Implementation Guidelines
for DVB-I

DVB Document A184 Rev.1

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Contents

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Foreword

The DVB Project is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulators and others from around the world committed to designing open, interoperable technical specifications for the global delivery of digital media and broadcast services. DVB specifications cover all aspects of digital television from transmission through interfacing, conditional access and interactivity for digital video, audio and data. The consortium came together in 1993.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

DVB-I represents the intersection of linear broadcast television and internet media streaming, offering the possibility for linear television services to be delivered to internet connected devices. The present document defines the mechanisms to be used to find sets of linear television services delivered through broadband or broadcast mechanisms as well as methods to retrieve electronic programme data for those services.

1   Scope

The present document provides supportive information and recommendations pertaining to the operational deployment and use of DVB A177 [1].

2   References

2.1   Normative references

None.

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.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

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

[1]   DVB Bluebook A177r6: "Service Discovery and programme Metadata for DVB-I".

[2]   ETSI TS 103 285: "Digital Video Broadcasting (DVB); MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks".

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.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

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]   ETSI TS 102 796: "Hybrid Broadcast Broadband TV".

[i.2]   DVB Bluebook A179: "Home Broadcast".

3   Definition of terms, symbols and abbreviations

3.1   Terms

For the purposes of the present document, the terms given in DVB A177 [1] apply.

3.2   Symbols

For the purposes of the present document, the symbols given in DVB A177 [1] apply.

3.3   Abbreviations

For the purposes of the present document, the abbreviations given in DVB A177 [1] apply.

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4   Implementation Guidelines

4.1   Interface between DVB-I client and DVB-DASH player

4.1.1   General

The interface between the DVB-I client and the DVB-DASH player is outside the scope of the present document. For example:

- In a TV set, the DVB-I client and the DVB-DASH player may be integrated in the TV software by the TV manufacturer or a supplier.

- In a mobile device, the DVB-I client may be an app and the DVB-DASH player may an off the shelf component, either commercial or open source.

There are however a number of functional requirements which apply to this interface and that need to be addressed in order for a DVB-I client to successfully provide functionality expected by consumers of linear TV services.

These requirements are written on the assumption that the DVB-DASH player is purely a software library and does not show a user interface. It is also possible to implement DVB-I such that the DVB-DASH player shows a user interface under some circumstances. The term "Broadband service playback UI" is used for the component of a DVB-I client that shows these user interfaces - see clause 4.2 of DVB A177 [1].

These requirements are examples and cover the most obvious interactions between a DVB-DASH player without a user interface and a DVB-I client. They are not intended to be exhaustive and other examples may exist.

4.1.2   Adaptation Set Selection

ContentAttributesType as defined in clause 5.5.5 of DVB A177 [1] allows signalling a variety of attributes about a service including technical parameters and some user-oriented information such as audio language. What is present in a service at any particular time may not be the same as what is signalled in the service instance metadata. For example, some programmes in a service instance may only have one audio language and some may have more than one.

The Broadband service playback UI will need to be provided with a list of audio Adaptation Sets from the DVB-DASH player and will need to be able to instruct the DVB-DASH player to select one of those Adaptation Sets. The same is true for audio for accessibility, both audio description and clean audio.

The Broadband service playback UI will need to be provided with a list of subtitle Adaptation Sets from the DVB-DASH player and will need to be able to instruct the DVB-DASH player to select one of those Adaptation Sets.

4.1.3   Error Conditions

There are a number of error conditions under which playback of a DVB-DASH service may not start in the first place or may fail once started. Examples of failure before playback starts include the following:

- Failure to load DASH MPD for a variety of reasons:

  - DNS resolution failure

  - DNS resolves but TCP connection fails

  - TCP connection established but TLS was specified and session setup failed, e.g. due to TLS server certificate mismatch (e.g. a re-direct to an HTML page saying that the URL is not available in your country)

- TCP connection established (and TLS session successfully setup if specified) but GET request for MPD fails with an HTTP error

- Resource successfully downloaded but it is not a DASH MPD

- MPD successfully downloaded but cannot be played - e.g. mismatch with DVB-I service list about codec/DRM

- The same reasons why an MPD may fail to be loaded may also apply to the DASH initialization segment and the first media segment(s)

- Content may be protected by DRM and either a license could not be obtained and/or the content could not be decrypted for some other reason

Examples of failure during playback include the following:

- The DVB-DASH player itself decides to terminate playback following repeated buffering on the lowest bitrate Representation

- Transition from content the DVB-DASH player can decode to content it cannot decode. While codec transitions are unlikely, transitions from unprotected content to DRM protected content are likely as are requirements to obtain a new license from a DRM license server

- Some kind of network problem e.g. fatal connection loss

NOTE: Clauses 10.8.2 and 11.9 of ETSI TS 103 285 [2] define how content providers may provide multiple base URLs for the media data. One reason for this is to allow failover in the event of a failure of an entire hosting location, or link from one ISP to a CDN. Where multiple base URLs have been provided, connection loss is only fatal if none of the possibilities can be contacted.

The Broadband service playback UI will need to be notified by the DVB-DASH player that an error has occurred and be given enough information by the DVB-DASH player to show messages that are understandable by users. Providing HTTP status codes may help in some circumstances although the meanings of them may be content provider and/or CDN dependent, for example failure due to geo-blocking may use different HTTP status codes.

4.1.4   Parental Access Control

In the event that presentation of a DVB-DASH service is blocked by a parental access control mechanism, some UI will be needed. Depending on the circumstances, this may be a UI to just report that presentation has been blocked. In other circumstances, the UI may permit entering a PIN code or equivalent in order to re-enable presentation. See also clause 6.13 and table 105f of DVB A177 [1].

The Broadbandservice playback UI will need to be notified by the DVB-DASH player when presentation is blocked (and re-enabled). Such a user interface may also need the ability to instruct the DVB-DASH player to re-enable presentation.

4.1.5   Network Timeshift

Live DASH services can support network-based timeshift (including pause/resume and jumping forwards/backwards) within the network timeshift buffer whose size is indicated by MPD@timeshiftBufferDepth.

If a DVB-I client supports network timeshift then the Broadband service playback UI will need to be able to request the DVB-DASH player to pause, resume, jump forwards, jump backwards. It will need to be notified by the DVB-DASH player of the completed requests and of attempts to go outside the network timeshift buffer - both by jump forwards/backwards and by leaving presentation paused until the start of the timeshift buffer reaches the paused position. It may need to be notified by the DVB-DASH player of the size of the network timeshift buffer.

4.2 Handling multiple service lists

Here is a list of a number of possible approaches for how a DVB-I client may handle multiple service lists. This list is not exclusive and other approaches are possible. The list is ordered from least flexible to most flexible and not any kind of priority.

- A DVB-I client may only ever support one service list.

EXAMPLE 1: A DVB-I client that is branded by an organization that provides a service list such as a platform/network operator or an EPG provider.

- Where a DVB-I client is integrated into a media consumption device, a single service list may be implicitly selected as part of the installation/configuration process for the device.

EXAMPLE 2: When installing a TV set, if a user would choose a language, then choose a country and then choose a platform or network operator who has a DVB-I service list then this might implicitly select that operator's service list.

EXAMPLE 3: A hybrid DVB-I client may support a single service list discovered from signalling in the broadcast (see clause 5.1.3.3 of DVB A177 [1]) after the selection of a platform or network operator and doing a channel scan or similar according to the requirements of the selected operator.

- A DVB-I client may permit the user to choose one service list from a limited number of possibilities at the time the DVB-I client is installed. Changing the service list would require re-installing the DVB-I client.

EXAMPLE 4: A DVB-I client can connect to multiple networks and/or bouquets that have different service lists signalled.

EXAMPLE 5: A DVB-I client is intended to access services from a small number of countries and enables the user to choose one a service list from one of these regardless of the country where the DVB-I client believes itself to be located or was installed.

- A DVB-I client may permit the user to choose one service list from a limited number of possibilities at any time.

EXAMPLE 6: The current service list may be a menu item in the UI of the DVB-I client.

- A DVB-I client may permit the user to choose one service list by searching a service list registry (see clause 5.1.3.2 of DVB A177 [1]).

EXAMPLE 7: A search based on one or more of Service List Provider name, language, genre, target country and service lists that are the official service list for a country as defined by the appropriate regulator.

- A DVB-I client that enables users to switch between service lists at any time may enable users to create user-defined lists of services from services in any of those service lists.

EXAMPLE 8: Expatriates or immigrants could create a custom DVB-I service list including services from a service list for their current country, a service list for their original country and anywhere else they found interesting.

- A DVB-I client may support choosing multiple service lists that the DVB-I client then merges into a single list.

NOTE: Merging multiple service lists into a single list may have technical and organizational challenges where logical channel numbers are used.

In many of these approaches, the user experience is independent of the underlying mechanism by which the service list is obtained. A DVB-I client may query or search a public service list registry, query or search a private service list registry or have one or more service list references hard coded or acquire a list according to signalling in the broadcast.

Approaches outside the scope of the present document include distributing service lists by mechanisms such as social media, email, push or cast over a home network and physical media such as USB sticks.

Also outside the scope of the present document, in a hybrid DVB-I client, the service list resulting from a DVB-C/S/T channel scan or other service list acquisition mechanism (e.g. DVB-SI SDT other in a home channel) may be separate from and additional to the DVB-I service list or service lists.

A media consumption device may support multiple instances of the DVB-I client with different branding/labelling. It may be possible to start a single DVB-I client in a number of different ways, each with a different branding and different approaches from the list above.

4.3 A typical service installation according to clause 5.2.1 of DVB A177 (informative)

A DVB-I client will first typically offer the user a choice of language and country, fundamental parameters for the UI and installation context.

It may be beneficial for hybrid DVB-I clients to start by scanning available broadcast signals before selection and installation of a DVB-I service list for multiple reasons:

1. Relevant DVB-I service lists may be discovered in broadcast service information (see clause 5.1.3.2 of DVB A177 [1]).

2. Available broadcast signals and services may impact the choice of DVB-I service list.

3. All available broadcast services can then be mapped to DVB-I services during installation of a selected DVB-I service list.

When installing a DVB-I service list that has been selected by the user, or automatically by the DVB-I client, a client should first determine the region and/or subscription package to use, if such mechanisms are used by the service list.

A DVB-I client should then determine which services to install. This can be done by verifying multiple criteria are met for each service, including the following:

- The service includes a service instance and/or a linked application where HowRelated@href is set to `urn:dvb:metadata:cs:LinkedApplicationCS:2019:1.2` (application controlling media presentation) supported by the client, meaning the client, where applicable:

  - supports the delivery parameters,

  - has installed the corresponding broadcast service,

  - supports the audio/video format(s),

  - supports the content protection,

  - supports the application media type e.g. application/vnd.dvb.ait+xml.

- The supported service instance(s) applies/apply to the selected subscription package (if applicable), i.e.

  - the service instance(s) applies/apply to one or more subscription packages including the one selected,

  - or the service instance(s) applies/apply to all subscription packages.

- The service applies to the selected region (if applicable), i.e. has no target region or is targeted at one or more regions including the selected region.

For a client that opts not use LCNs (e.g. some mobile devices), service installation is now complete. Such clients may initially order and present services based on their name, and may depend more on the presence of service logos for the visual presentation of services to the user. Lean-forward devices may offer more contextual filters and search options to the user to facilitate service selection on a touch screen, for example.

A client that uses LCNs (e.g. a lean-back client such as a TV), should determine which LCN to allocate to the service. For services defined in the DVB-I service list, this depends on whether LCN tables are used.

- If LCN tables are used, and more than 1 LCN table is defined, the client should select the applicable LCN table based on the selected region and/or subscription package. Once the LCN table is selected, the client can

use the unique ID of each service to find the service's corresponding LCN, if one is defined within the selected LCN table. For installed services that do not have a corresponding LCN in the LCN table, the client is free to use the LCN of its choosing. This often consists of allocating an LCN in a so-called "overflow range" such as the 800+ range or 1000+ range. The choice of appropriate overflow range may be dependent on the region and/or broadcast medium for hybrid installations.

- If LCN tables are not used, then the client may allocate LCNs to each of the installed services defined in the DVB-I service list using its own method. One approach consists of allocating LCNs in the order services are declared in the service list XML starting with LCN 1.

Finally, a hybrid client may have discovered broadcast services that are not referenced in the DVB-I service list, such as services from a neighbouring country. These can be allocated an LCN in the so-called "overflow range" to ensure users are able to access all the services their client can receive.

4.4   A typical service installation combining clauses 5.2.1 and 5.2.12 of DVB A177 (informative)

Hybrid DVB-I clients with one or more satellite tuners may also implement a combination of both the mechanisms in clauses 5.2.1 and 5.2.12 of DVB A177 [1] in order to provide up-to-date robust tuning information.

An example installation process is shown below. Other mechansims are possible also:

1. Optional: The Hybrid DVB-I Satellite IRD may do a scan to attain the channel list
   The DVB-I compliant hybrid satellite receiver setup could propose two initial installation methods:
   i.   Legacy based on a DVB Network Scan
   ii. Instant based on a DVB-I Service List (for connected receivers only)

2. Channel list contains 0 or more channels

3. For each `ServiceInstance` containing a `DVBSDeliveryParameters` element
   a. If a match according to clause 5.2.1 of DVB A177 [1] is found then select channel based on tuned parameters and ignore direct-tune related elements
   b. If no match and direct-tune element provided, then add channel with tuning based on using direct-tune elements
   c. If no match and no direct-tune elements provided then add scanned channel in overflow range.

A hybrid DVB-I receiver not implementing 'direct tuning' functionality would perform 1i and 3a or 3c.

4.5   Interpreting Program Schedules

The following applies to DVB-I service instances delivered by DASH that either have no linked application or with a linked "application with media in parallel". DVB-I services instances where media presentation is done by a linked "application controlling media presentation" are very different and outside the scope of this clause.

There are a number of reasons why a DVB-I player may need to know when one programme ends and the next one starts. Some examples include;

- Showing the correct summary information, e.g. what would be shown on a TV set when the user presses an "info" button. This typically includes information about the current programme.
- Applying the correct parental access control for the new programme.

There are 4 sources of information about programme start and end times.

- `ScheduleEvent/PublishedStartTime` and `PublishedDuration` (see clause 6.10.77 of ETSI TS 103 770 [1]) provide a start time and duration that are intended to be visible to end-users of the DVB-I player. For example, they may be rounded up or down.

- `ScheduleEvent/ActualStartTime` and `ActualDuration` (see clause 6.10.77 of ETSI TS 103 770 [1]) provides the actual start time and duration in the schedule.
- Content Programme Metadata (see clause 9.1.2 of ETSI TS 103 285 [2]) carried in MPD events. The payload of the event is a TV Anytime BroadcastEvent structure however the start time and duration of the programme are inherited from the DASH event structure.
- Content Programme Metadata (see clause 9.1.2 of ETSI TS 103 285 [2]) carried in inband events. The same details apply as for metadata carried in MPD events.

Some broadcaster's playout systems are completely schedule driven so it is guaranteed that programmes start at `ActualStartTime` and finish at `ActualStartTime+ActualDuration` except in the presence of exceptional circumstances. Such broadcasters just need to provide content guide metadata and ensure that the data is correct, including parental rating information.

For broadcasters where the playout is not exactly driven from the schedule;

- It may still be possible to rely on the content guide server for metadata and parental access control information if the decision(s) on scheduling are made far enough in advance for them to be pushed to the content guide server and picked up by terminals. Clause 6.5.3.2 7 of ETSI TS 103 770 [1] describes how broadcasters can configure DVB-I player polling of the content guide server using a Now/Next Filtered Schedule Request. Broadcasters may be able to find a suitable polling interval that 1) ensures DVB-I players will always have correct and appropriate information and 2) does not result in an unacceptable load on the server.
- Otherwise Broadcasters need to ensure that there is a feed from their guide data server to the DASH encoder or packager so that system is able to insert Content Programme Metadata either in the MPD, or in the video segments or in the audio segments. If the Content Programme Metadata is inserted in the MPD then the MPD needs to be configured to update frequently enough that the Content Programme Metadata will be detected in good time by DVB-I players.

The actual start time and actual duration of a programme (as denoted by the (`ActualStartTime` and `ActualDuration` elements on clause 6.10.7 of ETSI TS 103 770 [1]) should only be provided if the accuracy of these times can be guaranteed,

If DVB-I players enable the user to access live pause (i.e. within `MPD@timeshiftBufferDepth`) then they need to take account of the delay with respect to the live edge. This is particularly sensitive with parental access control otherwise the end of a lower rated programme may be cut off by a following higher rated programme. Alternatively, the end of a higher rated programme may not be blocked when it needs to be. The first of these may result in user complaints but the second may more serious as inappropriate content may be visible to children.

4.6 Service List Extensibility

4.6.1 Introduction

The DVB-I service lists offers a structured mechanism for including elements that are defined by other organizations or specifications. This is achieved by specifying a concrete data type that is derived from the abstract `ExtensionBaseType`, see also clause 5.2.9.2 of DVB A177 [1]. The mandatory `extensionName` attribute is used to convey attribution information for the extension. It is expected that the `extensionName` attribute should be uniquely defined in a way that allows the semantics of the extension elements to unambiguously be determined, a however no registry nor format for the values of the attribute is defined.

All extensibility in the service list discovery and service list XML documents uses the same approach. The `ExtensionBaseType` is abstractly defined and mandates the use of the `extensionName` attribute. Organisations or entities that desire to provide additional metadata in these XML documents need to schematically define the elements and attributes they wish to convey in a concrete type which is extended from `ExtensionBaseType`.

XML polymorphism is used to attribute the third party concrete type with the extension point in the service list discovery document or the service list document. The `extensionName` should aid the user of the extended document to determine the origins and meanings of the additional metadata.

The following clauses provide examples for the different extension points defined in the Service List Registry response and the Service List.

4.6.2   `Extension` in `ServiceListEntryPoints`

The `Extension` element in the `ServiceListEntryPoints` element is provided to allow the service list registry operator to provide additional information about their registry or other types of services supported by the registry.

4.6.3   `OtherDeliveryParameters` of `Delivery` in `ServiceListOffering`

The `OtherDeliveryParameters` element within the `ServiceListOffering` response from a service list registry denotes an alternative mechanism for delivering a service instance for one of more of the services specified in the service list. One such use would be to indicate that a service instances may use HLS based delivery such as is shown in clause 4.x.5.

A service list offering that utilises HLS and DASH based signalling would most likely appear as follows in the `ServiceListOffering` element.

```
 1. <?xml version="1.0" encoding="UTF-8"?>
 2. <ServiceListEntryPoints xmlns="urn:dvb:metadata:servicelistdiscovery:2023" xml:lang="en"
 3.     xmlns:dvbisd="urn:dvb:metadata:servicediscovery:2023"
 4.     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 5.     xsi:schemaLocation="
 6.       urn:dvb:metadata:servicelistdiscovery:2023 dvbi_service_list_discovery_v1.5.xsd
 7.       urn:dvb:metadata:servicediscovery:2023 dvbi_v5.0.xsd">
 8.   <ServiceListRegistryEntity>
 9.     <Name>My Registry</Name>
10.   </ServiceListRegistryEntity>
11.   <ProviderOffering>
12.     <Provider>
13.       <Name>Me</Name>
14.     </Provider>
15.     <ServiceListOffering>
16.       <ServiceListName>My broadband services</ServiceListName>
17.       <ServiceListURI contentType="application/vnd.dvb.dvbisl+xml">
18.         <dvbisd:URI>http://my.tv/channel-list.xml</dvbisd:URI>
19.       </ServiceListURI>
20.       <Delivery>
21.         <DASHDelivery required="true"/>
22.         <OtherDeliveryParameters xmlns:hls="vnd:apple:mpegurl" xsi:type="hls:m3u8RefType"
23.             xsi:schemaLocation="vnd:apple:mpegurl hls-url.xsd"
24.             extensionName="vnd.apple.mpegurl">
25.           <hls:UriBasedLocation contentType="application/vnd.apple.mpegurl">
26.             <dvbisd:URI/>
27.           </hls:UriBasedLocation>
28.         </OtherDeliveryParameters>
29.         <OtherDeliveryParameters xmlns:morse="vnd:morse:dot-dash" xsi:type="MorseMode"
30.             xsi:schemaLocation="vnd:morse:dot-dash morse-code.xsd"
31.             extensionName="MorseTelegraph">
32.           <morse:Voltage>37</morse:Voltage>
33.           <morse:Duration dot="0.1" dash="0.4"/>
34.         </OtherDeliveryParameters>
35.       </Delivery>
36.     </ServiceListOffering>
37.   </ProviderOffering>
38. </ServiceListEntryPoints>
```

Lines 1 through 19 are provide a minimal example of declaring the service list registry provider in the `ServiceListRegistryEntity` element (line 8), the service list provider information in the `Provider` element (line 12) and the service list name (line 16) and location (line 17).

The `Delivery` element (line 20) as defined in Table 12 of DVB A177 [1] identifies the delivery methods used to deliver services in the service list. In this case the DVB-I client is required to support DVB-DASH based delivery of the service according to ETSI TS 103 285 [2] (line 21) while some services may also make use of HLS delivery as defined by the `vnd.apple.mpegurl` format (`OtherDeliveryParematers` at line 22) or Morse code (`OtherDeliveryParematers` at line 29) with the specified arguments as defined in the schema declared in line 30.

4.6.4　`AdditionalServiceParameters` of `Service` in `ServiceList`

Third party service level metadata can be defined for a service by defining an extension to be used with the `AdditionalServiceParameters` element. Such an extension is defined by HbbTV as `ServiceIdentifierTriplet` (see annex O.4 of HbbTV 2.0.4 [i.1]).

The additional metadata elements in a concrete complex datatype that is derived from `ExtensionBaseType` and instantiated for the `AdditionalServiceParameters` elements in the service. Using the HbbTV extension as an example, the service list and service elements would be

```
1. <?xml version="1.0" encoding="UTF-8"?>
2. <ServiceList xmlns="urn:dvb:metadata:servicediscovery:2023" version="12" xml:lang="en"
3.     xmlns:hbbtv-i="urn:hbbtv:dvbi:schema:2021"
4.     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
5.     xsi:schemaLocation="urn:dvb:metadata:servicediscovery:2023 dvbi_v5.0.xsd
6.                         urn:hbbtv:dvbi:schema:2021 hbbtv-ext-5.0.xsd">
7.   <Name>List Name</Name>
8.   <ProviderName>List Provider</ProviderName>
9.   <Service version="1">
10.    <UniqueIdentifier>12345</UniqueIdentifier>
11.    <ServiceName>Service Name</ServiceName>
12.    <ProviderName>Provider Name</ProviderName>
13.    <AdditionalServiceParameters
14.        xsi:type="hbbtv-i:ServiceIdentifierTriplet"
15.        extensionName="urn:hbbtv:dvbi:service:serviceIdentifierTriplet">
16.      <hbbtv-i:DVBTriplet origNetId="8916" tsId="4097" serviceId="74"/>
17.    </AdditionalServiceParameters>
18.   </Service>
19. </ServiceList>
```

Line 3 declares that the HbbTV defined schema with the `urn:hbbtv:dvbi:schema:2021` namespace can be referred to using the `hbbtv-i` prefix and that the formal definition of the schema can be found in the local file named `hbbtv-ext-5.0.xsd` (line 6).

The `AdditionalServiceParamaters` element declared in line 13 then derives its type from the `ServiceIdentifierTriplet` (line 14) defined in the HbbTV extension schema using the `extensionName` (line 15) defined by HbbTV. The `DVBTriplet` element which is defined in the HbbTV extension schema is then used in line 16.

The previous example in this clause declared the HbbTV extension schema in the root level `ServiceList` element, as such, the prefix can be used with any appropriate descendant child. If the extension is not expected to be widely used in the service list, it can be scope to the relevant service of addition metadata element as shown in the following two examples.

```
1. <?xml version="1.0" encoding="UTF-8"?>
2. <ServiceList xmlns="urn:dvb:metadata:servicediscovery:2023" version="12" xml:lang="en"
3.     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4.     xsi:schemaLocation="urn:dvb:metadata:servicediscovery:2023 dvbi_v5.0.xsd">
5.   <Name>List Name</Name>
6.   <ProviderName>List Provider</ProviderName>
7.   <Service version="1" xmlns:hbbtv-i="urn:hbbtv:dvbi:schema:2021"
8.       xsi:schemaLocation=" urn:hbbtv:dvbi:schema:2021 hbbtv-ext-5.0.xsd">
9.     <UniqueIdentifier>12345</UniqueIdentifier>
10.    <ServiceName>Service Name</ServiceName>
11.    <ProviderName>Provider Name</ProviderName>
```

```
12.     <AdditionalServiceParameters
13.         xsi:type="hbbtv-i:ServiceIdentifierTriplet"
14.         extensionName="urn:hbbtv:dvbi:service:serviceIdentifierTriplet">
15.       <hbbtv-i:DVBTriplet origNetId="8916" tsId="4097" serviceId="74"/>
16.     </AdditionalServiceParameters>
17.   </Service>
18. </ServiceList>
```

```
 1. <?xml version="1.0" encoding="UTF-8"?>
 2. <ServiceList xmlns="urn:dvb:metadata:servicediscovery:2023" version="12" xml:lang="en"
 3.     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 4.     xsi:schemaLocation="urn:dvb:metadata:servicediscovery:2023 dvbi_v5.0.xsd">
 5.   <Name>List Name</Name>
 6.   <ProviderName>List Provider</ProviderName>
 7.   <Service version="1">
 8.     <UniqueIdentifier>12345</UniqueIdentifier>
 9.     <ServiceName>Service Name</ServiceName>
10.     <ProviderName>Provider Name</ProviderName>
11.     <AdditionalServiceParameters xmlns:hbbtv-i="urn:hbbtv:dvbi:schema:2021"
12.         xsi:schemaLocation="urn:hbbtv:dvbi:schema:2021 hbbtv-ext-5.0.xsd"
13.         xsi:type="hbbtv-i:ServiceIdentifierTriplet"
14.         extensionName="urn:hbbtv:dvbi:service:serviceIdentifierTriplet">
15.       <hbbtv-i:DVBTriplet origNetId="8916" tsId="4097" serviceId="74"/>
16.     </AdditionalServiceParameters>
17.   </Service>
18. </ServiceList>
```

4.6.5   `OtherDeliveryParameters` of `ServiceInstance`

The `OtherDeliveryParameters` element within a service instance allows other types of delivery systems, or specific media players to be launched based on the format of the instance. Annex G.2.2 of DVB A177 [1] provides a schematic definition of a complex datatype which can be used to convey the URL of an HLS playlist. The following example illustrated how this datatype utilised in a service instance.

```
 1. <ServiceInstance>
 2.   <OtherDeliveryParameters xmlns:hls_url="vnd:apple:mpegurl"
 3.       xsi:schemaLocation="vnd:apple:mpegurl http://my.tv/hls-url-rfc8216.xsd"
 4.       xsi:type="hls_url:m3u8RefType"
 5.       extensionName="vnd.apple.mpegurl">
 6.     <hls_uri:UriBasedLocation contentType="application/vnd.apple.mpegurl">
 7.       <URI>http://my.tv/channel1/playlist.m3u8</URI>
 8.     </hls_uri:UriBasedLocation>
 9.   </OtherDeliveryParameters>
10. </ServiceInstance>
```

Line 2 declares the namespace for the `hls_url` prefix while line 3 provides a URL where the schema for the extension can be obtained. Line 4 defines the concrete type of `m3u8RefType` for the `OtherDeliveryParameters` element which contains the URL to the playlist (line 7) and the MIME type (`contentType` attribute on line 6).

4.6.6   Extension of `DASHDeliveryParameters`

The DVB-DASH specification, ETSI TS 103 285 [2], permits the definition of additional elements and attributes using the `<xs:any>` and `<xs:anyAttribute>` XML schema constructs to provide third party extensions to the manifest data.

The `Extension` element within the `DASHDeliveryParameters` provides an anchor for specifying additional information related to either the DASH delivery or expectations on the client player beyond those specified in the service instance.

DVB Home Broadcasting defines in clause 9.3.2 of DVB A179 [i.2] an extension to be used within the `DASHDeliveryParameters` element. This extension defines `OriginalDeliverySource` which contains the source type of the service before it was converted to DVB-DASH. An example is provided in clause 9.3.3 of DVB A179 [i.2] which depicts the original delivery source of the service as being DVB-S.

4.7 Roaming

The `targetCountry` in a service list registry query and the `TargetRegion` in a service list are intended to help people find service lists and services targeted at a particular location. This need not be the current location of the person concerned. In both cases, a DVB-I client should enable a user to find a service list targetted at some other location, for example, an expat should be able to find service lists targeted at their original country and region. Someone temporarily working away from home should be able to find service lists targeted at their home country and region. Moving a DVB-I client from one place to another should not automatically trigger installation of a new service list and selection of a new region.

Of course choosing a service list not targeted at someone's current location may have consequences including the following;

- Terrestrial and cable broadcast service instances in the service may not be available at the current location.

- Some broadband-delivered service instances may not be available due to rights or other reasons or may be restricted either in resolution or at certain times of day.

As explained in clause 4.2 of DVB A177 [1], a "DVB-I client that enables users to switch between service lists at any time may enable users to create user-defined lists of services from services in any of those service lists." Such a DVB-I client would enable an expat or a someone travelling to create their own list of services mixing those from their current location and their original location.

5 Linked Applications

5.1 General

Linked applications can be provided in any appropriate technology for the devices and operating systems that have a DVB-I client that a content provider wants to reach.

- Linked applications can be provided as HbbTV applications to reach Smart TV sets in many markets

- Linked applications can be provided in generic HTML5 to reach mobile devices (via a webview) as well as HbbTV and other Smart TVs

- Linked applications can even be provided in native code for particular hardware and OS combinations

5.2 Home Page applications

A service provider may define a linked application that gives access to their home page (see `urn:dvb:metadata:cs:LinkedApplicationCS:2019:3`). DVB-I clients may launch this application in response to the user selecting one of a number of elements in several different contexts in their UI.

In order to give access to this home page application, a DVB-I client may show the user any one (or more) of the following elements and enable the user to select it;

- The `Service.ProviderName` element for a service with a home page application or

- The `application.appName` element from the XML AIT for a home page application or

- The `applicationDescriptor.icon` element from the XML AIT for a home page application

These could be shown in any UI context where the user is presented with information about a service. For example;

- In a content guide

- In a UI offering a list of services (i.e. one that is not a content guide & does not show content guide data)

- In a so-called "info banner" typically shown temporarily when the user selects a new service or when the user presses an "info" button on a classic TV remote control.

As UI design is intentionally outside the scope of the present document, how, when or if the DVB-I client gives access to type home page applications is implementation specific. Some UI designs may struggle to find a big enough area of the screen to show the text based descriptions and may only use them for accessibility and text to speech.

What happens when a home page application exits is also outside the scope of the present document. Some possibilities include the following;

- The DVB-I client returns to the context from which the home page application was started (as in the list above)

- The DVB-I client goes to whatever it has defined as its entry screen

- The DVB-I client shows the last linear TV service successfully watched

History

Document history		
A184	July 2023	Initial Version
A184r1	February 2024	Includes bug 3098 (examples of extensibility)
		Includes bug 3116 (use of targetted country and region by client)
		Includes bug 3106 (home page applications), 3125 (clarifications on parental rating signalling)
		Updated HbbTV reference from 2.0.4 to TS 102 796.
		Corrected element names in home page XMLAIT.