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Performance Analysis of MPEG-2 Streaming in a Cloud

*Dinesh Goyal, **Dr. Naveen Hemrajani, *Rajendra Gurjar

*Suresh Gyan Vihar University, Jaipur

** Professor, JECRC University, Jaipur

Abstract: Video Streaming has been a major application of today's IT enabled society both in professional & personal life of users. This has been used in Video Conferencing, E-education, closed room chatting and group discussions. Various organizations have developed and deployed their own clouds, and most of their conferences and meeting are held in the same clouds, for which various video codec are being used for real time streaming. MPEG is one of the formats which is used in real time streaming.

In this paper we analyze the performance of MPEG video format streaming in different environmental conditions and their quality of delivery.

Keywords: Cloud, Multimedia, Video, MPEG, Streaming

I. MULTIMEDIA

Multimedia is the field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.[1]

It has been hailed as the next revolution in computing, However, with the decline in performance and price, multimedia is now commonplace. Almost all computers are capable of displaying video, though the resolution depending on your computer's video adapter and CPU power.

Multimedia is usually recorded and played, displayed or accessed information content processing devices, such as computers and electronic devices, but can also be part of a live performance.

II. ELEMENTS OF MULTIMEDIA

There are six basic multimedia elements, including video, audio, photography, animation, text and graphics. In the use of multimedia elements are present. Multimedia is powerful tool which is a combination of these elements.[2]

Out of all the elements, text has the largest impact on the quality of multimedia interactive. In general, the text provides important information. Sound is used to emphasize or highlight the transition from one page to another. Sound synchronizes screen display.

By using the visualization capabilities of video information representation, can be direct and powerful. While there is no doubt on its ability to view and interact with digital video content, the use of digital video is to give education, which is a new possibility.

Animation is used to display status changes, over time, present information to the students slowly, so that they have time to absorb it in smaller blocks. Graphics Card provides a learning session most creative possibilities.

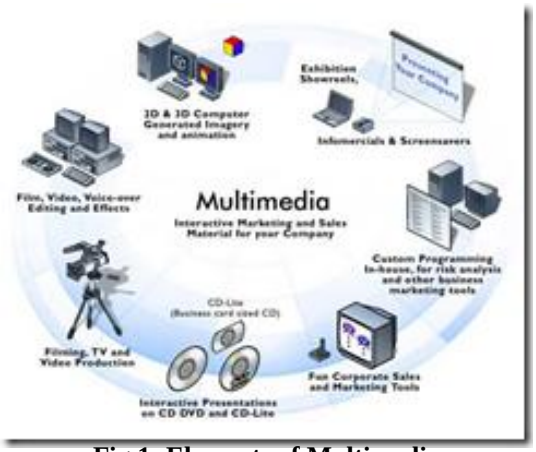


Fig 1: Elements of Multimedia

III. DIGITAL VIDEO

Digital Video is in binary format of video and audio. It is a digital sequence of data, rather than in a continuous signal.

In the nature of the information received through the five senses, is in analog form. This means that it is having infinitely variables. Digital A / V information, on the other hand, is having discrete units of data so that the human senses perceive them in a continuous stream to be placed. Analog data, as recorded on the video tape, transmitted as electron signal and added to a given carrier frequency of the different frequency or amplitude. In order to make this information, you can use a computer or a modern media player, analog Digital conversion of the analog signal is done in form of a series of 0 and 1, respectively, "negative" and "positive", "close" and ", "or" low "and" high. [3]

Digital video offers many features, than analog video including:
• Easy sharing and storage.
• Replication
• Simple and inexpensive replication.
• Multicast capability.

IV. TYPES OF VIDEO FORMATS

When the video went digital , Suddenly there was a dizzying array of video formats - WMV, ASF, RM, MOV, MPEG, compressed files. In fact many of these standards have their own sub-standard (MPEG-1, MPEG -2, and so on).[4]

4.1 Containers and codec

Digital video format that may be relevant most confusing thing is that there's a "container" and "Decoder" idea - you might think it is enough to make your longing for the days when you could just the tape in the camera to start recording.

4.2 Container

We take a look at some of the container, and then in some codec. Video file extension usually refers to the container. Several containers, they almost always use the codecs and other containers tend to use many different codecs.

a. **Audio Video Interleave (AVI):** Developed and released by Microsoft with Windows 3.1. AVI digital video files have been a work. Despite its popularity has gradually subsided, left a lot of AVI video can be found all over the web. Recently, AVI has abandoned Microsoft's WMV (Windows Media Video).
b. **Advanced Systems Format (ASF)**: ASF is a proprietary Microsoft containers typically include file compression with Microsoft WMV codec – make things confusing, usually specified files, WMV, and ASF. ASF container has the advantage of many other formats, which can include a DRM (Digital Rights Management), a form of copy protection.
c. **The QuickTime (MOV or QT)**: QuickTime, which is developed by Apple, and supports a variety of codecs. Although this is a proprietary format and Apple decided to support it.
d. Advanced Video Coding, high definition (AVCHD): AVCHD is a very popular container H.264 data compression – it involves cooperation between Sony and Panasonic as a digital video camera format. This is a file-based format, it means a disk or other storage device storage and playback. It supports standard definition and high definition different from 720-1080.
e. Flash Video (FLV, SWF): Flash was originally developed by a company called Macromedia, which was acquired by Adobe in 2005. Flash has been around for some time, and there are several versions and some are better than others. Older Flash videos often use the Sorenson codec. This is an extremely wide range of containers for the entire network video streaming format. Its main drawback is that it will not play on iOS devices, such as an iPad or iPhone.

4.3 Container codec

If things are not confusing enough, some containers with codec's have the same name.

a. **MPEG-1**: MPEG-1 video CD (VCD), which is particularly popular in some parts of the world, but never in the U.S. Video quality, is lower than almost exclusively for the DVD.
b. **MPEG-2 (H.262)**: MPEG-2 is a container format, but have a same name, the majority of the H.262 codec, so it is not so confusing. While we are talking about something H.262 world, has been more confusing than it should be. Using MPEG-2 DVD, and pretty much nothing else than broadcasting high-definition television (HDTV).

V. MPEG Video Format

Moving Picture Experts Group (MPEG) is a working group of experts from the International Organization for Standardization (ISO) and International Electro technical Commission (IEC) for audio and video compression and transmission standards. It was founded in 1988. By 2005, MPEG has grown to

include researchers from different industries, universities and research institutes.[5]

MPEG algorithms, compress data to form small bits, one can easily send and decompression. MPEG stores only one through a change, rather than each complete frame to another, to achieve its high compression ratio. Video information, and then using a technique called discrete cosine transform (DCT) coding. MPEG uses lossy compression type, since some of the data is deleted. , But the diminishment of data is generally imperceptible to the human eye.

MPEG1 is a standard lossy compression of video and audio. It is designed to compress VHS-quality raw digital video and CD audio down to 1.5 Mbit / s in (26:1 and 6:1 compression ratio) without excessive quality loss, making video CDs, digital cable / satellite TV and digital audio broadcasting (DAB).

MPEG2 format is widely used as a digital television signals from terrestrial broadcasting, cable broadcasting, and direct broadcast satellite TV systems. It also specifies distributed on DVD and similar discs formatted movies and other programs. Thus, television, television receivers, DVD players and other devices are usually designed to this standard.

MPEG2 is the second by the Moving Picture Experts Group (MPEG) developed some standards, is an international standard. 1 and 2 with the ITU-T MPEG2 developed in a joint collaboration of the team, they have their own directory number in ITU-T Recommendation series.

Difference between MPEG1 and MPEG2[6]

1. MPEG1 MPEG2 successfully resolved some of the old standards weakness;
2. MPEG1 MPEG2 has a better quality than that;
3. For VCD MPEG1& MPEG2 for DVD;
4. Some people may consider MPEG2, MPEG1, to support higher resolutions, to use a higher and variable bit rate;
5. MPEG1 is older than MPEG2, but the former is arguably better low bit rate;
6. MPEG2 has a more complex coding algorithm

VI. VIDEO STREAMING

Multimedia streaming is constantly receiving and presented to end users while delivering by the provider. Its verb form, "flow" refers to the process of storage media, in this manner, the term refers to the method of transmitting the media, not the media itself.

The client's media player can start playing before the entire file has been transmitted data (such as movies). Distribution of distinction from the media delivery method is particularly applicable to the telecommunications network.

Live, which refers to the content provided live on the Internet, you need a camera for the media, encoder digital content, media publishing, content delivery network for content distribution and delivery.

Useful - Typical - Applications "flow" concept, for example, perform long video lecture "online" on the Internet. One advantage of this presentation is that these talks can be very long indeed, although they can always be interrupted or duplicate in any place.

Video streams are usually from a pre-recorded video file is sent, but can be published as a live "feed part." In the live broadcast, the video signal is converted into a compressed digital signal and is capable do multicast users, at the same time to a multi-user sends the same files from a particular Web server sends.

Streaming media storage size is calculated from the streaming bandwidth and length of the media using the following formula (for a single user and file):

Storage size (in megabytes) = length (in seconds) × bit rate (in bit/s) / (8 × 1024 × 1024)

VII. STREAMING QoS PARAMETERS

1. PSNR - Peak Signal-to-Noise Ratio.
2. NQI - New Quality Metrics.
3. VQM - Video Quality Measurement Techniques.
4. SSIM - Structural SIMilarity. This metric is based on measuring three components (luminance similarity, contrast similarity and structural similarity) and combining them into result value

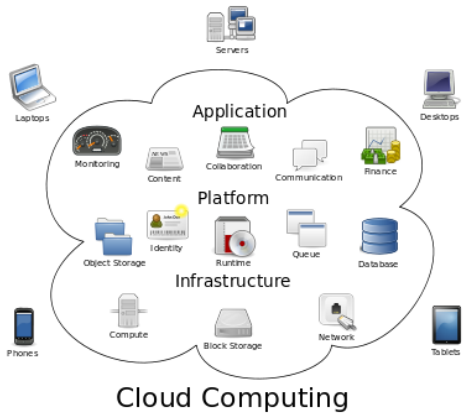
VIII. CLOUD COMPUTING

Cloud computing is Internet ("cloud") based development and use of computer technology ("computing"). It is a style of computing in which dynamically scalable and often virtualized resources are provided as a service over the Internet. Users need not have knowledge of, expertise in, or control over

the technology infrastructure "in the cloud" that supports them.

The concept incorporates infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS) as well as Web 2.0 and other recent technology trends which have the common theme of reliance on the Internet for satisfying the computing needs of the users. Examples of SaaS vendors include Salesforce.com and Google Apps which provide common business applications online that are accessed from a web browser, while the software and data are stored on the servers.[7]

Cloud computing is a subscription-based service where you can obtain networked storage space and computer resources



IX. EXPERIMENTAL SETUP

9.1 WINDOWS MULTIPOINT SERVER: Windows multi-point-server 2011 is the second version of Windows multipoint server. It is mainly used in educational institutions that allow multiple users to simultaneously share a single computer. Users have their own independent and familiar Windows computing experience, using their own monitor, keyboard and mouse directly connected to the host. Windows Multi Point Server 2011 enables more users to access technology at a lower total cost of ownership.

Designed for non-technical users, it is simple to manage and use. Unlike other similar solutions in the market, Windows Multi Point Server 2011 is based on the latest Windows technology and thus can run Windows applications.

9.2 **Scenarios:** In this experiment, we are trying to analyze performance of WMV video stream requested by various users of a cloud. All the access are done simultaneously in case of multiple access. Every user is having different environmental conditions some of them are having dynamic IP address, some are using Wired Connectivity, or some of them are having Wireless connectivity.

Results have been taken on the below given tool on above mentioned four parameters i.e. PSNR. NQI. VQM, SSIM.

X. ANALYSIS TOOL

a. **Elecard Video QuEst:** The Elecard Video QuEst (Quality Estimator) is a powerful tool designed for professionals and prosumers in the video compression field. Elecard Video QuEst allows the user to calculate video quality metrics, such as PSNR, NQI, VQM, SSIM, DELTA, MSE and MSAD. It has been designed and implemented for reverse engineering and analysis. It Supported following Media Types [8]

1. **YV12**: This is the format of choice for many software MPEG codecs. It comprises an NxM Y plane followed by (N/2)x(M/2) V and U planes
2. **UYVY:** YUV 4:2:2 (Y sample at every pixel, U and V sampled at every second pixel horizontally on each line). A macro pixel contains 2 pixels in 1 u_int32.

XI. RESULTS

11.1 Scenario 1: In this scenario a single desktop machine with an Ethernet connectivity of 100 Mbps tries to access the video, single user access only. The results for the same on all the parameters are as follows:

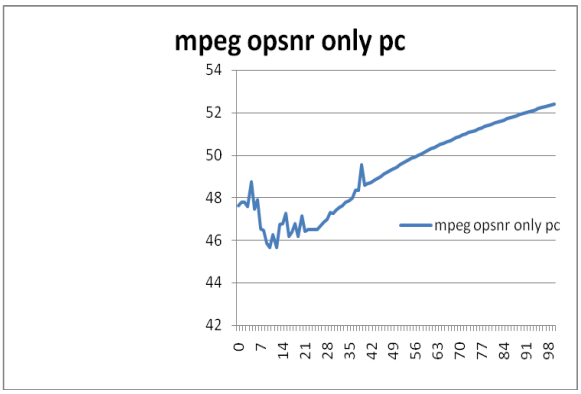


Fig 2: PSNR of real time video streaming compared with existing video played on the same machine

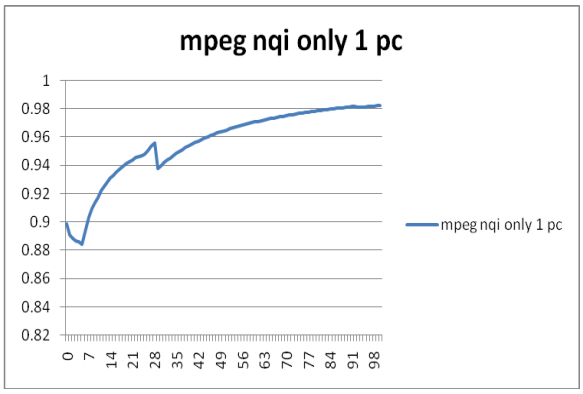


Fig 3: NQI of real time video streaming compared with existing video played on the same machine

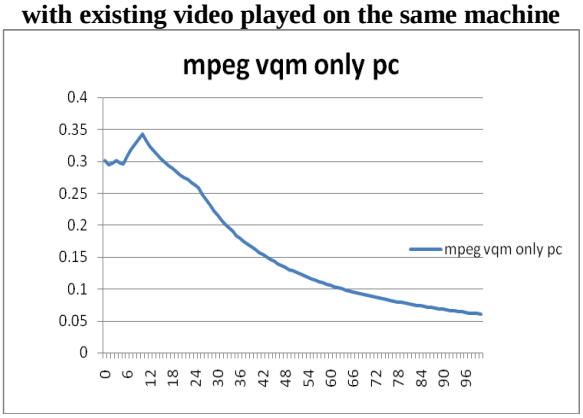


Fig 4: VQM of real time video streaming compared with existing video played on the same machine

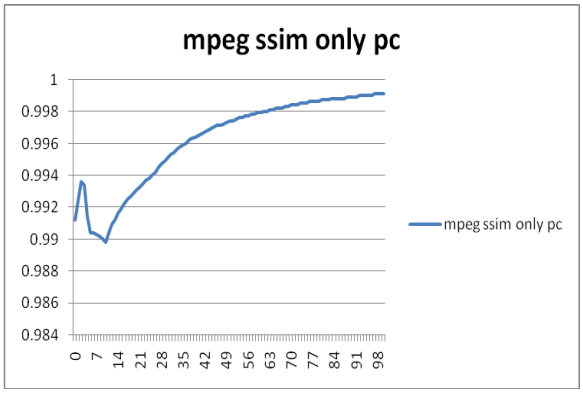


Fig 5: SSIM of real time video streaming compared with existing video played on the same machine

11.2 Scenario 2: In this scenario two desktops and a laptop machine with Ethernet connectivity of 100 Mbps and a wireless connectivity tries to access the video, multiple user access. The results for the same on all the parameters are as follows:

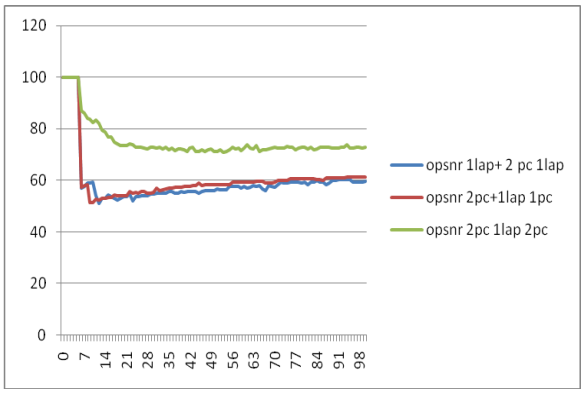


Fig 6: PSNR of real time video streaming for multiple accesses, compared with existing video played on the same machine

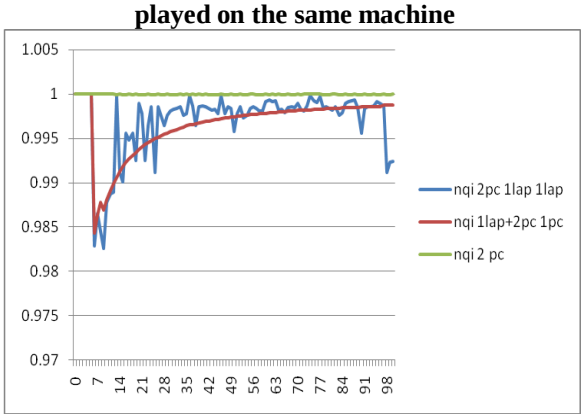


Fig 7: NQI of real time video streaming for multiple accesses, compared with existing video played on the same machine

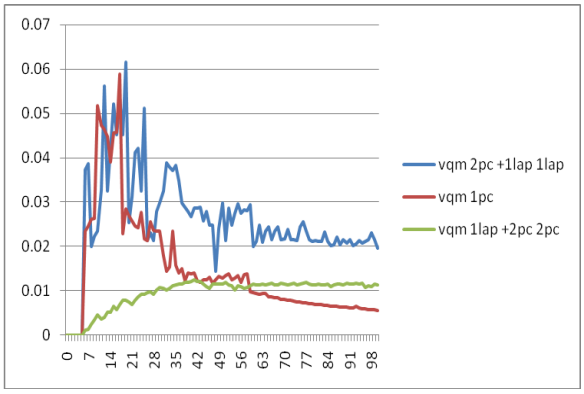


Fig 8: VQM of real time video streaming for multiple accesses, compared with existing video played on the same machine

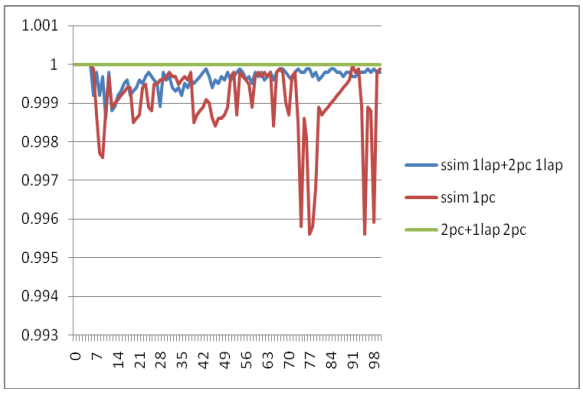


Fig 9: SSIM of real time video streaming for multiple accesses, compared with existing video played on the same machine

11.3 Scenario 3: In this scenario two desktops with Ethernet connectivity of 100 Mbps connectivity tries to access the video, multiple user access. The results for the same on all the parameters are as follows

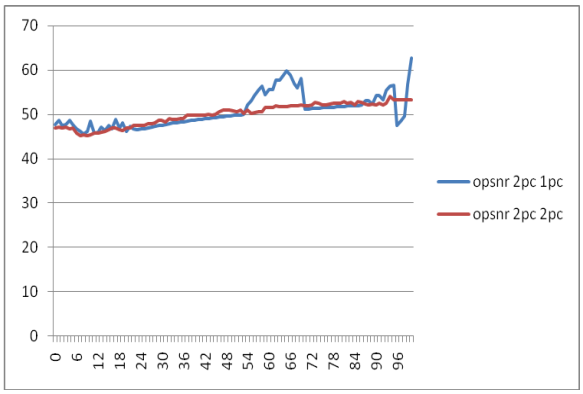


Fig 10: PSNR of real time video streaming for multiple accesses, compared with existing video played on the same machine

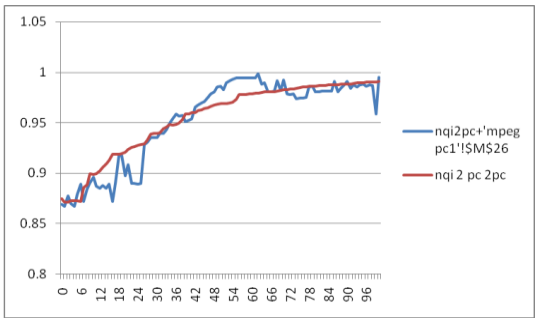


Fig 11: NQI of real time video streaming for multiple accesses, compared with existing video played on the same machine

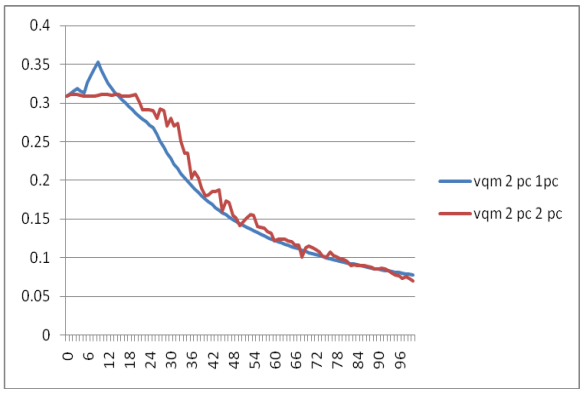


Fig 12: VQM of real time video streaming for multiple accesses, compared with existing video played on the same machine

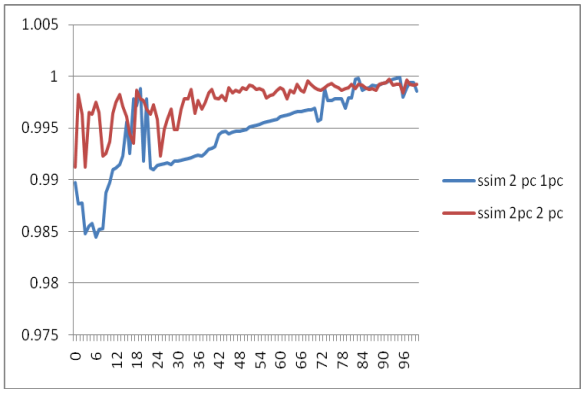


Fig 13: SSIM of real time video streaming for multiple accesses, compared with existing video played on the same machine

11.4 Scenario 4: In this scenario single laptop with wireless connectivity tries to access the video, multiple user access. The results for the same on all the parameters are as follows:

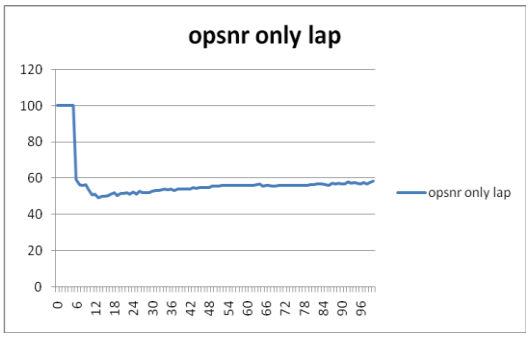


Fig 14: SSIM of real time video streaming compared with existing video played on the same machine

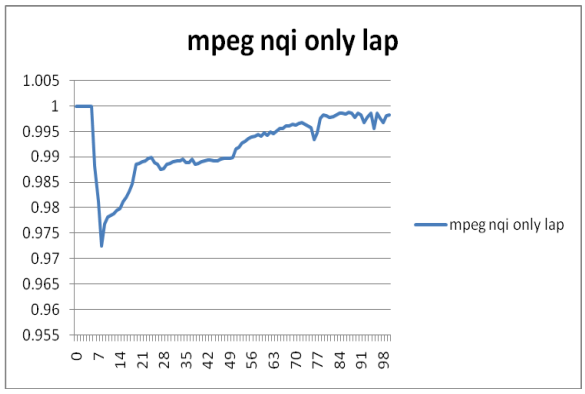


Fig 15: NQI of real time video streaming compared with existing video played on the same machine

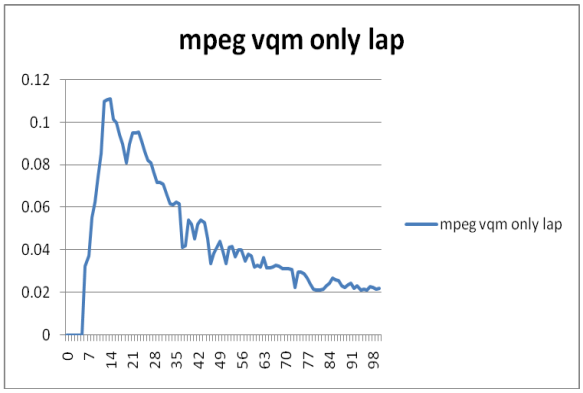


Fig 16: VQM of real time video streaming compared with existing video played on the same machine

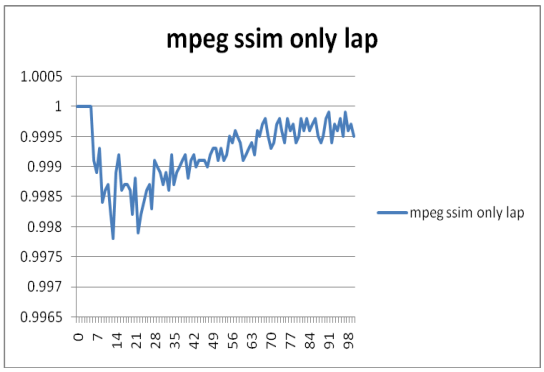


Fig 17: SSIM of real time video streaming compared with existing video played on the same machine

XII. CONCLUSION

In this work we have tried to compare one of the codec formats of video in real time streaming scenario with various environment conditions.

Above analysis has been done for 4 different scenarios of single and multiple user in different environments.

From the above results following can be easily concluded:

1. The performance of mpeg streaming is better in case of wired network than in case of wireless network
2. PSNR of video quality frame by frame is best in case of single user access and least in case of wireless access.
3. The performance of mpeg video gets effected as more number of clients try to access the video simultaneously
4. SSIM index proves that video structure remains almost same in all the scenarios
5. NQI is least in a wireless network.
6. VQM is best in a wireless network as its almost zero in case of a wired network.

XIII. FUTURE WORK

Cloud is the latest platform available in the sector to ensure availability of resources online in a closed or an open network.

Video streaming has been used by many organizations to conduct various meeting in their cloud.

The quality of video helps in easy understanding of the message communicated over the stream.

Though this work surround around some environments, In future analysis can be done for other video formats also; results of two or more video formats may be compared to find out the quality of delivery in a cloud.

Various environmental and quality metric parameters may also be added to prove the efficiency of video streams.

Current work is on streaming of normal video, this work may also be carried out on secure video networks.

Even more improved codec and video streaming mechanisms may be developed to get better quality of delivery in wireless networks

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