Communications WebRTC Session Controller Application Developer's Guide

13 Developing WebRTC-enabled Android Applications

This chapter shows how you can use the Oracle Communications WebRTC Session Controller Android application programming interface (API) library to develop WebRTC-enabled Android applications.

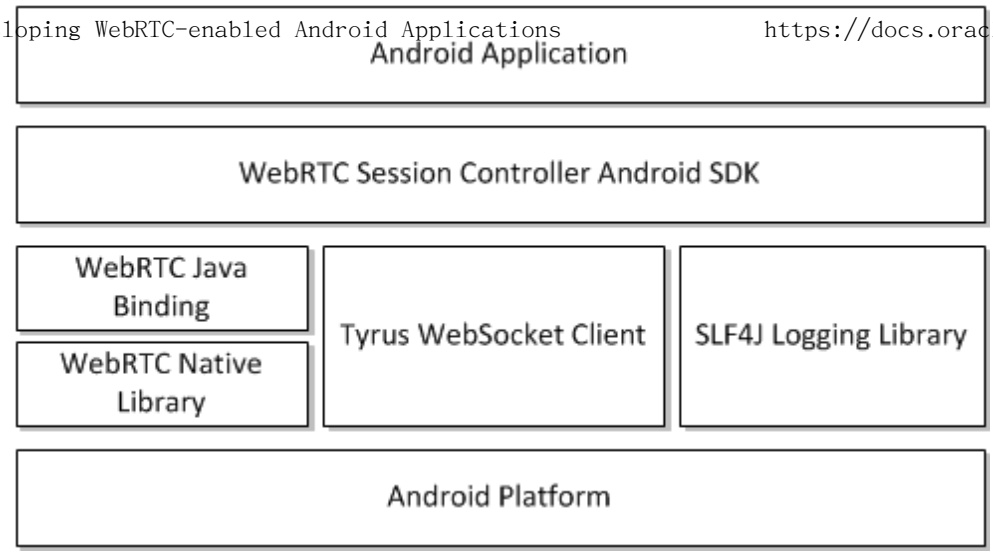
About the Android SDK

The WebRTC Session Controller Android SDK enables you to integrate your Android applications with core WebRTC Session Controller functions. You can use the Android SDK to implement the following features:

- Audio calls between an Android application and any other WebRTC-enabled application, a Session Initialization Protocol (SIP) endpoint, or a Public Switched Telephone Network endpoint using a SIP trunk.
- Video calls between an Android application and any other WebRTC-enabled application, with suitable video conferencing support.
- Seamless upgrading of an audio call to a video call and downgrading of a video call to an audio call.
- Support for Interactive connectivity Establishment (ICE) server configuration, including support for Trickle ICE.
- Transparent session reconnection following network connectivity interruption.

The WebRTC Session Controller Android SDK is built upon several additional libraries and modules as shown in Figure 13-1 (#CIHIGJBG) .

Figure 13-1 Android SDK Architecture



The WebRTC Java binding enables Java access to the native WebRTC library which itself provides WebRTC support. The Tyrus websocket client enables the websocket access required to communicate with WebRTC Session Controller. Finally, the SLF4J logging library enables you to plug in a logging framework of your choice to create persistent log files for application monitoring and troubleshooting.

For more details on any of the APIs described in this document, see *Oracle Communications WebRTC Session Controller Android API Reference* (http://www.oracle.com/pls/topic/lookup?ctx=wsc71&id=wscandroid) .

About the Android SDK WebRTC Call Workflow

The general workflow for using the WebRTC Session Controller Android SDK is:

1. Authenticate against WebRTC Session Controller using the **HttpContext** class. You initialize the HttpContext with necessary HTTP headers and optional SSLContext information in the following manner:

    a. Send an HTTP GET request to the login URI of WebRTC Session Controller

    b. Complete the authentication process based upon your authentication scheme

    c. Proceed with the WebSocket handshake on the established authentication context

2. Establish a WebRTC Session Controller session using the **WSCSession** class. Two additional classes must be implemented:

    - **ConnectionCallback**: An interface that reports on the success or failure of the session creation.
    - **WSCSession.Observer**: An abstract class that signals on various session state changes, including **CLOSED**, **CONNECTED**, **FAILED**, and others.

3. Once a session is established, create a **CallPackage** which manages **Call** objects in a **WSCSession**.

4. Create a **Call** using the **CallPackage createCall** method with a callee ID as its argument, for example, alice@example.com.

5. Create a Call.Observer class which attaches to the **Call** to monitor call events such as **ACCEPTED**, **REJECTED**, **RECEIVED**.

6. Create a new **CallConfig** object to determine the nature of the WebRTC call, whether bi or mono-directional audio or video or both.

7. Create and configure a new **PeerConnectionFactory** object and start the **Call** using the Call object's start method.

8. When the call is complete, terminate the **Call** object using its **end** method.

Prerequisites

Before continuing, make sure you thoroughly review and understand the JavaScript API discussed in the following chapters:

- About Using the WebRTC Session Controller JavaScript API (wd_javascriptapis.htm#CIHGDFAI)
- Setting Up Security (wd_appsecurity.htm#CDDHACBC)
- Setting Up Audio Calls in Your Applications (wd_callsinapps.htm#BACICBGE)
- Setting Up Video Calls in Your Applications (wd_videoinapps.htm#BACHCBAH)

The WebRTC Session Controller Android SDK is closely aligned in concept and functionality with the JavaScript SDK to ensure a seamless transition.

In addition to an understanding of the WebRTC Session Controller JavaScript API, you are expected to be familiar with:

- Java and object oriented programming concepts
- General Android SDK programming concepts including event handling, and activities

There are many excellent online resources for learning Java programming, and, for a practical introduction to Android programming, see `http://developer.android.com/guide/index.html` (http://developer.android.com/guide/index.html) .

Android SDK System Requirements

In order to develop applications with the WebRTC Session Controller SDK, you must meeting the following software/hardware requirements:

- Java Development Kit (JDK) 1.6 or higher installed with all available security patches: `http://www.oracle.com/technetwork/java/javase/downloads/java-archive-downloads-javase6-419409.html` (http://www.oracle.com/technetwork/java/javase/downloads/java-archive-downloads-javase6-419409.html)

  > **Note:**
  >
  > OpenJDK is not supported.

- The latest version of the Android SDK available from `http://developer.android.com/sdk/installing/index.html` (http://developer.android.com/sdk/installing/index.html) , running on a supported version of Windows, Mac OS X, or Linux.

- If you are using the Android SDK command line tools, you must have Apache ANT 1.8 or later: `http://ant.apache.org/` (http://ant.apache.org/) .

- A installed and fully configured WebRTC Session Controller installation. See the WebRTC Session Controller Installation Guide.

- An actual Android hardware device. While you can test the general flow and function of your Android WebRTC Session Controller application using the Android emulator, a physical Android device such as a phone or tablet is required to utilize audio or video functionality.

About the Examples in This Chapter

The examples and descriptions in this chapter are kept intentionally straightforward in order to illustrate the functionality of the WebRTC Session Controller Android SDK API without obscuring it with user interface code and other abstractions and indirections. Since it is likely that use cases for production applications will take many forms, the examples assume no pre-existing interface schemes except when absolutely necessary, and then, only with the barest minimum of code. For example, if a particular method requires arguments such as a user name, a code example will show a plain string *username* such as "*alice@example.com*" being passed to the method. It is assumed that in a production application, you would interface with the Android device's contact manager.

General Android SDK Best Practices

When designing and implementing your WebRTC-enabled Android application, keep the following best practices in mind:

- Following Android application development general guidelines, do not invoke any networking operations in the main Application UI thread. Instead, run network operations on a separate background thread, using the supplied Observer mechanisms to handle any necessary responses.

- The Observers themselves run on a separate background thread, and your application should not make any user interface updates on that thread since the Android user interface toolkit is not thread safe. For more information, see `https://developer.android.com/training/multiple-threads/communicate-ui.html` (https://developer.android.com/training/multiple-threads/communicate-ui.html) .

- In any class that extends or uses the android.app.Application class or any initial Activity class, initialize the WebRTC PeerConnectionFactory only once during its lifetime:

```
PeerConnectionFactory.initializeAndroidGlobals(context, true /* initializeAudio */, true
/* initializeVideo */);
```

- Since the signaling communications takes place over a background thread, initialize and create WebRTC Session Controller sessions using an Android background service to prevent communications disruption. The background service can maintain a reference to the Session object and share that among all of your Android application's activities, fragments and other components. The service can also be run at a higher priority and be used to handle notifications. For more information, see `https://developer.android.com/training/best-background.html` (https://developer.android.com/training/best-background.html) .

Installing the Android SDK

To install the WebRTC Session Controller Android SDK, do the following:

1. After you have installed your Android development environment, use the Android SDK Manager to download the required SDK tools and platform support: `http://developer.android.com/sdk/installing/adding-packages.html` (http://developer.android.com/sdk/installing/adding-packages.html) .

> **Note:**
>
> Android API level 17 (4.2.2 *Jellybean*) is the minimum required by the WebRTC Session Controller Android SDK for full functionality. Generally, you should target the lowest API level possible to ensure the broadest application compatibility.

2. Configure virtual and hardware devices as required for your application: `http://developer.android.com/tools/devices/index.html` (http://developer.android.com/tools/devices/index.html) and `http://developer.android.com/tools/device.html` (http://developer.android.com/tools/device.html) .

3. Create a new Android project using the Android development environment of your choice: `http://developer.android.com/tools/projects/index.html` (http://developer.android.com/tools/projects/index.html) .

4. Download and extract the libs folder from the WebRTC Session Controller Android SDK zip file into the libs folder of your Android application. Create the libs folder if it does not already exist.

> **Note:**
>
> Both debug and release versions of the WebRTC peer connection library are included. Choose the correct one for the development state of your project.

5. Depending on your Android development environment, add the path to the libs folder to your Android project as indicated in your Android development environment documentation.

WebRTC Session Controller SDK Required Permissions

The WebRTC Session Controller SDK requires the following Android permissions to function correctly:

- android.permission.**INTERNET**
- android.permission.**ACCESS_NETWORK_STATE**
- android.permission.**CAMERA**
- android.permission.**RECORD_AUDIO**

Additionally, if your logging subsystem requires access to an external SD card (or a different storage volume) also grant the android.permission.**WRITE_EXTERNAL_STORAGE** permission.

Configuring Logging

The WebRTC Session Controller Android SDK includes support for the Simple Logging Facade for Java (SLF4J) which lets you plug in your preferred logging framework.

Examples in this chapter use the popular Log4J logging framework which requires the addition of the following libraries to your project, where *n* indicates a version number:

- slf4j-log4j*n*-*n*.*n*.*n*.jar
- log4j-*n*.*n*.*n*.jar
- android-logging-log4j-*n*.*n*.*n*.jar

Example 13-1 Configuring Log4J

```
public class ConfigureLog4J { public void configureLogging() { Log.i(MyApp.TAG,
"Configuring the Log4J logging framework..."); final LogConfigurator logConfigurator =
new LogConfigurator();
logConfigurator.setFileName(Environment.getExternalStorageDirectory() + File.separator +
"sample_android_app.log"); logConfigurator.setRootLevel(Level.DEBUG);
logConfigurator.setFilePattern("%d %-5p [%c{2}]-[%L] %m%n");
logConfigurator.setMaxFileSize(1024 * 1024 * 5); logConfigurator.setImmediateFlush(true);
logConfigurator.configure(); } }
```

> **Note:**
>
> If you want to write log files to any location other than an Android device's internal storage, you must grant the **WRITE_EXTERNAL_STORAGE** permission.

For more information on configuring and using Log4J, see `http://logging.apache.org/log4j/` (http://logging.apache.org/log4j/) .

Authenticating with WebRTC Session Controller

You use the class **HttpContext** to set up an authentication context. The authentication context contains the necessary HTTP headers and **SSLContext** information, and is used when setting up a **wsc.Session**.

Initialize the CookieManager

You initialize the cookie manager to handle storage of authentication headers and URIs. For more information on the Android CookieManager class, see `http://developer.android.com/reference/android/webkit/CookieManager.html` (http://developer.android.com/reference/android/webkit/CookieManager.html) .

Example 13-2 Initializing the CookieManager

```
Log.i(MyApp.TAG, "Initialize the cookie manager..."); CookieManager cookieManager = new
CookieManager(null, CookiePolicy.ACCEPT_ALL);
java.net.CookieHandler.setDefault(cookieManager);
```

Initialize a URL Connection

You then create a new URL object using the URI to your WebRTC Session Controller endpoint and open a urlConnection using the URL object openConnection method.

Example 13-3 Initializing a URL Connection

```
try { url = new URL("http://server:port/login?wsc_app_uri=/ws/webrtc/myapp"); } catch
(MalformedURLException e1) { Log.i(MyApp.TAG, "Malformed URL."); } try { urlConnection =
(HttpURLConnection) url.openConnection(); } catch (IOException e) { Log.i(MyApp.TAG, "IO
Exception."); }
```

> **Note:**
>
> The default WebRTC Session Controller port is 7001.

Configure Authorization Headers if Required

You then configure authorization headers as required by your authentication scheme. The following example uses Basic authentication; OAuth and other authentication schemes will be similarly configured. For more information on WebRTC Session Controller authentication, see "Setting Up Security." (wd_appsecurity.htm#CDDHACBC)

Example 13-4 Initializing Basic Authentication Headers

```
String name = "username"; String password = "password"; String authString = "Basic " +
name + ":" + password; byte[] authEncBytes = Base64.encode(authString.getBytes(), 0);
String authHeader = new String(authEncBytes);
urlConnection.setRequestProperty(HttpContext.AUTHORIZATION_HEADER, authHeader);
```

> **Note:**
>
> If you are using Guest authentication, no headers are required.

Configure the SSL Context if Required

If you are using Secure Sockets Layer (SSL), configure the SSL context, including the TrustManager if required. Example 13-6 (#CIHDCCFD) expects as URL object and passes that object to a custom **getNullHostVerifier** method, whose job is to validate that the URL is actually live.

Example 13-5 Configuring the SSL Context

```
if (HTTPS.equals(url.getProtocol())) { Log.i(MyApp.TAG, "Configuring SSL context...");
HttpsURLConnection.setDefaultHostnameVerifier(getNullHostVerifier()); SSLContext ctx =
null; try { ctx = SSLContext.getInstance("TLS"); } catch (NoSuchAlgorithmException e) {
Log.i(MyApp.TAG, "No Such Algorithm."); } try { ctx.init(null, getTrustAllManager(), new
SecureRandom()); } catch (KeyManagementException e) { Log.i(MyApp.TAG, "Key Management
Exception."); } final SSLSocketFactory sslFactory = ctx.getSocketFactory();
HttpsURLConnection.setDefaultSSLSocketFactory(sslFactory); }
```

Example 13-6 (#CIHDCCFD) is a stub method in which you can implement a routine to test the validity of the input URL object, and handle program flow based upon HTTP return codes.

Example 13-6 Host Name Verification

```
private HostnameVerifier getNullHostVerifier() { return new HostnameVerifier() {
@Override public boolean verify(final String hostname, final SSLSession session) {
Log.i(MyApp.TAG, "Stub verification for " + hostname + " for session: " + session);
return true; } }; }
```

Finally, if your implementation depends upon a Java Secure Socket Extension implementation, configure the Android TrustManager class as required. For more information on the Android TrustManager class, see `http://developer.android.com/reference/android/webkit/CookieManager.html` (http://developer.android.com/reference/android/webkit/CookieManager.html) .

Example 13-7 Configuring the TrustManager

```
public static TrustManager[] getTrustAllManager() { return new X509TrustManager[] { new
X509TrustManager() { @Override public java.security.cert.X509Certificate[]
getAcceptedIssuers() { return null; } @Override public void checkClientTrusted(
java.security.cert.X509Certificate[] certs, String authType) { } @Override public void
checkServerTrusted( java.security.cert.X509Certificate[] certs, String authType) { } } };
}
```

Build the HTTP Context

Next you build the HTTP context, retrieving the authorization headers using the CookieManager class you instantiated in "Initialize the CookieManager." (#CIHEABAB)

Example 13-8 Building the HTTP Context

```
Log.i(MyApp.TAG, "Building the HTTP context..."); Map<String, List<String>> headers = new
HashMap<String, List<String>>(); HttpContext httpContext = null; try { httpContext =
HttpContext.Builder.create() .withHeaders(cookieManager.get(url.toURI(), headers))
.build(); } catch (IOException e) { e.printStackTrace(); } catch (URISyntaxException e) {
e.printStackTrace(); }
```

Connect to the URL

With your authentication parameters configured, you can now connect to the WebRTC Session Controller URL using the **UrlConnection** object's **connect** method.

Example 13-9 Connecting to the WebRTC Session Controller URL

```
try { urlConnection.connect(); } catch (IOException e) { e.printStackTrace(); }
```

Configuring Interactive Connectivity Establishment (ICE)

If you have access to one or more STUN/TURN ICE servers, you can implement the **IceServerConfig** interface. For details on ICE, see "Managing Interactive Connectivity Establishment Interval." (wd_callsinapps.htm#BACGFCDA)

Example 13-10 Configuring the ICE Server Config Class

```
class MyIceServerConfig implements IceServerConfig { public Set<IceServer>
getIceServers() { Log.i(MyApp.TAG, "Setting up ICE servers..."); Set<IceServer>
iceServers = new HashSet<IceServer>(); iceServers.add(new IceServerConfig.IceServer(
"stun:stun-relay.example.net:3478", "admin", "password")); iceServers.add(new
IceServerConfig.IceServer( "turn:turn-relay.example.net:3478", "admin", "password"));
return iceServers; } }
```

Creating a WebRTC Session Controller Session

Once you have configured your authentication method and connected to your WebRTC Session Controller endpoint, you can instantiate a WebRTC Session Controller session object. Before instantiating a session object you configure the following elements:

- To handle the results of a session creation request, you "Implement the ConnectionCallback Interface." (#CIHIAGCF)
- To monitor and respond to changes in session state, you "Create a Session Observer Object." (#CIHBDGJG)
- To configure specific session object behaviors and performance parameters, you "Configure Session Properties." (#CIHBEJHD)

Implement the ConnectionCallback Interface

You must implement the ConnectionCallback interface to handle the results of your session creation request. The ConnectionCallback interface has two event handlers:

- **onSuccess**: Triggered upon a successful session creation.
- **onFailure**: Returns a an enum of type StatusCode. Triggered when session creation fails. For a listing of status code, see *Oracle Communications WebRTC Session Controller Android API Reference* (http://www.oracle.com/pls/topic/lookup?ctx=wsc71&id=wscandroid) .

Example 13-11 Implementing the ConnectionCallback Interface

```
public class MyConnectionCallback implements ConnectionCallback { @Override public void
onFailure(StatusCode arg0) { Log.i(MyApp.TAG, "Handle a connection failure..."); }
@Override public void onSuccess() { Log.i(MyApp.TAG, "Handle a connection success..."); }
}
```

Create a Session Observer Object

You must create a session Observer object to monitor and respond to changes in session state.

Example 13-12 Instantiating a Session Observer

```
public class MySessionObserver extends Observer { @Override public void
stateChanged(final SessionState state) { runOnUiThread(new Runnable() { @Override public
void run() { Log.i(MyApp.TAG, "Session state changed to " + state); switch (state) { case
CONNECTED: break; case RECONNECTING: break; case FAILED: Log.i(MyApp.TAG, "Send events to
various active activities as required..."); shutdownCall(); break; case CLOSED: default:
break; } } }); } }
```

Build the Session Object

With the ConnectionCallback and Session Observer configured, you now build a WebRTC Session Controller session using the session **Builder** method.

Example 13-13 Building the Session Object

```
Log.i(MyApp.TAG, "Creating a WebRTC Session Controller session..."); WSCSession.Builder
builder = null; try { builder = WSCSession.Builder.create(new java.net.URI(webSocketURL))
.withUserName(userName) .withPackage(new CallPackage()) .withHttpContext(httpContext)
.withConnectionCallback(new MyConnectionCallback()) .withIceServerConfig(new
MyIceServerConfig()) .withObserver(new MySessionObserver()); } catch (URISyntaxException
e) { e.printStackTrace(); } WSCSession session = builder.build();
```

In Example 13-13 (#CIHJEFDJ) , note that the **withPackage** method registers a new **CallPackage** with the session that will be instantiated when creating voice or video calls. Also registered are the **ConnectionCallback**, **IceServerConfig**, and **SessionObserver** objects created earler.

Configure Session Properties

You can configure additional properties when creating a session using the **withProperty** method.

For a complete list of properties and their descriptions, see the *Oracle Communications WebRTC Session Controller Android SDK API Reference* (http://www.oracle.com/pls/topic/lookup?ctx=wsc71&id=wscandroid) .

Example 13-14 Configuring Session Properties

```
WSCSession.Builder builder = WSCSession.Builder.create(...) .withUserName(userName) ...
.withProperty(WSCSession.PROP_RECONNECT_INTERVAL, 5000)
.withProperty(WSCSession.PROP_IDLE_PING_INTERVAL, 15000)); WSCSession session =
sessionbuilder.build();
```

Adding WebRTC Voice Support to your Android Application

This section describes adding WebRTC voice support to your Android application.

Initialize the CallPackage Object

When you created your Session, you registered a new **CallPackage** object using the Session object's

withPackage method. You now instantiate that **CallPackage**.

Example 13-15 Initializing the CallPackage

```
String callType = CallPackage.PACKAGE_TYPE; CallPackage callPackage = (CallPackage)
session.getPackage(callType);
```

> **Note:**
>
> Use the default **PACKAGE_TYPE** call type unless you have defined a custom call type.

Place a WebRTC Voice Call from Your Android Application

Once you have configured your authentication scheme, created a **Session**, and initialized a **CallPackage**, you can place voice calls from your Android application.

Initialize the Call Object

With the CallPackage object created, initialize a Call object, passing the callee's ID as an argument.

> **Note:**
>
> In a production application you may wish to integrate with the Android contacts provider or another enterprise directory system, rather than passing a bare string to the **createCall** method. For more information on integrating with the Android contacts provider, see `http://developer.android.com/guide/topics/providers/contacts-provider.html` (http://developer.android.com/guide/topics/providers/contacts-provider.html) .

Example 13-16 Initializing the Call Object

```
String calleeId = "bob@example.com"; call = callPackage.createCall(calleeId);
```

Configure Trickle ICE

To improve ICE candidate gathering performance, you can choose to enable Trickle ICE in your application using the Call object's **setTrickleIceMode** method. For more information see "Enabling Trickle ICE to Improve Application Performance." (wd_callsinapps.htm#CIHJJABE)

Example 13-17 Configuring Trickle ICE

```
Log.i(MyApp.TAG, "Configure Trickle ICE options, OFF, HALF, or FULL...");
call.setTrickleIceMode(Call.TrickleIceMode.FULL);
```

Create a Call Observer Object

You next create a **CallObserver** object so you can respond to Call events. Example 13-18 (#CIHDBIDC) provides a skeleton with the appropriate call update, media, and call states, which you can use to handle updates to, and input from, your application accordingly.

Example 13-18 Creating a CallObserver Object

```
create a Call observer object You next create a CallObserver object so you can respond to
Call events. Example 12–18 provides a skeleton with the appropriate call update, media,
and call states, which you can use to handle updates to, and input from, your application
accordingly. Creating a CallObserver Object public class MyCallObserver extends
oracle.wsc.android.call.Call.Observer { @Override public void callUpdated(final
CallUpdateEvent state, final CallConfig callConfig, Cause cause) { Log.i(MyApp.TAG, "Call
updated: " + state); runOnUiThread(new Runnable() { @Override public void run() { switch
(state) { case SENT: break; case RECEIVED: break; case ACCEPTED: break; case REJECTED:
break; default: break; } } }); } @Override public void mediaStateChanged(MediaStreamEvent
mediaStreamEvent, MediaStream mediaStream) { Log.i(MyApp.TAG, "Media State " +
mediaStreamEvent + " for media stream " + mediaStream.label()); } @Override public void
stateChanged(final CallState state, Cause cause) { runOnUiThread(new Runnable() {
@Override public void run() { switch (state) { case ESTABLISHED: Log.i(MyApp.TAG, "Update
the UI to indicate that the call has been accepted..."); break; case ENDED:
Log.i(MyApp.TAG, "Update the UI and possibly close the activity..."); break; case
REJECTED: break; case FAILED: break; default: break; } } }); } }
```

Register the CallObserver with the Call Object

Once you've implemented the **CallObserver**, register it with the Call object.

Example 13-19 Registering a Call Observer

```
call.setObserver(new MyCallObserver());
```

Create a CallConfig Object

You create a **CallConfig** object to determine the type of call you wish to make. The **CallConfig** constructor takes two parameters, both named **MediaDirection**. The first parameter configures an audio call while the second configures a video call:

```
CallConfig(MediaDirection audioMediaDirection, MediaDirection videoMediaDirection)
```

The values for each **MediaDirection** parameter are:

- **NONE**: No direction; media support disabled.
- **RECV_ONLY**: The media stream is receive only.
- **SEND_ONLY**: The media stream is send only.
- **SEND_RECV**: The media stream is bi-directional.

Example 13-20 (#CIHJDCHB) shows the configuration for a bi-directional, audio-only call.

Example 13-20 Creating an Audio CallConfig Object

```
CallConfig callConfig = new CallConfig(MediaDirection.SEND_RECV, MediaDirection.NONE);
```


Configure the Local MediaStream for Audio

With the **CallConfig** object created, you then configure the local audio **MediaStream** using the WebRTC **PeerConnectionFactory**. For information on the WebRTC SDK API, see `http://www.webrtc.org/reference/native-apis` (`http://www.webrtc.org/reference/native-apis`) .

Example 13-21 Configuring the Local MediaStream for Audio

```
Log.i(MyApp.TAG, "Get the local media streams..."); PeerConnectionFactory pcf =
call.getPeerConnectionFactory(); mediaStream = pcf.createLocalMediaStream("ARDAMS");
AudioSource audioSource = pcf.createAudioSource(new MediaConstraints());
mediaStream.addTrack(pcf.createAudioTrack("ARDAMSa0", audioSource));
```

Start the Audio Call

Finally, you start the audio call using the **Call** object's start method and passing it the **CallConfig** object and the **MediaStream** object.

Example 13-22 Starting the Audio Call

```
Log.i(MyApp.TAG, "Start the audio call..."); call.start(callConfig, mediaStream);
```

Terminating the Audio Call

To terminate the audio call, use the **Call** object's **end** method:

```
call.end()
```

> **Note:**
>
> You may want to explicitly set the **MediaStream** object to null as well to reclaim any resources it is using.

Receiving a WebRTC Voice Call in Your Android Application

This section configuring your Android application to receive WebRTC voice calls.

Create a CallPackage Observer

To be notified of an incoming call, create a **CallPackageObserver** and attach it to your **CallPackage**. The CallPackageObserver lets you intercept and respond to changes in the CallPackage object's state.

Example 13-23 A CallPackage Observer

```
public class MyCallPackageObserver extends oracle.wsc.android.call.CallPackage.Observer {
@Override public void callArrived(Call call, CallConfig callConfig, Map<String, ?>
extHeaders) { Log.i(MyApp.TAG, "Registering a call observer..."); call.setObserver(new
MyCallObserver()); Log.i(MyApp.TAG, "Getting the local media stream...");
PeerConnectionFactory pcf = call.getPeerConnectionFactory(); MediaStream mediaStream =
pcf.createLocalMediaStream("ARDAMS"); AudioSource audioSource = pcf.createAudioSource(new
MediaConstraints()); mediaStream.addTrack(pcf.createAudioTrack("ARDAMSa0", audioSource));
Log.i(MyApp.TAG, "Accept or reject the call..."); if (answerTheCall) { Log.i(MyApp.TAG,
"Answering the call..."); call.accept(callConfig, mediaStream); } else { Log.i(MyApp.TAG,
"Declining the call..."); call.decline(StatusCode.DECLINED.getCode()); } } }
```

In Example 13-23 (#CIHHAFHF) , the **callArrived** event handler processes an incoming call request:

1. The method registers a **CallObserver** for the incoming call. In this case, it uses the same CallObserver, **myCallObserver**, from the example in "Create a Call Observer Object." (#CIHHEGDB)

2. The method then configures the local media stream, in the same manner as the example in "Configure the Local MediaStream for Audio." (#CIHEGGEE)

3. The method determines whether to accept or reject the call based upon the value of the **answerTheCall** boolean using either Call object's **accept** or **decline** methods.

> **Note:**
>
> The **answerTheCall** boolean will most likely be set by a user interface element in your application such as a button or link.

Bind the CallPackage Observer to the CallPackage

With the **CallPackageObserver** object created, you bind it to your **CallPackage** object:

```
callPackage.setObserver(new MyCallPackageObserver());
```

Adding WebRTC Video Support to your Android Application

This section describes how you can add WebRTC video support to your Android application. While the methods are almost completely identical to adding voice call support to an Android application, additional preparation is required.

Find and Return the Video Capture Device

Before your application tries to initialize a video calling session, it should verify that the Android device it is running on actually has a video capture device available. Find the video capture device and return a **VideoCapturer** object. For more information on handling an Android device's camera, see `http://developer.android.com/guide/topics/media/camera.html` (http://developer.android.com/guide/topics/media/camera.html) .

Example 13-24 Finding a Video Capture Device

```
private VideoCapturer getVideoCapturer() { Log.i(MyApp.TAG, "Cycle through likely device
names for a camera and return the first " + "available capture device. Throw an exception
if none exists."); final String[] cameraFacing = { "front", "back" }; final int[]
cameraIndex = { 0, 1 }; final int[] cameraOrientation = { 0, 90, 180, 270 }; for (final
String facing : cameraFacing) { for (final int index : cameraIndex) { for (final int
orientation : cameraOrientation) { final String name = "Camera " + index + ", Facing " +
facing + ", Orientation " + orientation; final VideoCapturer capturer =
VideoCapturer.create(name); if (capturer != null) { Log.i(MyApp.TAG, "Using camera: " +
name); return capturer; } } } } throw new RuntimeException("Failed to open a capture
device."); }
```

> **Note:**
>
> Example 13-24 (#CIHCEJEB) is not a robust algorithm for video capturer detection is not recommended for production use.

Create a GLSurfaceView in Your User Interface Layout

Your application must provide a container to display a local or remote video feed. To do that, you add an OpenGL **SurfaceView** container to your user interface layout. In Example 13-25 (#CIHGDFHC) a GLSurfaceView container is created with the ID, *video_view*. For more information on GLSurfaceView containers, see `http://developer.android.com/reference/android/opengl/GLSurfaceView.html` (http://developer.android.com/reference/android/opengl/GLSurfaceView.html) .

> **Note:**
>
> You, of course, customize the GLSurfaceView container for the requirements of your specific application.

Example 13-25 A Layout Containing a GLSurfaceView Element

```
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
xmlns:tools="http://schemas.android.com/tools" android:layout_width="match_parent"
android:layout_height="match_parent"
android:paddingBottom="@dimen/activity_vertical_margin"
android:paddingLeft="@dimen/activity_horizontal_margin"
android:paddingRight="@dimen/activity_horizontal_margin"
android:paddingTop="@dimen/activity_vertical_margin" tools:context=".MyActivity"
android:orientation="vertical" > <android.opengl.GLSurfaceView
android:id="@+id/video_view" android:orientation="horizontal"
android:layout_width="fill_parent" android:layout_height="0dp" android:layout_weight="1"
/> </LinearLayout>
```

Initialize the GLSurfaceView Control

Next, you initialize the **GLSurfaceView** container by finding its ID in your Android application's resource list, *video_view*, and creating a **VideoRenderer** object using the control ID as an argument.

Example 13-26 Initializing the GLSurfaceView Control

```
Log.i(MyApp.TAG, "Initialize the video view control in your main layout."); mVideoView =
(GLSurfaceView) findViewById(R.id.video_view); myVideoRenderer = new
VideoRendererGUI(mVideoView); localRender = myVideoRenderer.create(70, 70, 25, 25);
```

> **Note:**
>
> The **VideoRendererGUI** class is freely available. Use Google Code search to find the latest version.

Placing a WebRTC Video Call from Your Android Application

To place a video call from your Android application, complete the coding tasks contained in the following sections:

- Authenticating with WebRTC Session Controller (#CIHGJADF)
- Configuring Interactive Connectivity Establishment (ICE) (#CIHHEHDG) (if required)
- Creating a WebRTC Session Controller Session (#CIHBAGEJ)

In addition, complete the coding tasks for an audio call contained in the following sections:

- Initialize the Call Object (#CIHCEDHA)
- Configure Trickle ICE (#CIHGIBHA) (if required)
- Create a Call Observer Object (#CIHHEGDB)
- Register the CallObserver with the Call Object (#CIHBJFAE)

> **Note:**
>
> Audio and video call work flows are identical with the exception of media directions, local media stream configuration, and the additional considerations described earlier in this section.

Create a CallConfig Object

You create a **CallConfig** object as described in "Create a CallConfig Object," (#CIHFDGDA) in the audio call section, setting both arguments to **MediaDirection.SEND_RECV**.

Example 13-27 Creating an Audio/Video CallConfig Object

```
CallConfig callConfig = new CallConfig(MediaDirection.SEND_RECV,
MediaDirection.SEND_RECV);
```

Configure the Local MediaStream for Audio and Video

With the CallConfig object created, you then configure the local video and audio MediaStream objects using the WebRTC **PeerConnectionFactory**. For information on the WebRTC SDK API, see `http://www.webrtc.org/reference/native-apis` (http://www.webrtc.org/reference/native-apis) .

Example 13-28 Configuring the Local MediaStream for Video

```
Log.i(MyApp.TAG, "Get the local media streams..."); PeerConnectionFactory pcf =
call.getPeerConnectionFactory(); mediaStream = pcf.createLocalMediaStream("ARDAMS");
Log.i(MyApp.TAG, "Attach the audio source..."); AudioSource audioSource =
pcf.createAudioSource(new MediaConstraints());
mediaStream.addTrack(pcf.createAudioTrack("ARDAMSa0", audioSource)); Log.i(MyApp.TAG,
"Attach the video source..."); videoCapturer = getVideoCapturer(); videoSource =
pcf.createVideoSource(videoCapturer, new MediaConstraints()); final VideoTrack videoTrack
= pcf.createVideoTrack("ARDAMSv0", videoSource); videoTrack.addRenderer(new
VideoRenderer(localRender)); mediaStream.addTrack(videoTrack);
```

In Example 13-28 (#CIHFAAHC) , of note is that the WebRTC SDK **PeerConnectionFactory** adds both an audio and a video stream to the **MediaStream** object. For the **VideoStream** object, a **videoCapturer** object is returned from the **getVideoCapturer** method described in Example 13-24 (#CIHCEJEB) . In addition, the **VideoTrack** object is bound to the **localRender** object created in Example 13-26 (#CIHHJJBC) .

Start the Video Call

Finally, start the audio/video call using the Call object's start method and passing it the **CallConfig** object and the **MediaStream** object.

Example 13-29 Starting the Video Call

```
Log.i(MyApp.TAG, "Start the video call..."); call.start(callConfig, mediaStream);
```

Terminate the Video Call

To terminate the video call, reinitialize the appropriate objects to reclaim their resources, and use the **Call** object's **end** method as with an audio only call.

Example 13-30 Terminating the Video Call

```
Log.i(MyApp.TAG, "Shutting down the call..."); if (videoCapturer != null) {
videoCapturer.dispose(); videoCapturer = null; videoSource.dispose(); videoSource = null;
} call.end(); mVideoView = null; localRender = null; mediaStream = null;
```

Receiving a WebRTC Video Call in Your Android Application

Receiving a video call is identical to receiving an audio call as decribed here, "Receiving a WebRTC Voice Call in Your Android Application." (#CIHFCDHC) The only difference is the configuration of the **MediaStream** object, as described in "Configure the Local MediaStream for Audio and Video." (#CIHJHDDE)

Upgrading and Downgrading Calls

This section describes how you can handle upgrading an audio call to an audio video call and downgrading a video call to an audio-only call in your Android application.

Handle Upgrade and Downgrade Requests from Your Application

To upgrade from a voice call to a video call, you can bind a user interface element such as a button or link to a class containing the Call update logic using the interface object's **setOnClickListener** method:

```
myButton.setOnClickListener(new CallUpdateHandler());
```

You handle the upgrade or downgrade workflow in the **onClick** event handler of the **CallUpdateHandler** class. In Example 13-31 (#CIHEFFAI) the **myButton** object simply serves to toggle video support on and off for the current call object. Once the **CallConfig** object is reconfigured, the actual state change for the call is initiated using the **Call** object's **update** method.

Example 13-31 Handling Upgrade Downgrade Requests from Your Application

```
class CallUpdateHandler implements View.OnClickListener { @Override public void
onClick(final View v) { // Toggle between video on/off MediaDirection videoDirection; if
(call.getCallConfig().shouldSendVideo()) { videoDirection = MediaDirection.NONE; } else {
videoDirection = MediaDirection.SEND_RECV; } Log.i(MyApp.TAG, "Toggle Video"); CallConfig
callConfig = new CallConfig(MediaDirection.SEND_RECV, videoDirection); MediaStream
mediaStream = getLocalMediaStreams(call .getPeerConnectionFactory()); try {
call.update(callConfig, mediaStream); } catch (IllegalStateException e) {
Log.e(MyApp.TAG, "Invalid state", e); } } }
```

Handle Incoming Upgrade Requests

You configure the **callUpdated** method of your **CallObserver** class to handle incoming upgrade requests in the case of a **RECEIVED** state change. See Example 13-18 (#CIHDBIDC) for the complete CallObserver framework. In Example 13-32 (#CIHHCIIB) , a simple Yes/No dialog is presented when an upgrade request is received. Clicking the Yes button accepts the upgrade request, while clicking no declines it.

Example 13-32 Handling an Incoming Upgrade Request

```
case RECEIVED: String mediaConfig = "Video - " + callConfig.getVideoConfig().name(); new
AlertDialog.Builder(CallProgressActivity.this)
.setIcon(android.R.drawable.ic_dialog_alert) .setTitle("Incoming Call Update")
.setMessage("Do you want you accept this update: " + mediaConfig + " ?")
.setPositiveButton("Yes", new DialogInterface.OnClickListener() { @Override public void
onClick( DialogInterface dialog, int which) { MediaStream mediaStream =
getLocalMediaStreams(call.getPeerConnectionFactory()); call.accept(callConfig,
mediaStream); } }) .setNegativeButton("No", new DialogInterface.OnClickListener() {
@Override public void onClick(DialogInterface dialog, int which) {
call.decline(StatusCode.DECLINED.getCode()); } }).show(); break;
```