

**SS7 Stack User Guide**

# **The guide to the JBoss Communications SS7 Stack**

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## Preface

# 1. Document Conventions

This manual uses several conventions to highlight certain words and phrases and draw attention to specific pieces of information.

In PDF and paper editions, this manual uses typefaces drawn from the [Liberation Fonts](https://fedorahosted.org/liberation-fonts/) [https://fedorahosted.org/liberation-fonts/] set. The Liberation Fonts set is also used in HTML editions if the set is installed on your system. If not, alternative but equivalent typefaces are displayed. Note: Red Hat Enterprise Linux 5 and later includes the Liberation Fonts set by default.

## 1.1. Typographic Conventions

Four typographic conventions are used to call attention to specific words and phrases. These conventions, and the circumstances they apply to, are as follows.

**Mono-spaced Bold**

Used to highlight system input, including shell commands, file names and paths. Also used to highlight key caps and key-combinations. For example:

To see the contents of the file `my_next_bestselling_novel` in your current working directory, enter the `cat my_next_bestselling_novel` command at the shell prompt and press **Enter** to execute the command.

The above includes a file name, a shell command and a key cap, all presented in Mono-spaced Bold and all distinguishable thanks to context.

Key-combinations can be distinguished from key caps by the hyphen connecting each part of a key-combination. For example:

Press **Enter** to execute the command.

Press **Ctrl+Alt+F1** to switch to the first virtual terminal. Press **Ctrl+Alt+F7** to return to your X-Windows session.

The first sentence highlights the particular key cap to press. The second highlights two sets of three key caps, each set pressed simultaneously.

If source code is discussed, class names, methods, functions, variable names and returned values mentioned within a paragraph will be presented as above, in **Mono-spaced Bold**. For example:

File-related classes include `filesystem` for file systems, `file` for files, and `dir` for directories. Each class has its own associated set of permissions.

### Proportional Bold

This denotes words or phrases encountered on a system, including application names; dialogue box text; labelled buttons; check-box and radio button labels; menu titles and sub-menu titles. For example:

Choose **System > Preferences > Mouse** from the main menu bar to launch **Mouse Preferences**. In the **Buttons** tab, click the **Left-handed mouse** check box and click **Close** to switch the primary mouse button from the left to the right (making the mouse suitable for use in the left hand).

To insert a special character into a **gedit** file, choose **Applications > Accessories > Character Map** from the main menu bar. Next, choose **Search > Find...** from the **Character Map** menu bar, type the name of the character in the **Search** field and click **Next**. The character you sought will be highlighted in the **Character Table**. Double-click this highlighted character to place it in the **Text to copy** field and then click the **Copy** button. Now switch back to your document and choose **Edit > Paste** from the **gedit** menu bar.

The above text includes application names; system-wide menu names and items; application-specific menu names; and buttons and text found within a GUI interface, all presented in Proportional Bold and all distinguishable by context.

Note the **>** shorthand used to indicate traversal through a menu and its sub-menus. This is to avoid the difficult-to-follow 'Select **Mouse** from the **Preferences** sub-menu in the **System** menu of the main menu bar' approach.

*Mono-spaced Bold Italic Of Proportional Bold Italic*

Whether Mono-spaced Bold or Proportional Bold, the addition of Italics indicates replaceable or variable text. Italics denotes text you do not input literally or displayed text that changes depending on circumstance. For example:

To connect to a remote machine using ssh, type `ssh username@domain.name` at a shell prompt. If the remote machine is `example.com` and your username on that machine is john, type `ssh john@example.com`.

The `mount -o remount file-system` command remounts the named file system. For example, to remount the `/home` file system, the command is `mount -o remount /home`.

To see the version of a currently installed package, use the `rpm -q package` command. It will return a result as follows: `package-version-release`.

Note the words in bold italics above — *username*, *domain.name*, *file-system*, *package*, *version* and *release*. Each word is a placeholder, either for text you enter when issuing a command or for text displayed by the system.

Aside from standard usage for presenting the title of a work, italics denotes the first use of a new and important term. For example:

When the Apache HTTP Server accepts requests, it dispatches child processes or threads to handle them. This group of child processes or threads is known as

a *server-pool*. Under Apache HTTP Server 2.0, the responsibility for creating and maintaining these server-pools has been abstracted to a group of modules called *Multi-Processing Modules (MPMs)*. Unlike other modules, only one module from the MPM group can be loaded by the Apache HTTP Server.

## 1.2. Pull-quote Conventions

Two, commonly multi-line, data types are set off visually from the surrounding text.

Output sent to a terminal is set in `Mono-spaced Roman` and presented thus:

```
books      Desktop  documentation  drafts  mss    photos  stuff  svn
books_tests Desktop1  downloads      images  notes  scripts svgs
```

Source-code listings are also set in `Mono-spaced Roman` but are presented and highlighted as follows:

```
package org.jboss.book.jca.ex1;

import javax.naming.InitialContext;

public class ExClient
{
    public static void main(String args[])
        throws Exception
    {
        InitialContext iniCtx = new InitialContext();
        Object      ref  = iniCtx.lookup("EchoBean");
        EchoHome    home = (EchoHome) ref;
        Echo        echo = home.create();

        System.out.println("Created Echo");

        System.out.println("Echo.echo('Hello') = " + echo.echo("Hello"));
    }
}
```

## 1.3. Notes and Warnings

Finally, we use three visual styles to draw attention to information that might otherwise be overlooked.



### Note

A note is a tip or shortcut or alternative approach to the task at hand. Ignoring a note should have no negative consequences, but you might miss out on a trick that makes your life easier.



### Important

Important boxes detail things that are easily missed: configuration changes that only apply to the current session, or services that need restarting before an update will apply. Ignoring Important boxes won't cause data loss but may cause irritation and frustration.



### Warning

A Warning should not be ignored. Ignoring warnings will most likely cause data loss.

## 2. Provide feedback to the authors!

If you find a typographical error in this manual, or if you have thought of a way to make this manual better, we would love to hear from you! Please submit a report in the the [Issue Tracker](http://bugzilla.redhat.com/bugzilla/) [http://bugzilla.redhat.com/bugzilla/], against the product **JBoss Communications SS7 Stack** , or contact the authors.

When submitting a bug report, be sure to mention the manual's identifier: SS7Stack\_User\_Guide

If you have a suggestion for improving the documentation, try to be as specific as possible when describing it. If you have found an error, please include the section number and some of the surrounding text so we can find it easily.



# Introduction to JBoss

## Communications SS7 Stack

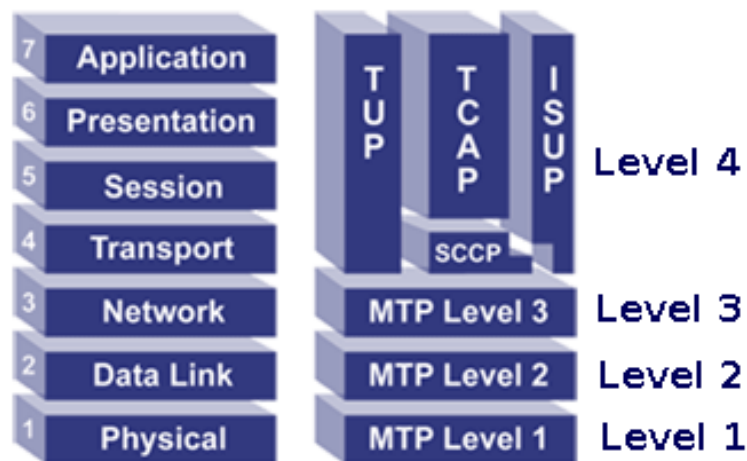


### Important

Spaces were introduced in in some tables and code listings to ensure proper page render.

Common Channel Signaling System No. 7 (i.e., SS7 or C7) is a global standard for telecommunications defined by the [International Telecommunication Union \(ITU\) Telecommunication Standardization Sector \(ITU-T\)](http://www.voip-info.org/wiki/view/ITU) [http://www.voip-info.org/wiki/view/ITU]. The standard defines the procedures and protocol by which network elements in the public switched telephone network (PSTN) exchange information over a digital signaling network to effect wireless (cellular) and wireline call setup, routing and control. The ITU definition of SS7 allows for national variants such as the American National Standards Institute (ANSI) and Bell Communications Research (Telcordia Technologies) standards used in North America and the European Telecommunications Standards Institute ( [ETSI](http://www.voip-info.org/wiki/view/ETSI) [http://www.voip-info.org/wiki/view/ETSI] ) standard used in Europe.

The hardware and software functions of the SS7 protocol are divided into functional abstractions called "levels". These levels map loosely to the Open Systems Interconnect (OSI) 7-layer model defined by the [International Standards Organization \(ISO\)](http://www.iso.ch/) [http://www.iso.ch/].



SS7 Stack overview

JBoss Communications SS7 Stack is software based SS7 protocol implementation providing Level 2 and above. The JBoss Communications SS7 Stack is a platform in the sense that it does not provide the application itself but rather allows users to build the application

## 1.1. Time Division Multiplexing

In circuit switched networks such as the Public Switched Telephone Network (PSTN) there exists the need to transmit multiple subscribers' calls along the same transmission medium. To accomplish this, network designers make use of TDM. TDM allows switches to create channels, also known as tributaries, within a transmission stream. A standard DS0 voice signal has a data bit rate of 64 kbit/s, determined using Nyquist's sampling criterion. TDM takes frames of the voice signals and multiplexes them into a TDM frame which runs at a higher bandwidth. So if the TDM frame consists of  $n$  voice frames, the bandwidth will be  $n \times 64$  kbit/s. Each voice sample timeslot in the TDM frame is called a channel. In European systems, TDM frames contain 30 digital voice channels, and in American systems, they contain 24 channels. Both standards also contain extra bits (or bit timeslots) for signalling (SS7) and synchronisation bits. Multiplexing more than 24 or 30 digital voice channels is called higher order multiplexing. Higher order multiplexing is accomplished by multiplexing the standard TDM frames. For example, a European 120 channel TDM frame is formed by multiplexing four standard 30 channel TDM frames. At each higher order multiplex, four TDM frames from the immediate lower order are combined, creating multiplexes with a bandwidth of  $n \times 64$  kbit/s, where  $n = 120, 480, 1920$ , etc.

# The Basics



## Important

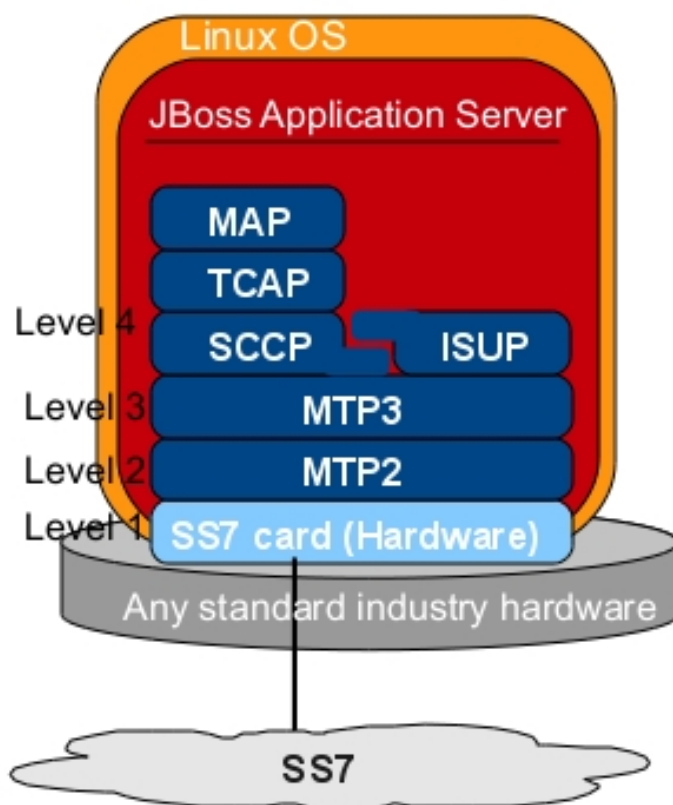
Be aware, JBoss Communications SS7 Stack is subject to changes as it is under active development!

The JBoss Communications SS7 Stack is logically divided into two sections. The lower section includes SS7 Level 3 and below. The lower section is influenced by type of SS7 hardware (Level 1) used.

The upper section includes SS7 Level 4 and above. This logical division is widely based on flexibility of JBoss Communications SS7 Stack to allow usage of any SS7 hardware available in the market and yet JBoss Communications SS7 Stack Level 4 and above remains the same.

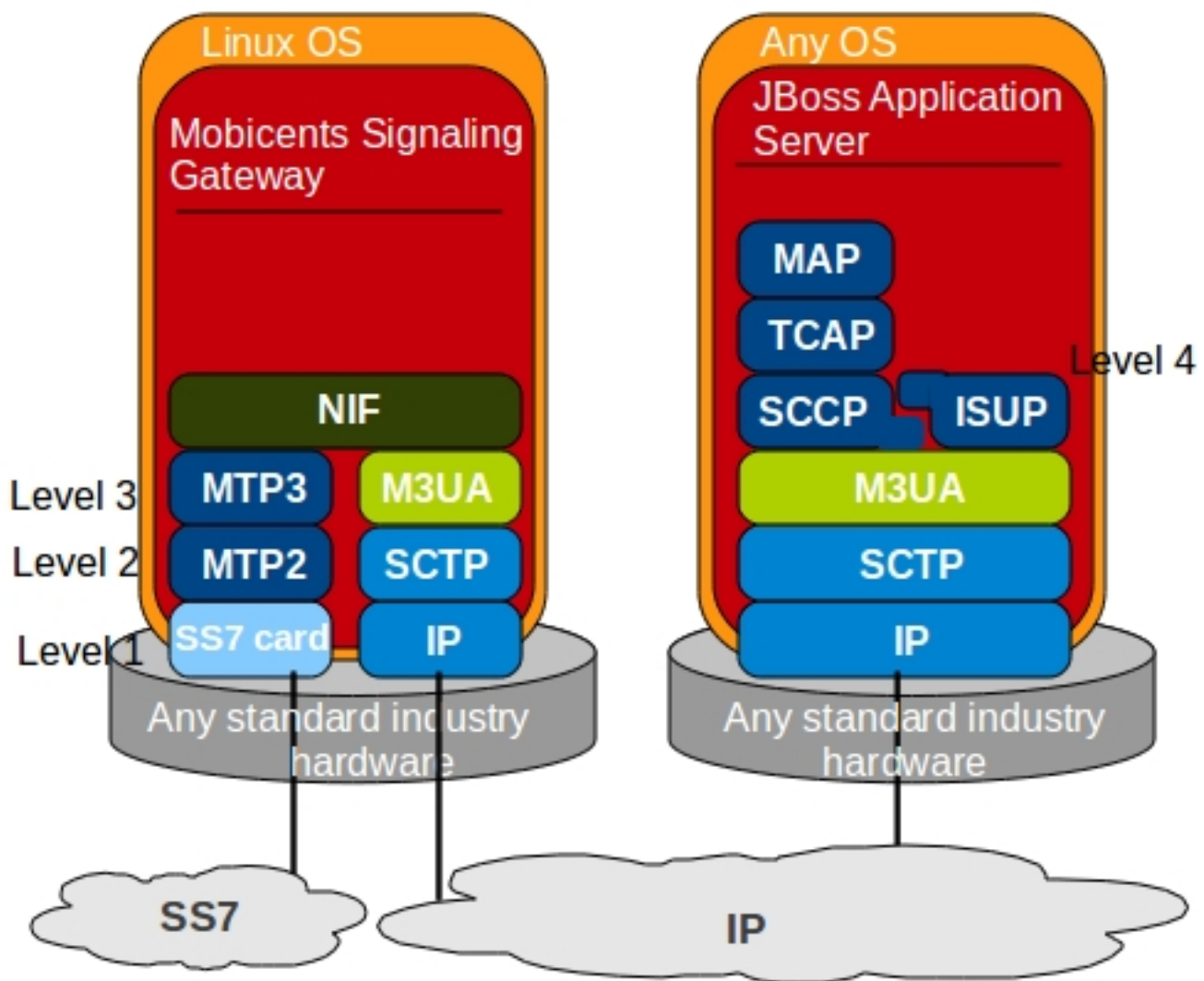
Further JBoss Communications SS7 Stack provides flexibility to use the Level 2,3 and Level 4 in same JVM and in same machine where SS7 Hardware (Level 1) is installed. Or its also possible to have Level 1,2,3 to be installed on separate machine and Level 4 on separate machine. In latter case M3UA over SCTP is leveraged for communication between Level 4 and Level 3 and is called JBoss Communications Signaling Gateway.

Bellow diagram shows complete JBoss Communications SS7 Stack in same machine



JBoss Communications SS7 Stack

Bellow diagram shows JBoss Communications Signaling Gateway



## NIF - Nodal Interworking Function

JBoss Communications Signaling Gateway



### Important

If you use JBoss Communications M3UA stack, you have to use JDK 7 to run the stack as well as to compile source code. M3UA leverages Java SCTP which is available only from JDK 7.

Apart from advantages mentioned in

JBoss Communications SS7 Stack consists of following functional blocks:

### 2.1. Shell Management client

`Shell` is Command Line Interface (CLI) tool which allows to manage different aspects of JBoss Communications SS7 Stack in interactive manner. It connects to different instances of JBoss Communications SS7 Stack which manage `Linksets`, `SCCP` resource, routing, `M3UA` and `SCTP`. For detailed information please refer to: [Chapter 5, Shell Command Line](#). Usually `Shell` will be invoked from remote machine(remote to `Linksets` and application protocols).

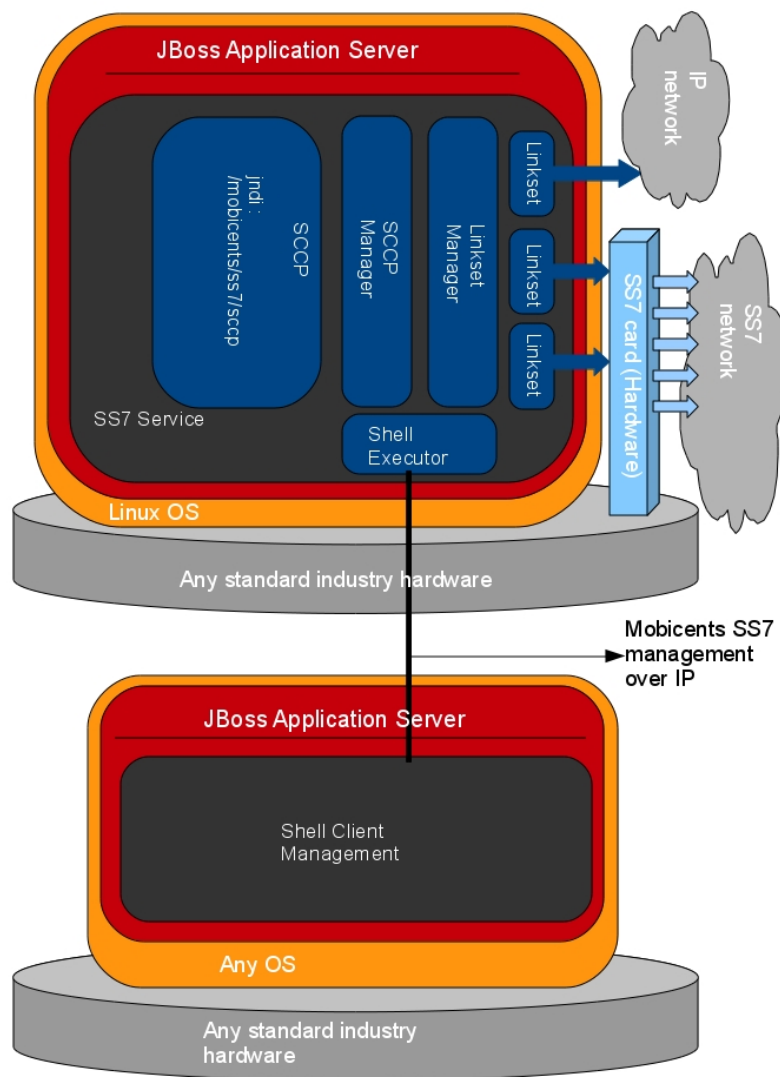
### 2.2. SS7 Service

SS7 service creates instance of JBoss Communications SCCP Stack and bind's it to JNDI name `java:/mobicents/ss7/sccp`

SS7 Service is JMX based service deployed in JBoss Application Server

SS7 Service hides the details like whether Level 4 and above connects to JBoss Communications Signaling Gateway via M3UA or SS7 Hardware installed in same machine as Level 4

Diagram below depicts elements which are deployed as part of `SS7 Service`:



JBoss Communications SS7 Stack SS7Service elements.

Service serves following purposes:

Expose protocol access points

Access points allows user to access lower layer protocols, like `SCCP` and interact through such protocols with `SS7` network.

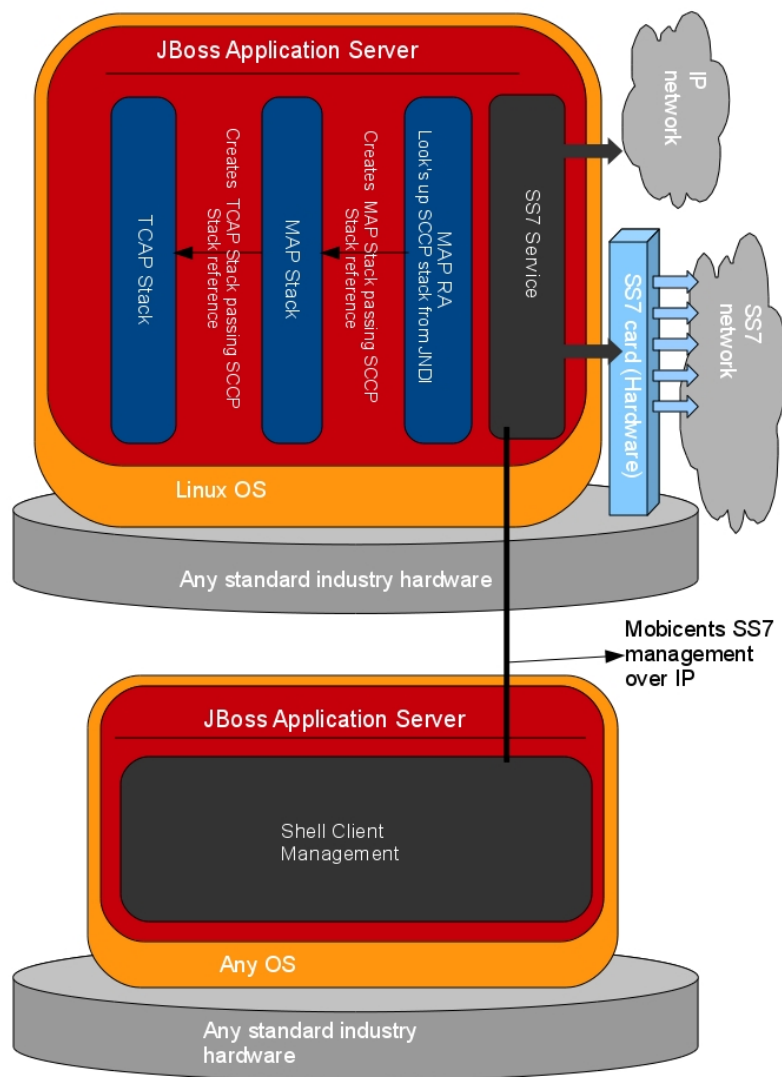
Expose management interface

`Shell Executor` allows `Shell` client to connect and issue commands.

Configuration of `SS7 Service` is explained in section [Section 3.4, “Configuring JBoss Communications SS7 Service”](#)

## 2.3. JBoss Communications SS7 Stack Usage

Diagram below depicts how JBoss Communications SS7 Stack is used:



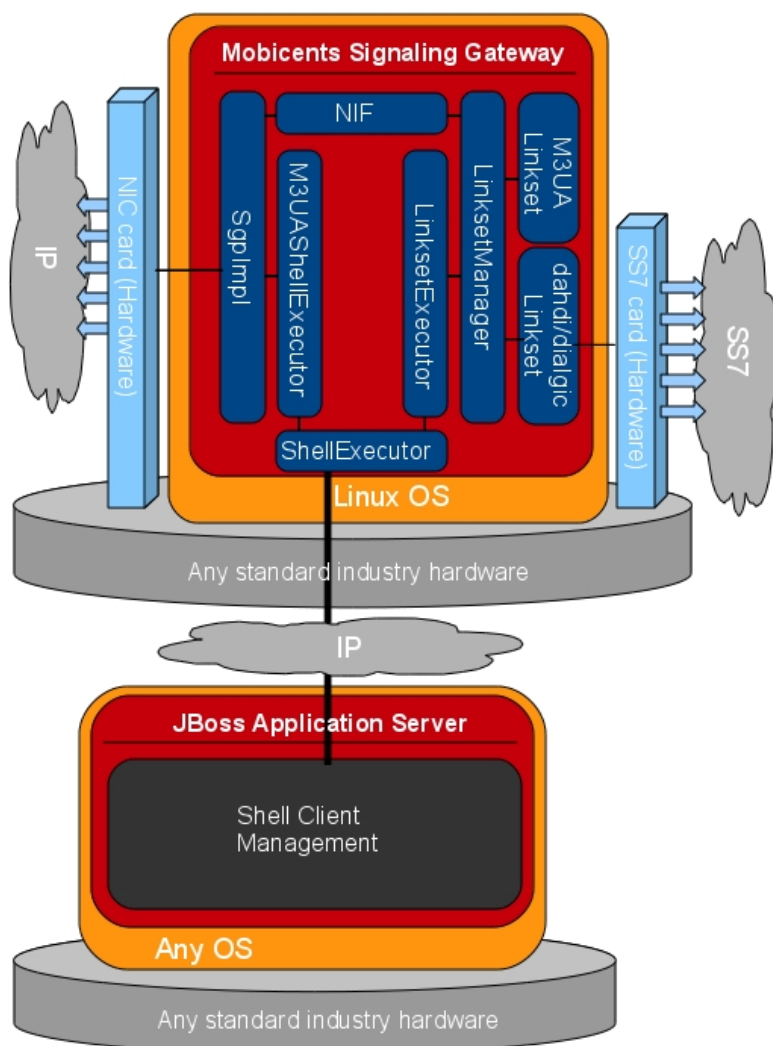
JBoss Communications SS7 Stack general design

## 2.4. JBoss Communications Signaling Gateway

JBoss Communications Signaling Gateway (SG) is a signaling agent that receives/sends Switched Circuit Network (SCN) native signaling at the edge of the IP network. JBoss Communications Signaling Gateway leverages JBoss Communications M3UA Stack explained in ??? and MTP

Diagram below shows the components which are included in JBoss Communications SG. Configuration of SG is explained in ???





JBoss Communications Signaling Gateway components



# Installation and Running

## 3.1. Installing

JBoss Communications SS7 stack at its core requires only Java if you are using only M3UA. However if you plan to use dahdi or dialogic SS7 hardware, respective SS7 cards needs to be installed on the server along with native libraries.

A simple way to get started is to download and install binary. This will provide you with all the dependencies you need to get going. You can obtain binary release from NOT AVAILABLE

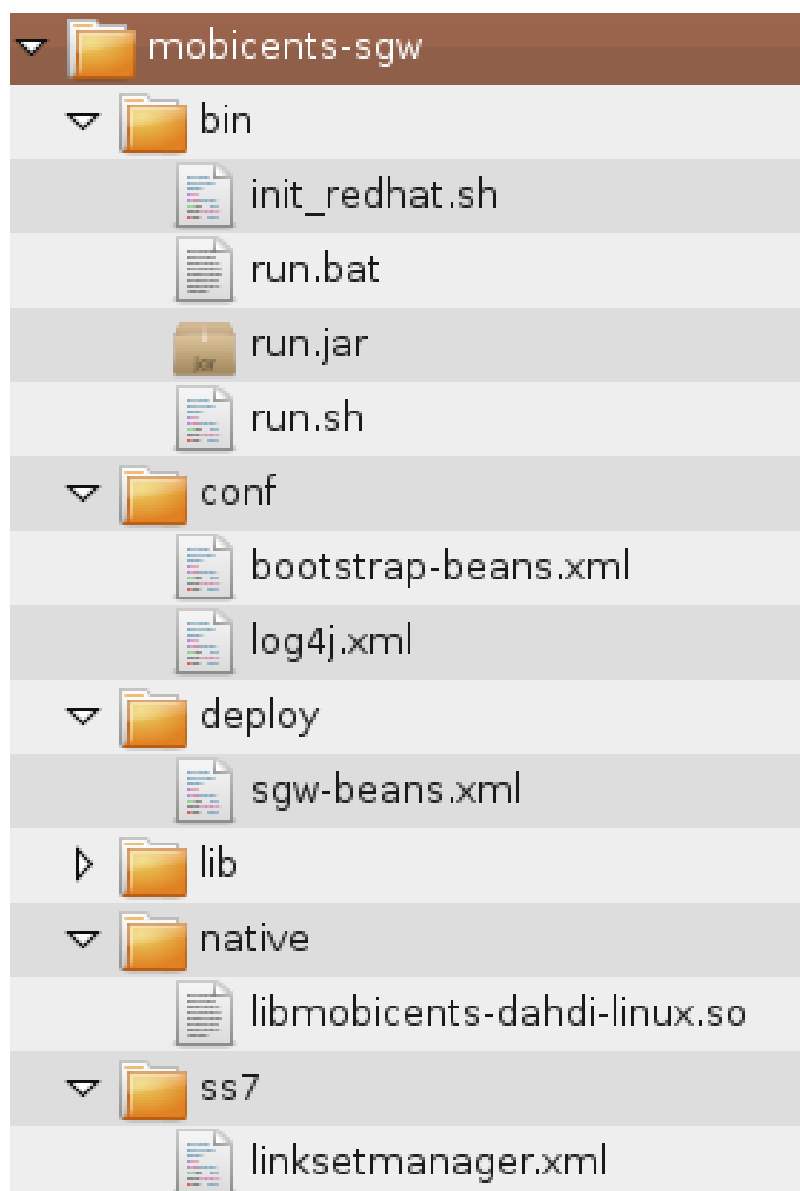
### 3.1.1. Binary

The JBoss Communications SS7 Stack binary is broken down into a few modules.

The following is a description of the important services and libraries that make up JBoss Communications SS7 Stack

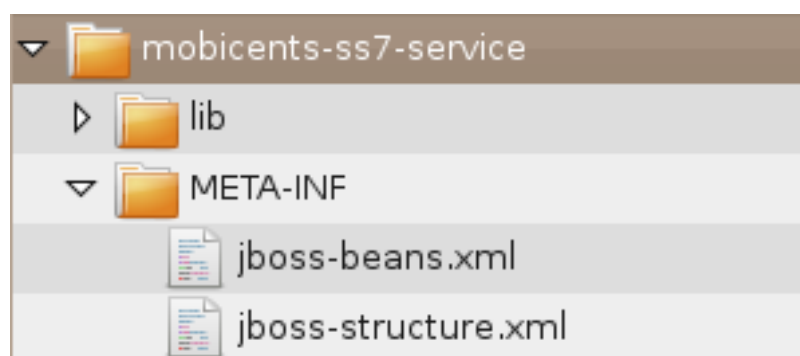
- `asn` : Abstract Syntax Notation One (ASN.1) library is used by various JBoss Communications SS7 Stack protocols to encode/decode the structured data exchanged between Signaling Point over networks. To know more about `asn` library refer to document included with `asn`. Applications using any of the JBoss Communications SS7 Stack User Protocols may never need to call `asn` API directly, however it must be in classpath as JBoss Communications SS7 Stack User Protocols refers this library.
- `ss7` : `ss7` contains the service that is deployed in JBoss AS and libraries that end applications refers to. It also includes JBoss Communications Signaling Gateway. The sub-modules included in `ss7` are
  - `docs` : User guide for JBoss Communications SS7 Stack
  - `mobicents-sgw` : Standalone Signaling Gateway as explained in section [Section 2.4, “JBoss Communications Signaling Gateway”](#)

`mobicents-sgw` binary has following layout:



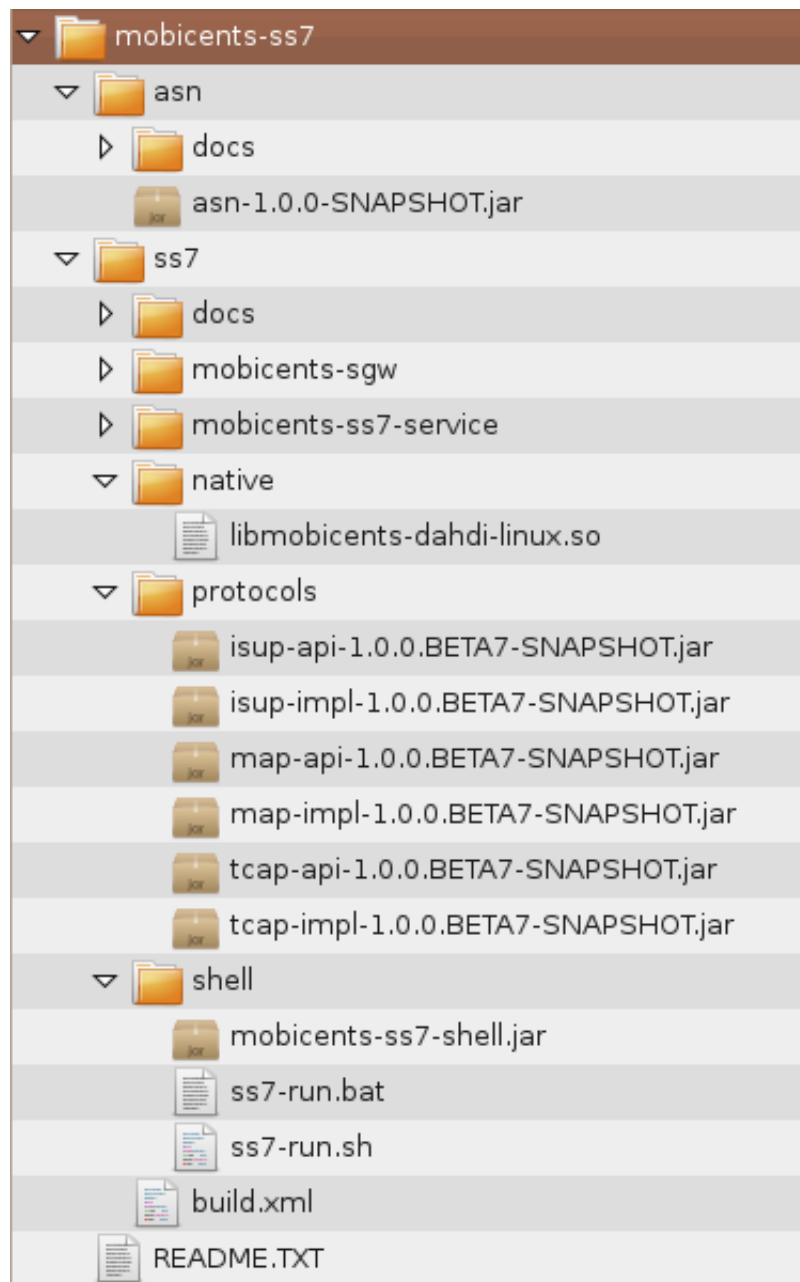
- `mobicents-ss7-service` : SS7 service is the core engine as explained in section [Section 2.2](#), “SS7 Service”

`mobicents-ss7-service` binary has following layout:



- `native` : native libraries component to interact with SS7 Card installed on server, runtime component. As of now native libraries are compiled only for linux OS. However if you plan to use M3UA there is no dependency on OS as everything is 100% java.
- `protocols` : The JBoss Communications SS7 Stack User Protocols libraries. Your application would directly call the API's exposed by these libraries. Depending on application you may be either interested in TCAP, MAP or both or ISUP libraries
- `shell` : the Command Line Interface (CLI) module to manage the JBoss Communications SS7 Stack. Refer [Chapter 5, Shell Command Line](#) to understand how to use shell

Binary release has following layout:



JBoss Communications SS7 Stack binary layout.

### 3.2. Installing JBoss Communications SS7 Service Binary

The upper layers of Mobicents SS7 viz., TCAP, MAP depends on JBoss Communications SS7 Service and JBoss Communications SS7 Service must be installed before upper layers can be used. The JBoss Communications SS7 Service binary requires that you have JBoss Application Server installed and JBOSS\_HOME system property set. To know further details on setting JBOSS\_HOME look [Appendix B, Setting the JBOSS\\_HOME Environment Variable](#)

Once JBOSS\_HOME is properly set, use ant to deploy the mobicents-ss7-service, shell scripts and shell library.



#### Important

Ant 1.6 (or higher) is used to install the binary. Instructions for using Ant, including install, can be found at <http://ant.apache.org/>

```
[usr]$ cd ss7-1.0.0.CR2/ss7
[usr]$ ant deploy
```

To undeploy these services

```
[usr]$ cd ss7-1.0.0.CR2/ss7
[usr]$ ant undeploy
```

While above steps will deploy the necessary ss7 service and shell components, the `java.library.path` should be set to point the directory containing native component or should be copied to JBoss native library path manually. This step is only required if you are using the SS7 board on server.

### 3.3. Running JBoss Communications SS7 Service

Starting or stopping JBoss Communications SS7 Service is no different than starting or stopping JBoss Application Server

### 3.3.1. Starting

Once installed, you can run server by executing the `run.sh` (Unix) or `run.bat` (Microsoft Windows) startup scripts in the `<install_directory>/bin` directory (on Unix or Windows). If the service started properly you should see following lines in the Unix terminal or Command Prompt depending on your environment:

```
23:22:26,079 INFO [LinksetManager] SS7 configuration file path /
home/abhayani/workarea/mobicents/jboss-5.1.0.GA/server/default/data/
linksetmanager.xml
23:22:26,141 INFO [LinksetManager] Started LinksetManager
23:22:26,199 INFO [SS7Service] Starting SCCP stack...
23:22:26,229 INFO [SccpStackImpl] Starting ...
23:22:26,230 INFO [RouterImpl] SCCP Router configuration file: /home/
abhayani/workarea/mobicents/jboss-5.1.0.GA/server/default/deploy/mobicents-
ss7-service/sccp-routing.txt
23:22:26,261 INFO [SS7Service] SCCP stack Started. SccpProvider bound to
java:/mobicents/ss7/sccp
23:22:26,261 INFO [ShellExecutor] Starting SS7 management shell environment
23:22:26,270 INFO [ShellExecutor] ShellExecutor listening
at /127.0.0.1:3435
23:22:26,270 INFO [SS7Service] [||||| Mobicents SS7 service
started ]|||||]
```

If you have started `ss7-1.0.0.CR2` for the first time, `SS7` is not configured. You need to use Shell Client to connect to `ss7-1.0.0.CR2` as defined in [Chapter 5, Shell Command Line](#). With `CLI` you can configure how service interacts with `SS7` network, that is you configure either installed `SS7` card and its native library, or `M3UA` layer.

Once the configured, the state and configuration of `SS7` is persisted which stands server re-start.

### 3.3.2. Stopping

You can shut down the server(s) by executing the `shutdown.sh -s` (Unix) or `shutdown.bat -s` (Microsoft Windows) scripts in the `<install_directory>/bin` directory (on Unix or Windows). Note that if you properly stop the server, you will see the following three lines as the last output in the Unix terminal or Command Prompt:

```
[Server] Shutdown complete
Halting VM
```

## 3.4. Configuring JBoss Communications SS7 Service

Configuration is done through an XML descriptor named `jboss-beans.xml` and is located at `$JBOSS_HOME/server/profile_name/deploy/mobicents-ss7-service/META-INF`, where **profile\_name** is the server profile name.

The JBoss Communications SS7 Layer 4 (SCCP, ISUP) leverages either of following MTP layers to exchange signalling messages with remote signalling points

- M3UA
- dialogic

The ss7 service will be configured with either of these services.

### 3.4.1. Configuring M3UA

M3UAManagement is only needed if the underlying SS7 service will leverage M3UA. M3UAManagement configuration is further explained in [Section 6.2, “M3UAManagement”](#)

```
<!--
===== -->
<!-- M3UA -->
<!-- M3UAManagement is managing the m3ua side commands -->
<!--
===== -->

<bean name="Mtp3UserPart" class="org.mobicents.protocols.ss7.m3ua.impl.M3UAManagement">
  <constructor>
    <parameter>Mtp3UserPart</parameter>
  </constructor>
  <property name="persistDir">${jboss.server.data.dir}</property>
  <property name="transportManagement">
    <inject bean="SCTPManagement" />
  </property>
</bean>

<bean name="M3UAShellExecutor"
  class="org.mobicents.protocols.ss7.m3ua.impl.oam.M3UAShellExecutor">
  <property name="m3uaManagement">
    <inject bean="Mtp3UserPart" />
  </property>
  <property name="sctpManagement">
    <inject bean="SCTPManagement" />
  </property>
```



```
</bean>
```

### 3.4.2. Configuring dialogic

Dialogic based MTP layer will only be used when you have installed Dialogic cards. DialogicMtp3UserPart communicates with Dialogic hardware. Its assumed here that MTP3 and MTP2 is leveraged from Dialogic stack either on-board or on-host.

```

<!-- ===== -->
<!-- Dialogic Mtp3UserPart -->
<!-- ===== -->

<bean name="Mtp3UserPart" class="org.mobicenss7.hardware.dialogic.DialogicMtp3UserPart">
    <property name="sourceModuleId">61</
property> <property name="destinationModuleId">34</property>
</bean>

```

sourceModuleId is source module id and should match with configured in system.txt used by dialogic drivers. Here 61 is assigned for Mobicenss process. destinationModuleId is destination module id. 34 is Dialogic MTP3 module id.

### 3.4.3. Configuring ShellExecutor

ShellExecutor is responsible for listening to incoming command. Received commands are executed on local resources to perform actions like creation and management of SCCP routing rule, creation and management of Linkset, management of M3UA stack.

```

<!-- ===== -->
<!-- Shell Service -->
<!-- ===== -->
<!-- Define Shell Executor -->
<bean name="ShellExecutor" class="org.mobicenss7.ShellExecutor">
    <property name="address">${boss.bind.address}</property>
    <property name="port">3435</property>

    <property name="sccpExecutor">
        <inject bean="SccpExecutor" />
    </property>
</bean>

```

```
</property>
<property name="m3UAShellExecutor">
  <inject bean="M3UAShellExecutor" />
</property>
</bean>
```

By default ShellExecutor listens at `jboss.bind.address` and port 3435. You may set the `address` property to any valid IP address that your host is assigned. The shell commands are exchanged over TCP/IP.



### Note

To understand JBoss bind options look at [Installation\\_And\\_Getting\\_Started\\_Guide](http://docs.jboss.org/jbossas/docs/Installation_And_Getting_Started_Guide/5/html_single/index.html) [http://docs.jboss.org/jbossas/docs/Installation\_And\_Getting\_Started\_Guide/5/html\_single/index.html]

### 3.4.4. Configuring SCCP

As name suggests `SccpStack` initiates the SCCP stack routines. Stack has following properties:

`localSpc`

property specifies the local signaling point code.

`ni`

specifies the network indicator that forms the part of service information octet (SIO)

`Router`

manages the route for SCCP. When Router is started it looks for file `sccprouter.xml` containing the serialized information about routes configured. The directory path is configurable by changing value of `persistDir` property

`SccpResource`

manages the remote resource for SCCP, for example Remote Subsystem Number and Remote Signalling Pointcode. When `SccpResource` is started it looks for file `sccpresource.xml` containing the serialized information about resources configured. The directory path is configurable by changing value of `persistDir` property

`mtp3UserPart`

specifies SS7 Level 3 to be used as transport medium( be it SS7 card or M3UA)

`SccpExecutor` accepts `sccp` commands and executes necessary operations

`SccpProvider` is bound to JNDI by SS7 Service and is used by upper layers

```
===== <!-- -->
```

```

<!-- SCCP Router Service -->
<!--
===== -->
<!--Define Router for SCCP -->
<bean name="Router" class="org.mobicens.protocols.ss7.sccp.impl.router.Router">
    <property name="persistDir">${jboss.server.data.dir}</property>
</bean>

<bean name="SccpResource" class="org.mobicens.protocols.ss7.sccp.impl.SccpResource">
    <property name="persistDir">${jboss.server.data.dir}</property>
</bean>

<bean name="SccpExecutor"
    class="org.mobicens.protocols.ss7.sccp.impl.oam.SccpExecutor">
    <property name="router">
        <inject bean="Router" />
    </property>
    <property name="sccpResource">
        <inject bean="SccpResource" />
    </property>
</bean>

<bean name="SccpStack" class="org.mobicens.protocols.ss7.sccp.impl.SccpStackImpl">
    <property name="localSpc">2</property>
    <property name="ni">2</property>
    <property name="router">
        <inject bean="Router" />
    </property>
    <property name="sccpResource">
        <inject bean="SccpResource" />
    </property>
    <property name="mtp3UserPart">
        <inject bean="Mtp3UserPart" />
    </property>
</bean>

<bean name="SccpProvider"
    class="org.mobicens.protocols.ss7.sccp.impl.SccpProviderImpl">
    <constructor factoryMethod="getSccpProvider">
        <factory bean="SccpStack" />
    </constructor>
</bean>

```

### 3.4.5. Configuring SS7Service

SS7Service acts as core engine binding all the components together. To get holistic view of SS7 Service look at [Section 2.2, “SS7 Service”](#)

```

<!--
===== -->
<!-- Mobicents SS7 Service -->
<!--
===== -->

<bean name="SS7Service" class="org.mobicents.ss7.SS7Service">
  <annotation>@org.jboss.aop.microcontainer.aspects.jmx.JMX(name=
    "org.mobicents.ss7:service=SS7Service",
    exposedInterface=org.mobicents.ss7.SS7ServiceMBean.class,
    registerDirectly=true)</annotation>
  <property name="jndiName">java:/mobicents/ss7/sccp</property>
  <property name="stack">
    <inject bean="SccpProvider" />
  </property>
</bean>
```

SS7 service binds SccpProvider to JNDI `java:/mobicents/ss7/sccp`. The JNDI name can be configured to any valid JNDI name specific to your application.

## 3.5. Setup from source

JBoss Communications SS7 Stack is an open source project, instructions for building from source are part of the manual! Building from source means you can stay on top with the latest features. Whilst aspects of JBoss Communications SS7 Stack are quite complicated, you may find ways to become contributors.

JBoss Communications SS7 Stack works with JDK1.5 and above (If using M3UA, JDK1.7 and above ). you will also need to have the following tools installed. Minimum requirement version numbers provided.

- Subversion Client 1.4 : Instructions for using SVN, including install, can be found at <http://subversion.tigris.org>
- Maven 2.0.9 : Instructions for using Maven, including install, can be found at <http://maven.apache.org/>
- Ant 1.7.0 : Instructions for using Ant, including install, can be found at <http://ant.apache.org>

### 3.5.1. Release Source Code Building

#### 1. Downloading the source code

Use SVN to checkout a specific release source, the base URL is ?, then add the specific release version, lets consider 1.0.0.CR2.

```
[usr]$ svn co ?/ss7-1.0.0.CR2
```

#### 2. Building the source code

Now that we have the source the next step is to build and install the source. JBoss Communications SS7 Stack uses Maven 2 to build the system. There are three profiles. Default one builds only java source. The other two profiles available "dahdilinux" and "dialogiclinux" additionally compile native modules.



#### Note

Native modules are supported only for linux OS for now.

Use "dahdilinux" profile if linux server on which this code is built already has dahdi module installed. Make sure you pass "include.zap" system property pointing to correct directory where dahdi is installed

```
[usr]$ cd ss7-1.0.0.CR2
[usr]$ mvn install -Pdahdilinux -Dinclude.zap=/usr/include/dahdi
```

Use "dialogiclinux" profile if linux server on which this code is built already has dialogic module installed. Make sure you pass "include.dialogic" and "include.dialogic.gctlib" system property pointing to correct directory where dialogic libraries are installed. include.dialogic.gctlib points to directory where `gctload` is present (generally `/opt/dpklx` for linux OS)

```
[usr]$ cd ss7-1.0.0.CR2
[usr]$ mvn install -Pdialogiclinux -Dinclude.dialogic=/opt/dpklx/INC -
Dinclude.dialogic.gctlib=/opt/dpklx
```

To build JBoss Communications SS7 Stack without building any native libraries use

```
[usr]$ cd ss7-1.0.0.CR2  
[usr]$ mvn install
```



### Note

If you are using JBoss Communications SS7 Stack without any native dependencies, JBoss Communications SS7 Stack can run on any OS.

Use Ant to build the binary .

```
[usr]$ cd ss7-1.0.0.CR2/release  
[usr]$ ant
```

### 3.5.2. Development Trunk Source Building

Similar process as for [Section 3.5.1, “Release Source Code Building”](#), the only change is the SVN source code URL, which is NOT AVAILABLE.

# Hardware Setup

This chapter contains reference to configure hardware drivers for different types of SS7 cards.

JBoss Communications SS7 Stack supports dahdi based SS7 cards like diguim and sangoma. Generally dahdi based SS7 crads doesn't have MTP2/MTP3 support on board and relies on external software to provide these services.

JBoss Communications SS7 Stack also supports dialogic based SS7 cards which has on board support for MTP2/MTP3

## 4.1. Sangoma

To install Sangoma cards visit the Sangoma wiki at <http://wiki.sangoma.com/>

## 4.2. Diguim

To install Diguim cards visit the Diguim site at <http://www.digium.com/en/products/digital/>

## 4.3. Dialogic

To install Dialogic cards visit the Dialogic site at <http://www.dialogic.com/>





# Shell Command Line

## 5.1. Introduction

JBoss Communications SS7 Stack provides Shell client to manage configuration of SS7 Stack Services. This chapter describes how to install and start client. Also it describes available commands and provides examples. To see examples of specific flow, to perform certain tasks, please refer to sections in chapter devoted to [Linksets](#), [SCCP](#) or [M3UA](#).

## 5.2. Starting

Shell client can be started with following command from `$JBOSS_HOME/bin`:

```
[$] ./ss7-run.sh
```

Once console starts, it will print following information:

```
=====
Mobicents SS7: release.version=1.0.0-SNAPSHOT
This is free software, with components licensed under the GNU General Public
License
version 2 and other licenses. For further details visit http://mobicents.org
=====
mobicents>
```

The `ss7-run` script supports following options

```
Usage: SS7 [OPTIONS]
Valid Options
-v          Display version number and exit
-h          This help screen
```

Shell needs to connect to managed instance. Command to connect has following structure:

```
ss7 connect <IP> <PORT>
```

### Example 5.1. Connec to remote machine

```
mobicents>ss7 connect 10.65.208.215 3435

mobicents(10.65.208.215:3435)>
```



#### Note

Host IP and port are optional, if not specified, shell will try to connect to 127.0.0.1:3435

Command to disconnect has following structure:

```
ss7 disconnect
```

### Example 5.2. Disconnect

```
mobicents(10.65.208.215:3435)>ss7 disconnect

Bye
mobicents>
```

## 5.3. Linkset Management

Linksets are managed by `linkset` command. It allows to perform following:

- create linkset
- delete linkset
- activate linkset
- deactivate linkset
- create link
- delete link
- activate link

- deactivate link
- list state of linksets and present links

### 5.3.1. Create Linkset

Linkset can be create by issuing command with following structure:

```
linkset create <linkset-type> opc <point-code> apc <point-code> ni <network-id> <linkset-name>
```

or in case of dialogic:

```
linkset create dialogic opc <point-code> apc <point-code> ni <network-id> srcmod <src-mode>  
destmod <dest-mode> <linkset-name>
```

or in case of M3UA:

```
linkset create m3ua opc <point-code> apc <point-code> ni <network-id> as <as-name> <linkset-name>
```

Where:

**linkset-type**

refers to type of linkset to be created, ie. `dahdi` , `dialogic` or `m3ua` . Correct values depend on which linkset factories have been deployed.

**point-code**

is simply `MTP` point - either local( `opc` ) or remote( `dpc` )

**ni**

is simply network identifier. It can have following values:

0

International network

1

Spare (for international use only)

2

National network

3

Reserved for national use

linkset-name

simple string name, which identifies linkset

as-name

Name of AS that M3UALinkset wraps. Make sure that AS is already created as explained in [Section 5.5.2.1, “Create AS”](#)

### Example 5.3. Linkset creation

```
mobicents(10.65.208.215:3435)>linkset create dahdi opc 1 apc 2 ni 0 linkset1
LinkSet successfully added
mobicents(10.65.208.215:3435)>linkset create dialogic opc 3 apc 4 ni 3
srcmod 1 destmod 2 linkset2
LinkSet successfully added
```

#### 5.3.2. Remove Linkset

Linkset can be deleted by issuing command with following structure:

```
linkset delete <linkset-name>
```

Where:

linkset-name

is name set during link creation

### Example 5.4. Linkset Removal

```
mobicents(10.65.208.215:3435)>linkset delete linkset1
LinkSet successfully deleted
```

#### 5.3.3. Activate Linkset

Linkset can be activated by issuing command with following structure:

```
linkset activate <linkset-name>
```

Where:

linkset-name

is name set during link creation

### Example 5.5. Linkset Activation

```
mobicents(10.65.208.215)>linkset activate linkset1
LinkSet activated successfully
```

### 5.3.4. Deactivate Linkset

Linkset can be deactivated by issuing command with following structure:

```
linkset deactivate <linkset-name>
```

Where:

linkset-name

is name set during link creation

### Example 5.6. Linkset Deactivateion

```
mobicents(10.65.208.215)>linkset deactivate linkset1
LinkSet deactivated successfully
```

### 5.3.5. Create Link

Link can be created in Linkset by issuing command with following structure:

```
linkset link create span <span-num> code <code-num> channel <channel-num> <linkset-name>
<link-name>
```

Where:

span-num

integer number. It represents port number in card(indexed from 0).

code-num

link code(sls assigned to this link).

channel-num

integer number indicating time slot number(TDM time slot).

linkset-name

is name set during link creation.

link-name

name which identifies link in linkset.

### Example 5.7.

```
mobicents(10.65.208.215:3435)>linkset link create span 1 code 1 channel 1
linkset1 link1
Link successfully added
```

### 5.3.6. Remove Link

Link can be removed from in Linkset by issuing command with following structure:

```
linkset link delete <linkset-name> <link-name>
```

Where:

linkset-name

is name set during link creation

link-name

name which identifies link in linkset

### Example 5.8. Link Removal

```
mobicents(10.65.208.215:3435)>linkset link delete linkset1 link1
Link successfully deleted
```

### 5.3.7. Activate Link

Link can be activated by issuing command with following structure:

```
linkset link activate <linkset-name> <link-name>
```

Where:

linkset-name

is name set during link creation

link-name

name which identifies link in linkset

#### Example 5.9. Link Activation

```
mobicents(10.65.208.215:3435)>linkset link activate linkset1 link1  
Link activated successfully
```

### 5.3.8. Deactivate Link

Link can be deactivated by issuing command with following structure:

```
linkset link deactivate <linkset-name> <link-name>
```

Where:

linkset-name

is name set during link creation

link-name

name which identifies link in linkset

#### Example 5.10. Link Deactivateion

```
mobicents(10.65.208.215:3435)>linkset link deactivate linkset1 link1  
Link deactivated successfully
```

### 5.3.9. Show status

Linkset and Link's status can be viewed by issuing command with following structure:

```
linkset show
```

#### Example 5.11. Linkset Status

```
mobicents(10.65.208.215:3435)>linkset show
linkset1      dahdi      opc=1          apc=2          ni=0
state=UNAVAILABLE
      link1      span=1    channelId=1    code=1    state=UNAVAILABLE
```

The possible state of Linkset are

- UNAVAILABLE : Indicates the linkset does not have any “available” links and cannot transport traffic
- SHUTDOWN : Indicates the linkset has been shutdown in the configuration
- AVAILABLE : Indicates the linkset has at least one available link and can carry traffic

The possible state of Link are

- UNAVAILABLE : Indicates the link is not available to carry traffic. This can occur if the link is remotely or locally inhibited by a user. It can also be unavailable if MTP2 has not been able to successfully activate the link connection.
- SHUTDOWN : Indicates the link has been shutdown in the configuration.
- AVAILABLE : Indicates the link is active and able to transport traffic
- FAILED : A link is FAILED when the link is not shutdown but is unavailable at layer2 for some reason. For example Initial Alignment failed or the link test messages sent by MTP3 are not being acknowledged.

## 5.4. SCCP Management

SCCP provides connectionless and connection-oriented network services. This includes address(GTT) translation and routing, flow control segmentation and reassembly.



A global title is an address (e.g., a dialed 800 number, calling card number, or mobile subscriber identification number) which is translated by SCCP into a destination point code and subsystem number. A subsystem number uniquely identifies an application at the destination signaling point. SCCP is used as the transport layer for TCAP -based services

As SCCP acts as message router, it requires means to configure routing information. CLI provides way to easily manage routing rules information in JBoss Communications SCCP implementation.

User should also configure the remote subsystem number and remote signaling pointcode. In some cases where global title is used, SCCP will only require configuring of remote signaling pointcode and configuring of remote subsystem is not required.

## 5.4.1. Rule Management

SCCP routing rules are managed by `sccp rule` command. It allows to perform following:

- `sccp rule create`
- `sccp rule modify`
- `sccp rule delete`
- `sccp rule show`

### 5.4.1.1. Create Rule

Rule can be create by issuing command with following structure:

```
sccp rule create <id> <mask> <address-indicator> <point-code> <subsystem-number>
<translation-type> <numbering-plan>
<nature-of-address-indicator> <digits> <primary-address-id> <backup-address-id>
```

This command should be specified after `primary_add` and `backup_add` are configured. Please refer [Section 5.4.2, “Address Management”](#) on how to configure `primary_add` and `backup_add`

<id>

A unique number to identify this rule

<mask>

mask defines which part of the originally dialed digits remains in the translated digits and which part is replaced by the digits from primary or backup address. mask is divided into sections by separator /. The number of sections in mask should be equal to sections in digits passed in this command and sections in primary or backup address

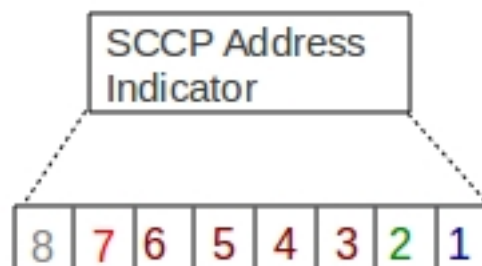
Table 5.1. mask definitions

Mnemonic	Function
-	Ignore
/	Separator used to split the mask into sections.
K	Keep the original dialed digits of this section into translated digits
R	Replace the original dialed digits of this section with same section from primary or backup address into translated digits

## &lt;address-indicator&gt;

The address indicator is the first field in SCCP Party Address(called/calling) and is one octet in length. Its function is to indicate which information elements are present so that the address can be interpreted, in other words, it indicates the type of addressing information that is to be found in the address field. The addressing information from original global title is then compared with passed address information to match the rule.

- **'1' Bit:** PC Indicator (1=included)
- **'2' Bit:** SSN Indicator (1=included)
- **3 - 6 Bit:** GT Indicator
  - 0000 = GT Not Included
  - 0001 = GT Includes Nature of Address,
  - 0010 = GT Includes Translation Type
  - 0011 = GT Includes Translation Type, Numbering Plan and Encoding Scheme
  - 0100 = GT Includes Translation Type, Numbering Plan, Encoding Scheme, and Nature of Address Indicator
- **'7' Bit:** Routing Indicator
  - 0 = Route on GT
  - 1 = Route on PC + SSN
- **'8' Bit:** Reserved for National Use



SCCP Address Indicator

## &lt;point-code&gt;

Point code. This is ignored if bit 0 of address-indicator is not set.

## &lt;subsystem-number&gt;

Subsystem Number. This is ignored if bit 1 of address-indicator is not set.

## &lt;translation-type&gt;

Translation type. This is ignored if GT Indicator is 0000 or 0001

**Table 5.2. Translation Type Values**

Value	Description
0	Unknown
1 to 63	International Service
64 to 127	Spare
128 to 254	National Network Specific
255	Reserved for Expansion

## &lt;numbering-plan&gt;

The Number Plan (NP) field specifies the numbering plan that the address information follows. This is ignored if GT Indicator is 0000, 0001 or 0010

## &lt;nature-of-address-indicator&gt;

The Nature of Address Indicator (NAI) field defines the address range for a specific numbering plan. This is only used if GT Indicator is 0100

## &lt;digits&gt;

Specifies the string of digits divided into subsections using separator '/' depending on if mask contains separator. The dialed digits should match with theses digits as per rule specified bellow

**Table 5.3. digit pattern**

Value	Description
-	padding - ignored
*	wildcard - matches any number of digits
?	wildcard - matches exactly one digit
/	sparator used to split the digit pattern into sections. Each section can be processed

Value	Description
	differently as specified by mask parameter.

<primary-address-id>

Identifies the SCCP Address used as the primary translation

<backup-address-id>

Identifies the SCCP Address used as the backup translation incase if pointcode specified by primary address is not available

### Example 5.12. SCCP Rule creation

```
mobicents(10.65.208.215:3435)>sccp rule create 1 R 71 2 8 0 0 3 123456789 1
mobicents(10.65.208.215:3435)>sccp rule create 2 R 71 2 8 0 0 3 123456789 1
1
```

#### 5.4.1.2. Delete SCCP Rule

SCCP Rule can be deleted by issuing command with following structure:

```
sccp rule delete <id>
```

Where:

<id>

is id set during rule creation

### Example 5.13. SCCP Rule Removal

```
mobicents(10.65.208.215:3435)>sccp rule delete 1
Rule successfully removed
```

#### 5.4.1.3. Show SCCP Rule

Rule's can be viewed by issuing command with following structure:

```
sccp rule show <id>
```

Where:

<id>

id is optional. If passed only rule matching the id will be shown, else all the rules will be shown

## 5.4.2. Address Management

The command is used to define primary or backup address of translation. The global title address information of this command is combined with the global title being translated by examining the mask provided in the `sccp rule create` command. The syntax remains same except for primary address `sccp primary_add` is used and for backup address `sccp backup_add` is used

- `sccp primary_add create`  
`sccp backup_add create`
- `sccp primary_add modify`  
`sccp backup_add modify`
- `sccp primary_add delete`  
`sccp backup_add delete`
- `sccp primary_add show`  
`sccp backup_add show`

### 5.4.2.1. Create Address

Address can be create by issuing command with following structure:

- For primary address

```
sccp primary_add create <id> <address-indicator> <point-code> <subsystem-number>
<translation-type> <numbering-plan>
<nature-of-address-indicator> <digits>
```

- For backup address

```
sccp backup_add create <id> <address-indicator> <point-code> <subsystem-number>
<translation-type> <numbering-plan>
```

<nature-of-address-indicator> <digits>

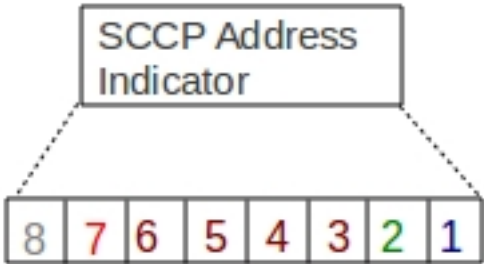
<id>

A unique number to identify this address

<address-indicator>

The address indicator is the first field in SCCP Party Address(called/calling) and is one octet in length. Its function is to indicate which information elements are present so that the address can be interpreted, in other words, it indicates the type of addressing information that is to be found in the address field. The addressing information from original global title is then compared with passed address information to match the rule.

- **'1' Bit:** PC Indicator (1=included)
- **'2' Bit:** SSN Indicator (1=included)
- **3 - 6 Bit:** GT Indicator
  - 0000 = GT Not Included
  - 0001 = GT Includes Nature of Address,
  - 0010 = GT Includes Translation Type
  - 0011 = GT Includes Translation Type, Numbering Plan and Encoding Scheme
  - 0100 = GT Includes Translation Type, Numbering Plan, Encoding Scheme, and Nature of Address Indicator
- **'7' Bit:** Routing Indicator
  - 0 = Route on GT
  - 1 = Route on PC + SSN
- **'8' Bit:** Reserved for National Use



SCCP Address Indicator

<point-code>

Point code. This is ignored if bit 0 of address-indicator is not set.

<subsystem-number>

Subsystem Number. This is ignored if bit 1 of address-indicator is not set.

<translation-type>

Translation type. This is ignored if GT Indicator is 0000 or 0001

Table 5.4. Translation Type Values

Value	Description
0	Unknown

Value	Description
1 to 63	International Service
64 to 127	Spare
128 to 254	National Network Specific
255	Reserved for Expansion

## &lt;numbering-plan&gt;

The Number Plan (NP) field specifies the numbering plan that the address information follows. This is ignored if GT Indicator is 0000, 0001 or 0010

## &lt;nature-of-address-indicator&gt;

The Nature of Address Indicator (NAI) field defines the address range for a specific numbering plan. This is only used if GT Indicator is 0100

## &lt;digits&gt;

The global title address information to translate to, specified as string of digits divided into subsections using separator '/' depending on if mask contains separator.

In addition the digits string can contain

**Table 5.5. Address digit**

Value	Description
-	padding - ignore
/	Separator to split the digits into sections. Each section is processed differently as specified by the mask in <code>sccp rule create</code> command.

**Example 5.14. SCCP Primary Address creation**

```
mobicents(10.65.208.215:3435)>sccp primary_add create 1 71 2 8 0 0 3
123456789
```

**Example 5.15. SCCP Backup Address creation**

```
mobicents(10.65.208.215:3435)>sccp backup_add create 1 71 3 8 0 0 3
123456789
```

### 5.4.2.2. Delete Address

- For primary address

```
sccp primary_add delete <id>
```

- For backup address

```
sccp backup_add delete <id>
```

Where:

<id>

is id set during address creation

### Example 5.16. Primary Address Removal

```
mobicents(10.65.208.215:3435)>sccp primary_add delete 1
Rule successfully removed
```

### Example 5.17. Backup Address Removal

```
mobicents(10.65.208.215:3435)>sccp backup_add delete 1
Rule successfully removed
```

### 5.4.2.3. Show Address

Address's can be viewed by issuing command with following structure:

- For primary address



```
sccp primary_add show <id>
```

- For backup address

```
sccp backup_add show <id>
```

Where:

<id>

id is optional. If passed only address matching the id will be shown, else all the addresses will be shown

### 5.4.3. Remote Signaling Point Management

SCCP resources includes remote signaling point and remote subsystem. Each remote signaling point that SCCP can communicate with must be configured using `sccp rsp` command

- `sccp rsp create`
- `sccp rsp modify`
- `sccp rsp delete`
- `sccp rsp show`

#### 5.4.3.1. Create Remote Signaling Point

Remote signaling point can be create by issuing command with following structure:

```
sccp rsp create <id> <remote-spc> <rspc-flag> <mask>
```

<id>

A unique number to identify this remote signaling point

<remote-spc>

The remote signaling point

<rspc-flag>

32 bit value. Not used for now. Reserved for future

<mask>

32 bit value. Not used for now. Reserved for future

### Example 5.18. Remote Signalin Point creation

```
mobicents(10.65.208.215:3435)>sccp rsp create 1 6477 0 0
```

#### 5.4.3.2. Delete Remote Signaling Point

```
sccp rsp delete <id>
```

Where:

<id>

is id set during remote signaling point creation

### Example 5.19. Remote Signaling Point removal

```
mobicents(10.65.208.215:3435)>sccp rsp delete 1
```

#### 5.4.3.3. Show Remote Signaling Point/s

Remote signaling point can be viewed by issuing command with following structure:

```
sccp rsp show <id>
```

Where:

<id>

id is optional. If passed only remote signaling point matching the id will be shown, else all the addresses will be shown

#### 5.4.4. Remote Sub-System Management

SCCP resources includes remote signaling point and remote subsystem. Each remote subsystem that SCCP can communicate with must be configured using `sccp rss` command

- `sccp rss create`
- `sccp rss modify`

- `sccp rss delete`
- `sccp rss show`

This command should be specified after remote signaling point is configured. Please refer [Section 5.4.3, “Remote Signaling Point Management”](#) on how to configure remote signaling point

#### 5.4.4.1. Create Remote Sub-System

Remote subsystem can be created by issuing command with following structure:

```
sccp rss create <id> <remote-spc> <remote-ssn> <rss-flag>
```

<id>

A unique number to identify this remote subsystem

<remote-spc>

The remote signaling point where this remote subsystem is deployed

<remote-ssn>

The remote subsystem number

<rss-flag>

32 bit value. Not used for now. Reserved for future

#### Example 5.20. Remote Sub-System creation

```
mobicents(10.65.208.215:3435)>sccp rss create 1 6477 8 0
```

#### 5.4.4.2. Delete Remote Sub-System

```
sccp rss delete <id>
```

Where:

<id>

is id set during remote subsystem creation

#### Example 5.21. Remote Sub-System removal

```
mobicents(10.65.208.215:3435)>sccp rss delete 1
```

### 5.4.4.3. Show Remote Sub-System/s

Remote subsystem can be viewed by issuing command with following structure:

```
sccp rss show <id>
```

Where:

<id>

id is optional. If passed only remote subsystem matching the id will be shown, else all will be shown

## 5.5. M3UA Management

M3UA stack is also responsible to manage the SCTP Associations.

### 5.5.1. M3UA Management - SCTP

M3UA - SCTP is managed by `sctp` command. It allows to perform following:

- `sctp server create`
- `sctp server destroy`
- `sctp server start`
- `sctp server stop`
- `sctp server show`
- `sctp association create`
- `sctp association destroy`
- `sctp association show`

#### 5.5.1.1. Create SCTP Server

SCTP Server can be created by issuing command with following structure:

```
sctp server create <server-name> <host-ip> <host-port>
```

Where:

server-name

Unique name assigned to the server.

host-ip

The host ip address where underlying SCTP server socket will bind

host-port

The host port where underlying SCTP server socket will bind

### Example 5.22. SCTP Server creation

```
mobicents(127.0.0.1:3436)>sctp server create TestServer 127.0.0.1 2905
Successfully added Server=TestServer
```

#### 5.5.1.2. Destroy SCTP Server

SCTP Server can be destroyed by issuing command with following structure:

```
sctp server destroy <server-name>
```

Where:

server-name

Unique name of the server to be destroyed. Make sure server is stopped before destroying.

### Example 5.23. Destroy SCTP Server

```
mobicents(127.0.0.1:3436)>sctp server destroy TestServer
Successfully removed Server=TestServer
```

#### 5.5.1.3. Start SCTP Server

SCTP Server can be started by issuing command with following structure:

```
sctp server start <server-name>
```

Where:

server-name

Unique name of the server to be started. The underlying SCTP server socket is bound to ip:port configured at creation time.

### Example 5.24. Start SCTP Server

```
mobicents(127.0.0.1:3436)>sctp server start TestServer
Successfully started Server=TestServer
```

#### 5.5.1.4. Stop SCTP Server

SCTP Server can be stopped by issuing command with following structure:

```
sctp server stop <server-name>
```

Where:

server-name

Unique name of the server to be stopped. The underlying socket is closed at this point and all resource are released.

### Example 5.25. Stop SCTP Server

```
mobicents(127.0.0.1:3436)>sctp server stop TestServer
Successfully stopped Server=TestServer
```

#### 5.5.1.5. Show SCTP Server

SCTP Server's configuration can be viewed by issuing command with following structure:

```
sctp server show
```

### Example 5.26. Show SCTP Server

```
mobicents(127.0.0.1:3436)>sctp server show
Not supported yet
```

### 5.5.1.6. Create SCTP Association

Association can be created by issuing command with following structure:

```
sctp association create <assoc-name> <CLIENT | SERVER> <server-name> <peer-ip> <peer-port> <host-ip> <host-port>
```

Where:

**assoc-name**

Unique name of the association

**CLIENT | SERVER**

If this association is client side or server side. If its client side, it will initiate the connection to peer and bind's to host-ip:host-port trying to connect to peer-ip:peer-port.

If its server side, it waits for peer to initiate connection. The connection request will be accepted from peer-ip:peer-port. host-ip and host-port is not required, even if passed it will be ignored

**server-name**

If this association is server side, server-name must be passed to associate with server. Server with server-name should have already been created by using command [Section 5.5.1.1, "Create SCTP Server"](#)

If this association is client side, server-name shouldn't be passed.

#### Example 5.27. Create CLIENT SCTP Association

```
mobicents(192.168.56.1:3436)>sctp association create Assoc1 CLIENT
192.168.56.101 2905 192.168.56.1 2905
Successfully added client Association=Assoc1
```

#### Example 5.28. Create SERVER SCTP Association

```
mobicents(192.168.56.1:3436)>sctp association create Assoc2 SERVER
TestServer 192.168.56.1 2905
Successfully added server Association=TestServer
```

### 5.5.1.7. Destroy SCTP Association

Association can be destroyed by issuing command with following structure:

```
sctp association destroy <assoc-name>
```

Where:

assoc-name

Unique name of the association to be destroyed

### Example 5.29. Destroy SCTP Association

```
mobicents(192.168.56.1:3436)>sctp association destroy Assoc1  
Successfully removed association=Assoc1
```

#### 5.5.1.8. Show SCTP Association

Configuration of Association can be viewed by issuing command with following structure:

```
sctp association show
```

### Example 5.30. Show SCTP Association

```
mobicents(192.168.56.1:3436)>sctp association show  
Not supported yet
```

#### 5.5.2. M3UA Management

M3UA is managed by `m3ua` command. It allows to perform following:

- `m3ua as create`
- `m3ua as destroy`
- `m3ua as show`
- `m3ua asp create`
- `m3ua asp destroy`
- `m3ua asp show`
- `m3ua asp start`



- `m3ua asp stop`
- `m3ua as add`
- `m3ua as remove`
- `m3ua route add`
- `m3ua route remove`
- `m3ua route show`

### 5.5.2.1. Create AS

Application Server (AS) can be created by issuing command with following structure:

```
m3ua as create <as-name> <AS | SGW | IPSP> mode <SE | DE> ipspType <client | server> rc
<routing-context> traffic-mode <traffic mode>
```

Where:

**as-name**

simple string name, which identifies AS. Make sure this is unique

**AS | SGW | IPSP**

Specify if this is of type AS or SGW or IPSP

**SE | DE**

Specify if the single or double exchange of ASP State Maintenance (ASPSM) and ASP Traffic Maintenance (ASPTM) messages should be performed

**client | server**

If As is of type IPSP, specify here if its client or server type.

**routing-context**

refers to Routing Context already configured on M3UA stack on SGW side.

**traffic-mode**

Traffic mode for ASP's. By default its loadshare. Mobicents M3UA only supports loadshare and override, broadcast is not supported.

### Example 5.31. AS (IPSP) creation

```
mobicents(127.0.0.1:3435)>m3ua as create AS1 IPSP mode DE ipspType server rc
1 traffic-mode loadshare
Successfully created AS name=AS1
```

### Example 5.32. AS creation

```
mobicents(127.0.0.1:3435)>m3ua as create AS2 AS mode SE rc 100 traffic-mode  
loadshare  
Successfully created AS name=AS2
```

#### 5.5.2.2. Destroy AS

Application Server (AS) can be destroyed by issuing command with following structure:

```
m3ua as destroy <as-name>
```

Where:

as-name

Simple string name, which identifies AS. Make sure AS is in state INACTIVE and all the ASP's are unassigned before destroying

### Example 5.33. Destroy AS

```
mobicents(127.0.0.1:3435)>m3ua as destroy AS1  
Successfully destroyed AS name=AS1
```

#### 5.5.2.3. Show AS

Application Server configured can viewed by issuing command with following structure:

```
m3ua as show
```

### Example 5.34. Show AS

```
mobicents(127.0.0.1:3435)>m3ua as show  
Not supported yet
```

#### 5.5.2.4. Create ASP

Application Server Process (ASP) can be created by issuing command with following structure:

```
m3ua asp create <asp-name> <sctp-association>
```

Where:

asp-name

Name of this ASP. It should be unique

sctp-association

name of SCTP Association

### Example 5.35. ASP creation

```
mobicents(127.0.0.1:3435)>m3ua asp create ASP1 Assoc1  
Successfully created AS name=ASP1
```

#### 5.5.2.5. Destroy ASP

ASP can be destroyed by issuing command with following structure:

```
m3ua asp destroy <asp-name>
```

Where:

asp-name

Name of this ASP to be destroyed. Make sure ASP is stopped before destroying

### Example 5.36. Destroy ASP

```
mobicents(127.0.0.1:3435)>m3ua asp destroy ASP1  
Successfully destroyed ASP name=ASP1
```

#### 5.5.2.6. Show ASP

ASP configured can be viewed by issuing command with following structure:

```
m3ua asp show
```

### Example 5.37. Show ASP

```
mobicents(127.0.0.1:3435)>m3ua asp show
Not supported yet
```

#### 5.5.2.7. Start ASP

Application Server Process (ASP) can be started with following structure

```
m3ua asp start <asp-name>
```

Where:

asp name

name of ASP created earlier. Make sure ASP you are trying to start is assigned to at least one AS

### Example 5.38. Start ASP

```
mobicents(127.0.0.1:3435)>m3ua asp start ASP1
Successfully started ASP name=ASP1
```

#### 5.5.2.8. Stop ASP

Application Server Process (ASP) can be stopped with following structure

```
m3ua asp stop <asp-name>
```

Where:

asp name

name of ASP started earlier.

### Example 5.39. Stop ASP

```
mobicents(127.0.0.1:3435)>m3ua asp stop ASP1
Successfully stopped ASP name=ASP1
```

### 5.5.2.9. Add ASP to AS

Application Server Process (ASP) can be assigned to Application Server (AS) with following structure

```
m3ua as add <as-name> <asp-name>
```

Where:

as name  
name of AS created earlier

asp name  
name of ASP created earlier



#### Note

Mobicents M3UA supports configuring ASP to process signalling traffic related to more than one Application Server, over a single SCTP Association. However you need to make sure that all the AS's that ASP is shared with has Routing Context (unique) configured.

### Example 5.40. Add ASP to AS

```
mobicents(127.0.0.1:3435)>m3ua as add AS1 ASP1  
Successfully added ASP name=ASP1 to AS name=AS1
```

### 5.5.2.10. Remove ASP from AS

Application Server Process (ASP) can be unassigned from Application Server (AS) with following structure

```
m3ua as remove <as-name> <asp-name>
```

Where:

as name  
name of AS

asp name  
name of ASP

### Example 5.41. Remove ASP from AS

```
mobicents(127.0.0.1:3435)>m3ua as remove AS1 ASP1  
Successfully removed ASP name=ASP1 from AS name=AS1
```

#### 5.5.2.11. Add Route

Configure the destination point code that message will be routed to

```
m3ua route add <as-name> <dpc> <opc> <si>
```

Where:

as name  
name of AS created earlier

dpc  
Destination point code

opc  
Originating point code

si  
Service Indicator

### Example 5.42. Add Route

```
mobicents(127.0.0.1:3435)>m3ua route add AS1 2 -1 -1
```

#### 5.5.2.12. Remove Route

Remove the As configured for the destination point code

```
m3ua route remove <as-name> <dpc> <opc> <si>
```

Where:

as name  
name of AS assigned to route message for this dpc

dpc  
Destination point code

opc  
Originating point code

si  
Service Indicator

### Example 5.43. Remove Route

```
mobicents(127.0.0.1:3435)>m3ua route remove AS1 2 -1 -1
```

#### 5.5.2.13. Show Route

Show all the routes configured

```
m3ua route show
```

### Example 5.44. Show Route

```
mobicents(127.0.0.1:3435)>m3ua route show
```





# M3UA

M3UA stands for MTP Level 3 (MTP3) User Adaptation Layer as defined by the IETF SIGTRAN working group in [RFC 4666](http://tools.ietf.org/html/rfc4666) [http://tools.ietf.org/html/rfc4666] (which replaces and supersedes RFC 3332). M3UA enables the SS7 protocol's User Parts (e.g. ISUP, SCCP and TUP) to run over IP instead of legacy SS7. JBoss Communications M3UA Stack use the services of Mobicents SCTP stack to transmit MTP-TRANSFER primitives.



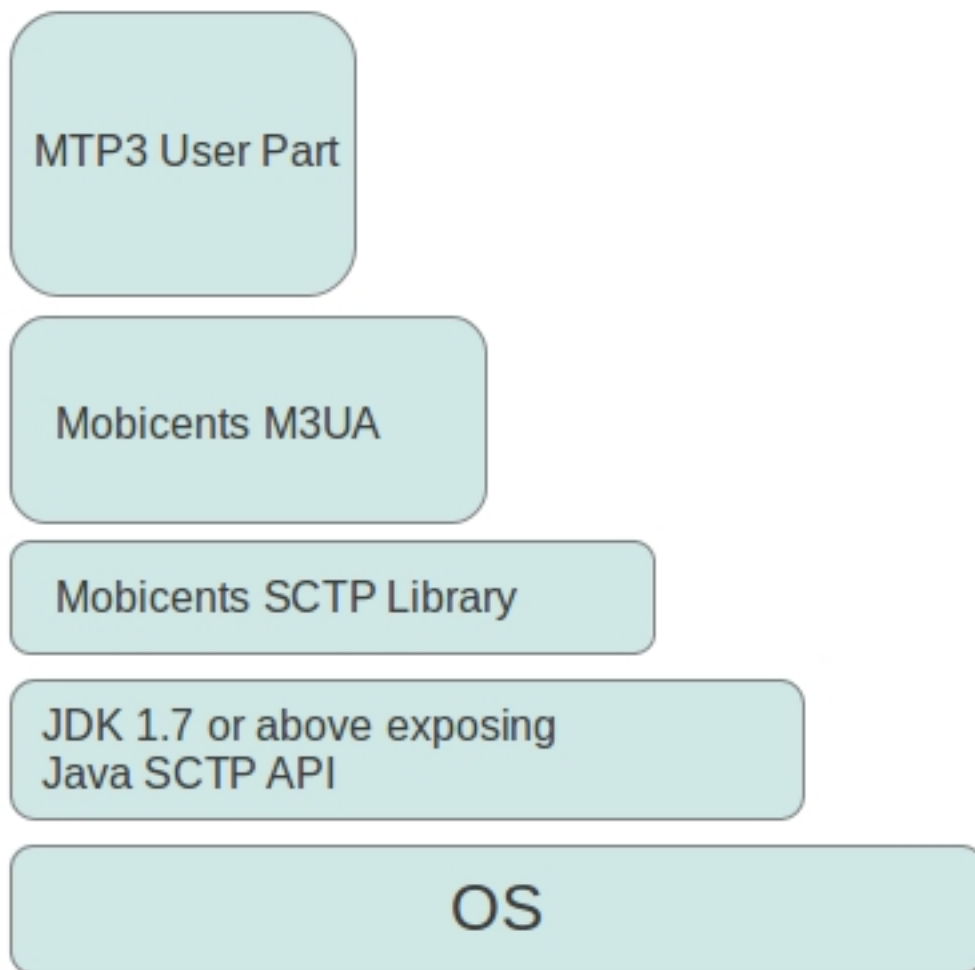
## Note

To know more about Mobicents SCTP stack, read the documentation included with Mobicents SCTP library.

JBoss Communications M3UA Stack provides the transport of MTP-TRANSFER primitives across an established SCTP association between an SGP and an ASP. The JBoss Communications M3UA Stack may also be used for point-to-point signaling between two IP Server Processes (IPSPs).

JBoss Communications M3UA Stack provides flexibility to be configured as either Single Exchange (SE) or Double Exchange (DE) of ASP State Maintenance (ASPSM) Messages and ASP Traffic Maintenance (ASPTM) messages

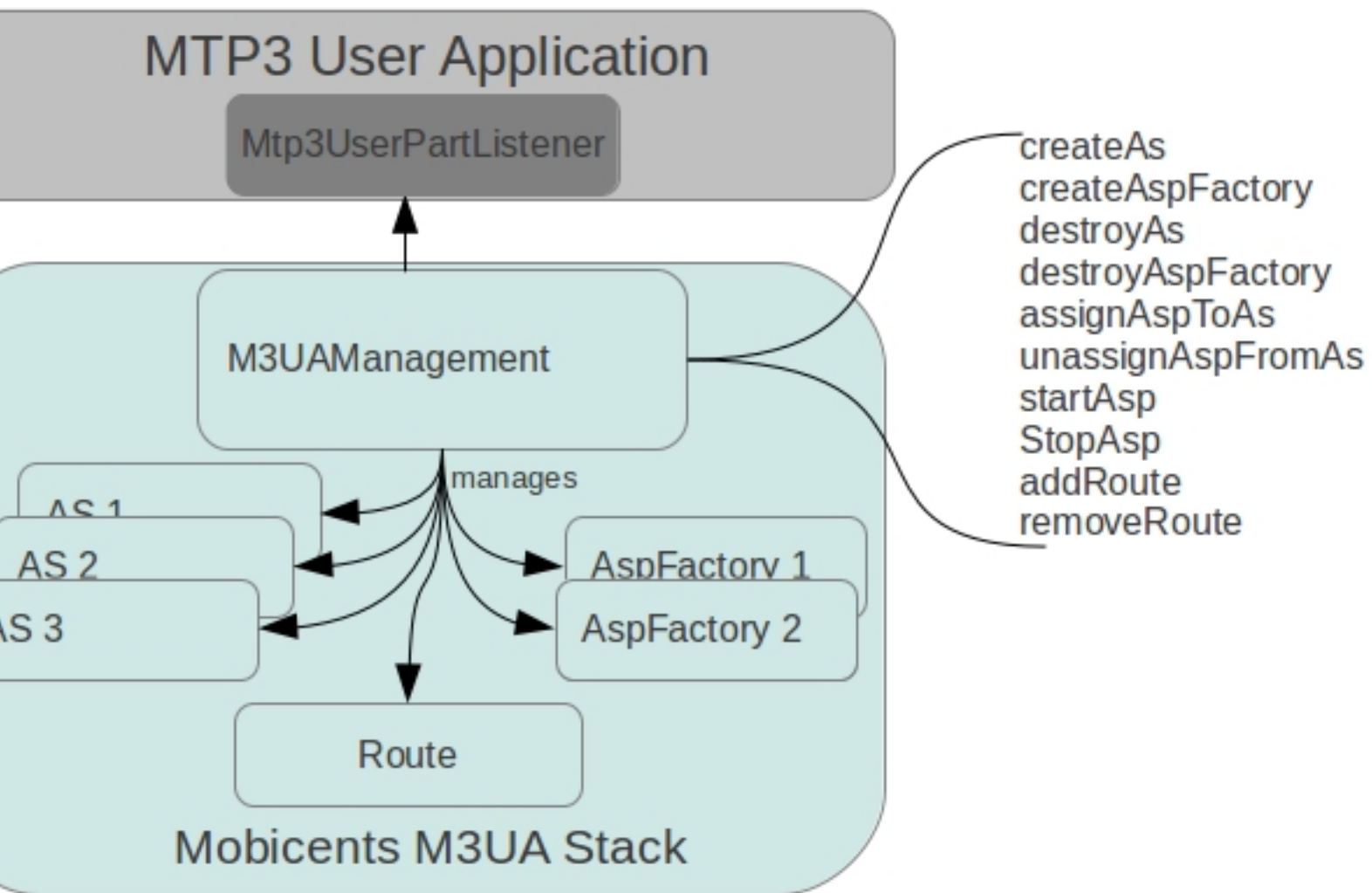
Below diagram shows various layers involved



**Figure 6.1. Layers involved**

## 6.1. JBoss Communications M3UA Design Overview

The internal structure of JBoss Communications M3UA stack looks like



**Figure 6.2. Architecture**

Instance of `M3UAManagement` manages the `AS`, `AspFactory` and routes.

## 6.2. M3UAManagement

In addition to manage `As`, `AspFactory` and routes, management also persist the state of each in `XXX_M3UA.xml` file, where `XXX` is unique name give to management instance.

`M3UAManagement` is divided into two sections 1) managing the resources and 2) configuring management



### Important

In case of Mobicents SS7 Service, the managing resources is taken care by Shell Command Line as explained in [Section 5.5, "M3UA Management"](#) and configuration of management is done in jboss-beans.xml as explained in [Section 3.4.1, "Configuring M3UA"](#)

### 6.2.1. API's to manage resource

```
public As createAs(String asName, Functionality functionality, ExchangeType exchangeType, IPSSType ipspType, RoutingContext rc, TrafficModeType trafficMode)
```

Create's a new As of type specified by `Functionality`. `Functionality` is enum of type AS, IPSP or SGW. If the `Functionality` is IPSP, `IPSSType` type should specify if its SERVER or CLIENT side.

If `Functionality` is AS, it automatically assumes client side and tries to send the ASPUP to peer.

If `Functionality` is SGW, it automatically assumes server side and wait's for ASPUP from peer.

`ExchangeType` specifies if its single or double exchange.

`RoutingContext` is not mandatory, if passed same value will be used in all the relevant ASP Traffic Maintenance, Management and Transfer Messages

`TrafficModeType` is not mandatory and default is Loadshare. Broadcast mode is not supported.

Appropriate Exception is thrown if there is already As with same name.

```
public AspFactory createAspFactory(String aspName, String associationName)
```

Create's a new `AspFactory`. There is one-to-one relation between `AspFactory` and SCTP's Association. `associationName` represents the underlying SCTP Association.

Appropriate Exception's are thrown if there is already `AspFactory` with same name or there is no SCTP Association with the given name or SCTP Association is already assigned to some other `AspFactory`.

```
public As destroyAs(String asName)
```

Destroy existing As.

Appropriate Exception's are thrown if there is no As with given name, or As is ACTIVE or one ore more ASP's are assigned to this AS.

```
public AspFactory destroyAspFactory(String aspName)
```

Destroy existing `AspFactory`.

Appropriate Exception's are thrown if there is no AspFactory with given name.

```
public Asp assignAspToAs(String asName, String aspName)
```

Assign's the Asp (AspFactory with name aspName should be created before this step) to As.

Appropriate Exception's are thrown if there is no AspFactory with given name or no As with given name.

```
public Asp unassignAspFromAs(String asName, String aspName)
```

Unassign's the Asp from As.

Appropriate Exception's are thrown if there is no ASP or As with given name.

```
public void startAsp(String aspName)
```

Start's the ASP. The ASP state maintenance messages are exchanged if this ASP is of IPSP and client side or if its AS side. This will automatically start the underlying SCTP's Asscoiation.

Appropriate Exception's are thrown if there is no ASP with given name or ASP is already started.

```
public void stopAsp(String aspName)
```

Stop's the ASP. This will automatically stop the underlying SCTP's Asscoiation.

Appropriate Exception's are thrown if there is no ASP with given name or ASP is already stoped.

```
public void addRoute(int dpc, int opc, int si, String asName)
```

Add the As with the given asName as route for given dpc, opc and si. Specifying DPC is mandatory, however opc and si can be passed as -1 which is wild character. For example if MTP3 User Application sends message with dpc=5, opc=4 and si=3, management will try to search the AS with exact value of dpc, opc and si. If not found, managemnt will subsitute si with wild character and serach again. If not found management will substitute opc with wild character and search again. If not found its an error and message is dropped with appropriate error message.

Appropriate Exception's are thrown if there are already maximum AS configured for give combination of dpc, opc and si or there is no As for given asName.

```
public void removeRoute(int dpc, int opc, int si, String asName)
```

Remove the As as route for passed comibnation of dpc, opc and si.

Appropriate Exception's are thrown if is no As for given asName.

## 6.2.2. Configuration

```
setPersistDir
```

Management when started looks for file XXX\_M3UA.xml containing serialized state of underlying As, AspFactory and routes. Set the directory path to direct M3UAManagement to look at specified directory for underlying serialized file.

If directory path is not set, Management searches for system property `m3ua.persist.dir` to get the path for directory. Even if `m3ua.persist.dir` system property is not set, Management will look at System set property `user.dir`

`setTransportManagement`

Set the instance of SCTP transport Management



### Important

SCTP `Management` instance should have already been created and configured

`setMaxAsForRoute`

Maximum number of AS that can be configured for routing for same DPC.

`setDeliveryMessageThreadCount`

Number of threads for call back to `Mtp3UserPartListener`. The order is maintained with respect to SLS. For example same thread will make call back for every message with same SLS. Default value is set to 1.

# ISUP

ISUP( ISDN User Part or ISUP ) is part of SS7 which is used to establish telephone calls and manage call switches( *exchanges* ). Exchanges are connected via E1 or T1 trunks. Each trunk is divided by means of TDM into time slots. Each time slot is distinguished as circuit. Circuits (identified by code) are used as medium to transmit voice data between user equipment (or exchanges if more than one is involved).

ISUP allows not only to setup a call, but to exchange information about exchange state and its resources(circuits).



## Note

JBoss Communications ISUP is based on ITU-T Q.76x series of documents.

## 7.1. ISUP Configuration

JBoss Communications ISUP stack is configured with simple properties. Currently following properties are supported:

**Table 7.1. ISUP Configuration options**

Name	Default value	Value range	Description
ni	None, must be provided	0-3	Sets value of network indicator that should be used by stack.
localspc	None, must be provided	0 - (2 <sup>14</sup> )-1	Sets local signaling point code. It will be used as OPC for outgoing signaling units.
t1	4s	4s - 15s	Sets T1 value. Started when REL is sent. See A.1/Q.764
t5	5 min.	5min - 15 min	Sets T5 value. Started when initial REL is sent. See A.1/Q.764
t7	20s	20s -30s	Sets T7 value. (Re)Started when Address Message is sent. See A.1/Q.764

Name	Default value	Value range	Description
t12	15s	15s - 60s	Sets T12 value. Started when BLO is sent. See A.1/Q.764
t13	5min	5min - 15min	Sets T13 value. Started when initial BLO is sent. See A.1/Q.764
t14	5s	15s - 60s	Sets T14 value. Started when UBL is sent. See A.1/Q.764
t15	5min	5min - 15min	Sets T15 value. Started when initial UBL is sent. See A.1/Q.764
t16	5s	15s - 60s	Sets T16 value. Started when RSC is sent. See A.1/Q.764
t17	5min	5min - 15min	Sets T17 value. Started when initial RSC is sent. See A.1/Q.764
t18	5s	15s - 60s	Sets T18 value. Started when CGB is sent. See A.1/Q.764
t19	5min	5min - 15min	Sets T19 value. Started when initial CGB is sent. See A.1/Q.764
t20	5s	15s - 60s	Sets T20 value. Started when CGU is sent. See A.1/Q.764
t21	5min	5min - 15min	Sets T21 value. Started when initial CGU is sent. See A.1/Q.764
t22	5s	15s - 60s	Sets T22 value. Started when GRS is sent. See A.1/Q.764
t23	5min	5min - 15min	Sets T23 value. Started when initial



Name	Default value	Value range	Description
			GRS is sent. See A.1/Q.764
t28	10s	10s	Sets T28 value. Started when CQM is sent. See A.1/Q.764
t33	12s	12s - 15s	Sets T33 value. Started when INR is sent. See A.1/Q.764

Note that before start user must provide two interfaces to stack:

**Mtp3UserPart**

implementation of transport layer which should be used by stack

**CircuitManager**

circuit manager implementation. This interface stores information on mapping between **CIC**(Circuit Identification Code) and **DPC**(Destination Point Code) used as destination for outgoing messages.

## 7.2. ISUP Usage

The `org.mobicenss7.isup.ISUPStack` interface defines the methods required to represent ISUP Protocol Stack. `ISUPStack` exposes `org.mobicenss7.isup.ISUPProvider`. This interface defines the methods that will be used by any registered ISUP User application implementing the `org.mobicenss7.isup.ISUPListener` to listen ISUP events(messages and timeouts).

## 7.3. ISUP Example

Below is simple example of stack usage:

```
import java.io.ByteArrayOutputStream;
import java.io.IOException;
import java.util.ArrayList;
import java.util.List;
import java.util.Properties;

import org.mobicenss7.isup.ISUPEvent;
import org.mobicenss7.isup.ISUPListener;
import org.mobicenss7.isup.ISUPProvider;
import org.mobicenss7.isup.ISUPStack;
```

```
import org.mobicenss7.isup.ISUPTimeoutEvent;
import org.mobicenss7.isup.ParameterException;
import org.mobicenss7.isup.impl.ISUPStackImpl;
import org.mobicenss7.isup.message.ISUPMessage;

import org.mobicenss7.linkset.oam.Layer4;
import org.mobicenss7.linkset.oam.Linkset;

public class ISUPTest implements ISUPListener
{

    protected ISUPStack stack;
    protected ISUPProvider provider;

    protected Linkset isupLinkSet;

    public void setUp() throws Exception {

        this.isupLinkSet = ....; //same linksets as in SS7Service
        this.stack = new ISUPStackImpl();
        this.stack.configure(getSpecificConfig());
        this.provider = this.stack.getIsupProvider();
        this.provider.addListener(this);
        Mtp3UserPart userPart = // create with proper factory, dahdii, dialogi, m3ua
        this.stack.setMtp3UserPart(userPart);
        CircuitManagerImpl circuitManager = new CircuitManagerImpl();
        circuitManager.addCircuit(1, 431613); // CIC - 1, DPC for it - 431613

        this.stack.setCircuitManager(circuitManager);
        this.stack.start();

    }

    public void onEvent(ISUPEvent event) {
        ISUPMessage msg = event.getMessage();
        switch(msg.getCircuitIdentificationCode().getCIC())
        {
            case AddressCompleteMessage._COMMAND_CODE:
                //only complete
                break;
            case ConnectedMessage._COMMAND_CODE:
```

```
        case AnswerMessage._COMMAND_CODE:
            //we are good to go
            ConnectedNumber cn = (ConnectedNumber)msg.getParameter(ConnectedNumber._PARAMETER_CODE);
            //do something
            break;
        case ReleaseMessage._COMMAND_CODE:
            //remote end does not want to talk
            ReleaseCompleteMessage rlc = provider.getMessageFactory().createRLC();
            rlc.setCircuitIdentificationCode(msg.getCircuitIdentificationCode());
            rlc.setCauseIndicators( ((ReleaseComplete)msg).getCauseIndicators());
            provider.sendMessage(rlc);

    }

}

public void onTimeout(ISUPTimeoutEvent event) {
    switch(event.getTimerId())
    {
        case ISUPTimeoutEvent.T1:
            //do something
            break;
        case ISUPTimeoutEvent.T7:
            //do even more
            break;
    }
}

}
```



# SCCP

The Signaling Connection Control Part (SCCP) is defined in ITU-T Recommendations Q.711-Q.716. SCCP sits on top of Message Transfer Part 3 (MTP3) in the SS7 protocol stack. The SCCP provides additional network layer functions to provide transfer of noncircuit-related (NCR) signaling information, application management procedures and alternative, more flexible methods of routing.

## 8.1. Routing Management

SCCP provides a routing function that allows signaling messages to be routed to a signaling point based on dialed digits, for example. This capability is known as Global Title Translation (GTT), which translates what is known as a global title (for example, dialed digits for a toll free number) into a signaling point code and a subsystem number so that it can be processed at the correct application.

Routing rules are configured using the Command Line Interface as explained [Section 5.4, “SCCP Management”](#)

### 8.1.1. GTT Configuration

GTT is performed in two stages. First is matching the rule and second is actual translation.

For matching the rule, the called party address global title digits are matched with <digits> configured in `sccp rule create` [Section 5.4.1.1, “Create Rule”](#) command above. Once the digits match actual translation is done

#### Matching rule

As explained in `sccp rule create` [Section 5.4.1.1, “Create Rule”](#) command the <digits> can be divided into sections using the "/" separate character. Each section defines set of digits to be matched. Wild card \* can be used to match any digits and ? can be used to match exactly one digit

For example Rule is to match starting 4 digits (should be 1234) and doesn't care for rest; the <digits> in the command will be 1234/\*. If the Rule is such that starting 3 digits should be 123, doesn't care for other three digits but last two digits should be 78; the <digits> in the command will be 123/???/78. If digit to digit matching is needed the the <digits> in the command will be exact digits to be matched without sections.

#### Translation

For translation each section in <mask> defined in `sccp rule create` command defines how replacement operation is performed. If <mask> defines K, the originally dialed digits are kept and if <mask> defines R the digits from primary address or back address are used. The primary/backup address should always define the point code and the translated address will always have this point code. If the primary/backup address defines the subsystem number the

translated address will also have this subsystem number. The address-indicator of translated address is always from primary/backup address. See bellow examples

Example 1 : Remove the Global Title and add PC and SSN

Element	Address Indicator	PC	SSN	TT	NP	NAI	Digits
Dialed Address	0 0 0 1 0 0 0 0			1			123456789
Rule Address	0 0 0 1 0 0 0 0			1			123456789
Rule mask							R
Primary Address	0 1 0 0 0 0 1 1	123	8				-
Translated Address	0 1 0 0 0 0 1 1	123	8				

GTT - Example 1

Example 2 : Partial match

Match a eight digit number starting "800", followed by any four digits, then "9". If the translated digits is not null and if the primary/backup address has no Global Title, the Global Title from dialed address is kept with new translated digits.

Element	Address Indicator	PC	SSN	TT	NP	NAI	Digits
Dialed Address	0 0 0 1 0 0 0 0			1			80012349
Rule Address	0 0 0 1 0 0 0 0			1			800/????/9
Rule mask							R/K/R
Primary Address	0 0 0 0 0 0 0 1	123					123/---/4
Translated Address	0 0 0 1 0 0 0 1	123		1			12312344

## GTT - Example 2

## Example 3 : Partial match

Match "800800", followed by any digits Remove the first six digits. Keep any following digits in the Input. Add a PC(123) and SSN (8).

Element	Address Indicator	PC	SSN	TT	NP	NAI	Digits
Dialed Address	0 0 0 1 0 0 0 0			1			80080012345
Rule Address	0 0 0 1 0 0 0 0			1			800800/*
Rule mask							R/K
Primary Address	0 0 0 0 0 0 1 1	123	8				-/-
Translated Address	0 0 0 1 0 0 1 1	123	8	1			12345

## GTT - Example 3

## Example 4 : Partial match

Match any digits keep the digits in the and add a PC(123) and SSN (8). If the translated digits is not null and if the primary/backup address has no Global Title, the Global Title from dialed address is kept with new translated digits.



Element	Address Indicator	PC	SSN	TT	NP	NAI	Digits
Dialed Address	0 0 0 1 0 0 0 0			1			4414257897897
Rule Address	0 0 0 1 0 0 0 0			1			*
Rule mask							K
Primary Address	0 0 0 0 0 0 1 1	123	8				-
Translated Address	0 0 0 1 0 0 1 1	123	8	1			4414257897897

GTT - Example 4

## 8.2. SCCP Usage

The instance of `org.mobicenss7.sccp.SccpStack` acts as starting point. All the sccp messages sent by SCCP User Part are routed as per the rule configured in Router



### Note

The term SCCP User Part refers to the applications that use SCCP's services.

The SCCP User Part gets handle to `SccpStack` by doing JNDI look-up as explained in [Section 8.3, "Access Point"](#)

`SccpStack` exposes `org.mobicenss7.sccp.SccpProvider` that interacts directly with `SccpStack`. This interface defines the methods that will be used by SCCP User Part to send `org.mobicenss7.sccp.message.SccpMessage` and register `org.mobicenss7.sccp.SccpListener`'s to listen for incoming SCCP messages.

SCCP User Part registers SccpListener for specific local subsystem number. For every incoming SccpMessage, if the called subsystem matches with this local subsystem, the corresponding SccpListner is called.

SccpProvider also exposes `org.mobicens.protocols.ss7.sccp.message.MessageFactory` and `org.mobicens.protocols.ss7.sccp.parameter.ParameterFactory` to create new concrete SccpMessage viz., `org.mobicens.protocols.ss7.sccp.message.UnitData` or `org.mobicens.protocols.ss7.sccp.message.XUnitData` passing the corresponding parameters created by leveraging ParameterFactory.

### 8.3. Access Point

SS7 Service provides user with access point to SCCP protocol/stack.

To get handle to SccpStack do the JNDI look-up passing the JNDI name configured in SS7 service as explained in [Section 3.4.5, "Configuring SS7Service"](#)

```
private static SccpProvider getSccpProvider() throws NamingException {  
  
    // no arg is ok, if we run in JBoss  
    InitialContext ctx = new InitialContext();  
    try {  
        String providerJndiName = "/mobicens/ss7/sccp";  
        return ((SccpStack) ctx.lookup(providerJndiName)).getSccpProvider();  
    } finally {  
        ctx.close();  
    }  
}
```

### 8.4. SCCP User Part Example

Below is SCCP User Part example listening for incoming SCCP message and sending back new message

```
public class Test implements SccpListener {  
  
    private SccpProvider sccpProvider;  
    private SccpAddress localAddress;
```

```

private static SccpProvider getSccpProvider() throws NamingException {

    // no arg is ok, if we run in JBoss
    InitialContext ctx = new InitialContext();
    try {
        String providerJndiName = "/mobicents/ss7/sccp";
        return ((SccpStack) ctx.lookup(providerJndiName)).getSccpProvider();
    } finally {
        ctx.close();
    }
}

public void start() throws Exception {

    this.sccpProvider = getSccpProvider();

    int translationType = 0;
    int subSystemNumber = 0;

    GlobalTitle gt = GlobalTitle.getInstance(translationType,
        NumberingPlan.ISDN_MOBILE, NatureOfAddress.NATIONAL, "1234");

    localAddress = new SccpAddress(gt, 0);

    this.sccpProvider.registerSccpListener(localAddress, this);
}

public void stop() {
    this.sccpProvider.deregisterSccpListener(localAddress);
}

public void onMessage(SccpMessage message) {

    if (message.getType() == MessageType.UDT) {
        throw new IllegalArgumentException("Dont like UDT");
    } else if (message.getType() == MessageType.XUDT) {
        XUnitData xudt = (XUnitData) message;
        localAddress = ((XUnitData) message).getCalledPartyAddress();
        SccpAddress remoteAddress = ((XUnitData) message)
            .getCallingPartyAddress();

        // now decode content
    }
}

```

```
byte[] data = xudt.getData();

// some data encoded in
CallRequest cr = new CallRequest(data);

byte[] answerData;

if (cr.getCallee().equals(this.localAddress)) {
    EstablishCallAnswer eca = new EstablishCallAnswer(cr);
    answerData = eca.encode();
} else {
    TearDownCallAnswer tdca = new TearDownCallAnswer(cr);
    answerData = tdca.encode();
}

HopCounter hc = this.sccpProvider.getParameterFactory()
    .createHopCounter(5);

XUnitData sccpAnswer = this.sccpProvider
    .getMessageFactory()
    .createXUnitData(hc, xudt.getProtocolClass(),
        message.getCallingPartyAddress(), this.localAddress);

this.sccpProvider.send(sccpAnswer);

}

}

}
```

# TCAP

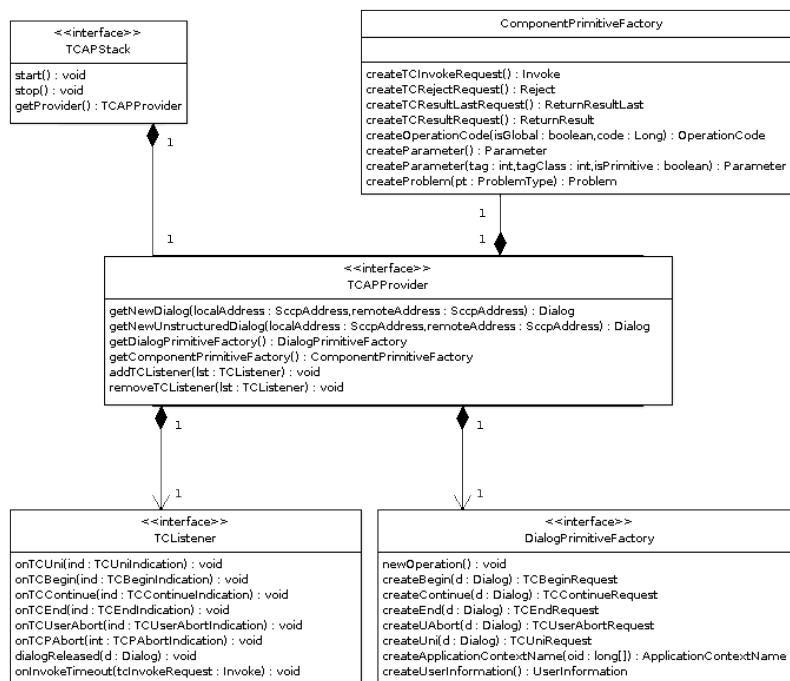
The Transaction Capabilities Application Part (TCAP) is defined in ITU-T Recommendations Q.771-Q.775. TCAP allows services at network nodes to communicate with each other using an agreed-upon set of data elements. Its primary purpose is to facilitate multiple concurrent dialogs between the same sub-systems on the same machines, using Transaction IDs to differentiate these, similar to the way TCP ports facilitate multiplexing connections between the same IP addresses on the Internet.

## 9.1. JBoss Communications SS7 Stack TCAP Usage

The `org.mobicenss7.protocols.ss7.tcap.api.TCAPStack` interface defines the methods required to represent TCAP Protocol Stack. `TCAPStack` exposes `org.mobicenss7.protocols.ss7.tcap.api.TCAPProvider` that interacts directly with `TCAPStack`. `TCAPProvider` defines methods that will be used by TCAP User Part to create new `org.mobicenss7.protocols.ss7.tcap.api.tc.dialog.Dialog` to be sent across network. TCAP User Part also allows to register `org.mobicenss7.protocols.ss7.tcap.api.TCListener` to listen TCAP messages.

`TCAPProvider` also exposes `org.mobicenss7.protocols.ss7.tcap.api.DialogPrimitiveFactory` to create dialog primitives and `org.mobicenss7.protocols.ss7.tcap.api.ComponentPrimitiveFactory` to create components. Components are a means of invoking an operation at a remote node

The UML Class Diagram looks like



JBoss Communications SS7 Stack TCAP Class Diagram

The `org.mobicenss7.tcap.TCAPStackImpl` is concrete implementation of `TCAPStack`. The TCAP User Part creates instance of `TCAPStackImpl` passing the reference of `SccpProvider` and new instance of `SccpAddress` representing address to which bind listener. The TCAP stack creates internaly JBoss Communications MAP Stack implementation. Passed `SccpAddress` is used to match against incoming messages destination address.

```
SccpProvider sccpProvider = getSccpProvider(); //JNDI lookup of SCCP Stack and get
Provider
SccpAddress localAddress createLocalAddress();

TCAPStack tcapStack = new TCAPStackImpl(sccpPprovider, localAddress);

...

private SccpAddress createLocalAddress()
{
    return new SccpAddress(RoutingIndicator.ROUTING_BASED_ON_DPC_AND_SSN, 1, null, 8);
}
```

The reference to `SccpProvider` is received from `SccpStack`. To get handle to `SccpStack` do the JNDI look-up passing the JNDI name configured in SS7 service as explained in [Section 8.3, “Access Point”](#)

The TCAP User Part should register the concrete implementation of `TCListener` with `TCAPProvider` to listen for incoming TCAP messages.

```
public class Client implements TCListener{
    ....
    tcapProvider = tcapStack.getProvider();
    tcapProvider.addTCListener(this);
    ....
}
```

The TCAP User Part leverages TCAPProvider to create new Dialog. The component's between the nodes are exchanged within this Dialog

```
clientDialog = this.tcapProvider.getNewDialog(thisAddress, remoteAddress);
```

The TCAP User Part leverages ComponentPrimitiveFactory to create new components. These components are sent using the dialog

```
//create some INVOKE
Invoke invoke = cpFactory.createTCInvokeRequest();
invoke.setInvokeId(this.clientDialog.getNewInvokeId());
OperationCode oc = cpFactory.createOperationCode();
oc.setLocalOperationCode(12L);
invoke.setOperationCode(oc);
//no parameter
this.clientDialog.sendComponent(invoke);
```

## 9.2. JBoss Communications SS7 Stack TCAP User Part Example

Below is TCAP User Part example. This example creates dialog and exchanges messages with structured dialog. Refer to source for function calls:

```
public class Client implements TListener{
    //encoded Application Context Name
    public static final long[] _ACN_ = new long[] { 0, 4, 0, 0, 1, 0, 19, 2 };

    private TCAPStack stack;
    private SccpAddress thisAddress;
    private SccpAddress remoteAddress;

    private TCAPProvider tcapProvider;
```

```
private Dialog clientDialog;

Client(SccpProvider sccpProvider, SccpAddress thisAddress, SccpAddress remoteAddress) {
    super();
    this.stack = new TCAPStackImpl(sccpProvider, thisAddress); //pass address, so stack can
register in SCCP
    this.runningTestCase = runningTestCase;
    this.thisAddress = thisAddress;
    this.remoteAddress = remoteAddress;
    this.tcapProvider = this.stack.getProvider();
    this.tcapProvider.addTCListener(this);
}

private static SccpProvider getSccpProvider() throws NamingException {

    // no arg is ok, if we run in JBoss
    InitialContext ctx = new InitialContext();
    try {
        String providerJndiName = "/mobicents/ss7/sccp";
        return ((SccpStack) ctx.lookup(providerJndiName)).getSccpProvider();
    } finally {
        ctx.close();
    }
}

public void start() throws TCAPException, TCAPSendException {
    clientDialog = this.tcapProvider.getNewDialog(thisAddress, remoteAddress);
    ComponentPrimitiveFactory cpFactory = this.tcapProvider.getComponentPrimitiveFactory();

    //create some INVOKE
    Invoke invoke = cpFactory.createTCInvokeRequest();
    invoke.setInvokeld(this.clientDialog.getNewInvokeld());

    OperationCode oc = cpFactory.createOperationCode();
    oc.setLocalOperationCode(12L);
    invoke.setOperationCode(oc);
    //no parameter
    this.clientDialog.sendComponent(invoke);

    ApplicationContextName acn = this.tcapProvider.getDialogPrimitiveFactory()
        .createApplicationContextName(_ACN_);
    //UI is optional!
    TCBeginRequest tcsr = this.tcapProvider.getDialogPrimitiveFactory().createBegin(this.clientDialog);
    tcsr.setApplicationContextName(acn);
}
```



```
this.clientDialog.send(tcbr);
}

public void onDialogReleased(Dialog d)
{
    d.keepAlive();
}

public void onInvokeTimeout(Invoke tcInvokeRequest)
{
}

public void onDialogTimeout(Dialog d)
{
}

public void onTCBegin(TCBeginIndication ind) {

}

public void onTCContinue(TCContinueIndication ind) {

    //send end
    TCEndRequest end = this.tcapProvider.getDialogPrimitiveFactory().createEnd(ind.getDialog());
    end.setTermination(TerminationType.Basic);
    try {
        ind.getDialog().send(end);

    } catch (TCAPSendException e) {
        throw new RuntimeException(e);
    }
}

public void onTCEnd(TCEndIndication ind) {
    //should not happen, in this scenario, we send data.
}

public void onTCUni(TCUniIndication ind) {
    //not going to happen

}
```

```
public void onTCPAbort(TCPAbortIndication ind) {  
    // TODO Auto-generated method stub  
  
}  
  
public void onTCUserAbort(TCUserAbortIndication ind) {  
    // TODO Auto-generated method stub  
  
}  
  
public static void main(String[] args)  
{  
  
    SccpAddress localAddress = new SccpAddress(RoutingIndicator.ROUTING_BASED_ON_DPC_AND_SSN, 1  
  
    SccpAddress remoteAddress = new SccpAddress(RoutingIndicator.ROUTING_BASED_ON_DPC_AND_SSN,  
    Client c = new Client(getSccpProvider(),localAddress,remoteAddress);  
}  
}
```

# MAP

Mobile application part (MAP) is the protocol that is used to allow the GSM network nodes within the Network Switching Subsystem (NSS ) to communicate with each other to provide services, such as roaming capability, text messaging (SMS), Unstructured Supplementary Service Data ( USSD) and subscriber authentication. MAP provides an application layer on which to build the services that support a GSM network. This application layer provides a standardized set of services. MAP uses the services of the SS7 network, specifically the Signaling Connection Control Part (SCCP ) and the Transaction Capabilities Application Part (TCAP)



## Important

For better understanding of this chapter please read GSM 09.02.



## Note

JBoss Communications SS7 Stack MAP has implementation for USSD, SMS and Location Management Service (LMS) Messages only. Any contribution to implement other messages are welcome. We will provide you all the help that you may need initially.

## 10.1. SS7 Stack MAP

The `org.mobicenss7.map.api.MAPStack` interface defines the methods required to represent MAP Protocol Stack. `MAPStack` exposes `org.mobicenss7.map.api.MAPProvider` that interacts directly with `MAPStack`. This interface defines the methods that will be used by any registered MAP User application implementing the `org.mobicenss7.map.api.MAPDialogListener` and `org.mobicenss7.map.api.MAPServiceListener` interface to listen MAP messages and dialogue handling primitives.

Each MAP-User interested in listening messages specific to MAP Service implements specific `MAPServiceListener`.

- MAP-User interested only in USSD messages implements `org.mobicenss7.map.api.service.supplementary.MAPServiceSupplementaryListener`
- MAP-User interested only in SMS messages implements `org.mobicenss7.map.api.service.sms.MAPServiceSmsListener`
- MAP-User interested only in USSD messages implements `org.mobicenss7.map.api.service.lsm.MAPServiceLsmListener`

MAP-User interested in all the services may implement all the service listener class.

The `org.mobicenss.protocols.ss7.map.MAPStackImpl` is concrete implementation of `MAPStack`. The MAP User application creates instance of `MAPStackImpl` passing the reference of `SccpProvider` and Sub System Number. All incoming messages are checked for destination SSN, if it matches with the one registered with this `MAPStackImpl` the corresponding listener is called else the peer receives error.

```
SccpProvider sccpProvider = getSccpProvider(); //JNDI lookup of SCCP Stack and get Provider
MAPStackImpl mapStack = new MAPStackImpl(sccpProvider, 8);
...
```

The reference to `SccpProvider` is received from `SccpStack`. To get handle to `SccpStack` do the JNDI look-up passing the JNDI name configured in SS7 service as explained in [Section 8.3, "Access Point"](#)

The MAP User application should register the concrete implementation of `MAPDialogListener` with `MAPProvider` to listen for incoming MAP Dialog and MAP Primitive messages.

The MAP User application should register the concrete implementation of `MAPServiceListener` with corresponding `MAPServiceBase` to listen for incoming MAP Service messages. Following `MAPServiceBase` are exposed by `MAPProvider`

- For LSM service `org.mobicenss.protocols.ss7.map.api.service.lsm.MAPServiceLsm`
- For SMS service `org.mobicenss.protocols.ss7.map.api.service.sms.MAPServiceSms`
- For 

USSD

 service  
`org.mobicenss.protocols.ss7.map.api.service.supplementary.MAPServiceSupplementary`

```
public class MAPExample implements MAPDialogListener, MAPServiceSupplementaryListener {
    ....
    mapProvider = mapStack.getMAPProvider();
    mapProvider.addMAPDialogListener(this);
    mapProvider.getMAPServiceSupplementary().addMAPServiceListener(this);
    ....
}
```

Before any MAP specific service can be used, the corresponding service should be activated

```
.....
```

```
// Make the supplementary service activated
mapProvider.getMapServiceSupplementary().activate();
....
```

The MAP User Application leverages `MapServiceFactory` to create instance of `USSDString` and `AddressString`

```
MapServiceFactory servFact = mapProvider.getMapServiceFactory();
USSDString ussdString = servFact.createUSSDString("*125*+31628839999#",
    null);

AddressString msisdn = this.servFact.createAddressString(
    AddressNature.international_number, NumberingPlan.ISDN,
    "31628838002");
```

The MAP User Application leverages specific `MAPServiceBase` to create new `MAPDialog` and send message

```
// First create Dialog
MAPDialogSupplementary mapDialog = mapProvider.getMapServiceSupplementary().createNewDialog(
    MAPApplicationContext.getInstance(MAPApplicationContextName.networkUnstructuredSsContext, MAPA
    destReference, origAddress, origReference);

// The dataCodingScheme is still byte, as I am not exactly getting how
// to encode/decode this.
byte ussdDataCodingScheme = 0x0f;

// USSD String: *125*+31628839999#
// The Charset is null, here we let system use default Charset (UTF-7 as
// explained in GSM 03.38. However if MAP User wants, it can set its own
// impl of Charset
USSDString ussdString = servFact.createUSSDString("*125*+31628839999#", null);

AddressString msisdn = this.servFact.createAddressString(AddressNature.international_number,
    NumberingPlan.ISDN, "31628838002");

mapDialog.addProcessUnstructuredSSRequest(ussdDataCodingScheme, ussdString, msisdn);
```

```
// This will initiate the TC-BEGIN with INVOKE component
mapDialog.send();
```

## 10.2. SS7 Stack MAP Usage

The complete example looks like

```
public class MAPExample implements MAPDialogListener, MAPServiceSupplementaryListener {

    private MAPStack mapStack;
    private MAPProvider mapProvider;

    MapServiceFactory servFact;

    SccpAddress destAddress = null;

    // The address created by passing the AddressNature, NumberingPlan and
    // actual address
    AddressString destReference = servFact.createAddressString(AddressNature.international_number,
        NumberingPlan.land_mobile, "204208300008002");

    SccpAddress origAddress = null;

    AddressString origReference = servFact.createAddressString(AddressNature.international_number, NumberingP
        "31628968300");

    MAPExample(SccpProvider sccpPprovider, SccpAddress address, SccpAddress remoteAddress) {
        origAddress = address;
        destAddress = remoteAddress;

        mapStack = new MAPStackImpl(sccpPprovider, 8);
        mapProvider = mapStack.getMAPProvider();
        servFact = mapProvider.getMapServiceFactory();

        mapProvider.addMAPDialogListener(this);
        mapProvider.getMapServiceSupplementary().addMAPServiceListener(this);
    }

    private static SccpProvider getSccpProvider() throws NamingException {

        // no arg is ok, if we run in JBoss
    }
}
```

```

InitialContext ctx = new InitialContext();
try {
    String providerJndiName = "/mobicents/ss7/sccp";
    return ((SccpStack) ctx.lookup(providerJndiName)).getSccpProvider();

} finally {
    ctx.close();
}
}

private static SccpAddress createLocalAddress() {
    return new SccpAddress(RoutingIndicator.ROUTING_BASED_ON_DPC_AND_SSN, 1, null, 8);
}

private static SccpAddress createRemoteAddress() {
    return new SccpAddress(RoutingIndicator.ROUTING_BASED_ON_DPC_AND_SSN, 2, null, 8);
}

public void run() throws Exception {

    // Make the supplementary service activated
    mapProvider.getMapServiceSupplementary().activate();

    // First create Dialog
    MAPDialogSupplementary mapDialog = mapProvider.getMapServiceSupplementary().createNewDialog(
        MAPApplicationContext.getInstance(MAPApplicationContextName.networkUnstructuredSsContext, MAPA
        destReference, origAddress, origReference);

    // The dataCodingScheme is still byte, as I am not exactly getting how
    // to encode/decode this.
    byte ussdDataCodingScheme = 0x0f;

    // USSD String: *125*+31628839999#
    // The Charset is null, here we let system use default Charset (UTF-7 as
    // explained in GSM 03.38. However if MAP User wants, it can set its own
    // impl of Charset
    USSDString ussdString = servFact.createUSSDString("*125*+31628839999#", null);

    AddressString msisdn = this.servFact.createAddressString(AddressNature.international_number,
        NumberingPlan.ISDN, "31628838002");

    mapDialog.addProcessUnstructuredSSRequest(ussdDataCodingScheme, ussdString, msisdn);

    // This will initiate the TC-BEGIN with INVOKE component

```

```
        mapDialog.send();
    }

    public void onProcessUnstructuredSSIndication(ProcessUnstructuredSSIndication procUnstrInd) {
        // TODO Auto-generated method stub
    }

    public void onUnstructuredSSIndication(UnstructuredSSIndication unstrInd) {
        // TODO Auto-generated method stub
    }

    public static void main(String[] args) throws Exception {
        SccpProvider sccpProvider = getSccpProvider(); // JNDI lookup of SCCP

        SccpAddress localAddress = createLocalAddress();
        SccpAddress remoteAddress = createRemoteAddress();

        MAPExample example = new MAPExample(sccpProvider, localAddress, remoteAddress);

        example.run();
    }

    @Override
    public void onDialogRequest(MAPDialog mapDialog, AddressString destReference, AddressString origReference,
        MAPExtensionContainer extensionContainer) {
        // TODO Auto-generated method stub
    }

    @Override
    public void onDialogAccept(MAPDialog mapDialog, MAPExtensionContainer extensionContainer) {
        // TODO Auto-generated method stub
    }

    @Override
    public void onDialogReject(MAPDialog mapDialog, MAPRefuseReason refuseReason, MAPProviderError providerError,
        ApplicationContextName alternativeApplicationContext, MAPExtensionContainer extensionContainer) {
        // TODO Auto-generated method stub
    }
}
```



```
@Override
public void onDialogUserAbort(MAPDialog mapDialog, MAPUserAbortChoice userReason,
    MAPExtensionContainer extensionContainer) {
    // TODO Auto-generated method stub

}

@Override
public void onDialogProviderAbort(MAPDialog mapDialog, MAPAbortProviderReason abortProviderReason,
    MAPAbortSource abortSource, MAPExtensionContainer extensionContainer) {
    // TODO Auto-generated method stub

}

@Override
public void onDialogClose(MAPDialog mapDialog) {
    // TODO Auto-generated method stub

}

@Override
public void onDialogDelimiter(MAPDialog mapDialog) {
    // TODO Auto-generated method stub

}

@Override
public void onDialogNotice(MAPDialog mapDialog, MAPNoticeProblemDiagnostic noticeProblemDiagnostic) {
    // TODO Auto-generated method stub

}

public void onDialogRelease(MAPDialog mapDialog) {

}

@Override
public void onDialogTimeout(MAPDialog mapDialog) {
    // TODO Auto-generated method stub

}

@Override
```

```
public void onErrorComponent(MAPDialog mapDialog, Long invokeId, MAPErrorMessage mapErrorMessage) {  
    // TODO Auto-generated method stub  
  
}  
  
@Override  
public void onProviderErrorComponent(MAPDialog mapDialog, Long invokeId, MAPProviderError providerError)  
    // TODO Auto-generated method stub  
  
}  
  
@Override  
public void onRejectComponent(MAPDialog mapDialog, Long invokeId, Problem problem) {  
    // TODO Auto-generated method stub  
  
}  
  
@Override  
public void onInvokeTimeout(MAPDialog mapDialog, Long invoke) {  
    // TODO Auto-generated method stub  
  
}  
  
}
```

---

# Appendix A. Java Development Kit (JDK): Installing, Configuring and Running

The **JBoss Communications Platform** is written in Java; therefore, before running any **JBoss Communications** server, you must have a working Java Runtime Environment (JRE) or Java Development Kit (JDK) installed on your system. In addition, the JRE or JDK you are using to run **JBoss Communications** must be version 5 or higher<sup>1</sup>.

**Should I Install the JRE or JDK?** Although you can run **JBoss Communications** servers using the Java Runtime Environment, we assume that most users are developers interested in developing Java-based, **JBoss Communications**-driven solutions. Therefore, in this guide we take the tact of showing how to install the full Java Development Kit.

**Should I Install the 32-Bit or the 64-Bit JDK, and Does It Matter?** Briefly stated: if you are running on a 64-Bit Linux or Windows platform, you should consider installing and running the 64-bit JDK over the 32-bit one. Here are some heuristics for determining whether you would rather run the 64-bit Java Virtual Machine (JVM) over its 32-bit cousin for your application:

- Wider datapath: the pipe between RAM and CPU is doubled, which improves the performance of memory-bound applications when using a 64-bit JVM.
- 64-bit memory addressing gives virtually unlimited (1 exabyte) heap allocation. However large heaps affect garbage collection.
- Applications that run with more than 1.5 GB of RAM (including free space for garbage collection optimization) should utilize the 64-bit JVM.
- Applications that run on a 32-bit JVM and do not require more than minimal heap sizes will gain nothing from a 64-bit JVM. Barring memory issues, 64-bit hardware with the same relative clock speed and architecture is not likely to run Java applications faster than their 32-bit cousin.

Note that the following instructions detail how to download and install the 32-bit JDK, although the steps are nearly identical for installing the 64-bit version.

**Downloading.** You can download the Sun JDK 5.0 (Java 2 Development Kit) from Sun's website: [http://java.sun.com/javase/downloads/index\\_jdk5.jsp](http://java.sun.com/javase/downloads/index_jdk5.jsp). Click on the **Download** link next to "JDK 5.0 Update <x>" (where <x> is the latest minor version release number). On the next page, select your language and platform (both architecture—whether 32- or 64-bit—and operating

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<sup>1</sup> At this point in time, it is possible to run most **JBoss Communications** servers, such as the JAIN SLEE, using a Java 6 JRE or JDK. Be aware, however, that presently the XML Document Management Server does not run on Java 6. We suggest checking the JBoss Communications web site, forums or discussion pages if you need to inquire about the status of running the XML Document Management Server with Java 6.

system), read and agree to the Java Development Kit 5.0 License Agreement, and proceed to the download page.

The Sun website will present two download alternatives to you: one is an RPM inside a self-extracting file (for example, `jdk-1_5_0_16-linux-i586-rpm.bin`), and the other is merely a self-extracting file (e.g. `jdk-1_5_0_16-linux-i586.bin`). If you are installing the JDK on Red Hat Enterprise Linux, Fedora, or another RPM-based Linux system, we suggest that you download the self-extracting file containing the RPM package, which will set up and use the SysV service scripts in addition to installing the JDK. We also suggest installing the self-extracting RPM file if you will be running **JBoss Communications** in a production environment.

**Installing.** The following procedures detail how to install the Java Development Kit on both Linux and Windows.

### Procedure A.1. Installing the JDK on Linux

- Regardless of which file you downloaded, you can install it on Linux by simply making sure the file is executable and then running it:

```
~]$ chmod +x "jdk-1_5_0_<minor_version>-linux-<architecture>-rpm.bin"
~]$ ./"jdk-1_5_0_<minor_version>-linux-<architecture>-rpm.bin"
```



#### You Installed Using the Non-RPM Installer, but Want the SysV Service Scripts

If you download the non-RPM self-extracting file (and installed it), and you are running on an RPM-based system, you can still set up the SysV service scripts by downloading and installing one of the `-compat` packages from the JPackage project. Remember to download the `-compat` package which corresponds correctly to the minor release number of the JDK you installed. The `compat` packages are available from <http://jpackage.hmdc.harvard.edu/JPackage/1.7/generic/RPMS.non-free/>.



#### Important

You do not need to install a `-compat` package in addition to the JDK if you installed the self-extracting RPM file! The `-compat` package merely performs the same SysV service script set up that the RPM version of the JDK installer does.

### Procedure A.2. Installing the JDK on Windows

- Using Explorer, simply double-click the downloaded self-extracting installer and follow the instructions to install the JDK.

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**Configuring.** Configuring your system for the JDK consists in two tasks: setting the `JAVA_HOME` environment variable, and ensuring that the system is using the proper JDK (or JRE) using the `alternatives` command. Setting `JAVA_HOME` usually overrides the values for `java`, `javac` and `java_sdk_1.5.0` in `alternatives`, but we will set them all just to be safe and consistent.

#### Setting the `JAVA_HOME` Environment Variable on Generic Linux

After installing the JDK, you must ensure that the `JAVA_HOME` environment variable exists and points to the location of your JDK installation.

**Setting the `JAVA_HOME` Environment Variable on Linux.** You can determine whether `JAVA_HOME` is set on your system by `echo`ing it on the command line:

```
~]$ echo $JAVA_HOME
```

If `JAVA_HOME` is not set already, then you must set its value to the location of the JDK installation on your system. You can do this by adding two lines to your personal `~/.bashrc` configuration file. Open `~/.bashrc` (or create it if it doesn't exist) and add a line similar to the following one anywhere inside the file:

```
export JAVA_HOME="/usr/lib/jvm/jdk1.5.0_<version>"
```

You should also set this environment variable for any other users who will be running **JBoss Communications** (any environment variables exported from `~/.bashrc` files are local to that user).

#### Setting `java`, `javac` and `java_sdk_1.5.0` Using the `alternatives` command

**Selecting the Correct System JVM on Linux using `alternatives`.** On systems with the `alternatives` command, including Red Hat Enterprise Linux and Fedora, you can easily choose which JDK (or JRE) installation you wish to use, as well as which `java` and `javac` executables should be run when called.

As the root user, call `/usr/sbin/alternatives` with the `--config java` option to select between JDKs and JREs installed on your system:

```
root@localhost ~]$ /usr/sbin/alternatives --config java
```

There are 3 programs which provide 'java'.

Selection	Command
1	/usr/lib/jvm/jre-1.5.0-gcj/bin/java
2	/usr/lib/jvm/jre-1.6.0-sun/bin/java
*+ 3	/usr/lib/jvm/jre-1.5.0-sun/bin/java

Enter to keep the current selection[+], or type selection number:

In our case, we want to use the Sun JDK, version 5, that we downloaded and installed, to run the `java` executable. In the `alternatives` information printout above, a plus (+) next to a number indicates the one currently being used. As per `alternatives`' instructions, pressing **Enter** will simply keep the current JVM, or you can enter the number corresponding to the JVM you would prefer to use.

Repeat the procedure above for the `javac` command and the `java_sdk_1.5.0` environment variable, as *the root user*:

```
~]$ /usr/sbin/alternatives --config javac
```

```
~]$ /usr/sbin/alternatives --config java_sdk_1.5.0
```

### Setting the `JAVA_HOME` Environment Variable on Windows

For information on how to set environment variables in Windows, refer to <http://support.microsoft.com/kb/931715>.

**Testing.** Finally, to make sure that you are using the correct JDK or Java version (5 or higher), and that the `java` executable is in your `PATH`, run the `java -version` command in the terminal from your home directory:

```
~]$ java -version
java version "1.5.0_16"
Java(TM) 2 Runtime Environment, Standard Edition (build 1.5.0_16-b03)
Java HotSpot(TM) Client VM (build 1.5.0_16-b03, mixed mode, sharing)
```

**Uninstalling.** There is usually no reason (other than space concerns) to remove a particular JDK from your system, given that you can switch between JDKs and JREs easily using `alternatives`, and/or by setting `JAVA_HOME`.

**Uninstalling the JDK on Linux.** On RPM-based systems, you can uninstall the JDK using the `yum remove <jdk_rpm_name>` command.

**Uninstalling the JDK on Windows.** On Windows systems, check the JDK entry in the `Start` menu for an uninstall command, or use `Add/Remove Programs`.

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# Appendix B. Setting the JBOSS\_HOME Environment Variable

The **JBoss Communications Platform (JBoss Communications)** is built on top of the **JBoss Enterprise Application Platform**. You do not need to set the `JBOSS_HOME` environment variable to run any of the **JBoss Communications Platform** servers *unless* `JBOSS_HOME` is *already* set.

The best way to know for sure whether `JBOSS_HOME` was set previously or not is to perform a simple check which may save you time and frustration.

**Checking to See If JBOSS\_HOME is Set on Unix.** At the command line, `echo $JBOSS_HOME` to see if it is currently defined in your environment:

```
~]$ echo $JBOSS_HOME
```

The **JBoss Communications Platform** and most JBoss Communications servers are built on top of the **JBoss Enterprise Application Platform (JBoss Enterprise Application Platform)**. When the **JBoss Communications Platform** or JBoss Communications servers are built *from source*, then `JBOSS_HOME` *must* be set, because the JBoss Communications files are installed into (or “over top of” if you prefer) a clean **JBoss Enterprise Application Platform** installation, and the build process assumes that the location pointed to by the `JBOSS_HOME` environment variable at the time of building is the **JBoss Enterprise Application Platform** installation into which you want it to install the JBoss Communications files.

This guide does not detail building the **JBoss Communications Platform** or any JBoss Communications servers from source. It is nevertheless useful to understand the role played by **JBoss AS** and `JBOSS_HOME` in the JBoss Communications ecosystem.

The immediately-following section considers whether you need to set `JBOSS_HOME` at all and, if so, when. The subsequent sections detail how to set `JBOSS_HOME` on Unix and Windows



## Important

Even if you fall into the category below of *not needing* to set `JBOSS_HOME`, you may want to for various reasons anyway. Also, even if you are instructed that you do *not need* to set `JBOSS_HOME`, it is good practice nonetheless to check and make sure that `JBOSS_HOME` actually *isn't* set or defined on your system for some reason. This can save you both time and frustration.

## You **DO NOT NEED** to set `JBOSS_HOME` if...

- ...you have installed the **JBoss Communications Platform** binary distribution.

- ...you have installed a JBoss Communications server binary distribution *which bundles JBoss Enterprise Application Platform*.

### You **MUST** set `JBOSS_HOME` if...

- ...you are installing the **JBoss Communications Platform** or any of the JBoss Communications servers *from source*.
- ...you are installing the **JBoss Communications Platform** binary distribution, or one of the JBoss Communications server binary distributions, which *do not* bundle **JBoss Enterprise Application Platform**.

Naturally, if you installed the **JBoss Communications Platform** or one of the JBoss Communications server binary releases which *do not* bundle **JBoss Enterprise Application Platform**, yet requires it to run, then you should install before setting `JBOSS_HOME` or proceeding with anything else.

**Setting the `JBOSS_HOME` Environment Variable on Unix.** The `JBOSS_HOME` environment variable must point to the directory which contains all of the files for the **JBoss Communications Platform** or individual JBoss Communications server that you installed. As another hint, this topmost directory contains a `bin` subdirectory.

Setting `JBOSS_HOME` in your personal `~/ .bashrc` startup script carries the advantage of retaining effect over reboots. Each time you log in, the environment variable is sure to be set for you, as a user. On Unix, it is possible to set `JBOSS_HOME` as a system-wide environment variable, by defining it in `/etc/bashrc`, but this method is neither recommended nor detailed in these instructions.

### Procedure B.1. To Set `JBOSS_HOME` on Unix...

1. Open the `~/ .bashrc` startup script, which is a hidden file in your home directory, in a text editor, and insert the following line on its own line while substituting for the actual install location on your system:

```
export JBOSS_HOME="/home/<username>/<path>/<to>/<install_directory>"
```

2. Save and close the `.bashrc` startup script.
3. You should `source` the `.bashrc` script to force your change to take effect, so that `JBOSS_HOME` becomes set for the current session<sup>1</sup>.

```
~]$ source ~/.bashrc
```

4. Finally, ensure that `JBOSS_HOME` is set in the current session, and actually points to the correct location:

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<sup>1</sup> Note that any other terminals which were opened prior to your having altered `.bashrc` will need to `source` `~/ .bashrc` as well should they require access to `JBOSS_HOME`.





### Note

The command line usage below is based upon a binary installation of the **JBoss Communications Platform**. In this sample output, JBOSS\_HOME has been set correctly to the *topmost\_directory* of the **JBoss Communications** installation. Note that if you are installing one of the standalone **JBoss Communications** servers (with **JBoss AS** bundled!), then JBOSS\_HOME would point to the *topmost\_directory* of your server installation.

```
~]$ echo $JBOSS_HOME  
/home/silas/<path>/<to>/<install_directory>
```

**Setting the JBOSS\_HOME Environment Variable on Windows.** The JBOSS\_HOME environment variable must point to the directory which contains all of the files for the JBoss Communications Platform or individual JBoss Communications server that you installed. As another hint, this topmost directory contains a `bin` subdirectory.

For information on how to set environment variables in recent versions of Windows, refer to <http://support.microsoft.com/kb/931715>.



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## Appendix C. Revision History

### Revision History

Revision 1.0	Wed June 2 2010	BartoszBaranowski
Creation of the JBoss Communications SS7 Stack User Guide.		
Revision 1.1	Tue Dec 21 2010	AmitBhayani
Creation of the JBoss Communications SS7 Stack User Guide.		

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