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Wowza Media Server<sup>®</sup> 3

# User's Guide

# Wowza Media Server 3: User's Guide



**Version: 3.0**

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## What's New

Change	Description	Release Date
Initial Release	Document release	
Doc v3.0.0	Updated for Wowza Media Server 3	October 7, 2011
Doc v3.0.1	Updated Wowza Transcoder Win requirements	November 18, 2011
Doc v3.0.2	Updated Trademarks	January 10, 2012

## Introduction

*What is Wowza Media Server® 3?*

Wowza Media Server 3 is high-performance, extensible and fully interactive media streaming software platform that provides live and on-demand streaming, chat and remote recording capabilities to a wide variety of media player technologies. Wowza Server can deliver content to many popular media players such as Adobe® Flash® Player, Microsoft Silverlight® player, Apple iPhone®, iPad® and iPod® touch and Apple QuickTime® player (version 10 or greater), Android™ smartphones and tablets, and IPTV/OTT set-top boxes among others. Wowza Media Server 3 includes support for many streaming protocols including the Real-Time Messaging Protocol (RTMP), Microsoft Smooth Streaming, Apple HTTP Live Streaming (HLS), Real-Time Streaming Protocol (RTSP), Flash HTTP Streaming protocol, Real-time Transport Protocol (RTP), MPEG2 Transport Streams (MPEG-TS) and more. It is an alternative to the Adobe Flash Media Server products (FMIS and FMSS), Apple Streaming Server (Darwin), Microsoft IIS (Internet Information Services) and other media servers.

For the most up to date information, tutorials and tips, visit the Article section of the Wowza forums:

<http://www.wowza.com/docredirect.php?doc=forumsHome>

To get started quickly with Wowza Media Server 3, see the [Quick Start Guide](#)

## **Real-Time Messaging Protocol (Adobe Flash Player)**

Wowza Media Server 3 communicates with the Adobe Flash player using the Real-Time Messaging Protocol (RTMP). Wowza Server can deliver multi-bitrate live and on-demand media, data and remote procedure call information to and from the Flash player using RTMP. It supports media streaming as well as other features such as: shared objects, video recording, video chat, remote procedure calls and more. Wowza Media Server 3 supports all video and audio formats that the Flash player supports:

### **Video**

- H.264
- VP6
- SorensonSpark
- Screen Share codec

### **Audio**

- AAC, AAC Low Complexity (AAC LC), AAC High Efficiency v1 and v2 (HE-AAC)
- MP3
- Speex
- NellyMoser ASAO

Wowza Server supports five variants of the protocol: RTMP, RTMPE (encrypted RTMP), RTMPT (tunneling), RTMPTE (encrypted RTMPT) and RTMPS (RTMPT over SSL). RTMP is the base protocol and is the most efficient and fastest of the five variants. RTMPT is a tunneling variant of the RTMP protocol that can be used to tunnel through firewalls that employ stateful packet inspection. RTMPE and RTMPTE are encrypted variants of the RTMP and RTMPT protocols that secure the data being transmitted between the Flash player and Wowza Media Server. Wowza Server includes bi-directional support for Action Message Format (AMF) AMF3 and AMF0 for data serialization (AMF3 was introduced in Flash Player 9 and ActionScript 3.0).

## **Flash HTTP Streaming (Adobe Flash Player)**

Wowza Media Server 3 can stream adaptive bitrate live and video on demand content to Flash player 10.1 or greater using the Flash HTTP Dynamic Streaming (HDS) protocol. Flash HDS is a chunk based streaming protocol that uses HTTP for delivery. All media chunking and packaging necessary to deliver a stream using this protocol is performed by Wowza Server. Flash (HDS) is referred to in the Wowza Server documentation and configuration files as sanjose streaming. When streaming video on demand content, Wowza Server supports MP4 files (QuickTime container) and MP3 files (FLV files are not supported at this time). As of the writing of this document Wowza Server supports the following video and audio codecs when using this streaming protocol:

## **Video**

- H.264
- VP6 (live only)
- SorensonSpark (live only)
- Screen Share codec (live only)

## **Audio**

- AAC, AAC Low Complexity (AAC LC), AAC High Efficiency v1 and v2 (HE-AAC)
- MP3
- Speex (live only)
- NellyMoser ASAO (live only)

## **Apple HTTP Live Streaming (iPhone, iPad, iPod touch, QuickTime and more)**

Wowza Media Server 3 can stream adaptive bitrate live and video on demand H.264, AAC and MP3 content to iOS based devices (iPhone/iPad/iPod Touch iOS version 3.0 or greater), QuickTime player (version 10 or greater), Safari® browser (version 4.0 or greater) and other devices such as the Roku® set-top box and some brands of Smart TVs using the Apple HTTP Live Streaming (HLS) protocol. Apple HLS is a chunk based streaming protocol that uses HTTP for delivery. All media chunking and packaging necessary to deliver a stream using this protocol is performed by Wowza Server. Wowza Server supports the encrypted version of the Apple HTTP Live Streaming protocol which uses a 128-bit version of the Advanced Encryption Standard (AES-128). Apple HLS is referred to in the Wowza Server documentation and configuration files as cupertino streaming. There is also the ability to specify a play start time and duration for HTTP streaming.

Wowza Media Server 3 has the ability to send timed data events to the iOS player in the form of ID3 tags. More detailed information regarding this feature can be found in the following article:

<http://www.wowza.com/docdirect.php?doc=usefulCodeCupertinoTimedDataEvents>

Wowza Media Server 3 populates the playlist file with metadata that describes each of the available streams in a multi-bitrate presentation. This enables the iOS based players to intelligently select the appropriate streams based on capabilities of the hardware device.

As of the writing of this document the iPhone, iPad and iPod touch (iOS devices) support the following media formats:

## **Video**

- H.264

## Audio

- AAC, AAC Low Complexity (AAC LC), High Efficiency AAC v1 (HE-AAC)
- MP3

## Microsoft Smooth Streaming (Microsoft Silverlight)

Wowza Media Server 3 can stream multi-bitrate live and video on demand H.264, AAC and MP3 content to the Microsoft Silverlight player, Windows® Phone 7 devices and other devices using the Smooth Streaming protocol. Microsoft Silverlight is a cross-browser, cross-platform technology that exists on many personal computing devices. Smooth Streaming is a chunk based streaming protocol that uses HTTP for delivery. All media chunking and packaging necessary to deliver a stream using this protocol is performed by Wowza Server so there is no need for an IIS 7 server.

The following media formats can be used when streaming to the Silverlight player using Wowza Server:

## Video

- H.264

## Audio

- AAC, AAC Low Complexity (AAC LC), AAC High Efficiency v1 and v2 (HE-AAC)
- MP3

## Real-Time Streaming Protocols (QuickTime, VLC, 3GPP Devices, Set-top Boxes)

Wowza Media Server 3 can stream live H.264, AAC and MP3 content to players and devices that support the Real Time Streaming Protocol (RTSP), Real-time Transport Protocol (RTP) and MPEG2 Transport Stream protocol (MPEG-TS). This includes players and devices such as QuickTime player (version 10 or greater), VideoLAN VLC player, set-top boxes and 3GPP devices. Wowza Server can also accept incoming streams from encoding devices that use these same protocols. Wowza Server supports RTP and MPEG-TS in and out over UDP as well as Multicast. In addition, Wowza Server supports interleaved RTSP/RTP (RTP over the RTSP TCP connection) and RTSP/RTP tunneling (RTSP/RTP over HTTP) which enables RTSP/RTP to be delivered in network environments that do not allow UDP transmission.

Wowza Server supports the following RTSP, RTP and MPEG-TS specifications:

<b>RTSP</b>	rfc2326
<b>RTP: H.264</b>	rfc3984, QuickTime Generic RTP Payload Format
<b>RTP: MPEG2 (video)</b>	rfc2250
<b>RTP: MPEG4 Part 2</b>	rfc3106

<b>RTP: AAC</b>	rfc3640, rfc3016, ISO/IEC 14496-3
<b>RTP: MP3</b>	rfc2250
<b>RTP: Speex</b>	rfc5574
<b>RTP: G.711</b>	rfc3551
<b>MPEG-TS</b>	ISO/IEC 13818-1
<b>MPEG-TS over RTP</b>	rfc2038

Wowza Media Server 3 provides the ability to specify a specific stream, a specific language or a specific audio or video track of an MPEG-TS stream. Query parameters are part of the udp:// URL inside of a .stream file. There are four options for selecting a stream. The query parameters can be found in [this online article](#).

## Video and Audio Streaming, Recording and Chat

Wowza Media Server 3 can stream live and video on demand content to many different player technologies. Wowza Media Server 3 supports the following video on demand file formats: FLV (Flash Video - .flv), MP4 (QuickTime container - .mp4, .f4v, .mov, .m4v, .mp4a, .3gp, and .3g2) and MP3 content (.mp3). Wowza Server can accept live video and audio streams from encoders that support the following protocols; RTMP, RTSP/RTP, native RTP and MPEG-TS. Wowza Server can record any incoming live stream to either the Flash Video (FLV) or MP4 (QuickTime container) format.

Wowza Media Server 3 is able to read and write AMF0 and AMF3 data events to and from MP4 files. In addition, Wowza Server supports MP4 multi-language subtitle and audio tracks. More information is available in this online article:

<http://www.wowza.com/docredirect.php?doc=filewritingMP4DataEvents>

Wowza Media Server 3 can be used to re-stream SHOUTcast and Icecast (MP3, AAC and AAC+) audio streams as well as IP Camera streams (H.264, AAC and MP3) to the supported player technologies. Wowza Server will maintain a single connection back to the original source stream while delivering the stream to multiple players. Wowza Server is also able to forward the embedded SHOUTcast and Icecast metadata such as song title and artist to the Adobe Flash player client as metadata. The SHOUTcast example that ships with Wowza Server illustrates these capabilities.

Wowza Media Server 3 can deliver two-way video, audio and text chat to the Adobe Flash player. This feature can be leveraged to deliver video conferencing applications or two-way messaging applications.

## Wowza Transcoder™ AddOn

The Wowza Transcoder AddOn provides the ability to ingest a live stream, decode the video and audio, and then re-encode the stream to suit the desired playback devices. Wowza Transcoder is a real time video transcoding and transrating solution. It can decode and re-encode audio and video in multiple formats properly key-frame aligned for multi-bitrate delivery. Here are a few common scenarios:

Transcode: Take in a non-H.264 video and non-AAC/MP3 audio media stream and convert it to a properly key frame aligned set of H.264 AAC or MP3 adaptive bitrate media streams.

Transrate: Take in a H.264 video and AAC/MP3 audio stream and create a full set of bitrate renditions that are key frame aligned to the source stream for adaptive bitrate delivery.

The Wowza Transcoder supports the following video and audio formats:

Video (decoding)

- MPEG2
- MPEG4 Part 2

Video (encoding)

- H.264

Audio (decoding):

- MPEG1 Layer 1/2
- MPEG3
- Speex
- G.711 (mu-law and a-law)

Audio (encoding):

- AAC

Full information regarding the Wowza Transcoder can be found in the [Wowza Transcoder User's Guide](#) and the Wowza forums at:

<http://www.wowza.com/docredirect.php?doc=forumsHome>

### Wowza nDVR™ AddOn (beta)

Wowza nDVR AddOn provides the ability to record a live stream into a cache on Wowza Media Server 3 while allowing users to play or pause a live stream, rewind to a previously recorded point, or resume viewing at the current live point. Customization is possible through XML configurations and the available APIs. Setup for client playback of recorded streams is similar to playback of live streams from Wowza Media Server 3.

Full information regarding the Wowza nDVR can be found in the [Wowza nDVR AddOn User's Guide](#) and the Wowza forums at:

<http://www.wowza.com/docredirect.php?doc=forumsHome>

### Wowza DRM™ AddOn

Wowza DRM AddOn provides integration with third party Digital Rights Management (DRM) Key Management Systems (KMS) to add on the fly encryption for both live and video on demand workflows. For the live workflow, encryption per-stream is available with the ability to rotate keys. For the on-demand workflow, encryption per-asset or per-session

is available with the ability to rotate keys. Both live and video on demand key rotation support is available for Apple HLS streaming.

As of this writing, integration for Verimatrix® VCAST™ for HLS playback with ViewRight® clients for iPhone/iPad, PC and set-top boxes and Microsoft PlayReady® for Silverlight smooth streaming client playback is supported.

Full information regarding the Wowza DRM can be found in the [Wowza DRM online tutorial](#) and the Wowza forums at:

<http://www.wowza.com/docredirect.php?doc=forumsHome>

## Extending the Server

Wowza Media Server 3 is built using Java technology. The server can be extended by writing custom Java classes that are dynamically loaded at runtime. Server extensions (also referred to as modules) run at the full speed of the server. The server includes a rich API to interact with and control the streaming process. Wowza Server ships with several example server extensions. See the chapter **Extending Wowza Media Server 3 Using Java**. Visit the Article section of the [Wowza forums](#) for code examples.

## Adobe Flash Player Features

Wowza Media Server 3 includes support for two Adobe Flash specific features; Remote Shared Objects (RSO) and bi-directional remote procedure calls. Remote Shared Objects are an extension of ActionScript® objects that enables the synchronization of shared object data between Flash players on the same or different client machines. Shared data is synchronized by the Wowza Server through an event based synchronization method. RSO's can also be persisted on the server to maintain data across sessions.

Bi-directional remote procedures calls are a way for ActionScript code running in the Flash player to invoke methods and pass data to Wowza Server. Wowza Server can in turn invoke methods and pass data to the Flash player. This enables rich client/server applications to be built using the Flash player and Wowza Server. These features are available when using the RTMP protocol.

## Server Architecture

Wowza Media Server 3 is a pure Java server. It is written in Java and can be extended dynamically using custom Java classes. Wowza Server can be deployed in any environment that supports the Java 6 and Java 7 virtual machine or later. Wowza Server is fully 64-bit compliant. It is architected to be highly multi-threaded and can take full advantage of multi-core hardware. All logging is done using the log4j logging component and utilizes the W3C Extended Common Log Format (ECLF).

Wowza Media Server 3 was architected from the ground up to handle multiple streaming protocols. The server side API is designed to make it easy to control the streaming process of each of the supported streaming protocols and player technologies. Streaming is controlled through the creation and configuration of a streaming application. A single application can be

configured to simultaneously deliver live or video on demand content to multiple player technologies.

Wowza Media Server 3 includes the ability to share a single server using a virtual hosting configuration. Virtual hosts can be configured with their own system resource and streaming limitations.

## Wowza Media Server 3 Editions

Wowza Media Server 3 comes in five editions: Trial, Monthly, Daily, Perpetual and Developer.

Trial Edition	The free Trial Edition provides full, unrestricted functionality of Wowza Media Server 3 and AddOns, but is limited to 30 days of use from the date of issue and the Wowza Transcoder™ streams contain audio/video watermarks. Other restrictions apply as described in the Wowza Media Software EULA.
Monthly or Daily Editions	These licenses provide full, unrestricted functionality of Wowza Media Server 3 and AddOns, and allow the use of an unlimited number of server instances and AddOns under a single license key. The Monthly and Daily Editions differ only in payment terms. The use of these Editions is further permitted on Amazon® Elastic Compute Cloud® (“EC2”) and other computing cloud environments. See Wowza Media Software EULA for more information.
Perpetual Edition	The Perpetual Edition provides full, unrestricted functionality of Wowza Media Server 3, but requires separate license keys for each server. In addition, each AddOn feature is licensed separately. Wowza nDVR™ AddOn and Wowza DRM™ AddOn licenses provide unlimited connection capacity per instance. Each Wowza nDVR and Wowza DRM license must be used with a Wowza Media Server 3 Perpetual Edition license. Each Wowza Transcoder AddOn license is limited to two incoming channels (streams) and an unlimited number of outbound streams per Wowza Media Server 3 Perpetual Edition license. Multiple Wowza Transcoder AddOn licenses can be stacked on a single Wowza Media Server 3 Perpetual Edition license for additional channel capacity. See Wowza Media Software EULA for more information.
Developer Edition	The Developer Edition provides full, unrestricted functionality of Wowza Media Server 3 and AddOns, but is limited to 180 days of use from the date of issue, and is further limited to ten (10) concurrent connections with live streaming restricted to one (1) inbound and nine (9) outgoing streams. The Wowza Transcoder streams contain audio/video watermarks. See Wowza Media Software EULA for more information.

## Server Installation

*How do I install Wowza Media Server 3?*

Wowza Media Server 3 is a small and powerful Java server. Below are the instructions needed to choose the correct version of Java and install and run Wowza Server.

### Before Installation

Wowza Media Server 3 is a Java 6 (aka 1.6) and Java 7 (aka 1.7) application. To run, it requires the installation of a Java 6 or greater runtime environment (JRE). To develop server side applications, a Java Development Kit (JDK) version 6 or later is required. The server also implements a Java Management Extensions (JMX) interface that can be used to manage and monitor the server. One of the more popular JMX consoles is JConsole, which ships with the JDK. Wowza Media Server 3 also includes an AddOn transcoder feature, which is only available for Windows or Linux when using a 64-bit operating system and 64-bit version of the Java VM.

So what does this all mean? If you are developing server side applications or are going to monitor a local or remote Wowza Server, you need to install Java Development Kit version 6 (aka 1.6) or 7 (aka 1.7) or greater. If you are simply deploying Wowza Server for production use, then you need only install a Java runtime environment version 6 (aka 1.6) or 7 (aka 1.7) or greater. We recommend installing the most recent version of the Java JDK or JRE for your platform. We do, however, recommend running a 64-bit operating system along with the most recent 64-bit version of the Java JDK or JRE for your platform in order to obtain the best performance.

#### Note

We suggest that you deploy Wowza Media Server 3 under the most recent 64-bit version of either the Java Development Kit (JDK) or Java Runtime Environment (JRE) available on your platform running under a 64-bit OS. On the Windows platform the Java Runtime Environment does not include the **server** runtime environment (which is explained in the tuning instructions). This environment is included with the Java Development Kit. For this reason when running on Windows, we suggest installing the JDK.

Once you have your Java environment installed and configured, you can validate that it is correct by opening a command prompt (command shell) and entering the command **java -version**. If

correctly installed and configured, it will return a version number that is equal to or greater than 1.6.

#### Note

The Support section of the Wowza website contains additional information and links to help with obtaining the correct Java environment and tools for your platform. You can visit this site at: <http://www.wowza.com/forums>.

#### Note

Wowza Media Server 3 on the Windows platform uses the JAVA\_HOME environment variable to determine the location of the Java environment under which to run. If you have problems starting Wowza Media Server 3 on Windows, double check to be sure the JAVA\_HOME variable is pointing to a Java 6 (aka 1.6) or greater Java environment. When making changes or upgrades to your Java environment that may affect the installation path, be sure to update the JAVA\_HOME variable to point to the new location. The JAVA\_HOME variable should point to the base folder of the Java installation. This is the folder that contains the **bin** folder.

## Installing the Server

On the Windows and Mac OS X platforms Wowza Media Server 3 is installed using an installer. On Linux<sup>®</sup>, Solaris<sup>®</sup> and other Unix<sup>®</sup> based platforms, the software is installed using a self extracting binary installer. These are available for download at:

<http://www.wowza.com/pricing/installer>

The most up to date information about the installation process can be found in the articles section of the Wowza forums.

<http://www.wowza.com/docredirect.php?doc=forumsHome>

## Windows

To install Wowza Media Server 3 on Windows, double-click the installer file and follow the instructions on the screen. During the installation process you will be asked to enter the product license key. You cannot proceed with the installation until you have entered a valid license key. There is information below on how to change your license key if you need to upgrade your server license. Files will be installed to the following location:

/Program Files (x86)/Wowza Media Systems/Wowza Media Server 3.0.5

### Note

To run the Wowza Transcoder on 64-bit Windows Server 2008 the following two components are required:

- \* .NET Framework 3.5.1 Feature
- \* Desktop Experience

Here you will find documentation, server application files and folder bin, conf, content, examples, lib and logs.

To uninstall, choose **Uninstall Wowza Media Server** from the **Start>Programs>Wowza Media Server 3.0.5** menu.

## Mac OS X

To install Wowza Media Server 3 on Mac OS X, mount the disk image (double-click .dmg) file, double-click the installer package (.pkg) file and follow the instructions on the screen. Files will be installed to the following locations.

/Applications/Wowza Media Server 3.0.5	- server startup/shutdown scripts & documentation
/Library/WowzaMediaServer	- server application files and folders: applications, bin, conf, content, examples, lib and logs
/Library/LaunchDaemons	- background service script com.wowza.WowzaMediaServer.plist

The first time you run the server in standalone mode you will be asked to enter your license key. The license key is stored in the file **/Library/WowzaMediaServer/conf/ Server.license**. There is information below on how to change your license key if you need to upgrade your server license.

To uninstall, throw the following folders and files into the trash.

folder:	/Applications/Wowza Media Server 3.0.5
folder:	/Library/WowzaMediaServer-3.0.5
symlink:	/Library/WowzaMediaServer
file:	/Library/LaunchDaemons/com.wowza.WowzaMediaServer.plist

## Linux

To install on Linux systems follow the steps below:

### Red Hat Package Manager Systems

```
sudo chmod +x WowzaMediaServer-3.0.5.rpm.bin
```

```
sudo ./WowzaMediaServer-3.0.5.rpm.bin
```

To uninstall:

```
sudo rpm -e WowzaMediaServer-3.0.5
```

### Debian Package Manager Systems

```
sudo chmod +x WowzaMediaServer-3.0.5.deb.bin
```

```
sudo ./WowzaMediaServer-3.0.5.deb.bin
```

To uninstall:

```
sudo dpkg --purge wowzamediaserver-3.0.5
```

You will be asked to agree to the **Wowza Media Software End User License Agreement (“Wowza Media Software EULA”)**. The package manager will extract and install the files in the **/usr/local/WowzaMediaServer-3.0.5** directory. The server will be installed as the root user. The first time you run the server in standalone mode you will be asked to enter your license key. The license key is stored in the file **/usr/local/WowzaMediaServer/conf/Server.license**. There is information below on how to change your license key if you need to upgrade your server license.

### Other Linux and Unix Systems

To install the server on other Linux and Unix based systems, such as Solaris, open a terminal window. Download **WowzaMediaServer-3.0.5.tar.bin** to any directory, and execute the self extracting installer:

```
sudo chmod +x WowzaMediaServer-3.0.5.tar.bin
```

```
sudo ./WowzaMediaServer-3.0.5.tar.bin
```

You will be asked to agree to the **Wowza Media Software EULA**. The self-extracting installer will install the files in the **/usr/local/WowzaMediaServer-3.0.5** directory. The server will be installed as the root user. The first time you run the server in standalone mode you will be asked to enter your license key. The license key is stored in the file **/usr/local/WowzaMediaServer/conf/Server.license**. There is information below on how to change your license key if you need to upgrade your server license.

To uninstall:

```
sudo rm -rf WowzaMediaServer-3.0.5
```

## Starting and Stopping the Server

### Windows: Standalone

On Windows, Wowza Media Server 3 can be started in standalone mode from the **Start** menu: **All Programs>Wowza Media Server 3.0.5>Wowza Startup/Shutdown**.

The server can also be started from a DOS command prompt. To do this, open a DOS command prompt and execute the following commands:

```
cd %WMSAPP_HOME%\bin
startup.bat
```

To stop the server open another command prompt and execute the following commands:

```
cd %WMSAPP_HOME%\bin
shutdown.bat
```

### Windows: Service

To start the server as a Windows service, from the **Windows Start** menu, enter **Services** into the search field. A list of search results will be displayed - select **Services** from the results. Scroll down the list until you locate the **Wowza Media Server 3** entry. Next, right click on the entry and select **Start** from the context menu. To stop the server select **Stop** from the same context menu. To configure the service to run each time Windows restarts, select **Properties** from the right click context menu, set **Startup type** to **Automatic** and click the **OK** button to close the dialog.

#### Note

By default the Windows service is running under the **Local System Account**. This can limit how Wowza Media Server 3 can interact with the underlying operating system. For example you might not be able to connect to Wowza Media Server 3 using JConsole/JMX or you may have issues streaming content from UNC paths. To address these issues, modify the service to run as a named user in the **Log On** tab of the service properties dialog.

#### Note

The hardware acceleration (nVIDIA® CUDA® and Intel® Quick Sync™) used by the Wowza Transcoder is only available when running Wowza Media Server 3 as a standalone application. The hardware acceleration will not be available when Wowza Media Server 3 is invoked as a service.

### Mac OSX: Standalone

On Mac OS X the server can be started in standalone mode either by invoking it from the **Server Startup** script in **/Applications/Wowza Media Server 3.0.5** or by opening a **Terminal** window and entering the following commands:

```
cd /Library/WowzaMediaServer/bin
./startup.sh
```

To stop the server open another Terminal window and enter the following commands:

```
cd /Library/WowzaMediaServer/bin
./shutdown.sh
```

## **Mac OSX: Service**

To start the server as a Mac OS X launchd service, open a **Terminal** window and enter:

```
sudo launchctl load -w /Library/LaunchDaemons/com.wowza.WowzaMediaServer.plist
```

To stop the service, enter:

```
sudo launchctl unload -w /Library/LaunchDaemons/com.wowza.WowzaMediaServer.plist
```

## **Linux: Standalone**

To start the server in standalone mode on Linux, open a command shell then enter the following commands:

```
cd /usr/local/WowzaMediaServer/bin
./startup.sh
```

To stop the server enter:

```
./shutdown.sh
```

## **Linux: Service**

To start the server as a Linux service, open a command prompt and enter one of these two commands (it differs based on your Linux distribution):

```
/sbin/service WowzaMediaServer start
```

or

```
/etc/init.d/WowzaMediaServer start
```

To stop the service, enter one of these two commands:

```
/sbin/service WowzaMediaServer stop
```

or

```
/etc/init.d/WowzaMediaServer stop
```

### Note

The method of running init.d based services may be different on different Linux distributions. Please consult your Linux manual if these instructions do not apply to your Linux distribution.

### Note

The Linux services script subsystem does not use the full \$PATH definition to determine the location of Linux commands. It uses what is known as the **init** path. This can lead to an issue on Linux distributions where the default installation location for Java cannot be found by applying the **init** path. See this support article for more information:

<http://www.wowza.com/docredirect.php?doc=tipsJavaInstall>

## Entering a New License Key

License keys for all Wowza products, Wowza Media Server 3 and AddOns, are stored in [install-dir]/conf/Server.license.

%WMSCONFIG_HOME%\conf\Server.license	- Windows
/Library/WowzaMediaServer/conf/Server.license	- Mac OS X
/usr/local/WowzaMediaServer/conf/Server.license	- Linux/Unix

Monthly or Daily Edition subscribers will have a single license key.

Perpetual Editions users may have more than one key to enable purchased AddOns.

To change or add a license key, edit this file using a text editor and enter each new license key on a new line. Upon next launch of the standalone server, the new license will be in effect. The licenses are additive, so when adding additional licenses, retain the original license information in the file and add each new license key on its own new line. The order that the keys are listed is not important. The first and last five digits of the license key will be displayed in the console window.

Example Server.license file for a Perpetual Edition user with a Wowza Media Server 3 license key, two Wowza Transcoder license keys and one Wowza nDVR license key.

```
SVRP3-LaGpC-ZrTD9-F4Y3S-a9bR2-h5t3C
TRN23-Ry6qe-4mT8J-yKj2W-4N5sH-2Td3a
TRN23-y9Gj2-kneqT-2zjHp-GadzB-N6fwa
DVRA3-k3r3R-nzxCB-ypjs5-Sk3y9-ahFdF
```

## Ports Used For Streaming

Before streaming with Wowza Media Server 3, it is important that you open the following ports on your firewall. The table below represents the default ports Wowza Server uses for streaming. All of these port numbers are configurable through the configuration files described later in this document.

TCP 1935	<b>RTMP/RTMPT/RTMPE/RTSP-interleaved Streaming</b>
UDP 6970-9999	<b>RTP UDP Streaming</b>
TCP 8084-8085	<b>JMX/JConsole Monitoring and Administration</b>
TCP 8086	<b>Administration</b>

By default Wowza Media Server 3 is configured to only use TCP port 1935 for streaming. You may want to configure additional ports for streaming such as TCP port 80 for HTTP or RTMPT or TCP port 554 for RTSP streaming. To add an additional port using a text editor, edit **[install-dir]/conf/VHost.xml** and add the additional ports to the **<Port>** list (this list is comma delimited). Wowza Server cannot share ports with other programs or services. So be sure there are no other programs or services running that share the added ports. Below is a table of common ports used for streaming:

TCP 80	<b>RTMPT, Smooth Streaming, Cupertino Streaming, San Jose Streaming</b>
TCP 443	<b>RTMPS</b>
TCP 554	<b>RTSP</b>

## Server Configuration and Tuning

Wowza Media Server 3 is configured through a set of XML, configuration and properties files in the **[install-dir]/conf** folder. These configuration files are read during server startup. The configuration files can be directly edited using a standard text editor. Below is a brief explanation of each of the configuration files:

### Server Configuration Files

Server.xml	- General Server configuration
VHosts.xml	- Define virtual hosts
log4j.properties	- Logging configuration

## Virtual Host Configuration Files

Authentication.xml	- RTSP and HTTP authentication configuration
DVR.xml	- nDVR base configuration
HTTPStreamers.xml	- Cupertino, Smooth and San Jose Streaming configuration
LiveStreamPacketizers.xml	- HTTP packetization configuration
LiveStreamTranscoders.xml	- Transcoder base configuration
MediaCasters.xml	- MediaCaster (SHOUTcast, Live Repeater...) configuration
MediaReaders.xml	- File format reader configuration
MediaWriters.xml	- File format writer configuration
MP3Tags.xml	- MP3 ID3 tag naming
RTP.xml	- RTP and MPEG-TS packetization configuration
StartupStreams.xml	- Streams started at virtual host startup
Streams.xml	- Stream type configuration
VHost.xml	- Virtual host configuration

## Application Configuration Files

Application.xml	- Application configuration
-----------------	-----------------------------

The **Configuration Reference** document that accompanies this User's Guide contains detail information on each of these configuration files.

The settings associated with the Java runtime environment, such as the command used to invoke Java and the maximum Java heap size, are controlled through a set of scripts and configuration files. The location of these files differs depending on platform and the method used to invoke the server. Below is a description of each of these files.

### bin\setenv.bat (Windows)

The bin\setenv.bat is invoked when the server is started from the command line. The most important settings in this file are:

```
set _EXECJAVA=java          # Command used to invoke java
set JAVA_OPTS="-Xmx768M"    # Command line options for java
                             command
```

### bin\WowzaMediaServer-Service.conf (Windows)

The bin\WowzaMediaServer-Service.conf is the configuration file used when the server is invoked as a Windows service. The most important settings in this file are:

```
wrapper.java.command=%JAVA_HOME%\bin\java.exe wrapper.java.init
memory=3 # Initial Java Heap Size (in MB)
wrapper.java.additional.1=-Xmx768M)
```

### /Library/WowzaMediaServer/bin/setenv.sh (Mac OS X)

The bin/setenv.sh is invoked when the server is started in standalone and service mode. The most important settings in this file are:

```
_EXECJAVA=java          # Command used to invoke java
JAVA_OPTS="-Xmx768M"    # Command line options for java command
```

## **/usr/local/WowzaMediaServer/bin/setenv.sh (Linux)**

The bin/setenv.sh is invoked when the server is started in standalone mode. The most important settings in this file are:

```
_EXECJAVA=java          # Command used to invoke java
JAVA_OPTS="-Xmx1200M"    # Command line opts for java command
```

### **Note**

It is very import that Wowza Media Server 3 be tuned properly so that it can take best advantage of the available hardware resources. The default tuning of the server is sufficient for application development, but it not for productions use. Without proper tuning, the server under medium to heavy load will run out of resources and will stop working properly. See the **General Tuning Guide** support article online at:

<http://www.wowza.com/docredirect.php?doc=performanceGeneralTuning>

## **Run Server as Named User**

The default installation of Wowza Media Server 3 on Linux and Mac<sup>®</sup> OS X<sup>®</sup> will install and run the server as the **root** user. If you would like to run the server as a user other than **root**, you can follow these instructions to create a new user and configure the server to run as that new user.

### **Note**

For security reasons, most Linux and Unix distributions do not allow user's other than the **root** user to bind to port numbers less than 1024. If you plan on running Wowza Server on a lowered numbered ports such as 80 (HTTP), 443 (RTMPS, HTTPS) and/or 554 (RTSP) then the server will need to continue to run as the **root** user.

## **Linux**

First, we are going to create a new user and group named **wowza**.

```
groupadd wowza
useradd -g wowza wowza
passwd wowza
```

Next, we are going to change ownership and permissions on Wowza Server installation files.

```
cd /usr/local
chown wowza:wowza WowzaMediaServer
chown -R wowza:wowza WowzaMediaServer-3.0.5
chmod -R 775 WowzaMediaServer-3.0.5
rm -f /var/run/WowzaMediaServer.pid
rm -f /var/run/WowzaMediaServer.lock
```

Finally, we are going to change the command that is used to start the server so that it is run as the new **wowza** user. Change directory to the **/usr/local/WowzaMediaServer/bin** directory. Edit the standalone startup script **startup.sh** and prepend **sudo -u wowza** to the 24<sup>th</sup> line. It should now be:

```
sudo -u wowza $_EXECJAVA $JAVA_OPTS $JMXOPTIONS -
Dcom.wowza.wms.runmode="standalone" -
Dcom.wowza.wms.native.base="linux" -
Dcom.wowza.wms.AppHome="$WMSAPP_HOME" -
Dcom.wowza.wms.ConfigURL="$WMSCONFIG_URL" -
Dcom.wowza.wms.ConfigHome="$WMSCONFIG_HOME" -cp
$WMSAPP_HOME/bin/wms-bootstrap.jar
com.wowza.wms.bootstrap.Bootstrap start
```

You will also need to edit the service startup script **wms.sh** and make the same change to line 24. Now both the standalone startup script and the service startup script will start the server as the user **wowza**.

## Mac OS X

First, we are going to create a new user named **wowza**. Open the **Accounts** systems preferences panel. Unlock the add user functionality by clicking on the lock icon in the lower left hand corner of the panel (you will be asked to enter your administrative password). Click the **+** button below the list of users to add a new user. Enter the following values and click the **Create Account** button:

```
Name:          wowza
Short Name:     wowza
Passord:        [enter a password]
Verify:         [enter a password]
```

Next, we are going to change the permissions on Wowza Media Server 3 installation files. Open a **Terminal** window and enter the following commands:

```
cd /Library
sudo chown wowza:admin WowzaMediaServer
sudo chown -R wowza:admin WowzaMediaServer-3.0.5
```

Finally, we are going to change the command that is used to start the server so that it is run as the new **wowza** user. Change directory to the **/Library/WowzaMediaServer/bin** directory. Edit

the standalone startup script **startup.sh** and prepend **sudo -u wowza** to the 24<sup>th</sup> line. It should now be:

```
sudo -u wowza $_EXECJAVA $JAVA_OPTS -Dcom.wowza.wms.AppHome=
"$WMSAPP_HOME" -Dcom.wowza.wms.ConfigHome=
"$WMSCONFIG_HOME" -cp
$WMSAPP_HOME/bin/wms-bootstrap.jar
com.wowza.wms.bootstrap.Bootstrap start
```

Now when you start the server in standalone and service mode it will run as user **wowza**. You can verify this by executing the **ps -ja** command in a **Terminal** window while the server is running.

## Upgrading from a Previous Release

Before upgrading to Wowza Media Server 3 the previously installed version should first be uninstalled.

The steps for upgrading to Wowza Media Server 3 from a previous release (such as Wowza Media Server 2) should be followed in the available [Upgrade Guide](#).

## Co-Existence of Multiple Wowza Media Server Versions

It is possible for multiple versions of Wowza Media Server to be installed at the same time for testing and comparison purposes. Only one version should be running / started at any one time due to network port conflicts. You will also need to ensure that the additional Wowza Media Server is properly licensed.

During installation each different version is installed to a folder with its unique folder name,

Example:

### Linux:

```
/usr/local/WowzaMediaServer-2.2.4
/usr/local/WowzaMediaServer-3.0.5
```

### Windows:

```
C:\Program Files (x86)\Wowza Media Systems\Wowza Media Server 2.2.4
C:\Program Files (x86)\Wowza Media Systems\Wowza Media Server 3.0.5
```

### Linux:

During installation the Linux installer creates a symbolic link in `/usr/local` named `WowzaMediaServer` that points to the most recent installation. The same symbolic link is used by all versions, so if 2.2.4 was previously installed and 3.0.5 installed later then the link will point to the 3.0.5 install.

The symbolic link should be updated to point to whichever version needs to be run at the time. So if 2.2.4 is required then the link would need to be updated as follows before starting the server:

```
sudo ln -s /usr/local/WowzaMediaServer-2.2.4 /usr/local/WowzaMediaServer
```

### Windows:

Switching between installed versions on Windows platforms involves updating the following environment variables to point to the required installation version:

WMSAPP\_HOME  
WMSCONFIG\_HOME

Switching to use Wowza Media Server 3 from Wowza Media Server 2.2.4 you would update as follows:

Start->Control Panel->System and Security->System->Advanced->Environment Variables->System Variables

Edit WMSAPP\_HOME and change and change variable value from:

C:\Program Files (x86)\Wowza Media Systems\Wowza Media Server 2.2.4

To:

C:\Program Files (x86)\Wowza Media Systems\Wowza Media Server 3.0.5

Edit WMSCONFIG\_HOME and change variable value from:

C:\Program Files (x86)\Wowza Media Systems\Wowza Media Server 2.2.4

To:

C:\Program Files (x86)\Wowza Media Systems\Wowza Media Server 3.0.5

Click OK after changing each value, then click OK and Apply.

The server can then be started as normal (see platform specific startup instructions earlier in this Chapter).

### Patch Updates

There will be patch updates made available from time to time. Specific instructions for installing such patches will be provided, within a ReadMe file, with the Patch archive file.

## Application Configuration

*How do I create and configure an application for streaming?*

All streaming in Wowza Media Server 3 is controlled through the creation and configuration of an application. An application is defined simply by creating a folder in the **[install-dir]/applications** folder. For example, to create a new application named **myapplication**, create the folder:

**[install-dir]/applications/myapplication**

A single application can be configured to deliver a live or video on demand stream to the Adobe Flash player, the Silverlight player, an Apple iOS devices (iPhone, iPad or iPod touch, Roku set-top box) and an RTSP/RTP based player (including 3GPP smart phones and tablets, and Android based devices) at the same time. The [Quick Start Guide](#) contains basic tutorials with the step by step instructions on how to configure an application for the more common streaming tasks. The remainder of this chapter will cover the details of application configuration. For more detailed configuration information see the **Configuration Reference** document that accompanies this document.

### Applications and Application Instances (Application.xml)

As seen above, an application is created by creating a named folder in **[install-dir]/application**. The name of the application is the name of the folder. An **Application.xml** file defines the configuration for a given application. An application instance is an instantiation of an application and provides a name space and context for streaming. An application instance is started dynamically and a single application may have multiple named application instances all running at the same time. If no name is specified for an application instance then the default name **\_definst\_** is used. In many streaming scenarios, a single application instance is used per-application and the name is never referenced and defaults to **\_definst\_**. Multiple application instances are more commonly used in video chat and video conferencing scenarios where you need to create multiple rooms for streaming. In this case, an application instance is used to separate streaming into rooms. Each room is a separate application instance and provides separation and a name space for each room.

Application configuration is defined in an **Application.xml** file. When an application instance is loaded, it looks in the following two locations for an **Application.xml** file (where **[application]** is the application name):

```
[install-dir]/conf/[application]/Application.xml
[install-dir]/conf/Application.xml
```

The first **Application.xml** file located will be used.

### Note

It is a common mistake to put the **Application.xml** file in the **[install-dir]/applications/[application]** folder. All configuration files for Wowza Server and its applications should be located in the **[install-dir]/conf** folder.

## URL Formats

All streaming in Wowza Media Server 3 is initiated with a Uniform Resource Locator (URL). The application and application instance names are specified as part of the streaming URL. The URL format used for streaming whether it be for the Flash player, Silverlight, RTSP/RTP or iOS devices all follow a similar format:

```
[protocol]://[address]:[port]/[application]/[appInstance]/[streamName]/[post-fix]
```

Where:

[protocol]:	- streaming protocol (rtmp, rtsp, http ...)
[address]:	- address of the server running Wowza Server
[port]:	- port number to use for streaming (1935 is the default)
[application]	- application name
[appInstance]	- application instance name
[streamName]	- stream name and prefix
[post-fix]	- option information specific to player technology

In most streaming scenarios, if the stream name does not contain any path elements and the default application instance name is to be used, the URL can be shortened to:

```
[protocol]://[address]:[port]/[application]/[streamName]
```

Below are example URLs for the different player technologies. This example assumes we are streaming the live video with the stream name **myStream** using the application name **live**.

#### Adobe Flash Player (RTMP):

```
Server: rtmp://mycompany.com/live
Stream: myStream
```

#### Adobe Flash Player (Flash HTTP - San Jose Streaming):

```
http://mycompany.com:1935/live/myStream/manifest.f4m
```

#### Apple iPhone, iPad or iPod touch (Cupertino Streaming):

```
http://mycompany.com:1935/live/myStream/playlist.m3u8
```

#### Microsoft Silverlight (Smooth Streaming):

```
http://mycompany.com:1935/live/myStream/Manifest
```

**RTSP/RTP:**

rtsp://mycompany.com:1935/live/myStream

Now is probably a good time to take a quick look at the default **Application.xml** file. Use a text editor to edit the default[install-dir]/conf/Application.xml file. The rest of this chapter covers the more commonly configured items in this file.

## Stream Types

Wowza Media Server 3 uses named stream types to control the different types of streaming (live, video on demand, chat, remote recording...). Stream types are configured using the **Streams/StreamType** property in **Application.xml**. Stream types are defined in [install-dir]/conf/Streams.xml. Below is a list of the stream types and their uses:

Stream Type	Use
<b>default</b>	Video on demand
<b>file</b>	Video on demand
<b>record</b>	Video recording
<b>live</b>	Publish and play live video content (best for one-to-many streaming of live events)
<b>live-lowlatency</b>	Publish and play live video content (best for one-to-one or one-to-few video/audio chat applications)
<b>live-record</b>	Same as <b>live</b> in addition content will be recorded
<b>live-record-lowlatency</b>	Same as <b>live-lowlatency</b> in addition content will be recorded
<b>shoutcast</b>	Audio re-streaming of a SHOUTcast/Icecast MP3 or AAC+ audio stream
<b>shoutcast-record</b>	Same as <b>shoutcast</b> in addition content will be recorded
<b>liverepeater-origin</b>	Publish and play live video content across multiple Wowza Media Server servers in an origin/edge configuration (use to configure origin application)
<b>liverepeater-origin-record</b>	Same as <b>liverepeater-origin</b> in addition content will be recorded
<b>liverepeater-edge</b>	Publish and play live video content across multiple Wowza Servers in an origin/edge configuration (use to configure edge application)
<b>liverepeater-edge-lowlatency</b>	Publish and play live video content across multiple Wowza Servers in an origin/edge configuration (use to configure edge application when latency is important)
<b>liverepeater-edge-origin</b>	Publish and play live video content across multiple Wowza Servers in an origin/edge/edge configuration (use to configure an middle-edge application)
<b>rtp-live</b>	Re-streaming of an RTSP/RTP, native RTP or MPEG-TS stream
<b>rtp-live-lowlatency</b>	Re-streaming of an RTSP/RTP, native RTP or MPEG-TS stream when latency is important)
<b>rtp-live-record</b>	Same as <b>rtp-live</b> in addition content will be recorded

<b>rtp-live-record-lowlatency</b>	Same as <b>rtp-live-lowlatency</b> in addition content will be recorded
-----------------------------------	---

Each stream type exposes properties that are used for tuning of the stream type. For example, the stream type definition for **live** and **live-lowlatency** only differ in the tuning which is accomplished through the stream properties. Properties defined in **[install-dir]/conf/Streams.xml** for a given stream type can be overridden on a per-application basis by defining new values in the **Streams/Properties** container in **Application.xml**. For example, to change the **flushInterval** of the **live-lowlatency** stream type the **<Streams>** section of the **Application.xml** should look like this:

```
<Streams>
  <StreamType>live-lowlatency</StreamType>
  <StorageDir>${com.wowza.wms.context.VHostConfigHome}/content</StorageDir>
  <KeyDir>${com.wowza.wms.context.VHostConfigHome}/keys</KeyDir>
  <LiveStreamPacketizers></LiveStreamPacketizers>
  <Properties>
    <Property>
      <Name>flushInterval</Name>
      <Value>30</Value>
      <Type>Integer</Type>
    </Property>
  </Properties>
</Streams>
```

## Wowza Transcoder AddOn and Wowza nDVR AddOn Configurations

There are two sections, DVR and Transcoder, in the **Application.xml** file, that serve to configure the application to use the Wowza nDVR AddOn and/or the Wowza Transcoder AddOn. Further information regarding these sections can be found in the tutorials and **Configuration Reference** provided with this guide.

Wowza Transcoder AddOn tutorial,

<http://www.wowza.com/docredirect.php?doc=tutorialsTranscoder>

Wowza nDVR AddOn tutorial,

<http://www.wowza.com/forums/content.php?300-How-to-setup-and-run-Wowza-network-DVR>

## HTTPStreamers and LiveStreamPacketizers

The **<HTTPStreamers>** setting in **Application.xml** controls if the streams in the defined application (live or video on demand) are made available for playback to iOS devices, Microsoft Silverlight players and HTTP streaming to Adobe Flash players. **HTTPStreamers** can contain none, one or more the following values (separated by commas): **cupertinostreaming**, **smoothstreaming**, **sanjosestreaming**. If the **cupertinostreaming** value is present then the stream is available for playback by iOS devices (as well as with an appropriate version of QuickTime/Safari on Mac OS). If the **smoothstreaming** is present then the stream is available for playback by Microsoft Silverlight.

HTTPStreamers	Description
cupertinostreaming	Cupertino: HTTP streaming to iPhone and iPod touch
smoothstreaming	Smooth: HTTP streaming to Microsoft Silverlight
sanjosestreaming	San Jose: HTTP streaming to Adobe Flash
dvrchunkstreaming	DVR: Enable streaming from origin to edge

The **<LiveStreamPacketizers>** setting works in a similar fashion but only applies to live streams. It controls how live streams are packetized for delivery to the the HTTP streaming technologies. **LiveStreamPacketizers** can contain none, one or more of the following values (separated by commas):

LiveStreamPacketizers	Description
cupertinostreamingpacketizer	Cupertino: iPhone, iPad and iPod touch
dvrstreamingpacketizer	nDVR packetizer
smoothstreamingpacketizer	Smooth: Microsoft Silverlight
sanjosestreamingpacketizer	San Jose: Flash HTTP
cupertinostreamingrepeater	Cupertino: Live stream repeater for iPhone/iPad/iPod touch
dvrstreamingrepeater	nDVR live stream repeater
smoothstreamingrepeater	Smooth: Live stream repeater for Microsoft Silverlight
sanjosestreamingrepeater	San Jose: Live stream repeater for Flash HTTP

You would set the packetizer with a repeater value when using the server in an Origin/Edge configuration. This is described later in this document in the section titled **Live Stream Repeater (Multiple Server Live Streaming)**.

## Modules

Modules are Java classes that are loaded dynamically when an application instance is loaded and provide an application's functionality. In **Application.xml**, the **<Modules>** list defines an order dependent list of the modules to be loaded for a given application. Many AddOn Packages provide additional functionality through the use of modules. The details of modules are discussed in the **Server-side Modules** chapter.

A basic module definition looks like this:

```
<Module>
  <Name>base</Name>
  <Description>Base</Description>
  <Class>com.wowza.wms.module.ModuleCore</Class>
</Module>
```

Each module must have a unique name. The **<Description>** information is for providing a detailed description of the module and is not used in any operations. The **<Class>** item is the full path to the Java class that is providing the module's functionality. In general new modules are

always added to the end of the **<Modules>** list. The Java class that makes up a server-side module is most often bound into a **.jar** file that is copied to the **[install-dir]/lib** folder. The Wowza Server comes with many modules that can be added to the **<Modules>** list to provide additional functionality. See the **Built-in Modules** section for a complete list. You can also use the **Wowza IDE** to develop your own custom modules to provide additional functionality. See the **Extending Wowza Media Server 3 Using Java** chapter for more information.

### Note

The Wowza Integrated Development Environment (Wowza IDE) is a free tool available for download at:

<http://www.wowza.com/docredirect.php?doc=ideHome>

## Properties

The default **Application.xml** file contains several different **<Properties>** containers that can be used to add or override property values within Wowza Server. Properties are a list of name/value pairs that provide a means for tuning and modifying the default configuration of the Wowza Server. Properties can also be used server-side as a means to pass data to custom modules from **Application.xml**. You will see in this document, the support section of <http://www.wowza.com> and the **Quick Start Guide** references to individual properties. There currently is not a comprehensive document that lists all the available properties. A property definition has the following form:

```
<Property>
  <Name>[name]</Name>
  <Value>[value]</Value>
  <Type>[type]</Type>
</Property>
```

Where **<Name>** is the property name, **<Value>** is the property value and **<Type>** is the property type. Valid property types are: String, Integer, Boolean, Double and Long. It is important when tuning the server to be sure to add properties to the correct container. The instructions for tuning will always specify which **<Properties>** container a property should be added to for tuning.

## Media Types

Media types are not configured in **Application.xml** but are an important part of streaming. Wowza Media Server 3 supports many different media types. Wowza Server can read the following media or file types: **FLV** (Flash Video - .flv), **MP4** (QuickTime container - .mp4, .f4v, .mov, .m4v, .mp4a, .3gp, .3g2 ...), **MP3** content (.mp3) and **SMIL** (Synchronized Multimedia Integration Language - .smil). Media types are specified through a prefix to the stream name. For example to play the MP4 file **mycoolvideo.mov** use the stream name **mp4:mycoolvideo.mov** where **mp4:** is the media type prefix. The default media type prefix if none is specified is **flv:**. Below is the table of the supported media type prefixes:

Media type prefix	Description
<b>flv:</b>	Flash Video (default if no prefix specified)
<b>mp4:</b>	QuickTime container
<b>mp3:</b>	MP3 file
<b>id3:</b>	MP3 file (return only ID3 tag information)
<b>smil:</b>	Synchronized Multimedia Integration Language (for adaptive-bitrate delivery)
<b>ngrp:</b>	Named Group (for adaptive-bitrate delivery)

The media type prefix is also used to control the file container used to record live video. If when publishing video the media type prefix **mp4:** is specified, then the content will be recorded to an **MP4** (QuickTime) container. If the media type prefix **flv:** or no prefix is specified an **FLV** or Flash Video container will be used. Only H.264, AAC and MP3 content can be recorded to an **MP4** container.

Either SMIL files or StreamNameGroups (**ngrp:**) can be used for playback of the newly encoded streams created by Wowza Transcoder. With Wowza Media Server 3 and Wowza Transcoder, a templating system provides a method to group streams together in logical groups for live adaptive bitrate delivery.

## Content Storage

By default Wowza Media Server 3 is setup to stream video on demand content and record to the **[install-dir]/content** folder. You can easily change this behavior by editing an application's **Application.xml** file and changing the value of **Streams/StorageDir**. For example to setup an Application to use an application specific content folder you might change this value to:

```
${com.wowza.wms.context.VHostConfigHome}/applications/ ${com.wowza.wms.context.Application}/content
```

Using this setting content will be streamed from the **[install-dir]/applications/[application]/content** folder where **[application]** is the application's name. The Streams/StorageDir field supports the following variables:

<code>\${com.wowza.wms.AppHome}</code>	- Application home directory
<code>\${com.wowza.wms.ConfigHome}</code>	- Configuration home directory
<code>\${com.wowza.wms.context.VHost}</code>	- Virtual host name
<code>\${com.wowza.wms.context.VHostConfigHome}</code>	- Virtual host config directory
<code>\${com.wowza.wms.context.Application}</code>	- Application name
<code>\${com.wowza.wms.context.ApplicationInstance}</code>	- Application instance name

## Streaming Tutorials

*Where do I get step-by-step instructions?*

The support section of the Wowza web site contains tutorials that include step by step instructions for common streaming scenarios. These instructions cover how to setup up streaming to the common player technologies such as the Flash player, Silverlight player, iOS devices and mobile devices. Below is a brief description of each of the streaming scenarios with a link to the online tutorial:

### **How to play a video on demand file**

Wowza Media Server 3 installs, by default, a video on demand application named 'vod'.

This tutorial describes how to stream video on demand files.

[How to play a video on demand file](#)

### **How to publish and play a live stream (RTMP or RTSP/RTP based encoder)**

This tutorial describes how to publish and play a live stream when using an encoder that supports either the Real-time Messaging Protocol (RTMP) or the RTSP Announce Method. Examples of encoders that support RTMP publishing are: Telestream Wirecast, On2 Flix Live and Orban Opticodec. Examples of encoders that support the RTSP Announce Method are: Telestream Wirecast and QuickTime Broadcaster.

[How to publish and play a live stream \(RTMP or RTSP/RTP based encoder\)](#)

### **How to publish and play a live stream (MPEG-TS based encoder)**

This tutorial describes how to publish and play a live stream when using an encoder that supports MPEG2 Transport Streams (MPEG-TS). Examples of encoder vendors that sell products that support MPEG-TS publishing are: HaiVision®, Digital Rapids® and ViewCast®.

[How to publish and play a live stream \(MPEG-TS based encoder\)](#)

### **How to publish and play a live stream (native RTP encoder with SDP file)**

This tutorial describes how to publish and play a live stream when using an encoder that supports Real-time Transport Protocol (native RTP). Examples of encoder vendors that sell products that support native RTP publishing are: HaiVision, Digital Rapids, ViewCast and Telestream®.

[How to publish and play a live stream \(native RTP encoder with SDP file\)](#)

### **How to re-stream video from an IP camera**

This tutorial describes how to re-stream and play a live stream from an IP camera.

[How to re-stream video from an IP camera](#)

### **How to re-stream audio from SHOUTcast/Icecast**

This tutorial describes how to re-stream and play a live SHOUTcast® or Icecast® audio stream.

[How to re-stream audio from SHOUTcast/Icecast](#)

### **How to setup video chat application**

This tutorial describes how to setup an application for video chat using the Adobe Flash player.

[How to setup video chat application](#)

### **How to setup video recording application**

This tutorial describes how to setup an application for video recording using the Adobe Flash player.

[How to setup video recording application](#)

### **How to setup and run the Wowza Transcoder AddOn**

This tutorial describes how to setup an application to use the Wowza Transcoder.

[How to Setup and run Wowza Transcoder](#)

### **How to setup and run the Wowza nDVR AddOn**

This tutorial describes how to setup an application to use the Wowza nDVR.

[How to Setup and run Wowza nDVR](#)

### **How to setup and run the Wowza DRM AddOn**

This tutorial describes how to setup an application to use the Wowza DRM.

[How to Setup and run Wowza DRM](#)

## Advanced Configuration Topics

*How do I take advantage of Wowza Media Server 3's features?*

This chapter covers more advanced streaming topics. Some of the functionality discussed is provided by AddOn Packages. AddOn Packages are downloadable packages that include server extensions along with documentation for adding more advanced features to Wowza Media Server 3. Because of this several of these advanced topics will include a brief overview with a link to the AddOn Package. A list of available AddOn packages can be found here:

[AddOn Packages](#)

### MediaCasters, Stream Manager and StartupStreams.xml

Wowza Media Server 3 includes a system for re-streaming called MediaCaster<sup>®</sup>. The MediaCaster system is used for re-streaming IP Camera streams (RTSP/RTP streams), SHOUTcast/Icecast streams and native RTP encoders. The MediaCaster system pulls a stream from a stream source and makes it available for streaming to the different player technologies supported by Wowza Server. This system works on demand - when the first request comes in for a given stream a connection is made to the source stream and the stream is made available to the player. When the last viewer of the stream stops watching a given stream the MediaCaster system waits for a timeout period. If no other players request the stream, then the stream is stopped and the stream is no longer available for streaming until another request comes in for the streams.

This methodology works great for the Adobe Flash player (RTMP) and RTSP/RTP streaming where there is no need for advanced packetization. For HTTP Streamers such as Cupertino, Smooth Streaming and Flash HTTP streaming the pull model does not work. The iOS devices require about 30 seconds of video to be pre-packetized before they can begin playback. Microsoft Silverlight requires three times the key frame duration. For this reason it is necessary to start the stream prior to the stream being ready for streaming to these player technologies. There are two methodologies for starting a stream that uses the MediaCaster system and keeping it running; **Stream Manager** and the **StartupStreams.xml**.

The **Stream Manager** is a web based tool for starting and stopping MediaCaster streams on the fly that is built into Wowza Media Server 3. To startup the Stream Manager, do the following:

1. Edit **[install-dir]/conf/admin.password** and enter a new line with a username and password. For example to add the username **myuser** with the password **mypassword** the contents of this file should look like:

```
# Admin password file (format
[username] [space] [password])
#username password
myuser mypassword
```

2. Open a web browser and enter the URL:

**http://[wowza-ip-address]:8086/streammanager**

To start a stream, click on the **[start-receiving-stream]** link under the application to which you want to startup the stream, select the MediaCaster type, type in the stream name and click, OK. To stop a stream, click the **[stop-receiving-stream]** link next to stream name. You can reset a stream by clicking on the **[reset-receiving-stream]** link.

The second method for starting MediaCaster streams is using the **StartupStreams.xml** file. Stream entries in this file are automatically started when the server is started (or more specifically when a virtual host is started). The **StartupStreams.xml** is a list of application, media caster types and stream names. The format of a single entry is:

```
<StartupStream>
  <Application>live</Application>
  <MediaCasterType>rtsp</MediaCasterType>
  <StreamName>rtsp://192.168.1.7:554/mycoolstream.sdp</StreamName>
</StartupStream>
```

There are also several server-side methods that can be used to start and stop streams using the MediaCaster system. See the server-side API documentation for the following two methods:

```
IApplicationInstance.startMediaCasterStream(...);
IApplicationInstance.stopMediaCasterStream(...);
```

### Live Stream Repeater (Multiple Server Live Streaming)

The following example illustrates a suggested configuration and implementation for delivering a live media event across multiple Wowza Media Server 3 servers. We will walk through the configuration and deployment of the live stream repeater. The live stream repeater uses multiple Wowza Servers in an origin and edge configuration to deliver live media content across multiple servers. The encoded media content will be delivered to the origin server in the same manner as if you were delivering the content to a single Wowza Server. The player will request the content from an edge server and the edge server will maintain a single connection per-unique stream to the origin. Origin and edge configuration is an application level configuration. A single Wowza Server instance can be configured as an origin for one application and an edge for another.

For this example we will setup a single origin server using the application name **liverepeater**. Here are the steps to configure the origin server:

Create a folder named **[install-dir]/applications/liveorigin**.

1. Create a folder named **[install-dir]/conf/liveorigin** and copy the file **[install-dir]/conf/Application.xml** into this new folder.
2. Edit the newly copied **Application.xml** file and make the following changes:

- a. Change the **Streams/StreamType** to **liverepeater-origin**
- b. Change the **LiveStreamPacketizers** to:

```
cupertinostreamingpacketizer,smoothstreamingpacketizer,sanjosestreamingpacketizer
```

Next, configure each of the edge servers as follows:

1. Create a folder named **[install-dir]/applications/liveedge**.
2. Create a folder named **[install-dir]/conf/liveedge** and copy the file **[install-dir]/conf/Application.xml** into this new folder.
3. Edit the newly copied **Application.xml** file and make the following changes:
  - a. Change the **Streams/StreamType** to **liverepeater-edge** (you can use the **liverepeater-edge-lowlatency** stream type if low latency is important, this will add extra load to the server).
  - b. Change the **LiveStreamPacketizers** to:

```
cupertinostreamingrepeater,smoothstreamingrepeater,sanjosestreamingrepeater
```

- c. Uncomment the **Repeater/OriginURL** section and set **OriginURL** to rtmp URL of the origin server. For example if the origin server uses the domain name **origin.mycompany.com**, this value should be set to:

```
<Repeater>
  <OriginURL>rtmp://origin.mycompany.com/liveorigin</OriginURL>
  <QueryString></QueryString>
</Repeater>
```

For this example let's assume the origin server uses the domain name **origin.mycompany.com** and that there are 3 edge servers with the domain names **edge1.mycompany.com**, **edge2.mycompany.com**, **edge3.mycompany.com**. Let's also assume that we are going to use the stream name **mycoolevent**. The URLs for the players are as follows (assuming we are streaming off of edge1):

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### Adobe Flash Player (RTMP):

Server: `rtmp://edge1.mycompany.com/liveedge`  
Stream: `mycoolevent`

### Adobe Flash Player (Flash HTTP - San Jose):

`http://edge1.mycompany.com:1935/liveedge/mycoolevent/manifest.f4m`

### Apple iPhone, iPad or iPod touch (Cupertino):

`http://edge1.mycompany.com:1935/liveedge/mycoolevent/playlist.m3u8`

### Microsoft Silverlight (Smooth):

`http://edge1.mycompany.com:1935/liveedge/mycoolevent/Manifest`

### RTSP/RTP:

`rtsp://edge1.mycompany.com:1935/liveedge/mycoolevent`

It is possible to configure more than one origin server to provide a hot backup in case the main origin server goes down. Let's say the failover origin server has the domain name **origin2.mycompany.com**. Assuming it is configured in the same manner as the main origin server, you would set the following Repeater/OriginURL in each of the edge's **Applications.xml** files:

```
<Repeater>
  <OriginURL>rtmp://origin.mycompany.com/liveedge|rtmp://origin2.mycompany.com/liveedge</OriginURL>
  <QueryString></QueryString>
</Repeater>
```

Basically it's the two connection URLs concatenated together with the pipe ( | ) character. The edge servers will first try to connect to the first origin server, if this fails they will attempt to connect to the second origin server.

This example assumes you are using an encoder in which the stream name is a simple name and not a URL. If you are using an encoder such as an MPEG-TS encoder in which the stream name is not a simple stream name, then you can use **.stream** files on the origin to hide the complex stream names. For example if your complex stream name on the origin is `udp://0.0.0.0:10000`, use a text editor to create a file in the **[install-dir]/content** folder with the name **mycoolevent.stream** and set the contents to `udp://0.0.0.0:10000`. You then use **mycoolevent.stream** in place of **mycoolevent** in the URLs above to play the stream.

### Note

The **Media Security** AddOn Package describes how to secure the connection between the origin and edge machines using SecureToken. See the MediaSecurity AddOn package described at the end of this document.

### Note

If you are streaming to an iOS device, Microsoft Silverlight player or are using Flash HTTP to stream to Flash and are using a non-push based encoder (native RTP or MPEG-TS) then you will

need to use the Stream Manager to start and keep the stream running on the origin. The streams do not need to be kept running on the edges.

**Note**

To provide load balancing between the edge servers you can use the dynamic load balancing system referenced in the **Dynamic Load Balancing** section.

**Wowza Transcoder AddOn**

Wowza Transcoder is a premium AddOn that provides the ability to ingest a live stream (channel) and transrate it to multiple outbound bitrates; or decode the video and audio from the incoming channel, and then re-encode the stream into multiple bitrates, frame sizes and profiles to suit the desired playback devices. Transcoding of multiple channels is possible on the same server instance.

Further information can be found in the [Wowza Transcoder AddOn User's Guide](#)

**Wowza nDVR AddOn**

Wowza nDVR is a premium AddOn that provides the ability to record a live stream into a cache on Wowza Media Server 3 while allowing users to play or pause a live stream, rewind to a previously recorded point, or resume viewing at the current live point. Customization is possible through XML configurations and the available APIs.

Further information can be found in the [Wowza nDVR AddOn User's Guide](#)

**Wowza DRM AddOn**

Wowza DRM is a premium AddOn which provides encryption key exchange integration with third party Digital Rights Management (DRM) platforms. Using these keys, Wowza Media Server 3 performs on-the-fly encryption for both live and on-demand content. For the live workflow, encryption per-stream is available with the ability to rotate keys. For the on-demand workflow, encryption per-asset or per-session is available with the ability to rotate keys. Both live and video on demand key rotation support is available for Apple HLS streaming.

As of this writing, integration is supported for Verimatrix® VCAST™ for HLS playback with ViewRight™ clients for iPhone/iPad, PC, Mac, Android smartphones and tablets, and set-top boxes; and Microsoft® PlayReady® for Silverlight® smooth streaming client playback.

Further information can be found in the [Wowza DRM AddOn online Tutorials](#)

## Live Stream Recording

The **VideoRecording** example that ships with Wowza Media Server 3 is a specialized way of remote recording of a live stream when using the Adobe Flash player. It uses the **record** stream type and special capabilities built into the Flash player to control the recording process. If you simply want to record an incoming live stream from an encoder, then there are two more general purpose methods to accomplish this; use one of the **\*-record** stream types (such as **live-record**) or use the **LiveStreamRecord** AddOn package.

The **\*-record** stream types are the simplest method but give you the least amount of control. If you use this method the entire duration of the published stream will be recorded. If the encoder starts and stops, the file will be versioned with a version number and a new file will start. You can control the container format used (FLV or MP4) by specifying a stream name prefix in the encoder. If the prefix **FLV:** is specified, then the stream will be recorded to an FLV container. If the prefix is **mp4:**, then the stream will be recorded to an MP4 (QuickTime) container. Remember that an MP4 container can only record H.264, AAC and MP3 media data. If you are recording using the Flash player the FLV container is the only option.

Another option is the **LiveStreamRecord** AddOn package. This package gives you more control over the recording process. This package includes a server-side module and an HTTPProvider that can be used to control the recording process from a remote computer (the source code is included). You can control when the recording starts and stops, the file name and location and the container format as well as other small details. The LiveStreamRecord package has also been updated for Wowza Media Server 3 to support data events. The package is available for download here:

<http://www.wowza.com/docredirect.php?doc=addOnLiveStreamRecord>

## Server-side Publishing (Stream and Publisher classes)

Wowza Media Server 3 includes two methods for doing server-side publishing; the Stream class and the Publisher class. The Stream class is a high level server-side API for mixing live and video on demand content on the fly into a single destination stream. It provides the ability to do television style publishing. It also includes a package that enables creation of a server-side XML based playlist. For more information regarding the Stream class see this support article:

<http://www.wowza.com/docredirect.php?doc=usefulCodeStreamClass>

The Publisher class is a low level publishing API to provide the ability to inject raw compressed video and audio frames into Wowza Server to create a custom live stream. See the Publisher classes server-side API (Javadoc documentation) for the current detailed documentation. There is also an audio example which walks through the process of publishing Speex data to a stream in this support article:

<http://www.wowza.com/docredirect.php?doc=usefulCodePublisherClass>

### **Dynamic Load Balancing**

The Dynamic Load Balancing AddOn package provides a method for dynamically load balancing RTMP streams between multiple Wowza Server edge servers. The edge servers communicate with one or more load balancing Wowza Servers. You can then connect to the load balancing server to get the currently least loaded edge server. You can download the package from this support article:

<http://www.wowza.com/docredirect.php?doc=addOnDynamicLoadBalancing>

### **Media Security (SecureToken, authentication and encryption)**

The MediaSecurity AddOn Package provides a set of server-side modules and methodologies for protecting streaming to the different player technologies. It includes a detailed tutorial for protecting streaming using SecureToken, authentication and encryption. You can download the package from this support article:

<http://www.wowza.com/docredirect.php?doc=addOnMediaSecurity>

### **Push Publishing**

The Push Publishing AddOn Package provides an API for pushing streams from a Wowza Media Server 3 to a remote Wowza Media Server 3, Flash Media Server or CDN (Content Delivery Network). You can request this package from this support article:

<http://www.wowza.com/docredirect.php?doc=addOnPushPublishing>

### **MediaCache**

The MediaCache AddOn package is a read through caching mechanism for video on demand streaming. Similar to the live repeater technology aimed at increasing the scalability of live streaming, the MediaCache technology is a means of scaling video on demand streaming. You can request this package from this support article:

<http://www.wowza.com/docredirect.php?doc=addOnMediaCache>

## Adobe Flash Streaming and Scripting

*What can I do with Wowza Media Server 3 and the Adobe Flash player?*

Wowza Media Server 3 includes additional features that are only applicable to the Adobe Flash player when using the RTMP protocol (or any of the variants). When using Wowza Media Server 3 with the Adobe Flash player, Wowza Server is much more than just a streaming server - it is an application server. It provides features such as shared objects, video chat, remote recording and bi-directional remote procedures calls. This chapter covers all of these topics.

### Streaming Basics

We will start with the most basic code needed to play a live or video on demand stream in Flash. Let's assume we have followed the instructions in the **How to play a video on demand file** tutorial in the [Quick Start Guide](#) and we have an application with the name **vod** that is setup for video on demand streaming. Do the following in Adobe Flash CS3 or CS4:

1. Create a new **Flash File** with ActionScript 3.0 support.
2. Select **Library** from the **Window** menu to open the library palette.
3. Right click in the library palette and select **New Video...**, enter symbol name **video** and click **OK** to create the video object.
4. Drag the **video** item from the library to the stage, then in the properties palette give it an instance name of **video1**.
5. Select the menu item **Window->Actions** from the menu and select **Scene 1** in the Actions items list.
6. Enter the following code:

```
var nc:NetConnection = new NetConnection();
var ns:NetStream = null;

function ncOnStatus(infoObject:NetStatusEvent)
{
    trace("ncOnStatus: "+infoObject.info.code);
    if (infoObject.info.code == "NetConnection.Connect.Success")
    {
        trace("Connection established");
        ns = new NetStream(nc);

        ns.bufferTime = 3;

        video1.attachNetStream(ns);

        ns.play("mp4:Sample.mp4");
    }
}
nc.addEventListener(NetStatusEvent.NET_STATUS, ncOnStatus);
nc.connect("rtmp://localhost/vod");
```

### 7. Select **Control->Test Movie** from the menu.

You should be streaming the Sample.mp4 example file. This is the most basic ActionScript 3.0 code needed for live or video on demand playback. If you quickly inspect the code, you can see how simple it is. We create a NetConnection object for streaming, add an event listener so that we get notified when the connection to Wowza Media Server 3 is established, and when we are notified of a successful connection, we create a NetStream object and begin playback of the stream.

The **SimpleVideoStreaming** and **LiveVideoStreaming** example players that ship with Wowza Media Server 3 take this example a little further. These example players support progress bars, pause, stop and full screen. Inspecting the code for these two examples is a good next step for learning how to stream. The VideoChat and VideoRecording examples are a great starting point to learn how to publish video and audio using the built-in **Camera** and **Microphone** objects.

## Pre-built Media Players

Building your own custom player with advanced functionality can be a daunting task. Another option is to use pre-built Flash video players. There are many options. We are going to cover a few of the more popular options: Adobe FLVPlayback component, JW Player, FlowPlayer and the Adobe Media Playback player.

The Adobe FLVPlayback component is a pre-built video player component that you can add to your own Flash project. It includes features such as play, pause, seek, stop and fullscreen. It comes with Adobe Flash CS3, CS4 and CS5. From time to time the component is updated. It is best to keep your Adobe Flash software up to date to be sure you are running the most recent version. The nice thing about this component is that it can be integrated into your own custom Flash code.

JW Player is pre-built Flash based player offered by Long Tail Video. It includes a rich set of features such as playlists, skinning and ad serving. It is fully supported and there is a commercial option. It also includes a built-in version of the Wowza SecureToken security mechanism. You can download it from here:

<http://www.longtailvideo.com>

There are instructions on how to use it with Wowza Media Server 3 in these support articles:

<http://www.wowza.com/docredirect.php?doc=usefulCodeJWPlayerLatest>

<http://www.wowza.com/docredirect.php?doc=usefulCodeJWTokenLatest>

Another option is FlowPlayer which is an open source pre-built Flash based player. It includes a rich set of features similar to JW Player. It also includes a built-in version of the Wowza SecureToken. You can download it from here:

<http://flowplayer.org>

There are instructions on how to use it with Wowza Media Server 3 in this support article:

<http://www.wowza.com/docredirect.php?doc=usefulCodeFlowPlayerLatest>

Another option is the Adobe Media Playback player. This player supports both RTMP streaming as well as Flash HTTP streaming (San Jose Streaming). The player is built on the Open Software Media Framework (OSMF) and is hosted by Adobe. There are instructions on how to use it with Wowza Media Server 3 in this support article:

<http://www.wowza.com/docredirect.php?doc=usefulCodeAdobeMediaPlaybackLatest>

## Bi-directional Remote Procedure Calls

Wowza Media Server 3 supports bi-direction remote procedure calls to and from the Adobe Flash player. What this means is from the Flash player you can call a server-side Java method and pass data to the Wowza Media Server 3 server and from the Wowza Media Server 3 server you can call a client-side ActionScript method and pass data to the Flash player. This is very useful when building Rich Internet Applications.

Calls from the Flash player to Wowza Media Server 3 are performed using the following method:

```
NetConnection.call(methodName, resultObj, params...)
```

For example, to call the server-side method **doSomething** and pass two parameters **value1** and **value2** and receive a single return value, the ActionScript 3.0 client-side code looks like this (we will cover the server-side code for this method later in this document):

```
function onMethodResult(returnVal:String):Void
{
    trace("onMethodResult: "+returnVal);
}
nc.call("doSomething", new Responder(onMethodResult), value1, value2);
```

Receiving method calls from Wowza Media Server 3 are done by adding handler methods/functions to the client object that is attached to the NetConnection object. For

example, to add the handler method **onSomethingHappened** that receives two string parameters **value1** and **value2**, the ActionScript 3.0 code looks like this:

```
var clientObj:Object = new Object();
clientObj.onSomethingHappened(value1:String, value2:String):Void
{
    trace("onSomethingHappened: "+value1+" "+value2);
}
nc.client = clientObj;
```

We will go into more detail on the programming model in the chapter; **Extending Wowza Media Server 3 Using Java**.

### **Remote Shared Objects**

Wowza Media Server 3 supports Adobe Flash remote shared objects. Remote shared objects are a means for sharing data between Wowza Media Server 3 and multiple Flash players. Each Flash player that subscribes to a shared object will be notified of updates to the shared object data. Shared object data can be changed client-side by a Flash player or server-side through the Wowza Media Server 3 ISharedObject API. Below is an example of the ActionScript 3.0 code needed to create a remote shared object and set a value:

```

var nc:NetConnection = new NetConnection();
var test_so:SharedObject = null;
var timer:Timer = null;

function ncOnStatus(infoObject:NetStatusEvent)
{
    trace("ncOnStatus: "+infoObject.info.code);
    if (infoObject.info.code == "NetConnection.Connect.Success")
    {
        test_so = SharedObject.getRemote("test", nc.uri);
        test_so.addEventListener(SyncEvent.SYNC, syncEventHandler);
        test_so.connect(nc);

        timer = new Timer(1000, 1);
        timer.addEventListener(TimerEvent.TIMER, setSOProperty);
        timer.start();
    }
}

function syncEventHandler(ev:SyncEvent)
{
    trace("syncEventHandler");
    var infoObj:Object = ev.changeList;
    for (var i = 0; i < infoObj.length; i++)
    {
        var info:Object = infoObj[i];
        if (info.name != undefined)
            trace("  "+info.name+"="+test_so.data[info.name]);
        else
            trace("  [action]="+info.code);
    }
}

function setSOProperty(ev:TimerEvent):void
{
    test_so.setProperty("testName", "testValue");
}

nc.addEventListener(NetStatusEvent.NET_STATUS, ncOnStatus);

nc.connect("rtmp://localhost/vod");

```

The **RemoteSharedObjects** example that ships with Wowza Media Server 3 is a more complete remote shared object example. We will go into more detail on the programming model in the chapter; **Extending Wowza Media Server 3 Using Java**.

## Server-side Modules and Extensions

*What is a server-side module and what server-side functionality ships with Wowza Media Server 3?*

Much of the functionality delivered by Wowza Media Server 3 is done through server-side modules and HTTPProviders. Server-side modules are Java classes that are configured on a per-application basis and are loaded at application instance startup and provide much of the functionality needed to control the streaming process. HTTPProviders are Java classes that are configured on a per-virtual host basis and are light-weight HTTP servers that can be used to query server information. In this chapter we discuss each of these methods of extending Wowza Server and the built-in Java classes that are immediately available for use. In the next chapter we discuss how to create your own server-side extensions.

### Server-side Modules

Server-side modules are Java classes that are configured on a per-application basis and are dynamically loaded at application instance startup. For the most part, server-side modules provide remote methods that are callable from the Adobe Flash player. It is these methods that provide the play, publish, seek, pause and resume functionality needed to control the Flash player streaming process. Server-side modules can also be used to control iPhone/iPad/iPod touch, Microsoft Silverlight, Flash HTTP (San Jose) and RTSP/RTP streaming as well. The details of how the API works are in the next chapter.

Server-side modules are configured by adding **<Module>** entries to the **<Modules>** list in an application's **Application.xml** file. The default **<Modules>** list looks like this:

```
<Modules>
  <Module>
    <Name>base</Name>
    <Description>Base</Description>
    <Class>com.wowza.wms.module.ModuleCore</Class>
  </Module>
  <Module>
    <Name>properties</Name>
    <Description>Properties</Description>
    <Class>com.wowza.wms.module.ModuleProperties</Class>
  </Module>
  <Module>
    <Name>logging</Name>
    <Description>Client Logging</Description>
    <Class>com.wowza.wms.module.ModuleClientLogging</Class>
  </Module>
  <Module>
    <Name>flvplayback</Name>
    <Description>FLVPlayback</Description>
    <Class>com.wowza.wms.module.ModuleFLVPlayback</Class>
  </Module>
</Modules>
```

Each of these modules is described in detail in the **Built-in Server-side Module** section below. Creating custom server-side modules is covered in the next chapter.

## HTTPProviders

HTTPProviders are mini HTTP servers that can be used to extend the functionality of Wowza Server and are configured on a per-port basis in **[install-dir]/conf/VHost.xml**. An individual HTTPProvider can be username and password protected. Multiple HTTPProviders can be attached to a single port and the HTTPProvider is selected based on request filter. An example HTTPProvider configuration looks like this:

```
<HTTPProvider>
  <BaseClass>com.wowza.wms.http.streammanager.HTTPStreamManager</BaseClass>
  <RequestFilters>streammanager*</RequestFilters>
  <AuthenticationMethod>admin-digest</AuthenticationMethod>
</HTTPProvider>
```

The **BaseClass** property is the full path to the class overrides the HTTPProvider2Base class and implements the IHTTPProvider interface. The **RequestFilters** is a pipe ( | ) separated list of filters that control when this provider will be invoked based on the HTTP request path. For example, the above request filter will only be invoked if the path portion of the HTTP request URL starts with **streammanager**. (eg. **http://[wowza-ip-address]:8086/streammanager**). The AuthenticationMethod is the authentication method used to control access to this HTTPProvider. Valid values are **admin-digest** and **none**. The **admin-digest** authentication method uses digest authentication (a challenge/response system to authenticate user – passwords are never sent in clear text) to control access to the HTTPProvider. The usernames and passwords for admin-digest authentication are stored in the file **[install-dir]/conf/admin.password**. The **none** method allows all access.

Creating custom HTTPProviders is covered in the next chapter.

## Built-in Server-side Modules

Below is a list of each of the built-in server-side modules along with a brief description of the functionality that is provided. For detailed information on each of the methods provided in a module see the server-side API reference.

### ModuleCore – (com.wowza.module.ModuleCore)

The ModuleCore module represents the server-side implementation of the Adobe Flash **NetConnection**, **NetStream** and **SharedObject** objects. It is required that this module be included by all applications for the server to operate properly. This module contains several additional server side methods that are highlighted here:

Function call	Description
<code>setStreamType(streamType:String);</code> <code>getStreamType();</code>	Returns and sets the default stream type for this client connection.
<code>setRepeaterOriginUrl(originUrl:String);</code> <code>getRepeaterOriginUrl();</code>	Returns and sets the live stream repeater origin URL to use for this connection.
<code>getStreamLength(streamName:String);</code> <code>getStreamLength(streamNames:Array);</code>	For video on demand streaming it returns the duration of the stream in seconds. If an array of stream names is passed in an array of durations is returned.
<code>getClientID();</code>	Returns the client ID for this client connection.
<code>getReferrer();</code>	Get the referrer from the <code>onConnect</code> method.
<code>getPageUrl();</code>	Get the <code>pageUrl</code> from the <code>onConnect</code> method.
<code>getVersion();</code>	Returns the server name and version.
<code>getLastStreamId();</code>	Returns the ID number of the last <code>NetStream</code> object that was created by this client.

<pre>FCSubscribe(streamName, [mediaCasterType]); FCUnSubscribe(streamName);</pre>	<p>When using the live stream repeater to lock and unlock a stream on the edge during streaming. This method is useful when doing dynamic streaming to lock all bitrate renditions of a live stream on an edge server to be sure they are available when a switch is made between bitrate renditions.</p>
<pre>FCPublish(streamName); FCUnpublish(streamName);</pre>	<p>Called to tell the Wowza Server server a new stream is being published.</p>

## ModuleProperties - (com.wowza.module.ModuleProperties)

The ModuleProperties module gives the Flash player client code access to application specific properties (name, value pairs) that are attached to the objects in the server object hierarchy.

Function call	Description
<pre>setApplicationProperty(name:String, value:String); getApplicationProperty(name:String);</pre>	<p>Returns and sets properties attached to this client's Application object.</p>
<pre>setAppInstanceProperty(name:String, value:String); getAppInstanceProperty(name:String);</pre>	<p>Returns and sets properties attached to this client's Application Instance object.</p>
<pre>setClientProperty(name:String, value:String); getClientProperty(name:String);</pre>	<p>Returns and sets properties attached to this client's object.</p>
<pre>setStreamProperty(streamId:Number, value:String); getStreamProperty(streamId:Number);</pre>	<p>Returns and sets properties attached to a NetStream object. NetStream objects are identified by StreamId which can be returned to the client by making a call to <code>getLastStreamId()</code> directly following a call to "new NetStream(nc)".</p>

## ModuleClientLogging - (com.wowza.module.ModuleClientLogging)

The ModuleClientLogging module enables client side logging to the server.

```
logDebug(logStr:String);
```

```
logInfo(logStr:String);  
logWarn(logStr:String);  
logError(logStr:String);
```

The following call from the Flash player client:

```
nc.call("logDebug", null, "log this string");
```

Is the same as a server side call to:

```
getLogger().debug("log this string");
```

### **ModuleFLVPlayback - (com.wowza.module.ModuleFLVPlayback)**

The ModuleFLVPlayback module is required by the FLVPlayback component. This module must be added to any application that is going to use the FLVPlayback component.

### **Built-in HTTPProviders**

Below is a list of each of the built-in HTTPProviders along with a brief description. These are found in VHost.xml.

### **HTTPServerVersion - (com.wowza.wms.http.HTTPServerVersion)**

HTTPServerVersion returns the Wowza Server version and build number. It is the default HTTPProvider on port 1935.

### **HTTPCrossdomain - (com.wowza.wms.http.HTTPCrossdomain)**

HTTPCrossdomain serves up the Adobe Flash **crossdomain.xml** file when present in **[install-dir]/conf** folder.

### **HTTPClientAccessPolicy - (com.wowza.wms.http.HTTPClientAccessPolicy)**

HTTPClientAccessPolicy serves up the Microsoft Silverlight **clientaccesspolicy.xml** file when present in **[install-dir]/conf** folder.

### **HTTPStreamManager - (com.wowza.wms.http.HTTPStreamManager)**

HTTPStreamManager is the Stream Manager HTTPProvider that is available through administrative port 8086 ([http://\[wowza-ip-address\]:8086/streammanager](http://[wowza-ip-address]:8086/streammanager)).

### **HTTPServerInfoXML - (com.wowza.wms.http.HTTPServerInfoXML)**

HTTPServerInfoXML return detailed server and connection information in XML format and is available through administrative port 8086 ([http://\[wowza-ip-address\]:8086/serverinfo](http://[wowza-ip-address]:8086/serverinfo)).

### **HTTPConnectionInfo - (com.wowza.wms.http.HTTPConnectionInfo)**

HTTPConnectionInfo return detailed connection information in XML format and is available through administrative port 8086 ([http://\[wowza-ip-address\]:8086/connectioninfo](http://[wowza-ip-address]:8086/connectioninfo)).

### **HTTPConnectionCountsXML - (com.wowza.wms.http.HTTPConnectionCountsXML)**

HTTPConnectionCountsXML return connection information in XML format and is available through administrative port 8086 ([http://\[wowza-ip-address\]:8086/connectioncounts](http://[wowza-ip-address]:8086/connectioncounts)).

### **HTTPTranscoderThumbnail - (com.wowza.wms.http.HTTPTranscoderThumbnail)**

HTTPTranscoderThumbnail return bitmap image from source stream being transcoded, available through administrative port 8086

([http://\[wowza-ip-address\]:8086/transcoderthumbnail?application=\[application-name\]&streamname=\[stream-name\]&format=\[jpeg or png\]&size=\[widthxheight\]](http://[wowza-ip-address]:8086/transcoderthumbnail?application=[application-name]&streamname=[stream-name]&format=[jpeg or png]&size=[widthxheight]))

## Extending Wowza Media Server 3 Using Java

*How do I extend the Wowza Media Server 3 server?*

Wowza Media Server 3 can easily be extended by writing Java classes that are loaded dynamically by the server. There are several integration points that can be used to extend the server; custom server-side modules, HTTPProviders and listeners. We will explore each of these integration points and provide a quick example. We provide a free integrated development environment called the Wowza IDE that can be used to extend the functionality of the server. You can download it from here:

<http://www.wowza.com/docredirect.php?doc=ideHome>

It is probably best to download and install the Wowza IDE first before reading this chapter. The included documentation will walk you through the creation of your first custom server-side module. It will point you back to this chapter for more information. Consult the **Server-side API Guide** for detailed information on the available APIs. There is also a wealth of knowledge and code snippets online in the support section of <http://www.wowza.com>.

### Custom Module Classes

Server-side modules are Java classes that are configured on a per-application basis and are dynamically created at application instance startup. Typically, module classes are bound into **.jar** files that are located in the **[install-dir]/lib** folder. Modules can leverage any available 3<sup>rd</sup> party libraries or built-in Java functionality as long as the dependent **.jar** files are copied into the **[install-dir]/lib** folder. Modules are added to an application configuration by adding a **<Module>** entry to the **<Modules>** list in the application's **Application.xml** file.

Let's start by creating our first module. It will have two methods **onAppStart** and **doSomething**. The **onAppStart** method is an event method and the **doSomething** method is a custom method. The details of event methods and custom methods will be discussed later.

```
package com.mycompany.module;

import com.wowza.wms.module.*;
import com.wowza.wms.client.*;
import com.wowza.wms.amf.*;
import com.wowza.wms.request.*;

public class MyModule extends ModuleBase
{
    public void onAppStart(IApplicationInstance appInstance)
    {
        getLogger().info("onAppStart");
    }

    public void doSomething(IClient client, RequestFunction function,
                           AMFDataList params)
    {
        getLogger().info("doSomething");
    }
}
```

Next, to add this module to an application configuration, edit **Application.xml** for the application and add the following **<Module>** entry for this module to the end of the **<Modules>** list:

```
<Module>
    <Name>MyModule</Name>
    <Description>This is MyModule</Description>
    <Class>com.mycompany.module.MyModule</Class>
</Module>
```

Each module must have a **<Name>** that is unique in that **<Modules>** list. The **<Description>** information is for providing a detailed description of the module and is not used in any operations. The **<Class>** item is the full path to the Java class that is providing the module's functionality. We combine the package path in the first line of the module to the class name to form the class path.

## Event Methods

Event methods are invoked by the server based on events that occur during server processing. Event methods apply to all types of streaming Adobe Flash, Microsoft Silverlight, iPhone/iPad/iPod touch and RTSP. Event methods are defined by the following interfaces:

```
IModuleOnAppIModuleOnConnect
IModuleOnStream
IModuleOnHTTPSession
IModuleOnRTPSession
IModuleOnHTTPCupertinoStreamingSession
IModuleOnHTTPSmoothStreamingSession
IModuleOnHTTPSanJoseStreamingSession
IModuleOnHTTPCupertinoEncryption
IModuleOnHTTPSmoothStreamingPlayReady
```

All event methods defined in all modules are invoked when an event occurs. What this means is that if two modules implement the **onAppStart** event method, then both modules **onAppStart**

methods will be invoked when a new application instance is created. Module methods are invoked starting at the top of the **<Modules>** list defined in **Application.xml**. So the first **<Modules>** entry in the list will be called first and it will work its way down to the last item in the list. Below are each of the event method interfaces and their corresponding event methods.

## IModuleOnApp

```
public void onAppStart(IApplicationInstance appInstance);
public void onAppStop(IApplicationInstance appInstance);
```

**onAppStart:** Invoked when an application instance is started

**onAppStop:** Invoked when an application instance is stopped

## IModuleOnConnect

```
public void onConnect(IClient client,
                    RequestFunction function, AMFDataList params);
public void onDisconnect(IClient client);
public void onConnectAccept(IClient client);
public void onConnectReject(IClient client);
```

**onConnect:** Invoked when a Flash player connects to an application instance

**onDisconnected:** Invoked when a Flash player disconnect from an application instance

**onConnectAccept:** Invoked when a Flash player connection is accepted

**onConnectReject:** Invoked when a Flash player connection is refused

## IModuleOnStream

```
public void onStreamCreate(IMediaStream stream);
public void onStreamDestroy(IMediaStream stream);
```

**onStreamCreate:** Invoked when a new IMediaStream object is created

**onStreamDestroy:** Invoked when a IMediaStream object is closed

### Note

The **onStreamCreate** event method is invoked before **play** or **publish** has been called for this IMediaStream object. For this reason the IMediaStream object does not have a name. See the IMediaStreamActionNotify2 interface to implement a server listener that is invoked when actions occur on this IMediaStream object.

## IModuleOnHTTPSession

```
public void onHTTPSessionCreate(IHTTPStreamerSession httpSession);
public void onHTTPSessionDestroy(IHTTPStreamerSession httpSession);
```

**onHTTPSessionCreate:** Invoked when HTTP streaming session(Cupertino or Smooth) created

**onHTTPSessionDestroy:** Invoked when HTTP streaming session(Cupertino or Smooth) closed

## IModuleOnRTPSession

```
public void onRTPSessionCreate(RTPSession rtpSession);
public void onRTPSessionDestroy(RTPSession rtpSession);
```

**onRTPSessionCreate:** Invoked when RTP session created  
**onRTPSessionDestroy:** Invoked when RTP session closed

## IModuleOnHTTPCupertinoStreamingSession

```
public void onHTTPCupertinoStreamingSessionCreate(
    HTTPStreamerSessionCupertino httpCupertinoStreamingSession);
public void onHTTPCupertinoStreamingSessionDestroy(
    HTTPStreamerSessionCupertino httpCupertinoStreamingSession);
```

**onHTTPCupertinoStreamingSessionCreate:** Invoked when Cupertino session created  
**onHTTPCupertinoStreamingSessionDestroy:** Invoked when Cupertino session closed

## IModuleOnHTTPSmoothStreamingSession

```
public void onHTTPSmoothStreamingSessionCreate(
    HTTPStreamerSessionSmoothStreamer httpSmoothStreamingSession);
public void onHTTPSmoothStreamingSessionDestroy(
    HTTPStreamerSessionSmoothStreamer httpSmoothStreamingSession);
```

**onHTTPSmoothStreamingSessionCreate:** Invoked when Smooth session created  
**onHTTPSmoothStreamingSessionDestroy:** Invoked when Smooth session closed

## IModuleOnHTTPSanJoseStreamingSession

```
public void onHTTPSanJoseStreamingSessionCreate(
    HTTPStreamerSessionSanJoseStreamer httpSanJoseStreamingSession);
public void onHTTPSanJoseStreamingSessionDestroy(
    HTTPStreamerSessionSanJoseStreamer httpSanJoseStreamingSession);
```

**onHTTPSanJoseStreamingSessionCreate:** Invoked when Smooth session created  
**onHTTPSanJoseStreamingSessionDestroy:** Invoked when Smooth session closed

## IModuleOn OnHTTPCupertinoEncryption

```
public void onHTTPCupertinoEncryptionKeyRequest(
    HTTPStreamerSessionCupertino httpSession, IHTTPRequest req,
    IHTTPResponse resp);
public void onHTTPCupertinoEncryptionKeyCreateVOD(
    HTTPStreamerSessionCupertino httpSession, byte[] encKey);
public void onHTTPCupertinoEncryptionKeyCreateLive(
    IApplicationInstance appInstance, String streamName, byte[] encKey);
```

**onHTTPCupertinoEncryptionKeyRequest:** Invoked when encryption key request is made for Cupertino streaming  
**onHTTPCupertinoEncryptionKeyCreateVOD:** Invoked when encryption key is created for video on demand stream  
**onHTTPCupertinoEncryptionKeyCreateLive:** Invoked when encryption key is created for live stream

## IModuleOnHTTPSmoothStreamingPlayReady

```
public void onHTTPSmoothStreamingPlayReadyCreateVOD(
    HTTPStreamerSessionSmoothStreamer httpSession,
    PlayReadyKeyInfo playReadyKeyInfo);
public void onHTTPSmoothStreamingPlayReadyCreateLive(
    IApplicationInstance appInstance, String streamName, PlayReadyKeyInfo
    playReadyKeyInfo);
```

**onHTTPSmoothStreamingPlayReadyCreateVOD:** Invoked when encryption key request is made for smooth streaming video on demand

**onHTTPSmoothStreamingPlayReadyCreateLive:** invoked when encryption key request is made for smooth streaming live

## Custom Methods

Custom methods are public methods that you wish to expose to the Adobe Flash player through calls to the client-side interface `NetConnection.call()` or are calls that are part of the `NetConnection` or `NetStream` command set. For example **play** and **publish** are defined in `ModuleCore` as custom methods. These methods must be public and must have the following argument signature (**IClient, RequestFunction, AMFDataList params**). Only public methods with this signature will be available to be called from the Flash player.

Processing for custom methods is different than that of event methods. When a given method such as **play** is invoked from the Flash player, only the last module in the **<Modules>** list that defines that custom method will be invoked. For example, the **ModuleCore** module defines the method **play** which is invoked when `NetStream.play(streamName)` is called from the Flash player. If you create your own custom module that defines the method **play** and add it to the **<Modules>** list after the **ModuleCore** module, then your **play** method will be invoked rather than the **play** method defined in `ModuleCore`. If in your implementation of **play**, you wish to invoke the **play** method of the next module up the list that precedes your module, you call **this.invokePrevious(client, function, params)**. Wowza Media Server 3 will search up the module list and find the next module that implements the **play** method and it will invoke that method. This is similar to traditional object orientated sub-classing. Each implementation of a method in the **<Modules>** list can perform an operation based on the invocation of a given method and can choose to pass control to the next module that implement that method above them in the **<Modules>** list.

For example, if in your implementation of **play** you wish to check the stream name of calls made to `NetStream.play(streamName)`. If the stream name starts with **goodstream/** you wish to append the phrase **\_good** to the stream name and call **this.invokePrevious(client, function, params)**. All other connections will be disconnected. The code looks like this:

```
package com.mycompany.module;

import com.wowza.wms.module.*;
import com.wowza.wms.client.*;
import com.wowza.wms.amf.*;
import com.wowza.wms.request.*;

public class MyModule extends ModuleBase
{
    public void play(IClient client, RequestFunction function, AMFDataList params)
    {
        boolean disconnect = false;
        if (params.get(PARAM1).getType() == AMFData.DATA_TYPE_STRING)
        {
            String playName = params.getString(PARAM1);
            if (playName.startsWith("goodstream/"))
            {
                playName += "_good";
                params.set(PARAM1, new AMFDataItem(playName));
            }
            else
                disconnect = true;
        }

        if (disconnect)
            client.setShutdownClient(true);
        else
            this.invokePrevious(client, function, params);
    }
}
```

## onCall

The onCall method is a catch-all for any methods that are undefined by custom methods. The interface for this method is defined in the **IModuleOnCall** interface class. The onCall method functions the same as an event method in that all onCall methods defined in all modules will be called. Example:

```
package com.mycompany.module;

import com.wowza.wms.module.*;
import com.wowza.wms.client.*;
import com.wowza.wms.amf.*;
import com.wowza.wms.request.*;

public class MyModule extends ModuleBase implements IModuleOnCall
{
    public void onCall(String handlerName, IClient client,
        RequestFunction function, AMFDataList params)
    {
        getLogger().info("onCall: "+handlerName);
    }
}
```

## Adobe Flash Player and Custom Methods

Parameters passed from the Adobe Flash player client to Wowza Media Server 3 need to be marshaled to Java primitive and object types. The com.wowza.wms.module.ModuleBase class includes a number of helper functions and constants for converting the parameter values. For more complex types, the **com.wowza.wms.amf** package contains an API for object conversion. Consult the server API javadocs and the **Server Side Coding** example for more detailed information. Below is a simple example of converting three incoming parameters:

```
package com.mycompany.module;
```

```
import com.wowza.wms.module.*;
import com.wowza.wms.client.*;
import com.wowza.wms.amf.*;
import com.wowza.wms.request.*;

public class MyModule extends ModuleBase
{
    public void myFunction(IClient client,
        RequestFunction function, AMFDataList params)
    {
        String param1 = getParamString(params, PARAM1);
        int param2 = getParamInt(params, PARAM2);
        boolean param3 = getParamBoolean(params, PARAM3);
    }
}
```

A custom method called from the Adobe Flash player may return a single result value. This value must be converted to an Action Message Format (AMF) object to be understood by the Flash player. These value types can include simple types like strings, integers and booleans as well as more complex types like objects, arrays or arrays of objects. The **com.wowza.wms.module.ModuleBase** class includes a number of helper functions for returning simple types. For more complex types, the **com.wowza.wms.amf** package contains an API for object creation and conversion. Consult the server API javadocs and the **Server Side Coding** example for more detailed information. Below is a simple example of three methods returning simple value types:

```
package com.mycompany.module;

import com.wowza.wms.module.*;
import com.wowza.wms.client.*;
import com.wowza.wms.amf.*;
import com.wowza.wms.request.*;

public class MyModule extends ModuleBase
{
    public void myFunctionString(IClient client,
        RequestFunction function, AMFDataList params)
    {
        sendResult(client, params, "Hello World");
    }

    public void myFunctionInt(IClient client,
        RequestFunction function, AMFDataList params)
    {
        sendResult(client, params, 536);
    }

    public void myFunctionBoolean(IClient client,
        RequestFunction function, AMFDataList params)
    {
        sendResult(client, params, true);
    }
}
```

## Adobe Flash Player and Server to Client Calls

A custom method can call a function in Adobe Flash player directly by invoking the `IClient.call()` method. The client call can return a single variable that will be received by the server by creating a result object that implements the **`com.mycompany.module.IModuleCallResult` interface**. The `IClient.call()` method has two forms:

```
public abstract void call(String handlerName);
public abstract void call(String handlerName,
                          IModuleCallResult resultObj, Object ... params);
```

Methods on the client side are made available to the server by attaching them to the `NetConnection` object. Below is sample ActionScript 3.0 client-side code:

```
var nc:NetConnection = new NetConnection();
var clientObj:Object = new Object();

clientObj.serverToClientMethod = function(param1, param2)
{
    return "Hello World";
}

nc.client = clientObj;
nc.connect("rtmp://wms.mycompany.com/mymodules");
```

To call this client-side method from the server, the custom method looks like this:

```
package com.mycompany.module;

import com.wowza.wms.module.*;
import com.wowza.wms.client.*;
import com.wowza.wms.amf.*;
import com.wowza.wms.request.*;

class MyResult implements IModuleCallResult
{
    public onResult(IClient client,
                   RequestFunction function, AMFDataList params)
    {
        String returnValue = getParamString(params, PARAM1);
        getLogger().info("got Result: "+ returnValue);
    }
}

public class MyModule extends ModuleBase
{
    public void myFunction(IClient client,
                          RequestFunction function, AMFDataList params)
    {
        client.call("serverToClientMethod", new MyResult(),
                   "param1: value", 1.5);
    }
}
```

## Logging

A custom method can get access to the server's logging interface using the `getLogger()` helper method that is implemented by the `com.wowza.wms.module.ModuleBase` base class. Log messages are written to the log files by using one of the following four methods:

```
getLogger().debug(logStr);
getLogger().info(logStr);
getLogger().warn(logStr);
getLogger().error(logStr);
```

## Java Management Extensions (JMX)

All modules instantiated for a given application instance will be made available through the Java Management Extension's (JMX) Interface. More information regarding JMX may be found at <http://3A%2Fwww.oracle.com%2Ftechnetwork%2Fjava%2Fjavase%2Ftech%2Fjavamanagment-140525.html>. The path to the modules section in the MBean interface is:

```
WowzaMediaServer/VHosts/[vHostName]/Applications/[applicationName]/
  ApplicationInstance/[applicationInstanceName]/Modules
```

All public methods and properties (wrapped in Java Bean get/set methods) will be made available through the **Instance** object found within each module definition. If you want to exclude a method or property from the JMX interface, import the `com.wowza.util.NoMBean` class and add the `@NoMBean` annotation to your method definition. So what this means is that your custom modules are instantly made available through the Wowza Media Server 3 administration interface without any additional programming. All property values can be inspected, properties with `get[property-name]` accessors can be changed and methods with simple Java types can be invoked through JConsole or VisualVM.

## HTTPProvider Classes

HTTPProviders are Java classes that are mini Java servlets that can be used to add an HTTP interface to Wowza Server. They are configured on a per-port basis in `[install-dir]/conf/VHost.xml` (configuration is covered in the previous chapter). Below is a simple HTTPProvider that returns the server version:

## USER'S GUIDE

```
package com.mycompany.wms.http;

import java.io.*;

import com.wowza.wms.server.*;
import com.wowza.wms.stream.*;
import com.wowza.wms.vhost.*;
import com.wowza.wms.http.*;

public class HTTPServerVersion extends HTTPProvider2Base
{
    public void onHTTPRequest(IVHost vhost, IHTTPRequest req, IHTTPResponse resp)
    {
        if (!doHTTPAuthentication(vhost, req, resp))
            return;

        String version = MediaStreamBase.p+" ";
        version += ReleaseInfo.getVersion();
        version += " build"+ReleaseInfo.getBuildNumber();

        String retStr = "<html><head><title>";
        retStr += version;
        retStr += "</title></head><body>"+version+"</body></html>";
        try
        {
            OutputStream out = resp.getOutputStream();
            byte[] outBytes = retStr.getBytes();
            out.write(outBytes);
        }
        catch (Exception e)
        {
            System.out.println("HTMLServerVersion: "+e.toString());
        }
    }
}
```

Much of the functionality of HTTPProviders is encapsulated in the HTTPProvider2Base base class. Your HTTPProvider, if it extends this class, only needs to implement the onHTTPRequest method. Below are a few interesting code snippets to aid in HTTPProvider development:

### Get HTTP request URL

```
String path = super.getPath(req, false);
```

### Get HTTP request header value

```
String headerValue = req.getHeader(headerName);
```

### Set HTTP response header value

```
resp.setHeader(headerName, headerValue);
```

### Set HTTP response status

```
resp.setResponseCode(404);
```

There are several more complex and interesting examples of HTTPProviders visit the Article section of the [Wowza forums](#).

## Event Listeners

There are many points within the Wowza Media Server 3 object hierarchy where event listeners can be added. Event listeners are classes that implement a notifier interface and are notified of specific events within the server. For example you can inject a server listener that gets notified of

server startup, initialization and shutdown or an application instance listener that is notified each time an application instance is started or stopped. Below are specifics on the more interesting and useful listener interfaces:

## Server Listener (IServerNotify2)

Server listeners are notified of the life cycle of the server and are a great place to invoke and attach functionality that you would like to make available while Wowza Server is running. Examples are web services or SOAP interface and a web server or HTTP interface. Below is a simple server listener:

```
package com.mycompany.wms;

import com.wowza.wms.server.*;

public class MyServerListener implements IServerNotify2
{
    public void onServerCreate(IServer server)
    {
        System.out.println("onServerCreate");
    }

    public void onServerConfigLoaded(IServer server)
    {
        System.out.println("onServerConfigLoaded");
    }

    public void onServerInit(IServer server)
    {
        System.out.println("onServerInit");
    }

    public void onServerShutdownStart(IServer server)
    {
        System.out.println("onServerShutdownStart");
    }

    public void onServerShutdownComplete(IServer server)
    {
        System.out.println("onServerShutdownComplete");
    }
}
```

Once compiled, packaged into a **.jar** file and placed in the **[install-dir]/lib** folder, this server listener can be invoked by adding an entry to the **<ServerListeners>** list in **[install-dir]/conf/Server.xml**:

```
<ServerListener>
  <BaseClass>com.mycompany.wms.MyServerListener</BaseClass>
</ServerListener>
```

## Virtual Host Listener (IServerNotify2)

Virtual host listeners are notified of the life cycle of virtual host. Below is a simple virtual listener:

```
package com.mycompany.wms;

import com.wowza.wms.amf.*;
import com.wowza.wms.client.*;
import com.wowza.wms.request.*;
import com.wowza.wms.vhost.*;

public class MyVHostListener implements IVHostNotify
{
    public void onVHostCreate(IVHost vhost)
    {
        System.out.println("onVHostCreate: "+vhost.getName());
    }

    public void onVHostInit(IVHost vhost)
    {
        System.out.println("onVHostInit: "+vhost.getName());
    }

    public void onVHostShutdownStart(IVHost vhost)
    {
        System.out.println("onVHostShutdownStart: "+vhost.getName());
    }

    public void onVHostShutdownComplete(IVHost vhost)
    {
        System.out.println("onVHostShutdownComplete: "+vhost.getName());
    }

    public void onVHostClientConnect(IVHost vhost, IClient inClient,
        RequestFunction function, AMFDataList params)
    {
        System.out.println("onVHostClientConnect: "+vhost.getName());
    }
}
```

Once compiled, packaged into a **.jar** file and placed in the **[install-dir]/lib** folder this virtual host listener can be invoked by adding an entry to the **<VHostListeners>** list in **[install-dir]/conf/Server.xml**:

```
<VHostListener>
    <BaseClass>com.mycompany.wms.MyVHostListener</BaseClass>
</VHostListener>
```

## MediaStream Listeners (IMediaStreamActionNotify3)

MediaStream listeners receive play, publish, pause, seek, stop, and codec notification events for an Adobe Flash MediaStream object. Below is a simple MediaStream listener:

## USER'S GUIDE

```
package com.mycompany.wms;

import com.wowza.wms.amf.*;
import com.wowza.wms.stream.*;

public class MyMediaStreamListener implements IMediaStreamActionNotify3
{
    public void onMetaData(IMediaStream stream, AMFPacket metaDataPacket)
    {
        System.out.println("onMetaData");
    }

    public void onPauseRaw(IMediaStream stream, boolean isPause,
        double location)
    {
        System.out.println("onPauseRaw");
    }

    public void onPause(IMediaStream stream, boolean isPause,
        double location)
    {
        System.out.println("onPause");
    }

    public void onPlay(IMediaStream stream, String streamName,
        double playStart, double playLen, int playReset)
    {
        System.out.println("onPlay");
    }

    public void onPublish(IMediaStream stream, String streamName,
        boolean isRecord, boolean isAppend)
    {
        System.out.println("onPublish");
    }

    public void onSeek(IMediaStream stream, double location)
    {
        System.out.println("onSeek");
    }

    public void onStop(IMediaStream stream)
    {
        System.out.println("onStop");
    }

    public void onUnPublish(IMediaStream stream, String streamName,
        boolean isRecord, boolean isAppend)
    {
        System.out.println("onUnPublish");
    }

    public void onCodecInfoVideo(IMediaStream stream,
        MediaCodecInfoVideo codecInfoVideo)
    {
        System.out.println("onCodecInfoVideo");
    }

    public void onCodecInfoAudio(IMediaStream stream,
        MediaCodecInfoAudio codecInfoAudio)
    {
        System.out.println("onCodecInfoAudio");
    }
}
```

Once compiled, packaged into a **.jar** file and placed in the **[install-dir]/lib** folder, this **MediaStream** listener can be invoked by creating an instance of this object and attaching it to an **IMediaStream** object. You might do this in an **onStreamCreate** event method like this:

```
public void onStreamCreate(IMediaStream stream)
{
    stream.addClientListener(new MyMediaStreamListener());
}
```

## Server Administration

*How do I setup, manage, and deploy Wowza Media Server 3?*

Wowza Media Server 3 is a powerful Java server. It is configured through a set of XML files. The server can be run standalone from a command shell or installed as a system service. Running the server standalone is best for developing Wowza Server custom applications since the server can be started and stopped quickly and server log messages can be seen immediately in the console window. Running the server as a system service is most often used for server deployment where the server needs to continue to run even after you log off the machine or be automatically started when the server is rebooted.

### Configuring SSL and RTMPS

Wowza Media Server 3 supports Secure Socket Layer (SSL) and RTMPS (RTMP over SSL) streaming protection. SSL is a technology which allows web browsers and web servers to communicate over a secured connection. This means that the data being sent and received is encrypted in both directions. You can get an SSL certificate from a certificate authority or you can create a certificate your self. The instructions below will walk you through the steps to create a self signed SSL certificate for use with Wowza Server. If you would like to obtain an SSL certificate from a certificate authority follow the steps in this support article:

<http://www.wowza.com/docredirect.php?doc=tutorialsSSLCA>

Below are the steps to create a self-signed SSL certificate using the keytool application that comes with the Java JDK. To get started, install the Java JDK and be sure the **bin** folder of your JDK installation has been added to your PATH variable. If the PATH variable is configured correctly, you should be able to open a command prompt and execute the command **keytool**. This should return the command reference for the keytool command. Once you have the keytool command up and running, proceed to the following steps to create a self-signed SSL certificate:

1. Open a command prompt and change directory to **[install-dir]/conf**
2. Execute the following command:

```
keytool -genkey -alias wowza -keyalg RSA -keystore ssl.mycompany.com.cert
```

3. You will then be prompted to answer several questions. Below are sample responses assuming the domain name that you wish this certificate to be tied to is **ssl.mycompany.com**:

```
[Enter keystore password]
password
[What is your first and last name]
ssl.mycompany.com
[What is the name of your organizational unit]
Web Department
[What is the name of your organization]
My Company Name
[What is the name of your City or Locality]
Cincinnati
[What is the name of your State or Province]
Ohio
[What is the two-letter country code for this unit]
US
[Enter key password for <password>]
password
```

Once complete, you will see a file named **ssl.mycompany.com.cert** in the **[install-dir]/conf** folder. This is the certificate file. To configure TCP port to use this certificate, edit **[install-dir]/conf/VHost.xml** and make the following changes:

1. Uncomment the **<HostPort>** definition for port **443** that is just following the comment **<!-- 443 with SSL -->** (be sure to remove the comment before **<HostPort>** and after **</HostPort>**).

2. Set the value **SSLConfig/KeyStorePath** to:

```
${com.wowza.wms.context.VHostConfigHome}/conf/ssl.mycompany.com.cert
```

3. Set the **SSLConfig/KeyStorePassword** to key store password entered above.

TCP port 443 is now protected by SSL and RTMPS. You will need to setup a domain name entry for the domain chosen above and all communications using port 443 will need to be done using SSL or RTMPS and the domain name specified in the certificate.

Self-signed certificates (this does not apply to certificates from certificate authorities) do not work on the Mac (OSX) when using Adobe Flash to stream over RTMPS without first installing the certificate in the Keychain and setting its trust level to Always Trust. To extract the certificate and install in the OSX Keychain, do the following:

1. Extract the certificate from the keystore using the following command and copy the **ssl.mycompany.com.crt** file to the Mac:

```
keytool -export -alias wowza -file ssl.mycompany.com.crt -keystore
ssl.mycompany.com.cert
```

2. Open the **Applications > Utilities > Keychain Access** utility and select the **Certificates** category
3. Drag and drop the **ssl.mycompany.com.crt** onto this utility
4. Right click on the **ssl.mycompany.com** entry in the list and select **Get Info**
5. Open the **Trust** section of the info dialog and set **When using this certificate** to **Always Trust**

These steps need to be followed on any machine that is going to use RTMPS to play a stream that is protected using a self-signed certificate. Obviously this is not the preferred way to stream using RTMPS. It is better to obtain a signed certificate from a trusted certificate authority. With a trusted certificate these additional steps are not necessary.

There are two methods of doing RTMPS streaming when using the Adobe Flash player. The default method leverages tunneling (RTMPT over SSL) which can be slow and causes additional server load. The second method is RTMP over SSL which performs better. You can enable this mode by setting the **NetConnection.proxyType** to **"best"** before calling **NetConnection.connect**. The code looks like this:

```
var nc:NetConnection = new NetConnection();
nc.proxyType = "best";
nc.connect("rtmps://ssl.mycompany.com/myapplication");
```

## Logging

Wowza Media Server 3 uses the **apache.org log4j** library as its logging implementation. The log4j logging system provides ample functionality for log formatting, log rolling and log retrieval for most applications. By default, Wowza Server is configured to log basic information to the server console and detailed information in the W3C Extended Common Log Format (ECLF) to a log file. Java messaging is also captured in the log files to help monitor and aid troubleshooting. The log files are written to the following folder:

```
[install-dir]/logs
```

For a list of messages, scenarios that may cause these messages and suggestions for resolution, see the Wowza Media Server Logging Messages article:

<http://www.wowza.com/docredirect.php?doc=adminLoggingMessages>

Wowza Media Server logging can generate the following logging fields:

<b>date</b>	Date of log event
<b>time</b>	Time of log event
<b>tz</b>	Time zone of log event
<b>x-event</b>	Log event (see table below)
<b>x-category</b>	Log event category (server, vhost, application, session, stream)
<b>x-severity</b>	Log event severity (DEBUG, INFO, WARN, ERROR, FATAL)
<b>x-status</b>	Status of log event (see table below)
<b>x-ctx</b>	Extra data about the context of the log event
<b>x-comment</b>	Extra comment about the log event
<b>x-vhost</b>	Name of the virtual host from which the event was generated
<b>x-app</b>	Name of the application from which the event was generated
<b>x-appinst</b>	Name of the application instance from which the event was generated
<b>x-duration</b>	Time in seconds that this event occurred within the lifetime of the x-category object
<b>s-ip</b>	IP address on which the server received this event
<b>s-port</b>	Port number on which the server received this event
<b>s-uri</b>	Full connection string on which the server received this event
<b>c-ip</b>	Client connection IP address
<b>c-proto</b>	Client connection protocol (rtmp, rtmpe, rtmpt(HTTP-1.1), rtmpte(HTTP-1.1), rtmpe(HTTP-1.1), http (cupertino), http (smooth))
<b>c-referrer</b>	URL of the Flash movie that initiated the connection to the server
<b>c-user-agent</b>	Version of the Flash client that initiated the connection to the server
<b>c-client-id</b>	Client ID number assigned by the server to the connection
<b>cs-bytes</b>	Total number of bytes transferred from client to server (accumulative)
<b>sc-bytes</b>	Total number of bytes transferred from server to client (accumulative)
<b>x-stream-id</b>	Stream ID number assigned by server to the stream object
<b>x-spos</b>	Position in milliseconds within the media stream
<b>cs-stream-bytes</b>	Total number of bytes transferred from client to server for stream x-stream-id (accumulative)
<b>sc-stream-bytes</b>	Total number of bytes transferred from server to client for stream x-stream-id (accumulative)
<b>x-sname</b>	Name of stream x-stream-id
<b>x-sname-query</b>	Query parameters of stream x-stream-id
<b>x-file-name</b>	Full file path of stream x-stream-id
<b>x-file-ext</b>	File extension of stream x-stream-id
<b>x-file-size</b>	File size in bytes of stream x-stream-id
<b>x-file-length</b>	File length in seconds of stream x-stream-id
<b>x-suri</b>	Full connection string for stream x-stream-id (including query parameters)
<b>x-suri-stem</b>	Full connection string for stream x-stream-id (excluding query parameters)
<b>x-suri-query</b>	Query parameter for connection string
<b>cs-uri-stem</b>	Full connection string for stream x-stream-id (excluding query parameters)
<b>cs-uri-query</b>	Query parameter for stream x-stream-id

Wowza Media Server 3 generates the following logging events:

<b>comment</b>	Comment
<b>server-start</b>	Server start
<b>server-stop</b>	Server shutdown
<b>vhost-start</b>	Virtual host start
<b>vhost-stop</b>	Virtual host shutdown
<b>app-start</b>	Application instance start
<b>app-stop</b>	Application instance shutdown
<b>connect-pending</b>	Connection pending approval by application and license manager
<b>connect</b>	Connection result
<b>connect-burst</b>	Connection accepted in burst zone
<b>disconnect</b>	Client (session) disconnected from server
<b>play</b>	Play has started
<b>pause</b>	Play has paused
<b>unpause</b>	Play has unpaused /resumed
<b>seek</b>	Seek has occurred
<b>setstreamtype</b>	Client call to netConnection.call("setStreamType", null, "[streamtype]");
<b>setbuffertime</b>	Client call to NetStream.setBufferTime(secs) logged in milliseconds
<b>stop</b>	Play has stopped on a stream
<b>create</b>	Media or data stream created
<b>decoder-audio-start</b>	Audio decoding has started for a transcoded stream
<b>decoder-audio-stop</b>	Audio decoding has stopped for a transcoded stream
<b>decoder-video-start</b>	Video decoding has started for a transcoded stream
<b>decoder-video-stop</b>	Video decoding has stopped for a transcoded stream
<b>encoder-audio-start</b>	Audio encoding has started for a transcoded stream
<b>encoder-audio-stop</b>	Audio encoding has stopped for a transcoded stream
<b>encoder-video-start</b>	Video encoding has started for a transcoded stream
<b>encoder-video-stop</b>	Video encoding has stopped for a transcoded stream
<b>destroy</b>	Media or data stream destroyed
<b>publish</b>	Start stream publishing
<b>unpublish</b>	Stop stream publishing
<b>record</b>	Start stream recording
<b>recordstop</b>	Stop stream recording
<b>announce</b>	RTSP Session Description Protocol (SDP) ANNOUNCE

Wowza Media Server 3 generates the following logging status values:

<b>100</b>	Pending or waiting (for approval)
<b>200</b>	Success
<b>302</b>	Rejected by application with redirect information
<b>400</b>	Bad request
<b>401</b>	Rejected by application

413	Rejected by license manager
500	Internal error

Wowza Media Server 3 logging is configured in the `conf/log4j.properties` file. There are many logging configuration options made available by the log4j logging system. The remainder of this section will cover the basic options for enabling and disabling different logging fields, events and categories. Below is an example of a basic `log4j.properties` file for Wowza Media Server 3.

```
log4j.rootCategory=INFO, stdout, serverAccess, serverError

# Console appender
log4j.appender.stdout=org.apache.log4j.ConsoleAppender
log4j.appender.stdout.layout=com.wowza.wms.logging.ECLFPatternLayout
log4j.appender.stdout.layout.Fields=x-severity,x-category,x-event,x-ctx,x-comment
log4j.appender.stdout.layout.OutputHeader=false
log4j.appender.stdout.layout.QuoteFields=false
log4j.appender.stdout.layout.Delimiter=space

# Access appender
log4j.appender.serverAccess=org.apache.log4j.DailyRollingFileAppender
log4j.appender.serverAccess.DatePattern='.'yyyy-MM-dd
log4j.appender.serverAccess.File=${com.wowza.wms.ConfigHome}/logs/wowzamediaserver_access.log
log4j.appender.serverAccess.layout=com.wowza.wms.logging.ECLFPatternLayout
log4j.appender.serverAccess.layout.Fields=x-severity,x-category,x-event;date,time,c-client-id,c-ip,c-port,cs-bytes,sc-bytes,x-duration,x-sname,x-stream-id,sc-stream-bytes,cs-stream-bytes,x-file-size,x-file-length,x-ctx,x-comment
log4j.appender.serverAccess.layout.OutputHeader=true
log4j.appender.serverAccess.layout.QuoteFields=false
log4j.appender.serverAccess.layout.Delimiter=tab

# Error appender
log4j.appender.serverError=org.apache.log4j.DailyRollingFileAppender
log4j.appender.serverError.DatePattern='.'yyyy-MM-dd
log4j.appender.serverError.File=${com.wowza.wms.ConfigHome}/logs/wowzamediaserver_error.log
log4j.appender.serverError.layout=com.wowza.wms.logging.ECLFPatternLayout
log4j.appender.serverError.layout.Fields=x-severity,x-category,x-event;date,time,c-client-id,c-ip,c-port,cs-bytes,sc-bytes,x-duration,x-sname,x-stream-id,sc-stream-bytes,cs-stream-bytes,x-file-size,x-file-length,x-ctx,x-comment
log4j.appender.serverError.layout.OutputHeader=true
log4j.appender.serverError.layout.QuoteFields=false
log4j.appender.serverError.layout.Delimiter=tab
log4j.appender.serverError.Threshold=WARN
```

## Note

Always use forward slashes when referring to file paths (even on the Windows platform).

The first statement in this file sets the logging level to INFO and defines three appenders; `stdout`, `serverAccess`, `serverError`. Setting the logging level to INFO configures the logging mechanism such that it will only log events with a severity of INFO or greater. The logging severity in ascending order is: DEBUG, INFO, WARN, ERROR and FATAL. To log all events set the logging level to DEBUG.

Next, we configure each of the appenders. The important properties in this section are:

<b>Field</b>	Comma delimited list of fields to log
<b>OutputHeader</b>	Boolean value (true/false) that instructs the logging system to write out a W3C Extended Common Log Format header each time the server is started.
<b>QuoteFields</b>	Boolean value (true/false) that instructs the logging system to surround all field data in double quotes
<b>Delimiter</b>	The delimiter character to use between field values. Valid values are <b>tab</b> , <b>space</b> or the actual delimiter character.
<b>CategoryInclude</b>	Comma separated list of logging categories. Only log events with the specified categories will be logged.
<b>CategoryExclude</b>	Comma separated list of logging categories. Only log events whose category is not in this list will be logged.
<b>EventInclude</b>	Comma separated list of logging events. Only log events with the specified event name will be logged.
<b>EventExclude</b>	Comma separated list of logging categories. Only log events whose event name is not in this list will be logged.

These properties allow you to control the way the log information is formatted and filtered. For more detailed information on how to configure the log4j specific properties such as log file rolling and additional log appender types, visit the apache.org website at <http://logging.apache.org/log4j>.

Wowza Media Server 3 can also be configured to generate logs on a per-virtual host and per-application basis. These configurations are included but commented out at the bottom of the default [install-dir]/conf/log4j.properties file. The first commented out section includes configuration for per-application logging. The second commented out section includes configuration for per-virtual host logging. To turn either of these features on, simply remove the comments (# sign at the beginning of each of the lines) from the section. The per-virtual host logging will generate log files using the following directory structure:

```
[install-dir]/logs/[vhost]/wowzamediaserver_access.log
[install-dir]/logs/[vhost]/wowzamediaserver_error.log
[install-dir]/logs/[vhost]/wowzamediaserver_stats.log
```

The per-application logging will generate log files using the following directory structure:

```
[install-dir]/logs/[vhost]/[application]/wowzamediaserver_access.log
[install-dir]/logs/[vhost]/[application]/wowzamediaserver_error.log
[install-dir]/logs/[vhost]/[application]/wowzamediaserver_stats.log
```

This method of log file generation can be very useful if you plan on offering the Wowza Media Server 3 as a shared service to several customers.

**Note**

For more up to date security information visit the **Server-Side Modules and Code Samples** section at:

<http://www.wowza.com/docredirect.php?doc=forumsHome>

## Server Management Console and Monitoring

*How do I manage and monitor Wowza Media Server 3?*

Wowza Media Server 3 can be managed and monitored through a Java Management Extensions (JMX) interface.  
<http://www.oracle.com/technetwork/java/javase/tech/javamanagement-140525.html>

JMX is a standards-based technology for exposing components of a Java application through a unified object interface. This interface can then be consumed by open source and commercial monitoring tools such as HP OpenView, OpenNMS (<http://www.opennms.org>), JConsole and VisualVM (<http://visualvm.dev.java.net>).

### Note

Most Java Runtime Environment (JRE or JVM) vendors require that you install the full Java Development Kit (JDK) to get the JConsole management and monitoring application. Please consult your vendor's documentation.

### Note

A good place to learn more about the Java Management Extension (JMX) standard is from the Oracle website (<http://download.oracle.com/javase/6/docs/technotes/guides/jmx/>).

## Local Management Using JConsole

Wowza Media Server 3 exposes a rich set of objects for monitoring the server. The Java virtual machine also exposes a set of JMX objects that can be used to monitor the virtual machine. The easiest way to view these objects is by using the JConsole applet that ships with the Java Development Kit (JDK) of most popular VMs. This tool is usually located in the bin folder of your Java JDK installation. By default the startup.bat and startup.sh are configured to expose the JMX object interface to a locally running copy of JConsole. To view the JMX interface, first start Wowza Media Server 3 (either by running it as a service or standalone from a command prompt).

Next, run JConsole. In JConsole you should see a list of the currently running Java virtual machines that are exposing a JMX interface. Wowza Server will be listed as **com.wowza.wms.bootstrap.Bootstrap start**. Select this item and click the **Connect** button.

### Note

On Windows, for security reasons, local monitoring and management is only supported if your default Windows temporary directory is on a file system that supports setting permissions on files and directories (for example, on an NTFS file system). It is not supported on a FAT file system that provides insufficient access controls. The workaround is to setup remote monitoring. See the **Remote Management** section below, to learn how to configure the remote JMX interface.

From here you can explore the different tab panels that are part of JConsole. Wowza Media Server 3 management objects are located under the **MBean** tab in the **WowzaMediaServerPro** group. The JMX objects are organized based on the configured virtual hosts, applications and applications instances. Monitoring objects will be created and deleted on the fly as applications, application instances, client connections and streams are created and deleted from the server.

## Remote JMX Interface Configuration

By default the startup and service scripts are configured to only expose the JMX interface to a locally running monitoring application. You can also configure a remote JMX interface for monitoring Wowza Server from a remote computer. Both the JVM and Wowza Server include remote JMX interfaces. It is only necessary to configure one of these remote interfaces to enable remote monitoring. It is suggested that you use the Wowza Server remote interface since it is more easily configured and can be properly exposed through hardware or software based firewalls.

### Wowza Media Server 3 built-in JMX interface configuration

The remote JMX interface built into Wowza Media Server 3 can be configured through the **JMXRemoteConfiguration** and **AdminInterface** sections of the **[install-dir]/conf/Server.xml** file. This section contains the following settings:

#### JMXRemoteConfiguration - Enable, IpAddress, RMIServerHostName, RMIConnectionPort, RMIRegistryPort

The **Enable** setting is a boolean value that can either be **true** or **false** and is the main switch to turn on and off the remote JMX interface. The default value is **false**. Setting this value to **true** (with no further modifications to the other settings), will turn on the remote JMX interface with authentication. The default username/password is admin/admin and the URL for invocation in JConsole or VisualVM is:

```
service:jmx:rmi:///localhost:8084/jndi/rmi:///localhost:8085/jmx
rmi
```

The **IpAddress** and **RMIServerHostName** work together to properly expose the JMX interface to the network. In general, the **IpAddress** should be set to the internal ip address of the server

running Wowza Media Server 3 and **RMIServerHostName** should be set to the external ip address or domain name of the machine. For example, if the server running Wowza Media Server 3 is behind a network translated ip address (NAT) such that the internal ip address of the server is 192.168.1.7 and the external ip address is 40.128.7.4, the two settings should be as follows:

```
<IpAddress>192.168.1.7</IpAddress>
<RMIServerHostName>40.128.7.4</RMIServerHostName>
```

With this configuration you would use the following URL to connect to the JMX interface:

```
service:jmx:rmi:///40.128.7.4:8084/jndi/rmi:///40.128.7.4:8085/jmxrmi
```

The **RMIServerHostName** and **RMIServerPort** settings control the TCP ports used to expose the RMI connection and RMI registry interfaces. These values only need to be changed if Wowza Media Server 3 reports port conflicts upon startup. The default values for these settings are 8084 and 8085 respectively. The **RMIServerPort** corresponds to the first port number in the connection URL and the **RMIServerPort** to the second.

The **IpAddress**, **RMIServerPort** and **RMIServerPort** effect the connection URL in the following way:

```
service:jmx:rmi://[RMIServerHostName]:[RMIServerPort]/jndi/rmi://[RMIServerHostName]:[RMIServerPort]/jmxrmi
```

If the remote JMX interface is enabled, Wowza Media Server 3 upon startup will log the URL of the currently configured JMX interface. This is probably the most reliable way to determine the JMX URL to use to connect to the server.

To enable remote JMX monitoring through software or hardware based firewalls, open TCP communication for the two ports defined by the **RMIServerPort** and **RMIServerPort** settings.

## JMXRemoteConfiguration - Authenticate, PasswordFile, AccessFile

The **Authenticate** setting is a boolean value that can either be **true** or **false** and is the main switch to turn on and off remote JMX interface authentication. The **PasswordFile** and **AccessFile** settings are the full path to the JMX password and access files.

The password file is a text file with one line per user. Each line contains a username followed by a space followed by a password. The access file contains one line per user. Each line contains a username followed one of two access permission identifiers; **readwrite** or **readonly**. A sample password file **jmxremote.password** and sample access file **jmxremote.access** can be found in the conf directory of the installation.

These files define three named users:

admin (password admin)	- access readwrite
monitorRole (password admin)	- access readonly
controlRol (password admin)	- access readwrite

### Note

Some Java Runtime Environments require that both the password and access files have read only privileges. On Linux, this can be achieved by setting the permissions on both files to 600.

```
chmod 600 conf/jmxremote.access
chmod 600 conf/jmxremote.password
```

## JMXRemoteConfiguration - SSLSecure

The **SSLSecure** setting is a boolean value that can either be **true** or **false** and is the switch to turn on and off remote JMX interface over SSL. SSL configuration can get quite involved. The following online documentation describes the process for enabling SSL with JMX:

<http://download.oracle.com/javase/6/docs/technotes/guides/management/agent.html#gdemv>

## AdminInterface/ObjectList

The **AdminInterface/ObjectList** setting is a comma separated list of object types that you wish to expose through the JMX interface. This list can contain any number of the following items:

Server	- Server level connection and performance info and notifications
VHost	- Information about currently running virtual hosts
VHostItem	- Details of currently configured virtual hosts
Application	- Application level connection and performance info
ApplicationInstance	- Application Instance level connection and connection info
Module	- Details of currently loaded modules
MediaCaster	- Details of media caster objects (ie, live stream repeater)
Client	- Details of each connected Flash session
MediaStream	- Details of each individual server side NetStream object
SharedObject	- Details of currently loaded shared objects
Acceptor	- Details of currently running host ports or TCP ports
IdleWorker	- Details of currently running idle workers

Exposing **Client**, **MediaStream** and/or **SharedObject** information can add significant load to the server and to the JMX interface. You will most likely want to turn off this level of detail for deployed solutions.

### Note

When running Wowza Media Server 3 as a Windows service, the JMX interface will not be available unless the service is running as a named user. To configure the service to run as a named user, go to **Settings>Control Panel>Administrative Tools>Services** and right click on the **Wowza Media Server** service and select **Properties**. Next, click on the **Log On** tab, change the **Log on as** radio to **This account** and enter a user name and password for a local user.

## Remote Management

### Remote Management Using JConsole

JConsole can also be used to monitor a remote Wowza Media Server 3 server. Once you configured the remote JMX interface as described above, run JConsole. Enter the remote JMX interface URL into the **Remote Process** field. The default remote JMX interface URL for the Wowza Media Server 3 built-in JMX interface is:

```
service:jmx:rmi:///localhost:8084/jndi/rmi:///localhost:8085/jmx
rmi
```

Finally, enter your user name and password into the provided fields and click the **Connect** button. You should now be connected to the remote server and able to view the JMX hierarchy.

### Remote Management Using VisualVM

Another great tool for monitoring Wowza Media Server 3 over JMX is VisualVM. VisualVM can be downloaded from the following location:

<http://visualvm.dev.java.net>

Once you get it installed and running, it is best to install the MBean plugin. To do this select the **Plugins** command from the **Tools** menu. In the **Available Plugins** tab put a check mark next to the **VisualVM-MBean** plugin and click the **Install** button. Once you get this plugin installed it will provide similar information to JConsole. You can select **Add JMX Connection** from the **File** menu to add your Wowza Media Server 3 to the **Applications** list.

## Object Overview

This section describes the more important top level objects that can be used to monitor the server's performance and uptime. This section will not cover each and every object that is exposed by the server. These objects are available under the **WowzaMediaServer** object in the MBean section of JConsole and VisualVM.

### Server

The server object contains information about when the server was started and how long it has been running.

### VHosts

The VHosts collection includes information on each of the running virtual hosts. From here you get access to each of the running applications and applications instances. At each level of the hierarchy (Server, VHost, Application, ApplicationInstance) you can get detailed information on number of connections (Connections object) and the input/output performance (IOPerformance object).

### IOPerformance

The Server exposes IOPerformance objects at many different levels of the object hierarchy. These objects can be used to monitor server performance and throughput at that section of the

server. For example the IOPerformance object under a particular VHost will display the throughput of that particular virtual host.

## Connections

The Server exposes Connections objects at many different levels of the object hierarchy. These objects can be used to monitor client connections to that section of the server. For example the Connections object under a particular Application object will display the current clients connected to that particular Application.

## VHost/[vHostName] - HandlerThreadPool, TransportThreadPool

The HandlerThreadPool and TransportThreadPool objects expose information about each of the worker thread pools that are owned by each of the virtual hosts. You can use this object to monitor thread usage and load.

## ServerNotifications

The ServerNotifications object publishes notification events pertaining to the connection limits and connection bursting capabilities of Wowza Media Server. Wowza Media Server 3 can generate the following notification events:

<code>com.wowza.wms.connect.WarningServerLicenseLimit</code>	- connection accepted in bursting zone (warning)
<code>com.wowza.wms.connect.ErrorServerLicenseLimit</code>	- connection refused due to license limit
<code>com.wowza.wms.connect.WarningVHostLimit</code>	- connection refused due to virtual host limit

The body of the JMX notification message is a string with information about the virtual host, application, application instance, client id, ip address and referrer that generated the event. Notification events can be viewed in JConsole by navigating to the **MBean** tab, opening the **WowzaMediaServer** group and selecting the **ServerNotification** object. Next, select the **Notifications** tab and click the **Subscribe** button. All events will display as new rows in the **Notifications** list. Only events that occur after you subscribe to the notifications will be displayed.

## Virtual Hosting

*How do I let multiple users share my Wowza Media Server 3 server?*

Wowza Media Server 3 can be configured to run multiple virtual host environments. Each of these virtual host environments has its own set of configuration files, application folders and log files. This enables a single server to serve multiple users in separate environments. By default the server is configured with a single virtual host named `_defaultVHost_`.

### Configuration Files

Below is a description of the `VHosts.xml` file in the `conf` directory that is used to define a virtual host.

#### **VHosts.xml**

The `VHosts.xml` configuration file is used to define each of the virtual host environments. Below is a description of each of the items that are required to define a virtual host.

#### **VHosts/VHost/Name**

The name of the virtual host.

#### **VHosts/VHost/ConfigDir**

The configuration directory for the virtual host. The contents of this directory will be described below.

#### **VHosts/VHost/ConnectionLimit**

The maximum number of simultaneous connections this virtual host can support. If this value is zero the virtual host can have an unlimited number of simultaneous connections.

## Typical Configuration

Let's jump in and look at a typical VHosts.xml file for a virtual host environment that contains two virtual hosts: **vhost1** and **vhost2**.

```
<Root>
  <VHosts>
    <VHost>
      <Name>vhost1</Name>
      <ConfigDir>/home/vhosts/vhost1</ConfigDir>
      <ConnectionLimit>0</ConnectionLimit>
    </VHost>
    <VHost>
      <Name>vhost2</Name>
      <ConfigDir>/home/vhosts/vhost2</ConfigDir>
      <ConnectionLimit>0</ConnectionLimit>
    </VHost>
  </VHosts>
</Root>
```

The directory structure for these two virtual hosts would be the following:

```
[/home/vhosts]
  [vhost1]
    [applications]
    [conf]
      Application.xml
      Authentication.xml
      DVR.xml
      HTTPStreamers.xml
      LiveStreamPacketizers.xml
      LiveStreamTranscoders.xml
      MediaCasters.xml
      MediaReaders.xml
      MediaWriters.xml
      MP3Tags.xml
      RTP.xml
      StartupStreams.xml
      Streams.xml
      VHost.xml
      admin.password
      publish.password
    [content]
    [keys]
    [logs]
  [vhost2]
    [applications]
    [conf]
      Application.xml
      Authentication.xml
      DVR.xml
      HTTPStreamers.xml
      LiveStreamPacketizers.xml
      LiveStreamTranscoders.xml
      MediaCasters.xml
      MediaReaders.xml
      MediaWriters.xml
      MP3Tags.xml
      RTP.xml
      StartupStreams.xml
      Streams.xml
      VHost.xml
      admin.password
      publish.password
    [content]
    [keys]
    [logs]
```

**Note**

See the logging section for instructions on how to configure per virtual host logging.

The process for virtual host configuration is very simple. Virtual hosts are defined in the VHosts.xml file in the conf directory. Each virtual host gets its own configuration directory structure that contains an application, conf and logs directory. Each virtual host gets its own set of configuration files.

It is very important to note that Wowza Media Server 3 only supports ip-address/port based virtual hosting and does not support domain named based virtual hosting. What this means is that in VHost.xml each virtual host must define HostPort entries with unique ip-address and port combinations that do not conflict with other virtual hosts defined on a given server. The following combinations represent valid vhost port configurations:

```
vhost1:
<HostPort>
  <IpAddress>192.168.1.2</IpAddress>
  <Port>1935</Port>
</HostPort>
```

```
vhost2:
<HostPort>
  <IpAddress>192.168.1.2</IpAddress>
  <Port>1936</Port>
</HostPort>
```

Or

```
vhost1:
<HostPort>
  <IpAddress>192.168.1.2</IpAddress>
  <Port>1935</Port>
</HostPort>
```

```
vhost2:
<HostPort>
  <IpAddress>192.168.1.3</IpAddress>
  <Port>1935</Port>
</HostPort>
```

Through the JMX interface and the VHosts.xml configuration file, virtual hosts can be added, modified and deleted on the fly without stopping and restarting the server. The virtual host operations can be accessed through JConsole. First, with the server running, start JConsole and select the **MBean** tab. Open the **WowzaMediaServer** group and select the **Server** object. The virtual host operations are found under the **Operations** tab. There are three operations of interest:

startVHost	- start an individual vhost by name
stopVHost	- stop an individual vhost by name
reloadVHostConfig	- reload the VHosts.xml
configuration file	

To add a new virtual host without restarting the server, edit **VHosts.xml**, add a new virtual host definition, then copy and configure a new set of configuration files as described above. Next, open JConsole and navigate to the **Server** object and click the **reloadVHostConfig** to reload the **VHosts.xml** file. Finally, enter the name of the new virtual host into the text entry box next to the **startVHost** button and click the button. The new virtual host will be started immediately.

## Examples & AddOn Packages

*What do each of these examples do and where do I get AddOn Packages?*

Wowza Media Server 3 ships with many examples that highlight the functionality of the server. This chapter describes each of these examples. All Adobe Flash examples are implemented using ActionScript 3.0.

Wowza also provides several AddOn Packages that extend and enhance the functionality of Wowza Media Server 3. While some AddOns are already built-in, others need to be downloaded and installed. Some of the AddOns are available for free, while others may require the purchase of a specific license, depending on the Edition being used, in order to run the AddOn.

An up to date list of AddOn Packages can be found here:

[AddOn Packages](#)

For the most up to date information, tutorials and tips, visit the Article section of the Wowza forums:

<http://www.wowza.com/docredirect.php?doc=forumsHome>

### Note

In the root folder of each example is a README.txt that contains any extra installation steps that are necessary to make the example function. To view the examples, navigate to [wowza-install-dir]/examples

## SimpleVideoStreaming

This example includes a video on demand player for Adobe Flash and Microsoft Silverlight. It includes source code for Adobe Flash CS3 or greater, Adobe Flex 3 or greater, Microsoft Silverlight 3 or greater and an Open Source Media Framework (OSMF) based Flash player. It utilizes the **default** stream type.

## LiveVideoStreaming

This is an Adobe Flash example that illustrates how to setup and playback live video. It includes source code for Adobe Flash CS3 or greater, Adobe Flex 3 or greater, Microsoft Silverlight 3 or greater and an Open Source Media Framework (OSMF) based Flash player. It utilizes the **live** and **rtp-live** stream types.

## LiveDVRStreaming

This is example illustrates how to setup the nDVR to record and playback a Live Video.

## VideoChat

This is an Adobe Flash example that illustrates how to implement video chat between two users. It utilizes the **live-lowlatency** stream type and uses the Camera and Microphone objects to obtain video and audio content. The example can either stream video and audio data between two client connections or loop the data back to itself.

## VideoRecording

This is an Adobe Flash example that illustrates how to implement client to server video recording. It utilizes the **record** stream type and uses the Camera and Microphone objects to obtain video and audio content.

## TextChat

This is an Adobe Flash example that illustrates how to implement a simple text chat application. It utilizes the **default** stream type.

## SHOUTcast

This is an Adobe Flash example that illustrates how re-stream SHOUTcast MP3 or AAC+ audio data through Wowza Media Server 3. It utilizes the **shoutcast** stream type.

## RemoteSharedObjects

This is an Adobe Flash example that illustrates the basics of remote shared objects. It implements the basic remote shared object interface and the onSync event handler to highlight how data is synchronized between client connections. To see the data synchronization in action, try opening two instances of the example. While you make changes in one instance you will see the data update in the other.

## ServerSideModules

This example is referenced by the Wowza IDE: User's Guide and is a good starting point to learn how to create your first custom server side module.

## **MediaSecurity**

Wowza Media Systems provides a media security package that includes SecureToken and RTMP Authentication functionality as well as a document that covers other methods of securing Wowza Media Server 3. To obtain the latest version of this package, visit the following Wowza Media Server support article:

<http://www.wowza.com/docredirect.php?doc=addOnMediaSecurity>

## **BWChecker**

This is an Adobe Flash example that provides a means for testing the bandwidth between individual Flash client connections and Wowza Media Server 3. It includes both a debugging tool that can be used to interactively test bandwidth as well as Flash code that you can embed into your Flash application.

## **LoadBalancer**

Wowza Media Systems provides a dynamic load balancing package that you can add to the Wowza Media Server 3. To obtain the latest version of this package, visit the following Wowza Media Server support article:

<http://www.wowza.com/docredirect.php?doc=addOnDynamicLoadBalancing>