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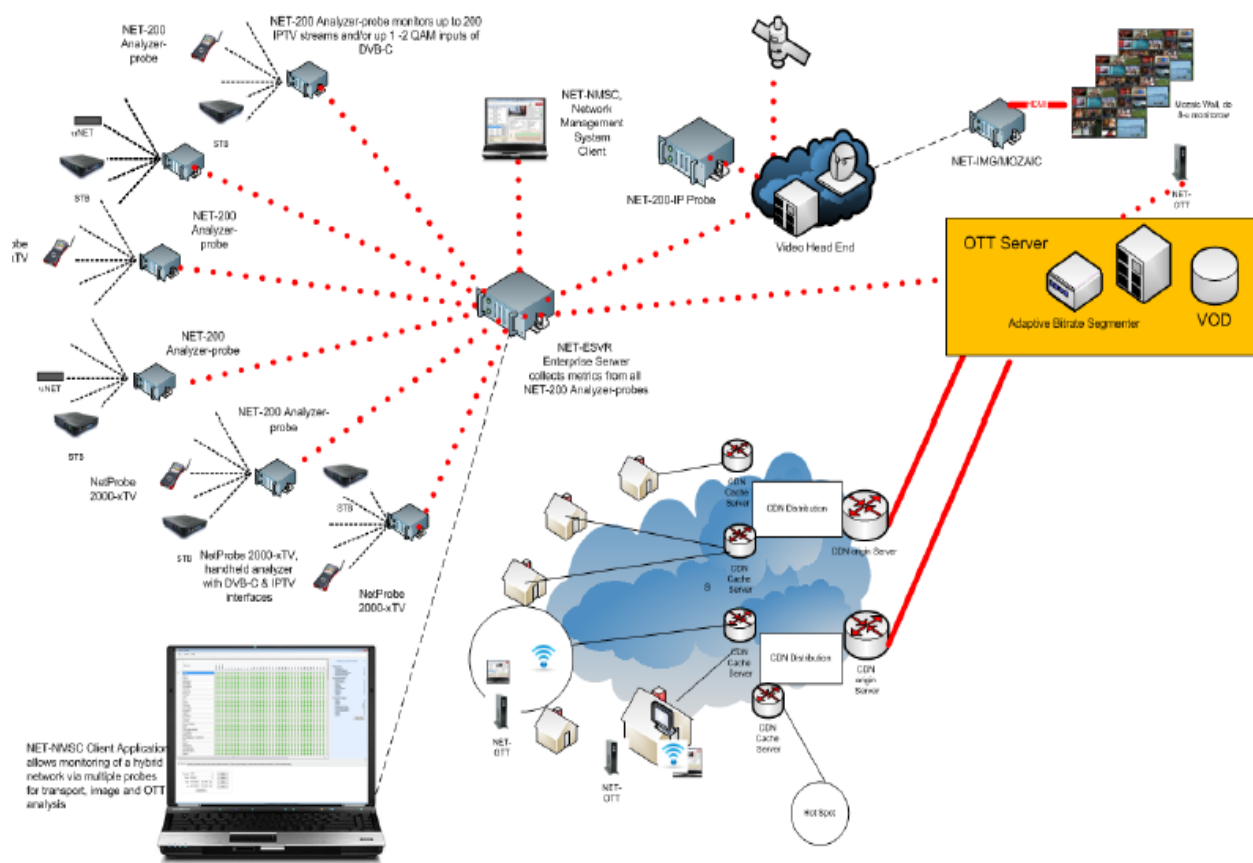
NET-xTVMS Digital TV Monitoring System

The NET-xTVMS provides video quality assurance solutions for different size and type of IPTV services such as linear programming, VoD, streaming for telco/telecom and cable TV operators. These scalable solutions are available for:

- Network Monitoring
- Headend Monitoring
- Point-to-point Monitoring
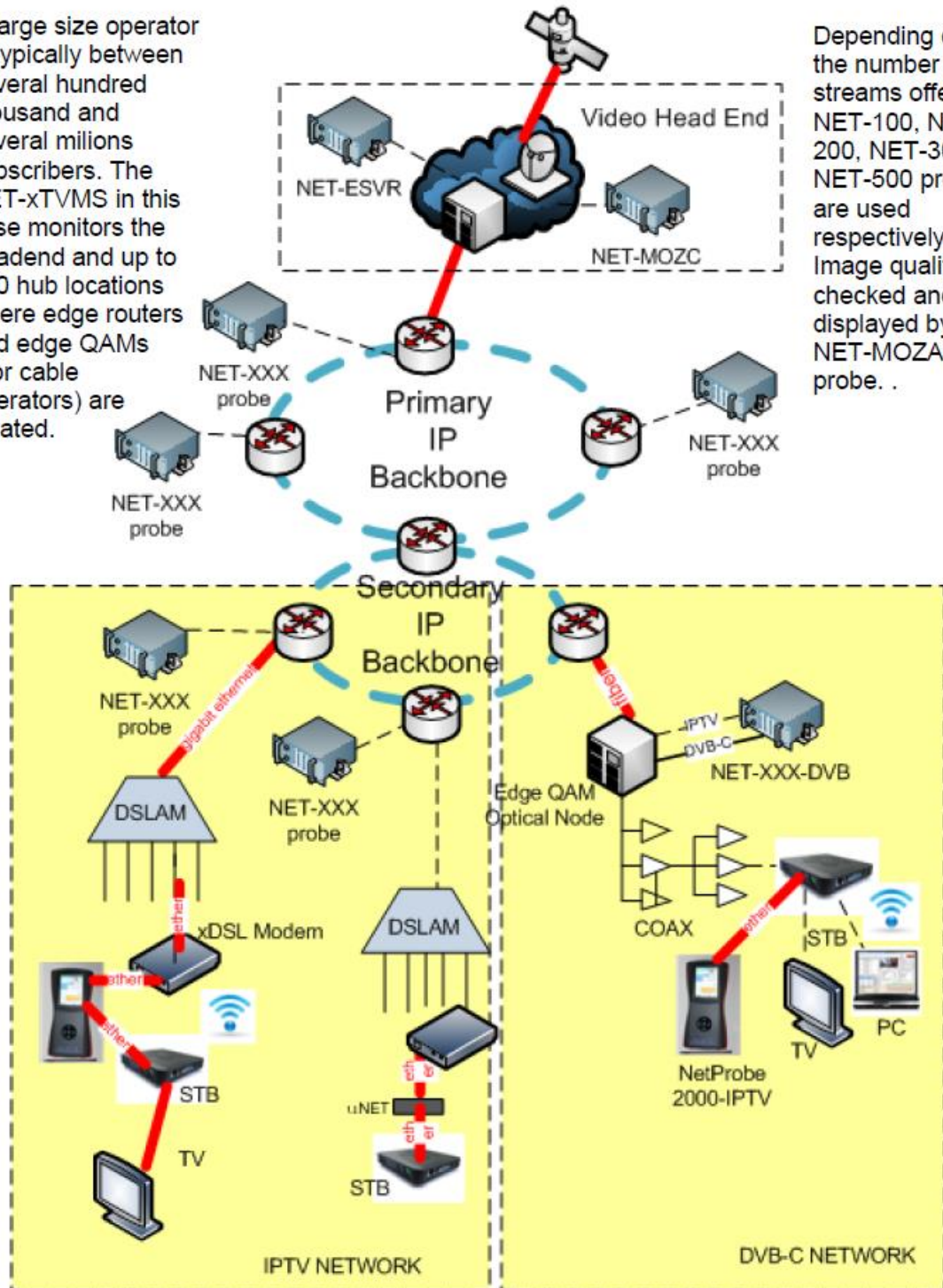- End-point monitoring

The software-based solution is flexible, easily migrating to future hardware platforms and adapting to new media and transport delivery technologies.
The architecture of the system uses distributed processing at the remote data collecting NET-XXX probes so that it can operate autonomously of the Enterprise Server . Variety of sizes and types of these probes allow configurations best suited for the operator requirements.

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## Application: NET-xTVMS in a Large Size IPTV & DVB-C Network

A large size operator is typically between several hundred thousand and several milions subscribers. The NET-xTVMS in this case monitors the headend and up to 200 hub locations where edge routers and edge QAMs (for cable operators) are located.

Depending on the number of streams offered NET-100, NET-200, NET-300 NET-500 probe are used respectively. Image quality is checked and displayed by NET-MOZAIC probe. .

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Application: Medium Size IPTV Operator

A medium size IPTV operator is typically up to several hundred thousand subscribers. The NET-xTVMS in this case monitors the headend and and up to tens of hub locations where edge routers are located. To minimize cost the Enterprise Server can be integrated with NET-XXX probe as NET-HDEND. Number of serviced streams can still be up to 500. Image quality is checked and displayed by NET-MOZAIC probe. Point-to-point monitoring is also possible with end user probes.
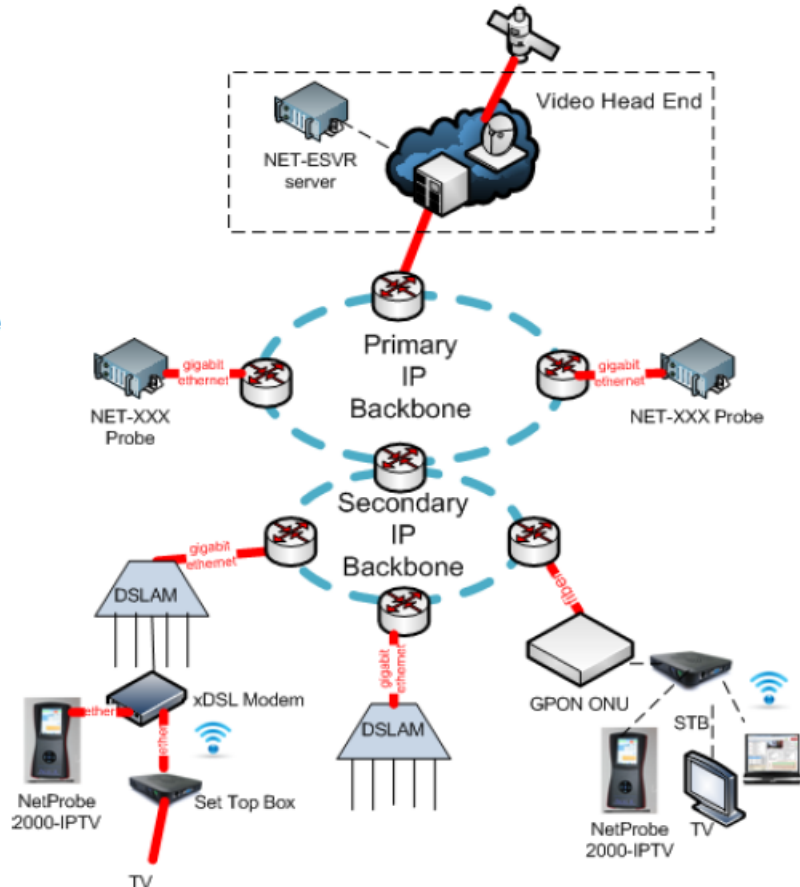

Application: Point-to-point network monitoring

		NET-20	NetProbe 2000 IPTV	μNET
Transport metrics	NET-200/300/500	X	X	X
	NET-HDEND	X	X	X
Image quality metrics	**NET- MOZAIC**	X		

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Application: Small network monitoring

A small IPTV operator is typically from thousands to ten of thousands subscribers. The NET-xTVMS in this case monitors the headend. To minimize cost the Enterprise Server can be integrated with NET-XXX probe as NET-HDEND. Number of serviced streams can still be up to 500. Image quality is checked and displayed by NET-MOZAIC probe. Point-to-point monitoring is also possible with end user probes such as uNET and NetProbe 2000.
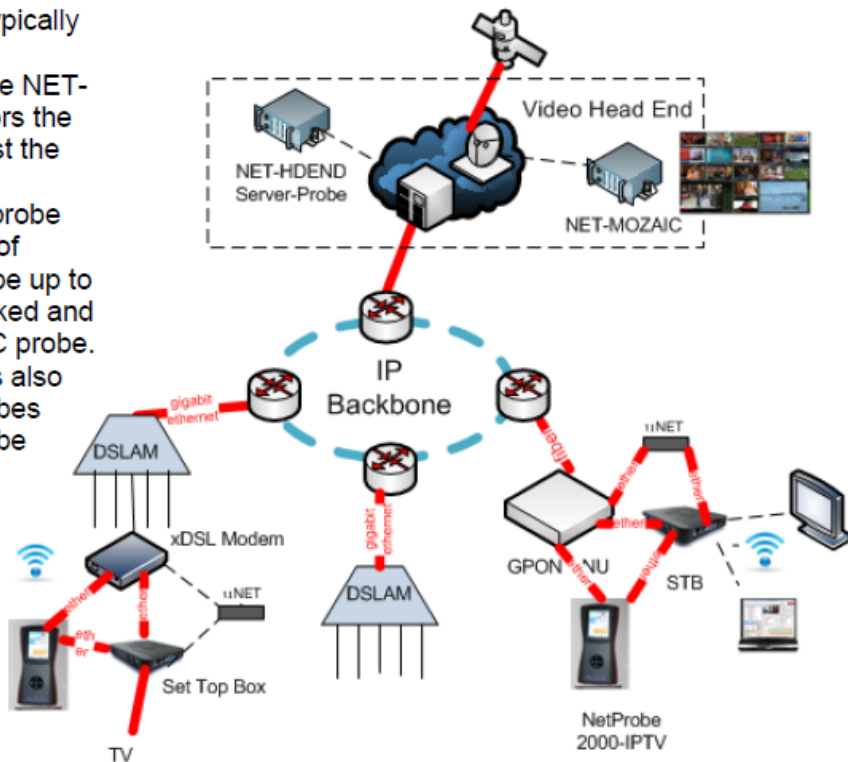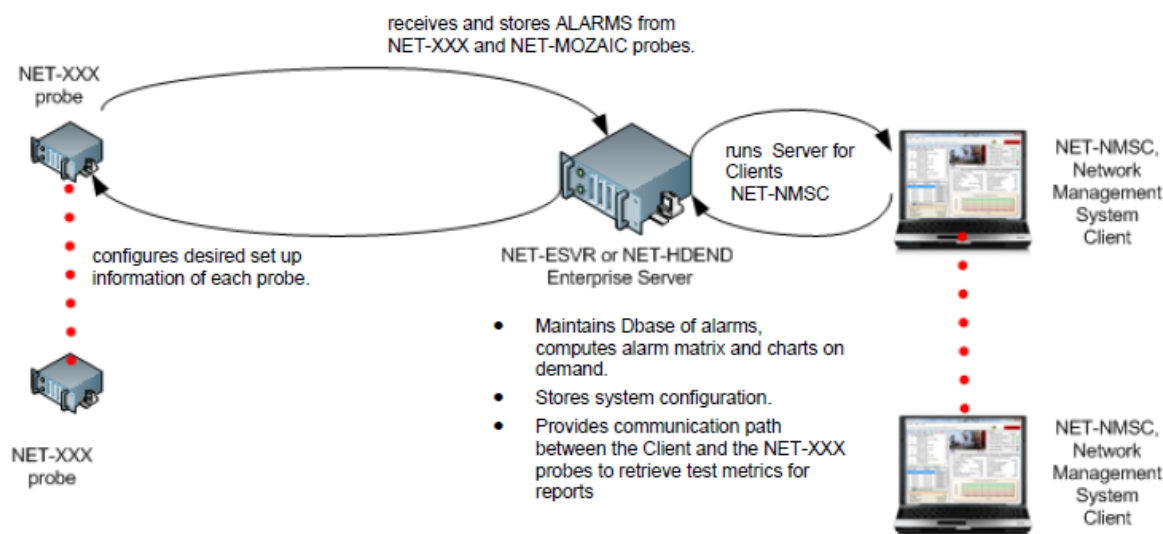
Computer requirements for NET– xxx Probes

	Recommended Processor	Ethernet interface
NET-500	XEON E5-2690 Dual 8-core	Single 10 Gigabit (XFP)
NET-300	XEON E5-2650 Dual 8-core	Single 10 Gigabit (XFP)
NET-200	XEON E5-2630 Dual 8-core	Single 1000Base-T
NET-100	XEON E5-2620 Dual 8-core	Single 1000Base-T
NET-MOZAIC	XEON E5-2690 Dual 8-core	Single 1000Base-T
NET-HDEND	XEON E5-2690 Dual 8-core	Single 1000B-T , opt. 10G XFP

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Components of NET-xTVMS

Name	Description
NET-ESVR	The hub of the system. It collects alarms and provides alarm matrix, and stores alarms historical data. Provides Client(s) with access to the probes. Correlates metrics in end-to-end monitoring and more...
NET-CLIENT	The only user interface to the system. Allows configuration of the probes (channels, metrics tresholds, invalid PIDs , etc..). Displays alarm matrix or alarm Map. displays detail metrics, alarm logs.
NET-500	The largest of NET-XXX series probes can process up to 500 streams (channels) H.264 SD and HD. Connect via 10G Ethernet interface.
NET-300	The second largest of NET-XXX series probes can process up to 300 streams (channels) H.264 SD and HD. Connect via 10G Ethernet interface.
NET-200	The medium of NET-XXX series probes can process up to 200 streams (channels) H.264 SD and HD. Connect via 1Gigabit Ethernet interface.
NET-100	The smallest of NET-XXX series probes can process up to 100 streams (channels) H.264 SD and HD. Connect via 1Gigabit Ethernet interface.
NET-20	The probe can be used as customer area monitoring probe for up to 20 streams (channels), also for end-to-end testing. In very small IPTV systems in can be used near edge routers to monitor all channels liek NET-XXX does.
NET-HDEND	To provide better economics and reduce power/space requirements the NET-HDEND combine the NET-ESVR and NET-XXX probe capabilities, frequently as the only NET-XXX probe in the system.
NET-MOZAIC	Connects to a group of 16 unencrypted channels at eth headend and scan the remaining groups on round-robin. Decodes image of each of the 16 SD/HD streams (channels), check for black or frozen screen, pixelization , blurriness, and more.. Displays 16 channel mozaic with video and audio.
uNET	Low cost field probe to monitor one channel in thru mode at customer location. Auto login to the NET-ESVR.
NetProbe 2000 IPTV	Handheld IPTV analyzer for service turn up and maintenance. Emulates STB, autoscan all channels, performs video quality measurements.

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NET-ESVR Enterprise Server

The Enterprise Server NET-ESVR is a hub of the system. Its central role is to receive every 5 seconds the alarm status of each probe NET-XXX and to store the status and update system alarm matrix. It also provides communication with the multiple Clients NET-NMSC.

receives and stores ALARMS from
NET-XXX and NET-MOZAIC probes.

NET-XXX
probe

runs Server for
Clients
NET-NMSC

NET-NMSC,
Network
Management
System
Client

configures desired set up
information of each probe.

NET-XXX
probe

NET-ESVR or NET-HDEND
Enterprise Server

- Maintains Dbase of alarms, computes alarm matrix and charts on demand.
- Stores system configuration.
- Provides communication path between the Client and the NET-XXX probes to retrieve test metrics for reports

NET-NMSC,
Network
Management
System
Client

The NET-ESVR provides also correlation of metrics and alarms between point-to-point probes anywhere in the network. It logs in automatically all detected customer site probes, saves their alarms and quality metrics summary results.
To maintain distributed processing each NET-XXX probe collects and stores test metrics on its hard drive. Therefore the NET-ESVR is not burden with huge data collection and does not require expensive storage and processor hardware.
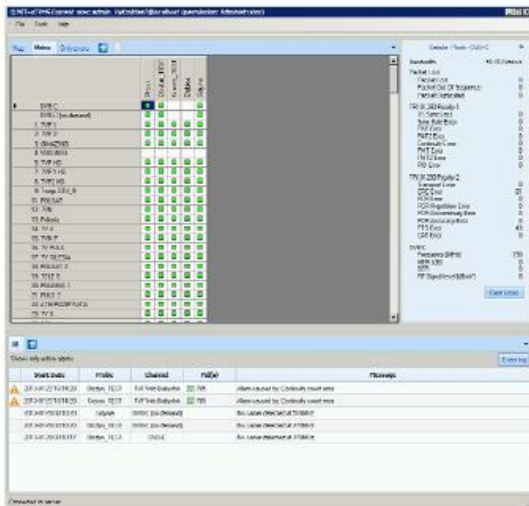
NET-NMSC Client

The NET-NSMC Client is a MS Windows application that communicates with the NET-ESVR remotely and in any place with Internet access. Multiple users can access the NET-xTVMS system at the same time.
The Client is the main and only interface to the system. It provides realtime status information from the server such as:
- Alarm matrix view of all channels at all locations
- Geographical view of Map with aggregate alarm status
- Alarm log, current and historical with view filters.
- Details of the chosen NET-XXX probe metrics, both current and historical
- QAM metrics for the selected frequency of DVB-C carrier (cable TV only)

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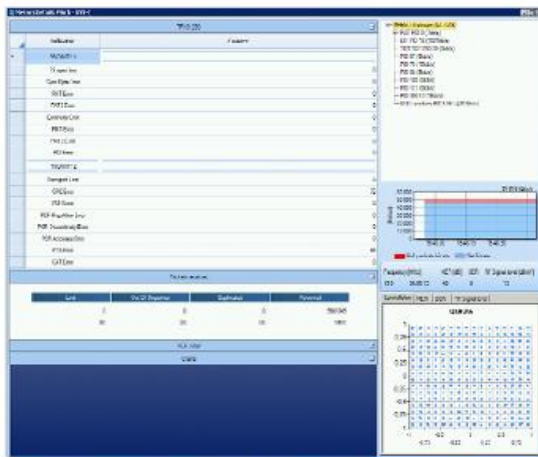FTTx,GSM, CDMA, UMTS ● *dostęp* xDSL ● *systemy i sieci* WAN/LAN ●

Examples of NET-NMSC Client - operational info screenshots
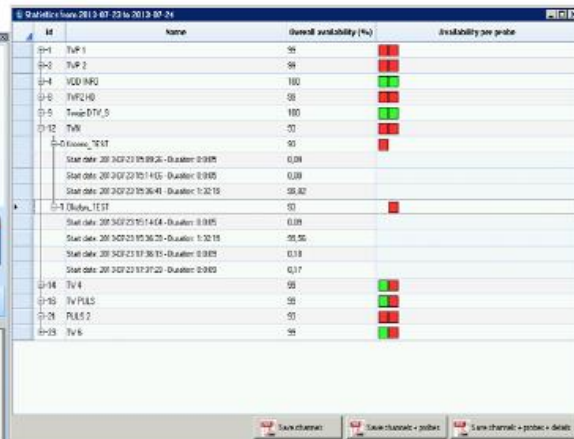

Alarm matrix of a system with 5 probes. Alarm log is at the bottom and detail metrics on the right side
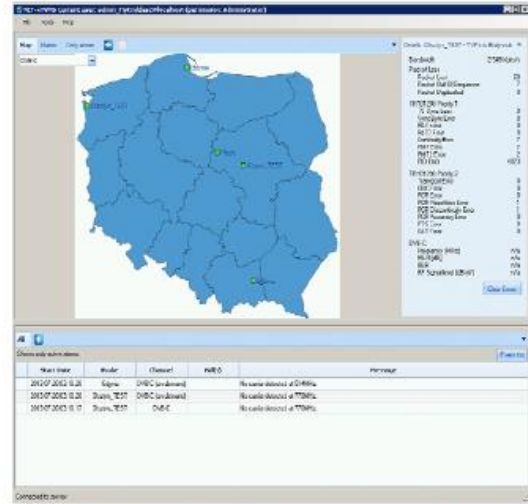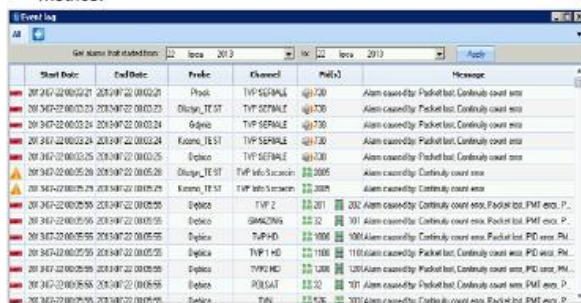


MAP view of 5 hubs with aggregated alarm status.

Detailed metrics for a site with DVB-C. Shows QAM RF measurements, MPEG2-TS TR101290 and other transport metrics.

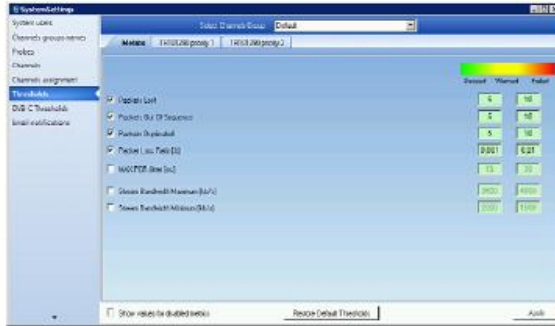Sample availability of channels in the selected window of time.

Detailed alarm log in the selected time period shows alarm status, its time and location, channel name and PID type and number, also alarm description.
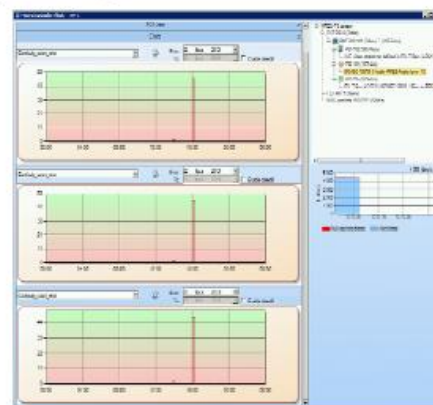

Sample view of triple charts for the selected metrics of the selected PID. Null and Net Bit rate histogram is also shown.

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Examples of NET-NMSC Client - configuration screenshots

Sample of Passed, Warned and Failed threshold set up for Metrics. TR 101290 Priority 1 and 2 thresholds are also selectable.
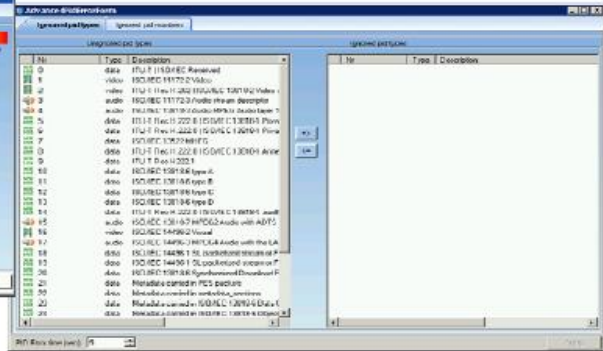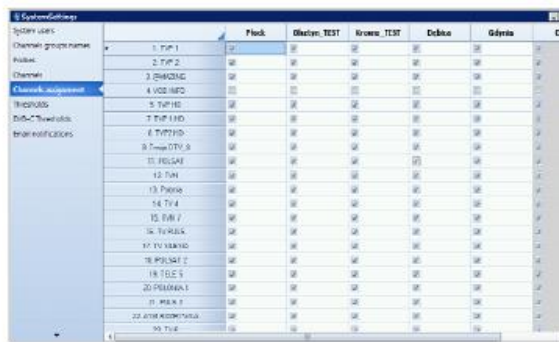

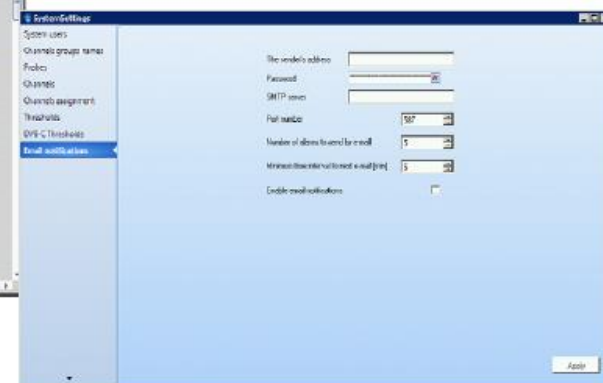Sample of Ignored PID editing. The Ignored PIDs will be excluded from alarm and metrics.

Sample of editor to add or delete probes to the system

Sample of editor to add or remove channel for the selected probe(s).

Sample of editor to assign channels to the specific probe(s).

Sample of editor to add or rchange email address for alarm notification.

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NET-XXX Probes (NET-500, NET-300, NET-200, NET-100)

The NET-XXX analyzer is an integral part of the state-of-the-art NET-xTVMS , the real-time monitoring of IPTV services. Intended for locations at the core or distribution networks, the NET-XXX is designed to function autonomously for an extended period of time should communication with the NET-ESVR Enterprise Server be interrupted. Monitoring of 2 DVB-C QAM carriers is possible as an option. The NET-XXX is a software solution running under stable and safe Linux OS on server class computers of customer choice.

Key Features

- Monitors 24/7 simultaneously up to XXX SD and /or HD channels in MPEG-2 TS format in real time. XXX is 500, 300, 200 or 100
- Actively connects to all these channels at the edge router and edge QAM locations
- Supports MPEG2-TS from IPTV or DVB-C sources
- Supports UDP or UDP/RTP encapsulation
- Monitors end-to-end quality of service of IP transport
- Captures and stores over 30 transport metrics including TR101290 priority 1 & 2, packet loss rate and PCR jitter, and more…
- Provides realtime and historical data on the metrics and alarms via Net-ESVR and NET-NMSC Clients
- All metrics have user defined alarm thresholds
- Sends alarms with 5 second resolution to the NET-ESVR alarm matrix and alarm MAP
- Fail safe autorestart in case of power outage
- Uses 1Gigabit Ethernet for up to 200 channels and 10G Ethernet for more up to 500 channels.

Example of PC:
Dell server class R210 with XEON E5-2630 dual 8-core processor, used for NET-200 probe. Customer can purchase and maintain their own computers minimizing cost and simplifying installation logistics.

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NET-XXX Probes– Technical Specification

Key alarms reported:

Stream Presence
Packet loss :
    Number of Packets Lost
    Number of Packets Discarded
    Number of Packets Out Of Sequence
    Number of Packets Duplicated
    Packet Loss Ratio in %

TR 101290 PARAMETERS
    Priority 1:
        TS Sync Loss
        Sync Byte Error Count
        PAT Error Count
        PAT2 Error Count
        Continuity Error Count
        PMT Error Count
        PMT2 Error Count
        PID Error Count
    Priority 2:
        Transport Error Count
        CRC Error Count
        PCR Error Count
        PCR Repetition Error Count
        PCR Discontinuity Error Count
        PCR Accuracy Error Count
        PTS Error Count
        CAT Error Count

Video Stream Resolution Changed

Metrics and Alarms Resolution:
5 seconds

Optional DVB-C Interface:

Dual demodulators
QAM 256 constellation diagram
RF Signal Level dBmV
MER 0-40 dB
BER counter
Frequency of the carrier in Mhz

Metrics calculated:

Video Bit Rate in kbps
Audio Bit Rate in kbps
TR 101290 Priority 1 Errors (8)
TR 101290 Priority 2 Errors (8)
Packet Lost ratio in %
Packets Discarded
Packets Out of Sequence
Packets Received
Packets Duplicated
Video PIDs
Audio PIDs
Jitter
Video Codec
Audio Codec
Encapsulation Protocol
Video Stream Resolution
Total Bandwidth Usage
MOS Score
Type of Service
Time to Live

Computer Equipment Requirements:
Linux OS
RAM -   8 Gbytes
Hard Drive -   512 Gbyte
USB ports -   4
RGB Graphics Interface -   1
Enclosure -   server class 19"
Operating Temperature - 0 to+40 ° C (relative humidity 90%)

	Recommended Processor	Ethernet interface
NET-500	XEON E5-2690 Dual 8-core	Single 10 Gigabit (XFP)
NET-300	XEON E5-2650 Dual 8-core	Single 10 Gigabit (XFP)
NET-200	XEON E5-2630 Dual 8-core	Single 1000Base-T
NET-100	XEON E5-2620 Dual 8-core	Single 1000Base-T
NET-HDEND	XEON E5-2690 Dual 8-core	Single 1000B-T , opt. 10G XFP

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NET-MOZAIC Probe

The NET-MOZAIC Probe is a stand alone or an integral part of the NET-xTVMS , the real-time monitoring system of IPTV services. The NET-MOZAIC is normally located at the Head End with access to unencrypted TV channels. Customers defined group of 16 channels at the time are then decoded and analyzed for picture quality. Hundreds of channels can be analyzed this way on the round robbin.

Key Features

- Simultaneous full motion preview and image analysis of up to 16 SD and/or HD channels
- Round-robbin for up to hundreds of channels
- Integrated with Net-xTVMS system for centralized control/access
- Supports MPEG-2 and H.264/AVC
- Supports audio codecs AC-3, MPEG-1 Level 2, MPEG-2 AAC, MPEG-4 AAC
- Supports UDP or UDP/RTP encapsulation
- All metrics have user defined alarm thresholds
- Long term storage of metrics
- Optional HDMI/IP encoding of a 16 channel group for advertising
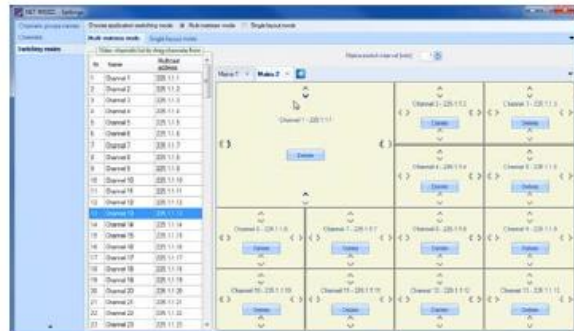
Mozaic format is user configurable

OS ,HD. Memory	Windows 7 64-bit, 512 Gbyte, 8 Gbyte RAM,
Recommended processor	XEON E5-2690 Dual 8-core
Ethernet interface	Dual1Gigabit Base-T or optical (SFP)
Graphic card	Gigabyte GeForce GTX650 OC 2 GB DDR5 PCI-E

Recommended PC Information

Example of NET-Mozaic with 12 small and 1 large frames channels

IMAGE ANALYSIS
Monitoring Video streams for:

- Blockiness
- Frozen picture
- Black screen
- Jerkiness
- Brightness problem
- Contrast problem
- Video picture noise
- Video blur
- Block missing
- Flickering
- Audio silence detection
- Audio clipping detection

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Blockiness

They are the most visible image and video degradation of all artifacts. This effect is caused by all block-based coding techniques. It is a well-known fact that all compression techniques divide image into small blocks and then compress them separately.

Frozen picture

Stilted and jerky motion — often found on occasions

of high motion within IPTV streams— is seen as time-discrete 'snapshots' of the original continuous scene strung together as a disjointed sequence

Black screen

It shows as disappearing of picture - black screen. Appears, when all packets of data or as a result of incorrect video recording.

Block missing

It occurs when some of the data packets that form the video signal are lost during some stage of the transmis
sion. The result of that loss is that one or more false black blocks are included in the frame instead of the original (lost) ones

Flickering

Flickering is one of the most annoying temporal artifacts in predictive video coding. As it is widely known, modern algorithms encode video as a sequence of images. The first frame from this sequence is a key frame (I), others are additional (previous [P] and subsequent [B]) frames. All sequences are encoded by motion-compensated algorithms. When an observer watches the decoded video, the flickering effect is noticeable due to the difference between key frames (I) and other frames (P, B).

Jerkiness

Transmission of digital videos over band limited often results in a non fluent and non smooth presentation of video during playback. Perceptually, this is called jerkiness.

Brightness problem
Contrast problem

Exposure time distortions are visible as imbalance in the brightness (too dark or bright frames). They are caused by incorrect exposure time or video recording without a lighting device

Video blur

Blurring shows as reduced sharpness of edges an spatial detail. It the result of the lost of high frequency information during the coding.
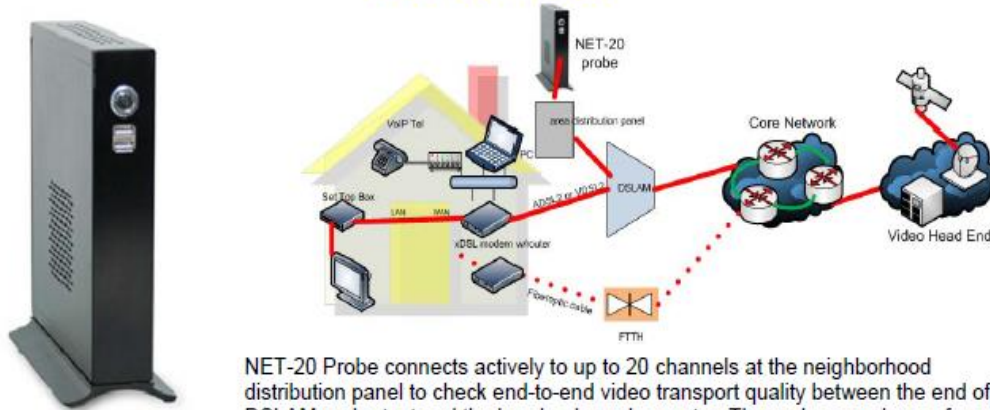

Audio silence detection

The original audio signal may be clipped in some special situation during the recording due to the impact of environmental noise or recording equipment. The maximum amplitude of the clipped signal is often limited to a constant. This clipping distortion will lead to a harsh noise. It will affect the subjective listening quality seriously if the clipping intensity is strong or the clipping density is large.

Audio clipping detection

Signal losses are one of the most common degradations in audio streaming at low bit rate. The end-user perceives a silence followed by abrupt clipping. Cell loss in the packet networks, restitution strategy or audio recording error could be the origin of this perceived temporal audio discontinuity.

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NET-20 Probe

NET-20 Probe connects actively to up to 20 channels at the neighborhood distribution panel to check end-to-end video transport quality between the end of the DSLAM under test and the headend or edge router. The probe can also perform point-to-point image quality analysis on one unencrypted channel.

µNET Probe
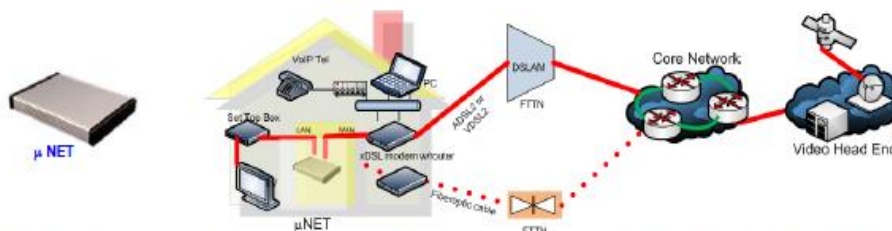
The uNET probe connects in pass-thru mode between the customer modem and set top box. It logs in automatically to the Net-xTVMS system and is ready for a local or point-to-point testing on a specific channel currently watched by the customer. Customer complaints can then be isolated, identified and fixed. The probe is optionally powered by the set top box.

NetProbe 2000 IPTV
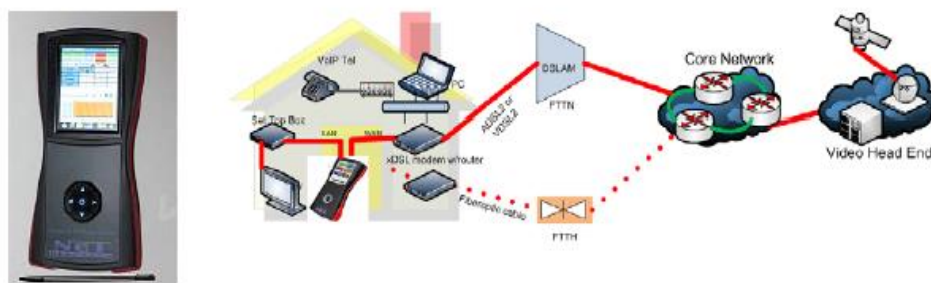
The NetProbe 2000 IPTV is a handheld IPTV tester that can emulate set top box or passively monitor video channels in pass-thru mode. It can be used to turn up new service by ato scanning all channels and checking their quality or troubleshoot the service. It is battery powered and easy to operate by tier one technician.

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