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ClickView – An Overview for I.T. Professionals

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CLICKVIEW PRODUCT MANAGER

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OVERVIEW

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EXECUTIVE SUMMARY

Whilst ClickView was developed to provide schools with a simple and reliable platform for delivering high quality video over their data networks – it is strongly recommended that I.T. professionals take time to understand the core processes which are carried out behind the scenes.

This document aims to outline the technical specifics behind ClickView's video delivery methodology.

NOTE: This document assumes that the reader has a basic understanding of the functionality of the ClickView Library Server and ClickView Player applications. The document also assumes a solid understanding of data network fundamentals and the Microsoft Windows operating system.

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HOW THE CLICKVIEW LIBRARY SERVER OPERATES

ClickView Library Server is the core application in the ClickView system. It acts as a TCP/IP data server and content management system. The ClickView Library Server is built on the .NET Framework 1.1.

ClickView Player is the primary client application which provides teachers, students, and staff with a simple interface allowing 'read-only' access to the contents of the ClickView Library. It is available for Windows (.NET) and Mac OS X (Java).

When the ClickView Library Server is started, the ClickView Library Server Service opens port **9053** and waits for incoming TCP/IP requests to its default NIC (network interface card). This mimics the operation of a traditional web server which opens port 80 and waits for incoming TCP/IP requests from web browsers.

Generally, the ClickView Player sends requests to the I.P. address of the ClickView Library Server in encrypted ASCII. The ClickView Library Server will process the request and then respond to the source I.P. address of the TCP/IP connection with the appropriate ASCII (XML) or binary data.

ClickView communication is strictly 'Player Request/ Server Response' - much the same as the relationship between a web browser and a web server – all connections are established by the client. The ClickView Library Server will never attempt to establish a connection to the ClickView Player or any other ClickView client device. ClickView Player will always close its connection with the ClickView Library Server after each request/response - similar to an HTTP request/response between a web browser and a web server.

NOTE: To minimize impact on the network and server, the video delivery process does not rely on drive-mappings or Windows file sharing.

HOW CLICKVIEW QUERIES THE CLICKVIEW LIBRARY SERVER

ClickView has a platform independent query protocol which the ClickView Player uses to query and request data from the ClickView Library Server.

For security reasons, all ASCII transmissions between the ClickView Library Server and ClickView Player are encrypted. In this way, teacher's passwords and other sensitive information cannot be intercepted by packet sniffers operating on the school network.

Generally the ClickView Library Server will return ASCII data to the ClickView Player in XML format which the system will store in memory ready for interpretation.

Binary data which is sent to the ClickView Player is temporarily cached in the %TEMP%\ClickView\ directory. When the ClickView Player application is closed, the cache is cleared.

Once the ClickView Player has been informed of the available videos by querying

the ClickView Library Server (which it does when the ClickView Player synchronizes with the ClickView Library Server), the ClickView Player is ready to request videos and resources from the ClickView Library Server.

HOW CLICKVIEW PLAYER OBTAINS VIDEO FROM THE SERVER

ClickView uses **predictive file transfer (PFT)** to deliver video from the ClickView Library Server to the ClickView Player.

PFT works on the concept of delivering video files to the user on a chapter-by-chapter/just-in-time basis.

When the ClickView Player application is instructed to request, receive and display a selected video, only the first chapter of the video will be requested from the ClickView Library Server. Once the ClickView Player receives the entire first chapter file, it will begin to display it to the user. As the first chapter nears completion, the ClickView Player will invoke a background thread which will request and receive the second chapter file – ready to display to the user immediately after the conclusion of the first chapter of the video. Then, as the second chapter draws to a close, ClickView Player will request/receive the third chapter... and so on.

The benefits of PFT over earlier network video delivery techniques such as video streaming are:

- PFT is unaffected by data traffic spikes due to the chapter-sized video buffer
- PFT lowers the real-time urgency of data which needs to be sent to the client
- PFT permits a higher level of video compression (since DivX does not stream)
- PFT can deliver any format of digital video compressed using any codec
- PFT minimises required server CPU utilization (Hard-Disk to NIC data transfer)
- PFT allows faster processing of the frame index of an MPEG-4 file by reducing seek latency as the entire file exists locally at the point of display
- PFT allows the caching of video – which also allows remote video usage
- PFT provides a far simpler server platform which allows ClickView to embed the server framework into the client application which can facilitate a sub-server.

During the video serving process, the ClickView Library Server's CPU is not utilized since the video file itself is simply transferred directly from the hard-disk to the data buffer on the network interface card (NIC). This removes the CPU speed bottleneck which had hindered other ethernet-based video solutions.

The simultaneous user capacity can be determined using the following equation:

$$\text{Maximum Simultaneous Users} = \frac{(\text{Min}(\text{harddisk read bitrate}, \text{NIC bitrate}))}{(\text{video bitrate})}$$

THE CLICKVIEW PLAYER LESSON-SERVER

During periods of high-demand for video from the ClickView Library Server, the ClickView Player is capable of reducing the load on the central video server by allocating itself as a sub-server for a selection of video and digital resources (referred to as a ClickView Lesson).

NOTE: This is an **optional** user selection when creating a ClickView Lesson.

When a Lesson-Server is started on a particular PC, the contents of the ClickView Lesson are transferred temporarily to the %TEMP%\ClickView\ClassServer\ directory – ready to be delivered to other ClickView Player applications.

Network port 9053 is then opened and a listener waits for ClickView Player requests for those videos and resources contained within the ClickView Lesson.

When a ClickView Player user queries the ClickView Library Server for the contents of the Lesson, the ClickView Player will be informed that there is a Lesson-Server which also offers the videos and resources contained within the lesson. When the user chooses to access these videos and resources, the request is sent to the IP address of the Lesson-Server rather than the ClickView Library Server.

Consider a scenario of 30 students seated in a computer lab who have been instructed to view a particular selection of videos. Typically the central video server would need to provide 30 individual streams of video to the class of students. Using the ClickView Lesson Server feature, the teacher is able to request a single instance of these videos onto the teacher's PC, where they are then made available to the class. In this way, the load on the ClickView Library Server and the network backbone is reduced by a factor of up to 30 – as the data traffic is localised to the sub-node within the computer lab.

NOTE: If the Lesson Server is unable to fulfill the request or no connection can be established with the target IP address, the ClickView Player will forward the request to the ClickView Library Server.

THE CLICKVIEW LIBRARY DATA REPOSITORY

The ClickView Library Server installation process gives you the option to custom select the directory which will store the ClickView Library Server application assembly, the ClickView Library Server database, the ClickView Library data repository (which can be later relocated) and any other resources which the ClickView Library Server may require. The folder location of the core ClickView Library Server database, CVDB.mdb, is **always** identical to the location of the ClickViewServer.exe assembly.

The default location of the ClickView Library Server data repository is the same directory used to store the ClickView Library Server assembly (ClickViewServer.exe). The path of this directory is:

%Program Files%\ClickView\ClickView Library

During installation, ClickView Library Server will create the following sub-directories which it will use to store video, resources and images:

**\Files\
\Resources\
\CoverImages\
\Updates**

The **\Files** directory is used to store video added to the ClickView Library Server. When added into the ClickView Library Server, the video is encrypted and its filename changed to the unique chapter ID (assigned by the ClickView Library Server database) followed by the original file extension. eg. 123.avi

The **\Resources** directory is used to store digital resources which have been added into the ClickView Library Server. When added into the ClickView Library Server, the resource's filename is changed to the unique resource ID (assigned by the Library Server database) followed by the original file extension. eg. 231.pdf

The **\CoverImages** directory is used by ClickView Library Server to store video images. When added into the Library Server, an image's filename is renamed to the unique cover image ID followed by the original file extension. eg. 321.gif

The **\Updates** directory is used by ClickView Library Server to store 'update images' which are ready to be served to any client who wishes to update to the latest available version of the ClickView Player.

NOTE: The data which is stored in the above directories is not directly accessible (read/write/execute) to other machines. A user must use the ClickView Player to request the video from the ClickView Library Server which then retrieves the file and then replies to the ClickView Player's request with a binary TCP response.

ALTERING THE LOCATION OF THE LIBRARY'S BINARY DATA

The ClickView Library Server registry settings can be used to alter the default location of the ClickView Library Server's binary data.

After stopping the ClickView Library Server, simply transfer the **\Files**, **\Resources**, **\CoverImages**, and **\Update** directories and their contents to the intended new location. ie. 'E:\ClickView\'

Then use 'Registry Editor' to open the following registry key:

My Computer\HKEY_LOCAL_MACHINE\SOFTWARE\ClickView\ClickView Library\

Create a new string value called **DataPath** and set its values to be the absolute path of the intended directory location for the ClickView Library Server's binary data.

ie. **DataPath** = E:\ClickView\

NOTE: If the **DataPath** string value cannot be found in the ClickView Library Server registry settings, the ClickView Library's binary data is assumed to be located in the default location of:

%Program Files%\ClickView\ClickView Library\

RECOMMENDED VIDEO FORMATS, CODECS, AND BIT-RATES

Whilst ClickView is able to deliver ANY format of digital video, the performance of ClickView relies upon a good choice of video format, compression codec, and video and audio bit-rate.

ClickView strongly recommends the use of the DivX video codec which is a popular implementation of the MPEG-4 video compression standard. More information on the DivX codec can be found at: <http://www.divx.com/>

The DivX codec is ideal for educational video which is typically low movement and can be compressed significantly whilst minimising quality loss.

To achieve a compromise between quality and filesize, ClickView's partner visual education producers use the settings below to digitally encode their videos ready for ClickView.

Video Settings:

Video compression:	DivX codec
Data rate:	900 kbps
Frame rate:	25 frames /second
Resolution:	512 x 384

Audio Settings:

Audio compression:	MP3
Data rate:	96kbps

A digital video encoded using the above encoding settings will result in a filesize of roughly **8MB per minute (~1Mbit/second)**. A typical 25 minute video, therefore, will be approximately 200MB in filesize.

RELATED WEBSITES

ClickView Support website
<http://www.clickview.com.au/support/>

DivX website
<http://www.divx.com/>

Microsoft .NET website
<http://www.microsoft.com/net/>