

**Oracle® Communications WebRTC Session
Controller**

Extension Developer's Guide

Release 7.0

E40977-01

November 2013

Copyright © 2013, Oracle and/or its affiliates. All rights reserved.

This software and related documentation are provided under a license agreement containing restrictions on use and disclosure and are protected by intellectual property laws. Except as expressly permitted in your license agreement or allowed by law, you may not use, copy, reproduce, translate, broadcast, modify, license, transmit, distribute, exhibit, perform, publish, or display any part, in any form, or by any means. Reverse engineering, disassembly, or decompilation of this software, unless required by law for interoperability, is prohibited.

The information contained herein is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

If this is software or related documentation that is delivered to the U.S. Government or anyone licensing it on behalf of the U.S. Government, the following notice is applicable:

U.S. GOVERNMENT END USERS: Oracle programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, delivered to U.S. Government end users are "commercial computer software" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, use, duplication, disclosure, modification, and adaptation of the programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, shall be subject to license terms and license restrictions applicable to the programs. No other rights are granted to the U.S. Government.

This software or hardware is developed for general use in a variety of information management applications. It is not developed or intended for use in any inherently dangerous applications, including applications that may create a risk of personal injury. If you use this software or hardware in dangerous applications, then you shall be responsible to take all appropriate fail-safe, backup, redundancy, and other measures to ensure its safe use. Oracle Corporation and its affiliates disclaim any liability for any damages caused by use of this software or hardware in dangerous applications.

Oracle and Java are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Xeon are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Opteron, the AMD logo, and the AMD Opteron logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

This software or hardware and documentation may provide access to or information on content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services.

This documentation is in preproduction status and is intended for demonstration and preliminary use only. It may not be specific to the hardware on which you are using the software. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to this documentation and will not be responsible for any loss, costs, or damages incurred due to the use of this documentation.

The information contained in this document is for informational sharing purposes only and should be considered in your capacity as a customer advisory board member or pursuant to your beta trial agreement only. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described in this document remains at the sole discretion of Oracle.

This document in any form, software or printed matter, contains proprietary information that is the exclusive property of Oracle. Your access to and use of this confidential material is subject to the terms and conditions of your Oracle Software License and Service Agreement, which has been executed and with which you agree to comply. This document and information contained herein may not be disclosed, copied, reproduced, or distributed to anyone outside Oracle without prior written consent of Oracle. This document is not part of your license agreement nor can it be incorporated into any contractual agreement with Oracle or its subsidiaries or affiliates.

Contents

Preface	v
Audience.....	v
Related Documents	v
Documentation Accessibility	v
1 About Extending WebRTC Session Controller	
About Extending WebRTC Session Controller Functionality	1-1
About the WebRTC Session Controller Console Components.....	1-4
About the WebRTC Session Controller Groovy Scripts	1-5
About Creating Client Applications Using the JavaScript API	1-5
About Translating Calls Using the Configuration API	1-6
About Extending WebRTC Session Controller Using the JsonRTC Protocol.....	1-6
WebRTC Session Controller Software and Protocol Conformance.....	1-6
Prerequisites for Extending WebRTC Session Controller Functionality.....	1-7
2 About Building JSON to SIP Communication	
About Building JSON to SIP Communication.....	2-1
Securing Signaling Engine Connections	2-1
About Connecting to a Client Application.....	2-2
About Sessions and Subsessions.....	2-2
About JSON to SIP Communication	2-2
About SIP to Client Communication.....	2-4
About Storing Data Within Sessions	2-4
Understanding the WebRTC Session Controller Components	2-5
About Applications.....	2-5
About Packages	2-5
About Criteria.....	2-6
About the WebRTC Session Controller Console.....	2-7
About the Groovy Scripts	2-8
About the Script Library	2-10
About the Normalized Data Format	2-10
3 Creating WebRTC Session Controller Applications, Packages, and Criteria	
Starting the WebRTC Session Controller Console.....	3-1
Creating Criteria	3-2

Creating Packages	3-3
Creating Applications.....	3-3
Debugging Groovy Script Run Time Errors	3-4
About the WebRTC Session Controller Console Validation Tests.....	3-6
4 Customizing Messages for New SIP or JSON Data	
Processing Messages With Custom SIP Data	4-1
Example SIP Request Variable	4-1
Extending SIP Messages with New Headers	4-2
Protecting System Performance by Removing SIP Messages.....	4-2
Removing a SIP Header in a Message.....	4-2
Replacing a SIP Header in a Message	4-2
Conditionally Passing SIP Headers in Messages.....	4-2
Changing JSON Data to Support Protocol Changes	4-3
Extending WebRTC Session Controller Functionality	4-3
5 Using Policy Data in Messages	
About Using Policy Control Data with Signaling Engine	5-1
Creating and Sending Diameter Rx Request messages.....	5-2
Accepting and Using Diameter Rx Answer Messages	5-4
6 Anchoring Media Sessions	
About the WebRTC Session Controller Media Server	6-1
About Media Engine Sessions	6-3
About Using createSdpOffer to Modify INVITE SDP Data.....	6-4
About Using createSdpAnswer to Process 200 Message SDP Data.....	6-4
About Using createReleaseRequest to Explicitly Release Media	6-4
A JsonRTC Protocol Reference	
About the JsonRTC Protocol	A-1
Initiating a HTTP/HTTPS Handshake with Signaling Engine.....	A-1
Tearing Down a JsonRTC Session	A-2
About JsonRTC Sessions and SubSessions.....	A-2
About Message Reliability	A-2
About the JsonRTC Session Controller Messages.....	A-2
Control Headers.....	A-3
General and Action Headers.....	A-5
Message Payloads.....	A-6
Example Message Bodies	A-7

Preface

This document describes the developer extensions for Oracle Communications WebRTC Session Controller product.

Audience

This document is intended for developers who use WebRTC Session Controller to make their SIP-based services available to users using WebRTC-enabled web browsers. WebRTC Session Controller does this by making your web-based JSON messages understandable to a SIP network, and your SIP messages understandable to JSON-based browsers and applications. This document also explains the points where the SIP to JSON translation is extendable to add new features and incorporate other features and technologies. This document further explains how to take advantage of the WebRTC Session Controller Media Engine media anchoring features, and how to incorporate WebRTC Session Controller policy (QoS) restrictions in your implementation.

Related Documents

For more information, see the following documents in the Oracle Communications WebRTC Session Controller Release 7.0 documentation set:

- *Oracle Communications WebRTC Session Controller Concepts*
- *Oracle Communications WebRTC Session Controller System Administrator's Guide*
- *Oracle Communications WebRTC Session Controller Security Guide*
- *Oracle Communications WebRTC Session Controller Web Application Developer's Guide*
- *Oracle Communications WebRTC Session Controller Configuration API Reference*
- *Oracle Communications WebRTC Session Controller JavaScript API Reference*

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at
<http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc>.

Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support. For information, visit <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info> or visit <http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs> if you are hearing impaired.

About Extending WebRTC Session Controller

This chapter introduces the Oracle Communications WebRTC Session Controller Signaling Engine (Signaling Engine) and WebRTC Session Controller Media Engine (Media Engine) features that you use to establish communication between WebRTC-enabled browsers and SIP-based network services.

In order to use WebRTC Session Controller functionality, you must be familiar with

- The SIP transport protocol, and how it builds up and tears down calls.
- The JSON data format.
- JavaScript, and how it communicates with web servers.
- The Java and Groovy Programming Languages that you use to create scripts that perform JSON to SIP and SIP to JSON translations within Signaling Engine.

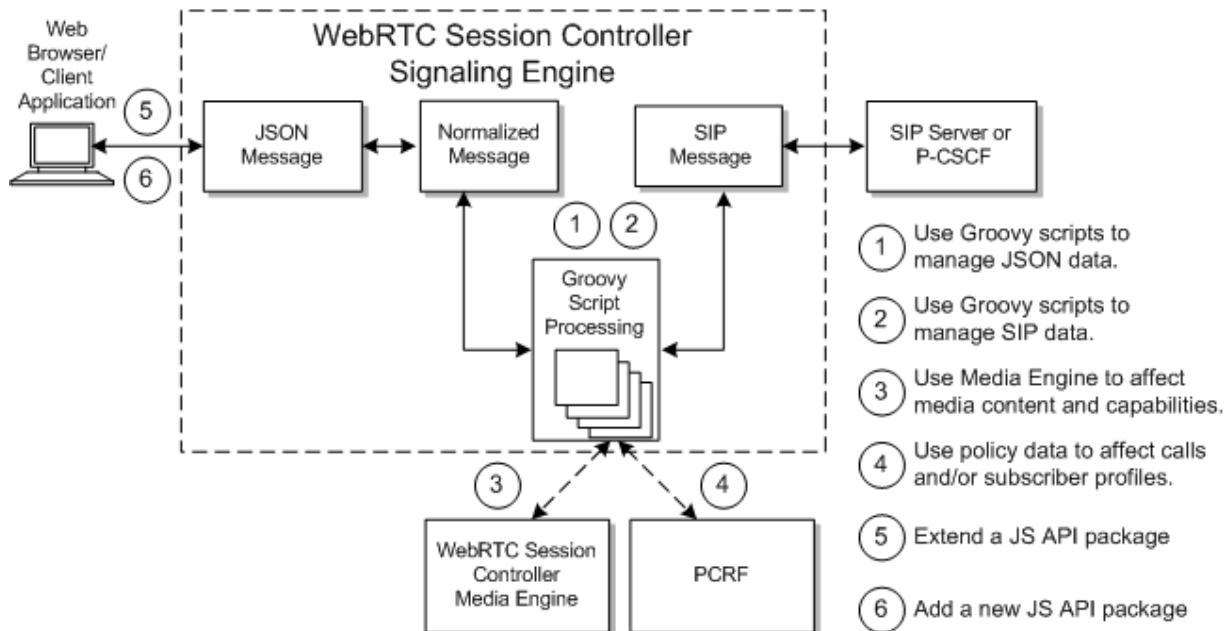
About Extending WebRTC Session Controller Functionality

WebRTC Session Controller builds up and tears down real-time multimedia calls between client applications on WebRTC-enabled web browsers, and your SIP multimedia services. WebRTC Session Controller does this by translating telecom messages between the JSON data structure used by the client applications and the SIP protocol used by your IMS core.

See "[WebRTC Session Controller Software and Protocol Conformance](#)" for details on the protocol levels this release uses.

[Figure 1-1](#) illustrates the WebRTC Session Controller architecture, lists the developer extension points you use to customize the JSON to SIP communication, and shows how JSON messages are translated to SIP and SIP messages to JSON.

Client applications send JSON messages to Signaling Engine, which uses Groovy scripts to process them and translate them to SIP messages and send them on to your SIP servers and IMS core. During Groovy processing you can use interact with a Policy Control and Rules Function (PCRF) to include policy (QoS) information, and Media Engine to manage the call's media session.

Figure 1–1 WebRTC Session Controller Components and Developer Extension Points

This guide explains how to customize Signaling Engine Groovy scripts to:

- Change the JSON data used in messages. For example, to modify your JSON data if the JSON specifications change.
- Change the SIP data used in messages. You can then add any additional SIP header data that your SIP implementation requires.
- Use Media Engine to affect the media parameters (SDP data) of media sessions. For example, you can use Media Engine to negotiate a codec supported by both call parties.
- Send and receive policy information from your PCRF. You can exchange information with a PCRF and affect the call (or the subscriber's account) either before or after the call's media session.
- Streamline communication between client applications and WebRTC Session Controller to provide a more lightweight and efficient protocol. You can tune the network traffic by filtering or aggregating messages to limit the call flow. For example, you could remove some or all of the SIP 1xx informational messages from the call flow as they arrive at WebRTC Session Controller. Or you could aggregate related SIP messages and forward them to the client application as a single combined message once WebRTC Session Controller has received them all. This reduces the amount of traffic that the client application must process, enabling you to simplify the client applications logic.

The *WebRTC Session Controller Web Application Developer's Guide* explains the extension points not covered in this document, including:

- How to extend the default WebRTC Session Controller JavaScript API package
- How to create a WebRTC Session Controller JavaScript API package

During the JSON to SIP translation you have a lot of flexibility in what you can do with individual messages. You can manipulate messages:

- At the field level, by adding new fields, creating a new field layout, adding optional data, and creating a new data representation.

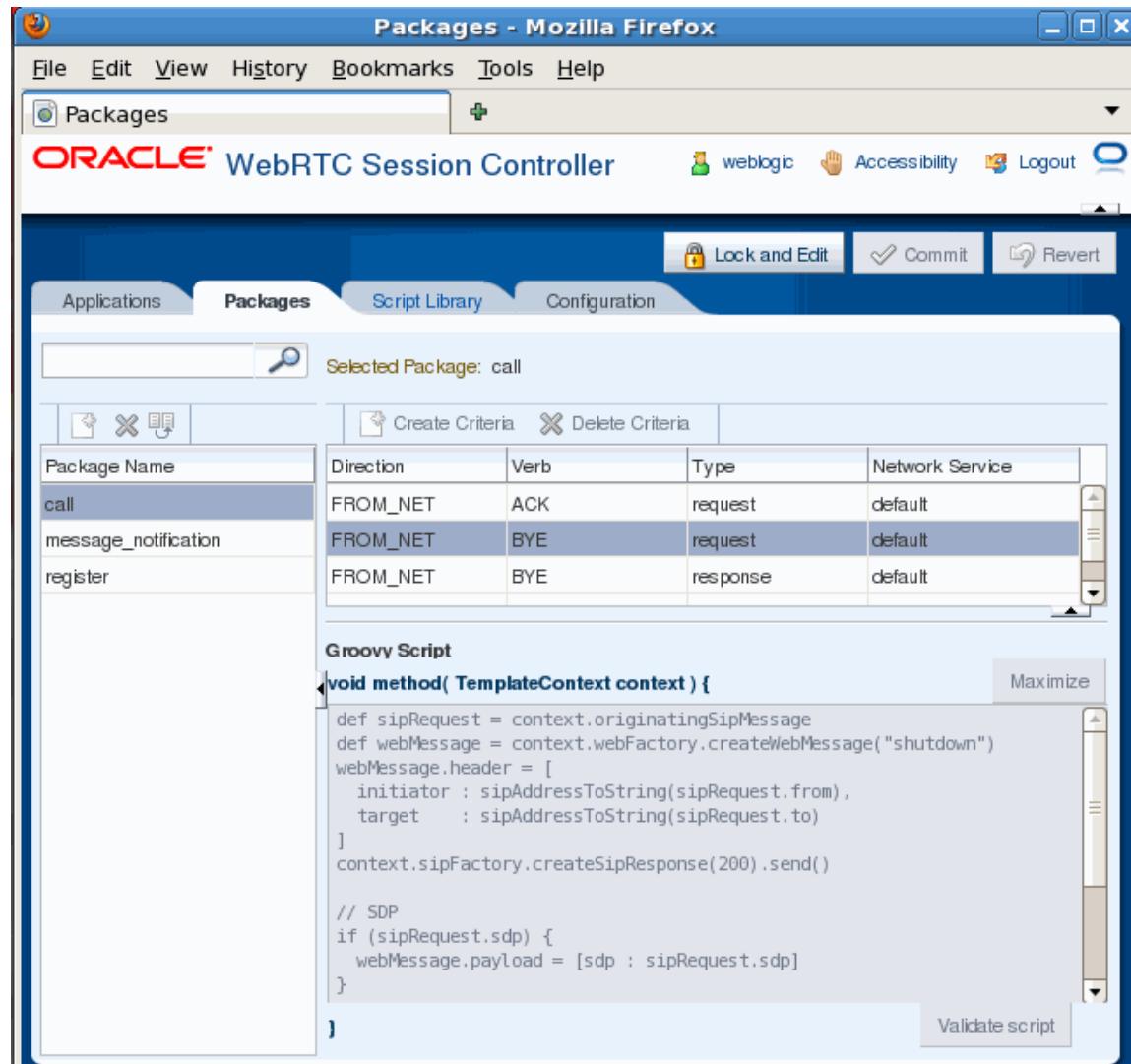
- At the header level, by separating a SIP message header from the message content, and pass on one or the other in a new message (for a different service). You can then pass one or both to a new service.

As shown in [Figure 1-1](#), calls can originate either from a WebRTC-enabled web browser (client application), or from the SIP IMS core itself. Browser-originating messages are first translated from JSON to a normalized format by Signaling Engine. Then the normalized message is translated to the SIP protocol by Signaling Engine Groovy scripts calling methods from the WebRTC Session Controller API.

Signaling Engine processes SIP server-originated messages in the opposite direction. They are first translated from SIP to a normalized format using your Groovy scripts. Then Signaling Engine translates them again from the normalized format to the JSON format that your web browser can parse.

[Figure 1-2](#) shows the WebRTC Session Controller console graphical interface that you use to create, select, and modify the Groovy scripts that translate and customize messages. In [Figure 1-2](#) the Packages tab is selected, showing one of the default Groovy scripts provided with this release.

Figure 1-2 The WebRTC Session Controller Console Window



See "[Customizing Messages for New SIP or JSON Data](#)" for details on how to use the WebRTC Session Controller console.

About the WebRTC Session Controller Console Components

WebRTC Session Controller uses these concepts and components:

- WebRTC Session Controller applications - Each application represents a single WebRTC-enabled client application and all of its capabilities. For example, an application could be a website that offers a video and audio chat capabilities. Each application uses a set of WebRTC Session Controller packages.

See "[About Applications](#)" for more details and "[Creating Applications](#)" for instructions on how to create them.

- WebRTC Session Controller packages - Each WebRTC Session Controller package is a unit of real time communication capability that WebRTC Session Controller supports. Each package is a collection of the individual Groovy scripts (criteria) that actually do the message processing and translation from SIP to JSON and back. Each JavaScript client application must reference the packages that it is allowed to use.

Each package typically includes the logical set of message processing behaviors for an application. For example you might put all message translation scripts for video chat calls between a web browser and a SIP phone in one package. You would probably define a separate package for audio chat calls, and another for a sending SMSs, and another for file transfers.

See "[About Packages](#)" for more details and "[Creating Packages](#)" for details on how to create one.

- WebRTC Session Controller criteria - Each criteria includes information to identify a SIP or JSON message to translate, and a Groovy script to do the translation. The translation can be from SIP to JSON or JSON to SIP. For example one criteria accepts the BYE message from a SIP phone to stop a media stream, and translates it to a JSON shutdown message.

You use one criteria for each type of message that you expect to receive during the process of setting up or tearing down the WebRTC multimedia calls that WebRTC Session Controller processes. The Groovy scripts that you create and use are where you add code to process any new or custom SIP or JSON data that your implementation requires.

See "[About Criteria](#)" for more details on WebRTC Session Controller criteria, and "[Creating Criteria](#)" for details on creating criteria.

- Script Library - The script library is a collection of useful groovy code and examples that you can use or reuse in any of the criteria Groovy scripts that you create.

See "[About the Groovy Scripts](#)" for details on using the script library.

- WebRTC Session Controller console - A Graphical User Interface (GUI) that you use to create WebRTC Session Controller applications, packages, and criteria. This GUI also contains the Script Library, and a Configuration tab that use to configure Signaling Engine and Media Engine.

See "[About the WebRTC Session Controller Console](#)" for information about this GUI. See the *WebRTC Session Controller System Administrator's Guide* for information on the configuration settings.

- Web RTC Session Controller console configuration settings - Used to set performance limits for each Signaling Controller implementation. You use these settings to balance WebRTC Session Controller capabilities with your network load and hardware capabilities. For example you use this tab to enable/disable glare handling (avoiding race conditions caused by concurrent requests), and set a maximum number of WebSocket connections.

About the WebRTC Session Controller Groovy Scripts

The WebRTC Signaling Controller Groovy scripts translate WebRTC messages between JSON messages to SIP, and also serve as extension points that you use to customize behavior during the translation. During the translation process you can:

- Make your WebRTC-based client web applications communicate with your SIP servers and IMS core.
- Make the client-to-SIP communication more efficient by removing unimportant messages. For example, your IMS core probably includes media servers, which send status messages that may be unimportant to a client application. You can add instructions to the Groovy scripts to remove any unnecessary messages from traffic, to save bandwidth.
- Redirect the messages to different SIP services. For example, during a shopping session, offer a video chat with a customer representative. As the chat session is being set up, you can automatically provision the chat session with subscriber information.
- Intercept, modify, or replace individual messages as they are being processed, within the same session. For example, you could modify or replace functionality based on the values included in the message parameters. If your message includes subscriber information, you could apply a special deal to all residents of a specific city; or shut off service to all residents of a city; or redirect suspicious messages to a quarantine area. You can make these decisions based on any information contained in the messages from your SIP servers or client application. You are only limited by the information in your JSON and SIP messages and the capabilities of the Groovy scripting language.
- Use policy control and charging rules function (PCRF) information to affect the call or the subscriber's account. You can use policy information to affect the call either before the media stream is set up or afterward.
- Use Media Engine data to change the call's Session Description Protocol (SDP) parameters. for example, to negotiate a codec that two web browsers support.
- Add other features or behaviors that your implementation requires.

About Creating Client Applications Using the JavaScript API

You use the WebRTC Session Controller JavaScript API library to create multimedia applications that run on WebRTC-enabled browsers. These client applications use this API to communicate with the Signaling Engine, and Signaling Engine, in turn, translates the JSON data format to one the SIP nodes can use.

See *WebRTC Session Controller Web Application Developer's Guide* for details on how to use this API to create client applications.

About Translating Calls Using the Configuration API

You use the WebRTC Session Controller Configuration API, documented in the *WebRTC Session Controller Configuration API Reference* and *WebRTC Session Controller JavaScript API Reference* documents to translate call messages between the JSON data format that the client application uses, and the SIP language that your IMS core understands. It contains separate packages for:

- Creating, sending, and receiving SIP messages
- Creating, sending, and receiving JSON messages
- Sending and receiving policy (Diameter Rx) messages
- Creating and using Java **Future** interface objects to delay processing until computations by Media Engine or a PCRF are complete. For example you can delay establishing a media session until your PCRF confirms that the subscriber is entitled to the resources.
- Using Media Engine to translate between WebRTC-enabled browsers and entities that do not support the same codecs. These entities can be SIP nodes, or web browsers that do not support the codec sent in the call request.
- Administering Signaling Engine. WebRTC Session Controller API contains a configuration MBean. See *WebRTC Session Controller System Administrator's Guide* for details on using this MBean.

About Extending WebRTC Session Controller Using the JsonRTC Protocol

WebRTC Session Controller includes the JsonRTC WebSocket subprotocol that it uses to communicate with client applications and extend the default JavaScript capabilities. JsonRTC uses the JSON data interchange format and the MBWS subprotocol as the basis for message reliability.

If you use the WebRTC Session Controller console to create applications and packages, then you do not need to understand this protocol. However, if your implementation requires that you extend WebRTC Session Controller with new software packages, you use this protocol to do so.

You can use this protocol to change the extend the JSON and SIP data structures and add new fields and headers as necessary using the optional fields in the JsonRTC protocol. However, you must use a Groovy script to validate and use the data as necessary. WebRTC Session Controller accepts new data freely, but ignores if you do not process it in your Groovy scripts.

See "[Extending WebRTC Session Controller Functionality](#)" for guidelines for creating a custom package, and "[JsonRTC Protocol Reference](#)" for details on the WebRTC Session Controller JsonRTC Protocol.

WebRTC Session Controller Software and Protocol Conformance

WebRTC Session Controller uses the following revision levels of the software tools and protocols:

- The JSON data format for communicating with web browsers and other HTTP nodes.

- Session Description Protocol (SDP) RFC 4566 for communicating information about message media streams. The specification is available at the SDP specification website: <http://tools.ietf.org/html/rfc4566>
- The default JDK version - 1.7.
- The Groovy scripting engine version 2.1.3.
- The SIP protocol RFC 3261 for building up, tearing down calls.
- A Groovy scripting language. See this Groovy website for information and documentation:
<http://groovy.codehaus.org/JSR+223+Scripting+with+Groovy>

Prerequisites for Extending WebRTC Session Controller Functionality

Before using the instructions in this guide to configure and customize your WebRTC to SIP communication, you need to know:

- How to program in the Groovy scripting language. This Groovy website can get you started: <http://groovy.codehaus.org>. There are also third party tutorials and books available.
- Details of your WebRTC client application message requirements.
- Details of your SIP message requirements.
- Details of any policy information that you provide to a PCRF to affect subscriber profiles or accounts, and any policy information that you intend to use to affect calls.
- Details of the security groups that your WebLogic server uses. For details on using security roles, see the discussion on users, groups, and security roles in *Oracle Fusion Middleware Securing Resources and Policies for Oracle Weblogic Server*.
- Details on the other security considerations that your network requires. See *WebRTC Session Controller Security Guide* for information about setting up a secure WebRTC Session Controller implementation.

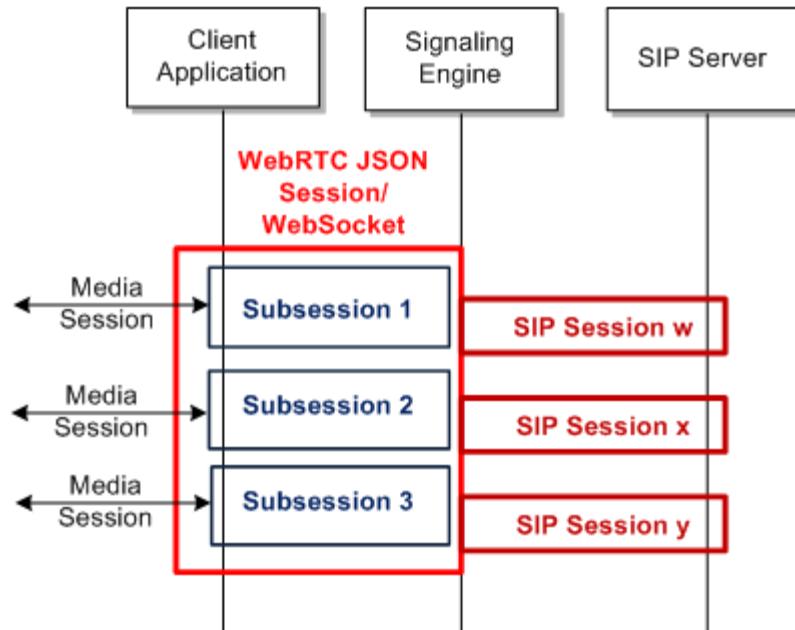
About Building JSON to SIP Communication

This chapter explains how you use WebRTC Session Controller Signaling Engine (Signaling Engine) to build up and tear down calls, and translate them between the JSON data format and the SIP protocol.

About Building JSON to SIP Communication

Figure 2-1 shows the sessions and subsessions used in making a simple JSON to SIP call flow. Client applications first set up JSON sessions that include WebSocket connections to start communicating with Signaling Engine. Signaling Engine then starts subsessions to communicate with the client application, and SIP sessions to communicate with your IMS core. The sections that follow explain information you need to know to set up this communication.

Figure 2-1 Signaling Engine Call Flow Overview



Securing Signaling Engine Connections

See the *Oracle Communications WebRTC Session Controller Security Guide* for information on securing:

- Signaling Engine-SIP connections.

- Client application to Signaling Engine connections.
- Internal Signaling Engine internal components and processes.
- WebRTC to SIP connections.

About Connecting to a Client Application

Signaling Engine uses the JsonRTC protocol to communicate between client applications and the WebRTC Session Controller console. Signaling Engine establishes communication using an HTTP/HTTPS handshake message using a value of `webrtc.oracle.com` for `Sec-WebSocket-Protocol`.

See "[JsonRTC Protocol Reference](#)" and *WebRTC Session Controller Web Application Developer's Guide* for details on this protocol and how to use it to develop client applications.

About Sessions and Subsessions

[Figure 2–1](#) shows an overview of how Signaling Engine handles JSON sessions, WebSockets, and subsessions, and how they relate to SIP sessions. First, Signaling Engine opens a protocol session using the WebRTC Session Controller Configuration API, and within that session Signaling Engine then opens a WebSocket connection. Inside the WebSocket connection, Signaling Engine uses the JsonRTC protocol to open a subsession to pass messages between the browser and the Signaling Engine. Finally Signaling Engine opens a SIP session to communicate with your IMS core.

There is usually a 1:1 relationship between WebRTC sessions and WebSocket connections. However if a network problem interrupts the WebRTC session, the WebSocket connection can be reestablished with session information (rehydrated) if the problem is fixed before the connection timeout limit is reached. If the time limit is reached, the WebRTC session exits. See *WebRTC Session Controller System Administrator's Guide* for details.

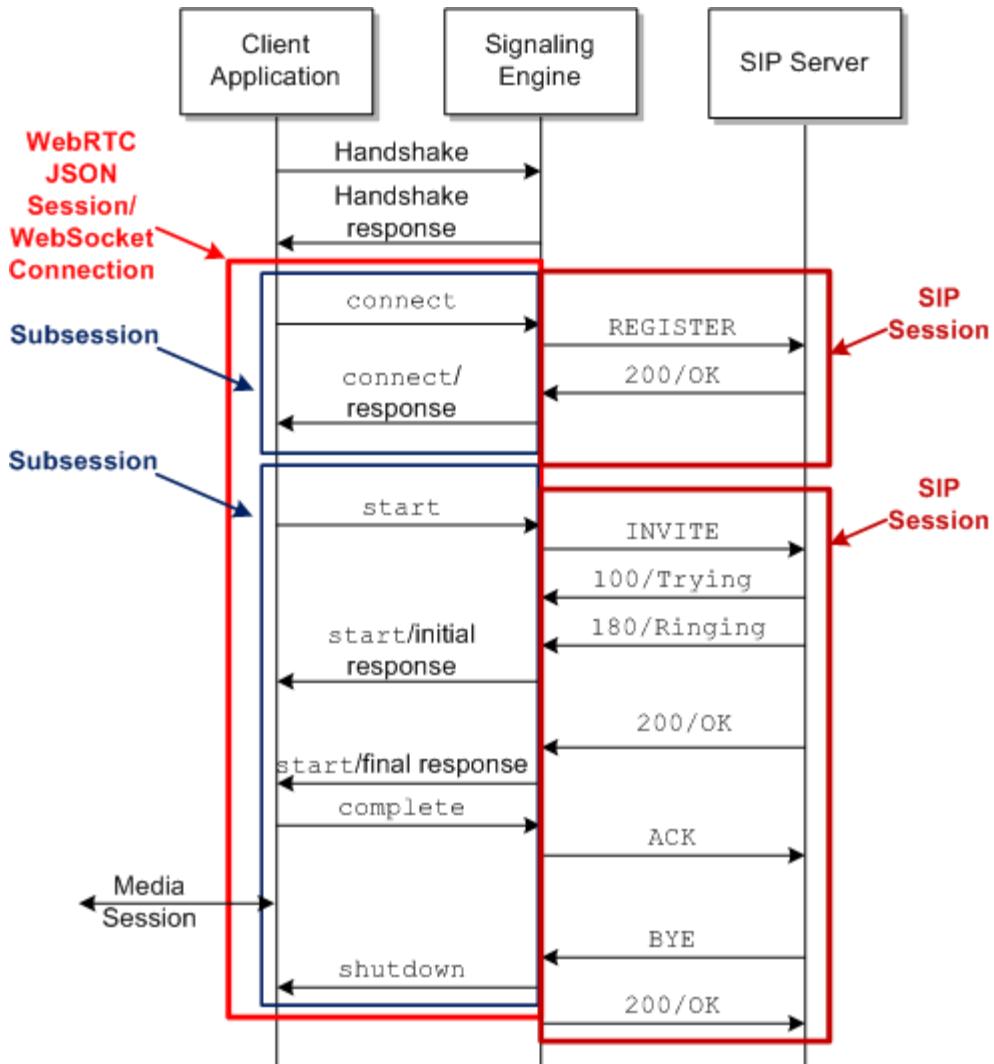
Each subsession is associated with a WebRTC Session Controller package, which defines the allowable actions for the WebSocket and its subsessions. Each subsession is responsible for maintaining the media session between the client application and the peer (media server, SIP phone, web client, and so on). When call is torn down, the media stream and the subsession are closed.

Usually each Signaling Engine subsession has one corresponding SIP session. However, a SIP session may not always required. If for example, a SubSession that just sends a SIP MESSAGE outside of a dialog would not create a media session or require a SIP session.

There is usually only one JSON session per WebSocket. However, each JSON session can have multiple WebSocket connections which run in parallel. If a WebSocket is disconnected unexpectedly, Signaling Engine can start a new one to continue using the existing subsessions. This enables you to continue sessions if a WebSocket connection is unexpectedly terminated by a network failure, HTML refresh, or other service interruption.

About JSON to SIP Communication

[Figure 2–2](#) shows the JSON and SIP message flow for a call originating from the client application and how the messages relate to JSON sessions, WebSocket connections, subsessions, and SIP sessions.

Figure 2-2 Default WebRTC Session Controller FROM_APP Call Flow Detail

The client application initiates communication with Signaling Engine by sending a **wsc.session** object (not shown), which includes the handshake and **connect** message.

The call shown in [Figure 2-2](#) originates from a client application (WebRTC-enabled browser) using the RFC WebSocket protocol. In this case Signaling Engine translates the JSON data into SIP protocol messages for the SIP server to respond to. The call recipient (not shown) may be a SIP device served by the SIP server itself, or another WebRTC browser using another Signaling Engine implementation.

As [Figure 2-2](#) shows, Signaling Engine translates the JSON messages to SIP and passes them to the SIP server, and translates the SIP messages to JSON and passes them back to the client. Signaling Engine groups the Groovy-based translation code segments into *applications*, *packages*, and *criteria*. Each application represents all JSON to SIP communication for a collection of related Signaling Engine features. Each of the features is composed of a package, which is a collection of individual criteria that each perform a single translation action. These criteria contain the individual Groovy scripts that perform each action.

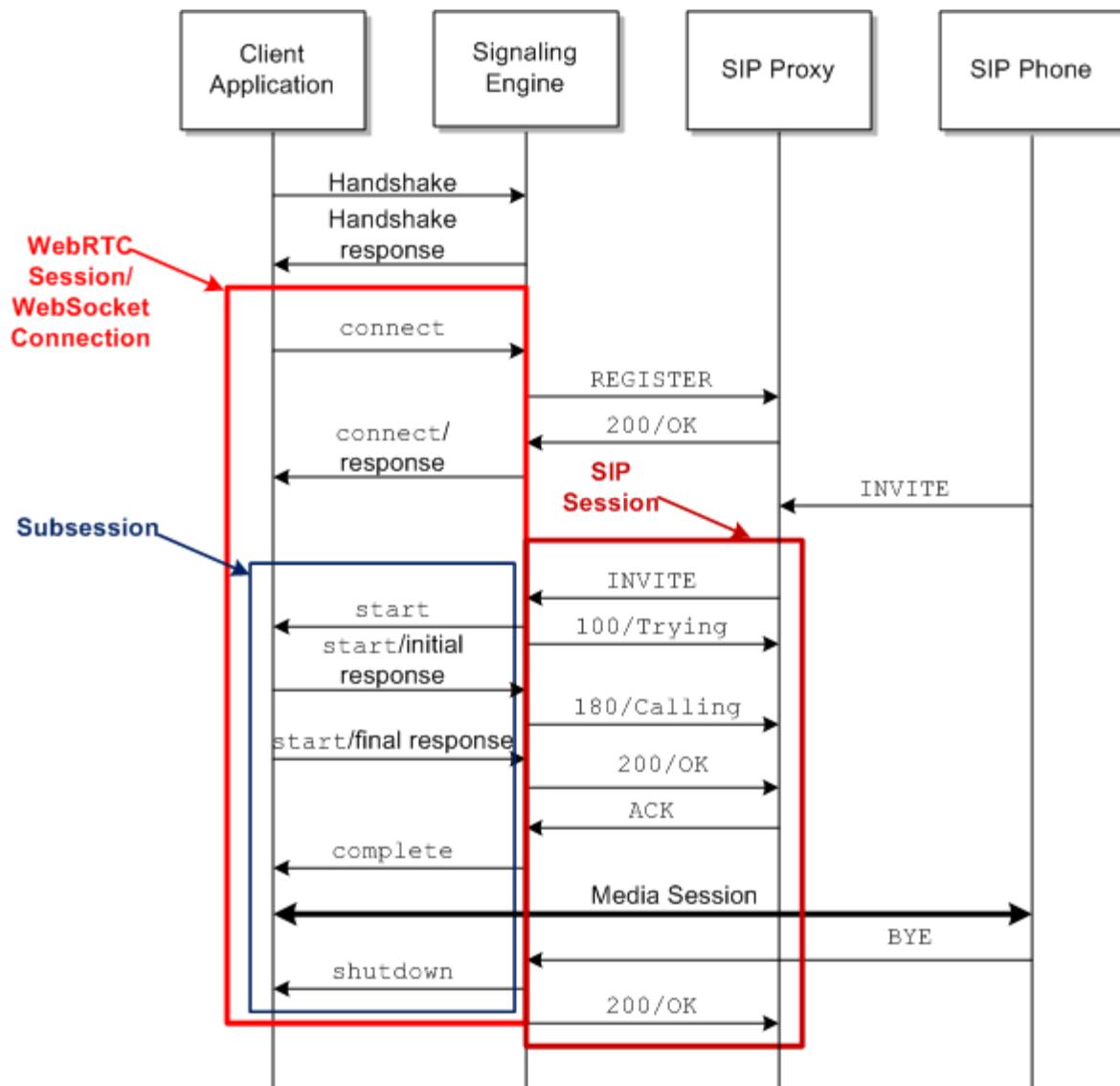
See "[About SIP to Client Communication](#)" for a description of how Signaling Engine processes messages that originate in your IMS core.

About SIP to Client Communication

This section explains how Signaling Engine processes messages what originate from your IMS core. For example, if a subscriber using a SIP phone attempts to communicate with a Signaling Engine client application. The call could originate from any SIP device or another Signaling Engine implementation. From the Signaling Engine perspective, these calls originate from a SIP server.

Figure 2-3 shows a sample call flow initiated by a SIP phone and how Signaling Engine translates the SIP messages from the phone's SIP server to the JSON data format that the client application can use for communication.

Figure 2-3 Default Signaling Engine FROM_.NET Call Flow Detail



About Storing Data Within Sessions

As you are building up and tearing down calls, you will probably need to store data within Signaling Engine for different messages to use, such as customer subscriber data. Signaling Engine provides an attribute store to hold data that you use within sessions. You use the `getSessionStore()` class in the

oracle.wsc.feature.webrtc.template package (**TemplateContext** interface) to retrieve data from the attribute store. The attribute store is created when a WebSocket session or SIP session is created within Signaling Engine, and is persistent until that session is torn down.

Understanding the WebRTC Session Controller Components

Using the WebRTC Session Controller console, you equate one WebRTC-enabled client application to a WebRTC Session Controller application. Each Signaling Engine application in turn, is a collection of WebRTC Session Controller packages that each roughly equate to a single real time WebRTC feature. Each package contains any number of Groovy scripts, called criteria, that each perform a single translation function on a single type of call message. The sections below provide more detail on applications, packages, and criteria.

About Applications

A WebRTC Session Controller application represents a single client application or service that sends messages between a browser and a SIP server through WebRTC Session Controller. Each application must have at least two packages, one for translating from the SIP server to the application and one for translating from the application to the SIP server. Each application has:

- An informal name.
- An active/inactive setting.
- An informal description.
- References to the WebRTC Session Controller packages that contain the Groovy scripts that performs message processing and translation.
- A Request URI that the application uses to communicate with a SIP server or proxy.
- The WebLogic security group. The security groups is required, and the Weblogic Server contains some default security groups that you can use. For details on using security groups, see the discussion on users, groups, and security roles in *Oracle Fusion Middleware Securing Resources and Policies for Oracle Weblogic Server*.
- A list of Allowed Domains that serve as a white list of domains the application is allowed to contact.
- Resource limits that allow you to protect system performance by limiting an application's impact on Signaling Engine. These resource limits can also serve as application white- and black-lists for individual applications.

See "[About Packages](#)" for details on the packages that comprise an application.

About Packages

Each WebRTC Session Controller package contains a group of criteria that contain the Groovy scripts to translate a logical group of messages from JSON to SIP or SIP to JSON. For example, Signaling Engine provides an example **call** package that includes all of the JSON (FROM_APP) and SIP (FROM_NET) criteria to build up and tear down a JSON to SIP call, including:

- JSON start messages (request, response, and error)
- JSON complete message

- JSON prack message
- JSON shutdown message
- SIP INVITE messages (request and response)
- SIP CANCEL message
- SIP ACK messages (request and response)
- SIP UPDATE messages (request and response)
- SIP PRACK message
- SIP BYE messages (request and response)

A package generally contains criteria for a single client application. Each package can be used by any number of Signaling Engine applications.

See the WebRTC Session Controller console to inspect the default packages provided, and "[About Criteria](#)" for details about the criteria that comprise a package.

About Criteria

Each WebRTC Session Controller criteria matches one kind of JSON or SIP message and runs the code in a Groovy script against it. For example, one criteria translates an INVITE request message from SIP to JSON, and another translates the response back from JSON to your SIP format.

Each criteria uses this information to identify the messages it translates:

- A **FROM_APP** or **FROM_NET** direction that specifies whether the message originated in a WebRTC-enabled browser, or your SIP IMS core.
- A verb matching the type of JSON or SIP request or response. For example, an UPDATE verb matches SIP UPDATE requests and response messages, and a **complete** verb matches a JSON **complete** request or response message.
- A type of message for the criteria to match. For example **request** or **response**. See "[JsonRTC Protocol Reference](#)" for the list of supported type values.
- A Network Service name. Each default criteria uses a Script Library call to return the network service of the call. A **default** network service name is the default.

See "[About the Groovy Scripts](#)" for details on the Groovy scripts.

By default, WebRTC Session Controller contains useful criteria that you can use to build and tear down calls, and use as stubs to add functionality that your implementation requires. You can use these default criteria as provided but you will probably modify them to fit your implementation's needs.

This is the default FROM_NET/INVITE/request/default criteria Groovy script:

```
def sipRequest = context.originatingSipMessage
def webMessage = context.webFactory.createWebRequest("start")
webMessage.header = [
    initiator : sipAddressToString(sipRequest.from),
    target     : sipAddressToString(sipRequest.to)
]
// SDP
if (sipRequest.sdp) {
    webMessage.payload = [sdp : sipRequest.sdp]
}
def sdpString = sipRequest.sdp
```

```
if(context.mediaFactory.isAvailable() && sdpString!=null) {  
    def sdpOffer = context.mediaFactory.createSdpOffer("1", sdpString,  
    Constants.ME_CONFIG_NAME, null, sipAddressToString(sipRequest.to),  
    sipAddressToString(sipRequest.from));  
    def ascFuture = sdpOffer.send()  
    context.getTaskBuilder("processMediaResponseToSendWebMsg").withArg("ascFuture",  
    ascFuture).withArg("webMessage", webMessage).onSuccess(ascFuture).build();  
}  
else{  
    webMessage.send()  
}
```

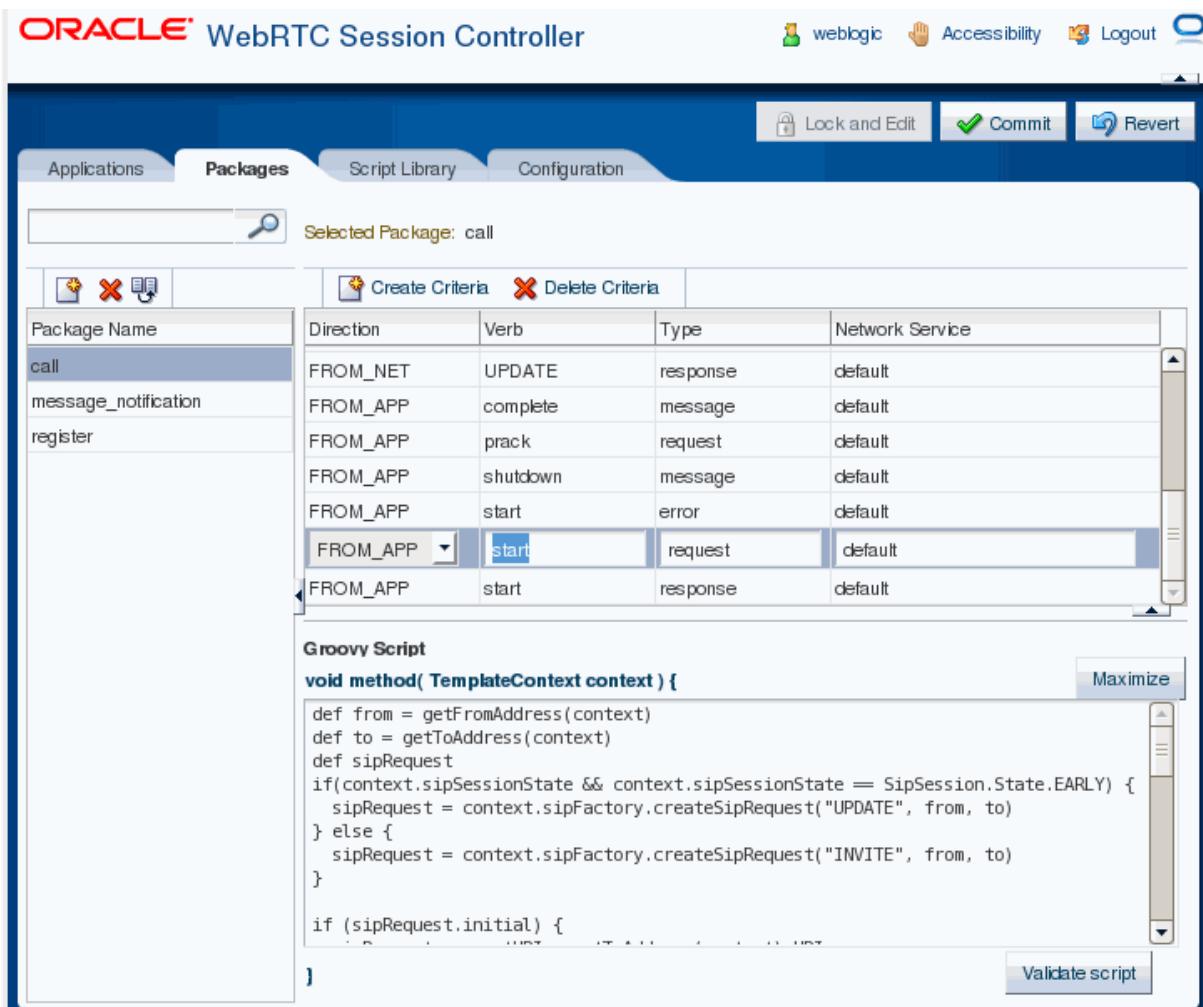
About the WebRTC Session Controller Console

You use the WebRTC Session Controller console to create, organize, use, and extend the applications, packages, and criteria for your implementation.

At the highest level, you use the **Applications** tab to create and manage applications, that roughly equate to a single web client application. See "["Creating Applications"](#)" for details on creating applications.

[Figure 2-4](#) shows the WebRTC Session Controller console with the **Packages** tab exposed. Each package is listed with its direction, verb, type, and network service. The Groovy script used in each criteria is shown on the bottom right of the pane. You enter or change the Groovy script for each package in this pane. You can also reference any existing Groovy code stored in the **Scripting Library** tab. See "["Creating Packages"](#)" for details on creating packages for your applications.

Figure 2–4 WebRTC Session Controller Console Packages Tab



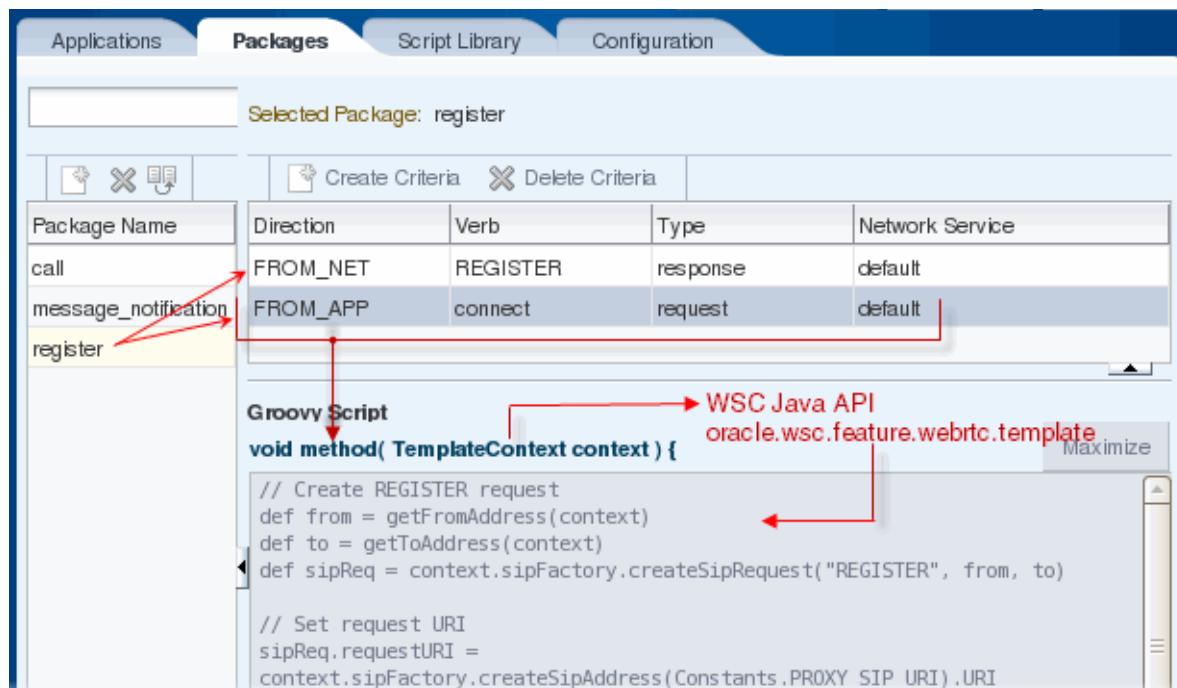
The **Script Library** tab is a repository of validated Groovy scripting code that you can reference in any of your packages.

About the Groovy Scripts

Groovy is a scripting language based on, and very similar to the Java programming language. Each Signaling Engine package contains its own individual Groovy scripts that translate messages matching its criteria specifications. The translation is either from WebRTC Session Controller's normalized format to SIP, or SIP to the normalized format depending on the direction you set. Packages require that you set up one criteria for translating in one direction, and a corresponding criteria for translating messages in the other direction. Signaling Engine then translates the normalized format to a format that your browser/application uses and back again.

Most packages use synchronous communication, so most criteria are created in pairs; one that translates messages from the client application (JSON) to SIP, and the other to translate from SIP to JSON. However the traffic can be asynchronous, as with SMS messages for example.

Figure 2–5 shows how criteria use Signaling Engine components to translate messages. The **register** package shown contains two criteria, one for **FROM_NET** messages and the other for **FROM_APP** messages.

Figure 2-5 Signaling Engine Criteria Components

Every criteria uses this Java signature:

```
void method (TemplateContext context) { Groovy script }
```

At run time, Signaling Engine converts the criteria identifying information (**FROM_APP** or **FROM_NET**, the verb, message type, and network service) to a method name. However, you only encounter this method name while debugging criteria operations.

The signature calls the **TemplateContext** interface of the **oracle.wsc.feature.webrtc.template** package in the WebRTC Session Controller JsonRTC protocol to act on the Groovy script. This interface includes all of the other JsonRTC protocol interfaces that specify the specific Java methods that you can use to get information from or set information to a message.

See *WebRTC Session Controller Configuration API* for details on this API.

Finally every criteria contains a Groovy script that acts on the information obtained from the context. It is in these scripts that you add any new functionality or redirection instructions that change the behavior or destination of the message. In addition to simple translation, you can add any other processing that your implementation requires to each message. For example, you could:

- Map JSON information to SIP fields so that your SIP server accepts it.
- Map SIP header information to a form that your web application can use.
- Route the message to a specific URL based on its JSON information.
- Route the message to a specific URL based on its SIP information.
- Incorporate features such as redirecting a message to a different URL for example, to prevent bill shock.

See *WebRTC Session Controller Configuration API* for details on the packages and methods of the API.

About the Script Library

The Groovy scripts you create for a package will probably use some functionality provided in the *script library*. The script library contains a set of useful methods that you can add to as required by your implementation. To use one of these methods, select the **Script Library** tab, click **Lock and Edit**, make your changes, then click **Commit**. Example methods in the **Script Library** include code to:

- Return a user address based on the characteristics of a SIP string.
- Set the SIP routing URI.
- Set the SIP message contact parameter.
- Copy SDP data to a SIP header.

The Groovy code that you create in a package's criteria is appended to the code in the script library at run time. So you can reuse any of the library code in the scripts that you create for each individual package. You can also add more code to the library as needed, and use it in other individual packages.

After changing the code in either a package or the library, you need to validate it to ensure that it compiles correctly. You use the **Validate Script** button on the **Package** tab to validate an individual script, and the **Validate Library** button on the **Script Library** tab to validate the library.

About the Normalized Data Format

As pictured in [Figure 1–1](#) Signaling Engine converts messages into a normalized data format in the process of translating them between SIP and JSON. All messages are converted to the normalized format, regardless of whether they originated in a WebRTC client application, or from your IMS core.

The syntax for the normalized format is straightforward:

```
Map<String, Object>
```

For example, this JSON data format message:

```
{
  "age":25,
  "name": {
    "first":"joe",
    "last":"smith"
  },
  "messages": ["msg 1", "msg 2", "msg 3"]
}
```

Is translated to this normalized message format, which is a hash map representation of the message:

```
{"age":25,
{"name":{"first":"joe", "last":"smith"}},
{"messages":["msg1", "msg2", "msg3"]}}
```

Notice that the **messages** array is a nested hash map of its own.

[Table 2–1](#) lists a variety of actions that you might perform while creating a Groovy translation script and the Groovy code that performs the action.

Table 2–1 Java and Groovy Actions on the Normalized Format

Translation Action	Groovy Code
Get the age	def age = map.age
Get the first name	def firstName = map.name.first
Get the list of messages	def messages = map.messages
Get message 2 from the list	def message2 = messages[1]
Modify the last name	map.name.last = "doe"
Add a middle name	map.name.middle = "bob"

Creating WebRTC Session Controller Applications, Packages, and Criteria

This chapter explains how to create the applications, packages, and criteria that WebRTC Session Controller Signaling Engine (Signaling Engine) uses to establish and modify communication between your client applications and IMS core.

Starting the WebRTC Session Controller Console

You use the WebRTC Session Controller console GUI to create and manage the applications, packages, and criteria that Signaling Controller uses to translate and modify messages between client applications and your IMS core.

This procedure requires a running WebLogic server, and that you know the WebLogic username and password that you created for the domain. See the discussion on getting started in *WebRTC Session Controller System Administrator's Guide* for instructions on creating and starting a WebLogic domain.

To start the WebRTC Session Controller console:

1. Start the WebRTC Session Controller domain server.
2. Open a web browser.
3. Access this URL:

`http://localhost:port/wsc-console`

or this command if HTTP security is configured:

`https://localhost:port/wsc-console`

Where:

localhost is the IP address of the system running the WebLogic domain or the value **localhost**.

port is the port of the domain. The default port is **7001**.

This command starts the WebRTC Session Controller console on a local system using the default port:

`http://localhost:7001/wsc-console`

4. The WebLogic user login screen appears. Enter the username and password you set when creating the WebLogic domain.

The WebRTC Session Controller console window appears.

- The item marked **weblogic** in this screen capture is the username of the user or group logged into the WebRTC Session Controller console. In this case it shows the default user, **Weblogic**.
- The **Accessibility** item brings up the WebRTC Session Controller console accessibility tools. For details see the discussion on starting the WebRTC Session Controller console in the *WebRTC Session Controller Installation Guide*.
- The **Logout** item logs the current user out of the WebRTC Session Controller console.

Creating Criteria

Each Signaling Engine criteria contains a single Groovy script that performs all translation and processing tasks for a single type of JSON or SIP message. You must create separate criteria for all possible JSON or SIP message that your Signaling Engine implementation processes. In synchronous request/response communication, you must create a separate criteria for each request and response message.

Before creating a new criteria, look through the Groovy code in the default packages, and in the **Script Library** to see whether there is already some code that accomplishes what your message requires.

Criteria are applied to messages based on this information included in each criteria:

- **Direction** - Either **FROM_APP** for messages originated in a WebRTC-enabled browser, or **FROM_NET** for messages originating from your IMS core (SIP server or proxy).
- **Verb** - Identifies the message action verb (SIP method or JSON action) that the criteria matches. For example **PUT**, **GET**, **INVITE**, **complete**, **shutdown**, and so on.
- **Type** - The type of message; can be one of:
 - **request**
 - **response**
 - **message**
 - **error**
 - **acknowledgment**
- **Network Service** - Identifies the application that the message is being used for.

To create a Signaling Engine criteria:

1. Start the WebRTC Session Controller console.

See "[Starting the WebRTC Session Controller Console](#)" for details on starting the Signaling Engine console.

2. Select the **Packages** tab.
3. Select the package to add criteria for from the **Package Name** table.
4. Click **Lock and Edit** at the top of the window.
5. Click **Create Criteria**.

A blank criteria appears at the top of the criteria table and a Groovy script pane appears below the criteria table.

6. In the **Direction** field, select either **FROM_APP** or **FROM_NET**. If the criteria affects calls originating in a WebRTC-enabled browser, select **FROM_APP**. If the criteria is for calls originating in the IMS core, select **FROM_NET**.
7. In the **Verb** field, Enter a SIP method name or HTTP request that identifies the message to affect.
8. In the **Type** field, enter (**request** or **response**) as appropriate.
9. In the **Network Service** field enter the network service for messages that you want to affect.
10. In the **Groovy Script** window enter a Groovy script as appropriate for this criteria. The Groovy script defines all actions for this criteria. See "[About the Groovy Scripts](#)" for more information.
11. Click **Validate Script** to ensure that your Groovy script meets the Signaling Engine validation requirements. See "[About the WebRTC Session Controller Console Validation Tests](#)" for a list of the validation tests and error messages.
12. Click **Commit** to save your new criteria. See "[About the Groovy Scripts](#)" for details.
13. Click **Commit** to make your changes take effect.

Creating Packages

A package is a collection of all the criteria (Groovy scripts) necessary to translate the telecom messages in a session from JSON to SIP and back. So creating a new package really just creates a shell that you fill with criteria. This procedure assumes that you have already created the criteria required.

To create a package:

1. Start the Signaling Engine console. See "[Starting the WebRTC Session Controller Console](#)" for details on starting the Signaling Engine console.
2. Click **Lock and Edit**.
3. Click the **Create Package** icon (blank page with "+" sign). The **Create Package** dialog box appears.
4. Enter a logical name for the new package and click **OK**. Your new package now appears in the package table which is arranged alphabetically.
5. Click **Commit** to make your changes take effect.

Creating Applications

Each application is a collection of packages that contain the criteria that translate (and probably change) WebRTC application to SIP network communication for a single program. This procedure assumes that you have already created the criteria and packages required.

Applications reference your WebLogic security groups. Create any security groups your implementation requires before following this procedure.

To create an Application:

1. Start the WebRTC Session Controller console.

See "[Starting the WebRTC Session Controller Console](#)" for details on starting the Signaling Engine console.

2. Select the **Applications** tab.
3. Click the **Lock and Edit** button.
4. Click **Create**.

The **Create Application** dialog box appears.

5. Enter a logical name for the application.
6. Click **OK**

The **Applications** table appears with the new application in the top row.

7. Select the **Active** check box if you want the application to take effect immediately.
8. **Description** - Enter an informative description of the application.
9. **Request-URI** - Enter the URI that messages are allowed to originate from. The WebRTC application's name. The default location is `/ws/webrtc/application_name`.
10. **Resource Limits** - Select the pencil icon to enter resource limits and the **Resource Limits** screen appears. Enter positive integers to set maximum session limits; enter **0** to prohibit any sessions, and **-1** to allow unlimited sessions.
 - **Max sessions** - Enter the grand total number of sessions that the original session can spawn.
 - **Max sessions per user** - Enter the total number of sessions that a subscriber is allowed to spawn.
 - **Max sub sessions per user** - Enter the total number of sessions that each user is allowed to spawn within a session.
 - **Max sub sessions per session** - Enter the total number of sub sessions spawned by a single session.
- Click **OK**.
11. **Allowed Domains** - Click the pencil icon to edit the list of cross-origin resource sharing (CORS) domains to share data with this application. **Allowed Domains** window appears. Enter all domains to allow cross-origin resources sharing (CORS) with this application. Click **OK** when finished.
12. **Packages** - Click the pencil icon to edit the list of packages that apply to this application. The **Packages** window appears. Move all packages that apply to this application to the **Selected Packages** list. Move all others to the **Existing Packages** list. Click **OK** when finished.
13. Any warning icons disappear and the new application is shown in the applications table.
14. Click **Commit** to make your changes take effect.

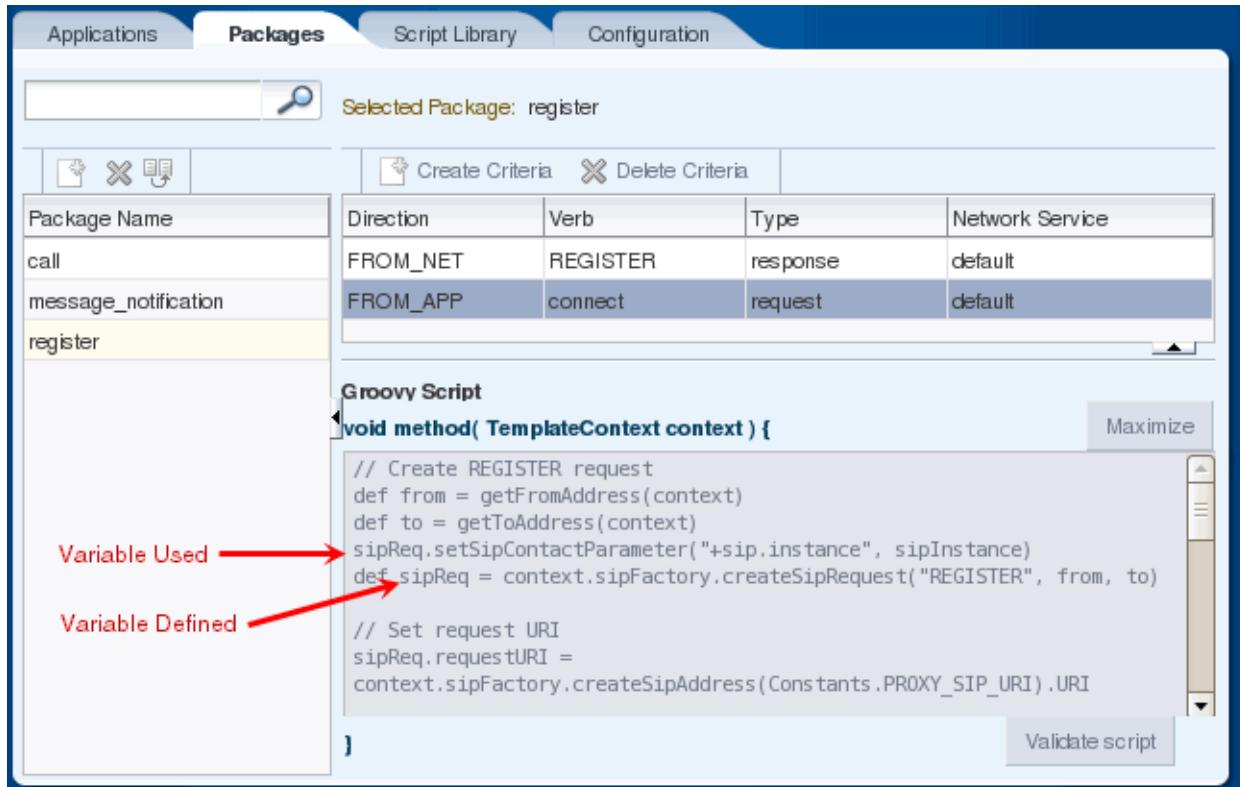
Debugging Groovy Script Run Time Errors

You can diagnose Groovy script problems using the stack trace in the `domain_home/wsc.log` file, which contains Signaling Engine stack trace messages. You identify the individual Groovy script by searching for the individual criteria method name that

contains the criteria information. See "[About the Groovy Scripts](#)" for details on the signature that each script uses, and the method it invokes.

[Figure 3-1](#) shows an illustration of a formatting problem in the **register** package, in the **FROM_APP/connect/request/default** criteria shown highlighted. The red arrows show the problem, the **sipReq** variable is used *before* it is declared.

Figure 3-1 Groovy Script With a Formatting Error



This is a violation of Java syntax, and as you would expect, the operation failed and these debugging messages were written to the **wsc.log** file:

```

Caused by: groovy.lang.MissingPropertyException: No such property: sipReq for
class: Script2
    at
org.codehaus.groovy.runtime.ScriptBytecodeAdapter.unwrap(ScriptBytecodeAdapter.jav
a:50)
    at
org.codehaus.groovy.runtime.callsite.PogoGetPropertySite.getProperty(PogoGetProperty
Site.java:49)
    at
org.codehaus.groovy.runtime.callsite.AbstractCallSite.callGroovyObjectGetProperty(
AbstractCallSite.java:231)
    at Script2.pkg_register_dir_FROM_APP_typ_request_verb_connect_netsvc_
default(Script2.groovy:705)
    at sun.reflect.NativeMethodAccessorImpl.invoke0(Native Method)
    at
sun.reflect.NativeMethodAccessorImpl.invoke(NativeMethodAccessorImpl.java:57)
    at
sun.reflect.DelegatingMethodAccessorImpl.invoke(DelegatingMethodAccessorImpl.java:
43)
    at java.lang.reflect.Method.invoke(Method.java:606)

```

```

at org.codehaus.groovy.reflection.CachedMethod.invoke(CachedMethod.java:90)
at groovy.lang.MetaMethod.doMethodInvoke(MetaMethod.java:233)
at groovy.lang.MetaClassImpl.invokeMethod(MetaClassImpl.java:1085)
at groovy.lang.MetaClassImpl.invokeMethod(MetaClassImpl.java:952)
at groovy.lang.MetaClassImpl.invokeMethod(MetaClassImpl.java:909)
at groovy.lang.Closure.call(Closure.java:411)
at
org.codehaus.groovy.jsr223.GroovyScriptEngineImpl.callGlobal(GroovyScriptEngineImpl.java:411)
at
org.codehaus.groovy.jsr223.GroovyScriptEngineImpl.callGlobal(GroovyScriptEngineImpl.java:405)
at
org.codehaus.groovy.jsr223.GroovyScriptEngineImpl.invokeImpl(GroovyScriptEngineImpl.java:394)
...

```

The package and criteria values of the offending Groovy script are identified in this line from `wsc.log`:

```
Script2.pkg_register_dir_FROM_APP_typ_request_verb_connect_netsvc_
default(Script2.groovy:705)
```

This message shows the method name that Signaling Engine creates from each criteria's package name and criteria values (highlighted).

In this example, the criteria with the syntax error is in the `register` package. Within that package the criteria with the problem has a `FROM_APP` direction; a `request` type; a `connect` verb; and a `default` network service. This matches the syntax error of the `FROM_APP/connect/request/default` criteria shown in [Figure 3-1](#).

About the WebRTC Session Controller Console Validation Tests

The WebRTC Session Controller console runs validation tests to confirm that your Groovy scripts, Groovy library, packages, and applications are all valid. It runs the validation tests each time you commit changes to an application, package, or criteria, or click the **Validate Script** or **Validate Library** buttons.

[Table 3-1](#) lists the validation error types and their error messages.

Table 3-1 WebRTC Session Controller Groovy Script Validity Tests

Error Type	Error Message
APPLICATION_NAME_NOT_UNIQUE	Application name <i>application_name</i> is not unique.
RESOURCE_LIMITS_PROFILE_NAME_IS_NOT_UNIQUE	Resource limits profile name <i>resource_limit_profile_name</i> is not unique.
INVALID_RESOURCE_NAME	Invalid resource name <i>resource_name</i> , do not enter invalid characters.
INVALID_APP_NAME	The <i>application_name</i> application contains invalid characters.
INVALID_REQUEST_URI	The <i>request_URI</i> request URI contains invalid characters.
INVALID_SECURITY_EXPRESSION	The <i>security_expression</i> security expression contains invalid characters.
INVALID_ALLOWED_DOMAINS_EXPRESSION	The <i>domains_expression</i> domains expression contains invalid characters.
INVALID_RESOURCE_LIMITS_NAME	Invalid resource name <i>resource_name</i> in <i>application_name</i> application.

Table 3-1 (Cont.) WebRTC Session Controller Groovy Script Validity Tests

Error Type	Error Message
PACKAGE_NAME_NOT_UNIQUE	Package name <i>package_name</i> is not unique..
SCRIPT_NAME_NOT_UNIQUE	Script name <i>script_name</i> is not unique for package <i>package_name</i> .
MODULE_NAME_NOT_UNIQUE	Module name <i>module_name</i> is not unique.
INVALID_PKG_NAME	The <i>package_name</i> package contains invalid characters.
INVALID_CRITERIA_VERB	The <i>verb_name</i> verb name contains invalid characters.
INVALID_CRITERIA_TYPE	The <i>type_name</i> type contains invalid characters.
INVALID_CRITERIA_NETWORK	The <i>network_name</i> network contains invalid characters.
PKG_REQUIRED	At least one package is required for the application <i>application_name</i> .
INVALID_PACKAGE_REFERENCE	Package name <i>package_name</i> is referenced from app <i>application_name</i> but it does not exist.
GROOVYALL_COMPILATION_ERRORS	Error occurred for the criteria <i>criteria</i> , in the package <i>package_name</i> and the error message is <i>reason</i> at line number <i>line_number</i> .
GROOVY_COMPILATION_ERRORS	Error is <i>reason</i> , at line number <i>line_number</i> .
DUPLICATE_CRITERIA	Duplicate criteria found for criteria <i>direction</i> , <i>verb</i> , <i>type</i> , <i>network_service</i> in package <i>package_name</i> .
GROOVYALL_SCRIPT_RESTRICTION	Error occurred for the criteria <i>criteria</i> , in the package <i>package_name</i> and the error message is <i>reason</i> .
GROOVY_SCRIPT_LIBRARY_COMPILATION_ERRORS	Script library validation error is <i>reason</i> at line number <i>line_number</i> .
ME_INVALID_LOGIN	Invalid credentials found, for the media engine.
ME_ADDRESS_IS_NOT_UNIQU	Media engine address <i>address</i> is not unique.
ME_PORT_IS_INVALID	Invalid media engine port <i>port_number</i> .
ME_NODE_NOT_REACHABLE	Server not reachable with address <i>address</i> and port <i>port_number</i> .
ME_LIFE_CYCLE_ERROR	Media engine life cycle is not initiated for the server <i>server_name</i> and port <i>port_number</i> .
INVALID_MODULE_NAME	The <i>module_name</i> moduel contains invalid characters.
INVALID_MODULE_REFERENCE	Nonexistant module <i>module_name</i> is referenced from application <i>application_name</i> .
INVALID_SCRIPT_TYPE	The script <i>script_name</i> contains an error of type <i>error_type</i> .
GROOVY_SCRIPT_LIBRARY_RESTRICTIONS	Error occurred in script library <i>reason</i> .
GROOVY_SCRIPT_RESTRICTIONS	Error message is <i>reason</i> .

Customizing Messages for New SIP or JSON Data

This chapter contains examples of how to use Oracle Communications WebRTC Session Controller Signaling Engine (Signaling Engine) to process customized SIP data in messages, and add new JSON data to support protocol changes.

Processing Messages With Custom SIP Data

This section provides some examples for how to translate SIP messages which contain custom SIP data.

Example SIP Request Variable

The examples in this chapter assume that you have created a custom **sipReq** variable as shown in this example:

```
// Create REGISTER request
def from = getFromAddress(context)
def to = getToAddress(context)
def sipReq = context.sipFactory.createSipRequest("REGISTER", from, to)

// Set request URI
sipReq.requestURI = context.sipFactory.createSipAddress(Constants.PROXY_SIP_
URI).URI

// Set contact user
if (from.URI?.user) {
    sipReq.setContactUser(from.URI.user)
}

// Set sip.instance to allow container to use SIP Outbound
// for routing purposes as defined in RFC 5626
def sipInstance = "\"><urn:uuid:" + java.util.UUID.randomUUID() + ">\""
sipReq.setSipContactParameter("+sip.instance", sipInstance)
sipReq.setSipContactParameter("reg-id", "1")
context.subSessionStore.put("sip.instance", sipInstance)

// Enable GRUU support (disabled by default)
//sipReq.setHeader("Supported", "gruu")

// P-Charging-Vector example
//def icidValue = context.uniqueId
//def myIp = java.net.InetAddress.localHost.hostAddress
//sipReq.setHeader("P-Charging-Vector", "icid-value=" + icidValue +
```

```
//";icid-generated-at=" + myIp)  
  
sipReq.send()
```

Extending SIP Messages with New Headers

This Groovy code snippet from the default **register** package, in the **FROM_APP/connect/request/default** criteria (commented out) adds support for a Globally Routable User agent URI (GRUU).

```
sipReq.setHeader("Supported", "gruu")
```

Protecting System Performance by Removing SIP Messages

You can save network bandwidth by removing unimportant messages during processing. For example, you would use this code snippet to remove provisional SIP responses (the 1xx SIP messages). You would put this in the Groovy script for the **FROM_NET/INVITE/response** criteria:

```
if (sipResponse.status < 200) {  
    // Ignore provisional responses  
} else if (sipResponse.status < 300)  
    // Proceed with processing  
}  
{...  
}
```

Removing a SIP Header in a Message

Use this Groovy code snippet to remove a header. Headers cannot be renamed.

```
sipReq.removeHeader("headername")
```

Replacing a SIP Header in a Message

You use the **setHeader** method to replace a header in a SIP message. Setting a header overwrites its value.

Conditionally Passing SIP Headers in Messages

This example Groovy code snippet probes for a JSON parameter called **myWebParmeter** and if present it copies the value to a SIP header.

```
def myWebParameter = context.webMessage?.header?.myParameter  
if (myWebParameter) {  
    sipRequest.setHeader("MyHeader", myWebParameter)  
}
```

You pass SIP headers as extension headers (**extHeader**) in the JSON API. See *WebRTC Session Controller Web Application Developer's Guide* for examples of using extension headers.

Changing JSON Data to Support Protocol Changes

If the JSON protocol specification changes, you can add processing for additional data in your Groovy scripts. WebRTC Session Controller ignores new JSON data if you do not use it in processing.

Extending WebRTC Session Controller Functionality

If your implementation requires client application logic that WebRTC Session Controller or Javascript does not support by default, you need to create new software packages to implement it. The procedure below offers guidelines for creating a new package. The exact steps and sequence depend on your requirements.

See "[JsonRTC Protocol Reference](#)" for details on the JsonRTC protocol that WebRTC uses to communicate with client applications. Also see "[Prerequisites for Extending WebRTC Session Controller Functionality](#)" for information on other protocols you may need to understand.

To create a new package:

1. Design your new package.

Include the new JSON to SIP message mapping and any new JSON and SIP data, formats, and headers.

2. Use the WebRTC Session Controller console to create the criteria and Groovy script processing necessary to implement your new package.

See "[Creating Criteria](#)" for details on creating criteria.

3. Create or extend the tools necessary to use the package with a client application.

- If you use the JavaScript Development Environment client operating system, see the *WebRTC Session Controller Web Application Developer's Guide* for more information.

- If you use a different client operating system, see that operating system documentation for details. You may also find the *WebRTC Session Controller Web Application Developer's Guide* helpful.

4. Write the client application.

- To develop JavaScript client applications see the *WebRTC Session Controller Web Application Developer's Guide* for more information.

- To develop client applications in another operating system, see that operating system documentation for information on how to communicate with WebRTC Session Controller.

Using Policy Data in Messages

This chapter explains how Oracle Communications WebRTC Session Controller Signaling Engine (Signaling Engine) uses policy data from policy charging rule functions (PCRFs) to affect subscriber calls and profiles.

About Using Policy Control Data with Signaling Engine

Signaling Engine supports using its Groovy script translation capability to make policy (QoS) decisions by using the policy information contained in Diameter Rx interface messages. Signaling Engine acts as a Diameter application function (AF) by exchanging Diameter Rx messages with your policy control and charging rules function (PCRF) in a 3GPP architecture.

Signaling Engine supports sending AA Request (AAR) and Session Termination Request (STR) Diameter Rx messages from Signaling Engine to your PCRF, and using the data from AA Answer (AAA) and Session Termination Answer (STA) messages that it receives in return.

The Diameter Rx messages and their responses are frequently used with the **pcrfFuture** interface that enables you to delay processing until a later message arrives. Oracle expects that most implementations will send Diameter AAR requests and then delay the media session until they receive an AAA confirming that the subscriber is entitled to the service.

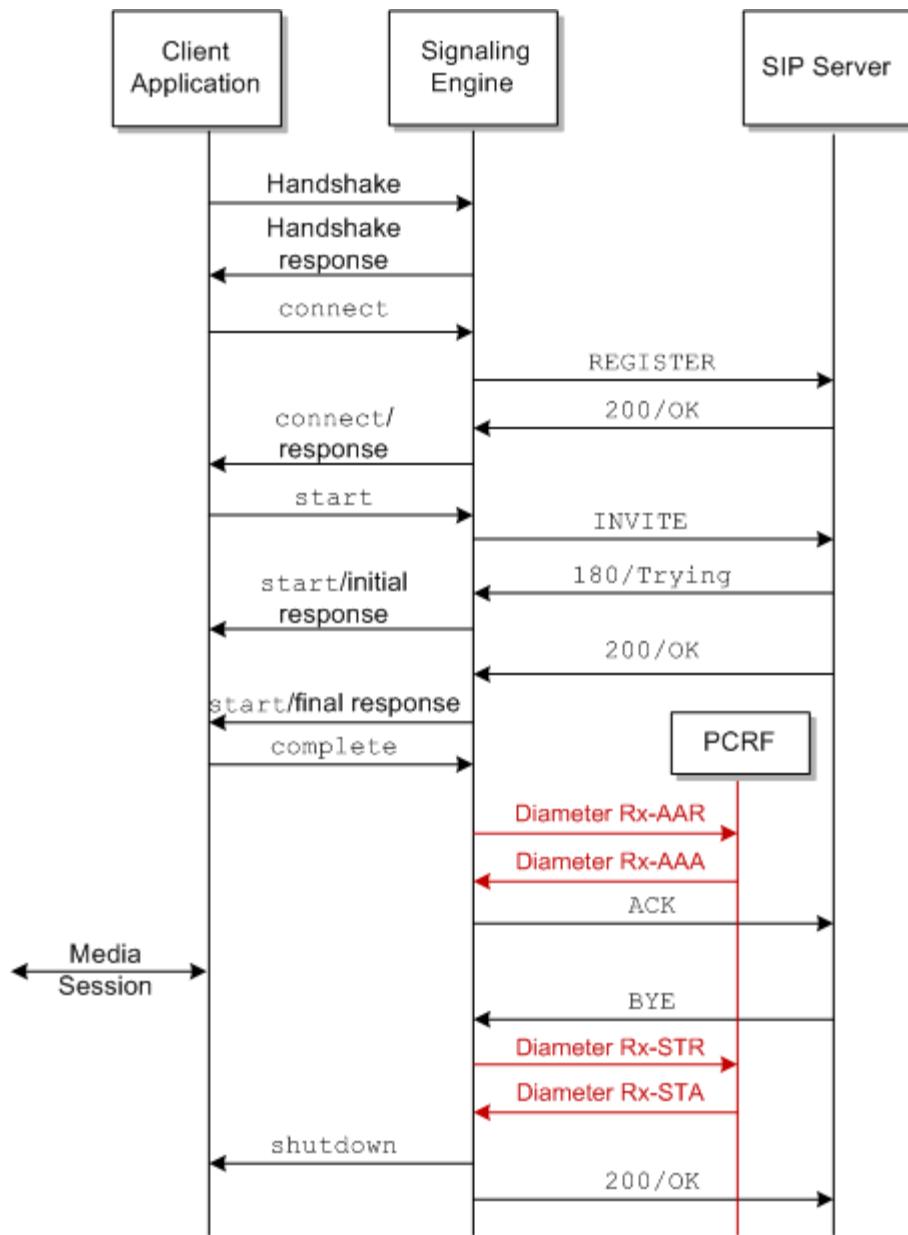
The AAR and AAA messages can be exchanged any time before a call's media stream, and the STR and STA messages are exchanged after the stream. So you can affect your PCRF and PCEF affect the subscriber profile before the media stream resources are used, update the subscriber's profile after the media stream resources have been consumed, or both.

See *WebRTC Session Controller Statement of Conformance* for the complete list of Diameter Rx commands and AVPs that Signaling Engine Supports.

Before the AAR and STR messages can be useful, you must configure your PCRF to accept and make policy decisions based on the AVPs that you send them. If your implementation requires it, you must also configure a PCEF to enforce those decisions.

[Figure 5-1](#) shows an example call flow in which Signaling Engine exchanges messages with a PCRF both before and after the call's multimedia stream. Diameter Rx AAR, AAA, STR, and STA messages are shown in red in the call flow.

Figure 5–1 Signaling Engine Call Flow with PCRF Support



Creating and Sending Diameter Rx Request messages

You use the `createRxAAR` and `createRxSTR` methods in the `WscDiameterFactory` interface of the `oracle.wsc.feature.webrtc.template.diameter` package to create AAR and STR messages. These methods accept a map of AVPs that you create, and adds them to a Diameter Rx message that your PCRF can parse. Your PCRF then accepts the AVPs and take whatever action that you have configured it.

These AVPs are automatically added to each outgoing request and need not be specified in a Groovy script:

- Session-Id
- Origin-Host
- Origin-Realm

- Auth-Application-Id
- Destination-Realm

You must specify any other AVPs that your implementation requires in your Groovy scripts. See *WebRTC Session Controller Conformance Statement* for details on the AVPs supported.

This example defines an AAR message and specifically defines the AVPs used (for example: Subscription-Id, Subscription-Id-Type, and Subscription-Id-Data):

```
def avps = [
    'Subscription-Id': [
        'Subscription-Id-Type': 2, //END_USER_SIP_URI
        'Subscription-Id-Data': "bob@example.com"
    ],
    'Framed-IP-Address': [
        0x84,
        0x08,
        0x88,
        0x65] as byte[],
    'AF-Application-Identifier': "WSE".getBytes("utf-8"),
    'Media-Type': 0, //Audio
    'AF-Charging-Identifier': 'charing-id-55'.getBytes("utf-8"), //Audio
    'Media-Component-Description': [
        'Media-Component-Number': [0, 1],
        'Media-Sub-Component': [
            [
                'Flow-Number': 1,
                'Flow-Description': 'permit out 8001 from assigned 34 to 24.2.1.6/18
8000'
            ],
            [
                'Flow-Number': 1,
                'Flow-Description': 'permit out 8005 from assigned 36 to 24.2.1.6/18
8001'
            ]
        ],
        'Flow-Status': 2
    ]
]

def aar = context.diameterFactory.createRxAAR(avps)
```

After creating a Diameter request message, you must explicitly send it using a **send** method call. **send** is a method in the **WscDiameterRequest** interface in the **oracle.wsc.feature.webrtc.template.diameter** package. This example sends an AAR message, and provides example success and error conditions:

```
def pcrfFuture = aar.send();

//success
context.getTaskBuilder("processSuccessFromPcrf").withArg("sipRequest", sipRequest)
    .withArg("pcrfFuture", pcrfFuture).onSuccess(pcrfFuture).build();

//error
context.getTaskBuilder("processErrorFromPcrf").withArg("sipRequest", sipRequest)
    .withArg("pcrfFuture", pcrfFuture).onError(pcrfFuture).build();
```

This example lists the **pcrfSuccessHandler** and **pcrfErrorHandler** methods that you would define to handle the success and failure conditions.

You use the methods in the **PcrfFuture** interface in the **oracle.wscfeature.webrtc.template.diameter** package to determine if any future objects are ready for use by your Groovy scripts. This interface extends the **oracle.wsc.feature.webrtc.template.future** interface.

This example checks the AVP values in the response to confirm that the subscriber **bob@example.com** uses a media type of 0.

```
def avps = context.taskArgs.pcrfFuture.get().getAvps()

if(avps.'Subscription-Id'?.'Subscription-Id-Data'=='bob@example.com') {
    //add logic here.
} else if(avps.'Media-Type'==0) {
    //provide alternative
}
```

Accepting and Using Diameter Rx Answer Messages

You use the **getAvps**, **getCommandCode**, and **getresultCode** methods in the **WscDiameterResponse** interface of the **oracle.wscfeature.webrtc.template.diameter** package to process the Diameter Rx AAA and STA messages returned by your PCRF. **getCommandCode**, returns the command code identifying the type of message (265 for AAR and AAA, and 275 for STR and STA). **getresultCode** returns the integer values for the Result-Code AVP. **getAvps** returns a map of all the AVPs in the AAA or STA message. You use this method in groovy scripts you create to obtain the data necessary to perform policy actions, and take those actions.

6

Anchoring Media Sessions

This chapter explains how to use the Oracle Communications WebRTC Session Controller Media Engine (Media Engine) features to anchor media sessions.

About the WebRTC Session Controller Media Server

You use Media Engine to:

- Establish communication between a WebRTC-enabled browser and a SIP/PSTN device.
- Establish communication between two end points (WebRTC-enabled browsers, or SIP or PSTN based devices) that do not share a common codec they can use to communicate directly.
- Enable a content service provider to forcibly anchor a call for example, to lawfully intercept it.

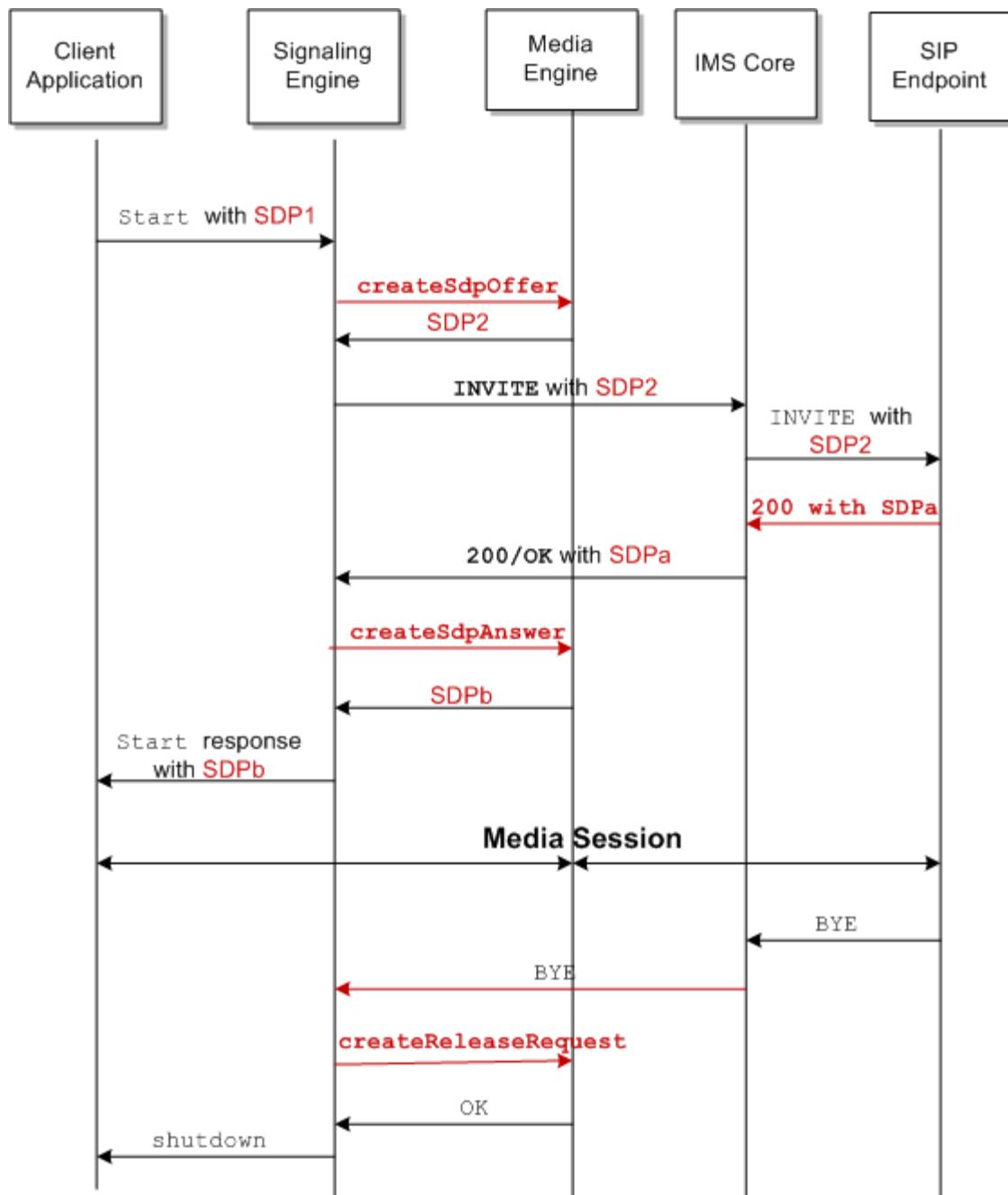
In the WebRTC Session Controller JsonRTC protocol, you use the **WscMediaFactory** interface in the **oracle.wsc.feature.webrtc.template.media** package to interact with Media Engine. It includes these methods:

- **createSdpOffer** - Can contain the media session ID, SDP data, **fromMediaConfigName**, and **toMediaConfigName** to use, and the From and To URLs to use for communication. See "[About Media Engine Sessions](#)" for details on the supported sessions.
- **createSdpAnswer** - Contains the media session ID and SDP data.
- **createReleaseRequest** - Contains the media session ID to release. This method releases the media or resources currently being used by the callee.
- **isAvailable** - Confirms that a Media Engine can be used. This is useful in cases where your Groovy script uses the Media Engine functionality if one is available, or does its own internal processing (attempts to connect the two client directly) if not.

See *WebRTC Session Controller Configuration API Reference* for details on this interface and these methods.

[Figure 6-1](#) shows a flow of SDP data between two clients, in this case a WebRTC-enabled browser and a SIP endpoint. The two Signaling Engines may be different nodes in a clustered implementation, or they may be the same instance. This flow also shows where the **processSdpOffer**, **processSdpAnswer**, and **createReleaseRequest** actions occur.

Figure 6-1 Media Engine SDP Flow



In a typical scenario, Signaling Engine sends a **createSdpOffer** message to the Media Engine that includes all possible codecs that the caller supports. The Media Engine then returns modified SDP data including a list of the codecs that it supports and allows.

Further, the callee's SDP data, including a list of supported codecs, is sent from the SIP proxy to Signaling Engine in a **200/OK** message, as shown in Figure 6-1. Signaling Engine then sends a **createSdpAnswer** to Media Engine with the list of codecs. If any codecs sent by Signaling Engine match the codecs supported by the Media Engine, the Media Engine returns the codecs it supports. Or, if Media Engine is configured to do so, it may attempt to convert the media stream to an alternate codec that the callee can use.

Once the media session has terminated, you send a **createReleaseRequest** message to the media server to release any resources the media server has allocated.

This code snippet from the Signaling Engine default **call** package, **FROM-NET/INVITE/request** criteria shows how to set up media anchoring:

```
if(Constants.ME_CONFIG_NAME_NET && sdpString!=null) {
    def sdpOffer = context.mediaFactory.createSdpOffer("1", sdpString, Constants.ME_CONFIG_NAME_NET, null, sipAddressToString(sipRequest.to),
    sipAddressToString(sipRequest.from));
    def ascFuture = sdpOffer.send()
    context.getTaskBuilder("processMediaResponseToSendWebMsg").withArg("ascFuture", ascFuture).withArg("webMessage", webMessage).onSuccess(ascFuture).build();
}
else{
    webMessage.send()
}
```

This Groovy code tests whether a Media Engine is available, and if so sends a **createSdpOffer** request to the Media Engine with SDP data. If no Media Engine is available sends a **webMessage**.

This code snippet from the Script Library shows one example of handling a reply from Media Engine:

```
void processMediaResponseToSendWebMsg(TemplateContext context) {
    def resp = context.taskArgs.ascFuture.get();
    def newSdp = resp.getSdp();
    def webMessage = context.taskArgs.webMessage
    if (webMessage.payload) {
        webMessage.payload.sdp = newSdp
    } else {
        webMessage.payload = [sdp : newSdp]
    }
    webMessage.send()
}
```

It processes the response and sends the new SDP data back to the original caller.

About Media Engine Sessions

Table 6–1 lists the supported Media Engine session types, lists their Media Engine config names, and describes how they are used.

Table 6–1 Media Engine Session Types

Session Type	Config Name	Description
Web to Web Conditional Anchoring	web-to-web-anchor-conditional	Used when WebRTC-enabled browsers are allowed to communicate directly. If for some reason they cannot communicate directly, they can communicate through WebRTC Session Controller
Web to Web Forced Anchoring	web-to-web-anchor-anchored	Forces all media flows through Media Engine.
Web to SIP	web-to-sip	For WebRTC-enabled browser to PSTN communication. All media flows through Media Engine.

Table 6–1 (Cont.) Media Engine Session Types

Session Type	Config Name	Description
SIP to Web	sip-to-web	Used for making calls from a SIP phone/PSTN to a WebRTC client application. All media flows through Media Engine.

About Using `createSdpOffer` to Modify INVITE SDP Data

You use the `createSdpOffer` method to direct Media Engine to process SDP data sent by the calling end point. You either send SDP data with this method for Media Engine to process, or send the name of a media configuration that the node uses to determine for itself which SDP data to use. The Media Engine replies to Signaling Engine with the new or modified SDP data. Signaling Engine then uses the SDP data returned in the call's media session.

`createSdpOffer` includes these parameters:

- A set of SDP data to use.
- A media configuration name. The Media Engine uses the media configuration to select SDP data to return to the Signaling Engine. Media configuration names must be preconfigured on the Media Engine. See "["About Media Engine Sessions"](#)" for details.
- A `fromURI`.
- A `toURI`.

You can send a `session_id` value with `createSdpOffer` to identify a specific media session. For example, `createSdpAnswer` requires a `session_id` to function.

You use the `send()` method from the `oracle.wsc.feature.webrtc.template` interface, `WscMessage` package to send `createSdpOffer`. See *WebRTC Session Controller Configuration API Reference* for details on `send()`.

About Using `createSdpAnswer` to Process 200 Message SDP Data

A SIP 200/OK message that accepts a session invitation contains SDP data to use in that session. You use the `createSdpAnswer` method in a Groovy script to accept and process that SDP.

About Using `createReleaseRequest` to Explicitly Release Media

All media sessions are released automatically when the call terminates. You can also force Media Engine to release all media for a session immediately by sending the session ID to the `createReleaseRequest` method in a Groovy script.

JsonRTC Protocol Reference

This appendix provides reference information for the WebRTC Session Controller JsonRTC Protocol used by WebRTC Session Controller Signaling Engine (Signaling Engine).

About the JsonRTC Protocol

WebRTC Session Controller uses this protocol to communicate with WebRTC-enabled browser client applications. It establishes the sessions and subsessions that you use to pass messages between WebRTC Session Controller and its client applications inside WebSocket connections.

You can also use this protocol to create new WebRTC Session Controller packages for your WebRTC Session Controller implementation.

See "[About Building JSON to SIP Communication](#)" for more information about how WebRTC Session Controller handles WebSocket connections, sessions, and subsessions.

While WebRTC Session Controller uses this protocol to communicate with JavaScript-based applications by default, this protocol also communicates with client applications based on different operating systems. Your client application must open the WebSockets necessary for the JsonRTC protocol subsessions to communicate with.

Initiating a HTTP/HTTPS Handshake with Signaling Engine

The JsonRTC protocol is a sub protocol of the WebSocket protocol, and you establish a handshake with a WebSocket protocol to initiate communication between the two. The handshake establishes a connection between the client (usually an application in a browser) and the Signaling Engine server inside HTTP/HTTPS. Once the client receives the handshake response, communication can proceed. The handshake is an HTTP GET /chat message using `webrtc.oracle.com` as the value for Sec-WebSocket-Protocol. For Example:

```
GET /chat HTTP/1.1
Host: server.wsc_IP.com
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Key: dGhIHNhbXBsZSBub25jZQ==
Origin: http://client_IP.com
Sec-WebSocket-Protocol: webrtc.oracle.com
Sec-WebSocket-Version: 13
```

Where:

`wsc_IP` is the domain name of the Signaling Engine server.

client_IP is the domain name of the client.

The handshake reply must include a 101 Switching Protocols entry to allow the connection, as shown in this example handshake reply:

```
HTTP/1.1 101 Switching Protocols
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Accept: s3pPLMBiTxaQ9kYGzhZBk+xOo=
Sec-WebSocket-Protocol: webrtc.oracle.com
```

Once the client receives the handshake response, the client and Signaling Engine server can communicate further.

Immediately after establishing a WebSocket connection, the client sends a JsonRTC CONNECT message to establish the WebRTC Session Controller JsonRTC session. Once WebRTC Signaling Controller accepts the CONNECT message, it responds by sending back a **session_id**. If the WebSocket connection is broken unexpectedly, for example by a network problem, the client can re-establish the session by starting a new websocket connection with the original **session_id** in a CONNECT message.

Tearing Down a JsonRTC Session

You tear down a JsonRTC session by closing the WebSocket connection.

About JsonRTC Sessions and SubSessions

See "[About Sessions and Subsessions](#)" for details on how this protocol establishes and manipulates sessions and subsessions.

JsonRTC uses a **session_id** field instead of a Message Broker WebSocket Subprotocol (MBWS) **connection_name** to identify the WebSocket session. The **session_id** field value must be unique across time and space to work with geographically redundant clusters.

The **subsession_id** is the **session_id** value with a **c** or **s** prefix added to it.

Also see "[Initiating a HTTP/HTTPS Handshake with Signaling Engine](#)" for more information about using **session_id** to reconnect a session.

About Message Reliability

This protocol uses the MessageBroker WebSocket Subprotocol (MBWS) as basis for message reliability. For more information on MBWS, see the MBWS specification:

<http://tools.ietf.org/html/draft-hapner-hybi-messagebroker-subprotocol-03>

About the JsonRTC Session Controller Messages

The basic communication unit used between a WebRTC-enabled client application and the WebRTC Session Controller JsonRTC protocol is a message. Signaling Engine communication can be synchronous or asynchronous. Each messages includes these components:

- [Control Headers](#)
- [General and Action Headers](#)
- [Message Payloads](#)

This section also includes "[Example Message Bodies](#)" that you can use for reference.

Control Headers

The control header specifies information that the client and server use to handle (control) the message. It includes the message type, session ID, message state, and so on. Typically Signaling Engine uses this information itself, not applications or Groovy scripts.

type

The control type of JSON message. Can be one of:

request

A message that requires a response. A protocol frame with control type **request** may also contain a payload header.

response

This message is a response to a request message. A protocol frame with control type **request** may also contain a payload header.

message

A message that does not require a response. For example **notification**, or **publish**. A protocol frame with control type **request** may also contain a payload header.

acknowledge

A message that acknowledges another message. Can not contain a payload header.

error

Indicates that an error has arrived. Can not contain a payload header.

package_type

Optional. The **call**, **presence**, and **message_notification** types are defined by default. Identifies the Signaling Engine package that the message applies to. If no **package_type** is specified, Signaling Engine assumes that the default **call** package is used for all messages except messages those with a CONNECT action. CONNECT messages attempt to establish a session and are not associated with a package. See "["Creating Packages"](#)" for details about the Signaling Engine packages.

session_id

Identifies a WebSocket session. The server creates the session ID and returns it to the client in the CONNECT response. A CONNECT message containing a session ID reestablishes a JsonRTC session. This value must be completely unique so that it may be used across redundant clusters. This has the same role as the MessageBroker WebSocket Subprotocol (MBWS) **connection-name**.

sequence

A serial number that uniquely identifies a message in a JsonRTC session. Both the client and server keep their own serial number counts, starting with 1.

ack_sequence

Optional. Identifies a message to acknowledge. Used to confirm that the client received the message with the **ack_sequence** value. A value of 0 means the message was not received. All messages with a lower value than the **ack_sequence** are also considered acknowledged.

subsession_id

Identifies a subsession with a session. The sequence numbers are incremented each time a new session is started. The client and server keep separate subsession ID counts. This subsession ID typically includes a **c** prefix if the subsession originated with the client and an **s** prefix if it originated with the server. An implementation can also choose to use a globally unique identifier as the subsession ID.

For example the second client-originated subsession has the value "**subsession_id**":"**c2**". The seventh server-originated session uses the value "**subsession_id**":"**s7**"

correlation_id

A string that identifies a specific message within a session. It can simply be a sequence number incremented each time a new message is sent. The client and server keep separate message counts. Messages from the client have a "c" suffix and messages from the server have an "s" suffix.

For example the third client-originated message has the value "**correlation_id**":"**c3**". The sixth server-originated message has the value "**correlation_id**":"**s6**".

message_state

Identifies the message state as Initial, Subsequent, or Final. A state of Initial is assumed if no state is present. Only Subsequent or Final messages need specify the message_state.

For example: "**message_state**":"**Final**"

version

Identifies the JsonRTC protocol version that message sender supports (client or server). If none is present in the message version "**1.0**" is assumed.

General and Action Headers

The general header (**header**) includes fields that Signaling Engine uses to build up and tear down calls. These fields are specific to one or more packages and are available to use in both client applications and Groovy scripts.

action

The purpose of the message. Can be one of:

CONNECT

Establishes a session with the server. These general headers are only used with the CONNECT action.

cslr

Optional. Sent with the **session_id** of a session to reconnect. Uses the sequence number of the last message received from the client to identify the session.

cslw

Optional. Sent with the **session_id** of a session to reconnect. Uses the lower bound of the messages in the client's retained window to identify the session.

csuw

Optional. Sent with the **session_id** of a session to reconnect. Uses the upper bound of the messages in the client's retained window to identify the session.

sslr

Optional. Sent with the **session_id** of a session to reconnect. Uses the sequence number of the last message received by the server to identify the session.

START

Starts a session with a specific package.

COMPLETE

Announces that the media session has been established.

NOTIFY

Equivalent to Notification of Notification Server.

SHUTDOWN

Shuts down session opened by a specific request.

initiator

Optional. Identifies the URI of the user initiating the HTTP request. If this value exists, it may be set by the client or the HTTP session.

target

Optional. Identifies the URI of the Signaling Engine server being targeted by the message.

error_code

Optional. In error type messages, lists the error message.

Message Payloads

The message payload is specific to Signaling Engine package that the message is used for. The default **call** package the payload is an SDP offer or answer. The default **message-notification** package includes JSON data with message text. If you created a **presence** package, that package probably includes presence data.

Example Message Bodies

The following sections show message body examples.

Connect Request Message

```
{
  "control": {
    "type": "request",
    "sequence": "1",
    "version": "1.0"
  },
  "header": {
    "action": "connect",
    "initiator": "bob@example.com",
  }
}
```

CONNECT Response Message

```
{
  "control": {
    "type": "response",
    "sequence": "1",
    "correlation_id": "c1",
    "subsession_id": "c1",
    "session_id": "Hyi89JUThhjjR",
    "version": "1.0"
  },
  "header": {
    "action": "connect"
  }
}
```

START Request Message

```
{
  "control": {
    "type": "request",
    "sequence": "2",
  },
  "header": {
    "action": "start",
    "initiator": "bob@example.com",
    "target": "alice@example.com",
  },
  "payload": {
    "<offer_sdp>"
  }
}
```

START Response Message

```
{
  "control": {
    "type": "response",
    "sequence": "2",
    "correlation_id": "c2",
    "subsession_id": "c2"
  },
}
```

```
    "header": {  
        "action": "start"  
    },  
    "payload": {  
        "<pranswer_sdp>"  
    }  
}
```

SHUTDOWN Message

```
{  
    "control": {  
        "type": "message"  
        "sequence": "4",  
        "subsession_id": "c2"  
    },  
    "header": {  
        "action": "shutdown"  
    }  
}
```

ERROR Message

```
{  
    "control": {  
        "type": "error"  
        "sequence": "6",  
        "correlation_id": "c2"  
        "subsession_id": "c2"  
        "error_code": "480"  
    }  
}
```