

ANALYZING H.261, H.263 AND MPEG – 2 CODING AND MPEG – 4 FUNCTION IN INTERNET PROTOCOL BASED TELEVISION

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ABSTRACT

Increasing development of production technology, saving and playing videos have made it necessary to apply developed and optimized approaches in coding and saving videos. To do so, a lot of groups worldwide and specially in different media have introduced or done researches and operational projects to present an efficient approach designing to code videos – considering functional limitations such as sending bite rate, user and the least required quality, selecting suitable coding for introduced user is very important .Today there are diverse ways to send videos for users by a content producer. TV which is also considered as an epidemic media has faced to a spread spectrum of users in different areas ranging from sending data to represent media services based on sending videos. Represent services in different points makes working with quality based methods and different setting more important. To reach to this goal, present study analyses different kinds of H.263, MPEG-2 and H.261 coding and it finally suggests considering MPEG-4 content based coding for internet protocol based TV .

KEYWORDS: H.263, IPTV, MPEG – 2, MPEG – 4. human eyes.

INTRODUCTION

IPTV is a new technology which provides more flexibility for content management and makes it easy to access to the content and it also improves the function and programming. The possibility to have more control over the existed content kind, such as mutual relationship with content providers improves the costumer experience in a considerable way. IPTV is a new approach to transfer public broadcasting channels through an Ip network which is replaced by land broad casting, cable TV and satellite. IPTV explains video Tran’s fering mechanism through a network which uses internet protocol. Taking advantages of wide band width and digital TV services are represented and different applications are in users hand (Johan, 2008).

a service provider can present these services along with some other services like IPTV browsing, electronic program guide, caller id on TV, IPTV advertising, gaming on demand, emergency alert system, digital video recording, personalized channels, al relationship with user. because of little bandwidth of internet networks this technology couldn’t develop a lot in the past (Johan, 2008).In future regarding to the great increase in bandwidth and wide public usage of internet network, it can be predicted that TV industry experiences its golden age.by increasing growth of digital technology internet networks, it can be predicted that TV industry experiences its golden age. By increasing growth of digital technology, internet networks, telecommunication and wireless systems, radio and TV channels content providers also think about publishing this content by a new approach which is called IPTV. That’s why these kinds of networks have developed rapidly word wide. On the other hand the quality of sending services to attract users is the main criteria to which broad casters give their full attention. HD programs with the dimensions of 1920*1080 pixel per second and number of 25 – 30 images per second 4:2:2 format and with the least bit per 8 bit pixel, at least needs 800 megabyte band width – saving a 90 minute movie requires a memory which equals to 500 Gigabyte. IPTV explains the video transferring mechanism through a network which uses internet protocol. Taking advantages of wide band wide which depends on suitable coding, digital TV services are represented and more applications are available to users.

COMPRESSION

Compression means coding procedure which leads to reduce the total number of required bytes for representing personal information. In the world wide network, fast and easy access to a huge volume of information is a required and undeniable effort. Regarding to the huge volume of information in which the great section belongs to the pictures, the existence of some systems to compress and recovering them by I is really important. Primary approaches in illustrating an image is the text explanations which due to the picture data base volume and different ladles to choose, it turned to a none efficient approach. Since transferring an image through communicational passages is a really bit costly, the main objective of picture compressing is to reduce the required bit numbers to show an image. Data

increasing is the most important case in image compression. Among the kinds of data increasing we can refer to coding increasing, pixel increasing and visual mood increasing. Image compressing algorithms try to reduce the number of image increasing kinds. In Figure 1, general process of compressing is illustrated (Ghambari, 2011).



Figure 1. General process of compressing

If compressing process and returning to the primary volume run without losing information, compressing is lossless and if not, it will be lossy.

Compressing Coefficient

Compressing is a process in which removing extra information reduces data to the digital sings. Image compressing is a function of information compressing on digital images. The main objective of doing so is to reduce image content increasing to save or transfer data optimizing. The principal of all compressing approaches is to remove some information and data. Compression coefficient or rate specifies the percentage and the amount of removing information. Image compressing coefficient is obtained function where B0 is the number of bits before compressing and B1 is the number of bit after compressing.?

$$\text{Compressing Coefficient} = B0/B1$$

Compressing coefficient bound is always between 4:1 to 100:1. Other cases are unchanged. Color images are compressed in bigger size than gray images. Image file size is specified by the number of its PIFS adaptors. Imagine that a 8*256*256 image is divided to 8*8 blocks to reach similarity and to adopt to Dpeg. We have 1024 scope block so we will have 1024 adaption for saving in most operations. Table 1 lists the cases which should be saved.

Table 1. Saved Cases in Compressing

X location from scope block	6	8
Y location from scope block	6	8
Scaling	5	8
Replacing	6	8
Asymmetric	3	3
Total	26	35

In the first arrangement, using bit is considered for each number except for asymmetric scale. In the second arrangement, scope blocks are limited to the 4 measure characteristics. In addition to this, experiences show that considering 5 bit for each scale criteria and 6 bit for each replacement, we will again get good results. Thus, at the present the compression bound rate is 19. 69 which are good but it hasn't reached to excellent yet. There are other arrangements with more complexity which reduce the bit rate.

Compression Principals

Image compression fallows rules including:

- Human eye sees the distance between two closed image as the same and can't recognize their differences.
- Light and image influences stay in the eye for a determined time and it doesn't disappear which this case was considered in animating images.
- Human eye is more sensitive to the light and brightness changing than color changing.
- Among all colors, human eyes are sensitive to yellow green and blue.
- Human eye is also more sensitive to the moving things than immovable ones.

Different Kinds of Compression

These days, the huge volume of images leads to pay more attention to compressed images. Image compression with maintaining the relative quality reduces the image volume a lot. Low volume of the image is really important where we want to transfer data. Algorithms which were used to compress images are divided into two groups of loss and lossless (Marpe and Cycon, 1999).

Lossless Compression

In lossless method, image information is not lost and we can return the primary image by using compressed image and decoding algorithm. In this approach all main data which exist in the main image can be returned. Just like compressing a document, lossless compressing is suitable for those images their parts don't have specific colors like. The blue sky, computer made images and those parts which have just one specific color and they don't contain any remarkable point. As same as cartoons, graphics and 3d animations are kind of lossless compression. This method is also suitable for images which have spread parts which are fixed by colors or similar patterns are repeated in them where there is no guarantee that the compressed content volume reaches to that percentage of the primary data. Lossless compressing methods are represented in table 2.

Table 2. lossless compressing methods

Run length coding	Applied in default approaches in DCX and one of bmp , tiff , TGA , facilities
Dictionary adopted algorithms	Such as applied izw in gif , tiff
Deflation reduction	Applied in TIFF , MNG and PNG

Lossy Compression

In this kind of compression, bit reduction is done based on identifying and removing worthless information and this information is not able to be returned. Videos which are recorded by handy cams are not suitable for Lossy compression since, their length is rarely suitable to worth pixels and the image efficiency is not increased by applying these techniques. Dynamic video compression is actually the subset of Lossy compression in this method, data in places where human eye is less sensitive to be removed to hide the lack of information. Lossy compression methods are listed in table 3.

Table 3. Lossy Compressing Method

Reducing the color space	Reducing the color space for those colors which are used a lot in the image. Selected color is specified in color above the image. each pixel is just referred to the color criteria which in color Palette
Chrome sub sampling	This method is an advantage for the reality since eyes recognize the brightness more difficult than color in it dose it by removing half or most color information in an image.
Transform coding	This method is usually used the most
Fractal compression	The best quality of the image in a determined bit rate (or compression rate) is the main goal of image compression.

COMPRESSING BY H.261 CODEC

This is known also p*64, these standards provide coding algorithm, image figuring and error correction techniques for video codecs of different manufacturers. H.261 is a standard ITU codec which is compressed as video transferring with 64 KBP s rate and it is designed with the capability of being break down of 176*44 Q-CIF pixels.

COMPRESSING BY H.263 CODEC

This is a standard ITU video codec which is based on H.261 and it also has better compressing standard than H.261 and transfers video with 176*44 pixel Q-CIF.

COMPRESSING BY H.264 CODEC

H.264 was introduced for video compression with video telephone quality. Its quality has attracted broadcasters such that most of countries started to broad cast HD and they also decided to choose H.264 as the main compressor of HD.

The main reason to choose it was that this compressor has compressing ability almost twice MPEG – 2 and this score of H.264 over MPEG – 2 is very valuable for some users like satellite and IPTV which splits bit rate.

COMPRESSING BY MPEG CODEC

MPEG video format is a file format which is developed by Moving Picture Experts Group. This format is an international standard compressing format for animated images which is used for vcd, svcd and DVD disks. At the three compressing standard of MPEG- 1, MPEG-2 and MPEG-4 are used worldwide from this family. In addition to these, MPEG-7 and MPEG - 21 are also developing now. MPEG video file formats have mpg and DAT suffixes, while audio files which are based on this codec usually have mp.2, mp.1 and mp.3 suffixes. Moving picture experts group is one of the operational groups of ISO/ IEC. MPEG-1 compression format was developed by this group in 1993, while MPEG-2 was introduced in 1995 for using dvd-rom. MPEG-3 was designed for HD TV and MPEG-24 was also standardized in 1998. MPEG-7 provides a tool to explain the multimedia content completely, but MPEG-2 is a standard which determines how to explain the content and also processing of access, research, saving and protecting copyright content. The main benefice of MPEG format comparing other video and audio coding formats is its small size for a similar quality. Mentioned superiority relates to this fact that MPEG format uses a very developed compressing format. This format uses removing compression algorithms which remove extra data among consecutive images and it also removes most of similar parts at the same time to reduce the amount of extra data. In fact, MPEG format just saves those changes that are made between consecutive frames instead of complete data in each frame to reach its own high compressing rate. Video data are then coded by a technique which is called Discrete Cosine Transformer. Most of the video cards which are today available for public consumers have CHIPS that accelerate encoding and decoding MPEG as a software to record and broadcast these files without losing their frames. Diverse software codecs are also represented to do so which are used in many cases. Considering all these, software method still depends on your main system processor. If your computer has a multicourse powerful processor, then you won't have any problem with this fact (Lee *et al.*,2011).

MPEG-2 Coding

In this standard, images are compressed in three ways (Morris, 1998).

- Intra frame image, I
- Forward prediction frame image, P
- Bi-directional image, B

Intra Frame Image

These frames are coded without referring to other frames, compressing rate for these cases is low and they are considered as reference frames to access to a string of images and they are coded locationally not timely. Which are finally compressed as different length codes by half man binary encoder.

Forward Prediction Frame

In this kind of frames, the differences between a 8*8 pixel block and the block in the reference block after moving compensation turns to DCT and then is quantized like the block in I image and after that is coded by binary encoder with changeable half man. Since TV images are of woven kind, I pixel block can be made in the reference frame from an amateur square or frame. Choosing between them means that which one has the least error difference after movement compensation which leads to minimize the error rate. Since determining movement axis needs a lot of accounting operations and since these operations should be performed both on the square and on the frame, p image compressing operation has shorter time than I image but its bit rate is too low. P image bit rate over I image equals to 1 to 3-5 which depends on the movement scope and the texture.

B-Directional

They are coded by referring to their previous I or p code. We can reach to the 85-90 percent their compressing level of I-frame by applying motion estimation technique. I and p frames are known as MPEG-2 basic frames and in frame buffers are saved both in encoders and decoders and according to that b frames are made and decoded. I frames as a resource to prevent the errors in bit circuit should be sent in a systematic way. This procedure leads to produce a part of bit circuit standard which is named group of pictures GOP that includes I, p or I, B or B, p, I. In picture string 2, M is the distance between two consecutive pictures of p and N is the distance between two consecutive pictures of I.

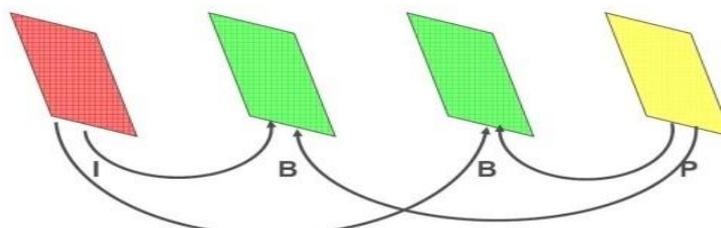


Figure 2. picture string

Which in for better image quality, the following equation should be performed:

$$\text{Gop} = N = 12, M = 3$$

Figure 3 shows the raising compression rate by applying three kinds of I, b and p frames. assume considering the primary complexity of the original image could reach to 50% coding interest for I, thus it is expected that primary I ,830 k byte frames produce 415 k bit size, by coded p frame by using data differences and estimating motion with I frames could reach to coding interest between 70% to 75 % in which the frames size will be 100 k byte and finally using coded b frames could reach to 9 % coding interest comparing I frame it means frames with the size of 90 k byte. The final bit circuited is called access unit that produces MPEG bit string after passing intra frame coding process and removing extra location data to reduce general rate bit.

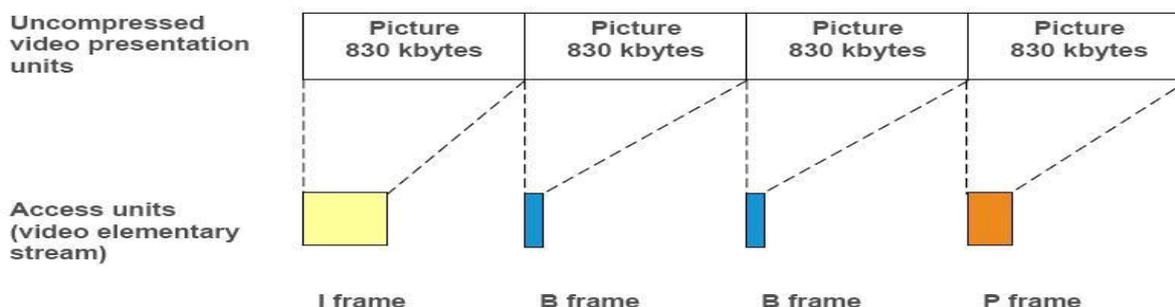


Figure 3. Compressing by I, B, P

Separation of One MPEG String

According to figure 4 we can consider a multilayer video string; each of these layers has a specific task in MPEG processing. Here we are about to analyses each of these layers.

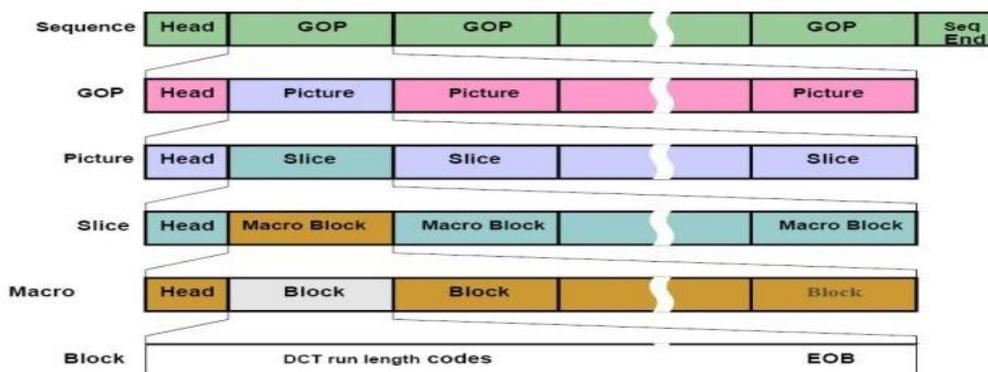


Figure 4. Separation of one MPEG string

- **Sequence**

It has a desired length it can be a video CLIP or a complete program which is in a primary circuit. Sequence is a very important layer and contains basic information. This way decoder can easily decode the primary circuit. Sequence is a very important layer and contains basic information. This way decoder can easily decode the primary circuit. Required information for a decoder is put in a header of one sequence and decoder first evaluates this header.

- **Group Of Pictures**

It's a group of images including some coded frame which are from p, b or I kind. The layer of GOP can include a group of pictures from three kinds of b, p and I. But if we don't have interred frame coding, then this group will include only I. GOP can be regular or irregular. In the regular kind of there is a fixed and permanent relationship between the length of GOP and frame numbers of I and p . A systematic group of 12 should be in the form of figure 5 IBB P BB P BB P BB I WHERE $M = 3$, $GOP = 12$ and $B = M - 1$

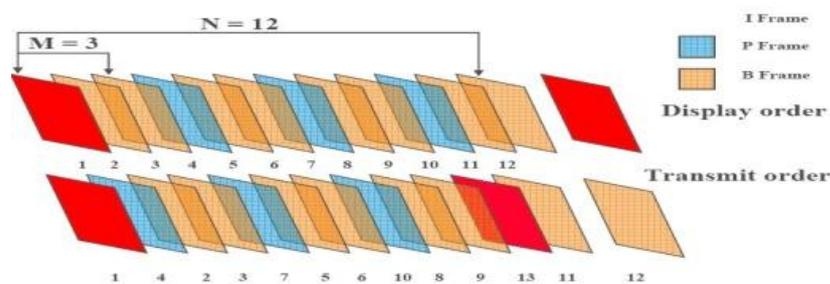


Figure 5. GOP Structure

- **Picture**

It's made of sickbed slices and header. As it was told before, frames have three kinds. I, B, P regarding the kind of frame and the level, P in which the frame is coded, each frame size is made by macro block. Figure 6 shows the frame from me kind which is coded like 4:2:2 MP@ ML. We have 720 samples in each line and the number of lines is up to 576 lines , assuming that each micro block has 16*16 dimensions then we will have a frame with 720/16*576/16 dimensions.

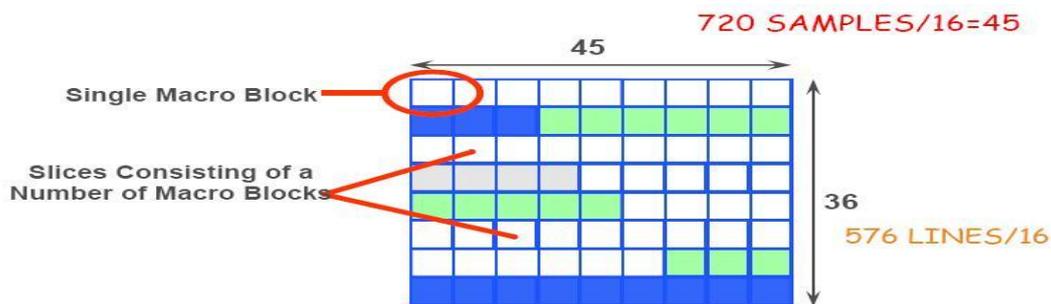


Figure 6.frame of I kind as Mp @ ML 4:2:2

- **Slice**

They are actually horizontal slices of one picture and they contain several micro block. There is just one limitation in figure 7 where macro block that just make one slice should be in one line. Each slice is coded by referring to the other slice .



Figure 7. slice

- **Macro block**

Each macro block includes all related information to one part of the picture and 16*16 blocks are made of four 8*8 block. Figure 8 which shows blue and red luminance blocks actually includes samples that show the same area color.

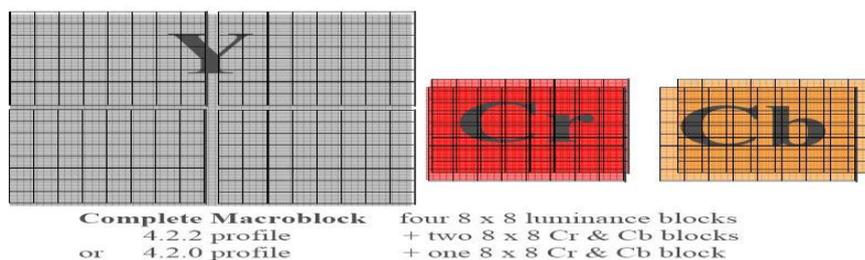


Figure 8. Macro block

Macro block is actually a surface on which compensation and predictable coding to make predicted p picture is done. Number of 8*8 blocks in each macro block depends on the profile kind.

H.264 AND MPEG – 2 DIFFERENCES

Generally there isn't basic difference between MPEG – 2 and H.264. Since both work based on frequency adopting of motion compensation, Quantized of adopting coefficients and finally binary code with changeable length. The main differences in processing compression components between MPEG – 2 and H.264 include: (shen L *et al.*, 2006).

- **Kind and Dimensions of Transforming**

In MPEG-2 transferring is from DCT and with 8*8 pixel blocks, while in H.264, transforming coefficients is integer and its dimensions can be 4*4 or 8*8.

- **Intra Frame**

In H.264, before transferring blocks which are going to be coded as intra frame, each 4*4 pixel blocks is subtracted from pixel estimation of neighboring block which is in the same picture and then transforming is done. This is just the reverse of MPEG-2 in which no estimation is done on the pixels (MARP and Cycon, 1999).

- **Motion Compensation**

In MPEG – 2, for each 16*16 pixel block, a motion axis is introduced. But in 2 H.264 we can divide a 16*16 macro block into different shape in dimensions of 16*16 , 8*16 , 16*18 , 8*4 , 8*4 , 8*4 . And each of them can be compensated separately.

INTERNET PROTOCOL TELEVISION

IPTV Definition

IPTV technology is developing in a high pace and it will put a great effect on the present traditional Tv networks. Since the invention of TV. About 100 years ago, the most important development in this industry is digital television creation. Analog TV program broadcasting was used over years. During this period , viewers evidenced the changing from black and white to color pictures (Johan, 2008). Changing from black and white was an important point to stimulate viewers to buy new TV .Providers should obtain new equipment in producing, broad casting and sending pictures. Future prediction has never been as dangerous as our time. Increasing technological changes have also faced trading and markets with thousands of threatens and opportunities. What is known as IPTV or internet protocol based TV, is the joining point of distance communication with information technology. This is the same thing which flashes in future technology. Imagine an interactive media which makes any kind of audio – visual entertainment available to you is not very far. During the next few years, TV will change more than how it changed in past five decades. Although we still don't know what will be the end of these revolutions, it can be understood that its appearance should not be ignored. Future TV, with new technologies is not only related to the telephone industry, but to the internet video band width service. But what does IPTV mean? And how does it affect watching TV? IPTV is called by other names such as: teleco TV, broad band TV which means secure delivery of high qualified TV with good audio visual quality on a broad band TV network. IPTV is usually used in common TV channel transferring and movie in a private network. ITU

definition of IPTV is like following, IPTV is considered for multimedia services like TV, image, audio files, text and data which is sent via an equipped Ip network . This network is designed in a way that provides validation ability and service quality (Johan, 2008).

IPTV Characteristics

Since the past up to now. TV wave publishing was done through one wire system or direct sending from satellite. Today, TV and any audio or video services like high speed internet is represented by broad band networks and received to the houses via a simple connection. This connection can both be wired or a telephone line. Telephone lines which just carried the voice today are able to transfer a broad band services. Regarding to digital caring ability, traditional method of TV industry is basically changed and old communicational borders are disappeared (Imsook and Seungyun, 2009).

Theoric infrastructure has got such a big revolution titled IPTV. IPTV explains the video transferring though a network which uses protocol network. And by using broad – band width represents digital TV services and makes a lot of capabilities available to the users – a service provider can do these services along with some other services like IPTV browsing electronic program guide , caller id on TV , IPTV advertising , gaming on demand , emergency alert system , digital video recording , personalized channels , weather forecast , localized video content , IPTV instant messaging and it also can make a mutual relationship with users . Because of little band width of internet networks, this technology couldn't develop a lot in the past (Johan, 2008).

IPTV Coding

Thanks to the development in world communication, sending digital images and compressing them became very important (Kwangseok *et al.*, 2009).

Image compressing is done before sending or saving and the image is compressed in the destination. While sending an image, because of the channel noise some of the image information is lost and this lead to reduce the quality of renewed image. Rest of the activities of ISO and ITU in designing video codec is continued in corporate operations that led to MPEG-4 compressing. This standard at first was defined as H. 26L in VCEG. in video coding case , such as MPEG -2 and H. 263 , there are several explained profiles in MPEG-4. The parts of this standard are listed in table 4 (wiegand *et al.*, 2009) .

Table 4. some parts of MPEG – 4 standard

PART 1	system
PART 2	Visual
PART 3	Audio
PART 4	Conformance testing
PART 5	Reference software
PART 6	Delivery Multimedia Integration Framework
PART 7	Optimized software for MPEG – 4 visual tools
PART 8	Carriage MPEG – 4 contents over IP networks

There are diver's ways to improve the quality of MPEG-4 compressing among which we can refer to multi explanation coding. For example MPEG – 4 standards which is the combination of audio and visual coding that have a broad band ranging from 4800 bit to 4 mega bite per second. The main functions of this standard include all parts TV. Circulating the video and multimedia, video phone and IPTV. This standard has a lot of features than pervious and newer features. Among its capabilities we can refer to supporting signing language, virtual reality for Synthesis of three-dimensiona, material based mixing in producing and video mixing, audio and VRML 46. Most of the selective capabilities in this standard are for applications. Which some of them are designed and used and some have not used yet. so there is a little complete running for this standard. Based on the predicting that even designers have about this situation of applying features of this standard, they have represented a definition as profile. As it was mentioned before this standard is made of several standard which are introduced as layers. Part 2 of MPEG-4 standard intro duces two profiles of this codec, SP47 and ASP48 is for compressing video. This codec is similar to the old codec structure and meanings and a discrete cosine transform codec such that such a H.263 video with baseline profile is completely under the two parts of MPEG-

4 profile and its able to adopt and decoding. it important to note that except for SP and ASP profiles , other profiles of part 2 in MPEG-4 use the coding algorithms which are based on the thing and they also have different encoding and decoding structure. Thing based profile haven't accomplished in trading functions. Some of important criteria in increasing functionality of MPEG – 4 codes are represented in table 5.

Table 5.main criteria in increasing the functionality of MPEG – 4

Global motion compensation
Quarter – pixel motion compensation
Shape – ad aptive discrete cosine trans form

CONCLUSIONS

The information volume should be reduced as much as possible in order to be saved. Principals of all compressing methods are to put some data and information away. Coefficient or the percentage of compression specifies the amount of removed data. Data transferring is easier in compression and the required band width and frequency is also reduced. There are different developed approaches for compressing. Image compressing fallow this fact that human eyes see the distance between tow closed material as the same and they can't recognize their differences and the effect of light and image stays in the eye for a specific time and it does go away . About motion picture, data from one frame to the other just changes when the information of that pixel has been changed. It means that permanent back ground data and motion object data are saved or sent separately. So in this general statej, audio visual signal coding leads to save required band width to transport on the other hand spreading internet protocol services which are known as IPTV don't use this technology. The solution to this problem is to use different compression kinds which aim to reduce sending information. According to this fact, MPEG-4 coding was introduced and considering its advantages over other coding standards it became a good choice in IPTV.MPEG-4 is used for equipments which deal with fast or slow data transporting. The main idea of this approach is to divide one video frame to one or several topics which are arranged based on a specific order. Like a tree in which you can access to its branches root or trunk through its leaves. Each leaf can include one audio or visual content. Each of these elements are able to copied or transport in a separate way. We can compare this technique with language learning. As in language learning in which all words are put in a separate form and we can make specific sentences by arranging them and we can write mutual words in several sentences just once and while arranging them we refer to the mutual words here each of these elements also specify a specific content and we can use mutual components just once and when we are making the content we refer to them. Each of contents can also be mixed by other contents and create a new collection .This case leads to move flexibility and different function of MPEG-4 for example imagine a teniss court, in teniss we can divide the scene to tow topic of the court and player, the court is always fixed so it's always repeated as a fixed topic, but the player is always moving and it can be different topics. This leads to reduction of occupied bandwidth by digital images. Attention that in addition to the related signals in these topics, there are also corporation signals that specify the mixing and correct localizing of the topics.

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