



**Reconfigurable Radio Systems (RRS);
System architecture for information exchange
between different Geo-location Databases (GLDBs)
enabling the operation of White Space Devices (WSDs)**

PREVIEW
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Contents

Intellectual Property Rights	4
Foreword.....	4
Modal verbs terminology.....	4
1 Scope	5
2 References	5
2.1 Normative references	5
2.2 Informative references.....	5
3 Definitions and abbreviations.....	6
3.1 Definitions.....	6
3.2 Abbreviations	6
4 Overview of WSD GLDBs architecture reference model.....	6
4.1 Introduction	6
4.2 Architecture.....	7
4.3 Reference model of GLDB.....	7
4.4 Reference model between GLDBs	7
5 Reference Points.....	8
5.1 Reference point: Logical interface between GLDBs.....	8
5.2 Reference point requirements.....	8
6 High Level Procedures: Overview of information exchange between different GLDBs related Architecture.....	9
6.1 Basic Procedures	9
6.1.1 Incumbents information sharing procedure	9
6.1.2 Victim GLDB discovery procedure.....	10
6.1.3 CRS spectrum usage modification procedure.....	10
6.1.4 CRS Operating Parameters checking procedure.....	13
6.1.5 Procedure of CRS channel usage registration between GLDBs	13
6.1.6 Exchange the number of CRSs over a certain region.....	14
6.1.7 Update the number of CRSs over a certain region.....	14
6.1.8 Sequence of exchange the number of CRSs over a certain region.....	15
6.1.9 CRS transfer between GLDBs.....	16
6.2 Flow charts for determining the available channels of a CRS	17
7 Overview on GLDB Functional requirements	19
Annex A (informative): Physical implementation examples of logical functions.....	20
A.1 Introduction	20
A.2 GLDB operated by different National Regulatory Authorities	20
A.3 Third party geo-location function management	20
History	22

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Reconfigurable Radio Systems (RRS).

Modal verbs terminology

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1 Scope

The present document defines the system architecture for the information exchange between different Geo-location Databases (GLDBs) enabling the operation of White Space Devices (WSDs) for the protection of the incumbent service. The architecture stems from the system requirements described in clause 7.1 of ETSI TS 102 946 [i.1].

System Architecture and High Level Procedures for Coordinated and Uncoordinated Use of TV White Spaces are described in ETSI TS 103 145 [i.4].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI TS 102 946 (V1.1.1): "Reconfigurable Radio Systems (RRS); System requirements for Operation in UHF TV Band White Spaces".
- [i.2] ECC Report 186 (2013): "Technical and operational requirements for the operation of white space devices under geo-location approach".
- [i.3] ETSI EN 301 598 (V1.1.1): "White Space Devices (WSD); Wireless Access Systems operating in the 470 MHz to 790 MHz TV broadcast band; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive".
- [i.4] ETSI TS 103 145 (V1.1.1): "Reconfigurable Radio Systems (RRS); System Architecture and High Level Procedures for Coordinated and Uncoordinated Use of TV White Spaces".

3 Definitions and abbreviations

3.1 Definitions

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

communication function: hardware/software module that provides communication services required by the interfaces between logical entities based on communications protocol stack

database function: software/hardware that stores necessary information provided by regulators for calculating available spectrum that a WSD in a CRS can operate on with protection to incumbent services as well as registration of the WSDs under regulatory requirements and for protecting incumbent services purposes

geo-location function: software/hardware that calculates location specific EIRP of a frequency band and that a WSD in a CRS can use based on the information on incumbents stored in database function

G-G Interface function: abstraction of the totality of those functional blocks inside a geo-location database realizing the G-G logical interface between GLDBs

G-G Logical interface: conceptual boundary between GLDBs for information exchange to enable the operation of a CRS with protection of the incumbent service

victim GLDB: GLDB whose incumbents can suffer interference from CRSs that are under the management of another GLDB (the querying GLDB)

3.2 Abbreviations

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

CEPT	Conférence Européenne des administrations des Postes et Télécommunications
CRS	Cognitive Radio System
DB-SAP	DataBase- Service Access Point
EIRP	Effective Isotropic Radiated Power
GLDB	Geo-Location DataBase
GL-SAP	GeoLocation - Service Access Point
ID	IDentifier
IP	Internet Protocol
NRA	National Regulatory Authority
SAP	Service Access Point
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
WSD	White Space Device

4 Overview of WSD GLDBs architecture reference model

4.1 Introduction

This clause describes the general WSD GLDBs architecture as well as the reference model of the logical entity, the GLDB, involved in the scope. The architecture shows the relationship of logical entities and the logical interface as detailed in the following clauses. The reference model shows the abstract architecture of components of logical entities and the logical interface.

4.2 Architecture

Figure 4.1 shows the instance of the G-G logical interface. The interface is used for the information exchange between GLDBs for enabling the operation of White Space Devices (WSDs) for the protection of the incumbent service.

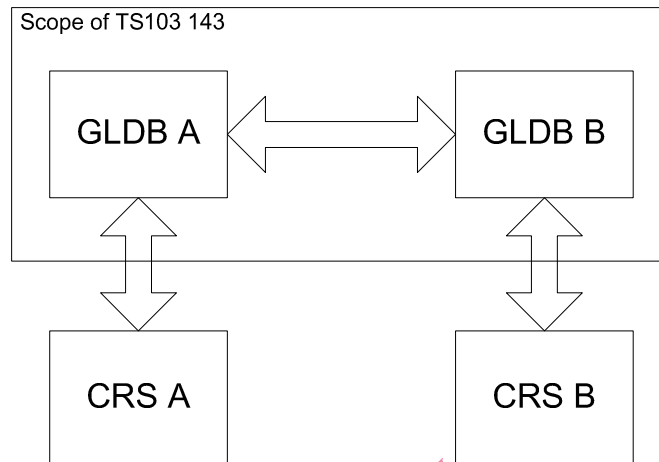


Figure 4.1: Architecture

4.3 Reference model of GLDB

Figure 4.2 shows an architectural view of a GLDB emphasizing the separation of GLDB into Database function, Geo-location function and G-G Interface function. A function can access the services provided by another function via a corresponding Service Access Point (SAP). A GLDB exchanges information with another GLDB by accessing communication services via the Com-SAP.

The DB-SAP is used by the G-G Interface function to access the services provided by the Database function such as registration of CRS and provision of incumbent information.

The GL-SAP is used by the G-G Interface function to access the services provided by the Geo-location function such as the calculation of location specific EIRP that a WSD in a CRS can use in a frequency band.

The Com-SAP is used by the G-G Interface function to access communication services provided by communication function for the information exchange with another G-G interface function.

Note that the G-G interface function inside the GLDB uses the services provided at the above three SAPs to realize the logical interface between different GLDBs.

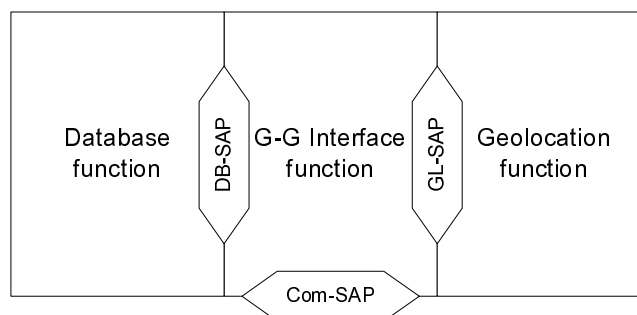


Figure 4.2: Reference model of GLDB

4.4 Reference model between GLDBs

Figure 4.3 shows an alternative view of the reference model for the information exchange between two GLDBs. A communication function is a hardware/software module that provides the communication services required by the interfaces between logical entities based on a communications protocol stack.

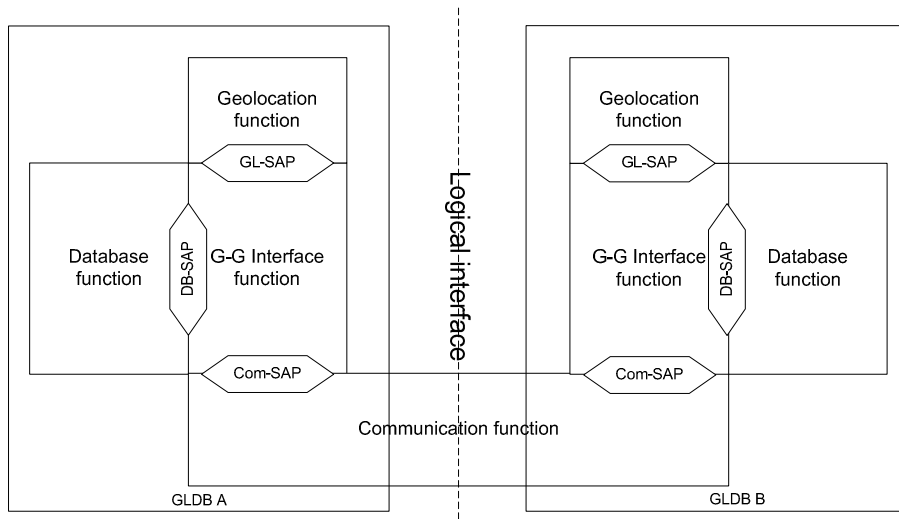


Figure 4.3: View of reference model for the information exchange between GLDBs using the G-G logical interface

5 Reference Points

5.1 Reference point: Logical interface between GLDBs

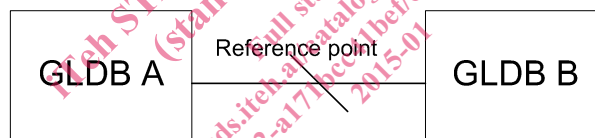


Figure 5.1: Reference point for information exchange between GLDBs

Figure 5.1 shows the reference point between GLDBs which is the G-G logical interface between the GLDBs for enabling the operation of White Space Devices (WSDs) for the protection of the incumbent service. Specifically, the reference point enables one GLDB to interface with other GLDBs in order to guaranty that the operations of CRS managed by one GLDB satisfy the protection requirements of incumbents such as the Terrestrial Broadcasting Service registered in different GLDBs as specified by respective regulations.

5.2 Reference point requirements

The following requirements do not mandate that GLDB implements any specific calculation methods.

- The reference point shall support information exchange between GLDB A and GLDB B to allow GLDB A to discover its affecting/neighbouring GLDB B.
- The reference point shall support information exchange between GLDB A and GLDB B to allow GLDB A to obtain necessary information to determine the available spectrum for a CRS managed by GLDB A while satisfying the protection requirements of incumbents registered in GLDB B under the regulatory domain of GLDB B.
- The reference point shall support information exchange between GLDB A and GLDB B to allow GLDB A to provide information about a CRS under its management to GLDB B to allow GLDB B to calculate the interference to incumbents registered in GLDB B.

- The reference point shall support information exchange between GLDB A and GLDB B to allow GLDB A to obtain information about the CRSs that are managed by GLDB B that affect the interference to incumbents registered in GLDB A. Those CRSs may create interference below the interference reference field strength at a given location probability of the incumbents that are registered in GLDB A. However, they may still contribute adversely when considering aggregate/cumulative interference (see also section A11.1.1.4 of ECC report 186 [i.2]).

6 High Level Procedures: Overview of information exchange between different GLDBs related Architecture

6.1 Basic Procedures

6.1.1 Incumbents information sharing procedure

Subject to regulatory agreements, a GLDB can send the information related to its registered incumbents to other GLDBs. This procedure populates the incumbent's information among GLDBs so that each GLDB can determine the available channels of CRSs independently of other GLDBs and protect the incumbents registered in different GLDBs. The procedure is shown in Figure 6.1 and shall be as follows:

1. GLDB A sends an "Incumbent_Info_Update_Request" message to GLDB B, containing information of incumbents registered in GLDB A, to request GLDB B to update its information by including the incumbent information from GLDB A.
2. The GLDB B that receives the "Incumbent_Info_Update_Request" message shall update its incumbents' information by including the incumbents' information from GLDB A.
3. The GLDB B sends an "Incumbent_Info_Update_Response" message to inform the result of information update.

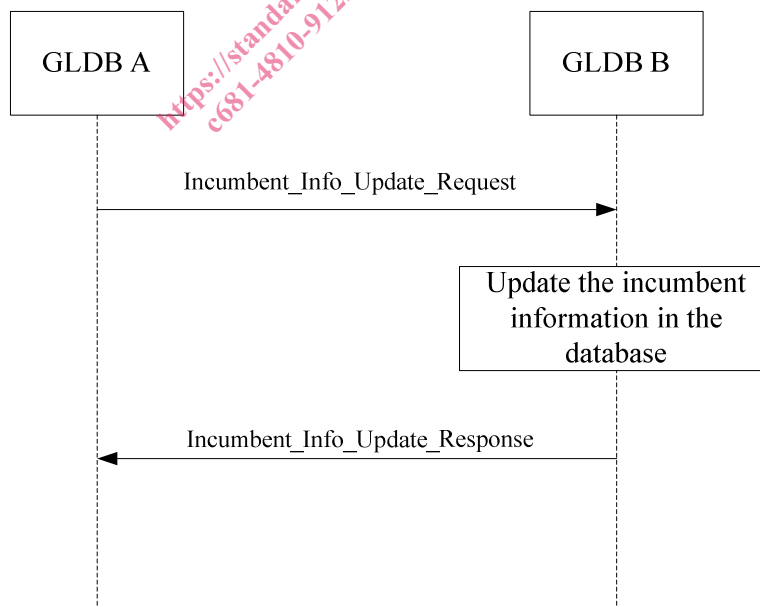


Figure 6.1: Incumbents information sharing procedure

This procedure is used for sharing information of all incumbents among GLDBs. The procedure for sharing information limited to the incumbents that can be subject to interference by CRSs managed by different GLDBs is given in clause 6.1.3 below. The procedure for discovering such GLDBs is given in clause 6.1.2.

6.1.2 Victim GLDB discovery procedure

Before providing information of available channels to a CRS, the managing GLDB shall check whether the use of such available channels by the CRS brings interference to incumbents registered in other GLDBs. To this end, the managing GLDB sends a "victim discovery request" to a list of potential victim GLDBs. This list of potential victim databases would be generated by a third party responsible for planning (e.g. CEPT in Europe) and would be given to each database operator. Such a list would avoid having to perform discovery with every database in Europe, for example, and only perform discovery with the databases which manage countries that have a geographical border in common, or that actually manage spectrum on the same band (as examples). The request message contains information of one or multiple CRSs' intended spectrum usage at a given location. Such location could be one single geo-location or multiple geo-locations forming a geographical area in which the CRSs intend to operate. The responding GLDB shall check whether the incumbents registered in the responding GLDB are within the interference range of the CRSs managed by the requesting GLDB which use the available channel. If this is the case, the responding GLDB is a victim GLDB of the requesting GLDB. Then, the responding GLDB sends a result to the requesting GLDB. The procedure is shown in Figure 6.2 and shall be as follows.

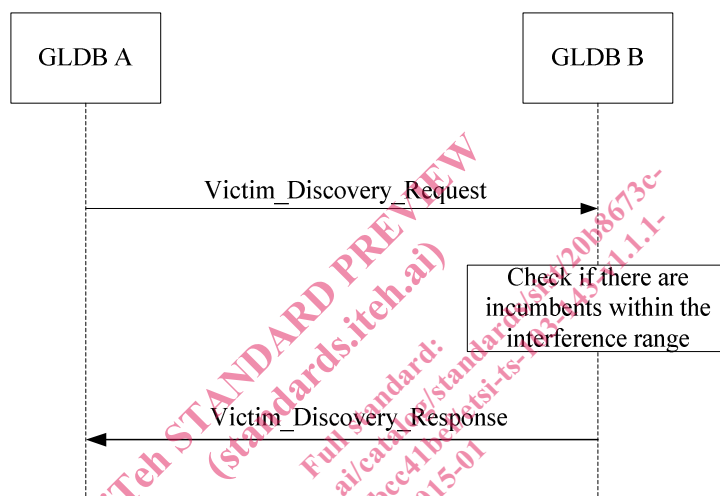


Figure 6.2: Victim GLDB

1. GLDB A sends a "Victim_Discovery_Request" message to GLDB_B by providing device and operating parameters for available channels of the CRS managed by the GLDB A.
2. The GLDB B, upon receiving the Victim_Discovery_Request message from GLDB A, checks if its incumbents are within the interference range. There are two types of interferences to be taken into account:
 - direct interference from the CRS to incumbents as shown in Figure 6.2;
 - direct interference from the CRS together with interference coming from other existing CRSs that together bring a cumulative interference to incumbents (see clause A11.1.1.4 of ECC Report 186 [i.2]). GLDB B checks whether this cumulative interference would be harmful to the incumbents registered in its domain. If this is the case, then the GLDB B is a "victim GLDB".
3. The GLDB B sends a "Victim_Discovery_Response" message to GLDB A containing the result of victim GLDB discovery. The result indicates whether GLDB B is a victim GLDB of GLDB A.

6.1.3 CRS spectrum usage modification procedure

Once a GLDB is found to be a victim GLDB of the querying GLDB, the operating parameters for available channels of the CRS managed by the querying GLDB shall be modified. The modification can include changes on the available frequency bands, maximum permitted EIRP of certain frequency band and spectrum validity time. There are two variants of this procedure.