

Video Content Delivery: Red 5

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Abstract

In modern era, E-learning has been emerged as the new learning approach that incorporates multimedia and other technologies. As a part of e-learning, video lectures recorded from classroom teaching includes the important content. This paper describes the process of implementing open source media streaming server for delivering e-learning video content. Server uses RTMP protocol for distribution of videos over web. With the use of RTMP protocol, streaming media server maintains the connection between the client & server and also preserves the client interaction with the video stream. The server can publish real-time data or a file in the server to the Web so that end users can view all the videos at anytime and anywhere over web, without being forced to be downloaded entirely. The paper contains the design of streaming server and how videos will be delivered to the end user.

Keywords: RED 5, RTMP, Pedagogy, Streaming, Video-on-Demand, Multi-Bit Rate Streaming

1. Introduction

Evolvement of virtual workspaces and digital libraries has provided new environments for learning and teaching. It has also increased the areas of research. E-learning induces as an anticipating choice to the conventional schoolroom acquisition, facilitating smart set to move towards a sight of lifelong and on-demand learning. It emerges as a fastest growing course and designs to provide a base that incorporates relevant tools, materials and services into an individual solution to create and present training or informative content promptly. Many courses are online available. In addition to online learning material, interactive learning and discussion can also be possible.

Video lectures are productive, creative and almighty feature that can be used in online learning and acquisition. It demonstrates selective information in an engaged and ordered way. An anterior analysis shows the impression of video on learning out-

comes. Video lecturers are considered as add-on towards the traditional learning where all the learners are viewing lectures at different times and places.

The growth in interactive video permits scholars to interact with video. This would raise scholar or learner involvement and therefore improve learning strength. The main property of video is random access to the scholarly content where learners can play the video section with minimum seek time. Following this section we will discuss how the video lectures are delivered to the learners or students.

2. Delivering Video E-content

The delivery of e-learning content to the lifelong learners is also considered as dominant factor. Professors and educates can approach and implement knowledge in an extensive manners through the use of digital media, YouTube videos in the form of short lectures, animations, simulations, or virtual worlds. MIT's OpenCourseWare, Apple's iTunes University, and the UK Open University's OpenLearn provide educational resources for free. They offer an option



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route for students who struggle to follow in classroom lectures.

Even texts are getting converted to integrate video and audio clips, animations and rich graphics and turning more synergistic, providing both instructors and students to contribute or alter material including assessment questions and answers. Video and pedagogy are closely related. Pedagogy deals with the theory and practice of education; or the study and practice of 'how best to teach'. Professors and learners both need pedagogy. Professor needs it for how he should produce effective video resources. Learner would be able to know whether he is looking at or learning right thing or not.

Video lecture delivery method includes Cable, Video Tape, Satellite Transmission and Streaming Video. Webinars and courseware are also used by some academic institutions and organizations to deliver the video lectures. The delivery of video in these manners has some drawbacks. Video delivery using video tapes is irritating for batch video files. The cost of delivering large number of video lectures using webinars is high.

In addition to this, video can be delivered in store and forward pattern. In this pattern user first downloads the whole video and then watch it. This is unacceptable for large file sizes. These delivery techniques presumes that learner have to live up with predestined quality. To get over these consequences video streaming gets into impression. One survey shows the use of streaming media is growing exponentially that is depicted in following figure:

Video streaming refers to term that is constantly delivered and presented to the end user while being delivered by provider. The end user do not have to download whole file, he can play before downloading the whole file. Scholars or educates could begin learning the pre-recorded lecturers earlier to downloading them in local file system.

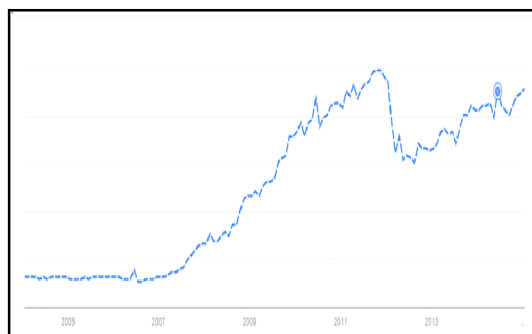


Figure 1: Streaming Media Growth (2004-2015)

3. Different Media Streaming Servers

In order to deliver video lectures using streaming, many media servers are available. The criteria for selecting video streaming server include Protocol, supported Audio, Video Formats, cost and additional features like compatible platforms, live and on-demand streaming, recording, multi- protocol streaming. Below comprehends the available media streaming servers.

3.1 Adobe Media Server

Adobe Media Server is a proprietary data and media server from Adobe Systems (originally a Macromedia product). This server works with the Flash Player runtime to create media driven, multiuser RIAs (Rich Internet Applications). The server uses ActionScript 1, an ECMAScript based scripting language, for server-side logic. It is known as Flash Media Server.

3.2 Wowza Media Server

Wowza Streaming Engine is unified streaming media server software developed by Wowza Media Systems. The server is used for streaming of live and on-demand video, audio, and RIAs (rich Internet applications) over IP networks to desktop, laptop, and tablet computers, mobile devices, IPTV set-top boxes, internet-connected TV sets, game consoles, and other network-connected devices.

3.3 Red5 Media Server

Red5 is open source flash server written in java which supports streaming audio/video, recording client streams, shared objects, live stream broadcasting etc. Red5 can do nearly everything that Adobe FMS

can do. Red5 is also used for Video chat sites and recording live streams.

4. Comparison of Media Streaming Servers

The following table gives the comparison of Flash Media Server, Wowza Media Server and Red 5 Media Server.

Table 1: Streaming Media Systems Comparison

Feature	Flash Media Server	Wowza Media Server	Red5
Protocols	RTMP, RTMPT, RTMPS, RTMPE, RTMPTE, RTMFP	RTMP, RTMPT, RTMPS, RTMPE, RTMPTE	RTMP, RTMPT, RTMPS, RTMPE, RTMPTE
Open Source	No	Limited	Yes
Platforms	Microsoft® Windows Server® 2003 with Service Pack 2 or Windows Server 2008, Linux® Red Hat® 4 or 5.2	Windows, Mac OS X, Linux, Solaris, Unix, 64-bit Support on all, IPv6 Support	Windows, Debian/Ubuntu, Mac OS X, WAR, Gentoo
Live and On-demand Audio / Video Streaming	FLV, H.264, MP3, AAC, LC-AAC, HE-AAC, Speex	FLV, H.264, MP3, AAC, LC-AAC, HE-AAC, Speex	(On Demand) FLV, MP3, F4V, MP4, AAC, M4A (Live) Sorenson, VP6, h.264, Nelly Moser, MP3, Speex, AAC, NSV
Server Side	AS2	Java	Java
Multi Client/ Multi Protocol Streaming	Flash (RTMP / HTTP) iPhone/iPad (HTTP Streaming)	Flash (RTMP) iPhone/iPad (HTTP Streaming) Silverlight (Smooth Streaming) QucikTime/3GPP (RTSP/RTP) IPTV (MPEG-TS)	Flash (RTMP)
Recording	H.264/AAC to FLV container MPEG-4	H.264/AAC to FLV container H.264/AAC to MP4 (Quick time) container	FLV Only

On the basis of above listed parameters, Red 5 media server is well worth for the delivery of videos or lectures. Following section covers RED 5 streaming server.

5. RED 5

Red 5-Media Server [13] offers almighty video streaming and multi-user solution to Adobe Flash based sites, application programs and articles, besides exciting client technologies. It is grounded upon a few and most powerful open source frameworks and Java, and provides the best solution for open source media server. Red 5 is open source by nature and used for video on demand streaming and web-cam streaming. Red5 server provides scalable platform for video conferences, multi user gaming application and enterprise application software. Below table shows the services offered by Red 5.

Table 2: Services offered by Red 5

Services offered by Red5	
Streaming Video	FLV, F4V, MP4, 3GP formats
Streaming Audio	MP3, F4A, M4A, AAC fomats
Recording Client Streams	FLV and AVC+AAC in FLV container
Live Stream Video Publishing	FLV, VP6 formats
Live Stream Audio Publishing	MP3, AAC formats
Protocols supported	RTMP, RTMPT, RTMPS, and RTMPE
Allows Objects Sharing	
Allows Live Streaming Publishing	

4.1 RED 5 Installation

Red 5 media server helps the organizations and institutions to host their video sites. In this we are going to discuss how to install Red 5 Development Server with required pre-requisites on CenOS-6.5 64 bit.

Installing JAVA

Red is a java based streaming server. So we will need Java to be installed on the server. To check whether java is installed or not, use the following command.

```
# java -version
```

If java is not installed, it can be installed by running the following YUM command on CentOS Server:

```
# yum -y install java-1.6.0-openjdk java-1.6.0-openjdk-devel
```

Setting Environment variables

After installing java, you first have to set environment variables so that other application or programs on server can identify that java is installed. Environment variables can be set by following two commands:

```
# echo 'export JAVA_HOME=/opt/jdk1.7.0_25' >> /etc/bashrc
# source /etc/bashrc
```

Installing Apache Ant

Apache Ant is a build tool for Java applications. It essentially permits various java applications to be compiled at one time. So we will download source code and then we will build Red 5 media server using Apache Ant. It can be downloaded and installed by using following commands.

```
# wget http://opensource.become.com/apache/ant/binaries/apache-ant-1.8.2-bin.tar.gz
# tar zxvf apache-ant-1.8.2-bin.tar.gz
# mv apache-ant-1.8.2/ /usr/local/ant
```

First command will download the source code of Apache Ant from websites. Downloaded file can be extracted using the second command. Third one will place the Apache Ant in respective directory for use.

Setting Environment Variables for Apache Ant

Setting proper environment variable for Apache Ant will help us to build the Red 5 Media Server and many other java applications. It can be fixed by:

```
# echo 'export ANT_HOME=/usr/local/ant' >> /etc/bashrc
# source /etc/bashrc
```

Installing SVN

Apache Subversion, SVN [21] is a software versioning and revision control system distributed as free software under the Apache License. It is used by developers to download source code, web pages, and documentation. We will use it to fetch latest source code of Red5 from SVN repository. SVN can be installed by executing following commands:

```
# yum install subversion
```

Red 5 installation

First of all we have to download source code and store it in some folder. It can be done by:

```
# svn checkout http://red5.googlecode.com/svn/
java/server/trunk/ red5
# mv red5 /usr/local/
```

Now enter the directory and build it by executing following commands:

```
# cd /usr/local/red 5
```

```
# ant prepare
```

```
#ant dist
```

After executing above command, we will get BUILD SUCCESSFUL message at the end. This message presumes that we have a build of Red 5 server. We can the successful installation by executing ./red5.sh command.

Service

The most important part of installing Red 5 server is creating Service Script. This script will be used to start, stop and restart the media server. So create Red 5 service script using:

```
# vi /etc/init.d/red5
```

Add the following lines into the script file.

```
#!/bin/bash
PROG=red5
RED5_HOME=/usr/local/red5
DAEMON=$RED5_HOME/$PROG.sh
PIDFILE=/var/run/$PROG.pid

# Source function library
./etc/rc.d/init.d/functions

[ -r /etc/sysconfig/red5 ] && ./etc/sysconfig/red5

RETVAL=0

case "$1" in
  start)
    echo -n $"Starting $PROG: "
    cd $RED5_HOME
    $DAEMON >/dev/null 2>/dev/null &
    RETVAL=$?
    if [ $RETVAL -eq 0 ]; then
      echo $! > $PIDFILE
      touch /var/lock/subsys/$PROG
    fi
  ;;
  stop)
    echo -n $"Shutting down $PROG: "
    killproc -p $PIDFILE
    RETVAL=$?
    echo
    [ $RETVAL -eq 0 ] && rm -f /var/lock/subsys/$PROG
  ;;
  restart)
    $0 stop
    $0 start
  ;;
  status)
    status $PROG -p $PIDFILE
    RETVAL=$?
  ;;
  *)
    echo $"Usage: $0 {start|stop|restart|status}"
    RETVAL=1
  ;;
esac
```

Figure 2: RED 5 Script

Red 5 started by following command:

```
# /etc/init.d/red5 start
```

Now navigate browser to <http://localhost:5080/>, you will get your server ready.

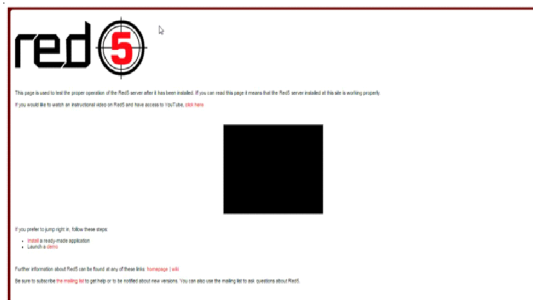


Figure 3: Red 5 Server Start Page

6. Implementation

Red 5 server will generate RTMP stream. Real Time Messaging Protocol (RTMP) is used to deliver multimedia or real time data over web. RTMP is responsible for handling interaction between client and server. To deliver the video lecture to the learners, we have to embed Red5 RTMP stream into page. With the help of Jwplayer, we can embed the RTMP stream into page which will be accessible over internet. Following code shows the how we can embed video into page using Jwplayer.

```
<div id='player_1'>loading the player</div>
<script type='text/javascript'>
jwplayer('player_1').setup({
  flashplayer : "jwplayer/jwplayer.flash.swf",
  width : "100%",
  height : "100%",
  primary : "flash",
  file : rtmp://14.139.116.6:1935/epgp/mp4:ls.mp4"
});
</script>
```

Figure 4: Embedding Video into Page

The below figure shows the snapshot of the live stream from RED 5 media server.



Figure 5: Red 5 Media Server Output

In addition to live streaming and Video on Demand Streaming, RED 5 can be used to implement multi-bit rate streaming. In multi-bit rate streaming, scholar will be presented with same video encoded at different quality levels. So users can adapt to quality according to their bandwidth. For delivering multi-bit rate streaming, we have to create Synchronized Multimedia Integration Language (SMIL) file. The file contains the url of the same file encoded at different quality levels. The following figure shows the snippet for smil file:

```
<smil>
<head>
<meta base="rtmp://172.16.16.13:1935/adaptive_stream/" />
</head>
<body>
<switch>
<video src="tech_1280.mp4" height="720" system-
bitrate="2000000" width="1280" />
<video src="tech_640.mp4" height="360" system-
bitrate="800000" width="640" />
<video src="tech_320.mp4" height="180" system-
bitrate="300000" width="320" />
</switch>
</body>
</smil>
```

Figure 6: Snippet of SMIL FILE

The output of multi-bit rate streaming is shown in below figure:

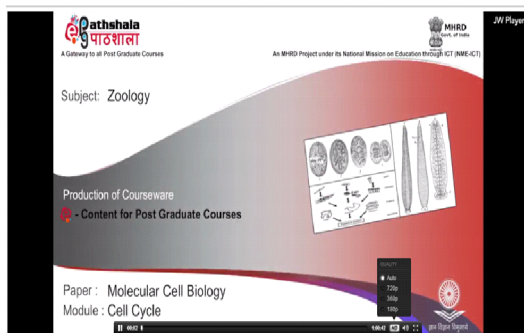


Figure 7: Output of Multi-Bit Rate Streaming

7. Conclusion

In this Paper, we have presented how multimedia is useful in delivering the online learning content. For the delivery of video content, we have implemented Red 5 media streaming server. Red 5, an open source media streaming server facilitates us live video streaming and video-on-demand streaming. We have also shown how to install and implement Red 5 media streaming server on Linux system. We have also presented snippet for embedding the RTMP stream from Red 5 into a page so the videos will be accessed around the globe via web.

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