

BeyondTest IPTV – An Introduction

The Endpoint Quality Measurement Solution in IPTV Network

NEXTLab, 2019

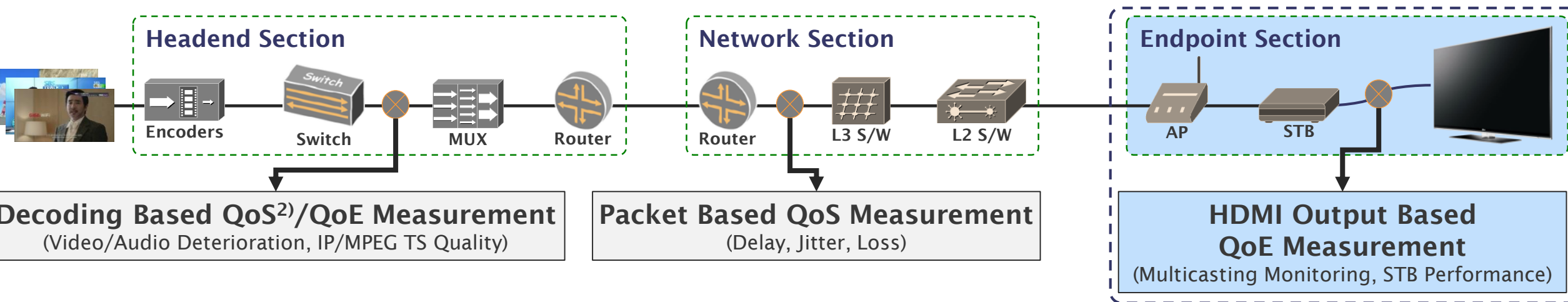


- **Overview & Advantages**
- **Features**
 - Broadcasting Monitoring
 - STB Performance Testing
 - STB Function Testing (Test Case based)
- **Case Study**
- **Capable Applications**
 - 24/7 Broadcasting Monitoring
 - STB Verification Center
- **Appendix. Company Profile**



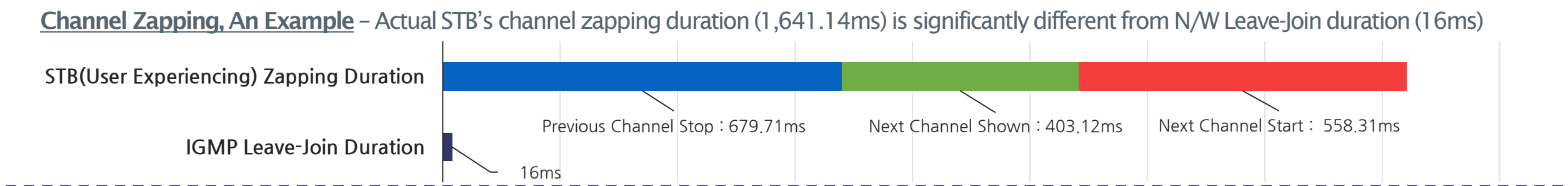
Overview - IPTV Endpoint Measurement

BeyondTest IPTV is an Endpoint Section's Quality Measurement Solution
“HDMI Output based QoE¹⁾ Measurement” is the Key Feature which Enables Measuring End-User's experience



The Needs for Endpoint Quality Control

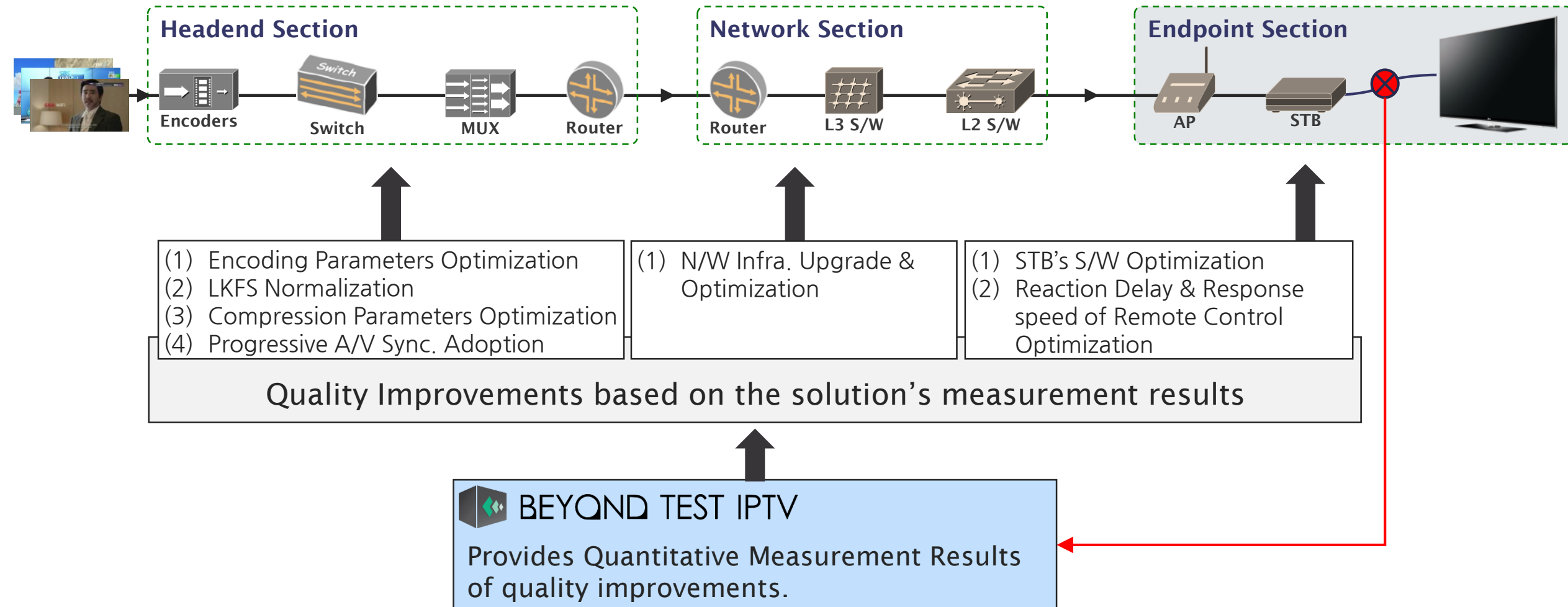
- ✓ The actual quality of the end user experience can not be measured only by Headend or Network sections
- ✓ As the IPTV service requires more resolution, bandwidth and compression rate, the sensitivity of QoE deterioration has increased



Advantages

BeyondTest IPTV acts as a feedback circuit in the IPTV network

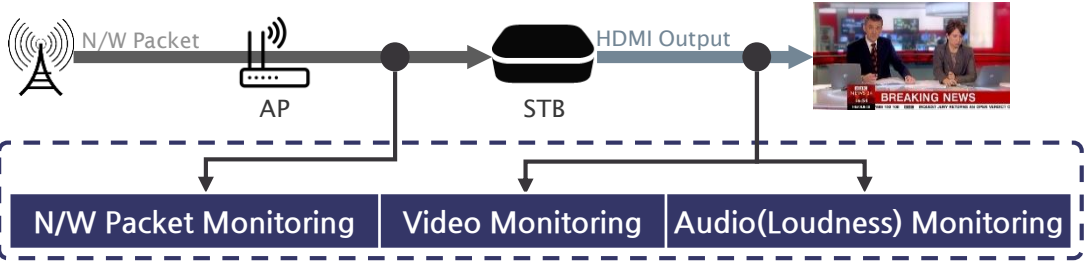
It can verify the results of the whole network and STB's quality improvement at the end-user's point of view



Features – Broadcasting Monitoring

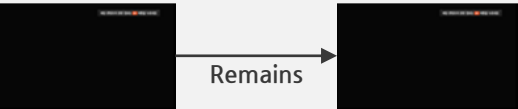
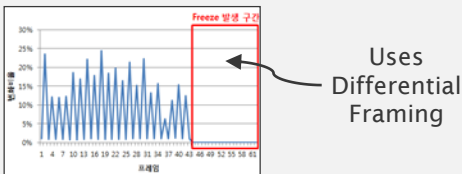

Real-time QoE and QoS simultaneous monitoring is available

(1) Workflow



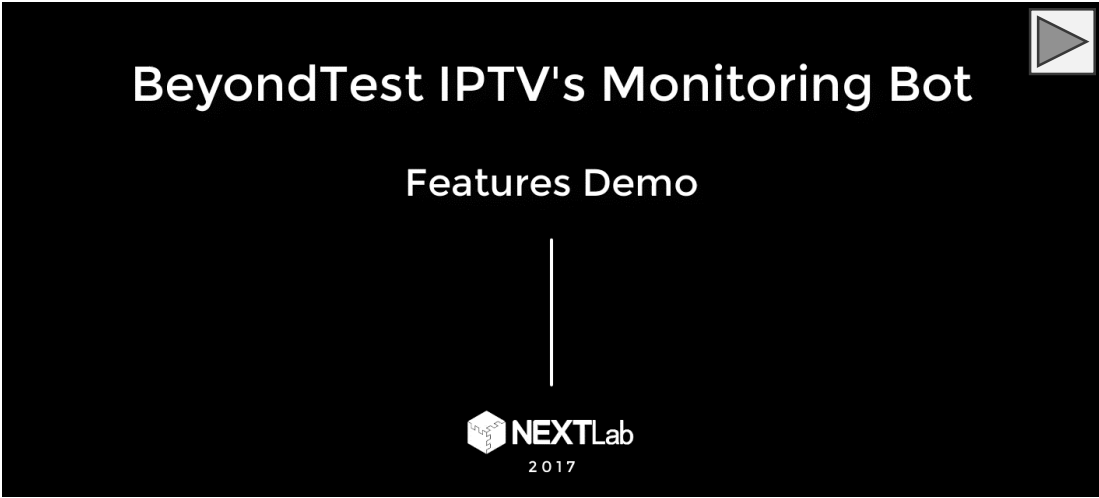
(2) Monitoring Criteria

QoE

Video Quality			Audio Quality	
Black Screen	Freeze	Macro Block	Loudness	Silence
Raises when whole screen remains black [for more than N ms (milli-seconds)]	Raises when screen keeps output same frame [for more than N ms (milli-seconds)]	Raises when Macro blocks occurred for more than N% of the screen area	Continuously Measures Loudness in LKFS ¹⁾ unit (ITU-R BS.1770 Compatible)	Raises when audio remains mute [for more than N ms]
				

QoS

Media Delivery Index (MDI)	
Media Loss Rate (MLR)	Delay Factor (DL)
Detects damaged packets from MPEG2TS	Detects Jitter from streaming packets



Demonstration Videoclip

Broadcasting Monitoring – Necessities for monitoring both QoE & QoS

The video may be broken even if the packet is normal, due to poor encoding

The poor encoding may be caused by

- The Head-end
- The contents itself which already created in low-quality

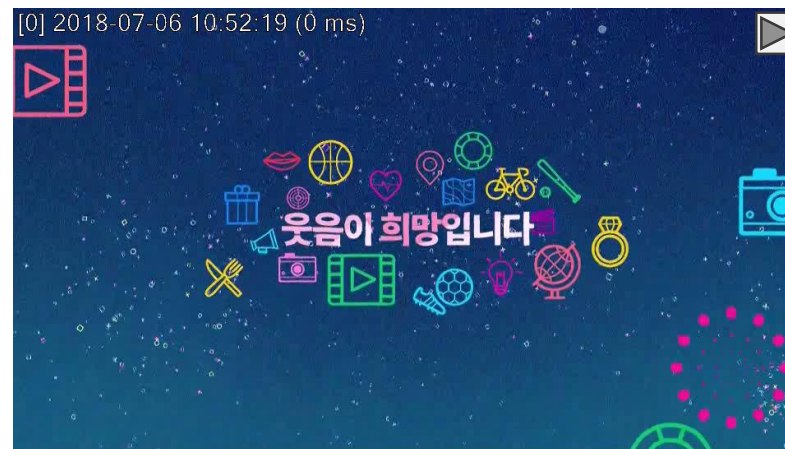
Common Macro-Block Cases

- MPEG2TS packets are damaged



Special Macro-Block Cases

- Although the packets are normal, Macro-Block may occur due to other reasons



(1) Head-end Encoding Issue

- The content is wrongly encoded at the Head-end



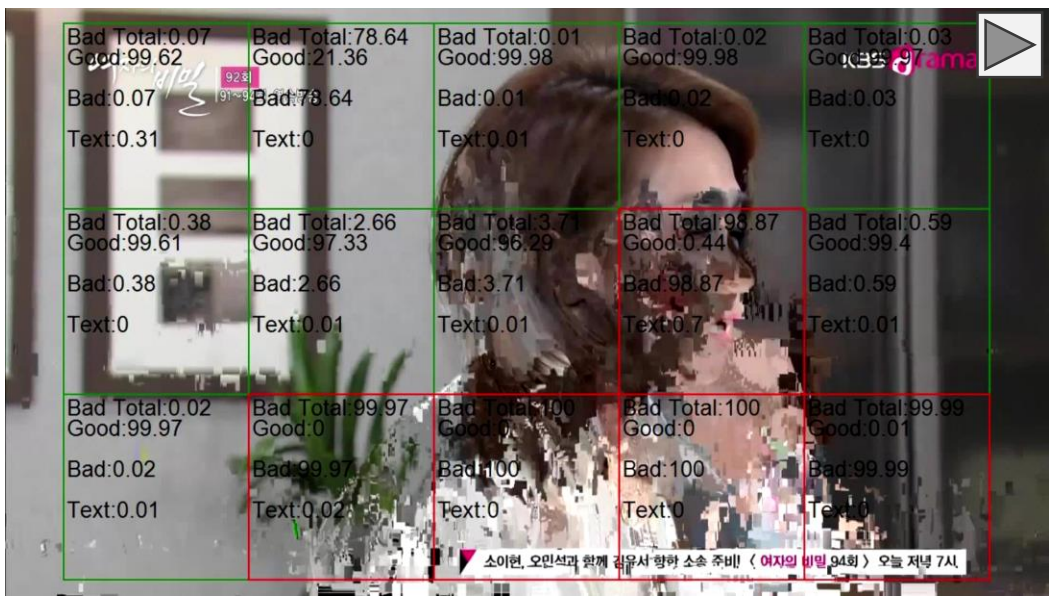
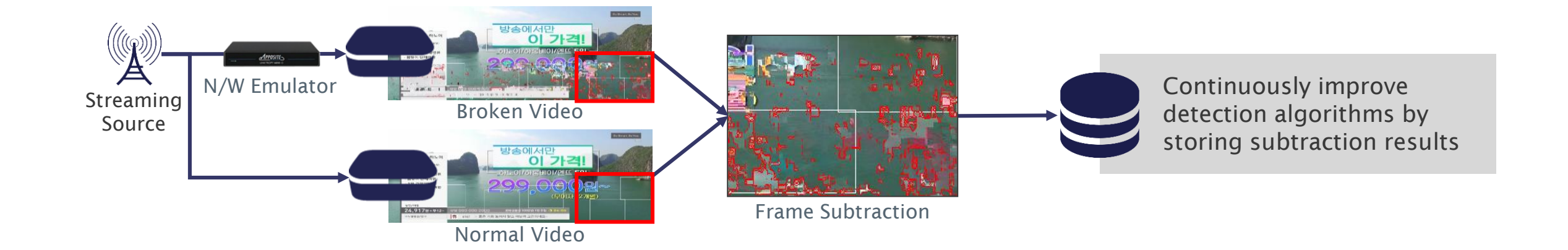
(2) Contents Quality Issue

- The content(vehicle black box's videoclip) is already created in low-quality

Broadcasting Monitoring – Deep-Learning based Monitoring

NEXTLab adopted deep-learning based monitoring technology for continuous detection improvement

Deep-Learning based Macro Block Detection Technology¹⁾



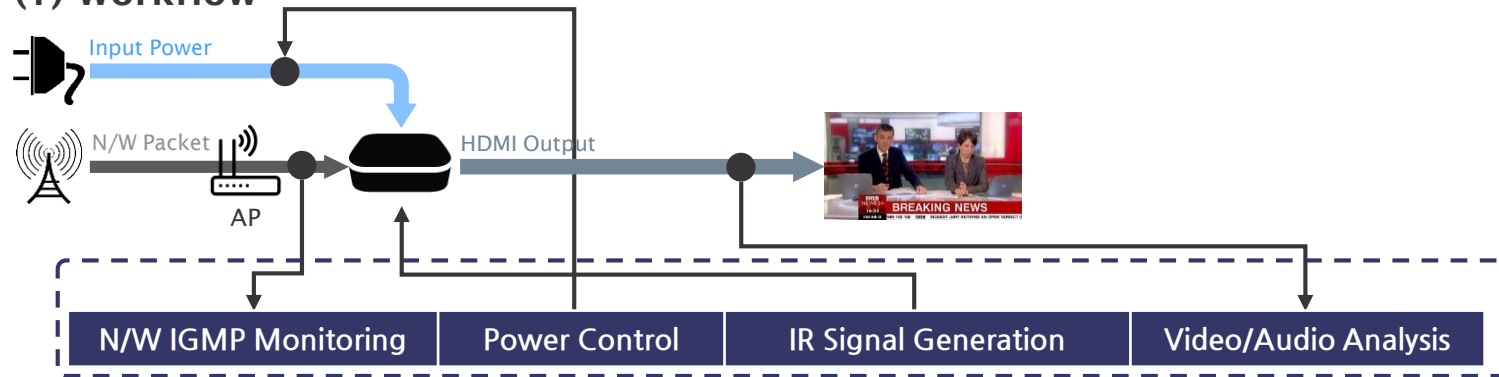
1) “Method and apparatus for detecting screen broken from real time video streaming” : Korean Patent Registered(10-1849092) & PCT Pending NEXTLab

Features - STB Performance Testing

Quantitative Measurement of STB's performance is available

Co-developed with SK Telecom between 2015~2016

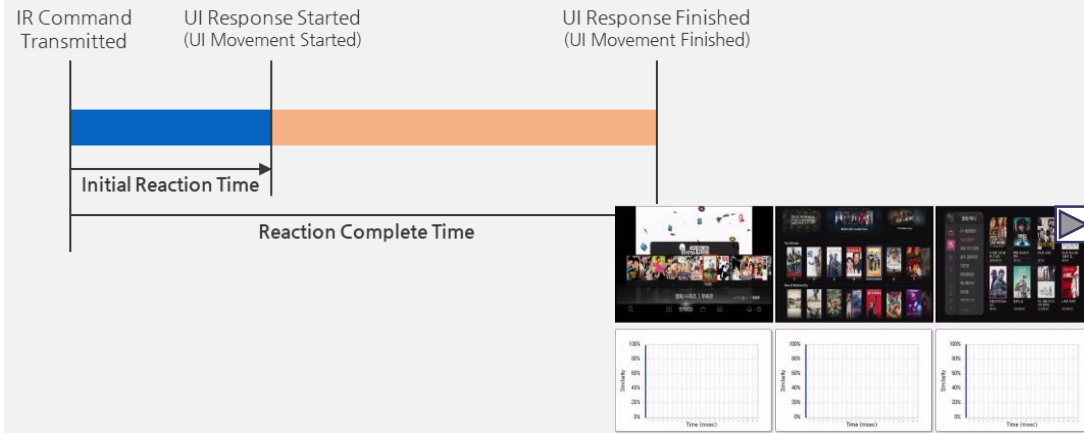
(1) Workflow



(2) Testing Criteria

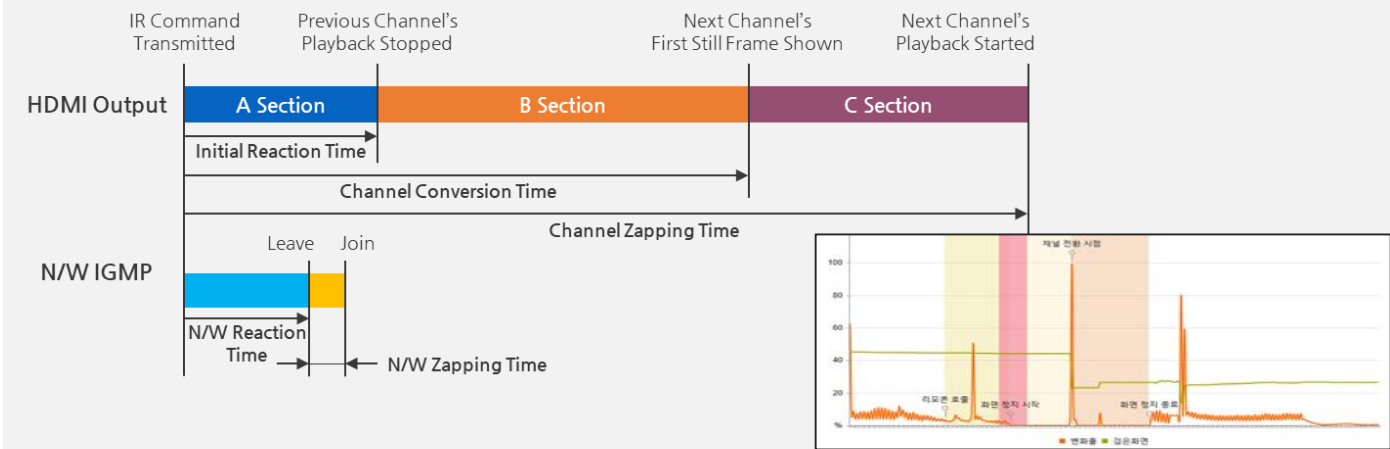
Reaction Delay

Measures the UI response from the entire screen or ROI area to the IR command



Channel Zapping

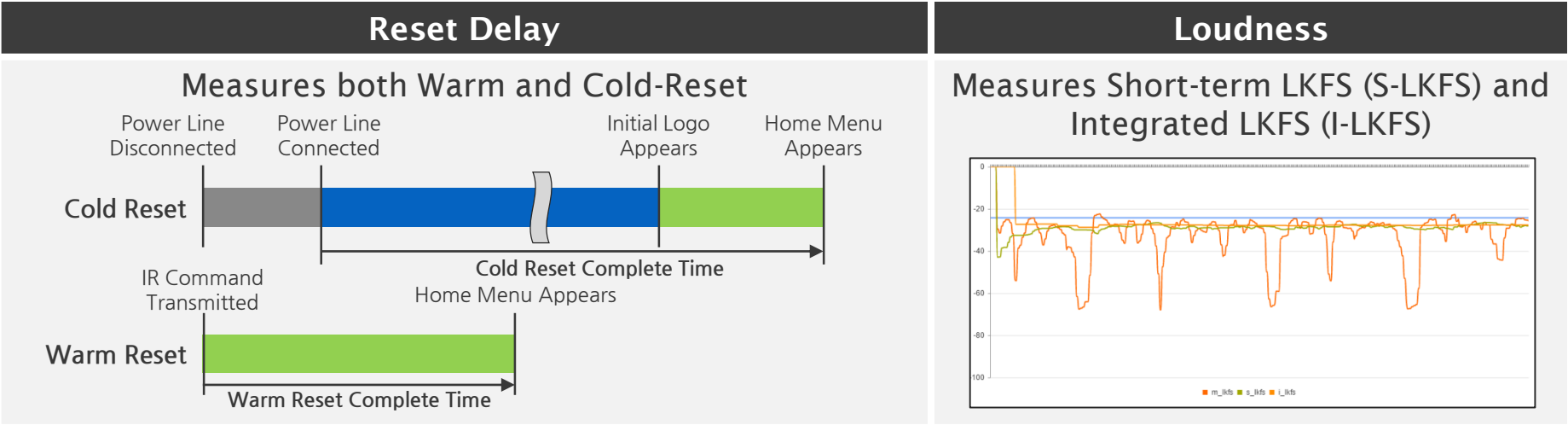
Measures Channel change delay



Features - STB Performance Testing (Cont'd)

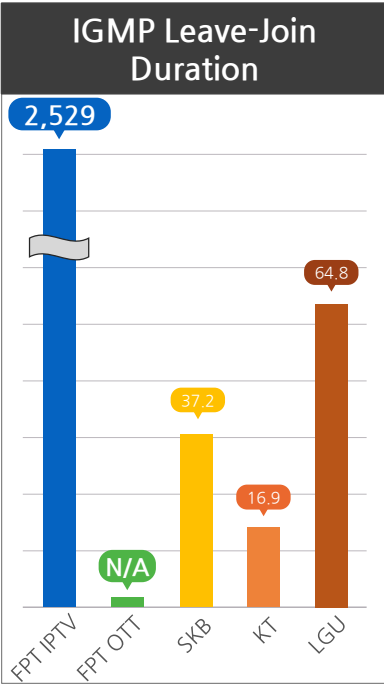
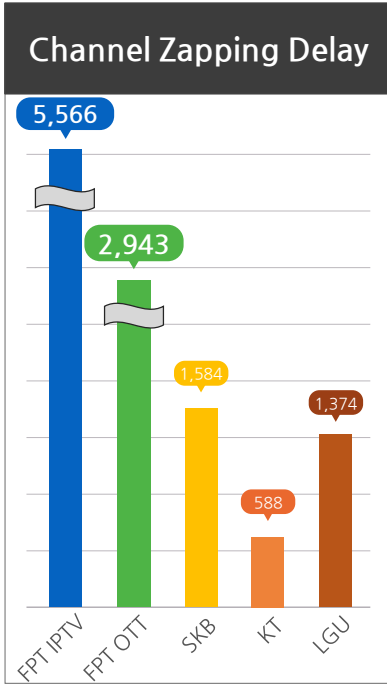
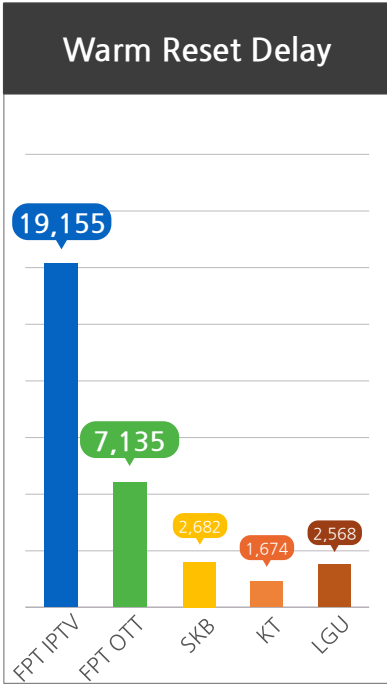
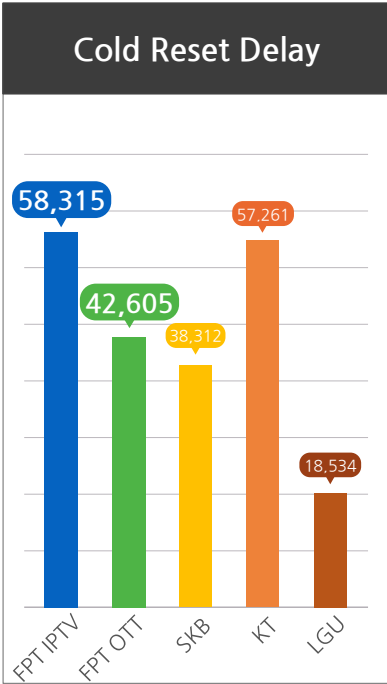
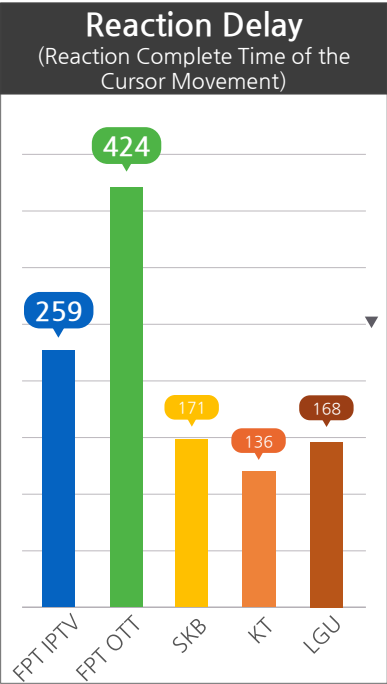
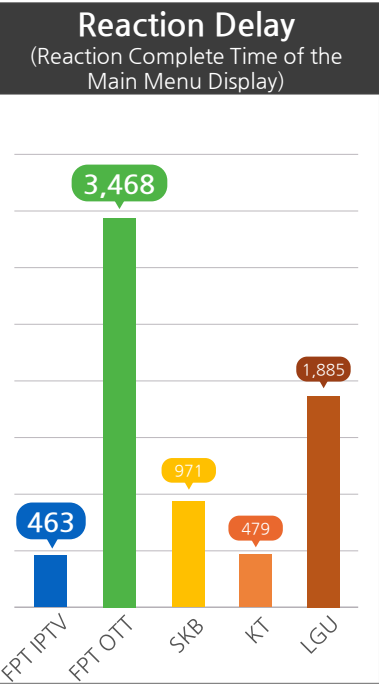
Quantitative Measurement of STB's performance is available

(2) Testing Criteria (Cont'd)



1) LKFS : Loudness, K-weighted, relative to full scale

STB Performance Testing – Measurement Comparison Samples



[Units : ms (milli-second)]

Features - STB Function Testing (Test Case based)

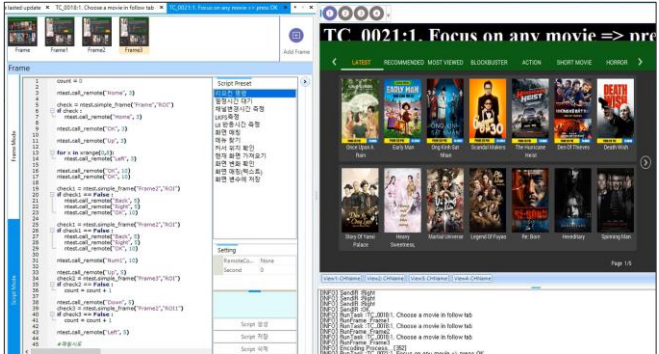
Available to test STB's functions with script based test cases

(1) Workflow

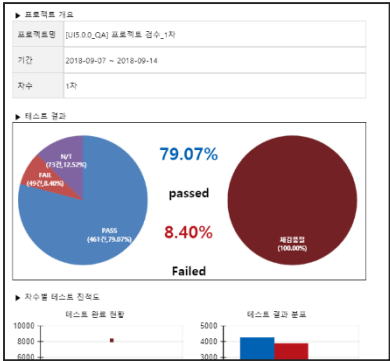
TC #	Description Test Case	Steps to Perform	Expected Result
TC_001	Go to Movie app	1. In Hot Movies/ Fmv/ Events/ Television/ Sports/ KaraTV/ Music/ Account/ Fado/ VnExpress/ Youtube/ FShare/ Istream/ Mail Box/ USB/ Money TV/ Bigschool/ Games screen 2. Press HOME => choose Movies app	2. - Show Movies Home screen - include all Tabs above, all movies poster below, focus on first movies of Latest Tab
TC_002	Operations in Movies home	1. Open Movies app 2. Press LEFT/ RIGHT/ UP/ DOWN key 3. Choose any Tab => Press OK 4. Choose any movie => Press OK	1. Focus on first Movie 2. Move left/ right/ up/ down in movies list 3. Focus on chosen Tab 4. Show detail screen of chosen Movie
TC_003	Moving in movie home screen	1. In movie home screen 2. Press 1,2,3...key on remote	2. - Move to chosen page - If the page does not exist, screen show notify page does not exist
TC_004		1. In movies home screen, focus on any movie 2. Press CH+ key 3. Press CH- key	2. Move to next Page. In last page, press CH+ effect 3. Move to previous Page. In first page, press CH- not effect

```
1 ntest.call_remote("Home", 3)
2
3 check = ntest.simple_frame("Frame", "ROI")
4 if check :
5     ntest.call_remote("Home", 3)
6
7 ntest.call_remote("OK", 3)
8
9 ntest.call_remote("OK", 10)
10
11 #매칭시도
12 ntest.check_frame("Frame1","ROI")
13 ntest.sleep(3)
14
15 ntest.call_remote("Back", 5)
16 ntest.call_remote("Left", 3)
```

Convert Hand-written Test Cases into script



Execute tests through BEYOND TEST IPTV
(Repeatable testing is possible)



Check the results

(2) Application examples

Contents Purchase Verify

Test Case

Navigate to the target page using IR Generation & Image Matching

Purchase & Playback check

Output results

Pass : if the purchased content has played normally

Fail : if the purchase is failed or the content has not played

Contents Follow Verify

Navigate to the target content

Enable 'Follow' button

Navigate to 'MY' menu

Check if the following content is shown

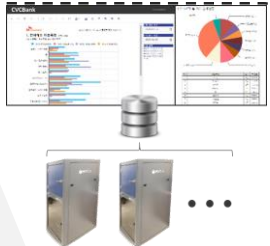



Output results

Pass : if the followed content is shown in 'Following' list

Fail : if the followed content is not shown

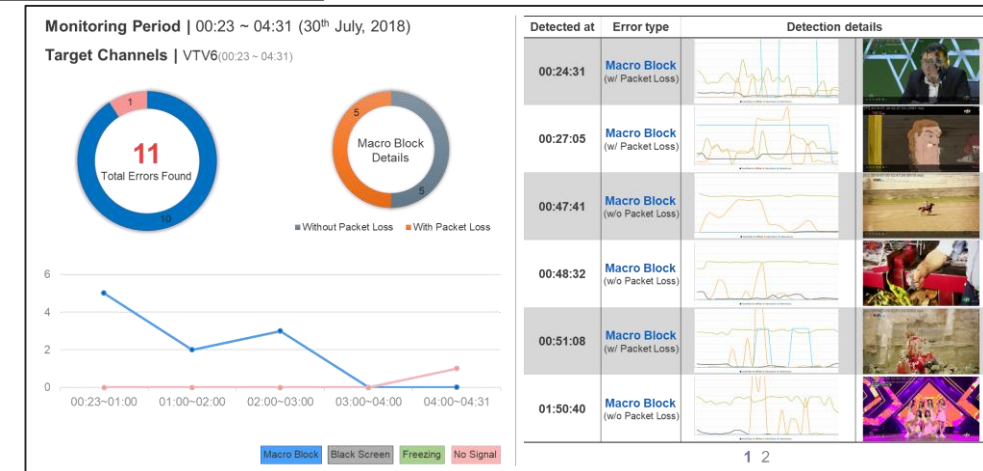
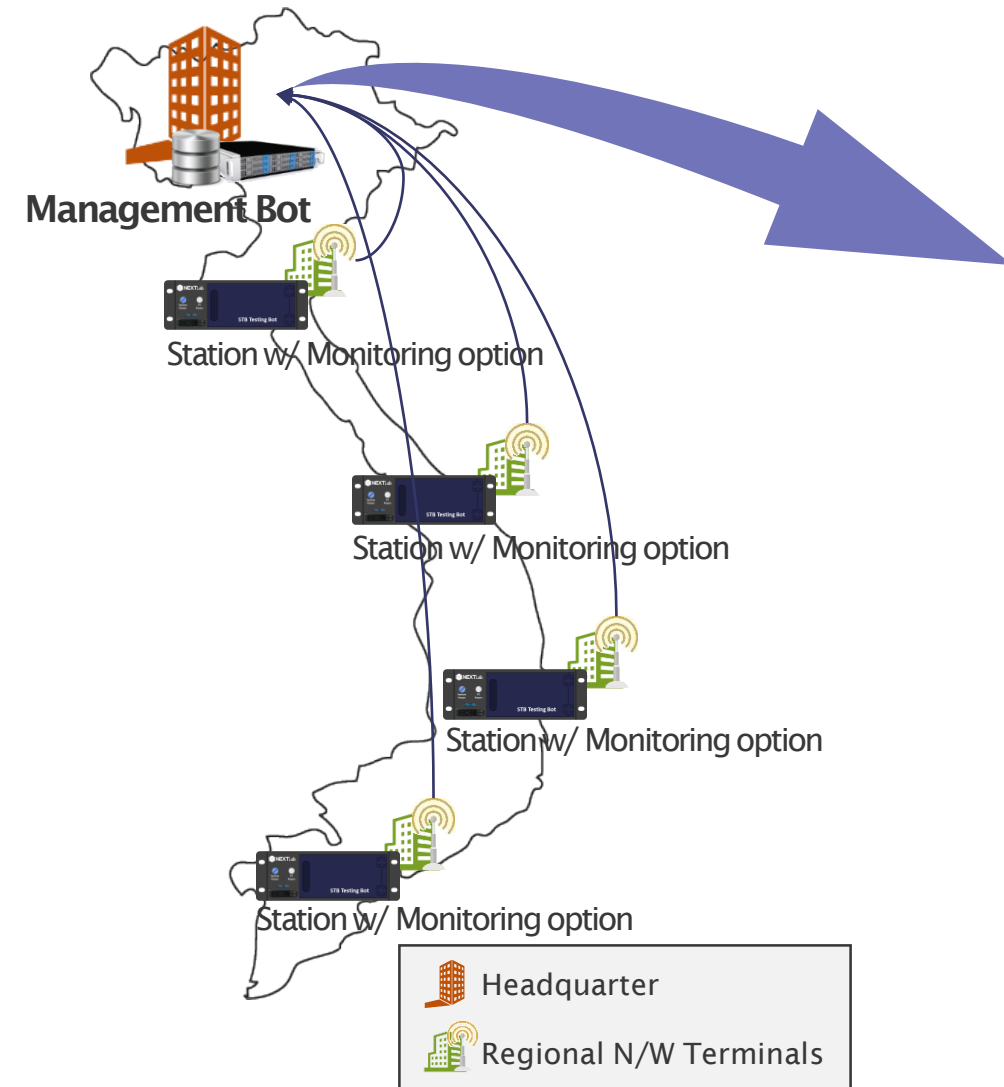
Case Study – SK Broadband in Korea

NEXTLab has been providing BeyondTest IPTV to SK Broadband since 2014
The Solution's Quantitative Measurement helped SK Broadband to improve service quality and STB performance

Customer Benefits Earned	Customer Needs	NEXTLab's Solution
<div>Life Cycle Management at Every STB Development Process</div> <div>2018</div>	<div>- Manage measurement history during STB development and upgrade process</div>	<div>- Upload every STB UI's QoE test results</div> <div>- Track issue processing status regarding test result</div> <div></div>
<div>Optimized Servers & Network by Region</div> <div>Verified QoE Change Correlation with Servers & Network Load</div> <div>2017</div>	<div>- New cloud-based STB UI has leaded quality deviation by region and time</div> <div>- Improve cloud-based UI quality</div>	<div>- 24/7 Iterative STB UI's QoE testing by region</div> <div>- Upload results to server</div> <div></div>
<div>Improved STB Performance by Analyzing the Weaknesses against Competitors</div> <div>2016</div>	<div>- Usability became major differentiation factor</div> <div>- Improve STB's reaction quality</div>	<div>- Quantitative measurement of STB UI's QoE</div> <div></div>
<div>Optimized Headend & Network (Video Monitoring)</div> <div>Met Gov't Loudness Regulation (Audio Monitoring)</div> <div>2014</div>	<div>- Improve channel streaming quality</div> <div>- Compliance Loudness Level</div>	<div>- Every Channel's real-time video & audio monitoring nationwide</div> <div>- 24/7 unmanned monitoring</div> <div></div>

Capable Applications – 24/7 Broadcasting Monitoring

- 24/7 Nationwide IPTV Broadcasting monitoring is available
- Monitoring status can be checked at once on the website of the 'Management Bot'



Checking monitoring status & Getting report from the Management Bot's website

Capable Applications – Integrated STB QA Platform

- Collecting test results and performing issue tracking are available
- You can compare test results or get Insights through the automated reporting

Stations



STB Function Testing
STB Performance Testing



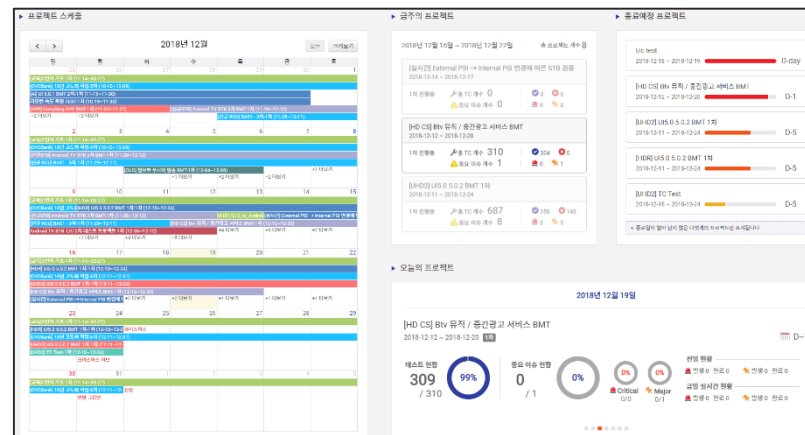
Remote Controller Testing

Upload
Test
Results

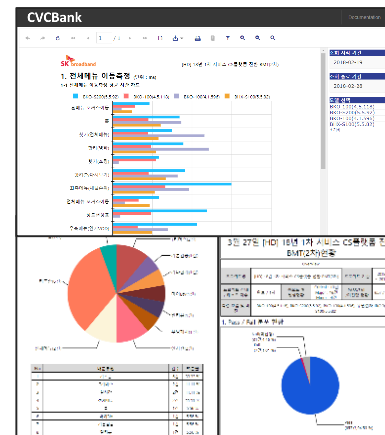
Control
Stations



Web-based QA Management Server



Dashboard



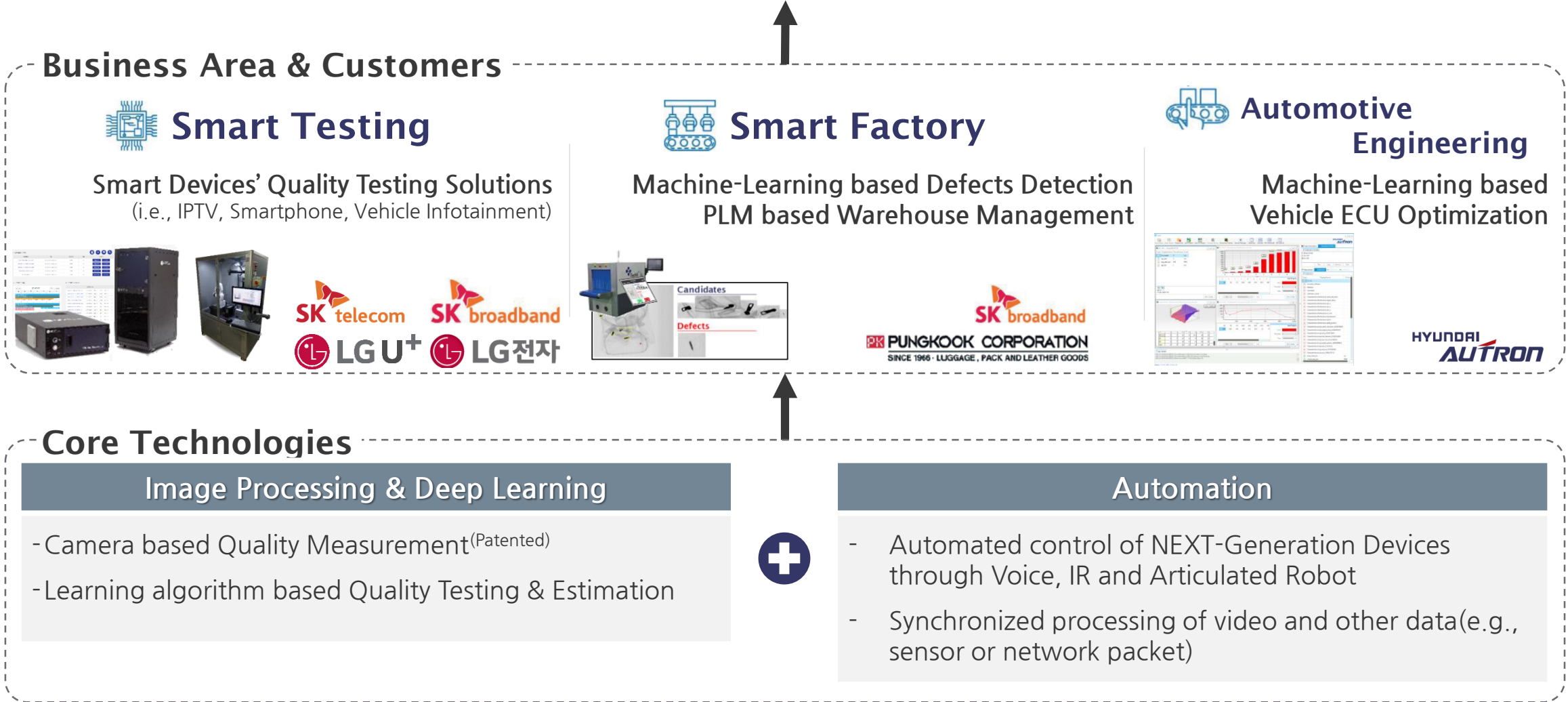
BI based Statistical
Analysis Report



STB S/W's Quality Index
Tracking

Appendix. Company Profile

Providing Automated Products & Services for Customers to Focus the Core



Appendix. Delivery History

Year	Customer	Delivery Type	Quantity
2018	SK Broadband	(1) STB QA Platform (Management Server's Features Improvement) (2) AI STB (Smart Speaker) Testing Station	- 2 Stations (AI STB Testing Duo Type) - 1 Improvement Development
	SK Planet	(1) STB QA Platform (2) STB Testing Station (w/ STB Performance Testing)	- 3 Stations (Quad Type) - 1 Management Server
	LGU+	(1) STB Testing Station (w/ STB Performance Testing + Broadcasting Monitoring)	- 1 Station (Quad Type)
2017	SK Broadband	(1) STB QA Platform (2) STB Testing Station (w/ STB Performance Testing)	- 3 Stations (Quad Type) - 1 Management Server
	SK Broadband	(1) STB Testing Station (w/ STB Performance Testing)	- 12 Stations (Single Type)
2016	LGU+	(1) STB Testing Station (w/ Broadcasting Monitoring)	- 2 (S/W Installed PC Type)
2015	SK Telecom	(1) Co-Develop with SK Telecom (STB Automated Testing Technology)	Joint R&D
2014	SK Broadband	(1) Broadcasting Monitoring	- 50 (S/W Installed PC Type)

INNOVATION WITH NEXTLab



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