



Request for proposals for the development and validation of a DVB-I reference application

The DVB Project invites proposals (the "**Proposals**") from potential suppliers ("**Suppliers**") for the development and validation of a reference application for the DVB-I specification as specified in the attached Request for Proposals (the "**RfP**").

The content and structure of the Proposal shall follow the guidance given in the RfP. Details of how to submit your Proposal and the deadline for submission are given in the RfP.

Suppliers should note the requirement to submit Proposals in the format set out in Annex 1 of the RfP.

The DVB Project reserves the right to appoint any number of Suppliers or may decide to appoint no Suppliers at all in respect of this RfP. Where necessary, DVB may enter into several agreements with the same Supplier in respect of different features or options or phases.

Interested organisations that are not members of DVB should contact the DVB Project Office (dvb@dvb.org) in order to obtain an advance copy of the DVB-I specification.

Dated this 27th September 2019

Signed by

Peter MacAvock
(no signature – electronic delivery)
For and on behalf of the DVB Project
Attachment: RfP for Reference Application for DVB-I



**Request for proposals for the development and validation of
reference application for DVB-I**

Phases 1 and 2

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Scope of the RfP

Proposals are invited for the supply of an HTML5/JavaScript DVB-I reference application as specified in Annex 2 to this RfP.

Proposals shall include:

- the creation of the reference application,
- the validation of the reference application on a selection of Android mobile phones and tablets, on a selection of HbbTV TV sets (including a hybrid channel list on the latter) and on a PC browser (for development only),
- the creation of documentation showing how broadcasters and network / platform operators may re-use all or part of the code as part of their own applications and how they may extend it,
- the creation of one or two DVB-I 'linked application's for that present DASH content
- the reporting of issues where the DVB-I specification is felt to be incomplete or insufficiently detailed or contradictory and participating in the resolution of those issues within the DVB process,
- the maintenance and support of the delivered reference application during acceptance, during the warranty period and subsequently.

The proposal includes two phases: phase 1 that is a robust, stable and responsive demonstration to be shown at the DVB World conference on March 9th to 11th 2020 in Valencia, Spain. Phase 2 that contains lower priority features and elements whose early development may put achieving the phase 1 goal at risk. This does not imply that development of phase 2 has to wait until after March 11th 2020, just that the development needs to be managed to ensure that development of phase 2 features before March 9th 2020 does not put the phase 1 goal at risk. The proposal also includes an optional extension to phase 2 including support for live services encrypted using DRM.

The reference application must be licensed under an open source license such as the MIT license.

This RfP replaces any previous RfP referring to the same subject.

1.1 Deliverables

The package of deliverables shall comprise the following:

Phase 1

HTML5 and JavaScript code according to the phase 1 functional requirements and the non-functional requirements (both of which are set forth in Annex 2) that has been tested and is sufficiently convincing, stable, robust and responsive to give, in the opinion of the DVB Project, a good impression of DVB-I to the attendees at the DVB World conference on March 9th to 11th 2020.

For Android mobile devices, the HTML5 and JavaScript code shall be either a WebView based application or a Progressive Web Application. For TV sets, the HTML5 and JavaScript code shall be packaged as an HbbTV Operator Application for the demonstrations at DVB World and IBC in 2020 but shall also be capable of running as a regular HbbTV broadcast-related application in a lab environment - without the integration with the TV set UI.

Phase 2

HTML5 and JavaScript code building on the phase 1 deliverables to additionally meet the phase 2 functional requirements and the non-functional requirements (both of which are set forth in Annex 2) that have been tested and are sufficiently stable, robust and responsive to give, in the opinion of the DVB Project, a good impression of DVB-I to the attendees of IBC 2020.

Reports showing the validation of the application on a number of hardware / software platforms (as set forth in Annex 2).

Documentation of the design and implementation of the HTML5 and JavaScript code showing how broadcasters, network / platform operators and their suppliers may re-use all or part of the code as part of their own offerings and how it may be extended.

1.2 Common deliverables for both phases

The reporting of issues where the DVB-I specification is felt to be incomplete or insufficiently detailed or contradictory and participating in the resolution of those reports within the DVB process,

1.3 Deliverables for DRM option of this proposal

Extensions to the HTML and JavaScript code from phase 2 to support obtaining DRM licenses for protected content and managing key rotation. Testing this code on devices supporting the DRM systems identified by DVB.

Reports showing the validation of the application on a number of hardware / software platforms (as set forth in Annex 2).

1. Guidance for submission

2.1 Period of validity

The Proposal shall be valid for a period of six months from the date of the Proposal.

2.2 Delivery of Proposal

The deadline for submitting a Proposal shall be 9am CET on Monday October 28th 2019.

The Proposal shall be submitted by the deadline by email to the <dvb@dvb.org> email address. A signed copy of the Proposal shall also be provided by mail as soon after this date as possible to the following address:

DVB Project
L'Ancienne-Route 17A
CH-1218 Grand-Saconnex
Suisse

2.3 Further information

Contract, administrative and technical queries should be sent to the <dvb@dvb.org> email address.

Queries should be clearly marked as confidential if the Supplier wishes them to be treated as such. Suppliers are allowed to send in questions related to RfP subjects until 9am CET on Wednesday October 9th 2019. Anonymized responses to these questions will be provided by DVB to all Suppliers between October 9th and October 14th.

2.4 Potential dependencies on the DVB project

The DVB Project and its members expect to be responsible for the following two sets of dependencies for the reference application. However Suppliers are invited to make proposals to take on either or both of these activities instead of DVB.

- To arrange for the provision and hosting of live DASH streams for use in testing and demonstrating the reference application including the following;
 - Streams containing one video track and one audio track for phase 1
 - Streams including one video track and more than one audio track for phase 2 (both multiple languages and accessibility)
 - Streams including one video track, one audio track and at least one subtitle track for phase 2
 - Streams where the video is encoded in more than one codec and where the audio is encoded in more than one codec
 - Encrypted streams for the DRM option of this proposal

Proposals based on Supplier's existing business relationships are preferred; however DVB would be prepared to distribute requests from the Supplier to its members collectively and to contact individual members who are known to be active in a particular field.

In any event, the Supplier is expected to ensure that, in its Phase 1 deliverable at DVB World 2020, some streams compatible with the DVB-I demonstration platforms used at IBC 2019 will be available

- To create and arrange for the hosting of the following;
 - DVB-I service lists suitable for developing and testing the phase 1 application
 - Content guide server and data suitable for developing and testing the phase 1 application
 - Content guide server and data suitable for developing and testing the phase 2 application
 - A DVB-I service list and content guide server / data suitable for demonstrating the phase 1 application at the DVB world event in Valencia (e.g. including Spanish DVB-T channels)
 - DVB-I service lists and content guide server / data suitable for demonstrating the phase 2 application at IBC 2020.

All of the above would be subject to technical review and approval by the participants in the DVB TM-IPi group.

For the DRM option, the DVB project would be responsible for identifying which DRM systems would be included and arranging with DRM providers for license servers and for availability of live DVB-DASH streams that are encrypted and that can be decrypted using the identified DRM systems.

2. Requirements

The Suppliers and the Proposals must fulfil the following requirements:

3.1 Proposal structure and contents

Proposals shall follow the proposal structure and provide the contents specified in Annex 1.

3.2 Pricing

The preferred model for the creation of the reference application, content, tools and documentation is a fixed payment although DVB Project is open to other payment models as well.

Supplier shall provide prices for the following;

- For phase 1 only,
- For both phase 1 and phase 2 without the DRM option,
- For phase 1, phase 2 and including the DRM option

Prices quoted shall include coverage for warranty as well as technical support for demonstrating the deliverables at DVB World 2020 and IBC 2020.

Supplier shall provide separate pricing and terms for support and maintenance (see section 3.8).

Suppliers may provide pricing for either or both of the two activities listed under “2.4 Potential dependencies on the DVB project” above.

All pricing must be in Euros including all applicable fees and taxes.

3.3 Schedule

The following major milestones are defined;

Milestones	Commentary	Initial acceptance period	Payment after initial acceptance
1. Initial delivery of phase 1 reference application	A delivery suitable for interested DVB members to review including running in their own facilities.	4 weeks	10%
2. Phase 1 reference application for DVB World 2020	A delivery suitable for showing at the DVB World 2020 event.	From delivery until March 11 th 2020.	30%
3. Initial delivery of phase 2 reference application	For ease of acceptance, it is preferred that this is split into a number of intermediate deliveries	4 weeks from last intermediate delivery	20%
4. Delivery of validated phase 2 reference application	A delivery suitable 1) for showing at IBC 2020 and 2) for DVB to promote outside the members of the TM-IPI group following the activity.	4 weeks	20%
5. Final delivery including documentation.	The end of the development phase of the project.	12 weeks	20%

Supplier should provide a schedule including at least these milestones together with an approximate schedule for the intermediate deliveries of phase 2. It is preferred that the development of the features required for phase 2 not be delayed until after DVB World 2020 as long as this does not risk the quality of the demo for DVB World.

For each of the milestones identified above, DVB Project will carry out initial acceptance testing within the initial acceptance period (as indicated in the table above) starting from the actual date of each delivery. If DVB Project rejects the delivery, it shall notify Supplier of such rejection and Supplier must fix any errors notified to it and re-submit what was rejected. Upon re-submission DVB Project will recommence initial acceptance testing which it will carry out within the initial acceptance period (as indicated in the table above) starting from the actual date of re-submission. Initial acceptance of any delivery shall be notified to Supplier by DVB Project once DVB Project has completed initial acceptance testing. In the event that no notice of rejection

is made to Supplier within the initial acceptance period (as indicated in the table above) following the delivery or re-submission of the delivery, then initial acceptance of the delivery shall be deemed to have taken place.

The DVB Project will carry out full acceptance testing of the milestone 5 delivery within 12 weeks of the actual date of delivery. If DVB Project rejects the delivery, it shall notify Supplier of such rejection and Supplier must fix any errors notified to it and re-submit what was rejected. Upon re-submission DVB Project will recommence full acceptance testing which it will carry out within 12 weeks of the actual date of re-submission. Final acceptance of any delivery shall be notified to Supplier by DVB Project once DVB Project has completed final acceptance testing. In the event that no notice of rejection is made to Supplier within a period expiring 12 weeks following the delivery or re-submission of the delivery, then final acceptance of the delivery shall be deemed to have taken place and Supplier may invoice the remainder.

3.4 General expertise

Developing this reference demonstration application and documentation will require specialised expertise in HTML5 and JavaScript development for embedded devices, live MPEG-DASH, JavaScript DASH players such as dash.js, Android and HbbTV. Proposals shall identify what, if any, expertise the Supplier has related to these subjects. If the Supplier does not yet have the needed expertise, then its Proposal shall identify how the Supplier would address this (e.g. hire, sub-contract, partner) including the lead time expected to put those arrangements in place.

DVB Project requires that the primary point of contact for project management and technical issues shall be located in Europe. Proposals shall identify the location from which these activities will be carried out and the names of those staff involved. There shall be no requirement for DVB Project (or company members representing DVB Project) to travel outside Europe for the purposes of this contract.

It is important that the Proposals indicate how they will manage continuity of staff and expertise over the period of time covering application creation, testing, warranty and maintenance.

3.5 Warranty

DVB Project requires a 12 months warranty period starting from the submission date of the invoice relating to the final delivery. Suppliers shall provide without delay any updates to the application and/or content and/or documentation if errors are found.

Suppliers shall indicate in their Proposal what is covered by the warranty.

3.6 Way of working

The application shall be developed and maintained in a public github repository. The DVB Project, any DVB member and any other Interested organisation shall be able to fork the github repository.

3.7 Change control

While DVB intends, expects and needs the DVB-I specification to be stable, Supplier must recognise that bugs in the specification will be found and fixed (see also under clause 3.8). Ideally the impact of these on the reference application will be trivial or at least small but the possibility of a bug being found whose solution has a non-trivial impact cannot be excluded. Supplier will track proposed bug fixes to the DVB-I specification and promptly report to DVB any proposed fixes that will have a significant impact. The reference application shall track fixes to the DVB-I specification except for those reported to DVB as described. Supplier will have a good faith negotiation with DVB concerning any increase in the price due to if DVB would go ahead with any proposed fixes reported as described.

3.8 Additional duties of Suppliers

Any technology or information that needs to be licensed from third parties in order to develop the application is the responsibility of Supplier. It is not practical for DVB Project to be a party to confidentiality agreements with third parties. Any arrangement with a third party shall provide for the use by users of the deliverables without further licence from or payment to the third party.

The process of validating the reference application on Android phones, tablets and HbbTV TV sets may result in Supplier identifying issues with those products. For HbbTV TV sets, Supplier is responsible for discussing these issues directly with the manufacturer of the products concerned. If Supplier is unable to find contact names then DVB may be able to assist with this but cannot be a party in the handling of such issues themselves.

Supplier shall attend the 2020 DVB World conference in Valencia to present and demonstrate the reference application. Supplier is responsible for provision of equipment and travel expenses for the demonstration. This will not give Supplier any privileges provided to Conference sponsors. Supplier will be free to take up sponsorship packages.

3.9 Maintenance

DVB Project requires the Supplier to provide pricing for annual maintenance for a fixed fee. Suppliers will be expected to provide guaranteed response times for fixing issues found with the reference application and supporting documentation. Suppliers will be expected to respond to questions concerning the package raised as issues in github.

3. Appointment Process

The process of making any appointments of a Supplier or Suppliers is the following:

4.1 Evaluation and Appointment

Proposals will be opened and reviewed internally at the convenience of DVB Project. Within 6 weeks of the submission deadline, DVB Project will have completed a comparative assessment of received Proposals in order to decide as to which Proposals, if any, should be selected for further analysis and negotiation.

At the end of the analysis and negotiation phase, DVB Project will make a provisional appointment (the "**Appointment**"), at its entire discretion, of the Supplier or Suppliers who demonstrate the best ability to meet the requirements set out in this RfP to deliver and validate the reference application.

Proposals will be subject to a technical review and a commercial/business review:

- The significant factors for the technical review shall be
 - the quality of the Proposal,
 - the technical understanding of the subject area demonstrated by the Proposal
 - the Supplier's experience relating to live DASH, to HTML / JavaScript development for Android and to HbbTV (operator) application development
- The significant factors for the commercial/business review are
 - the perceived ability and track record of the Supplier,
 - the Supplier's approach ensuring the schedule for the phase 1 deliverable is met,
 - other aspects of the proposed delivery schedule,
 - the Supplier's access to implementations of the HbbTV operator application specification,
 - the price and the maintenance commitments for the reference application and content after it has been released.
 - The Supplier's ability to manage continuity of staff and expertise over the period of the contract and subsequent maintenance
 - If the DRM option would be selected, the Supplier's ability to support multiple DRM technologies relevant for the market and for the DVB membership

None of these factors is dominant and Proposals which score highly on one factor may be rejected due to scoring badly on another. Paramount however is DVB's confidence that supplier can and will achieve a convincing, stable, robust and responsive demonstration that gives a good impression of DVB-I to the attendees at the DVB World conference on March 9th to 11th 2020.

If other factors are equal, DVB has a slight preference for Suppliers who are members of the DVB Project.

4.2 Clarification of Proposals / Changes to process

Notwithstanding any other provision of this RfP, DVB Project reserves, at its entire discretion, the right to:

- a) Conduct discussions with any or all potential Suppliers for the purpose of clarification of Proposals;
- b) Waive, or decline to waive, any defect in any Proposal;
- c) Accept, reject, or negotiate any or all Proposals or the terms of any Proposal for the purpose of obtaining the best and final offer;
- d) Cancel or amend this RfP or issue other requests for proposals (and in doing so will endeavor to communicate transparently and in a timely manner with all Suppliers);
- e) Request Suppliers submitting Proposals to resubmit Proposals with a modified scope;
- f) Provisionally appoint any number of Suppliers and complete more than one agreement with any one Supplier relating to different phases and to complete agreements at different times; and
- g) Select no Proposals at all.

4.3 Negotiation and execution of agreements

In the event that there is negotiation and the appointed Supplier and DVB Project are not able to reach agreement and execute such agreements within 30 days of the Appointment, DVB Project may declare the Appointment void and may provisionally appoint another Supplier or Suppliers or issue a new RfP.

4.4 Rejected Proposals

DVB Project has no duty to provide Suppliers with any explanation or justification of its decisions not to accept a Proposal or to accept a Proposal only in part.

4. Intellectual Property

The reference application and documentation must be licensed under an open source license such as the MIT license - <https://opensource.org/licenses/MIT>.

If any part of the reference application or content is making use of any third party intellectual property, it must be clearly identified and must follow that third party's intellectual property licensing requirements.

If the reference application or related tools contain open source components, this must be disclosed in the Proposal.

5. Exclusion of liability / costs

The DVB Project has prepared this RfP in good faith with a particular interest for swift and cooperative progress in the development of the reference application. To the extent permitted by law, the DVB Project excludes any liability (whether in contract, tort, negligence or otherwise) for any incorrect or misleading information contained in this RfP.

Any costs or expenses incurred by any Supplier or other person under the present submission process will not be reimbursed by the DVB Project and neither the DVB Project nor any of its representatives will be liable in any way to any Supplier or other person for any costs, expenses or losses incurred by any Supplier or other person in connection with this RfP.

6. Confidentiality

Sections 1 to 8 of the Proposals may be shared with any member of the DVB Project. Sections 9 to 12 will only be shared with members who have been specifically tasked with considering the Proposals and will not be shared more widely.

7. Applicable Law and Dispute Settlement

This present RfP, as well as subsequent negotiations shall in all respects be governed by and construed in accordance with Swiss law.

The present RfP must be regarded as a modality of a negotiation subject to the general rules of the Swiss Code of Obligations. Swiss law does not subject requests for proposals in the present context to any specific rules, such as e.g. public procurement rules, and DVB Project is entirely free to enter into contract with whatever Supplier it considers best suited for the awarded work. As a consequence, no claims can be brought against the DVB Project out of the present procedure. For all practical purposes, the following dispute settlement rules shall nevertheless apply:

All disputes arising out of or in connection with the present RfP shall be submitted, in the first instance, to the Dispute Adjudication Board ("**DAB**") in accordance with the Dispute Adjudication Board Rules of the International Chamber of Commerce (the "**DAB Rules**"), which are incorporated herein by reference.

The DAB shall consist of three (3) members to be appointed as follows: when a dispute arises that could not be amicably settled, each of the potential Supplier and DVB Project (each a "**Party**", collectively the "**Parties**") may send a written notice to the other Party requesting the establishment of the DAB. Each Party shall then within 10 business days appoint one independent DAB member who must have the following credentials: (i) be demonstrably experienced in the subject matter of the dispute, and (ii) be an employee or representative of a company that is a member of the DVB Project. The two appointed DAB members shall appoint, within 10 business days, the third independent DAB member, who shall act as chairman of the DAB.

The DAB procedure shall be purely private, and the parties shall not revert to the ICC Dispute Board Center. Problems arising from not having the support of the ICC Dispute Board Center shall be resolved ad hoc by the DAB.

For any given dispute, the DAB shall issue a decision in accordance with the DAB Rules and within a time period of 2 months. The deadlines for the various steps of the procedure shall be set (and if longer deadlines are mentioned in the DAB Rules be

systematically reduced) to allow for a swift rendering of the decision of the DAB within the time limit of 2 months.

If (i) any Party fails to comply with a decision when required to do so pursuant to the DAB Rules, (ii) any Party sends a written notice to the other Party and to the DAB expressing its dissatisfaction with a decision, as provided in the DAB Rules, (iii) the DAB does not issue the decision within the time limit of 2 months, or (iv) if the DAB is disbanded pursuant to the DAB Rules, the dispute shall be finally resolved by arbitration in accordance with the Swiss Rules of International Arbitration of the Swiss Chambers of Commerce (the "**Swiss Rules**") in force on the date when the notice of arbitration is submitted in accordance with these Swiss Rules. The number of arbitrators shall be one (1). The applicable procedure shall be the expedite procedure under Article 42 para 1 of the Swiss Rules (in particular: award to be made within six months). The seat of the arbitration shall be Geneva and the arbitral proceedings shall be conducted in English.

Each Party hereby: (i) irrevocably consents to the exclusive jurisdiction of such arbitral tribunal for the resolution of such disputes; (ii) irrevocably waives any objection that it may now or hereafter have to the venue of any such action or proceeding in such arbitral tribunal or to the convenience of conducting or pursuing any action or proceeding in such arbitral tribunal; and (iii) irrevocably waives any right to a trial by jury regarding the resolution of any dispute between the Parties hereto.

Neither the DAB procedure, nor the arbitration under the Swiss Rules oblige the DVB Project to suspend or abort its work relating to DVB-I.

Annex 1: Proposal Structure

1. Table of Contents
2. Executive Summary
3. Reference application to be supplied
 - 3.1. Features included within the reference application
 - 3.2. Expected source of the application (e.g. open source, 3rd party, created by Supplier for the purpose of this RfP, re-use of existing application) with details.
 - 3.3. How the reference application would run on Android (e.g. WebView based application, Progressive Web App, ...)
 - 3.4. Initial proposed approach to launching linked application from phase 2
 - 3.5. License(s) to be used for reference application
4. Hardware and software platforms to be used
 - 4.1. Proposed Android devices to be used
 - 4.2. Proposed HbbTV operator application TV set to be used
5. DRM option
 - 5.1. Listing of DRM systems that Supplier has already worked with and/or has necessary agreements in place to be able to work with
 - 5.2. Identification of any support needed or expected from listed DRM system suppliers for this project
6. Validation
 - 6.1. Description of how Supplier proposes to validate that the reference application works on the proposed hardware and software platforms to be used
7. Deviations from the RfP
 - 7.1. Specific deviations
8. Supplier's Project Personnel
 - 8.1. List of Project Members and contact information
 - 8.2. Background, Experience and Skill Sets of Project Members
 - 8.3. Source of specialised or scarce expertise
9. Schedule for deliverables
10. Supplier Information
 - 10.1. Corporate Information
 - 10.2. References
 - 10.3. Other relevant involvement – Video streaming on Android, HbbTV applications, live DASH
 - 10.4. QA processes
 - 10.5. Contact Information

11. Payments and terms & conditions

- 11.1. Prices and terms & conditions relating to Pricing, Pricing models, warranty
- 11.2. Support and maintenance prices and terms
- 11.3. Any other costs

12. Supporting confidential information

Each section should start on a new page.

Section 12 should only be used for material that is clearly confidential. Use of section 12 for material that needs to be assessed by the DVB membership outside the small group of volunteers evaluating the responses may damage the chances of the Proposal being accepted.

Annex 2: Reference application requirements

All UIs are assumed to have some aspects that are specific to mobile devices (or to the Android operating system) and some aspects that are specific to TV sets (or to HbbTV). In the interests of clarity and brevity, these aspects are not listed separately in the Android-specific and the HbbTV-specific requirements below. This includes but is not limited to user input. In the case of an HbbTV operator application, the dedicated keys must be used on the remote control where they exist – Info, Guide, P+, P-, audio track selection, subtitle control and so on.

Phase 1 Functional Requirements

- General requirements
 - Downloading a DVB-I service list from a pre-defined location
 - Showing a service list UI with a list of linear services based on the downloaded service list
 - Navigation within the service list UI including selecting a linear service
 - Showing a UI when a linear service is selected including information on the current and next program and other information typically shown in TV channel banners that is available in DVB-I.
 - Showing a classic time vs channel grid of program titles and durations using information from a DVB-I content guide and navigation within that grid.
 - Support for low-latency DASH content as generated by the joint DASH-IF/DVB activity to extend ffmpeg.
- Requirements specific to Android mobile devices
 - The reference application shall be a WebView based application or a Progressive Web App
 - Presenting selected DVB-I linear services using a JavaScript MSE-based DASH player such as dash.js
- Requirements specific to HbbTV
 - For DVB World 2020, IBC 2020 and other demonstrations, the reference application shall be an HbbTV operator application.
 - The reference application shall also be capable of running as a regular HbbTV broadcast-related application in a lab environment – without the integration with the TV set UI.
 - Merging DVB-C/S/S2/T/T2 services from the terminal service list with the DVB-I service list and showing the results as a single integrated service list UI.
 - Displaying logical channel numbers in the service list UI
 - Presenting selected DVB-I linear services using the HbbTV DVB-DASH player implementation
 - Presenting selected DVB-C/S/S2/T/T2 services using the HbbTV API

Phase 2 Functional Requirements

- General requirements
 - Discovery of a DVB-I service list including selection of one list from a number of different ones
 - A set-up UI including at least the following;
 - asking the user to choose a region where they are located

- allowing the user to enter a parental rating age and PIN number when the app starts
- allowing the user to enter default preferred languages for audio, subtitles and UI (see below)
- allowing the user to enter default settings for accessible audio
- In the service list UI from phase 1,
 - presenting the appropriate service list for the region where the user has indicated they are located
 - where text is available in multiple languages in the DVB-I service list or content guide, presenting text in the language in the user preferred language for UI if available
- Presenting additional data in the EPG grid that is supported by the DVB-I specification beyond what is presented in phase 1
- A UI showing additional information on the currently watched program equivalent to what would be shown on a typical TV set when the “info” button (or equivalent) is pressed.
- Parental access control including blocking of channels and blocking of events within a channel based on parental access control signalling and allowing the user to enter a PIN number to over-ride parental access control blocking
- A UI for subtitle control including allowing the user to turn subtitles on and off and allowing the user to select the subtitle language and connecting the results of this UI to the DASH player when linear services are played back.
- Pause live TV for DASH delivered channels (within the time shift buffer in the network) and resume
- A UI for selecting audio channels / tracks including language and accessibility, temporarily over-riding the default setting and connecting the results of this UI to the DASH player when linear services are played back.
- Identifying services where no instances can be presented based on device media and DRM capabilities and showing them differently in the service list and EPG and blocking their selection.
 - Android mobile devices and HbbTV terminals have different mechanisms for determining device media capabilities
- Services that are not available at the current time and are replaced by a graphic.
- A service with a linked application where the media presentation is to be managed by the linked application.
- Support for indicating that a program is part of a series including allowing the user to link to future and previous episodes.
- Requirements specific to Android mobile devices
 - A linked application that presents a DVB-I service (preferably HTML5 but Android native can be considered)
- Requirements specific to HbbTV
 - Use of logical channel numbers appropriate for the selected region in the service list UI
 - Switching from an HD broadcast instance of a service to a UHD DVB-DASH instance of the same service for one program and back again

- Presenting selected DVB-I services using a JavaScript MSE-based DASH player such as dash.js as an alternative to the HbbTV native DVB-DASH implementation (assuming availability of an HbbTV operator application implementation that supports MSE).
- A linked application that presents a DVB-I service (an HbbTV broadcast-independent application)

Requirements for DRM option

- Identify services protected by a supported DRM
- Identify programs / events protected by a supported DRM when the service is not protected as a whole
- Request licenses from DRM server(s) and pass them to EME
- Handle key rotation

Non-functional requirements

The reference application must run on the following hardware and software platforms;

- At least 4 Android mobile devices from different manufacturers and using different versions of the Android operating system. At least two of these must be devices that are still available to purchase in retail.
- At least 3 HbbTV TV sets from different manufacturers. At least one of which supports operator applications and, for phase 2, at least one of which has a working implementation of W3C Media Source Extensions that is available to HbbTV applications.
- For the purposes of development / debugging only, a PC.

The application must be suitable for broadcasters and application developers to use as a starting point for commercial applications and services. DVB requires a functional, working application and is not interested in UI design and development.

The amount of common code between the versions for the different hardware and software platforms must be as large as reasonably possible without compromising either the look and feel of the UI or the readability and re-use of the code. The design and architecture of the application shall cleanly separate common code from hardware / software platform specific code. Code specific to HbbTV shall be cleanly separated into code that is applicable to any HbbTV 2 implementation and code specific to operator applications.

The performance of the application must be comparable to applications of a similar scope on set-top box and TV platforms. The application must be sufficiently stable, robust and responsive to give a good impression of DVB-I to the attendees at the DVB World conference on March 9th to 11th 2020 and at IBC 2020.

For the DRM option, code specific to a particular DRM technology or system must be minimised and cleanly separated from code specific to other DRM technologies and from code independent of any DRM technology or system. The work in the DASH-IF on “Uniform client workflow for multi-DRM scenarios” should be considered as part of this option.

<https://github.com/Dash-Industry-Forum/DASH-IF-IOP/issues/300> and <https://github.com/Dash-Industry-Forum/DASH-IF-IOP/pull/343> .

Non-requirements

The user interface of the reference application does not need high graphical production value.

The user interface of the reference application on Android mobile devices needs to be functional and broadly consistent with normal practice for Android apps. It does not need to represent the state of the art.

The user interface of the reference application on PCs needs to be functional but does not need to be suitable for use by anyone other than a developer.

In phase 1 and phase 2, there is no requirement to support languages other than English for the text in the reference application itself.

Potential future requirements

The following are potential future requirements. When designing and implementing the application, Supplier should make reasonable best efforts to avoid design or implementation choices that would mean significant re-working should DVB Project choose to commission a phase 3 including some or all of these requirements.

- DVB-I services where the content is a playlist
- Handling updates to the service list
- Features needed to enable personalisation such as the ability for the user to identify themselves to service providers
- Support for the reference application on Android set-top boxes (both Android TV and AOSP) and on set-top boxes based on RDK
- Support for advert insertion in live DASH services (as specified by DASH-IF)
- The ability to support multiple languages in the UI of the reference application
- DVB-DASH services including HDR video and next generation audio
- On demand content including linking from future and past scheduled events to on-demand content and box sets
- mABR
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