Smart TV Technology
and Service

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1. Introduction of Smart TV
2. Smart TV Platform
3. Smart TV Technology
4. Smart TV Service
5. Summary
1. Introduction of Smart TV
1.1 What is Smart TV

- App Market
- Service
- Internet
- Apps
- TV Sets
- Platform
- SDK

Smart TV
1.2 Smart TV Platforms

<table>
<thead>
<tr>
<th>TV Platform</th>
<th>Mobile Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMSUNG SMART TV</td>
<td>iOS 4</td>
</tr>
<tr>
<td>Google TV</td>
<td>MeeGo</td>
</tr>
<tr>
<td>Open</td>
<td>Android</td>
</tr>
<tr>
<td>Reliability</td>
<td>Windows phone</td>
</tr>
<tr>
<td></td>
<td>WIPI the way!</td>
</tr>
</tbody>
</table>

- Open IPTV Forum
- DVB-MHP
- DVB-SEK
- DVB-C
- DVB-T
- Cable DSM-CC
- Blu-ray Disc
- DVB-IF
- DVB-S2
- ATSC
2.1 Samsung Smart TV
2.2 LG Smart TV
2.3 Google TV
2.4 W3C Web on TV
2.5 Hbb TV

2. Smart TV Platform
2.1.1 Samsung Smart TV

- Samsung Smart TV
  - SAMSUNG Smart TV Device + Samsung TV Hub site
2.1.2 Samsung Smart TV Platform

- Platform Architecture

- Maple Browser 6.0 (Markup Engine Platform for Embedded Systems)
  - Samsung TV Web Run-Time Engine
  - Supported web standards
    - HTML5, XHTML1.0, XML1.0
    - CSS1, CSS2, CSS TV Profile 1.0
    - DOM1, DOM2
    - JavaScript 1.8, Adobe Flash 10.1, HTTP1.0/1.1
2.1.2 Samsung Smart TV Platform - Application Manager

- Application Manager controls install, register, update, remove, and manage applications.
2.1.2 Samsung Smart TV Platform - Common Modules

- **JavaScript Core Library Set** provided in the Samsung Web Run-Time

- **Provided Common Module Functions**
  - Event
  - Remote Key Value
  - System
  - Image View, ...

- **How to Use**
  - in .html
    - `<script type="text/javascript" language="javascript" src="$MANAGER_WIDGET/Common/API/TVKeyValue.js"></script>`
  - in .js
    - `var tvKey = new Common.API.TVKeyValue();`
2.1.2 Samsung Smart TV Platform - Device APIs

- JavaScript APIs for Device Native call

- DeviceAPI can be called as Javascript
- DeviceAPI can be called as callback
- DeviceAPI is coupled with browser

- Functions
  - Basic TV function calls (File Systems, Channel, ...)
  - Audio, Video, Player,
  - IME, Networks, ...
2.1.2 Samsung Smart TV Platform - Applications

- **Web/Flash-based applications** on Samsung Smart TV.
- Using remote controller Interface as an user interface.
- **Application Type**

<table>
<thead>
<tr>
<th>Display Type</th>
<th>Description</th>
<th>Screen Layout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-screen application</td>
<td>Fills the entire screen with an application</td>
<td></td>
</tr>
<tr>
<td>Single-wide application</td>
<td>Makes an application displayed only on part of the screen</td>
<td></td>
</tr>
<tr>
<td>Ticker</td>
<td>Keeps an application on the screen while you do other things with your TV</td>
<td></td>
</tr>
</tbody>
</table>
2.1.3 Samsung TV App Development

- An application should contain following elements:
  - **index.html**: access point of an application.
  - **JavaScript files**: defining the behavior of the application.
  - **CSS files**: Layout of the application.
  - **Resource files**
  - **Config.xml**: An application configuration file, holding information for the application.
2.1.3 Samsung TV App Dev: index.html

3. Writing **index.html**

- Title: Hello World
- Javascript: JavaScript/Main.js
- CSS: CSS/Main.css
- Call Main.onLoad() when the document is loaded.
- Deal with KeyDown events: Main.KeyDown()

```html
<!DOCTYPE html>
<html>
<head>
  <meta http-equiv="Content-Type" content="text/html; charset=utf-8">
  <title>Hello World!!</title>
  <script type="text/javascript" language="javascript" src="$MANAGER_WIDGET/Common/API/Widget.js"></script>
  <script type="text/javascript" language="javascript" src="$MANAGER_WIDGET/Common/API/TVKeyValue.js"></script>
  <script type="text/javascript" language="javascript" src="JavaScript/Main.js"></script>
  <link rel='stylesheet' type='text/css' href ='CSS/Main.css'/>
</head>
<body onload="Main.onLoad();">
  <div id='welcome'>Welcome to Samsung widget world!</div>
  <a href='javascript:void(0);' id='anchor' onkeydown='Main.keyDown();'></a>
</body>
</html>
```
4. Writing **Main.js**

- var widgetAPI
- var tvKey
- Main.onLoad method
- Main.keyDown method

```javascript
var widgetAPI = new Common.API.Widget(); // Create Common module
var tvKey = new Common.API.TVKeyValue();

var Main = { // Main object
}

Main.onLoad = function() { // called by <body>'s onload event
    alert("Main.onLoad()");
    widgetAPI.sendReadyEvent(); // Send ready message to Application Manager
document.getElementById("anchor").focus(); // Focus to Anchor for handling key inputs
    // from remote controller

    /**
     * JavaScript code Here!
     */
}
```
```javascript
Main.keyDown = function() { // Key handler
    var keyCode = event.keyCode;
    alert("Main Key code : " + keyCode);

    switch (keyCode) {
        case tvKey.KEY_LEFT:
            document.getElementById("welcome").innerHTML = "Key Left";
            break;
        case tvKey.KEY_RIGHT:
            document.getElementById("welcome").innerHTML = "Key Right";
            break;
        case tvKey.KEY_UP:
            document.getElementById("welcome").innerHTML = "Key Up";
            break;
        case tvKey.KEY_DOWN:
            document.getElementById("welcome").innerHTML = "Key Down";
            break;
    }
}
```
5. Writing **Main.css**

- specify the Layout and style of the page

```css
body {
    margin: 0;
    padding: 0;
    background-color: transparent;
}

#welcome {
    position: absolute;
    left: 50px;
    top: 50px;
    width: 500px;
    height: 50px;
    background-color: transparent;
    color: #99FFFF;
    font-size: 30px;
    text-align: center;
}
```
## 2.1.3 Samsung TV App Dev: config.xml

### Tag information in config.xml

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;widget&gt;</code></td>
<td>Indicates that the information is relevant to the application.</td>
<td>-</td>
</tr>
<tr>
<td><code>&lt;ThumbIcon&gt;</code></td>
<td>An icon image displayed in the Application Manager. It is used in case of no focus and its size is 106 x 86 pixel.</td>
<td>File path</td>
</tr>
<tr>
<td><code>&lt;BigThumbIcon&gt;</code></td>
<td>An icon image displayed in the Application Manager. It is used in case that the focus is placed on an image and its size is 115 x 95 pixel.</td>
<td>File path</td>
</tr>
<tr>
<td><code>&lt;ListIcon&gt;</code></td>
<td>An icon image displayed in the Application Manager. The size is 85 x 70 pixel.</td>
<td>File path</td>
</tr>
<tr>
<td><code>&lt;BigListIcon&gt;</code></td>
<td>An icon image displayed in the Application Manager. The size is 95 x 78 pixel.</td>
<td>File path</td>
</tr>
<tr>
<td><code>&lt;category&gt;</code></td>
<td>The category to distinguish applications, available items are video, sports, game, lifestyle, information, others.</td>
<td>String</td>
</tr>
<tr>
<td><code>&lt;autoUpdate&gt;</code></td>
<td>Decides whether to synchronize with hub site. The application which doesn&quot;t need synchronization chooses &quot;n&quot;.</td>
<td>y</td>
</tr>
<tr>
<td><code>&lt;apptype&gt;</code></td>
<td>Shows information on contents type.(11:javascript, 12: Adobe Flash Lite 3.1, 13: Adobe Flash 10.1, 14 : Lua Script)</td>
<td>Number</td>
</tr>
<tr>
<td><code>&lt;contents&gt;</code></td>
<td>File route at the initial execution of contents (Limited to non-Javascript based applications)</td>
<td>File Path</td>
</tr>
<tr>
<td><code>&lt;channelType&gt;</code></td>
<td>Channel Bound Service Type(optional)</td>
<td>root</td>
</tr>
</tbody>
</table>
### 2.1.4 Samsung TV Hub

- Samsung TV Application Market

<table>
<thead>
<tr>
<th>Category</th>
<th>설명</th>
<th>Apps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video</td>
<td>VOD Service</td>
<td>KTH, EBS, SBS, YouTube, Blockbuster, Hulu Plus, Playy, TED tv</td>
</tr>
<tr>
<td>Game</td>
<td>Games</td>
<td>Bowling, Wise Star, Cooking Game, Quizz Master</td>
</tr>
<tr>
<td>Sports</td>
<td>Sport, Health</td>
<td>Yoga Helper, Six-Pack Pro, ESPN</td>
</tr>
<tr>
<td>Life Style</td>
<td>SNS, Music, Photo</td>
<td>Twitter, Facebook, Pandora, Picasa, Samsung Imaging, Cyworld Photo Album</td>
</tr>
<tr>
<td>etc</td>
<td>Video Phone, Utility</td>
<td>Skype, Dibo’s Story book</td>
</tr>
</tbody>
</table>
2.2.1 LG Smart TV

- LG Smart TV
  - LG NetCast Smart TV Platform + LG Apps TV (AppStore)
2.2.2 LG NetCast Smart TV Platform - Architecture

- LG NetCast Platform Architecture
  - Two Main Components of LG NetCast
    - LG Web Browser Engine (WebKit based)
    - media player plug-in
2.2.2 LG NetCast Smart TV Platform
- Operating Environment

- WebKit 528.5+ based LG Browser
- LG TV Application Programming Environment
- Supported web standards
  - HTTP1.0/1.1
  - HTML4.01, XHTML1.0/1.1
  - XML, XSLT, XPath
  - CSS2.1, CSS3, CSS2D/3D, CSS TV Profile 1.0
  - DOM1, DOM2, DOM3(Partly)
  - JavaScript 1.6
  - XMLHttpRequest
  - JSON, RSS, Atom
2.2.3 LG Apps TV

- [http://kr.lgappstv.com](http://kr.lgappstv.com)

- Category
  - Game
  - Entertainment
  - Life
  - Education
  - News & Information
2.3.1 Google TV

- **Android 3.1** (Honeycomb)
  - Tablet
  - TV

- **Android 3.2** (Ice cream Sandwich)
  - Mobile
  - Tablet
  - TV
  - TV specific functionality
  - 3D

- **Google TV**
  - Android compatibility
  - Android Market for TV
  - Emulator
  - Adb
  - USB Host
  - Samsung, Vizio

- **Chrome**
  - Sony, Logitech

Timeline:
- 2010
- May 2011
- Late Summer, 2011
- Q4 2011
2.3.2 Google TV Features

- Android 3.1 (Honeycomb)
- Chrome browser
- Not a cable replacement
- App friendly
- Full web experience on the TV
2.3.2 Google TV Features

- Screen Shot: Search Box
- Android Market for Google TV
2.3.3 Google TV H/W Specifications

- Intel Atom CE4100 chip (Sony)
- ARM-based dual core (?)
- HDMI
- Bluetooth
- USB port
- Streaming 1080p
2.4 W3C Web on TV

- **Web Technology on TV**
  - HTML5
  - CE-HTML
  - JavaScript
  - SVG
  - Device API on TV

- **Requirements**
  - Extensions of the existing standards and hardware
  - Developing TV S/W efficiently based on the standards
  - Collaboration with other consumer electronics devices

---

from “W3G Web on TV Workshop”
2.4 W3C Web on TV

- Markup language for Web on TV
  - HTML5 / CE-HTML

- Design principles for TV Applications
  - Content-oriented design
  - Resolution guide
  - Limited text length due to legibility

To provide the best UI, the browser needs to know what kind of I/O device is being connected and be able to send requests to relevant server based on the information.

from “W3G Web on TV Workshop”
2.5 HbbTV

- **HbbTV = Hybrid Broadcast Broadband TV**
- New pan-European initiative
- Combining the broadcast and broadband delivery through TVs and set-tops.
  - catch-up TV
  - VoD
  - Interactive advertising
  - Personalization
  - Voting
  - Games and social networking
  - Program-related services (digital text, EPG, ...).
- Current specification **Version 1.1.1** (ETSI TS 102 796, June 2010)
- Members: France Televisions, IRT GmbH, OpenTV, Philips, SES ASTRA, European Broadcasting Union, ANT SW, Samsung, Sony
2.5 HbbTV

- based on existing specifications, OIPF (Open IPTV Forum), CEA-2014 (CE-HTML), W3C (HTML etc.) and DVB Application Signaling Spec (ETSI TS 102 809).
### 2.5 HbbTV

- **CEA-2014 (CE-HTML) for HbbTV**
  - Definition of the application language (XHTML, CSS, and AJAX)
  - Definition of DOM event handling (eg key events)
  - Definition of how to embed non-linear A/V Content in an application
  - Specification of still image formats
- **OIPF for HbbTV**
  - **DAE** (Declarative Application Environment)
    - JavaScript APIs for applications running in a TV environment (eg channel change)
    - Definition of how to embed linear A/V content in an application
  - **Media Formats**
    - Supported audio and video formats
- **DVB Application Signaling Specification** (TS 102 809) for HbbTV
  - Application signaling
  - Application transport via broadcast or HTTP
- **HbbTV RunTime Environment**
  - Application Lifecycle Management
  - AIT interfaces
  - DSM-CC Stream Event Listener
2.5 HbbTV

- Module diagram of HbbTV
2.5 HbbTV

- Functional components of a hybrid terminal
2.5 HbbTV

- Service samples
3. Smart TV Technology

3.1 Web and Smart TV
3.2 Digital Convergence
3.3 Semantic TV
3. Smart TV Technology

Applications
- Game, ...
- Broadcasting Service
- Widgets
- Contents Sharing
- Contents Sharing

UI Framework
- UI Components
- Windows Manager

Broadcast & Media F/W
- Media Player
- Codec

Web Framework
- Browser
- Web Engine

Semantic Engine
- Context-Aware
- Context DB

Connectivity
- DLNA
- UpnP

Engine
- Graphics
- CAS/DRM
- Networking
- Database
- Broadcasting
3. Smart TV Technology Trend

- **Web based Platforms**
  - PC: Google Chrome OS
  - Mobile: HP Web OS
  - Samsung Smart TV, LG Smart TV, W3C Web on TV, HbbTV ...

- **Digital Convergence**
  - Large Screen & Contents Oriented Device for Contents Sharing
  - Networking for Primary Home Hub & Remote Controller

- **Semantic & Context-Aware Engine**
  - Context-Aware Solution for TV
  - Personalization, Info & EPG recommendation, Shopping
  - Semantic Engine for Commercial Services and Target Advertisements
3.1 Web and TV

- Web & Browser based TV Platform
  - HTML, XML, JavaScript, CSS
  - SVG, Flash
  - Device APIs
  - ...

![Diagram of Web Applications and Browser Engine](image-url)
3.1 Web and TV

Application Manager
Maple Browser

Device APIs
Common Modules

Internet@TV

Samsung

LG

Google TV

Now (Proprietary) Future (Standards)

Video Playback Flash HTML5<video>

Real-time Comments XML Sockets (Flash) Web Socket

Comment Overlay Flash HTML5<canvas>

W3C
3.1 Web and TV

NbbTV

OHTV (Open Hybrid TV)
## 3.2 Contents Sharing & Convergence

- **UPnP & DNLA**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRM/Link Protection</td>
<td>How commercial content is protected on the Home Network</td>
</tr>
<tr>
<td>Media Formats</td>
<td>How media content is encoded and identified for interoperability</td>
</tr>
<tr>
<td>Media Transport</td>
<td>How media content is transferred</td>
</tr>
<tr>
<td>Media Management</td>
<td>How media content is identified, managed, and distributed</td>
</tr>
<tr>
<td>Discovery &amp; Control</td>
<td>How devices discover and control each other</td>
</tr>
<tr>
<td>IP Networking</td>
<td>How wired and wireless devices physically connect and communicate</td>
</tr>
</tbody>
</table>

### DRM/Link Protection
- DTCP/IP (mandatory)
- WMDRM-ND (optional)

### Media Formats
- MPEG2, MPEG4, AVC/H.264, LPCM, MP3, AAC LC, JPEG, XHTML-Print
- + optional formats

### Media Transport
- HTTP (mandatory)
- RTP (optional)
- Quality of Service

### Media Management
- UPnP AV 1.0
- UPnP Print Enhanced 1.0

### Discovery & Control
- UPnP Device Architecture 1.0

### IP Networking
- IP Protocol Suite

### Connectivity
- Mandatory Ethernet 802.3 or Wi-Fi 802.11
3.2.1 Samsung All Share & Remote

- **All Share**: Contents Sharing
- **Remote**: iPhone TV Remote Controller App
3.2.2 LG Smart Share

- **Smart Share**: Contents Sharing based on DLNA
- **Remote**: iPhone TV Remote Controller App
3.2.3 Apple iPhone/iPad

- Home Sharing

Setting up Remote with Home Sharing is simple and secure.

1. Download the free Remote app from the App Store.
2. Set up Home Sharing in iTunes.
3. Connect your device to your home Wi-Fi network and sign in to Home Sharing.
3.2.3 Apple iPhone/iPad

- TV Controller

Controlling the show on Apple TV.

Get more control with gestures.
Remote makes it easy to control your Apple TV using simple gestures on your iPhone, iPad, or iPod touch. Use the screen of your device just as you would a trackpad. Swipe left and right between menu options then tap when you find the item you’re looking for.

Touch. Type. Search.
If you know the song, movie, or TV show you want to play from your iTunes library, use your device’s QWERTY keyboard to tap out the title. It’s a quick and easy way to search on Apple TV.
3.2.4 Nielson ®
- Media-Sync Platform

- ABC “My Generation Sync”
3.3 Semantic TV

- **Semantic technologies to make links** between broadcast, video and the Web.
- **Connecting user activities and contexts with TV**, for example, automated ratings generated by your use of a set top box, or reuse of user activities and profiles described on the social web.

from “EU NoTube Project”
3.3 Semantic TV Architecture

- **User services**: include identity and privacy management, profiling, and recommendations provision.

- **Metadata services**: are in charge of discovering, analyzing, translating and enriching metadata associated to content items.

- **Content services**: support operations of the typical content life cycle, e.g. ingestion (e.g. recording from TV), storage and indexing, transcoding (e.g. from high definition to mobile phone formats) and streaming.
3.3 Semantic TV Architecture

“Modeling of User Interaction in Context-Aware Interactive Television Application on Distributed Environments”, J. Santos et al.
3.3 Semantic TV Architecture

“Modeling of User Interaction in Context-Aware Interactive Television Application on Distributed Environments”, J. Santos et al.
4.1 Manufacturer
4.2 Web Service & Contents Provider
4.3 Broadcaster

4. Smart TV Service
4. TV Service

Search

SNS

twitter

skype

facebook

Social networking

Gaming

Content Provider

Google tv

Yahoo!

Connected TV

Widget Channel

iMDB

You Tube

music beta by Google

amazon MP3

at&t

BIGPOND TV

comcast

VERIZON

FiOS TV

Broadcaster

Manufacturer

LG

SAMSUNG

SONY

VIZIO
4. TV Service

**Independent Apps**

- Search
- News / Weather / Finance
- SNS
- Music / Video
- Game
- Photo
- Video Call

**Hybrid Apps**

- Search
- Shopping
- Multi-view
- Chats
- Ads
4.1 Manufacturer & Platform Developer

**Companies**
- Platform Developer: Samsung, LG, Apple, Google, Yahoo, MS
- Manufacturer: Samsung, LG, Apple, Sony

**Services**
- App Market
- Digital Convergence & N-Screen Service

**Goal**
- Platform Developer: Ads profit Increase or S/W sales
- Manufacturer: Devices sales profit Increase
4.2 Web Service & Contents Provider

- **Companies**
  - Google, Yahoo, Apple, NHN, Daum, SKComs, Amazon

- **Services**
  - Search
    - Independent: Naver, Duam, SKComs, Google, Bing
    - Hybrid: Naver-‘Contents Info Search’, SKComs ‘Real-Time TV search’
  - Hybrid & Target Ads
  - Shopping
  - Email, SNS, News, Map
  - Education, Health, Finance
  - Cloud, N-Screen
  - Contents Sales Market
    - Apple: iTunes, Ping
    - Google: “Google Movie”, “Google Music beta”

- **Goal**
  - Ads profit Increase
  - Contents sales profit Increase
4.3 Broadcaster

- **Companies**
  - on Smart TV app: Telstra in Austria, Comcast & Time Warner in the U.S
  - on Setup box: AT&T, Verizon, KT, SKB, LG U+

- **Services**
  - TV & VOD on Smart TV app
  - Apps & Widgets on Setup box

- **Goal**
  - Subscriber/Audience Increase
  - ARPU(Average revenue per user) Increase
4.4 Service Examples

NHL App: Video Highlights and Hockey Stats
5. Summary
5. Summary

- Smart TV Platform
  - Web based TV Platform
  - Digital Convergence
  - Semantic TV
  - New Services on TV