



SmartLabs

SmartCARE 6

Solution Description

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SmartCARE is a software solution for monitoring the quality of providing the services of video content delivery in IPTV and OTT networks.

What is it for?

The quality of video content delivery services on the user's side is directly dependent on the quality of hardware operation at the operator's and the quality of the access network at the subscriber's. Network-level problems and problems on the operator's platform side influence the service quality and can cause image freezing, reduced image quality, frame loss. Eventually this has a bad impact on subscribers' perception of the service and can cause them to cancel it. SmartCARE makes it possible for the operator to continuously analyze the quality of content delivery and quickly react to emerging problems.

1 Advantages

Integrated Monitoring System for IPTV and OTT

SmartCARE supports collection and analysis of data for both of these delivery technologies: in managed networks (IPTV) as well as through the Internet (OTT). It enables an operator to use a unified solution for any service provision options.

Preventive Detection of Problems

A unique feature of SmartCARE is the possibility to detect potential areas of concern in advance. Using mathematical clustering techniques and algorithms of decision-making SmartCARE is capable of online identification of dependencies (access networks, type of equipment, versions of applications, currently viewed content and many other parameters) for subscribers facing difficulties in obtaining services. SmartCARE analyzes this data and determines which subscribers with similar parameters are at risk. This data can be used to inform subscribers on possible problems and the ways to resolve them.

The Use of All Information Obtained

SmartCARE uses both realtime data and all stored statistic data, aggregating the entire information in a particular way for further prompt access.

SmartCARE provides for possibilities to monitor customers' current sessions and quality of real-time services (real-time monitoring, tracking). The values of monitored parameters are getting renewed at the toolbar every 60 seconds.

And also you can filter and analyze the history of system events. For example, you can identify services quality subsidence with filtering of past events by average number of bitrate switchings during specified period of time: lower the number of bitrate switchings – higher the quality.

Convenient set of tools

SmartCARE system makes the work of operations departments easier. Convenient and functional SmartCARE interface can be used by departments of monitoring, technical support as well as the team of service managers makes it

possible to identify the emergence and development of critical situations in the network in good time and take measures to maintain the high level of service quality. The analysis of dependencies of parameters for subscribers experiencing deterioration in their service allows for a quicker identification of problems occurred and their removal. The obtained data can be exported to CSV and PDF files as diagrams and tables.

Modularity and Scalability

The use of the latest advanced data storage and processing technologies makes it possible for SmartCARE to build up customer information system by adding extra system modules and data storing hardware almost without limits.

Data accuracy

SmartCARE collects the data both from clients' devices and broadcasting servers of your system. As a result, you receive more accurate and detailed information on the quality of the digital TV services you are providing.

Quick data presentation

The data you requested is displayed in the interface very quickly regardless of the length of the time period you indicated in the filter. This is possible due to preliminary data aggregation by the SmartCARE system.

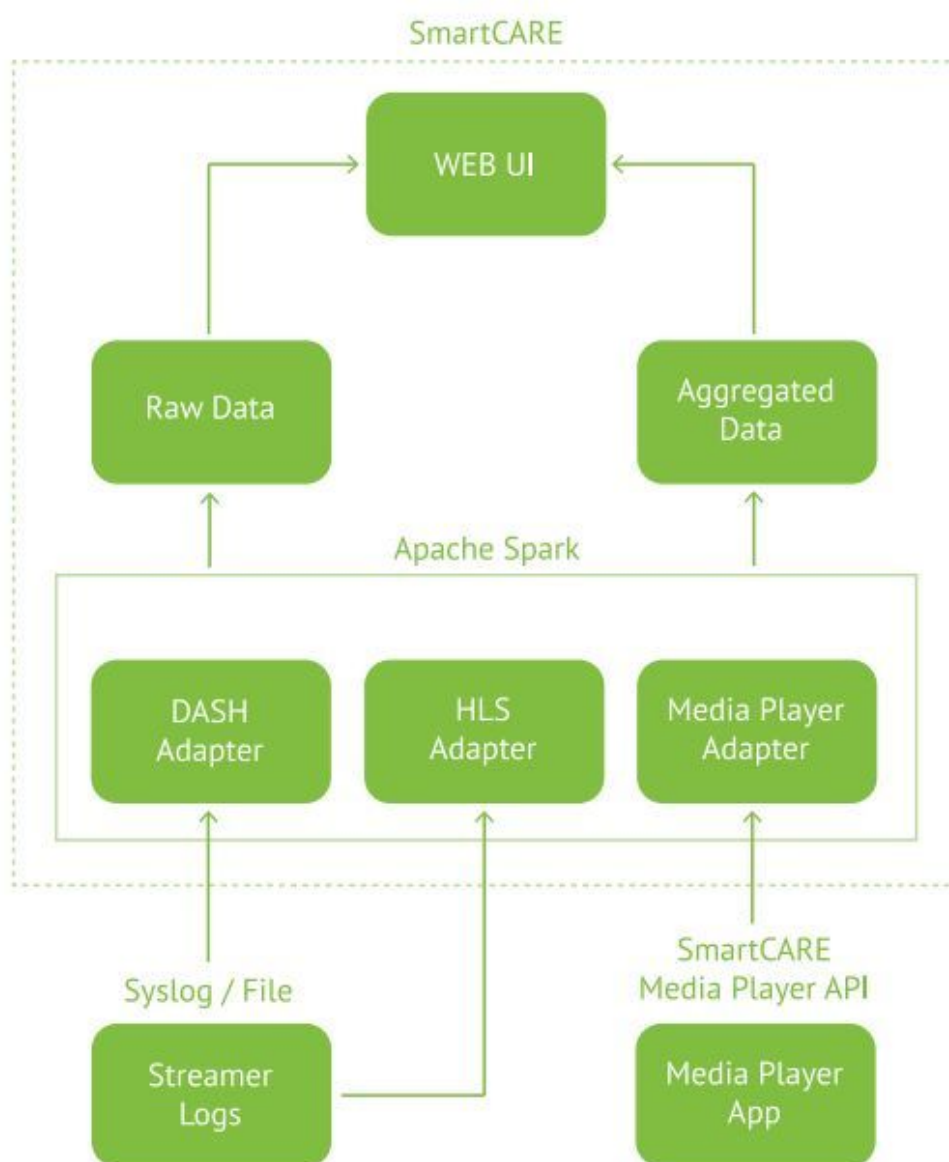
2 Full list of current functions of the SmartCARE system

- Working in IPTV / OTT networks
- Supporting smartlabs infrastructure and capable of integrating in the outside infrastructure
- Supporting most customer premises devices
- Analyzing data collected both from client applications and from servers
- Analytics, monitoring, reporting tools
- Real-time monitoring, data actuality of 1 minute
- Capability of filtering events with the accuracy up to specific subscriber
- Capability of filtering data by time interval
- Setting up time interval for data aggregation
- Monitoring the quality of HLS streaming
- Convenient graphical interface
- Includes all key metrics for quality assessment (the list of metrics is continuously expanded)
- Timely and preventive notification on changes or problems in the system with the help of mathematical algorithms used for system behavior analysis
- Capability of exporting data to CSV and PDF files as diagrams and tables
- Capability of filtering event history
- Quick data input into graphical interface
- Creating scheduled reports
- Role model of system users

3 How does it work?

SmartCARE system has a client-server architecture.

Data from clients' devices and live streaming servers is forwarded to SmartCARE server for processing. Based on the incoming data, the server controls the quality of the provided services and identifies mistakes that can cause complete image loss, its distortion, rippling or freezing.



Methods of data collection by the SmartCARE system:

- API for clients' applications.
- SmartCARE's own client implementing data submission via API from customer premises equipment.

3.1 List of metrics

The below metrics can be used for monitoring, analysis and reporting.

Monitoring client sessions

- Number of bit rate switches at clients' devices during the indicated time interval
- Maximum number of simultaneously active client sessions during the indicated time interval
- Number of switches on client devices (for example, playing different content) during the indicated time interval
- Number of mistakes of metadata downloads at clients' devices, for example mistakes of downloading playlists, during the indicated time interval
- Number of mistakes of chunks downloads at clients' devices during the indicated time interval
- Average bit rate, i.e. average rate of downloading content at customer premises devices

Monitoring live streaming servers

- Average bitrate of incoming / outgoing stream at all server's network interfaces during the indicated time interval
- Usage of server's network interfaces, i.e. average load on the interface (%) when processing incoming / outgoing traffic
- Average value of IOWait system parameter during the indicated time interval

Real time monitoring

- Session quality in the real time
- Number of sessions in the real time
- Current session bit rate
- Distributing the quality of subscribers' stream viewing by bit rate (stream quality) and the number of bit rate switches by the player (stability of stream quality)

Monitoring streams

- Stream quality at clients' devices; the percentage of time spent on content delivery at peak bit rate
- Number of actual mistakes in the incoming streams during a time interval
- Average bitrate of a TV channel stream, i.e. average number of traffic transferred over a unit of time

Statistical reports

- Rating of a TV channel based on the number of views or the time of viewing
- Number of devices receiving TV channel's stream during the indicated time interval
- Number of unique subscribers who have viewed a TV channel during the indicated time interval
- Total duration (in minutes) of viewing a TV channel during the indicated time interval

3.2 Events analyzed by SmartCARE

Events from Client Applications

- Subscriber authorization attempt (successful and failed)
- Beginning of content viewing (channel, recorded show, movie)
- "Keep alive" event during content viewing (every 2–5 minutes, configurable)
- Start, stop, rewind, pause during content viewing
- Critical low memory
- Finishing of content viewing
- Changing the bitrate during content viewing
- Delay between the request for content and the beginning of its playback
- Start and end of stream buffering
- TV programs change
- Abnormal change in the CPU and memory load
- Abnormal change in the WiFi signal level
- Switch to / from standby mode (for STB)
- Internet connection loss
- Transition to the key Client UI sections (the amount of information on these events depends on the set detailization level of analyzing user's activity). For example:
 - main menu,
 - transition to the detailed channel info form (specifying the transfer point: from the channel list, recommendations, etc.),
 - transition to the detailed movie info form,
 - transition to the full screen viewing mode,
 - transition to the service management section,
 - transition to the settings section, etc.

Analyzing the Streaming Servers' Logs

- Starting a stream playback
- Switching to another stream
- Bitrate switching (video / audio quality changing)
- Playlist uploading error
- Chunks uploading error

Analyzing the Incoming Stream Recording Servers' Logs

- Incoming streams recording errors

3.3 Parameters Sent Within Events and from External Systems

Parameters within the Client Application Events

- Content ID (channel, program, movie, local file, external VoD content)
- URL of the external VoD content (YouTube, MEGOGO, etc.)
- Type of content viewed (Live, nDVR, VoD)
- Number of frames with playback and decoding errors
- Event type and its time on the client application
- Frame rate
- Number of frames played
- Number of RAM page access errors
- Number of load buffer underrun events
- Content view start/end time
- Join time (the time between the content request and the content begins to play)
- Duration of the stream buffering
- Rewind start time, duration and direction (backward / forward) — for TSTV-programs
- Time of TV program change
- Stream bitrate
- Content viewing mode (online / offline)
- Result of content launching (successful or failed)
- Device ID (UID)
- Subscriber ID (SmartTUBE SDP account number)
- Device type (STB, iPad, Android, etc.)
- IP address of the subscriber device
- Version of the client application
- Geo ID received during the authorization (region ID in the middleware dictionary or from the geolocation system)
- Load buffer filling level
- Wi-Fi signal strength (for STB with Wi-Fi module)
- CPU and memory usage (for STB)
- Duration of Internet connection absence
- Custom fields (up to 10, for optional parameters transmitting)

Parameters within the Streaming Servers' Logs Events

- Content ID
- URL of the content requested (playlist /chunk)
- Content request result (error or success)
- Amount of information sent to the client application
- Time the event was logged
- Stream bitrate
- Device ID (UID) — if it was sent in the HTTP request
- Subscriber ID (SmartTUBE SDP account number) — if it was sent in the HTTP request
- Full text of the client application User Agent string. Includes the following parameters:
 - version of the client application,
 - type of the subscriber device.
 - IP address of the subscriber device

Parameters within the Recording Servers' Logs Events

- Hostname of the incoming streams recording server
- Recorded channel
- Recording error sign
- Full text of the log entry
- Bitrate of the recorded channels

Parameters from Zabbix Agents

- Average CPU IOWait of the monitored server (streaming, recording, storage, etc.)
- Incoming / outgoing bitrate of the monitored server network interfaces
- Inbound / outbound utilization of monitored server network interfaces

Parameters From Border Routers

- Autonomous system IDs on the network section between the streaming server and the subscriber device
- Data route change time

Parameters from OSS/BSS Systems

- Subscriber ID in OSS / BSS
- Subscriber connection address
- Subscriber device type

4 Supported client devices

SmartCARE can analyze data received from:

Devices with installed SmartTUBE UI application

- STB
- Android / iOS smartphones and tablets
- SmartTV
- PC / MAC

Other devices

Any third-party STBs or applications that send data with SmartCARE API.

5 SmartCARE user interface

SmartCARE user interface is a dashboard that makes it possible to:

- View detailed statistics by subscribers, detalizing up to the end user or group of users for any time period - from one minute to several months.



- Receive notifications about problems reducing the service quality, with the information on problem scale and consequences.



- Set up personal interface for monitoring service quality - collect the necessary set of diagrams and reports on a single page and preserve the established filters and dates.



- Export data to CSV and PDF files as diagrams and tables.
- Apply a role model to distinguish SmartCARE users' access to data.

6 Technology Used


- *Programming language:* Java, JavaScript/HTML.
- *Third-party components, frameworks, etc.:* PostgreSQL, MongoDB.

7 Roadmap

We are in active process of development of our product in accordance with the needs of our customers. We are constantly expanding the range of collected data and the functionality of our solution and adding new data-handling tools allowing you to customize SmartCARE for your needs.

Scheduled improvements:

Improvement	Description
Cloud service	We plan to deploy our solution into a cloud service and provide access to data from the Internet. All you have to do is add call-in of necessary methods using our API.
Extended notification system	Setting up notification sending - for example, messages on changes or problems in the system (alerts) - not only by email but also by text messages and Zabbix. Setting up notification sending on any combination of analyzed metrics and filters. For example, you can set up sending a notification when the average bitrate of devices of a certain type (STB, iPad, Android) is below the average value by more than 5 minutes or the number of simultaneous sessions has reached 1,000.
New valuations from customers' equipment	Join time - information on the interval of time from the subscriber's request to view content (by pressing Play button) to the beginning of playing the stream in client's application player. Etc.
DASH	Supporting the analysis of quality of content delivery by DASH protocol.
Scheduled reports	Setting up sending any reports for the indicated time interval by customizable schedule. For example, sending weekly reports on the quality of provided services.



New technologies	Support for monitoring the quality of broadcasts VR и 360°.
Improvements in system for identifying accident situations	Using machine learning algorithms for identifying accident service conditions.