

**RadioEPG Technical Specification**  
**REPG01 V1.0.0-DRAFT (2011-08)**

An application to enhance broadcast audio services  
with rich programme related meta-data.

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## Intellectual Property Rights

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## Foreword

Modern connected radio devices have the ability to use IP and broadcast technologies together to provide a compelling user experience that combines the best of both.

The RadioEPG application provides a methodology for devices receiving a broadcast to acquire additional metadata for the audio service, including schedule information.

It allows devices to be more service-oriented, rather than platform-oriented, and instructs the device on the different ways the service can be received, allowing the device to choose the best one for its capabilities and the circumstances.

It also provides the means to implement Service Following, allowing the device to switch between receiving the service using IP-based streaming or broadcast as the conditions change, thus enabling it to behave like a true **Hybrid Radio**.

This specification has been built upon the existing DAB EPG XML specification [ETSI TS 102 818]. The aim was to ease adoption for device manufacturers and service providers alike who may already utilise the ETSI specification.

## 1. Scope

The present document defines the protocol for RadioEPG to allow implementation from both a service provider and client (devices and directory service providers) perspective.

## 2. References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

- [1] RFC 2782 (2000): 'A DNS RR for specifying the location of services (DNS SRV)'
- [2] RDNS01: 'RadioDNS Technical Specification'
- [3] RFC 2616 (1999): 'Hypertext Transfer Protocol – HTTP/1.1'
- [4] ETSI TS 102 818: 'Digital Audio Broadcasting (DAB); Digital Radio Mondial (DRM); XML Specification for Electronic Programme Guide (EPG)'
- [5] IEC 62106 (2009): 'Specification of the Radio Data System (RDS) for VHF/FM sound broadcasting in the frequency range from 87,5 MHz to 108,0 MHz'
- [6] ISO 3166-1, 'Codes for the representation of names of countries and their subdivisions – Part 1: Country codes'
- [7] NRSC-5-B:2008, 'In-band/on-channel Digital Radio Broadcasting Standard'

## 3. Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

<b>RadioDNS</b>	Centralised lookup for radio services, allowing the resolution of broadcast parameters to an authoritative FQDN as detailed in the RadioDNS specification [2].
<b>service</b>	An audio service such as a talk or music radio station
<b>service provider</b>	The organisation providing a service
<b>device</b>	A device for receiving and listening to a service, or an implementation of a directory service, unless explicitly differentiated

### 3.2 Abbreviations

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

AMSS	Amplitude Modulation Signalling System
CNAME	DNS Canonical Name record
DAB	Digital Audio Broadcasting
DNS	Domain Name System
DRM	Digital Radio Mondiale
EPG	Electronic Programme Guide
FCC	Federal Communications Commission (of the United States of America)
FQDN	Fully Qualified Domain Name
IP	Internet Protocol
NS	Name Server
RBDS	Radio Broadcast Data System
RDS	Radio Data System
SRV	DNS Service record
VHF/FM	Very High Frequency/Frequency Modulation

DRAFT

## 4. Application Discovery

A device must be capable of resolving the authoritative FQDN for an audio service via the methodology defined in the RadioDNS specification [2].

Application lookup for RadioEPG services must then be performed against this FQDN by means of a SRV Record request for the RadioEPG service name: `radioepg`

If at least one SRV record is successfully resolved, this audio service supports the RadioEPG application, accessed on the host and port indicated in the relevant SRV record. For example, for a query made to:

```
_radioepg._tcp.rdns.musicradio.com
```

Using the `nslookup` tool, this would yield the following SRV record:

```
service = 0 100 80 epg.musicradio.com.
```

This indicates that the RadioVIS application can be accessed on the FQDN `epg.musicradio.com`, port 80.

Note that more than one SRV record may be returned with different values. This can potentially be used for loadbalancing purposes by providing different FQDNs/Ports with different priorities/weightings. See the SRV record specification [1] for a more detailed explanation on handling SRV resolution results.

## 5. Document retrieval

The host and port returned with the SRV record(s) refers to a HTTP server containing XML documents. The following sections of the present document detail these documents and how they are retrieved and parsed.

Because the resource is returned via HTTP, the HTTP specification [3] must be correctly and fully implemented. Attention is particularly drawn to the status codes section which must be used to indicate problems and failures during attempts to retrieve documents.

A device **MUST** correctly follow any HTTP redirects that are returned when retrieving a document.

A device **MUST** respect any indicated document expiry in the HTTP response, and request the documents again upon expiry.

It is **RECOMMENDED** that devices cache retrieved documents, as per the HTTP specification.

It must also be noted that any filenames given in this document should be treated as *case sensitive* in order to support different web servers.

## 6. XSI document

This document is intended to encompass the functionality provided by an SI file in the DAB EPG XML specification [4], with a restructuring of the document to make it suitable for signalling non-DAB bearers.

It holds a definition of all services provided by the service provider, including any relevant metadata and bearer details, such as:

- Names (in different lengths and languages)
- Descriptions (in different lengths and languages)
- Logos
- Genres
- Keywords
- Other bearers the service can be received over

The XSI document allows the definition of **all** bearers the service is available on, over all platforms and in all locations. This enables *Service Following* – i.e. enabling a client to switch between bearers (both broadcast and streaming) as suits the quality of service provided, and its implementation is explained in more detail in 8 Broadcast/IP Service Following.

## 6.2 Location

The document can be acquired in one of three ways:

- Performing a RadioDNS lookup for the RadioEPG application
- Link to URL of the XSI document within the HTML pages of the service website
- Document placed in a defined location on the service website

The first method is applicable to clients currently receiving a broadcast signal, and using the broadcast parameters to form a RadioDNS query to locate the RadioEPG application and XSI document.

The second and third methods are applicable to clients, or the directory service provider supporting them, that need to switch from an IP stream back to broadcast. A directory service could locate, parse and store metadata from XSI documents by crawling across service provider websites.

### 6.2.1 Using host from RadioDNS SRV lookup

The URL to obtain the XSI document is constructed as follows:

```
http://<host>:<port>/radiodns/epg/XSI.xml
```

Where `host` and `port` are populated by the `host` and `port` values obtained from the SRV record lookup for the RadioEPG application.

### 6.2.2 Using link within pages of the Service Website

The URL of the XSI document is contained within the (X)HTML header section `<link>` tag of any HTML pages likely to be discovered by a Directory Service Provider.

For example, for a service with a website at `http://www.capitalfm.com/london`, the header section may contain:

```
<head>
  ...
  <link rel="radioepg" href="http://epg.musicradio.com/XSI.xml">
  ...
</head>
```

Similarly, a service with a website at `http://www.classicfm.com`, the header section may contain the same link as above, representing the XSI document for that service provider across all the service website it manages.

### 6.2.3 Using placement in a defined location on the Service Website

The URL to obtain the XSI document is constructed as follows:

```
http://<host>:<port>/radiodns/epg/XSI.xml
```

Where `host` and `port` are populated by the `host` and `port` of the service website.

For example, for a service with a website at `http://www.capitalfm.com/london`, the URL will be:

**`http://radiodns.org/`**



## 6.3 Implementation

For service providers implementing the RadioEPG application:

- You **MUST** implement 6.2.1 Using host from RadioDNS SRV lookup.
- You are **STRONGLY RECOMMENDED** to implement document discovery on the standard HTTP port 80, due to the possibility that traffic on its non-standard port may be rejected by firewall/proxy configurations.
- You are **STRONGLY RECOMMENDED** to implement 6.2.2 Using link within pages of the Service Website.
- You are **STRONGLY RECOMMENDED** to implement 6.2.3 Using placement in a defined location on the Service Website.

For device manufacturers and developers implementing a RadioEPG client:

- You **MUST** implement at least one method for discovering XSI documents.
- It is **RECOMMENDED** to discover the XSI document immediately upon tuning to a service.
- It is **RECOMMENDED** to cache any discovered documents as per standard HTTP behaviour

For directory service providers implementing the ingestion of RadioEPG documents:

- You **MUST** implement at least one method for discovering XSI documents.
- It is **STRONGLY RECOMMENDED** to discover XSI documents by using 6.2.2 Using link within pages of the Service Website or 6.2.3 Using placement in a defined location on the Service Website.

## 6.4 Contents

Many elements in the XSI document are taken from the DAB EPG XML specification [4], and will be referred to as such in the text and XSD definitions. The following sections detail the points where the specifications diverge and other important notes.

An example of an XSI is shown in A.1 Example XSI Document.

The namespace of the document is specific to the RadioEPG XSI document, but the DAB EPG XML namespace is also referenced in order to utilise common datatypes.

### 6.4.1 serviceInformation

This is the root element of an XSI file and can contain the following elements:

- `services`
- `groups`

Its attributes are detailed below:

Attribute	Description	Type	Status
<code>creationTime</code>	<b>Document creation datetime</b> Service broadcast RDS PI code.	<i>epg:timePointType</i>	
<code>originator</code>	<b>Originator</b> Describes the originator of the schedule	<i>epg:originatorType</i>	
<code>serviceProvider</code>	<b>Service Provider</b> Describes the service provider	<i>epg:serviceProviderType</i>	
<code>xml:lang</code>	<b>Document Language</b> Defines the base language of the document	<i>xml:lang</i>	<i>Mandatory</i>

## 6.4.2 services

Contains zero or more `service` elements

## 6.4.3 service

Describes metadata and available bearers for a service.

Can contain the following elements:

- `serviceID`
- `radiodns`

It also uses the following elements from the DAB EPG XML Specification:

- Service Name Group (`epg:shortName`, `epg:mediumName`, `epg:longName`)
- Media Description (`mediaDescription`)
- `genre`
- `keywords`
- `link`

## 6.4.4 radiodns

This element is used to signal RadioDNS lookup parameters for the service, and can be used in the discovery of additional RadioDNS applications as per the RadioDNS specification [2], section 6.

Parameters	Description	Value	Status
<code>fqdn</code>	<b>RadioDNS Authoritative FQDN</b> The Authoritative FQDN used in the discovery of RadioDNS applications when no broadcast parameters are available.	<i>Valid domain</i>	<i>mandatory</i>
<code>serviceIdentifier</code>	<b>RadioDNS Service Identifier</b> The Service Identifier used in the discovery of RadioDNS applications when no broadcast parameters are available.	<i>16 lower case characters in the range [a-z] [0-9]</i>	<i>mandatory</i>

## 6.4.5 serviceID

Describes an individual bearer upon which this service is carried.

The bearer string is given in a URI format, with the scheme specific to the bearer platform. The following sections detail the schemes as defined within this version of the RadioEPG specification

Its attributes are detailed below:

Attribute	Description	Type	Status
cost	<b>Bearer Cost</b> An indication of a relative 'cost' of acquiring the service from the service provider. This is intended to be used by the device as a means of selecting an appropriate bearer to use.  This is detailed in 8.1 Initial Bearer Selection	<i>Non-negative non-zero integer</i>	<i>Mandatory</i>
mime	<b>MIME Type</b> The MIME Type of the audio carried by the bearer.	<i>Valid mimetype</i>	<i>Dependant on the bearer</i>
bitrate	<b>Audio Bitrate</b> Bitrate of the audio carried by the bearer, in kilobits per second (kbps).	<i>integer</i>	<i>Dependant on the bearer</i>
offset	<b>Audio Offset</b> An indication of the offset given to the audio feed on this bearer by the service provider, in milliseconds relative to bearers given an offset of zero.	<i>Non-negative integer</i>	<i>Optional, defaults to zero</i>

#### 6.4.5.1 VHF/FM

The bearer string for a VHF/FM service is constructed as follows:

fm: (<ecc>|<country>).<pi>.<freq>

The parameters are populated with the following values:

Parameters	Description	Value	Status
ecc	<b>Extended Country Code (ECC) and country code</b> Service broadcast RDS [5] ECC concatenated with the first character of the broadcast RDS PI code (country code) must be supplied if available.	<i>3-char hexadecimal</i>	<i>mutually exclusive</i>
country	<b>ISO 3166 two-letter country code</b> In the event that a service broadcast ECC is unavailable, an ISO 2-letter country code [6] must be provided.	<i>2-char string</i>	
pi	<b>Programme Identification (PI)</b> Service broadcast RDS PI code.	<i>4-char hexadecimal</i>	<i>mandatory</i>
frequency	<b>Frequency</b> Frequency on which the service broadcast is received, formatted to 5 characters in units of 100KHz. Frequencies below 100MHz must be supplied with a leading zero, for example 95.8MHz would be represented as 09580, 104.9MHz as 10490.	<i>5-char string</i>	<i>mandatory</i>

For a detailed explanation on these parameters and their values, please refer to the VHF/FM section of RDNS01 [2].

#### 6.4.5.2 DAB/DAB+ Digital Radio

The bearer string for a DAB/DAB+ Digital Radio service is constructed as follows:

<http://radiodns.org/>

dab:<ecc>.<eid>.<sid>.<scids>[. (<appty-uetype>|<pa>)]

The parameters are populated with the following values:

Parameters	Description	Value	Status
ecc	<b>Extended Country Code (ECC)</b> Service broadcast multiplex ECC code.	3-char hexadecimal	mandatory
eid	<b>Ensemble Identifier (Eid)</b> Service broadcast multiplex ensemble ID code.	4-char hexadecimal	mandatory
sid	<b>Service Identifier (Sid)</b> Service broadcast identifier.	4 or 8-char hexadecimal	mandatory
scids	<b>Service Component Identifier within the Service (SCIDs)</b> Service broadcast component identifier within the service.	1 or 3-char hexadecimal	mandatory

If an audio service is delivered as data via X-PAD, the following additional parameter is mandatory:

Parameters	Description	Value	Status
appty- uetype	<b>X-PAD Application Type (AppTy) and User Application type (UATYPE)</b> The X-PAD Application Type number and User Application Type, concatenated with a hyphen (only for applications broadcast in X-PAD). Where Application Types are allocated in pairs, the lower value (indicating the start of the application data group) must be used.	2-char hexadecimal, hyphen, 3-char hexadecimal	mandatory, when referring to an X-PAD component, otherwise omitted

If an audio service is delivered as data in an independent Service Component, the following additional parameter is mandatory:

Parameters	Description	Value	Status
pa	<b>Packet Address</b> Packet address of the data service delivering the audio service.	integer, between 1 and 1023	mandatory, when referring to a data service component, otherwise omitted

For a detailed explanation on these parameters and their values, please refer to the DAB/DAB+ section of RDNS01 [2].

The mime attribute is **MANDATORY** for this bearer, and should be defined as audio/mpeg for DAB and audio/aacp for DAB+ services.

### 6.4.5.3 Digital Radio Mondiale (DRM)/AM Signalling System (AMSS)

The bearer string for a DRM/AMSS service is constructed as follows:

(drm|amss):<sid>

The parameters are populated with the following values:

Parameters	Description	Value	Status
------------	-------------	-------	--------

sid	<b>Service Identifier (Sid)</b> Service broadcast identifier.	6-char hexadecimal	mandatory
-----	--	-----------------------	-----------

For a detailed explanation on these parameters and their values, please refer to the DRM/AMSS section of RDNS01 [2].

The `mime` attribute is **MANDATORY** for DRM, and should be defined as the MIME type of the encoded audio stream.

#### 6.4.5.4 iBiquity Digital Corporation's HD Radio™ (HD Radio™)

The bearer string for a HD Radio™ [7] service is constructed as follows:

hd:<cc>.<tx>.<frequency>

The parameters are populated with the following values:

Parameters	Description	Value	Status
cc	<b>Country Code</b> Service broadcast country code	3-char hexadecimal	mandatory
tx	<b>Transmitter Identifier</b> Service broadcast identifier	5-char hexadecimal	mandatory
frequency	<b>Frequency</b> Frequency on which the service broadcast is received, formatted to 5 characters in units of 100KHz. Frequencies below 100MHz must be supplied with a leading zero, for example 95.9MHz would be represented as 09590, 104.9MHz as 10490.	5-char string	

For a detailed explanation on these parameters and their values, please refer to the HD Radio™ section of RDNS01 [2].

#### 6.4.5.5 HTTP-based

The bearer string takes the form of a valid URL as defined in the HTTP specification [3].

The `mime` attribute is **MANDATORY** and must indicate the MIME type of the audio codec carried in the HTTP response.

The `bitrate` attribute is **RECOMMENDED** and should indicate the bitrate of the audio stream.

The parameters are populated with the following values:

Parameters	Description	Value	Status
mime	<b>MIME Type</b> Audio stream MIME type	string	mandatory
bitrate	<b>Stream Bitrate</b> Bitrate of the audio stream (kbps).	Non-zero, non-negative integer	

For example:

```
<serviceID id="http://media-ice.musicradio.com/Capital" mime="audio/aacp"
bitrate="48" offset="6000" cost="40"/>
```

### 6.4.5.6 Other Bearers

While other bearers exist over which audio can be carried (e.g. DVB, IPTV, etc.) this version of the RadioEPG specification does not define the format by which they may be expressed.

### 6.4.6 memberOf

This can be used to group services together for the purposes of similar service selection or presentation to a user. A service may be a member of zero or more groups, using zero or more `memberOf` elements.

The group the service belongs to is indicated with the `id` attribute in the following manner:

Parameters	Description	Value	Status
<code>id</code>	<b>Group Identifier</b> An identifying string for the group.	<i>string</i>	<i>mandatory</i>

Other members of the group should share this identifier to be placed in the same group, and the group should be defined with the exact identifying string as stated within the group definition within the relevant `group` element (see 6.4.8 `group`).

### 6.4.7 groups

Contains zero or more `group` elements.

### 6.4.8 group

This can be used to hold the details of a group, which can be used to group services together for the purposes of similar service selection or presentation to a user. The ID of the group is contained within the `id` attribute in the following manner:

Parameters	Description	Value	Status
<code>id</code>	<b>Group Identifier</b> An identifying string for the group.	<i>string</i>	<i>mandatory</i>

It can also contain the following descriptive elements from the DAB EPG XML Specification:

- Service Name Group (`epg:shortName`, `epg:mediumName`, `epg:longName`)
- Media Description (`mediaDescription`)
- `genre`
- `keywords`
- `link`

These are all specific to the group they are specified within.

A service wishing to be a member of the group should use this group identifier in their `memberOf` element (see 6.4.6 `memberOf`). A group may contain zero or more services.

## 7. PI document

This document contains programme information for a particular service and is an extension of the PI file in the DAB EPG XML specification [4].

New elements are added in the RadioEPG namespace to provide additional functionality, and the filename conventions and method of discovery differs to that of the core DAB EPG XML specification. It is important to note that, because of this and the fact that the DAB EPG XML PI XSD declaration does not explicitly accommodate elements foreign to its own namespace, a strict validation of this augmented PI file against the PI XSD will fail.

### 7.1 Location

The document is acquired using a URL constructed using the format:

```
http://<host>:<port>/<broadcast parameters>/<date>_PI.xml
```

Where `host` and `port` are populated by the host and port values obtained from the SRV record lookup for the RadioEPG application.

PI documents are stored as a file per day's schedule contained within. The `date` value represents the day you wish to obtain the schedule for. It is populated in the format `YYYYMMDD`, for example Sunday, 9<sup>th</sup> October, 2011 would be represented as `20111009`.

The `broadcast parameters` segment is based on the bearer of the service being consumed and is specified in the following subsections, specific to each bearer.

#### 7.1.1 VHF/FM

The broadcast parameters value for a VHF/FM service PI request URI is constructed as follows:

```
fm/(<ecc>|<country>)/<pi>/<freq>
```

The parameters are populated with the following values:

Parameters	Description	Value	Status
<code>ecc</code>	<b>Extended Country Code (ECC) and country code</b> Service broadcast RDS [5] ECC concatenated with the first character of the broadcast RDS PI code (country code) must be supplied if available.	<i>3-char hexadecimal</i>	<i>mutually exclusive</i>
<code>country</code>	<b>ISO 3166 two-letter country code</b> In the event that a service broadcast ECC is unavailable, an ISO 2-letter country code [6] must be provided.	<i>2-char string</i>	
<code>pi</code>	<b>Programme Identification (PI)</b> Service broadcast RDS PI code.	<i>4-char hexadecimal</i>	<i>mandatory</i>
<code>frequency</code>	<b>Frequency</b> Frequency on which the service broadcast is received, formatted to 5 characters in units of 100KHz. Frequencies below 100MHz must be supplied with a leading zero, for example 95.8MHz would be represented as 09580, 104.9MHz as 10490.	<i>5-char string</i>	<i>mandatory</i>

A server must implement URLs for both `ecc` and `country` values to handle a situation where the device may not acquire the RDS ECC.

For a detailed explanation on these parameters and their values, please refer to the VHF/FM section of RDNS01 [2].

### 7.1.2 DAB/DAB+ Digital Radio

The broadcast parameters value for a DAB/DAB+ Digital Radio service PI request URI is constructed as follows:

dab/<ecc>/<eid>/<sid>/<scids>/ [ (<appty-ua-type>|<pa> ) ]

The parameters are populated with the following values:

Parameters	Description	Value	Status
ecc	<b>Extended Country Code (ECC)</b> Service broadcast multiplex ECC code.	3-char hexadecimal	mandatory
eid	<b>Ensemble Identifier (Eid)</b> Service broadcast multiplex ensemble ID code.	4-char hexadecimal	mandatory
sid	<b>Service Identifier (Sid)</b> Service broadcast identifier.	4 or 8-char hexadecimal	mandatory
scids	<b>Service Component Identifier within the Service (SCIDs)</b> Service broadcast component identifier within the service.	1 or 3-char hexadecimal	mandatory

If the audio service is delivered as data via X-PAD, the following additional parameter is mandatory:

Parameters	Description	Value	Status
appty-ua-type	<b>X-PAD Application Type (AppTy) and User Application type (UATYPE)</b> The X-PAD Application Type number and User Application Type, concatenated with a hyphen (only for applications broadcast in X-PAD). Where Application Types are allocated in pairs, the lower value (indicating the start of the application data group) must be used.	2-char hexadecimal, hyphen, 3-char hexadecimal	mandatory, when referring to an X-PAD component, otherwise omitted

If the audio service is delivered as data in an independent Service Component, the following additional parameter is mandatory:

Parameters	Description	Value	Status
pa	<b>Packet Address</b> Packet address of the data service delivering the audio service.	integer, between 1 and 1023	mandatory, when referring to a data service component, otherwise omitted

For a detailed explanation on these parameters and their values, please refer to the DAB/DAB+ section of RDNS01 [2].



### 7.1.3 Digital Radio Mondiale (DRM)/AM Signalling System (AMSS)

The broadcast parameters value for a DRM/AMSS service PI request URI is constructed as follows:

(drm|amss)/<sid>

The parameters are populated with the following values:

Parameters	Description	Value	Status
sid	<b>Service Identifier (Sid)</b> Service broadcast identifier.	6-char hexadecimal	mandatory

For a detailed explanation on these parameters and their values, please refer to the DRM/AMSS section of RDNS01 [2].

### 7.1.4 iBiquity Digital Corporation's HD Radio™ (HD Radio™)

The broadcast parameters value for a HD Radio™ [7] service PI request URI is constructed as follows:

hd/<cc>/<tx>

The parameters are populated with the following values:

Parameters	Description	Value	Status
cc	<b>Country Code</b> Service broadcast country code	3-char hexadecimal	mandatory
tx	<b>Transmitter Identifier</b> Service broadcast identifier	5-char hexadecimal	mandatory

For a detailed explanation on these parameters and their values, please refer to the HD Radio™ section of RDNS01 [2].

### 7.1.5 IP-delivered audio service

The broadcast parameters value for a request URI when receiving IP-delivered audio is constructed as follows:

id/<sid>

The parameters are populated with the following values:

Parameters	Description	Value	Status
sid	<b>Service Identifier</b> Unique identifier of the service for all documents within the scope of the service provider.  This <b>MUST</b> match the <code>ServiceIdentifier</code> parameter signalled for the IP stream as per the RadioDNS Specification [2], and the <code>serviceIdentifier</code> attribute on the <code>radiodns</code> element of the service in the relevant XSI document.	16 lower case characters in the range [a-z] [0-9]	mandatory

## 7.2 Contents

All standard elements within the DAB EPG XML specification can be used, in the format the specification states. The RadioEPG specification adds to this with extra elements in the RadioEPG namespace, detailed in the following sections.

### 7.2.1 bearer

This element exists under the core DAB EPG XML `location` element of each programme, and details the non-DAB bearers that this programme is available on, in the same way that the core DAB EPG XML `bearer` element does for DAB bearers.

Its attributes are formatted in the same way as for the `serviceID` element in the XSI, as detailed in 6.4.5 `serviceID`.

Defining any `bearer` elements within the `location` element of a `programme` element will override a global declaration of bearers in the XSI for the service the programme is carried on, over the duration of the programme. This applies across both core DAB EPG XML bearers and RadioEPG bearers.

## 8 Broadcast/IP Service Following

Intelligent switching between broadcast and streaming can be used to provide the client with a common experience between different bearers of the same service, appropriate to the situation. It can also optimise the costs associated with the different bearers, e.g. by using broadcast instead of IP streaming.

It is important to note that Service Following using RadioEPG is not intended to be a replacement for similar bearer-specific functionality, for instance the AF/Service Following techniques on broadcast platforms. It is intended for a receiver to follow between IP-delivered and broadcast bearers.

Service following can be defined globally in the XSI document, and on a per-programme basis in the PI document.

### 8.1 Initial Bearer Selection

It is up to a device or client to select an initial bearer, but it is **RECOMMENDED** that this be a function of device/client preference, possible user preference and indicated bearer cost.

The device should determine the relative preference between certain bearers based on device functionality (e.g. what bearers the device is able to use, available codecs).

The device may wish to expose a degree of choice of bearer to the user and allow them to indicate a preference to a particular bearer. This may also be an indirect consequence of a user action – for example, if a user deactivates WiFi functionality on a mobile/cellular network phone, the device may decide to use FM instead of IP streaming over mobile data.

A *cost* is indicated against each bearer for a service, as determined by the service provider and indicates an order of preference *in respect to the service provider*. This is a relative non-negative non-zero integer which can be used to select the *best preferred* from the bearer list. A lower value of cost should be preferred.

A device/client should start from the most preferred bearer and work down the list until a successful reception is made.

The device may apply rules to determine a successful reception, such as whether the broadcast signal quality is sufficiently strong, or whether an IP connection can be made.

### 8.2 Bearer Switching Behaviour

Service following information provided in XSI allows the device to consider a transition to IP streaming of the current service when all possible service following possibilities in the broadcast domain for the current service have been exhausted. It also allows a device receiving a service through IP streaming to consider switching to

the same service on broadcast.

In all cases, the provided cost preferences should be considered in the decision to switch between broadcast and IP, and when deciding which broadcast to switch to if multiple equitable options are available.

Information provided in the XSI shall not be used in preference to information provided by the current broadcast platform, such as AF information in RDS-FM and Service Following information in DAB. Where the broadcast platform allows signalling of similar services, such as Soft Links in DAB, the device may decide whether to offer the user a switch to the same service on IP streaming, or one of the alternative similar services specified in the broadcast domain.

For example; a service is currently being received on DAB. DAB Service Following provides alternative locations for the current service on other ensembles and on FM radio, but none of the signals are of acceptable quality.

The device inspects the RadioEPG Service Following information, finds an appropriate IP streaming bearer for the current service, and switches to that. The device continues to monitor the broadcast signals available to it, and finds that the same service is now available with equitable signal qualities on both DAB and FM.

The service provider has specified a lower-cost for the DAB bearer, so the device switches from IP Streaming to DAB. Devices should implement appropriate strategies for managing the frequency and duration of switches between IP and broadcast.

The value of the *offset* of a particular bearer, relative to a zero baseline, allows the device to implement functionality to attempt co-timing when switching bearers. It should be noted that any offset is an indicative, rather than precise, value.

### 8.3 Implementation

The following matrix gives the conditions under which Service Following to another bearer may or may not be implemented by a device:

XSI Available Bearers defined for this service	PI Available		Device Behaviour
		Bearers defined in current programme	
N	N	-	Service following <b>not</b> allowed
Y	N	-	Service following allowed to bearers defined for this service, within the XSI
Y	Y	N	Service following allowed to bearers defined for this service, within the XSI
Y	Y	Y	Service following allowed to bearers defined for the current programme, within the <code>location</code> element of the PI
N	Y	Y	Service following allowed to bearers defined for the current programme, within the <code>location</code> element of the PI
N	Y	N	Service following <b>not</b> allowed

*Available* and *Unavailable* refer to whether a document (XSI or PI) can or cannot be retrieved using HTTP as per 5. Document retrieval.

*Bearer present* refers to a bearer being within the document, either within the `service` element of the XSI file, or the `location` element of the current programme within the PI file. This signals that the bearer is allowed for that service/programme.

*Bearer missing* refers to a bearer not being within the document, either within the `service` element of the

XSI file, or the `location` element of the current programme within the PI file. This signals that the bearer is not allowed for that service/programme.

A Service Provider may wish to signal different bearer availability on a per-programme for a variety of reasons, e.g. to enforce licensing restrictions.

A Service Provider wishing to allow Service Following **MUST** provide bearer information in the XSI document, and **MAY** provide a PI document with programme-specific bearer information.

## 9 Preference of RadioEPG over existing EPG delivery methodologies

It is acknowledged that DAB and DRM have existing methods in place for the delivery of EPG data over the broadcast platform. This specification is not designed to replace these. However, it may only be possible for some service providers to offer EPG data over IP through a system such as RadioEPG. The aim of this specification is to provide a common method for multiple audio delivery protocols for radio.

On certain radio services it is possible that EPG data may be available both as part of a broadcast and also via RadioEPG over IP. In this case, it is up to device implementation which data is used.

It is **RECOMMENDED** that service providers ensure any broadcast EPG data is similarly available over IP using RadioEPG.

# Annex A: Example RadioEPG Documents

## A.1 Example XSI Document

```
<?xml version="1.0" encoding="UTF-8"?>
<serviceInformation xmlns="http://radiodns.org/schemas/repGXSI/10"
  xmlns:epg="http://www.worlddab.org/schemas/epgDataTypes/14"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://radiodns.org/schemas/repGXSI/10 repGXSI_10.xsd"
  creationTime="2011-07-01T00:00:00" originator="Global Radio" serviceProvider="Global Radio"
  xml:lang="en">
  <services>
    <service>
      <radiodns fqdn="rdns.musicradio.com" serviceIdentifier="caplon"/>
      <serviceID id="dab:ce1.c185.c586.0" mime="audio/aacp" delay="3000" cost="10"/>
      <serviceID id="fm:ce1.c586.09580" cost="30"/>
      <serviceID id="http://media-ice.musicradio.com/Capital" offset="4000" mime="audio/aacp"
        bitrate="48" cost="40"/>
      <serviceID id="http://media-ice.musicradio.com/CapitalMP3Low" offset="4000" mime="audio/mpeg"
        bitrate="48" cost="40"/>
      <epg:shortName xml:lang="en">Capital</epg:shortName>
      <epg:mediumName xml:lang="en">95.8 Capital FM</epg:mediumName>
      <epg:longName xml:lang="en">95.8 Capital FM</epg:longName>
      <mediaDescription>
        <epg:shortDescription xml:lang="en">London's No.1 Hit Music Station</epg:shortDescription>
      </mediaDescription>
      <mediaDescription>
        <epg:multimedia url="http://musicradio.com/devices/ip/capital/london/capital_logo.png"
          type="logo_colour_square"/>
      </mediaDescription>
      <keywords xml:lang="en">London, music, pop, rock, dance, urban</keywords>
      <link url="http://www.capitalfm.com/london" mimeType="text/html" xml:lang="en"/>
      <memberOf id="CapitalNetwork"/>
    </service>
  </services>
  <groups>
    <group id="CapitalNetwork">
      <epg:shortName xml:lang="en">Capital</epg:shortName>
      <epg:mediumName xml:lang="en">Capital Network</epg:mediumName>
      <epg:longName xml:lang="en">The Capital Network</epg:longName>
      <mediaDescription>
        <epg:shortDescription xml:lang="en">The Capital Network</epg:shortDescription>
      </mediaDescription>
      <mediaDescription>
        <epg:multimedia url="http://musicradio.com/devices/ip/capital/capital_network.png"
          type="logo_colour_square"/>
      </mediaDescription>
      <keywords xml:lang="en">music, pop, rock, dance, urban</keywords>
      <link url="http://www.capitalfm.com/london" mimeType="text/html" xml:lang="en"/>
    </group>
  </groups>
</serviceInformation>
```

## A.2 Example PI Document

```
<?xml version="1.0" encoding="UTF-8"?>
<epg xmlns="http://www.worlddab.org/schemas/epgSchedule/14"
  xmlns:epg="http://www.worlddab.org/schemas/epgDataTypes/14"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:repg="http://www.radiodns.org/schemas/repgPI/10"
  http://www.radiodns.org/schemas/repgPI/10/repgPI_10.xsd"
  system="DAB"
  xsi:schemaLocation="http://www.worlddab.org/schemas/epgSchedule/14
  http://www.worlddab.org/schemas/epgSchedule/14/epgSchedule_14.xsd"
  xml:lang="en">
  <schedule version="1" creationTime="2009-10-05T00:00:00+01:00" originator="Global Radio">
    <scope startTime="2009-10-05T06:00:00+01:00" stopTime="2009-10-05T13:00:00+01:00">
      <serviceScope id="ce1.c185.c586.0"/>
    </scope>
    <programme shortId="1190223" id="crid://thisisglobal.com/1190223" recommendation="yes">
      <epg:shortName>B'fast</epg:shortName>
      <epg:mediumName>Johnny & Lisa</epg:mediumName>
      <epg:longName>Capital Breakfast With Johnny & Lisa</epg:longName>
      <epg:location>
        <epg:time time="2009-10-05T06:00:00+01:00" duration="PT4H0M0S" actualTime="2009-10-05T06:00:00+01:00" actualDuration="PT4H0M0S"/>
        <epg:bearer id="ce1.c185.c586.0"/>
        <repg:bearer id="dab:ce1.c185.c586.0" mime="audio/mpeg" bitrate="128" cost="10"/>
        <repg:bearer id="fm:ce1.c586.09580" cost="30"/>
        <repg:bearer id="http://media-ice.musicradio.com/Capital" offset="4000" mime="audio/aacp"
  bitrate="56" cost="40"/>
        <repg:bearer id="http://vis.media-ice.musicradio.com/CapitalMP3Low" mime="audio/mpeg"
  bitrate="56" cost="40"/>
      </epg:location>
      <epg:mediaDescription>
        <epg:shortDescription>Forget the coffee, Johnny and Lisa provide the perfect morning pick-me-up
  with a blend of the latest hits, travel news and incomparable morning banter.</epg:shortDescription>
      </epg:mediaDescription>
      <epg:genre href="urn:tva:metadata:cs:ContentCS:2002:3.6.8">
        <epg:name><![CDATA[ Electronic/Club/Urban/Dance]]></epg:name>
      </epg:genre>
      <epg:genre href="urn:tva:metadata:cs:IntentionCS:2002:1.1">
        <epg:name><![CDATA[ ENTERTAINMENT]]></epg:name>
      </epg:genre>
      <epg:memberOf shortId="1000" id="crid://thisisglobal.com/Capital/breakfastGroup"/>
      <epg:link url="mailto:capital.breakfast@capitalfm.com" description="Email:"/>
      <epg:link url="http://www.capitalfm.com/on-air/breakfast-show/" description="Web:"/>
      <epg:programmeEvent shortId="11902231" id="crid://thisisglobal.com/1190223/1"
  recommendation="yes">
        <epg:shortName xml:lang="en">Pun</epg:shortName>
        <epg:mediumName xml:lang="en">No.1 Pun</epg:mediumName>
        <epg:longName xml:lang="en">London's No. 1 Pun</epg:longName>
        <epg:location>
          <epg:relativeTime time="PT3H10M" duration="PT25M"/>
        </epg:location>
        <epg:mediaDescription>
          <epg:shortDescription xml:lang="en">Can you come up with London's No.1 Pun for our story of
  the day?</epg:shortDescription>
        </epg:mediaDescription>
      </epg:programmeEvent>
    </programme>
  </schedule>
</epg>
```

## Annex B: XSD Definitions

### B.1 XSI XSD

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns="http://radiodns.org/schemas/repGXSIXSI/10"
  targetNamespace="http://radiodns.org/schemas/repGXSIXSI/10"
  xmlns:epg="http://www.worlddab.org/schemas/epgDataTypes/14"
  xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
  attributeFormDefault="unqualified">

  <xs:import namespace="http://www.w3.org/XML/1998/namespace"
    schemaLocation="http://www.w3.org/2001/xml.xsd" />
  <xs:import namespace="http://www.worlddab.org/schemas/epgDataTypes/14"
    schemaLocation="http://www.worlddab.org/schemas/epgDataTypes/14/epgDataTypes_14.xsd" />

  <xs:element name="serviceInformation">
    <xs:annotation>
      <xs:documentation xml:lang="en">Service information
        includes the structure of and information about its bearers and
        associated services</xs:documentation>
    </xs:annotation>
    <xs:complexType>
      <xs:sequence>
        <xs:element name="services" type="servicesType"
          minOccurs="0" maxOccurs="1" />
        <xs:element name="groups" type="groupsType" minOccurs="0"
          maxOccurs="1" />
      </xs:sequence>
      <xs:attribute name="creationTime" type="epg:timePointType" />
      <xs:attribute name="originator" type="epg:originatorType" />
      <xs:attribute name="serviceProvider" type="epg:serviceProviderType" />
      <xs:attribute ref="xml:lang" use="required" />
    </xs:complexType>
  </xs:element>

  <xs:complexType name="groupsType">
    <xs:sequence>
      <xs:element name="group" type="groupType" maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="servicesType">
    <xs:sequence>
      <xs:element name="service" type="serviceType" maxOccurs="unbounded" />
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="serviceType">
    <xs:sequence>
      <xs:element name="serviceID" type="serviceIDType"
        maxOccurs="unbounded" />
      <xs:group ref="epg:serviceNameGroup" maxOccurs="unbounded" />
      <xs:element name="mediaDescription" type="epg:mediaDescriptionType"
        minOccurs="0" maxOccurs="unbounded" />
      <xs:element name="genre" type="epg:genreType" minOccurs="0"
        maxOccurs="unbounded" />
      <xs:element name="keywords" type="epg:keywordsType"
        minOccurs="0" maxOccurs="unbounded" />
      <xs:element name="link" type="epg:linkType" minOccurs="0"
        maxOccurs="unbounded" />
      <xs:element name="memberOf" type="memberOfType" minOccurs="0" />
      <xs:element name="radiodns" type="radiodnsType" minOccurs="0" />
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="memberOfType">
    <xs:attribute name="id" type="xs:string" use="required" />
  </xs:complexType>

  <xs:complexType name="radiodnsType">
    <xs:attribute name="fqdn" type="xs:string" use="required" />
    <xs:attribute name="serviceIdentifier" type="xs:string" use="required" />
  </xs:complexType>

  <xs:complexType name="serviceIDType">
    <xs:attribute name="id" type="xs:anyURI" />
    <xs:attribute name="mime" type="xs:string" />
  </xs:complexType>
```

```

    <xs:attribute name="bitrate" type="xs:nonNegativeInteger" />
    <xs:attribute name="cost" type="xs:nonNegativeInteger" />
    <xs:attribute name="offset" type="xs:nonNegativeInteger" default="0"/>
</xs:complexType>

<xs:complexType name="groupType">
  <xs:sequence>
    <xs:group ref="epg:serviceNameGroup" maxOccurs="unbounded" />
  </xs:sequence>
  <xs:element name="mediaDescription" type="epg:mediaDescriptionType"
    minOccurs="0" maxOccurs="unbounded" />
  <xs:element name="genre" type="epg:genreType" minOccurs="0"
    maxOccurs="unbounded" />
  <xs:element name="keywords" type="epg:keywordsType"
    minOccurs="0" maxOccurs="unbounded" />
  <xs:element name="link" type="epg:linkType" minOccurs="0"
    maxOccurs="unbounded" />
  <xs:attribute name="id" type="xs:string" />
</xs:complexType>

</xs:schema>

```

## B.2 PI XSD Extensions

As the PI XML file has been added to with the RadioEPG-specific bearer element, it may no longer be deemed valid by a strict parser. However, for reference purposes, the following element is defined:

```
<xs:element name="bearer" type="serviceIDType"/>
```



## History

Document history		
V0.6.1	June, 2009	Working Draft
V1.0.0	August, 2011	Publication

DRAFT