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Frame Work for Video Content Management

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Abstract
This paper deals with the aspects of video content management & aims at providing a framework for the existing video content management and delivery system. The core function and use of this video content management system is to present information to the end user more efficiently. In this paper a view is presented for acquiring, creating, delivering, and managing live and on-demand static pre-recorded videos. This paper will focus on a various new tools and technologies which are evolving and could be the essential components to be deployed as a solution for live and on demand delivery of video and its content management. Thus in this paper a comprehensive framework will be developed for video and its content management

Keywords: Framework, Video on Demand, Load Balancing, Encoding, File Storage.

Introduction

Video as a content Strategy is blooming today, according to a lot of internet traffic analyst & the data from various info graphs it can be concluded that video data is growing, as more and more people are consuming the video contents and also increase in mobile devices has resulted in more consumption of video data. It has been observed that 42.9% of peak internet traffic involves video, overtaking the web surfing, thus the people are moving towards video data and are spending their efforts for streaming video either to their computers or mobile devices[1]. Corporate trainings, product launches are being carried out through Internet video, to more complex streamed content such as live televised sports events, day to day video archives etc. So it is now evident, one needs an online video program which is carefully-planned with definite workflows that employs the right technology and tools, network architecture, and event management [2]. Network multimedia system has immensely contributed towards the growth of video and is now progressively the medium of choice for a multiplicity of communication channels, corporations, organizations. Now the questions such as controlling the potential content chaos that comes with that amount of video, bandwidth utilization and number of users comes into macroscopic arena. Moreover to create, search, manage and deliver the mission critical information while keeping some of it classified and secure is yet another challenge. To overcome all these issues & challenges we need a framework to manage the videos and deliver this video content efficiently. Different video processing techniques were used to build a semi- automatic video framework. A video content structure is constructed with clustering different pieces of technology. The advances in the data storage, data retrieval and various communication technologies have made it possible to be easily accessible the amount of video data content available to consumer, end user, organizational and enterprise applications. However, to deal with multimedia data and in particular with the video data, requires some task. This is just not simply connecting with data centers and delivering data via networks to the clients or an organization. As of now, methodology and applications to describe, organize, and manage video data content are limited. Currently video data is indexed and a structured media is made. [3] The subtle task is how the video content is presented for access. This access could be browsing or retrieval which is a challenging task, both for the end users and an organization. Few common approaches such as hierarchical browsing storyboard posting and few others are prevalent. Through these approaches content of the video can be presented in many ways. The end user or client can quickly browse through a video browser sequence, navigate i. e., quickly get an overview of the video content, and search the videos. But the major problem of optimality remains the same.

Related Work

In this section we review the ongoing work on efficient video content management & delivery across a number of platforms. Video Content Management has been addressed through many different approaches, though not a very large amount of work on the framework implementation as a standard has been done. Top notch corporates have also done a lot of work to improve the current user experience as well as video on demand services [4].

Smooth Streaming

Smooth Streaming technology enables adaptive streaming of media to any Smooth Streaming client like Microsoft Silverlight [5] over HTTP. Through this user experiences a high-quality viewing that scales enormously on content distribution networks. This technology banks upon on Windows 2008 Server and uses Internet Information Services (IIS) Media Services technology.

The advantage of smooth Streaming being that it can dynamically identifies the local bandwidth and video rendering conditions. Based on these conditions it can and switch, in near real time, the quality of video of a media file that a player receives. Client with high bandwidth availability can get high definition quality streaming, while the end user having lower bandwidth connections may receive the suitable stream. Thus allowing all the end users to enjoy a compelling, uninterrupted streaming experience, and removing the need for media com-

panies to serve to the minimum common quality level and thus help to increase their audience base.
The video is stored on disk as a single full length file as per the encoded bitrate however in smooth streaming file blocks are created virtually on the end user request. This results in file-management benefits. Smooth Streaming client development is the heuristics module that determines when and how to switch bitrates. Simple stream switching functionality requires the ability to swiftly adapt to current changing network conditions with affecting end user and to deliver a great experience.

Proposed Framework for Video Content Management
Video and its Content Management Framework can be divided into logical sections namely Content Management Workflow, Security Management, Video Engine, Load Balancer, Content Delivery System Manager and User Interface as shown in Figure 1.

1. CONTENT MANAGEMENT WORKFLOW

Video content sources can be either through live events or stage production. However valuable video contents come from events such as training program, communication broadcasts etc. Both live and stage presentations can be viewed later on the demand. There are different requirements for live and on demand streaming video in terms of management and transport. The management guidelines include the following: Content Authoring or Content Originating Guidelines, Planning Guidelines, Filming / Recording Guidelines and Visual / Lighting Guidelines

A. Content Authoring or Content Originating Guidelines

In this one can adopt decentralized approach for content creation by using the expertise of subject matter in an organization. Content created should be such that it meets the broadcasting requirements and each slide should have few major points. Contents should be structured around the following principles : Set the context i. e. tell the students/audience what you are going to tell them, Get the information i. e., tell the students what you want to tell them and finally Review i. e., tell the student what you told them.

B. Planning Guidelines

In this user / students should be given clear instruction on how to access the content, To ensure quality presentation, its content must be ensured for accuracy, proper technical support must be there and provide a test stream before broadcasting so that any eventualities can be met there and then itself.

C. Recording Guidelines

In this one need to Use high quality cameras, Background should be proper, Static camera is preferable for slide projector screen, proper Use of wireless microphone and lastly Since broadcast will be used as Video on Demand module, during the streaming all the requirements for storing etc. should be taken care of.

D. Visual / Lighting Guidelines

Light should be adequate so that no shadows appears however over lighting should be avoided and size of set should also be taken into account.

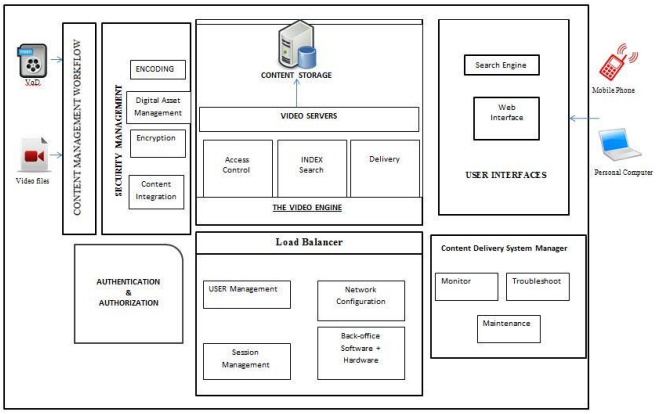

Fig. 1. Proposed Framework for Video Content Management

2. SECURITY MANAGEMENT

This is the key feature in Video on Demand. This feature can be categorized into four main components viz., Encoding, Digital Asset Management, Encryption, and Content Integration.

A. Encoding

The programs captured from devices such as video cameras, DVDs, Blue Rays etc. are feed to broadcast servers which in turn encode these programs on to different streams for each broadcast. [7] The encoding depends how the further connectivity is like. For example one stream of broadcast could be accessible via a satellite WAN Connection, other could be through a terrestrial WAN connections. Encoding tools enables the inclusion of PowerPoint slides within the live video streams.
Various type of Encoding scheme and there bandwidth are as listed in Table 1.

Table 1 Encoding and Bandwidth requirements

S N	Type	Bandwidth
1	Windows media audio stream	14 kbps
2	Windows media video stream	56/100/300 kbps
3	Real audio stream	28kbps
4	Real video stream	56/100/300 kbps

B. Digital Asset Management (Managing and Disseminating Tool)

Digital asset management can help universities address various issues like managing and disseminating information. It can have digital assets store and index assets for efficient searching retrieve assets for use in different environments and manage the rights associated with the assets [8]. In essence the digital asset management is an integrated suite of infrastructure components used to capture, catalog, and store and man-

age digital assets, and to expose those assets to creative tools for producing video audio and web content. Digital Asset Management System uses standard relational database and includes functionalities like workflow, security, storage, file capture, manipulation and delivery. Each discipline, school, project or application type may require unique meta data structures and all digital asset management should share common meta data information established upon intake. Digital Asset management technologies have the ability to manage multiple digital assets.

C. Encryption

As the lecture is streaming video data will be cache-d at the client end and it is possible that this data may get replicated, recorded, altered and further retransmitted by some of the user as garbage without teachers permission therefore a mechanism is needed to stop this alteration, replication. To address the illegal copying and distribution of Multimedia content, digital rights management (DRM) has been widely studied. DRM is generally taken to refer to technologies or systems that protect or enforce the rights associated with digital contents [10]. Two common techniques that are used to prohibit copying of illegal data are Digital Watermarking and Encryption [11]

D. Video Encryption

Encryption is the process of controlling access to confidential data by scrambling the data into cipher text, once plain text, with knowledge of a key. Inverse of Encryption is Decryption, is easy to perform when the key is known while it is very difficult to perform when the key is unknown. To encrypt the videos, special application requirements must be taken into account. For example some errors in multimedia content with bit stream may not crash the usage of the content.

Watermarking: Now a days Internet is being widely used as a medium to transmit digital signals and the contents are getting transmitted very rapidly. To ensure the validity of contents some kind of technique is needed that ensures that contents are original. Digital Watermarking technology adds copyright or content creation information into digital data, in our case it can be video. Thus digital watermarking provides an added layer of security for the content protection. Digital watermarking can help us to achieve the following: Protect content against common threats of piracy like Camcorder recording, Peer to Peer sharing, Copying, Format conversion and other forms of re-processing like Rights of usage and Copyright Ownership.

Content Integration: It is predominantly a software technique used in universities/ organizations that can connect different type of computer systems which can manage documents and video contents. Two types of approaches exist to manage video content from various sources namely centralized and other is decentralized. A decentralized approach is used in order to manage video contents

3. VIDEO ENGINE

Video Engine can be considered to be the heart of proposed Video Content Management Framework. This section can be broken down into following logical units like Video Servers, Storage, I/O Performance and Fault Tolerance

A. Video Servers

Video server has one of the most important roles in video on Demand system and is the most critical component of the Video Content Management Framework. Video Server will be having access to the video content and will deliver the video content as a continuous stream. Following characteristic of Video Server should be considered namely Server Capacity and type of video stream. Server Capacity is the number of video stream to be delivered simultaneously i. e., the number of users accessing the video stream and the type of video stream: - e. g. MEPG-2, MPEG-4 etc. [6]

Storage: Storage of Video can be done on any one or combination of all on the following physical media namely Hard Disk, Optical Disk, and Tape Drives. Each of the physical media has its own advantages and disadvantages in terms of technical performance and cost the tapes provide low cost tertiary storage system and are a reasonable solution for lowering the cost of storage and management of data. Video objects should be distributed across multiple tapes so that data could be transferred from multiple tapes simultaneously such that seek and transfer time may be reduced.

B. I/O Performance

Application sends read write request to operating system which execute read and write operations on the secondary storage devices. These Read write operations enables transactions between front end and back end. How much is the storage requirement is for applications, this requirement starts with how much storage capacity is required for an application that can easily handle the size and number of file systems and database components.

C. Data Protection

Hard disk and Tape drives are low cost but massive storage devices however these devices are more prone to failures due to mechanical wear and tear and other environmental factors. Due to failure data loss may not be recovered and get lost. For this Redundant Array of Inexpensive Disks (RAID) is good solution. RAID Technology enables to leverage multiple disks as a part of a set which helps to protect the data against such failures. Various level of RAID exist ranging from level 0 to level 6 and combination of certain RAID levels. It is up to the organization which has to decide what kind of data protection it requires.

D. Fault Tolerance:

Fault tolerance mechanism is needed to avoid single point of failure. To achieve this system intentionally introduces redundancy. Redundancy ensures high data availability as that system will only fail if all components in the redundancy group will fail and thus high data availability is ensured at all time

E. Backup and Recovery

With the growing demands of a university / organization for data storage and retention and availability back up has become an essential requirement

4. LOAD BALANCER

Application Delivery is an integral part of Video on Demand. Load balancer has become essential in modern networks and is also called as Application Delivery Controllers [9]. Application Delivery Controllers not only provides rich load balancing capabilities but also include advance functionalities of application layer protocols such as SSL offload, HTTP compression, content caching, application firewall security, TCP connection management, URL rewriting and application performance monitoring.

Load balancers also do one more important task as they take dynamic choice of making traffic decisions based on the Open System Interconnect protocol layer 2 i. e., switching and layer 3 routing information. Based on Open System Interconnect Layer 4 i. e. Transport Layer, Session Layer to Layer 7 i. e. application layer, advanced load balancers can make intelligent traffic management decisions also.

In many application environments, this application layer intelligence is necessary including those in which demand for application data can only be encountered by a specific server or a collection of servers.

Load balancing decisions needs to take the quick decisions and are usually very fast, typically in less than one millisecond, and thus a good load balancer capable of high performance can make billions of decisions per second. Normally an efficient algorithm is used by an administrator which load balancer implements it to decide the physical server or virtual server to be communicated and there after the request is send. There is a list of algorithms which are presently available and one can choose from the algorithms such as, weighted round robin, URL hash, Source IP hash, Domain Hash and Least packets. These algorithms are used by the load balancer and are being used to identify the server to which a client request is sent. Different type of load balancer uses different type of load balancing algorithms for different set of criteria. Once the communication is received from the client and processed by the server, the application server sends its reaction to the client through the load balancer. All the traffic i. e., from the client to the server or from server to the client between the client and the server is being managed through the load balancer. Load Balancer finds the right client connection for each application server response, ensuring that each end user / client receives the proper response. Load balancers are also configured to ensure that all subsequent requests from the same user, and also part of the same session are directed to the same server as the initial request was.

Availability of video servers is again managed and monitored through load balancers so that any prospect of sending client requests to a server that is in any way unable to respond due to whatsoever reasons can be avoided. Server resources can be monitored through a different ways. The load balancer constructs and issue application specific requests to each server in its pool.

The load balancer then checks and finds out the resulting responses to define whether the server is capable of handling the incoming traffic or not. If the load balancer find outs that a server that is not responding properly, it marks the server as "down" i. e. the server is not available and no longer sends requests to that server.

Load Balancer can be logically broken down to four components namely User Management, Session Management, Network Configuration and Back Office (Software and Hardware).

A. User Management

User management is done through Active directory. This active directory keeps the records of active users and groups. Inefficient and ineffective user group and privileges can lead to system being compromised.

B. Session Management

Sessions are created from multiple users accessing the Video on Demand. This session information is stored by using the session ID generated from the authentication request from the end user running the web browser in the web server. Multiple web servers must share knowledge of the current session state this is accomplished using the multicasting session this information among the member nodes. This can be done using Distributed shared memory or memory virtualization.

C. Network configuration

Design of Network Configuration is the most important parameters which must be looked in. there are two major type of cost associated with network configuration first is cost of servers and second is the cost of transferring contents or delivery of contents also referred as bandwidth cost. Video on Demand system should be configured in such a way that the cost is reduced. Four major approaches exist to implement this network architecture namely

D. *Back Office Software and Hardware*

This is required to keep track of content, user accounts, group management etc. It coordinates with the remaining components in its block for efficient management purpose of the whole architecture.

5. Content Delivery System Manager

It can be logically divided into the following parts namely monitor, troubleshoot and maintenance.

6. User Interface

It can be logically bifurcated into two units namely Web Interface and Search Engine

Conclusion

This paper has presented a new framework for the video content management that enjoys attractive features for future use. The concepts of server selection along with load balancing enable the framework to accommodate with a range of issues which were there in old architectures, in a well-structured manner. Streaming video is an exciting way to create compelling content that will resonate with the people we are trying to reach. Delivering high-quality streaming media is among the most effective ways to connect with end-user. As the new tools and technologies are rapidly coming in focus, it has never been easier or more cost-effective to produce rich media content. By taking advantage of IIS Media Services, Smooth

Streaming technology combined with load balancing and efficient server, network configuration even growing businesses can deliver customized, interactive webcasts to a wide range of audiences along with education institutes who are using the framework for video delivery purposes.

The comprehensive and flexible nature of the framework makes it a candidate to become an ‘‘open reference’’ that can be widely used by enterprises seeking a new video content management framework. With careful planning and best practices, combined with the right technology and production team, today’s organizations can take their first steps toward unlocking the benefits of live and on-demand streaming video.

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