machine with a graphical interface.
HTTP	Hypertext Transfer Protocol, communication protocol used for communication over computer network.
HTTPS	Hypertext Transfer Protocol Secure, communication protocol used for secure communication over a computer network.
TCP	Transmission Control Protocol, one of the two protocols used in the Internet protocol suite.
GB	Gigabyte, unit of measurement of digital information storage.
FQDN	Fully Qualified Domain Name, domain name that specifies the exact location in the tree hierarchy of the domain name system.
CPU	Central Processing Unit, hardware within a computer that carries out instructions of a computer.
HDD	Hard Disk Drive, data storage device used for storing and retrieving digital information.

NIC	Network Interface Controller, network adapter which connects computers into routers with a LAN or Fiber cable.
SCSI	Small Computer System Interface, standard for delivering information between a computer and peripheral devices.
ESX	VMware product, bare metal embedded hypervisor used as a virtualization platform.
VMXNET	Network interface adapter from VMware team. It is used in virtual machines running on ESX hosts.
SSL	Secure Sockets Layer, protocol for encrypting information over the Internet.
ID	Identifier, name that identifies either a unique object or a unique class of objects.
RHEL	Red Hat Enterprise Linux, Linux distribution developed by Red Hat. Targeted for commercial use.
URL	Uniform Resource Locator, web address given as a string of characters.

1 Introduction

Big hosting companies such as Capgemini struggle nowadays with management software to make hosting services cost effective and efficient. Management software helps administrators work with large amount of systems one at a time which saves effort and costs.

This thesis presents the installation and configuration of Linux management software called Spacewalk which was ordered by Capgemini Finland Oy. There are many software for management purposes but the reason why Spacewalk was chosen is that it is a pioneer in Linux management mostly because of an active community, Red Hat developers and it being open source. The thesis goes through planning, deployment, configuration and maintenance steps for the product. Capgemini has a large amount of Linux servers with numerous clients. The management software helps Capgemini be more cost effective and competitive.

2 Product Introduction

Spacewalk is an open source based Linux server administration tool. It is registered under the open source license GPLv2. Spacewalk is community driven software from which few commercial products as Red Hat Satellite and Novell SUSE Manager have derived. Spacewalk started in June 2008 when it became officially an open source project. It is based on Red Hat Network which was started in 2001 and it later spawned into a stand-alone Red Hat Satellite product. [1.]

Spacewalk has many features that allow Linux administrators to manage hardware and software information, install and update systems, manage systems as a group, provision systems, configuration file management and deployment and monitoring. Spacewalk works with virtualization platforms such as VMware and Xen to create and configure virtual guests and manage systems efficiently in multiple geographical locations. Spacewalk is managed through a web interface where all the information about servers is located. Administration software supports many Linux distributions such as Fedora, CentOS, SLES and Debian with both versions of architecture, 32-bit and 64-bit. [1.]

3 Planning

Capgemini has two infrastructures, one is for case sensitive customers and the other one is for other customers. These infrastructures are called SUOJA and Common. Capgemini also has many people working in India and their access to the SUOJA infrastructure is restricted. Indian specialists handle almost all customers in the Common infrastructure. Capgemini needs software that could handle both infrastructures without compromising the SUOJA infrastructure. [1.]

Capgemini had features which were wanted for the selected product, RBAC which stands for role based access control. This was needed because of the two infrastructure environments that Capgemini has. Only Finnish specialists can access SUOJA servers and other workers can access and see only systems in the Common infrastructure. For software to work securely in two infrastructures, a proxy server is needed between the environments. Spacewalk Proxy enables this feature without firewall vulnerabilities because Spacewalk and proxy talk with each other with one protocol. Linux automated patch management helps specialists to schedule patch operations. This feature brings down time that specialists have to take when updating Linux systems one at a time. Provisioning enables virtual and physical systems to be installed from kickstart profiles. This feature ensures that all new servers are installed in the same way with pre-configurations which saves specialists' work effort. Provisioning is done with PXE boot protocol which directs servers to a remote location for installation images. PXE boot needs DHCP service enabled for the network interface of servers. Specialists also need systems to be managed as a group. This helps specialists to work more than one system at a time which brings down time and costs. Deployment and modification of systems configuration files are a wanted feature in a hosting service. Specialists can run scripts or change configuration file parameters on multiple systems at the same time. Installing third party software as in monitoring or backup software is a nice feature to have. Spacewalk offers all the features that Capgemini had specified and more. [1.]

Spacewalk will be placed in the SUOJA infrastructure because of security reasons so that only Finnish specialists could access the host itself. Figure 1 shows how Spacewalk is planted and how specialists use it.

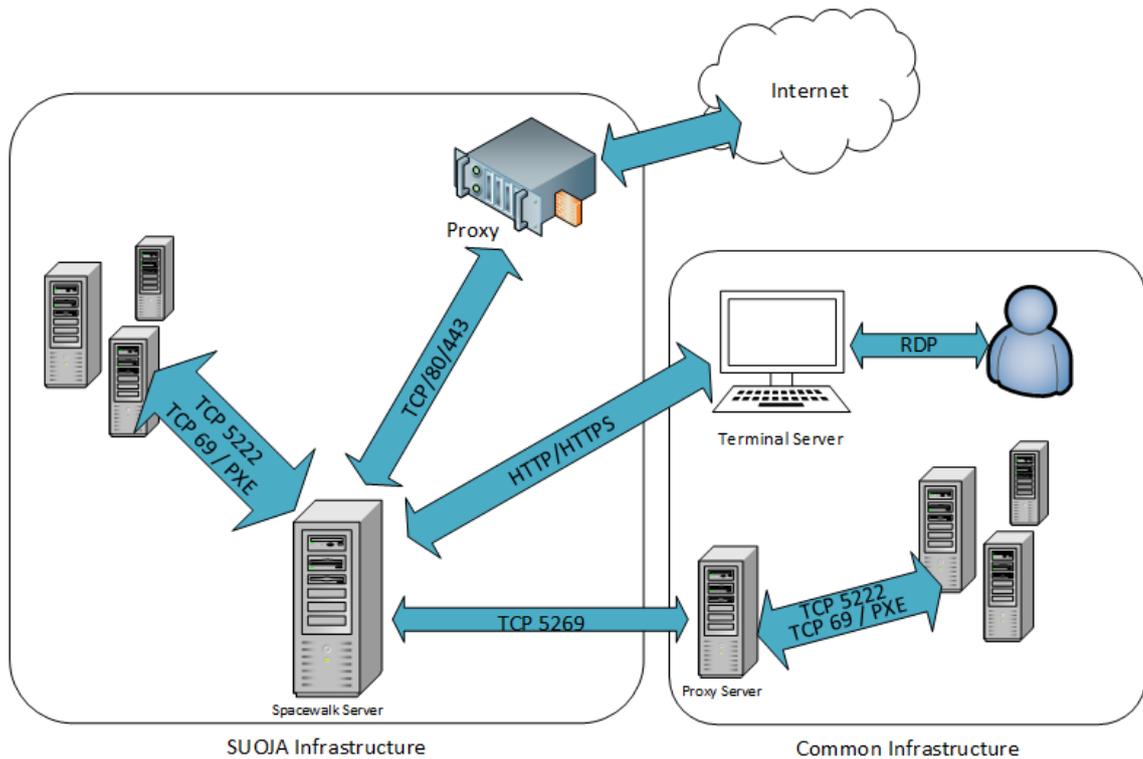


Figure 1. Architecture design of Spacewalk in Capgemini. [2.]

Specialists connect a terminal server using Remote Desktop Protocol (RDP). The terminal server is accessible for all Capgemini UNIX specialists. From there the specialists use a web browser to start a session with the Spacewalk server using a HTTPS protocol and then authenticate with it. All actions that specialists do are done from the web interface. Spacewalk has access to the internet via the Capgemini proxy server. The proxy is an intermediary for servers connected to the Internet and these are used because systems are not allowed to access directly to the Internet because of security risks. Spacewalk communicates protocols HTTP/HTTPS with the proxy server. Spacewalk software commands client systems in the Common infrastructure via Spacewalk proxy server. This obviates the need of two Spacewalk servers. The role of the proxy server is to deploy assigned commands to the systems in the Common infrastructure. Spacewalk and proxy communicate with a static protocol TCP 5269. Spacewalk communicates with the same protocol (TCP 5222) to the client systems as the proxy does. Protocol TCP 69 is used for the PXE boot option. This enables system provisioning so that virtual and physical servers can be installed using Spacewalk kickstart configuration files. All these ports must be opened from the firewall for Spacewalk to work.

Spacewalk requires a couple of special software repositories. These repositories help the installation of Spacewalk management software. The repositories that are required are Spacewalk, EPEL and Jpackage because The Spacewalk is installed on the CentOS operating system. [2;3]

Spacewalk has hardware specifications. Capgemini uses VMware as a main virtualization platform where management software will be installed. The spacewalk server and proxy server specifications are introduced in the table below.

	Spacewalk	Proxy server
FQDN	suo-swk-01.suoja.local	cap-spx-01.cap.local
CPU	2	1
Memory	4Gb	2Gb
HDD	100Gb	50Gb
Disk Provisioning	Thick Provision	Thick Provision
Management Network	xxx.xxx.xxx.xxx/xx	xxx.xxx.xxx.xxx/xx
Backup Network	xxx.xxx.xxx.xxx/xx	xxx.xxx.xxx.xxx/xx
Installation Network	xxx.xxx.xxx.xxx/xx	
Operating System	CentOS 6.3 64-bit	CentOS 6.3 64-bit
Database	PostgreSQL	N/A
NIC amount	3	2
Network Adapter	VMXNET 3	VMXNET 3
Host Provider	VMware	VMware
Hardware Version	Version 8	Version 8
SCSI Controller	LSI Logic Parallel	LSI Logic Parallel

Table 1. Spacewalk and Proxy server hardware specifications. [2;3]

FQDN as a fully qualified domain name was given to Spacewalk and the proxy server. The name was based on the naming standard of Capgemini. Spacewalk community specified that the server can manage with two virtual CPUs and the proxy server with one virtual CPU. The memory amount is specified to 4 GB for Spacewalk and 2 GB for Proxy. HDD amount was specified as 6 GB per software channel and because Capgemini uses many different Linux distributions, so 100 GB of VMware High End storage was given to the server. Red Hat recommends that Spacewalk should have at least 80 GB of HDD. The proxy server as it also holds packages and cache files 50 GB HDD is specified for it. VMWare has two disk provisioning types: thick and thin

provision. Thin provision means that storage is dynamically allocated from data storage while thick allocates the whole size of data storage. Thick is preferred because of performance factors. A management interface is the network where all the main traffic moves. Backup network is dedicated for system backups only. Spacewalk is backed up weekly and differential backups are done daily. Installation network is used for PXE boots. Installation network has DHCP service which is running on the same Spacewalk server. For security reasons network information cannot be shared. The operating system is CentOS 6.3 which was the newest version of the community enterprise operating system. Spacewalk will be installed as a minimal version of CentOS because there is no need for extra packages. CentOS is a free open source derivative of Red Hat Enterprise Linux. This operating system was selected because it is Spacewalk recommended and it is a very stable Linux distribution. Spacewalk requires a database where it stores all channel and system data. PostgreSQL was recommended by the Spacewalk community. As there are management, installation and backup networks, three network interface controllers are needed. VMXNET 3 adapters of VMware are used for all NICs. VMXNET 3 provides the highest performance and it does not load the CPU on high traffic. As VMware is the platform, virtual machines are using VMware hardware version 8, which is the newest stable release. Different hardware versions enable virtual machines to have more RAM, graphics support and for example CPU hot swap. VMware SCSI controller LSI Logic Parallel was selected as it works perfectly on Linux distributions. [2;3]

Kickstart will be used when deploying new systems. Kickstart is a configuration of automatic system installation. It uses "answer files" to automate the installation process. These features are configured from Spacewalk. A new installation network will be created to Capgemini infrastructure to make the installation procedure as secure and easy as possible. Network mask will be of size 27 so it can hold 29 simultaneous installation systems and one Spacewalk server. The network will have its own VLAN which will be provided and configured to all ESX hosts and switches. The PXE boot requires DHCP service which the Spacewalk server will provide. Systems connected to the installation network get an IP address from Spacewalk server with DHCP service. The systems will be connected to the installation network and boot with the PXE protocol to cobbler and use kickstart files which are created in Spacewalk. The PXE protocol can use a HTTP or TFTP protocol for installation. Capgemini will use the TFTP protocol because it is the recommended one. The administrator will then select the correct installation template and kickstart profile will do the rest of the installation.

Systems interface installation VLAN will be changed to production VLAN after installation, and the correct production IP address is given.[4.]

The Capgemini infrastructure uses distributions CentOS and SUSE Linux Enterprise Server one local repository server is needed. This server will have 70Gb of HDD with 1 CPU and 2Gb of RAM. The system will create a local repository of SLES packages. Local repositories are needed because SLES is a commercial version of Linux and packages need to be retrieved by SLES servers and then deployed to Spacewalk. [2.]

4 Implementation

This section will describe how Spacewalk was installed and configured to the Capgemini infrastructure. Detailed steps are introduced with photos.

4.1 Installation

Spacewalk is installed on VMware ESX host with planned hardware specifications. After CentOS is set up and all basic configurations and security hardenings are done, Spacewalk installation can start. Spacewalk requires a couple of special repositories where installation packages are downloaded from. Spacewalk installation files are brought to Linux system with the following command:

```
#rpm -Uvh http://yum.spacewalkproject.org/1.9/RHEL/6/x86_64/spacewalk
-repo-1.9-1.el6.noarch.rpm
```

Listing 1. Spacewalk repository installation command. [2.]

Spacewalk needs Java Virtual Machine 1.6.0 or greater and therefore EPEL repositories need to be installed. EPEL repositories also provide other dependencies that are installed with Spacewalk. Repository can be installed with the following command:

```
#rpm -Uvh http://dl.fedoraproject.org/pub/epel/6/i386/epel-
release-6-8.noarch.rpm
```

Listing 2. Epel repository installation command. [2.]

Because CentOS 6 version is used, Spacewalk requires a few dependencies from jpackage repositories. A jpackage repository can be configured with the a following command:

```
#cat > /etc/yum.repos.d/jpackage-generic.repo << EOF
[jpackage-generic]
name=JPackage generic
#baseurl=http://mirrors.dotsrc.org/pub/jpackage/5.0/generic
/free/
mirrorlist=http://www.jpackage.org/mirrorlist.php?dist=generic&type=free&release=5.0
enabled=1
gpgcheck=1
gpgkey=http://www.jpackage.org/jpackage.asc
EOF
```

Listing 3. Jpackage repository installation command. [2.]

After all Spacewalk required dependencies are installed and configured, the software itself can be installed. First, the PostgreSQL database is installed as listing 4 suggests:

```
#yum install spacewalk-setup-embedded-postgresql
```

Listing 4. Spacewalk postgresQL installation command. [2.]

Subsequently, the Spacewalk software is installed with PostgreSQL as the database, as listing 5 demonstrates:

```
#yum install spacewalk-postgresql
```

Listing 5. Spacewalk installation command. [2.]

The installation will begin, and about 240Mb of files are downloaded from the different repositories. After packages are installed iptables are turned off. This is because Capgemini uses hardware based firewalls so software firewalls are not required, as suggested by listing 6:

```
#service iptables stop
#chkconfig iptables off
```

Listing 6. IPTables service disable command. [2.]

The first command stops the iptables service and the second one will prevent it from starting on system startup. Spacewalk is now ready for the configuration phase. The Spacewalk configuration needs to be started with the following command:

```
#spacewalk-setup -disconnected[2.]
```

Listing 7. Spacewalk configuration command.

The installation will go through a few steps, for example admin email address, SSL and certificate configuration. In SSL certification, several sections must be filled for the certificate work properly as listing 8 shows:

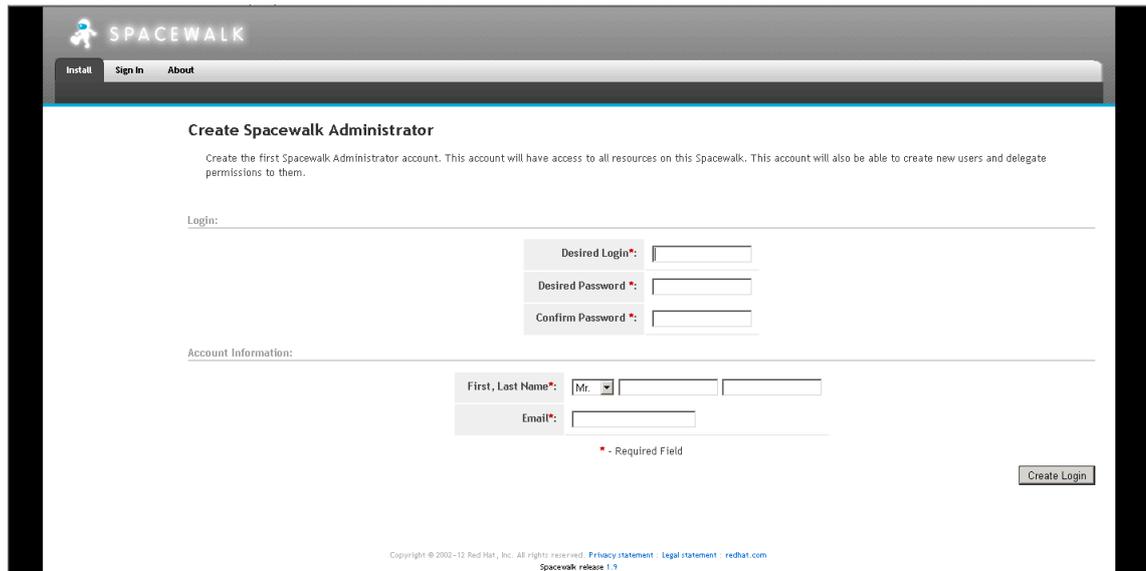
```
CA certificate password? < Password for the certificate >
Re-enter CA certificate password? < Confirm the password >
Organization? < Organization name i.e. Capgemini >
Organization Unit < Organizations team i.e. UNIX >
Email Address [jooonas.lehtimaki@gmail.com]? < email address
which is represented in the certificate >
City? < City where Spacewalk is located i.e. Espoo >
State? < State where Spacewalk is located i.e. Espoo >
Country code (Examples: "US", "JP", "IN", or type "?" to
see a list)? < Country code i.e. FI for Finland >
```

Listing 8. Spacewalk setup SSL phase. [2.]

After SSL configuration, the installation asks if the cobbler should be enabled. Y or YES has to be entered to that section. After that the installation finishes and the configuration phase can be started. [2;3]

4.2 Configuration

This section describes how Spacewalk is configured for use. The software is configured and managed from the web interface. Administration credentials are created on the first login to Spacewalk as shown in figure 2.



The screenshot shows the 'Create Spacewalk Administrator' web form. At the top, there is a navigation bar with 'Install', 'Sign In', and 'About' links. The main heading is 'Create Spacewalk Administrator'. Below the heading, a paragraph explains that this is the first administrator account. The form is divided into two sections: 'Login:' and 'Account Information:'. The 'Login:' section contains three required fields: 'Desired Login*', 'Desired Password*', and 'Confirm Password*'. The 'Account Information:' section contains a 'First, Last Name*' field with a dropdown menu set to 'Mr.', and an 'Email*' field. A legend indicates that an asterisk (*) denotes a required field. A 'Create Login' button is located at the bottom right of the form. At the very bottom of the page, there is a small copyright notice: 'Copyright © 2002–12 Red Hat, Inc. All rights reserved. [Privacy statement](#) [Legal statement](#) [redhat.com](#) Spacewalk release 1.9'.

Figure 2 Spacewalk first login. Screenshot [5].

Creation of new administrative user account requires filling the desired information. This becomes the default administration account for Spacewalk. After filling in the information, clicking the *Create Login* button to finishes the setup. [5]

The Spacewalk default view is quite simple. It is very easy to read, and it informs about every problem, scheduled tasks or updates on the first page.

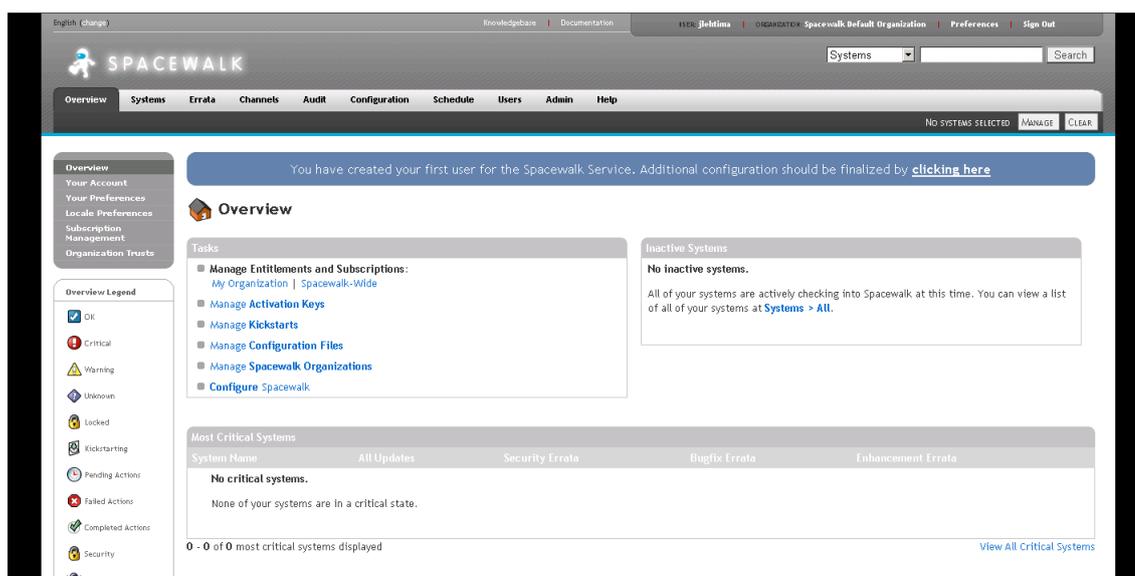


Figure 3 Spacewalk default view. Screenshot [5].

Spacewalk is managed through several tabs. The overview tab shows if the system needs attention, provides a quick link to systems and displays the most recent errata information available for the account. The overview tab also has links to different configuration pages which are very useful. For example *Your Account* link goes directly to the personal profile which can be modified. All hosts are managed from the *systems* tab. From there administrators can create and view systems, create system groups, create activation keys, create kickstart configuration profiles and use the system set manager. The errata page is for viewing errata alerts, managing and cloning errata. The channels tab is where managing and viewing software channels is done. Software channels are local package databases for registered systems. Package search can also be executed from the channels tab. On the configuration page, specialists can manage configuration channels, actions and individual configuration files. The configuration channel is a database for configuration files which can be deployed to the registered systems. The schedule tab shows all scheduled actions happening in Spacewalk. A specialist can view pending, failed, completed and archived actions. The users page shows all users in the organization which can be managed by administrators. The monitor tab is where monitoring probes and notifications are displayed. Probe suites can be created which are a set of probes. The admin page is only visible for Spacewalk administrators. There administrators can list, create and manage one or more Spacewalk organizations and assign channel entitlements for them. Administrator account creation is also done from this page. The Spacewalk administrator can assign administrator rights for other accounts in all organizations.

The admin page also has a Spacewalk configuration sub-tab which allows to make general configurations to Spacewalk including proxy settings, certificate configuration, bootstrap script configuration, organization changes and restarting the Spacewalk server. On the overview page, a list of different images is shown (see Figure 4). [6.]

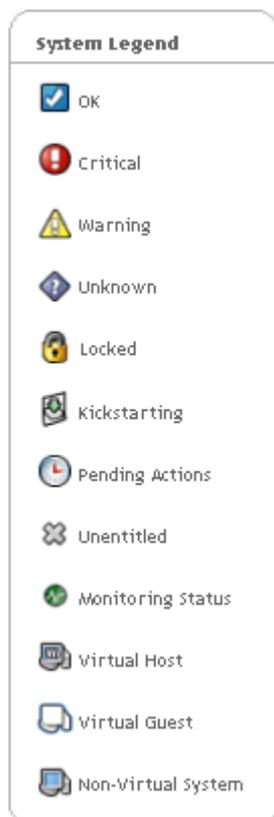


Figure 4 Spacewalk legend information. Screenshot [5].

The system legend field is where information about different images is displayed. An OK image is displayed when the system has no updates or errata available. A warning image is displayed when updates are available, and a red critical image is displayed when critical updates are available. An unknown image means that Spacewalk was unable to receive information about the system for example monitoring has failed due to firewall blocking. A lock image is displayed when the system is in lock down. Systems that are in lock down cannot be updated or scheduled with any activity. Kickstarting an image means that the system is being installed from the kickstart profile. A pending actions image is shown when the system has one or several scheduled activities. An unentitled image is shown to the systems that are no longer connected to Spacewalk. A monitoring status means that the server is being monitored or information is being polled. A virtual host is a virtual platform system such as

VMware ESX or Citrix XenServer. A virtual guest is a virtual machine running under the virtual host. Non-virtual means that the system is physical server. [6.]

4.2.1 Creating New Organization

Organizations in Spacewalk are like different environments. Every organization has its own user database, repositories and software channels. Organizations can share information, objects and configurations with each other. Creating a new organization is done from the Spacewalk web interface as shown in figure 5.

The screenshot shows the Spacewalk web interface. The top navigation bar includes 'Overview', 'Systems', 'Errata', 'Channels', 'Audit', 'Configuration', 'Schedule', 'Users', 'Admin', and 'Help'. The 'Admin' tab is selected. The main content area is titled 'Organizations' and features a 'create new organization' button. Below this is a table with the following data:

Organization	Systems	Users	Trusts
Spacewalk Default Organization *	0	1	0
Capgemini	0	2	0

A tip at the bottom states: '*Tip: This organization is your Spacewalk's default organization. Entitlements for this organization are linked to your Spacewalk certificate file, so they are not modifiable. If you remove entitlements from a non-default organization above, those entitlements will be added back to the default organization, and if you add entitlements from a non-default organization they will be deducted from the default organization.'

Figure 5 Spacewalk organization view. Screenshot [5].

A link for creating an organization can be found from the Admin tab. The organization view shows all the existing organizations in Spacewalk. A spacewalk default organization is the main organization of the Spacewalk. It holds all entitlements but the administrator can give entitlements to other organizations and those will be subtracted from the default organization. By clicking the *Create New Organization* button, the creation of an organization starts. Only Spacewalk administrators can create new organizations.

SPACEWALK Systems [Search]

Overview Systems Errata Channels Audit Configuration Schedule Users Admin Help

NO SYSTEMS SELECTED [MANAGE] [CLEAR]

Organizations
Subscriptions
Users
Spacewalk Configuration
Task Schedules
Task Engine Status
Show Tomcat Logs

Create New Organization

Organization Details

Organization Name* Tip: Between 3 and 128 characters

Create Initial Organization Administrator

Your **Spacewalk Administrator** role will not allow you to login into or modify this new organization, and your Spacewalk login cannot be a member of more than one organization. Consequently, you will need to create a new login for the initial **Organization Administrator** for this organization:

Desired Login* Tip: Between 5 and 64 characters
* Examples: 'sake-admin', 'admin_prodopr@example.com', 'sake.admin'

Desired Password*

Confirm Password*

Pluggable Authentication Modules (PAM): If you would like to set up your satellite to authenticate against LDAP, kerberos, and other network-based authentication systems, please visit the [reference guide](#) for instructions on how to set up PAM.

Email*

First Name*

Last Name*

* - Required Field

[Create Organization]

Figure 6 Spacewalk create new organization form. Screenshot [5].

The organization name can be from three characters up to 128 characters long. It is recommended that organization names are kept as specific as possible. An administrator account name for the organization is specified in the *Desire Login* section. The administrator can manage all assets in the organization. The administrator's password is defined in the *Desired Password* and *Confirm Password* section. Spacewalk also requires that email, first and last names are given. It is wise to put a team's information for the organization administrator. After filling in the requested information, next step is displayed by clicking the *Create Organization* button.

SPACEWALK Systems [Search]

Overview Systems Errata Channels Audit Configuration Schedule Users Admin Help

NO SYSTEMS SELECTED [MANAGE] [CLEAR]

Organizations
Subscriptions
Users
Spacewalk Configuration
Task Schedules
Task Engine Status
Show Tomcat Logs

Capgemini

[delete organization]

Details Users Subscriptions Trusts Configuration

System Entitlements Software Channel Entitlements

System Entitlement Counts

Below you modify the total number of software channel entitlements available to the **Capgemini** organization on a per-channel basis. If you'd like to modify the number of entitlements available to a particular channel note that you are limited by the range indicated next to the field.

Entitlement Name	Total	Usage	Proposed Total
Management (Base) <small>Required for all systems registered to the Spacewalk.</small>	20000	0	20000 <small>Possible Values: 0 to 20000.</small>
Monitoring (Add-On) <small>Enables the tracking of monitoring data for a system.</small>	20000	0	20000 <small>Possible Values: 0 to 20000.</small>
Provisioning (Add-On) <small>Allows various advanced functionality such as kickstart and configuration file provisioning.</small>	20000	0	20000 <small>Possible Values: 0 to 20000.</small>
Virtualization (Add-On) <small>Applied to a host system, enables management for up to 4 guests.</small>	20000	0	20000 <small>Possible Values: 0 to 20000.</small>
Virtualization Platform (Add-On) <small>Applied to a host system, enables management for unlimited guests.</small>	20000	0	20000 <small>Possible Values: 0 to 20000.</small>

[Update Organization]

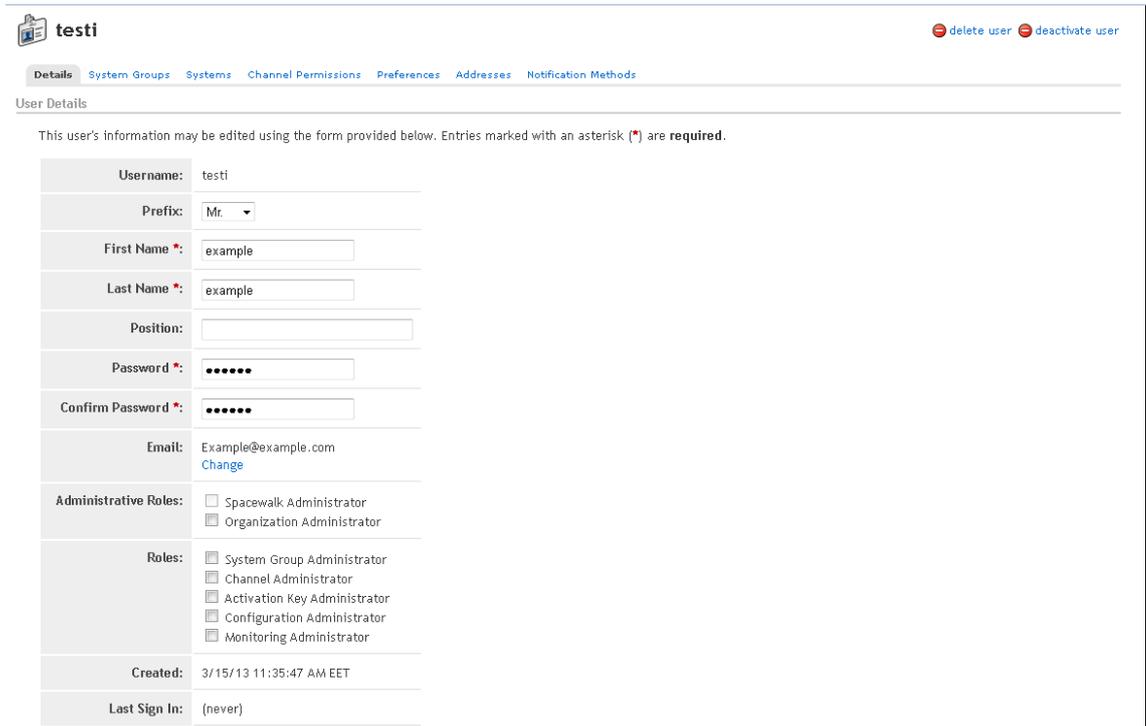
Figure 7 Spacewalk organization subscriptions. Screenshot [5].

Subsequently, organization subscription amounts are defined. There are overall 20,000 subscriptions available in Spacewalk. Usually 1,000 entitlements is enough for most of organizations. Entitlement amounts can be changed to the proposed section and by clicking update organization finishes the creation phase. [6.]

Organizations also need configuration which can be done from the admin tab and selecting the organization from the organization view. The page shows details, users, subscriptions, trust and configuration tabs. The details page is where administrators can configure the organizations name, ID, users, systems, system groups, activation keys, kickstart profiles and configuration channels. The users tab shows all users in the organization. On this page users passwords, information and access rights can be modified. Administrators can modify the amount of subscriptions in the organization and also software channel entitlements in the subscription section. The trust page enables organizations to share content and migrate systems between trusted organizations. Adding a trusted organization is done by checking the box for that organization and clicking modify trust button which saves the settings. The configuration tab allows organizations to stage content and limit crash file size. Administrators can set crash file to be limitless by adding zero to the limit section. [6.]

4.2.2 Creating New User

It is recommended that all administrators have their own account. This way troubleshooting is made easier when administrators can see who has made changes to Spacewalk and when. Creating a new user is possible through the users tab and can be done by clicking *create new user* link. Users will automatically join the organization which the administrator is in. Basic account information is requested. Remember to select the correct time zone. For example, the Finnish time zone is GMT +0200. After creating the user, the account needs to be modified. The modify page is opened when clicking the user account. The following page will be displayed.



The screenshot shows the 'User Details' page for a user named 'testi'. The page includes a navigation menu with tabs for 'Details', 'System Groups', 'Systems', 'Channel Permissions', 'Preferences', 'Addresses', and 'Notification Methods'. The 'Details' tab is active. Below the navigation, there are two buttons: 'delete user' and 'deactivate user'. The main content area contains a form for editing user information. A note states: 'This user's information may be edited using the form provided below. Entries marked with an asterisk (*) are required.' The form fields are as follows:

Username:	testi
Prefix:	Mr. ▾
First Name *:	example
Last Name *:	example
Position:	
Password *:	••••••
Confirm Password *:	••••••
Email:	Example@example.com Change
Administrative Roles:	<input type="checkbox"/> Spacewalk Administrator <input type="checkbox"/> Organization Administrator
Roles:	<input type="checkbox"/> System Group Administrator <input type="checkbox"/> Channel Administrator <input type="checkbox"/> Activation Key Administrator <input type="checkbox"/> Configuration Administrator <input type="checkbox"/> Monitoring Administrator
Created:	3/15/13 11:35:47 AM EET
Last Sign In:	(never)

Figure 8 Spacewalk user modification page. Screenshot [5].

The details page shows user information and roles that the user has. The organization administrator role should only be given to appropriate employees because they have all permissions to all system groups and their settings in that organization. Note that only Spacewalk administrators can grant Spacewalk administrator roles to accounts. Users can have several roles like system group, channel, activation key, configuration and monitoring administrator. The system group administrator can manage all systems in specific group and the users' information. Channels provide packages for systems. Users that are in a channel administration group can create, delete and modify these channels. Activation key administrators can manage activation keys which are used for attaching systems into Spacewalk with the correct group and software channel settings. Configuration administrators can manage configuration channels which are used for synchronizing multiple configuration files for systems. Monitoring administrators can create, delete and modify monitoring profiles for system and also create new probing settings. Attaching users to certain administrator groups is done by checking preferred groups and saving the settings. Users can be attached to system groups from the system groups tab by checking groups and clicking the *Update Permissions* button. Users can then view, create and modify all systems in that system group. Administrators can also give access only to the selected systems from the systems tab but users must first be added to the system group where the system lies.

On the channel permissions tab, administrators can restrict user permissions in channel management. Users have access to subscribe all channels that are available in the organization but channel management can be and should be restricted. The preferences tab shows settings about email notifications, list sizes and the overview page. Users can modify these setting for their liking. The addresses tab shows user contact information like phone number, address, fax number, city, state, zip code and country of origin. The notification method page requires that monitoring entitlements are in place. This tab lists email and pager addresses which will get alerts from monitoring probes. Users can create new methods of notification by clicking *create new method* and completing required fields. Users can also delete their notification methods from this page. [6.]

4.2.3 Creating Software Channel

Software channels provide packages for systems. Channels must be dedicated for correct Linux distribution and architecture for example CentOS 6.3-x86_64 operating system should only have CentOS packages with 64-bit architecture. All channels have repositories attached to them. Spacewalk repositories are links to the repositories located on the Internet. Spacewalk downloads these packages and stores them on the local HDD. Software channels can be found in the manage software channels under the Channels tab. Channels can be created from manage software channels under the Channels tab and by clicking the *create new channel* button. The following page will be shown:

Software Channels

Package Search

Manage Software Channels

Manage Software Packages

Manage Repositories

Distribution Channel Mapping

Create Software Channel

Details

Basic: Channel Details

Create or edit software channels from this page.

If the parent channel is set to 'none', the channel is a base channel. Otherwise, the channel is a child of the specified channel.

Channel name and label are required. They each must be at least 6 characters in length. Labels must begin with a letter, contain only lowercase letters, hyphens ('-'), periods ('.'), underscores ('_'), and numerals. Channel name may also contain spaces and forward slashes ('/').

Channel summary is also required.

Channel Name*	<input type="text"/>
Channel Label*	<input type="text"/>
Parent Channel:	None ▼
Architecture:	IA-32 ▼
Yum Repository Checksum Type:	sha1 ▼
<small>Tip: sha1 offers the widest compatibility with clients. sha-256 offers higher security, but is compatible only with newer clients: Fedora 11 and newer, or Enterprise Linux 6 and newer.</small>	
Channel Summary*	<input type="text"/>
Channel Description:	<div style="border: 1px solid #ccc; height: 40px; width: 100%;"></div>

Contact/Support Information

Maintainer Name:	<input type="text"/>
Maintainer Contact Information:	Email Address: <input type="text"/> Phone Number: <input type="text"/>
Support Policy:	<div style="border: 1px solid #ccc; height: 40px; width: 100%;"></div>

Channel Access Control

Per-User Subscription Restrictions:	<input checked="" type="radio"/> All users within your organization may subscribe to this channel. <input type="radio"/> Only selected users within your organization may subscribe to this channel.
Organization Sharing	<input checked="" type="radio"/> This channel is private and cannot be accessed by any other organization. <input type="radio"/> This channel is protected and may only be accessed by specific trusted organizations . <input type="radio"/> This channel is public and may be accessed by any of the trusted organizations trusted by this organization.

Security: GPG

GPG key URL:	<input type="text"/>
GPG key ID:	<input type="text"/> <small>Ex: DB42A60E</small>
GPG key Fingerprint:	<input type="text"/> <small>Ex: CA20 8686 2BD6 9DFC 65F6 ECC4 2191 80CD DB42 A60E</small>

Figure 9 Spacewalk create software channel. Screenshot [5].

Channels should be named after the operating system name, version and architecture such as `centos_5-x86_64`. This helps administrators to select the correct software channel for their systems. The channel label should be named in the same way. The parent channel is the base channel for the child channel. Base channels consist of a list of packages based on a specified architecture and Linux distribution version. The child channel is associated with the base channel, and it contains extra packages. Architecture configures what packages the software channels can have. The yum repository checksum type shows which algorithm is used when obtaining packages with the `spacewalk-repository-sync` command. The SHA1 algorithm can be used for almost every client repository because it is most compatible but SHA-256 and stronger

ones offer higher security; however, they are less compatible with clients. Nowadays SHA-256 is strongly recommended because SHA1 is too vulnerable. The channel summary is for a short description of the software channel. All the description can be written in the channel description section. The Contact/Support information section should hold information about the creator of the software channel so if questions or problems arise, administrators can easily find whom to contact. Channel access control has restriction settings for the channel. Administrators can select that all or selected users can subscribe the channel. Organization sharing settings show options as private, protected and public. Private means that other organizations cannot access the software channel and its contents. Selecting the protected option grants access to the channel for specific trusted organizations and the public option gives permissions to all trusted organizations. URL of the GPG key must be situated on the server. GPG key ID is the unique identifier which makes sure that packages come from the right source. GPG information can be retrieved from repository server of the distribution. Software channel installation needs to be finished by clicking the *create channel* button. [7.]

4.2.4 Creating Repository for Software Channel

Repositories provide links to packages for software channels. Spacewalk uses the command *spacewalk-repo-sync* to retrieve packages using a link the repository has. Repositories can be created from manage repositories under manage software channels on the channels tab as shown in figure 10.

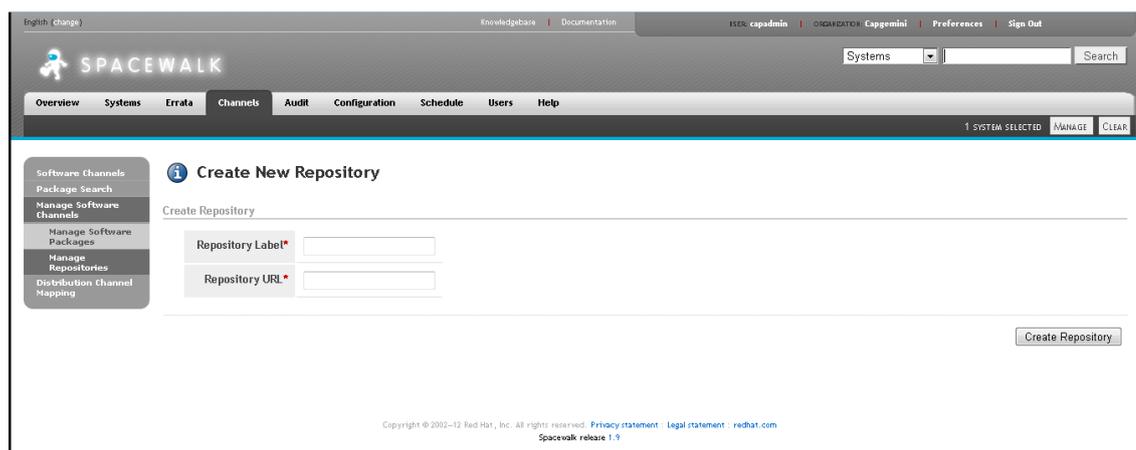


Figure 10 Spacewalk create new repository. Screenshot [5].

The repository label should be named after the channel that it is attached to. The repository URL contains the HTTP path to the repository which in this case is

http://ftp.funet.fi/index/Centos/5/updates/x86_64/. Enter the information and click the *create repository* button to finish the creating phase. [8.]

Spacewalk repositories need to be attached to software channels and they need to be synchronized with Linux repositories regularly so that the newest packages are always available. Attaching happens in the software channel management window as shown in figure 11.

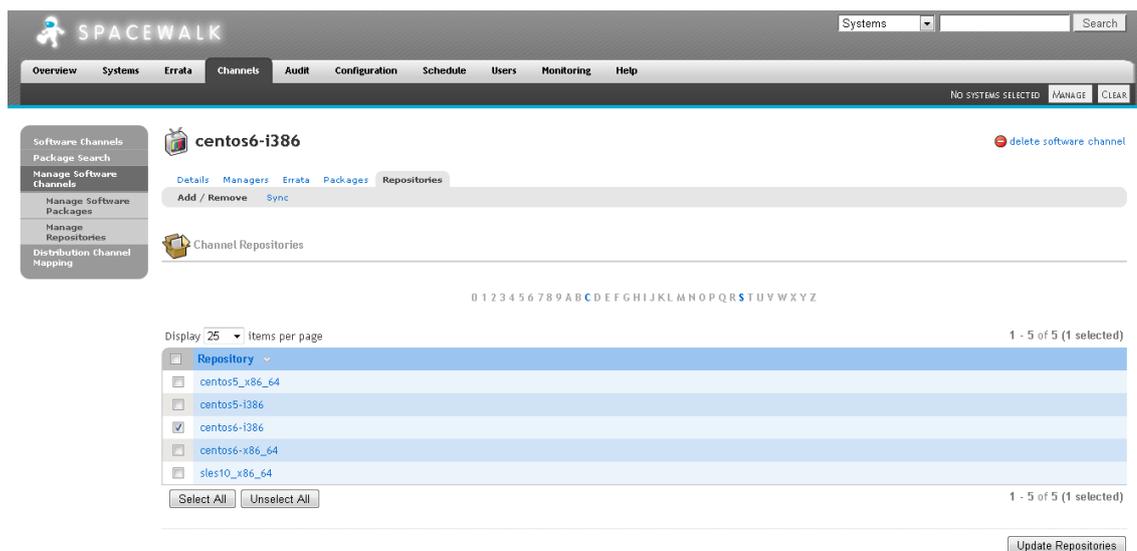


Figure 11 Spacewalk attaching repository. Screenshot [5].

To attach the repository click the select box for wanted repositories and click the update repositories button to save the settings. All packages coming from that repository now belong to that software channel. All packages need to be retrieved from the source. [8.]

The Spacewalk repository synchronization from web interface does not always work perfectly. A good way to make sure that the packages are up to date is to make a script which runs in Cron. Cron is a Linux operating systems scheduler. Synchronizations are scheduled to start daily at 03:00 a.m. with the script running in Cron. The script is written in bash:

```
#!/bin/bash

## Spacewalk repository sync ##
spacewalk-repo-sync --channel centos5-x86_64
spacewalk-repo-sync --channel centos6-x86_64
spacewalk-repo-sync --channel centos5-i386
spacewalk-repo-sync --channel centos6-i386
```

Listing 9. Spacewalk repository sync script. [8.]

As listing 9 shows, the script starts with the definition of bash language. Spacewalk-repo-sync commands tell Spacewalk to start synchronizing the provided channel. The script will run synchronization command for each channel individually and log the progress in `/var/log/rhn/reposync` directory. [8.]

4.2.5 Creating Activation Keys

Activation keys are used for attaching systems into Spacewalk. Each Linux distribution and architecture should have its own activation key, so when a registering system, it goes to the right system category. An activation key is created on the systems tab and by clicking the *activation keys* link. The page shows all activation keys available in the organization as shown in figure 12.

The screenshot shows the Spacewalk web interface. The top navigation bar includes 'Overview', 'Systems', 'Errata', 'Channels', 'Audit', 'Configuration', 'Schedule', 'Users', 'Monitoring', and 'Help'. The left sidebar has a menu with 'Activation Keys' highlighted. The main content area is titled 'Activation Keys' and contains the following text:

Activation Keys are used to register systems. Systems registered with an activation key will inherit the characteristics defined by that key.

Universal Default

If a universal default activation key is set for your organization, then systems registered to your organization will inherit the properties of that key by default without the need to explicitly specify that key during registration.

You do not currently have a universal default activation key set. To set a key as the universal default, please visit the details page of that key and check off the 'Universal Default?' checkbox.

All Activation Keys

The following activation keys have been created for use by your organization.

0 1 2 3 4 5 6 7 8 9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Filter by Description:

Enabled?	Description	Key	Usage
<input checked="" type="checkbox"/>	centos5_x86_64-suoj-a-capgemini	[REDACTED]	0/(unlimited)
<input checked="" type="checkbox"/>	centos6_x86_64-suoj-a-capgemini	[REDACTED]	1/(unlimited)

1 - 2 of 2 (2 selected)

1 - 2 of 2 (2 selected)

Figure 12 Spacewalk activation keys. Screenshot [5].

The enabled section tells if keys are usable in the organization. The description section shows the name of the activation key. It is recommended that the name includes Linux distribution, architecture, infrastructure and customer information. This way administrators can easily pick the correct key for the systems. The actual activation key is presented in the key section. It is covered for security reasons. Administrators will use that key in the activation phase to identify the correct key. Usage tells how many systems are registered to that key and if there are any limitations the centos6_x86_64-suoja-capgemini key has one system registered and no limitations of usage. Creating a new activation key is done by clicking create new key link in the upper right corner. The following page will be displayed.

Create Activation Key

Activation Key Details

Systems registered with this activation key will inherit the settings listed below.

Description	<input type="text"/>	<small>Tip: Use this to describe what kind of settings this key will reflect on systems that use it. If left blank, this field will be filled in "None".</small>
Key:	2- <input type="text"/>	<small>Tip: Leave blank for automatic key generation. Note that the prefix is an indication of the Spacewalk organization the key is associated with.</small>
Usage:	<input type="text"/>	<small>Tip: Leave blank for unlimited use.</small>
Base Channels:	<input type="text" value="Spacewalk Default"/>	<small>Tip: Choose "Spacewalk Default" to allow systems to register to the default Red Hat provided channel that corresponds to their installed version of Red Hat Enterprise Linux. You may also choose particular Red Hat provided channels or custom base channels here, but please note if a system using this key is not compatible with the selected channel, it will fall back to its Red Hat default channel.</small>
Add-On Entitlements:	<input type="checkbox"/> Monitoring <input type="checkbox"/> Provisioning <input type="checkbox"/> Virtualization <input type="checkbox"/> Virtualization Platform	
Universal Default:	<input type="checkbox"/>	<small>Tip: Only one universal default activation key may be set for this organization. By setting this key as universal default, you will remove universal default status from the current universal default key if it exists. If this key is set as universal default, then newly-registered systems to your organization will inherit the properties of this key.</small>

Figure 13 Spacewalk create activation key. Screenshot [5].

The description field should have a name that consists of Linux distribution and version, architecture, infrastructure and client. The key section is recommended to be left blank for security reasons. When blank it creates a random 32 character long key. The usage field is for restricting available licenses for a specific key but because the organization usually has enough licenses, restriction is not mandatory. Blank means the activation key has unlimited usage. The base channel defines what channel system is attached. For example, centos5_i686-suoja-capgemini key should be attached to the centos-i686 base channel so that Linux distribution and architecture matches to the systems. The add-on entitlements section defines to what service attached systems are connected. The universal default key is the main key of the organization. This is

recommended to be left blank. When done, clicking the *create activation key* finishes creation phase. [6.]

Activation keys must also be configured. Keys need to have a proper child channel and group so they can categorize systems properly as shown in figure 14.

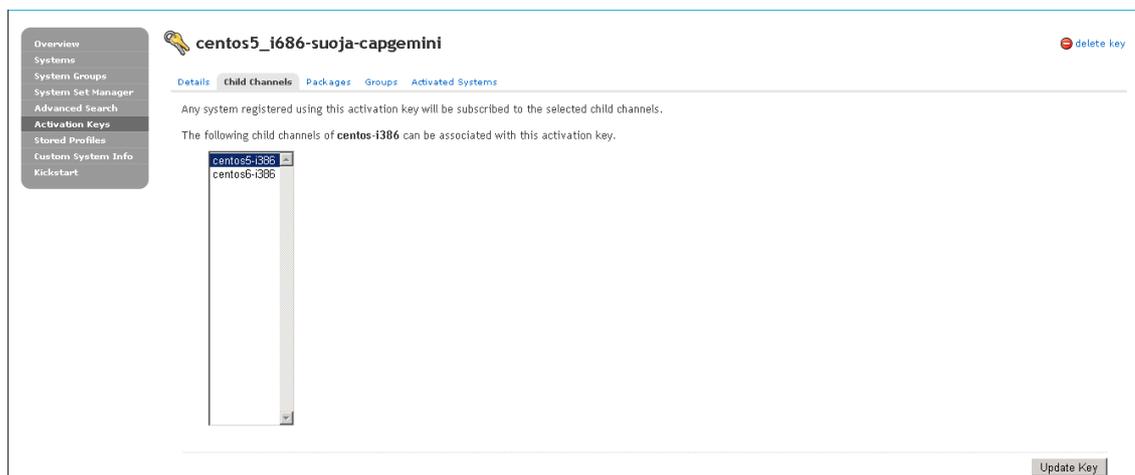


Figure 14 Spacewalk activation key child channel. Screenshot [5].

The child channels tab is for attaching systems into the proper channel behind the base channel so that systems will get correct packages. Select the wanted child channel and click the update key to save the selection. On the packages tab, administrators can list packages that attached systems will have. When systems are registered with the activation key, packages will be installed from that list. Packages must exist in the channel repository; otherwise, they are not installed. Packages can be listed as just a name or name with the extension such as nmap or nmap-5.51-2.el6.x86_64. Only one package name should be included per line.

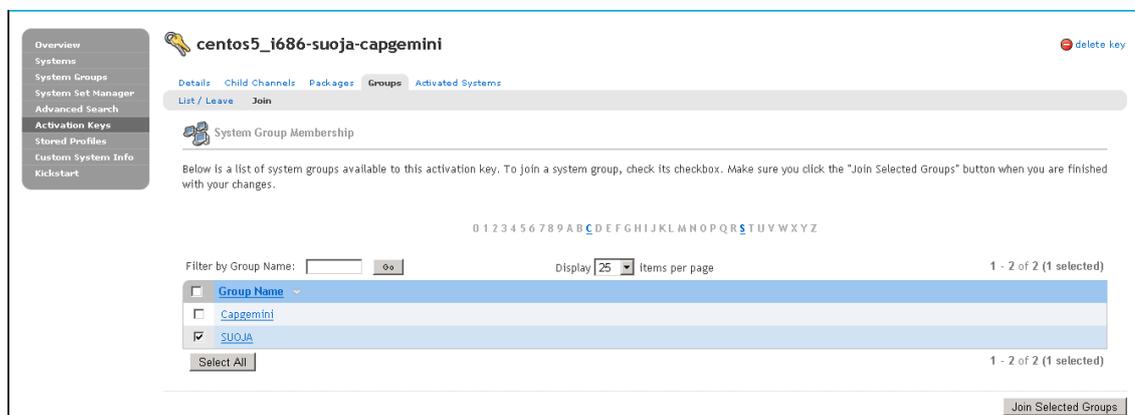


Figure 15 Spacewalk activation key system group. Screenshot [5].

The group information of activation keys is configured on the Groups tab. New activation keys have not joined by default any group, therefore nothing is displayed on the List/Leave tab. Group joining is done from the Join tab. Select the correct group and click join the selected groups button to finish joining. Now all newly registered systems will join the specific key to the attached group. The activated systems tab shows all systems which are registered with that activation key. The activation key is now ready to be used. [6.]

4.2.6 Enabling Kickstart for Spacewalk

Spacewalk supports kickstart profiles as main its installation platform. Kickstarting requires Cobbler and installation media. Configuration is done from the Spacewalk web interface. First, the Spacewalk configuration files need to be changed because the installation network resides in a subnet other than Spacewalk management network. The value `cobbler.host` in the `/etc/rhn/rhn.conf` file needs to match the address of Spacewalk installation network. The values `server` and `redhat_management_server` in the `/etc/cobbler/settings` file need to be corrected. Next, the Cobbler needs to get its loaders. This is done with the following command:

```
#cobbler get-loaders
```

Listing 10. Cobbler loader installation command. [9.]

This command will download several files from the Internet. Next cobbler needs to be build:

```
#cobbler buildiso
```

Listing 11. Cobbler build command. [9.]

This command creates a file called `generated.iso` in the directory where the command was executed. Installation files need to be added to the system. Mount Linux installation media to the folder `/mnt/` and execute the following command:

```
#mkdir -p /var/distro-trees/<linux distribution>  
#cp -R /mnt/* /var/distro-trees/<linux-distribution>
```

Listing 12. Commands to copy image files. [9.]

The first command will create two folders. The first folder is where all installation media should reside. The second command will copy all files from the installation media to that folder. Kickstart needs DHCP and TFTP service to be enabled. A working DHCP example is given below:

```
#
# DHCP Server Configuration file.

default-lease-time 600;
max-lease-time 7200;
log-facility local7;

allow booting;
allow bootp;

filename "pxelinux.0";

subnet xxx.xxx.xxx.xxx netmask xxx.xxx.xxx.xxx {
    range xxx.xxx.xxx.xxx xxx.xxx.xxx.xxx;
    option broadcast-address xxx.xxx.xxx.xxx;
    option routers xxx.xxx.xxx.xxx;
}
```

Listing 13. DHCP configuration file. [9.]

Listing 3 shows different parameters in the file. Lease times can be altered as wanted. Allow booting and bootp are necessary options for PXE boot to work. Filename is the syslinux file which should be located in the /var/lib/tftpboot folder. If the file is missing, make sure that the system has syslinux rpm installed. The file can be found in the /usr/share/syslinux/ folder. Ensure also that the menu.c32 file is located in the tftpboot folder. Subnet configuration can also be altered as wanted. Ensure that TFTP service is running under xinetd service with the following command:

```
#netstat -lnp | grep 69
```

Listing 14. Command to check status of TFTP service. [9.]

The command shows all ports that are in listening mode and the program that controls them. If TFTP service is down, make sure that tftp configuration looks like the following:

```
service tftp
{
    disable = no
    socket_type = dgram
    protocol = udp
    wait = yes
    user = root
    server = /usr/sbin/in.tftpd
    server_args = -s /var/lib/tftpboot
    per_source = 11
    cps = 100 2
    flags = IPv4
}
```

Listing 15. TFTP configuration example. [9.]

TFTP configuration file can be found in the `/etc/xinetd.d/tftp` folder. If necessary, change the configuration and restart xinetd service with the command given below:

```
# service xinetd restart
```

Listing 16. Xinetd service restart command. [9.]

After that kickstart configuration can be done. Kickstart can be setup under the Systems tab and kickstart.

The screenshot displays the 'Kickstart Overview' page in Spacewalk. On the left is a navigation sidebar with categories like Overview, Systems, System Groups, System Set Manager, Advanced Search, Activation Keys, Stored Profiles, Custom System Info, Kickstart, Profiles, Bare Metal, GPG and SSL Keys, Distributions, File Preservation, and Kickstart Snippets. The main content area is titled 'Kickstart Overview' and includes a 'Kickstart Summary' section with a table showing 'Red Hat Enterprise Linux 6 Kickstart Profiles' with a count of 1. There are also 'Kickstart Actions' buttons for 'View a List of Kickstart Profiles', 'Create a New Kickstart Profile', and 'Upload a New Kickstart File'. Below this, there are sections for 'Systems Currently Kickstarting' and 'Systems Scheduled to be Kickstarted', both showing 'There are no systems currently kickstarting'.

Figure 16 Spacewalk Kickstart Overview. Screenshot [5].

The overview page displays all kickstart profiles, the status of kickstarting systems and any scheduled kickstart activity. The profiles page is where new kickstart setups are done. The Bare Metal page shows IP addresses that have been associated with kickstart profiles. GPG and SSL keys page lists all certificates available for inclusion in the kickstart profiles and enables creating new certificates. Every system will have the SSL certificate of Spacewalk for it to work securely. The Distributions page enables administrators to create and find custom installation trees which are used in kickstarting. The File Preservation page gives a chance to make a list of files that are not altered when kickstarting. This is extremely useful when kickstarting an old system with custom files. [9.]

The first step is to create a new distribution tree. This is done from the distribution page by clicking *create new distribution* link.

Create Kickstart Distribution

Distribution Label*:	<input type="text"/>
Tree Path*:	<input type="text"/>
Base Channel*:	centos5-i386 ▾
Installer Generation*:	Red Hat Enterprise Linux 7 ▾
Kernel Options:	<input type="text"/>
Post Kernel Options:	<input type="text"/>

Create Kickstart Distribution

Figure 17 Spacewalk create new distribution. Screenshot [5].

The page will require sections to be filled out. Distribution label is the name of the installation media, for example centos6-x86_64. Tree path section is the local path of the installation media files, for example /var/distro-trees/centos6-x86_64. Select the matching base channel for the distribution. Select the Linux distribution that this kickstart distribution is for. The Linux versions of Red Hat can be used in CentOS installations. Kernel Options can have custom kernel based commands. The post kernel option is for kernel custom commands that are meant to be used after the installation. The next step is to make the kickstart configuration profile. This is done from the Profiles page by clicking the *create new kickstart profile* button. First, the label of the profile needs to be entered. The base channel also needs to be selected. The kickstart able tree drop down list is shown based on the base channel selection. The virtualization type selection is for XEN and KVM based virtualization platforms. Select the correct type and when done click the *next* button to display the kickstart profile configuration page. [9.]

The screenshot displays the 'Kickstart Details' configuration page in Spacewalk. The interface includes a left-hand navigation menu with options like 'System Groups', 'System Set Manager', 'Advanced Search', 'Activation Keys', 'Stored Profiles', 'Custom System Info', 'Kickstart', 'Profiles', 'Bare Metal', 'GPG and SSL Keys', 'Distributions', 'File Preservation', and 'Kickstart Snippets'. The main content area is titled 'Kickstart Details' and contains the following fields and options:

- Kickstart Label:** A text input field containing 'centos63-x86_64-suoj-minimal'. A tip below it states: 'Tip: The label field should not be easily guessable, since it could be used to expose information about this kickstart profile to a 3rd party.'
- Operating System:** A dropdown menu showing 'centos6-x86_64' with a '(Change)' link.
- Virtualization Type:** A dropdown menu showing 'None'.
- Active:** A checked checkbox with a note: 'You cannot kickstart a system registered to Spacewalk using an inactive kickstart profile. However, the kickstart files for inactive kickstart profiles are still available for manual download and may be used for bare metal kickstarts.'
- Log custom post scripts:** An unchecked checkbox with a note: 'If selected, all output of custom post scripts will be logged to /root/ks-post.log.'
- Log custom pre scripts:** An unchecked checkbox with a note: 'If selected, all output of pre scripts will be logged to /root/ks-pre.log.'
- Preserve ks.cfg:** An unchecked checkbox with a note: 'If selected, ks.cfg and all %include fragments will be copied to /root.'
- Organization Default Profile:** An unchecked checkbox with a note: 'The Organization Default Profile setting can be used with manually-created or bare-metal kickstart files. Select this option to indicate which profile in your Organization is used when the URL from this link is specified in the ks- section of your kickstart file. The link will not work unless an Organization Default is specified.'
- Kernel Options:** An empty text input field.
- Post Kernel Options:** An empty text input field.
- Comments:** A large, empty text area.

An 'Update Kickstart' button is located at the bottom of the form.

Figure 18 Spacewalk create kickstart profile. Screenshot [5].

The first page shows the basic configurations which were gathered from distribution configurations. This page allows having logging enabled for the kickstart procedure. The operating system tab administrator can modify the base channel, child channels and available trees. Note that it is not recommended to have the update child channel selected because installation can fail because of that. The variables page is used for substitute values to the kickstart profile. The advanced option tab enables administrators easily to modify kickstart configuration such as keyboard layout, logging, and firewall. The bare metal kickstart page enables defining IP address ranges for the kickstart profile. The profile can only be used from a specified IP address range. [9.]

The sub-tabs on the system detail page are details, locale, partitioning, file preservation, GPG & SSL and troubleshooting. The details page enables administrators to manage SELinux parameters. Administrators can also select if the system will be enabled to have configuration management and remote commands. A root password can be applied from this page. The locale sub-tab shows the timezone option for the profile. Finland uses the Europe/Helsinki option. The partitioning page enables administrators to alter the partition table of kickstarted systems. The file preservation page shows all the files that have been listed as preserved for this profile. On the GPG & SSL page the administrator can select which certification will be deployed in to the system. The troubleshooting tab gives options for administrators to solve hardware and other issues in the created systems. [9.]

The software page is for administrators to select packages or package groups that will be installed when kickstarting. It is recommended that in addition to base packages the following will be installed: `rhncfg-client` and `rhncfg-actions`. With these packages, setup can register a system, and all necessary client tools are found. The kickstart profile can be attached to an activation key which will automatically bring the system to the correct system group and software channel. Scripts page administrators can write scripts to be executed before or after installation. This is a very useful tool when for example creating users or giving basic security settings for new systems. The kickstart page shows the kickstart profile which is used when kickstarting. Administrators can also download the profile. After profile creation, Spacewalk is set for installing new systems. Profiles can be found from the `/var/lib/tftpboot/images` folder. [9.]

4.2.7 Creating Configuration Channels

Configuration channels enable administrators to modify, create and deploy configuration files or scripts for multiple servers at the same time. This feature is very useful for example when the `/etc/hosts` file has to be up to date with the IP address of each system in the infrastructure. Creating the configuration channel can be done from the configuration channels page on the configuration tab and by clicking the *create new config channel* button. A new page opens and administrators are required to enter the name, label and description of the channel. The next page will show the overview page of the newly created configuration channel. It shows overall information about the channel as shown in figure 19.

The screenshot displays the Spacewalk Configuration Channel Overview page for a channel named 'Test'. The interface includes a sidebar with navigation options: Overview, Configuration Channels, Configuration Files, and Systems. The main content area is titled 'Test' and features a 'delete channel' button. Below the title are tabs for 'Overview', 'Add Files', and 'Systems'. The 'Overview' tab is active, showing 'Channel Properties (Edit Properties)' with fields for Name (Test), Label (test), and Description (Test phase). Below this is a 'Channel Information' table with four rows: Number of Files (No files found), Systems (No systems subscribed), Most-Recently Subscribed System (No systems subscribed), and Most-Recently Modified File (No files modified). On the right side, there is a 'Configuration Actions' section with an 'Add/Create Files' button and three options: 'Create new configuration file or directory', 'Upload configuration files', and 'Import a file from another channel or system'.

Figure 19 Spacewalk Configuration Channel Overview. Screenshot [5].

A couple of options will be needed for the configuration channel to work properly. Files can be imported, uploaded or created from the add files tab. From the systems tab the systems are connected to the channel and also contains a list of all systems attached to the channel. First, the systems need to be added to the configuration channel. Each system needs few packages for this feature to work. Install these packages with the following command:

```
#yum install -y rhncfg rhncfg-actions rhncfg-client
```

Listing 17. RHN package installation commands. [9.]

Go to the systems page on the configuration tab. Then select target systems and the page will display every system that has not been targeted for configuration channels. Select the system which needs to be targeted and click the *enable Spacewalk configuration management* button. Sometimes the configuration feature will need to be setup by hand. Entering these commands from the client command line will enable the feature:

```
#rhn_check
#rhn-actions-control -enable all
```

Listing 18. Commands to enable software configuration.[5]

After this step the systems can be subscribed to configuration channels. This is done either from activation key management or from configuration channel settings on the systems tab.

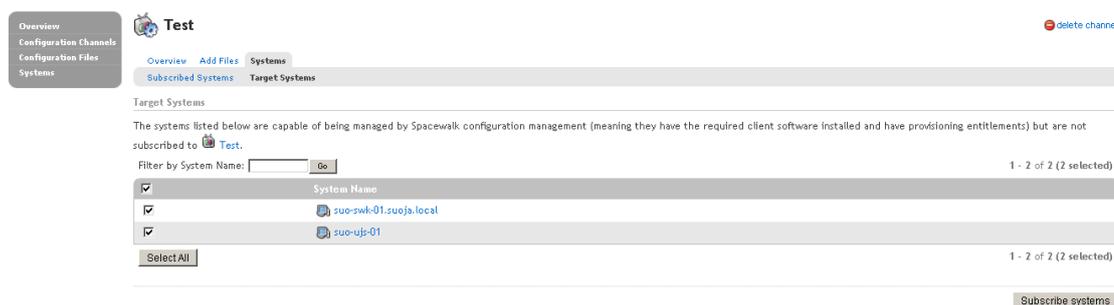


Figure 20 Spacewalk subscribe configuration channel. Screenshot [5].

The subscribed systems tab shows all systems that are getting configuration files from the channel. Systems are added to the channel from the target systems tab. Select the wanted systems and click the *subscribe* button to attach them to the channel.

Adding files to the configuration channel can be done in three different ways: uploading, importing and creating files. Administrators can upload files to Spacewalk from their workstation or network location. Importing enables administrators to collect files from other channels in the organization. Creating files creates a new file to the system:

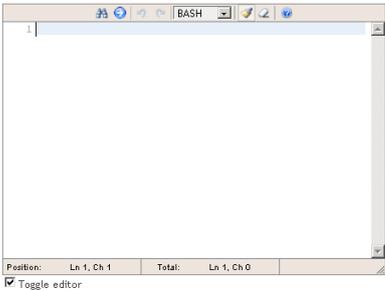
File Type:	<input checked="" type="radio"/> Text file <input type="radio"/> Directory <input type="radio"/> Symbolic link
Filename/Path *:	<input type="text"/>
Symbolic Link Target Filename/Path *:	<input type="text"/>
Ownership:	User name *: <input type="text" value="root"/> Group name *: <input type="text" value="root"/> <small>Tip: if the user and/or group indicated here does not exist on system(s) to which this file is deployed, the deploy will fail.</small>
File Permissions Mode *:	<input type="text" value="644"/> <small>Tip: 644 for text files and 755 for directories and executables will allow global access or execution (but not modification).</small>
SELinux context	<input type="text"/> <small>Tip: Enter SELinux context like user_u:role_r:type_t:s0-c1024 (note: you don't have to enter all parts)</small>
Macro Delimiters *:	Start Delimiter: <input type="text"/> End Delimiter: <input type="text"/>
File Contents:	

Figure 21 Spacewalk create configuration file. Screenshot [5].

Creating a file needs a few configuration steps. First, the file type must be specified. It can be a text file, directory or symbolic link. The text file can be a configuration file, script or just a text file. The directory creates a new directory to the system. The symbolic link creates a link to the wanted file so it can be accessed from another location. The filename/path section specifies the location where the file, directory or symbolic link will be created. The ownership of the file can be selected. In most cases, for security reasons, it is good that root is both the user and the group. Note that if the username or group does not exist in the system, deployment of the file will fail. The file permission mode gives the files and directories permissions according to a three digit number. These numbers are based on octal digits. The best practice for the permissions is that the text and configuration files will have 644 permissions so they can be read but not modified, and directories and executables should have 755 permissions so they can be executed and read but not modified by anyone else than the root. The SELinux section specifies the required file attributes that are enabled such as user, role or file type. Macro delimiters define the symbols that mark the

beginning and the end of a macro. File contents are available only when creating a new text file. Enter the configuration, text or script lines into the file and click the *create configuration file* button to finish the creation phase. [6.]

4.2.8 Managing Errata

Errata is information about packages that have security, bug fix or enhancement updates available. Distributions stop their support at some point for later versions and information about for example security patches become unavailable. Errata helps to detect these issues even in later versions of packages. Errata legends are shown in figure 22.

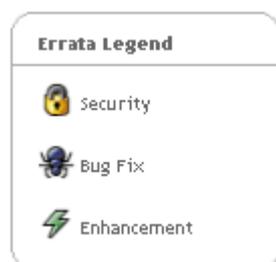


Figure 22 Spacewalk Errata Legend. Screenshot [5].

Security errata are for packages that need a security patch. These packages must be updated as soon as possible. Bug fix errata contain updates to the issues in the package that were reported by users or discovered during development or testing. Enhancement errata means that a newer version of a package contains either new features, improved functionality or enhanced performance. [6.]

Errata information is brought to Spacewalk by a script. This is because CentOS does not provide a straight way to errata. Fixes are reported via mailing lists or posted on the web. Script is written in bash as shown in listing 19.

```

#!/bin/bash
cd /etc/rhn/
export http_proxy=http://<ip address and port>
export https_proxy=http://<ip address and port>

wget -N http://cefs.steve-meier.de/errata.latest.xml
wget -N
https://www.redhat.com/security/data/oval/com.redhat.rhsa-
all.xml

export SPACEWALK_USER='<spacewalkadmin username>'
export SPACEWALK_PASS='<password>'
./errata-import.pl --server suo-swk-01.suoja.local --errata
errata.latest.xml --rhsa-oval com.redhat.rhsa-all.xml --
publish
unset http_proxy
unset https_proxy
unset SPACEWALK_USER
unset SPACEWALK_PASS

```

Listing 19. Spacewalk errata sync script. [4.]

This script is located in the `/etc/rhn` folder. The script will start going to the folder `/etc/rhn` with the `cd` command. As listing 19 illustrates, HTTP and HTTPS proxies are set with an `export` command. The script checks if a new errata xml file is available with the `wget` command. Then the script exports the Spacewalk admin username and password to two variables which are used in the `errata-import.pl` script. This script was provided on the Internet. The script needs the command `server`, `errata`, `rhsa-oval` and `publish` to work correctly. The Spacewalks FQDN name is specified in the `--server` command, `--errata` points to the location where the xml file is found, `--rhsa-oval` indicates the Red Hat oval errata xml location and `--publish` enables errata to be synchronized with Spacewalk software channels. Unset commands are used to clear the variables. This is done for security reasons. To always get the latest versions of errata, the script will run daily at 01:00 a.m. [4.]

Errata is now displayed on the Errata tab. The relevant page shows errata updates for the registered systems. The list contains information about each errata update including its severity, type, advisory number and the systems' affected. All sub-tabs

show all the errata information available in the Spacewalk organization. Administrators can also search for any errata on the advanced search page. [6.]

5 Testing

5.1 Installing New Systems

Installing new systems is done using a kickstart automated process. In the VMware environment administrators need to create a new VMware server with requested specifications. Spacewalk can make new virtual machines to XEN and KVM based virtualization environments. Capgemini will use specific VLAN for the installation network. This needs to be changed in the interface so that DHCP and Cobbler will work as wanted. After installations, VLAN must be changed to the production VLAN. The kickstart test phase will consist of installing all used versions of Linux in Capgemini, which includes CentOS and RHEL versions 5.8 & 6.3. SLES does not support kickstart configuration, so it cannot be used in Spacewalk. [9.]

The systems will get their IP address from the DHCP service in Spacewalk server. The network can hold up to 29 simultaneous installation addresses. On boot, the administrator needs to choose the network boot option, and after DHCP request, the Cobbler menu will be displayed:

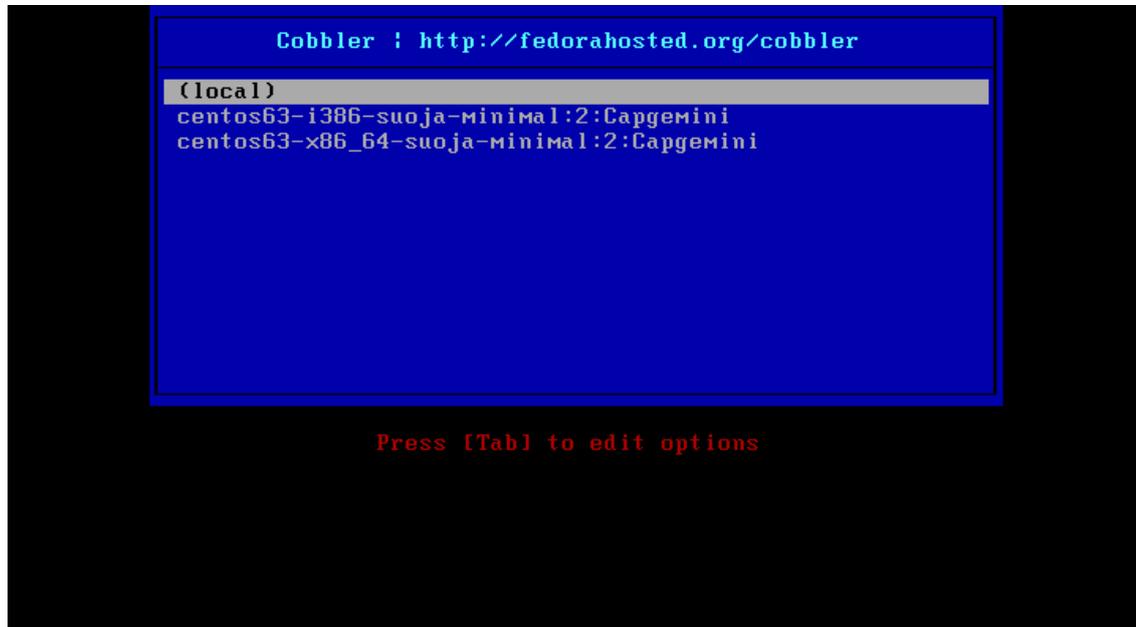


Figure 23 Spacewalk cobbler menu. Screenshot [10].

This is the Cobbler menu. Here administrators can choose which installation profile will be used. The name specifies which distribution, architecture and installation type is used. For example, centos63-i386-suoja-minimal will create CentOS 6.3 minimal

installation with architecture i386 and the location will be in the SUOJA system group. The installation will proceed several installation steps automatically.

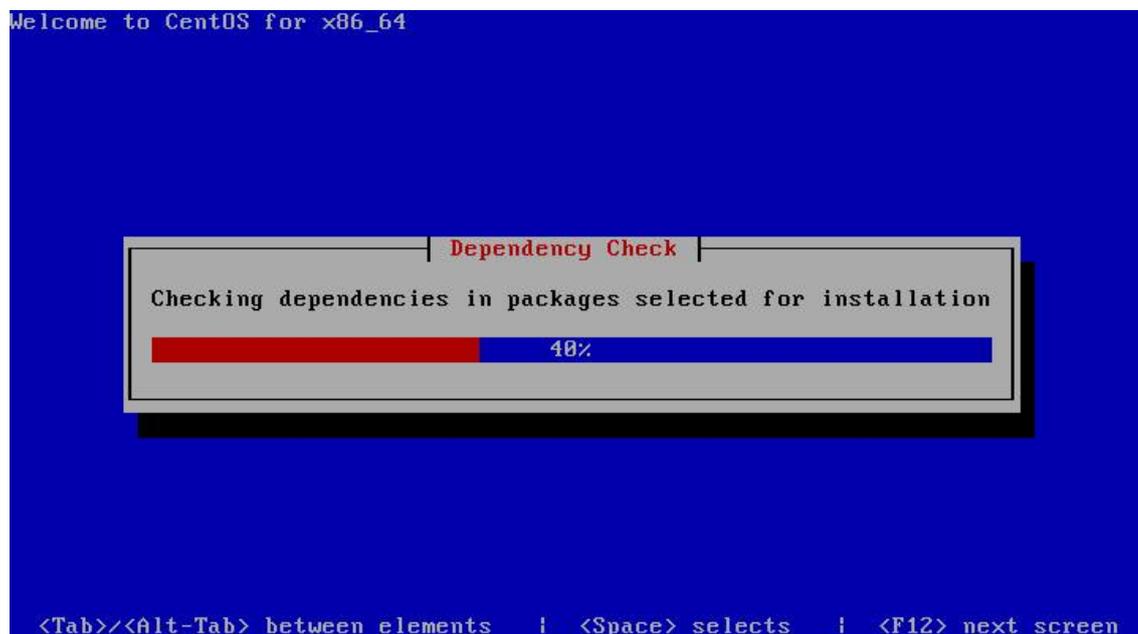


Figure 24 Spacewalk kickstart automated installation. Screenshot [10].

After installation, the system will reboot and show the login screen. Login credentials are created with post scripts in kickstart profile. System will be displayed in Spacewalk as localhost.localdomain because hostname can't be given while installing. Because of this systems need to be re-registered with Spacewalk. This must be done after changing hostname and interface VLAN to production. Re-registration is done with command:

```
#rhnreg_ks --serverUrl=http://<ip address>/XMLRPC --
activationkey=<activation key number> --force
```

Listing 20. Registering client command. [11]

After that re-registration server is getting all necessary update packages and features. Installation profile localhost.localdomain can be removed from the Spacewalk. Each installation step was successful and so this feature can be brought into production use.

[11.]

5.2 Updating Systems with Spacewalk

Spacewalk can be used to update packages for one or multiple systems at the same time. Package updates can be scheduled as wanted. With errata information packages can be updated with specific profile i.e. security, bug fix or enhancement. Administrators can also update all packages available in the software channel.

5.2.1 Patching Security, Bug and Enhancement Packages

Security patches can be applied to systems by going systems information and selecting errata sub tab under software tab. Select security advisory from the drop down box and click show button which will show all security related packages.

The screenshot shows the Spacewalk interface for selecting security advisories. The top navigation bar includes 'Recently Registered', 'Proxy', 'Duplicate Systems', 'System Currency', 'System Groups', 'System Set Manager', 'Advanced Search', 'Activation Keys', 'Stored Profiles', 'Custom System Info', and 'Kickstart'. The 'Errata Legend' on the left indicates Security (lock icon), Bug Fix (bug icon), and Enhancement (gear icon). The main content area shows a table of advisories with the following columns: Type, Advisory, Synopsis, Status, and Updated. The table contains 22 rows of advisories, all with a lock icon in the Type column. The 'Status' column for all advisories is 'None', and the 'Updated' column shows the date '4/13/13'. A 'Select All' button is located at the bottom left of the table, and an 'Apply Errata' button is at the bottom right. The page number '1 - 22 of 22 (0 selected)' is displayed at the bottom right.

Type	Advisory	Synopsis	Status	Updated
<input type="checkbox"/>	CESA-2013-0135	Low CentOS gtk2 Update	None	4/13/13
<input type="checkbox"/>	CESA-2013-0132	Low CentOS autofs Update	None	4/13/13
<input type="checkbox"/>	CESA-2013-0131	Low CentOS gnome-vfs2 Update	None	4/13/13
<input type="checkbox"/>	CESA-2013-0124	Moderate CentOS netsnmp Update	None	4/13/13
<input type="checkbox"/>	CESA-2013-0123	Low CentOS OpenPMI Update	None	4/13/13
<input type="checkbox"/>	CESA-2013-0122	Moderate CentOS tcl Update	None	4/13/13
<input type="checkbox"/>	CESA-2013-0120	Low CentOS quota Update	None	4/13/13
<input type="checkbox"/>	CESA-2012-1265	Important CentOS libsoft Update	None	4/13/13
<input type="checkbox"/>	CESA-2012-0731	Moderate CentOS expat Update	None	4/13/13
<input type="checkbox"/>	CESA-2012-0523	Moderate CentOS libpng Update	None	4/13/13
<input type="checkbox"/>	CESA-2012-0465	Critical CentOS samba Update	None	4/13/13
<input type="checkbox"/>	CESA-2012-0306	Low CentOS krb5 security and bug fix update	None	4/13/13
<input type="checkbox"/>	CESA-2012-0304	Low CentOS xfs-progs security, bug fix, and enhancement update	None	4/13/13
<input type="checkbox"/>	CESA-2012-0153	Low CentOS sos security, bug fix and enhancement update	None	4/13/13
<input type="checkbox"/>	CESA-2012-0136	Important CentOS libwordis Update	None	4/13/13
<input type="checkbox"/>	CESA-2011-1815	Moderate CentOS icu Update	None	4/13/13
<input type="checkbox"/>	CESA-2011-1326	Moderate CentOS pango Update	None	4/13/13
<input type="checkbox"/>	CESA-2011-1154	Important CentOS libXfont Update	None	4/13/13
<input type="checkbox"/>	CESA-2011-1132	Moderate CentOS dbus Update	None	4/13/13
<input type="checkbox"/>	CESA-2011-1073	Low CentOS bash Update	None	4/13/13
<input type="checkbox"/>	CESA-2011-0486	Moderate CentOS xmbsec1 Update	None	4/13/13
<input type="checkbox"/>	CESA-2011-0436	Moderate CentOS avahi Update	None	4/13/13

Figure 25 Spacewalk patching security fixes. Screenshot [5].

All security packages will be displayed with a lock icon. Click select all buttons to choose all packages for update and click apply the errata button and confirm on the next page. Spacewalk will schedule package installations to the administrators' choosing. Administrators can view the patch process from the schedule tab. After the patch process, the system will be security patched. [6.]

Bug fixes can be applied from the same menu than security fixes. Select bug fix advisory from the drop down box and click the *show* button to display the packages with bugs. [6.]

All bug fixes are displayed on that page. Click the *select all* button to choose all packages and click the *apply errata* and confirm the selection. Spacewalk will schedule these in the same way as the security patches. Enhancement package updates are done in the same way as the security and bug fixes. [6.]

5.2.2 Patching All Packages

A full system patch can also be applied from Spacewalk. This is done from the upgrade page which is located under the software and packages.

The screenshot shows the 'Upgradable Packages' page in Spacewalk. The page title is 'Upgradable Packages' and it indicates that the following packages on this system are out-of-date and may be upgraded. Below this, there is a table with the following columns: 'Latest Package', 'Installed Package', and 'Related Errata'. The table lists various packages with their current installed versions and the latest available versions. For example, 'act-2.2.39-8.el5.i386' is installed as 'act-2.2.39-6.el5.i386'. The 'Related Errata' column shows links to errata such as 'CEBA-2012-0242-1' for the 'act' package. The page also includes a search filter, a 'Go' button, and a 'Display' dropdown set to '25' items per page. The total number of items is '1 - 25 of 236 (0 selected)'.

Latest Package	Installed Package	Related Errata
<input type="checkbox"/> act-2.2.39-8.el5.i386	act-2.2.39-6.el5.i386	CEBA-2012-0242-1
<input type="checkbox"/> acpid-1.0.4-12.el5.i386	acpid-1.0.4-9.el5_4.2.i386	CEBA-2011-1786-1
<input type="checkbox"/> aide-0.13.1-8.el5.i386	aide-0.13.1-6.el5.i386	CEBA-2012-1119-1
<input type="checkbox"/> alsa-utils-1.0.17-7.el5.i386	alsa-utils-1.0.17-1.el5.i386	CEBA-2013-0113-1
<input type="checkbox"/> aspell-0.60.3-12.12.i386	aspell-0.60.3-7.1-12.i386	CEBA-2011-1372-1
<input type="checkbox"/> aspell-en-6.0-3-50.i386	aspell-en-6.0-2.1-50.i386	CEBA-2012-0581-1
<input type="checkbox"/> audit-1.8-2.el5.i386	audit-1.7.18-2.el5.i386	CEBA-2012-0265-1
<input type="checkbox"/> audit-libs-1.8-2.el5.i386	audit-libs-1.7.18-2.el5.i386	CEBA-2012-0265-1
<input type="checkbox"/> audit-libs-python-1.8-2.el5.i386	audit-libs-python-1.7.18-2.el5.i386	CEBA-2012-0265-1
<input type="checkbox"/> authconfig-5.3.21-7.el5.i386	authconfig-5.3.21-6.el5.i386	CEEA-2011-1003-2
<input type="checkbox"/> authconfig-gtk-5.3.21-7.el5.i386	authconfig-gtk-5.3.21-6.el5.i386	CEEA-2011-1003-2
<input type="checkbox"/> autofs-5.0.1-0.rc2.177.el5.i386	autofs-5.0.1-0.rc2.143.el5_5.6-1.i386	CESA-2013-0132-1
<input type="checkbox"/> avahi-0.6.16-10.el5_6.i386	avahi-0.6.16-9.el5_5.i386	CESA-2011-0436-2
<input type="checkbox"/> avahi-glib-0.6.16-10.el5_6.i386	avahi-glib-0.6.16-9.el5_5.i386	CESA-2011-0436-2
<input type="checkbox"/> bash-3.2-32.el5.i386	bash-3.2-24.el5.i386	CESA-2011-1073-2
<input type="checkbox"/> binutils-2.17.50.0-6-20.el5_8.3.i386	binutils-2.17.50.0-6-14.el5.i386	CEBA-2012-0672-1
<input type="checkbox"/> busybox-1.2.0-14.el5.centos.1.i386	busybox-1.2.0-7.el5.centos.1.i386	CEBA-2013-0075-1
<input type="checkbox"/> centos-release-5-9.el5.centos.1-10.i386	centos-release-5-6.el5.centos.1-10.i386	
<input type="checkbox"/> centos-release-notes-5-9-0.i386	centos-release-notes-5-6-0.i386	
<input type="checkbox"/> comps-extras-11.4-1.el5.centos.noarch	comps-extras-11.1-1.1.el5.centos.noarch	

Figure 26 Spacewalk patching system. Screenshot [5].

All packages that have an update available will be displayed as shown in the figure 26. Page shows which version is installed of the package and which version is available. Errata information is also shown for relevant packages. Click the *select all* button to select all packages and click the *upgrade button* and confirm after that to submit the patch process. The patch process will be displayed on the schedule tab. [6.]

After patching, the systems will need to be restarted if updates include kernel patches. Spacewalk will show systems that need to be restarted on the systems sub tab and on the requiring reboot page. Scheduling a reboot can be done by clicking the system name and clicking the *Schedule System Reboot* link. [6.]

5.3 Managing Configuration Files

Testing configuration file management will be done with two systems connected to Spacewalk. A configuration channel called Test will be used. This channel holds one script file which will be deployed to /tmp/ location. Deployment of the file will be done from the deploy file tab of the configuration channel.

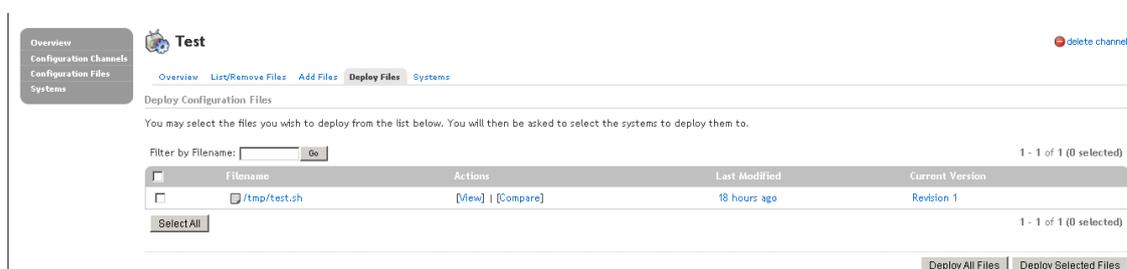


Figure 27 Spacewalk deploy configuration file. Screenshot [5].

All files in the configuration channel are displayed on the deploy file page. The page shows the configurations file name, modification and version number. Version numbers are displayed as revision numbers. Each revision is saved in Spacewalk and they can be compared from the *compare* link under the *Actions* column. To deploy a file, select it and click the *deploy selected files* button, or if all files need to be deployed, click the *deploy all files* button. The administrator must then select the systems where the configuration file will be deployed. In this case the administrator will deploy one file to two systems. After selection is done, click *confirm and deploy* button to deploy the files. After the schedule tab shows that the operation was successfully completed the administrator will log on to the systems and study the /tmp/ directory to see if the script has arrived with the correct settings and context. [6.]

6 Deployment Planning & Implementation

This section will cover the planning and implementation phase when Spacewalk is correctly installed, configured and ready to use. Every company is different, and planning how to attach systems that are already in production into Spacewalk is crucial.

6.1 Planning

Deployment will be done one customer at a time. Systems that have the lowest priority will be added first. After adding development and test systems, they will be tested against Spacewalk. Production systems can be registered when no errors occur. Systems will be registered in the same way with correct activation keys. Every customer will have their own system category and the administrator's rights will be setup accordingly. Configuration files will be added to the systems for example hosts files will be identical with every system in one company. Administrators will be educated to Spacewalk so that they know how to use it in every situation.

6.2 Implementation

Systems need to be registered with Spacewalk. The registration process will be done to one customer at a time. This helps administrators work and errors can be noticed easily. The new installation procedure is instructed to administrators.

6.2.1 Registering Systems into Spacewalk

Every system that has not been installed through the Spacewalk kickstart profile needs to be registered. Attaching is done using Red Hat tools. These tools can be installed from Spacewalk client repository. To install Spacewalk repository to different distributions, select one of these commands:

RHEL 5 / CentOS 5:

```
#BASEARCH=$(uname -i)
#rpm -Uvh http://yum.spacewalkproject.org/1.9-
client/RHEL/5/$BASEARCH/spacewalk-client-repo-1.9-
1.el5.noarch.rpm
```

Listing 21. Spacewalk client repository install command. [11.]

RHEL 6 / CentOS 6:

```
#BASEARCH=$(uname -i)
#rpm -Uvh http://yum.spacewalkproject.org/1.9-
client/RHEL/6/$BASEARCH/spacewalk-client-repo-1.9-
1.el6.noarch.rpm
```

Listing 22. Spacewalk client repository install command. [11.]

Extra packages may be needed when installing the Red Hat tools. These EPEL repositories (see listings 23- 24) will provide the needed packages:

RHEL 5 / CentOS 5:

```
BASEARCH=$(uname -i)
#rpm -Uvh
http://dl.fedoraproject.org/pub/epel/5/$BASEARCH/epel-
release-5-4.noarch.rpm
```

Listing 23. EPEL repository install command. [11.]

RHEL 6 / CentOS 6:

```
# BASEARCH=$(uname -i)
#rpm -Uvh
http://dl.fedoraproject.org/pub/epel/6/$BASEARCH/epel-
release-6-7.noarch.rpm
```

Listing 24. EPEL repository install command. [11.]

After repositories are setup, the required client packages can be installed:

```
#yum install rhn-client-tools rhn-check rhn-setup rhnsd
m2crypto yum-rhn-plugin
```

Listing 25. Spacewalk client package installation command. [11.]

SLES requires a different repository. In SLES 11 openSUSE 12 repositories will be used. These will work fine with it. Install the repository with the following command:

```
# zypper ar -f
http://download.opensuse.org/repositories/systemsmanagement
:/spacewalk/SLE_11_SP2/systemsmanagement:spacewalk.repo
```

Listing 26. Spacewalk client repository for SLES installation command. [11.]

After the repository is installed SLES requires several packages. Installation is done with command given below:

```
# zypper install rhn-client-tools zypp-plugin-spacewalk
rhnspd rhn-setup rhn-check yum
```

Listing 27. Spacewalk client installation command for SLES. [11.]

These packages will enable different features in Spacewalk. After installation finishes, disable Spacewalk and all other repositories so client will not try to update packages from that repository. This is done from `/etc/yum.repos.d/<repository-name>.repo` file by switching enabled value to 0. In SLES, repositories are disabled in the same way but from the directory `/etc/zypp/repos.d/`. Registering the system can now be done as listing 28 suggests:

```
#rhnreg_ks --serverUrl=http://<Spacewalk-server-URL>/XMLRPC
--activationkey=<activation key number>
```

Listing 28. Client registration command. [11.]

The server URL is the address for the Spacewalk server and the activation key is the unique Spacewalk activation key for example: 2-12345678912345678912345678912345. Make sure that the correct activation key is used for the registration. The system will now be displayed on Spacewalk systems tab.

If the system is registered with the wrong activation key, it can be re-registered to the Spacewalk. Re-registering is done with the following command:

```
#rhnreg_ks --serverUrl=http://<ip address>/XMLRPC --
activationkey=<activation key number> --force
```

Listing 29. Client re-registration command. [11.]

The command is almost same as the normal registration command but `--force` will force system to register even if it is found in Spacewalk. The system will be deleted from the existing group and added to the new one. [11.]

7 Maintenance

This section describes how to maintain Spacewalk. Spacewalk does not need much maintenance but it can be updated to the latest version. This section also describes how to restart Spacewalk and how to manage its processes.

7.1 Updating Spacewalk

Spacewalk upgrades are presented regularly. These patches include enhancements, new features and bug fixes. The Spacewalk upgrade requires a few prerequisites: enabled EPEL repositories, enabled CentOS/RHEL repositories and the Spacewalk repository needs to be replaced with the newest one for example when upgrading from 1.8 to 1.9, change the Spacewalk repository URL from the `/etc/yum.repos.d/` folder. [12.]

After the prerequisites are configured, upgrade the procedure start. First, the files need to be backed up. It is a good practice to use a different server when backing up files. Backup files are backed up with the following commands:

```
# scp -R /etc/sysconfig/rhn/* <ip address of backup
server>:/tmp/Backup/sysrhn
# scp -R /etc/rhn/* <ip address of backup
server>:/tmp/Backup/rhn
# scp -R /etc/jabberd/* <ip address of backup
server>:/tmp/Backup/jabberd
# scp -R /root/ssl-build/* <ip address of backup
server>:/tmp/Backup/ssl-build
```

Listing 30. File transfer commands.[12.]

After backups are done, the administrator needs to take a backup of the PostgreSQL or Oracle databases. The dump file can also be sent to a remote server. The next procedure needs Spacewalk to be shutdown with the command given below:

```
#spacewalk-service stop
```

Listing 31. Spacewalk service stop command. [12.]

When Spacewalk has shut down all its processes, yum repositories must be updated. This command will update all packages in the Spacewalk system:

```
#yum upgrade
```

Listing 32. Update packages command. [12.]

After the packages have been upgraded, check all `.rpmnew/.rpmsave` files which were created during the upgrade procedure. These files describe the changes made to the configuration files. Run this command to ensure configuration files have been preserved:

```
# yum install rpmconf
# rpmconf -a
```

Listing 33. Package installation command. [12.]

The next procedure is schema upgrading. This upgrades the database schema of the Spacewalk server. Make sure that Spacewalk is still in shutdown state:

```
#spacewalk-service status
```

Listing 34. Show Spacewalk status command. [12.]

If Spacewalk processes are shut down, the database schema can be upgraded. Make sure that a backup exists of the database. The schema can be upgraded with the following command:

```
#spacewalk-schema-upgrade
```

Listing 35. Spacewalk database upgrade command. [12.]

Schema upgrade logs can be found in `/var/log/spacewalk/schema-upgrade`. If the upgrade fails, the cause of the failure will be displayed in the log file. When the upgrade fails, the recommended procedure is to first investigate, then restore from backup, fix the cause and rerun the `spacewalk-schema-upgrade` command. After a successful database upgrade, Spacewalk configuration needs to be upgraded. This is done with the command given below:

```
#spacewalk-setup -disconnected -external-db -upgrade
```

Listing 36. Spacewalk configuration after upgrade command. [12.]

After the update is done, restore the modified values from the `/etc/rhn/rhn.conf` file. When done, the administrator can start the Spacewalk service with the command below:

```
#spacewalk-service start
```

Listing 37. Start Spacewalk command. [12.]

Spacewalk will start all its required processes. Now Spacewalk is upgraded to the latest version. [12.]

7.2 Manage Spacewalk

Spacewalk processes can be managed from the command line or from the web interface Admin tab. It is recommended to use the command line if Spacewalk freezes or any problems occur. Spacewalk processes can be managed with the following command:

```
#spacewalk-service start/stop/status/restart
```

Listing 38. Spacewalk service commands. [3.]

The start sub-command will start all Spacewalk services. Stop will halt Spacewalk. This is good to do before restarting the platform server or doing changes to Spacewalk core files. The status shows all processes of Spacewalk and their status. This is good for for example troubleshooting purposes to see what processes are up and running and which are not. The restart sub-command will make stop and start commands automatically. Spacewalk has a built in debug command as shown in listing 39:

```
#spacewalk-debug --dir
```

Listing 39. Spacewalk debug command. [6.]

This command is a utility for troubleshooting problems with Spacewalk. It packages all log files to a designated folder with the `--dir` parameter. This command provides full diagnostics of Spacewalk server issues.

Spacewalk-debug and *spacewalk-service* commands are the most important commands in Spacewalk. Administrators can solve most of the issues with only these two commands. [6]

8 Conclusion

The goal of this project was to create working Linux management software for Capgemini Finland. Spacewalk was selected as the management software because it is a pioneer in the Linux management. The main objectives were that with Spacewalk the company's administrators could easily manage multiple systems at the same time, deploy updates, deploy configuration files and have role based access control. These objectives were successfully added to Spacewalk.

Difficulties included implementing the SLES operating system to the Spacewalk. This was difficult because SLES is based on its own Linux distribution and support is minimal. All difficulties were beaten with work around solutions, such as a local SLES repository server had to be created because repositories could not be gathered from Novell sites.

In the future, Spacewalk could be enhanced by delivering updates to the Solaris systems and deploying a monitoring feature. Also an audit feature could be implemented, so customers could get automatic reports of their systems.

Overall this project was a success. Spacewalk is now running and it has already been implemented to the Capgemini infrastructure.

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