RadioDNS Technical Specification

RDNS01 V1.0.0 (2012-02)

A centralised lookup for radio services.

The RadioDNS Project

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Contents

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Foreword

Radio devices should be aware of what applications are available on the Internet for each radio service it receives. Standardising the ability to locate these applications would allow a manufacturer to support internet-based applications on a per radio service basis directly on the device. The ability to locate applications is equally applicable for devices that have a permanent connection to the Internet as it is for devices with periodic connectivity, such as media players that dock with a computer or hand-held devices with Wi-Fi capabilities.

This document standardises a method to facilitate both the location of resources hosted by radio service providers and the the discovery of their associated applications. This method utilises the existing DNS.

The definition of resource location is relevant across IP based and multiple non-IP based transmission systems; VHF/FM, DAB/DAB+ Digital Radio [1], Digital Radio Mondiale [2]/AM Signalling System [3], HD Radio™ [4]. Resources can be offered for both traditional 'as live' linear listening as well as non-linear listening such as podcasts, time-shifted or on-demand content.

RadioDNS standardises a method for advertising applications and applications wishing to use this methodology must use this method of advertising.

1. Scope

The present document defines the methodology for discovering an Authoritative FQDN for an audio service based on its broadcast parameters. It also specifies how application discovery is performed from this FQDN.

The present document does not discuss specific applications built upon the RadioDNS methodology. This is within the scope of individual specification documents from the RadioDNS project, which can be found at: http://radiodns.org/docs

The present document does not discuss the administration and governance of the RadioDNS project, this is within the scope of a separate document [5].

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] ETSI EN 300 401: 'Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers'

[2] ETSI ES 201 980, 'Digital Radio Mondiale (DRM); System Specification'

[3] ETSI TS 102 386, 'Digital Radio Mondiale (DRM); AM signalling system (AMSS)'

[4] NRSC-5-B:2008, 'In-band/on-channel Digital Radio Broadcasting Standard'

[5] RVIS02: 'RadioDNS Administration and Governance'

[6] RFC 1035 (1987): 'Domain Names – Implementation and Specification'

[7] RFC 3761 (2004), 'The E.164 to Uniform Resource Identifiers (URI) Dynamic Delegation Discovery System (DDDS) Application (ENUM)'

[8] 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'

[9] NRSC-4-A: 'Specification of the radio broadcast datasystem (RBDS)'

[10] ISO 3166-1, 'Codes for the representation of names of countries and their subdivisions – Part 1: Country codes'

[11] RFC 2782 (2000): "A DNS RR for specifying the location of services (DNS SRV)"

[12] ICY protocol specification: http://forums.radiotoolbox.com/viewtopic.php?t=74

[13] Advanced Systems Format (ASF) specification - http://www.microsoft.com/downloads/en/details.aspx?FamilyID=56de5ee4-51ca-46c6-903b-97390ad14fea

[14] Flash Audio: http://en.wikipedia.org/wiki/Adobe_Flash#Flash_Audio

[15] Flash Remote Shared Objects: http://help.adobe.com/en_US/FlashMediaServer/3.5_Deving/WS5b3ccc516d4fbf351e63e3d11a0773d37a-7fff.html#WS5b3ccc516d4fbf351e63e3d11a0773d37a-7ffa

[16] REPG01: 'RadioEPG Technical Specification' v.1.0

3. Definitions and abbreviations

3.1 Definitions

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

Authoritative FQDN: a domain for a service provider, of which the service provider has total administrative control, which provides a basis from which the advertisement of applications can be made

Service: an audio service such as a talk or music radio station

Service Provider: the organisation providing a service

Nibble: a four-bit aggregation, or half an octet

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/DAB+	Digital Audio Broadcasting
DNS	Domain Name System
DRM	Digital Radio Mondiale
ECC	Extended Country Code
FCC	Federal Communications Commission (of the United States of America)
FQDN	Fully Qualified Domain Name
IP	Internet Protocol
NS	Name Server
ODA	RDS Open Data Applications
RBDS	Radio Broadcast Data System
RDS	Radio Data System
SRV	DNS Service record
SId	Service Identifier
VHF/FM	Very High Frequency/Frequency Modulation

4. Overview

The methodology is based upon the existing DNS methodology [6]. DNS is utilised by compiling broadcast service identifiers in to a FQDN to allow look up. This domain is resolved to locate a CNAME pointing to the Authoritative FQDN for a service provider. From this it is then possible to discover which applications are supported by the service provider.

The basis for this methodology broadly follows that used to map E.164 format telephone numbers to URIs [7].

No user identifiable information is distributed.

5. Authoritative FQDN resolution for broadcast audio services

For broadcast protocols it is initially required to construct a FQDN based upon the broadcast parameters of the service being requested. Querying DNS with this FQDN will return a single CNAME record for the radio service provider's own Authoritative FQDN.

The FQDN's constructed are based upon the NS records for the domain `radiodns.org`, a domain whose administration is overseen by the RadioDNS project.

If the broadcast parameters change without user intervention, the DNS must be queried again with a newly constructed FQDN. Any existing application connections must be closed and reconnected using the newly acquired Authoritative FQDN.

5.1 RadioDNS FQDN construction

The schema for the initial FQDN used to query the `radiodns.org` NS records is dependent on the service bearer and is explained in the following sections of the present document.

The following note is for users of previous versions of this specification in order to highlight an important clarification, and will not be present in subsequent versions:

> Previous versions of this specification specified `ecc` as a parameter. This was potentially confusing as it was not the same as ECC provided by DAB/DAB+ and VHF/FM RDS. To clarify this, the parameter has been renamed `gcc`. The construction of `gcc` as a compound parameter of ECC and the Country Code remains unchanged.

5.1.1 VHF/FM

The VHF/FM system supports identification of a radio service through transmission of meta-data by using RDS [8] or RBDS [9].

The FQDN for a VHF/FM service is compiled as follows:

`<frequency>.<pi>.(<gcc>|<country>).fm.radiodns.org`

The parameters are populated with the following values:

Parameters	Description	Value	Status
`gcc`	**Global Country Code** The Country Code (first nibble of the broadcast RDS PI code) concatenated with the broadcast RDS [7] ECC.	*3-char hexadecimal*	*mandatory, mutually exclusive*
`country`	**ISO 3166 two-letter country code** In the event that a service broadcast ECC is unavailable, an	*2-char string*	

	ISO 2-letter country code [10] must be provided.		
`pi`	**Programme Identification (PI)** Service broadcast RDS PI code.	*4-char hexadecimal*	*mandatory*
`frequency`	**Frequency** 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.	*5-char string*	*mandatory*

In order to construct the GCC, the device should acquire the ECC and PI values by inspection of the RDS or RBDS for the received radio service.

For example, given an ECC of `e1` and a PI of `c586` this will result in a GCC of `ce1`

It is recommended that the device set a value for `country` to be used if acquisition of the `ecc` code is delayed or is never received. The device may implement one or more methods to derive the `country` value, such as allowing a user to select from a list of countries; using GPS location information; reference to information provided by a cellular telephony network, or reference to information related to an IP address ("GeoIP" location). It should be recognised that the `country` method is inaccurate for services received across borders from other countries, although this is corrected in most cases by the provision of additional DNS records for the affected services.

If the ECC code is subsequently received from RDS, this ECC and PI derived country code combination must override the user configured `country` setting and the process of resolving the FQDN should be repeated using the newly acquired ECC code.

The RDS Programme Identification parameter, `pi` is mandatory.

Some examples of FQDNs constructed from broadcast parameters are shown below:

ECC	Country Code	PI	Frequency (KHz)	RadioDNS FQDN
e1	gb	c586	95.8	09580.c586.ce1.fm.radiodns.org
	gb	c586	95.8	09580.c586.gb.fm.radiodns.org

5.1.2 DAB/DAB+ Digital Radio

The FQDN construction for a DAB/DAB+ Digital Radio [1] service is compiled as follows:

`[(<appty-uatype>|<pa>).]<scids>.<sid>.<eid>.<gcc>.dab.radiodns.org`

The parameters are populated with the following values:

Parameters	Description	Value	Status
`gcc`	**Global Country Code** For services with a 16-bit Service Identifier (SId), this is the	*3-char hexadecimal*	*mandatory*

	first nibble of the SId followed by the Extended Country Code (ECC). For services with a 32-bit SId, this is the third nibble of the SId followed by the first two nibbles of the SId.		
`eid`	**Ensemble Identifier (EId)** Service broadcast multiplex ensemble ID code.	*4-char hexadecimal*	*mandatory*
`sid`	**Service Identifier (SId)** Service broadcast identifier.	*4 or 8-char hexadecimal*	*mandatory*
`scids`	**Service Component Identifier within the Service (SCIdS)** Service broadcast component identifier within the service.	*1 or 3-char hexadecimal*	*mandatory*

The construction of the GCC is dependent on the length of the SId (i.e. whether it is a Programme or Data service).

Some examples of FQDNs constructed from broadcast parameters are shown below:

ECC	EId	SId	SCIdS	RadioDNS FQDN
`e0`	`100c`	`d220`	`0`	`0.d220.100c.de0.dab.radiodns.org`
`e1`	`c18c`	`cc86`	`0`	`0.cc86.c18c.ce1.dab.radiodns.org`
`e1`	`c185`	`e1c00098`	`0`	`0.e1c00098.c185.ce1.dab.radiodns.org`

If the audio service is delivered as data via X-PAD (see [1], section 7.4.5), the following parameter is also mandatory:

Parameters	Description	Value	Status
`appty-uatype`	**X-PAD Application Type (AppTy) and User Application type (UAtype)** 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`	**Packet Address** 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*

5.1.3 Digital Radio Mondiale (DRM)/AM Signalling System (AMSS)

The FQDN construction for a Digital Radio Mondiale [2] or AM Signalling System [3] is compiled as follows:

```
<sid>.(drm|amss).radiodns.org
```

The parameters are populated with the following values:

Parameters	Description	Value	Status
`sid`	**Service Identifier (SId)** Service broadcast identifier.	*6-char hexadecimal*	mandatory

The SId value for DRM and AMSS are intended to be suitably unique internationally so as to not require region identification.

5.1.4 iBiquity Digital Corporation's HD Radio™ (HD Radio™)

Whilst HD Radio™ is a proprietary format [4], the following broadcast parameters have been identified as suitable for constructing a RadioDNS FQDN for lookup. The parameters are used as follows:

```
<tx>.<cc>.hd.radiodns.org
```

The parameters are populated with the following values:

Parameters	Description	Value	Status
`tx`	**Transmitter Identifier** Service broadcast identifier	*5-char hexadecimal*	*mandatory*
`cc`	**Country Code** Service broadcast country code	*3-char hexadecimal*	*mandatory*

In the United States of America, the `tx` value is populated by the FCC facility code of the transmitter. However, this does not uniquely distinguish between multicast services (for example HD2 audio streams). As a result distinguishing between services on the same frequency must be conducted at the application level.

5.2 CNAME resolution of Authoritative FQDN

The response from the `radiodns.org` constructed FQDN will return a single CNAME result if the service is known.

For example, consider an FM service identified by the constructed FQDN:

```
09580.c586.ce1.fm.radiodns.org
```

Using the nslookup tool would yield the following lookup result:

```
09580.c586.ce1.fm.radiodns.org  canonical name = rdns.musicradio.com
```

Therefore, for this service, the Authoritative FQDN is:

```
rdns.musicradio.com
```

The TTL parameter of the Authoritative FQDN must be respected. Upon expiry, the DNS must be queried again.

If the returned CNAME has changed, the Authoritative FQDN must be updated, and existing application connections must be closed and reconnected using the newly acquired Authoritative FQDN.

6. Authoritative FQDN resolution for IP-delivered audio services

RadioDNS applications may also be signalled for IP-delivered audio services. In this case, three methods are possible to signal and acquire the relevant FQDN and service identification. These methods are:

- Insertion of parameters into in-band stream metadata
- Inclusion of parameters in the IMDA Service Definition XML
- Inclusion of parameters in the RadioEPG XSI Service Definition XML

The implementation recommendations for each are discussed in .

6.1 Parameters

All methods support two parameters: ***FQDN*** and ***ServiceIdentifier***.

6.1.1 FQDN

This is the Authoritative FQDN used to query for a SRV record to discover a RadioDNS application.

6.1.2 ServiceIdentifier

As the same Authoritative FQDN can be used for multiple services, it is necessary to provide disambiguation so that the particular RadioDNS application can determine the exact service being used.

To do this, the `ServiceIdentifier` parameter uniquely identifies each individual service..

The `ServiceIdentifier` **MUST** be unique across all the services using the same Authoritative FQDN for application discovery, with a maximum character limit of 16 lower case characters in the range [a-z][0-9].

The exact use of this parameter is specific to the RadioDNS application being used.

6.2 Inclusion of parameters into Stream Metadata

Certain IP streaming transports allow the inclusion of meta-data either as part of an initial response, or within the stream itself. The following sections detail the methods of inserting in-band metadata for some common streaming transports.

6.2.1 Streaming Transports

6.2.1.1 ICY (also known as SHOUTcast)

ICY [12] uses the HTTP specification as its base, and features optional periodic metadata in its stream.

The RadioDNS parameters should be contained within the initial HTTP Response at the start of the stream, using the Shoutcast standard `icy-url` header, in the following format:

`http://<FQDN>/<ServiceIdentifier>`

This is to ensure support by the majority of encoders and clients.

If a Service Provider wishes to also support the intended functionality of this parameter to indicate a website

to clients, it is **RECOMMENDED** that HTTP requests to this URL are correctly handled.

Device manufacturers should note that this field can be used to signal an associated stream website with no RadioDNS signalling, and thus **MUST** handle a lack of response or error from an SRV request to the FQDN.

6.2.1.2 ASF

Advanced Systems Format (ASF) [13] is a container format from Microsoft, and is part of the Windows Media framework. It typically defines a payload containing multiple streams of data, e.g. Audio and a Metadata stream.

An additional stream should be created, solely containing RadioDNS metadata, declared as Custom Metadata using *key*/*value* pairs for attributes with the following keys:

radiodns-fqdn for the FQDN

radiodns-sid for the ServiceIdentifier

It is **RECOMMENDED** that the values be programmatically specified as a null-terminated Unicode string, using the default platform language.

If using Windows Media Encoder, this can be entered in as Custom Metadata when setting up the stream.

6.2.1.3 Flash Audio

Flash Audio [14] is a container format for Flash Audio and Video streams from Adobe Inc.

The metadata should be implemented as a non-persistent Remote Shared Object [15] available on the URI of the Flash Audio stream itself. The object **MUST** be read-only for clients.

The object **MUST** be named: `radiodns`

And have the following named *String properties*:

fqdn for the FQDN

sid for the ServiceIdentifier

Clients should listen to changes on these properties and update accordingly.

6.2.2 Metadata Intervals

It is desirable that the client receives initial or updated parameters with as short a delay as possible. The interval between metadata transmission will directly affect the speed at which clients can access applications..

It is recommended that Service Providers provide the metadata within 5 seconds or less.

6.2.3 Receiver Behaviour

A receiver **MUST** cache the acquired parameters for the currently active IP stream. When this IP-delivered stream is no longer active, these parameters **MUST** be discarded.

A change indicated in the in-band metadata **MUST** update any cached parameters, and force a renegotiation of any active connections to RadioDNS applications.

Should an audio stream be recorded for future playback, the in-band metadata **MAY** be included, although any implementation should be aware that the parameters contained may not longer be applicable.

6.3 Inclusion of Parameters in IMDA Service Definition

A reference to the relevant section in the IMDA Service Description will be included following publication of an updated document from the IMDA.

6.4 Inclusion of Parameters in RadioEPG XSI Service Definition XML

The Authoritative FQDN and Service Identifier are given by the RadioEPG specification [16] using the `fqdn` and `serviceIdentifier` attributes of the `radiodns` element, within the `service` element of the service provider's XSI document.

These are for use in situations where the device needs to use a RadioDNS application, but does not have the ability to do this using the broadcast parameters – either because they are not available (e.g. for IP-based streams), or because they are using a bearer not yet supported (e.g. for DVB services). In this circumstance, the XSI must have already been discovered and ingested either directly by the device, or by using a *Directory Service Provider*.

A Directory Service Provider aggregates information from many Service Providers and provides it in a simplified or proprietary form to devices.

The precise use of the Service Identifier is defined in the specifics of the RadioDNS application being used, but is generally used to disambiguate a service when using the same Authoritative FQDN.

6.5 Implementation Recommendations

6.5.1 Service Provider Implementation

A service provider **MUST** support at least one of the specified methods to provide `FQDN` and `ServiceIdentifier` parameters for audio services provided using IP streaming.

It is **RECOMMENDED** to implement inclusion of parameters into stream meta-data (see)

A service provider providing IMDA XML **MUST** implement the inclusion of parameters into the IMDA Service Definition XML (see) for all services providing RadioDNS applications.

A service provider providing RadioEPG **MUST** implement the inclusion of parameters into the XSI (see) for all services providing RadioDNS applications.

6.5.2 Device Implementation

A device **MUST** support at least one of the specified methods to acquire `FQDN` and `ServiceIdentifier` parameters, if it receives audio services using IP streaming.

Is it **RECOMMENDED** to implement the extraction of parameters from stream meta-data.

A device using IMDA XML **MUST** implement the extraction of parameters from the IMDA Service Definition XML.

A device using RadioEPG **MUST** implement the extraction of parameters from the RadioEPG XSI.

7. Application advertisement and discovery

7.1 Advertisement

The presence of the application-specific SRV record on the Authoritative FQDN confirms whether that service provider supports that application. A device should make interaction for all device-supported applications available to the end user until it is otherwise authoritatively established that the specific application is not supported by the audio service provider.

It is important to consider the differing connectivity states for devices. Where a continuous connection is available, such as a broadband Wi-Fi connection, it is preferred for a device to look ahead before any user interaction occurs to establish which services should remain advertised to the user. However on devices with

limited or expensive connectivity, such as EDGE or GPRS, it is preferred to only perform application availability checks when interaction for that application occurs, minimising network activity.

7.2 Discovery

A service provider may advertise available applications by application-specific SRV records [11] on their Authoritative FQDN.

For example, an application identified by the SRV record label `foobar` would be discovered on a service with the Authoritative FQDN `musicradio.com` by querying the SRV record:

```
_foobar._tcp.musicradio.com.
```

A successful response would return one or more hostnames for the application along with port and priority/weighting details.

Please refer to the SRV record specification [11] for detailed information on handling these responses.

The TTL parameters of SRV records must be respected. Upon expiry, existing application connections must be closed and reconnected using the most recently acquired Authoritative FQDN and SRV records.

History

Document history		
First Release	May, 2008	Initial release
V0.4	June, 2008	HD Radio™ and DRM bearers added to the specification
V0.6	September, 2008	No changes to RadioDNS spec, number jump to align all RadioDNS specification documents
V0.6.1	June, 2009	Minor corrections applied
V1.0.0	February, 2012	Discovery for IP-delivered services added Clarification on use of ECC and Country Code in constructing DAB/DAB+ and FM broadcast parameters Clarification on number of CNAME records returned Clarify device behaviour on TTL expiration of DNS record Clarify device behaviour on Broadcast Parameter change to current service Formatting and sectional changes to bring into line with other RadioDNS specifications References to DAB become DAB/DAB+ Clarify construction of FM and DAB/DAB+ ECC Minor corrections applied