



IP-Delivered Broadcast Channels and Related Signalling of HbbTV Applications

2017-04-07

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Contents

Introduction	4
1 Scope	5
2 References	5
2.1 Normative references	5
2.2 Informative references	5
3 Definitions, symbols and abbreviations	6
3.1 Definitions	6
3.2 Abbreviations.....	6
4 IPTV as the “broadcast”	6
4.1 General principles.....	6
4.2 Application Lifecycle.....	7
4.3 OIPF DAE Specification Profile	7
4.4 Terminal Capabilities	7
4.5 Access to EIT Schedule Information	7
5 Integration of HbbTV and Service Discovery Mechanisms.....	8
5.1 Overview	8
5.2 Service Discovery by HbbTV Application.....	8
5.3 Service Discovery & Selection via SD&S.....	8
5.3.1 General	8
5.3.2 Determining the service discovery location.....	8
5.3.3 Selecting a Service Provider	9
5.3.4 Obtaining Service Offerings	9
5.4 DVB OSDT	9
5.5 Others (informative).....	10
6 Integration of HbbTV and Content Delivery Protocols	10
6.1 Multicast IP.....	10
6.2 MPEG DASH	11
6.3 Other Transport Protocols for Delivery of Linear Channels	12
7 Content protection (informative).....	12
Annex (informative): Change History	13
History	14

Introduction

The present document defines how HbbTV terminals can be used with IPTV services. Two distinct types of terminals are considered:

- Pure IPTV terminals (IP-only): These terminals only have an IP connection and no classical RF-based broadcast connection. Hence all TV content is received via IP. A small number of features of the complete HbbTV specification that are not applicable in this context are therefore optional for pure IPTV terminals to implement. Identical to “pure IPTV terminals” at a practical level are terminals with a hard switch (akin to a reboot) between an IPTV mode and a RF-based broadcast mode.
- Hybrid IPTV terminals: These terminals have both an IP connection and a classical RF-based broadcast connection. The terminal can change from presenting content received via IP and content received via RF-based broadcast without rebooting or even interrupting a running HbbTV application.

The present document includes three mechanisms by which IPTV delivered audio-visual content can be presented.

- It can appear in the terminal’s channel or service list and be presented following selection of a service either by a terminal-resident channel / service selection UI or by a broadcast-related HbbTV application. In this case, broadcast-related HbbTV applications signalled in the channel or service will just work indistinguishably from a channel or service delivered by a classical RF-based broadcast network.
- Alternatively it can be presented by an HbbTV application in the same way as IP delivered content streamed using MPEG-DASH or simple HTTP.
- Finally, a broadcast-independent HbbTV application can manage the channel/service selection instead of relying on a terminal-resident channel / service selection UI. A primary example of such an application is one delivered by the network operator, e.g. as defined in OIPF STB-less Implementation Guideline [4].

1 Scope

The present document describes how IPTV Terminals can make use of HbbTV features. It does not, in any way, describe an IPTV delivery system itself. As such, technologies like fast channel change, retransmission and forward error correction are out-of-scope. Instead it defines how several technologies may be used in combination with HbbTV in a form that can be referenced by markets or organisations that have made choices.

Clause 4 of the present document contains requirements that are generic to any IPTV system when used in combination with HbbTV. Clause 5 contains requirements that are specific to particular IPTV service discovery technologies. Clause 6 contains requirements that are specific to particular IPTV content delivery technologies. HbbTV terminals supporting the present document shall comply with clause 4, and sub-clauses of 5 and/or 6 depending on the technologies used for service discovery and content delivery.

Please note that the scope of the present document only includes channels that use either MPEG-2 Transport Stream or MPEG DASH in the way defined in clause 6.2.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

The following referenced documents are necessary for the application of the present document.

- [1] ETSI TS 102 796: "Hybrid Broadcast Broadband TV"
- [2] ETSI TS 102 034 (V2.1): "Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks".
- [3] ETSI TS 103 205 (V1.1.1): "Digital Video Broadcasting (DVB); Extensions to the CI Plus Specification". March 2014
- [4] Open IPTV Forum: "Implementation Guideline for STB-less IPTV", V1.1, October 2015
- [5] Open IPTV Forum: "Feature Package: Additional Features to Support STB-less IPTV", V1.1, October 2015
- [6] Open IPTV Forum Release 2 specification, volume 5 (V2.3): "Declarative Application Environment"
- [7] DVB Document A168: "MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks."

NOTE: Available at https://www.dvb.org/resources/public/standards/a168_dvb-dash.pdf

- [8] ETSI TS 102 539 (V1.3.1): "Digital Video Broadcasting (DVB); Carriage of Broadband Content Guide (BCG) information over Internet Protocol (IP)".
- [9] IETF RFC 2782: "A DNS RR for specifying the location of services (DNS SRV)"

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies. The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] DASH-IF: DASH-AVC/264 Interoperability Points V3.0: "DRM updates, Improved Live, Ad Insertion, Events, H.265/HEVC support, Trick Modes, CEA608/708"

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TS 102796 [1] and the following apply:

broadcast: uni-directional MPEG-2 transport stream based on delivery systems such as DVB-T, DVB-S, DVB-C or DVB-IPTV

hybrid IPTV terminal: terminal that has both an IP connection and a classical RF-based broadcast connection

pure IPTV terminal: terminal that has only an IP connection and no classical RF-based broadcast connection

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AIT	Application Information Table
DAE	Declarative Application Environment
DASH	Dynamic Adaptive Streaming over HTTP
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name System
DSM-CC	Digital Storage Media - Command and Control
DVB	Digital Video Broadcasting
DVB-SI	DVB Service Information
EIT	Event Information Table
EPG	Electronic Program Guide
HEVC	High Efficiency Video Coding
HTTP	Hypertext Transfer Protocol
IP	Internet Protocol
IPTV	Internet Protocol Television
MPD	Media Presentation Description
MPEG	Motion Picture Experts Group
OIPF	Open IPTV Forum
OSDT	Online SDT
PMT	Program Map Table
RTP	Real-time Transport Protocol
RTSP	Real Time Streaming Protocol
SD&S	Service Discovery and Selection
SDT	Service Description Table
SRV	Service
TLS	Transport Layer Security
TV	Television
URL	Uniform Resource Locator
XML	eXtensible Markup Language

4 IPTV as the “broadcast”

4.1 General principles

All definitions and requirements of the Hybrid Broadcast Broadband TV specification [1] shall also apply for usage in an IPTV service except for the changes explicitly listed in this clause. Specifically, unless explicitly stated otherwise below:

- All relevant signalling and transport (PMT entries, AITs, DSM-CC carousels, ...) which can be used in the MPEG2-TS of a conventional DVB broadcast signal shall be supported in the same way for an MPEG2-TS which is carried via IP in an IPTV system as they would be in a conventional broadcast signal.
- Selecting a broadcast channel by creating a Channel object using a DVB triplet and then selecting that channel using the `setChannel()` method on the video/broadcast object shall work as specified in the OIPF DAE

specification [6] with the DVB triplet being resolved by the service discovery mechanism (for example one of the mechanisms addressed in clause 5 of the present document).

- The requirements on starting broadcast-related applications defined in clause 6.2.2.8 of TS 102 796 [1] are applicable to channels delivered according to the present document.

4.2 Application Lifecycle

The exceptional rules for the application lifecycle related to services without an SDT entry (in clause 6.2.2.2 of TS 102 796 [1]) shall also apply for IPTV streams without an entry in the Service Discovery Mechanism (SD&S, OSDT or other).

4.3 OIPF DAE Specification Profile

For the following sections of Annex A of TS 102 796 [1] the changes in table 1 below shall apply:

Table 1: Changed sections in the profile of the OIPF DAE specification

Section, sub-section	Reference in DAE (see Annex A.1 of [1])	Status in Hybrid Broadcast Broadband TV	Notes	Security
Metadata APIs				
The application/oipfSearchManager embedded object	7.12.1	M (*)	Optional for pure IPTV terminals	Broadcast-related
The MetadataSearch class	7.12.2	M (*)	Optional for pure IPTV terminals	Broadcast-related
The Query class	7.12.3	M (*)	Optional for pure IPTV terminals	Broadcast-related
The SearchResults class	7.12.4	M (*)	Optional for pure IPTV terminals	Broadcast-related
Scheduled content and hybrid tuner APIs				
video/broadcast embedded object	7.13.1	M	Support for the method <code>Channel createChannelObject(Integer idType, String dsd, Integer sid)</code> is optional on pure IPTV terminals, but support for the method <code>createChannelObject(Integer idType, Integer onid, Integer tsid, Integer sid, Integer sourceID, String ipBroadcastID)</code> is mandatory.	
NOTE: In IPTV networks, objects marked with (*) are expected to be fed with service-specific data via broadband connections for EPG purposes				

4.4 Terminal Capabilities

The requirement in clause 10.2.4 of TS 102 796 [1] for terminals to include the client metadata element with type “dvb-si” set to true in their xmlCapabilities does not apply for pure IPTV terminals.

4.5 Access to EIT Schedule Information

The requirement in clause A.2.9 of TS 102 796 [1] to allow access to DVB-SI EIT event schedule information does not apply at all for pure IPTV terminals. For hybrid IPTV terminals, it is not required to access DVB-SI EIT event schedule information of services delivered via IPTV.

5 Integration of HbbTV and Service Discovery Mechanisms

5.1 Overview

The present document defines how HbbTV can be integrated with three different mechanisms for service discovery. Table 2 below lists these three mechanisms and indicates how support for each mechanism shall be indicated in the XML device capabilities of the HbbTV terminal.

Table 2: Service discovery mechanisms, integration and XML capabilities

Mechanism	Entry in XML device capabilities indicating support for mechanism (see clause 9.3.1 of the OIPF DAE specification [6])	Definition of how mechanism shall be integrated with HbbTV
HbbTV application providing the URLs for the service to the terminal	a <code>video_broadcast</code> element with a type attribute including "ID_IPTV_URI"	clause 5.2
DVB SD&S	a <code>video_broadcast</code> element with a type attribute including "ID_IPTV_SDS"	clause 5.3
DVB OSDT	a <code>video_broadcast</code> element with type ID_IPTV_OSDT - see clause 4.5 of OIPF Additional Features to Support STB-less IPTV [5].	clause 5.4

5.2 Service Discovery by HbbTV Application

The following shall apply when an HbbTV terminal indicates support for IPTV service discovery by the mechanism of an HbbTV application providing the URLs for the service as defined in Table 2 above:

- The terminal shall support creation of Channel objects with the `idType` argument being `ID_IPTV_URI` and the `ipBroadcastID` argument containing a URL corresponding to a transport protocol listed in the transport attribute of the `video_broadcast` element in the XML device capabilities.
- The terminal shall support presentation of such Channel objects using the `setChannel` method on the `video/broadcast` object.

5.3 Service Discovery & Selection via SD&S

5.3.1 General

The following three consecutive steps shall be applied when an HbbTV terminal indicates support for IPTV service discovery via DVB SD&S as defined in table 2 above:

- 1) The terminal shall determine the service discovery location as defined in clause 5.3.2.
- 2) The terminal shall request information for discovering Service Providers as defined in clause 5.3.3.
- 3) The terminal shall request information about the service offerings of any selected Service Providers as defined in clause 5.3.4.

5.3.2 Determining the service discovery location

Whenever the terminal wants to provide an IPTV service it has to find an entry point for obtaining the appropriate information about the location of that service.

NOTE: This step partly picks up the procedural steps for discovering a service as described in clause 5.2.4 of TS 102 034 [2].

- 1) When the terminal connects to the network to request its own address (e.g. during DHCP) it may be provided with domain names via DHCP option 15 for IPv4 or via DHCP option 24 for IPv6. When a domain name is specified by one of these techniques, the terminal shall obtain a list of SD&S entry point addresses via DNS according to the service location specification described in RFC 2782 [9]. The service name is `_dvbservdsc`,

the protocol may be tcp or udp, while the rest of the name is the domain name provided via DHCPv4 Option 15 or DHCPv6 Option 24. This requires that the terminal supports an SRV cognizant DNS client according to the specification in RFC 2782 [9].

- 2) The method described under 1) shall be attempted before any other solution the terminal may support.
- 3) In order to provide a fallback for the case that the DHCP option is not provided by the network and other methods are either not implemented or fail, the terminal may provide to the user an option to manually enter the IP address of the entry point.

5.3.3 Selecting a Service Provider

For selecting service providers the terminal shall apply the following requirements:

- HTTP over TLS shall be used for all communication between the terminal and the SD&S server.
- The communication process shall follow the description given in clause 5.4.2.0 of TS 102 034 [2]
- The request for a service provider discovery shall conform to clause 5.4.2.1 of TS 102 034 [2]
- The data format of the response shall conform to clause 5.2.13.7 of TS 102 034 [2].

The terminal shall provide to the user an implementation-specific selection mechanism based on the service provider name which shall result in the selection of one or more of the discovered service providers, or in no service provider being selected.

5.3.4 Obtaining Service Offerings

When the selection of service providers has completed, the service offerings of each selected service provider shall be obtained by the terminal. During this process the following requirements shall apply:

- For all communication between the terminal and the SD&S server the protocol and the transport method shall be used that is given in the scheme of the URL returned to the terminal in the response mentioned in the previous clause. If the service provider doesn't specify a protocol and transport method, HTTP over TLS shall be used.
- The communication process shall follow the description given in clause 5.4.2.0 of TS 102 034 [2]
- The request for a service discovery shall conform to clause 5.4.2.2 of TS 102 034 [2]. The terminal shall only support payload ID = 0x02 (for Broadcast Discovery Information) according to clause 5.4.4.1 of TS 102 034 [1].

The data format shall conform to clause 5.2.13.2 of TS 102 034 [2].

5.4 DVB OSDT

The following shall apply when a terminal indicates support for IPTV service discovery by DVB OSDT as defined in Table 2 above:

- The changes to the methods `createChannelObject(Integer idType, Integer onid, Integer tsid, Integer sid, Integer sourceID, String ipBroadcastID)`, `setChannel(Channel channel, Boolean trickplay, String contentAccessDescriptorURL)` and to the `ChannelConfig` class as defined in section 4.5 of OIPF Additional Features to Support STB-less IPTV [5] shall apply.
- For each `Channel` object created for a service discovered by OSDT, the terminal shall populate the properties required to be supported by TS 102 796 [1] as defined for each such property by the table in clause 4.5 of OIPF Additional Features to Support STB-less IPTV [5] introduced by "For channels of type `ID_IPTV_OSDT`:"
- Each `IPService` element listed in the OSDT shall contain at least one `ServiceLocation` and the `DVBTriplet` element. If an `IPService` does not contain the `DVBTriplet` element, the terminal shall consider the particular service to be invalid.

5.5 Others (informative)

If other service discovery mechanisms are used, clause 5.1 of the present document should be used as the reference for mapping the metadata of the service discovery mechanism to the relevant APIs.

6 Integration of HbbTV and Content Delivery Protocols

6.1 Multicast IP

The following shall apply when a terminal indicates support for multicast streaming by including a `video_broadcast` element in the XML device capabilities with a transport attribute including either “`igmp-rtp-udp`” or “`igmp-udp`” as defined in clause 9.3.1 of the OIPF DAE specification [6].

NOTE: Due to an editorial error, clause 9.3.1 of the OIPF DAE specification points to Annex F of the OIPF protocols specification. The actual values for the transport attribute are defined in Annex E of the OIPF protocols specification instead.

- If the `video_broadcast` element in the XML device capabilities has a transport attribute including “`igmp-rtp-udp`” then transport streams encapsulated in RTP which in turn is carried in UDP shall be supported as defined in clause 7.1.1 of TS 102 034 [2].
- If the `video_broadcast` element in the XML device capabilities has a transport attribute including “`igmp-udp`” then transport streams encapsulated directly in UDP shall be supported as defined in clause 7.1.2 of TS 102 034 [2].

For multicast as the protocol for the delivery of the linear broadcast stream, the integration with the video broadcast object shall be as follows:

- Channel objects of type `ID_IPTV_URI` shall be supported as defined in clause 8.4.3 of the OIPF DAE specification [6].
- MPEG-2 transport streams as defined in clause 7.3.1 of TS 102 796 [1] for non-adaptive HTTP streaming shall be supported as a format for delivery via multicast. Additionally broadcast application signalling as defined in clause 7.2.3.1 of TS 102 796 [1] shall be supported as shall the broadcast-related application lifecycle model as defined in clause 6 of TS 102 796 [1] even though they may not fall within the definition of broadcast DVB services in clause 6.2.2.2 of that document.

NOTE 1: MPEG-2 transport streams delivered via multicast typically do not contain an SDT and hence would otherwise be processed according to the rules for MPEG programs that are not a broadcast DVB service as defined in clause 6.2.2.2 of TS 102 796 [1].

NOTE 2: This does not preclude support for MPEG-2 transport streams containing additional features beyond those required - it just defines a base level of inter-operability.

NOTE 3: Terminals may support recording and/or timeshift of content delivered by some content delivery protocols but not others. Support for recording of multicast is indicated by the `recording` element in the XML capabilities including a `ipBroadcast` attribute with value `true` as defined in clause 9.3.3 of the OIPF DAE specification [6].

For multicast as the protocol for the delivery of content, the `<source>` element in case of using an AV Control Object or the `src` attribute in case of using an HTML5 video element SHALL be set to a “`dvb-mcast://`” URL as defined in Annex A.1 of ETSI TS 102 539 [8]. In this case, the optional ‘`dvb-service`’ element shall not be used, resulting in the following format:

```
- "dvb-mcast://" [ src-host "@" ] mcast-addr ":" port "?payload=" ("mp2t"|"mp2t/rtp")
```

For both above usage variants of multicast, the following apply:

- Reception of audio-visual content delivered via multicast IP for presentation shall be initiated using the appropriate multicast access mechanism described in clause 7.3.1 of ETSI TS 102 034 [2] depending on which of IPv4 or IPv6 will be used.

NOTE: This is equally applicable regardless of whether the service is selected using a terminal-resident channel / service selection UI or by an HbbTV application calling methods such as `setChannel`,

- When audio-visual content delivered via multicast stops being selected, the terminal shall leave the selected multicast group by using the appropriate leave mechanism as described in clause 7.3.1 of ETSI TS 102 034 [2]

NOTE: This is equally applicable regardless of how the service stopped being selected.

6.2 MPEG DASH

This clause applies to a TV channel or service regardless of whether the presentation of that channel or service is started by a terminal UI, an HbbTV application using a video/broadcast object or something else. It does not apply to on-demand MPEG DASH content presented by an HbbTV application using either the A/V control object or the HTML5 video element.

The following shall apply when a terminal indicates support for MPEG-DASH by including a `video_broadcast` element in the XML device capabilities with a `transport` attribute including "dash" as defined in clause 9.3.1 of the OIPF DAE specification [6].

For DASH as the protocol for the delivery of the linear broadcast stream, the integration with the video broadcast object shall be as follows:

- Channel objects of type `ID_IPTV_URI` shall be supported as defined in clause 8.4.3 of the OIPF DAE specification [5].
- Selecting a TV channel or service delivered by MPEG DASH shall result in the MPD being loaded and presentation starting at the live edge.

NOTE: Guidelines on use of DASH for live services can be found in clause 4 of the DASH-IF Interoperability Points document [i.1] and clause 10.9 of the DVB DASH specification [7].

Table 3 below defines how the values of the properties of the Programme class shall be derived for instances of that class returned by the `programmes` property on a video/broadcast object and the `MetadataSearch.findProgrammesFromStream` method when the channel being presented is delivered by MPEG DASH as defined by the DVB DASH specification [7]. In all cases, values refer to the content programme metadata defined in clause 9.1.2 of the DVB DASH specification [7].

Table 3: Derivation of programme class properties from content programme metadata

Property name	Programme Class Property
Name	Assigned by the terminal from <code>BroadcastEvent/InstanceDescription/Title</code>
description	Assigned by the terminal from <code>BroadcastEvent/InstanceDescription/Synopsis</code> with length attribute being "medium".
longDescription	Assigned by the terminal from <code>BroadcastEvent/InstanceDescription/Synopsis</code> with length attribute being "long".
startTime	Assigned by the terminal from <code>BroadcastEvent/PublishedStartTime</code>
duration	Assigned by the terminal from <code>BroadcastEvent/PublishedDuration</code>
channelID	Unique identifier for the channel.
programmeID	Assigned by the terminal from <code>BroadcastEvent/InstanceDescription/ProgramURL</code> .
programmeIDType	If the contents of the <code>programmeID</code> are a <code>dvb:</code> URL that identifies a DVB-SI event then this shall be <code>ID_DVB_EVENT</code> . If the contents of the <code>programmeID</code> are a <code>crid:</code> URL then this shall be <code>ID_TVA_CRID</code> . Otherwise this shall be Undefined. Note that the above does not imply support for <code>crid:</code> 's, just checking if the protocol / scheme of the <code>ProgramURL</code> is 'crid:'.
parentalRatings	Assigned by the terminal from <code>BroadcastEvent/InstanceDescription/ParentalGuidance</code> – see clause 9.1.2.3 of the DVB DASH specification [7].

There is no requirement for content programme metadata carried in MPEG DASH to be merged with other metadata known to the terminal. Hence there is no requirement for DASH content programme metadata to be accessed through the `oipfSearchManager` object and related classes except for the specific case of the `MetadataSearch.findProgrammesFromStream` method as stated above.

Broadcast-related applications shall be supported in channels delivered using MPEG DASH using MPD events as follows:

- The application signalling shall be as defined in clause 9.1.8 of DVB-DASH [7].
- The value of the element shall be an XML AIT that shall be as defined in clause 7.2.3.2 of TS 102 796 [1] for broadcast-independent applications but used instead for broadcast-related applications with the following exceptions:
 - it may contain applications with different orgId and/or appId values.
 - applicationDescriptor/serviceBound is not required to be false
 - applicationDescriptor/controlCode can take the same values as in a regular DVB- C/S/T broadcast and is not limited to AUTOSTART.
- When a channel or service delivered through MPEG DASH starts being presented, the terminal shall apply clause 6.2.2.2 of TS 102 796 [1], “Behaviour when selecting a broadcast service” using the applicable XML AIT information.
- When an application signalling event stops being applicable and/or a new application signalling event becomes applicable, the terminal shall apply clause 6.2.2.3 of TS 102 796 [1], “Behaviour while a broadcast service is selected” using the applicable XML AIT information (if any). The requirement in that clause to "include a mechanism to start and stop digital teletext applications" shall also apply for TV channels or services delivered by MPEG DASH.

NOTE: Terminals may support recording and/or timeshift of content delivered by some content delivery protocols but not others. Support for recording of DASH is indicated by the `recording` element in the XML capabilities including a DASH attribute with value `true` as defined in clause 9.3.3 of the OIPF DAE specification [6].

6.3 Other Transport Protocols for Delivery of Linear Channels

In the case other IP based transport protocols (such as RTSP) are used for the distribution of linear broadcast streams based on MPEG-2 transport stream, an integration with Hybrid Broadcast Broadband TV shall be done as follows:

- The rules of clause 4 of the present document are applied.
- The `channelType` of the video broadcast object is set to "undefined"
- A channel change is supported via onid/tsid/sid or via the channel name (data to be retrieved during the channel set-up or via the service discovery mechanism)

7 Content protection (informative)

The protection, by technical means, of IPTV content is outside the scope of the present document except as follows:

- Protected content delivered in an MPEG-2 transport stream may be decrypted using a DVB Common Interface module as defined in ETSI TS 103 205 [3]. Support for this will be indicated in the XML capabilities using the `<drm>` element as defined in clause 10.2.4 and clause 9.3.10 of the OIPF DAE specification [6]
- Content delivered in MPEG DASH may be protected using MPEG common encryption as defined in the DVB DASH specification [7].

Annex (informative): Change History

Date	Version	Information about changes
<Month year>	<#>	<Changes made are listed in this cell>

History

Document history		
<Version>	<Date>	<Milestone>