alticast

WINDMILL™

CLOUD SERVICE PLATFORM

STRATEGIC WHITE PAPER

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Rapid increase of the internet speed and the popularization of smart devices, which have grown explosively, are bringing a fundamental change to the media market. In terms of competition, the range of the competition has been expanded to all business operators who provide media service through smart devices from the existing PayTV operators, and service is being diversified from existing linear TV into smart TV, cloud-based, and multi-screen services.

Due to this environmental change, PayTV operators are facing a severe reduction of subscribers and the increase of contents cost. Under this structure of profit reduction and gradual increase of costs, PayTV operators must secure service competitiveness. To realize this, the introduction of smart TV service platform is becoming a core strategy to all business operators.

The requirements of each operator for this smart TV service platform are different and varied depending on their environment and strategy. However, the important elements considered when smart TV service platform is introduced are the Variety, Speed, Cost and the Expandability of service.

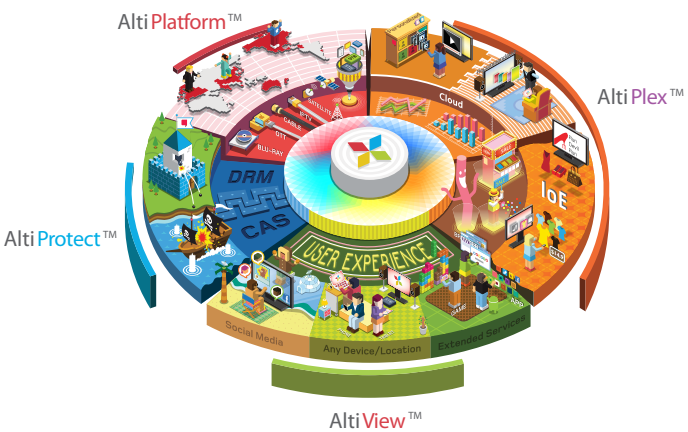
Alticast's Windmill Smart Platform is designed and developed to satisfy such a requirement from PayTV operators toward smart service platform. Windmill Smart Platform is one of the most innovative and evolved software solution-based smart service platforms available. It is composed of packages of individual modularized solutions, so diverse services can be provided effectively and economically without any hardware dependencies.

Windmill Smart Platform is an End-to-End solution for the creation of a state of the art PayTV smart platform. It consists of four parts; :

- AltiView™, UI/UX for STBs and Multi-Screen Devices
- AltiPlex™, a cloud server solution that processes SDP, Cloud DVR, Cloud UI, Big Data Analysis and Smart Search/Recommendation functions at a PayTV operator's back-office
- AltiPlatform™, a Middleware solution
- AltiProtect™, a security solution that provides the distribution, security, and billing functions for TV Everywhere service provision

Not only can Windmill Smart Platform provide all functions and services necessary for the currently existing PayTV smart platforms, it can also be used for Home Automation and TPS(Triple Play Service) fusion next-generation services. Windmill Smart Platform is designed around a cloud-client structure that can be flexibly applied according to the operators business and technical requirements. The Windmill Smart Platform can be deployed in a short period of time and at a minimum cost.

Alticast's experience in commercializing software solutions for clouds and clients is a definite advantage to providing quick economical deployment of smart services.



Main contributions of Windmill Smart Platform for the PayTV operators are;

- Saving Money

- PayTV operators can deploy without the related problems of introducing solutions one by one
- Existing legacy environments are reused through pre-integration with client devices, CAS, and back-office systems

- Saving Time

- Designed in an open architecture-based structure, combining the experience of integration of diverse solutions and newest software technology, Windmill Smart Platform can be rapidly integrated with any systems
- Windmill Smart Platform products provide end-to-end services including development of UI/UX, Applications and Platform construction. In addition Alticast supplies STB migration and Quality Assurance so that project implementation schedules can be shortened dramatically

- Increasing Quality

- Windmill Smart Platform is an open source-based smart service platform that supports not only existing global standard software platforms, but also HTML5 and RDK, leading next-generation broadcasting software platforms
- Individual products of the Windmill Smart Platform solution are recognized for excellent quality. With optimized designed interfaces between individual products and optimized system configuration, Windmill Smart Platform provides diverse cloud-based services and business operators' TV Everywhere environments
- Using Alticast's Cloud UI System, broadcasters are enabled to provide advanced service on thin clients.

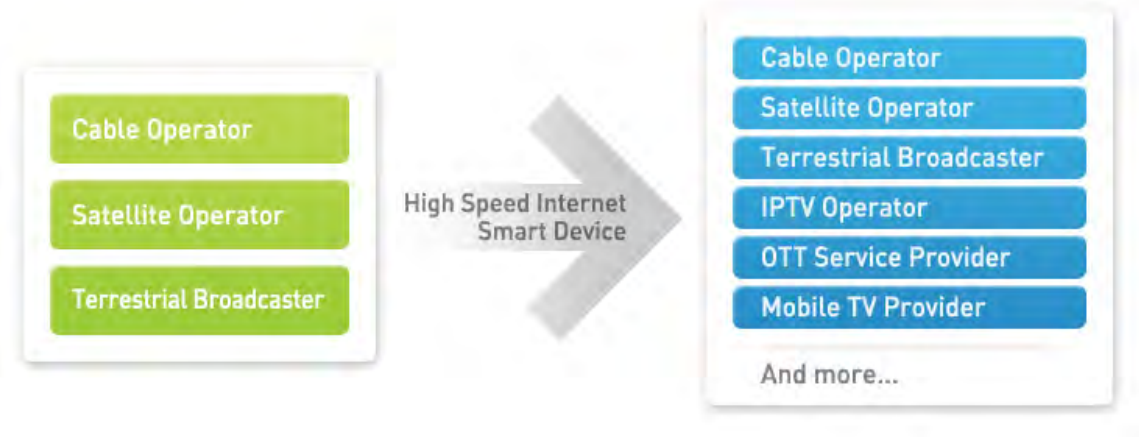
Windmill Smart Platform can add value in a number of ways, such as reducing the time cost of scheduling, expansion and reorganization, and improved opportunity cost arising from the operator's selection of Windmill Smart Platform features. The PayTV operator can reduce initial deployment costs and future maintenance costs through End-to-End services, which dramatically shorten the project implementation schedule, including the UI/UX for each Windmill Smart Platform package, application development, platform construction and adjustment, STB/CAS migration, and Quality Assurance.
When a PayTV operator adopts Alticast's Windmill Smart Platform, subscribers can be attracted to Global Top PayTV services itself, rather than any other peripheral services. Also, Windmill Smart Plaform will deal with subscribers' needs, future changes in subscribers' needs, and time necessary for the application of systematic differential services.

This strategic white paper shows what should be considered when business operators introduce smart TV service platform and how the Windmill Smart TV Service Platform of Alticast can meet this various requirements. Also, the Windmill Smart Platform of Alticast provides the guideline on the establishment of the most effective and competitive smart TV service platform to PayTV operators who are in dire trouble caused by the profit reduction and cost increase.

01. OVERVIEW OF THE WINDMILL™ SMART PLATFORM (WSP)

1.1 PAYTV MARKET TRENDS

PayTV service ⇒ Triple Play Service (TPS) : switched to era of limitless competition



Today's PayTV market led by Cable Operators, Satellite Operators, and Terrestrial Broadcasters is entering an era of tremendous competition with the appearance of IPTV and OTT. As the fusion of broadcasting channels and communication channels accelerates, competition among TPSs (Triple Play Services), and between TPSs and alternate content providers, is expected to increase substantially.

Switching from Linear PayTV to Nonlinear, TV Everywhere, Cloud-based, Smart PayTV

Increased data network speeds, new digital compression techniques, the increased accessibility of high-resolution content, and alternative consumer premises equipment (CPE) has resulted in a rapidly changing the paradigm of existing PayTV services. Innovative smart technology in mobile services, which has spread to prototype driverless cars and wearable devices, is changing the quality of people's lives. PayTV services, which until now have been providing only linear real-time broadcasting channels and simple VOD services, are seeing an opportunity to develop into nonlinear services with smart functions such as Search and Recommendation and Cloud-based TV Everywhere, services that enable subscribers to view any content on any device at anytime, and anywhere.

Switching from traditional PayTV solutions to Open Platform Software-based Eco-Systems

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1.2 MAJOR CHARACTERISTICS OF WSP

Cloud-based TV Everywhere: a Total Solution implemented with Open Platform Software

WSP is an integrated Cloud-based TV Everywhere solution implemented with HTML5. It is next-generation open platform software that enables PayTV business operators to provide global, state of the art smart services to their subscribers in this era of limitless competition.

A Low-Cost Flexible Solution Enabling SimulCast, SimulCrypt, and Migration

WSP focuses on enabling PayTV business operators to provide smart services without excessive additional investments by maximizing the use of their legacy systems and STBs. Integrated use of existing Middleware and CAS solutions reduces the costs of solution introduction and management costs when migrating to Smart services.

A Provision of both STB and Multi-Screen Services with a Single Headend System

WSP provides SDP (Service Delivery Platform) functions to manage not only traditional MSO-managed delivery services (STB, etc.), but also the profiles of diverse multi-screen devices connected to the Internet. Requested services can then be transmitted to subscribers after optimizing the resolutions according to the assigned networks and devices

1.3 RESULTS WHEN DEPLOYING WSP

Reduction of churn and increased acquisition of new subscribers

When competing with one another to prevent subscriber breakaways, PayTV business operators differentiate themselves from their competitors who provide only TV services by providing subscriber services such as TPS (Triple Play Service). Now, PayTV must compete not only with TPS business operators but also with OTT business operators who reinforce TV services. In areas where mobile devices are widespread, business operators who are strong in wired/wireless Internet and mobile services also dominate the PayTV markets. When a provider adopts Alticast's WSP, however, subscribers can be attracted to Global Top PayTV services, rather than by TPS combination products. Subscriber interest in innovative PayTV services has also been observed in advanced business operator markets in North America and Europe, which are leading in the adoption of smart platforms.

Creation of new PayTV revenue models for increased ROI and ARPU

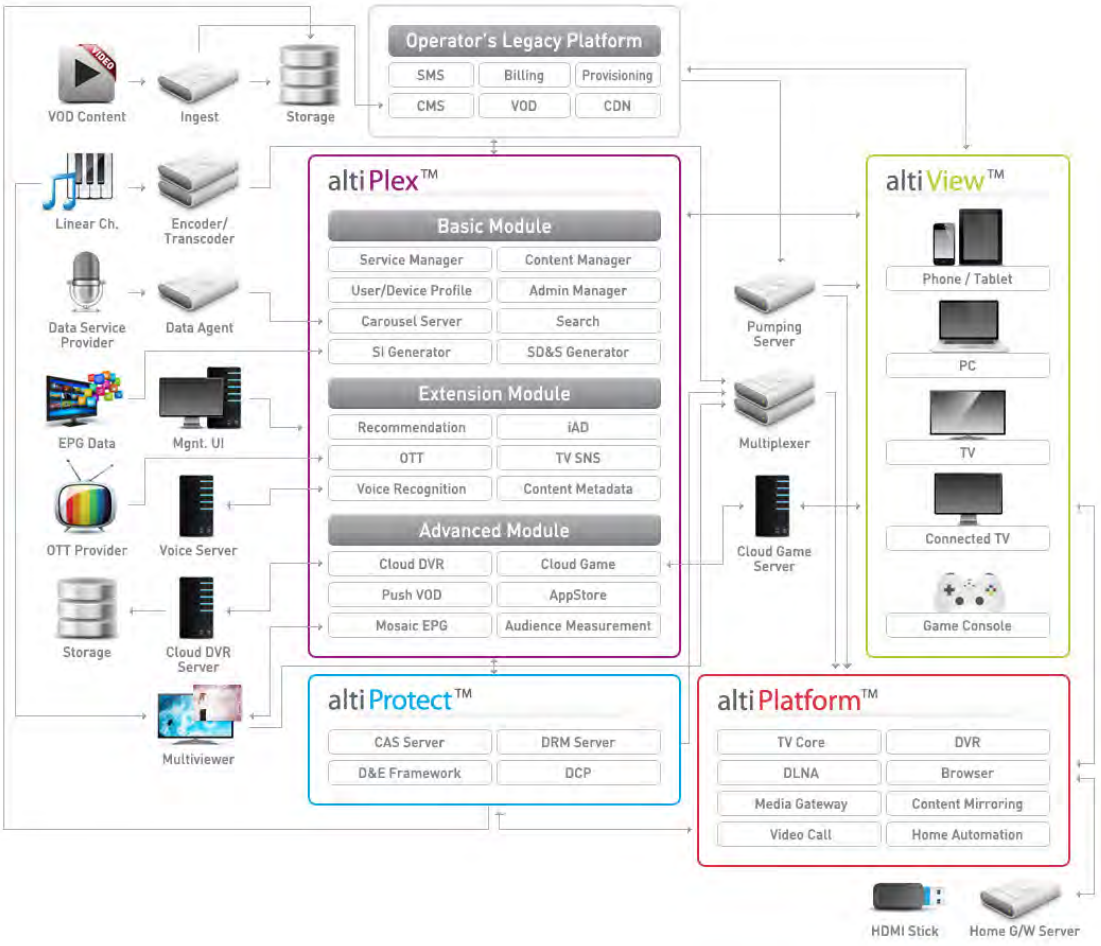
Many PayTV business operators go through trials and errors while switching their hardware to smart platforms. While applying systems centering on changes in solution equipment based on technology development rather than agonizing over subscriber-oriented differential services considering competition, most business operators go through trials and errors that render them unable to reap actual investment effects despite making excessive investments. WSP will deal with subscribers' needs, future changes in subscribers' needs, and time necessary for the application of systematic differential services. In particular, it will provide investment effects of creating new revenue models through DVR, Big Data Mining-based recommendations, advertisements, and Commerce and improving the ARPU of existing services.

Expansion of future TPS integrated systems combining PayTV, Internet, and Mobile services

In addition to basic services such as Search, Recommendation, TV Everywhere, Cloud DVR, Cloud Online Gaming, Big Data Mining-based advertisements, Commerce, TV Internet, and TV App Store services, Smart PayTV will develop into a new service model between IoT (Internet of Things)-based Devices linked to Mobile Networks such as WiFi, Zigbee, and 3G/4G/5G and Mobile Multi-Screen Devices. Home Automation and TV SNS-based advertisement platforms have already appeared in North American PayTV markets, and TPS fusion services such as TV VoIP are expected to become a new PayTV service model soon. WSP consists of Cloud-based TV Everywhere Total Systems that can provide all future TPS fusion services in addition to the smart functions currently being developed.

02. WINDMILL™ SMART PLATFORM (WSP) ARCHITECTURE & SERVICES

2.1 WSP ARCHITECTURE



WSP is an End-To-End solution for the creation of a state of the art PayTV Smart Platform.

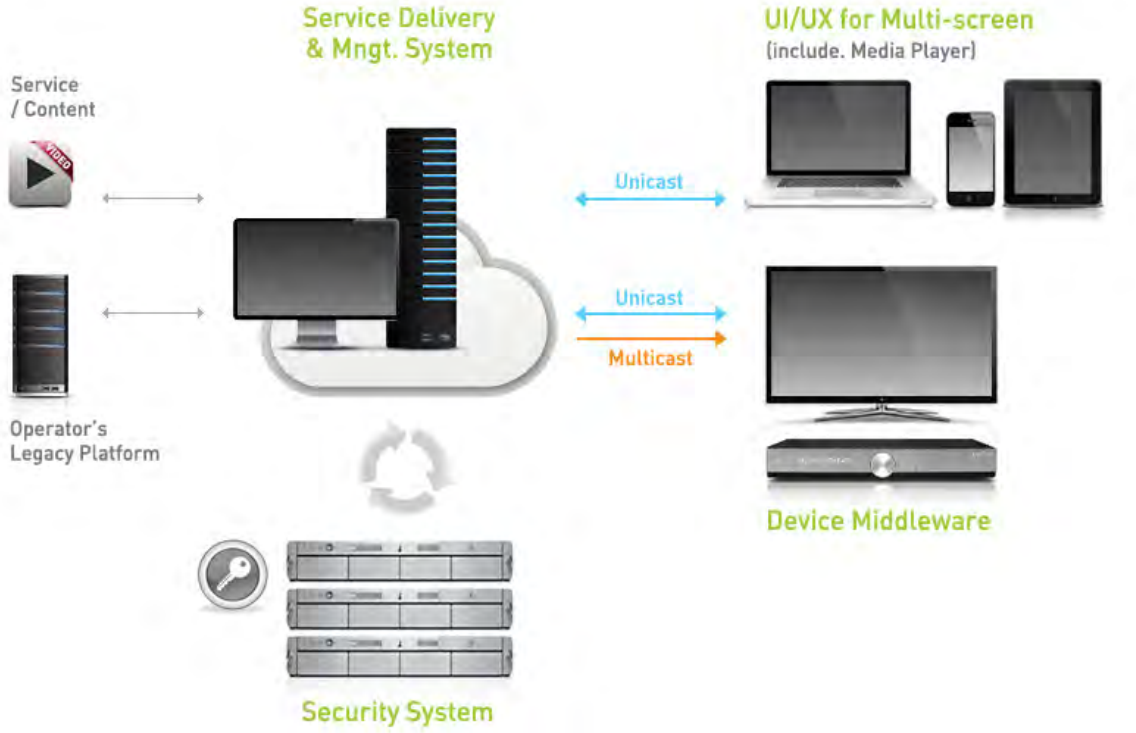
WSP consists of four parts :

- AltiView™, a UI/UX for STBs and Multi-Screen Devices
- AltiPlex™, a Cloud Server solution that processes Search, Recommendation, CMS (Content Management System), SDP (Service Delivery Platform), and PMS (Profile Management System) functions at a PayTV operator's Back-Office
- AltiPlatform™, a Middleware solution
- AltiProtect™, a security solution that provides the distribution, security, and billing functions for TV Everywhere service provision

Component	Division	Subject	Explanation
AltiView™	UI/UX	• UI/UX for TV • UI/UX for Multi-screen	Service interface and user experience
AltiPlex™	Back-office platform	• Service Delivery & Management System • Cloud Service System	Service/Content operation management
AltiPlatform™	Terminal platform	• Device Middleware	Service driving and content expression
AltiProtect™	Security platform	• Security System	Subscriber authority management and content security

2.2 MAJOR FUNCTIONS AND SERVICES OF WSP

WSP service block diagram



Services that can be provided by WSP include :

- TV Everywhere
- Search & Recommendation
- Cloud DVR & Local DVR
- TV App Store
- TV Internet
- TV Advertisement
- TV Home Automation
- TV Commerce
- TV Online Game
- TV SNS
- TV Voice & SMS
- Cloud UI
- Big Data Mining

Not only can WSP provide all functions and services necessary for the currently existing PayTV smart platforms; it can also be used for Home Automation and TPS fusion next-generation services. WSP is designed around a Cloud-Client structure that can be flexibly applied according to the operators business and technical requirements. The Windmill™ Smart Platform can be deployed in a short period of time and at a minimum cost. Alticast's experience in commercializing software solutions for clouds and clients is a definite advantage to providing quick economical deployment of smart services.

Smart Service	Implementation
TV Everywhere	TV Everywhere Services are largely divided into two approaches : · Indoor TV Everywhere service using a gateway STB · Indoor & Outdoor TV Everywhere service using Cloud SDP PayTV business operators may select one of these solutions or use both measures in combination depending on the network, terminal, infrastructure, and service policies. WSP solutions can implement both solutions.
Search & Recommendation	WSP provides Search and Recommendation functions for all Content provided by PayTV. · Search and Recommendation using Cloud CMS · Recommendation through Big Data Mining (optional)
Cloud DVR & Local DVR	WSP provides the functions necessary for Cloud or Local DVR services. · Cloud DVR using Cloud Personal Storage and SDP · Local DVR using Local Personal Storage
TV App Store	WSP provides two options for TV App Stores : · Cloud-based TV App Stores configured by HTML5 Applications · Utilization of Mobile App Stores using Miracast Technology To utilize Mobile App Stores using Miracast Technology, a WiFi Direct solution can loaded on the STB, or a USB Dongle loaded with WiFi Direct SW can be prepared.
Open and Standard-based TV Internet, HbbTV, OIPF	WSP enables Internet services through TV via the STB's HTML5 Browser. · HTML5-based Full Browsing Service (choice of QT, WebKit, or Blink Browser) · Browser Service using HbbTV, OIPF standards as International Standards
TV Promotion, Advertisement, & Commerce	WSP provides the diverse advertisement platforms needed for TV Advertisements of various types : · Interactive Promotion capabilities for notifying customers about service use and service upgrades · Interactive Advertisement & Commerce used for VOD content and TV product advertising · Interactive Targeted Advertisement (optional) & Commerce using Big Data Mining
TV SNS	WSP offers three options for constructing TV SNS platforms : · Mobile SNS's TV APPs are installed and used either integrated with the content on the TV, or as a companion application · Miracast Technology is used · PayTV business operators construct and operate TV SNS platforms by themselves
TV Voice & SMS	WSP offers three options for implementing TV Voice and SMS · mVoIPs or VoIP's TV Apps are installed and operated · Miracast Technology is used · PayTV business operators construct and operate TV Voice and SMS platforms

2.3 MEASURES TO IMPLEMENT CLOUD-BASED TV EVERYWHERE

OVERVIEW

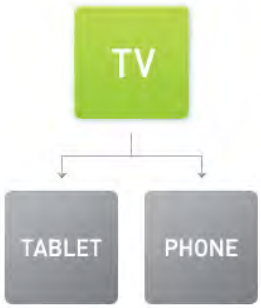
Although PayTV operators believe that providing service to as many devices as possible is of substantial benefit to subscribers, the highest priority for subscribers is that content be delivered with the same quality on all devices. The most important objective of the UI/UX provided by AltiView™ of Alticast WSP is providing the same QoE (Quality of Experience) to subscribers regardless of the device.
Toward this end, AltiView™ is loaded with an Adaptive UI optimized to the screen resolution providing the same experience on each device.

■ QOE of AltiView™

Multi-Screen capability is part of the M2M concept, and at its core lie connectivity among devices. TVs, air conditioners and other appliances can be regarded as Multi-Screens. From the viewpoint of TV, Multi-Screens can be divided into three different types -- Top-Down, Bottom-Up, and Parallel Types -- as explained below.

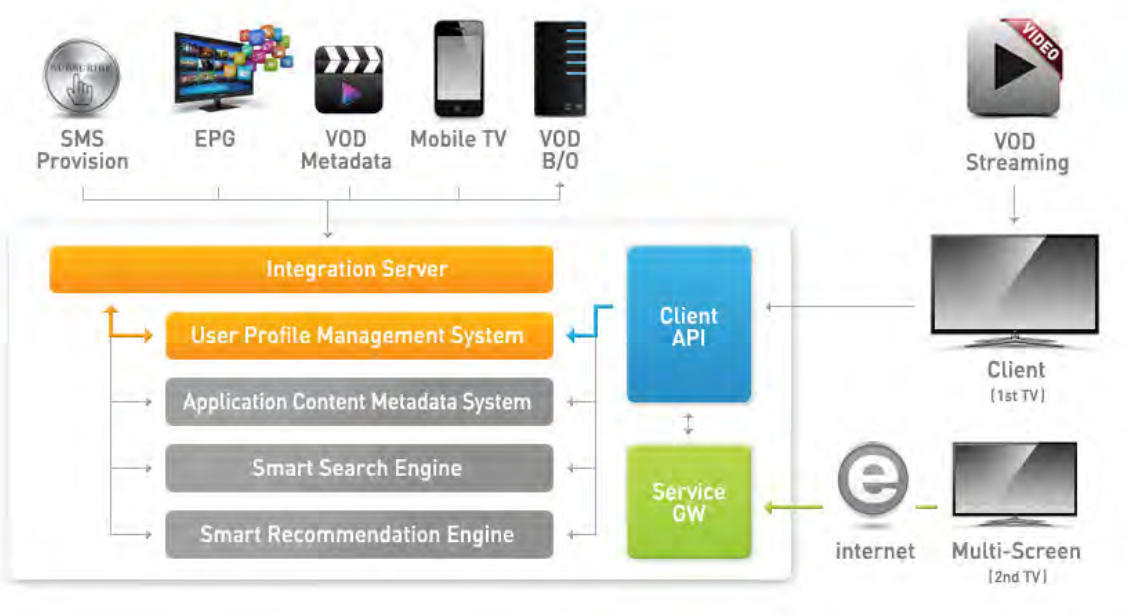
TOP-DOWN TYPE

Provide Big Screen-related content to fit the characteristics of Smaller Screens

Configuration	Major content
	· A Top-down allows watching TV while simultaneously using information suitable for mobile devices in real time in the Push or Pull form · In the case of watching home shopping through TV, it automatically links the information on the relevant product (characteristics, prices at other shops, product reviews, etc.) to a Tablet PC or a smart phone in real time. · TV-related Services of AltiPlex™ (see below)

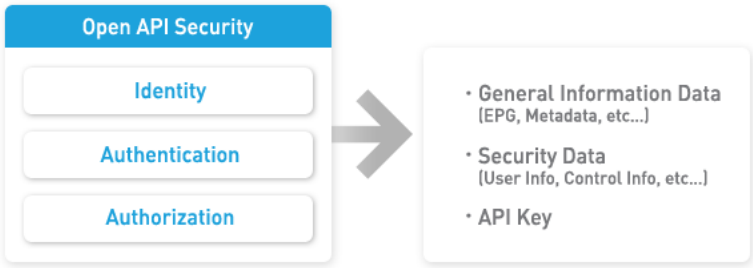
If the TV-related Services of AltiPlex™ are used, TV is mainly for content watching, and diverse program-related information is provided through companion devices such as smart phones and Tablet PCs. In this scenario multi-sided platforms maximize the effects of value chains with interactions through network effect. The STB is less burdened, and the value added by services can be increased.
When configuring TV-related Services, one of the biggest problems is authentication and control of mutliple models of internal and external devices. Along with the authentication of these devices en masse, issues related to network delay need to be considered when STB controls must be performed in synchronization with the device.
In the case of AltiPlex™, AltiPlex™ UPMS (User Profile Management System) and Service Gateways are closely interlocked with each other for device authentication and control.

■ Plan to implement TV-related services



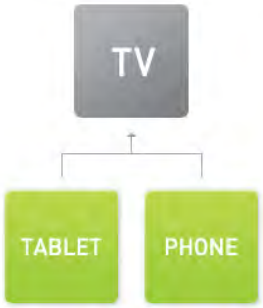
In the case of devices in external networks, subscribers are authenticated through the UPMS of the internal network via the Proxy Server called a Service Gateway, which is connected to external networks. When control between devices and a STB is necessary, the STB and external device are paired using OTP, and communication is made through IP addresses or Bluetooth, etc. STB's Key Events can be processed, and Mouse Events can be executed using IETP.
For TV-related Services to supply more diverse content, open APIs should be supplied to a Third Party or the developer to obtain and control services supplied by operators. Since all systems of AltiPlex™ are open platforms, diverse services can be easily and quickly launched. To prevent data spills and abuse of device control through open APIs, all systems of AltiPlex™ operate while fully distinguishing Identity, Authentication, and Authorization.

■ AltiPlex™ Open API security system



BOTTOM-UP TYPE

Provide Small Screen-related content to fit the characteristics of Bigger Screens

Configuration	Major content
	· In the case of Bottom-up styles, information that has been used in mobile devices such as smartphones and Tablet PCs is transmitted to larger TV and Public Displays. · Content Mirroring (Miracast), Content Sharing (DLNA)

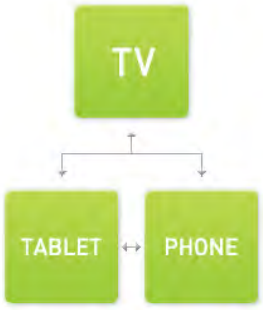
The content mirroring function provided by AltiPlatform™ is based on Miracast technology. Miracast-certified devices provide simple search and setting functions so that users can quickly transmit video content from one device to another.
Miracast-certified device users can view photos in smartphones via large TV screens, share notebook screens with meeting room projectors in real time, and watch home cable broadcasting programs on tablet PCs.
A special advantage of Miracast is convenience, using common solutions for Multi-Screen devices and household electrical appliances.

■ Advantage of Miracast

When AltiPlatform™ Content Mirroring is used, existing Displays not loaded with Miracast can be used as they are, and supplementary services can be applied.

■ Configuration of Content Mirroring

PARALLEL TYPE

Configuration	Major content
	· The Parallel type is a Hybrid model where Top-down and Bottom-up types are mixed · Communications between devices occur in real time regardless of the kinds of devices. · Media Cloud, Gateway STB, DLNA

To accommodate operators' requirements for Multi-Screens, Alticast supports Media Cloud modes, Gateway STB (+DLNA) modes, and Hybrid (Media Cloud + STB + DLNA) modes. Diverse Multi-Screen solutions can be introduced in accord with the operator's situation to reconfigure services efficiently for subscribers.

Media Cloud mode

Service type	Major content
STB Streaming	· RTSP-based Streaming Servers are configured. · Can be interlocked with the existing VOD Streaming Servers (optional)
Mobile Streaming	· HLS based Streaming Servers are configured · Can be interlocked with the existing Mobile Streaming Servers (optional)
Content Sharing	· Perform Transcoding of Live/VOD/Private Content. · Content Sharing through Private Cloud Storage areas
RS-DVR	· Using Buffer Storage or Private Cloud Storage.
Start-Over	· Using Buffer Storage or Private Cloud Storage.
Time-Shift	· Using Buffer Storage or Streaming Server

Gateway STB mode

Service type	Major content
RS-DVR	· Perform in-house Content Streaming at Gateway STB.
Mobile Streaming	· Perform Content Transcoding at Gateway STB. · Perform in-house Content Streaming.
Content Sharing	· Content Sharing among in-house devices using DLNA
RS-DVR	· In the case of cable or satellite operators, Dual or Multi-Tuner-based Recording is performed.
Start-Over	· Cannot be served
Time-Shift	· In the case of cable or satellite operators, Dual or Multi-Tuner-based Recording is performed.

Hybrid mode

The Hybrid mode uses the AltiPlex™ Media Cloud in combination with a Gateway STB. When a satellite business operator provides bi-directional services such as VOD, if the QoS of the Internet is not guaranteed, the Media Cloud can be used for VOD and the STB utilized for Time-Shift, etc. In other words, operators can use Media Cloud in combination with Gateway STBs depending on the situation, for example environmental restrictions and legal institutional restrictions.

Service type	Major content
STB Streaming	· RTSP-based Streaming Servers are configured · May be interlocked with the existing VOD Streaming Servers (optional)
Mobile Streaming	· HLS based Streaming Servers are configured · May be interlocked with the existing Mobile Streaming Servers (optional)
Content Sharing	· Content Sharing among in-house devices using DLNA
RS-DVR	· Use Buffer Storage or Private Cloud Storage.
Start-Over	· Use Buffer Storage or Private Cloud Storage
Time-Shift	· When entering channels at STB, Local HDD or USB Storage is used to start recording and provide services

2.4 MEASURES TO IMPLEMENT WSP-BASED CLOUD SERVICES

OVERVIEW

With Cloud services, video and music and other content need not reside on the local device – they can be accessed from the Cloud.

■ Change in people's access to information

The AltiPlex™ Media Cloud provides cloud services including RS-DVR, VOD, Start-Over, and Time-Shift for media use and access to media.
The AltiPlex™ Media Cloud consists of four platforms :

Cloud Content Ingest/Delivery System

An ingest system that supports reserved channel recording, Start-Over, Time-Shift, and VOD content acquisition and distribution

Cloud Service System

A system that supports integration with terminals and business operator Legacy systems for Media Cloud service management

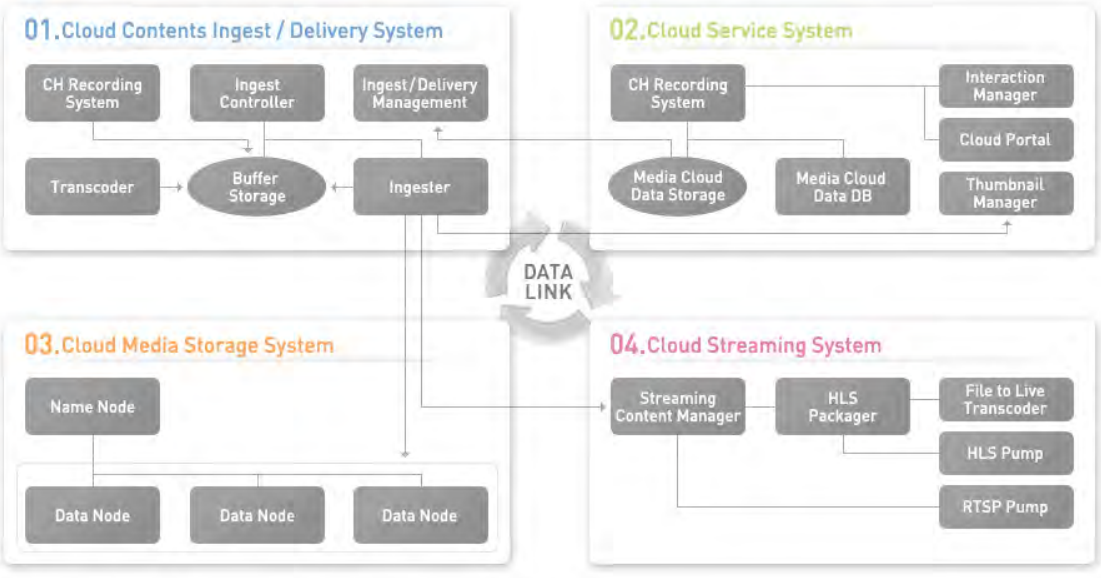
Cloud Media Storage System

A Cloud Storage system equipped with distributed cluster functions that can process large-volume data

Cloud Streaming System

A streaming system that supports the transmission of Media Cloud content through various devices

■ Major components of AltiPlex™ Media Cloud



PayTV business operators providing Media Cloud services should consider the following :

MATTERS TO BE CONSIDERED WHEN INTRODUCING MEDIA CLOUD SERVICES

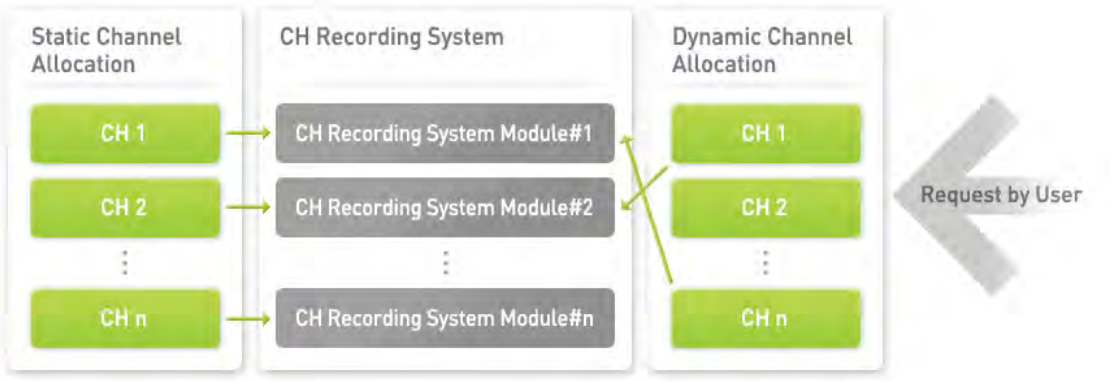
Media Cloud service selection

Because AltiPlex™ Media Cloud is a software-based solution with no hardware dependencies, system configurations can be re-combined depending on the services to be provided by operators to their subscribers. For instance, if the devices to be served by Media Cloud are limited to STBs, then video transcoding and HLS-based streaming systems can be bypassed for efficiency. In addition, if services such as Start-Over and Time-Shift are excluded, the channel recording systems ingesters, and streaming systems associated with the relevant services may be excluded from the processing path. In this way, diverse system combinations can be tailored to the services and devices selected through Media Cloud.

Selection of channels for Media Cloud services

Once Media Cloud services and devices have been identified, live channels for the services can be selected. The number of systems to be constructed and construction costs may vary according to the number of channels and encoder assignment methods.
The channel recording system provided by AltiPlex™ Media Cloud supports both static and dynamic channel assignment. Static assigns the processing module for one channel recording system to each Live Channel. Therefore, 200 channel recording system modules are necessary to provide services to all 200 channels. Dynamic channel assignment provides services to all 200 channels using only 50 channel recording system modules; note, however, that channel recording system modules are assigned by the order in which requests arrive. Using a Dynamic system, up to 50 channels can be accommodated.

■ Media Cloud channel recording system's channel assignment method



The channel recording system has a Thumbnail image extraction module so that viewers can search sections quickly through the images extracted from individual sections.

Private Cloud Storage space assignment setting

In general, images from reserved recording, images from real-time recording, operator Push VOD, and private media can be stored in the private storage spaces of the Media Cloud. Private storage spaces may vary according to the types of services provided by the operator. optimized storage spaces can be assigned based on the use rate of the subscriber, on a decreasing rate when the Storage Shared method is used, and other criteria.

02. UTILIZATION OF THE WINDMILL™ SMART PLATFORM (WSP)

3.1 BENEFITS OF WSP

WSP is a solution that can be applied to all operators, including Cable, Satellite, IPTV, and Terrestrial broadcasting companies. Appropriate packages can be selected for use depending on the operators' service strategies and business policies.

■ WSP Package

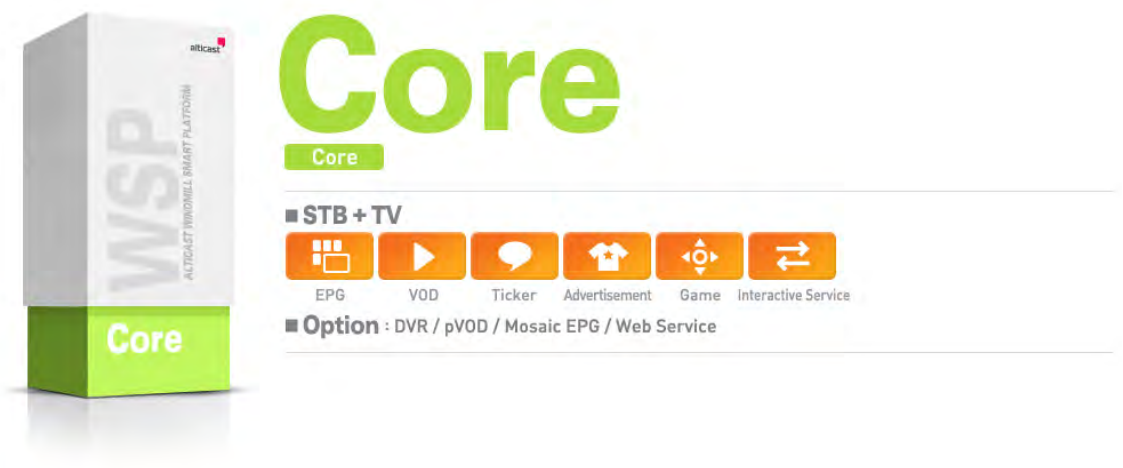
OVERVIEW

WSP is one of the most innovative and evolved software solution-based Smart Service Platforms available. It is composed of packages of individual modularized solutions, so diverse services can be provided effectively and economically without any hardware dependencies. WSP provides Core, Standard, and Premium packages. Operators can maximize their investment deployment costs by selecting the package that fits their service, budget, and business needs.

FEATURES

Main Features	Description
Saving Money	· Flexibility: operators can deploy without the related problems of introducing solutions one by one. This reduces time and cost to deployment. · Since business operators' existing Legacy environments are reused (Migration & Integration) through Pre-Integration with Client Devices, CAS, and Back-Office systems, services can be provided economically.
Saving Time	· WSP's individual solutions are already deployed and have been verified for integration with leading operators' Back-Office Systems. · Because WSP is designed in an open architecture-based structure, combining the experience of integration of diverse solutions and newest software technology, it can be rapidly integrated with any business operators' Back-Office systems. · The Alticast Prime Integration Service supports fast analysis of and solution to problems in the performance and stability of Client Device terminals. · WSP Package products provide end-to-end services including development of UI/UX, Applications and Platform construction. In addition Alticast supplies STB Migration and QA (Quality Assurance) so that project implementation schedules can be shortened dramatically. · The reduction in time and operation costs from the shortening of service introduction, expansion, and schedules, WSP provides additional economic added value to business operators.
Increasing Quality	· WSP is an open source-based smart service platform that supports not only existing Global Standard Software Platforms, but also HTML5 and RDK (Reference Design Kit), leading next-generation broadcasting Software Platforms. · WSP does not provide closed platform environments that may be locked in by a certain solution vendor. Alticast offers open platforms ranging from service platforms to client device platforms. Commercialized in terrestrial, cable, satellite, and IPTVs worldwide, the WSP is a proven solution with high, dependable performance and stability, and excellent expandability. · Individual products of the WSP solution are recognized for excellent quality. With optimized designed interfaces between individual products and optimized system configuration, WSP provides diverse Cloud-based services and business operators' TV Everywhere environments.

3.2 WSP PACKAGE



The Core Package is a Smart Service Platform product designed to repurpose operators' existing Legacy environments (STB, Back-Office) focusing on the provision of core services. Additional services can be added by selecting options in the Core Package. These include End-to-End services ranging from service development, system construction, STB integrations and Back-Office System integration. Seamless expansion and migration environments can be provided later with Standard or Premium Packages.

Features provided by the Core Package include :

- Low Cost, Fast Delivery
  - Package products consisting of modules to ease the burden of initial investment costs and secure economic efficiency
  - Complete integration and performance with any back-office system through open platform software
  - Project implementation periods are dramatically shortened through the combinations of products that have been verified through commercialization.

- Well-made H/W Integration
  - High-quality optimized UI/UX provided for exemplary STB H/W performance
  - Minimized STB memory footprint
  - Essential services for pay broadcasting service operations
  - Adminstration Console to manage services

Smart Services provided with the Core Package and HW Requirements

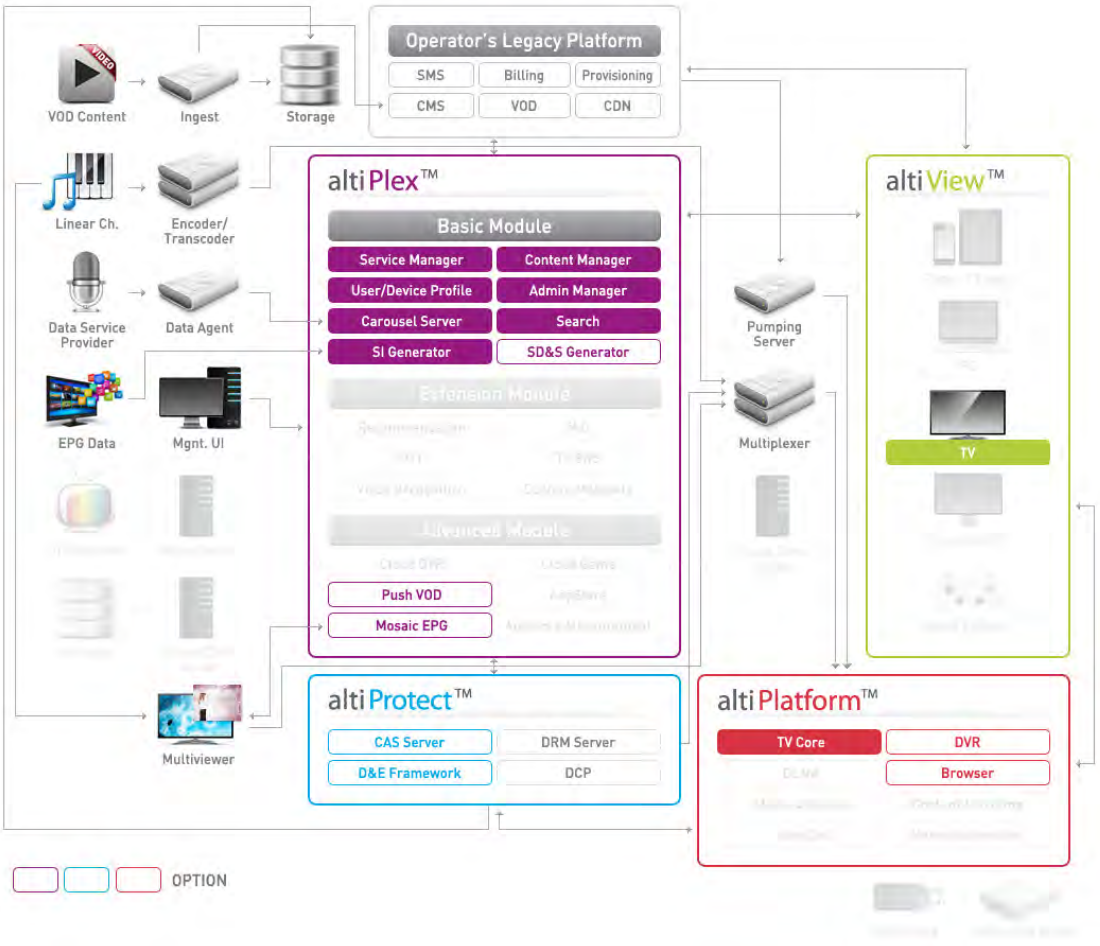
Division	Content
Smart Service	· 2D Animation Smart UI/UX (EPG) · Search & Recommendation-based VOD · Interactive Promotion & Advertisement
STB Requirement	· CPU < 1,000 DMIPS · DRAM < 512 MBytes · Flash <512 MBytes

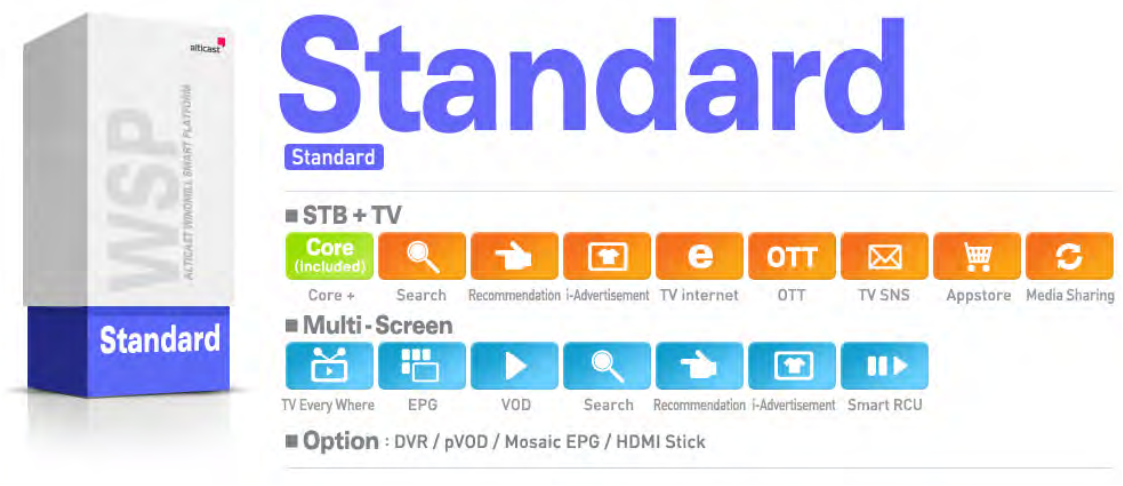
Recommendation

Component	Recommendation
AltiView™	· 2D Animation Smart UI/UX (EPG)
AltiPlex™	· Minimum functions necessary for the operation of AltiView™ are performed.
AltiPlatform™	· Java Middleware is recommended for STBs with low DMIP and memory footprint
AltiProtect™	· D&E Frameworks are recommended for CAS and SimulCrypt

Core Package Architecture

The WSP Core Package can be configured for Legacy STBs and/or STBs with low DMIP and memory footprints that offer Client-oriented Smart Services.





The Standard Package includes the Core Package service and additional services by supporting Service Frameworks that provide customized UI, HTML5-based Web Applications and Multi-Screen services.

The features provided by the Standard Package include :

· Flexible Service Framework

- Server & Client Framework; offerings configured by operator
- Operator Customized UIs combined with Add-on, Mode functions

· Smart Service

- Diverse HTML5-based Web Applications and TV App Stores
- Search, recommendation, OTT, SNS-linked services
- Multi-Screens that support Anytime, Anywhere, Any Device

Smart Services provided with the Core Package and HW Requirements

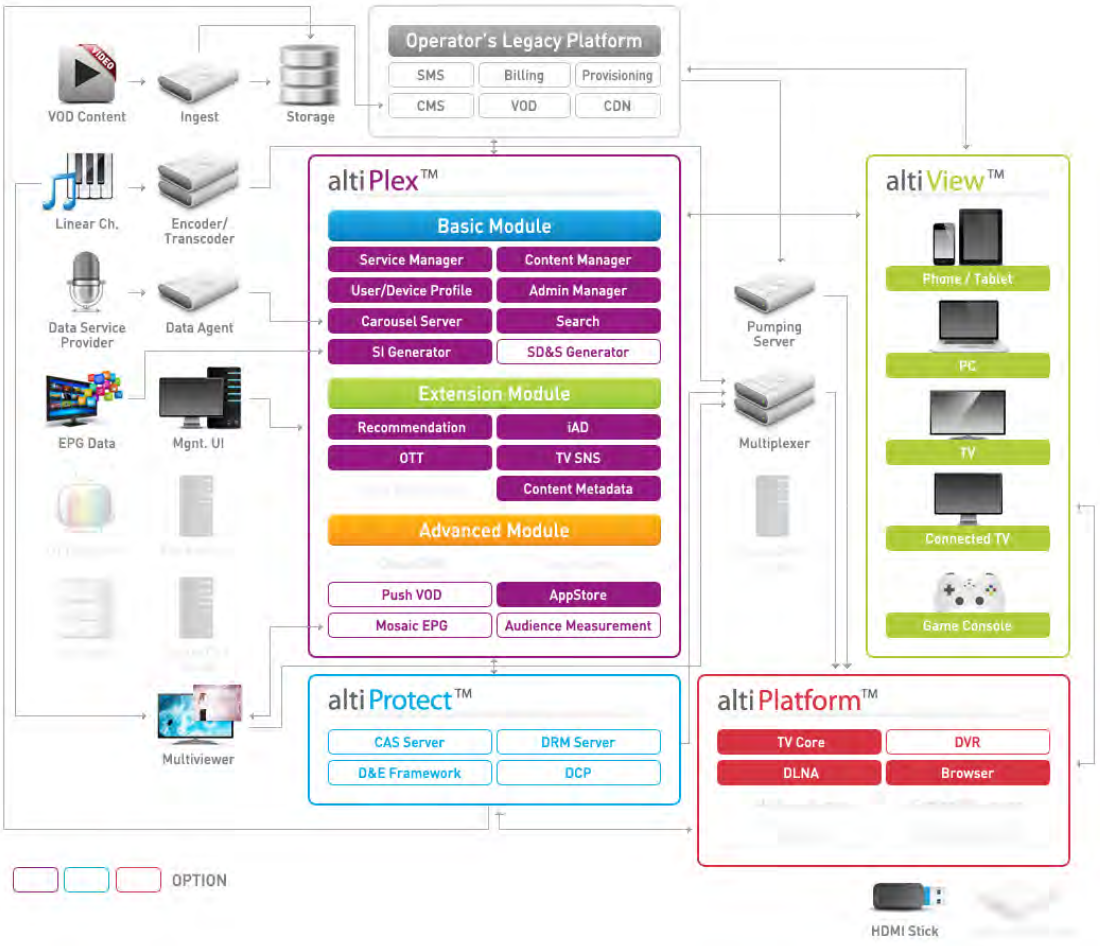
Division	Features
Smart Service	Services provided by the Core Package, plus : · 2D/3D Animation Smart UI/UX(EPG) · TV App Store
STB Requirement	· CPU < 3,000 DMIPS · DRAM < 1 GBytes · Flash < 1 GBytes

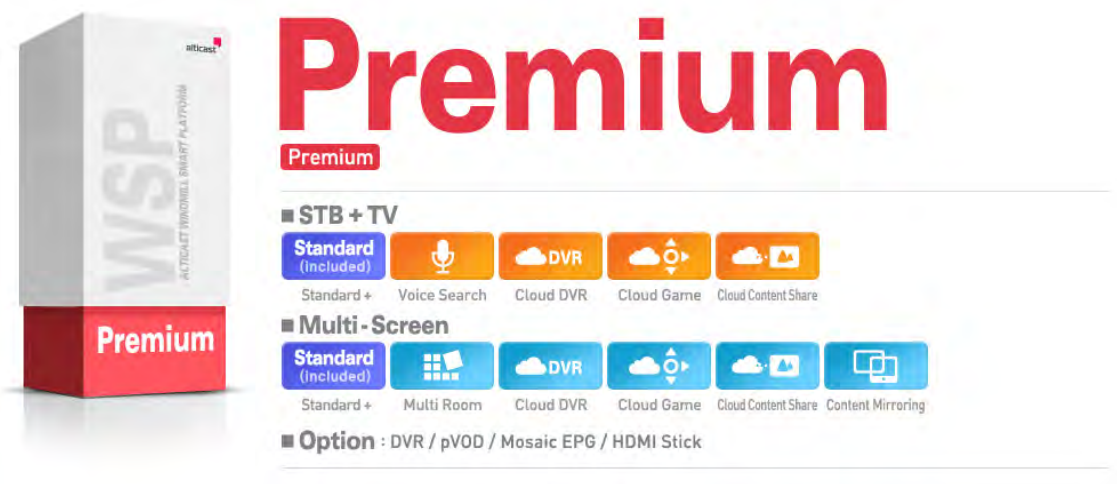
Recommendation

Component	Recommendation
AltiView™	· 2D/3D Animation Effect-based STB UI/UX.
AltiPlex™	· Service modules APIs that support search, recommendation, and Multi-Screen
AltiPlatform™	· Web MW for diverse Web-based service, alternative RDK MW or custom integrations
AltiProtect™	· Downloadable and Exchangeable Framework for CAS and DRM and SimulCrypt Security

Standard Package Architecture

The WSP Core Package can be configured for Legacy STBs and/or STBs with low DMIP and memory footprints that offer Client-oriented Smart Services.





The WSP Service Package offers a Premium Package combining a cloud-based ecosystem with the Standard Package of Smart Services. This enables operators to expand from Live TV and VOD to multiple Cloud-based services, including Cloud Game, Cloud DVR, and Cloud Content Sharing. It can be further expanded to include Content Mirroring, Video Calling, and Home Automation.

The features provided by the Premium Package include :

· Media Cloud Service

- Cloud-based services such as Cloud Game, Cloud DVR, and Cloud Content Share
- Content Metadata-based Mash-Up services

· Home Gateway & Home Automation

- Support for Multi-Room and Content Mirroring through Home Gateway STB
- Support for Seamless service switches between Home Gateway-based Multi-Screen Devices
- Support for the expansion of Home Automation services

Smart Services provided with the Premium Package and HW Requirements

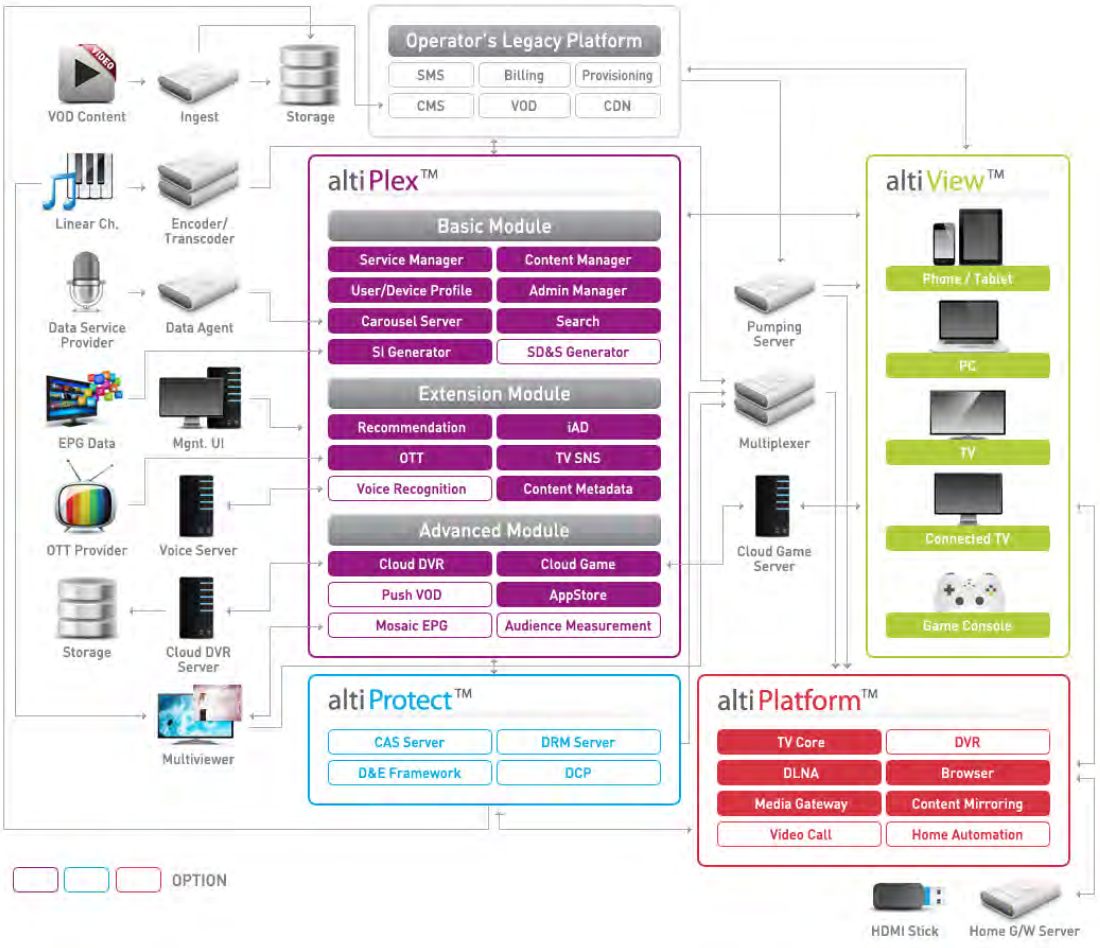
Division	Features
Smart Service	Services provided by Standard Package, plus: · 3D Animation UI/UX · TV Internet · TV SNS · TV Voice & SMS · TV Home Automation · Cloud Online Gaming
STB Requirement	· CPU ≥ 3,000DMIPS · DRAM ≥ 1GByte · Flash ≥ 1GByte

Recommendation

Component	Recommendation
AltiView™	· Apply 3D Animation Effect-based STB UI/UX.
AltiPlex™	· Apply diverse Media Cloud-based Smart service modules.
AltiPlatform™	· WebMW or RDK for Web-based services
AltiProtect™	· Downloadable and Exchangeable Framework for CAS and DRM and SimulCrypt Security

Premium Package Architecture

The WSP Premium Package provides Global Top-level Smart services including Gateway and Media Cloud-based services.



OPTIONS

Smart Services Options	· TV Everywhere Service · Cloud DVR · Cloud UI · Push VOD · TV App Store · TV Commerce · Smart RCU

04. WINDMILL™ SMART PLATFORM (WSP) COMPONENTS

4.1 PATENTED SMART UI/UX : AltiView™

The AltiView™ UI/UX enables subscribers to select Smart Services for use from various media devices depending on the PayTV business operator's service policies.

Media Device	MW or OS	AltiView™
STB & Game Console	Java Middleware	Java STB-Embedded Application
	HTML5 Web Middleware	HTML5 STB-Embedded Application
STB function-embedded TV	Java STB Middleware	Java STB-Embedded Application
	HTML5 Web Middleware	HTML5 STB-Embedded Application
	TV manufacturer OS	TV manufacturer OS-based Application
Tablet & Smart Phone	iOS	iOS-based Media Player
	Android	Android-based Media Player
	HTML5	Browser Based Interface
PC	Windows or iOS	Windows-based PC Player
	HTML5	Browser Based Interface

AltiView™ characteristics

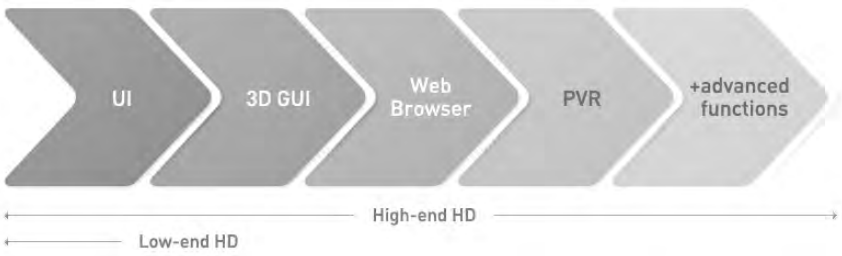
- AltiView™ = World's Best Smart Service
- Refined design
- Fast 2D/3D Animation
- Ground-Breaking Design
- Modular Design for Adding Functionality

Competitive offerings are often distinguished by the user's experience. The AltiView™ user interface is provides elegant and easy use. This is seamlessly integrated with AltiPlex™ and AltiPlatform™ providing software graphic acceleration, cloud-based system integration, content metadata, interactive service signal processing, search & recommendation, UI/UX upgrade, and multi-screen device profile management.

As thousands of TV Applications have been recently developed for PayTV Smart Services, particularly within the mobile ecosystem, and users' needs have become increasingly diverse, the AltiView™ modular approach allows users to freely add or delete media services and applications to/from the UI/UX.

OVERVIEW

AltiView™ is a revolutionary user experience framework built using a modular architecture that allows the operator to pick and choose interoperable plug-in components. This architecture allows for easy feature expansion.



- For the viewer modularity supports a seamless integrated media experience that provides content and interactivity across set-top boxes and consumer devices.
- For the operator, flexible modular architecture allows easy integration over diverse networks, keeping implementation and maintenance costs low.

AltiView™ is the provider's window to the world of complex multi-service, multi-device television. It allows delivery of a fantastic multimedia environment through a single User Interface, enhancing and simplifying the User Experience in a complex TV world.

With basic and advanced searching across a variety of sources, viewers will spend less time aimlessly surfing the airwaves to find the desired content. AltiView™ automatically discovers content for each viewer based on usage, user profile, and advanced metadata content. Viewers can also discover content using social network posts, chat, and like-minded viewers. AltiView™ anticipates and delivers relevant content even before the user attempts a search, intelligently providing seamless discovery.

AltiView™ provides seamless viewing regardless of the type of companion device or operating system. Subscribers have the ability to resume viewing PVR content from their companion devices on their TV. AltiView™'s flexible and open software architecture increases ARPU by allowing operators to easily expand exciting and advanced interactive services across a broad range of devices and operating systems.

The user interface is adaptable and customizable to the specific needs of any operator. Operators can increase customer loyalty and reduce churn, offering the a branded experience for subscribers on companion devices inside and outside the home.

- Seamless Discovery
  - Single interface to VoD, OTT and broadcast content
  - Social discovery of content from friends & like-minded viewers
  - Personalized recommendations
  - Easy discovery of related content
  - Advanced search interfaces
- Seamless Watching
  - Viewer access to content from any device, anywhere
  - Time shifted and on-demand viewing
  - Seamless cross device viewing, allowing transfer from one device to the next
  - Remote PVR scheduling
- Seamless Experience
  - Interactive TV and contextual content on all devices
  - Shopping, Apps, Games, Social
  - Connected device with contextually TV aware content

· Seamless Converting

- Touch based simple UI/UX can be converted easily to traditional GRID EPG
- Specific RCU buttons can be mapped, e.g. EPG, Guide

BENEFIT

Unique :
Each user can experience a unique TV service

Flexible :
UI structure can be easily assembled

Attractive :
TV viewers are able to get any menu without secondary devices

For Viewers

· Controlling your Media

Viewers can independently control their TV service environment, going beyond the bounds of unilateral TV services, controlling the time, location, devices, content and services.

· Finding from your Log

AltiView™ provides services based on the user's log, rather than piecemeal viewing history, to reflect their use patterns and tendencies. In this way, the user has opportunities to discover meaningful content of the past, present, and future.

For Service Operators

· Expanded Opportunity

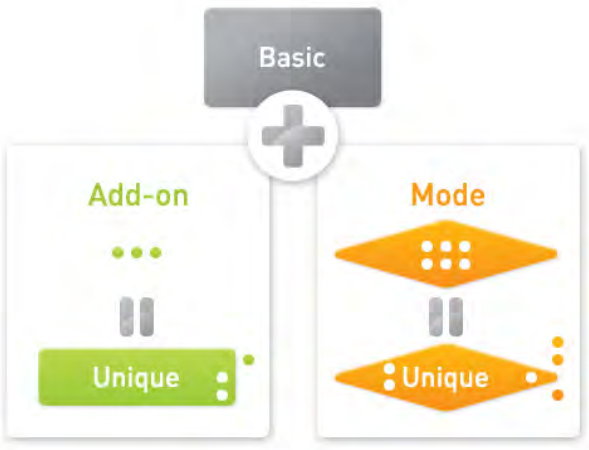
There are increased opportunities for new revenue streams by providing additional services and applications.

· Satisfying the Various Needs

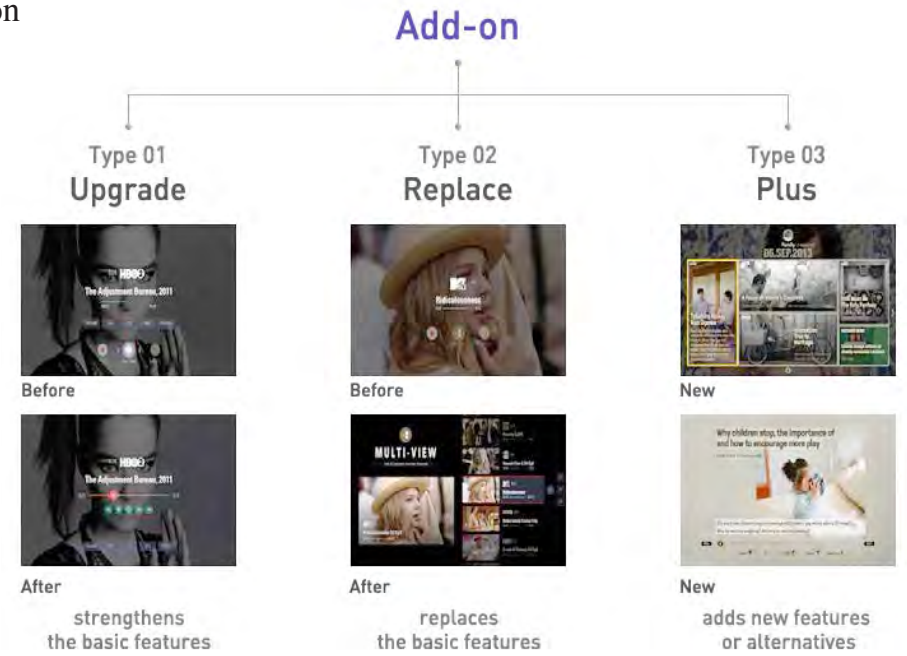
In contrast with the current hardware-oriented structure, Alticast provides a SW based solution that provides various services without an additional HW investment. New services can be easily added and service maintenance is greatly improved.
AltiView™ starts with a "Basic" service and users can then add features and applications.

Key elements of assembling structure are "Add-on" and "Mode".

- "Add-on" is a unit feature that the user can add to basic service. The user can make their unique TV services simply by adding "Add-on"
- "Mode" is a personalized UI that has a unique UI design and may include an appropriate package of add-ons; for example, kids mode or sports mode



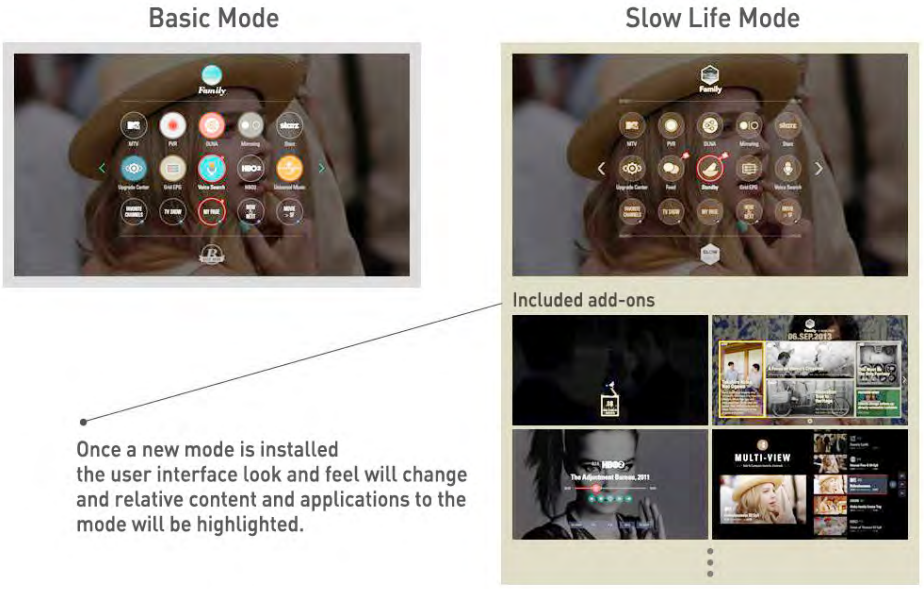
Add-on



Types of Add-ons

Voice Search, Multi View, Time Shift, PVR, Device Sync, Mirroring, DLNA, My Log, News feed, Stand-by, Movie inside, Universal Music, Game Center, and others.

Mode



Slow Life Mode

- For relaxed media consumption, replacing the tired patterns
- Freedom from the TV schedules
- Handing live TV program

Included Add-ons

› Time Shift
› Feed
› Standby
› Log › Multi View

Kids Mode

- For rearing, educationg and protecting clildren
- Contents for babies / kids / children
- Parental Control

Included Add-ons

› Kids VOD Finder
› Kids VOD Controller
› Distance Keeper
› Time Keeper

Edu Mode

- For Studying and learning information
- Informative contents
- Studying environment composition

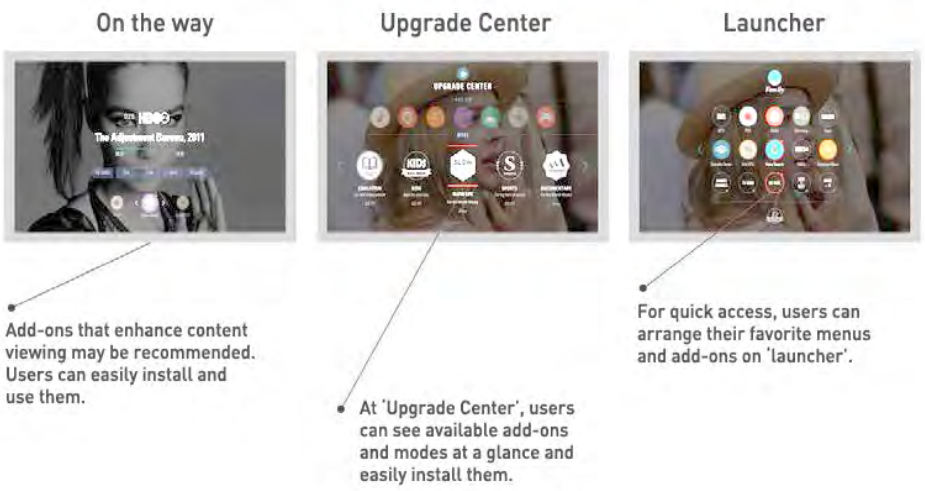
Included Add-ons

› VOD Controller Extreme
› Highlighting
› Caption Generator
› Dictionary › Scheduler

Other Mode Examples

Sports, Documentary, Shopping, Finance, Light, Basic, Premium, and others.

Add-on & Mode



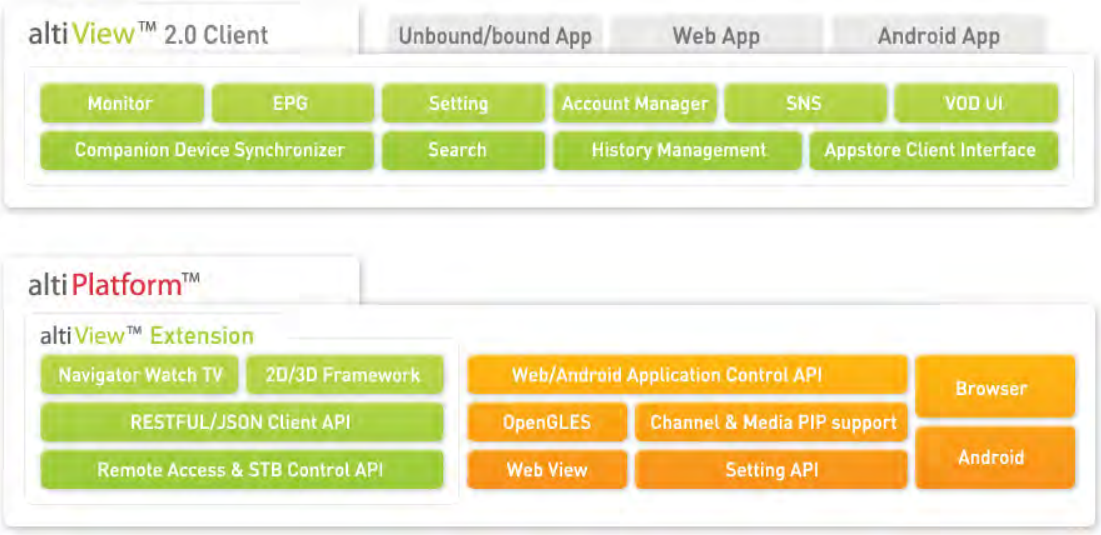
AltiView™ simplifies the television experience for subscribers, while providing an advanced and multi-device user experience. AltiView™ allows an operator to deliver a multimedia environment from a wide array of sources through a natural and intuitive User Interface. Its flexible architecture facilitates easy addition of new features with minimum integration costs.
Linear content, DVR, VOD, IP-streamed video, Catch-Up, Search & Recommendation, Shopping, and Social Media can all be delivered through a consistent and unified user experience across devices, so that subscribers can watch TV and access related content seamlessly.

UI/UX STRUCTURE

The AltiView™ Architecture allows users to “Assemble” a personalized experience.

Client Architecture

AltiView™ Client is composed of a downloadable area and an AltiPlatform™ service expansion area in the Firmware area.



Media Cloud service selection

This architecture enables users to configure desired watching environments through the AltiView™ Add-on function.

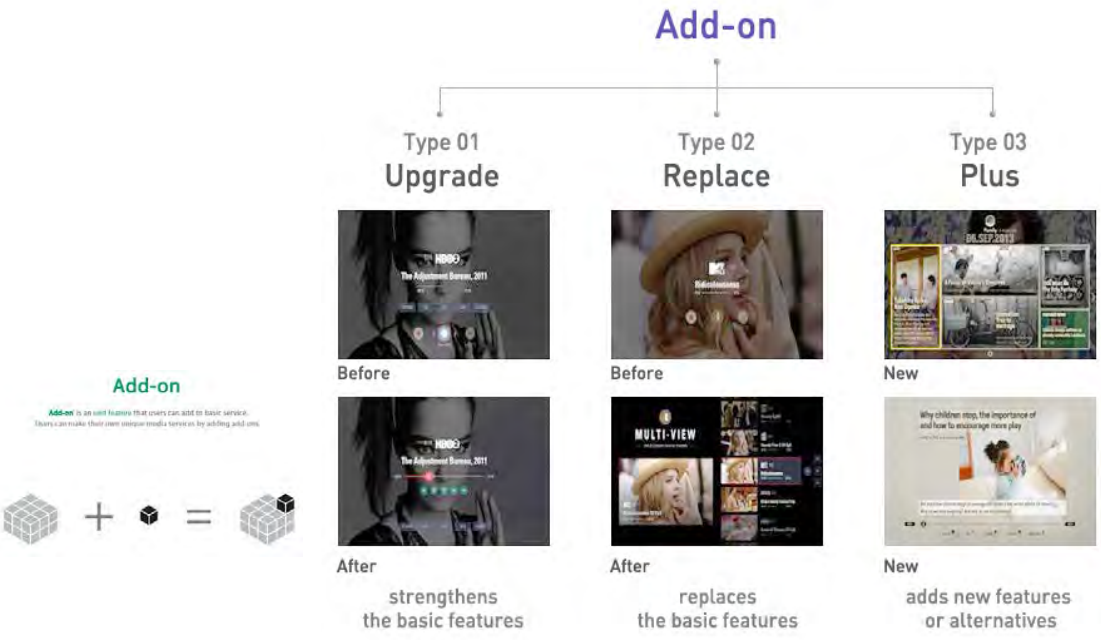
More services can be added by demand from customers.

FUNCTION

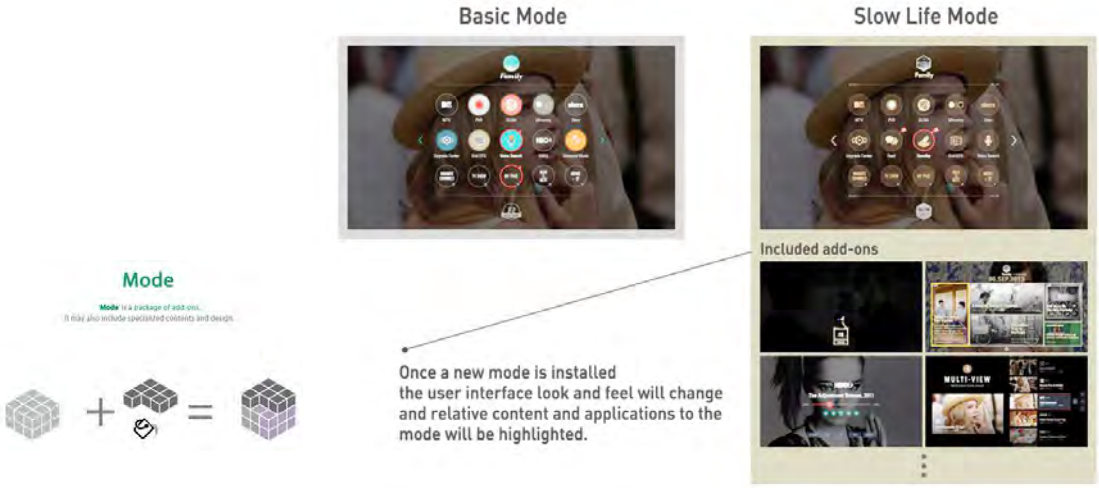
Division	UI/UX for TV
A La Carte	Selective channel purchase service
Advertisement	Advertisement service
Audience Rating (VBM)	Provides functions such as real-time popular channel selection
Book	TV Book service
Browser	TV web browser service
Catch up	Past program catch-up service
Channel +/-	Zapping function using the channel up/down key
Clip (YouTube)	Web video service such as YouTube
Clip Controller	Controller dedicated to short videos
Content (Disney)	Third-party content
Content Keeper	Digital Rights and Usage Management
CP EPG	EPG service provided by Content Provider
CP VOD	VOD service provided by Content Provider
Direct Channel Access	A function to change channels by entering channel numbers
Distance Keeper	A function to control services by recognizing the distance between the TV (STB) and the user

Division	UI/UX for TV
EPG	A function to provide EIT information by channel/hour, etc.
Games (EG: Netmarble)	Third-party game service
Home menu	Platform business operator menu
Book	Home control service to control lighting, room heating, etc.
Home Network	TV web browser service
Hotel Service	Provides functions for accommodations such as room service, room information, and reservation changes, check out
Info. (TV Guide)	Third-party content information service
Interval Jump	Image section jump
Karaoke	Karaoke (usable by pairing private Devices)
Launcher	UI builder for Add-ons, Menu Shortcut, HOME menu, etc.
Local PVR	PVR service utilizing STB's internal/external storage spaces
Local Service	Region-based service (hospital reservation, food delivery, etc.)
Magnifier	Image and screen element zooming function
Mini-EPG	Full EPG's (size/information/function) mini version
Mini-Guide	Provides program information and interaction functions while watching Live TV
Mirroring	A function to reproduce mobile device screens and display them on TV screens
Mobile Payment	A function to pay through mobile devices such as smart phones
Multi-Angle	A function to provide multiple camera angles
Multi-View (Excite)	A function to provide multiple video windows simultaneously
Multi-View (Tuner)	A function to provide multiple images simultaneously using multiple Tuners
Multichannel Sound	Multichannel-sound control
Music (EG: Universal)	Third-party music service
Music Player	A function to select/play Media music files
My Log	Provides watching history and popular content
My Page	Provides Profile management and details of use of Profiles
Network PVR	PVR service utilizing remote storage spaces
News Ticker	A function to provide real-time information to the screen in the form of Tickers
Now Guide	Provide currently watchable content and missed content
Parental Control	Provide simple settings for child protection
Photo Viewer	A function to select/play and manage image files
Picture-In-Picture	A function to provide a smaller superimposed video window over the primary selected video
Picture-In-Picture (Tuner)	A function to provide superimposed videos using multiple Tuners
Play Media (DLNA)	A function to replay Consumer Generated or Privately owned media from devices on the home network using DLNA through the STB
Profile	Profile creation and management function
Recent Ch. List	Recently watched channel list
Recommendation	Third Party Recommendation service
Review	Content evaluation/opinion registration and checking function (considering Integration with SNS)
Scrap Book	A function to store/manage information

Division	UI/UX for TV
Search	Basic search function
Search (Yahoo)	Third-party search service
Secretary	Functions to aid in media life/daily routine/work such as schedulers and reminders
Send Media (DLNA / CAS)	A function to play STB Media on private devices through DLNA
Setting	Setting
Shopping (Amazon)	Third-party shopping service
Standby	A function to put web video content in Standby
Subtitle Controller	Subtitle control
Tag Search	Content Tag-based search service
Thumbnail Extraction	(Live/VOD/Clip, etc.) A function to extract video thumbnail images
Time Keeper	A function to control the watching time
Time Shift	A function to control Live content (pause/rewind, etc.)
Upgrade Center	Screen for installing Add-on, Modes, etc.
Video Player	A function to select/play video files
VOD Catalog	Search screen through VOD categories/lists
VOD Controller	Controller for VOD watching
Voice Search	Voice search (usable by pairing private Devices)
Volume +/-	Volume control
Web Feed	A function to collect web content (information/images) of interest
Welcoming	A function to recognize users upon service booting/login
Well-being Guide	Provides information and content filtering and recommendation functions
Voice Search	Controller for VOD watching

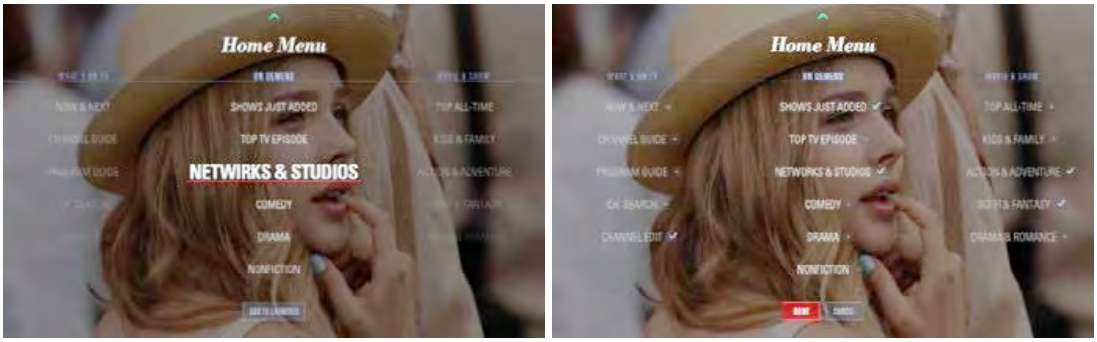


Although the Add-on technique was used to satisfy young people's needs and reinforce Smart Service functions, since the needs of middle-aged/elderly persons should ultimately be considered because of the attributes of TV as a universal media service, a mode system that gathered related Add-ons was provided to enhance users' convenience fully in service selection



Major Screen of AltiView™

■ Main Menu



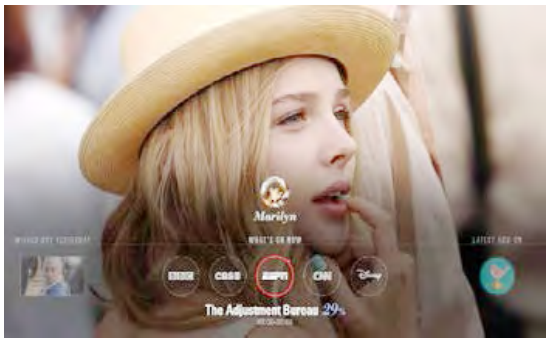
■ Search & Recommendation

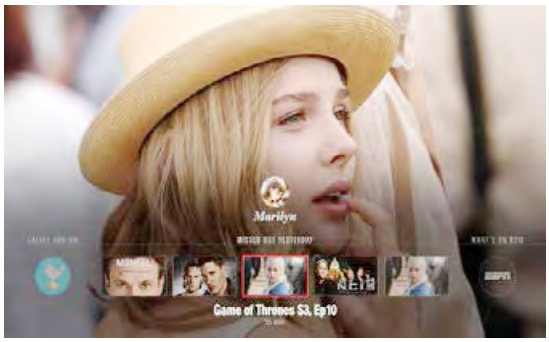
The search and recommendation services are based on the users' content consumption history.

■ Individuation (account management)

With the current account displayed, accounts settings can be transferred between family members

■ Now Guide



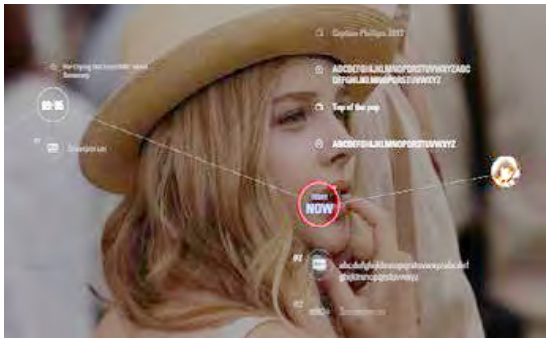


Current watchable live programs and missed past programs can be identified based on users' viewing patterns.

■ Launcher and upgrade center

Users can add add-on specialized services and content by function and modes through the Upgrade Center.

■ Quick Access

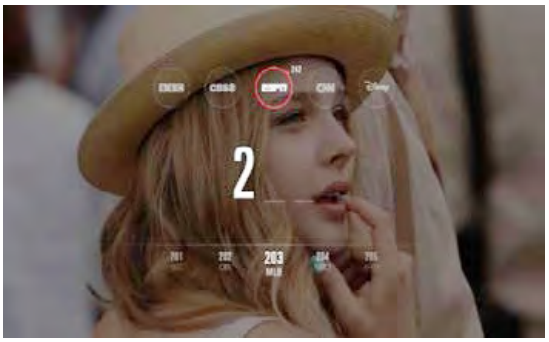


Up to five channels recently watched and current programs for individual channels can be identified for easy access.

■ My Log

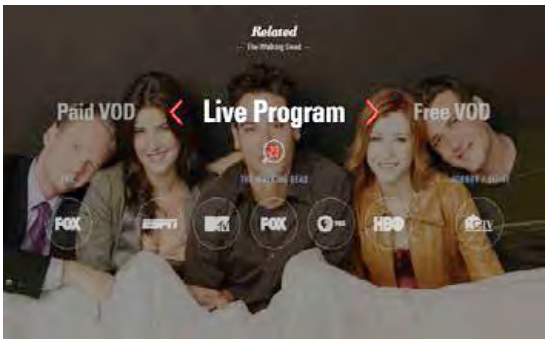
The log of watched and popular content by day can be identified prior to access.

■ Direct Channel Access (DCA)



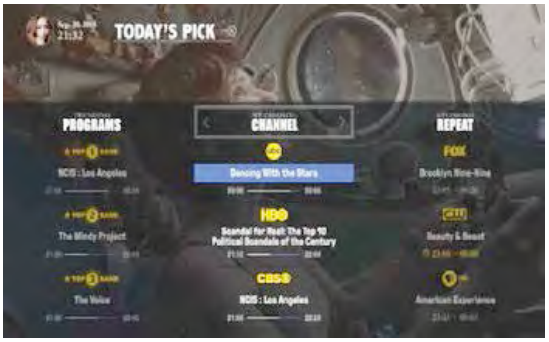
When a number has been entered, a list of channels frequently accessed through DCA is provided in addition to the general, channel lists.

■ Live INFO



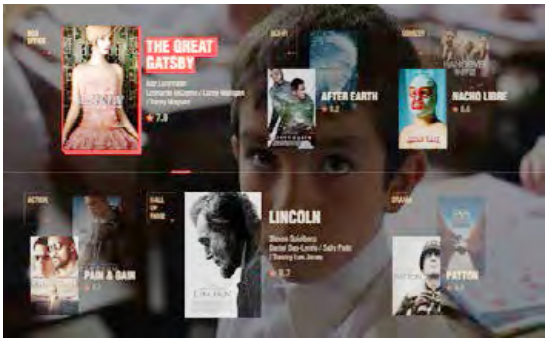
Additional Information can be accessed related to the live program being watched, such as series programs, VODs of other seasons.

■ EPG



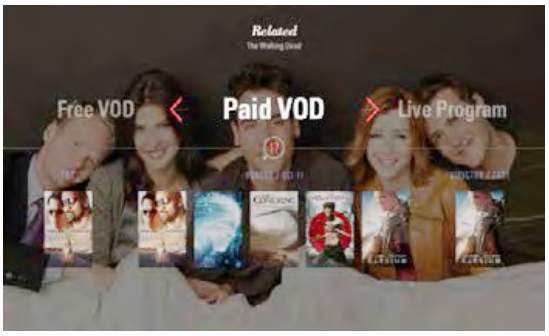
A television grid that identifies currently viewed programs and preferred programs simultaneously

■ VOD



VOD UI for quickly identifying preferred content in categories at a glance.

■ Big Data (Metadata)

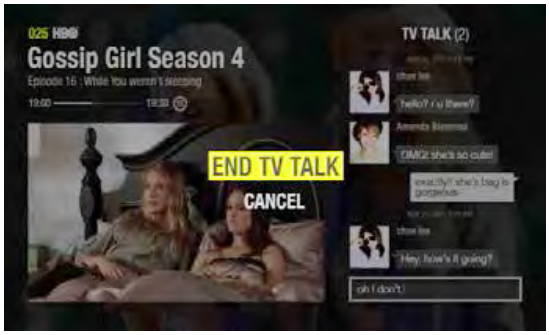


A Metadata service is provided to collect and provide additional program information

■ TV AppStore

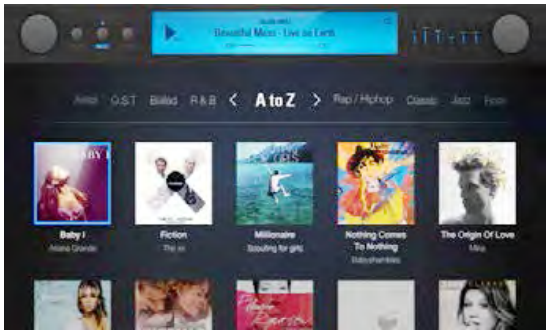
The AltiView™ “add-on” feature is like adding applications , they can either be provided by the operator as the basic service and extensions, or the model can be further extended as a full open app store allowing developers to provide apps to users. The catalog offered to customers is completely controlled by the operator.

■ TV Social Networking Services



The TV SNS lets the user communicate with friends through chatting and real-time messaging while watching TV or as a stand alone application.

■ Mash Up Service



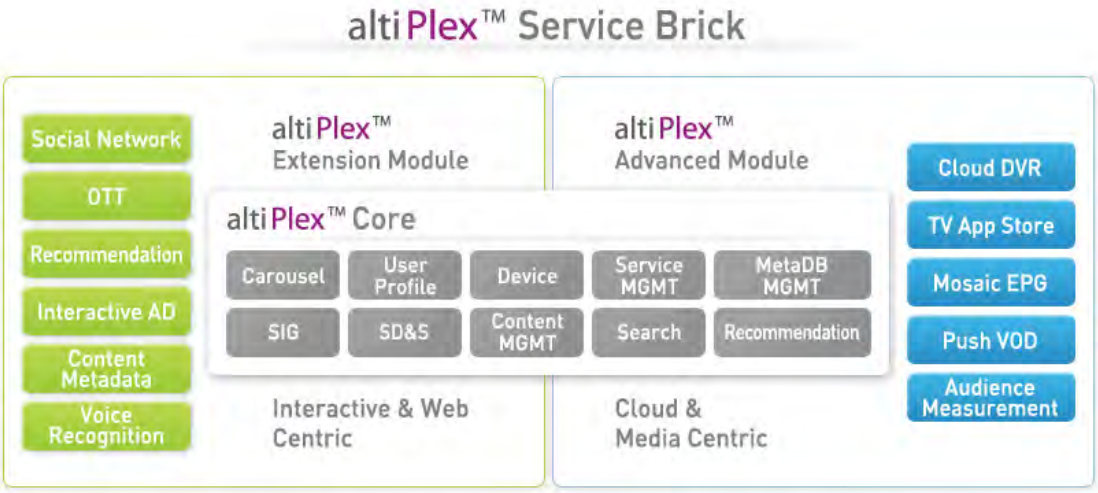
Provides a function of identifying and sharing diverse broadcasting-related information in real time while watching broadcast and VOD content on one screen.

4.2 CLOUD SDP SERVER : AltiPlex™

As a Server solution that provides all Cloud-based Smart Services according to PayTV's service policies, AltiPlex™ is installed and operated as a back-office headend or cloud-based system.

AltiPlex™ Architecture

AltiPlex™ has three components: AltiPlex™ Core, which is in charge of the minimum functions necessary for the operation of AltiView™, the AltiPlex™ Extension Module necessary for PayTV's Legacy Headend system matching, and the AltiPlex™ Advanced Module for the additional introduction of PayTV business operators' Smart Services.



AltiPlex™ Back-Office Integration

OVERVIEW

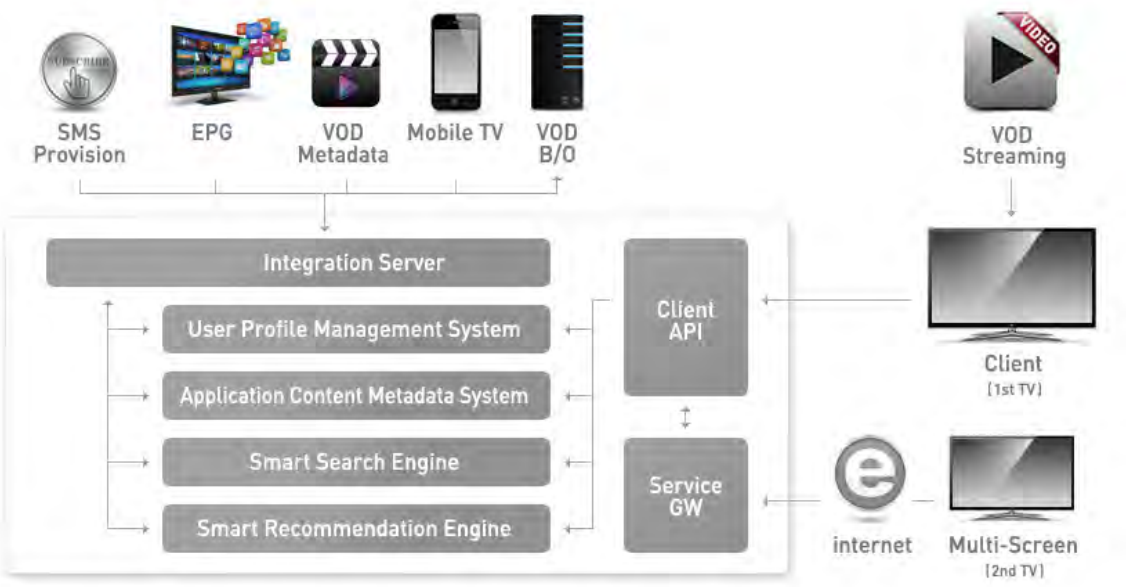
Introducing new services is a complex undertaking, The coordination required between broadcast services, subscriber management, and the infrastructure's hardware and software components is called Provisioning and Mediation.
WSP AltiPlex™ provides a function for Provisioning and Mediation with operators' Headend systems. It enables easy and rapid introduction of new services because all data can be interfaced with open APIs for processing. This provides the ability for quick upgrades.

Issue	Detailed explanation
STB & Game Console	・Overlapping system investments can be high because of complicated and diverse integration between operation systems; between operation systems and platforms; and between platforms. ⇒ CAPEX cost increase ・Monitoring and management systems are a separate system, adding to the burden of operation. ⇒ OPEX cost increase
Difficulties in introducing new services	・When introducing new services, linked systems are configured separately for individual services. ・Delay in service introduction due to increases in quality test schedules by system

AltiPlex™ provides a Provisioning & Mediation function that can prevent system fragmentation. This function links and comprehensively manages the subscriber information and billing systems (SMS/Billing etc.), the EPG information management and transmission

system, the Metadata provisioning system, the VOD Back-Office system, and the interfaces for Multi-Screens. AltiPlex™ also provides open APIs for Third-Party service provision. Through this function, operators can provide new services easily and quickly.
Operators' BSS/OSS and third Parties' services are interlocked through the Integration Server that performs the Mediation function and are collected together and managed through UPMS (User Profile Management System), APMS (Application Content Metadata System), SSE (Smart Search Engine), and SRE (Smart Recommendation Engine).

■ AltiPlex™ Provisioning & Mediation logic block diagram



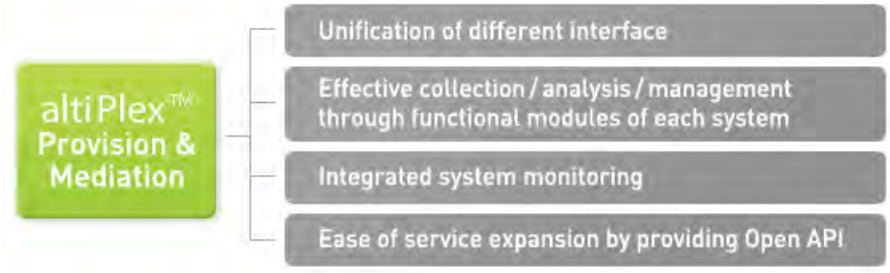
AltiPlex™'s Integration Server is organically interlocked with operators' Headend systems to collect data, enabling AltiPlex™ submodules to use the necessary data.

Integration Server

Service division	Major content
BSS/OSS integration	· Subscriber system integration · VOD Back Office integration · Billing system integration
Metadata integration	· Live Schedule data integration · VOD Metadata integration · Third Party Metadata integration
Viewing rate integration	· Subscribers' viewing rate survey system integration
Interactive advertisement integration	· Target-based advertisement system integration

The AltiPlex™ Provisioning & Mediation provides operators with the following benefits :

■ Benefits of AltiPlex™ Provisioning & Mediation

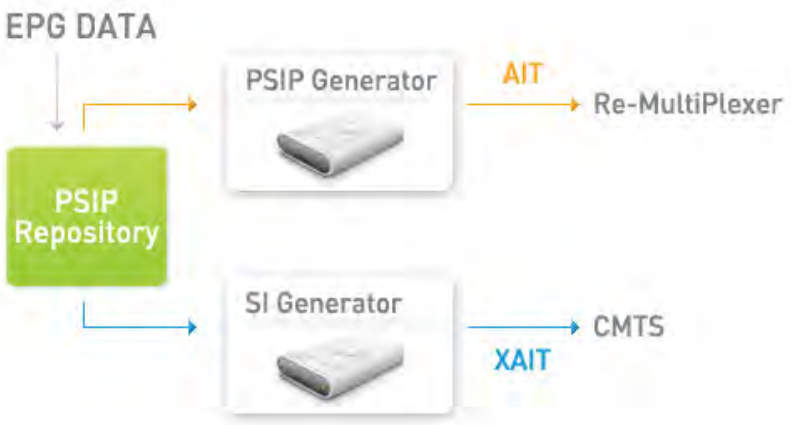


AltiPlex™ Core Module

OVERVIEW

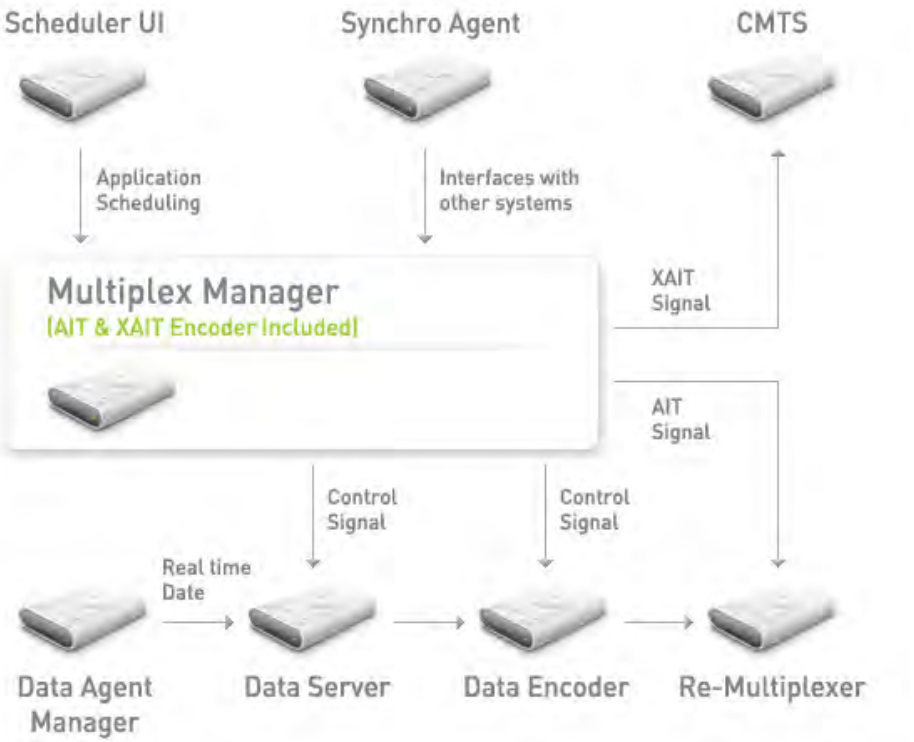
AltiPlex™ Core Module provides interfaces between business operators' existing Legacy platforms, Headend systems and service terminals. This is an essential module for business operators' provision of basic media services,

EPG INFORMATION TRANSMISSION



- Creates basic EPG data under PSIP or SI data standards and transmits the data to STB screens through the Multiplexer
- Scheduling of applications by channel (independent type / integration type) in real time
- Creates and transmits SI / XAIT Tables
- Transmits OCAP Application Signaling

APPLICATION TRANSMISSION



- Transmits Data, broadcasts, stores, and schedules applications and delivers the applications to the Multiplexer at a fixed time
- Provides management functions such as application storage, revision, deletion, and inquiry
- In charge of application format changes, encoding (Object Carousel), and transmission
- Handles and processes real-time update data received from the outside

- Modularizes/Componentizes to guarantee reliability, stability, and expandability
- Integrated management of individual modules
- Monitoring function using standard SNMP

USER & DEVICE PROFILE MANAGEMENT

- Authentication and checking for Users and Devices
- Provides system management and API to create user accounts and profiles
- User and Device policy management system
- Provides safe communication rules through HTTPS
- Provides social network services through plug-ins

CONTENT METADATA MANAGEMENT

- Collects primitive data for grasping VoD purchase and viewer behavior
- Content management for VOD or program schedules
- Provides content adjustment functions for categories, packages, etc.
- Provides plug-in models for the publishing of dynamic content such as OTT and shopping
- Integrated management of individual modules
- Integrated search function for regionally classified content
- Auto-complete function during search
- Provides high-ranking search words in real time
- User history search function
- Connects to outside Search Engines and provides Third-Party search solutions as options through plug-in interfaces
- Integrates Third-Party recommendation systems and provides related searches

SEARCH ENGINE (OPTIONAL)

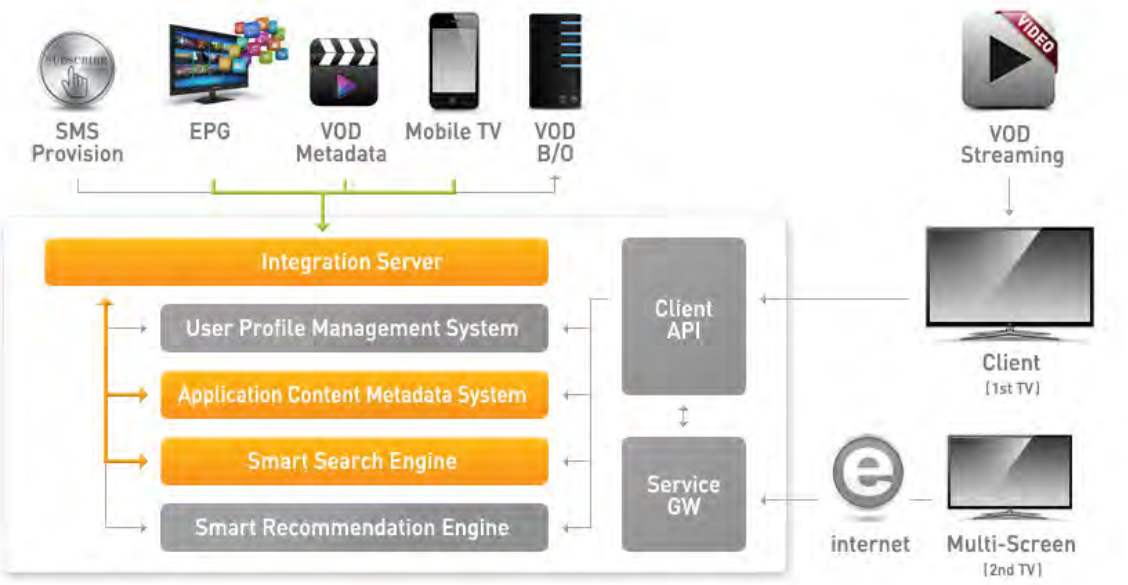
AltiPlex™'s SSE (Smart Search Engine) enables subscribers to search content and view the results conveniently and easily by providing intelligent search services before, during, and after users input their search terms. Before the search, SSE provides a ranking of search words that are currently becoming Hot Issues and recently-used search terms. When entering search words, AltiPlex™ provides an initial consonant search function and an auto-complete function to minimize the user's keystrokes. Results are organized for rapid identification using relevant criteria.

Major functions of the SSE are:

Service	Major function
Smart Search Engine	· Search keyword ranking · Recent search words · Initial consonant search · Auto-complete

The SSE system enables using initial consonant search and auto-complete functions in advance through the search keyword dictionary; it also shows meaningful content-based data search results collected from ACMS (Application Content Metadata System).

■ Smart Search Service implementation plan



For instance, if a T-Commerce company's data integration is carried out through ACMS, information on T-Commerce products can be shown to users. If information-type data integration in the form of a Mash-up is carried out, additional information services can be provided, such as real-time player information in baseball broadcasting.
SSE provides semantic searches that can largely be divided into information indexes and inquiries. Information indexes collect information, construct information using an identification system and an information management system, and expand information by applying natural language processing and inference technologies. The collected information is given as the final results with identification information, such as URI. Queries receive inputs from users and create search results using an analysis process to grasp meanings or contexts of search words ; a verification process to check whether search words have logical defects; a conversion process to map search words with semantic web inquiry languages such as SPARQL; and a search process to find information from RDF triple storages and databases, etc.
As such, using AltiPlex™'s SSE, the user can more easily and quickly find relevant results from queries.

RECOMMENDATION (OPTIONAL)

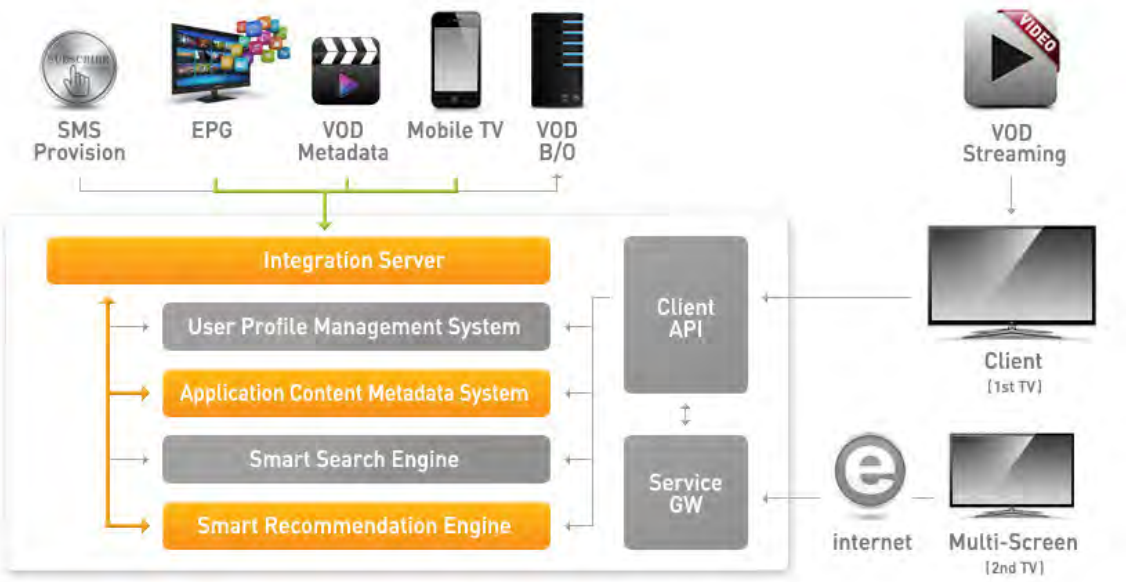
- Content recommendation function based on user preference and previous viewing histories
- Integrated search function for regionally classified content
- Business operators can provide push content to subscribers for advertising
- Presents related content to subscribers using history views.
- The most closely related content is always displayed on individual viewers
- Content can be changed into other proposed content using the tag editing or refresh function

Service division	Major content
Smart Recommendation Engine	·Personal viewing pattern-based content recommendation service ·Related content provision service by content

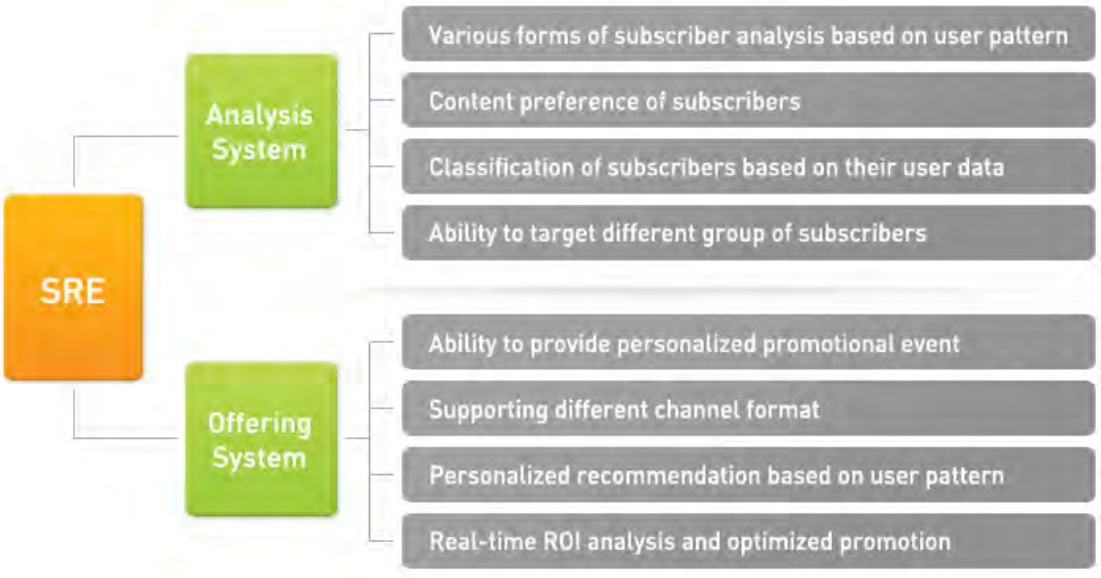
Through the SRE, operators can enjoy the following service advantages :

AltiPlex™'s SRE can integrate with the Application Content Metadata System (ACMS) based on Content IDs to provide content-based smart recommendation services.

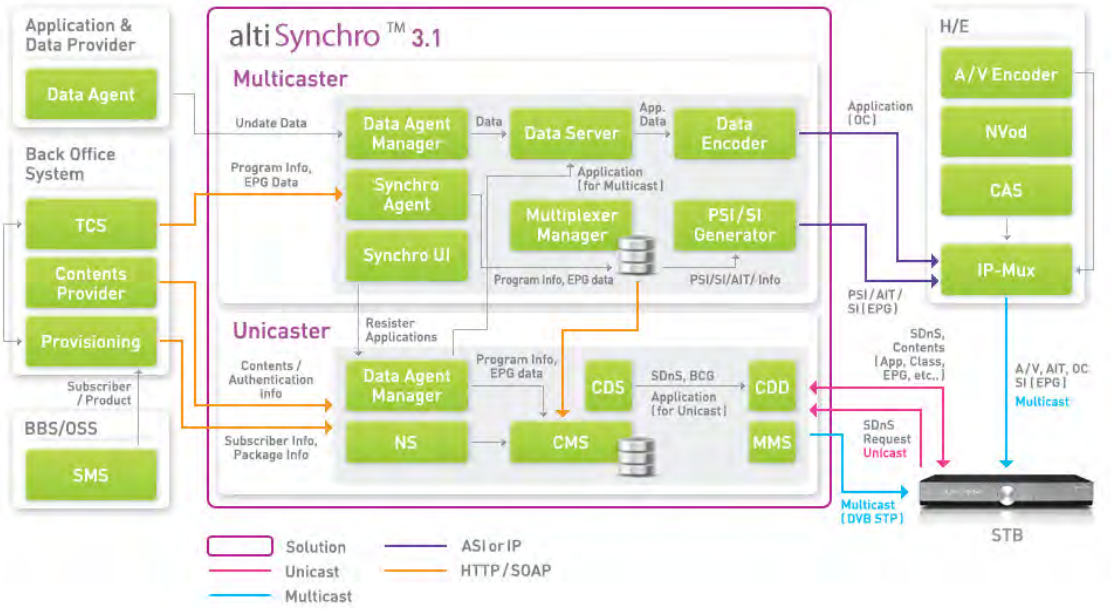
■ Smart Recommendation Service



EPG, VOD Metadata, and Mobile TV data interlock with the Integration Server using standard protocols such as FTP and HTTP. Through these content-based Metadata, SRE provides subscribers with content recommendations and related content information. SRE is divided into an Analysis System that provides log analysis/optimization/profiles and an Offering System that provides personalized campaign management and real-time recommendation functions.



SD&S (SERVICE DISCOVERY & SELECTION)

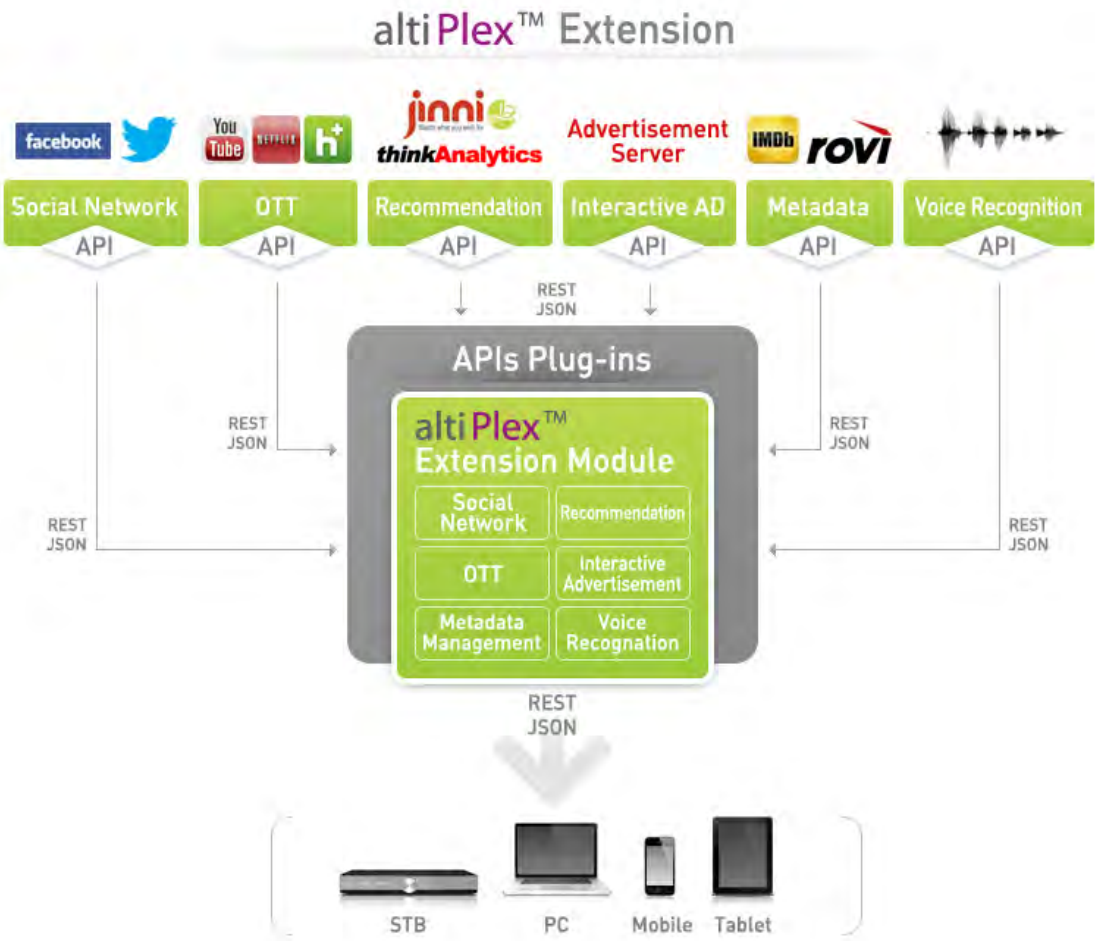


- SD&S standard introduction : conforms to international standards DVB-IPI (ETSI TS 102 034) and MHP 1.2 IPTV profiles
- DVBSTP is used for Multicast transmission, and HTTP, for Unicast, transmission to individual terminals.
- Transmission of content guide information : satisfies the TV Anytime standard
- Individual customized service configuration : Individuals' channels or Content can be grouped and transmitted according to package types (ex. : by region / platform / group)
- Creation of personalized information : for individual configurations, the provisioning system is interlocked for subscription information and channel product information, etc., to obtain the necessary information
- Provision of Unicasting Download server : The download server is provided so that a STB's request can be received, and related information can be downloaded
- Subscriber-based services are possible ; creation of subscriber-based package information, integration interface with the provisioning system provided

AltiPlex™ Extension Module

OVERVIEW

AltiPlex™'s Extension Module provides SDP (Service Delivery Platform) that enables integration with diverse TV content, Applications, and various Web Service/Content information. For integration with diverse third-party solutions, SDP offers a single API that provides an environment where viewers can enjoy fused services of web and broadcasting on diverse terminals for multi-screens.



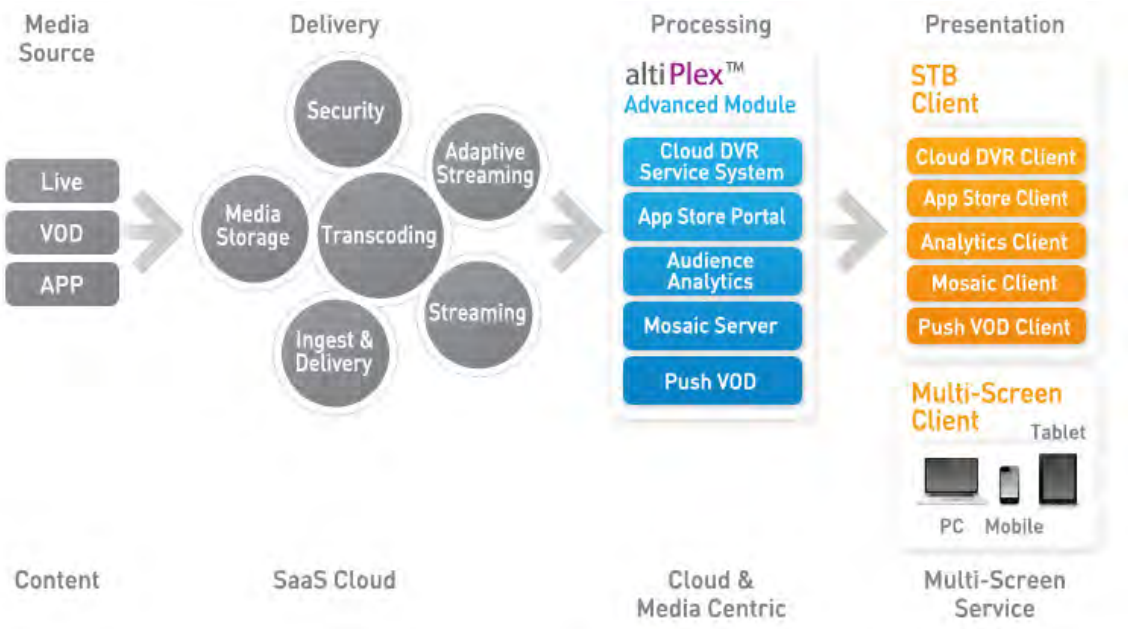
MAJOR INTERLOCKING INTERFACE

- Social TV Service Provider System: Facebook, Twitter
- OTT Service Provider System: YouTube, Netflix, Hulu
- Third-Party Search or Recommendation System
- Interactive Advertisement
- Voice Recognition
- Metadata Provider System: IMDB, Rovi, GraceNote

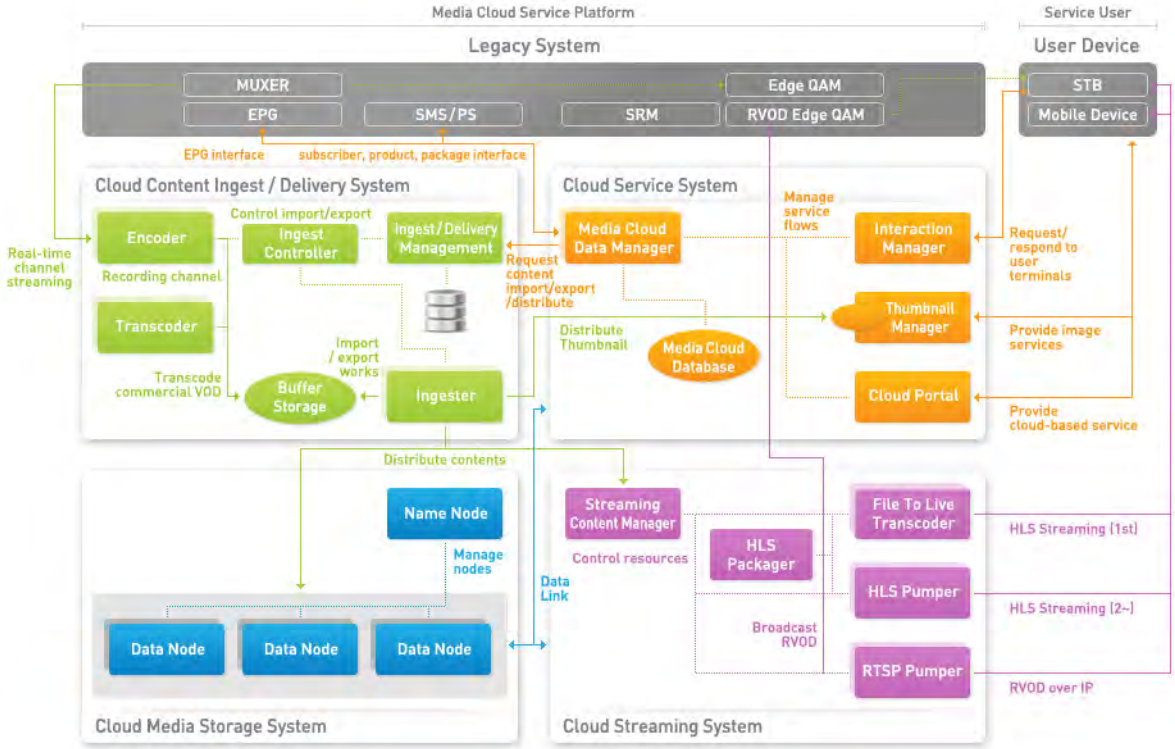
AltiPlex™ Advanced Module

OVERVIEW

The AltiPlex™ Advanced Module is a cloud and media-related, server-based solution that undergoes a process of Data Mining from various media content provided by Live TV, VOD, and Application Providers through Cloud-based solutions, providing services such as Cloud DVR, TV App store, Big Data, Mosaic EPG, and Push VOD. In addition, the AltiPlex™ Advanced Module is interlocked with SDP -- which is a function of the basic Core -- to enable user-based personalized content, recommendations, and searches.



CLOUD DVR



- The Cloud DVR stores recorded content in Cloud Storage provided by business operators instead of the HDD of the STB
- The content can be accessed whenever and wherever through various smart devices
- Time-Shift and Catch-up service
- Simultaneous recording of many channels; successive viewing, viewing again, and lifelong viewing of recorded content are possible

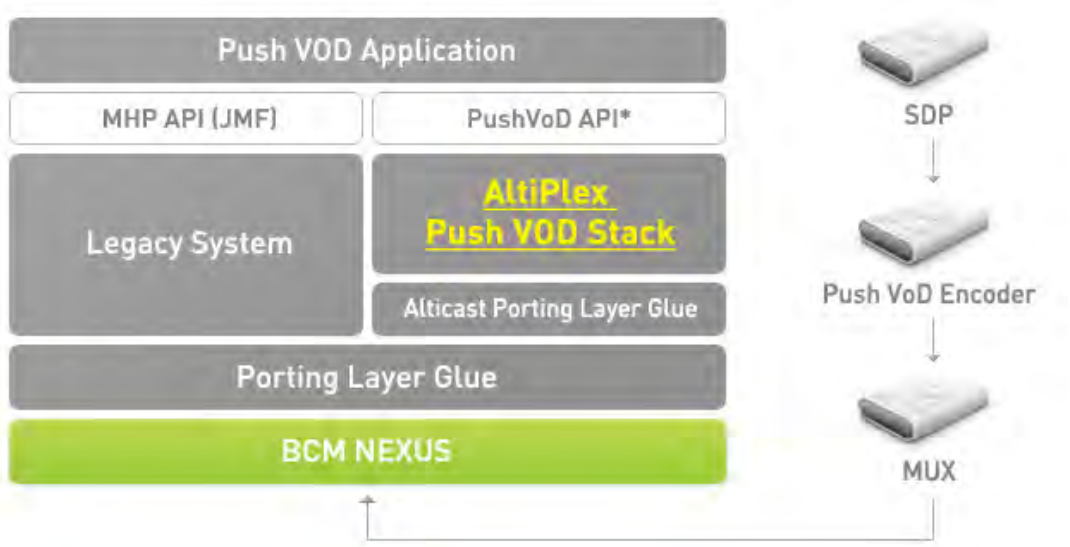
TV APP STORE

- Diverse HTML-based Applications can be run in a variety of STBs
- SDK console tools to allow TV Application Developers, to upload, manage and monitor their applications
- Utilizes web-based Front-Ends, with low hardware dependence
- Provides open integration APIs that can be organically integrated with existing environments

MOSAIC EPG

- EPG menus can be searched easily, quickly, and intuitively by viewers.
- Diverse added services are possible, and TV menu Navigation, On-Screen, operation management, and user preferred channel layouts are freely customized.
- In the case of the 1080i resolution, approximately 100 (10x10) multi-channels can be
- configured with one Mosaic screen.

PUSH VOD



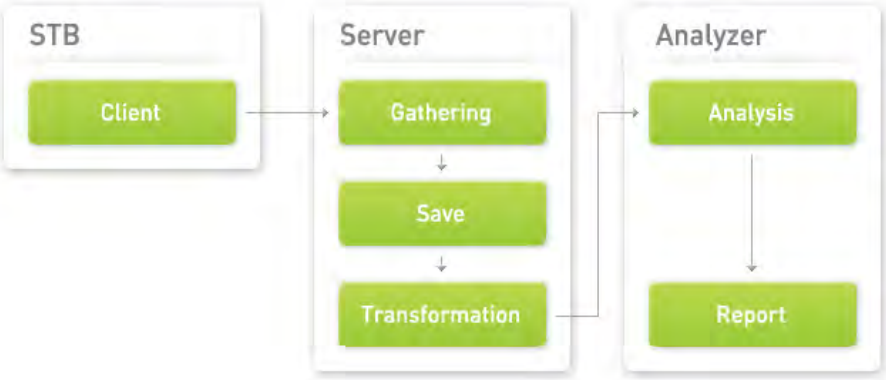
- A VOD service that lets operators transmit content to STB HDD for storage utilizing extra Bandwidth in environments where bidirectional networks for VOD services are either unavailable or poor
- Smart Bandwidth Control function allows downloads from diverse network bandwidths
- Allows subscribers to select their preferred content hourly/daily/weekly
- Enables control such as reservations using diverse Companion devices

AUDIENCE MEASUREMENT

- Collects and statistically processes viewers' program viewing information and interactive service use information in real time
- Using viewing statistics, business operators can provide individual customized content to viewers
- Advertisers can deliver meaningful advertisement data to individual viewers

AltiPlex™ Metrics make target advertisements possible through the collection of diverse kinds of viewing information, data mining, and log analysis. AltiPlex™ Metrics analyzes advertisement utility through accurate channel shares and interactive service shares and enables effective interactive advertisements. In addition, it analyzes customers' behavior patterns such as product searches and purchase patterns to support product-linked marketing. To implement interactive advertising, applications including data should be transmitted during advertisement transmission time, and related schedules should be managed simultaneously. AltiPlex™ Metrics can be divided into a collection/analysis system, a monitoring system, and a scheduling system. The collection/analysis system analyzes in real time VOD and interactive data broadcasting service use behaviors, and shares and extracts meaningful data through analysis modules.

■ Major functions of the AltiPlex™ – Metrics' collection / analysis system



Based on information from the collection/analysis system, business operators can produce and organize advertisements using the scheduling system. Target advertisements can be implemented based on systematized data such as those by channel, interactive data broadcasting service, and based on subscriber information.Based on information from the collection/analysis system, business operators can produce and organize advertisements using the scheduling system. Target advertisements can be implemented based on systematized data such as those by channel, interactive data broadcasting service, and based on subscriber information.

CLOUD ONLINE GAMING

- Without a separate game console, this system drives games in the cloud server and transmits processing results to clients
- Provides functions that can be matched to user profiles such as personalization and recommendation and searches as an integrated UI in TV, STB menus
- Since the Process is executed based on Cloud SaaS, functions such as 3D are processed even without resident 3D support on the STB

BIG DATA (METADATA)

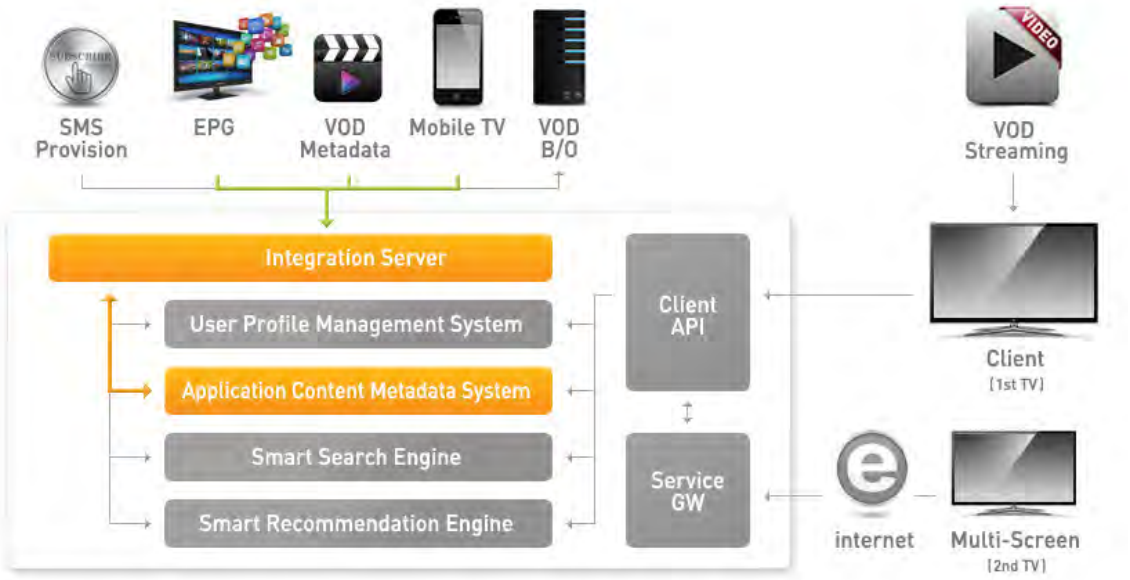
Existing broadcasting networks have been operated more exclusively compared to public Internet networks. Full Internet browsing was impossible with the universal data supplied by operators, and limited data information in the form of a Walled Garden has been provided to users. As full Internet browsing has recently become possible through TV App Stores and browser installation, big data analysis technologies are deemed essential for not only the content Metadata provided by operators but also for the provision of web-based Mash-up services. Big data analysis is very complex, delicate work where cutting-edge technologies must be applied. Cloud computing technologies for the processing of large data in real time are basic and artificial intelligence technologies such as natural language processing, text mining, and machine learning, and semantic technologies are widely utilized.
Based on operators' EPG, VOD, and Mobile TV's Metadata, the AltiPlex™ ACMS (Application Content Metadata System) comprehensively collects information from Web, TV App Stores, TV SNS, and peripheral devices and converts its findings into meaningful data.

The major functions of the ACMS are as follows :

Function	Major content
Metadata acquisition / analysis / distribution	·Live Schedule ·VOD Metadata ·Mobile TV ·Web, TV App Store, TV SNS, etc.
Metadata management	·Menu organization ·VOD and catalog organization

The AltiPlex™ ACMS configuration is as follows :

■ ACMS implementation plan



ACMS uses several state-of-the-art technologies to process metadata. For example, it uses Natural Language Processing (NLP), a technology for processing human languages consisting of characters through computers, consisting of morpheme analysis, syntax analysis, entity name recognition, etc.

For big-data processing, information searches are essential. Large data is indexed, and data related to the theme is extracted from the large data and quickly analyzed. Much more advanced information collecting technologies are necessary than those of existing collectors for web searches. For instance for real-time collection of social media such as Twitter AltiPlex™ applies stream data processing, and AJAX and Focused Crawling technology that can process Java scripts.

Machine Learning is a system that creates models from sufficient learning data and automatically analyzes large volume data through the relevant models to induce and infer results. Usually based on statistical theories such as SVM, it supports powerful data analysis functions such as automatic classification, automatic clustering, and Bayesian network-based inference.

Text Mining is a technology for extracting and analyzing meaningful information from large texts. Its methods include machine learning based-statistical methods and rule-based methods. Nowadays, these methods are used in combination in the form of hybrids. In addition to existing classification and clustering functions, text mining is essential for implementing other functions such as emotion (reputation) analysis.

Cloud computing technologies are basic for extra-large data storage, management, and operation. In particular, NoSQL technologies such as Hadoop, HBase, Casandra, and MongoDB are utilized.

The semantic analysis of data is very important for in-depth analysis. Semantic technologies include the automatic extraction of semantic Metadata, semantic network creation, knowledge base construction, topology utilization, and logical and statistical inference. Semantic technologies are the core for connection between atypical data and typical data based on their meanings and analysis. This fact is proven by Watson computers, Apple's Siri, and Wolfram Alpha.

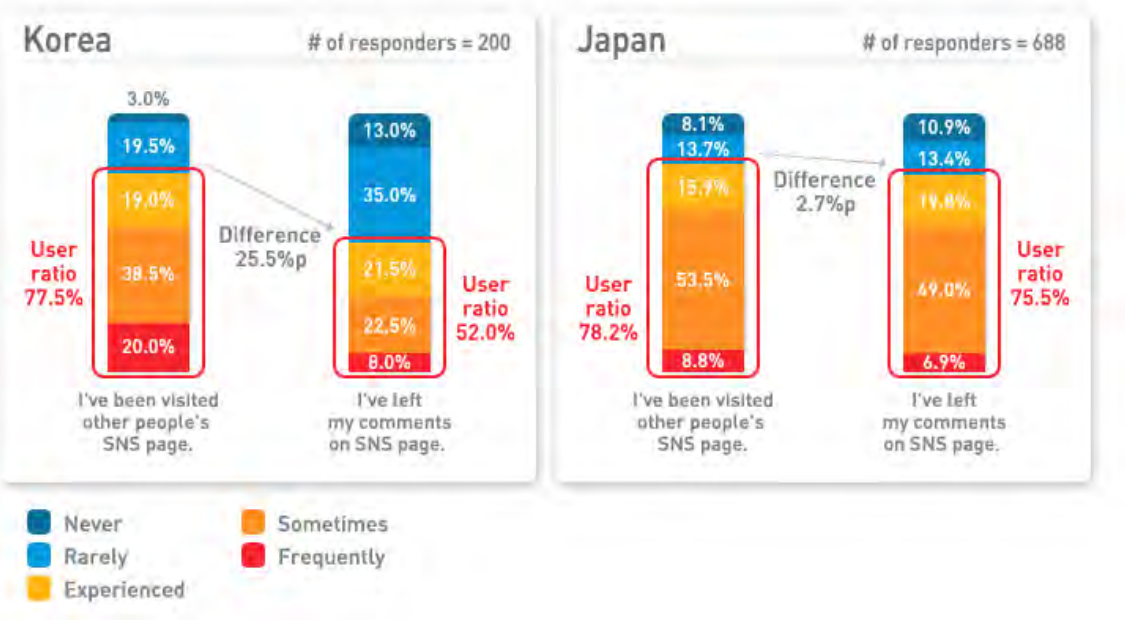
Powerful statistical functions are necessary to find the statistical meaning of big-data and analyze the pattern. In addition, data visualization is becoming more and more important for insightful understanding of analysis results. Technologies ranging from basic visualization such as graphs to network expression and interaction technologies between expression types and analysts are applied.

■ ACMS's technologies applied to big data

TV SNS

There are a growing number of active users who find and read others' opinions or information related to broadcasting programs and content through Social Network Services (SNS) or blogs while watching TV. According to a recent report, in the case of some countries, the rates of SNS usage during broadcasting exceed 50%. As information exchanges through Internet online increase because of the spread of smart devices, the number of cases of active viewing through SNS is also increasing, adding complexity to simple passive ' Lean-back ' TV viewing.

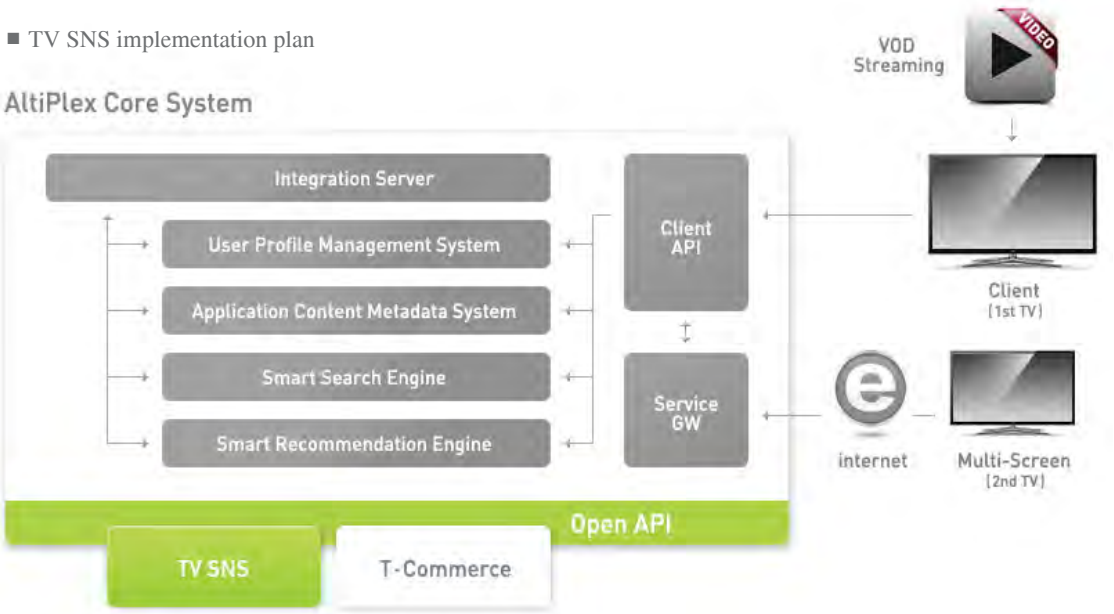
■ Comparison of the forms of use of those who experienced using social TV (Korea Communications Agency)



AltiPlex™'s TV SNS provides SNS solutions linked to existing Legacy SNS and new SNS solutions. Subscribers can enjoy broadcasting program-centered interactive services with existing SNSs such as Twitter and Facebook; if operators want to construct new SNS systems, they can introduce TV SNS solutions optimized for TV and mobile devices. By integrating AltiPlex™ Media Cloud, users can directly share image frames with their friends; separate personal recording systems (PVRs) are not necessary. With the appropriate

rights, users can send Pay VOD to friends on TV SNS, allowing users to view the video together.
The TV SNS is integrates with AltiPlex™ Core Module's open APIs. SNS data by program are collected/analyzed by the ACMS, allowing subscribers to search friends opinions and identify related content through the Smart Search Engine.

■ TV SNS implementation plan



A smart appliance is any home appliances that has been connected to network functions and equipped with service control functions to provide customized content and smart home service functions. AltiPlex™ – Smart Appliance encompasses various smart devices such as smartphones and smart networks at home and related networks to implement integrated smart homes.
AltiPlex™ – Smart Appliance performs the role of home automation gateway for monitoring and control so that smart devices can deliver optimum performance befitting each device.
Major features of this Smart Appliance include Smart Control, Application, and Save.

SMART APPLIANCE

Component	Detailed explanation
Smart Control	· Provides improved control methods such as voice control and motion control, connected with users' smart devices such as smart phones and tablet PCs for remotely monitoring and controling smart home appliances · Up to 30% of troubles are resolved with customers' brief diagnoses without visiting services
Smart Application	· Provides dedicated applications suitable for smart home appliances to maximize the usability of home appliances
Smart Save	· Analyzes users' power use patterns to minimize unnecessary power consumption

4.3 OPEN PLATFORM : AltiPlatform™

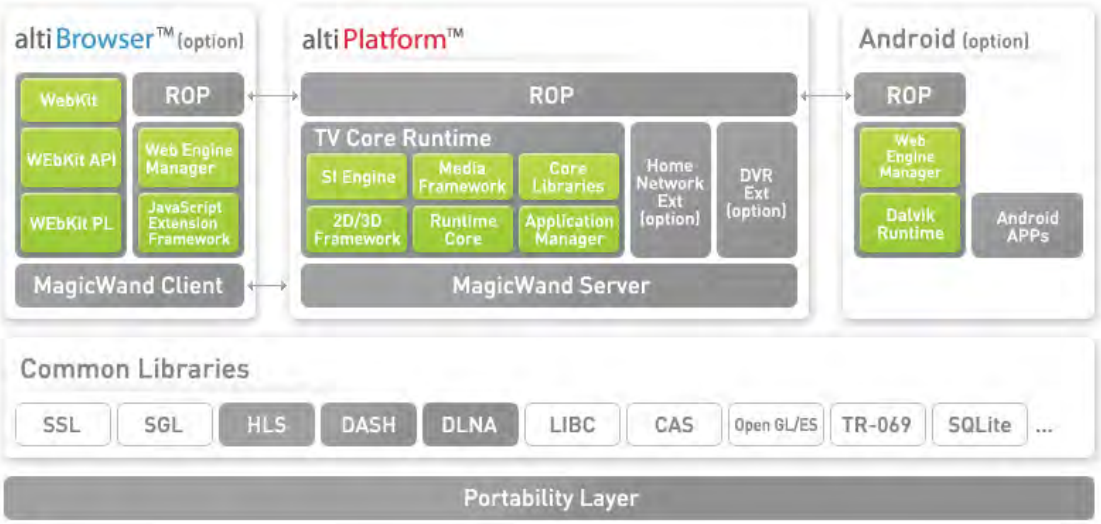
AltiPlatform™ is a Middleware solution that implements STB, STB embedded TV, Game Consoles, and Multi Screen Devices' Media Players according to PayTV's STB software and Application policies.
AltiPlatform™ is one of the most widely adopted STB middleware systems in the world and has been ported to over 30 million set-top boxes from various CPE manufacturers with various chips and operating systems. A market leading middleware solution, AltiPlatform™ offers high portability and system stability. AltiPlatform™ middleware has evolved to support various iTV service platforms and technologies including DVB-MHP, OCAP / tru2way platform, HTML5-based browser, and Android for terrestrial, Satellite, Cable and IPTV operators.
AltiPlatform™ is portable software that can be implemented across a range of hardware devices.
AltiPlatform™ is an evolutionary step, not a revolutionary one. By seamlessly coupling a worldwide proven technology with technologies that cover other features, AltiPlatform™ is a proven platform for customers moving content product offerings forward.
In order to meet the most demanding Hybrid solution, Alticast has extensive experience with multiple customers and vendors throughout the world including SkyLife, KT, T-Broad, CJ Hellovison, Videotron, Time Warner Cable, Cablevision USA, UnityMedia, and Italian DTT Broadcasters. Based on this excellent experience, Alticast has a world-wide reputation for on time delivery while meeting project deadlines.

AltiPlatform™ Overview

FEATURES

- High Performance STB Software
  - Based on open standards, optimized for high performance
- Modular Architecture
  - Flexible and component-based core for addressing legacy and advanced devices
  - Easy to support various customer needs and wants (i.e. HTML-5, Android & more)
- Pre-integrated with the industry-leading solutions
  - Pre-integrated with the industry's leading set-top box manufacturers, chipsets and CAS / DRM solutions
- Open Standard
  - Open solution for operator freedom to choose best-of-breed (no vendor lock-in)
- Flexibility and Scalability
  - Modular based architecture (middleware, ecosystem)
  - All fit, size of deployment) well to various customer requirements (legacy to advanced platform with more than 30 device vendors)
- Portability
  - Compatible with multiple vendors and different hardware platforms
- Market Proven solution
  - Worldwide deployment of over 30 million devices within 8 years
- Strong system integration expertise
  - Proven Partnership, Technology, and Experience
  - Great experience in multi-vendor project management

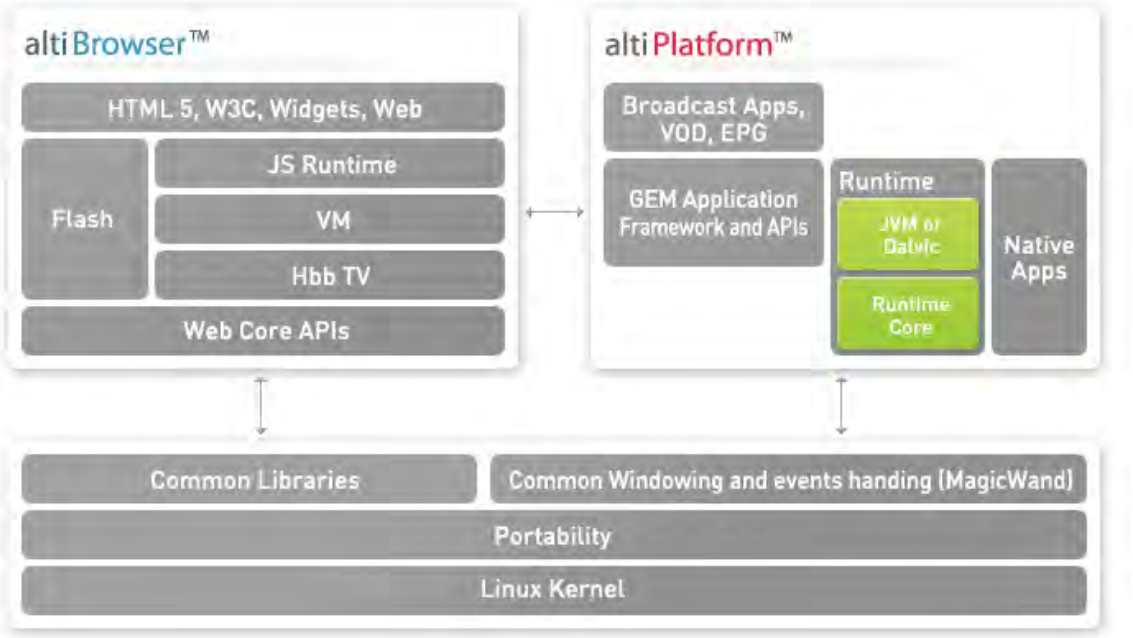
ARCHITECTURE



- Portability Layer
  - Provides well-defined APIs and a developer's test kit
  - Reference implementations on major chipset makers available
- Common Libraries
  - TV functions such as HLS, DASH and DLNA stack
  - Built on top of the portability layer to remain independent of the chipset or kernel
- HLS / DASH
  - Supports adaptive streaming such as DASH and HLS
- DLNA
  - Supports DMS(Digital Media Server), DMR(Digital Media Renderer), DMP(Digital Media Player) scenario category
  - Supports Home networking service like multi-room DVR and enables sharing private content on multiple devices within the home network
  - Supports Multi-Screen media sharing by converting live TV show or VoD delivered to STB to the format adapted to various mobile devices using trans-coding
- TV Core Runtime
  - Delivers reliable TV services covering both free-to-air and Pay TV
  - Supports all content delivery networks – broadcast, hybrid, IPTV and OTT
  - Provides application management system for various types of applications (i.e. web, Java, C and Android) to run within the platform
- ROP (Remote Object Protocol)

  In order to enable TV functions within Browser or Android environments, AltiPlatform™ includes a module to handle TV-specific requests/requirements based on JSON

  - Accommodate interface among multiple application environments, i.e. Java or C (AltiPlatform™), TV Core(AltiPlatform™), web(AltiBrowser), and others such as Android
  - Enables other environments to use TV Core's TV functionality and TV Core to manage all applications
  - More detail explanation cab be found in AltiPlatform™_DVB RDK section



- DVR External
  - Extension for service applications to enable PVR service
  - Supports trick-play and time-shifting
  - Supports series recording, remote recording, and recording from the time-shift buffer
  - Supports external HDD
  - Fully integrated in Pay TV delivery system

- Home Network External
  - Extension for service applications to enable home networking service using DLNA

- MagicWand Server/Client
  - Serves as a window management system
  - Prioritizes and distributes layers of applications from multiple environments and user inputs

SUPPORTED SERVICE FUNCTIONS

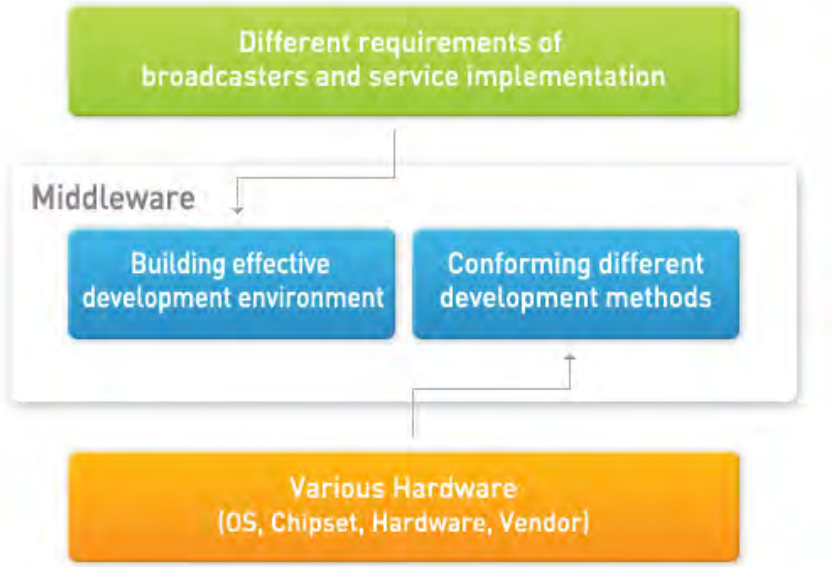
- All delivery networks support: Cable, Terrestrial, Satellite, IP and Hybrid
- Web-based service using AltiBrowser
- DVR, including multi-room DVR
- Trick play and time-shift
- Companion screen support: Content distribution to multiple devices
- Remote programming
- A wide variety of remote control units including Smart Remotes
- VOD, PVOD, Catch-up TV, OTT, Start-Over, Progressive download
- Home Gateway solutions
- Multiple CAS and DRM integrations
- Supports access to cloud APIs and services
- Application store (HTML or Android) and application platform (T-Shopping, social TV, recommendation, quiz, game…)
- Remote set top box monitoring
- Viewer behavior measurement
- 3D Graphics
- Social TV
- Closed caption, subtitle, and teletext
- Picture-in-Picture
- Adaptive streaming over HTTP
- Multiple graphic resolutions support

AltiPlatform™'s STB Integration

OVERVIEW

Alticast has been applying high-performance Middleware and CAS equipped with both stability and expandability to STBs of broadcasting business operators worldwide for many years. Based on the foregoing, Alticast is providing diverse digital broadcasting services. Middleware means integrating different types of hardware and environments to provide the same single software environment. Broadcasting business operators can apply Middleware regardless of STB hardware environments to provide diverse application services.

■ Advantages of using Middleware



AltiPlatform™, is an STB Middleware platform, a solution optimized by Alticast's years of experience; it is high-performance, proven Middleware that can be designed to support Java, HTML5, Android, HbbTV, and/or RDK. AltiPlatform™ accommodates the security and stability required by business operators, so it can easily accommodate not only standard TV functions but also new web and mobile services.

RECOMMENDED

Division		Entry-level STB	Mid-Tier STB	High-End STB
CPU		< 1,000DMIPS	< 3,000DMIPS	≥ 3,000DMIPS
Main Memory		< 512MB	< 1GB	≥ 1GB
Flash Memory		< 512MB	< 1GB	≥ 1GB
Tuner		Single or Twin	Twin or Quad	Multi-tuner
Middleware	Java	O	O	O
	HbbTV	O	O	O
	RDK	X	O	O
	HTML5	X	O	O
	Web MW	X	X	O

CASES OF APPLICATION

AltiPlatform™'s SimulCast plan

OVERVIEW

For operators to migrate to a new Middleware and CAS solution, they must have high technical skills and experience. Even though middleware can be standard, private APIs may be included. CAS Middleware and Applications are rarely interchangeable with those of other vendors. Alticast provides standard-based Middleware, CAS, and Applications so that operators can recombine software easily and quickly

MIDDLEWARE MIGRATION

The following table shows cases of application of AltiPlatform™'s Smart Middleware :

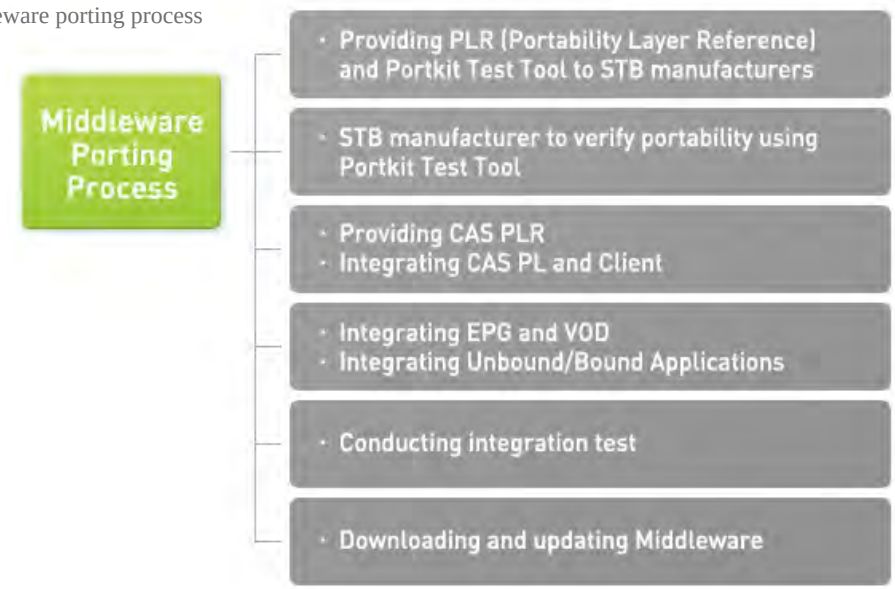
Division	Hybrid Smart Middleware	Smart Web Middleware
Composition	Java + HTML5	HTML5
Broadcasting signal control	Java	HTML5 (Private JavaScript)
Development of applications	Java or HTML5	HTML5
Advantages	Accommodates previously provided Java-based application services	Provides HTML5-based Mash-up integrated services
Weaknesses	Cannot provide HTML5-based Mash-up integrated type services ⇒ applications should be developed with Java	Cannot accommodate existing Java-based application services ⇒ should be newly developed

AltiPlatform™ Introduction Process

OVERVIEW

Alticast generally provides the following process for operators' Middleware Porting or Migration :

■ Middleware porting process



Alticast performs Prime Integration of Middleware, CAS, and Applications for vendors to ensure smooth, rapid integration and porting.

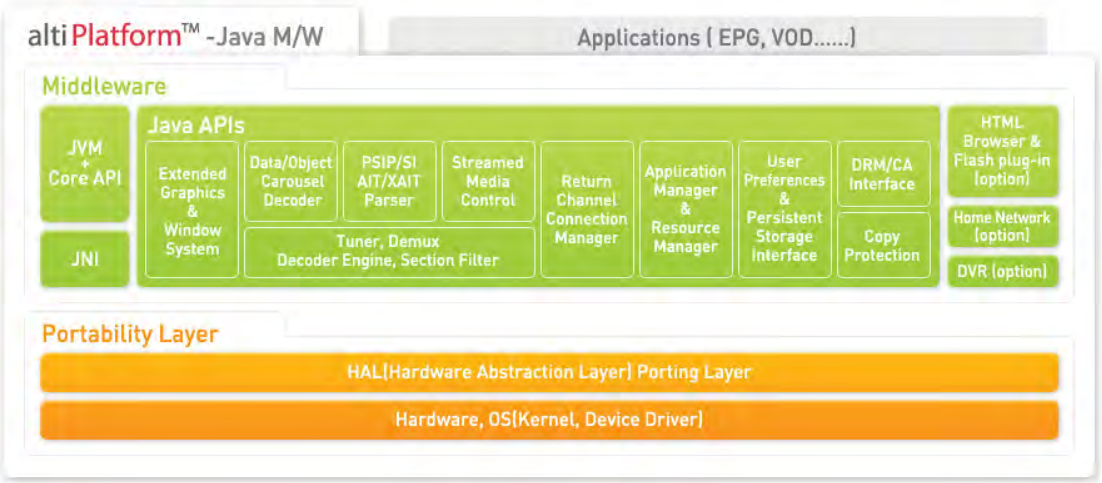
Kinds of AltiPlatform™

CHARACTERISTICS

AltiPlatform™_Java

- International standard GEM (MHP, OCAP/tru2way, ACAP) is applied where applicable
- Optimum as operation software for low-priced STBs below 1,000 DMIPS
- DVB-T, DVB-C, DVB-S, OpenCable, and RDK technical standards are applied where applicable

ARCHITECTURE



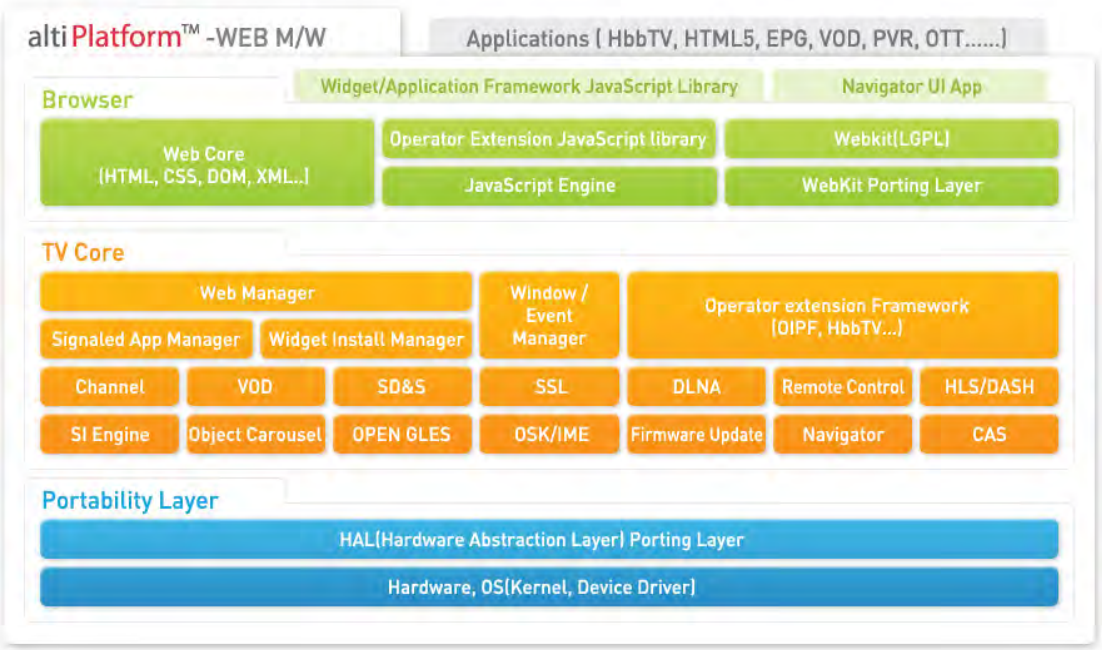
- Korea : SkyLife (Satellite), T-Broad, CJ Hellovision, C&M, HCN (Cable)
- Taiwan : Kbro, CNS, TBC, TFN (Cable)
- North America : Time Warner Cable, Cablevision, VideoTron (Cable)
- Europe : Mediaset (Terrestrial), Unity Media (Cable)

AltiPlatform™_HTML5 Web Middleware

- Satisfies open source-based HTML5, RDK standards
- Requires 3,000 DMIPS or higher STB CPU performance

CHARACTERISTICS

■ AltiPlatform™_Web MW



CASES OF APPLICATION

KT (Korean IPTV), T-Broad (Korean Cable)

AltiBrowser

OVERVIEW

AltiBrowser is a Webkit-based browser component optimized and enhanced for TV platforms. It is the engine that powers the HTML5 user experience to deliver TV and Internet functionality to the TV experience. AltiBrowser is compliant with HTML5 and Hybrid Broadcast Broadband TV (HbbTV) standards. It implements Open IPTV Forum (OIPF) APIs for TV-specific functionality. Because AltiBrowser complies with web standards like HTML5 and JavaScript, the user interface can run on a STB or other compatible device, including tablets, phones, and PCs.

AltiBrowser is based on trusted technologies, offering maximum performance with unsurpassed stability and full TV functionality. It harmonizes the delivery of broadcast and broadband content through a single easy to use and familiar web-based interface. It is built on open standards, providing freedom from the monopolization and limitations created from proprietary technologies.

The interoperability and cross platform capabilities of HTML5 and native support expand these services to anyone, anywhere, on any device. The value of open and global web standards reduces time to market of new services, simplifying UI deployments and upgrades while minimizing implementation costs.

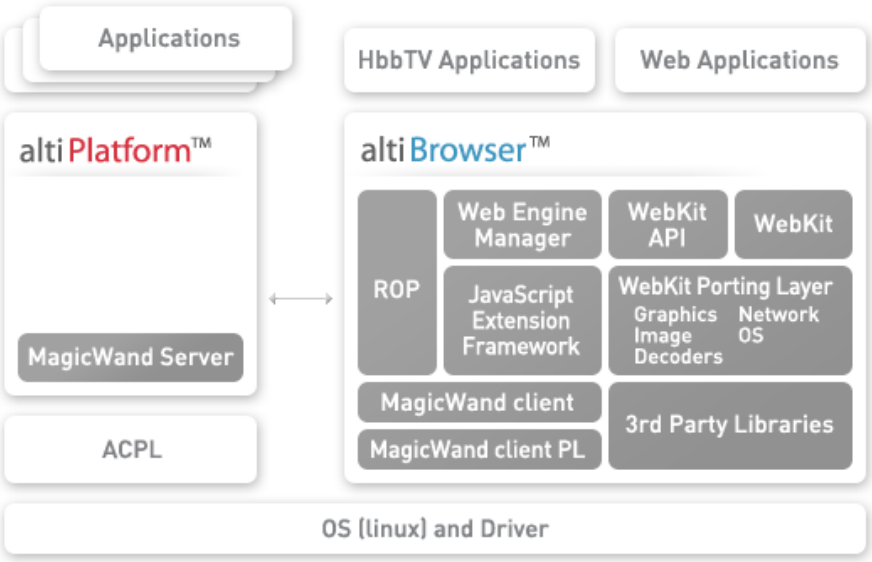
Operators now can unleash the potential of connected Television offering tremendous opportunities for entertainment, commerce, games, and social interaction.

Supported international standards

Web standard	TV standard
W3C web standard(HTML5.0 etc.) Java Script 1.8.1 (ECMA262.5.1) CSS3 1, 2, 3 DOM Level 1, 2, 3	HbbTV v1.5 OIPF 2.1 CEA 2014A CEA 2014B Smart TV Alliance v3.0

- Home Network External
  - With Cookies, AJAX, JSON, etc.
- JavaScript 1.8.1
- DOM
  - CSS 1,2,3
- HTML5
  - Web messaging
  - Web storage
  - Web SQL Database
  - Offline web applications
  - Extended UI attributes for input and form.
  - Canvas
  - WebSocket
  - Video / audio (Integration is required)
  - WebGL (OpenGL ES 2.0 is required)
  - XMLHttpRequest Level 2
  - SVG
- HbbTV v1.5
  - Web messaging
- MW Integration Interface
  - Control browser from AltiPlatform™
  - User AltiPlatform™ features from AltiBrowser Side

ARCHITECTURE



- WebKit
  - WebKit engine : JavaScriptCore + WebCore
- WebKit Porting Layer
  - Graphics
  - Network
  - Encoding / Decoding
  - Image decoder
  - Threading and synchronization
  - Direct OS system call
  - HTML5 relevant feature porting
- MagicWand Client
  - Vector graphics back-end for AltiBrowser
  - More detail for MagicWand can be found in AltiPlatform™_DVB RDK section
- MagicWand Client PL(optional)
  - ACPL extension for AltiBrowser
  - Middleware interfacing module.
  - Exposes browser controller interfaces
- Web Engine Manager
  - Manage multiple web engine instances
- JavaScript Extension Framework
  - HbbTV APIs
  - Project dependent APIs(optional)

PERFORMANCE

Browser performance benchmarks are used to measure the performance of the JavaScript engine of a web browser.
There are numerous test suites available for benchmarking browser performance, and most are free of charge. Typical test tasks include rendering and animation, DOM transformations, string operations, mathematical calculations, sorting algorithms, graphic performance tests, and memory instructions.
Browser tests deliver different results depending on the type and structure of testing, as well as the focus of their measurement. JavaScript and JavaScript engine speed are not the only criteria by which to evaluate the speed of a browser.
Loading and rendering speed for a specific website via the Internet, memory consumption, hard disk storage consumption, and start-up speed may also be considered when rating the

performance of a browser, but normally are not included in online browser speed tests. AltiBrowser evolves overtime as HTML5 continues to expand and grow. Regularly tested with the standard web test suites, AltiBrowser continually out performs competitive TV Browser solutions.

AltiPlatform™_RDK-IP

OVERVIEW

- North American business operator Comcast's open source-based HTML5 web Middleware
- QT was the original framework for RDK ▶ Recently, switching to Blink Browsers was reviewed
- Commercial version RDK 2.0 is planned to be released in the 1Q of 2014

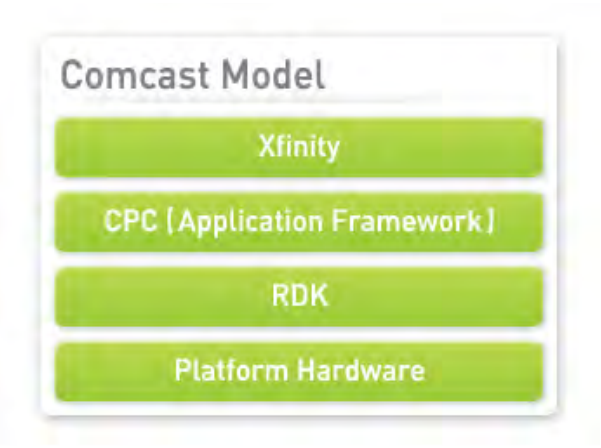
RDK-IP is a pre-integrated software bundle targeting an IP-based device platform and SoC, which are cost-effective IP-Client devices that can run native and cloud-based applications. The RDK-IP platform is a subset of the hybrid RDK platform that targets pure, IP-only set-tops interacting with the IP gateway devices or home networking clients. The RDK-IP platform can be implemented to support QAM-based tuning which is sometimes used for Hybrid Gateway STBs.

The following RDK-IP components are some of the key pieces that are important to understand :

- User Interface Framework — Qt is the application framework that supports the graphical user interface, although in 2014 RDK will transition to Blink.
- HTML5 Engine — QtWebKit is the port of the WebKit web browser engine on top of the Qt framework.
- Multimedia Framework — Gstreamer provides the video pipeline and media-handling components for audio and video playback, recording, and streaming. A more thorough Media Framework will be introduced in version 2.0
- UPnP Libraries — Provide support for home networking content discovery and sharing.
- HTTP Server — Open source web server optimized for speed-critical environments.
- Security Libraries — Several provided libraries for secure communications including SSL / TLS, PGP, and other cryptographic functions.

At the top level, the constituent pieces and providers of an RDK-IP solution are depicted in the following diagram.

In the Comcast case, the overall picture is as follows :

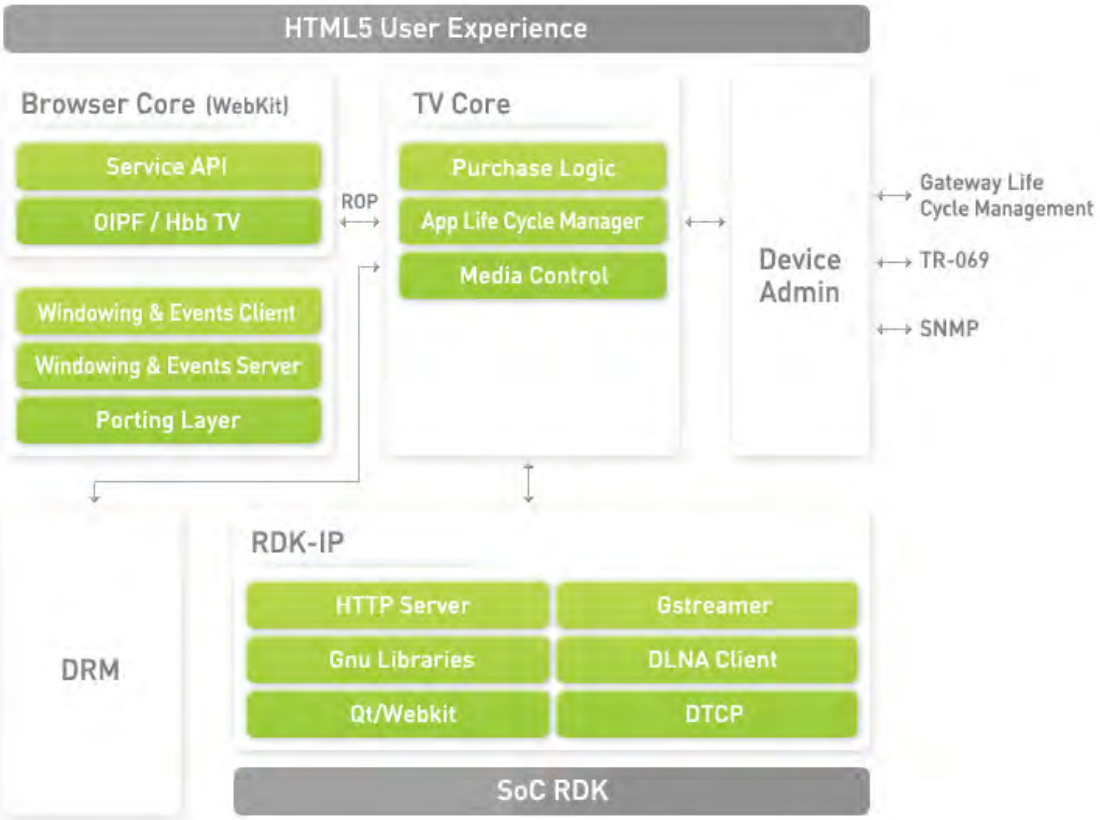


The guiding concept here is that a solution is composed of discrete tiers of functionality provided by a set of integrated vendors. In most cases, MSOs choose to implement the top layer to deliver a branded user experience. In some cases, like Comcast has developed CPC for its application framework layer, an MSO may choose to implement the second layer, the application framework, which is the set of enabling functionality that interlinks with the RDK-IP core. The RDK-IP core is, of course, then interlinked with the platform hardware as provided by the OEM and the SoC provider.

BENEFIT

One of the most pronounced advantages of the RDK-IP initiative is its reliance on open source software components. The versatility of component-based design using open standards ensures that operators can build systems without risk of lock-in to ineffective component suppliers. Operators are free to substitute components of the RDK as desired, or they may choose to leverage only pieces and parts of the RDK, connecting additional standards-based components to suit their particular technological and business objectives. As expected, continuous integration support for the open source components is a consideration. Components may be free to the community, and they may also provide cost-based versions that provide associated support. Service operators will likely rely on an in-house or third-party integrator with continuous integration expertise to manage the open source components within the layers of the solution stack.

ARCHITECTURE



- Browser Core

The Browser Core component is the engine for layout, rendering, and presentation of the HTML5 User Experience. Alticast has developed the AltiBrowser solution specifically for TV platforms. AltiBrowser is a WebKit-based browser, and is compliant with HTML5 and HbbTV standards. AltiBrowser implements Open IPTV Forum (OIPF) APIs for TV support. Because AltiBrowser complies with web standards like HTML5 and JavaScript, the user interface can run on a STB or another compatible device, including tablets, phones, and PCs.

- Windowing and Event Management

IP devices moving to a browser-based user experience require an underlying mechanism to support the multi-tab browsing experience that users have come to expect during their content consumption. Alticast implements their Magic Wand framework to provide the necessary elements to handle multiple windows or applications running on the device.

- TV Core

The Alticast TV Core is a Javascript-based engine optimized for video processing and presentation. Its primary responsibility is to expose the television-specific functionality to the HTML application layer. For example, TV Core implements the open standards protocols OIPF and HbbTV to handle tuning and streaming operations on the device. This component also provides southbound access to device settings for controlling the LED displays and/or power cycling the device.
TV Core also provides the necessary agent for application life cycle management, which is critical for real-time resource management in the multi-browser/multi-application environment envisioned for next-generation IP devices. TV Core can support the media handling for multiple user agents in an Alticast solution, so operators can have HTML5, and Native applications side-by-side on the same device.

· Device Administration

AltiOp is a Device Administrator that provides the on-board services and APIs to manage the CPE device including :

- Device authentication
- Software download
- Configuration management
- Network management
- Diagnostics and logging
- Usage measurement and billing

AltiOp securely connects to equipment in the MSO back-end systems and integrates with industry standard control and management protocols. Most prominent among these is integration with the Auto Configuration Server (ACS) using the Broadband Forum TR-069 specification. AltiOp includes support for Internet protocol detail record (IPDR) for usage-based billing in the high speed data applications. IPDR future extensions could prove complementary to SNMP and TR-069 objects.

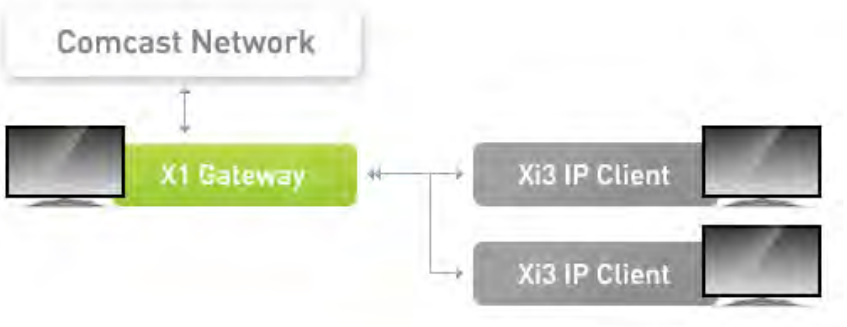
· Additional Considerations

There are a number of additional considerations that depend on the specific partner and licensing arrangements that a service operator wishes to pursue. In particular, there is the question of video transport and the supporting protocol(s). For example, HTTP Live Streaming (HLS), Microsoft Smooth Streaming, Adobe Flash, and MPEG DASH, as well as others, that may be required by video service operators. Business arrangement and licensing agreements precede the technical integration of these components.
There is also the question of content interoperability and security. Along these lines, decisions and integration points must be met for DLNA, DTCP, and/or DRM components.

RDK ARCHITECTURE AND ALL-IP MIGRATION

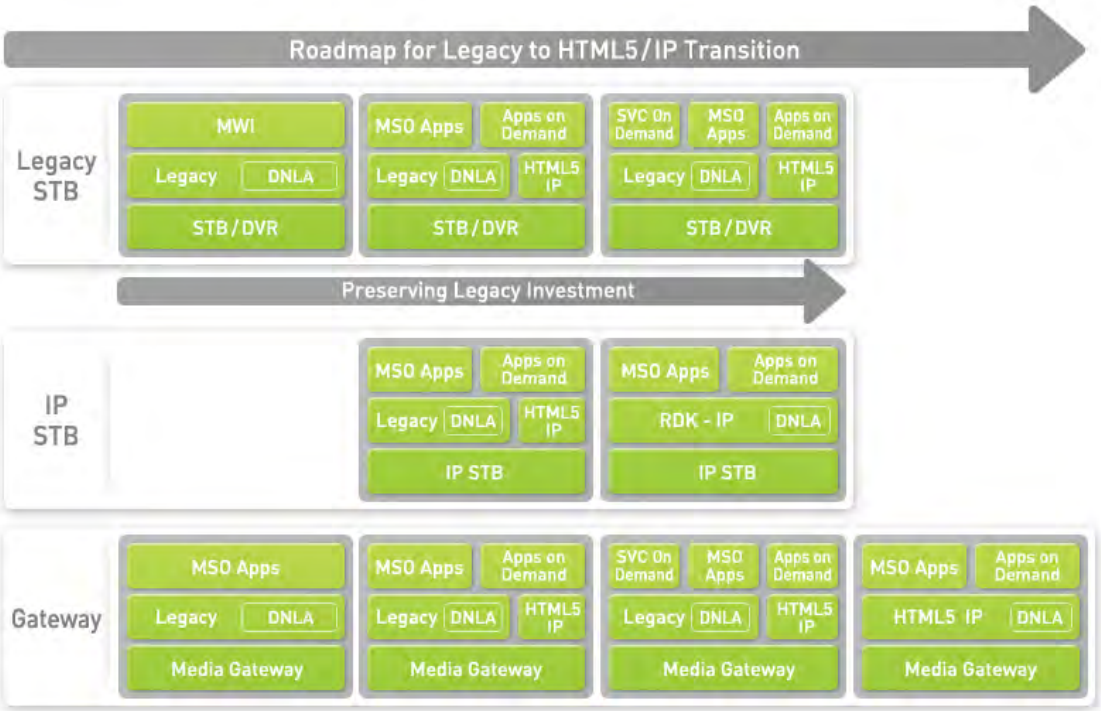
The current Comcast RDK architecture uses the hybrid RDK stack on the X1 Gateway that includes OCAP support, and the Xi3 RDK-IP stack on the IP Clients. The Xi3 clients connect to the X1 gateway, providing guide information and transcoded IP video. Code updates and related monitoring and provisioning also route through the gateway to the IP clients. Future configurations of this architecture will presumably support the IP clients connecting directly to the Content Delivery Network (CDN) for video services delivered via IP or to a future in-home IP only gateway.

■ Current Comcast RDK architecture



This Comcast approach is supportive of architectural innovation and potential shift to all-IP services. In this regard, RDK represents a blueprint for the industry. Other MSOs may follow suit in some form or fashion or may strike out in other directions. Nevertheless, the industry does appear to be moving along an evolutionary path toward all-IP video services delivery.

This potential evolutionary path is illustrated in the following figure :



Many operators wish to preserve their current software and hardware investments as they develop a path for rolling out new hardware for customers. Some existing set-top boxes (STBs) in the field could provide a transition wherein new HTML5 IP functionality can be added side-by-side with Native implementations on legacy hardware. This development can become the catalyst for the eventual complete transition to IP STBs or gateways. As seen in the diagram above, the final goal is to move the user experience to complete IP.
An efficient solution is to preserve tru2way core functionality that can provide basic support for either legacy or IP delivery.

DEPLOYING AND RDK-IP SOLUTION

Consider the current status of RDK-IP and its readiness for deployments beyond those owned and operated by Comcast. As discussed above, RDK-IP is a platform that enables rapid development and deployment of new broadcast and IP-based video solutions. No doubt, RDK-IP significantly levels the cost curve, but in and of itself, RDK-IP is not ready for systems integration testing in any MSO integration lab.
Consequently, many MSOs are now asking: Is RDK-IP a viable platform for my next-generation IP client strategy? How quickly can RDK-IP integrate into my back-end systems architecture?
Alticast believes that the RDK-IP initiative presents a critical "leg up" for developing new and cost-effective IP solutions, and that it will most certainly reduce time-to-market for operators. Comcast has developed CPC for its Application Framework layer, a proprietary piece of their solution. Service operators must source their own components essential for a fully realized solution.
Together, the RDK and RDK-IP subset should provide reduced development and faster time-to-market for cable industry operators as they move into the future of all-IP video delivery and next-generation user experience. Comcast has provided leadership and direction to align SoC and OEM vendors beneficially in support of this industry initiative. Nonetheless, RDK does not provide a complete end-to-end solution for the deployment of devices onto the typical MSO network. MSOs must integrate and optimize RDK for their own networks.
As discussed above, a deployable IP client solution is composed of discrete tiers of functionality provided by an integrated set of vendors working with MSO. The RDK-IP is a viable, and in many cases, advantageous, core component for the device software.

An alternative approach to the RDK-IP client device software is the IP client stack already developed and deployed by Alticast in Korea. AltiPlatform™ is an open standards device software solution that uses many of the same open source software components in RDK-IP. Alticast developed this solution in 2012 to help its customers who had specific time-to-market objectives for IP video services delivery.

CASE OF APPLICATION

US Cable Operator

AltiPlatform™_DVB RDK

OVERVIEW

The Alticast implementation of DVB-RDK is closely aligned to generic RDK version 2.0, more commonly known in the community as the Delia project. The generic RDK v2.0 is an OCAP-less implementation geared more toward an All-IP environment with the addition of an improved Media Framework to support natively advanced IP features such as DLNA streaming, IP time shifting, IP buffering, etc. Loosely modeled after GStreamer, the RDK Media Framework (RMF) defines an architecture composed of Media Sources (IP, VOD, DVR, DLNA), Media Sinks (DVR, HTTP), and Filters (transcoders).
The Alticast DVB-RDK is highly customizable and is based on device requirements; it can be packaged with the right set of components. For example, a device with QAM tuning capability will need the QAM module and CA/Network component. To implement a time-shift buffer or DVR recording, the DVR source and DVR sink would be needed. In the case of a different network/CA provider, only the CA/Network component requires modification. The same applies to the out-of-band SI (System Information) module, which can be implemented with SI delivery through HTTP or DSG tunnels.
Alticast DVB-RDK can also be configured with the Qt/Webkit 4.8/5.0 browser that comes with the generic RDK as well as Alticast's high-performance AltiBrowser. This flexibility allows MSOs to take advantage of the higher performance and stability of AltiBrowser and implement a smooth UI/UX on top of it while keeping the option to switch to the standard Qt/Webkit browser in the future if the need arises. For HTML5 UI/UX in particular, browser performance is clearly the key indicator for the quality of user experience.
Another key feature of Alticast DVB-RDK is the support of a Multiple Applications Environment. This allows having HTML5 UI/UX running on the browser while other applications such as "Red button" or HbbTV can be executed in parallel.
Another important benefit for MSOs is the guarantee of new Cable-oriented features regardless of a single vendor roadmap. This means that MSOs can plan and roll out new cutting-edge features in sync with the RDK quarterly drops without being dependent on any vendor's roadmap.

BENEFITS

- RDK roadmap compatibility

  Alticast is committed to maintaining compatibility with the generic RDK roadmap. The quarterly/semi-annual feature drops are already scheduled until version 2.5, and all these new features can be integrated into the specific MSO configuration based on requirement. This guarantees that there will be no separate branches of the main RDK but separate configuration of the main RDK components.

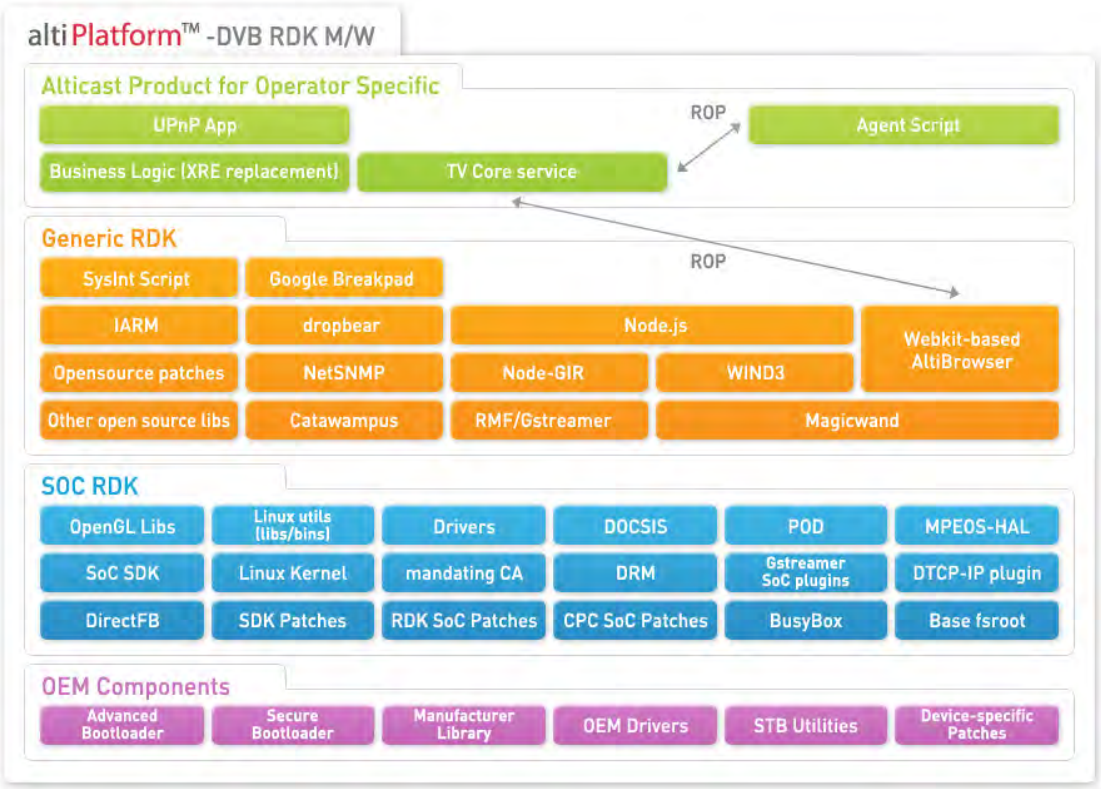
- Flexibility

  The main goal of incorporating Alticast's components is performance and robustness. Alticast is committed to maintaining full flexibility in the software stack to guarantee seamless transition if, in the future, for example, the Qt/Webkit browser shows better performance or if the MSO wishes to switch components for any other reason.

- Performance and Stability

  Even though RDK is open source and royalty-free, Alticast will make sure that the quality of user experience will meet the expectations of the MSO and its subscribers, either by optimizing generic components or by replacing them with more mature components to guarantee the best possible customer experience.

ARCHITECTURE



As mentioned earlier, the implementation of Alticast DVB-RDK is closely aligned with RDK version 2.0, more commonly known in the RDK community as the Delia project. The generic RDK v2.0 is an OCAP-less implementation more geared toward an All-IP environment with the addition of an improved media framework to support natively advanced IP features, such as DLNA streaming, IP time shifting, IP buffering, etc.

The overall architecture, which can be seen in the picture above, is divided into four main horizontal blocks or layers as follows :

- Alticast Product for Operator-Specific Layer

  This top layer (where the proprietary Comcast XRE UI used to be) represents the backend integration, including protocols, services, TV specific features, business logic, etc. This integration layer is completely independent of the layers below; thus, for example, the replacement of the browser in RDK v2.0, v3.0, etc., will have no impact on this layer, and the existing services will be intact.
  Alticast has developed this layer as two sets of Javascript modules, one standard and one customizable, to assure smooth and fast integration with the MSO's back office. Besides its flexibility, another key advantage of implementing these modules in Javascript is that they can be very easily moved into the cloud if the MSO so wishes.
  This means that the Alticast DVB-RDK not only fully supports the current generation of traditional DVB networks; as the MSO gradually moves some back office systems to IP and to the cloud, the STB software is future-proof and ready to embrace this All-IP environment.
  The TVCore module is the basic standard DVB implementation. Most of the TV features are implemented in C language as GStreamer plug-ins, but high-level Javascript APIs are

supported to control those underlying features. The TV Core module is built on top of Node.js (see next section below).
The Agent Script is the implementation in JavaScript of most of the MSO-specific DVB descriptors, rules, and plugins (PSI, SI, subtitles, teletext, etc.)
Finally, the Business Logic contains all the operator-specific business logic, aligned with those features from TV Core.

- Generic RDK Layer

  This is the layer commonly referred to as generic RDK, and it consists of a set of open source modules packaged together to generate a middleware system.
  A notable component within the Alticast implementation is Node.JS, which is a set of libraries and plugins serving as the foundation for the TVCore DVB stack. This component can be considered the static part, and the javascript modules on top the dynamic part. Node.JS is fully supported by Google, and it can support both web and hybrid environments; thus, it is well suited to an All-IP future.

- SoC (System on Chip) RDK Layer

  This layer represents the interface to the silicon chosen by the MSO, such as Broadcom, Intel, ST, Entropic, etc., and includes components such as Linux drivers, GStreamer plugins, and OpenGL.
  The CA and DRM modules will be replaced at the request of the MSO with the appropriate ones, e.g., Widevine (Google), Playready (Microsoft), Marlin, etc. The Alticast DVB-RDK is flexible enough to support a wide variety of CA and DRMs vendors. Alticast is not only a certified partner of many of these vendors; it also has experience in these integration activities already.

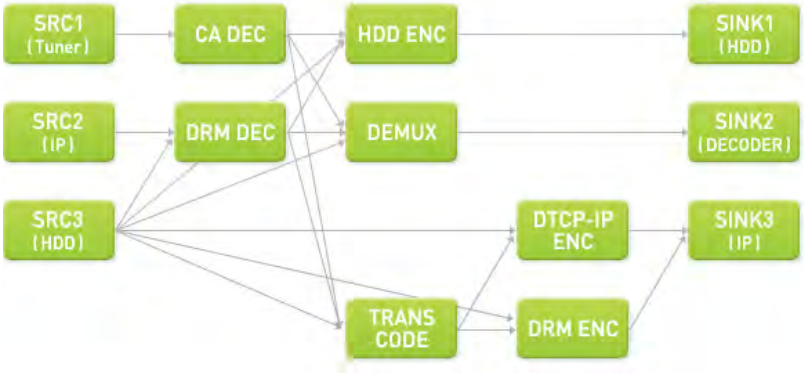
- OEM Components Layer

  At the bottom of the diagram is the OEM software for bootloader/disaster recovery, image updates, and APIs to read certificates and handle custom drivers. The STB manufacturer normally provides these components.

- GStreamer

  The GStreamer component was one of the main reasons RDK was chosen by Comcast and Liberty Global for their future platforms. It is a very good framework for combining the DVB, IP and Hybrid worlds, and that is why many of the leading middleware and SOC vendors have also chosen to include it in the future roadmap for their proprietary platforms. Modeled after GStreamer, RDK Media Framework (RMF) basically defines an architecture composed of Media Sources (IP, VOD, DVR, DLNA) Media Sinks (DVR, HTTP), and Filters (transcoders). In the diagram below, we can see the conceptual model wherein the Alticast DVB-RDK will implement these three types of plug-ins.

■ Diagram for Gateway



■ Diagram for IP Client

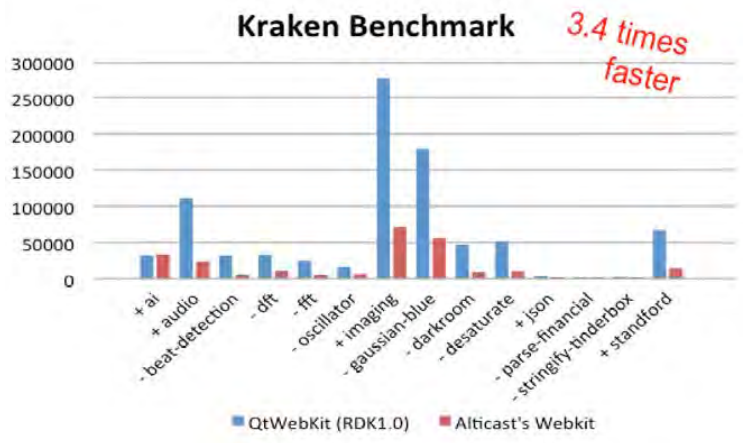
GStreamer will remain as the main framework, and some additional TV-specific features will be added as plug-ins onto this core framework. Even though there are no publicly known details available yet, this strategy is very similar and is aligned to RDK version 2.0, also known as the Delia project. The Alticast DVB-RDK also uses Gstreamer plug-ins for DVB stack media processing. This means that the H/A DVB-RDK media pipelining is close to what Delia is considering as baseline for the RDK Media Framework.

ENHANCEMENTS TO THE GENERIC RDK

The Alticast DVB-RDK adds 4 key improvements -- AltiBrowser, Magic Wand, ROP, and TR69 -- which will be explained in the following paragraphs :

- Reliability – AltiBrowser

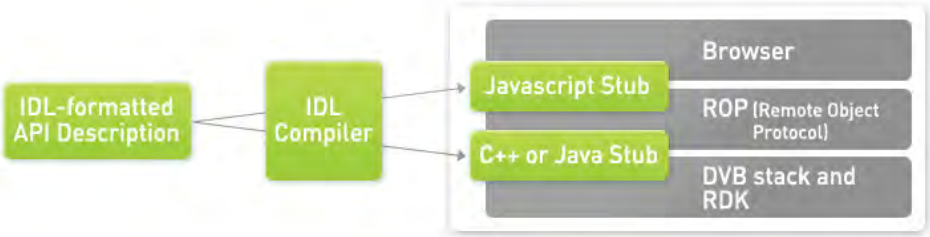
Alticast DVB-RDK can be configured with the Qt/Webkit 4.8/5.0 browser that comes with the generic RDK as well as with the high-performance AltiBrowser. This flexibility allows MSOs to take full advantage of the higher performance and stability of AltiBrowser and implement a smooth UI/UX on top of it while keeping the option to switch to the standard Qt/Webkit browser in the future if the need arises. For an HTML5 UI/UX in particular, browser performance is clearly the key indicator for the quality of user experience. As seen below, the AltiBrowser clearly excelled in all areas of the Kraken tests.



Mozilla released the Kraken JavaScript benchmark in late 2010; since then, it has become extremely popular for measuring actual browser performance. Unlike other methods such as V8 and SunSpider, Kraken focuses mainly on realistic workloads and forward-looking applications. Among the real-world things being tested by Kraken is beat detection, which uses experimental audio APIs and image processing tools such as the ones that apply a Gaussian blur or de-saturate a JPG using JavaScript. Such real-world tests are important for measuring browser performance in ways that other benchmarks fail to take into account. Alticast performed extensive testing and benchmarking with the most demanding tools, and it was concluded that the only way to have smooth and forward-looking RDK implementation capable of providing above 30/ 35fps (frames per second) was with AltiBrowser. Perhaps this will be a temporary solution until the Qt/Webkit browser improves, so the architecture will stay flexible to switch back to the generic RDK browser whenever necessary with as minimal integration effort as possible.

- Efficiency – Remote Object Protocol (ROP)

ROP is one of Alticast's mechanisms developed in-house for inter-process communications, and its key advantage is performance and efficiency. It is very fast thanks, in part, to compressed message handling. This means that, in comparison with the traditional methods, for example, Linux IPC (inter-process communication), ROP is much more lightweight and optimized.
Its second advantage is the support for multiple programming languages. ROP supports C++, Java, and Javascript, and this is key for the Alticast DVB-RDK implementation. The reason is that the complex base logic will be implemented in C and C++, whereas the high-level APIs will be in Javascript; thus, ROP is the perfect bridge between them.
An additional advantage of ROP is that it allows isolating the browser from the other components around it; therefore, it enables expanding or enhancing the TV specific features independently of the browser. In the diagram below, we can see a high-level description of the ROP inner blocks.



This protocol is not a new development; ROP has already been deployed in millions of STBs as part of Alticast's proprietary solution, so it is a proven technology in the field.

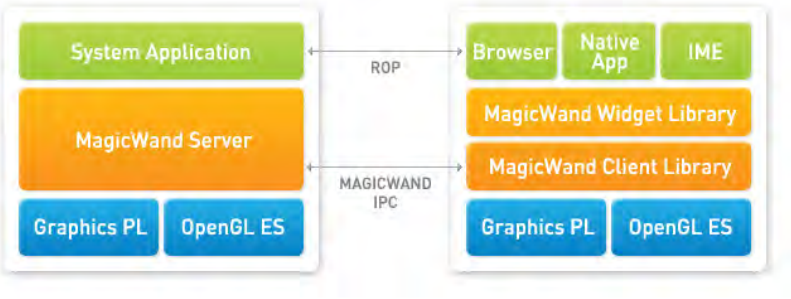
- Multiple Application Environment – MagicWand

Magic Wand is Alticast's commercial name for the Graphic Library together with the Window Manager. It is based on top of DirectFB with the addition of a window manager to support multiple applications running in parallel, such as native apps, browser, HbbTV, etc.

Since RDK was originally designed for the North American market, it was never intended to support multiple applications. Therefore, the Magic Wand module is the perfect addition for bringing the generic RDK to a worldwide market.

Besides the multiple window support, another key feature of this Library is that if SoC has native hardware support for OpenGL, the software can utilize the full power of the chipset. On the other hand, if SoC is not so advanced, the Library can emulate the 3D or 2D accelerated graphics, of course with the performance allowed by SoC.

This is very useful, for example, when Operators wish to emulate the user experience of new STBs HW and new UIs with existing legacy boxes, with performance typically around 1000DMIPS. The MagicWand Library can emulate the OpenGL capabilities and provide similar 3D effects. The high-level block diagram (displayed in the picture below) shows how the MagicWand module provides the foundation for both Native and HTML5 applications to run in parallel in a smooth, reliable manner, without conflicting with each other.



As before, the MagicWand Library has been successfully implemented in millions of boxes in the field (as part of Alticast's proprietary middleware solution); during the last few years, it has been refined and optimized to its best possible level of performance and reliability.

- Monitoring & Device Management – TR 69

The generic Comcast RDK includes the NetSNMP component, but SNMP has several problems. First is that each device needs its own Management information base (MIB), with different names and mapping trees. In addition to that, the V2 protocol has some security issues. Most importantly, it is limited to the demarcation device within the subscriber home. On the other hand, TR 69 was created specifically to be device-agnostic, so all compliant STB devices can be fully managed and validated by the same TR 69 Auto Configuration Server (ACS) regardless of its origin. On top of this, it is flexible in terms of the security mechanism, allowing easy implementation (less robust security) as well as an advanced one. This module helps greatly in STB troubleshooting and performance monitoring. Since it is not available in the current RDK, Alticast is going to implement it and license it as an option. The implementation will be based on Javascript, so this module can remain embedded in the STB or it can also be moved into the cloud.

Bringing open source software to a reliable and robust product can be a difficult challenge. The sheer number of inherent complexities requires strong base know-how and previous experience. Alticast has a successful track record of implementing open standards such as MHP and OCAP, with many live projects delivered across multiple countries.
Not only in the past, but currently as well, Alticast has a very strong and active position in the RDK community.
It is also worthwhile to note that building an outstanding product is as important as providing great system integration to the existing infrastructure. Here, Alticast also excelled, having delivered complex projects with different CA, DRM, hardware, and software vendors, so such knowledge can be tapped into as needed.
Finally, even though the RDK road ahead may not seem completely clear, Alticast has chosen a very similar architecture and 70% of the same components for its solution. This will benefit the MSO since all this knowledge and experience will be reused to improve and optimize the RDK platform in the future.

CASE OF APPLICATION

European Cable Opearator

AltiPlatform™_Windmill™ EX

CHARACTERISTICS

- DRealizes the best performance on extremely low-priced STBs at 500DMIPS ~ 1,000 DMIPS
- Supports HbbTV and applies 2D Animation UI, USB Player, DLNA, and PVR

ARCHITECTURE

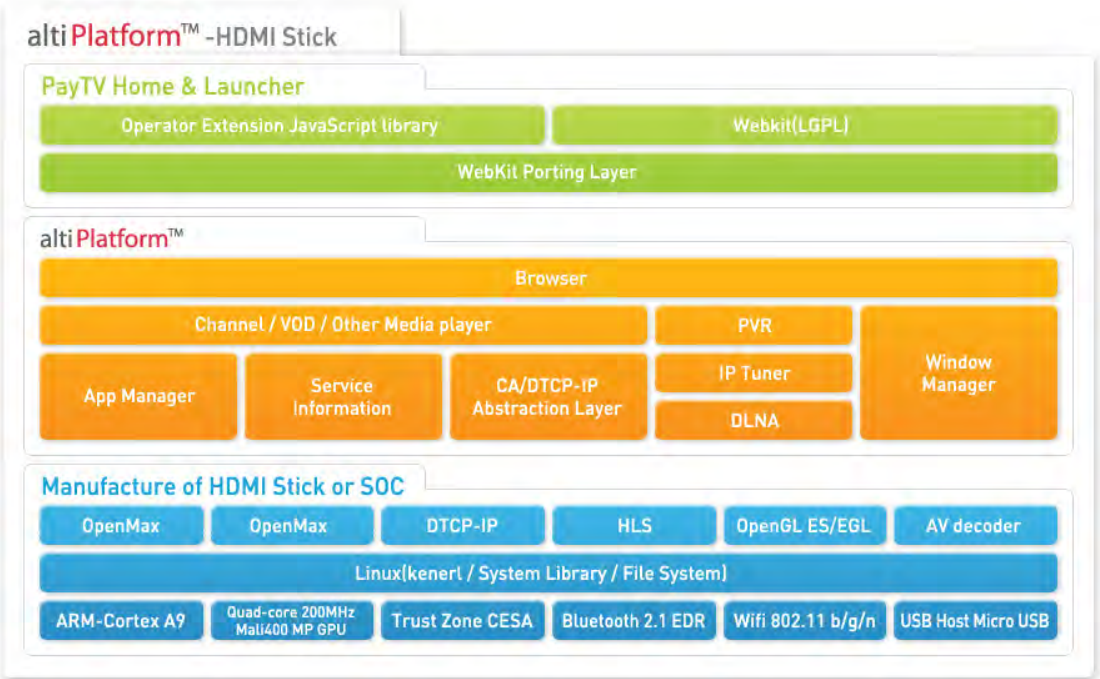
AltiPlatform™_HDMI Stick

CHARACTERISTICS

- IP-based Smart Service Platform
- Provides IP Connected PayTV services

Detail information can be found in Appendix

ARCHITECTURE



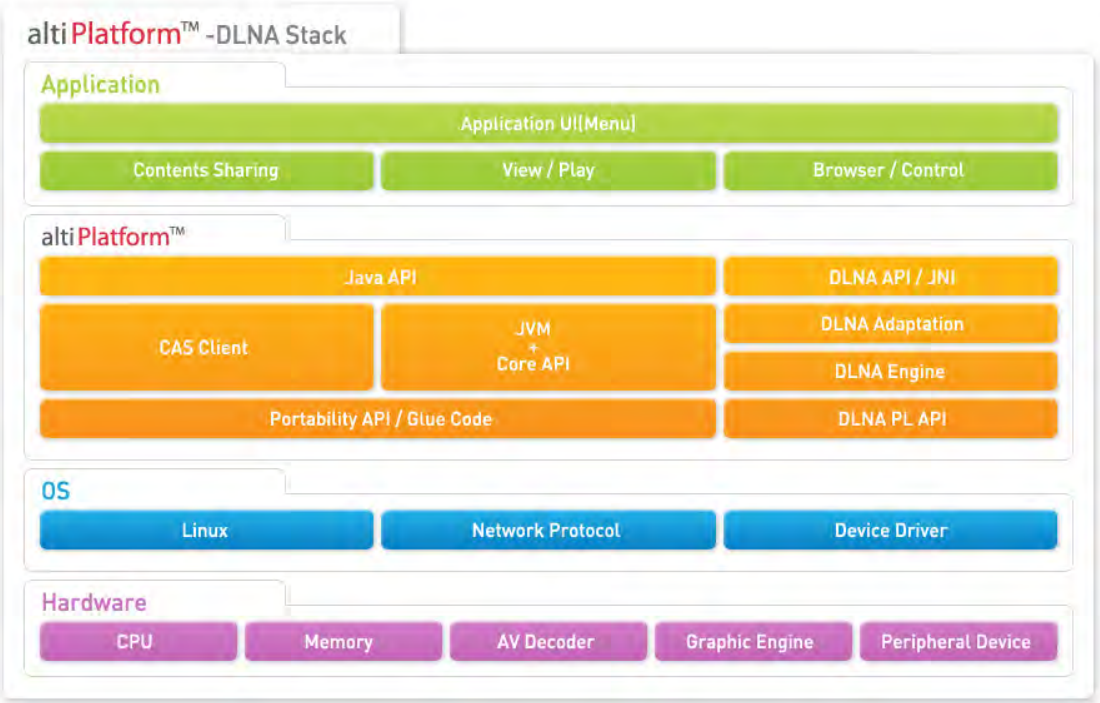
AltiPlatform™_DNLA

CHARACTERISTICS

Provides Home Network and Media Sharing functions

Components	Role	Major function
DMS	Provides content to other terminals (DMP, DMR) connected to the home network	Content sharing
DMP	Searches the content provided by DMS and plays the content on the self-terminal firsthand	Content search Content receiving Content play Content play control
DMS	Provides content to other terminals (DMP, DMR) connected to the home network	Content receiving Content play

ARCHITECTURE



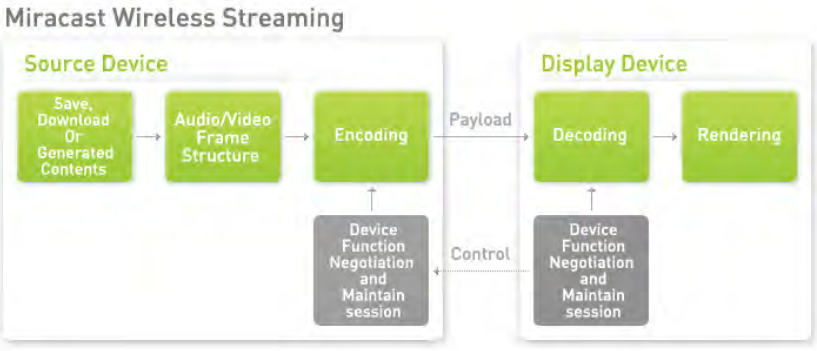
AltiPlatform™_Miracast

CHARACTERISTICS

Can use existing Displays not applied with Miracast technology as they are, applies diverse additional services in addition to simple Content Mirroring

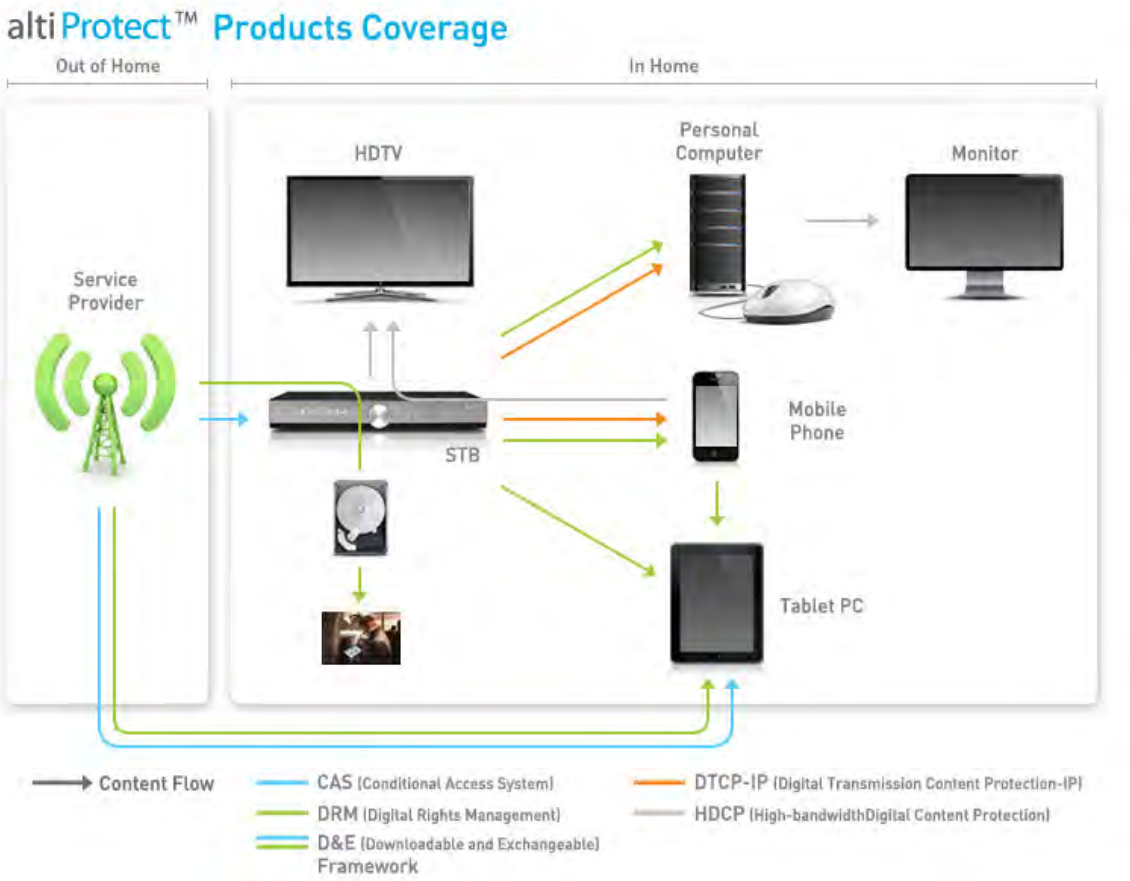
Accommodates common solutions accommodated by most home appliance manufacturers, Multi-Screen devices, and diverse content and ensures convenience of use

ARCHITECTURE



4.4 TV EVERYWHERE CAS / DRM SOLUTION : AltiProtect™

AltiProtect™ is a solution that covers not only existing services through PayTV's STB but also TV Everywhere services' content security and billing; it consists of four modules : AltiProtect™-CAS, a conditional access solution; AltiProtect™-DRM, a digital authority management solution; AltiProtect™-D&E (Downloadable and Exchangeable) Framework, a security framework, and; AltiProtect™-DCP (Digital Content Protection), a content reproduction prevention solution.



OVERVIEW

As the digital pay-TV market continues to rapidly evolve, pay TV operators are facing threats and opportunities. Viewers are watching more TV on more devices, and operators must secure their content on every screen to prevent unauthorized use, protecting their revenue stream. All pay TV operators need to build a secure channel to deliver the right content to the right person.

Broadcasters need a powerful CAS solution to expand their business models by making a variety of subscription packages. DRMs are also necessary to protect content delivered to the viewers on multiple devices as the demand for multi-screen services.

Changing CA systems or maintaining multiple CA solutions can be a difficult burden for broadcasters. Systems should be easy to configure so that minimal time and expense are involved. The system must also be flexible enough to integrate with existing broadcast and third-party products and comply with industry standards. Broadcasters must also ensure they have sufficient monitoring measures in place so that they can track subscription status and quickly detect unauthorized use.

Alticast's Service & Content Protection solution provides the pay-TV industry with advanced conditional access and digital rights management systems. It dynamically protects premium services and enables operators to provide a wide range of business models and flexible subscription packages to their subscribers.

The AltiProtect™ system can be implemented in set-top boxes, TVs, game consoles and mobile devices for both one-way and two-way network environments.

The AltiProtect™ solution is comprised of :

· AltiProtect™ - CAS

- Secure - Micro (SM) based CA solution
- Server based CA solution

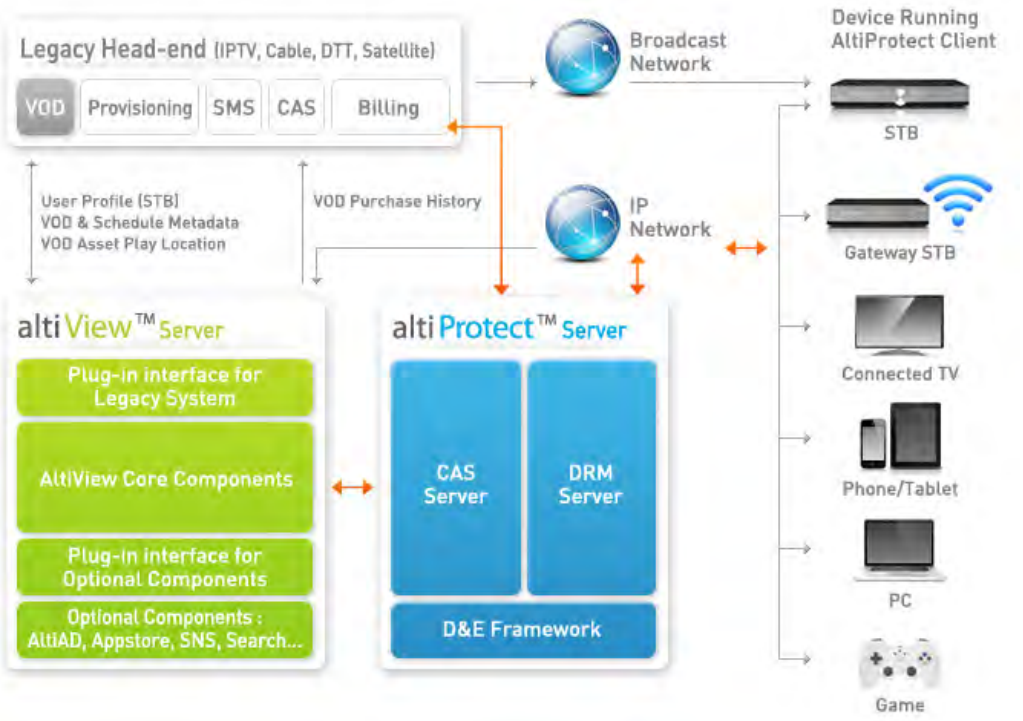
· AltiProtect™ - DRM
· AltiProtect™ - D&E (Downloadable and Exchangeable) Framework
· AltiProtect™ - DCP

AltiProtect™ is a modular solution with the flexibility to help operators offer diversified services to their subscribers.

· Server or SM based CAS + D&E Framework
· Server or SM based CAS + DRM
· DRM + D&E Framework

ARCHITECTURE

■ AltiProtect™ Architecture



FEATURES

· Proven Security

Premium pay TV services are dynamically protected over an interactive network of cable, IP, and hybrid. The secure encryption protocols of the AltiProtect™ system can be integrated into the operator's existing system to support various security policies.

With Alticast's dynamically downloadable and exchangeable framework, the AltiProtect™ client module is securely downloaded onto subscribers' devices.

· Powerful security module, AltiTRS

- SW based solution to reinforce the security by blocking reverse engineering and tampering attack.
- Enhanced security applying code obfuscation technology, data hiding technology, self-integrity check technology, and debugging tool detection technology.

· Telcordia Certified

· Provably Secure

- Efficient key management.
- Powerful authentication algorithm.
- Secure communication between server and client by securely shared keys on all protocols.
- Secure storage management for key and entitlement information.
  (Building Trusted Platform Infrastructure)

· Preventing Piracy

- Pirate device detection through validating unique HW information of each device.
- Strong countermeasure security through remote download and upgrade of core key and security clients in response to hacks and piracy.

· Compatibility and Flexibility

AltiProtect™'s open architecture makes it possible to optimize the system for each device and platform, making it easy for operators to expand their business models to include services such as mobile and multi-room. When it comes to mobile devices, SW descrambling (Trusted Platform Infrastructure) is processed regardless of device models.

The AltiProtect™ system supports various encoding media for different device types, not only MPEG2 TS, but also MP4 and other file formats of various content.

· Efficiency and Convenience

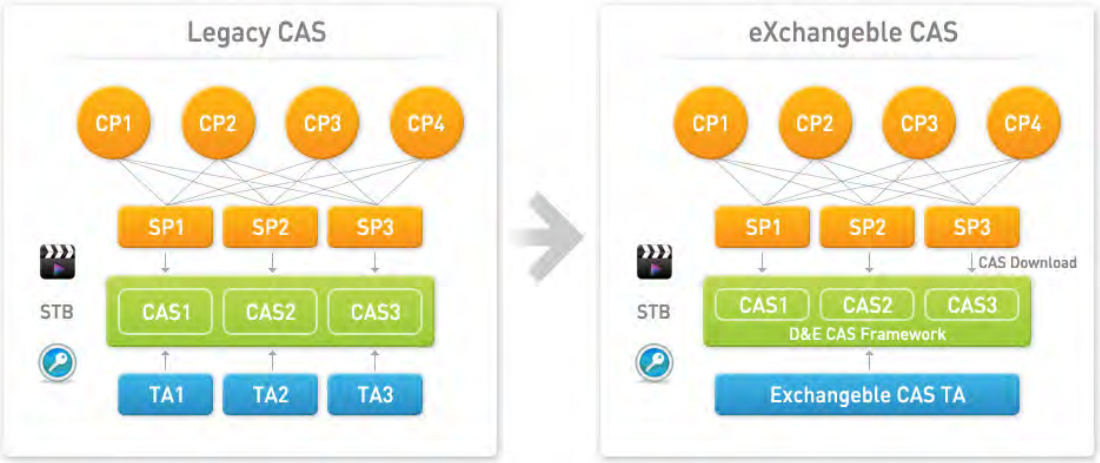
- AltiProtect™ provides administration and monitoring tools, which make management and control of the system efficient and convenient.
- Control and Management of subscriber information and resources
- Subscription package and content information
- Subscription rights and license
- Device information
- System monitoring and statistics

AltiProtect™ SimulCrypt plan

OVERVIEW

The CAS(Conditional Access System) is a technology for restricting accessible channels according to subscribers' Subscription Packages to enabling the channels they have bought and other purchased event based content. Alticast commercialized eXchangeable CAS(XCAS), that is, a form of CASs that enables separating CAS modules from devices or for the first time replacing CAS modules. Several major operators have adopted the AltiProtect™ CAS to provide services to subscribers. This Alticast design thoroughly separates hardware and software to combine modules for a complete and flexible security solution.

■ Difference between existing CAS and XCAS



While existing CAS constructed separate end-to-end CAS systems for individual business operators and used separate Trusted Authorities (TA) for individual operators, XCAS is applied with standard technologies for provisioning so all provided services use the same separable and replaceable CAS. This way operators can accommodate diverse CAS providers' solutions without configuring separate TAs.

ARCHITECTURE

Alticast has been successfully migrating operators' CAS vendors' solutions to the AltiProtect™ CAS system. Since CASs are major security systems for the encoding/authentication/authorization of broadcasting channels and VODs, breaking from dependence on existing CAS vendors is considered almost impossible. AltiProtect™ - CAS overcomes this obstacle allowing legacy CAS upgrades instantly and remotely.

The following table shows Alticast's CAS Migration Reference Sites.

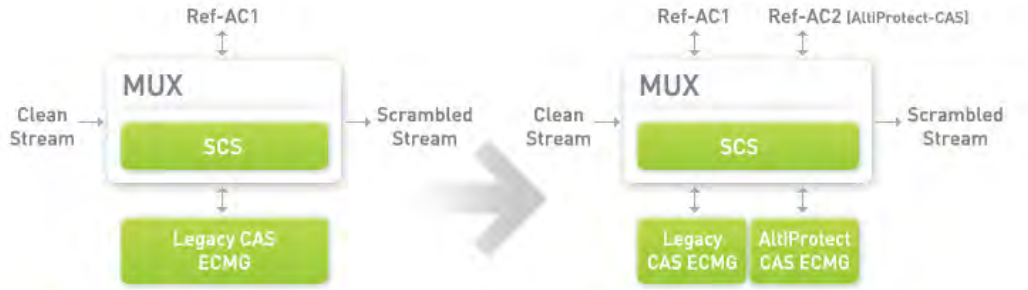
Division	TBroad	C&M	KCTV
Target of Simulcrypt	NDS, Nagravision	NDS	Conax
Date of launching	2009.11.08	2010.09.07	2010.10.19
AC	Integrated EIS based	Ref-AC based	Ref-AC based
MUX	Harmonic ProStream 1000, NSG9000, NSG9116, Motorola RFGW	Harmonic ProStream 1000, NSG9000, NSG9116, BNG6108	Bigband BMR1200A
SMS(PS)/TCS	In-house solution	Hangang Systems	Hangang Systems
STB	Samsung SMTC3022, SMTC5010, LG LSC630, Humax UC1000, UC1500, UC2000, OC2500	Samsung SMTC5010, SMTC5011, LG LSC330, LSC530, LSC530	Samsung SMTC3022, SMTC5010

Systems integrated using the AltiProtect™ - CAS solution can be largely divided into PS, TCS, SCS, EdgeQAM, and CMTS. The integrated interfaces by system are as follows.

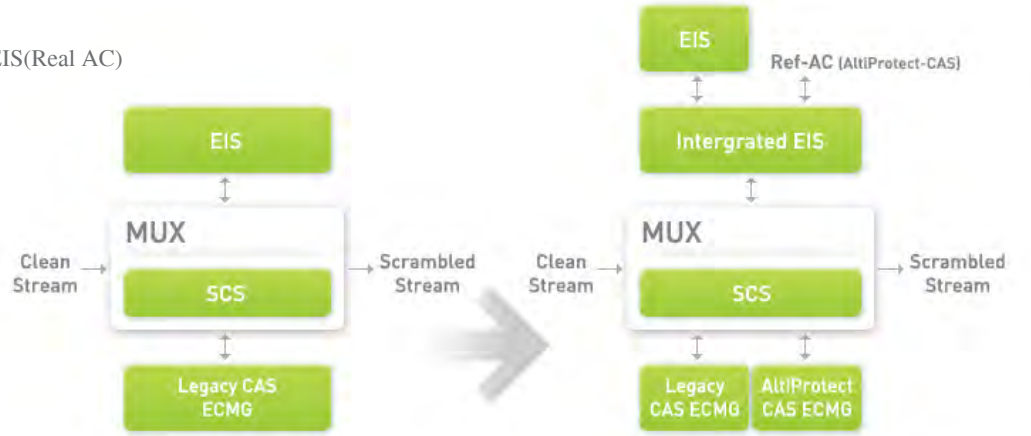
Division	TBroad	C&M	KCTV
XCAS System	NDS, Nagravision	NDS	Delivers subscriber registration/cancellation information
	DMS2CMTS	CMTS	Transmits XCAS Messages
	AP2CMTS	CMTS	Interface between XCAS Server and SM Bootloader
CAS System	TCSGateway	TCS	Delivers channel, product, programming information lists
	PVSGateway	PS(SMS/BS)	Delivers product information, subscriber authority information
	EIS2SCS	SCS	Simulcrypt V3.0(or OpenCAS)
	ECMG2SCS	SCS	Simulcrypt V3.0
	VoDECMG2 EdgeQAM	EdgeQAM	Simulcrypt V3.0
	EMMG2CMTS	CMTS	Transmits EMM Messages
	AS2CMTS	CMTS	Interface between CAS Server and CAS Client modules for delivering messages such as Reportback

Measures to integrate the SCS supported by Multiplexers or Modulators for live channel Scrambling are largely Ref-AC and EIS(Real AC) and both can migrate to the AltiProtect™ - CAS without difficulties depending on operators' environments.

■ Ref-AC

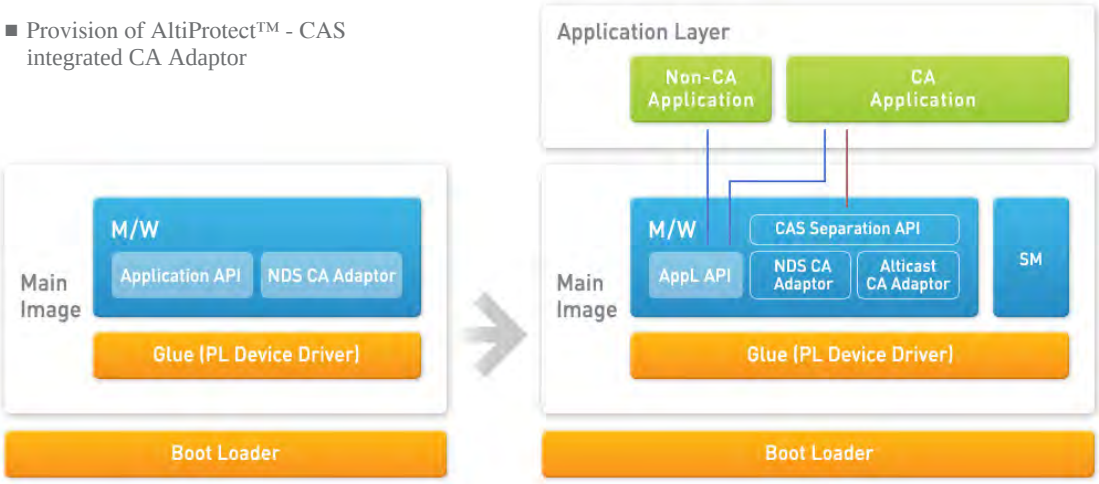


■ EIS(Real AC)



Some CAS vendors prohibit other companies' use of their CA adaptors. To resolve this problem, AltiProtect™ applies an integrated CA Adaptor so that CA Adaptors can be selectively used depending on the CAS.

■ Provision of AltiProtect™ - CAS integrated CA Adaptor



AltiProtect™ has solutions for issues related to new implementations of CAS but also existing Legacy CAS Migration using our wealth of experience in security and Simulcrypt.

AltiProtect™ - CAS

CHARACTERISTICS

- Blocks illegal reproduction and distribution of real-time channels and VOD content
- Applies encoding technologies with proven security and built-in AltiTRS security technology
- Has been certified by Telcordia the international security certification institution
- Provides diverse PayTV services and business models

AltiProtect™ - CAS is classified by two types :

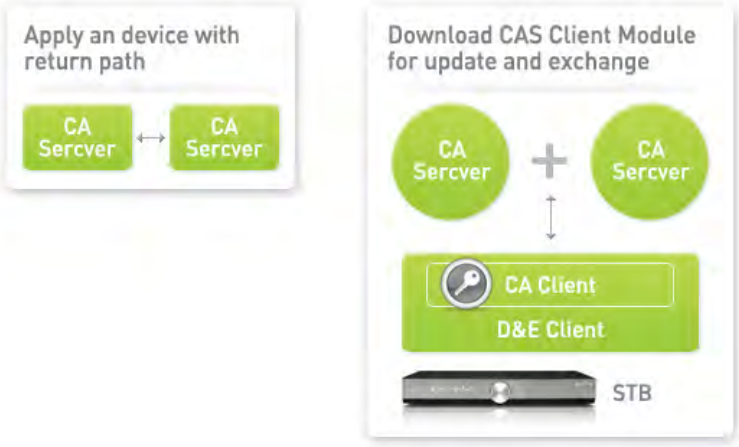
- AltiProtect™ – Server based CA solution
- AltiProtect™ – Secure-Micro based CA solution

• Server based

Server based AltiProtect™ - CAS is built to be optimized as card-less CA solution for pay-TV services base on two-way for IP and cable networks.

- Network: IP, Cable (two-way network)
- Devices: STB, Game Console, Integrated DTV

ARCHITECTURE

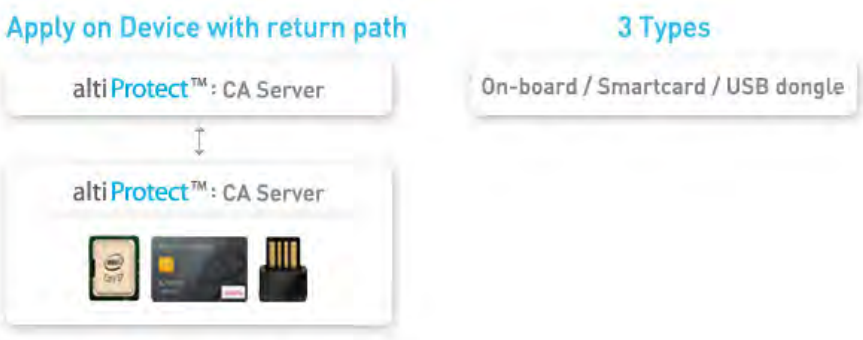


- Optimized to protect digital broadcasting services and prevent illicit use of content.
- Proven for security and reliability with secure cryptography and AltiTRS.
- Secure and flexible providing support for service expansion and various business models.

• Secure Micro (SM) based

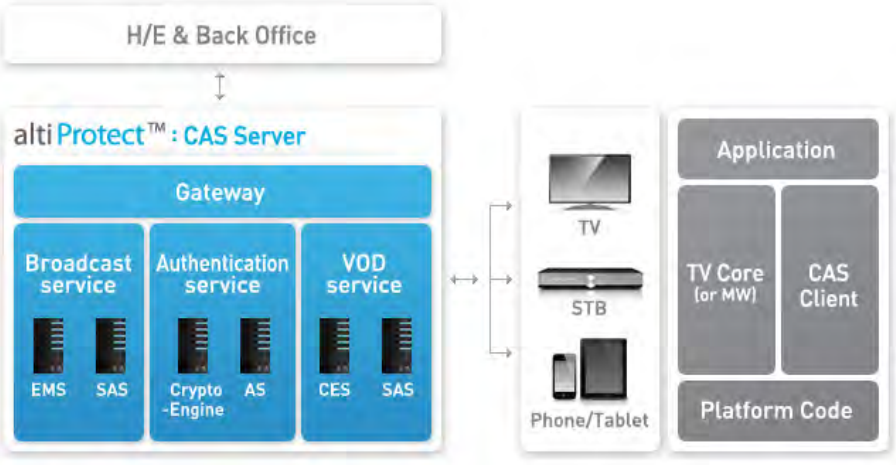
SM based AltiProtect™ - CAS solution is built to be optimized for pay TV services based on both one-way and two - way IP and cable networks.

- Network: IP, Cable, Satellite, Hybrid/IP
- Devices: STB, PC



- Optimized to protect live channels and VOD content from hacks and piracy.
- Security proven using Secure-Micro with powerful Alticast cryptographic technology.

AltiProtect™ - CAS Server



AltiProtect™ - CAS servers consist of four parts.

· Broadcast service : Provides conditional access of live channels.

- EMS (Entitlement Management System) server : Channel scrambling support
- SAS (Subscriber Authorizing System) server : subscription management

· VOD service : Providing conditional access control of VOD and PPV content.

- CES : Pre-encryption and session based encryption support.
- CDS : VOD service support and rights management.

· Authentication System : Supports subscriber and device authentication.

- AS server : Manages subscribers and device authentication.
- Crypto Engine : Provides cryptosystem to control and manage key information.

· Gateway : Support full compatibility with the operators' H/E and back-office systems.

- Management Tool : Providing administration and monitoring UI.
- Interface module for AltiProtect™ servers : the interface to integrate with system servers.

FEATURES

Main Features	Detailed explanation
Entitlement Management	· Subscription Service - Multiple Subscription Service : Normal/Bonus Package, A La Carte, PPV · VoD Service - Real-time Scrambling(Session-based Encryption) for service protection - Pre-Encryption for content protection · Package Purchase Service - ISU, OPPV/IPPV
Service Access Control	· Blackout/SPOT Service based on Region, Specified Subscriber Group · Parental Rating Control
Resource Management	· Package/Channel Management & Control - Package/Channel Management & Control Service through Interconnection with TCS & PS · Subscription Management & Control - Subscription management & Control Service thru Interconnection with PS
Copy Protection	· Supports Copy Protection · Macrovision/CGMS-A/HDCP
EMM Management & Monitoring	· EMM Management by Priority · EMM B/W Control & Monitoring
Message Service	· Subscriber/Group/All-based OSD/Bmail/Fingerprint Message transmission service
Reportback Service	· On Demand/By Period/Event-based reporting Service
System Management & Monitoring	· System & Resource Monitoring · Log Management & Monitoring
Others	· Security Client Status Check Service · Hidden Menu for Security Client Status

MEASURES TO BE APPLIED ACCORDING TO NETWORKS

Division	Measures to be applied	Remarks
Uni-directional network	SM(Secure Micro)-based CAS (H/W based)	· Smartcard · On-board · USB Dongle
Bi-directional network	Server-based CAS (SOFTWARE based)	· Terminal price reduction as CableCard and SmartCards are not necessary

CASES OF APPLICATION

KT(IPTV), T-Broad(Cable), C&M(Cable), Jeju Cable(Cable), SkyLife(Satellite)

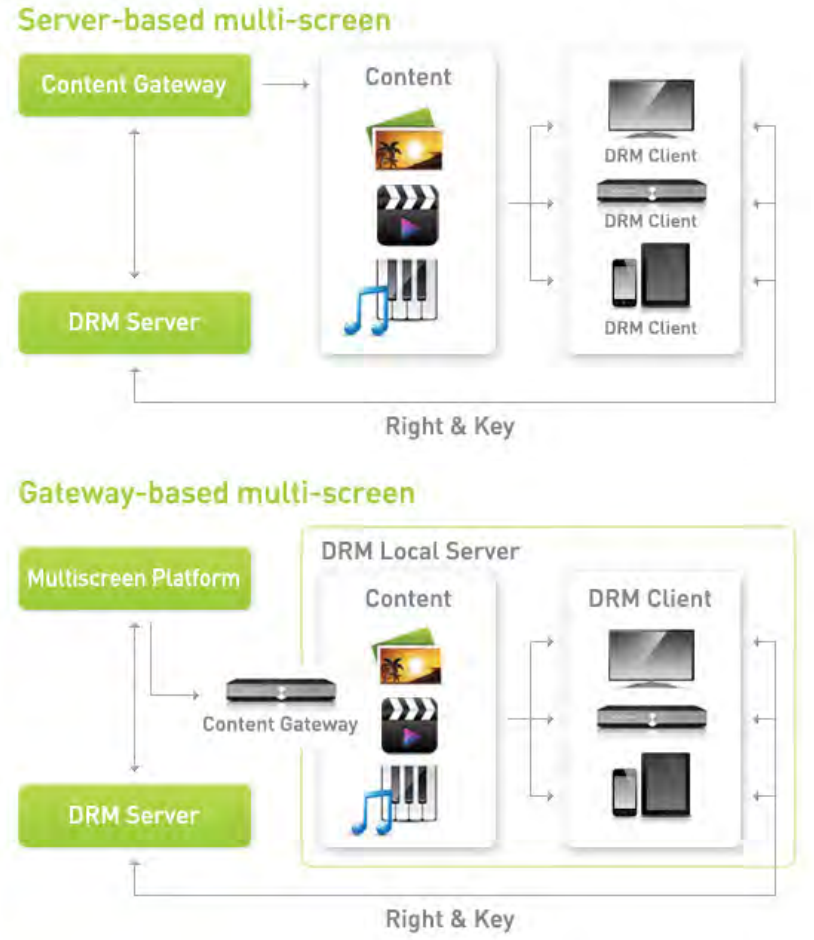
AltiProtect™ - DRM

CHARACTERISTICS

AltiProtect™ - DRM is built to be optimized for copyright protection of content on two-way network of IP and cable and multi-screen service.

- Network : IP, Cable (two-way network)
- Devices : STB, Game Consoles, Mobile Devices, Integrated DTV

ARCHITECTURE



- Secure SW solution for digital rights management with the powerful cryptographic technology of AltiTRS.
- Flexible and compatible SW solution provides standard channel package security while providing content viewing upgrade options
- Secure authentication and key management system.
- End-to-end secure communication.
- Device clone detection.

• AltiProtect™ - DRM Server

AltiProtect™ - DRM server consists of three parts.

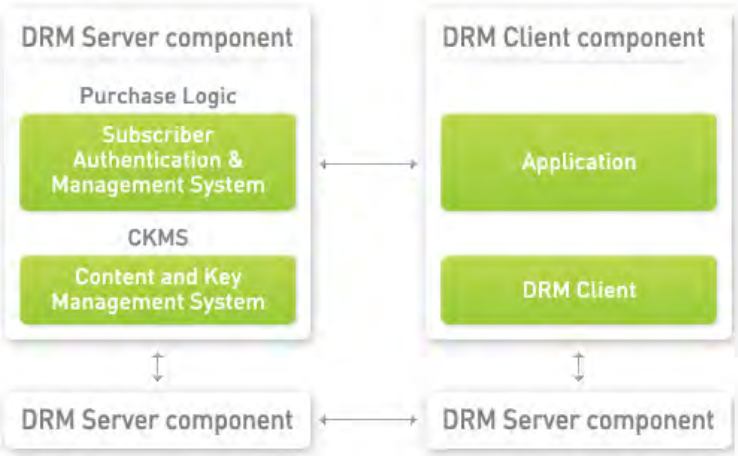
• SAMS : Subscriber Authentication and Management System

- Subscription control and management
- Subscriber and device authentication support

• CKMS : Content and Key Management System

- Control and management of content and key information
- Content Encryption Support

• Gateway : Interoperation support between operators' H/E and back-office system.



With full compatibility and scalability, the AltiProtect™ system is easily integrated into the operator's existing infrastructure to protect their investment. The AltiProtect™ simple and intuitive GUI-based monitoring tool provides easy to track subscriber status and instantly detects unauthorized use of content. The AltiProtect™ system is customizable to support all enterprises from small to large scale, and is fully compatible with a wide range of client devices and headend systems.

FEATURES

Main Features	Description
Content protection	· Anywhere, anytime, any device - Confidentiality of content - Integrity of data
Content Sharing	· Content sharing with family and friends - On-line sharing - Off-line sharing
Content Access Control	· Based on Rights and License - Playback/Record - Count, Date-time, Interval, Accumulated · Parental Rating Control · PIN control and management
Subscriber and Device Authentication	· Subscriber and Profile Log in/out management · Device authentication based on X.509 certification · Mutual Authentication between DRM Server and Client
Content Encryption	· Real-time encryption · Pre-encryption
Subscription Management (Domain Management)	· Rights and Domain based on : - Subscriber (Family Domain) - Profile (Personal Domain) - Device
Content Management	· Content and License Mapping
License Management	· Various License Management
Certification and Key Management	· Certification generation & management · Content Encryption Key management · Subscriber based Key Information management
System Management	· System Monitoring · System Log Management · Statistics

CASES OF APPLICATION

SkyLife (Satellite)

AltiProtect™ - D&E Framework

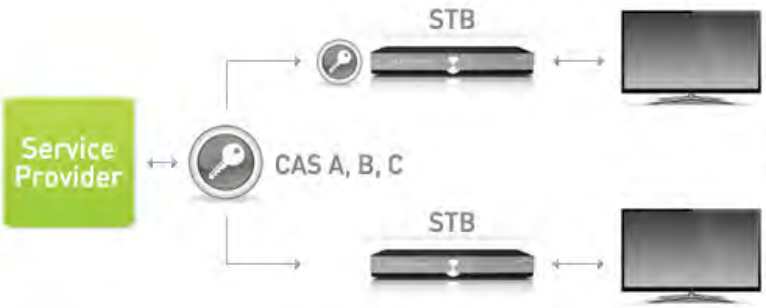
CHARACTERISTICS

Based on the X.509v3 certificate, mutual authentication between the D&E framework server and client devices is performed and a key is shared to build a secure channel to transmit data and an exchange of CAS and DRM modules.

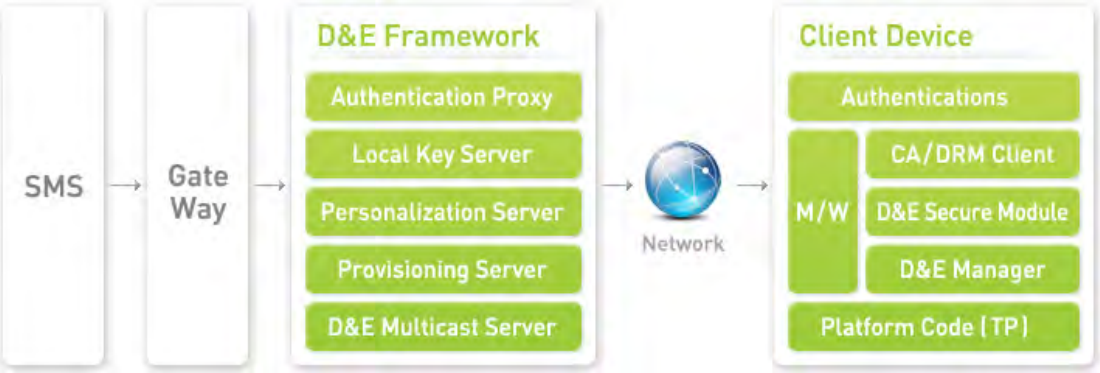
Downloading and exchanging CAS and DRM modules

- Network : IP, Cable (two-way network)
- Devices : STB, game console, built-in TV

The AltiProtect™ D&E framework supports multi-CAS systems and enables secure downloads of Security client modules based on strong device authentication



ARCHITECTURE



The following procedures are performed in order to securely download data and security client modules after completing mutual authentication between D&E framework server and clients :

- Set-up secure channel
- Secure communication between server and client devices

• AltiProtect™ - D&E Framework Server

D&E framework servers include the following :

• Authentication Proxy : Interface between D&E framework servers and devices
- Secure component that mediates infrastructure messaging by communicating directly with Secure Module (SM)
- Securely communicates to the SM to provide CAS/DRM Client image configuration and other download information
- Authenticates all terminal device SMs

• Local Key Server : Management of certificates and key
- Provides local storage of keying information for disaster recovery and provision workflow for AP and Provisioning server
- Contains and manages SM Keying and identity information and Server Keying and identity information

· Personalization Server : Management and generation of key for individual device

- Secure element and source of all CAS/DRM Client images for secure distribution, download, and management
- Supports personalized image & data encryption

· D&E Framework Provisioning Server

- Determines and persists Broadcaster's Security Policy and is the central manage for SM configuration
- D&E Framework Multicast Server Generates D&E messages for triggering CAS/DRM client upgrade

FEATURES

Main Features	Description
Content protection	Two step authentication · Initial authentication - Process the device registration procedure and provide the right further downloading. · Typical authentication - For the initial authenticated device, provide typical authentication for downloading
Secure download	Certification based secure communication · Individual device certification · SSD (Secure Software Download) · Manage the connection id for pirate device detection
One way Image-Update	Client Update using multicast message · Model based client update
Report Back	On demand Report Back service · Device status · Encrypted log to detect obstruction reason
Various Clients	Support various clients · CAS / ASD / DRM

CASES OF APPLICATION

KT (IPTV), T-Broad (Cable), C&M (Cable), Jeju Cable (Cable)

AltiProtect™ - DCP

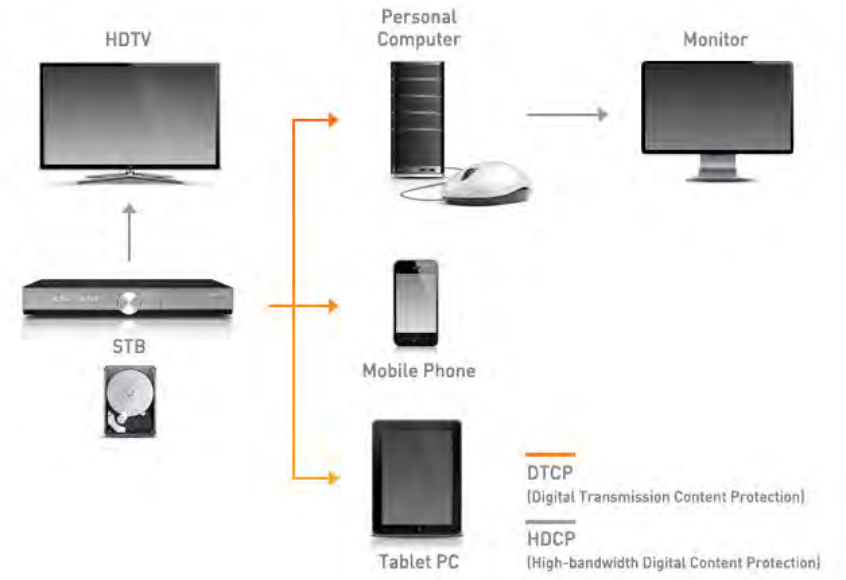
CHARACTERISTICS

AltiProtect™ - DCP (Digital Content Protection) is a solution for Link Protection of digital content. Data for transmitting between different devices.

AltiProtect™ - DCP(Digital Content Protection) provides the followings for a secure gateway service.

- HDCP(High Bandwidth Content Protection)
- DTCP(Digital Transmission Content Protection)

ARCHITECTURE



FEATURES

Main Features	Description
Content protection	· Link Protection · DTCP_IP: Mapping DTCP to IP · Device authentication and key exchange(AKE) · Content Encryption · Content Copy Control based on CCI(Copy Control Information) · System Renewability
HDCP	· Digital Copy Protection · Authentication and Key Exchange(AKE) · Locality Check · Session Key Exchange(SKE) · HDCP Encryption

CASES OF APPLICATION

KT(IPTV)

05. CASES OF WSP CONSTRUCTION AND MEASURES

5.1 WSP REFERENCE SITE

Alticast has worked with many TV operators globally both in as a Principal Systems Integrator and as a subsystems integrator. Our system integration references include :

Alticast Major Customer References (As of January, 2014)

Operator	Country	Platform	Launched	STB	Deployed Units
KT	Korea	IPTV	2007	Samsung, Humax, Kaon, DMT, Dasan LG, Millinet	5,242,952
Skylife	Korea	Satellite	2006	Samsung, Humax, HDT, Dasan, LG, DMT, Kaon, Global Tech	3,749,792
T-Broad	Korea	Cable	2005	Samsung, Humax, LG	1,764,184
CJ Hellovision	Korea	Cable	2005	Samsung, Humax, LG	2,473,447
CNM	Korea	Cable	2006	Samsung, Humax, LG	1,439,878
HCN	Korea	Cable	2009	Samsung	614,060
Other SOs	Korea	Cable	2006	Samsung	175,420
Time Warner Cable	USA	Cable	2010	Samsung, Cisco	3,407,215
Cablevision	USA	Cable	2010	Samsung	2,929,568
Videotron	USA	Cable	2011	Samsung, Cisco	1,467,615
Videon-Central	USA	BD-J	2010	Freebox	3,448,666
Italy Retail	Italy	DTT, Satellite	2004	Telesystem, Sagemcom, Humax, Philips, Sony, Vestel, Loewe	2,733,559
Unitymedia	Germany	Cable	2010	Samsung, Echostar	858,876
CME	Czech	DTT Hybrid	2013	Intek	10,000
KBRO	Taiwan	Cable	2009	Prime, HDT	272,207
CNS	Taiwan	Cable	2010	Prime	135,343
TBC	Taiwan	Cable	2009	HDT	99,848
TFN	Taiwan	Cable	2012	Prime	80,376

AltiProtect™ Major Customer References (As of January, 2014)

In less than four years AltiProtect™ has been deployed in satellite, IPTV, and cable operator systems running on over 6 million set-top boxes.

Operator	Network	Deployed	Product
KT	IP	4,334,021	AltiProtect™-CAS + D&E
Skylife	Satellite	100,000	AltiProtect™-DRM + D&E
T-Broad	Cable	1,389,660	AltiProtect™-CAS + D&E
C&M	Cable	220,350	AltiProtect™-CAS + D&E
Other SOs	Cable	116,950	AltiProtect™-CAS + D&E

06. INTRODUCTION OF THEWSP AND ECONOMIC ANALYSIS

This chapter looks at the economics of introducing the Alticast Windmill™ Smart Platform into an existing service operator's environment. Topics addressed are the WSP introduction process, medium-specific considerations, and IPTV considerations.

6.1 WSP INTRODUCTION PROCESS

As described earlier, WSP provides a modular approach to features and capabilities. The process of WSP introduction consists of choosing the features that best suit the operator's current situation and future migration path, keeping in mind both customer satisfaction and business requirements.

Items to be constructed	Content of Construction	
The PayTV business operators' services and media terminal policy decisions		
Requirements of Business Operators	Service	· UI/UX · Smart Service selection and scenario
	Media Terminals	· STB
		· Game Console
		· Connected TV
		· Smart PAD/Phone
		· PC
WSP Package Selection and Deciding on features	AltiView™	· UI/UX version or select features
	AltiPlex™	· Select from Core, Standard, Premium Package · Select from additional services or services provided by Third Parties (optional)
	AltiPlatform™	· Select a platform standard (GEM, HbbTV, RDK, HTML5) · Select a Smart platform configuration (Hybrid, Web Middleware) · Select Second Devices' Media Player and decide whether STB is remote controlled (optional)
	AltiProtect™	· CAS/DRM construction : selection from new, substitution, or Simulcrypt
WSP Construction	AltiView™ Customization	· AltiView™ UI/UX Customization
	AltiPlatform™ Integration	· Smart STB development - Middleware Integration and CAS linked module matching - Service Integration (EPG, VOD, Application, etc.)
		· Replace the existing Legacy STB UI (optional)
	AltiPlex™ Integration	· AltiPlex™ Core System Integration - Integration Server(Provisioning & Mediation) - UPMS(User Profile Management System) - ACMS(Application Content Metadata System) - SSE(Smart Search Engine) - STB API Integration - Service Gateway(Second devices) API - PSIP/SI Broadcasting System - Interactional Data Broadcasting System · AltiPlex™ Media Cloud Integration(optional) - Cloud Content Ingest/Delivery System - Cloud Service System - Cloud Media Storage System

		- Cloud Streaming System · AltiPlex™ Additional System Integration(optional) - SRE(Smart Recommendation Engine) - Home Automation(Smart Appliance) System - TV SNS System - TV Interactional Advertisement System - Metrics System · AltiPlex™ Third Parties System Integration(optional) - T-Commerce, etc.
	AltiPlex™	· AltiProtect™ - CAS or DRM system construction · Legacy Headend(CMTS, SCS) linked · AltiPlex™ linked
Integration Testing		· Perform system and device's performance and reliability tests · Perform integration testing, all functions of all devices are tested individually
Trial Services		· Perform trial services on screened subscribers or selected groups
Commercial Services		· Perform switching to commercial services and monitoring

6.2 MEDIUM-SPECIFIC CONSIDERATIONS

WSP addresses delivery on all media, and exploits to the full the capabilities of the operator's infrastructure. This section describes specific interactions, issues, and opportunities that should be considered for each delivery medium: Cable, IPTV, Satellite, Terrestrial, and OTT.

Cable

Division		Major Content
Restrictions of WSP introduction	Two-way communication is not possible	· Available services - Real-time broadcasting services : PSIP Broadcasting System - One-way data broadcasting services : Data Broadcasting System - Content encryption and authority control : AltiProtect™ - CAS
	Two-way communication is possible - CMTS	· All services are available - However, real-time broadcasting services and VOD service transmit RF (substitute)
	Two-way communication is possible - QoS not guaranteed (IP Network)	· All services are available - However, real-time broadcasting services and VOD service transmit RF (substitute) - However, when providing the VOD service through the IP Network, Download & play mode is realized for Content Buffering
WSP Recommend	Apply the recommended logic	· Subscribers' viewing patterns analysis logic · Linked content recommendation Analysis logic
	Content information linked	· Integration information - Content metadata · Target system - AltiPlex™ : ACMS
AltiView™ Customization		· UI of AltiView™ selection · Reflect the site requirements
	Provisioning & Mediation	· Integration information - Data broadcast · Target system - Legacy Headend : SMS/Billing, EPG, VOD Metadata, VOD Back Office - AltiPlex™ : Integration Server

AltiPlex™ Integration	Subscriber information	· Integration information - Subscriber information, device information, product information · Target system - AltiPlex™ : Integration Server, UPMS
	Metadata handling	· Integration information - Live Metadata, VOD Metadata, Web Crawling · Target system - AltiPlex™ : ACMS
	Smart Search	· Integration information - Recent search words list dictionary, AutoComplete key-words dictionary, Real-time search words ranking · Target system - AltiPlex™ : SSE
	VOD RS-DVR Time-Shift Start-Over	· Integration information - Real-time channel content, VOD content, personal recording content, content encryption · Target system - Legacy Headend : Live Content Multiplexer - AltiPlex™ : Media Cloud – Cloud Content Ingest/Delivery System - AltiProtect™ : CAS, DRM
		· Integration information - Subscriber information, billing information, device request information · Target system - AltiPlex™ : Media Cloud – Cloud Service System, UPMS
		· Integration information - Streaming content · Target system - AltiPlex™ : Media Cloud – Cloud Streaming System, Edge QAM
	Broadcasting information transmission	· Integration information - Broadcasting EPG · Target system - Legacy Headend : EPG System, Multiplexer - AltiPlex™ : PSIP/SI Broadcasting System
	Data broadcasting services	· Integration information - Data broadcasting OC data · Target system - AltiPlex™ : Data Agency System, Interactive Data Broadcasting System
	TV SNS	· Integration information - Subscriber information, Chat Text, Private Media Content · Target system - AltiPlex™ : TV SNS System, UPMS
	TV App Store	· Integration information - TV App lists / data / update information · Target system - AltiPlex™ : TV App Store
	Home Automation (Smart Appliance)	· Integration information - Device monitoring and control data · Target system - AltiPlex™ : Home Automation System - AltiPlatform™ : Smart Appliances
	STB	· Middleware selection - Java, HbbTV, RDK, Web M/W, Hybrid M/W · Middleware and CAS potting

AltiPlatform™ Integration		· Service integration - EPG, Bound/Unbound Application
	Multi-Screen	· Hardware - USB Type, HDMI Stick, Smart TV, Smart Phone · UI realization - Adaptive UI(HTML5) or individual optimization · Media Player - M/W or platform-based default Player or AltiPlatform™ - Media Player · CAS potting or Service Integration
AltiProtect™ Integration	System Integration	· CMTS integration - Integration of AltiProtect™ system and STB CAS Client · Multiplexer SCS integration - Real-time broadcasting channel Simulcrypt integration · EdgeQAM integration - VOD Simulcrypt integration

IPTV

Division	Major Content	
Restrictions of WSP introduction	Two-way communication is not possible	· Available services - Real-time broadcasting services : PSIP Broadcasting System - One-way data broadcasting services : Data Broadcasting System - Content encryption and authority control : AltiProtect™ - CAS
	Two-way communication is possible - CMTS	· All services are available - However, real-time broadcasting services and VOD service transmit RF (substitute)
	Two-way communication is possible - QoS not guaranteed (IP Network)	· All services are available - However, real-time broadcasting services and VOD service transmit RF (substitute) - However, when providing the VOD service through the IP Network, Download & play mode is realized for Content Buffering
AltiView™ Customization		· UI of AltiView™ selection · Reflect the site requirements
AltiPlex™ Integration	Provisioning & Mediation	· Integration information - Data broadcast · Target system - Legacy Headend : SMS/Billing, EPG, VOD Metadata, VOD Back Office - AltiPlex™ : Integration Server
	Subscriber information	· Integration information - Subscriber information, device information, product information · Target system - AltiPlex™ : Integration Server, UPMS
	Metadata handling	· Integration information - Live Metadata, VOD Metadata, Web Crawling · Target system - AltiPlex™ : ACMS
	Smart Search	· Integration information - Recent search words list dictionary, AutoComplete key-words dictionary, Real-time search words ranking · Target system - AltiPlex™ : SSE

	VOD RS-DVR Time-Shift Start-Over	· Integration information - Real-time channel content, VOD content, personal recording content, content encryption · Target system - Legacy Headend : Live Content Multiplexer - AltiPlex™ : Media Cloud – Cloud Content Ingest/Delivery System - AltiProtect™ : CAS, DRM
		· Integration information - Subscriber information, billing information, device request information · Target system - AltiPlex™ : Media Cloud – Cloud Service System, UPMS
		· Integration information - Streaming content · Target system - AltiPlex™ : Media Cloud – Cloud Streaming System
	Broadcasting information transmission	· Integration information - Broadcasting EPG · Target system - Legacy Headend : EPG System, Multiplexer - AltiPlex™ : PSIP/SI Broadcasting System
	Data broadcasting services	· Integration information - Data broadcasting OC data · Target system - AltiPlex™ : Data Agency System, Interactive Data Broadcasting System
	TV SNS	· Integration information - Subscriber information, Chat Text, Private Media Content · Target system - AltiPlex™ : TV SNS System, UPMS
	TV App Store	· Integration information - TV App lists / data / update information · Target system - AltiPlex™ : TV App Store
	Home Automation (Smart Appliance)	· Integration information - Device monitoring and control data · Target system - AltiPlex™ : Home Automation System - AltiPlatform™ : Smart Appliance
AltiPlatform™ Integration	STB	· Middleware selection - Java, HbbTV, Web M/W, Hybrid M/W · Middleware and CAS potting · Service integration - EPG, Bound / Unbound Application
	Multi-Screen	· Hardware - USB Type, HDMI Stick, Smart TV, Smart Phone, · UI realization - Adaptive UI(HTML5) or individual optimization · Media Player - M/W or platform-based default Player or AltiPlatform™-Media Player · CAS potting and Service Integration
AltiProtect™ Integration	System Integration	· Integration of AltiProtect™ system and STB CAS Client · Multiplexer SCS integration - Real-time broadcasting channel Simulcrypt integration - VOD Simulcrypt integration

Satellite

Division	Major Content	
Restrictions of WSP introduction	Two-way communication is not possible	· Available services - Real-time broadcasting services : PSIP Broadcasting System - One-way data broadcasting services : Data Broadcasting System - Content encryption and authority control : AltiProtect™ - CAS
	Two-way communication is possible - QoS not guaranteed	· All services are available - However, real-time broadcasting services transmit RF (substitute) - VOD services use IP Network but download & play mode is realized for Content Buffering
	Two-way communication is possible - QoS guaranteed	· All services are available - All services, including real-time broadcasting, can be applied through IP Network
WSP Recommend	Apply the recommended logic	· Subscribers' viewing patterns analysis logic · Linked content recommendation Analysis logic
	Content information linked	· Integration information - Content metadata · Target system - AltiPlex™ : ACMS
AltiView™ Customization		· UI of AltiView™ selection · Reflect the site requirements
AltiPlex™ Integration	Provisioning & Mediation	· Integration information - Data broadcast · Target system - Legacy Headend : SMS/Billing, EPG, VOD Metadata, VOD Back Office - AltiPlex™ : Integration Server
	Subscriber information	· Integration information - Subscriber information, device information, product information · Target system - AltiPlex™ : Integration Server, UPMS
	Metadata handling	· Integration information - Live Metadata, VOD Metadata, Web Crawling · Target system - AltiPlex™ : ACMS
	Smart Search	· Integration information - Recent search words list dictionary, AutoComplete key-words dictionary, Real-time search words ranking · Target system - AltiPlex™ : SSE
	VOD RS-DVR Time-Shift Start-Over	· Integration information - Real-time channel content, VOD content, personal recording content, content encryption · Target system - Legacy Headend: Live Content Multiplexer - AltiPlex™ : Media Cloud – Cloud Content Ingest/Delivery System - AltiProtect™ : CAS, DRM
		· Integration information - Subscriber information, billing information, device request information · Target system - AltiPlex™ : Media Cloud – Cloud Service System, UPMS

		· Integration information - Streaming content · Target system - AltiPlex™ : Media Cloud – Cloud Streaming System, Edge QAM
	Broadcasting information transmission	· Integration information - Broadcasting EPG · Target system - Legacy Headend : EPG System, Multiplexer - AltiPlex™ : PSIP/SI Broadcasting System
	Data broadcasting services	· Integration information - Data broadcasting OC data · Target system - AltiPlex™ : Data Agency System, Interactive Data Broadcasting System
	TV SNS	· Integration information - Subscriber information, Chat Text, Private Media Content · Target system - AltiPlex™ : TV SNS System, UPMS
	Home Automation (Smart Appliance)	· Integration information - Device monitoring and control data · Target system - AltiPlex™ : Home Automation System - AltiPlatform™ : Smart Appliance
AltiPlatform™ Integration	STB	· Middleware selection - Subscriber information, Chat Text, Private Media Content · Middleware and CAS potting · Service integration - EPG, Bound/Unbound Application
	Multi-Screen	· Hardware - USB Type, HDMI Stick, Smart TV, Smart Phone · UI realization - Adaptive UI(HTML5) or individual optimization · Media Player - M/W or platform-based default Player or AltiPlatform™-Media Player · CAS potting and Service Integration
AltiProtect™ Integration	System Integration	· CMTS integration - Integration of AltiProtect™ system and STB CAS Client · Multiplexer SCS integration - Real-time broadcasting channel Simulcrypt integration · EdgeQAM integration - VOD Simulcrypt integration

Terrestrial

Division		Major Content
Restrictions of WSP introduction	Two-way communication is not possible	· Available services - Real-time broadcasting services : PSIP Broadcasting System - One-way data broadcasting services : Data Broadcasting System - Content encryption and authority control : AltiProtect™ - CAS
	Two-way communication is possible - QoS not guaranteed	· All services are available · Available services - However, real-time broadcasting services transmit RF (substitute)

		- VOD services use IP Network but download & play mode is realized for Content Buffering
Restrictions of WSP introduction	Apply the recommended logic	· Subscribers' viewing patterns analysis logic · Linked content recommendation Analysis logic
	Content information linked	· Integration information - Content metadata · Target system - AltiPlex™ : ACMS
AltiView™ Customization		· UI of AltiView™ selection · Reflect the site requirements
AltiPlex™ Integration	Provisioning & Mediation	· Integration information - Data broadcast · Target system - Legacy Headend : SMS/Billing, EPG, VOD Metadata, VOD Back Office - AltiPlex™ : Integration Server
	Subscriber information	· Integration information - Subscriber information, device information, product information · Target system - AltiPlex™ : Integration Server, UPMS
	Metadata handling	· Integration information - Live Metadata, VOD Metadata, Web Crawling · Target system - AltiPlex™ : ACMS
	Smart Search	· Integration information - Recent search words list dictionary, AutoComplete key-words dictionary, Real-time search words ranking · Target system - AltiPlex™ : SSE
	VOD RS-DVR Time-Shift Start-Over	· Integration information - Real-time channel content, VOD content, personal recording content, content encryption · Target system - Legacy Headend : Live Content Multiplexer - AltiPlex™ : Media Cloud – Cloud Content Ingest/Delivery System - AltiProtect™ : CAS, DRM
		· Integration information - Subscriber information, billing information, device request information · Target system - AltiPlex™ : Media Cloud – Cloud Service System, UPMS
		· Integration information - Streaming content · Target system - AltiPlex™ : Media Cloud – Cloud Streaming System, Edge QAM
	Broadcasting information transmission	· Integration information - Broadcasting EPG · Target system - Legacy Headend : EPG System, Multiplexer - AltiPlex™ : PSIP/SI Broadcasting System
	Data broadcasting services	· Integration information - Data broadcasting OC data · Target system - AltiPlex™ : Data Agency System, Interactive Data Broadcasting System

	TV SNS	· Integration information - Subscriber information, Chat Text, Private Media Content · Target system - AltiPlex™ : TV SNS System, UPMS
	Home Automation (Smart Appliance)	· Integration information - Device monitoring and control data · Target system - AltiPlex™ : Home Automation System - AltiPlatform™: Smart Appliance
AltiPlex™ Integration	STB	· Middleware selection - Java, HbbTV, RDK, Web M/W, Hybrid M/W · Middleware and CAS potting · Service integration - EPG, Bound/Unbound Application
	Multi-Screen	· Hardware - USB Type, HDMI Stick, Smart TV, Smart Phone, · UI realization - Adaptive UI(HTML5) or individual optimization · Media Player - M/W or platform-based default Player or AltiPlatform™-Media Player · CAS potting and Service Integration
AltiProtect™ Integration	System Integration	· CMTS integration - Integration of AltiProtect™ system and STB CAS Client · Multiplexer SCS integration - Real-time broadcasting channel Simulcrypt integration · EdgeQAM integration - VOD Simulcrypt integration

OTT or Channel business operators

Division	Major Content	
Restrictions of WSP introduction	Two-way communication is possible - QoS not guaranteed	· All services are available - However, Real-time broadcasting Services and VOD services use IP Network but download & play mode is realized for Content Buffering - Adaptive Streaming and HLS Pump applications : Media Cloud – Cloud Streaming System
WSP Recommend	Apply the recommended logic	· Subscribers' viewing patterns analysis logic · Linked content recommendation Analysis logic
	Content information linked	· Integration information - Content metadata · Target system - AltiPlex™ : ACMS
AltiView™ Customization		· UI of AltiView™ selection · Reflect the site requirements
AltiPlex™ Integration	Provisioning & Mediation	· Integration information - Data broadcast · Target system - Legacy Headend : SMS/Billing, EPG, VOD Metadata, VOD Back Office - AltiPlex™ : Integration Server

Subscriber information	· Integration information - Subscriber information, device information, product information · Target system - AltiPlex™ : Integration Server, UPMS
Metadata handling	· Integration information - Live Metadata, VOD Metadata, Web Crawling · Target system - AltiPlex™ : ACMS
Smart Search	· Integration information - Recent search words list dictionary, AutoComplete key-words dictionary, Real-time search words ranking · Target system - AltiPlex™ : SSE
VOD RS-DVR Time-Shift Start-Over	· Integration information - Real-time channel content, VOD content, personal recording content, content encryption · Target system - Legacy Headend : Live Content Multiplexer - AltiPlex™ : Media Cloud – Cloud Content Ingest/Delivery System - AltiProtect™ : CAS, DRM
	· Integration information - Subscriber information, billing information, device request information · Target system - AltiPlex™ : Media Cloud – Cloud Service System, UPMS
	· Integration information - Streaming content · Target system - AltiPlex™ : Media Cloud – Cloud Streaming System
Broadcasting information transmission	· Integration information - Broadcasting EPG · Target system - Legacy Headend : EPG System, Multiplexer - AltiPlex™ : PSIP/SI Broadcasting System
Data broadcasting services	· Integration information - Data broadcasting OC data · Target system - AltiPlex™ : Data Agency System, Interactive Data Broadcasting System
TV SNS	· Integration information - Subscriber information, Chat Text, Private Media Content · Target system - AltiPlex™ : TV SNS System, UPMS
TV App Store	· Integration information - TV App lists / data / update information · Target system - AltiPlex™ : TV App Store
Home Automation (Smart Appliance)	· Integration information - Device monitoring and control data · Target system - AltiPlex™ : Home Automation System - AltiPlatform™: Smart Appliance
STB	· Middleware selection - Java, HbbTV, Web M/W, Hybrid M/W

AltiPlatform™ Integration		· Middleware and CAS potting · Service integration - EPG, Bound / Unbound Application
	Multi-Screen	· Hardware - USB Type, HDMI Stick, Smart TV, Smart Phone · UI realization - Adaptive UI(HTML5) or individual optimization · Media Player - M/W or platform-based default Player or AltiPlatform™-Media Player · CAS potting and Service Integration
AltiProtect™ Integration	System Integration	· Integration of AltiProtect™ system and STB CAS Client · Multiplexer SCS integration - Real-time broadcasting channel Simulcrypt integration - VOD Simulcrypt integration

APPENDIX. HDMI MEDIA EXPRESS

New Footprint for Content Delivery

Alticast has developed the HDMI Media Express solution for emerging HDMI stick devices, bringing together content, security, portability, and more. HDMI Stick technology presents an opportunity for Operators to extend services to consumer owned and managed (COAM) devices. As well, operators can choose to brand their own HDMI devices and offer them directly to customers. HDMI Media Express can be launched in conjunction with a Gateway STB in the home, or it can be used to deliver cloud-based content directly to the TV or other compatible device.

HDMI sticks are quickly becoming more and more powerful and offer a number of unique capabilities not available in traditional STBs. Small size and standard plug-and-play footprint allow users to carry the device in their pocket for a truly portable experience. Alticast delivers this technology by providing the necessary components to make a versatile, high performing and secure solution

Overview of Features

- Supports multiple User Agents for HTML5 and Android Application Delivery
- IP Streaming Support – HLS, HTTP Progressive
- WiFi Connectivity
- Gateway architecture for multi-room channel and DVR experience
- Cloud-to-HDMI content delivery
- Portable untethered device that moves from TV to other HDMI-enabled devices like computers
- Personalized for the user with single identification
- Live Pause and Rewind
- USB support extends storage and provides other application opportunities
- IR Support allowing remote control usage for device operation
- Content Protection with AltiProtect™ DRM/CAS/DTCP-IP options
- AltiPlatform™ or RDK Software enabled
- Leverage Alticast graphics rendering and Built-in Browser for quick, reliable deployment

Benefit

- Multiple User Agents :
  Lets operators have a hybrid application environment allowing users access to a variety of entertainment
- Streaming Model :
  Provides a direct from cloud video playback for cloud VOD applications
- WiFi :
  No cables
- Gateway Model :
  Tuners from a gateway can provide video to multiple TVs with Sticks
- Portable :
  Users could record and take content with them and play video securely on the road (with proper operator rights)
- Personalized :
  Could be registered to a user, so once registered, sign-in could be simplified and device could be personalized with content
- Pause and Rewind :
  Better TV watching experience

- USB port :
  Provides application extensions, storage, etc.
- Built in Browser :
  Makes using apps easier

HDMI Media Express gives operators the flexibility to expand their services with a compact, secure device while broadening the portfolio of consumer delivery venues at home or on the go.