

MINISTRY FOR DEVELOPMENT OF INFORMATION TECHNOLOGIES
AND COMMUNICATION OF THE REPUBLIC OF UZBEKISTAN

TASHKENT UNIVERSITY INFORMATION TECHNOLOGIES

Admit to protection

Head of department

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2015 y. _____

FINAL QUALIFICATION WORK OF BACHELOR DEGREE

On the theme:

**“THE QUICK ESTIMATING OF VIDEO FLOW IN DATA
COMMUNICATION”**

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Tashkent 2015

MINISTRY FOR DEVELOPMENT OF INFORMATION TECHNOLOGIES AND
COMMUNICATION OF THE REPUBLIC OF UZBEKISTAN

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«__» _____ 2015 y.

T A S K

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Theme of the work: “The quick estimating of video flow in data communication”

1. Confirmed by order of the University from «25»12.2014 y. № 1467
2. Term of delivery of the finished work 06.06.2015
3. Initial data of work: Books, internet resource, journals, publications
4. The maintenance of a settlement – explanatory note (the list of questions subject to working out) 1. The analysis modern concept granting the services IPTV;
2. Analysis of the methods of the estimation quality of service in IPTV;
3. Development and analysis to models of the objective estimation quality issues
video flow in multiservice network; 4. Safety of vital activity and ecology.
5. The list of a graphic material: Demonstration slide, screenshot, images.
6. Data of task delivery 10.01.2015

Teacher _____

(signature)

Task accepted _____

(signature)

7. Adviser for separate sections of final work

Name of the chapter	Adviser	Signature, data	
		Given mission	Received mission
1. The main part of research	S.O.Mahmudov	10.01.2015 y.	
2. Safety of vital activity and ecology	F. M. Qodirov	19.05.2015 y.	

8. Progress chart

No	Name of the chapter	Due date	Signature of teacher and adviser
1.	The analysis modern concept granting the services IPTV	30.01.2015 y.	
2.	Analysis of the methods of the estimation quality of service in IPTV	25.02.2015 y.	
3.	Development and analysis to models of the objective estimation quality issues video flow in multiservice network	04.04.2015 y.	
4.	Safety of vital activity and ecology	25.05.2015 y.	

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Theoretical value of the final qualification work consists in development and study to models of the estimation quality issues video in IP-set, characterizing degree self-similarity, subjective and objective methods of the estimation quality perceptions video. Practical value of the work consists in possibility of the use got result for designing, planning and calculation of the limiting features IP-networks when granting video service.

The thesis also reviewed issues of life safety.

В данной выпускной квалификационной работе приведены в разработке и анализе в модели оценки качества видео потоков в IP - сеть, характеризующая степень самоподобия, методы субъективные и объективные видео восприятия качества оценки качества видео потоков. Практическая величина работы состоит в возможности использования получить результату для проектирования, планирования и вычисления ограничивающего представляет IP- сети предоставляющие видео услугу.

Также рассмотрены вопросы безопасности жизнедеятельности.

Introduction

The telecommunications at present feel verily revolutionary development. This is graphically seen on example multiservice networks. The traditional telecommunications are characterized narrow specialization, for each type relationship exists the separate network, which requires the own development and technical maintenance. Herewith free facility to one network can be not used by other network. Multiservice network allows abandoning to multiple assessed secondary networks, providing introducing the new services with different requirement to volume of sent information and quality of its issue. The operator multiservice to network will be able most packed to realize the pass band for integration different type traffic and granting the different services. The User will be able to satisfy their own need for reception of information of any type at access from any point and anytime. Need for creation multiservice networks is dictated market of the telecommunication services.

At present, the majority operator relationship came to need of the creation united multiservice ambiences for transportation and switching of the services. Multiservice network forms united information-telecommunication structure, which supports all types of the traffic (the data, voice, video) and gives all types of the services (traditional and new, base and additional) anytime, in any set and volume.

Beside us in country development multiservice of the networks is spared emphases. In report of the President of the Republic Uzbekistan on meeting of the Cabinet Minister, denoted total social-economic development of the country in 2012 and the most important priority directions of the economic program on 2013, I. A. Karimov has mentioned that, "all greater importance gains the speed realization of the measures and project in sphere information-communication and telecommunication technology. We must return itself report that without cardinal, I have said explosive advancement on way broadly introduction in all spheres of the economy, in our everyday life modern information-communication systems it is difficult to see the prospect. We necessary at the most short time not only to avoid having place backlog on many type of the rendering the information services, but also leave in bit of the

leading countries with high level of the introduction information-communication technology. There is terminate the construction more than 2 thousand kilometer fiber-optic networks of the broadband access on modern technology with granting the services video telephony, Internet-televisions, speediest internet, viewing channel HDTV and other" [1]. At present share company "Uzbektelekom" already gives the user a complex multiservice of the services data communication, IP-telephony and IPTV.

The building multiservice networks and connection of the consumer services at present does not present the person of the difficulties, but there are determined problems with provision quality.

Actuality of the theme. The modern society is characterized by penetration of the business in all area of the human life. Herewith in business world possible to observe two main trends to integration of the business and to all greater role, this in he plays the info communication. But modern facilities relationship necessary not only business customer, relationship all are more often used ordinary user: she becomes the integral part of the contact of the people, access to popular amusements, element of the prestige, facility earning and etc.

On measure of the development and complications of the services relationship, they usually become more demanding to resource of the telecommunications, on the base which they are given.

Concept telecommunications following generation Next Generation Network (NGN) gives operator greater possibilities on organizations practically unlimited amount of the services, in ditto time she puts new tasks with standpoint of the creation and introducing the new methods for estimation quality perceptions Quality of Experience (QoE).

Modern telecommunication operator, striving to increase average arrived with user Average Revenue per User (ARPU), necessary not only constantly to introduce newly appearing facilities, but also to remain competitive capable, follows to remember about quality of the provided toed services. Today facilities Internet Protocol Television (IPTV) conquer all greater popularity amongst

ordinary users, and majority operators have already unfolded or unwind the platforms for their introduction. The given type of the services is an unconventional with standpoint of the estimation quality. Exists the row of the methods for estimation quality sent video, but no unambiguous opinion and as effect of the approach, giving clear presentation operator that sees on screen of the television set user so in a complicated way forecast and prevent the appearing problems in broadcasting, warn the client and raise hereunder its loyalty. The Volume of the traffic IPTV greatly increased in recent years and influences upon factors quality of service for all type of the traffic, sent in IP-set, including, and on quality of delivery most traffic IPTV.

The facilities IPTV are realized on the base of the technologies TCP/IP, which is chose as base technology for building telecommunications following generation NGN. The measurements of the traffic IPTV, either as the whole traffic video apposition, show that he tends to exponential growing and begins to compete with traffic from traditional exhibits in IP- set in fight for network facility.

For a long time in role the main methods of the estimation quality IPTV were considered only subjective methods of the estimation quality issues video, however, their broad use in process of the usages of the services IPTV does not introduce possible in view of difficulties of the undertaking test (need constantly to contain the group or groups' expert). So in recently greater popularity have got the methods of the objective estimation, which are founded on collection and analysis of the network features. But also their it is impossible name universal and capable exactly to value sent video since majority of such methods does not take into account the features specific for video apposition. So today exists it is enough large number of the varied methods of the estimation quality IPTV as subjective, so and objective. Some of them standardized.

The purpose of the work and problems of the study. The Purpose qualification work consists in development and study of the models of the estimation quality issues and quality of the perception video in IP-set. For

achievement put purposes in qualification work consecutively dare the following problems:

- an analysis of the architecture and possibilities existing systems on example of the granting the services IPTV;
- an analysis existing methods of the estimation quality on example of the granting the services IPTV;
- a development of the complex parameter quality of service, rendering essential influence upon estimation quality issues video on IP-networks;
- a development to models of the estimation quality issues video on IP-networks, taking into account network features and parameters specific for video apposition;
- an undertaking of simulation modeling for check of correctness of the admissions, which were made in models for simplification of the calculation, as well as for estimation of fitness of the use to models;
- an analysis of the traffic of different exhibits in IP-oriented multiservice set with provision for characteristic self-similarity;
- a development to simulation model of the fragment IP-network for estimation of the influence characteristic self-similarity video traffic and traffic of different exhibits on quality of the issue video on IP-networks.

In introduction is motivated urgency of the subject of the study, is considered condition of the under investigation problem, is worded to purposes and problems of the work, are enumerated main scientific results, got in thesis's, are determined practical value and application result, is brought information about approbations of the work and are presented main positions, stood on protection.

In the first chapter qualification functioning is organized analysis existing services IPTV, modern systems for granting of such type of the services, technology and protocol, as well as trend of the development IP-networks toward granting the new services interesting for broad circle of the users. The main components of the standard complex are determined for granting interactive

services IPTV, their functionality and order of the interaction the reveal problems and difficulties of the introduction and realization of the services IPTV.

In the second is conducted chapter review of the most known methods of the estimation quality IPTV. Stand out the particularities and defect of the using the different methods. At the beginning initially chapters are considered main mechanisms of the provision quality of service in IP-set. Is it hereinafter conducted analysis and comparison subjective and objective methods of the estimation quality IPTV, and their role in shaping the new factor quality perceptions QoE (Quality of Experience) in IP-set. The dependency of the distortion video is defined from network factors. It is reveal the most suitable area and stage to realization of the services IPTV for use the method.

The third chapter is dedicated to development to models of the estimation quality transmissions video in IP-set, founded on inter coupling the losses, appearing on network, and distortion, visible spectator when viewing TV program and film. The model aside from features of the network allows taking into account the influence other parameter specific for video applications. In particular modeling of the influence different codecs is produced in the third chapter on quality of the transmission video depending on level of the losses, moment of the arising the losses. For check of fitness to models loss distortion is conducted on location experiment, which allows to value adequacy of the use offered models for the other methods of the estimation quality transmissions video. Restrictions are reveal In the course of modeling for model and is offered use the parameter, taking into account characteristic self-similarity video traffic.

1. THE ANALYSIS MODERN CONCEPT GRANTING THE SERVICES IPTV

1.1. Structure of building IPTV

Internet Protocol Television (IPTV) presents itself digital interactive television in IP-oriented set, including in set NGN in the first place. The classical scheme of the granting the services IPTV greatly differs from Internet-TV. Internet-TV gives a chance viewing TV programs through Internet, as transport uses the available(for all) network, which open for any user on any continent, moreover, each can publish information, which will be global available.

IPTV is one of the variant of the building of the networks cable, satellite television, in which as transport is used IP-network. This closing network, sometimes half closed, which been included in network of the operator relationship, depends on its topologies and infrastructures, completely he belongs to and not available wholly from internet. Moreover, all devices, connected to network, are checked by operator. Thereby, IPTV this one of the ways of delivery video before user in IP-set, etc. IPTV presents itself technology of delivery of the multimedia services (the television, audio/video, text, data, graphics) in interactive mode and in mode active [3].

Select the row a characteristic to technologies IPTV:

- support interactive televisions;
- personalization;
- remitted viewing;
- accessibility of the services IPTV when use terminal different users.

Under support interactive televisions understand the possibility to support the bidirectional transmission, etc. presence to feedback between operator/provider and user facilities that, in turn, allows realizing the broad spectrum interactive applications. Personal services IPTV allows the user by itself to choose, as when they want to look, from standard facilities Video on Demand (VoD) translation

film with video server on request of the user, before shaping the individual package channel and programs. Thereby, in current whole of extensive spectrum TV channel and TV service user can form the own package in accordance with their own preferences. Remitted viewing is an most extended realization of the services IPTV, allows to write the program with the following viewing, including there is possibility of the rewinding of the recorded program, for instance to exclude the advertisement. On today majority of the systems IPTV and operator do not allow the user to rewind the program, but not because of technical, but sooner marketing reasons. Accessibility of the services IPTV permits viewing with television receiver not only, but also with the other device, for instance, personal computer and mobile device.

The requirements to network and terminal equipment IPTV are determined in confirmed recommendations ITU-T Y.1910 Functional architecture IPTV. Given recommendation allows the supplier of the services to offer whole spectrum of the services IPTV on the base IP-networks [2].

Table 1.1

Difference between IPTV and Internet TV

Features	IPTV	Internet TV
Different platforms	Secure dedicated private networks based on IP, managed by provider of the IPTV service	Public internet for delivering
Geographical reach	Limited by fixed geographical areas	Nearly no geographic limitation
Ownership of the networking infrastructure	Network is owned by service provider Engineered for high quality videos	Public internet no guarantee undelayed and high resolution
Access mechanism	Over a digital set-top box	Nearly always a PC

Costs	Similar to pay-tv providers, monthly payment	Mostly free video content
Different content	Similar to traditional TV over cable and satellite	Small and regional channels

1.2. Service of IPTV

Interactive television IPTV is the most complex and interesting from all new type speaking. It gives the viewer the most incredible possibilities active participation in telecast from answer to questions on-line before participation in show by means of its virtual image. The typical particularity digital IPTV is, alongside with granting subscriber interactive content, high quality of the scene (television to high clearness High-Definition Television - HDTV) and additional facilities for spectator, allowing him through inverse channel relationship actively connect with system IPTV and influence that occurs on screen. The Functions interactive are realized by means of board of the remote control or interactive of the keyboard through patient terminal Set-Top-Box (STB).

At present studies, connected with expansion of the possibilities interactive televisions, and analysis existing systems to realization service data is denoted big amount of the work leading specialist.

In system IPTV can enter both unusual channels and channels of the extended television with interactive content and different variation of the services video on request Video-on-demand (VoD). VoD gives a chance viewing the booked programs in determined time, allows booking the films with board of control and includes the main functions of the video recorder: starting, pause and rewinding [12].

Known facilities IPTV possible to divide into three greater groups:

- Television services and Personal Video Recorder (PVR) services;
- Facilities VoD;

➤ Interactive services.

Such facilities pertain to the first group as: Broadcast Television (BTV), Electronic Program Guide (EPG), Start Over (SO), Network Personal Video Recorder (NPVR), Pause Live TV (PLTV), Instant Personal Video Recorder (IPVR), Time-shift TV (TSTV). They comprise of itself as classical facilities вещания television channel, so and realized in IPTV facilities record and rescanning of the liked telecast only. We shall Consider the data a facilities in detail.

BTV - Broadcast Television broadcasting television channel on IP-network. The classical service television broadcasting. As a rule, way of the payment is a rental fee TV channels for package or in broader version for channel. The User has a possibility subscription on packages channel. Is it in the future expected that user itself will be able to form the packages a TV channel, following only their own preferences [12].

EPG - Electronic Program Guide electronic program of the transmissions. It Is Given without payment, etc. is a main instrument of informing user about future program and for use PVR service [10].

NPVR - Network Personal Video Recorder network video recorder order record future programs through EPG. The Order of each program is paid apart. The user can view recorded program during determined time (for instance, 24 or 72 hours) unlimited amount once.

SO - Start Over rerun of the programs possibility of the viewing the current telecast first. The absence of the possibility of the scrolling. The technical possibility of the rewinding there is, but at present this option locked for user to when viewing the program did not rewind the advertisement [10].

PLTV - Pause Live TV pause of the direct airwaves. The subscriber to anytime direct translation can press the button pause on panel the remote control. After pause, having pressed button play, possible continues the viewing with place of the stop [10].

IPVR - Instant Personal Video Recorder realization record not through order on EPG, but on striking by subscriber of button record on panel the remote control in mode full-screen viewing. As a result realized writing the temporary interval between striking button record and stop.

TSTV - Time - shift TV - television with shift at time. This is a most broad realization all service, founded on PVR. TSTV allows any time to press on direct translation button rewind and rewind the TV channel for any time back (10 minutes, hour, day, and etc.).

To service video at the request possible refer: Video on Demand (VoD), Subscription Video on Demand (SVoD), Near Video on Demand (NVoD).

The base service is VoD - Video on Demand or video on request. The user can choose any film available in video collection and buy it on determined length of time. Possible variation price depending on period of the lease (for instance, 6/12/24 hours), also on cost of the film affects the category, in which he is found. For instance, novelties cost (stand) cherish, than films from section classics. The User before buying can gratis view the trailer to liked film under its presence; also film is supplied by detailed description and, as a rule, поstepом.

SVoD - Subscription Video on Demand video on request on subscription. Allows to pay the subscriber unlimited access to determined categories VoD content. When buying films from this categories will dispense more cheaply, than films from the other category. The Form payment also, either as for VoD is realized for order with variations of the price depending on period of the lease (for instance, 6/12/24 hours). Free viewing trailer.

NVoD - Near Video on Demand virtual cinema-hall, translation video content on timetable in mode of the group sending out (multicast). This service more interesting operator, than user, etc. allows to spare the resource to network, to account of the use the mode multicast and not to load the kernel to network big amount video flow, sending same film in one approximately and too time. So, for instance, when leaving new advertises film high probability that people will want look. At night after functioning (working), for instance, beside 20:00 on server

enters the flow of the applications for given film with difference in several minutes and operator to come to mode unicast to lose each user this film. Hereunder resource to network can be quickly exhausted. To send through network not 100 video flow, but 1, operator announces the popular film and fix him cost below, than cost(stand)s its buying on service VoD and time of the session, for instance 20:00 or 22:00. The Majority of the users never mind, begin viewing the film in 19:53 or exactly in 20:00. As a result operator effectively uses the resource to network, but user rationally spends the money on count. Either as in two previous events payment occurs for order. The Cost is fixed depending on categories of the film and period of the lease. Possible free viewing trailer.

That services pertain to the third group of the services, which are integrated from outside and can be a quotient by development of the operator communication, for instance, plays on the basis of the technologies Java (sea fighting, tick-tack-toe), integration with service IP- telephony, work with e-mail on screen of the television set, integration with internet-pager ICQ, information-reference and commercial services: weather, rate topple, news. Thereby, using IPTV, users can conclude the virtual bet, visit TV shop, vote on local referendum, participate in forum and chat, send SMS-messages, keep personal information in electronic directories and calendar, create household photo album and others. To this group of the services possible to refer the order and bugging music composition, album, concerto, realization facilities karaoke and radio, which are rather popular.

The most important role in system IPTV plays the characteristic interactive, which allows the spectator when viewing the television programs to call by means of board of control through STB and get on screen additional information: information on program, its author and participant, announcements of the future transmissions, material on the same subject, not came in the main TV programs. The user has an access to archive past issue of the program and others. In conclusion of the description of the services IPTV follows to note that given type of the services pertains to service Triple Play, which imply delivery of all types of

the traffic audio, video and given in fixed set communication. When granting the services IPTV in mobile set these facilities change in Quadro Play [4].

1.3. Architecture of IPTV

The Architecture IPTV in general type was submitted for Figure 1.1. In composition of the architecture possible to select the following functional blocks:

- The Sources content or suppliers content are a go-between between operator/provider, giving facilities IPTV and producer content, television studio and Film Company. Possible present the sources content in the manner of the center given IPTV, in which taken content is coded, process and sent user or is accumulated in database.
- The Nodes of the services IPTV are intended for receiving video flow in different format with the following their encapsulation in packages for issue on IP-networks.
- The Broadband networks comprise of its main networks and network of the access and meet the demands on reception capacity, factor quality of service.
- Equipping the user. In composition of the final equipping the user enters STB, which executes the role of the client IPTV and terminating the traffic IPTV, also can enter the floodgates, forming home networks.

Granting the services IPTV is closely connected with concept of the building of the networks of the following generation NGN, which was developed as central to making packet telecommunications general use. The Concept NGN implies gradual transition from networks with switching channel to packet with possibility of the granting multi services with certain guaranteed quality of service. The Theoretical base for making NGN was shown convergence telecommunications, as central to building of the transport network is at present used technology TCP/IP.

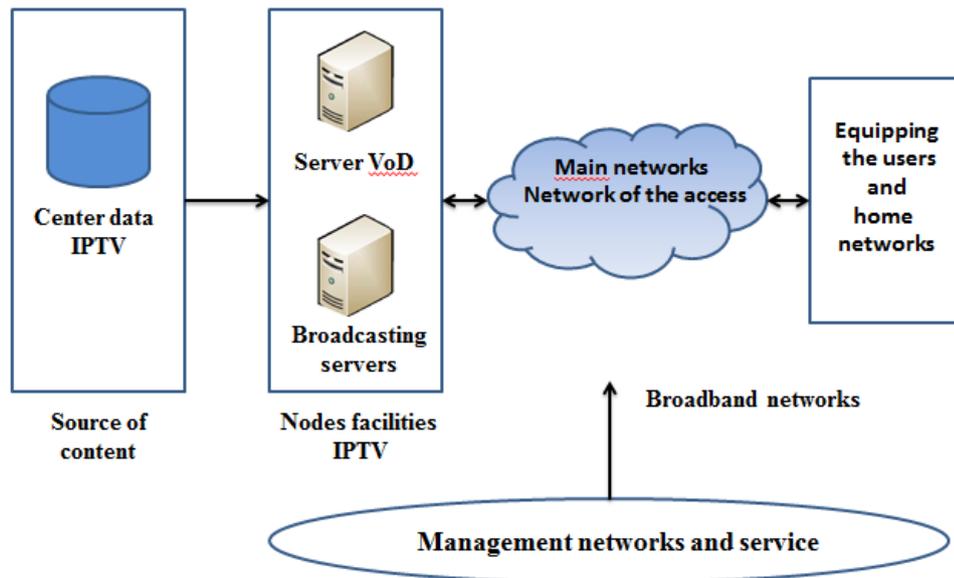


Figure 1.1. Simplify architecture of IPTV.

The Simplified architecture IPTV, submitted for figure 1.1, gives general understanding to realization of the services IPTV within the framework of existing networks. To better understand the processes, occurring in network at request facilities IPTV user, shall consider in more detail standard complex IPTV.

For present-day day on the market telecommunication by leading companies' producer and developer of the equipment and software is presented row of the decisions IPTV, agreeable to all declared requirements on the part of operator relationship. In spite of variety of the proposed decisions possible uniquely to select row a component, forming standard complex IPTV.

Main component of the complex IPTV are:

- The Main station (Head End) and element of the coding.
- The Subsystem Video at the request (Video on Demand).
- The Services platform (Middleware).
- Subscription equipment (Set-Top-Box).
- The Subsystem of the conditional access (Conditional Assess System).

The Main station (Head End) and element of the coding. As a matter of convenience Main station and element of the coding territorial are found on one platform and realize acceptance, transformation signal from different sources and

shaping flow IP-multicast/IP-unicast. Equipping the seizure content real-time gets the audio-visual flows from different sources at satellite dishes, frequency and etc. If required encodes, decrypt, digitizes and directs them in equipping the packing in packages IP - IP-streamer [8].

In composition component to main station select:

- The antenna post, primary task which provision acceptance signal from ethereal station and companion(satellite);
- The digital satellite receiver or descriptors provide the unscrambling digital signal, got with antenna post and issue material streamer/multiplexor;
- the element of the digital coding provides MPEG-coding analog and digital signal and transmission material streamer/multiplexor;
- Streamer/multiplexor is a key element to Main station, provides the multiplexing a material and IP-broadcasting thereby that each channel has its unique address and port IP-broadcasting.

Main station must work with broad range of the input sources video content:

- satellite TV-channels in format DVB-S;
- analog and digital not compressed video, got from studio of the television equipment in format SDI;
- the ethereal digital programs through DVB-interface and analog ethereal channels in format composite video;
- Video content, sent through transport networks in format IPTV (MPEG over IP).

The base function to main station is IP-encapsulation, which provides cut-in transport MPEG-package as useful information load in composition IP-package and following data communication on telecommunications. Also possible select other functions, realized Main station: Trans rating or change to velocities dataflow; Transcoding (change the format of the compression meta-data, for instance, flow MPEG-2 transcoded in MPEG-4); Encoding compression unrepeated video to achieve on output encoder transport flow in format MPEG-2

(4), at the input video signal can be in analog type; decoding (reconstruction source unreel information); Scrambling, under which is understood crypto operation with use the system of the conditional access; De-scrambling, is meant opening scrambled TV-channel; the multiplexing input single-program transport flow (SPTS) or multiprogramming (MPTS) in necessary operator output multiprogramming transport flow with the following filtering insignificant and spare data; editing the tables to service information (Program Specific Information - PSI).

The Subsystem Video at the request (Video on Demand). In task of the subsystem Video at the request - Video on Demand (VoD) enters record and playback on request of the user video material.

The Main component of the system VoD are:

- The central node hardware-programmer complex, located, as a rule, in “center” network in direct logical vicinity to system of the conditional access and main station;
- The managerial system content software, controlling video server and distribution content;
- Video server hardware-programmer complex, installed for servicing the groups of the users on determined territory, for instance, within one element of the aggregations.

The Scrambled system of the preliminary coding VoD content and metadata enter on element in system of keeping.

Metadata - one of essential forming digital television. In system IPTV at the request subscriber can be given unrolled description of the program or film, trailer, poster moreover any time, including long before its output in airwaves [5].

By means of managerial system content is realized distribution content on video server in accordance with given rule. At arrival user inquiry for broadcasting content, after procedures of the authentications by System of the conditional access (Conditional Access System - CAS), Middleware gets from managerial system content reference to nearest free video server, having in its base necessary user

content. Thereby, in kernel of the network is minimized unicast traffic, etc. big part broadcasting «video-on-request» is realized with nearest to user local video server. In kernel of the network circulates the official traffic and traffic of the distribution video content between central element and video server, which negligibly small and does not present the essential requirements to network [13].

System Planning VoD is connected with architecture and boot to network. The Central element serves, basically, for reception content and distribution it on peripheral server, as well as working off request users in the event of insufficiency functional peripheral video server. On the first stage of the development of the services Video-on-request possible uses the central element for granting the services user. Hereinafter, at growing of the subscription base, necessary to install video server on elements of the aggregations.

System video server VoD is presented on figure 1.2. By means of managerial system content (Content Management System - CMS) is realized distribution content on video server in accordance with given rule. At arrival user inquiry for broadcasting content, after procedures of the authentications CAS, Middleware gets from CMS reference to nearest free server, having in its base required by user content.

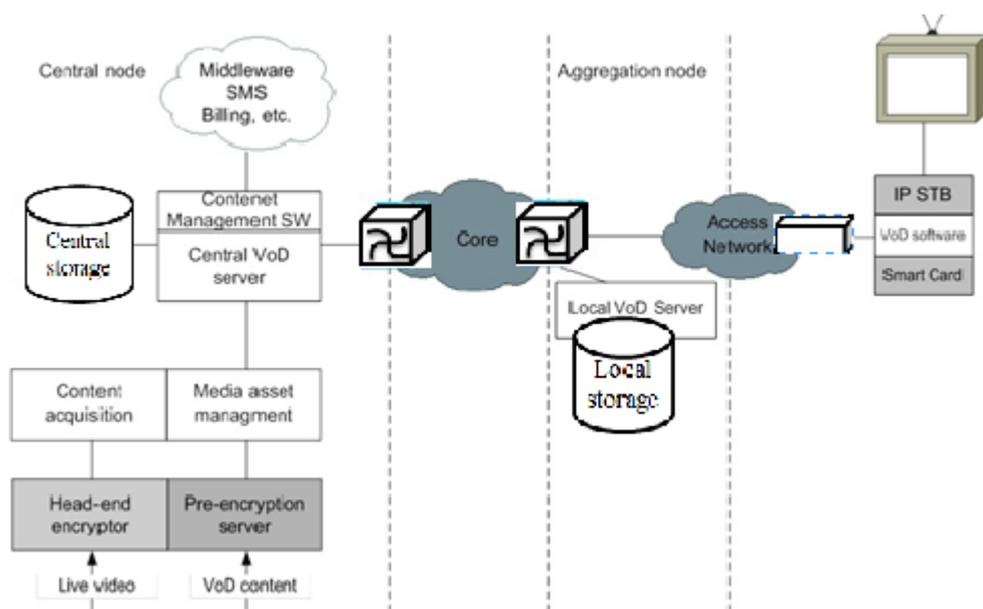


Figure 1.2. System video server.

For comparison, under broadcasting television channel by means of IPTV peak load on network depends on amount broadcast channel and from pass band, required for each channel.

Thereby, number simultaneous flow, which must broadcast the server in network, is a main parameter, from which depends the architecture of the server VoD. This parameter straight depends on amount client, which signed on given service.

The following parameter, which influences upon architecture of the server VoD this volume video content, which must be kept on server.

Thereby, considering all aforesaid, on architecture of the server Video on demand affect the following parameters:

- Maximum number flow, which will take to translate in network in watch of the most load, which straight depends on numbers client;
- General volume video content, which is expected place on server.

The Service platform (Middleware). Middleware - fire ware complex, which provides management all component decisions IPTV, as well as serves for simplification of the problems administration and management provided to service.

Middleware allows realizing:

- authorization subscriber;
- shaping the program of the transmissions EPG;
- shaping the interface and instrument of management decision IPTV;
- the interaction with system CAS, VoD, Main station, STB- device;
- The interaction with billing system and system of support of the business of the operator relationship.

Middleware has open architecture that allows operative to scale the components of the decision and increase the spectrum of the services. Hardware architecture Middleware is presented on figure 1.3 for installation without standby. In given desk sides for functioning (working) necessary 3 servers. All servers are fixed in one server carriage. Middleware is a single input point in system IPTV, though he is realized interactions as with all component of the system (VoD, CAS

and etc.), so and with external component and system (the billing of the system, workstation of the manager and etc.). Middleware consists of floodgate of the access, which organizes the access to server of exhibits from telecommunications of the general use in private network, where and is found Middleware. The Servers of exhibits process all requests, produce the calculations, and require other information systems. The Whole information on user, histories their request is kept in database [16].

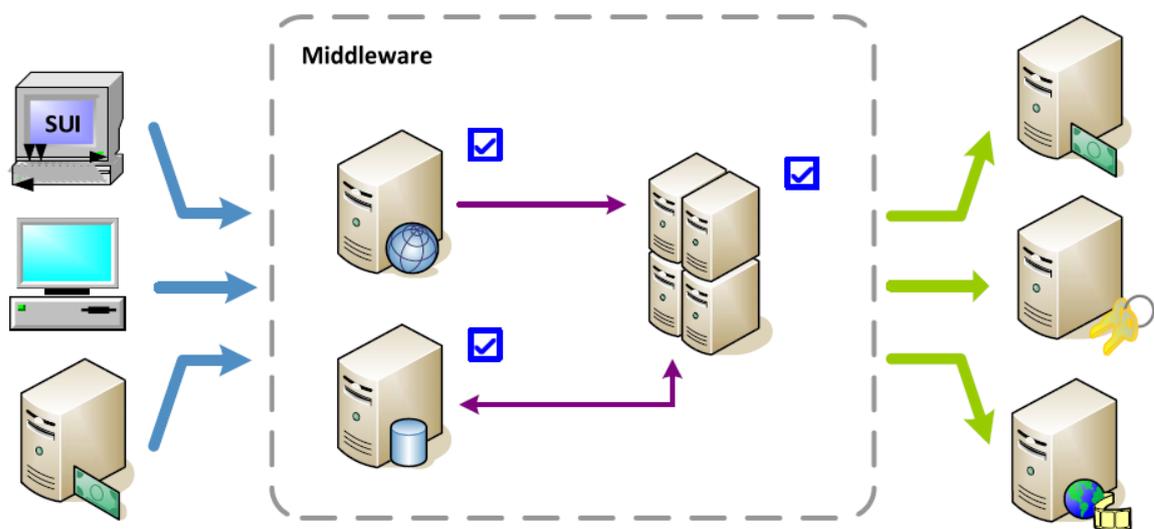


Figure 1.3. Hardware architecture Middleware.

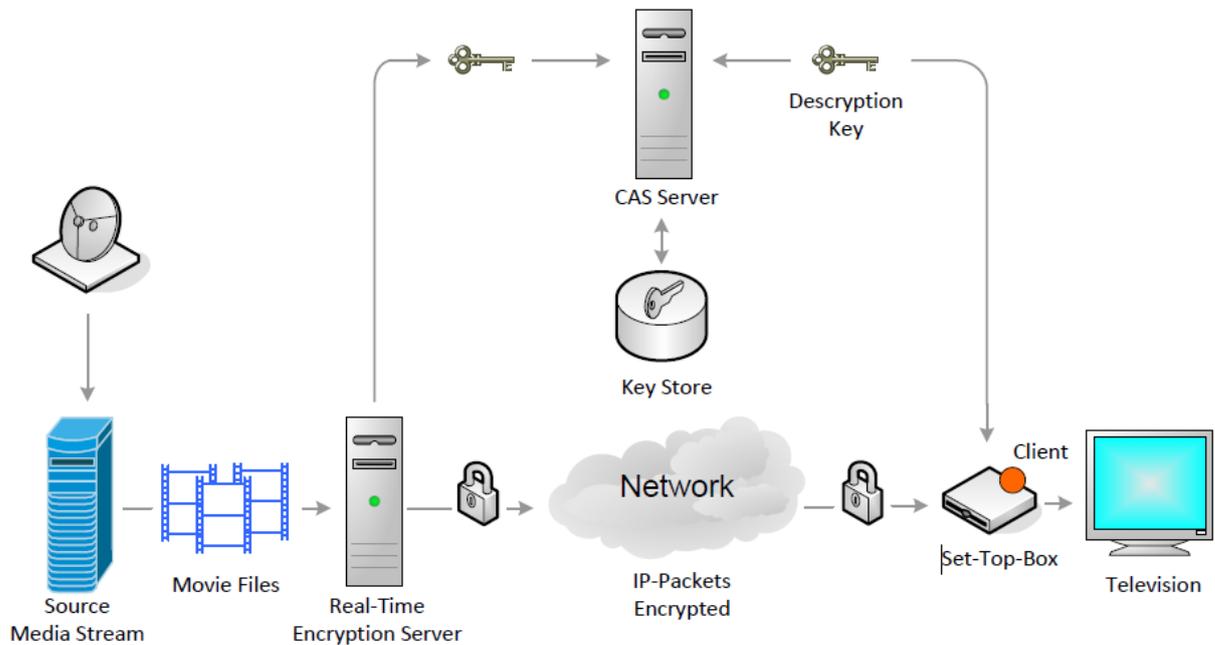
Subscriber device. Set-Top-Box (STB) - subscription device is a connecting-links between system of the shaping, deliveries audio and video material, and television set of the subscriber. STB this minicomputer with operating system, web- browser, MPEG-decoder. The main function STB are a determination of the join with system IPTV through Middleware, coding and decoding video flow, image of control on the part of user.

The device must be integrated under concrete project for interaction with all components of the system. The Cost and desk side STB hang from specifications and services, which plans to give the operator. Select as very simple STB with minimum set function, which have a low cost, so and

supporting broad set of the possibilities, including collection of the statistics, realization of some methods of the estimation quality transmissions video and etc.

Subsystem of the conditional access. The Subsystem of the conditional access (Conditional Assess System - CAS) presents itself technical means of protection audio-visual and the other messages and material, spread in composition of the television program on ethereal, cable and satellite telecommunications. Also CAS allows to delimit the access of the user to multimedia service, keep the copyrights, provide protection content from unauthorized access/copying. On figure 1.4 is presented scheme of the crypto operation broadcasting content, which is realized on summer. Broadcasting content (the television channels) with Main station in mode multicast available in open type in official Virtual Local Area Network (VLAN). The Servers of the crypto operation broadcasting channel sign on multicast of the group opened channel and encode them at a rate of MPEG. The Result of the crypto operation of the channel is new multicast group in public network. Subscription STB gets the keys on channels, on which they are signed when boot and are seasonally updated. When address channel switching for key does not occur that accelerates the given process.

The crypto operation content Video on request (VoD) differs from crypto operation broadcasting content. Each video file is beforehand encoded by system of the conditional access and through system of the distribution content gets on video server. Hereinafter, when viewing content, occurs address STB to CAS for reception of the key, which was encoded gave content [14].



The Figure 1.4. Crypto operation broadcasting channel.

All enumerated above components must interact with each other in spite of the fact that have a different producers and even can belong to the miscellaneous an operator and provider. So, for instance, at request of the viewing the film by user occur the following actions:

1. The Request from STB user on playback film, etc. user has chosen the film for viewing and has confirmed its choice.
2. The Server of the access, which stands in network of the operator at the input, addresses to user server, in which are brought all users, connected to service IPTV. Physically server of the access and user server can be marketed on one device.
3. User server addresses to database, in which is kept whole information on user, condition their count, bathed film, available services, age restrictions, etc. parental checking and etc.
4. If user has a right on viewing the required film, that he leaves the reference to server, which best included in systems video server (VoD) and have charge of processing user request from STB on контент and issue of the list video server, where this content is found.

5. STB sends the inquiry for specified server and in answer gets the reference to video server, on which is kept file with required by film, and, which territorial is situated greatly close to user.

6. STB sends the inquiry for video server on playback film.

7. Video server begins to lose the film in mode unicast.

The Whole above enumerated exchange by information must be realized greatly quickly, this entire time user ready and waits begin viewing. So emphasizes follows to spare the development Middleware, this exactly through he occurs the interactions between all components of the complex. And if rules of the interaction and sequence of the address are given incorrect, will appear the compelled delays when processing request user [5].

1.4. Modes of the issue of the traffic and protocols in IP-network

The Network of the issue possible to build the miscellaneous a way, base requirements possible to formulate as follows:

- The sufficient pass band from 4 Mbps for MPEG-2 and from 2,5 Mbps for MPEG-4 for reception acceptable quality scenes on average television set;
- Support Multicast network wide, obligatory condition for realization of the services IPTV;
- End-to-End support mechanism QoS for calculation resource pass band. If it is used sufficient pass band, service works, but necessary to take into account the priority traffic.

For granting the services IPTV use the following modes of the issue of the traffic: multicast at translations television channel, and unicast when granting facilities VoD [16].

I shall consider the specified modes in more detail.

Multicast - this multi address issue, which implies sending a package only that device, which have executed the respective request, hereunder joined to group. One of the comforts of the mode multicast is simplicity of the process of the connection and unhooking for subscriber any time. Given function is wholly entrusted on network device, and from the source video flow is not required no action at accompaniment/removing the new grantee multicast flow. In multicast system to all grantees can look simultaneously same video flow. The Advantage multicast: only one copy video flow is broadcast in network that reduces the requirements to pass band; the process of the creation mines package video flow is entrusted on network device that unloads the source video flow; the simplicity of the deployment of the system broadcasting on IP-networks; under multi caste possible use the video signal more high quality to account of the smaller compression. To defect multi caste possible refer that at concrete moment of time subscriber possible to look only that is broadcast by source of the video signal, and on this process to affect it is impossible. Network equipment must support multicast and must be configure corresponding to image. Multicast enlarges the load on routers of the network [11].

Unicast - this single - address sending out, etc. each package is delivered only one grantee. Each video flow is intended only for one grantee if several subscribers want to look same program (the film), that source of the signal necessary to create the corresponding to number a unicast flow from the source before each grantee. The main advantage unicast broadcasting is that subscriber can look exactly that he wants at concrete moment of time. Usually systems unicast broadcasting is complemented function, providing stop, pause and rewinding when viewing. The systems unicast broadcasting does not require special equipment, used for multi caste of applications. To defect unicast systems possible to refer need of presence big processor and network resource on the source video flow. Also necessary sufficient pass band between the source and grantee.

The following protocols must support for realization IPTV network:

Internet Group Management Protocol (IGMP), Protocol Independent Multicast (PIM), protocol to routings Open Shortest Path First (OSPF).

Protocol IGMP (Internet Group Management Protocol, IGMPv2, RFC 2236) pertains to controlling protocol, have charge of connection host to group. IGMP is integrated in IP on network level. The protocol is oriented on minimization of the official traffic. The principle of its functioning is concluded in following. First the command enters with subscription STB on connection to some channel. Then, the equipping the access sends the request to router on cut-ins in corresponding to group, in which lead the translation of the required channel. From the source (the main element) signal is sent through row router to equipping the access and leaves on that port, with which came the request STB. If one more subscriber sends the inquiry for viewing of this channel, he is included in group, and signal with equipping the access is duplicated and on its port. Thereby, on transport network signal passes in one copy and only on the last area is cloned for all connected to group subscriber. Seasonally, the special request routers define the actual condition of the groups. If on equipping the access is fixed at least one active subscriber, falling into group, router will send given on this equipment. When last subscriber will abandon to viewing the channel, on the next request of the router equipping the access will not answer the acknowledgement membership in group and transmission in its side stops. Formed main station IPTV flow television channel presents itself flow IP-package, sent in network on separate group IP-address, corresponding to given TV program. Thereby, broadcasting several channels presents itself shaping several flows multicast-traffic, when each of channels is uniquely defined by unique address of the group sending out.

Any time user IPTV switches the channel, active exchange begins in network by information. First, user it is necessary to disconnect from group Multicast, to which he is connected. Secondly, command Join to connect it to new group. V-third if channel broadcasting in general is absent at present, since its nobody does not look, signifies, it is necessary to initiate broadcasting and create the new group Multicast. V-fourth, in the event of use the procedure IGMP

snooping all enumerated change must be sent on network to will update the corresponding to rolls of the groups broadcasting. We shall add hereto that each of enumerated steps provides not simply transmission one-two messages, but execution whole protocol procedures, and then will become understandable that idle time keystroke on panel IPTV starts rather complex mechanism. Sometimes because of adjusting the network, delay, overloading on directions and t. d. switching channel can greatly lag. This delivers the inconvenience user, got accustomed to instant switching channel on traditional television set (at cable TV's, for instance). In the opinion of some specialist, IPTV-zapping time presents itself not as much technical problem as social disease. Many users love rather intensive begin to warble channel. But the source of the essential signal load becomes in condition IPTV such user on network [15].

The Protocol OSPF (Open Shortest Path First, RFC 2328) is a protocol to dynamic routing and uses the algorithm of searching for of the optimum way on condition channel. Works at base of the algorithm of searching for of the shortest way, offered Dijkstra. At relay out OSPF computes the routes anew, using minimum official traffic of the protocol to routings (so named renovations) for count calculation tables to routings on each router. Renovation of the table to routings occurs at the average each 4 s.

The protocol OSPF follows to use for organization of the routings in greater set, presenting itself separate isolated systems or regions to routings. For this purpose in OSPF is provided support four types router: autonomous, supporting, area and internetwork.

OSPF provides:

- the choice of the optimum way on the grounds of matrices, presenting itself function from importance's of reception capacity channel relationship, delay data communication on nodes, amount mistake at issue in each direction and other factor;
- the absence of the official traffic after building of the table to routings (the issue only short package between nearby router through

determined time lag, confirming their accessibility: renovations and messages of the type hello);

- quick spreading to information on relay out (each router contains get fat picture about structure of the whole zone so at relay out information is sent immediately all router of the zone);
- Distribution authority on management. Presence in OSPF own zones allows in big network delegate authorities on management different area (the zone) to network separate manager, saving general checking for network from the center due to presence so named central (supporting, backbone) of the zone, through which is realized joining the rest zones between itself;
- automatic aggregate subnets, etc. presentation several continuously following in address space of the subnets in the manner of one network if and when access to all this networks from given router is realized through one nearby router;
- Balancing the load, etc. possibility to distribute the load of the issue of the traffic on parallel channel that allows to enlarge reception capacity at channel relationship to necessary reception capacity .

Each router by itself solves the problem to optimization route. If two lead to the destination or more equivalent route, information flow will be divided between them equally. In process of the choice of the best-route is analysed oriented early to network [16].

The Protocol PIM (Protocol Independent Multicast, RFC 3973, 4601) solves the problems to routings for free number and locations of the members of the group and for free number of the senders to information. Allows to build the covering tree in group moreover between two host exists only one way. It is designed two versions of the protocol: one for thick (dense mode), but the other for rarefied (sparse mode) of the location of the members of the groups. Functioning (working) the protocol PIM does not depend on used protocol IP-routings. The Protocol PIM uses information to routings single address sending out

for performing the multi address routing. Though protocol PIM is identified the protocol to multi address routing, actually he does not create the independent table to routings of the multi address sending out, but uses the table to routings single address sending out. Unlike the other protocol of the routings protocol PIM does not send and does not get the reports on changes to routings, sent between routers.

The thick mode of the protocol PIM (PIM Dense Mode - PIM-DM) uses the model pulling(push) for avalanche spreading dataflow multi address sending out on all point of the network. This part pulling is a forced method of delivery given all grantee. Such method turns out to be efficient in that situation, when active grantees are found in all subnet of the network [17].

SUMMARY

1. On base of the analysis modern concept developments telecommunications and granting the new services are revealed the most perspective of them, to which pertain and facilities of the issue video within the framework of concept IPTV that has brought about motivated choice of the actual direction of the studies.

2. The organized review international and domestic activity on studies existing concept of the granting the services IPTV have shown that exists else much undecided questions at realization and granting the services IPTV. In this connection at present follows emphases to spare the development a standard on estimation quality granting the services IPTV.

3. On base of the analysis of the ways of the granting the services IPTV, requiring close-fitting interaction big amount intermix equipment and component to network, as well as protocol and software programs, is revealed particularities of their operation for realization of the models of the estimation quality issues video and using existing subjective and objective methods of the estimation.

2. ANALYSIS OF THE METHODS OF THE ESTIMATION QUALITY OF SERVICE IN IPTV

2.1. Factors quality of service in NGN

The next generation network NGN unlike preceding are heterogeneous and, as effect, can give the user any facilities. One of the most important problems herewith is a provision guaranteed level quality of service (Quality of Service QoS) for each facilities moreover requirements to parameter of the transmission on network specific for different applications. The Inconsistent requirements QoS for different services do not allow simply to unite the requirements QoS to united network resource.

In recommendations ITU Y.1540 are determined following network features, as the most important with standpoint degree their influences upon quality of service (from one interface user-network User Network Interface (UNI) to another interface user-network UNI):

- reception capacity;
- reliability to network/network element;
- the delay (ms) and jitter delays;
- The value of the losses (%);
- Vitality to network possibility of the conservation to capacity to work to network at mortality separate element.

Reception capacity to network (or send rate given) is defined as efficient send rate, measured in bit at second. Importance of reception capacity is brought In recommendations ITU-T Y.1540 not for different exhibits; but, together with that, is noted that parameters, connected with reception capacity, can be determined by means of recommendations ITU-T Y.1221.

Reliability to network/network element can be defined beside parameter, from which is most often used factor to readiness, representing itself attitude of time to

capacity to work of the object to time of the observation. In ideal event factor to readiness must be is 1 that means 100% readiness to network.

The delay of delivery of the package IP packet transfer delay (IPTD) is defined as time $t_2 - t_1$ between two events arrival of the package on outgoing UNI at moment t_1 and leaving the package from entering UNI at moment t_2 where $t_2 > t_1$ and $t_2 - t_1 \leq T_{max}$.

In general event IPTD is defined as time of delivery of the package from entry in network on UNI before output from network with the other UNI for all packages. The average delay of delivery of the package IP is defined as average arithmetical delay package in chosen set sent and taken package. The Growing of the load and reduction available network resource lead to growing of the queues in nodes of the network and, as effect, to increase the average delay of delivery.

Parameter V_k – variation delays IP-package IP packet delay variation (IPDV) between in and out point of the network is a deflection of importance The delays from given values. Variation delays of the package IP, named also jitter, reveals it in that that regularly sent packages arrive to grantee at irregular moments of time. In system IP-telephony this, too example, leads to garbling the sound and, as a result, to that that speech becomes illegible.

The factor of the losses IP-package IP packet loss ratio (IPLR) is defined as attitude of the total number lost package to the general count; calculate; list sent package in chosen set sent and taken package. If packages get lost then at data communication possible their retransmission on request taking sides.

The factor distorted by IP-package IP packet error ratio (IPER) is defined as attitude of the total number package, taken with distortion, to amount successfully taken package and package, taken with distortion.

Speech information and video information are an example of the traffic sensitive to delay then exhibits data, basically, to delay more sensitive. When delay of delivery of the package exceeds the definite sign T_{max} , package is rejected. In exhibits of the real-time (for instance, in IP-telephony, in system video conference) this leads to deterioration quality of service.

The rubber-band traffic, to which certain the transmission of the files and the document sensitive to loss and presents the low requirements to delay and jitter delays.

The stream traffic, to which possible refer the facilities video and audio at the request, Internet-broadcasting, presents the high requirements to loss, jitter delays and more sensitive to delay.

The recommendation ITU-T Y.1541 defines for parameter numerical importance rates, which must be executed in set IP under international join. These rates are divided on class QoS, which are determined depending on applications and network mechanism applicable for ensuring guaranteed quality of service. Rates are presented in table 2.1 for determined above network features [3].

Table 2.1

Important rates are divided on class QoS

Network features	Classes QoS					
	0	1	2	3	4	5
Delay of delivery of the package IP, IPTD	100 ms	400 ms	100 ms	400ms	1 s	N
Variation delays of the package IP, IPDV	50 ms	50 ms	N	N	N	N
Factor of the loss package IP, IPLR	1×10^{-3}	N				
Factor mistake package IP, IPER	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-3}	1×10^{-4}	N

N - is not normalized

Importance parameter, provided in table 2.1, present itself, accordingly, upper borders for average delay, jitter, losses and distortion package. The Recommendation Y.1541 installs also correspondence to between class quality of service and exhibits:

- The Class 0: Exhibits of the real time sensitive to jitter, characterized high level interactive (VoIP, video conference).
- The Class 1: Exhibits of the real time sensitive to jitter, interactive (VoIP, video conference).
- The Class 2: Transactions data, characterized high level interactive (for instance, signaling).
- The Class 3: Transactions data, interactive of exhibit.
- The Class 4: Exhibits, allowing low level of the losses (the short transactions, arrays data, stream video).
- The Class 5: Traditional types of exhibits in set IP [12].

2.2. Methods of the estimation quality issues video

The quality of the issue video depends on different factor. The losses package, network delays and jitter are defined feature to network of the issue. The type codec, technology of the disguise error, velocity of the coding, scheme packaging and the other factors, influencing upon quality of the transmission video, hang from type of application. The existing methods of the estimation quality transmissions video is accepted to divide into subjective and objective [7].

2.2.1. Subjective methods

Before recent time for video apposition existed only subjective methods of the estimation quality services, which in greater degree take into account the specific factors apposition, than features to network.

The subjective methods allow as a whole to value the service IPTV in step of introduction. In base broadly used methods of the subjective estimation quality issues video lays the method, founded on subjective estimation quality by group expert, the known as Mean Opinion Score (MOS). The given method is described

in Recommendations MSE-T R.800, used for subjective estimation quality issues speech.

For methods of the subjective estimation possible to select three main stages of the testing: choice or combination of the ways to demonstrations video sequence; the determination of the methods of the collection of the opinions expert; the choice of the methods of the processing result. The combinations of the possible methods in enumerated stage allow to realize the different methods of the subjective estimation.

Mean Opinion Score. In accordance with Mean Opinion Score (MOS) quality issues video, got at passing of the signal from the source through telecommunications to receiver, is valued as average arithmetical from all estimation, exposed expert after viewing video, sent on testable tract of the issue. The Expert estimations are defined in accordance with the following five score by scale: 5 fines; 4 well; 3 acceptable; 2 bad; 1 unacceptable. Obviously that given method does not take into account the row of the phenomena's peculiar to networks data communication and influencing upon quality of the issue video in system data communication.

In method, founded on MOS, is absent the possibility quantitative to take into account the factors, influencing upon quality video, as follows are not taken into account end-to-end (end-to-end) delay between the source video and receiver, influence variation delays and loss package. Also method MOS does not allow to realize checking a quality in real mode of time and, accordingly, in good time respond to possible problems in network and prevent the deterioration a quality services. So given method basically use for primary estimation of the network when testing the new equipment or facilities. Also this method is a cost - based since for reception of the reliable estimation necessary to invite the group an expert, but this, as a rule, 15-50 specialists. On the other hand, on today this one of the most exact methods of the estimation quality video. Within the framework of Recommendation BT.500-13 are entered additional methods for increasing of

accuracy of the estimation quality issues by video group expert. These methods are divided on three groups:

1. The methods "double stimulus" imply consequent reproduction each pair(vapor)s video, consisting of supporting and testable video;
2. The methods "single stimulus" realize reproduction and estimation to only testable sequence;
3. The methods stimulus comparison present reproduction pair(vapor)s miscellaneous video sequence and estimation their quality comparatively each other.

SSCQE (Single-Stimulus Continuous Quality Evaluation) - an unceasing estimation quality in the course of single viewing. The Watcher is demonstrated several video rollick. The Amount of the distortion in these rollers can be different. The estimations are exposed within from 0 (for the worse quality) before 1 (for the best quality). The estimation is exposed only once and hereinafter can be not changed.

DSIS (Double Stimulus Impairment Scale) - pairwise estimation of the deterioration quality video. The watcher is offered compare two video sequence - distorted and original. Duration of the test - 8 seconds. The Watcher values visual distortion on five score to scale. The Maximum ballet 5 - corresponds to imperceptible distortion, average ballet 3 - a distortion disturbs to look, minimum 1 - a scene to examine impossible.

DSCQS (Double Stimulus Continuous Quality Scale) - an unceasing estimation quality on result two viewings. This method founded on two earlier described metrics, has got broad using and allows to value stream video with high degree of accuracy. The Quality of the scenes is valued in the same way, as in methods DSIS. The Discriminating particularity is that video rollick is reproduced in pseudorandom order, but is then repeated. Certain time is given on completion of the viewing watcher for exposing the estimation. The Methods estimation also five score: 5 - a best quality, 4 - a goodness, 3 - a satisfactory quality, 2 - bad, 1 - very bad quality. The Watcher writes the exposed estimation in special form or

brings given in specialized program. Then all estimations are averaged and converted in standard scale (from 0 before 100). Thereby, always possible value the differences between original and distorted video sequence. On completion of the collection to information from all experts given are processed with use statistical algorithm.

Picture Quality Rating. The method Picture Quality Rating - (PQR) allows to define the ability of the user to notice difference between master video and testable while MOS defines the scale expert estimation and allows to expose their any video.

The method PQR is founded on algorithm Just Noticeable Difference (JND), which values the perception of the visual system of the person. In the course of experiment, founded on JND, are compared two video sequences: master and testable video, which is formed by artificial accompaniment worsening influences on master video.

Since human eye before determined moment does not perceive the deteriorations a quality video, in row of the events master video was valued expert worse, than testable. The method PQR will convert the perceptible difference between master and testable video in importance, which presents the ability of the spectator to notice differences between video sequences. The Experiments directed on estimation of sensitivity of the perception, measure the ability of the spectator to notice the difference. The given method suits for estimation facilities transmissions video in step of its introduction, when is realized choice of the format, standard of the coding, technologies of the transmission, is realized selection expert for undertaking test estimations quality video. In ditto time this method not acceptance for estimation quality transmissions video in process of the granting the services IPTV since does not allow in real scale of time to check the quality of the transmission video, delivered each user facilities.

In ditto time this method not acceptance for estimation quality transmissions video in process of the granting the services IPTV since does not allow in real

scale of time to check the quality of the transmission video, delivered each user facilities.

Difference Mean Opinion Score. The Method Difference Mean Opinion Score (DMOS) calculates the difference between estimation MOS testable and master video. In he is compared pair video sequence: master and testable video (same sequence, undergo worsening influence). The spectators first value on five score to scale master sequence, but then testable. The estimations MOS testable video sequence are subtracted from estimation of the master sequences MOS, as defines the estimation DMOS.

Before beginning of the experiment to group expert show video (burn-in sequence) and offer to value its quality. The Following estimations expert will be orientated on quality this video sequence.

For instance if two groups expert participate in experiment, one show burn-in video with goddesses, other with the most worst. Accordingly, estimations to testable sequence will also be a miscellaneous. Thereby, importance DMOS hang from range, in which is located estimations best event and the worst event of issue burn-in video sequence, and carry the relative nature.

The Method DMOS is used, when difference between video sequence not wait for, etc. impossible to predict, in what moment and on what reason will occur the deterioration video, or necessary to define quantitative this difference while PQR more suits for estimation of the abilities of the spectator to notice although some difference between under investigation video sequence. The Method DMOS does not reflect the processes, occurring in network.

Subjective Assessment Method for Video Quality evaluation. The Method Subjective Assessment Method for Video Quality evaluation (SAMVIQ) is created in European Broadcasting Union (EBU), realization MSU Perceptual Video Quality tool. The Expert show first source video sequence, on quality which they will be orientated, for the reason create the general scale an estimation, etc. that estimation fine signified approximately one and ditto beside miscellaneous expereturing test expert show video sequence, compressed by miscellaneous

codec moreover person does not know, what exactly codec is encoded sequence, for this their mark the letter. The primary task of the expert value demonstrated video on scale from 1 before 100. These estimations are afterwards processed and are averaged.

Since estimation video is produced person, on it can affect the external factors, one of which sequence of the show video sequence, or effect to memories. When viewing big amount video verge disappears beside expert between qualities of the miscellaneous video sequence. For decision of this problem in method SAMVIQ, in- first, seasonally in the course of undertaking the test demonstrate source video sequence, and, secondly, expert is allowed again examine video and change their own estimations.

Either as all subjective methods SAMVIQ is not used for estimation quality in real mode of time and, basically, is used for subjective comparison modern video codec.

Quality of Experience. In recently greater popularity has got the factor Quality of Experience (QoE) or quality of the perception facilities by user. QoE is a broader factor, than QoS since it is defined not only parameter to network or quality provided to content, but also takes into account the comfort of the use the system, contents content and waiting the user. The Determination quality perceptions QoE introduces in as the general factor quality applications or facilities, perceived by subjective final user. QoE forms from objective and subjective factors.

To subjective factor possible to refer the components of the perception of the person cultural background, motivation, emotional condition, attention and etc. Also to the pertain the functions of service control and tariffs. The Functions of service control take into account the experience of the work with concrete system and its level quality, comfort to navigations at choice of the services IPTV, at searching for content, intuitive comprehensible interface. The cost of the services can be a denominated person in granting advantage user, for instance low-

resolution scene will have more low QoE and cost facilities, but be wholly acceptable for user depending on final device, physical size display.

The Objective factors comprise of itself factors: issues to information, operation of exhibits, services. Under factor of the issue to information understand the minimum send rate data, maximum level of the losses package, delays and other network features. The Factors of the operation of applications take into account the parameters codec; permit video data source, velocity of the coding, scheme of the disguise error and etc. Factors of the services value the level of the granting facilities, for instance, time of the switching between channel (Zapping time), possibility of the choice content, electronic program of the transmissions (EPG), time of the response. At present, the new factors continue to add. Exists the row a publication modern researcher's quality perceptions, which seriously concern with the question of the estimation and minimization of time of the switching TV channel. Also, for instance, forum IPTV Interoperability Forum (IIF) on questions of the interaction in the field of IPTV, being included in American organization on standardizations Alliance for Telecommunications Industry Solutions (ATIS), has declared about renovation of the standard, installing requirements to factor quality facilities IPTV.

The new factors for transmission video comprise such factors of itself as: Frame Loss Length (length of the loss of the scene); I/P/BSlice/ Frame Losses (partial or full loss of the personnel (frames) I, P and B format MPEG); Motion Activity (the activity of the motion time factor, is computed as normal detour from average importance of the vector of the moving the scene). The New factors for transmission audio comprise such factors of itself as: Audio Dropouts (the fallout of the bleep); Loudness (loudness); Dial norm (the subjective level of the coding the dialogue, is used for turning level reproducing the sound); Program Reference Level (the supporting level of the signal) [7 8 9].

2.2.2. Objective methods

Applicable for present-day day methods estimations quality issues video, founded on analysis of the features to network, are practically same facility that are used for checking quality issues to vocal information, etc. they measure the parameters to transport network. Unlike subjective objective methods do not give the beliefs about that that indeed sees the user on screen of its television set, since they, on essences, do not do the differences between package, carrying video and the other information. On today is not designed Recommendation, specifying introduction of some metrics so exists the row of the methods and else more metrics, which greatly differ between itself and are based on miscellaneous approach.

The suppliers give video in different format. At present for testing video relationship in set special popularity have got the formats Common Intermediate Format (CIF) (the permit 352x288 pixels), and Quarter CIF, QCIF (the permit 176x144 pixel). They Also are broadly used formats 4:2:2 and 4:2:0 (the permit 720x576 pixels, main level standard MPEG-2). However issue of the scene without transformations is used only at studio to work, since requires enormous reception capacity a channel relationship. So in step of digital processing the scene is realized compression of the video signal different codec.)

The result of the compression is a signal, encoded in determined video size, in which are eliminated different forms to redundancy of the scene. The formats, in turn, differently perceptive to loss and delay on network. Different visible distortion such as twinkling, blockings, frozen video frame, is caused different level of the losses. Thereby, in a complicated way develop the method of the objective estimation quality issues video, founded on one or several network factors. Dependency different type distortion video is presented in table 2.2 from network features.

Dependency different type distortion video.

Distortion video	Network factors	Method of the measurement
Blackness video (pixelization, disintegration pictures on squares)	Losses package	VQM, PSNR, MDI, MPQM
Casual bands in scene	Jitter	MDI
Distorted video, spilling the scene	Arrival package in wrong order	
Nonsynchronous sound to scene	Mistakes in adjusting the buffer on acceptance, jitter	
Blurriness	Level of the losses 5 %	VQM, PSNR, MDI, MPQM
Twinkling	Overflow of the buffer subscription device and loss package	
Frozen video frame		
Collapses in video scene		VQM, PSNR, MDI, MPQM
Absence video	These distortion is caused miscellaneous level losses	
Loss of the sound in video	Delays, jitter	MDI

Media Delivery Index. Greater popularity has got the parameter of delivery to information Media Delivery Index (MDI), described in IETF RFC 4445. The Parameter MDI is used for checking the network, intended for delivery of stream

information, video in format MPEG, VoIP and the other information sensitive to delay and loss package. MDI defines the critical size of the buffer receiver, given jitter and loss package. Time of the measurements can vary from it is enough big gap to catch the anomalous situation on network, before infinitely big for constant checking.

The Parameter MDI consists of two components: factor of the delay (Delay Factor DF), measured in ms, and parameter of the losses package (Media Loss Rate MLR), and measured in package for second. The Factor of the delay presents itself maximum observed when acceptance of each package of the transport flow difference between real times of its arrival and expected. He defines time; on which dataflow must fit in buffer of the receiver for achievement constant send rate and preventions of the losses data. Thereby, he takes into account jitter and allows getting importance of the size of the buffer that helps to avoid the losses a package because of havoc buffer, in the event of big importance of the delay and insufficient size of the buffer for instance. Importance DF can be within the range of from 0 before 50 ms (according to MSE G.1050, in which is described well controlled network for issue of the sound and video). The Parameter of the loss package quantifies lost or wrong taken package given for under investigation length of time. Obviously that primary task for MLR is an achievement of the zero since loss several MPEG-2 TS-packages brings about visible deterioration quality scenes. However in practice all networks have certain level of the losses IP-package. So at loss less 0,5 % package are considered that network provides the goodness video for final user. Visible user of the problem appears under 5 % losses, for instance, disintegration of the scene on squares, blurriness and etc.

The length of each package of the transport flow MPEG-2 forms 188 bytes. As a rule if for issue is used technology Ethernet, for which size of the field given cannot exceed 1 500 bytes then in one package IP are sent seven packages of the transport flow MPEG-2. The Loss one such frame Ethernet means the loss to seeds package given MPEG-2. One of the main dignity of the parameter MDI possible to name the localization of the problems, appearing on network, since MDI allows to

take measurements in miscellaneous point to network that enables to get the data, pointing to presence of the problem in network before that, as she will bring about deterioration quality video. One more advantage MDI is that there is no need to in detailed analysis or decoding the transport flow MPEG-2 so for measurement is not required powerful processor for data processing real-time.

For measurement of the parameter MDI is used information of the transport headline, herewith MDI does not depend on type video codec that allows producing the measurements on big amount channel simultaneously and for scrambled video flow. Since parameter MDI is founded on network feature, he can be used for installing threshold importance in network, which achievement signalizes about approach the problem, influencing upon quality video. Also he can be used for checking the network equipment, for instance, router, on which often occur the delays and loss package.

In spite of row value, the parameter MDI does not give clear understanding that for picture sees the user on screen of its television set. In itself parameter linear displays the features to network while video data depending on algorithm of the compression differ the nonlinearity, and, as result, importance network parameter satisfactory in one event, can turn out to be to be critical for quality video in the other. For instance, at loss one I-frame MPEG-2 occurs the loss of the whole group R- and B-frame, predicted on base this I-frame. While, at loss even groups R- and B-frames, they can be restored on base I-frame.

Video Quality Measurement. The Method Video Quality Measurement (VQM) is described in Recommendations MSE-R BT.1683. He is founded on that that in most cases at estimation quality scenes watcher more attentive to small detail while its main attention concentrates on large object. For reception video, suitable to transmission on network, it is subjected to coding and compression. Basically used today methods of the compression to information are a methods with inconvertible loss, which appear in the course of reductions spatial, time and spectral redundancy. Consequently, possible present radio-frequency temporary and spatial information with smaller accuracy, but loss quality in such event

possible to neglect since human eye not very sensitive to distortion on like level. The Method VQM values the visible result of the deterioration video, including blurriness, flutter, blockings, noise, garbling the color. Hereinafter all these parameters combine in one metrics.

The results of the testing show that VQM has a high correlation with subjective methods of the estimation quality video and pretends on that to become the standard in the field of objective estimation quality. Since in him for calculation quality transmissions occurs the comparison source and got in endpoint video then for its realization is required large powered equipment that does this method not suitable to estimation quality video in real scale of time, when necessary to analyses simultaneously big amount flow.

Moving Picture Quality Metric. The method Moving Picture Quality Metric (MPQM), or in practical realization V-factor, realizes checking in real mode of time. First MPQM analyses the source sequence, which is in initial point of the measurements, and distorted version to these sequences, take in under investigation channel. Hereinafter measurements, founded on distortion in channel, are counted, taken into account sensitivity to contrast, and masquerade. Finally, information on measurements with all under investigation channel, which comprises of itself estimation 34 parameters, unites for count of the rating quality issues video, which varies from unit before poles (from bad before best).

In spite of the fact that given method allows it is enough packed and exactly value the quality of the scene by visible user, he is an cost based with standpoint of the use resource and does not suit for using in real scale of time.

Noise Quality Measure. The Metrics Noise Quality Measure (NQM) counts the influence an additive noise on source signal. Perceived by human eye effects from frequency distortion and influences of the noise are independent, at experiment separate these two sources of the deterioration video and measure insofar produced by them effect see.

NQM takes into consideration following: scatter of the contrast in dependencies from distance element, the permits of the scene and spatial

frequency; the scatter of importance of brightness nearby element; the dependency of the contrast from spatial frequencies; the effects, masking contrast. Such an approach allows to research the fundamental correlation between distortion and noise to perfect the algorithms of the reconstruction of video sequence, but does not give the full vision to situations, since does not take into account the majority of the network features and specific particularities video apposition.

Peak Signal to Noise Ratio. The Method Peak Signal to Noise Ratio (PSNR) is a most traditional method of the system quality measurement of the processing and issues digital video is measured in dB. PSNR measures the peak attitude of the signal to noise between source signal and signal on leaving the system. PSNR does not allow measuring all specific for video parameters since accuracy of the presentation of the scene constantly changes depending on visual difficulty of the scene, available send rate and even method to compression. Thereby, PSNR cannot define insofar observable this distortion will be for user. One of the main advantages PSNR possible to name the low computing difficulty. So, often exactly this method takes for central to making the different models of the estimation quality transmissions video and complements its necessary factor.

The peak attitude of the signal to noise more simply whole define through middle square mistake (MSE, Mean Square Error), which for two monochrome scenes R and Q size $i \times j$, one of which is considered loss by approach other, is calculated so:

$$MSE = \frac{\sum_i \sum_j (R_{i,j} - Q_{i,j})^2}{I * J} \quad (2.1)$$

PSNR is defined so:

$$PSNR = 10 * \log \left(\frac{A^2}{MSE} \right), \quad (2.2)$$

Where A - this maximum importance, taken by pixel of the scene. When pixels have capacity 8 bits, $A = 255$ [8 9].

2.3. Video codecs

A video codec is an electronic circuit or software that compresses or decompresses digital video, thus converting raw (uncompressed) digital video to a compressed format or vice-versa. In the context of video compression, "codec" is a concatenation of "encoder" and "decoder"; a device that can only compress is typically called an encoder, and one that can only decompress is known as a decoder.

The format of the compressed data usually conforms to a standard video compression specification. The compression is typically loss, meaning that the compressed video lacks some of the information present in the original video. A consequence of this is that decompressed video has lower quality than the original, uncompressed video because there is insufficient information to accurately reconstruct the original video.

There are complex relationships between the video quality, the amount of data used to represent the video (determined by the bit rate), the complexity of the encoding and decoding algorithms, sensitivity to data losses and errors, ease of editing, random access, and end-to-end delay (latency).

Historically, video was stored as an analog signal on magnetic tape. Around the time when the compact disc entered the market as a digital-format replacement for analog audio, it became feasible to also store and convey video in digital form. Because of Video codecs are used in DVD and video CD players and recorders, satellite and terrestrial video broadcast systems, personal computers, and a variety of other applications in which it is necessary to play, record, or transmit video. For example, they are used in operating theaters to record surgical operations, in IP-based security systems, and in remotely operated vehicles such as ROVs and UAVs. The large amount of storage and bandwidth needed to record and convey raw video, a method was needed to reduce the amount of data used to

represent the raw video. Since then, engineers and mathematicians have developed a number of solutions for achieving this goal.

Video codecs seek to represent a fundamentally analog data set in a digital format. Because of the design of analog video signals, which represent luma and color information separately, a common first step in image compression in codec design is to represent and store the image in a YCbCr color space. The conversion to YCbCr provides two benefits: first, it improves compressibility by providing decorrelation of the color signals; and second, it separates the luma signal, which is perceptually much more important, from the chroma signal, which is less perceptually important and which can be represented at lower resolution to achieve more efficient data compression. It is common to represent the ratios of information stored in these different channels in the following way Y: Cb: Cr. Refer to the following article for more information about Chroma subsampling.

Different codecs will use different chroma subsampling ratios as appropriate to their compression needs. Video compression schemes for Web and DVD make use of a 4:2:0 color sampling pattern, and the DV standard uses 4:1:1 sampling ratios. Professional video codecs designed to function at much higher bitrates and to record a greater amount of color information for post-production manipulation sample in 3:1:1 (uncommon), 4:2:2 and 4:4:4 ratios. Examples of these codecs include Panasonic's DVCPRO50 and DVCPROHD codecs (4:2:2), and then Sony's HDCAM-SR (4:4:4) or Panasonic's HDD5 (4:2:2). Apple's new Prores HQ 422 codec also samples in 4:2:2 color space. More codecs that sample in 4:4:4 patterns exist as well, but are less common, and tend to be used internally in post-production houses. It is also worth noting that video codecs can operate in RGB space as well. These codecs tend not to sample the red, green, and blue channels in different ratios, since there is less perceptual motivation for doing so—just the blue channel could be under sampled.

Some amount of spatial and temporal down sampling may also be used to reduce the raw data rate before the basic encoding process. The most popular such transform is the 8x8 discrete cosines transform (DCT). Codecs which make use of

a wavelet transform are also entering the market, especially in camera workflows which involve dealing with RAW image formatting in motion sequences. The output of the transform is first quantized, and then entropy encoding is applied to the quantized values. When a DCT has been used, the coefficients are typically scanned using a zigzag scan order, and the entropy coding typically combines a number of consecutive zero-valued quantized coefficients with the value of the next non-zero quantized coefficient into a single symbol, and also has special ways of indicating when all of the remaining quantized coefficient values are equal to zero. The entropy coding method typically uses variable-length coding tables. Some encoders can compress the video in a multiple step process called *n-pass* encoding (e.g. 2-pass), which performs a slower but potentially better quality compression.

The decoding process consists of performing, to the extent possible, an inversion of each stage of the encoding process. The one stage that cannot be exactly inverted is the quantization stage. There, a best-effort approximation of inversion is performed. This part of the process is often called "inverse quantization" or "dequantization", although quantization is an inherently non-invertible process.

This process involves representing the video image as a set of macro blocks. For more information about this critical facet of video codec design, see B-frames. Video codec designs are often standardized or will be in the future- i.e., specified precisely in a published document. However, only the decoding process needs to be standardized to enable interoperability. The encoding process is typically not specified at all in a standard, and implementers are free to design their encoder however they want, as long as the video can be decoded in the specified manner. For this reason, the quality of the video produced by decoding the results of different encoders that use the same video codec standard can vary dramatically from one encoder implementation to another [19].

A variety of video compression formats can be implemented on PCs and in consumer electronics equipment. It is therefore possible for multiple codecs to be

available in the same product, avoiding the need to choose a single dominant video compression format for compatibility reasons.

Video in most of the publicly documented or standardized video compression formats can be created with multiple encoders made by different people. Many video codecs use common, standard video compression formats, which makes them compatible. For example, video created with a standard MPEG-4 Part 2 codec such as Xvid can be decoded (played back) using any other standard MPEG-4 Part 2 codec such as FFmpeg MPEG-4 or DivX Pro Codec, because they all use the same video format.

Some widely used software codecs are listed below, grouped by which video compression format they implement.

H.265/MPEG-H HEVC codecs:

- X265: A GPL-licensed implementation of the H.265 video standard. X265 is only an encoder.

H.264/MPEG-4 AVC codecs:

- X264: A GPL-licensed implementation of the H.264 video standard. X264 is only an encoder.
- Nero Digital: Commercial MPEG-4 ASP and AVC codecs developed by Nero AG.
- QuickTime H.264: H.264 implementation released by Apple.
- DivX Pro Codec: An H.264 decoder and encoder were added in version 7.

H.263/MPEG-4 Part 2 codecs:

- DivX Pro Codec: A proprietary MPEG-4 ASP codec made by DivX, Inc.
- Xvid: Free/open-source implementation of MPEG-4 ASP, originally based on the Open DivX project.
- FFmpeg MPEG-4: Included in the open-source libavcodec codec library, which is used by default for decoding or encoding in many open-source video players, frameworks, editors and encoding tools such as MP

layer, VLC, show or Streamer. Compatible with other standard MPEG-4 codecs like Xvid or DivX Pro Codec.

- 3ivx: A commercial MPEG-4 codec created by 3ivx Technologies.

H.262/MPEG-2 codecs:

- X262: A GPL-licensed implementation of the H.262 video standard. X262 is only an encoder.

Microsoft codecs:

- WMV (Windows Media Video): Microsoft's family of proprietary video codec designs including WMV 7, WMV 8, and WMV 9. The latest generation of WMV is standardized by SMPTE as the VC-1 standard.
- MS MPEG-4v3: A proprietary and not MPEG-4 compliant video codec created by Microsoft. Released as a part of Windows Media Tools 4. A hacked version of Microsoft's MPEG-4v3 codec became known as DivX ;

Google (On2) codecs:

- VP6, VP6-E, VP6-S, VP7, VP8 VP9: Proprietary high definition video compression formats and codecs developed by On2 Technologies used in platforms such as Adobe Flash Player 8 and above, Adobe Flash Lite, Java FX and other mobile and desktop video platforms. Supports resolution up to 720p and 1080p. VP8 has been made open source by Google under the name libvpx or VP8 codec library.
- libtheora: A reference implementation of the Theory video compression format developed by the Xiph.org Foundation, based upon On2 Technologies' VP3 codec, and christened by On2 as the successor in VP3's lineage. Theory is targeted at competing with MPEG-4 video and similar lower-bitrate video compression schemes [19].

SUMMARY

1. On base of the analysis of the methods of the subjective estimation quality issues video in IP-set is reveal row defect, which do not allow to use the considered methods as main at estimation quality video real-time and preventions of the malfunctions in broadcasting and translation.
2. On base of the analysis of the objective methods quality estimations IPTV are reveal specific particularities of their using and realization, not allowing their efficient ubiquitous use. The Organized comparison value and defect subjective and objective methods of the estimation quality video.
3. On base of the analysis subjective and objective methods of the estimation quality video data communication in set are reveal particularities of their operation for realization in the following chapter of the objective model of the estimation quality issues video in IP-set.
4. As a result of analysis existing methods of the estimation quality issues video is shown need of the study of the influence specific characteristic video traffic on subjective and objective estimations with the following possibility of the cut-in parameter, taking into account these characteristic, in modern models of the estimation quality perceptions of the services IPTV.

3. DEVELOPMENT AND ANALYSIS TO MODELS OF THE OBJECTIVE ESTIMATION QUALITY ISSUES VIDEO IN IP-SET

3.1. The base model

The big interest causes the methods of the objective estimation, which are founded on collection and analysis of the network features. Will below is considered model of the objective estimation quality IPTV, in which estimation quality sent video is valued not only on base of the network features, but are also taken into account and specific particularities video traffic.

Applicable for present-day day methods estimations quality issues video, founded on analysis of the features to network, are practically same facility that are used for checking quality issues to vocal information, etc. They measure the parameters to transport network. Unlike subjective methods objective methods do not give the beliefs about that that indeed sees the user on screen of its television set, etc. they, on essences, do not do the differences between package, carrying video and package, carrying other information. To measure in quantitative attitude quality facilities IPTV, necessary to enter the certain metrics. On today is not designed Recommendation, specifying introduction of some metrics so exists the row of the methods, which have an essential differences between itself and are based on miscellaneous approach: MDI, VQM, MPQM, NQM and etc. Given methods possible to refer to the general method of the estimation to capacity to work to network, to the full not taking into account particularities of application. For more detailed estimation quality necessary development of the models, which at calculation of the factors are orientated on parameters of the network not only, but also on features video flow. The Row approach is founded on model loss distortion, etc. model, which display the influence of the losses package on quality video (in the form of the distortion).

At development of the models for estimation quality video necessary to take into account two main requirements: 1) fitness to models, which values the

different network parameters and parameters of exhibits and with high degree of accuracy project them on estimations quality issues video; and 2) ability easy to define quantitative these parameters so allow to use the estimation a quality issues video in real scale of time for potentially big amount video flow.

Observance of both requirements is it is enough difficult problems. On the one hand if produce the proper pricings a quality issues video, this requires detailed consideration of the condition to network and detailed information on exhibit. On the other hand, measurement all these parameter real-time in behooving volume much in a complicated way. As result, any decision in practice must be half-way between accuracy and velocity calculation or its difficulty.

To value the quality video, necessary to research the attitude between loss package and distortion in decoded video. We shall consider video sequence with personnel (frames) by size $N_1 \times N_2$ pixels, $f[k]$ marks 2-D vector (the size $N_1 \times N_2$) received through small unrolling the frame k , and $\bar{f}[k]$ marks the respective frame, recalled on decoder. Then signal of the mistake in frame k , which presents the deterioration of the signal, appeared by reason of loss package, and is defined:

$$e[k] = \bar{f}[k] - f[k] \quad (3.1)$$

The Square of the mistake in frame k is defined as:

$$\sigma^2[k] = (e^T[k] \times e[k]) / (N_1 \times N_2) \quad (3.2)$$

Importance $\sigma^2[k]$ subject to influence some network and hung from exhibit factor.

The massive problem at modeling of the distortion is a determination limit, in which mistake multiplies amongst personnel (frames). Since, the temporary prediction enters the dependencies between nearby personnel(frames), single loss of the package touches not only frame with data, which were carried in lost package, but as well as the other personnel(frames) with code dependency from lost frame. If mistake occurs in frame k , that importance of the duplicated mistake in frame $[k+i]$ can be expressed:

$$\sigma^2[k + i] = \sigma^2[k] \times \gamma^2 \quad (3.3)$$

The Factor of the fading γ ($\gamma < 1$) takes into account the influence to spatial filtering and is hung from spectrum of the signal of the mistake and type to spatial

filtering applicable in decoder, etc. is changed as function of the features video and process of the decoding.

If $(T - 1)$ of the personnel(frames) is encoded with unidirectional prediction (R- personnel(frames)) between two sequences of the personnel(frames) with internal coding (I-personnel(frames)), general distortion, appearing by reason of losses in frame k , is

$$D = \sum_{i=0}^{x-1} \sigma^2 [k + i] \quad (3.4)$$

Where x - this number of the personnel (frames), from frame, in which has occurred the primary mistake (the frame k) before the following I-frame.

Expecting that expected source distortion, appeared because of loss of the block, is σ_s^2 and that inwardly groups of the personnel (frames), encoded with prediction, location x frame with lost by block evenly portioned on interval $[0, T-1]$, the general average distortion, appeared by reason of loss of one block, will form:

$$D_1 = \sum_{i=0}^{T-1} \sigma_s^2 \cdot \gamma^2 \cdot \left(1 - \frac{i}{T}\right) = \frac{\gamma^{T+1} - (T+1) \cdot \gamma + T}{T \cdot (1-\gamma)^2} \cdot \sigma_s^2 = \alpha \cdot \sigma_s^2, \quad (3.6)$$

where- α function from γ and T , which takes into account the general influence of the duplication signal mistakes.

Since in IP-set of the loss video data occur because of loss package, rather than block, the following step brings about image of the loss IP-package on loss block video frame. When gets lost n ($n \geq 1$) consequent package for one event, $f(n)$ block will is touched, where $f(n)$ a reflection of the number is lost package on number lost block. This attitude depends on realization codec and technology of the recovering the losses. For instance, if each package contains exactly one block and decoder simply misses decoding a block, being kept in lost package, then $f(n) = n$; however if decoder rejects frame any time one of IP-package lost, attitude $f(n)$ takes other form. However, for any codec function $f(n)$ can be determined, and general distortion, appearing under n consecutively lost package, can be simulate pro rata distortion, appearing at loss block, etc [5].

$$D_n = f(n) \cdot D_1, \quad (3.7)$$

Hereinafter in process of modeling we shall express average distortion as function to models of the losses, considering size of the pack mistake and place, touched by mistake. We use P_n for determination of probability of the loss n consequent package and P_m for determination of probability that that two consequent events of the loss have touched m package separately (with begin package, hit in the first event of the loss before package, hit in the second event). We shall expect that each frame is sent L package and that n and m are an independent random quantities. Then the general average distortion restored video can be considered as:

$$\bar{D} = \frac{\sum_n P_n \cdot D_n}{\sum_m P_m \cdot (m/L)} = \frac{\overline{f(n)}}{\bar{m}} \cdot L \cdot D_1 \quad (3.8)$$

Or sometimes equal

$$\bar{D} = P_e \cdot \overline{f(n)} \cdot L \cdot D_1 \quad (3.9)$$

where P_e - this probability of the loss of any length in video flow;

$f(n)$ - The average number block, on which have affected the loss.

P_e and $f(n)$ express the features of the process of the losses ($f(n)$ also depends on packetization and technology schemes of the reconstruction after losses, used in decoder) while L and D_1 are a parameter, taking into account particularities video apposition [3].

3.2. Modeling of the influence different codecs

In spite of the fact that majority standard compressions video support division a video frame on blocks, codec realize the different schemes of the reconstruction frame in the event of loss block. For illustration and comparisons result shall consider the codec marketed in accordance with standard MPEG-2 and H.264, which have a reaction miscellaneous on happened mistake. In codec MPEG-2 at loss IP-package occurs following: if decoder finds that some number IP-package, carrying information one frame, lost, that he rejects whole damaged frame and changes his (its) previous decoded by frame. In codec H.264 marketed

other technology of the disguise mistake: all got blocks decode while blocks, exportable, lost IP-package, are restored, using blocks of the previous frame and information to compensations of the motion other block this frame [4].

In codec MPEG-2 losses touches not only blocks, residing in lost IP-package, but also the other blocks of this frame while in codec H.264 are touched only that blocks, which fell into lost packages. We shall Notice that foregoing description MPEG-2 and H.264 presents the concrete realization codec. In purpose of the simplification of the analysis, shall expect that each video package contains s block, and that each video frame is sent L package.

Also we suppose that in each frame initial moment events of the loss unevenly portioned between the first and last package. After these admissions becomes possible to define $f(n)$ for both codec.

For codec MPEG-2: possible $r = n \bmod L$, then $f(n)$

$$f(n) = s \cdot L \left[\frac{1}{L} \cdot \frac{n}{L} + (1 - \frac{1}{L})(\frac{n}{L} + 1) \right] \quad (3.10)$$

If $r=0$, then

$$f(n) = s \cdot L \left[\frac{L-r+1}{L} \cdot \binom{n}{L} + ((r-1)/L)(\binom{n}{L} + 1) \right], \quad (3.11)$$

If $r \geq 1$, that in both events simplifies function from n , making its linear

$$f(n) = s(n + L - 1) \quad (3.12)$$

For codec H.264 image of the losses on blocks idle time:

$$f(n) = sn. \quad (3.13)$$

Then the general distortion, influencing upon video sequence under n consecutively lost package, can be presented as:

$$\bar{D} = s \cdot (\bar{n} + L - 1) \cdot P_e \cdot L \cdot D_1 \quad : \text{ for codec MPEG-2} \quad (3.14)$$

$$\bar{D} = s \cdot \bar{n} \cdot P_e \cdot L \cdot D_1 \quad : \text{ for codec H.264} \quad (3.15)$$

Thus, showed above model allows to take into account following: 1) model losses package that is expressed through n and P_e ; 2) bit send rate, expressed through number IP-package, sending frame, and number block in video frame (is

defined s and L); 3) scheme packetization, expressed through L number IP-package, sending frame; 4) mechanisms reconstruction from losses, defined by $f(n)$ for codec MPEG-2 and H.264; and 5) sensitivity video sequence to mistake that comprises parameter D_I of itself.

Since distortion \bar{D} is determined, resulting quality video able to be expressed by means of peak relations signal/noise (Peak Signal to Noise Ratio - PSNR), etc.

$$PSNR = 10 \log_{10} \frac{255^2}{\bar{D}} \quad (3.16)$$

However PSNR does not give the clear belief about that, what will value the spectator a quality transmissions video, etc. correlation signal/noise shows that quality acceptable, but indeed occurs the systematic loss I-personnel(frames) video sequence and user observes the inferior picture with dying out and artifact. In consequence of particularities of the shaping video stream objective and subjective methods can give the estimation miscellaneous a quality transmissions video. The group expert Video Quality Expert Group (VQEG) in cooperation with different University USA, Europe, Asia and exploratory laboratory conducts the row an experiment targeted on image result objective methods on subjective estimations .

We use the result VQEG and shall express through PSNR quality of the transmission video (QTV), as shown in figure 3.1.

The attitude between these two parameters has a following type:

$$QVT = \frac{1}{1 + \exp(b_1(PSNR - b_2))} \quad (3.17)$$

- where b_1 and b_2 parameters, which take into account the features video.

The equality (3.17) expects that PSNR can value the subjective quality video.

For instance, when its importance less, than corresponding to point of the bend on figure 3.1, PSNR has a more linear dependency with quality of the issue video. When importance PSNR exceeds point of the bend, subjective quality video essentially is sated before limit so the further increase PSNR does not bring about improvement quality video, which will noticeably be for human eye [9].

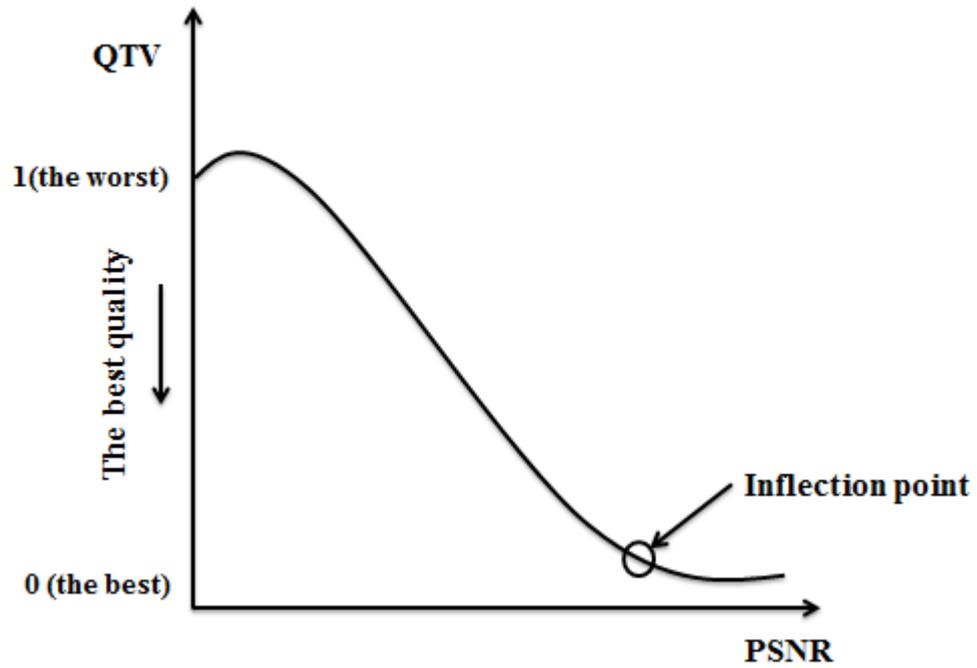


Figure 3.1 Attitude between PSNR and quality of the issue video, offered VQEG.

It is offered change the graph, offered VQEG. For this shall enter the factor $C = 1 + \exp(b_1(PSNR - b_2))$ which takes into account the features video and displays distortion video sequence, then formula (3.17) will have a following type:

$$QVT = 1 - \frac{1}{C} \tag{3.18}$$

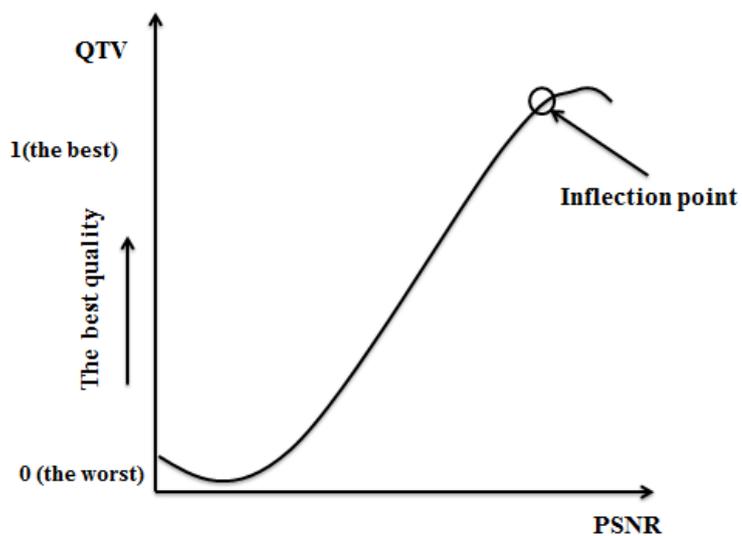


Figure 3.2. Attitude between PSNR and quality of the issue video.

The graph submitted for figure 3.2, shows inter coupling between objective and subjective estimation quality issues video. At achievement of importance objective estimation points of the bend hereinafter perfect the quality of the transmission inadvisable since particularities of the human vision such that user already will not notice the differences [6].

3.3. Estimation designed to models

The purpose of the estimation offered models is proving accuracy and fitness to models for estimation QTV under different level of the losses and miscellaneous codecs.

For this is conducted simulation modeling and experiment, in the course of which are compared importance QTV, got when use the models, with estimation subjective and objective methods of the estimation quality issues video. The Comparison with subjective methods of the estimation is produced for checking the abilities to models to take into account the specific features video apposition at estimation QTV. The Comparison with objective methods is called prove accuracy to models at calculation of the network factors.

The Estimation designed models was conducted several methods: in- first, by means of program product of the companies IXIA, which carries the name IxChariot, and is used for testing the packet networks. IxChariot gives the results of importance of rotational latency, jitter, reception capacity, as well as calculates importance MDI for video stream. This allows calculating importance PSNR for model depending on loss level miscellaneous and comparing it with importance MDI. Secondly, for estimation of accuracy to models was conducted experiment, taking into account influence of the specific features video apposition on quality of the issue video. In the course of experiment is made analysis and comparison of the methods of the estimation quality issues video MOS and PSNR. In- third, was conducted simulation modeling by means of specialized software for two codecs

MPEG-2 and H.264, for which changed the size of the frame and format to research sensitivity to models to this factor. They were researched two formats of the personnel (frames): QCIF and CIF, level of the losses, two types of the losses: independent, shall name their Bernoulli, and clustered. QCIF-frame consists of 144 x 176 pixels while CIF-frame has 288 x 352 pixels. Accordingly, each QCIF-frame contains 2 blocks while CIF-frame consists of eight blocks [7].

3.3.1 Estimation model by means of IxChariot

The purpose of the estimation to software models IxChariot is prove the ability to models to take into account the influence of the network factors and fitness of the use to models for estimation QTV. For achievement given purposes necessary to solve the following problems: conduct the experiment, in the course of which sent video sequence is subjected to the worsening influence; value the network factors at issue video sequence depending on loss level miscellaneous by means of models and method of the objective estimation MDI; analyze the got results of the estimation QTV when use two methods [20].

Experimental installation is shown on figure 3.3. It consists of the source video, sending packetization video on receiver through network, consisting of three commentators, where packages are subjected to the influence, imitating passing on real way with corresponding to feature.

Distribution program IxChariot was used for modeling of the real conditions. IxChariot this the most powerful instrument on the base of the software for estimation of the networks, used for measurement of the key functional features such as reception capacity, time of the delay, loss package, jitter, MOS for VoIP and MDI for video in real condition, and is used daily by leading companies and test laboratory for qualification and certification the most latest network device. The operating line Measurements are conducted by way of the issue real dataflow between devices, connected to network. IxChariot emulates the different types of portioned exhibits, collects and analyses the got results. The Final points IxChariot

generate the traffic, using same methods, as any network exhibit, allowing measure each element in tract data communication. Statistical information only on network level it is not enough to predict the operating line applied level in corporative set and broadband transport set. IxChariot possible to use for achievement of maximum capacity to network and device.

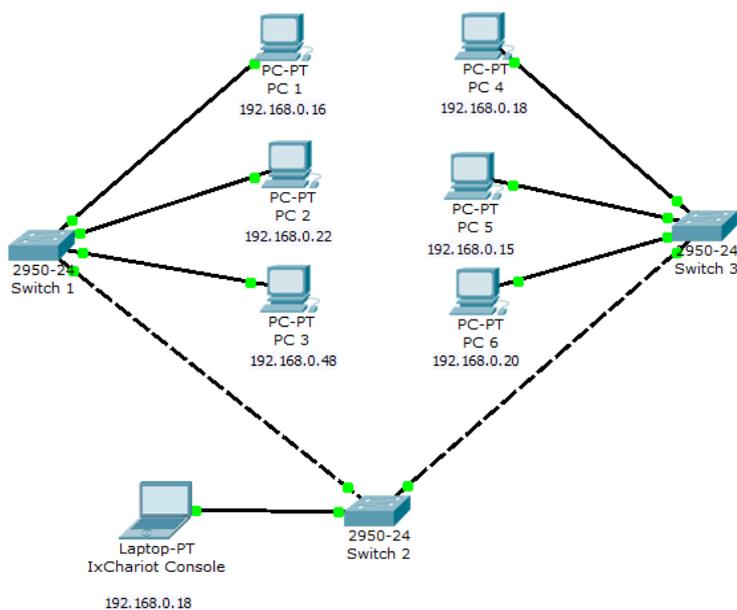


Figure 3.3. Experimental installation.

As consoles IxChariot was used personal computer (PC), to which is installed corresponding to software. The Console does not participate in shaping, issue and receiving the traffic, she only controls the process and removes got with final point results. The final points functional software elements in composition of the distribution program IxChariot, which execute the problems, delivered by console. The final points are fixed on PC. Thereby, is got configure computer network, consisting of poles PC, three commentator's and one consoles. To each 3 PC are connected of two extreme commutators, but central commutator connects the extreme commutators and in he is included console. The Network addresses (IP-address) are nominated dynamically (with use DHCP-server). Alongside with imitated by traffic must visual be valued and real. As source real video in IP-network was used media player VLC player, allowing lose video in mode multicast

and send it in network, as well as take on the other computer and lose. For this test were used 3 video sequences, encoded in format QCIF and CIF and two codecs MPEG-2 and H.264. As exercised example was will take video fragment duration 1 minute and 10 seconds with format of the frame 352 x 288 pixels encoded the codecs MPEG-2 and H.264/AVC. On begin undertaking the experiment reception capacity to network in laboratory formed 95 Mbit/s. By means of exhibits VLC player this fragment was transformed in transport flow MPEG-TS (Transport Stream) and is sent on network at the speed of flow 3,75 Mbit/s. Parallel on consoles IxChariot was an uncared-for imitation of the different types of the traffic with exponential distribution, comprising of itself data communication on File Transfer Protocol (FTP), speech Voice over IP (VoIP) and video real time. The number artificial flow reached 200 units [20].

Aside from imitation flow in network was uncared-for several multicast flow by means of VLC player. Also in some test of the loss in network were created artificially for count of the change the size of the buffer on close-by to receiving PC commutator. IxChariot allows valuing the quality of the issue video by means of methods MDI and PSNR. Importance PSNR was used for reception of the estimation quality video as forming models loss distortion. The results of the estimation quality by method MDI are submitted for figures 3.4 - 3.7.

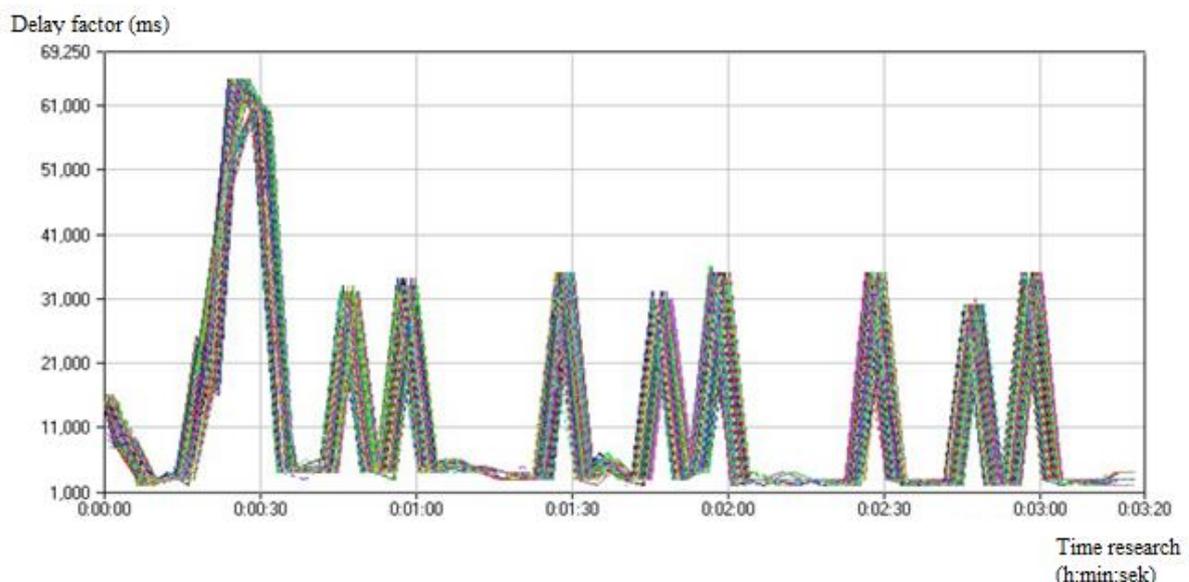


Figure 3.4 Factor of the delay for codec H.264/AVC.

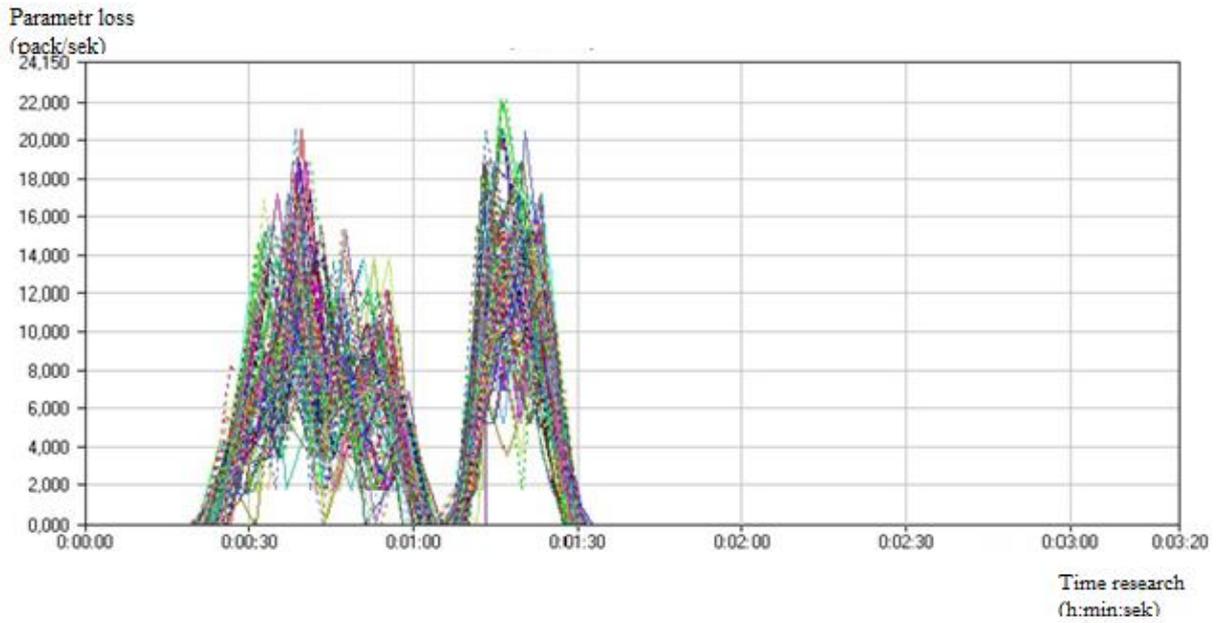


Figure 3.5 Level of the losses for codec H.264/AVC.

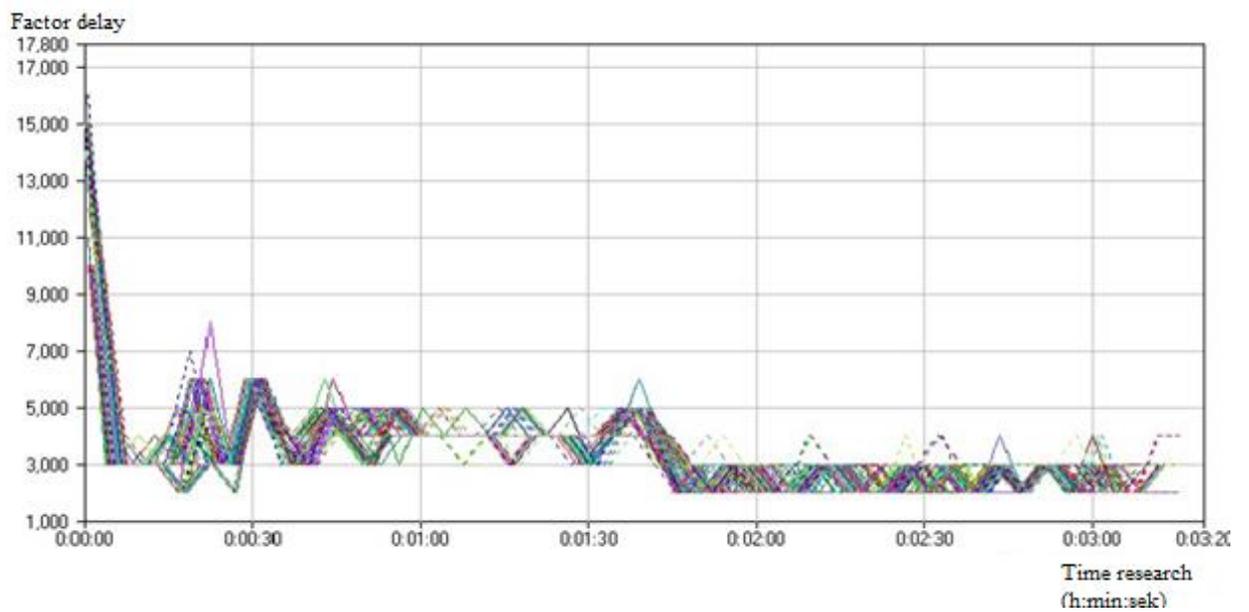


Figure 3.6 Factor of the delay for codec MPEG-2.

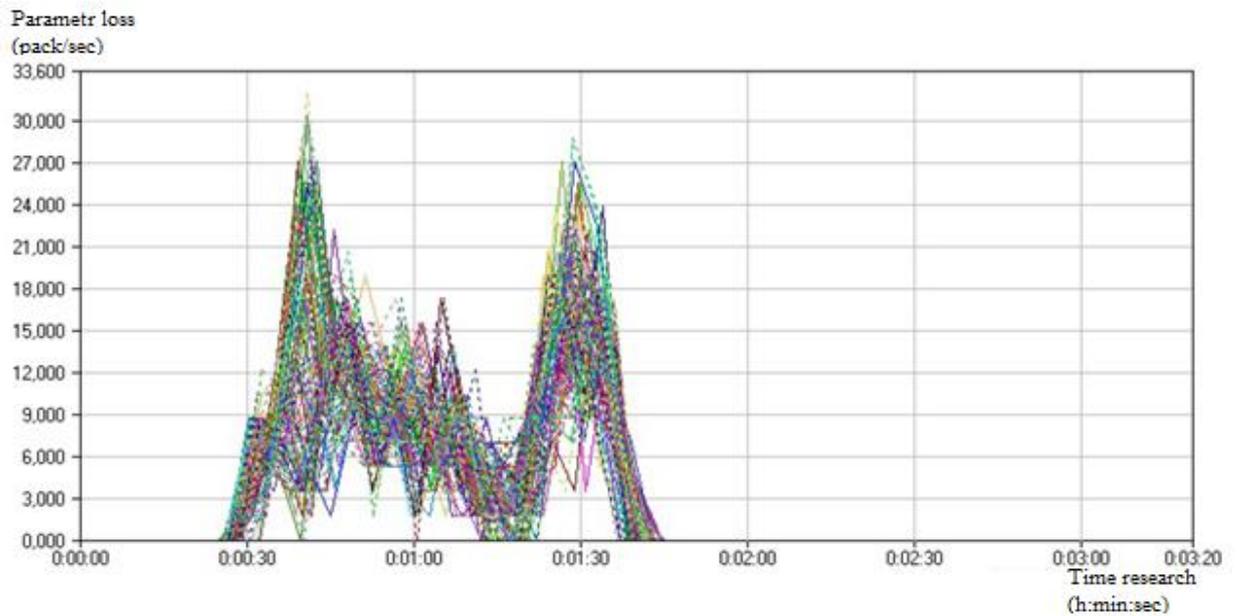


Figure 3.7 Level of the losses for codec MPEG-2

Engineering instrument Mathcad was used for calculation PSNR. The functions of the extraction of the matrix of the pixels enter in composition of the program from scene. For this save the certain frame source video apposition and load in Mathcad. At passing of the fragment on network on acceptance we save same frame and load in Mathcad. We enter the sizes of the frame and limits of the extraction of importance from matrix of the scene for calculation average quadrant errors: $I = 360$, $J = 480$, $i = 359$, $j = 479$. MSE and PSNR accordingly are: $MSE = 874,002$; $PSNR = 18,716$ dB.

Below happens to the example of the calculation of the transmission for codec MPEG-2. We shall Calculate general distortion, influencing upon video sequence through n consequent losses, formula use for calculation (3.15) (3.17). For calculation take following importance parameter:

- $s = 2$ amount block in package;
- $L = 2$ amount package in frame;
- $n = 3$ amount consecutively lost package for one event;
- $D_1 = 150$ general average distortion, appeared by reason of loss of one part.

Then, under $R_e = 0,04$ probability of the event of the loss (any lengths) in video sequences, $D = 96$; $PSNR = 28,38$ dB; $QTV = 0,75$.

Under $R_e = 0,4$ probability of the event of the loss (any lengths) in video sequences, $D = 960$; PSNR = 18,35 dB; QTV = 0,38.

The results of the works are presented in table 3.1 and table 3.2

Table 3.1

The result of calculating for CIF format

Format	P_e	\bar{D}	PSNR, dB	QTV	MDI:MLR Pack/sek
CIF (s=2 , L=4)	0.008	6.4	40.06	0.946	0.8
	0.01	16	36.08	0.906	2
	0.02	52	30.97	0.817	3
	0.03	120	27.33	0.722	9
	0.04	256	24.04	0.613	13
	0.06	672	19.85	0.458	17
	0.08	1184	17.39	0.369	21
	0.1	2040	15.03	0.291	24
	0.2	5120	11.03	0.184	27
	0.3	9600	8.3	0.13	29

Table 3.2

The result of calculating for CIF format

Format	P_e	\bar{D}	PSNR, dB	QTV	MDI:MLR Pack/sek
CIF (s=2 , L=1)	0.008	0.64	50.06	0.988	0.6
	0.01	1.6	46.08	0.978	2
	0.02	5.2	40.9	0.953	5
	0.03	12	37.33	0.921	8
	0.04	25.6	34.04	0.877	12
	0.06	67.2	29.85	0.791	18
	0.08	118.4	27.39	0.724	21

	0.1	204	25.03	0.647	23
	0.2	512	21.03	0.502	25
	0.3	960	18.3	0.401	26

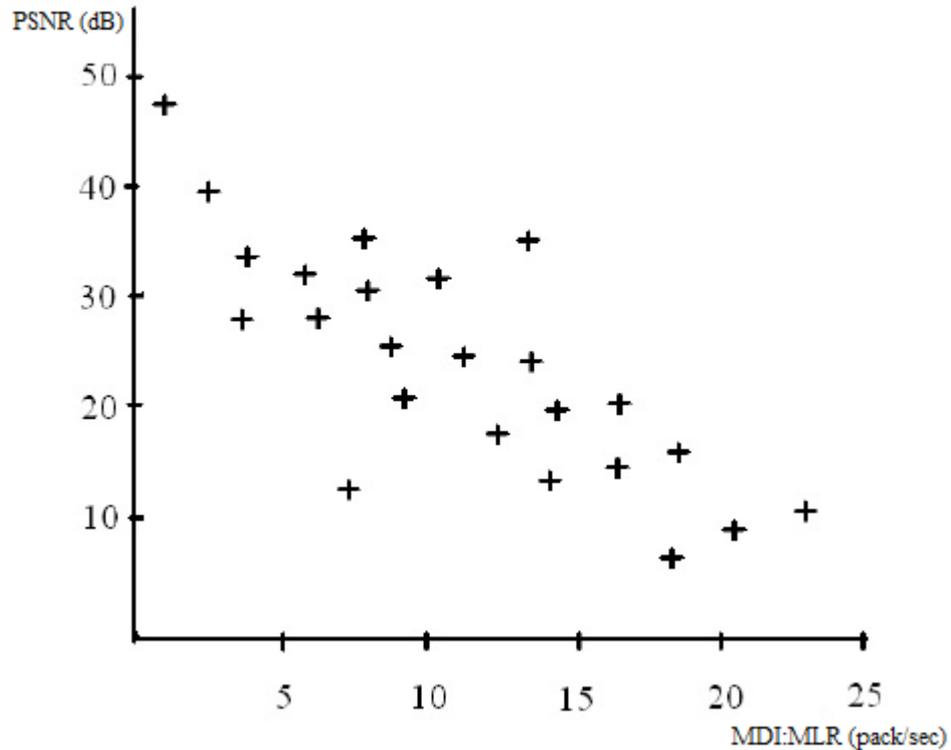


Figure 3.8. Relative dependency PSNR from MDI: MLR

The graph on figure 3.8 shows that model at estimation quality issues video completely reflects the situation, occurring on network. When increase the losses of importance PSNR grow worse in network and MDI. The model founded on method PSNR, takes into account the different level of the losses and can be used for estimation quality issues video [12].

On graph, submitted for figure 3.9, is shown inter coupling between objective and subjective estimation quality issues video, sent on network in format QCIF. Each package contains 2 blocks, 1 package will send 1 video frame.

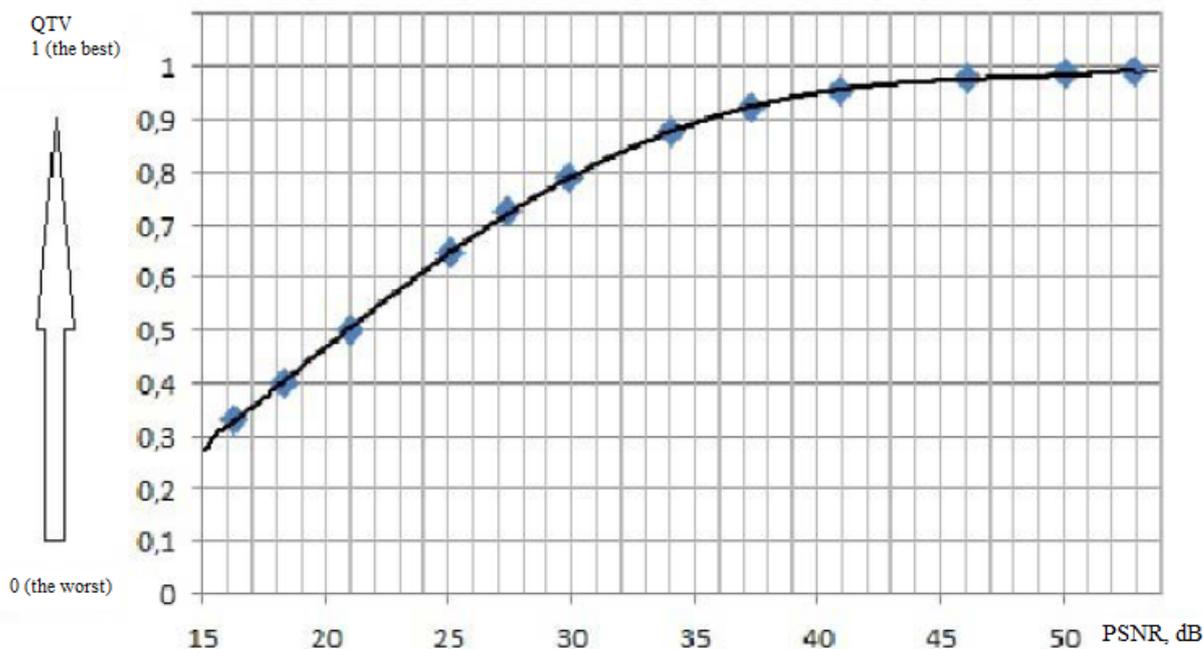


Figure 3.9. Attitude between PSNR and QTV for format QCIF.

On figure 3.9 is seen that at achievement of importance objective estimation certain values, hereinafter perfect the quality of the issue inadvisable since this already is not reflected on subjective estimation quality video, etc. person already does not see these improvements.

3.3.2 Experimental estimation

The purpose given experiment to prove the ability to models to take into account the influence of the specific features video. For this necessary to compare the estimations a quality issues video, got by model with subjective method of the estimation. As subjective method was chose method Double-Stimulus Continuous Quality-Scale (DSCQS) method with two sources of the influence and unceasing scale quality and with use the scale of the distortion described in recommendations ITU-R BT.500-13.

The method DSCQS can be applying for estimation of the new system, or influences tract issues on quality. The method DSCQS is used in that events, when is limited possibility of the sources of the influence and in a complicated way

provide the condition of the test, covering full range qualitative estimation. The method is round-robin, under which expert ask to consider the pair of the scenes, got from one and same source, but one of the herewith were subjected to the process of the processing (for instance, worsening influence), but the second is received directly from the source.

The watcher offer simply to value the general quality of each presented scene, having entered mark on vertical scale. Such vertical scales have something published for two-set presentation of each testable scene two by two. These scales present itself system of the unceasing estimation in order to avoid mistake of the slicing, but they are divided into 5 lengths of the equal length, corresponding to usual five score to scale quality ITU-T.

For increasing of accuracy of the studies is recommended expert first to test on ability color perception, quip of the vision and etc. For this use the tables Ishihara (for checking color perception), Landolita and Snellena (for determination of the quip of the vision).

Testing was conducted in laboratory condition, as expert emerged the students. An organized test was before undertaking experiment on checking the vision to exclude uprated/understated estimations on more early stage. In testing were researched three video sequences: 1) Go Pro contains the cutting of the video recordings with extreme sports; 2) Hip Hop demonstration dance; 3) scene to vital activity become mangy. All video sequence were presented in three formats: 1) CIF (Common Intermediate Format, general intermediate standard) permit 176x144; 3) format 4:2:0 with permit 720x576 that corresponds to the profile "Main" standard Moving Picture Experts Group (MPEG-2) [88]. At count of the average estimation in given method average difference between format 4:2:0 and CIF 0,3 point; between 4:2:0 and QCIF 2 point and between CIF and QCIF 0,9 point. The Results of the testing by method DSCQS are presented in table 3.2.

In the course of undertaking the experimental estimation was used same installation, as in previous point, she is shown on figure 3.9.

Table 3.2 Comparative table estimation on method of the study DSCQS

	QCIF	CIF	4:2:0
Hip Hop	2.4	4.3	4.5
Go Pro	2.6	4.5	4.6
New studio	1.8	3	4

Experimental installation consists of the source video, sending packetization video on receiver through network, consisting of three commutators, where packages are subjected to the influence, imitating passing on real way with corresponding to feature. As well as in previous study, as source real video in IP-network was used VLC player, allowing lose video in mode multicast and send it in network, as well as take on the other computer and lose. Estimation quality issues video was conducted In the course of experiment by means of subjective method DSCQS and method offered in models and founded on calculation of importance PSNR with account of the specific features flow. The Methods calculation importance PSNR is described above. On figure 3.10 and 3.11 is presented freeze-frames valued video on the part of the source and grantee for the sequence Go Pro.



Figure 3.10 Valued video on source.



Figure 3.11 Valued video on receiver.

SUMMARY

1. It is offered and explored model loss distortion, taking into account influence different factor, hung from features of the network and specific particularities video apposition, on quality video.

2. Made modeling depending on loss level miscellaneous and numbers contract appearing mistake, type codec, schemes of the disguise mistake, period of the estimation, format frame.

3. In the course of modeling and the following analysis is installed that amount lost package renders the deep influence on quality of the issue video. The specific parameters video such as scheme of the disguise mistake, way packetization, size frame marketed in codec, differently on alike level of the losses.

4. Offered use the factor C , which takes into account the features video and displays distortion video sequence for correlation, showing inter coupling between objective and subjective estimation quality issues video.

5. It is organized comparative estimation to models loss distortion and subjective and objective methods of the estimation quality issues video. The

Results which have proved; proven fitness to models and possibility of its use at estimation quality sent video with sufficient for practical persons by degree to accuracy.

6. Offered use given models for determination of the relative metrics of the estimation quality video, which does not require the analysis and decoding sent video stream, knowledge of the features video, thereby, vastly decreases the difficulty of the estimation, and in ditto time is provided accuracy that allows to use it for estimation quality issues video real-time.

4. SAFETY OF VITAL ACTIVITY AND ECOLOGY

4.1. Rational organization of work place

The complexity of production processes and equipment changed the functions of the person in modern industry: increased responsibility of tasks; increased volume of information perceived by the working and the performance of the equipment. A person's work has become more difficult, increased load on the nervous system and increased physical load. In some cases, the man has become the least reliable link of the system «man-machine». There is a task of providing reliability and safety of persons at work. Solves this task ergonomics and engineering psychology.

Ergonomics (from the Greek ergon work and nomos - law) is the scientific discipline that studies the human in terms of its activities related to the use of machines. The goal of ergonomics - optimization of conditions of work in the system "man-machine". Ergonomics defines the requirements of the person to technology and to the conditions of its functioning. The ergonomics of the equipment is the most generalized index of properties and other characteristics of equipment.

The connection of the man with the environment and the parameters of the workplace. Working place, this is the area in which the committed work of the performer or group of performers. Jobs may be individual and collective, universal, specialized and special.

General requirements, which must be observed when designing jobs, the following:

- Adequate working space for the person;
- Optimum position of the body of the worker;
- Sufficient physical, visual and auditory communication between man and machine;
- Optimal allocation of working space in the room;

- The permissible level of action of factors of production conditions;
- The optimal placement of the information and the motor field;
- Availability of means of protection from hazards.

Design should provide the zone of optimum and easy reach of the motor field of the workplace and the optimal area of the information field of the workplace. Angle of view in relation to the horizontal should be 30-40 degrees. The choice of working arrangements should take into account the efforts expended by the man, the magnitude of the movements, the need for movement, the pace of operations. The choice of working postures should take into account the physiology of man and parameters of working places determined by the choice of the position of the body at work (standing, sitting, a variable). Jobs for work «sitting» are organized in an easy job and middle severity, and the severe - working posture - "standing".

In the design of equipment and organization of a job it is necessary to foresee the possibility of regulating the individual elements, in order to ensure the optimum position of the operator.

The design of the equipment must ensure that it meets the anthropometric and bio mechanical characteristics of the individual on the basis of accounting change dynamics of the amount of heat when you move, the range of motion in joints.

For the account in the design of equipment anthropometric data should:

- determine the contingent of people for whom is designed equipment;
- select a group of anthropometric characteristics;
- install the percentage of working, which must meet the equipment;
- determine the boundaries of the interval size (efforts), which should be implemented in the hardware.

When designing the use anthropometric dimensions of the body, and take into account the differences in the sizes of the body of men and women, nationality, age, professional. To determine the boundaries of the intervals, which take account of the percentage of the population, the system is used pertseteley.

Design of the equipment should provide the ability to use at least for 90% of consumers.

To work in a position "sitting" are used by various operating seats. Distinguish workers seat for long and short term use. General requirements for the seat of long use of the following: the seat should ensure position, minimizing the statistical work of muscles; create conditions the possibility of changes in working postures; not to obstruct the activities of the systems of the body; to ensure the free movement relative to the working surface, have adjustable parameters; have the floor upholstery. For short - term use is recommended hard chairs and a different type of stools.

In the conditions of growing mechanization and automation of production processes is of special significance means of display of the information about the object of management. Widespread use of the received information model, which is organized according to certain rules information about the status of the object of control.

The information models of the following requirements:

- The content of the information model should adequately display the object of management;
- information model should provide the best information balance;
- The shape and composition of the information of the model must be consistent with the labor process and possibilities of man for the reception of the information.

Practice makes it possible to outline the sequence of the development of an information model: definition of the objectives of the system, the sequence of their decisions and sources of information; drawing up a list of control objects and their characteristics; the distribution of objects on the degree of importance; the distribution of functions between automation and man; the choice of coding of objects and drawing up of the overall composition models; determination of executive actions of man.

In the process of constructing information model are determined by the location of the media in the workplace, are selected dimensions of marks and the layout of. Displaying means are placed in the field of view of an observer with the account of optimum corners and observation areas. Dimensions signs monitoring are determined taking into account maximum accuracy and speed of perception of the information, as well as the brightness of the character, magnitude contrast, the use of color. Optimum brightness are considered to be the value at which the maximum contrast sensitivity. The value of it will be greater, the smaller the size of the object of discrimination. Optimal area size contrast is 60-90%. In the work of the eyes is a place of a certain inertia, which requires taking into account the time of exposure of the optic signal and the time intervals for the sense of separate signals the following one after the other. In most cases, the exposure time of the signal should be no less than 50 MS. Each variety of indicators has its area of use: indicators backlit used for the display of high-quality information that requires an immediate response of the operator; gauges are used for the reading of the measured parameters; integral indicators for combining information immediately on several parameters.

The structure and dynamics of the controlled object are usually with the help of a chip. In some cases the scoreboard used to display information and perception of the team of operators.

In the design of the workplace should take into account the rules of the economy's movements: when using two hands of their motion should be simultaneous and balanced; movement should be smooth and rounded, rhythmic and customary for working. The design of the equipment shall take into account the rules relating to the speed and accuracy of workers' struggles. For example, the most rapid movement to itself; in the horizontal plane of the hand speed more than in the vertical; the accuracy of movements better in a sitting position, than standing, etc. Controls, used in the workplace must comply with the General requirements of ergonomics: and direction of the management bodies must comply with the movement associated with him indicator; the compliance of the location

of the management bodies of the sequence of work of the operator; ease of use; the creation of the bodies of the Board of mechanical resistance and etc. In addition, for each type of bodies of pressure corresponds to a specific area of use and the special requirements of the size, form, effort, etc.

The automated workplace of the operator-Communicator (the operator in the control room) in the General case is used:

- Means of mapping the information of individual use (imaging units, signaling devices, and so on);
- Means of control and input of information (remote the display, keyboard control, separate controls, and so on);
- Devices of communication and transmission of information (modems, telegraphic and telephone sets):
- The device documentation and storage of information (printing devices, magnetic recording and so on);
- Auxiliary equipment (means of office equipment, the storage media, and the device of local lighting).

At the automated working place should be provided with information and constructive compatibility used by technical means, of anthropometric and physiological characteristics of the person.

At optimization of the procedures of interaction between operators of telecommunications workers with technical means in the conditions of automation ergonomic factors act as the main determining the probability-time characteristics and the intensity of the work. These factors are sensitive to variations of individual properties of the operator.

Working the furniture should be comfortable for the execution of planned operations. The design of the working furniture: table, chairs is of great importance for the creation of healthy environments and highly productive work. Working the furniture is designed with consideration of anthropometric data of human, technical, aesthetic and economic factors.

In the complete set of the working furniture of great importance is the design of the production of a chair, as it depends on the attitude of the employee and, therefore, energy consumption and the degree of its strain. Operating the seat must have the required dimensions, the relevant anthropometric data of the person and be flexible. The most comfortable chairs and seats with adjustable back tilt and height of seat. Changing the height of the seat from the floor and back angle, you can find the most appropriate labour process and the individual characteristics of the employee.

As a rule, all the surface of the written and desktops should be at the level of the elbow in the position of a person. When choosing the height of the table should be considered a man sits during work or stands.

The inconvenient of the table height reduces the efficiency of work and causes rapid fatigue. The lack of sufficient space for the knees and feet cause constant irritation of the employee. Minimum operating table height should be not less than 725 mm. As practice shows, for the working medium height the height of the desktop is accepted 800 mm. For the employee of another growth you can change the height of the working chair or the position of the boards so that the distance from the object processing before the eyes of the working height is equal to approximately 450 mm.

Accommodation of the technical means and the chair of the operator in the working zone should provide easy access to the main functional nodes and units of equipment for conducting technical diagnostics, preventive inspection and repair; the ability to quickly occupy and to leave the work area; the exception of accidental actuation means of control and input of information; comfortable working posture and position of rest. In addition, the scheme of accommodation should meet the requirements of integrity, compactness and technical and aesthetic expressiveness of the working postures.

The display must be placed on a table or stand so that the distance of observation on the screen does not exceed 700 mm (optimal distance of 450 - 500 mm). Display screen height must be located so that the angle between the center of

the screen and horizontal line of sight was 200. Horizontal viewing angle of the screen should not exceed 600. The remote display to be placed on a desktop or stand so that the height of the keypad in relation to sex was 650 - 720 mm. When placing the remote control on a standard desktop height of 750 mm it is necessary to use the seat with height adjustable seat (450 - 380 mm) and the footrests. Document (form) for entry operator data it is recommended to have at a distance of 450 - 500 mm from the eyes of the operator, predominantly on the left, with the angle between display screen and the document in the horizontal plane shall be 30 40 degrees. The tilt angle of the keyboard should be equal to 15 degrees.

Display screen, documents and keypad display should be located so that the difference of brightness surfaces, depending on their location relative to the source of light, not more than 1:10 (the recommended value 1:3). At nominal values of brightness of the image on the screen 50 - 100 CD/m² illumination of the document should be 300 - 500 Lux.

Working place should be equipped in such a way that the movement of an employee would be the most efficient, least tedious.

The device documentation and other, rarely used by technical means, it is recommended to concentrate on the right from the operator in the zone of maximum reach and means of communication to the left, to free the right hand for the entries.

4.2. Emergencies

In theory SAFETY EMERGENCIES - is a set of events, the result of the onset of which is characterized by one or more of the following signs

- a) Danger to life and health of a significant number of people;
- b) The material violation of the ecological balance in the area of the emergency;
- c) the failure of the life support systems and control, full or partial cessation of economic activities;

- d) Significant material and economic damage;
- e) The need to involve large as the usually external to the area of emergency forces and means for the salvation of men and the elimination of consequences;
- e) Psychological discomfort for large groups of people.

It is characteristic that emergency arises outwardly suddenly, suddenly. Specification of definition of the emergency is achieved by introduction of quantitative measures of the dangers.

The classification of emergencies.

For reasons of emergencies are of natural, man-made, man-made, environmental, and social.

To the natural (natural) emergency situations are dangerous natural phenomena or processes that have extraordinary in nature and lead to a breach of everyday life more or less significant groups of the population, loss of life destruction of material values. These include earthquakes, floods, tsunamis, volcanic eruptions, mudflows, landslides, avalanches, hurricanes and Smer-Chi, massive forest and peat fires, snow and avalanches. The number of natural disasters is also droughts, long-term heavy rains, strong stable frosts, epidemics, epizootics, epidemics, mass distribution of pests of agriculture and forestry. Natural disasters can happen: as a result of rapid movement of the substance (earthquakes, landslides); in the release of within the earth's energy (volcanic activity earthquakes) at increasing the overall level of rivers lakes and seas (floods tsunamis) under the influence of unusually strong wind hurricanes cyclones. Some natural disasters fires avalanches landslides, etc. may arise as a result of the actions of the people themselves but their consequences are always the result of the action of the forces of nature. For each natural disaster characterized by the presence of intrinsic in the affecting factors, adversely affecting human health.

Natural disasters are a tragedy of the entire state and especially for those areas where they occur. As a result of natural disasters are affecting the economy of the country since the collapse of production of the enterprise the destruction of material values and most importantly there are losses among the people killed

their housing and property. In addition, natural disasters pose extremely adverse conditions of life for the population, which may be the cause of outbreaks of infectious diseases. The number of people affected by natural disasters can be considerable and the nature of the lesions is very diverse. Most people suffer from floods (40% of the total damage), hurricanes (20%), earthquakes and droughts (15%). About 10% of the total damage is on the other types of disasters.

A number of Soviet and foreign experts, citing data on the losses in major disasters assume that in the future in connection with the growth and concentration of population similar in the force of the disaster will be accompanied by an increase in the number of casualties in the tens of times.

Man-made emergency situations is considered a sudden failure of machines, mechanisms and units during their operation accompanied by serious violations of the production process the explosions the formation of fire radioactive chemical or biological infections of large territories a group of damage destruction of people. To techno genic emergencies are accidents at industrial facilities construction as well as on rail airo roado pipeline and water transport as a result of which the firesa the destruction of civil and industrial buildingsa there was a danger of radioactive contamination chemical and bacterial contamination there was the spreading of the oil products and aggressive poisonous liquid on the surface of earth and water and there are other consequences endangering human health and the environment.

The nature of the consequences of techno genic catastrophes depends on the type of accident, its scale and characteristics of the enterprise, where the crash occurred (on the means of transport and the circumstances in which the accident occurred).

Anthropogenic emergency situations are the consequence of the erroneous actions of the personnel. This class of emergency can occur at the same objects that and man-made emergency situations. The difference consists only in the fact that man-made emergency situations are not connected with the human factor directly.

OVERALL CONCLUSION

In thesis is designed and explored models of the estimation quality issues and quality of the perception video in IP-set. Main results qualification work is concluded in following:

1. On base of the analysis existing models of the granting the services of the issue video and translations television channel are revealed particularities of their operation, which must be taken into account at development of the models of the estimation quality issues and quality of the perception on example of the granting the services IPTV.

2. It Is Designed mathematical model, founded on attitude loss distortion, which allows valuing the quality of the issue video and can be used in existing IP-set. In models are taken into account different parameters, referring both to specific feature video frame, and feature, reflecting condition to network.

3. Organized modeling depending on loss level miscellaneous, type codec, schemes of the disguise mistake, period of the study and format video frame, as a result which is proved influence to different realization codecs on quality sent video level depending on miscellaneous of the losses and size frame;

4. It is installed that one of the dominant factor at estimation quality issues video is an amount lost package. The influence specific parameters video also render To final score quality such as way packetization, size frame, scheme of the disguise mistake, which depending on docksides codec on miscellaneous on alike level of the losses.

5. Offered use the factor, allowing display inter coupling subjective and objective estimation quality issues video, and taking into account features frame at estimation of the distortion, appearing in the course of loss separate block frame. The organized row experiment for verification of the models, targeted on comparison estimation quality, got when uses the models, with estimation known subjective and objective methods of the estimation quality issues video. As a result of experimental studies is installed that offered model allows with sufficient for

practical persons by degree to accuracy, value the quality sent video sequence and, in too time, in contrast with the other methods takes into account at calculation and the leading indexes to network and features video flow, not requiring herewith detailed analysis and analysis video flow that allows to use one model for reception exhausting estimation quality instead of several models, parallel used at present on network.

LITERATURE LIST

1. The Report of the President of the Republic Uzbekistan Islam Karimov on meeting of the Cabinet Minister denoted total social-economic development of the country in 2012 and the most important priority directions of the economic program on 2013 18.01.2013.
2. The Recommendation ITU-T Y.1910. The Functional architecture IPTV: 2008.
3. ЭЛЕКТРОСВЯЗЬ. Monthly scientifically a technical journal on wire and radio relationship , television , broadcasting . № 8/2013
4. Bell Labs Video Traffic Study. Video Shakes Up IP Edge. URL: http://www.alcatel-lucent.com/wps/DocumentStreamerServlet?LIVISG_CABINET=Docs_and_Resource_Ctr&LMSG_CONTENT_FILE=White_Papers/Video_Shakes_Up_IP_Edge_EN_Whitepaper.pdf
5. Pullano V., Vanelli-Coralli A., Corazza G.E. PSNR evaluation and alignment recovery for mobile satellite video broadcasting // Advanced Satellite Multimedia Systems Conference (ASMS) and 12th Signal Processing for Space Communications Workshop (SPSC), 2012 6th // IEEE. - 2012. - P. 176-181.
6. An Chan, Kai Zeng, Prasant Mohapatra et al. Metrics for evaluating video streaming quality in lossy IEEE 802.11 wireless networks / INFOCOM, 2010 Proceedings IEEE // IEEE.-2010. - P. 1-9.
7. Syahbana Y.A. et al. Aligned-PSNR (APSNR) for Objective Video Quality Measurement (VQM) in video stream over wireless and mobile network / Information and Communication Technologies (WICT), 2011 World Congress on // IEEE. - 2011.- P. 330-335.
8. Atayero A.A. et al. Estimation of the Visual Quality of Video Streaming Under Desynchronization Conditions // International Journal of Advanced Computer Science and Applications (IJACSA).- 2011. — T. 2.

9. Greengrass J., Evans J., Begen A. C. Not all packets are equal, part 1: Streaming video coding and sla requirements // Internet Computing, IEEE. - 2009. -T. 13.-№ 1.- P . 70-75.
10. Greengrass J., Evans J., Begen A.C. Not all packets are equal, part 2: The impact of network packet loss on video quality // Internet Computing, IEEE. - 2009. - T. 13. - № 2. - P. 74-82.
11. Recommendation I. 500-11. Methodology for the Subjective Assessment of the Quality of Television Pictures. Recommendation ITU-R BT. 500-11 // ITU Telecom. Standardization Sector of ITU.- 2002.
12. Moorthy A.K. et al. Wireless video quality assessment: A study of subjective scores and objective algorithms // Circuits and Systems for Video Technology, IEEE Transactions on. — 2010. — T. 20. — № 4. - P. 587-599.
13. Wang Z. et al. Image quality assessment: From error visibility to structural similarity // Image Processing, IEEE Transactions on. —2004. - T. 13. - № 4. - P. 600-612.
14. Hardin, Glen VOD servers-Equations and solutions / Glen Hardin, W. Paul Sherer // CED. – Aug. 2005. – Vol. 31, Issue 8 – P. 32.
15. RFC 2236. Protocol Internet Group Management Protocol, IGMPv2. –1997.
16. RFC 2328. Protocol Open Shortest Path First, OSPF. – 1998
17. RFC 4601. Protocol Protocol Independent Multicast, PIM. – 2006.
18. Standard MPEG-2 (Moving Picture Experts Group), ISO/IEC JTC1/SC29 WG11 (ISO/IEC Joint Technical Committee 1, Subcommittee 29, Working Group 11, 1994.
19. www.wikipedia.com
20. www.ixia.com