Project MobiFix:

Study on
Interface profiling of mobile IPTV

Final version

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Content

1 Scope

This document details the service description and requirements for the trials of the **bmco**forum project Mobifix.

In Mobifix, the convergence between fixed and mobile audiovisual services was tested by multiple companies. From these trials the intention is to describe the different profiles needed to enable the different service propositions. The focus of this document is to carve out the prerequisites for a mobile IPTV profile for connected TV set's, mobile phones, tablet devices. This means use cases, service description, top level architecture and investigation of potential standards to be used.

This document can function as a start of profiling work that needs to take place in cooperation with other relevant organizations like e.g. Open IPTV Forum.

2 Use Case and service description

2.1 *Use case example*

Harry is subscribed to an IPTV service that delivers content to TV's, mobile phones, tablets and PC. Most viewed channels which are kept for e.g. 36 hours. Harry can get to this content using all of his devices. Recently Harry bought a net connected TV and can watch the linear channels from the IPTV offer direct on his TV set using the build in functionality. Content that Harry buys or select from the internet is available to all his devices. Through an additional offer his service provider makes this content also available outside his home.

Mobile use case 1: Mobile Access to IPTV Video/TV Serv**ices**

Experience:

- Harry's mobile phone recognizes the home network environment and the IPTV offer available to him. The media applications on his phone now change color to indicate availability free of network cost. Also an extra app is now "green" allowing additional functionality e.g. session transfer. One of the interaction possibilities Harry has is "personalize TV-set". Harry uses this when he is alone in the room to use the TV set do to personal things like twitter/ LinkedIn and e-email.
- Harry is on the move and likes to spend time in the bus to watch TV with his mobile phone. He browses the EPG for the ongoing TV programs and selects the sports channel. After a while Harry prefers to watch the comedy series he has recorded the previous day and is available in his personal IPTV services account. Later on at home Harry will select the best sketch in the comedy to show to his family in the home connected TV.

Typical functionality on the mobile phone:

- **Browse and search** available TV content for current or future viewing.
- Remotely set-up and manage **recordings** of TV shows and movies on your (Network) Personal Video Recorder.
- **Stream** live TV, TV/video library, or recorded content.
- **Download** selected TV/Video content for viewing on the go (on-demand, scheduled). For this also a recommendation feature is available to side-load automatically a recommended set of content.

End user benefits

- Reuse of living room content in mobile environment
- Mobile control of IPTV services

Mobile use case 2: Add or share content from the mobile device to the IPTV home environment

Experience:

- On his last trip Harry explored some new music and movies as well as took a lot of photos, some of these Harry wants to show to his family. Harry uses his phone to select the content and shares it on the big screen.
- Harry also changed the ratings of some of his music and movies. Harry can now add these changes to his personalized service provider environment if he wants.

The focus on the mobile phone:

- Stream and play content with mobile phone to other device.
- Share content from mobile phone with selected home devices (PC, TV) or other mobile devices at home network.
- Transfer content identifiers including ownerships proof (e.g DECE model) to personalized IPTV environment to enable better quality viewing in big screen.

End user benefits:

- Easy to share content and personal settings with devices at home environment.

Mobile use case 3: Content Sharing between IPTV subscribers

Experience:

- Harry can share parts of his content at Fred's home who also has an IPTV subscription.
- Note: Users to have a subscription with the same service provider?

The focus on the mobile phone:

- Controlling own content to share it on other home IPTV network.
- Providing access or access rights to other users to play or download the selected content from your personal IPTV environment.

End user Benefits

- Share easily own recorded free-to-air content within own community
- Give access on purchased video content according to purchased user rights (DRM requirement)

2.2 *Detailed service description*

This section contains a detailed service description of an example service. The example service can be described as seamless access to IPTV channels besides access to 'mobile broadcasted' channels via e.g. DVB-H with a mobile terminal. The case is that when a user enters a WiFi enabled environment, his ESG on the mobile phone automatically adds the IPTV channels available in that hotspot.

Service consumption can be decomposed into several phases:

- Service discovery
- Service selection
- Service negotiation
- Service consumption
- Service termination

Next to these service consumption phases, typically service creation, provisioning, deployment, operational management, billing and retirement are also aspects that should be considered when describing the services mentioned in the use cases.

The focus of this document is on the delivery profiles.

2.2.1 Prerequisites

Service prerequisites are:

- A mobile phone with network connectivity 3G / WiFi. Optionally with a receiver that allows access to broadcasted channels with the mobile phone (e.g., DVB-H).
- A mobile TV application on the phone that allows access to streaming content via 3G / WiFi, optional mobile broadcast.
- Optional, a subscription with an operator that provides a mobile broadcast service – or a FTA mobile broadcast service to be able to receive the channels.
- A TV set with Ethernet to connect to the internet.
- The service is protected by a CA/DRM solution.
- Devices are not specifically tailored to the local network.
- ….

The next sections describe how these prerequisites and requirements impact Mobifix and what additional pieces of software logic need to be developed to enable this service.

2.2.2 Service provisioning (needs work…..)

Mobile phone needs to connect/signal to the home (IPTV) network and authenticate against the IPTV service as a legitimate node/ equipment of the IPTV service.

Settings and location of metadata needs to be exchanged between the service and the mobile phone.

These settings may have a hierarchy meaning where an extra set of the data is exchanged, e.g., continuously small updates are exchanged in and out of the home network.

The use cases can have differences in the service provisioning requirements not detailed here.

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2.2.3 Service discovery

Service discovery is a process that requires multiple steps:

1. Discovery of a network (e.g., WiFi): (out of scope)
2. Discovery of multicast IPTV service by TV set /PC / mobile phone
3. Initial authentication of subscriber to the IPTV provide
4. Discovery and download of service list and content guide

Example scenario: Discovery of the IPTV Electronic Service Guide: The phone should automatically or on-demand (depending on user preference) be connected to the IPTV server and retrieve the ESG information. The IPTV server location may be pre-provisioned. The phone will need to supply the right credentials to access the ESG information.

2.2.4 Service selection

If the TV viewing application is not running, the user needs to start the TV application and navigate to the ESG. In the ESG additional channels are depicted that have been retrieved for the IPTV type of service. Selecting one of the channels for viewing in the application will result in the channel being streamed to the phone and displayed in the TV viewer.

If the TV application is running, and the user navigates to the ESG information after service discovery, the same service selection process as above will be followed.

If the TV viewing application is displaying the ESG, during and after the service discovery phase, ideally these new channels would be added (‘pop up’) without additional action of the user. For the Mobifix services this is not a requirement. Closing the EPG view and reopening should bring up the new channels. Selecting a channel will result in a streaming television experience.

Optional case: Some channels may be obtained through WiFi and DVB-H, in this case the ESG only displays the channel once and depending on coverage or presets the appropriate channel/technology is chosen by the client.

2.2.5 Service negotiation

There is no real negotiation phase, however once channel selection has been done, authentication is required to access the mobile television streams. The TV viewer must be able to supply the right credentials to access the stream.

For direct to TV delivery it is assumed that the Remote Gateway (RG) is terminating multicast and DRM functionality.

2.2.6 Service consumption

During the viewing of IPTV channels, the same functionality should be available to the user as when he is watching a regular broadcast TV channel:

- Channel switching by means of cursor keys and keypad
- Access to ESG by a single click
- Full screen mode
- Audio volume control
- Other features like mute, pause, etc.

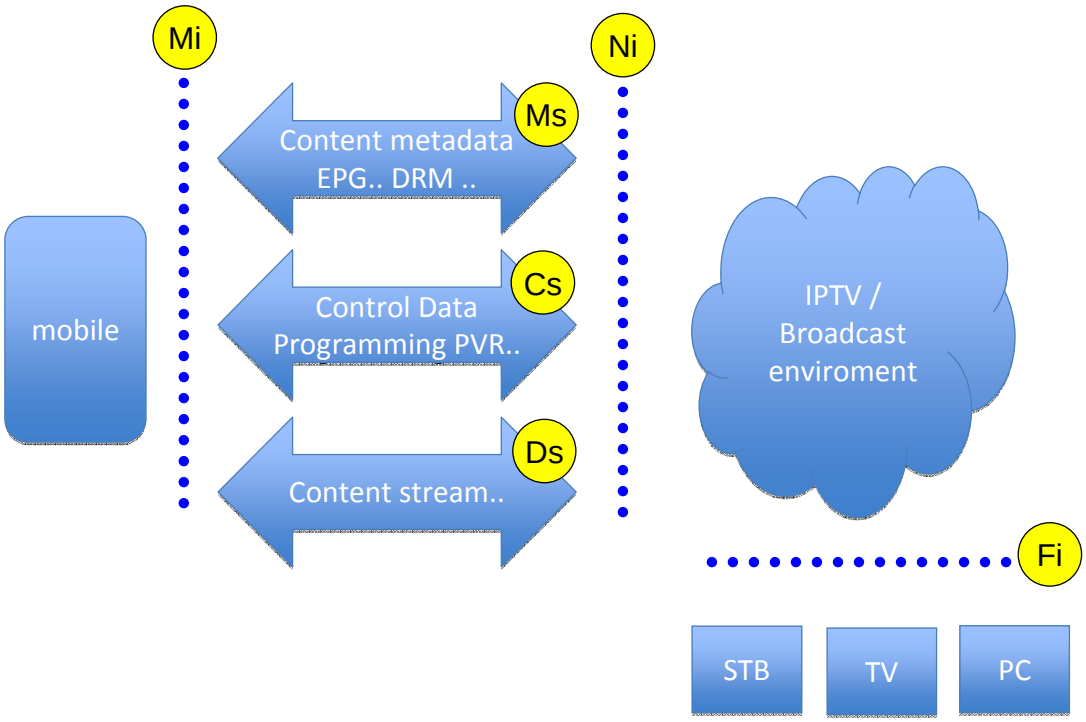
2.2.7 Service termination

Out of scope

3 Top level architecture

3.1 *Summary*

The architecture assumes a situation where multiple vendors, content providers and service providers coexist and develop user centric application / content to be delivered to multiple device platforms. The architecture is as such targeted to enable an eco system of application and service development based on a restricted set of core standards.



Basic architecture

Focus on three main standards,

1. Content metadata (Ms: metadata plane stream), e.g. EPG, where to find the content, DRM, rendering info
2. Control Data (Cs: control plane stream) used to control e.g. the PVR but also to be used for subscription etc
3. Content stream (Ds: data plane stream), the content itself, formats, interaction hooks …

And three interface points:

1. Mi (Mobile Interface): The interface between the mobile terminal and the streams described above

2. Ni (Network interface): The interface between the IPTV and broadcast network and the mobile domain.
3. Fi (Fixed interface): The interface between the TV network and the 'fixed' devices

For the purpose of this document we assume a content unaware network is used towards the mobile, and Mi and Ni are the same interface. For clarity of the picture, we have not depicted the Ms, Cs and Ds streams towards the 'TV' clients. The discussion in this document will mark the proposed standards on these interfaces e.g. as MiCs (Mobile interface Control stream) or FiDs (Fixed interface Data stream).

The assumption is that on both sides mobile and IPTV there will be an application interface, for standardization purposes the profile should focus on data-formats in between. This means that the use cases are examples and can be realized by an application but the application itself is not part of the work.

3.2 *Possible candidate standards to be used for further profiling*

Content Meta Data (MiMs and FiMs))

- **EPG:** XMLTV /OMA BCAST / TV-Anytime (for MiMs some data types/content classification schemes) / MPEG-7 (for MiMs some data types/content classification schemes)
- **DRM:** Ultraviolet (DECE) DRM interoperability format, Marlin, OMA-DRM V2

Control Data (MiCs and FiCs)

- **Zapping:** XML or JSON (JavaScript Object Notation) on HTTP (REST)
- **Content synchronisation:** HbbTV (MiCs not in scope); RTP/RTCP … for MiCs
- **PVR programming:** a subset of MiMs EPG standard enhanced with recording control

Content stream (on both MiDs and FiDs)

- **Application:** HTML5 (by W3C), Qt; CE-HTML for FiDs
- **Media:** H.264 and AAC+ (by MPEG/ITU)
- **Transport:** HTTP adaptive streaming (by 3GPP AHS/MPEG DASH/OIPF AHS), HTTP 1.1, multicast (IGMPv2)
- **Container:** MPEG-4 fragmented system streams

Other

- DLNA / UPnP technologies for sharing content between CE devices and mobile devices at home (& beyond)

Market development

For mobile TV, web TV, and media delivery in general, multiple initiatives exist in the market supported by different cross sections of the industry, although some of those initiatives might draw or use regular standards, published by official SDO's, it is not always clear if the surrounding governance model of those initiatives can be compared with those of the formal standards setting organizations.

Nevertheless, some of these initiatives might gain large traction in the market and might be interesting to be included in further work specifically on the issue how to interoperate with them. Examples of those initiatives are:

- Media room from Microsoft
- WebM by Google: See http://www.webmproject.org/license/ Open source initiative for content distribution.
- ,,,

Appendix

Reviewed standards and their use in the IBC 2010 showcases

The showcases at the International Broadcast Conference 2010 (IBC 2010) demonstrated the following functionalities:

- Consume live, on-demand and stored content directly on connected TV's, PC's or mobile devices.
- Search, select and control consumption with the mobile device:
    - Browse Electronic Program Guide (EPG) on mobile and switch channels on TV
    - Consume video on demand content, set and view recordings with Network Personal Video Recorder (NPVR).
- Push in content to device storage as a background download to improve mobile user experience.

IBC case 1: Delivering live IPTV to connected TV with mobile control (KPN/TNO)

In this showcase, a live IPTV signal from KPN's network was shown on a connected TV without the use of a set-top box. A web based user interface allowed for selection of channels and showed EPG information. Channels could also be selected with an android application on a mobile phone. There is no direct connection between television and mobile phone, the zapping takes place via a network server signalling the TV.

Technical description: Live IPTV from KPN network was DRM and IGMP terminated on the DSL gateway. A connected TV displayed a web4CE based user interface (with channel name, logo and now next information in a 'pushbutton'). When the user clicked on the channel pushbutton, the TV would do a http request to a pre provisioned URL e.g. http://kpntv.com/ned1. This URL would translate on the gateway to an IGMP join. On reception of the channel (ned1) the gateway would fill the URL response with HTTP 1.1 chunked responses containing the TV channel. The connected TV would receive this chunked transfer and decode the selected TV channel.

The connected TV would also listen asynchronously to a REST URL for zapping information (e.g. http://kpntv.com/zapme). A mobile android device was programmed to receive the same data as the connected TV (EPG, channel logo's etc), but with a slightly different user interface (it is a native android application). On pressing a channel logo on the mobile phone, a call was made to a REST URL in the network and the web server would generate a response on the asynchronous interface the television set was listening on. This would allow the TV set to select a new URL to watch e.g. http://kpntv.com/ned2.

Issue	Choice	Explanation
Middleware: Rendering engine and control software used in endpoint (this is a part of FiDs)	CAE-2014 (Web4CE)	Official standard, very close to upcoming HbbTV standard for interactive TV
Media profile: The codecs used for compressing audio and video signals (this is a part of FiDs)	MPEG-4 systems with H.264 and AAC in the home	Official standards, available in CE devices, good fit with streaming technology used on Internet, DLNA and 3GPP
Mobile control interface: The signaling used between the mobile and the fixed devices (MiCs)	SOAP-XML based, with AJAX polling mechanism from Web4CE	Standards based communication mechanism and Web4CE supported scripting engine (not a standard)
Metadata for EPG: The data used to construct an EPG on the mobile and fixed devices (MiMs and FiMs)	XMLTV	Simple to implement and XML based, very open but not an official standard
DRM: The encryption and right management technology used to only allow licensed users to access material (MiMs and FiMs)	Termination of proprietary protection mechanism at the home gateway	Terminating at the edge of the home gives flexibility to implement CE based protection schemes like CPCM, DECE or Marlin.
Service discovery and selection: The mechanism to discover which services are available in a mobile and fixed environment (MiCs and FiCs)	Pre-provisioned service mapping in the gateway. Discovery via Web4CE page.	Services are fairly static, so pre-provisioning with update possibility (via HTTP) was the most efficient solution
Session setup and transport: The mechanism to transport the Data in the fixed and mobile network. (FiDs)	IGMPv2 multicast stream to HTTP1.1 progressive download bridging in the gateway	Official standards, CE devices usually not able to handle multicast

IBC case 2: Delivering live/catch-up and VoD IPTV content to mobile device (Nokia/SofiaDigital/NSN)

In this showcase, live/catch-up TV and VoD content purposed for the use in the multi-screen environment was shown on a Nokia N8 mobile device. The access and selection of the content were enabled through an ESG that is based on the OMA BCAST standard. The content was streamed to the mobile device (RTP/RTSP). Trick modes in the VoD streaming were supported and purchase of VoD items was also demonstrated in the UI. Remote set-up and managing of the recordings of TV shows and movies on Network Personal Video Recorder is part of the solution. The mobile IPTV client application used Java APIs (JSR-272) with the native mobile TV client on Symbian S^3 smartphone platform.

Issue / Solution entity	Choice	Explanation
Middleware: Rendering engine and control software used in endpoint (MiDs)	OMA BCAST / native mobile TV client on Symbian S^3 / Java APIs (JSR-272) / NSN Application gateway	Mobile IPTV client application using Java APIs (JSR-272) with OMA BCAST –based native mobile TV client on Symbian S^3 smartphone platform.
Media profile: The codecs used for compressing audio and video signals (MiDs)	MPEG-4 systems with H.264 and HE-AAC v2	Official standards, available in mobile devices, good fit with streaming technology used on Internet, DLNA and 3GPP
Mobile control interface: The signaling used between the mobile and the nPVR (MiCs)	HTTP/OMA BCAST	Some extensions to OMA BCAST to support nPVR recording. Recording control via HTTP commands.
Metadata for EPG: The data used to construct an EPG (MiMs)	OMA BCAST metadata	OMA BCAST is a standardised specification, may need profiling for interoperable mobile IPTV implementations.

Issue / Solution entity	Choice	Explanation
CA/DRM: The encryption and right management technology used to only allow licensed users to access material (MiMs)	No DRM	Authentication procedures
Service discovery and selection: The mechanism to discover which services are available (MiCs)	OMA BCAST over unicast / HTTP requests	OMA BCAST mechanisms over unicast with HTTP requests to pre-provisioned URL in the demo showcase
Session setup and transport: The mechanism to transport the data in the network (MiDs)	OMA BCAST; RTP/ RTSP	OMA BCAST access description to RTP/RTSP streaming session.