Service Quality Assurance for Digital Media Services

iTVSense

NETvisor

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SERVICE QUALITY ASSURANCE FOR DIGITAL TV AND MULTI-PLAY SERVICE PROVIDERS

NETvisor's iTVSense product enables performance and quality monitoring of modern residential telecommunication services, covering the head-end systems, the core, aggregation and access networks, as well as the CPE devices. Measuring key parameters at the signal sources, at network distribution points and in the Customers' home enables end-to-end, proactive service assurance, resulting in quick error detection and localization.

Benefits

- Comprehensive monitoring for the entire service infrastructure

- Robust and scalable distributed monitoring platform

- Multi-layer analysis of both multicast TV and Video On Demand streams

- Passive and active monitoring for VoIP control and data

- Internet access service assurance, including active and passive testing on video over the internet

- Real-Time status Dashboard and long-term measurement collection for trends analysis

- Built on open standards, easy to extend and integrate

Architecture & components

The solution is implemented as a distributed architecture as shown in figure on page 3. consisting of the following components:

ITVSENSE CENTRAL MANAGER (CM)

The iTVSense Central Manager (CM) servers include the Dashboard and the Performance Monitor, described below.
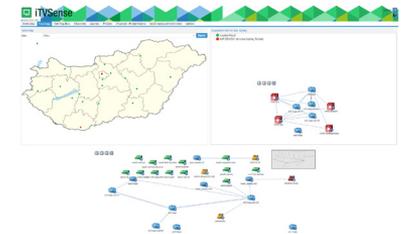
Figure 1. iTVSense Central Manager Dashboard (see description on page 4.)
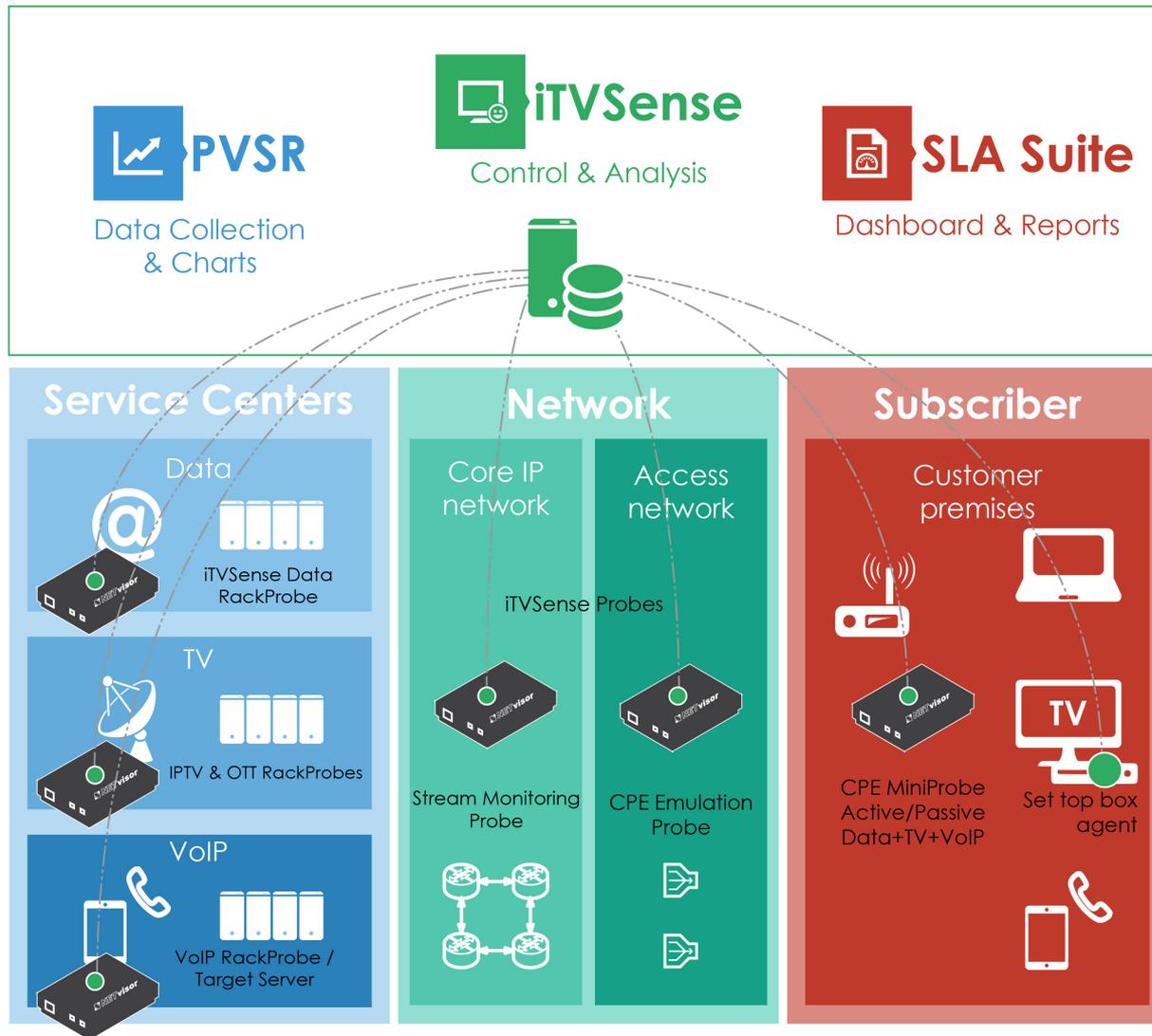
Distributed architecture

Architecture & components

iTVSense Management Dashboard

The iTVSense Management Dashboard as shown on page 2. is the heart of iTVSense system. This application maintains and updates the high-level iTVSense Dashboard overview, and manages the configuration of various iTVSense sub-systems, such as the Performance Monitor or Probes. The Dashboard provides the following views:

- Multicast Topology View displays selected parts of the provider's distribution network, and visualizes routes or multicast paths with status information for corresponding network devices.

- Core Network View shows the logical topology and status of the provider's core network

- Alarms View displays alerts relevant for the IPTV, VoIP or Internet access infrastructure. Alarms are grouped into two principal categories: Subscriber, Channel or Device alarms, and are further classified by their cause and expected impact. The Alarms View provides easy-to-use filtering and drill-down controls for the operators, as well as a customizable correlation module.

- Probes Management Console is the GUI for managing the configuration of the iTVSense probes, i.e. choosing the channels to be monitored, and setting various probe deployment information.

- TV Channels-Probes Matrix is the most detailed, tabular view showing real-time measurements and alarm information for all the channels monitored and all the probes deployed.

- Customer premises View shows in-depth measurement data and various related information (e.g subscriber device and package information) for individual CPE-s

iTVSense Performance Monitor (PM)

The iTVSense Performance Monitor (PM) is a customized instance of NETvisor's PVSR performance monitoring suite. This component provides data acquisition and alert evaluation, persistent data and configuration storage for the entire monitoring system.

Data collected from the managed system are categorized as either performance data or alarms. Data is received by an array of collectors that match the technology of the target device, i.e.

- SNMP/ICMP collector for network devices,

- Unix collector for servers,

- Oracle collector for databases

- JMX collector for J2EE servers and applications

- Additional infrastructure-related components (virtualizations, storages, databases, etc.)

Another class of collectors initiates test transactions towards the monitored systems, to test availability and response time. These include: network availability collector, HTTP/SOAP/RTSP collector, etc.

Being a central component the iTVSense management system, the Performance Monitor can be deployed on a server cluster, thus providing load balancing and failover.

Architecture & components

iTVSense RackProbes

iTVSense Probes, deployed in strategic locations across the network provide in-depth service analysis in passive mode, or provide active tests by joining multicast transmission streams, requesting VoD/OTT content   (up to 1000 IPTV channels simultaneously) or by placing test VoIP calls or access Internet content. They provide TCP/UDP and Transport Stream level analysis data like packet/byte rates, jitter, packet loss, counter and encapsulation errors, etc. As an overall aggregate quality metric, RFC 4445 Media Delivery Index (MDI), VoIP MoS and R factor are also computed.

Probes are also used to monitor the availability of other components, e.g. soft switches, media gateways, middleware server availability and response, DHCP and CPE boot image distribution.

Probes fully support SNMP for monitoring and configuration, while an http interface is also available for easy access through a web browser. Consequently, measurement data can also be made available for 3rd party management systems.

Figure 2. iTVSense RackProbe

iTVSense MiniProbes

iTVSense MiniProbes are small, economic, versions of the iTVSense probes supporting 3-20 TV channels and up to 10 VoIP calls in parallel to allow for monitoring the TV, Voice and Data services at arbitrary points of the network (even at the customer endpoint). They can be used for CPE-side monitoring where the STB type is not supported by our iTVSense Agent. In this case the CPE probe is connected into the data path between the STB and the IAD (Internet Access Device). Another application area is customer access line pre-qualification, when the CPE probe runs standalone and joins and monitors IPTV and VoD streams or makes test calls and downloads under remote control by iTVSense.

Their small form factor, trivial connection ports and low price allow for cost-effective distribution (i.e. through mail or a delivery service), and do-it-yourself installation of the CPE probes.

MiniProbes are also capable of standalone operation, not configured from the iTVSense Central Console. In this case, technicians access the MiniProbe's built-in GUI and configure individual measurements, down to the data resolution of 1 second.

Figure 3. iTVSense MiniProbe is very easy to deliver and install

Architecture & components

iTVSense STB Agents

iTVSense STB Agents are small-footprint software modules deployed on the customer set-top-boxes or home gateways. They provide UDP and Transport Stream signal quality measurements very similar to those of the IPTV Probe, but obviously for a single stream only, the one actually being viewed by the customer. In addition, various STB/IAD/HGW system health parameters are also reported (e.g. system and CPU load, available memory, uptime etc.). Agents deployed in the home gateway also support monitoring for Internet access and VoIP traffic, including active testing procedures.

Upon meeting configurable conditions, agents may send alerts to the management system. The protocol used for communication with the iTVSense PM is SNMP, or XML/HTTP, thus agent data can also be made available for 3rd party management systems.

The STB agent can be compiled and used with most Linux- or Android-based STB implementations.

iTVSense SLA Suite

iTVSense SLA Suite is a module based on the standard NETvisor SLA Suite product, deployed on the central monitor. This module can be used to define SLA metrics, display data on various SLA dashboards (operator, manager, executive) and generate SLA report documents.

The data used for SLA calculations typically originates from iTVSense CM, but it is also possible to include results of other, existing data acquisition systems like performance managers or trouble ticketing systems.

Measurements provided by the iTVSense Solution

CENTRAL HUB AND HEAD-END INFRASTRUCTURE:

Monitoring is provided for devices and applications running in the IPTV data center, including:

- Encoders: input signal strength, S/N ratio, operational and environmental alarms

- IPTV Server/Streamer: per-channel and aggregate processing metrics (packet and byte rates, queue lengths, hardware operation and resources, etc. MPEG TS level analysis of signal quality at entering the distribution network.

- VCAS/RTES system: stream rates, network traffic and operational characteristics

- VoD system: VoD sessions, stream rates, network traffic. MPEG TS level analysis of signal quality at entering the distribution network.

- IPTV Middleware: availability, execution rate and response time of individual operations, active clients, etc.

- DHCP and CPE firmware distribution: availability, request counts and data rate

- Server, OS, and database-level measurements: hardware characteristics, voltage and temperatures, memory and CPU resources used and available, processes, users, database usage and resources.

- OSS/BSS interfaces: availability of connected systems, number and outcome of provisioning operations, billing record submissions, etc.
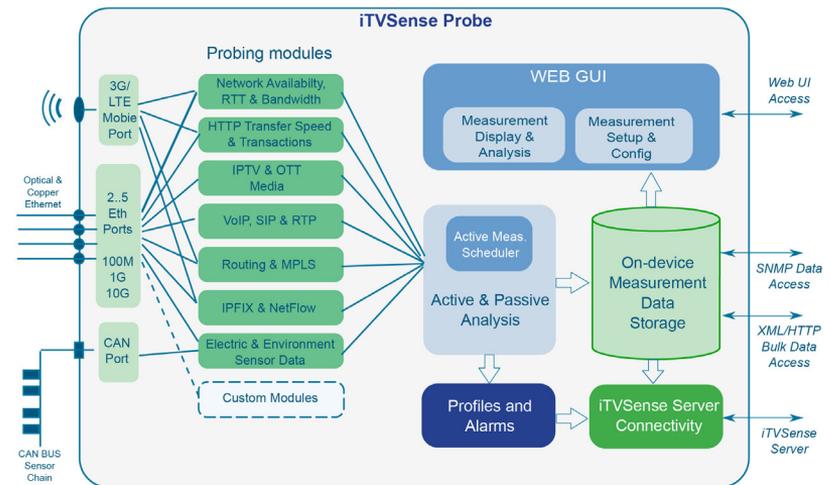
Measurements provided by the iTVSense Solution

PROVIDER NETWORK

The management system can be extended for monitoring and managing various network devices in the provider distribution network, i.e. routers, switches, DSLAM-s and SAM-s of other technologies. This includes per-stream availability and data/error rates, as well as performance and alarm management features, like collection of interface statistics, device CPU and memory resources, voltages and temperatures, reception of interface and device traps etc.

IPTV SIGNAL TRANSPORT

iTVSense Probes provide end-to-end signal transport data that includes minimum, maximum and average values for

- UDP stream packet rate, byte rate, packet loss rate and various jitter metrics

- MPEG Transport Stream packet rates, jitter, packet loss, counter and encapsulation errors. Metrics are provided both as an aggregate and also by individual Mpeg streams (video, audio, control).

- RFC 4445 Media Delivery Index (MDI).

- Multicast join times and zapping time.

- Middleware and VoD service response time

CPE DEVICES (FOR SUPPORTED STB-S):

In addition to signal transport parameters equal to those provided by the iTVSense probes (see previous section), CPE measurements also include important operational characteristics of the customer devices, including availability, CPU load, memory used and available, process count, reboot events and uptimes, process monitoring, STB agent footprint


Figure 4. CPE view

System Operation and Use Cases

iTVSense is operated form the Dashboard Web console, an intuitive, ergonomic and efficient AJAX-based user interface. The main functions are configuration, analysis, alarm management and statistics/reporting.

CONFIGURATION

iTVSense allows for unlimited additional flexible configuration by the customer on the iTVSense CM Web console. This typically includes:

- re-defining the channel list and changing per-channel profiles,
- adding and modifying devices (based on pre-configured device templates),
- defining custom graphs, and topologies
- defining alarm types, alarm threshold conditions, and alarm handling policies
- adding new users and setting user preferences
- configuring the SLA management parameters.
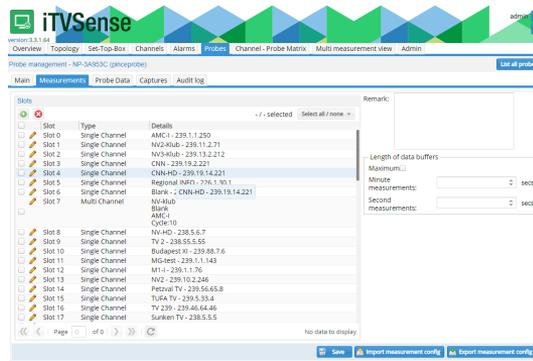
Figure 5. Configuration view

OVERVIEW

The iTVSense Dashboard Web console (Figure. 5) provides an easily comprehensible overview of the system, displaying diagrams with key performance data and color-coded icons that reflect the state of individual components. Further general displays include:

- Channel parameters and distribution: signal characteristics and network degradation of a selected channel.
- Customer data path: signal transmission to a selected customer.

Components displayed on the dashboard are hyperlinked to allow for immediate analysis, as described in the next section.
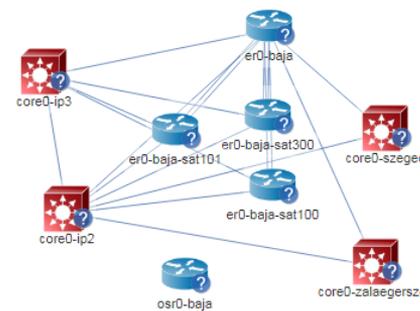
Figure 6. Overview

System Operation and Use Cases

ANALYSIS

iTVSense CM provides multiple means for the visualization, presentation and analysis of the recorded data.

- Access and display any single measurement on a graph, with arbitrary timescale.

- Display multiple measurements on a single graph or page. These can be related measurements of a single device or service, or a comparison of several services. For example, the following figure shows the overview of a STB's all measurements: any graph can be selected and zoomed for detailed inspection.

The next figure shows interactive the comparisons of Probe MDI-DF measurements at different points of the network. All data displayed on graphs can also be exported to XLS format.
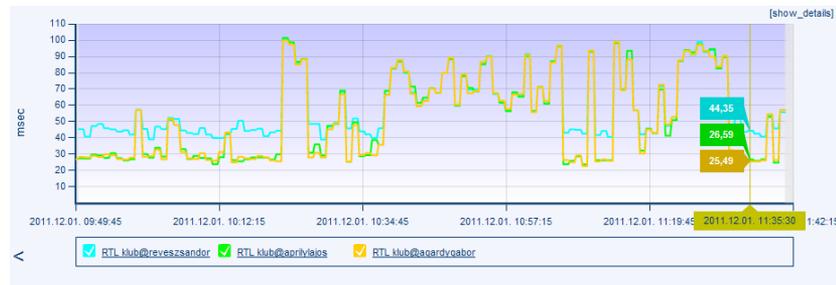

Figure 7. Correlating jitter measurements

ALARM MANAGEMENT

The iTVSense alarm management module processes alarms generated by the devices or calculated from threshold criteria defined for measurements. A simple alarm correlation feature allows for pairing alarms and suppression of repetitive alarms along the system.

Alarms do not only need to originate from the IPTV system, but other external alarms (e.g. network alarms) can also be received and processed.

The alarm console of the web GUI displays alarm states in a standard, color –coded format. Alarms can be filtered by various criteria (severity dates, device groups, acknowledgement status), acknowledged or escalated to a trouble ticketing system. For alarms generated by the performance monitoring system, underlying data can be displayed, with markers indicating the alarm events.
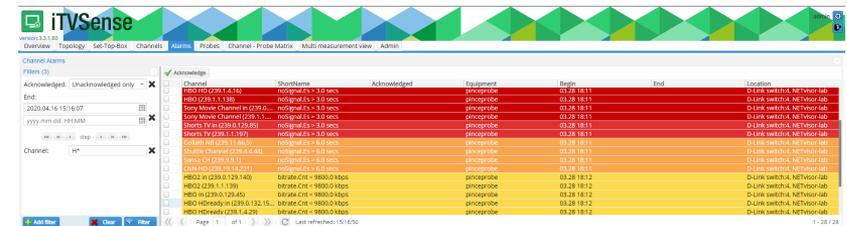
Figure 8. Alarm console

System Operation & Use Cases

Specifications

STATISTICS AND REPORTING

iTVSense can be configured to calculate statistics for selected data, e.g. jitter values for devices in a selected region, or average/minimum/maximum packet loss for all channels at a distribution point. These statistics can be configured into report pages and displayed in a tabular or graph format on the Web Console.

For more complex reporting, e.g. monthly reports in PDF format, the ITVSense SLA Suite can be used. This allows for the configuration of complex data selection, calculation, and aggregation rules, as well as selectable file format and customized formatting of report documents.

MONITORED DATA:

- Network UDP stream packet rate, byte rate, packet loss rate and various jitter metrics

- MPEG Transport Stream packet rates, jitter, packet loss, counter and encapsulation errors. Metrics are provided both as an aggregate and also by individual Mpeg streams (video, audio, control).

- RFC 4445 Media Delivery Index (MDI).

- Multicast join times and zapping time.

- Encoder alarm events

- IPTV server operation, network traffic and stream processing (via SNMP)

- VCAS Server network traffic and stream processing (via SNMP)

- Middleware and VoD service operation, resources and response time, server/OS/Database health.

- DHCP and Boot Image server availability and events

- STB CPU load, memory used and available, network traffic, process count, reboot events and uptimes, proce. monitoring, STB agent footprint.

Specifications

SUPPORTED STB-S FOR ITVSENSE AGENT:

- Motorola/Kreatel
- TechnoTrend
- SwedenTelecom/Zenterio
- Albis
- DUNE
- ZTE
- ZyXel
- ANTIK Juice
- AirTies
- Amino
- Arris
- Infomir

The agent software module can be ported to most Linux- and Android-based STB implementations with minimal support from the STB vendor.

SUPPORTED PROTOCOLS STANDARDS AND TECHNOLOGIES:

HTTP(s), SNMP	agent and probe configuration, data acquisition and alarms
RTSP, HTTP, IGMP	response time measurements
HTTP, HTTPS, AJAX	Web Console
SOAP/Web Services	ITVSense API, Alarm reception
SMTP, CLI:	alarm escalation
RFC 4445	Media Delivery Index (MDI)

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improving the quality & efficiency of ICT services
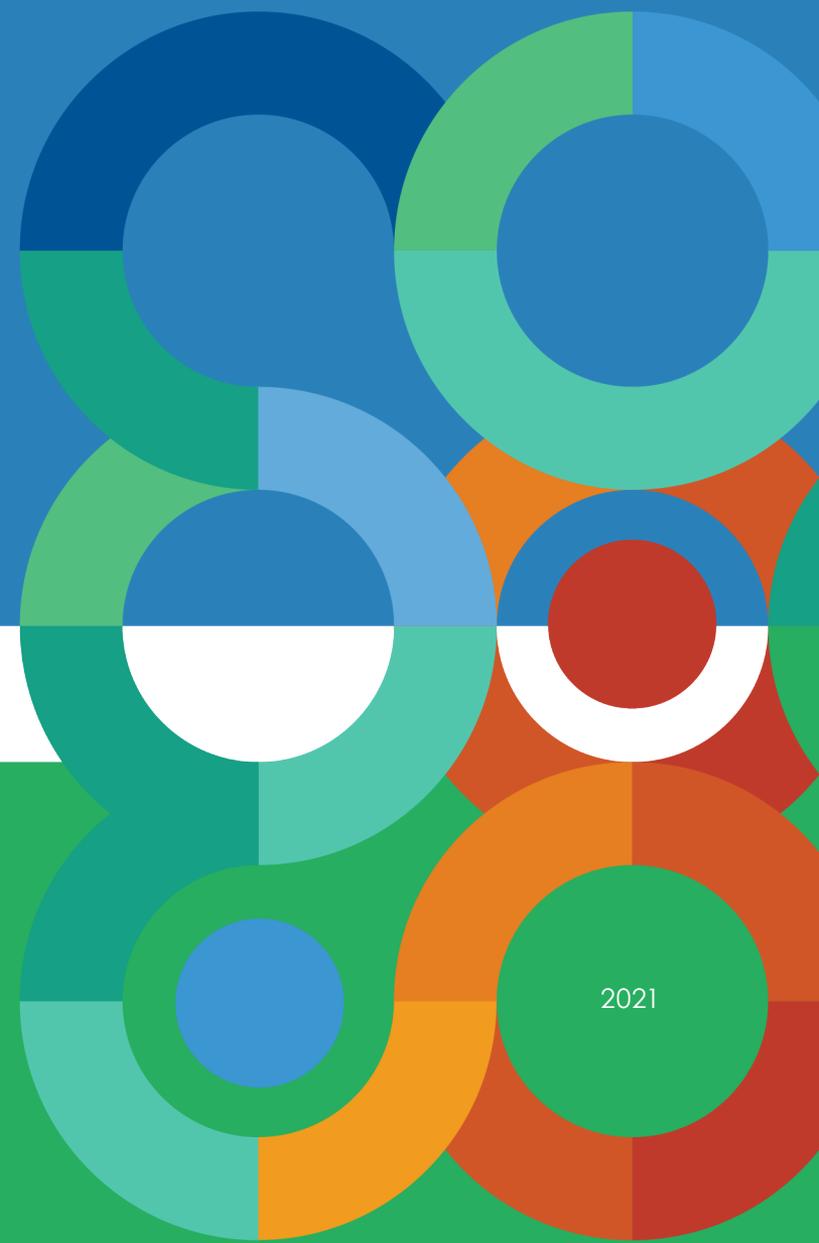
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