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Hybrid Broadcast Broadband TV
Application Discovery over Broadband

EBU

Reference
RTS/JTC-053

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Modal verbs terminology

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Introduction

The versions of ETSI TS 102 796 [1] published to date rely on signalling in the broadcast to start broadcast-related applications, through the Application Information Table (AIT). The present document defines methods for discovery of broadcast-related HbbTV® services via a broadband internet connection for circumstances when the AIT and related signalling via the broadcast network is not available to the HbbTV® terminal. The discovery methods rely on retrieving or extracting a unique identifier for a broadcast channel and then starting a discovery process to find a server that can be contacted to retrieve an AIT over the broadband connection. The broadband-retrieved AIT would only be used if no AIT is available in the broadcast channel. The discovery method relies on the Internet's DNS system. In simplified form, the process works as follows:

- Extract a unique identifier from the broadcast channel.
- With the unique identifier, perform a DNS query to find (resolve) the AIT server.
- Ask the AIT server for an AIT that matches the broadcast channel.
- Using the AIT, retrieve the HbbTV® application.

The present document is targeted at two main deployment scenarios:

- HbbTV® terminals connected to a DVB network which does not carry the HbbTV® AIT. In this case the unique identifier is based on DVB Service Information.
- HbbTV® TV sets connected via HDMI to a STB that is in turn connected to the DVB network. In this case the unique identifier is based on information carried in the video and audio content (referred to as a 'watermark' in the present document). This method has the additional capability of enabling discovery of a media timeline and stream events. This capability can also be employed when a terminal is connected to a DVB network that does not carry timeline or stream events.

Both discovery methods can also be used in other deployment scenarios, for example the watermark can be used for application discovery from a DVB broadcast and the service information approach could be adapted for use with IPTV or live OTT solutions using proprietary service discovery.

An AIT retrieved over the broadband connection and the Application referenced in that AIT are not necessarily the same as the AIT that would be available in the broadcast and the associated HbbTV® Application. Generally, when no AIT is available in the broadcast, then neither would be event signalling, and the provider of the application may want to resort to alternative methods for providing event signalling to the HbbTV® application. When discovery using DVB is employed, the application may have to be modified to receive events in another manner (e.g. via broadband). When discovery using watermarking is employed, stream events may be delivered via the watermark.

The discovery method that employs DVB Service Information does not allow for application changes over time - e.g. when the program changes. When this method is employed, the application will have to include the necessary logic. Entities relying on the functionality provided in the present document are advised to consider these limitations when writing their applications.

1 Scope

The present document augments clause 6 of ETSI TS 102 796 [1], which states that broadcast-related applications are signalled as part of the broadcast. It defines a method for discovery of HbbTV® applications in settings where AIT signalling via the broadcast network is not available to the terminal. In this situation, an HbbTV® terminal may discover broadcast-related HbbTV® services via a broadband internet connection.

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.

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

NOTE: Including the latest errata as published on http://hbbtv.org/resource-library/#specifications.

[2] ETSI TS 102 796 (V1.4.1): "Hybrid Broadcast Broadband TV".

NOTE: Including the latest errata as published on http://hbbtv.org/resource-library/#specifications.

[3] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".

[4] Open IPTV Forum Release 2 specification, volume 5 (V2.3): "Declarative Application Environment".

[5] ETSI TS 102 034 (V1.5.1): "Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks".

[6] ETSI TS 102 809: "Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid Broadcast/Broadband environments".

[7] IETF RFC 6066: "Transport Layer Security (TLS) Extensions: Extension Definitions".

[8] W3C Recommendation (Second Edition) (10 June 2008): "XML Signature Syntax and Processing".

[9] ATSC A/336: "Content Recovery in Redistribution Scenarios".

[10] IETF RFC 1034: "Domain Names - Concepts and Facilities".

[11] IETF RFC 1035: "Domain Names - Implementation and Specification".

[12] ATSC A/334: "Audio Watermark Emission".

[13] ATSC A/335: "Video Watermark Emission".

[14] ISO/IEC 8859-5: Information technology -- 8-bit single-byte coded graphic character sets -- Part 5: Latin/Cyrillic alphabet".

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.

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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 103 270 (V1.1.1): "RadioDNS Hybrid Radio; Hybrid lookup for radio services".

[i.2] ETSI TS 103 286-2 (V1.2.1):"Digital Video Broadcasting (DVB); Companion Screens and Streams; Part 2: Content Identification and Media Synchronization".

[i.3] ISO/IEC 13818-1:2018: "Information technology -- Generic coding of moving pictures and associated audio information -- Part 1: Systems".

[i.4] IETF RFC 4033: "DNS Security Introduction and Requirements".

[i.5] IETF RFC 4034: "Resource Records for the DNS Security Extensions".

[i.6] IETF RFC 4035: "Protocol Modifications for the DNS Security Extensions".

[i.7] ETSI TS 103 555: "IP-delivered Broadcast Channels and Related Signalling of HbbTV Applications".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI TS 102 796 [1] and the following apply:

AIT server: server that for provides broadcast-related AIT(s) over broadband

audio watermark segment: VP1 audio watermark segment as defined in clause 5.2.5 of ATSC A/336 [9]

authoritative FQDN: internet domain for a (HbbTV®) service provider

discovered AIT: broadcast related AIT retrieved according to the present document

HbbTV® DNS FQDN: internet domain constructed only for the purpose of querying DNS

interval_field: field in the ATSC A/336 VP1 payload containing the interval code

interval code: value that identifies the interval of content in which the VP1 payload value is embedded

query flag: value of the query_flag field in an instance of the VP1 Payload as defined in ATSC A/336 [9]

server code: value that identifies a server which acts as the starting point for acquisition of supplementary content

server field: field in the ATSC A/336 VP1 payload containing the server code

video watermark segment: VP1 video watermark segment as defined in clause 5.1.7 of ATSC 336 [9]

watermark segment: audio watermark segment or a video watermark segment

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 102 796 [1] and the following apply:

TTL Time To Live

4 Overview (informative)

The methodology is modelled after RadioDNS [i.1], using certain parameters provided in the broadcast for the identification of services. These could be digital parameters extracted from DVB Service Information, e.g. DVB-SI [3], or parameters encoded in a digital watermark that is inserted for the purpose of enabling this discovery method. The present document defines operation either in the presence of DVB Service Information or, alternatively, in the presence of specified audio and/or video watermarks; other operation modes may be added in a future version.

The discovery method allows broadcasters to uniquely associate an AIT server with their channel and comprises discovering an authoritative FQDN for an AIT server, using DNS queries to hbbtvdns.org, a root domain name server.

NOTE: It is possible for local markets to define a market-specific alternative to hbbtvdns.org; this is not further addressed in the present document.

The protocol for discovery and retrieval of an AIT for a single service follows a number of steps, as outlined below. Figure 1 illustrates the steps using the example of DVB-based parameters and figure 2 illustrates the steps using the example of watermark-based parameters:

- The terminal queries a DNS recursive resolver using an HbbTV® DNS FQDN constructed from information present in the broadcast (1). A DNS recursive resolver known to the terminal returns the authoritative FQDN for that service (2), acquiring the mapping (if available) from the root domain name server if it is not locally cached.
- Either (1) When the terminal is receiving a DVB broadcast, there is no AIT in the broadcast signal or (2) When the terminal is presenting video from HDMI and receives a watermark as defined in the present document; then the terminal retrieves an XML-encoded AIT from the server using a URL constructed from authoritative FQDN (3 and 4). AIT retrieval includes acquisition of the AIT server address by the terminal from a DNS recursive resolver, which in turn acquires it (if available) from the broadcaster's Authoritative FQDN DNS root if it is not locally cached.
- The terminal uses the AIT for that broadcast service and retrieves the application (5 and 6).

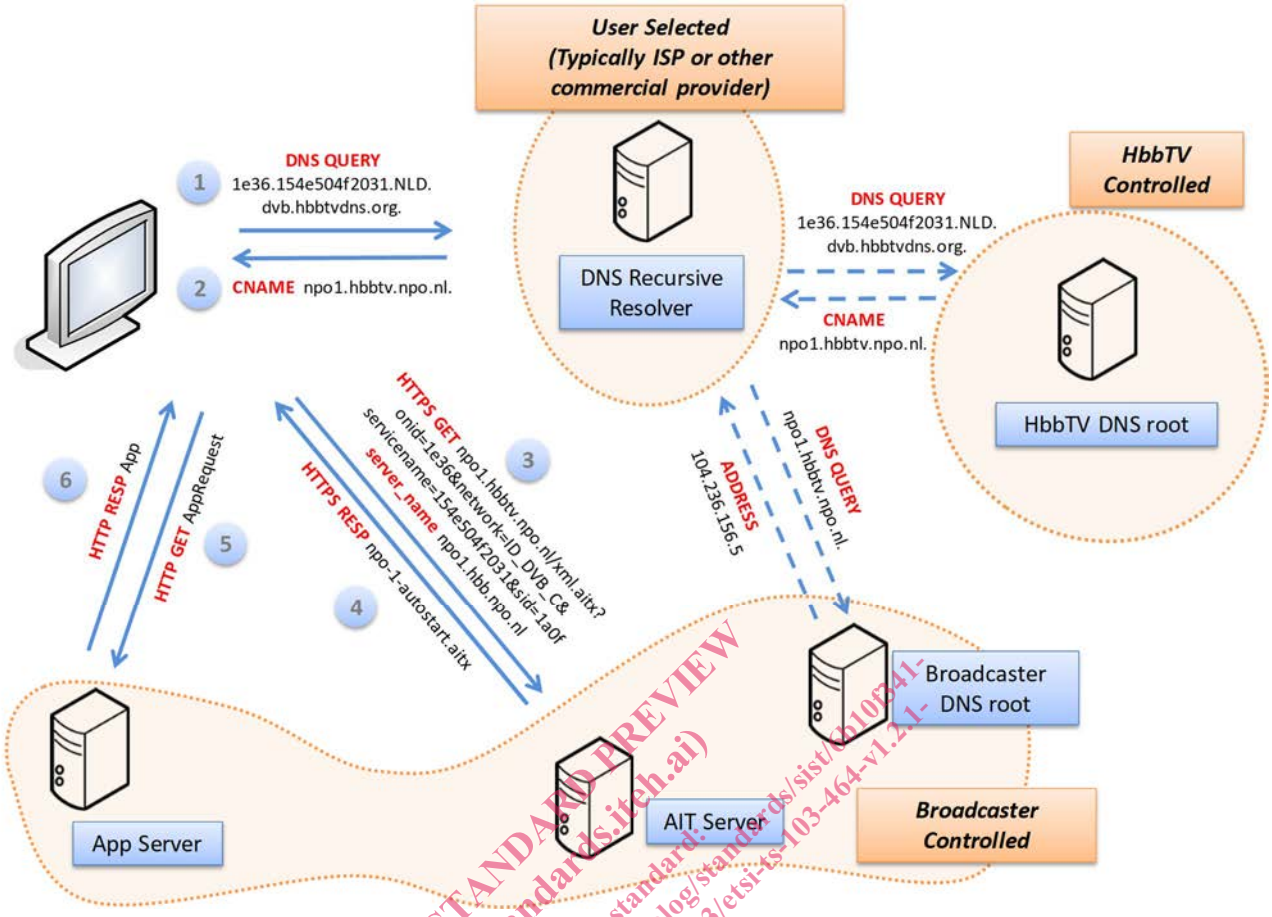

Figure 1: HbbTV® Application Discovery over Broadband in the presence of DVB Service Information

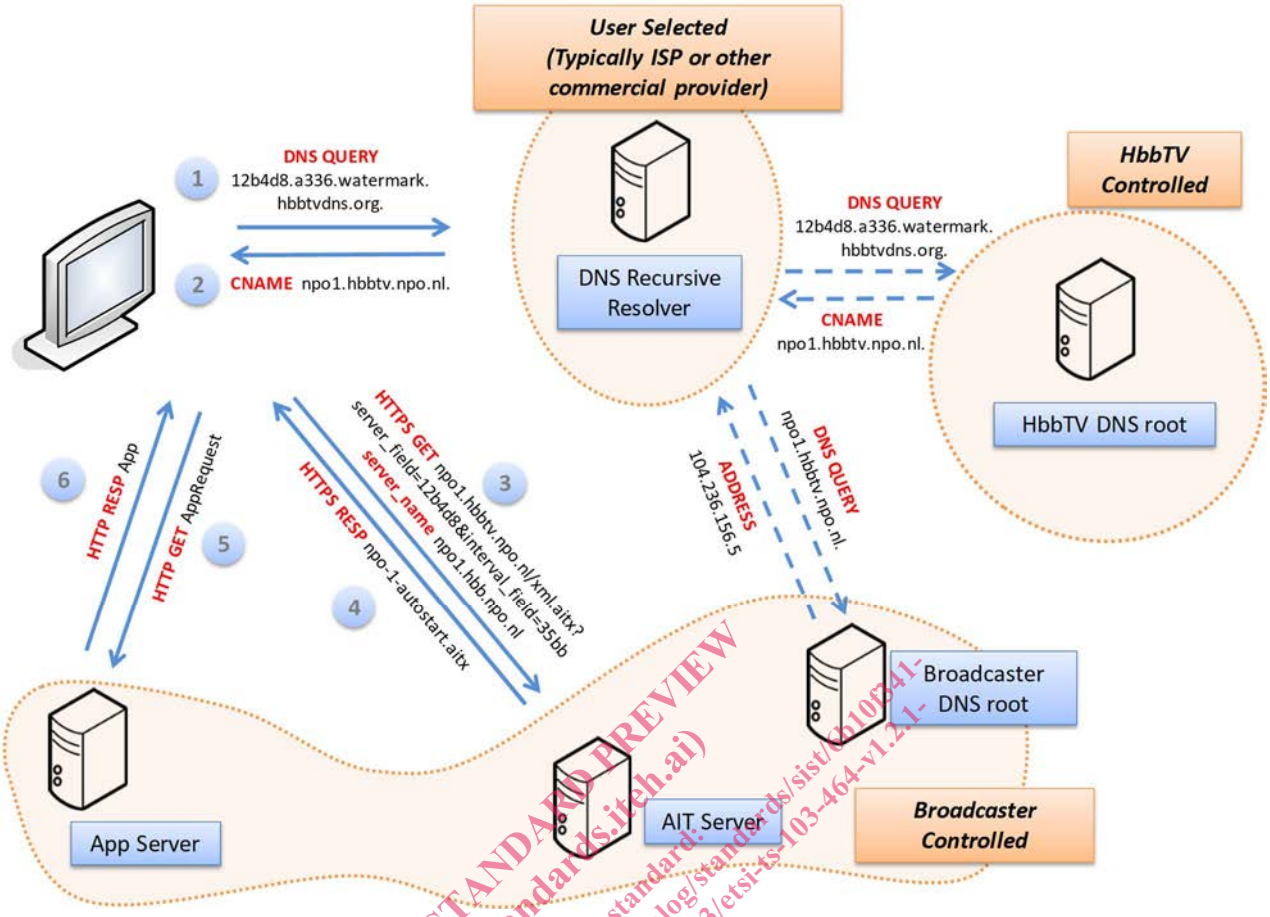

Figure 2: HbbTV® Application Discovery over Broadband in the presence of watermark information

5 HbbTV® Application Discovery over Broadband

5.1 Introduction

This clause defines a method for discovery and signalling of broadcast-related applications, which are discovered and signalled via broadband, instead of being signalled as part of the broadcast channel as defined in clause 7.2.3.1 of ETSI TS 102 796 [1].

The structure of this clause reflects the fact that the present document defines generic methods as well as instantiations that map on specific ways in which identifiers can be extracted and used. The present version defines such a mapping for a terminal that receives a DVB signal and one that relies on watermarking, to enable operation of terminals that do not receive the digital broadcast signal, for instance when the terminal is connected to a set top box with an HDMI cable. Mappings for non-DVB digital broadcasts can be added based on the HbbTV® IPTV specification ETSI TS 103 555 [i.7] or platform specific integration.

Terminals shall implement all of the mandatory requirements in the ETSI TS 102 796 [1], except where explicitly stated otherwise in the present document.

5.2 Discovering broadcaster AIT servers

The terminal shall attempt to discover broadcasters' AIT servers according to the process as described below. This process is independent from service selection by the user and shall be executed in the following cases:

- For each service in the terminal's channel list (see ETSI TS 102 796 [1] and the OIPF DAE specification [4]) and for each server_field in the server field cache (if application discovery using watermarking is supported), when the terminal is powered on. These attempts shall be made in alphabetical order by HbbTV® DNS FQDN.

- For any service where the terminal detects a change in the service name.
- For any service that is added to the terminal's channel list.
- For every service in the terminal's channel list, when the terminal's country setting is changed.
- For every server field value, when it is added to the server field cache.

Discovery of an AIT server shall be performed in the following way:

- The Authoritative FQDN shall be resolved as specified in clause 5.5, using Service Identification as specified in clause 5.3 and the HbbTV® DNS FQDN construction as specified in clause 5.4.

The following caching rules shall apply to DNS resolution performed for resolution of the Authoritative FQDN as specified in clause 5.5:

- DNS resource records shall be cached by the terminal in accordance with the resolver caching rules of IETF RFC 1034 [10] and IETF RFC 1035 [11], as amended by the present clause.
- Cached DNS resource records shall not be retained over a power cycle.
- Terminals shall be capable of simultaneously caching the DNS resource records of all services in the channel list and, if the terminal supports application discovery using watermarking, all server fields in the server_field cache as defined below.
- If a DNS resource record retrieval returns a name error (i.e. the record does not exist), the terminal shall cache this negative response with a TTL of 24 hours.
- Terminals shall refresh each cached DNS resource record once it has been stored in the cache for a number of seconds equal to the TTL associated with the DNS record (as defined in clause 5.1 of IETF RFC 1035 [11]), independently of and asynchronous to AIT retrieval.

NOTE: It is understood that terminals typically incorporate a DNS stub resolver that does not perform caching and rely on a remote recursive resolver identified via DHCP for caching. Terminals are not expected to implement a recursive resolver for the purpose of complying with these requirements. The DNS caching behaviour is expected to be included as part of a terminal implementation that employs a stub resolver.

The server field cache enables the terminal to populate its DNS cache with the records associated with previously viewed watermarked services upon power-up. Terminals supporting application discovery based on watermarking shall apply the following caching rules to server_field values detected from watermarks:

- server_field values detected from watermarks shall be cached by the terminal (the "server field cache").
- The server field cache shall be retained across power cycles and erased only upon user request (e.g. via a terminal feature such as "restore factory settings" or "delete stored information"). To ensure that the cache is retained when power is removed from the terminal entirely, terminals shall write changes to server field cache data to persistent storage within 5 minutes of the terminal being put into standby and should write changes to server field cache data to persistent storage soon after that data has been set or modified, e.g. within 30 s.
- Terminals shall be capable of storing 200 server_field values in the server field cache and the cached values shall not expire. However, if the cache does not have space to store a new server_field value, it shall replace the oldest (i.e. least recently added) entry in the cache.

5.3 Service Identification

5.3.1 Service Identification in the presence of DVB Service Information

For terminals supporting application discovery over broadband using DVB Service Information, identification of a service shall be provided by a combination of DVB service parameters. The parameters are defined in table 1.