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About This Document

Audience
The audience for this document includes system administrators responsible for the monitoring, maintenance, and configuration of the Oracle Communications Network Charging and Control IN applications. The reader will have a sound knowledge of Sun Solaris, Cisco IOS, and Intelligent Network concepts.

Scope
The scope of this document includes all the information required to install and operate the Oracle Communications Network Charging and Control platform securely.

Related documents
The following documents are related to this document:

- Oracle Communications Network Charging and Control Installation Guide
Document Conventions

Typographical Conventions

The following terms and typographical conventions are used in the Oracle Communications Network Charging and Control (NCC) documentation.

<table>
<thead>
<tr>
<th>Formatting convention</th>
<th>Type of information</th>
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<tr>
<td>Special Bold</td>
<td>Items you must select, such as names of tabs. Names of database tables and fields.</td>
</tr>
<tr>
<td>Italics</td>
<td>Name of a document, chapter, topic or other publication. Emphasis within text.</td>
</tr>
<tr>
<td>Button</td>
<td>The name of a button to click or a key to press. <strong>Example:</strong> To close the window, either click <strong>Close</strong>, or press <strong>Esc</strong>.</td>
</tr>
<tr>
<td>Key+Key</td>
<td>Key combinations for which the user must press and hold down one key and then press another. <strong>Example:</strong> <strong>Ctrl+P</strong>, or <strong>Alt+F4</strong>.</td>
</tr>
<tr>
<td>Monospace</td>
<td>Examples of code or standard output.</td>
</tr>
<tr>
<td>Monospace Bold</td>
<td>Text that you must enter.</td>
</tr>
<tr>
<td>variable</td>
<td>Used to indicate variables or text that should be replaced.</td>
</tr>
<tr>
<td>menu option &gt; menu option &gt;</td>
<td>Used to indicate the cascading menu option to be selected, or the location path of a file. <strong>Example:</strong> <strong>Operator Functions &gt; Report Functions</strong>  <strong>Example:</strong> <em>/IN/html/SMS/Helptext/</em></td>
</tr>
<tr>
<td>hypertext link</td>
<td>Used to indicate a hypertext link on an HTML page.</td>
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Specialized terms and acronyms are defined in the **Glossary** at the end of this guide.

Terminology

This topic explains any terminology specific to this manual.
Chapter 1

Introduction to Security

Chapter Overview

Introduction

This chapter provides an overview of Oracle Communications Network Charging and Control security.

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Basic Security Considerations

Basic security

Follow these fundamental principles to use any application securely:

- Keep your software up-to-date including the latest product release and any patches that apply to it. See https://edelivery.oracle.com and https://support.oracle.com for more information. These sites also include many of the documents referred to in this guide.
- Limit privileges as much as possible. Give users only the level of security access necessary for them to perform their work. Review user privileges periodically to determine the relevance to current work requirements. See the Oracle Solaris document System Administration Guide: Basic Administration for more information.
- Monitor system activity. Establish who should access which system components and how often and monitor those components.
- Install software securely. For example, use firewalls, secure protocols such as SSL, and secure passwords. See " for more information.
- Learn about and use the security features. See " for more information.
- Use secure development practices. For example, take advantage of existing database security functionality rather than creating your own application security. See " for more information.
About Security

Security Overview

Network Charging and Control uses Solaris and database as middleware. System security is managed in the following ways:

- To access the database, Network Charging and Control uses OPS$ accounts.
- Solaris security access policy is used for systems administrators’ access.
- User access to the graphical user interface screens is managed through user name and password that are stored in the database.
- Batch scripts access are managed through read and write access granted to the specific directory where the scripts are stored.
- Batch provisioning is managed through limited read and execute rights to the executable program in the /IN/service_packages/PI/bin directory.
- External systems connecting to Network Charging and Control through Diameter, SIP, and the SOAP interface are identified by their IP addresses or hostname by the system.

The Network Charging and Control product is typically located and managed within the internal corporate network. The external connections to other non–management systems are also protected through other network elements, for example, by firewalls. For each interface, configurable overload protection is available to prevent the system from overloading.

Understanding the Environment

Planning considerations

When planning your Network Charging and Control implementation, consider the following:

Which resources need to be protected?
- Customer data, such as traffic history.
- Internal data, such as proprietary source code.
- System components from being disabled by external attacks on the system or intentional system overloads.

Who are you protecting data from?
- You need to protect subscribers’ data for others, but people in your organization will need to access that data to manage it.
- You can analyze workflows to determine who needs access to the data; for example, it is possible for a system administrator to manage system components without needing access to system data.

What will happen if the protection of a strategic resource fails?
In some cases, a fault in your security scheme is nothing more than an inconvenience. In other cases, a fault might cause extensive damage to either your business or to one or more of your customers. Understanding the security ramifications of each resource will help you protect your business properly.

Recommended Deployment Configurations

Introduction

This section describes recommended deployment configuration options for your Network Charging and Control system.
### Test Bed Deployment

The simplest test bed architecture is shown here. This single-server deployment is cost effective and provides a functional test environment; however, it only provides limited hardware redundancy as all nodes are installed on the same server.

---

**Single server deployment**

The single-server deployment reduces the network vulnerability as the inter-node communication does not leave the server. This does not mean that network security is not required for such a deployment.

Generally, a test bed is only used inside a controlled environment within the company’s intranet. The network access that must be controlled by a firewall includes the following interfaces: provisioning, Diameter, SOAP, and the screen access for SMS, ACS, CCP and VPN.

Depend on the Oracle virtualization technology used, good security practices related to the chosen technology need to be put in place. More information on best practices for these technologies is available in the following Oracle guides:

- Secure Deployment of Oracle VM Server for SPARC
- Solaris Zones Administration

### Single server deployment Production Deployment

For the production environment, Oracle recommends the use of the Firewall-DMZ-Firewall-Intranet architecture shown in Figure 2, for all non voice and data based connections, with the exception of the SOAP interface. Servers can be deployed in a single location or be geographically distributed. This implies that there is a requirement for additional firewalls to handle access between sites.
Chapter 1

The Network Charging and Control product is designed to handle real time telecommunication traffic so it is essential that any security infrastructure is designed for optimal performance. The implementation of firewall rules must be effective, but also efficient. For this reason, the platform should be deployed inside a DMZ.

When considering a disaster recovery strategy for the SMS, the requirement for sufficient bandwidth to handle fail over in the event of a problem occurring in the primary node is essential.

Firewalls separating DMZ zones provide two essential functions:

- Blocking traffic types known to be illegal
- Providing intrusion containment, should a successful attack take over processes or processors
Network access

The product specific network access should be controlled by a firewall on the following interfaces: provisioning, diameter, SOAP and the screen access for SMS, ACS, CCP and VPN.
Chapter 1

Operation System and Database Security

Oracle Solaris Security

This section describes how to install and configure the OS infrastructure component securely for Network Charging and Control.

For installation of Network Charging and Control on Solaris, Oracle Solaris 11 Security Guidelines provides general guidelines for a secure default configuration. Exceptions are described in more detail in Oracle Communications Network Charging and Control Installation Guide. This guide also describes the installation and configuration of any third-party software.

Oracle Database Security

This section describes how to securely install and configure the database infrastructure component.

For a secure installation of the database, refer to Oracle 11g Database Security Guide. Archive logging should be enabled on the SMS and VWS as explained in Oracle Database Administrator’s Guide. This allows a second layer of redundancy. More product specific information is available in Oracle Communications Network Charging and Control Installation Guide.

Example configuration files for the database can be found in Oracle Communications Network Charging and Control Installation Guide.

The product is designed to be easily adapted and flexible. Depending on the node type (SMS, VWS, or SLC) and the services configured, a number of options to optimize the security of the system are possible. More information on these options is provided in this document.

Oracle Security Documentation

Overview

To implement security, Network Charging and Control uses other Oracle products, such as Solaris and the Oracle Database. See the following documents:

- Oracle Solaris 11 Security Guidelines
- Oracle 11g2 Database Security Guide
- Oracle 11g2 Database Administrator’s Guide
- Oracle documentation is also available from Oracle Technology Network: http://docs.oracle.com
Chapter 2
Performing a Secure Network Charging and Control Installation

Chapter Overview

Introduction
This chapter describes how to install the NCC and provides overall guidelines to configure the platform components securely.

The installation of the product is done through the use of the Network Charging and Control Installation Manager. The usage is described in Oracle Communications Network Charging and Control Installation Guide.

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Installing Network Charging and Control Securely

Pre-Installation Configuration
The planning and preparation required prior to installing Network Charging and Control is explained in the pre-installation tasks of Oracle Communications Network Charging and Control Installation Guide.

Installing Securely
When installing Network Charging and Control using the installer, you can choose to install:

- Each component separately
- Only the packages
- The packages and some basic component configuration
- A full installation which includes all of the packages, basic component configuration and installation of the service templates

For the first three options, the installation will need to be correctly configured to interact with the non-Network Charging and Control elements in the network. The default parameters will need to be modified and are documented in the component administration guides.

By choosing to install each component separately, you should be aware of the component dependencies, which are described in the component release notes and Oracle Communications Network Charging and Control Installation Guide.

Installing only the packages will allow you to configure only what is required by your business without the need to be concerned with the component dependencies.
Installing the packages and basic configuration will provide a correctly configured and working version of the Network Charging and Control product, ready to be configured for interaction with third-party network elements and service creation.

The full option will provide you with a fully working Network Charging and Control platform with example service templates. In this case, the default parameters are used in the install and need to be changed to an installation specific parameter set.

**Post-Installation Configuration**

**Post-install security**

This section documents any post-installation security amendments.

After the installation of the full platform, some security actions need to be undertaken:

- Change the default password for the all x_oper Oracle Solaris usernames on each product server:
  - acs_oper
  - smf_oper
  - ebe_oper
  - ccs_oper
  - uis_oper
  - upc_oper
  - rim_oper
  - xms_oper
  - lcp_oper
  - is41_oper
  - ses_oper
  - osa_oper

- Ensure that su is used so that if off root permissions are needed, all actions can be tracked.

- Set the security levels of the file and directory permissions of /IN and all child sub-directories:
  - All Network Charging and Control installed directories need to be set to permission level 750.
  - All executables need to be set to permission level 750.
  - All other files need to be set to permission level 640.
  - The system and application password stored in the /etc/shadow file are encrypted.

- Set the password policy “all passwords for system users and application users should be changed.”

- Disable remote access for root user.

- Network
  - Only essential traffic should be allowed, especially on the Network Charging and Control external network.
  - Network requirements are described in *Oracle Communications Network Charging and Control Installation Guide*, where more specific information about latency, bandwidth, security, redundancy and routing can be found.
  - It is recommended that an internal LAN is used for the HTTP/SOAP traffic from the VWS and SMS to the SLC nodes, if available.
  - Use an external encrypted connection (VPN, SSL,...) for the HTTP/SOAP traffic coming from external system.
  - Use a dedicated network for the interconnect if you install the SMS as a cluster.
  - Make sure that the internal networks described in *Oracle Communications Network Charging and Control Installation Guide* are only reachable by the Network Charging and Control servers and any directly linked servers, such as a third-party billing server, in the case of converged billing.
  - The access for administration of the platform is enabled on the management network through secure protocols only: ssh, sftp, scp.
  - Protocols such as ftp and telnet are blocked from external networks.
To allow easy access for the Oracle Advanced Customer Care VPN, check with their latest requirements.

**Network Charging and Control Backup**

**Backup overview**

**Database**

- Enable database archive logging on the SMS and VWS nodes.
- Make sure that database backups are taken from the SMS and the non-active of each VWS pair. These live backups need to be planned in off peak hours to keep the impact of the additional traffic as low as possible. See Oracle *Database Backup and Recovery User's Guide* for more information.
- The Oracle Secure Backup literature provides extensive information on how to securely backup your data.

**Flat file**

Run the Support Audit scripts on all Network Charging and Control nodes. The tool will collect flat file configuration and other useful system information. For more information, see Oracle Support.

The following configuration items are described in *Oracle Communications Network Charging and Control Installation Guide*:

- On each node, add SSH host keys to the SSH known hosts file, and set SSH StrictHostKeyChecking for user smf_oper on each node. More detailed information on this topic can be found in Oracle Support Documentation.
- Set up IP addresses and hostnames for servers.
- Update the tablespace storage allocation on each node in accordance with system implementation type.
- Update Oracle SGA parameters on each node.
- Set shared memory limits for the Network Charging and Control system.
Chapter 3

Implementing Security

Chapter Overview

Introduction

This chapter provides an overview of the threats that the system is designed to counter and how the individual security features combine to prevent attacks.

To prevent loss and corruption of data, the design of the product is discussed together with a number of the implementation options.

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Product Design

Functional layers

The design of Network Charging and Control can be viewed in multiple functional layers. On the server, which is designed to provide redundancy, there is:

- The VWS 2N design. The VWSs are always installed as a pair (primary and secondary) where the secondary works in active stand-by mode at the application level.
- There is an implementation option to install the SMS cluster in either active/active or active/passive mode.
- All SLCs are designed to receive the same data through replication of the database.

At the application level additional functionality is provided:

- All SLC have a read-only database. Writes to these databases are only allowed through replication application, which is controlled by the SMS
- Data update requests from the network coming in through the SLCs are sent to the SMS and from SMS pushed through replication to all nodes that require the data.
- In the case where SMS and VWS data inconsistency or loss occurs, the master subscriber data is held on the SMS and the error can be corrected by the use of the replication and resynchronization mechanisms: options include: enhanced, compare and full resynchronization.
- PI commands are executed in serial mode to prevent data inconsistency.
Implementation Options

Common options

This section focuses on the most common implementation options. To prevent data loss, some examples of the most common implementation strategies are:

- Usage of internal SSDs storage for SLCs, VWSs, and SMS with a data redundant and fast RAID configuration.
- Usage of disk arrays for SMS. Install the VWSs primary and secondary on a different disk array.
- Raid configuration on all nodes, which are also focused on data redundancy, for example, RAID 10 or 0+1.
- Geographical spread of servers over several locations to prevent a service outage in event of a catastrophic failure at a site. Make sure the network requirements, as described in the installation guide, are also followed for inter-site connectivity.
- The implementation of Oracle Disaster Recovery solution can provide an extra layer of security. For information on how to setup such a solution, see Oracle Database Backup and Recovery User’s Guide.
- Activation of database logs.

Access Control Mechanism

Rejection levels

To prevent overload of the systems coming from the external network, connection rejection levels can be set. The rejection level on the interfaces will reject all new incoming traffic on the specified interface.

Interfaces also need to be considered with network details such as IP addresses, ports, and point codes required to connect the user or network element to the product. The technical and operational guides provide more information on how to configure traffic rejection levels and network parameters.

The kernel settings are a deeper layer of protection for your systems. See NCC Advanced Control Services Technical Guide for a collection of kernel settings and Oracle Communications Network Charging and Control Installation Guide for example values.

Configuring and Using Authentication

Introduction

This topic explains how to configure the authentication mechanism.

Command Line

The database implementation for Network Charging and Control uses Oracle Solaris command line authentication to enable users to connect to systems.

Solaris permits the database to use information it maintains to authenticate users. This has the following benefits:

- Once authenticated by the operating system, users can connect to the Oracle systems more conveniently, without specifying a user name or password. For example, an operating-system-authenticated user can invoke SQL*Plus and skip the user name and password prompts by entering the following:

  SQLPLUS /


With control over user authentication centralized in the operating system, the Oracle database does not need to store or manage user passwords, though it still maintains user names in the database.

Audit trails in the database and operating system can use the same user names.

For more information on this subject, see Oracle Database 2 Day + Security Guide.

**GUI Access**

For all screens that can be started independently (VPN, CCP, ACS, SMS), usernames and passwords are setup by the master user through the Service Management System GUI.

When logging on, these passwords are encrypted before sending over the network to the SMS.

**Configuring and Using Access Control**

**Authorization systems**

This section explains the authorization system used to control access to data, resources and processes for Network Charging and Control users.

The Network Charging and Control system administrator can set the resource limits for each user through the GUI. Defining roles and creating the appropriate user templates for them on the system is advised. More information on this topic and on how to set this up is available can be found in these guides:

- NCC Service Management System User's Guide
- NCC Advanced Control Services Technical Guide

It is important when setting up a new MNVO Telco ACS customer in a MVNE that the following configuration options are considered:

- Create a ‘Termination Number Range Rule’ for this new Telco ACS customer. See NCC Advanced Control Services User's Guide.
- To select Own Range in the Termination Number Range Rules frame of the ACS New Customer screen, refer to NCC Advanced Control Services User's Guide.
- Never grant level 7 access.

For network access by a non-administrator, it is recommended that you:

- Work with a VPN connection.
- Connect on the external IP address defined for each server.

More details about the configuration of network ports for the product can be found on Oracle Support (Appendix B). This information can be used to restrict network traffic rules and control access to the network to a specific subset of known network connections.

Another layer of network security can be achieved by separating the different network domains, which can be achieved by using a number of virtual LANs, designed to carry very specific traffic such as:

- Management
- Billing
- Internal
- Signaling
- Cluster Inter-connect

It is advised, for performance reasons, that cluster inter-connect is separated from the other networks.
Chapter 3

Configuring and Using Security Audit

About middleware

Network Charging and Control is based on Oracle Solaris and Oracle Database middleware. The security audit capabilities of this middleware are utilized to provide the ability to audit Network Charging and Control at the system level.

For more information on database audit, refer to Oracle Database Security Guide for information on guidelines for auditing.

In Solaris, you can enable the User Audit features to get more visibility of the security status of the system, which will allow you to take remedial action if required. See Oracle Solaris System Administration Guide: Security Services for information on Solaris auditing.

Security Considerations for Developers

Developer information

This section provides information useful to developers using the Oracle Communications Network Charging and Control Software Development Kit and PI programming options. For more information, see Oracle Communications Network Charging and Control SDK Developer’s Guide and Oracle Communications Network Charging and Control Provisioning Interface User’s & Technical Guide.

- General vulnerabilities such as buffer overflow, error exceptions, and SQL injections must be prevented and/or correctly processed. Guidelines for secure coding can be found at: The CERT C++ Secure Coding Standard available at the CERT website: https://www.cert.org/
- Oracle Multithreaded Programming Guide when using Oracle T series hardware

Through the SDK, new database tables can be created. For secure setup and usage of database tables, see Oracle Database Security Guide.
Appendix A

Secure Deployment Checklist

Checklist

The following security checklist includes guidelines that help secure your database:

1. Install only what is required.
2. Lock and expire default user accounts.
3. Enforce password management.
4. Enable data dictionary protection.
5. Practice the principles of least privilege:
   - Grant necessary privileges only.
   - Revoke unnecessary privileges from the PUBLIC user group.
   - Restrict permissions on run-time facilities.
6. Enforce access controls effectively and authenticate clients stringently.
7. Restrict network access:
   a) Use a firewall.
   b) Never poke a hole through a firewall.
   c) Protect the Oracle listener.
   d) Monitor listener activity.
   e) Monitor who accesses your systems.
   f) Check network IP addresses.
   g) Encrypt network traffic.
   h) Harden the operating system.
8. Apply all security patches and workarounds.
9. Contact Oracle Security Products if you come across vulnerability in Oracle Database.

Refer to the security checklist in Oracle Database Security Guide.
NCC Glossary of Terms

AAA

ACS
Advanced Control Services configuration platform.

Diameter
A feature rich AAA protocol. Utilises SCTP and TCP transports.

DP
Detection Point

DTMF
Dual Tone Multi-Frequency - system used by touch tone telephones where one high and one low frequency, or tone, is assigned to each touch tone button on the phone.

GUI
Graphical User Interface

HTML
HyperText Markup Language, a small application of SGML used on the World Wide Web.
It defines a very simple class of report-style documents, with section headings, paragraphs, lists, tables, and illustrations, with a few informational and presentational items, and some hypertext and multimedia.

HTTP
Hypertext Transport Protocol is the standard protocol for the carriage of data around the Internet.

IN
Intelligent Network

IP
1) Internet Protocol
2) Intelligent Peripheral - This is a node in an Intelligent Network containing a Specialized Resource Function (SRF).

IP address
Internet Protocol Address - network address of a card on a computer

Oracle
Oracle Corporation
PI
Provisioning Interface - used for bulk database updates/configuration instead of GUI based configuration.

SCTP
Stream Control Transmission Protocol. A transport-layer protocol analogous to the TCP or User Datagram Protocol (UDP). SCTP provides some similar services as TCP (reliable, in-sequence transport of messages with congestion control) but adds high availability.

Session
Diameter exchange relating to a particular user or subscriber access to a provided service (for example, a telephone call).

SGML

SIP
Session Initiation Protocol - a signaling protocol for Internet conferencing, telephony, event notification and instant messaging. (IETF)

SLC
Service Logic Controller (formerly UAS).

SMS
Depending on context, can be:
- Short Message Service
- Service Management System platform
- NCC Service Management System application

SOAP

SQL
Structured Query Language - a database query language.

SRF
Specialized Resource Function - This is a node on an IN which can connect to both the SSP and the SLC and delivers additional special resources into the call, mostly related to voice data, for example play voice announcements or collect DTMF tones from the user. Can be present on an SSP or an Intelligent Peripheral (IP).

SSP
Service Switching Point
TCP
Transmission Control Protocol. This is a reliable octet streaming protocol used by the majority of applications on the Internet. It provides a connection-oriented, full-duplex, point to point service between hosts.

Telco
Telecommunications Provider. This is the company that provides the telephone service to customers.

Telecommunications Provider
See Telco.

Termination Number
The final number that a call terminates to. Can be set in control plan nodes such as Attempt Termination and Unconditional Termination for re-routing numbers such as Toll Free or Follow Me numbers.

VPN
The Virtual Private Network product is an enhanced services capability enabling private network facilities across a public telephony network.

VWS
Oracle Voucher and Wallet Server (formerly UBE).

XML
eXtensible Markup Language. It is designed to improve the functionality of the Web by providing more flexible and adaptable information identification.

It is called extensible because it is not a fixed format like HTML. XML is a `metalanguage’ — a language for describing other languages—which lets you design your own customized markup languages for limitless different types of documents. XML can do this because it's written in SGML.