



SmartCARE

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

### > 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.



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.

#### **> 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.

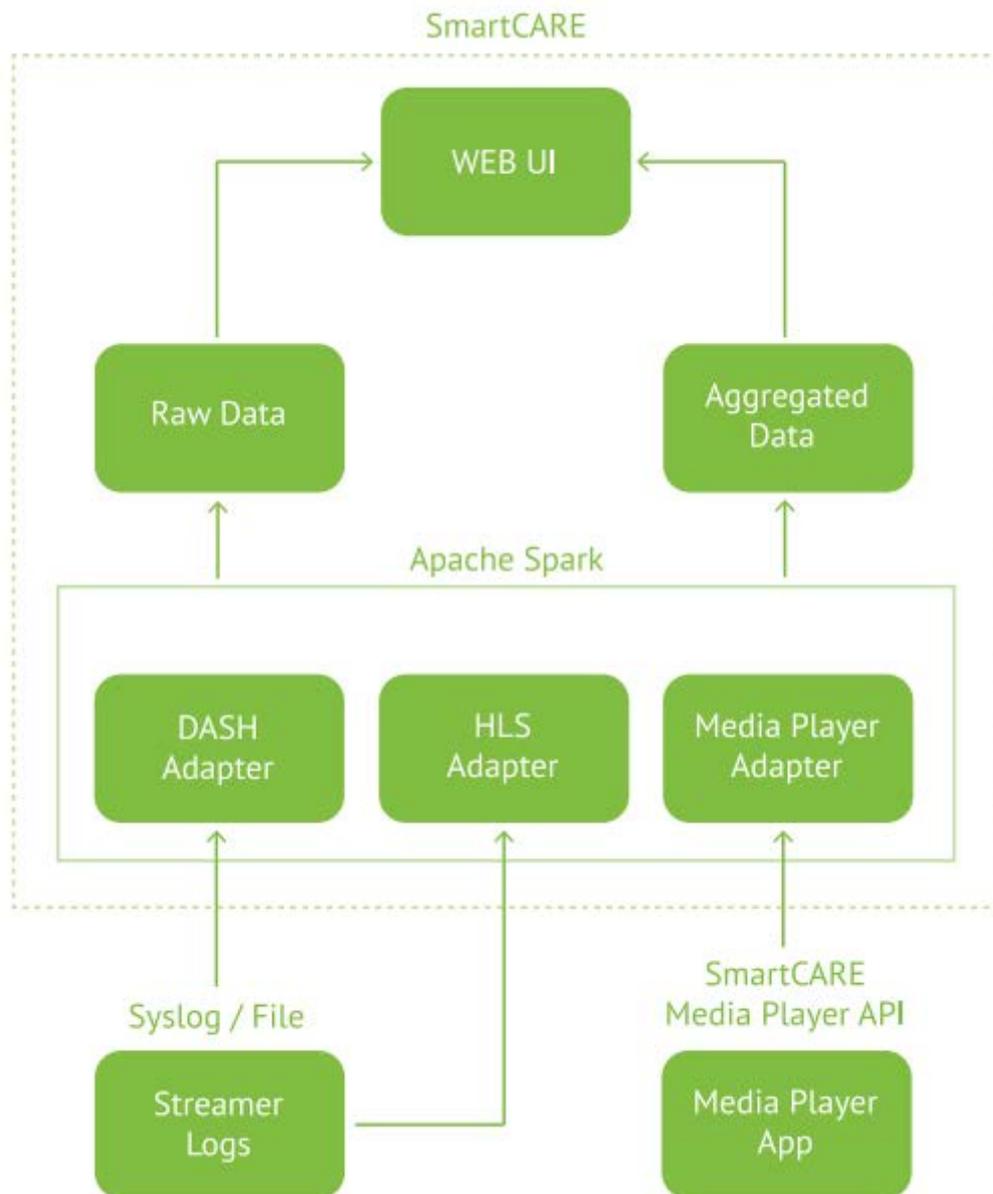
## 2 Full list of current functions of the SmartCARE system

- ▶ 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 play lists, 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 bit rate 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 bit rate 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 received by SmartCARE for analysis

Events from clients' applications	Analyzing the journals of streaming servers
<ul style="list-style-type: none"><li>▶ Launching an application (authorization)</li><li>▶ Beginning to watch content (a channel, a recorded show, a film)</li><li>▶ keep alive content viewing (every 2 - 5 minutes, set up)</li><li>▶ Pause during content viewing</li><li>▶ Finishing content viewing</li><li>▶ Changing bit rate during content viewing</li><li>▶ Mistake of playlist parsing</li><li>▶ Mistake of chunks downloading</li><li>▶ Incoming buffer underflow</li><li>▶ Going in / out of stand-by mode (for STB)</li><li>▶ Going to key interface sections (the amount of information on these events depends on the established detalization level of analyzing user's activity). For example:<ul style="list-style-type: none"><li>○ main menu</li><li>○ going to the form with detailed information on the channel (specifying the transfer point - from the list of channels, by a recommendation, etc.)</li><li>○ going to the form with detailed information on the film</li><li>○ going to the full screen viewing mode</li><li>○ going to the service management section</li><li>○ going to the settings section, etc.</li></ul></li></ul>	<ul style="list-style-type: none"><li>▶ Starting to play</li><li>▶ Switching to a different stream</li><li>▶ Switching bit rate (changing the quality)</li><li>▶ Mistakes of playlist downloading</li><li>▶ Mistakes of chunks downloading</li></ul>

### 3.3 Parameters that are reported within the events and can be used as filters when analyzing metrics

Parameters within the events from clients' applications	Parameters within the events from the journals of streaming servers
<ul style="list-style-type: none"> <li>▶ Content (channel, show, film) identifier</li> <li>▶ Content name</li> <li>▶ URL of played content</li> <li>▶ Type of viewed content (live, timeshift, vod)</li> <li>▶ Type of event (start, keep alive, pause, bitrate switch, stop)</li> <li>▶ Time of event occurrence at client's application</li> <li>▶ Time on the client's application</li> <li>▶ Join time (time from the moment the application requested a stream to the moment it started playing)</li> <li>▶ Time shift of the requested stream from live streaming (for TSTV shows)</li> <li>▶ Bit rate of content playing</li> <li>▶ Total number of downloaded / viewed chunks over an interval</li> <li>▶ Average time of chunk downloading</li> <li>▶ Number of mistakes during chunks downloading</li> <li>▶ Device identifier (mac, uid)</li> <li>▶ Subscriber identifier (account number)</li> <li>▶ Type of device (STB, iPad, Android, etc.)</li> <li>▶ IP address of the device</li> <li>▶ Version number of the client's application (makes it possible to determine if the reduced service quality is caused by network problems or by application upgrade)</li> <li>▶ Version number of the device's OS</li> <li>▶ Geo identifier received during the authorization (region ID in MW or from the geo locating system)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Content identifier</li> <li>▶ URL of played content</li> <li>▶ Type of viewed content (live, timeshift, vod)</li> <li>▶ Time of event occurrence at client's application</li> <li>▶ Time shift of the requested stream from live streaming (for TSTV shows)</li> <li>▶ Bit rate of content playing</li> <li>▶ Total number of downloaded / viewed chunks over an interval</li> <li>▶ Average time of chunk downloading</li> <li>▶ Number of mistakes during chunks downloading</li> <li>▶ Device identifier (mac, uid) - in case it is sent in an HTTP request</li> <li>▶ Subscriber identifier (account number) - in case it is sent in an HTTP request</li> <li>▶ User Agent</li> <li>▶ IP address of the device</li> </ul>

- ▶ Application operation uptime
- ▶ Wi-Fi signal level (for STBs with a Wi-Fi module)
- ▶ Maximum CPU load during the indicated period (for STBs)
- ▶ Custom fields (up to 10; for transmitting optional parameters)

## 4 Supported clients' devices

SmartCARE can analyze data received from:

### > Devices with installed SmartTUBE UI application

- ▶ STB
- ▶ Android / iOS smart phones 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 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 bit rate 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.