

**Oracle® Communications Application
Session Controller**

System Installation and Commissioning Guide

Release 3.8.0

Revision 1

September 2019

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Preface

About OS-E® Documentation

The OS-E references in this documentation apply to the OS-E operating system software that is used for Oracle Communications Application Session Controller (ASC).

Unless otherwise stated, references to OS-E in this document apply to all of the Oracle and third-party vendor products that use OS-E software.

The following documentation set supports the current release of the OS-E software.

- *Oracle Communications Application Session Controller System and Installation Commissioning Guide*
- *Oracle Communications Application Session Controller Management Tools*
- *Oracle Communications Application Session Controller System Administration Guide*
- *Oracle Communications Application Session Controller Session Services Configuration Guide*
- *Oracle Communications Application Session Controller Objects and Properties Reference*
- *Oracle Communications Application Session Controller System Operations and Troubleshooting*
- *Oracle Communications Application Session Controller Release Notes*
- *Oracle Communications Application Session Controller Single Number Reach Application Guide*

- *Oracle Communications Application Session Controller Web Services SOAP REST API*
- *Oracle Communications WebRTC Session Controller Installation Guide*

Revision History

This section contains a revision history for this document.

Date	Revision Number	Description
September 2019	Revision 1.00	• Added the “Upgrading/Downgrading instructions for unixODBC and net-SNMP”.

Conventions Used in This Manual

Typographical Conventions

Key Convention	Function	Example
key name	Identifies the name of a key to press.	Type abc , then press [ENTER]
CTRL+x	Indicates a control key combination.	Press CTRL+C
brackets []	Indicates an optional argument.	[portNumber]
braces { }	Indicates a required argument with a choice of values; choose one.	{enabled disabled}
vertical bar	Separates parameter values. Same as “or.”	{TCP TLS}
Monospaced bold	In screen displays, indicates user input.	config> config vsp
Monospaced italic	In screen displays, indicates a variable—generic text for which you supply a value.	config servers> config lcs <i>name</i>
bold	In text, indicates literal names of commands, actions, objects, or properties.	...set as the secondary directory service (with the unifier property)...
bold italic	In text, indicates a variable.	...set the domain property of the directory object.

Acronyms

The OS-E manuals contain the following industry-standard and product-specific acronyms:

AAA	Authentication, authorization, and accounting
ALI	Automatic location identifier
ANI	Automatic number identification
ANSI	American National Standards Institute
AOR	Address of record
API	Application programming interface
ARP	Address Resolution Protocol
AVERT	Anti-virus emergency response team

B2BUA	Back-to-back user agent
BOOTP	Bootstrap Protocol
CA	Certificate authority
CAP	Client application protocol
CBC	Cipher block chaining
CBN	Call back number
CCS	Converged Communication Server
CDR	Call detail record
CIDR	Classless interdomain routing
CLI	Command line interface
CMOS	Comparison mean opinion score
CNAME	Canonical name record
CNI	Calling number identification
CODEC	Compressor/decompressor or coder/decoder
CPE	Customer-premise equipment
CRL	Certificate revocation list
CSR	Certificate signing request
CSTA	Computer-supported telecommunications applications
CSV	Comma-separated values
DDDS	Dynamic delegation discovery system
DHCP	Dynamic Host Configuration Protocol
DMZ	Demilitarized zone
DN	Distinguished name
DNIS	Dialed number identification service
DNS	Domain name service
DOS	Denial of service
EIM	Enterprise instant messaging
ESD	Electrostatic discharge
ESGW	Emergency services gateway
ESQK	Emergency services query key
ESRN	Emergency services routing number
FQDN	Fully qualified domain name

GUI	Graphical user interface
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
I2	National Emergency Number Association defined VoIP solution
ICAP	Internet Calendar Access Protocol
ICMP	Internet Control Message Protocol
IM	Instant messaging
IP	Internet Protocol
JDBC	Java database connectivity
JMX	Java management extensions
JRE	Java runtime environment
LATA	Local access and transport area
LCS	Live Communications Server
LCR	Least-cost routing
LDAP	Lightweight Directory Access Protocol
LIS	Location information service
MAC	Media access control
MCS	Multimedia Communications Server
MIB	Management information base
MOS	Mean opinion score
MSAG	Master street address guide
MTU	Maximum transmission unit
NAPTR	Naming authority pointer
NAT	Network address translation
NENA	National Emergency Number Association
NIC	Network interface card
NS	Name server
NSE	Named signaling events
NTLM	NT Lan Manager
NTP	Network Time Protocol
OC	Office Communicator
OCI	Open Client Interface

ODBC	Open database connectivity
OTP	Over temperature protection
OVP	Over voltage protection
PBX	Private branch eXchange
PEM	Privacy-enhanced mail
PERL	Practical Extraction and Reporting Language
PING	Packet internet groper
PKCS#12	Public Key Cryptography Standard #12
PKI	Public Key Infrastructure
PSAP	Public safety answering point
PSCP	PuTTY secure copy
PSTN	Public switched telephone network
QOP	Quality of protection
QOS	Quality of service
RADIUS	Remote Authentication Dial-in User Service
RTC	Real-time collaboration
RTCP	Real-time Control Protocol
RTP	Real-time Transport Protocol
RTT	Round-trip time
SATA	Serial ATA
SCSI	Small computer system interface
SDK	Software development kit
SDP	Session Description Protocol
SFTP	Secure Shell File Transfer Protocol
SIMPLE	SIP Instant Messaging and Presence Leveraging Extension
SIP	Session Initiation Protocol
SIPS	Session Initiation Protocol over TLS
SLB	Server load balancing
SMB	Server message block
SNMP	Simple Network Management Protocol
SOA	Server of authority
SOAP	Simple Object Access Protocol

SQL	Structured Query Language
S RTP	Secure Real-time Transport Protocol
SRV	Server resource
SSH	Secure Shell
SSL	Secure socket layer
SSRC	Synchronization source
STUN	Simple Traversal of UDP over NATs
TCP	Transmission Control Protocol
TDM	Time division multiplexing
TGRP	Trunk group
TLS	Transport Layer Security
TOS	Type of service
TTL	Time to live
UPS	Uninterruptable power supply
US	User agent
UAC	User agent client
UAS	User agent server
UDP	User Datagram Protocol
UID	Unique identifier
URI	Uniform resource identifier
URL	Uniform resource locator
UTC	Universal coordinated time
VoIP	Voice over IP
VLAN	Virtual local area network
VPC	VoIP positioning center
VRRP	Virtual Router Redundancy Protocol
VSP	Virtual system partition
VXID	Virtual router interface ID
WAR	Web application resource
WAV	Waveform audio
WM	Windows Messenger
WSDL	Web Services Description Language

XML

Extensible Markup Language

XSL

Extensible Stylesheet Language

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Chapter 1. OS-E® Series Overview

About this Chapter

This chapter provides an overview of the Oracle OS-E® Series software. In addition to running on Oracle hardware offerings, OS-E software is supported on compatible third-party platforms and blades.

Supported Platforms for the OS-E

You can run the OS-E on a number of supported x86 servers.

The following platforms have been certified for use with the OS-E:

- Oracle Netra X3-2
- Oracle Netra X5-2
- Oracle Server X7-2

The following VM platforms have been certified for use with the OS-E:

- VMware version 6.7
- KVM version 1.5.3

Information on OS-E Software and Licensing

Using the Internet and secure Web URLs, Oracle provides all necessary software downloads for USB creation, product licensing, and commissioning of your selected hardware.

As part of each download, and depending on your actual requirements, Oracle can provide the following:

- Oracle USB Creation Utility with the OS-E software
- Documentation on how to create an Oracle USB stick and commission the OS-E software on your selected hardware
- Standard set of Oracle OS-E technical publications
- Royalty-bearing codec licenses (if purchased)

You must provide a USB stick with 4GB storage to handle Oracle software downloads. Oracle has tested a variety of USB sticks available from current suppliers and manufacturers. Most USB sticks manufactured today will work.

For complete information on accessing the Oracle download server, creating an installation USB stick, and commissioning OS-E systems, refer to Chapter 7, *Creating and Commissioning USB Sticks*.

Obtaining Your License

ASC 3.8.0 supports self-entitlement of licenses, where customers can provision the number of licenses that they have purchased for the system. Note that even though these licenses are no longer controlled by license key, the customer must still purchase licenses in sufficient quantity to cover all uses.

If you are running OS-E version 3.8.0 or later and are NOT using Royalty-bearing codecs, you should begin using the default shipping license. There is no loss of functionality as a result.

The default license enables the maximum number of sessions for the system. In the past, the software stopped allowing new sessions at your specific licensed maximum depending on the license. The system no longer relies on the license to apply an upper limit. However, depending on the server hardware in use, the system may not be capable of supporting a higher number of sessions. You may want to edit your configuration file and add the parameters for the maximum number of media session to be sure that you do not exceed the capabilities of your hardware. This applies to most deployments running a small number of sessions on smaller third-party hardware that could potentially have a problem if traffic increases to a number larger than the system can handle.

Note: You may continue using the legacy licensing system or you may transition to self-provisioning entitlements. In both cases, ensure that your system's functionality abides by your organization's contractual obligations with Oracle.

The following are the royalty-bearing codecs supported by the OS-E:

- AMR-WB
- AMR-NB

License Expirations and Renewals

If your customer-specific license comes with an expiration date, the OS-E system will generate an event 30 days prior to the expiration date. Contact your Oracle Sales Representative to complete the purchase of the features that you are testing. These expiring licenses should apply only to customers testing royalty-bearing codecs in the transcoding feature of the OS-E.

System Management

Before you install the system, you should decide on the management tool(s) that you want to use to configure and monitor the system. This will help you decide where you need to create connections based on your equipment and network resources.

System management capabilities include the following secure management interfaces:

- The OS-E command line interface (CLI) from a local console, Telnet, or SSH connection
- The OS-E Management System, a graphical user interface (GUI) that supports remote management using the Internet Explorer Web browser
- Simple Network Management Protocol (SNMP) using third party SNMP MIB compiler/browser applications
- Web Services Description Language (WSDL) and Simple Object Access Protocol (SOAP) messaging using the software development kit (SDK)

For information on configuring the management options, refer to *Oracle Communications OS-E Management Tools*.

Chapter 2. Installing And Upgrading The OS-E System

About This Chapter

This chapter covers OS-E system installation and upgrading.

Installing the OS-E

For release 3.8.0, as 3.7.1 and 3.7.0M4, the OS-E runs on Oracle Linux and uses yum to install and update RPM files. In the releases prior to 3.7.0M4, the OS-E install package came with its own custom kernel.

Note: While the OS-E operates under Oracle Linux, it is not certified to operate under other Linux environments.

You must have Oracle Linux Release 7.5 installed on your hardware prior to installing the OS-E for 3.8.0.

Note: If you are upgrading an older version of OS-E software as opposed to performing a fresh installation, Oracle recommends you create a USB rescue stick to preserve the existing configuration to install on the new software. For more information on creating a USB rescue stick, see “Creating a New USB Rescue Stick” in *Chapter 7, Creating and Commissioning USB Sticks*.

To install the OS-E you must:

- Install Oracle Linux version 7.5
- Download and copy the OS-E file to a USB stick
- Mount the OS-E software onto your hardware

- Configure a yum repository on which to point Oracle Linux
- Install the OS-E appliance

Installing Oracle Linux 7.5

Before you can install the OS-E, you must have Oracle Linux installed on your hardware. You can either install Oracle Linux via a USB stick or a DVD. This guide documents installing Oracle Linux via a USB.

Note: When you install Oracle Linux via a USB stick, you must have a 16 GB or bigger USB drive.

For a much more comprehensive and thorough description of installing Oracle Linux 7.5, see https://docs.oracle.com/cd/E52668_01/E54695/E54695.pdf.

To install Oracle Linux via a USB stick:

1. Download “Oracle Linux 7.5 for x86 64 bit ISO image” from <http://edelivery.oracle.com/linux>.
2. Create a bootable USB stick that contains the full Oracle Linux 7 ISO image. The following example uses Rufus 2.8 software to create the bootable USB stick.



Note: You can also install Oracle Linux via a DVD by downloading “Oracle Linux 7.5 for x86 64 bit ISO image” from <http://edelivery.oracle.com/linux> and burning the *.iso image onto a DVD.

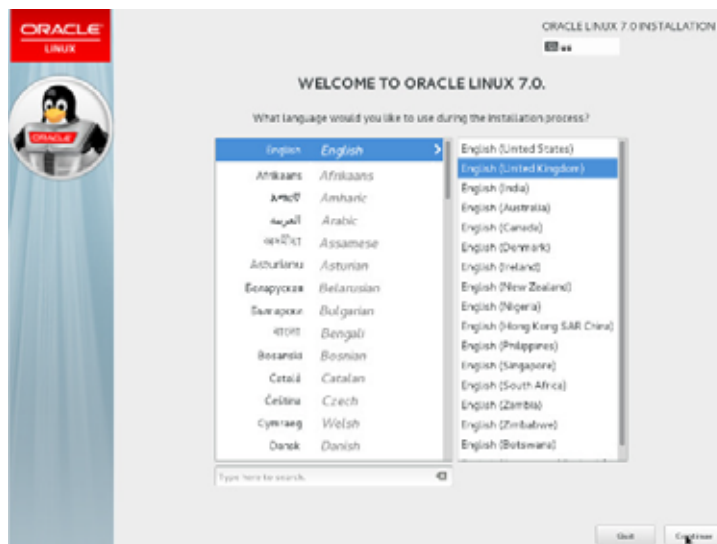
3. Insert your bootable Oracle Linux 7 USB drive onto your hardware.
4. Boot the system from the boot image by selecting **Boot from usb** from the boot menu options.

The system locates the boot image file and the boot menu appears.



5. Select **Install Oracle Linux 7.5** and hit <Enter>.

6. Select the appropriate language and select **Set keyboard to default layout for selected language**. Click **Continue**.



The “Installation Summary” screen appears.

7. Complete any marked items. Depending on your requirements, you may also need to alter the default settings by clicking on the relevant links.



8. Click **Installation Destination**.

9. Select the local disks you want to use for the installation.



Note: The installation program does not make any changes to any of the disks and storage until you click **Begin Installation** on the “Installation Summary” screen.

- Choose the disks on which you want to install Oracle Linux from the “Local Standard Disks” section. A tick icon displays next to the selected disks.
- Ensure the **Automatically configure partitioning** option is selected (by default, this option is selected).
- At the bottom of the screen, the system displays how much disk space you need for the software you have selected. With automatic partitioning, you may not have sufficient space to install the software if the disk is already partitioned. If you need to free some disk space, select **I would like to make additional space available** and click **Done**.

Note: You must have disk size of at least 70 G.

The “Reclaim Disk Space” window appears.



Note: If there is still insufficient disk space when you click **Done**, the system prompts you to free disk space.

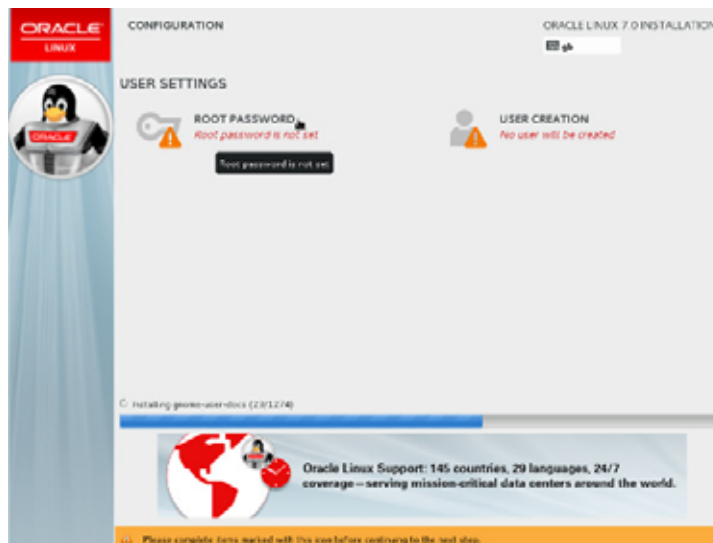
- Once you have selected the disks you want to use, click **Delete all** to free disk space and then click **Reclaim Space**.

For more information on configuring partitioning, see https://docs.oracle.com/cd/E52668_01/E54695/E54695.pdf.

10. Click **Begin Installation** once you have completed any necessary updates to the default configuration.



11. Click **Root Password**.

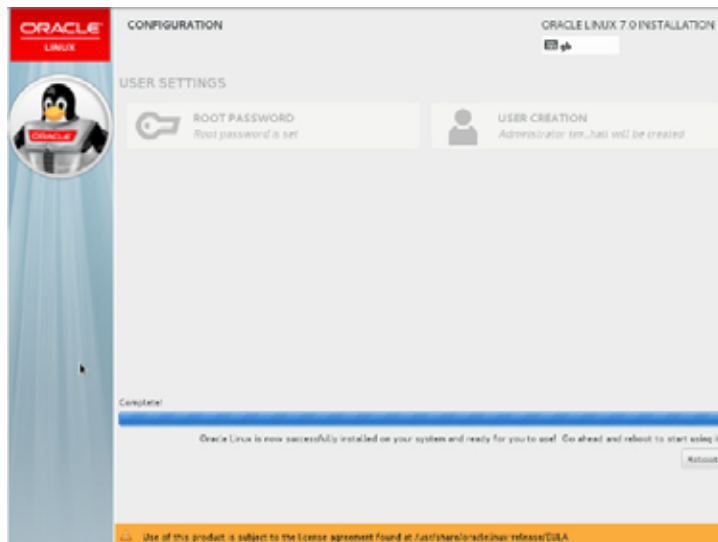


12. Enter the root password and click **Done**.



Linux installs.

13. Click **Reboot** when prompted.



14. Run the following command to rename the Ethernet devices according to your system BIOS once you successfully complete the installation.

```
grubby --args=net.ifnames=0 --update-kernel=ALL
```

15. Reboot the system.

Obtaining the OS-E Installation File

Before you can install the OS-E, you must first download the ISO files you need and copy them to a USB stick.

Software can be downloaded from either the Oracle Software Delivery Cloud or the My Oracle Support Patches and Updates tab.

To access the Oracle Software Delivery Cloud:

1. Access the <https://edelivery.oracle.com> link.
2. Select the **Sign In/Register** tab and enter your **username** and **password**.
Note: If you are a new user, you must create an account.
3. Click the checkbox to agree to the to the **Oracle Trial License Agreement and Export Restrictions** and click **Continue**.
4. From the list, select **Download Package**.
5. In the text field, enter **Oracle Communications Application Session Controller** and click **Search**. The search list appears.
6. Select the Oracle Communications Application Session Controller E3.8.0 from the search results.
7. From the **Platform** list, select the required platform.
8. Click **Continue**. The license agreement appears.
9. Review and accept the terms and click **Continue**. The File Download Box appears.
10. Select the zip file and click **Download** to download the file.
11. Copy the file onto a USB stick.

To access the Oracle Support Software Patches and Updates:

1. Log into the My Oracle Support Portal.
2. Select the **Patches and Updates** tab.
3. Select the **Search** tab and click **Product or Family (Advanced)**.

4. **Product:** Enter **Oracle Communications Application Session Controller**.
5. **Release:** Enter **Application Session Controller 3.8.0.0.0**.
6. Click **Search**. The available distribution formats appear and include the following information:
 - Patch Name
 - Description
 - Release
 - Platform (Language)
 - Classification
 - Product
 - Prerequisite Requirement
 - Size
 - Download Access
7. Select the distribution format that you require.
8. Click either **Download** to download the file or **Read Me** to view the Build Notes for this patch.
9. Copy the file onto a USB stick.

Mounting the OS-E Installation file

Once you have the installation file, you must install it on your hardware.

To mount the OS-E installation file:

1. Insert the USB stick onto your hardware and locate the USB stick partition to mount (for example, /dev/sdd1).

```
[root@localhost]# sudo <fdisk -l>
```

2. Create a mount point and mount the installation file.

```
[root@localhost]# sudo mkdir /mnt/<mount point name>
[root@localhost]# sudo mount /dev/sdd1 /mnt/usb
```

3. Check the installation file. The original installation file is a ZIP file. Extract the installation file via "unzip".

Note: If your system does not have the "unzip" package installed, execute the **yum install unzip** command in advance.

Note: The following is an example and uses example values only.

```
[root@localhost]#cd /mnt/usb
[root@localhost]#unzip V980558-01.zip
Archive:  V980558-01.zip
inflating: nnSE371m0-017iso-a72231.iso
```

Then, run below commands to extract it into another directory:

```
[root@localhost]#cd /mnt/<mount point name>
[root@localhost]# sudo mount /mnt/usb/<ASC iso file name> /mnt/<mount
point name>
[root@localhost]# ls -l /mnt/<mount point name>
total 18
drwxrwxr-x. 3 6789 6789 4096 Nov  9 05:52 asc
drwx----- 3 6789 6789 2048 Nov 25  2015 EFI
drwx----- 3 6789 6789 2048 Nov 25  2015 images
drwx----- 2 6789 6789 2048 Nov 25  2015 isolinux
-rw-rw-r-- 1 6789 6789 1063 Nov  9 05:52 ks_ol7_asc_appliance.cfg
-rw-rw-r-- 1 6789 6789  644 Nov  9 05:52 ks_ol7_asc_application.cfg
-rw-rw-r-- 1 6789 6789  642 Nov  9 05:52 ks_ol7_asc_container.cfg
drwx----- 2 6789 6789 2048 Nov 25  2015 LiveOS
-r--r--r-- 1 6789 6789 1796 Nov  9 05:52 TRANS.TBL
```

Configuring a Yum Repository

Oracle Linux 7 uses “yum” to install and update RPM files. Yum uses a URL to point at repositories. The URL must be pointed to the mounted USB directory you create when you mount the installation file, described in [Mounting the OS-E Installation file](#)

To configure a yum repository:

1. Create the repository entry using root permissions.

```
cat >/etc/yum.repos.d/asc.repo <<EOF
[asc-base]
name=Application Session Controller Base Repository
baseurl=file:///mnt/<mount point name>/asc
gpgcheck=0
exclude=libunwind
enabled=1

EOF
```

Note: The path for the baseurl depends on which directory the installation files are extracted into per above steps.

Configuring a Yum Repository for Oracle Linux 7

You must point the baseurl in the “public-yum-ol7.repo” file to an Oracle Linux 7 ISO DVD image partition.

1. Point the baseurl in the “public-yum-ol7.repo” file to an Oracle Linux 7 ISO DVD image partition.

Note: The following is an example and uses example values only.

```
vi /etc/yum.repos.d/public-yum-ol7.repo
```

```
[ol7_latest]
name=Oracle Linux $releasever Latest ($basearch)
baseurl=http://ap-yummy.us.oracle.com/oracle/OracleLinux/OL7/latest/
$basearch/
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
gpgcheck=1
enabled=0

[ol7_u5_base]
name=Oracle Linux $releasever Update 5 installation media copy
($basearch)
baseurl=file:///mnt/cdrom/Packages
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
gpgcheck=1
enabled=1

[ol7_UEKR4]
name=Latest Unbreakable Enterprise Kernel Release 4 for Oracle Linux
$releasever ($basearch)
baseurl=http://ap-yummy.us.oracle.com/oracle/OracleLinux/OL7/UEKR4/
$basearch/
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
gpgcheck=1
enabled=0
```

Installing the OS-E Appliance

Once the yum repository is configured, you can install the OS-E appliance onto an Oracle Linux 7 system.

To install the OS-E appliance:

1. Enter the **yum install** command with root permissions.

```
[root@localhost]# yum install app-appliance
```

If lcrimport service is needed, enter the yum install command to install it.

```
[root@localhost]# yum install asc-app-emblcrimport
```

2. Run below command to fix a Postgres encoding mismatch problem.

```
[root@localhost]# /usr/bin/alignPostGresEncoding.sh
```

Note: This step must be done before reboot of the system in the next step. In case this step is not done before the reboot of the system for mistake, then the system will be running with the ASC applications without the fix of the Postgres encoding mismatch problem. It may impact the applications that invoke Postgres to create database records. The mitigation action is:

- Check the folder **/var/lib/pgsql/data** and make sure it is empty. If it is not empty, you should remove all files under this folder. (You must backup the files in another place before removal.)
- Run below command to fix a Postgres encoding mismatch problem

```
[root@localhost]# /usr/bin/alignPostGresEncoding.sh
```

- Reboot the system.

3. Reboot your Oracle Linux system so that it starts with the new OS-E appliance kernel required for the OS-E to operate properly.
4. Once you've successfully completed the installation, unmount the OS-E installation USB stick.

```
[root@localhost]# umount /mnt/usb/
```

Upgrading To 3.8.0 From Release 3.7.1

This section explains how to upgrade to release 3.8.0 from previous releases of the OS-E.

The direct upgrade path is supported from 3.7.1 to 3.8.0.

Note: After upgrade to 3.8.0, the ASC runs with the existing configuration, without any change. It is not mandatory, however, it is recommended to backup the configuration, files and database before the upgrade.

To upgrade to 3.8.0 from 3.7.1:

1. Mount the ASC iso image to mount point using the mount command, described in [Mounting the OS-E Installation file](#).

2. Edit `asc.repo` file in `/etc/yum.repos.d/` as described in [Configuring a Yum Repository](#).
3. Run the following command:
`yum upgrade`
4. Reboot the server instead of only restarting ASC using the following commands:
`NNOS-E>shell`
`[root@ASC cxc]# reboot`

Downgrading from 3.8.0 to 3.7.1

To downgrade from 3.8.0 to 3.7.1:

1. Mount the ASC release 3.7.1 iso image to mount point using the mount command, described in [Mounting the OS-E Installation file](#).
2. Edit the `asc.repo` file in `/etc/yum.repos.d/` as described in [Configuring a Yum Repository](#).
3. Go to the `/mnt/<mount point name>/asc` directory, where the ASC iso image is mounted. Run the following command:
`yum downgrade *.rpm`
`yum reinstall kernel*.rpm`
4. Reboot the server instead of only restarting ASC using the following commands:
`NNOS-E>shell`
`[root@ASC cxc]# reboot`

If another upgrade follows the downgrade, perform the following procedure to upgrade to release 3.8.0:

1. Mount the ASC iso image to mount point using the mount command, described in [Mounting the OS-E Installation file](#).
2. Edit `asc.repo` file in `/etc/yum.repos.d/` as described in [Configuring a Yum Repository](#).
3. Go to the `/mnt/<mount point name>/asc` directory, where the ASC iso image is mounted. Run the following command:
`yum upgrade`
`yum reinstall kernel*.rpm`
4. Reboot the server instead of only restarting ASC using the following commands:

```
NNOS-E>shell  
[root@ASC cxc]# reboot
```

Checking ASC Version Number

After fresh installation, upgrade, or downgrade, the following commands can be used to check if the ASC version is expected:

```
NNOS-E>show version
```

```
NNOS-E>shell
```

```
[root@X32-ASC cxc]# uname -a
```

After the installation or upgrade to 3.8.0 is completed, Refer to Chapter 9 “Upgrading of unixODBC and net-SNMP” to check the ODBC and SNMP version, and upgrade if needed.

Chapter 3. Quick Commissioning New OS-E Systems

About This Chapter

The chapter provides the basic information that allows you to configure OS-E software after you have physically installed the system in your network. Commissioning enables an OS-E system or compatible third-party device to process locally registered SIP phone calls.

Prerequisites to Quick Commissioning

Before using the information in this chapter, make sure that you have properly installed and cabled the system, as covered in Chapter 1. The following OS-E documents provide additional information on configuring Session OS-E services, as well as how manage the system using the OS-E CLI and the OS-E Management System.

- *Net-Net OS-E – System Administration Guide*
- *Net-Net OS-E – Objects and Properties Reference*
- *Net-Net OS-E – Management Tools*

Additionally, the *Net-Net OS-E – Release Notes* provides important information about the software that you should review before commissioning a system in your network.

Steps 1 through 5 cover the tasks and services for getting the system up and running on an IP network so that the Ethernet interfaces can process SIP sessions. When enabled on an IP network, you can manage the system and its configuration remotely over the Internet using the OS-E Management System.

Steps 6 through 10 cover the tasks that allow you to control and monitor SIP sessions, as well as store call detail records and recordings.

Building the Configuration File

The OS-E configuration file (*cxc.cfg*) is made up of configuration objects and property settings that control how the system processes and manages SIP traffic. As you open these objects and set properties using the CLI or the OS-E Management System, the software builds a configuration hierarchy of objects that are applied to SIP sessions. You can display this configuration hierarchy using the **show** and **show -v** (verbose) commands.

For new users, as well as for users who are adding functionality to their configuration, you will need to open configuration objects using the **config** command to enable the default settings for those objects, even if you choose not to edit any of their associated properties. For example, if you need to enable the **ICMP** protocol and its default settings, you simply open the object and execute **return**, as shown in the session below. Notice that the ICMP object has been added to the configuration hierarchy at the end of the session on the eth4 interface.

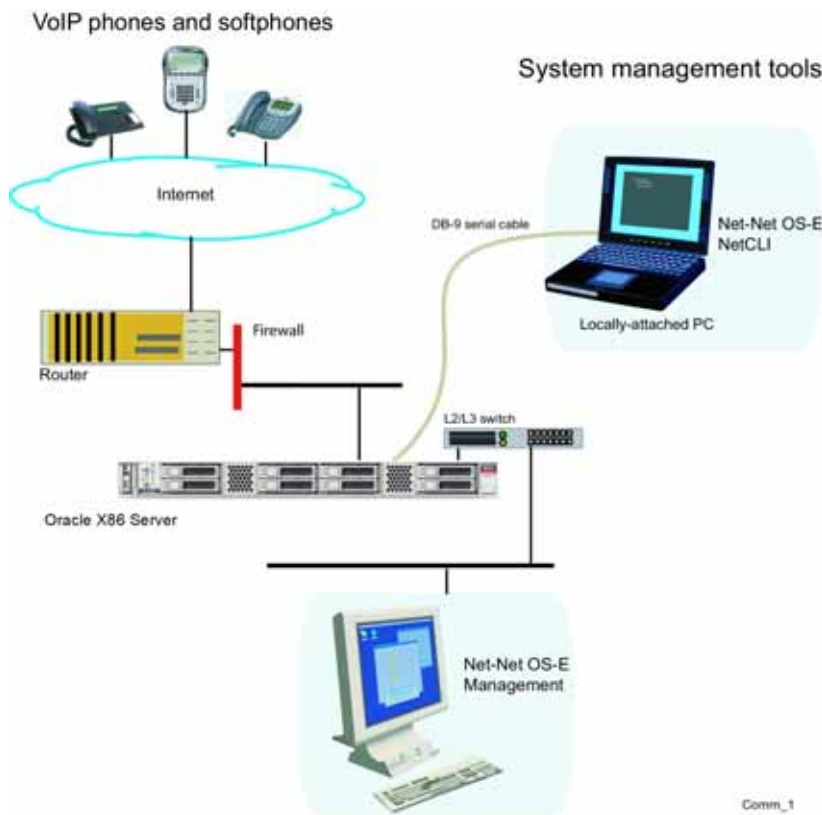
```
config> config box interface eth4
config interface eth4> config ip 172.26.2.14
config ip 172.26.2.14> config icmp
config ip 172.26.2.14> return
config interface eth4> return
config box> return
config> show -v
interface eth4
  admin enabled
  mtu 1500
  arp enabled
  speed 1Gb
  duplex full
  autoneg enabled
  ip 172.26.2.14
    admin enabled
    ip-address dhcp
    geolocation 0
    metric 1
    classification-tag
    security-domain
    address-scope
    filter-intf disabled
    icmp
      admin enabled
```

```
limit 10 5
```

To remove an object from the configuration hierarchy, use the CLI or OS-E Management System **delete** command.

Basic Network Topology

The following image illustrates a network topology using the OS-E with a directly-attached PC for initial setup, and the OS-E Management System for remote access using a graphical user interface.



Step 1. Configuring Basic IP Connectivity

Before you can manage an OS-E system remotely over the Internet using the OS-E Management System or over a Telnet or SSH connection, you need to locally assign an IP address to one of the Ethernet interfaces, **eth0**, **eth1**, **eth2**, or **eth3**. If you are setting up the device remotely, you will also need to configure an IP route, a route to a destination host or network, and a gateway IP address.

If you are using the OS-E Management System, you will also need to know the assigned IP address on one of the Ethernet ports to manage the OS-E configuration. The OS-E Management System application runs directly on the OS-E system over the Internet using the Internet Explorer Web browser.

The following CLI session creates and enables an IP interface named **192.168.124.5**, sets the static IP address and network mask, configures an IP route (if connecting remotely), and enables Web access on this IP interface. You will need to enable ICMP on the OS-E IP interface before you can use the **ping** command from your console to test the device as a responding node on the network. Use the **show -v** command to display the configuration.

CLI Session

```
NNOS-E> config box
config box> set hostname local2610
config box> config interface eth1
config interface eth1> config ip mgmt-int
Creating 'mgmt-int'
config mgmt-int> set admin enabled
config mgmt-int> set ip-address static 192.168.124.5/24
config mgmt-int> config routing
config routing> config route internetGateway
Creating 'route internetGateway'
config route internetGateway> set destination default
config route internetGateway> set gateway 192.168.124.3
config route internetGateway> return
config routing> return
config ip mgmt-int> config web
config web> set admin enabled
config web> set protocol http 80
config web> return
config mgmt-int> config icmp
config icmp> set admin enabled
config icmp> top
config> save
config> show -v
```

Using the Setup Script

An optional configuration setup script called *cxc.setup* is now included with newly shipped systems. After installing a new system, you can run the script directly from the NNOS-E> prompt, as shown in the example session below.

The script presents a set of questions to help you with the initial system configuration. The information in the script includes the following:

- Local hostname
- IP interface names and addresses
- SSH and Web access
- Default route and any additional static routes per interface for remote management
- User-defined CLI prompt

Every OS-E system has a minimum of two Ethernet interfaces. Any Ethernet interface on the system can be used for management traffic, however, Oracle recommends the use of eth1, as eth0 is reserved for fault-tolerant clustering with other OS-E systems. Management traffic is also supported on any interface that is carrying private or public network traffic. This means that it would be possible to use eth1 to carry SIP traffic and management traffic.

CLI Session

```
NNOS-E> config setup
set box\hostname: <name>
config box\interface: eth1
set box\interface eth1\ip a\ip-address: <ipAddress/mask>
config box\interface eth1\ip a\ssh (y or n)? n
config box\interface eth1\ip a\web (y or n)? y
config box\interface eth1\ip a\routing\route: <routeName>
set box\interface eth1\ip a\routing\route localGateway\gateway:
<ipAddress>
set box\cli\prompt: <newPrompt>
Do you want to commit this setup script (y or n)? y
Do you want to update the startup configuration (y or n)? y
```



Note: The `/cxc` directory on the OS-E system may include vendor-specific scripts that address unique startup configuration requirements. Specify the name of the script on the command line following the **config setup** command. For example:

```
NNOS-E> config setup vendor.setup
```

Check the `/cxc` directory for any vendor-specific setup files included with your system.

Enabling Network Access

To ensure you can manage the system using services such as Telnet or the OS-E Management System, you must configure the OS-E system so that it is available on the network. You need to create a default (or static) IP route, a route to a destination host or network, and a gateway IP address.

After you configure the static route, enable ICMP and then use the **ping** command at the top-level of the CLI to test network accessibility.

Defining a Default Route and Gateway IP

If you are setting the box remotely, you will need to configure an IP route, a route to a destination host or network, and a gateway IP address.

Refer to Step 1. Configuring Basic IP Connectivitythe previous section in this chapter, for the example CLI session that shows the routing context and the route named *internetGateway*. This is the default route that uses 192.168.124.3 as the default gateway.

Launching the OS-E Management System

In addition to the CLI, you can use the OS-E Management System to configure the OS-E. To access the OS-E using the OS-E Management System, open an HTTP or secure HTTP window (HTTPS) to the IP address of the Eth0 port on the OS-E system. For example:

```
https://192.168.124.5
```

You should see the Oracle OS-E Log In window, illustrated in the following image.

Oracle Net-Net OS-E

To access the NNOS-E management interface, you must first log in. Please provide your user name and password.

Username:	
Password:	
Login	

By default, there are no user accounts configured on a new system. This means any value can be entered in for username & password, or leave the fields blank and click **Login**. Once you log in, the OS-E Management System main page appears.

Root path: /

[Logout admin](#)
[Home](#)
[Configuration](#)
[Status](#)
[Call Logs](#)
[Event Logs](#)
[Actions](#)
[Services](#)
[Keys](#)
[Access](#)
[Tools](#)

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[\[www.oracle.com\]](#)

[NN ASC developers forum](#)

[Disable or enable NetBIOS](#)

[Set up SIP service](#)

[Set up secure SIP service](#)

[Set up Skype trunk](#)

Get summary for: Box 1 [Help](#)

box-identifier	0190-3db9-fc60-df8a	
box-status	IPAddress	LocalBox (10.113.71.41)
	State	Connected
	build-version	E3.7.1M0
	build-number	72231
master-services	accounting, authentication, cluster-master, database, file-mirror, registration, route-server, sampling	
up.time	time	13:02:59 Tue 2018-11-13
	timezone	EST
	uptime	0 days 03:05:38
system-info	cpu-usage-one-second	0%
call-info	active-calls	0
location-info	total-cache-entries	1
	location-bindings	1

The remaining steps in this chapter use the OS-E Management System to commission the OS-E.

Switching to the ACLI

From ASC380, we have to manually switch to the ACLI. For example:

```
[root@localhost ~]# login
```

NNOS-E

Copyright (c) 2004-2013 Oracle Inc.

```
username: admin
password: *****
NNOS-E>
```

Changing the Linux Root Password

To change the Linux root password, use the **secret root** action. When prompted, specify and confirm the new password. For example:

```
NNOS-E>secret root
password: *****
confirm: *****
Success!
NNOS-E>
```

Note: The password must be at least four characters long.

For more information on the **secret root** action, see the *Oracle Communications Application Session Controller Objects and Properties Reference Guide*.

Step 2. Configuring Advanced IP Connectivity

Use the **Configuration** tab or the CLI to configure several additional Ethernet interfaces, as covered in Step 1. As a security device, the NN 2600 Series uses a default setting of **disabled** for these objects in the configuration file. This means that you must enable each interface. These objects include:

- **SSH**—To enable SSH client connectivity on the interface
- **Media ports**—To enable a range of port numbers for on the interface
- **SIP**—To enable SIP traffic on the interface)

When editing Ethernet interface and examining each object using the OS-E Management System, note that many of the objects are already visible, but they are not yet enabled. For these objects to actually be enabled on the OS-E system, you must select the object and save the configuration.

After editing an interface configuration, select **Set**, then **Update & save configuration**, as illustrated in the following image.

ORACLE®

Configuration

Root path: /

Status Summary Logout

Home Configuration Status Call Logs Event Logs Actions Services Keys Access Tools

Configuration: all

Configuration Setup View

cluster DUT

box marty-dut1

interface eth0

ip mgmt

telnet

ssh

web

web-service

lcr-import-service

sip

icmp

routing

interface eth1

interface eth2

cli

processes

media-anchor-limits

box marty-dut2

vrrp

vsp

registration-service

default-session-config

policies

dial-plan

registration-plan

enterprise

accounting

Configuration Updated and Saved

The running configuration has been updated and saved.

Configure cluster DUTbox marty-dut1interface eth0ip mgmt Show basic

Set

Reset

Back

Copy

Delete

[Add allow rule](#), [Add deny rule](#)

general:

* name

mgmt

admin

enabled (Resource is active)

* ip-address

* type

static (static IP address)

* address/mask

10.138.216.241/22 (n.n.n.n/n)

geolocation

0

security-domain

enter or select from <Not configured>

address-scope

enter or select from <Not configured>

filter-intf

disabled (Resource is inactive)

media-ports

Configure

other properties:

metric

1 (from 0 to 1,000, default=1)

When you select **Configuration/Update and save configuration** you will be asked "Do you want to update the live configuration?" followed by "Do you also want to save the live configuration?" Click **OK** for both questions to ensure that the configuration is properly saved to the OS-E configuration file, *cxc.cfg*.

The following steps are necessary to set some specific parameters for the objects listed above:

1. Select the Configuration cluster **DUT/ box marty-dut1/interface eth0/ip mgmt** object on the left menu tree. Under the **General** field, edit the Media Ports properties as desired, then click **Set**.
2. Under the **Other Properties** field, edit the SSH properties. Accept the defaults by clicking **Set**.

3. Select **SIP** from the menu tree. Enter the following values for each fields:
 - admin: enabled (default)
 - NAT translation: disabled (default)
 - UDP port: Select **Add UDP port**, accept the defaults, then click **Finish->Set**.
 - TCP port: Select **Add UDP port**, accept the defaults, then click **Finish->Set**.
 - TLS port: Select **Add UDP port**, accept the defaults, then click **Finish->Set**.
 - Certificate: blank (default)

When you are finished editing the SIP fields, select **Set->Configuration/Update and save configuration**.

Note: The `/usr/share/snmp/cxc.conf` file is used only to configure SNMP community. For other SNMP configurations, the `cluster\box #\interface eth#\ip\snmp` file is used. The communities "public" (read-only) and "private" (read-write) are included by default in this file. However, You can add more communities or make changes as needed. Restart ASC after any changes so that the configuration changes can take effect.

Following is an example of the `/usr/share/snmp/cxc.conf` file:

```
[root@localhost snmp]# cat /usr/share/snmp/cxc.conf
rocommunity public
rwcommunity private
```

Step 3. Creating User Accounts for Basic Access

By default, the OS-E does not contain any predefined user accounts. This means it is possible to access the management interfaces without entering any login credentials (username and password). You are not required to create user accounts, but it may be desirable for security reasons. If you want to create a user account at this time, follow the steps below. If not, go directly to Step 4.

- Using the OS-E Management System, select the **Access** tab, then select **Access** from the left menu pane. The Access Permissions/Configure Access page appears.

Access Permissions
Root path: /

Home Configuration Status Call Logs Event Logs Actions Services Keys Access Tools

Access Permissions: all

Configuration Setup View

access

- permissions Superuser
- permissions admin
- permissions ops
- permissions alterpoint
- permissions maintenance
- users
- radius
- permission-filters

Configure access Help Index

Set Reset Delete

permissions	cli	gui	user-portal
Edit Delete permissions Superuser	advanced	enabled	enabled-advance
Edit Delete permissions admin	advanced	enabled	disabled
Edit Delete permissions ops	normal	enabled	disabled

- Under **permissions**, select **Add permissions** and create a permissions group called *super-user* and accept all default settings with all permission types enabled. Select **Set**, then select **Update and save configuration** from the Configuration pull-down in the left pane.
- From the **Directories** object, select **Add users**. Accept the default setting of enabled.
- Select **Add user** and enter the required **name** and **password** of your choice, then re-enter the password to **confirm** your original password entry. In the **permissions** field, choose the permissions group that you just created (*super-user*).
- Click **Create**. Select **Configuration->Update and save configuration**.

These steps created a username and password for a super-user account. Future attempts to log in to the OS-E (using the CLI or the OS-E Management System) will require that you specify these login credentials. If needed, you can also create user accounts with one or more of the super-user permissions.

Step 4. Enabling Master Services

The **master-services** configuration enables directory, accounting, database and registration services to run on the system. Perform the following steps to configure these master services:

1. Select the **Services** tab, then select **master-services** from the left menu pane.
2. Accept the default settings for **cluster-master**, **directory**, **accounting**, **database** (with **Show advanced** button selected), and **registration**. Click **Set**.

After you have configured all five services, select Configuration->**Update and save configuration**. The completed Master Services configuration should appear as shown in the following image.

The screenshot displays the Oracle Communications Application Session Controller configuration interface. The top navigation bar includes the Oracle logo, a 'Services' tab, and a 'Root path: /' indicator. Below the navigation bar, a 'Services' section is visible, showing a list of services on the left and a configuration area on the right. The left sidebar lists various services, including 'cluster-master', 'directory', 'accounting', 'database', and 'registration'. The right pane, titled 'Configure master-services', shows the configuration for these services. The 'cluster-master' service is selected, and its configuration is displayed. The 'admin' status is 'enabled' (Resource is active). The 'host-box' is set to 'cluster/box 1'. The 'group' is set to '1' (from 0 to 32, default=0). The 'directory' service is also shown, with 'admin' status 'enabled' (Resource is active), 'host-box' set to 'cluster/box 1', and 'group' set to '0' (from 0 to 32, default=0). The 'accounting' service is shown with 'admin' status 'enabled' (Resource is active), 'host-box' set to 'cluster/box 1', and 'group' set to '0' (from 0 to 32, default=0). The 'Show advanced' button is selected, and the 'Set' button is visible at the bottom of the configuration area.

Step 5. Configuring Basic Services

The **Services** configuration enables event logging and virus scanning services to run on the OS-E. Perform the following steps to configure event logging on the system.

1. Select the **Services** tab then select Services from the left menu pane.
2. On the Configure services page, select **event-log** from the menu pane, accept the defaults and click **Set**. Under the **event-log** configuration, additional options are available that you can configure, as illustrated in the following image.

The screenshot shows the Oracle Services configuration page for 'event-log'. The left sidebar lists various services, with 'event-log' selected. The main panel is titled 'Configure services/event-log' and includes buttons for 'Set', 'Reset', 'Back', and 'Delete'. It shows the 'admin' status as 'enabled' and a table of file logging configurations.

	file	admin	filter	size	count
Edit Delete	file_vrrp.txt	enabled	system, vrrp	10	5
Edit Delete	file_eventlog	enabled	all	10	5
Edit Delete	file_kmlsys	enabled	kml, kmlsys	10	5
Edit Delete	file_general	enabled	general, system	10	5
Edit Delete	file_db	enabled	db, dosDatabase	10	5
Edit Delete	file_access	enabled	access	10	5
Edit Delete	file_dos	enabled	dosSip	10	5
Edit Delete	file_acct	enabled	acct	10	5
Edit Delete	file_archive	enabled	archive	10	5

Below the table, there are links for 'Add syslog', 'Add file', 'local-database', 'external-database', and 'Add external-database'. The 'local-database' section shows 'admin' as 'disabled' and a 'history' field set to 10 days.

You can direct the event logs to one or more of the following locations:

- A syslog server
- An ASCII file in an OS-E directory
- A database on the OS-E system
- An external database

The following image shows a configuration that specifies that logs should be directed to a syslog host (at 192.168.215.1), a local file on the system, and the local database. The syslog system will receive messages of the system severity (or lower). The local file is named *messages* is created in the log directory.

The configuration also shows two filters: the first filter captures events of the *system* class with **debug** severity level, and the second filter captures event messages that match the **error** severity level. Refer to the *Net-Net OS-E – System Administration Guide* for information about event logs, syslog, and event filters.

3. In the **file** object, click **Edit**, then enter the name *event-log* in the text block. Click **Set**.

This configures event logging so that messages are written to the local file named *event-log*.

The screenshot shows the Oracle Net-Net OS-E Services configuration interface. The top navigation bar includes links for Home, Configuration, Status, Call Logs, Event Logs, Actions, Services, Keys, Access, and Tools. The main content area is titled "Configure services\event-log\file vrrp.txt" and includes buttons for Set, Reset, Back, Copy, and Delete. The configuration details are as follows:

- * file:** vrrp.txt
- admin:** enabled (Resource is active)
- filter:**

	filter	severity
Edit Delete	filter.system	info
Edit Delete	filter.vrrp	debug
- size:** 10 Mbytes (from 1 to 100, default=10)
- count:** 5 (from 1 to 20, default=5)

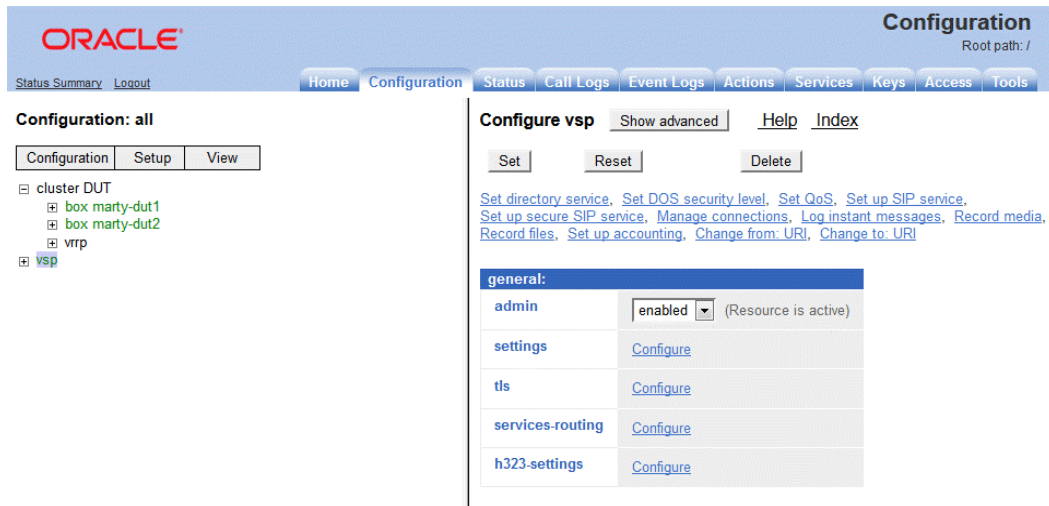
At the bottom, there are buttons for Set, Reset, Back, and Copy, along with links for Help and Index.

Step 6. Enabling the Virtual System Partition (VSP)

The OS-E virtual system partition (VSP) is the part of the system that holds the comprehensive customer-defined configuration that controls how the system processes, stores, directs, and routes SIP traffic. The VSP is where you can create session configurations, registration and dial plans, and policies that handle SIP REGISTER and SIP INVITE traffic (and other SIP methods) that the system will receive and forward to a SIP call destination, authentication and accounting database, VoIP service provider or carrier, enterprise server, and so on.

Using the OS-E Management System, perform the following steps.

1. Select the **Configuration** tab, then select **vsp** from the menu to open the Configure vsp page, as illustrated in the following image.



2. Under the general heading, change the **admin** state to **enabled**.
3. Click **Set**, then select **Configuration->Update and save configuration**.

Step 7. Configuring the Accounting Environments

This step is necessary to configure the system to store call detail records and voice call recordings.

1. Select the OS-E Management System **Configuration** tab, then select **vsp->accounting** from the menu to display the Configure vsp\accounting page, as illustrated in the following image.

The screenshot shows the Oracle Communications Application Session Controller Configuration interface. The top navigation bar includes the Oracle logo, the word "Configuration", and a "Root path: /" link. Below this is a menu bar with tabs: Home, Configuration, Status, Call Logs, Event Logs, Actions, Services, Keys, Access, and Tools. The "Configuration" tab is active. On the left, a tree view shows the configuration hierarchy: cluster DUT (with sub-items box marty-dut1, box marty-dut2, and vrrp), vsp (with sub-items default-session-config, policies, dial-plan, registration-plan, enterprise, and accounting), and database. The "accounting" item is selected. The main content area is titled "Configure vsp\accounting" and includes buttons for Set, Reset, Back, and Delete. It also has links for Show advanced, Help, and Index. The "options:" section shows the "admin" property set to "enabled" (Resource is active). The "targets:" section lists "radius" and "syslog" with "Configure" links. The "database" section shows the "admin" property set to "enabled" (Resource is active). Below this is a table for the "group" configuration.

group	group	admin	mode	server	call-fie
Edit Delete	group.test	enabled	duplicate	Edit	[Session Previous NextHo Disconr Packets Packets CodecC MaxLat Packets

2. Under **targets**, go to the **database** and set the **admin** property to enabled.
3. Select the database **Add group** command. The Edit group screen appears, as illustrated in the following image.

ORACLE Configuration
Root path: /

Status Summary Logout Home Configuration Status Call Logs Event Logs Actions Services Keys Access Tools

Configuration: all

Configuration Setup View

- cluster DUT
 - box marty-dut1
 - box marty-dut2
 - vrp
- vsp
 - default-session-config
 - policies
 - dial-plan
 - registration-plan
 - enterprise
 - accounting
 - database
 - group test

Create vsplaccounting|database|group testServer - Step 2 of 2: Edit server [Help](#) [Index](#)

group testServer >> server

Please configure a server for group testServer.

* name localdb

* type local (Write to the local database)

Previous Create Reset Cancel

- Enter *localdb* in the **target-name** field and select **Create** to display the Configure database group page, as illustrated in the following image..

ORACLE Configuration
Root path: /

Status Summary Logout Home Configuration Status Call Logs Event Logs Actions Services Keys Access Tools

Configuration: all

Configuration Setup View

- cluster DUT
 - box marty-dut1
 - box marty-dut2
 - vrp
- vsp
 - default-session-config
 - policies
 - dial-plan
 - registration-plan
 - enterprise
 - accounting
 - database
 - group test
 - group localdb

Configure vsplaccounting|database|group localdb [Show advanced](#) [Help](#) [Index](#)

Set Reset Back Copy Delete

* target-name localdb

admin enabled (Resource is active)

* mode duplicate (The system issues multiple duplicate accounting requ

* server

server	admin	type	username	password-tag
server localdb	enabled	local	postgres	postgres

[Edit](#) [Add server](#)

call-field-filter [Configure](#)

column-replacement-names [Add column-replacement-names](#)

batch-insert-size 25 (from 1 to 50, default=25)

custom-accounting disabled (Resource is inactive)

named-variable-entries [Configure](#)

Set Reset Back Copy

[Help](#) [Index](#)

- Click **Edit** and configure the following settings:
 - admin:** enabled
 - name:** localdb
 - type:** Select **local**

- **username:** postgres
- **password-tag:** postgres



Note: If you set the server **type** to *local*, using the local database as the accounting target, set the **username** and the **password-tag** to *postgres*. If you edit the **username** and **password-tag** properties to anything other than *postgres*, data will not be written to the database.

For information about password tags, refer to the *Net-Net OS-E – Objects and Properties Reference*.

6. Click **Set**, then select **Configuration->Update** and save configuration. The screen appears as illustrated in the following image.

ORACLE Configuration
Root path: /

Status Summary Logout Home Configuration Status Call Logs Event Logs Actions Services Keys Access Tools

Configuration: all

Configuration Setup View

- cluster DUT
 - box marty-dut1
 - box marty-dut2
 - vrp
- vsp
 - default-session-config
 - policies
 - dial-plan
 - registration-plan
 - enterprise
 - accounting
 - database
 - group test
 - group localdb
 - server localdb

Configure vsplaccounting/database/group localdb/server localdb Show advanced

Set Reset Back Copy

admin enabled (Resource is active)

* name localdb

* type local (Write to the local database)

username postgres

password-tag postgres [Manage Password](#)

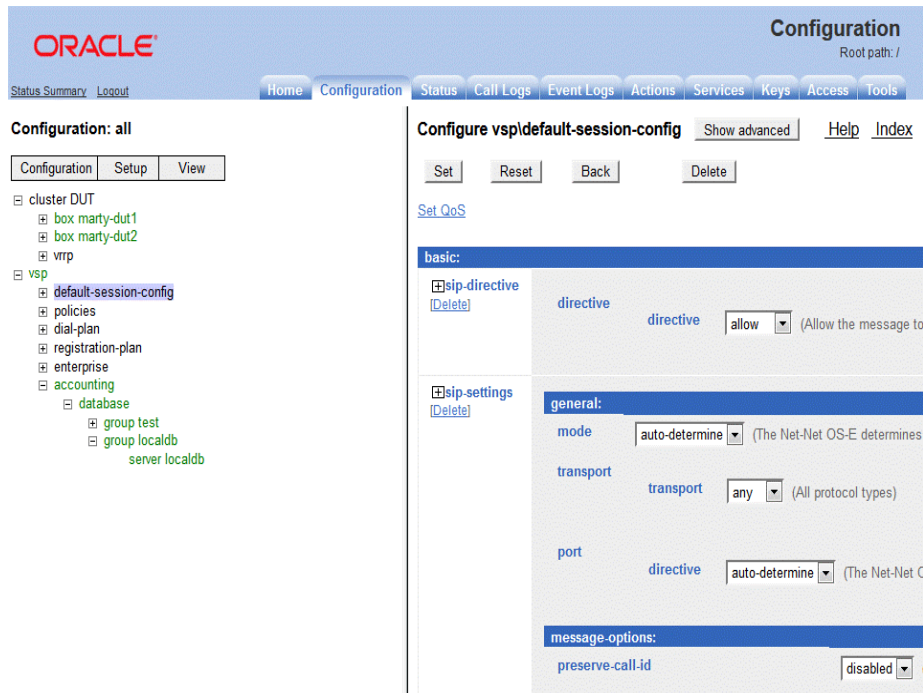
Set Reset Back Copy

[Help](#) [Index](#)

Step 8. Editing the Default Session Configuration

Step 8 configures a default system policy that allows the OS-E to process SIP traffic. By default, and for security purposes, the OS-E does not allow any SIP traffic to pass.

1. Select the Configuration tab, then select **vsp->default-session-config** from the menu to display the vsp/default-session-config page, as illustrated in the following image (top portion).



2. In the **sip-directive** object, change the directive policy to **allow**, if not already set. This allows SIP traffic to traverse the OS-E system. Click **Set**.
3. Scroll down to the **media** object. Change the **anchor** and the **recording-policy/record** properties to **enabled**. Accept all other default settings.
4. Click **Set**, then select **Configuration->Update and save configuration**.

Step 9. Enabling Registration Services

Step 9 enables the OS-E to handle SIP REGISTER sessions, allowing locally registered SIP clients to pass SIP sessions, as well as forward REGISTER sessions to upstream destination registrars.

1. Select the Configuration tab, then select **vsp/ registration-service** from the menu tree to display the vsp/registration-service page, as illustrated in the following image.

The screenshot shows the Oracle Communications Application Session Controller Configuration interface. The top navigation bar includes the Oracle logo, the title "Configuration", and a "Root path: /" link. Below this is a secondary navigation bar with tabs: Home, Configuration (selected), Status, Call Logs, Event Logs, Actions, Services, Keys, Access, and Tools. The main content area is titled "Configuration: all" and features a left-hand menu tree with expandable nodes: cluster DUT (containing box marty-dut1 and box marty-dut2), vrp, and vsp (containing registration-service, default-session-config, policies, dial-plan, registration-plan, enterprise, and accounting). The "registration-service" node is selected. The main panel is titled "Configure vsp/registration-service" and includes a "Show basic" button and links for "Help" and "Index". Below the title are "Set", "Reset", "Back", and "Delete" buttons. The configuration fields are as follows:

- admin**: A dropdown menu set to "enabled" with a note "(Resource is active)".
- max-expiration**: A text input field containing "as-requested", followed by "seconds or select from" and a dropdown menu set to "as-requested".
- min-expiration**: A text input field containing "as-requested", followed by "seconds or select from" and a dropdown menu set to "as-requested".
- session-linger**: A text input field containing "5", followed by "seconds(from 0 to 60,default=5)".

 At the bottom of the configuration area are "Set", "Reset", and "Back" buttons, along with "Help" and "Index" links.

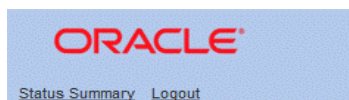
2. Accept the default settings and click **Set**. This enables the registration service on the OS-E system.

The OS-E will now provide support for basic SIP calls between locally registered clients.

Step 10. Reviewing the Configuration

Once you have completed Steps 1 through 9, review the configuration to make sure it is accurate. A quick way to do this is to scan the OS-E Management System navigation tree to make sure there is an entry for each of the objects that you configured.

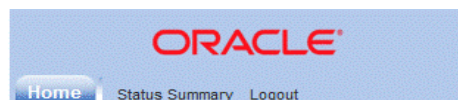
The following image is a listing of the Configuration and Services objects configured as part of basic OS-E commissioning. If you are using the CLI, run the **show -v** command from the NNOS-E prompt to display the configuration that you just created. The following image displays the configuration and services navigation trees.



Configuration: all

Configuration	Setup	View
---------------	-------	------

- [-] cluster DUT
 - [+] box marty-dut1
 - [+] box marty-dut2
 - [+] vrrp
- [-] vsp
 - registration-service
 - [+] default-session-config
 - [+] policies
 - [+] dial-plan
 - [+] registration-plan
 - [+] enterprise
 - [+] accounting



Services: all

Configuration	Setup	View
---------------	-------	------

- [-] services
 - [+] event-log
 - instrument
 - data-locations
 - storage-device
 - [+] collect
- [-] master-services
 - [+] cluster-master
 - [+] directory
 - [+] accounting
 - [+] authentication
 - [+] database
 - [+] registration
 - [+] call-failover
 - [+] route-server
 - [+] sampling
 - [+] jtapi
 - [+] events
- external-services
- [-] preferences
 - gui-preferences
- features

Chapter 4. Installing OS-E Clusters

About This Chapter

This chapter provides information on how to install an OS-E cluster, a group of OS-E systems that operate together to support redundancy and failover, high-availability, load balancing, and configuration.

OS-E Cluster Overview

A “high-availability” cluster is a group of OS-E systems that provides a single point of configuration management, and at the same time, expands functionality across multiple devices participating in the cluster. An OS-E *master* manages the configuration for the entire cluster. All members of the cluster share network resources, network load, media ports and streaming, registration, and other processes.

OS-E systems within a cluster may be geographically dispersed in the network. A cluster recovers from the failure of one or more cluster members through health monitoring, shared master services migration, and network redundancy using the Virtual Router Redundancy Protocol (VRRP).

A cluster can be set up to operate as a two-system primary/standby redundant configuration.

Cluster Operations and Services

In the two-system redundant configuration, one OS-E system is the active master, performing signaling & media processing, and the other OS-E system is available as a standby system for the signaling & media processing if the master fails. Master failover allows another OS-E system to assume the master role in the cluster should the originally configured master become unavailable. VRRP is responsible for handling the failover from the master to the backup device.

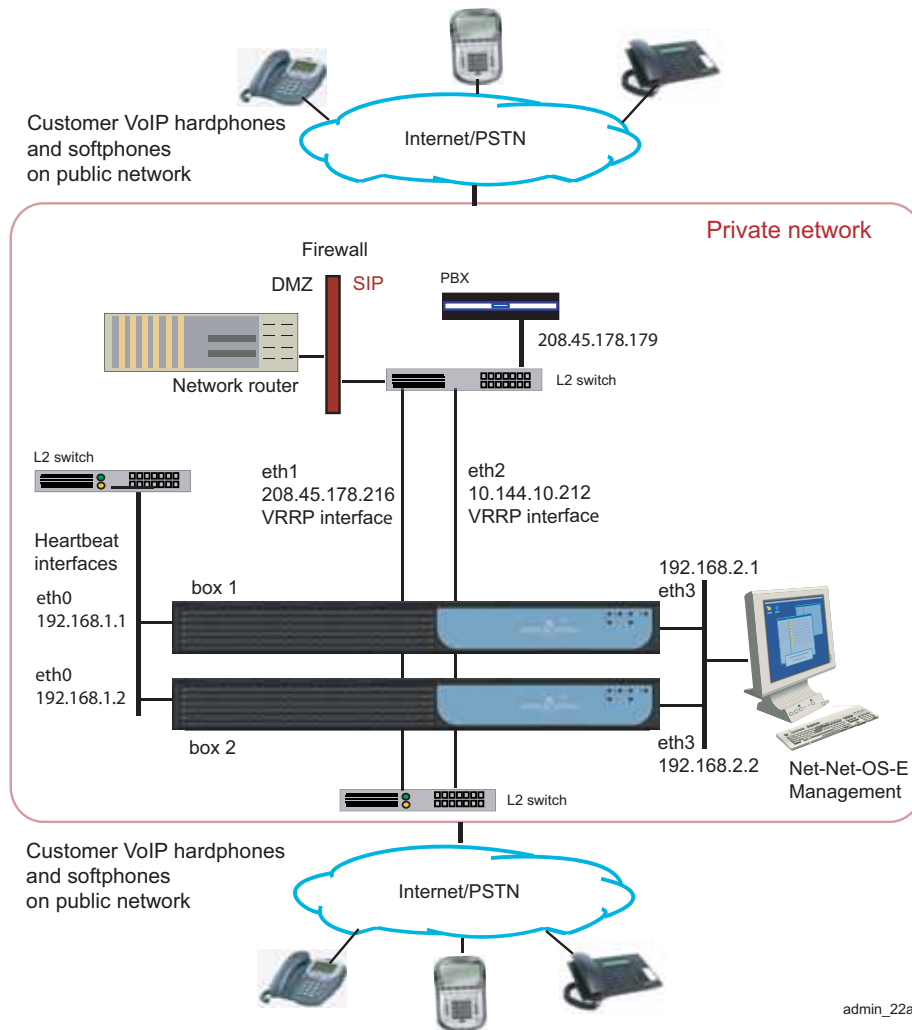
Master-Services

The **master-services** configuration is responsible for mirroring the state of the cluster to allow reliable failover to a standby device. The following sections describe the suggested settings for the **master-services** objects:

Cluster-Master

A **cluster-master** configuration on the OS-E system designated as the master is responsible for passing configuration changes to cluster members. A secondary property called **takeover-timer-value** specifies the number of milliseconds (such as 500) that the master-service stays in “awaiting takeover” mode at boot time.

Use the **show -v** command to display the **current takeover-timer** value. When the OS-E boots, each hosted master-service waits for this period to determine if any existing devices in the cluster are already running that service before assuming mastership.



Directory

When enabled, directory services allows the OS-E master to use enterprise (or corporate) directories that contain the identities of SIP users who are authorized to access the SIP enterprise communications servers.

In environments running CSTA, it is necessary to link the **directory** master service into a VRRP group with an interface to reach a Broadsoft OCI server. If the directory service is running on an OS-E system that cannot reach the OCI server, the CSTA-to-OCI translation will not function. Use a **takeover-timer-value** of 500 milliseconds.

Accounting

When enabled, accounting services supports RADIUS accounting, system logging (syslog), DIAMETER protocol services, the accounting database, and the accounting file-system

Authentication

Authentication services enables or disables all authentication functions on the OS-E, such as RADIUS and local user profiles. If authentication is disabled, you can still configure the authentication services, but the services do not become active until you enable this master service.

It may be necessary to link the authentication service to VRRP interface(s) using a group configuration if the VRRP interface is used to contact the authentication servers. Use a **takeover-timer-value** of 500 milliseconds for authentication.

Database

The master-services **database** object allows you to configure maintenance and other settings for the OS-E system database. The OS-E database is the local repository for call accounting records and media files

The **database** master service should be on a backup OS-E system, with the secondary property **preempt** set to *true*. This will help maintain the data in one location in the event of a brief service outage.

The **preempt** property specifies whether the master-service should resume the mastership if it has gone down and then returned to operation. If set to *true*, the master resumes its position. If set to *false*, the backup service retains master control.

Server-Load

The master-services **server-load** object configures the OS-E to calculate server load. This object must be enabled if your dial plan arbiter rule settings use **least-load** as the routing algorithm option. (The arbiter rule property sets the criteria by which the OS-E selects the server to which it forwards calls.)

Configure the **server-load** master-service for outbound server load balancing or server based admission\emission control. Currently, the **server-load** master-service should be linked to the VRRP SIP signaling interfaces over a configured group.

Call-Failover

The **call-failover** master-service configures failover for the media and signaling streams. As a master-service, the configured host OS-E master distributes copies of the media and kernel rules to all backup devices in a cluster. The OS-E uses the database on the host box, but enabling **call-failover** ensures that there is an active copy of the database on another device in the cluster in the event of a failure.

Registration

Enabling the registration service allows the OS-E to accept SIP REGISTER requests in behalf of other SIP servers (called *registrar peers*) that reside in other domains.

The **registration** master-service configures the registration process for intracuster registration lookups. In a cluster, the registration database runs on the specified master and the selected backups. The **host-box** property establishes the master and selective mirroring. The first OS-E listed is the master, while subsequent devices have mirrored databases. The OS-E systems not configured with the **host-box** property use the local location cache instead of the registration database. The **registration** master-service must be enabled for load-balancing of SIP processing (across backing interfaces configured with the **sip** object) to function correctly.

Load-Balancing

The master-services **load-balancing** object configures OS-E systems to host the load-balancing master service. For detailed information, see Configuring Cluster Load Balancing.

File-Mirror

The master-services **file-mirror** object sets all participating OS-E systems to share particular files (the types of files shared are preset in the OS-E operating system), such as media recordings, log files, etc. The file-mirror master service distributes files to all OS-E systems listed as hosts for the service.

Once the files are mirrored, you can play them back from any OS-E system that functions as a host.

Least-Cost-Routing

The master-services **route-server** object sets the route-server master service, which manages the server process. The master service handles requests from local or remote OS-E systems for least cost route definitions.

For detailed information on the route-server, see the following manuals:

- *Net-Net OS-E – System Administration Guide*
- *Net-Net OS-E – Objects and Properties Reference*
- *Net-Net OS-E – Session Services Configuration Guide*

Sampling

The master-services **sampling** object opens the mechanism for setting the interval at which the OS-E samples operational aspects of the system for either:

- Display in the OS-E Management System, or
- For sending to an IBM Tivoli server

By setting sampling for a status provider, you can view data for that provider over a specified period of time. The OS-E supports two sampling targets—a Postgres SQL database and an IBM tivoli server. (Set the provider data sent to the target using the **status** and **provider** objects. See *Net-Net OS-E – Objects and Properties Reference* for more information on configuring these objects.)

Once you have enabled **sampling**, the master service stores the samples in its local database.

Third-Party-Call-Control (3PCC)

The master-services **3pcc** (third-party-call-control) object configures call control, allowing the OS-E or a CSTA client to control (become the third party) in a call. Specifically, this object controls the WAV files that the OS-E should play and the external status events reported to an external server for calls created by the OS-E.

For detailed information on CSTA, see the following manuals:

- *Net-Net OS-E – System Administration Guide*
- *Net-Net OS-E – Objects and Properties Reference*
- *Net-Net OS-E – Session Services Configuration Guide*

Heartbeat Interface, BOOTP, and Messaging

Use the Ethernet physical interface **eth0** as the heartbeat interface for the OS-E cluster. This interface is used by default for any backup OS-E system that you added to the cluster. The systems will perform a BOOTP request over that interface and you will be able to add these systems by creating an entry for each to the configuration, and then booting them.

Once an OS-E is a member of the cluster, that system will receive a saved configuration file (*cxc.cfg*) from the master. Each time the *cxc.cfg* file is saved on the master, the latest copy of the *cxc.cfg* file is sent to each device in the cluster. You will need to configure a messaging interface on each cluster member so that the master knows the interface over which members of the cluster will receive the *cxc.cfg* file.

Event Logging

Event logs are stored on each box individually and represent the events that occurred on that particular OS-E system. You configure event logging in the **services/event-logs** configuration object. The recommended event log filters on a cluster are as follows:

- Local-database all error
- File *name* system error
- File *name* krnlsys info
- File *name* system info

- File *name* db info

Network Time Protocol (NTP)

Ensure that you have NTP configured on all OS-E systems, ensuring that they point to a timeserver which will keep their time synchronized. DO NOT use a VRRP interface as your route to the timeserver, since one device will always have the VRRP interfaces down and will not be able to contact the NTP server.

If you do not have access to an external NTP server, configure one of the clustered OS-E systems to be an NTP server for the other cluster members. It is important to run NTP, as the time on all clustered system must be kept synchronized. If the times on the OS-E systems drift apart, the Denial of Service (DOS) software will not function properly, as timestamps are required to make this work across the cluster.

You can configure the NTP-server on the messaging interface on one OS-E system, and have all other devices point to this IP address in their NTP-client configuration.

Cluster Redundancy Operations

The OS-E cluster redundancy operates as follows:

- Internal messaging is exchanged so that each OS-E system knows the state of the other boxes, either up or down.
- If the active cluster master goes down, the box listed next in the list of cluster masters becomes the active cluster master. (Note that mastership does not automatically go back to the original system when it returns to service.)
- All the other master services work similarly, with an ordered list of devices that can run the service and the active service running on the next device in the list if the active master fails.

If an OS-E system fails, another device in the cluster will assume its network interfaces using VRRP.

Notes on Cluster Management

The OS-E cluster management operates as follows:

- Within a given cluster, one box functions as the active cluster master.

- Configuration and management of all boxes within a cluster is performed through the cluster master.
- There are no limitations on how many boxes within the cluster can be configured as backup cluster masters or backups for any of the master services.
- The configuration contains a list of boxes that can be cluster masters. The ordering of this list reflects the order in which boxes attempt to become master (i.e. the box listed first becomes the initial master, if that box fails then the next box in the list attempts to become the master, etc.)
- The OS-E Management System connects to the cluster master and provides a single point of management for the following:
 - Configuration
 - Status reports
 - Call logs
 - Accounting data
 - Actions
- The CLI provides single point of management for configuration using the CLI on the cluster master. The CLI is still available on all the other devices in the cluster, so any CLI commands can be executed on individual boxes.
- Note that the management functionality available from a given cluster is dependent on the functionality being performed by that cluster. For example, call logs are available only on clusters where signaling is performed; media recordings are available only on clusters where media streaming is performed.

Cluster Installation Prerequisites

Before beginning the cluster installation, ensure that any L2/L3 switch supporting the cluster has the Port Fast, Fast Link, or similar feature turned on. This allows the switch to run the Spanning Tree 802.1 protocol so that the switch ports being used by the OS-E go directly to the “forwarding” state. If the switch does not support Port Fast or Fast Link, disable the Spanning Tree protocol for the VLANs associated with the switch ports being used by the OS-E.

Cluster Installation Procedure

There are a number of steps that you need to follow to install an OS-E network cluster. You will need to know certain information about all the systems in the cluster for proper operation.

Each step uses a sample CLI session of commands that best illustrate how to best configure important settings.

1. Determine the specific OS-E system to assume the role of cluster master. Configure **master-services** to specify the device the cluster to assume initial mastership.

```
NNOS-E> config master-services
config master-services> config cluster-master
config cluster-master> set admin enabled
config cluster-master> set host-box cluster\box 1
config cluster-master> set host-box cluster\box 2
config cluster-master> set group 1
config cluster-master> return
```

2. Note the MAC address (identifier) on each device in the cluster. The MAC address is on a sticker on the back of the system. Write down each MAC address on a pad or piece of paper.

On each device, if there is no sticker present, attach a laptop or standard PC to the system console port and perform the following steps:

- Power up the system
- At the NNOS-E prompt, execute the **show interface-details eth0** command to display the MAC address.

3. Attach a console to the cluster master and power up the OS-E system.
4. Configure the cluster master by configuring the Ethernet interfaces, IP addresses, and protocols. Ethernet interface eth0 is the “heartbeat” interface for the cluster. Use the eth0 interface on each OS-E system as the connection to the cluster.

```
NNOS-E> config cluster
config cluster> config box 1
config box 1> set identifier 00:04:23:d7:9f:34
config box 1> config interface eth0
config interface eth0> config ip heartbeat
Creating 'ip heartbeat'
config ip heartbeat> set ip-address static 192.168.1.1/24
config ip heartbeat> config telnet
config telnet> return
config ip heartbeat> config ssh
```

```
config ssh> return
config ip heartbeat> config bootp-server
config bootp-server> return
config ip heartbeat> config vrrp
config vrrp> return
```



Note: Optionally, you can run the **config setup** script to configure the IP addresses, management port, and other settings presented in the script.

By configuring messaging on the OS-E master, the master looks through the configurations of all other devices to find out which interface is used for messaging. (If multiple interfaces are configured, the master only communicates with one—the first it finds.) The master then communicates with the identified interface to share configuration and data.

```
config ip heartbeat> config messaging
config messaging> set admin enabled
config messaging> set certificate vsp tls
certificate 208.45.178.216.pfx
config messaging> set port 5312
config messaging> set protocol tls
config messaging> return
config ip heartbeat> return
config interface eth0> return
config box 1>
```

Configure the interface and the protocols over which you will run management sessions to the OS-E. This is an “out-of-band” interface that allows you to separate management traffic from SIP signaling and media streams.

```
config box 1> config interface eth3
Creating 'interface eth3'
config interface eth3> config ip mgmt
Creating 'ip mgmt'
config ip mgmt> set ip address static 192.168.2.1/24
config ip mgmt> config ssh
config ssh> return
config ip mgmt> config web
config web> set protocol https 443 0
config web> return
config ip mgmt> config sip
config sip> set udp-port 5060
config sip> return
config ip mgmt> config icmp
config icmp> return
config ip mgmt> config media-ports
config media-ports> return
config ip-mgmt> return
config interface eth3> return
```

```
config box 1> config cli
config cli> set prompt nn2610-1
config cli> set banner ""
config cli> set display paged 50
config cli> return
config box 1> return
config cluster>
```

5. Configure the second OS-E system in the cluster. Note that you also configure eth0 as the “heartbeat” interface to the cluster.

```
config cluster> config box 2
config box 2> set hostname nn2610-2
config box 2> set name ""
config box 2> set contact ""
config box 2> set location ""
config box 2> set identifier 00:04:23:c3:22:f4
config box 2> config interface eth0
config interface eth0> config ip heartbeat
config ip heartbeat> set ip-address static 192.168.1.2/24
config ip heartbeat> config telnet
config telnet> return
config ip heartbeat> config ssh
config ssh> return
config ip heartbeat> config web
config web> set protocol https 443 0
config web> return
config ip heartbeat> config icmp
config icmp> return
config ip heartbeat> config vrrp
config vrrp> return
config ip heartbeat> config messaging
config messaging> set admin enabled
config messaging> set certificate vsp tls
certificate 208.45.178.216.pfx
config messaging> set port 5312
config messaging> set protocol tls
config messaging> return
config ip heartbeat> return
config interface eth0> return
config box 2>
```

Configure the interface and the protocols over which you will run management sessions. This is an “out-of-band” interface that allows you to separate management traffic from SIP signaling and media streams.

```
config box 2> config interface eth3
Creating 'interface eth3'
config interface eth3> config ip mgmt
Creating 'ip mgmt'
config ip mgmt> set ip address static 192.168.2.2/24
```

```
config ip mgmt> config ssh
config ssh> return
config ip mgmt> config web
config web> set protocol https 443 0
config web> return
config ip mgmt> config sip
config sip> set udp-port 5060
config sip> set nat-translation enabled
config sip> return
config ip mgmt> config icmp
config icmp> return
config ip mgmt> config media-ports
config media-ports> return
config ip-mgmt> return
config interface eth3> return
config box 1> config cli
config cli> set prompt NNOS-E-2
config cli> set banner ""
config cli> set display paged 50
config cli> return
config box 1> return
config cluster> set share media-ports true
config cluster> set share signaling-entries true
config cluster> set mirror-media-streams true
```

6. Configure VRRP on the OS-E interfaces to handle the public and private sides of the network. Note that the first VRRP interface connects the public side; the second VRRP interface connects the private side.

A VRRP configuration for IP interfaces includes a list of box/interface pairings. The first pair in this list is the *primary interface*. The second pair in the list is the *backup interface* and will take over if the primary goes down. You can configure additional levels of redundancy by specifying more box/interface pairs of lower priority. Priority is based on the positioning of the **set host-interface** command.

```
config cluster> config vrrp
config vrrp> config vinterface vx0
config vinterface vx0> set group 1
...vinterface vx0> set host-interface cluster box 1 interface eth1
...vinterface vx0> set host-interface cluster box 2 interface eth1
config vinterface vx0> config ip public
Creating 'ip public'
config ip public> set ip-address static 208.45.178.216/28
config ip public> config ssh
config ssh> return
config ip public> config web
config web> set protocol https 443 0
config web> return
config ip public> config sip
config sip> set nat-translation enabled
```

```
config sip> set udp-port 5060
config sip> set tcp-port 5060
config sip> set tls-port 5061
config sip> set certificate vsp\tls\certificate 208.45.178.216.pfx
config sip> return
config ip public> config icmp
config icmp> return
config ip public> config media-ports
config media-ports> return
config ip public> config routing
config routing> config route default
Creating 'route default'
config route default> set gateway 208.45.178.209
config route default> return
config routing> return
config ip public> return
config vinterface vx0> return
config vrrp>

config cluster> config vrrp
config vrrp> config vinterface vx1
config vinterface vx1> set group 1
...vinterface vx1> set host-interface cluster box 1 interface eth2
...vinterface vx1> set host-interface cluster box 2 interface eth2
config vinterface vx1> config ip private
Creating 'ip private'
config ip private> set ip-address static 208.45.178.216/28
config ip private> config ssh
config ssh> return
config ip public> config web
config web> set protocol https 443 0
config web> return
config ip private> config sip
config sip> set nat-translation enabled
config sip> set udp-port 5060
config sip> set tcp-port 5060
config sip> set tls-port 5061
config sip> set certificate vsp\tls\certificate 208.45.178.216.pfx
config sip> return
config ip private> config icmp
config icmp> return
config ip private> config media-ports
config media-ports> return
config ip private> config routing
config routing> config route static-to-asx
Creating 'route static-to-asx'
config route static-to-asx> set destination network 208.45.178.0/24
config route static-to-asx> set gateway 10.144.10.254
config route static-to-asx> return
config routing> return
config ip private> return
```

```
config vinterface vx1> return
config vrrp> return
config cluster> return
```

7. Configure the master-services that you want to run on the cluster.

```
config> config master-services
config master-services> config accounting
config accounting> set host-box cluster\box 1
config accounting> set host-box cluster\box 2
config accounting> set group 1
config accounting> return
config master-services> config database
config database> set host-box cluster\box 1
config database> set host-box cluster\box 2
config database> set group 1
config database> set media enabled
config database> return
config master-services> return
config>
```

8. For TLS, you will need to upload the TLS certificate file on each OS-E system in the cluster. Copy the certificate that you receive from the CA to the OS-E using a compatible file transfer mechanism, such as PuTTY Secure Copy (PSCP). If you have the file on a local network PC, use PSCP to move the file to a directory path on the OS-E.

The following example PSCP command copies the certificate file named **208.45.178.216.pfx** from the PC root directory to the OS-E system at IP address **208.178.216.pfx** in the directory **/cxc/certs/208.45.178.216.pfx**.

```
C:\ pscp -l root -pw sips -P 2200 208.45.178.216.pfx 208.45.178.216:/
cxc/certs/208.45.178.216.pfx
```

The following CLI session sets the directory and certificate file name path, specifies the passphrase, and whether to allow SSL Version 2 operability.

```
NNOS-E> config vsp
config vsp> config tls
config tls> config certificate 208.45.178.216.pfx
config certificate 208.45.178.216.pfx> set allow-ssl2 true
config certificate 208.45.178.216.pfx> set certificate-file /cxc/
certs/208.45.178.216.pfx.pfx
config certificate 208.45.178.216.pfx> set passphrase-tag pass
```

By default, the OS-E only supports SSLv3 or TLSv1. If you require SSLv2 for interoperability, set this property **true**. Specify the passphrase-tag associated with the certificate file. Use this property if the certificate file is encrypted to have its private key information protected. This passphrase tag must match the string with which the certificate was encrypted.

9. Power up the other OS-E systems in the cluster and connect them to the network. This initiates a configuration download from the cluster master so the systems acquire their initial configuration (IP addresses, etc.).
10. Use the CLI or OS-E Management System at the cluster master to configure any additional features. These features include the objects and settings under the VSP object, including:
 - default-session-config
 - registration-plan
 - dial-plan
 - enterprise servers, carriers, and gateways

Configuring External Messaging

Messaging is the mechanism the OS-E uses to communicate among boxes in a cluster. Messaging sets up a listening socket on an interface, enabling the interface to receive messaging traffic and participate in clustering and media partnering.

In a cluster, the master looks through the configurations of all OS-E systems to find out which interface is used for messaging. (If multiple interfaces are configured, the master only communicates with one—the first it finds.) The master then communicates with the identified interface to share configuration and data.

In media partnering, you configure a specific IP address (on a different box) as a partner. On the box that owns that IP address, you need to configure and enable messaging for media partnering to operate.

CLI Session

The following CLI session configures messaging on box 1, interface eth0.

```
NNOS-E> config cluster
config cluster> config box 1
config box 1> config interface eth0
config interface eth0> config ip boston1
config ip boston1> config messaging
config messaging> set admin enabled
config messaging> set certificate vsp tls certificate name
config messaging> set port 13002
config messaging> set protocol tls
```

Configuring Cluster Load Balancing

Load balancing of SIP processing across cluster interfaces requires both headend and backing interfaces. The *headend* interface is the central distribution point. It does not do any SIP processing, it only forwards the calls to its configured backing interfaces. When you configure a SIP phone, you would configure it to point to the headend interface.

To configure an IP interface as a headend interface, you simply configure the **sip** object with backing interfaces. Their presence contained within the IP configuration results in the interface being treated by the OS-E as a headend interface.

The *backing-interfaces* are identified as such within this **sip** object. In the **backing-interface** property, you reference previously configured IP interfaces. The backing interface is the location at which the OS-E terminates TCP and TLS connections (and where UDP transport messages arrive) and handles SIP processing. The OS-E uses round-robin load-balancing to distribute message across the configured backing interfaces.

To correctly configure load-balancing for SIP processing, you must do the following:

1. Configure the IP interfaces that will be used for both the headend and backing interfaces.
2. The SIP properties of the backing interfaces must match those of the head interface. For example, they must all use the same port assignments, and if you are using TLS, they must all use the same certificate.
3. You must enable the **master-services registration** object so that the interfaces can share the registration database.

To verify your configuration, first ensure that all SIP properties match. From the CLI at the headend, execute the **show load-balance** command. This lists all associated backing interfaces (and statistics). From each box hosting a backing interface, execute **show backing-interface** to display configuration and statistics information.

The following CLI session assumes that you have configured a three-box cluster, with box 1 containing the headend interface, with boxes 2 and 3 containing the backing interfaces over which traffic is load balanced. This session sets the backing interfaces for load balancing SIP traffic that is distributed from the headend interface at IP address 215.2.3.0/24.

CLI Session

```

config cluster> config box 1
config box 2> config interface eth1
config interface eth1> config ip public
Creating 'ip public'
config ip public> set ip-address static 215.2.3.0/24

config> config cluster
config cluster> config box 2
config box 2> config interface eth1
config interface eth1> config ip public
Creating 'ip public'
config ip public> set ip-address static 215.6.7.0/24
config ip public> config sip
config sip> config load-balancing
config load-balancing> set head-end-interface cluster box 1 interface
    eth1 ip public

config> config cluster
config cluster> config box 3
config box 2> config interface eth1
config interface eth1> config ip public
Creating 'ip public'
config ip public> set ip-address static 215.8.9.0/24
config ip public> config sip
config sip> config load-balancing
config load-balancing> set head-end-interface cluster box 1 interface
    eth1 ip public

NNOS-E> show load-balance
Head-end IP 215.2.3.0: subscribed:
-----
Backing IP      State   Added   Removed   Maximum   Current   Percent
-----
215.6.7.0      Ready    0        0         0         0        0.0%
215.8.9.0      Ready    0        0         0         0        0.0%
-----
Sub-totals:           0        0         0         0        0.0%
Totals:              0        0         0         0       100.0%

```

Restarting an OS-E Cluster

You can perform a simultaneous warm restart of all systems in a cluster by using the **restart cluster** command. A warm restart simply restarts the OS-E applications on each system without rebooting the operating system.

If you warm restart an individual device in the cluster, the OS-E automatically rejoins the cluster when it comes back up. If that box is hosting a master service or a VRRP interface, the service or interface may fail over to a different OS-E system.

If you need to shut a system down by turning the power off, use the **restart halt** command before pressing the power button or disconnecting the power source. A **restart halt** will properly prepare a system for a shutdown. The OS-E system will rejoin the cluster when it comes back up.

Chapter 5. Installing Certificates and Commissioning TLS Networks

About This Chapter

This chapter provides information on commissioning the OS-E to run the Transport Layer Security protocol (TLS) over Ethernet interfaces.

TLS Overview

TLS is an encapsulation (and cryptographic) protocol that provides privacy and security between communicating applications over the Internet. The OS-E uses TLS to authenticate SIP users and to encrypt/decrypt SIP traffic across participating carrier and enterprise SIP applications.

For a complete description of the TLS protocol, refer to the following RFCs:

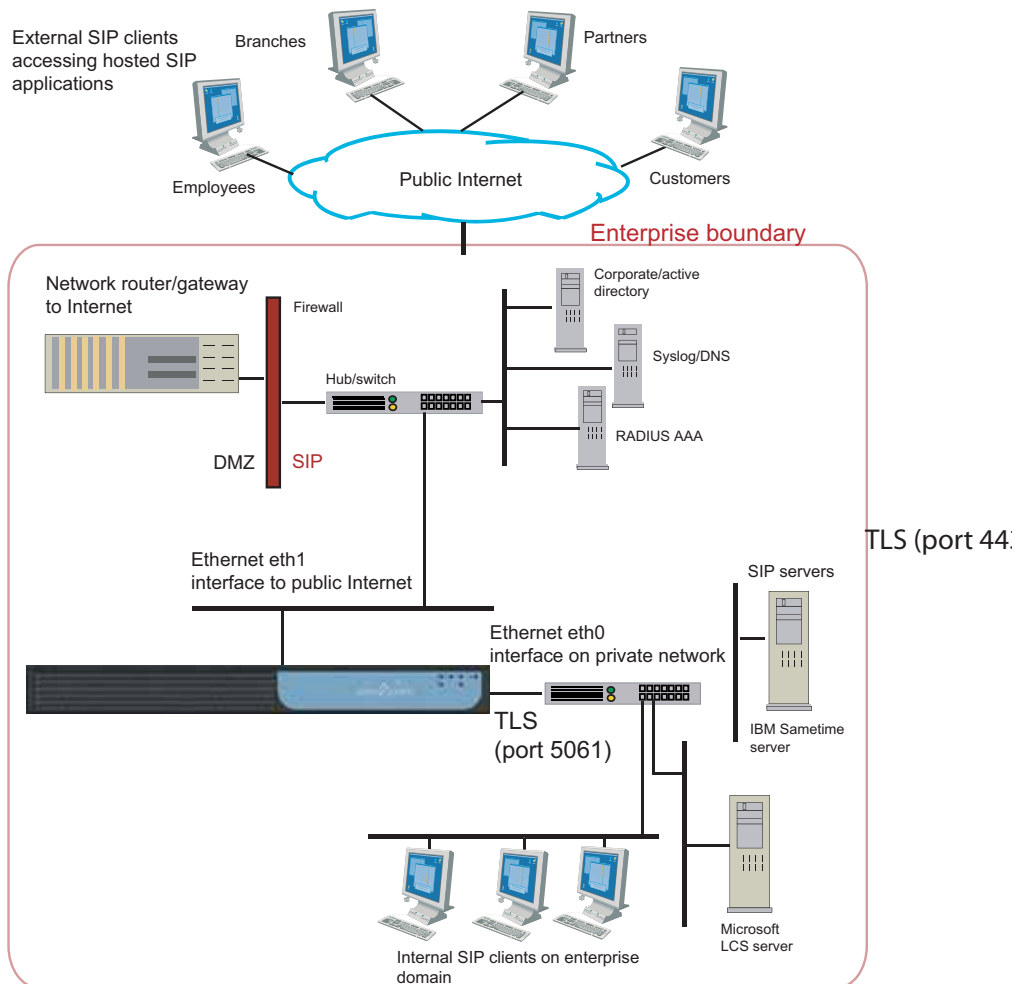
- RFC 2246, The TLS Protocol Version 1.0
- RFC 3261, Session Initiation Protocol (see Section 26.3.1)

The image below illustrates a sample network running TLS on Ethernet interfaces to both the private network and the public Internet.

Steps to Configuring TLS

To configure the private and public network interfaces in the image below, with TLS you need to perform the following steps:

1. If not already done, configure the management interfaces, network routes, protocols, and services using the **cluster/box**, **master-services**, and **services** objects.
2. If not already done, install a signed certificate from a valid Certificate Authority (CA). Go the section, “Before Configuring TLS.”.
3. Configure the certificate using the **vsp/tls** configuration object. Go to the section, “Configuring the Certificate on the OS-E.”
4. Configure the SIP protocol on each interface to use the installed certificate. Go to the section, “Configuring TLS on Ethernet Interfaces.”





Note: If you are operating with Microsoft Live Communications Server (LCS), refer to the *Net-Net OS-E – System Administration Guide* for information on installing, importing, and exporting certificates.

Before Configuring TLS

You will need to install the required X.509 certificate(s) for the TLS protocol and SIP session establishment. A certificate includes the .cer certificate file name and the encrypted keys, mathematically related private and public data keys indexed by a unique name. A private key is kept secure—never displayed and never transmitted over the network. A public key, when bound to a fully qualified domain name (FQDN) by an authorized certification authority (CA), becomes an X.509 certificate.

If you do not have a certificate and encrypted key for your network, use this section to create and install a certificate. See the following table below for a summary of required steps.

Task	See this section	CLI command
1. Using the OS-E software, create a self-signed X.509 certificate and encrypted key.	<i>Creating a self-signed certificate and key pair from the OS-E</i>	cert - gen
2. Using the self-signed certificate that you created in Step 1, generate a Certification Signing Request (CSR) in PEM format.	<i>Generating a Certification Signing Request (CSR)</i>	cert - request

Task	See this section	CLI command
3. Sign the CSR using one of these two methods: • Use a valid CA, like VeriSign (required if a “trusted” certificate is necessary) to sign the CSR or • Use OpenSSL to sign the CSR	<i>Signing a CSR using either a valid CA or OpenSSL</i>	N/A
4. When you receive the signed certificate, use the OS-E software to load the signed certificate onto the system.	<i>Updating the self-signed certificate</i>	cert-update

Step 1. Creating a Self-Signed Certificate and Key Pair from the OS-E

Use the OS-E software to generate a cryptographic key pair and a self-signed X.509 certificate in PKCS#12 format. Once you create a self-signed certificate, you can generate the Certification Signing Request, a portion of which will be required by the CA upon submission of their form.

Under **Actions**, select **cert-gen** from list. The following image illustrates the OS-E Management System Generate new key and certificate page.

ORACLE Actions
Root path: /

Status Summary Logout admin Home Configuration Status Call Logs Event Logs Actions Services Keys Access Tools

call-lookup
call-lookup-detail
call-modify
call-reject
call-retrieve
call-retrieved
cert-gen
cert-request
cert-update
clock
collect
config merge
config replace
config save
config validate
csta-moc-commands
csta-uri-normalization
database
database-backup
database-maintenance
del-location-presentity
dhcp
directory-reset
directory-reset-cancel
disconnect-call
disconnect-calls-all
dns

cert-gen
Generate 1024 or 2048 bits RSA private key and associated X509 certificate.

* keyFile		Browse System Files
* passphrase		
* alias		
* common-name		
days-valid	365	
country	enter US or select from US (United States)	
alternate-name		
organization		
organizational-unit		
state		
locality		
* certificate-key-size	2048 (2048 bits)	

Invoke

Complete the fields on the **Generate new key and certificates** page, as follows:

keyFile—Specify the name and directory path of the resulting key name that you want to use, along with the p12 or .pfx file extension.

Example: /cxc/certs/<myNetworkKey>.p12

passphrase—Specify a password to be associated with the self-signed certificate. The text that you specify will be encrypted in the certificate.

alias—Specify the FQDN of the OS-E system using this certificate, such as *nn2610.acmepacket.com*. Omit HTTP:// and HTTPS://. This allows the certificate to be referenced.



Note: The value (FQDN) you enter for the **alias** field must be identical to the value you enter for the **common-name** field.

common-name—Specify the FQDN of the OS-E system using this certificate, such as *nn2610.acmepacket.com*. Omit HTTP:// and HTTPS://. Do not use your personal name in this field. The common name is a component attribute of the certificate's *distinguished name*.

days-valid—Enter the number of days for which the certificate is valid. If your certificate is effective for one year, then enter the number 365

country—Select the ISO country code: US (United States), AU (Australia), IN (India), IT (Italy), UK (United Kingdom), CA (Canada). The country is a component attribute of the certificate's *distinguished name*.

alternate-name—Optional; this usually a name that complies with the ASN.1 specification, such as a DNS name, IP address, URI, etc.

organization—Optional. Enter the name under which your business is legally registered. The listed organization must be the legal registrant of the domain name in the certificate request. If you are enrolling as a small business/sole proprietor, enter the certificate requestor's name in the "Organization" field, and the DBA (doing business as) name in the "Organizational Unit" field. The organization is a component attribute of the certificate's *distinguished name*.

organizational-unit—Optional. Use this field to differentiate between divisions within an organization. For example, "Engineering" or "Human Resources." If applicable, you may enter the DBA (doing business as) name in this field. The organizational unit is a component attribute of the certificate's *distinguished name*.

state—Optional; if in the US, enter one of the fifty state names in full where your organization is located, such as Massachusetts; if outside the US, enter the full name of a province or region.

locality—Optional; enter the name of a city.

When you are finished filling out the fields, click **Invoke**. A Success message appears.

Viewing the Certificate

To view the self-signed certificate, select the **Keys** tab from the main menu bar, then select the keyFile that you just created from the Key Stores list on the left. Click View to display the Certificate Properties page, as shown in the following image.

Status SummaryLogout admin

HomeConfigurationStatusCall LogsEvent LogsActionsServicesKeysAccessTools

Key Stores / Certificates

enms.cert
netCert.p12

NewImport

Manage Key Store netCert

Type	Alias	Action
	www.company.com	View Request Update Delete

ImportNewSavePassphraseReloadDelete

www.company.com certificate, Key Store netCert

Certificate Properties

Properties	
Property	Value
Type	X.509
Version	3
Subject	CN=www.company.com, OU=network, O=Engineering, L=Bedfore, ST=MA, C=US
Issuer	CN=www.company.com, OU=network, O=Engineering, L=Bedfore, ST=MA, C=US
Valid After	Jan 25, 2016 2:17:10 PM
Valid Until	Jan 24, 2017 2:16:00 PM
Serial Number	1453749400324
Signature Algorithm	SHA1WithRSAEncryption

Other Properties	
Property	Value
Subject DN	C=US,ST=MA,L=Bedfore,O=Engineering,OU=network,CN=www.company.com
Issuer DN	C=US,ST=MA,L=Bedfore,O=Engineering,OU=network,CN=www.company.com

Extensions		
Critical	Extension	Value
☒	Basic Constraints (2.5.29.19)	
☒	Key Usage (2.5.29.15)	#030205A0
☒	Extended Key Usage (2.5.29.37)	TLS Web Server Authentication (1.3.6.1.5.5.7.3.1)

Close Window

Step 2. Generating a Certification Signing Request

After you create the self-signed certificate from Step 1, you must generate a certification signing request (CSR) that you can submit to the CA for the X.509 certificate. Select the **request** action.

The Generate Certificate Signing Request page and the resulting certificate signing request appear. Enter the password that you created in Step 1 in the **passphrase** field and click on **Generate Certificate Signing Request**. Select the key store file on the left and enter your password when prompted. Manage Key Store is displayed; click on **Request** under **Action**.





Click the **Export to File** button to save the CSR provided by the CA to external file.

If you choose to create a CSR in a PEM-formatted file, select the **cert-request** action. The file contains the same request as shown in the following image.



Complete the fields on the **Generate Certification Request** page, using the same settings that you invoked from Step 1, as follows:

key-file—Specify the name and OS-E directory path of the resulting key name that you want to use, along with the p12 or .pfx file extension. This is a mandatory field. Example: /cxc/certs/myNetworkKey.p12

passphrase—Specify a password to be associated with the certificate issued by the CA. The text that you specify will be encrypted in the CSR.

alias—Optional. However, the value you enter for the **alias** field must be identical to the value you enter for the **common-name** field.

csr-file—Specify the name and directory path of the resulting CSR file. This is the file from which you will cut and paste the required information for the CA at the time that you submit the certificate request. By default, the CSR file resides in the directory named /cxc/certs.

When you are finished filling out the fields, click **Invoke**. A Success message appears.

Viewing the .CSR File

Since the .cer file is in PEM format, you can open the file using a text editor.

Step 3. Signing a CSR Using Either a Valid CA or OpenSSL

After you generate the CSR, you must sign the CSR using *one* of two methods. You can either:

- Sign the CSR using a well-known CA, for example, VeriSign.

or

- Sign the CSR using OpenSSL.

This section describes how to sign the CSR using either method.



Note: If your network requires a “trusted” certificate, then follow the instructions below to sign the CSR using a valid, well-known CA.

Using a Certification Authority to Sign the CSR

You get the signed X.509 certificate from a valid CA, such as VeriSign. The CA issues a certificate stating and guaranteeing that the key contained in the certificate belongs to the person or organization noted in the certificate. The CA verifies the identity of the applicant's so that users can trust certificates issued by that CA to belong to the people and data identified in it, and not to an imposter.

Certificate Formats

The OS-E certificate file can be in the following formats:

- PKCS#12—Public Key Cryptography Standard #12 format from Microsoft IIS Version 5 (binary)
- PEM—Privacy-enhanced mail (PEM) encoded format from any OpenSSL-based Web server (ASCII)

Using OpenSSL to Sign the CSR

This section provides information on how you can generate a self-signed certificate for testing TLS with the OS-E using OpenSSL. This is an alternative method to using a valid CA to sign the CSR.

This section describes how to do the following things:

- Create an OpenSSL Certificate Authority (CA).
- Generate a private key and CSR on the OS-E system and sign in with the OpenSSL CA.
- Generate a Private Key and CSR without the OS-E system (not supported).
- Use OpenSSL to convert an X.509 certificate and/or RSA key to a Public-Key Cryptography Standard #12 (PKCS#12) format.



Note: Before using this method, download the OpenSSL program and install it on a Unix/Linux or Windows system. You also need to add the location of the OpenSSL executables to the PATH. In a Windows environment, this will need to do this manually, requiring a reboot to take effect.

Creating an OpenSSL Certificate Authority (CA)

To create and Open SSL Certificate Authority (CA) on a Unix/Linux system, perform all steps as “root.” On a Windows system, perform all steps as “Administrator.”

1. Create directories to store certificates.

The main CA folder is the directory where the Certificate Authority files will reside. The “private” directory stores the private keys. The “certs” directory stores the certificates (or public keys). The “csrs” directory stores the Certificate Signing Requests.

On Unix:

```
mkdir /CA
mkdir /CA/private
mkdir /CA/csrs
mkdir /CA/certs
```

Windows (cmd):

```
mkdir C:\CA
mkdir C:\CA\private
mkdir C:\CA\csrs
mkdir C:\CA\certs
```

2. Create files to support the generation process.

Create the “index.txt” file with no contents. This is the database to which OpenSSL keeps track of generated certificates generated. Create the “serial” file with a number so that each generated certificate is labeled with a number for tracking purposes.

Unix:

```
touch /CA/index.txt
echo 01 > /CA/serial
```

Windows (cmd):

```
copy con C:\CA\index.txt
echo 01 > C:\CA\serial
```

3. Create the OpenSSL configuration file.

Note: The following are example values only.

Unix:

Using a text editor, create “/CA/openssl.cnf.”

```
[ ca ]
default_ca      = local_ca

[ local_ca ]
dir             = /CA
certificate      = $dir/certs/ca.cer
database        = $dir/index.txt
new_certs_dir   = $dir/certs
private_key     = $dir/private/ca.key
serial          = $dir/serial

default_crl_days    = 365
default_days        = 365
default_md          = md5

policy             = local_ca_policy
x509_extensions    = local_ca_extensions

[ local_ca_policy ]
commonName         = supplied
stateOrProvinceName = optional
countryName        = optional
emailAddress       = optional
organizationName   = optional
organizationalUnitName = optional

[ local_ca_extensions ]
basicConstraints    = CA:true
nsCertType         = server

[ root_ca_extensions ]
basicConstraints    = CA:true
nsCertType         = server

[ req ]
default_bits       = 2048
default_keyfile    = /CA/private/ca.key
default_md         = md5

prompt             = yes
distinguished_name = root_ca_distinguished_name
x509_extensions    = root_ca_extensions

[ root_ca_distinguished_name ]
```

countryName	= Country Name (2 letter code)
countryName_default	= US
countryName_min	= 2
countryName_max	= 2
stateOrProvinceName	= State or Province Name (full name)
stateOrProvinceName_default	= MA
localityName	= Locality Name (eg, city)
localityName_default	= Maynard
0.organizationName	= Organization Name (eg, company)
0.organizationName_default	= Acme Packet, Inc.
organizationalUnitName	= Organizational Unit Name
(eg, section)	
organizationalUnitName_default	= Support
commonName	= Common Name (eg, YOUR name)
commonName_max	= 64
emailAddress	= Email Address
emailAddress_default	= jgentile@acmepacket.com
emailAddress_max	= 64
[req_attributes]	
challengePassword	= A challenge password
challengePassword_min	= 4
challengePassword_max	= 20
unstructuredName	= An optional company name

Windows:

Using a text editor, create “C:\CA\openssl.cnf.”

Note: The following are example values only.

```
[ ca ]
default_ca      = local_ca

[ local_ca ]
dir             = C:\\CA
certificate     = $dir\\certs\\ca.cer
database       = $dir\\index.txt
new_certs_dir  = $dir\\certs
private_key    = $dir\\private\\ca.key
serial         = $dir\\serial
```

```

default_crl_days      = 365
default_days          = 365
default_md             = md5

policy                = local_ca_policy
x509_extensions       = local_ca_extensions

[ local_ca_policy ]
commonName            = supplied
stateOrProvinceName   = optional
countryName           = optional
emailAddress          = optional
organizationName      = optional
organizationalUnitName = optional

[ local_ca_extensions ]
basicConstraints      = CA:false
nsCertType            = server

[ root_ca_extensions ]
basicConstraints      = CA:true
nsCertType            = server

[ req ]
default_bits          = 2048
default_keyfile        = C:\\CA\\private\\ca.key
default_md             = md5

prompt                = yes
distinguished_name     = root_ca_distinguished_name
x509_extensions        = root_ca_extensions

[ root_ca_distinguished_name ]
countryName            = Country Name (2 letter code)
countryName_default    = US
countryName_min        = 2
countryName_max        = 2

stateOrProvinceName     = State or Province Name (full name)
stateOrProvinceName_default = MA

localityName            = Locality Name (eg, city)
localityName_default    = Maynard

0.organizationName      = Organization Name (eg, company)
0.organizationName_default = Acme Packet, Inc.

organizationalUnitName   = Organizational Unit Name (eg,
                        section)
organizationalUnitName_default = Support

```

commonName	= Common Name (eg, YOUR name)
commonName_max	= 64
emailAddress	= Email Address
emailAddress_default	= jgentile@acmepacket.com
emailAddress_max	= 64
[req_attributes]	
challengePassword	= A challenge password
challengePassword_min	= 4
challengePassword_max	= 20
unstructuredName	= An optional company name

4. Generate the CA's private key and Master Certificate (public key).

This step will generate two files:

- **CA/private/ca.key** (C:\CA\private\ca.key on Windows) – This is the CA's private key used to sign certificates. Keep this secure. If this key is compromised, it can be used to create certificates for malicious purposes.
- **CA/certs/ca.cer** (C:\CA\certs\ca.cer on Windows) – This is the CA's certificate (public key). This is the file that would be distributed to client's "Trusted Root" stores to trust any certificates signed by this CA's private key.

Unix:

```
openssl req -x509 -new -config /CA/openssl.cnf -days 3000 -out /CA/certs/ca.cer
```

Windows (cmd):

```
openssl req -x509 -new -config C:\CA\openssl.cnf -days 3000 -out C:\CA\certs\ca.cer
```

The **ca.key** is created automatically based on the configuration file.

Enter a strong passphrase for the CA key. Remember it, as this helps protect the security of your CA.

Fill in the following fields:

```
Country Name (2 letter code) [US]: <your country>
State or Province Name (full name) [MA]: <your state/province>
Locality Name (eg, city) [Maynard]: <your locale>
Organization Name (eg, company) [Acme Packet]: <your company>
Organizational Unit Name (eg, section) [Support]: <your department>
Common Name (eg, YOUR name) []: <Use the FQDN of the CA system>
```

```
running OpenSSL>  
Email Address []: <your email address>
```



Note: The “Common Name” field is the most important. This is the name that will be provided to the CA, so use the Fully Qualified Domain Name (FQDN) of the system on which you are running OpenSSL.

5. Change permissions on the CA’s key to only allow “root” access:

Unix:

```
chmod 700 /CA/private/ca.key
```

Windows (cmd):

```
echo y|cacs C:\CA\private\ca.key /G %COMPUTERNAME%\Administrator:F
```



Note: You should only need to complete the process for setting up the CA once, while the processes for signing Certificates must be repeated every time a certificate needs to be generated.

Generating a Private Key and Certificate Signing Request (CSR) with the OS-E

To generate a private key and CSR on the OS-E and sign in with the OpenSSL CA, perform the following steps:

1. Create a CSR on the OS-E.

Refer to the section in the chapter, “Before Configuring TLS.”:

- Use the **cert-gen** utility to generate a Self-Signed Certificate (known as a private key) in PKCS#12 format. In this example, the file name is *cxc.pfx*.
- Use the **cert-request** utility to generate a Certificate Signing Request (CSR) in PEM format on the appropriate OS-E system. In this example, the file name is *cxc.csr*.



Note: The “common-name” field on the “cert-gen” page is the most important. This is the name that will be used to validate the certificate. Use the Fully Qualified Domain Name (FQDN) of the appropriate OS-E system, such as *nnose.acmepacket.com*.

Currently, some phones, such as Eyebeam do not support wildcard certificates where the common-name uses an asterisk character (*) in the domain name, such as *.acmepacket.com.

These files are created in the `/cxc/certs/` directory on the OS-E.

2. Copy the CSR to the OS-E.

Download the .csr file generated on the OS-E, and then copy it to the CA system into the `/CA/csrs/` directory. For a Windows system, copy it to the `C:\CA\csrs\` directory.

3. Sign the CSR with your OpenSSL CA.

Unix

```
openssl ca -config /CA/openssl.cnf -in /CA/csrs/cxc.csr -out /CA/certs/cxc.pem
```

Windows

```
openssl ca -config C:\CA\openssl.cnf -in C:\CA\csrs\cxc.csr -out C:\CA\certs\cxc.pem
```

Enter the pass phrase for the CA key

Respond “y” to the questions to generate and commit.

4. Update the private key (cxc.pfx) with the signed public key (cxc.pem) on the system.

Upload the newly generated `cxc.pem` file back to the OS-E , as covered earlier in this chapter. Refer to the section in the chapter, “Before Configuring TLS.”

- Use the **cert-update** utility to update the “`/cxc/certs/cxc.pfx`” file on the OS-E with the “`/cxc/certs/cxc.pem`” file.
- Configure a TLS certificate, as covered earlier in this chapter. Be sure to associate it with the SIP protocol on the appropriate network interface.



Note: You can use the `/CA/certs/ca.cer` (`C:\CA\certs\ca.cer` on Windows) file to import into a “Trusted Root Store.” For example, you can install this in Windows (Internet Explorer) for use with Soft Phones, such as Eyebeam. If you deploy the `ca.cer` file to multiple systems into the “Trusted Root Store”, then those systems will “trust” any certificates signed by this CA.

Generating a Private Key and Certificate Signing Request (CSR) without the OS-E

Instead of generating the private key and CSR on the OS-E, you can generate it using OpenSSL exclusively. This is not the supported method.

1. Create a CSR and Private Key for the OS-E System

Unix:

```
openssl req -new -config /CA/openssl.cnf -out /CA/csrs/cxc_csr.pem  
-keyout /CA/certs/cxc_pk.pem
```

Windows (cmd:)

```
openssl req -new -config C:\CA\openssl.cnf -out  
C:\CA\csrs\cxc_csr.pem -keyout C:\CA\certs\cxc_pk.pem
```

Use the OpenSSL “req” utility to generate a Self-Signed Certificate (private key) and the Certificate Signing Request (CSR) in PEM format. In this example, the file names are *cxc_pk.pem* for the private key, and *cxc_csr.pem* for the CSR.

Enter a pass phrase for the CA key, and complete the following fields::

```
Country Name (2 letter code) [US]: <your country>  
State or Province Name (full name) [MA]: <your state/province>  
Locality Name (eg, city) [Maynard]: <your locale>  
Organization Name (eg, company) [Acme Packet]: <your company>  
Organizational Unit Name (eg, section) [Support]: <your department>  
Common Name (eg, YOUR name) []: <Use the FQDN of the CXC>  
Email Address []: <your email address>
```



Note: The “common-name” field is the most important entry. This is the name that will be used to validate the certificate. Use the Fully Qualified Domain Name (FQDN) of the appropriate OS-E system, such as *nnose.acmepacket.com*.

Currently, some phones, such as Eyebeam do not support wildcard certificates where the common-name uses an asterisk character (*) in the domain name, such as **.acmepacket.com*

2. Sign the CSR with your OpenSSL CA.

Unix

```
openssl ca -config /CA/openssl.cnf -in /CA/csrs/cxc_csr.pem -out /  
CA/certs/cxc.pem
```

Windows

```
openssl ca -config C:\CA\openssl.cnf -in C:\CA\csrs\cxc_csr.pem  
-out C:\CA\certs\cxc.pem
```

Enter the pass phrase for the CA key, then respond “y” to the questions to generate and commit.

3. Merge the Private Key and Signed Public Key into one file.

Unix

```
cat /CA/certs/cxc.pem /CA/certs/cxc_pk.pem > /CA/certs/cxc.list.pem
```

Windows (cmd)

```
copy /CA/certs/cxc.pem + /CA/certs/cxc_pk.pem /CA/certs/  
cxc.list.pem
```

4. Upload the newly generated *cxc.list.pem* file back to the OS-E, then configure a TLS certificate, as covered earlier in this chapter. Be sure to associate it with the SIP protocol on the appropriate network interface.



Note: You can use the */CA/certs/ca.cer* (*C:\CA\certs\ca.cer* on Windows) file to import into a “Trusted Root Store.” For example, you can install this in Windows (Internet Explorer) for use with Soft Phones, such as Eyebeam. If you deploy the *ca.cer* file to multiple systems into the “Trusted Root Store”, then those systems will “trust” any certificates signed by this CA.

Using OpenSSL to Convert X.509 and RSA Keys

This section describes how to use OpenSSL to convert an X.509 certificate and/or RSA key to a Public-Key Cryptography Standard #12 (PKCS#12) format.

Requirements

You must have a working installation of the OpenSSL software and be able to execute OpenSSL from the command line.

Refer to “CTX106627 - How to Install the OpenSSL Toolkit,” for more information on obtaining and installing OpenSSL.

The PKCS#12 specifies a portable format for storing and transporting certificates, private keys, and miscellaneous secrets. It is the preferred format for many certificate handling operations and is supported by most browsers and recent releases of the Windows family of operating systems. It has the advantage of being able to store the certificate and corresponding key, root certificate, and any other certificates in the chain in a single file.

Procedure

1. Ensure that the certificate(s) and key are in PEM format.

- **To convert a certificate from DER to PEM:**

```
x509 -in input.crt -inform DER -out output.crt -outform PEM
```

- **To convert a key from DER to PEM:**

```
rsa -in input.key -inform DER -out output.key -outform PEM
```

- **To convert a key from NET to PEM:**

```
rsa -in input.key -inform NET -out output.key -outform PEM
```



Note: The obsolete NET (Netscape server) format is encrypted using an unsalted RC4 symmetric cipher so a passphrase will be requested. If you do not have access to this passphrase it is unlikely you will be able to recover the key

2. Use the **openssl** command to read the PEM encoded certificate(s) and key and export to a single PKCS#12 file as follows:

```
openssl pkcs12 -export -in input.crt -inkey input.key -out  
bundle.p12
```



Note: By default, the key will be encrypted with Triple DES so you will be prompted for an export password (which may be blank).

The PEM formatted root certificate and any other certificates in the chain can be merged into a single file such as root.crt, and included in the PKCS#12 file as follows:

```
openssl pkcs12 -export -in input.crt -inkey input.key -certfile  
root.crt -out bundle.p12
```

Step 4. Updating the Self-Signed Certificate

The **cert-update** action allows you to load the signed certificate that you receive from the CA. Once you have received the file, perform the following steps:

1. Upload the file to the OS-E using the **Tools/Upload file** function to browse for CA's certificate. Specify the destination path on the OS-E system, such as `/cxc/certs`, and specify the destination name of the certificate.
2. Select the **Keys** tab and select the appropriate key from the Key Stores list to display the Manage Key Store page.
3. Click **Update** to browse for the file that you uploaded in Step 1.
4. Click **Update** to load the signed certificate to the CXC.

If you choose to update the certificate using the **cert-update** action rather than from the **Keys** tab, complete the fields as follows:

keyFile—Specify the name and directory path of the key that you want to update.

Example: `/cxc/certs/<myNetworkKey>.p12`

alias—Optional. Specify the alias for the keyFile name, if previously created.

password—Specify the password associated with the keyFile, as specified previously.

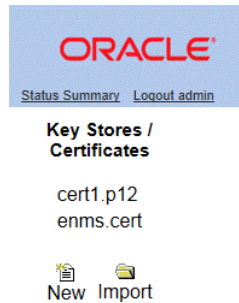
certFile—Specify the name and directory path of the signed certificate that you received from the CA and uploaded to the OS-E using the OS-E Management System **Tools/Upload File** function or other file transfer mechanism.

Subject Alternative Name for HTTPS Certificates Support

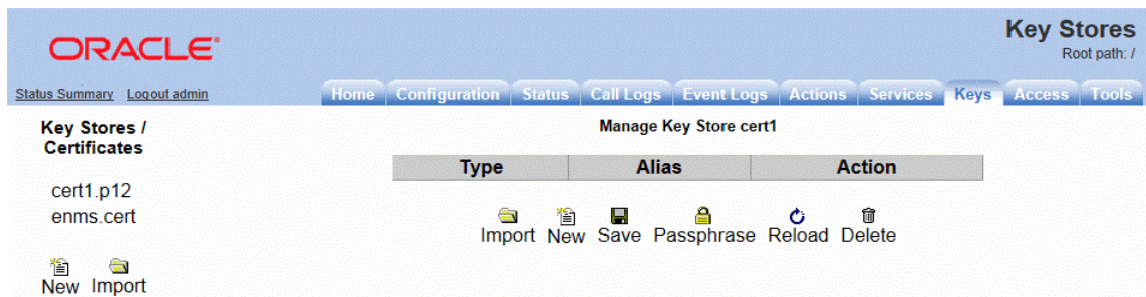
The OS-E supports Subject Alternative Name (SAN) for use with HTTPS certificates. SAN is a X509 version 3 certificate extension that allows one to specify a list of host names protected by a single SSL certificate.

To add multiple SANs to a certificate:

1. Select the **Keys** tab and either click **New** to create a new key store or select the existing store on which you want to add a certificate.



2. Enter a name and passphrase if creating a new key store and click **Create**.
The key store appears.



3. Click **New**. The Generate New Self-Signed Certificate in Key Store *X* page appears.

- Click **Add** beside the **Alternate name** field to add alternate host names be added to the certificate's subjectAltName field.

Key Stores
Root path: /

Home Configuration Status Call Logs Event Logs Actions Services **Keys** Access Tools

Generate New Self-Signed Certificate in Key Store cert1

Alias*

Common name*

Alternate name Add

Organizational Unit

Organization

State

Country (two-letter code)

Days valid (from 0 to 1095)

Key size (bits)

Create Cancel

- Click **Create**. The certificate appears in the key store.

Note: When configuring the OS-E via the CLI, separate multiple SAN entries using the ‘|’ character.

To view the SANs within a certificate click **View** next to the certificate name. The following image shows three SANs.

Properties	
Property	Value
Type	X.509
Version	3
Subject	CN=sjones@acmepacket.com, C=US
Issuer	CN=sjones@acmepacket.com, C=US
Valid After	Apr 29, 2013 8:59:26 AM
Valid Until	Apr 29, 2014 9:00:16 AM
Serial Number	1367240416880
Signature Algorithm	SHA1WithRSAEncryption

Other Properties	
Property	Value
Subject DN	C=US,CN=sjones@acmepacket.com
Subject Alternate Name	DNS Name:sjones@ap.com
Subject Alternate Name	DNS Name:sj@ap.com
Subject Alternate Name	DNS Name:sjones@acmepacket.com
Issuer DN	C=US,CN=sjones@acmepacket.com

Configuring the Certificate on the OS-E

Once you have imported the certificate to a directory on the OS-E system, configure the settings that control how the OS-E uses the certificate.

CLI session

The following CLI session sets the directory and certificate destination file name path and specifies the passphrase.

```
NNOS-E> config vsp
config vsp> config tls
config tls> config certificate myNetworkCert.pfx
Creating 'certificate myNetworkCert.pfx'
config certificate myNetworkCert.pfx> set allow-null-cipher enabled
config certificate myNetworkCert.pfx> set passphrase-tag pass
```

By default, the OS-E only supports TLSv1 and higher. Specify the **passphrase-tag** associated with the certificate file. Use this property if the certificate file is encrypted to have its private key information protected. This **passphrase-tag** must match the string with which the certificate was encrypted.

Displaying the Certificates Installed on the OS-E

Use the **show certificates** to command to display the list of installed certificates on the system.

Other TLS Certificate Settings

Using Certificate vs. Default-Outgoing-Settings

The OS-E uses a certificate configuration to identify the certificate file and the characteristics of the certificate. There are two types of certificate configuration—a named certificate entry that can be applied to specific TLS connects and a default certificate settings for use when a specific entry was not identified.

The entry created by the **certificate** object is used when the OS-E functions as a server in a TLS connection. Or, it can be used in an OS-E-as-client setup, if you have configured the connection to use a specific certificate. For example, when you set the connection type to the LDAP server to TLS in the **directory** object, you are required to enter a named certificate.

The entry created by the **default-outgoing-settings** object is used when the OS-E is a client with an unspecified certificate. For example, if you set the protocol that the DNS resolver server uses to TLS, you are not prompted for a certificate name. In this case, the OS-E uses either:

- The certificate identified in the **sip-settings** object, if the session matched a configured policy.
- The **default-outgoing-settings** if the session did not match a configured policy or the policy did not have a certificate specified.

Refer to the *Net-Net OS-E – Objects and Properties Reference* for detailed information on the default-outgoing-settings object under TLS.

Verifying Peer Certificates

The OS-E allows you to verify peer certificates. By default, the OS-E accepts all peer certificates. However, you can configure the OS-E to reject a connection if a peer's certificate does not meet the requirements of the network. Basic verification checks that the certificate's chain is valid, that it was signed by a trusted CA, and that the certificate has not expired.

To verify a peer's certificate, the appropriate CA file must be installed on the OS-E. For example, to connect to an LCS server, there are four requirements,

1. A client certificate that Session Presents presents to LCS at connection time,
2. A CA file (in PEM or PKCS#12) to verify the server's certificate when it is presented to the OS-E,
3. A Certificate Revocation List (CRL) in PEM format, a list of certificates that a CA has revoked, and thus can no longer be trusted. If any of the certificates in the chain presented to the OS-E appear in the CRL, the OS-E rejects the connection. This is an optional step. And,

4. A valid, verifiable host name that is presenting the certificate. If the host name doesn't match what the OS-E expects, the OS-E rejects the connection, even if the chain is valid.

CLI Session

The following CLI session defines multiple default CA files, and multiple default CRL files:

```
NNOS-E> config vsp tls
config tls> config default-ca
config default-ca> set ca-file /cxc/certs/ca1.pem tag1
config default-ca> set ca-file /cxc/certs/ca2.pem tag2
config default-ca> return
config tls> config default-crl
config default-crl> set crl-file /cxc/certs/crl1.pem tag3
config default-crl> set crl-file /cxc/certs/crl2.pem tag4
config default-crl>
```

Enabling Peer Certificate Verification

The **peer-certificate-verification** property allows you to control whether the OS-E validates a peer's certificate.

```
NNOS-E> config vsp tls
config tls> config certificate myNetworkCert.pfx
config myNetworkCert.pfx> set peer-certificate verification {none |
    if-presented | required}
```

None—The OS-E will not request a certificate from the peer, and will verify a certificate if presented with one. This is the default setting.

IfPresented—If a peer presents a certificate, the OS-E verifies it, or rejects the connection if the certificate fails verification. If no certificate is presented, the OS-E allows the connection.

Required—If a peer presents a certificate, the OS-E verifies it, or rejects the connection if the certificate fails verification. If no certificate is presented, the OS-E rejects the connection.



Note: TLS treats clients (initiators) and servers (answerers) differently. In a typical TLS connection, only the server presents a certificate; the client is only allowed to present a certificate if it is requested to do so by the server. Therefore, the **IfPresented** option applies only for a client connection.

Controlling the CA Files and CRLs to Apply to the Certificate

Configure each certificate entry to use or ignore the default CA and CRL settings.

```
config> config vsp tls certificate myNetworkCert.pfx
config certificate myNetworkCert.pfx> set use-default-ca true
config certificate myNetworkCert.pfx> set use-default-crl false
```

Optionally, you can configure each certificate entry to use an extra CA and an extra CRL, independent of the default settings, using the file path and passphrase tag.

```
config certificate myNetworkCert> set specific-ca-file /cxc/certs/
ca9.pem tag9
config certificate myNetworkCert> set specific-crl-file /cxc/certs/
cr19.pem tag10
```

Setting the Required Peer Name

The **required-peer-name** property specifies the name that appears in the presented certificate.

- If you do not configure a peer name, then the OS-E does not check the presented name.
- If you do configure a peer name, then that name must appear in the DNS field of the **alternateName** field, or in the **commonName** field for the certificate.

The **required-peer-name** can include wildcards, such as `"*.acmepacket.com"`. If the presented name does not match the required name, the OS-E rejects the connection.

Configuring TLS on Ethernet Interfaces

Referring to the network illustrated in the “Steps to Configuring TLS,” section, note that one Ethernet interface is connected to public Internet on port 443, and other Ethernet interface connects to the enterprise or service provider’s private network on the known TLS port 5061. Using port 443 on the public side of the network allows HTTPS requests to pass through the network firewall to the OS-E system.

CLI Session

The following CLI session configures IP on the public and private OS-E interfaces, and the SIP protocol, ports, and TLS certificate destination name references.

```
NNOS-E> config cluster
config cluster> config box 1
config box 1> config interface eth0
config interface eth0> config ip private
Creating 'ip private'
config ip private> set ip-address static 10.1.1.1/24
config ip private> config sip
config sip> set udp-port 5060
config sip> set tcp-port 5060
config sip> set tls-port 5061
config sip> set certificate vsp tls certificate myNetworkCert.pfx
Creating 'vsp\tls\certificate myNetworkCert.pfx'
config sip> return
config ip public> return
config interface eth0> return
config box 1>

config box 1> config interface eth1
config interface eth0> config ip public
Creating 'ip public'
config ip private> set ip-address static 216.1.1.1/24
config ip private> config sip
config sip> set udp-port 5060
config sip> set tcp-port 5060
config sip> set tls-port 443
config sip> set certificate vsp tls certificate myNetworkCert.pfx
Creating 'vsp\tls\certificate myNetworkCert.pfx'
config sip> return
config ip public> return
config interface eth0> return
config box 1>
```

Chapter 6. Configuring Secure Media (SRTP) Sessions

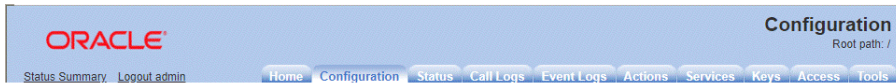
About This Chapter

This chapter provides information on configuring inbound and outbound encryption on SIP media sessions anchored by the OS-E.

Anchoring Media Sessions

Media anchoring forces the SIP media session to traverse the OS-E system. The **auto** setting enables conditional anchoring where the OS-E uses its auto-anchoring algorithms to determine anchoring necessity based on a variety of criteria, including whether you have configured smart anchoring via the **autonomous-ip** object and whether the calling devices are behind a firewall.

The following image shows an OS-E Management System session where you enable media anchoring in the default-session-config.



Configuring Inbound and Outbound Encryption

For secure inbound and outbound media sessions, you need to configure OS-E **in-encryption** and **out-encryption** settings. Inbound encryption handles the portion of the call from the initiator to the OS-E using a specified encryption method. Similarly, outbound encryption handles the portion of the call from the OS-E to the call recipient using a specified encryption method.

The following image shows the inbound encryption configuration page.

Status Summary Logout guest

Configuration

Home Configuration Status Call Logs Event Logs Actions Services Keys Access Tools Portal

Configuration: all

Configuration Setup View

cluster:asterisk

- box 1
- box 2
- box 3
- vrp

vsp

- registration-service
- access
- default-session-config
- sip-settings
- from-uri-specification
- media
- in-encryption
- bodypart-type
- in-codec-preferences
- out-codec-preferences
- in-media-normalization
- sip-directive
- presence
- authentication

Configure vspdefault-session-config-in-encryption

Show basic Help Index

Set Reset Back Delete

mode	none	(Do not allow encryption)
type	RFC-3711	(RFC-3711 compliant SRTP)
priority-AES-128-CM-HMAC-SHA1-32	1	(from 0 to 5, default=1)
priority-AES-128-CM-HMAC-SHA1-80	2	(from 0 to 5, default=2)
require-tls	false	
mki-length	0	(from 0 to 4, default=0)

Set Reset Back

Help Index

Inbound Encryption Mode and Type

Set the inbound encryption mode to one of the following settings:

- none**—The OS-E disables the encryption put forth by the incoming endpoint. (That is, it responds “no” to the encryption portion of the authentication handshake.) If the outbound endpoint requires encryption, then the call is dropped.
- allow**—The OS-E passes the call through, leaving the encryption setting unchanged.
- require**—The call must come in with encryption specified or the OS-E drops it.

Set the inbound encryption type to one of the following settings:

- RFC-1889**—Use encryption as defined in RFC 1889, RTP: A Transport Protocol for Real-Time Applications. This mode is used for compatibility with Windows Messenger and Microsoft Office Communicator, neither of which currently support RFC-3711 encryption. Instead, it uses a DES-CBC encryption of the entire UDP payload (including RTP headers) with no authentication.
- RFC-3711**—Use encryption as defined in RFC 3711, The Secure Real-time Transport Protocol (SRTP). This is the same encryption as used in the OS-E setting.

- **Linksys**—Use Linksys/Sipura encryption over Linksys phones. Refer to Linksys Encryption for more information

The following image shows the inbound encryption configuration page.

The screenshot shows the Asterisk configuration web interface. The top navigation bar includes links for Home, Configuration, Status, Call Logs, Event Logs, Actions, Services, Keys, Access, Tools, and Portal. The main content area is titled 'Configuration: all' and shows a tree view on the left with the following structure:

- cluster:asterisk
 - box 1
 - box 2
 - box 3
 - vrp
- vsp
 - registration-service
 - access
 - default-session-config
 - sip-settings
 - from-un-specification
 - media
 - in-encryption
 - out-encryption
 - bodypart-type
 - in-codec-preferences
 - out-codec-preferences
 - in-media-normalization
 - sip-directive
 - presence

The right pane shows the configuration for 'Configure vspdefault-session-config/out-encryption'. It includes a 'Show basic' button and links for 'Help' and 'Index'. The configuration fields are as follows:

mode	none	(Do not allow encryption)
type	RFC-3711	(RFC-3711 compliant SRTP)
priority-AES-128-CM-HMAC-SHA1-32	0	(from 0 to 5, default=0)
priority-AES-128-CM-HMAC-SHA1-80	1	(from 0 to 5, default=1)
require-tls	false	
mki-length	0	(from 0 to 4, default=0)

At the bottom of the configuration pane are buttons for 'Set', 'Reset', 'Back', and 'Delete', along with 'Help' and 'Index' links.

Outbound Encryption Mode, Type, and Require-TLS Setting

Set the out-encryption mode to one of the following settings:

- **none**—The OS-E disables the encryption put forth by the outbound endpoint. (That is, it responds “no” to the encryption portion of the authentication handshake.) If the inbound endpoint requires encryption, then the call is dropped.
- **offer**—The OS-E changes or establishes the encryption type to the value specified in the **type** property, below.
- **follow**—If the inbound endpoint offered encryption, the OS-E offers that type to the outbound endpoint.
- **require**—The call must come in with encryption specified or the OS-E drops it.

Set the out-encryption type to one of the following settings:

- **RFC-1889**—Use encryption as defined in RFC 1889, RTP: A Transport Protocol for Real-Time Applications. This mode is used for compatibility with Windows Messenger and Microsoft Office Communicator, neither of which currently support RFC-3711 encryption. Instead, it uses a DES-CBC encryption of the entire UDP payload (including RTP headers) with no authentication.

- **RFC-3711**—Use encryption as defined in RFC 3711, The Secure Real-time Transport Protocol (SRTP). This is the same encryption as used in the OS-E setting.
- **Linksys**—Use Linksys/Sipura encryption over Linksys phones. Refer to Linksys Encryption for more information.



Note: Because the OS-E does not always know on the outbound leg the encryption method expected by the recipient (because that recipient isn't in the registry), you must manually set the type of encryption to offer.

Require TLS

The **require-tls** property specifies the requirements of the signaling protocol for a call's outbound leg. That is, it defines whether the OS-E offers SRTP over a non-secure (TCP or UDP) signaling connection. The action of this property depends on the setting of the mode property. When this property is set to:

- **true**—The OS-E only offers encryption when talking to a TLS client. If TLS and SRTP are required (**mode** is set to **require**), the OS-E fails calls going to TCP/UDP clients. If the mode property is set to **offer** or **follow**, the OS-E forwards the call without SRTP.
- **false**—The OS-E offers SDP messages according to the mode setting without regard for the signaling transport. This allows keys to be exchanged in an insecure message.

Most phones follow [RFC 4568, SDP Security Descriptions for media Streams](#), and thus require that this property be set to *true*.

Linksys Encryption

The **linksys** action allows you to generate a Linksys/Sipura mini-certificate and private key which, after loaded into the phone, will be used to exchange the symmetric key. You must execute this action and load the result into both phone parties.

Linksys equipment supports a proprietary version of SRTP. It uses SIP INFO messages to exchange credentials (in mini-certificates) and securely distribute the key used to encrypt/decrypt the RTP packets. The RTP encryption is a variation of RFC-3711; the encryption algorithm is the same (AES-CM-128), but uses HMAC-MD5 instead of HMAC-SHA1 for authentication.

The CLI syntax for the **linksys mini-certificate** action is:

linksys mini-certificate user-id display-name expires [filename]

The following image shows the linksys mini-certificate page.

The screenshot shows the Oracle Communications Application Session Controller 3.8.0 web interface. The top navigation bar includes the Oracle logo, a 'Logout admin' link, and a series of tabs: Home, Configuration, Status, Call Logs, Event Logs, Actions, Services, Keys, Access, and Tools. The 'Actions' tab is selected. The main content area is titled 'linksys' and has a subtitle 'Generate or check Linksys/Sipura SRTP encryption parameters'. On the left side, there is a list of file-based actions. The main form area contains the following fields:

- * cert**: A section header for the certificate generation.
- * cert_type**: A dropdown menu set to 'mini-certificate'. A note next to it says '(Generate Linksys/Sipura mini-certificate and phone private key)'.
- * user-id**: A text input field.
- * display-name**: A text input field.
- * expires**: A text input field with an example value '23:05:45 2004-11-25'.
- filename**: A text input field with a 'Browse System Files' link next to it.

The **linksys** action provides three tools:

- **mini-certificate**—Creates a mini-certificate, which will later be used by a Linksys phone to exchange an encrypted symmetric key. When both phones in a call support cryptographic exchange, use this action to create a mini-certificate that is sent in an INFO message to the other phone. (You must execute this action for both phones.) After exchanging mini-certificate, the phones can then exchange an encrypted symmetric key.

Enter the following fields to generate a mini-certificate:

- **userID**—A name that identifies this phone (subscriber) to the other party. The user ID can be up to 32 characters.
- **displayName**—A name used by the caller to verify that the callee is the intended call recipient. Enter the user ID field in the Request URI of the INVITE message sent to the proxy server by the caller UAC when making a call to this subscriber (UAS). The display name can be up to 16 characters.
- **expiration**—The date and time at which this mini-certificate expires. Enter the date in the format *hh:mm:ss yyyy-mm-dd*.

- **filename**—A name for an output file that will contain the mini-certificate and private key. If you do not specify a file name, the output is not written to a file.

Once you execute this option, the OS-E returns the content of the mini-certificate and the SRTP private key. You can copy and paste each of these fields into your phones Web GUI (or other software interface), as well as test the certificate using the **check-mini-cert** option.

- **generate-ca-key**—Generates a Linksys/Sipura CA key. This is the public/private key pair that acts as the Sipura certificate authority. It is needed to generate the mini-certificates for each phone and during the key exchange.

The key is stored in **/cxc/certs/linksys_ca.pem**. When executing this action, you can specify whether to overwrite any previous CA key. The default setting, **false**, does not overwrite the key. Set the field to **true** to force an overwrite.

- **check-mini-cert**—Verifies the contents of a certificate created with the mini-certificate option. When executed, the OS-E checks the expiration date and signature of the certificate. Enter the content of the mini-certificate to invoke this option.



Note: You must have a root certificate loaded on the OS-E system for this action to be successful. The default location for the root certificate is **/cxc/certs/linksys_ca.pem**.

The following CLI session generates the mini-certificate and private key for the Linksys phones.

CLI Session

```
NNOS-E> linksys mini-certificate ?
```

Generate or load Linksys/Sipura SRTP encryption parameters

```
syntax: linksys mini-certificate user-id display-name expires  
[filename]  
        linksys generate-ca-key [force]  
        linksys check-mini-cert minicert
```

```
NNOS-E> linksys mini-certificate 9577 9577-display "23:05:45  
2004-11-25"
```

Mini Certificate:

```
OTU3Ny1kdWVyYb2QAAAAAAAAAAAAAAAAAAAAAAAAAAAAA5NTc3AAAAAAAAAAAAAAAAAMDMwNT
Q1MjYxMTA0yYbYgcwG8IeaYz225GrS7sDJfInfyJxARPEhQ+C06WisAZ77U2zBi8TCapI
wqcDhNXwgYKZxljAET3dFnzAxs2ze1/
kEHCqvUmDIEjaYL+1wTySaI1TGKy15FbyZb6dQXtbPF+fxiRP//
caFFkUBTUuwtjExxaAz0H3u8Tc2YT/wH7a0+snpUTFeK/
Sv9vd7aAUbufSxewlL2GeTd0u0v2i4R25/
RH6i0HyChGpVt2EJ3BHAlLgXTfJibiwwkrMSeigrSibsCy0D825ezAt66AVKTA/
h0mSBvdZvdamJIsbP89vnAJPi0fWNet8T40/w0YyyIAE5JDJ/2+G/
MDyc5ImzFTvifKvIQ55T7Jr5E0RUbacDZiIH5oW+x4sfawCiQZunnb11qlAgYhvOeuo
4f3JGUKJAlld0GRjHfvjRhb3c=
```

SRTP Private Key:

```
0xq38oJqjhe++yBTtTotoMndnZXulkgnnxFQpd0v96oc81IZ5dug9Szob9ZYQXsPkwAxSb
0xq38oJqjhe++BVpyxz2P2qtZEg==
```

NNOS-E> **linksys check-mini-cert**

```
OTU3NwAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA5NTc3AAAAAAAAAAAAAAAA
AAAMTU10DQ4MTEyNTA0z1TBkpXzjmR6PFX5K4S7G5SxdpozH460T14Kpw0xZ8
ly4KWpFlcC2rTTWEU6Wn0ufcj5Bfif7cdsAF/
89kZu83NFceK2ZBRGrJ4cbxREtuPwy1FqkXpBQczTTFXjeyFaq8K70ESebQay
FetBEceIupuzxfedlJPRsMRhsHN1uKpomc/
tdJFHJhXsZn+fX+GTACrXQEHZI+ooDL+iQvzhJ1zk/
gXTGuk76lkJG2XLvSvdjTp8RjQX/F5h0GnBa02d3bQ51n7IBvJnTeaGKp/U/
e5pQvW5u6vD/uHkqkTGkZDZz0yIISIdgWVxdjA9cpaSa2D5nPhr8G/
Wh0adLZ08fmB0kPwEFjJ0h0dojjknjNjp/
qVjR5NEEzuj5kH7Q1vxk25l0MThhydCYpbxShy2GSno7apnyCA02YBQCRlGB0
S=
```

Certificate has expired

NNOS-E> **linksys generate-ca-key**

Unable to overwrite Linksys CA key

Chapter 7. Creating and Commissioning USB Sticks

This chapter provides information on creating and commissioning OS-E USB software installation sticks for commissioning third-party servers. Using the Internet and secure Web URLs, Oracle provides all necessary software downloads for USB creation, product licensing, and commissioning of the OS-E on your selected hardware.

As part of each download, and depending on your actual requirements, Oracle can provide the following:

- USB Boot Media Creator (BMC) with the OS-E software.
- Documentation on how to create a USB stick and commission the OS-E software on your selected hardware
- Standard set of Oracle OS-E technical publications

Supported USB Sticks

You must provide a USB stick with at least 1GB storage, to handle OS-E software downloads. Oracle has tested a variety of USB sticks available from current suppliers and manufacturers. Most 4GB USB sticks manufactured today work.

USB Stick Restrictions

Files that are larger than 2 MB will not be backed up to the USB stick and restored during the upgrade process.

All *.cfg and *.xml files in the current working directory (/cxc) that are less than 2 MB in size are backed up to the stick and restored during the upgrade.

In the event that Internet access is unavailable, use the **show system-info** command to display the box identifier. Access <https://licensecodes.oracle.com> and click Acme Packet. The Acme Packet License Key Request page appears. Enter the required fields, including the **show system-info** value for **Original Chassis Serial #(s)**, and click **Submit**. After your customer information has been verified, Oracle will send the license(s) to you via email. You can then use the OS-E Management System **Upload License** function or **WinSCP** to place the license files on the system.

Note: Licenses are applicable to royalty-bearing codecs only.

- **Downloads for the OS-E Virtual Machine**—Includes the VM for running the OS-E/ASC software on x86-based hardware running your VM. The OS-E and ASC technical documentation download is also included.

For complete information on the VM, see “Installing and Running the OS-E Virtual Machine”.

Important Note About the New USB Stick

The OS-E USB stick provides three important functions:

- **Rescue utilities**—After you have successfully commissioned the system (booted and licensed), the system automatically rewrites the USB stick so that you can use it to run system utilities in the event of a catastrophic failure. You will not be able to use this USB again to license another system. The USB can only be used at the specific system from which it was originally written.

Additionally, licensing information is rewritten to the USB, directly associating the license with the system. Use the **show system-info** action to display the box identifier (box-id) to which this USB is associated. The USB also contains log and debug files that you can use to help diagnose problems associated with the USB licensing process.

- **Rescue stick creation**—With the original USB commissioning stick, use the **restore-stick-create full-backup** action to capture the current software, certificates, and operating system image to the USB stick. Oracle recommends that you use **restore-stick-create full-backup** to preserve the image prior to performing a system software upgrade, or whenever you have made significant and reliable changes to the system configuration.

See Chapter 3 of this guide for information on these functions.

Creating a New USB Rescue Stick

The **restore-stick-create full-backup** action allows captures the current OS-E software and the operating system image and creates a new USB rescue stick. Oracle recommends that you use **restore-stick-create full-backup** to preserve the image prior to performing a system software upgrade, or whenever you have made significant and reliable changes to the system configuration.

Perform the following steps:

1. At the NNOS-E prompt, type **umount usb**.
Ignore the warning about the USB stick not being mounted.
2. Remove the USB stick and wait at least five seconds before reinserting the stick.
3. Check if rsync was installed or not on ASC. If not, need to install it by using the command *yum install rsync*
4. Invoke the **restore-stick-create full-backup** action. The resulting USB is a boot device from which you can restart and restore the OS-E.



Note: The log event indicating that the operation has completed successfully appears while data is being written to the stick. DO NOT immediately remove the USB stick when you see this log event. Instead, issue the **umount usb** command again, and wait for it to complete.

5. Remove the restore USB when the **restore-stick-create** action has completed.



Note: PostgreSQL database, media recordings, system tar files(.gz) are not written to the restore stick with the **restore-stick-create** action.



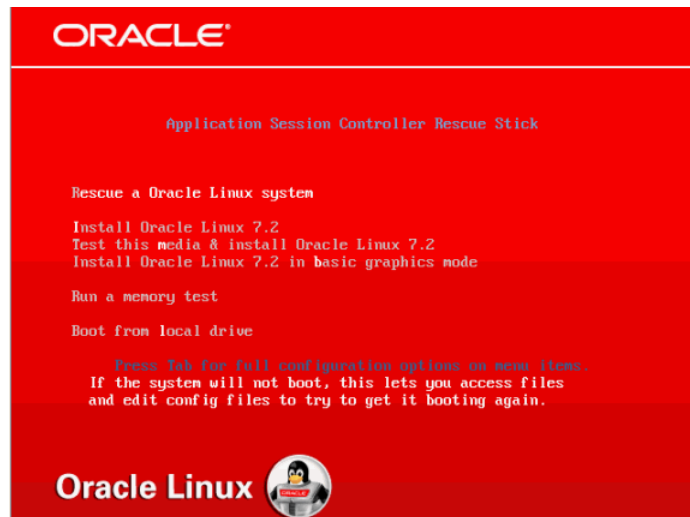
Note: Use the **restore-stick-create config-backup** action to create a restore stick containing the current configuration file only.

Using the Rescue Utility USB

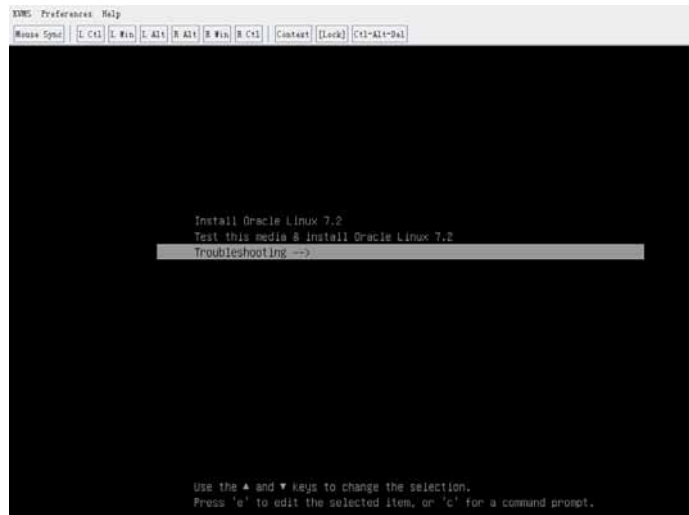
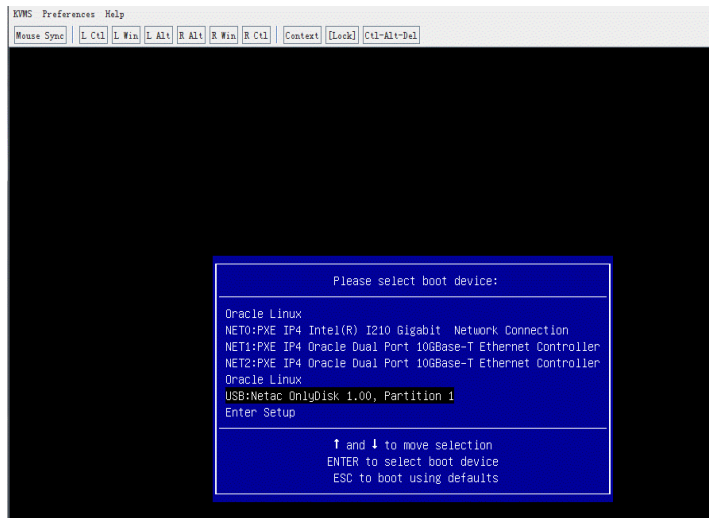
To use the rescue utility USB, perform the following steps:

1. Insert the rescue utility USB into one of the USB slots.

2. At the NNOS-E prompt, if available, enter **restart cold** to do a full restart.
3. The USB and disk lamps will blink during the boot-up process followed by a series of system messages. Press any key to continue, or perform the appropriate action below. On the
 - **Oracle Netra X7-2**—Press **F8**
 - **Oracle Netra X5-2**—Press **F8**
 - **Oracle Netra X3-2**—Press **F8**.
4. The system enters utility mode and the following menu appears for X3-2 and X5-2:



Following screens appears for X7-2 to enter rescue mode:



You can perform one of the following:

- Rescue an Oracle Linux system

Note: This boots the system into rescue mode and attempts to mount the OS-E drive under `/mnt/sysimage`. Refer to [Using the Rescue Mode](#) for more information.

- Install Oracle Linux 7.5.
- Test this media and install Oracle Linux 7.5.
- Install Oracle Linux 7.5 in basic graphics mode.

Note: The above three options run the Oracle Linux 7.2 installer. These actions wipe out any existing configuration and data. Using either the **restore-stick-create** action or the rescue mode, ensure your configuration and other data files have been backed up. Once Oracle Linux is reinstalled, the OS-E packages must be reinstalled. For more information on installing the OS-E, see “Installing the OS-E”.

- Run a memory test.
- Boot from the local drive. (Boots from the local hard disk and defaults to the first disk. To change the disk, use the <**Tab**> key.

Using the Rescue Mode

The Expert mode provides utilities that allow you to recover from system failures where there is apparent damage to the software and configuration file, and where recovery is necessary to return the OS-E to normal operation.

If you enter rescue mode, the system boots and attempts to mount the OS-E hard drive at `/mnt/sysimage`. If there are multiple Oracle Linux installations, there is a prompt to select which installation.

```
Starting installer, one moment...
anaconda 21.48.22.56-1 for Oracle Linux 7.2 started.
* installation log files are stored in /tmp during the installation
* shell is available on TTY2
* if the graphical installation interface fails to start, try again with the
  inst.text bootoption to start text installation
* when reporting a bug add logs from /tmp as separate text/plain attachments
=====
Rescue

The rescue environment will now attempt to find your Linux installation and mount
it under the directory : /mnt/sysimage. You can then make any changes require
d to your system. Choose '1' to proceed with this step.
You can choose to mount your file systems read-only instead of read-write by cho
osing '2'.
If for some reason this process does not work choose '3' to skip directly to a s
hell.

1) Continue
2) Read-only mount
3) Skip to shell
4) Quit (Reboot)

Please make a selection from the above: 1
=====
Rescue Mount

Your system has been mounted under /mnt/sysimage.

If you would like to make your system the root environment, run the command:

    chroot /mnt/sysimage
Your system is mounted under the /mnt/sysimage directory.
Please press <return> to get a shell.
When finished, please exit from the shell and your system will reboot.
sh-4.2#
```

If the system mounts the drive successfully, you can attempt to repair it or perform a backup.

Backing Up the Configuration

Execute the `save_box_config.sh` script to copy the configuration.

Note: The USB drive must be mounted prior to executing this script.

```
sh-4.2# mkdir /mnt/usb
sh-4.2# mount /dev/disk/by-label/ASC_RESCUE /mnt/usb
sh-4.2# save_box_config.sh ?/mnt/sysimage /mnt/usb
sh-4.2# umount /mnt/usb
```

After a fresh Oracle Linux and OS-E installation, booting with this USB stick inserted automatically restores this configuration.

Chapter 8. Installing and Running OS-E Virtual Machine

This chapter provides information on downloading, installing, and running the OS-E Virtual Machine (VM) software in virtual OS environments. This software is the same software as used for non-virtual OS but has been packaged specifically as a VM for use in virtual OS environments.

The OS-E VM is designed to be used as an evaluation platform so that potential customers can test the OS-E software in an environment that does not require them to install the software on a dedicated piece of hardware. In some cases, the VM can also be used in production environments provided that the customer understands the limitations associated with using the VM software in a virtual OS environment.

Server-Based Requirements

Before downloading the VM to an x86-based server, make sure that you have met the following hardware and software requirements:

Hardware

- x86-based Windows or Linux server with Intel 64-bit dual-core processors
- 8GB minimum (16 GB recommended) physical memory for each VM instance
- Minimum of 70GB hard disk space per VM instance
- One or two Ethernet interfaces

Software

The following VM platforms have been certified for use with the OS-E:

- VMware ESXi 6.7
- KVM 1.5.3

Linux Installations

If you are installing the OS-E VM on a Linux workstation running VMware, Oracle recommends the following technical resources:

For Server 1.0 and 2.0

http://www.vmware.com/support/pubs/server_pubs.html

Player 12.0

http://www.vmware.com/support/pubs/player_pubs.html

Installing the VM

This section describes the process for installing the OS-E VM on each of the certified VM platforms.

Installing the OS-E on VMware ESXi 6.7

The OS-E is certified to run on VMware ESXi 6.7.

Oracle recommends the following configuration.:

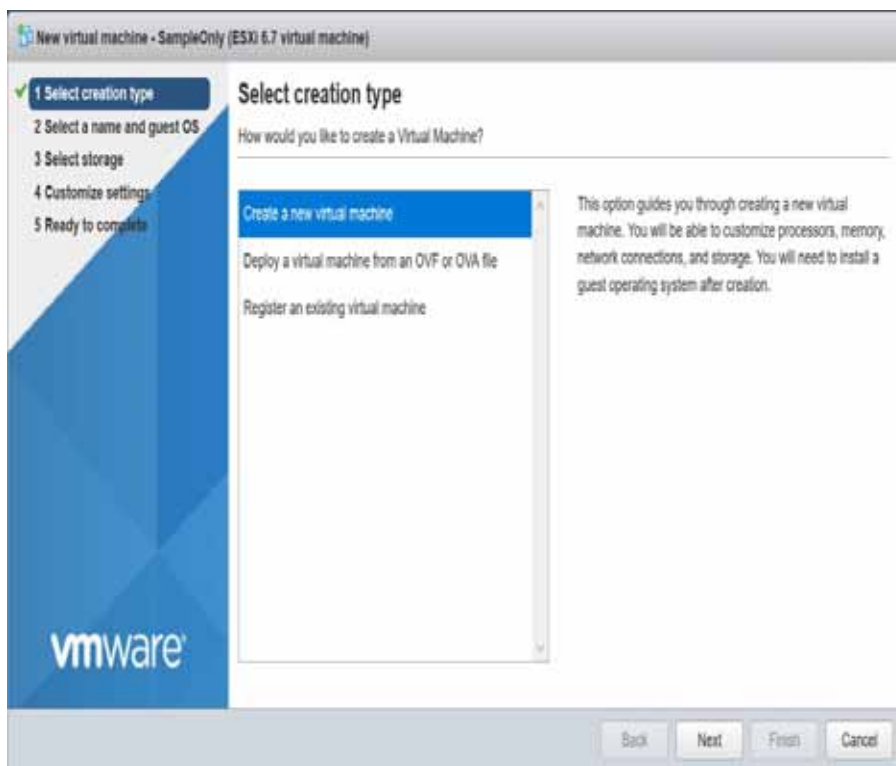
- vCPUs: 16 (16 sockets, 1 core per socket)
- RAM: 8GB
- Disk: 70G

To install the OS-E on a VMware ESXi:

1. Copy the OS-E's ISO file to the Datastore.
2. Click Create / Register VM to create a VM.

To create a VM:

1. Click **Select creation type**. Select **Create a new virtual machine**. Click **Next**.



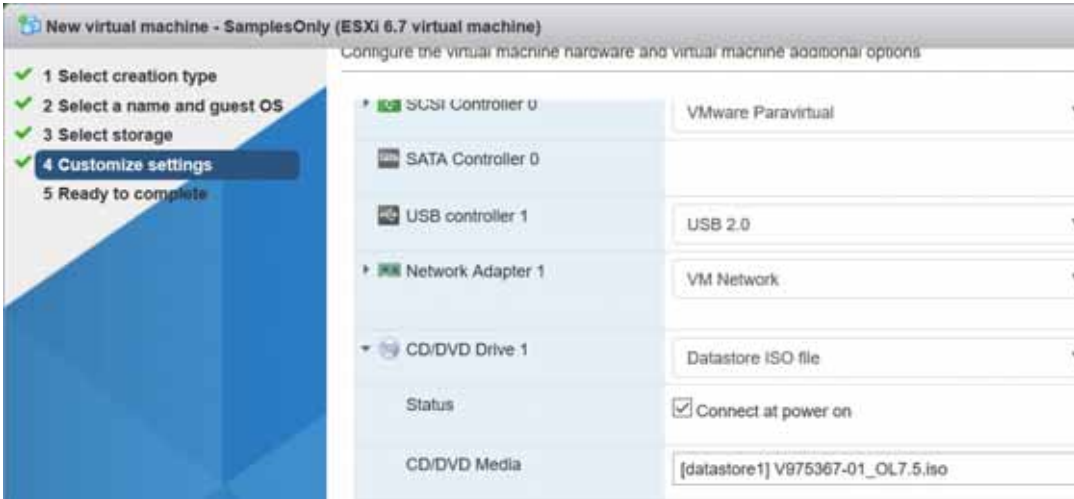
2. Click **Select a name and guest OS**. Specify a **Name**, select **ESXi 6.7 virtual machine** from **Compatibility** drop-down menu, select **Linux** from **Guest OS family** drop-down menu, and select **Oracle Linux 7 (64-bit)** from **Guest OS version** drop-down menu. Click **Next**.



3. Click **Select Storage**. Select datastore. Click **Next**.



4. Click **Customize settings**. Set the value as follows for the following fields for this VM: **CPU**: 16, **Memory**: 8 GB, **Hard disk**: 70 GB, **SCSI Controller 0**: default, **SATA Controller 0**: default, **USB Controller 1**: default, **Network Adapter**: default, **CD/DVD Drive 1**: Datastore ISO file, **Video Card**: default



5. Click **Next**.
6. Click **Ready to complete**. Review the settings and click **Finish**.



Installing the OS-E On KVM 1.5.3

The OS-E is certified to run on KVM 1.5.3 on OL7.

Oracle recommends the following configuration.

- vCPUs: 8
- RAM: 8GB
- Disk: 70G

Note: Oracle recommends using LVM partitions as disks.

1. Install dependent tools.

Note: The following example assumes the volume group is named “ol”.

```
# yum install -y qemu-kvm qemu-kvm-tools libvirt bridge-utils  
virt-manager virt-viewer virt-v2v virt-top virt-install
```

2. Enable service.

```
# systemctl start libvirtd && systemctl enable libvirtd
```

3. Create a raw disk.

```
# qemu-img create -f raw /opt/ol01.raw 70G
```

4. Create a bridge configuration file

```
# cp ifcfg-eth0 ifcfg-br0
```

Delete IPADDR, NETMASK, GATEWAY and so on in ifcfg-eth0
And add BRIDGE=br0 in ifcfg-eth0

5. Create a VM.

```
# virt-install -n SamplesOnly -r 8192 --os-type=linux --cdrom=/data/  
V975367-01.iso --disk path=/opt/  
ol01.raw,device=disk,bus=virtio,size=70,sparse=false,format=raw  
--vcpus=8 -w bridge=br0,model=virtio
```

Configuring the VM

Once the VM is installed and running, you now must configure it to match the SIP application you are supporting. Since the VM does not have a pre-installed base configuration, Oracle provides the **config setup** configuration setup script that you can use to create a base configuration.

Using Config Setup

For Oracle users who are familiar with OS-E, the *config setup* script enables the configuration on the VM to make it reachable via ICMP (ping), SSH, and HTTPS for further configuration. The script presents a set of questions to help you with the initial system configuration. The information in the script includes the following:

- Local hostname
- IP interface names and addresses
- SSH and Web access
- Default route and any additional static routes per interface for remote management
- User-defined OS-E

Every Oracle OS-E system has a minimum of two Ethernet interfaces. Any Ethernet interface on the system can be used for management traffic, however, Oracle recommends the use of eth1, as eth0 is reserved for fault-tolerant clustering with other OS-E systems. Management traffic is also supported on any interface that is carrying private or public network traffic. This means that it would be possible to use eth1 to carry SIP traffic and management traffic.

CLI Session

```
NNOS-E-VM> config setup
set box\hostname: <name>
config box\interface: eth1
set box\interface eth1\ip a\ip-address: <ipAddress/mask>
config box\interface eth1\ip a\ssh (y or n)? n
config box\interface eth1\ip a\web (y or n)? y
config box\interface eth1\ip a\routing\route: <routeName>
set box\interface eth1\ip a\routing\route localGateway\gateway:
<ipAddress>
set box\cli\prompt: <newPrompt>
Do you want to commit this setup script (y or n)? y
Do you want to update the startup configuration (y or n)? y
```

Sample VM Configuration

This section describes a base configuration designed to support a standard SBC application where the VM functions with SIP endpoints and a PBX or feature server. The high-level details of this configuration are provided below and additional details are embedded in the configuration file itself at the end of this section.

- Two interfaces: one "outside" and one "inside."
- Management ports for ICMP, SSH, and HTTPS open on both interfaces.
- The IP address associated with a DNS resolver.
- SIP UDP, TCP, and TLS ports open on both interfaces.
- NAT traversal & media anchoring enabled.
- A sample gateway configuration for an attached PBX or feature server.
- A sample registration- and dial-plan for delegation of SIP traffic to the attached PBX or feature server.
- A local registration plan to support registrations and calls locally through the VM (for cases where there is no attached PBX or feature server).



Note: Oracle recognizes that the items in the base configuration will not be 100% applicable to all OS-E-VM deployments. However, by including these items in this sample configuration, new VM users can observe the configuration structure and hierarchy. Any necessary changes to this base configuration can be made using the procedures described in the Oracle manual set. See, "Using Oracle Documentation," for more information.

Below is a copy of the base configuration. Note that any changes to the configuration should be made using the OS-E Management System (see, "Enabling the OS-E Management System").



Note: Oracle does not recommend editing the configuration file below directly, and then importing it into the VM. While the VM does support this function, it is possible to introduce syntax errors into the configuration file using this method. Modifying the configuration with the CLI or Management System prevents this possibility.

This section is unique to every VM; you do not need to edit this.

```
config cluster
  set name acmepacket-nnos-e-vm-demo
config box 1
  set hostname acmepacket-nnos-e-vm-demo
  set name acmepacket-nnos-e-vm-demo
  set identifier 00:0c:29:c9:7a:e2
```

The IP address is configured as part of the configuration script execution.

```
config interface eth0
  config ip outside
    set ip-address static 172.30.3.128/22
  config ssh
  return
  config web
  return
  config sip
    set nat-translation enabled
    set udp-port 5060 "" "" any 0
    set tcp-port 5060 "" "" any 0
    set tls-port 5061 "" "" any 0
    set certificate vsp\tls\certificate sample
  return
  config icmp
  return
  config media-ports
  return
  config routing
    config route default
      set gateway 172.30.0.1
    return
  return
  return
return
```

The following section of the configuration provides a DNS resolver entry and is configured as part of the configuration script execution. This is not required for operation but can be helpful if you want to use FQDNs in the config instead of IPs)

```
config dns
  config resolver
    set server 192.168.1.3 UDP 53 100 ALL
  return
  return
return
```

The following IP is disabled; you can enable it once you change the IP to match your local network conditions.

```
config interface eth1
  config ip inside
```

```
set admin disabled
set ip-address static 192.168.1.2/24
config ssh
return
config web
return
config sip
set udp-port 5060 "" "" any 0
set tcp-port 5060 "" "" any 0
set tls-port 5061 "" "" any 0
set certificate vsp\tls\certificate sample
return
config icmp
return
config media-ports
return
```

This routing config is provided as an example; edit it as needed. Change to match your preferred NTP server.

```
config routing
    config route inside-ntwk
        set destination network 192.168.0.0/16
        set gateway 192.168.1.1
    return
return
return
return
config ntp-client
    set server pool.ntp.org
return
config cli
    set prompt nnos-e-vm>
return
return
return
```

The following section of the configuration contains all of the event log filters and targets.

```
config services
config event-log
    config file eventlog
        set filter all error
    return
    config file access-log
        set filter access info
    return
    config file kernelsys
        set filter krnlsys debug
    return
```

```
config file db
  set filter db debug
return
config file system
  set filter general info
  set filter system info
return
config file access
  set filter access info
return
config file dos
  set filter dosSip alert
return
config local-database
  set filter all error
return
return
return
```

The following section of the config provides some commonly used default system parameters; further information on these parameters is provided in the tech manuals.

```
config master-services
  config database
    set media enabled
  return
return

config vsp
  set admin enabled
  config default-session-config
    config media
      set anchor enabled
    config nat-traversal
      set symmetricRTP true
    return
    set rtp-stats enabled
  return
  config sip-directive
    set directive allow
  return
  config log-alert
  return
return
config tls
  config certificate sample
  return
return
```

The following section of the configuration provides a sample policy rule to reject calls from a user with a URI that starts with 1000. This sample is provided as a means of introducing a new user to the concept of policy rules)

```
config policies
  config session-policies
    set default-policy vsp\policies\session-policies\policy default
  config policy default
    config rule sample-rule
      set description "sample rule to reject calls"
      config condition-list
        set from-uri-condition user match 1000
      return
    config session-config
      config sip-directive
        set directive refuse 400 "Please Pay Your Bill"
      return
    return
  return
return
```

The following configuration provides a sample dial-plan that takes a call with a Req URI domain of delegate.com and forwards it to the sample SIP gateway.

```
config dial-plan
  config route sample-delegate
    set description "delegate to defined server"
    set peer server "vsp\enterprise\servers\sip-gateway sample-gateway"
    set request-uri-match domain-exact delegate.com
  return
return
```

The following configuration provides a sample registration plan that takes a registration attempt with a domain of xyz.com and registers the endpoint locally. This is useful for cases where you want to register an endpoint locally for call testing purposes.

```
config registration-plan
  config route sample-accept-local
    set description "accept registers locally for this domain"
    set action accept
    set peer server "vsp\enterprise\servers\sip-gateway sample-gateway"
    set to-uri-match domain-exact xyz.com
  return
```

The following configuration provides a sample registration plan that takes a registration attempt with a domain of delegate.com and proxies the registration to the attached PBX or feature server.

```
config route sample-delegate
    set description "delegate to the defined server"
    set peer server "vsp\enterprise\servers\sip-gateway sample-gateway"
    set to-uri-match domain-exact delegate.com
    return
return
```

The following configuration provides a sample SIP gateway that could be used for an attached PBX or feature server. You will need to edit the IP address to reflect the actual server IP or FQDN.

```
config enterprise
    config servers
        config sip-gateway sample-gateway
            config server-pool
                config server sample-server
                    set host 192.168.1.4
                return
            return
        return
    return
return
```

```
config external-services
return
```

The following configuration provides two different sample permission sets. These permission sets modified and/or can be used with user accounts that you create.

```
config access
    config permissions super-user
        set cli advanced
    return
    config permissions view-only
        set cli disabled
        set config view
        set actions disabled
        set templates disabled
        set web-services disabled
        set debug disabled
    return
return

config features
return
```

Acme Packet recommends that the storage-device fail-threshold be set to 200.

```
config services
  set fail-threshold 200
return
```

Enabling the OS-E Management System

Once you have configured an Ethernet interface, such as eth1, you can use your Internet Explorer Web browser to point to the configured IP address of this interface to launch the OS-E Management System. The OS-E Management System provides a windows and menu user interface to configuring the OS-E. See the *Net-Net OS-E – Using the NNOS-E Management Tools* for information on using the CMS.

Bridging to Additional Ethernet Ports

Follow the steps in this section if you need to configure VMware Player on a Window platform to use two bridged networks. By default, VMWare Player allows the following functionality:

- One bridged interface (to the first host network interface)
- One NAT interface
- One host-only interface

To create two bridged interfaces, you will need to

1. add an additional VMnet associated with a second interface, and
2. edit the VM configuration file to use the new VMnet.

Adding an Additional VMnet

To add an additional VMnet, perform the following steps:

1. Halt all VMs currently running on this x86-based PC or server.
2. Launch the **vmnetcfg.exe** application from the VMware Player installation directory (c:\Program Files\VMware\VMware Player\vmnetcfg.exe).
3. Select the **Host Virtual Network Mapping** tab.

4. Select a VMnet to use for the second network interface card (NIC), such as VMnet3.
5. From the drop-down men, select the NIC you wish to connect to this VMnet.

If you want to have more control over which VMnet0 which connects to the first NIC perform the following steps:

1. Select the **Automatic Bridging** tab.
2. In the **Automatic Bridging** box, de-select the **Automatically choose and available physical network adapter to bridge to VMnet0**.
3. Select the **Host Virtual Network Mapping** tab.
4. Select a VMnet to use for the first NIC, such as VMnet2.
5. From the drop-down menu, select the NIC you wish to connect to this VMnet.



Note: You can use VMnet0 to assign to a specific NIC. However, avoiding VMnet0 will indicate to a later user of the VMs configuration file that specific NICs were assigned to the VMs virtual interfaces, thus removing any questions about the automatic nature implied with VMnet0 on any particular system.

Editing the VM Configuration File

You will need to edit the VMware configuration file to include the second NIC with the VMware Player. Perform the following steps:

1. Halt all VMs currently running on this x86-based PC or server.
2. Using Windows Explorer, open the Oracle OS-E folder.
 - Using a text editor such as Notepad, open the file **nnos-e-vm.vmx**.
 - At the bottom of the file add the following lines, substituting the desired VMnets for the Ethernet interfaces:
 - **ethernet0.connectionType = "custom"**
 - **ethernet0.vnet = "vmnet0"**
 - **ethernet1.connectionType = "custom"**
 - **ethernet1.vnet = "vmnet3"**

- Ensure that there are no other lines in the file specifying `ethernetX.connectionType = "XXXXXX"`.

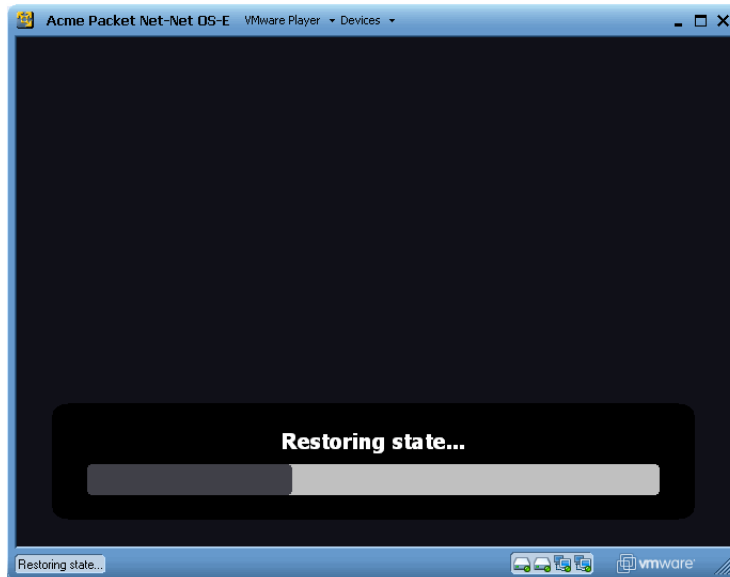
OS-E-VM Troubleshooting

Oracle makes every effort to test the VM in a variety of customer environments. This section covers recently reported issues directly from OS-E-VM customers. If you discover an issue with the VM that we need to know about, contact Oracle Customer Support for assistance.

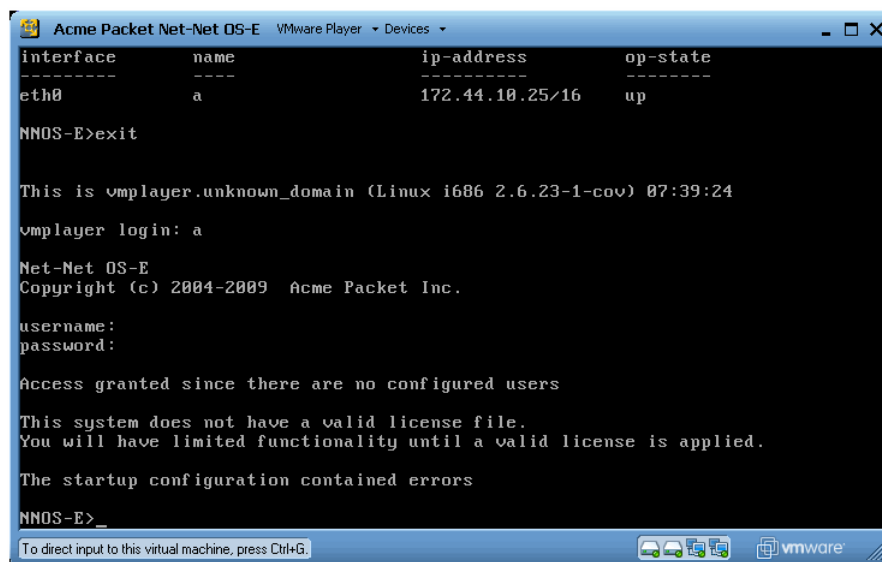
Installing the VM on Slow Systems

There may be cases where you are allowed to log in to the VM before the Oracle OS-E application starts up. This is usually caused by a slow system where you installed the VM, and all necessary software processes are requiring more time to complete their startup routines.

If you shut down the VM, and then start it again later, the VM will return you to the same screen and prompt that was displayed at the time of the shutdown. The VM startup would appear as shown in the following image.



When the VMWare system returns to the state where you previously logged out, and if you restart VMWare, you will see the login: prompt, such as the hostname *mikeo-cva* in the following image. If you did not previously configure a unique *username* and *password*, just press **ENTER** at the username and password prompts.



```
Acme Packet Net-Net OS-E VMware Player Devices
-----
interface      name      ip-address      op-state
-----
eth0            a         172.44.10.25/16  up

NNOS-E>exit

This is vmplayer.unknown_domain (Linux i686 2.6.23-1-cov) 07:39:24
vmplayer login: a

Net-Net OS-E
Copyright (c) 2004-2009 Acme Packet Inc.

username:
password:

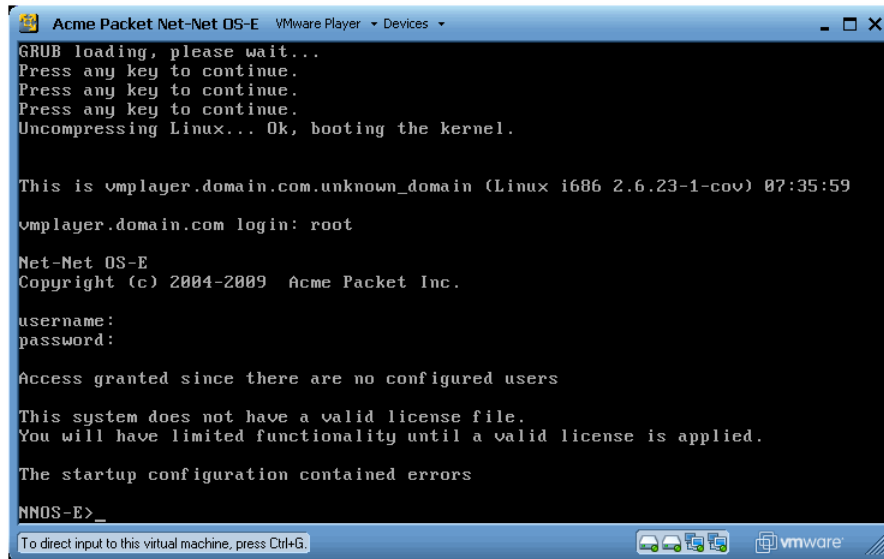
Access granted since there are no configured users

This system does not have a valid license file.
You will have limited functionality until a valid license is applied.

The startup configuration contained errors

NNOS-E>
```

If the Oracle OS-E-VM application has not yet started, your screen appears as shown in the following image. Exit and wait a few minutes for the application to complete all the essential startup processes. You can then log in by pressing ENTER/ ENTER at the username and password prompts, or you can enter the previously-configured username and password.



Other VM Limitations and Considerations

The following limitations and considerations apply:

- Configuring feature options that rely on critical timing are more problematic to VMs. This includes music-on-hold (MoH), announcements, periodic announcements, and transcoding.
- VMs running on AMD systems exhibit more timing issues than on Intel-based systems.
- The type of hardware over which you are running the VM can make a significant difference in VM performance. Improved performance is normal when running the VM over larger and faster running platforms.

Chapter 9. Upgrading unixODBC and net-SNMP

About This Chapter

This chapter covers upgrading and downgrading instructions for unixODBC and net-SNMP.

Upgrading/Downgrading unixODBC

Before you can upgrade or downgrade unixODBC, you must run the following command to check the installed version of unixODBC on ASC:

```
[root@X32-ASC-2 tmp]# rpm -qa|grep ODBC
unixODBC-2.3.1-11.el7.i686
```

Where, **unixODBC-2.3.1-11.el7.i686** is an old version, you need to upgrade to the **unixODBC-2.3.1-11.0.1.el7.i686** version.

Upgrading unixODBC

To upgrade to new unixODBC version:

1. If ASC can access the oracle yum server (<http://yum.oracle.com>), then
 - Modify the “/etc/yum.repos.d/public-yum-ol7.repo” file (You must backup the file before the modification since the file needs to be recovered after upgrade.)

```
[ol7_latest]
name=Oracle Linux $releasever Latest ($basearch)
baseurl=https://yum.oracle.com/repo/OracleLinux/OL7/latest/$basearch/
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
```

```
gpgcheck=1
enabled=1
```

- Run the following upgrade command with root permissions:

```
[root@X32-ASC-2/]# yum upgrade unixODBC-2.3.1-11.0.1.el7.i686.rpm
```

- After upgrade, check the unixODBC version is upgraded successfully.

```
[root@X32-ASC-2 tmp]# rpm -qa|grep ODBC
unixODBC-2.3.1-11.0.1.el7.i686
```

- Recover the "/etc/yum.repos.d/public-yum-ol7.repo" file.
- Reboot the system

2. If ASC can not access the oracle yum server, then you need to download the new ODBC rpm package (**unixODBC-2.3.1-11.0.1.el7.i686.rpm**) from oracle yum server (http://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/) manually, and then

- Copy the **unixODBC-2.3.1-11.0.1.el7.i686.rpm** file to /tmp

```
[root@X32-ASC-2 tmp]# ls unixODBC-2.3.1-11.0.1.el7.i686.rpm
unixODBC-2.3.1-11.0.1.el7.i686.rpm
```

- cd /tmp, then run the following upgrade command with root permissions:

```
[root@X32-ASC-2 tmp]# yum upgrade unixODBC-2.3.1-11.0.1.el7.i686.rpm
```

- After upgrade, check the unixODBC version is upgraded successfully.

```
[root@X32-ASC-2 tmp]# rpm -qa|grep ODBC
unixODBC-2.3.1-11.0.1.el7.i686
```

- Reboot the system.

Downgrading unixODBC

To downgrade to old unixODBC version, if needed:

1. If ASC can access the oracle yum server (<http://yum.oracle.com/>), then
 - Modify the “/etc/yum.repos.d/public-yum-ol7.repo” file (You must backup the file before the modification since the file needs to be recovered after upgrade.)

```
[ol7_latest]
name=Oracle Linux $releasever Latest ($basearch)
baseurl=https://yum.oracle.com/repo/OracleLinux/OL7/latest/$basearch/
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
gpgcheck=1
enabled=1
```

- Run the following downgrade command with root permissions:

```
[root@X32-ASC-2/]# yum downgrade unixODBC-2.3.1-11.el7.i686.rpm
```

- After downgrade, check the unixODBC version is downgraded successfully

```
[root@X32-ASC-2 tmp]# rpm -qa|grep ODBC
unixODBC-2.3.1-11.el7.i686
```

- Recover the "/etc/yum.repos.d/public-yum-ol7.repo" file.

- Reboot the system.

2. If ASC can not access the oracle yum server, then you need to download the new ODBC rpm package (**unixODBC-2.3.1-11.el7.i686.rpm**) from oracle yum server (http://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/) manually, and then

- Copy the **unixODBC-2.3.1-11.el7.i686.rpm** file to /tmp directory.

```
[root@X32-ASC-2 tmp]# ls unixODBC-2.3.1-11.el7.i686.rpm
unixODBC-2.3.1-11.el7.i686.rpm
```

- cd /tmp, then run the following downgrade command with root permissions:

```
[root@X32-ASC-2 tmp]# yum downgrade unixODBC-2.3.1-11.el7.i686.rpm
```

- After downgrade, check the unixODBC version is downgraded successfully.

```
[root@X32-ASC-2 tmp]# rpm -qa|grep ODBC
unixODBC-2.3.1-11.el7.i686
```

Reboot the system.

Upgrading/Downgrading net-SNMP

Before you can upgrade or downgrade net-SNMP, you must run the following command to check the installed version of net-SNMP on ASC:

```
[root@ASC5270 ~]# rpm -qa|grep net-SNMP
net-snmp-agent-libs-5.7.2-32.0.1.el7.i686
net-snmp-libs-5.7.2-32.0.1.el7.i686
```

Where, **net-snmp-agent-libs-5.7.2-32.0.1.el7.i686** and **net-snmp-libs-5.7.2-32.0.1.el7.i686** are old versions, you need to upgrade **net-snmp-libs** and **net-snmp-agent-libs** to latest version.

Note: **net-snmp-debuginfo-5.7.2-32.0.1.el7.i686** may be shown as an output of the above command, when the debuginfo package was installed for debugging purpose. Run the following command to erase debug package:

```
rpm -e --nodeps net-snmp-debuginfo-5.7.2-32.0.1.el7.i686
```

Upgrading net-snmp libs

To upgrade to new net-snmp libs version:

1. Download the new net-snmp rpm package (**net-snmp-agent-libs-5.7.2-43.el7.i686.rpm** and **net-snmp-libs-5.7.2-43.el7.i686.rpm**) from oracle yum server (http://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/) manually.
2. Copy the **net-snmp-agent-libs-5.7.2-43.el7.i686.rpm** and **net-snmp-libs-5.7.2-43.el7.i686.rpm** files to /tmp.

```
[root@ASC5270 tmp]# ls net-snmp*
net-snmp-agent-libs-5.7.2-43.el7.i686.rpm
net-snmp-libs-5.7.2-43.el7.i686.rpm
```

3. cd /tmp, then run the following commands with root permissions:

```
[root@ASC5270 tmp]# rpm -Uvh --nodeps
net-snmp-libs-5.7.2-43.el7.i686.rpm
```

```
[root@ASC5270tmp]# rpm -Uvh --nodeps
net-snmp-agent-libs-5.7.2-43.el7.i686.rpm
```

4. After upgrade, check the net-snmp version is upgraded successfully

```
[root@ASC5270 tmp]# rpm -qa|grep net-snmp
net-snmp-agent-libs-5.7.2-43.el7.i686
net-snmp-libs-5.7.2-43.el7.i686
```

5. Reboot the System.

Downgrading net-SNMP

To downgrade to old net-SNMP version, if needed:

1. Download the old net-snmp rpm package (**net-snmp-agent-libs-5.7.2-32.0.1.el7.i686.rpm** and **net-snmp-libs-5.7.2-32.0.1.el7.i686.rpm**) from oracle yum server (http://yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/) manually.
2. Copy the **net-snmp-agent-libs-5.7.2-32.0.1.el7.i686.rpm** and **net-snmp-libs-5.7.2-32.0.1.el7.i686.rpm** files to /tmp.

```
[root@ASC5270 tmp]# ls net-snm*  
net-snm-agent-libs-5.7.2-32.0.1.el7.i686.rpm  
net-snm-libs-5.7.2-32.0.1.el7.i686.rpm
```

3. cd /tmp, then run the following commands with root permissions:

```
[root@ASC5270 tmp]# rpm -e --nodeps net-snm-libs-5.7.2-43.el7.i686  
[root@ASC5270tmp]# rpm -ivh net-snm-libs-5.7.2-32.0.1.el7.i686.rpm  
[root@ASC5270 tmp]# rpm -e --nodeps net-snm-libs-5.7.2-43.el7.i686  
[root@ASC5270 tmp]# rpm -ivh  
net-snm-agent-libs-5.7.2-32.0.1.el7.i686.rpm
```

4. After downgrade, check the net-snm version is downgraded successfully.

```
[root@ASC5270 tmp]# rpm -qa|grep net-snm  
net-snm-libs-5.7.2-32.0.1.el7.i686  
net-snm-agent-libs-5.7.2-32.0.1.el7.i686
```

5. Reboot the System.

Appendix A. Technical Specifications

NEBS/ETSI

- Bellcore GR-63, Physical Protection Requirements
- Bellcore GR-1089, Electromagnetic Compatibility and Electrical Safety Req.
- ETSI 300 386, Telecommunication Network, Electromagnetic Compatibility
- ETSI 300 019, Environmental Conditions and Environmental Tests
- ETSI 753, Acoustic Noise

AC Power Cords

North America, Europe, United Kingdom, Japan, China, Korea, Australia

Safety and EMC Regulatory Compliance (Class A)

Country	Certification (Safety and/or EMC)	Regulatory Mark (Safety and/or EMC)
Argentina	IRAM	Not applicable
Australia/New Zealand	ACA, MED	C-Tick
Belarus	Bellis	Not applicable
Canada	UL / Industry Canada	cURus / ICES
China	CNCA	CCC
Europe	European Directives	CE
Germany	GS	GS
International	CB Repor / CISPR 22	Not applicable
Japan	VCCI	VCCI
Korea	RRL	MIC
Russia	GOST	GOST
Taiwan	BSMI RPC	BSMI
United States	UL / FCC	CULus / FCC

Product Regulatory Compliance Markings

This product is marked with the following Product Certification Markings:

Regulatory Compliance	Country	Marking
cULus Listing Marks	USA/Canada	
GS Mark	Germany	 
CE Mark	Europe	
FCC Marking (Class A)	USA	This device complies with Part 15 of the FCC Rules. Operation of this device is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. Manufactured by Intel Corporation
EMC Marking (Class A)	Canada	CANADA ICES-003 CLASS A CANADA NMB-003 CLASSE A
VCCI Marking (Class A)	Japan	この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。VCCI-A
C-Tick	Australia	 N12213

Regulatory Compliance	Country	Marking
BSMI Certification Number & Class A Warning	Taiwan	
		警告使用者： 這是甲類的資訊產品，在居住的環境中使用時， 可能會造成射頻干擾，在這種情況下，使用者會 被要求採取某些適當的對策
GOST R Marking	Russia	
RRL MIC Mark	Korea	
China Compulsory Certification Mark	China	

Electromagnetic Compatibility Notices

FCC (USA)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions related to the EMC performance of this product, contact:

Intel Corporation

5200 N.E. Elam Young Parkway

Hillsboro, OR 97124

1-800-628-8686

- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit other than the one to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment. The customer is responsible for ensuring compliance of the modified product.

Only peripherals (computer input/output devices, terminals, printers, etc.) that comply with FCC Class A or B limits may be attached to this computer product. Operation with noncompliant peripherals is likely to result in interference to radio and TV reception. All cables used to connect to peripherals must be shielded and grounded. Operation with cables, connected to peripherals, that are not shielded and grounded may result in interference to radio and TV reception.

Industry Canada (ICES-003)

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques", NMB-003 édictée par le Ministre Canadien des Communications.

English translation of the notice above:

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled “Digital Apparatus,” ICES-003 of the Canadian Department of Communications.

Europe (CE Declaration of Conformity)

This product has been tested in accordance too, and complies with the Low Voltage Directive (73/23/EEC) and EMC Directive (89/336/EEC). The product has been marked with the CE Mark to illustrate its compliance.

VCCI (Japan)

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

English translation of the notice above:

This is a Class A product based on the standard of the Voluntary Control Council for Interference (VCCI) from Information Technology Equipment. If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.

BSMI (Taiwan)

警告使用者：
這是甲類的資訊產品，在居住的環境中使用時，
可能會造成射頻干擾，在這種情況下，使用者會
被要求採取某些適當的對策

The BSMI Certification Marking and EMC warning is located on the outside rear area of the product.

Korean RRL Compliance



1. 기기의 명칭(모델명) :
2. 인증번호 :
3. 인증받은 자의 상호 :
4. 제조년월일 :
5. 제조자/제조국가 :

English translation of the notice above:

1. Type of Equipment (Model Name): On License and Product
2. Certification No.: On RRL certificate. Obtain certificate from local Intel representative
3. Name of Certification Recipient: Intel Corporation
4. Date of Manufacturer: Refer to date code on product
5. Manufacturer/Nation: Intel Corporation/Refer to country of origin marked on product

