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Radijski sistemi z možnostjo preoblikovanja (RRS) - Informacijski modeli in protokoli za mobilne naprave (MD) - 3. del: Enotni radijski aplikacijski vmesnik (URAI)

Reconfigurable Radio Systems (RRS) - Mobile Device (MD) information models and protocols - Part 3: Unified Radio Application Interface (URAI)

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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Reconfigurable Radio Systems (RRS).

The present document is part 3 of a multi-part deliverable covering the Mobile Device (MD) information models and protocols, as identified below:

ETSI EN 303 146-1:   "Multiradio Interface (MURI)";

ETSI EN 303 146-2:   "Reconfigurable Radio Frequency Interface (RRFI)";

ETSI EN 303 146-3:   "Unified Radio Application Interface (URAI)";

ETSI TS 103 146-4:   "Radio Programming Interface (RPI)".

National transposition dates	
Date of adoption of this EN:	1 August 2016
Date of latest announcement of this EN (doa):	30 November 2016
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	31 May 2017
Date of withdrawal of any conflicting National Standard (dow):	31 May 2017

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1   Scope

The scope of the present document is to define an information model and protocol for unified radio application interface for mobile device reconfiguration. The work is based on the Use Cases defined in ETSI TR 102 944 [i.1], on the system requirements defined in ETSI EN 302 969 [1] and on the radio reconfiguration related architecture for mobile devices defined in ETSI EN 303 095 [i.2] and on the mobile device information models and protocols related Multiradio Interface defined ETSI EN 303 146-1 [i.3].

2   References

2.1   Normative references

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

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1]   ETSI EN 302 969 (V1.2.1) (11-2014): "Reconfigurable Radio Systems (RRS); Radio Reconfiguration related Requirements for Mobile Devices".

2.2   Informative references

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

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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

[i.1]   ETSI TR 102 944: "Reconfigurable Radio Systems (RRS); Use Cases for Baseband Interfaces for Unified Radio Applications of Mobile Device".

[i.2]   ETSI EN 303 095 (V1.2.1): "Reconfigurable Radio Systems (RRS); Radio Reconfiguration related Architecture for Mobile Devices".

[i.3]   ETSI EN 303 146-1: "Reconfigurable Radio Systems (RRS); Mobile Device Information Models and Protocols; Part 1: Multiradio Interface (MURI)".

[i.4]   ETSI EN 303 146-2: "Reconfigurable Radio Systems (RRS); Mobile Device Information Models and Protocols; Part 2: Reconfigurable Radio Frequency Interface (RRFI)".

[i.5]   ETSI TR 102 839: "Reconfigurable Radio Systems (RRS); Multiradio Interface for Software Defined Radio (SDR) Mobile Device Architecture and Services".

[i.6]   IEEE 1900.4-2009™: "IEEE Standard for Architectural Building Blocks Enabling Network-Device Distributed Decision Making for Optimized Radio Resource Usage in Heterogeneous Wireless Access Networks".

[i.7]   Recommendation ITU-T X.680: "Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation".

3   Definitions and abbreviations

3.1   Definitions

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

association: logical communication link to a Radio Access Network or a peer equipment

> NOTE 1:   Typically, some control signalling is necessary to maintain the association. No user data transfer may occur with only an association present, but a data flow may be established into an association for this purpose.

> NOTE 2:   Peer equipment is any communication counterpart of a reconfigurable mobile device. It can be reached by establishing a logical communication link (i.e. an association) between the reconfigurable mobile device and peer equipment.

channel: designated part of the information transfer capability having specified characteristics, provided at the user network interface

> NOTE: It is the over-the-air wireless propagation channel which is used to convey an information signal from transmitter to receiver. This definition is specified in ETSI EN 303 095 [i.2].

communication services layer: layer related to communication services supporting generic applications

> NOTE: A communication services layer supports generic applications like Internet access. In the present document, it consists of Administrator, Mobility Policy Manager (MPM), Networking stack and Monitor.

link: connection from one location to another through a given Radio Access Technology for the purpose of transmitting and receiving digital information

Radio Application (RA): software which enforces the generation of the transmit RF signals or the decoding of the receive RF signals

> NOTE 1:   The Software is executed on a particular radio platform or an RVM as part of the radio platform.

> NOTE 2:   RAs might have different forms of representation. They are represented as:
>
>   ▪   source codes including Radio Library calls of Radio Library native implementation and Radio HAL calls;
>
>   ▪   IRs including Radio Library calls of Radio Library native implementation and radio HAL calls;
>
>   ▪   Executable codes for a particular radio platform.

radio computer: part of mobile device hardware working under ROS control and on which RAs are executed

> NOTE: A Radio Computer typically includes programmable processors, hardware accelerators, peripherals, etc. RF part is considered to be part of peripherals.

Radio Control Framework (RCF): control framework which, as a part of the OS, extends OS capabilities in terms of radio resource management

> NOTE: RCF is a control framework which consists of Configuration Manager (CM), Radio Connection Manager (RCM), Flow Controller (FC) and Multiradio Controller (MRC). The Resource Manager (RM) is typically part of OS.

3.2   Abbreviations

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

ASN	Abstract Syntax Notation
ASN.1	Abstract Syntax Notation One
BLER	BLock Error Rate

CM   Configuration Manager
CSL   Communication Services Layer
FC   Flow Controller
ID   IDentification
MD   Mobile Device
MPM   Mobility Policy Manager
MRC   MultiRadio Controller
MURI   MUltiRadio Interface
OS   Operating System
RA   Radio Application
RAN   Radio Access Network
RAP   Radio Application Package
RAT   Radio Access Technology
RCF   Radio Control Framework
RCM   Radio Connection Manager
RF   Radio Frequency
RM   Resource Manager
ROS   Radio Operating System
RPI   Radio Programming Interface
RRFI   Reconfigurable Radio Frequency Interface
SINR   Signal to Interference plus Noise Ratio
UML   Unified Modelling Language
URA   Unified Radio Applications
URAI   Unified Radio Application Interface

4   Introduction

A reconfigurable MD is capable of running multiple radios simultaneously and of changing the set of radios by loading new Radio Application Package (RAP). All Radio Applications (RAs) are called Unified Radio Applications (URAs) when they exhibit a common behaviour from the reconfigurable MD's point of view [i.2]. In order to run multiple URAs, the reconfigurable MD will include Communication Services Layer (CSL), Radio Control Framework (RCF), Radio Platform and 4 sets of interfaces for their interconnection.
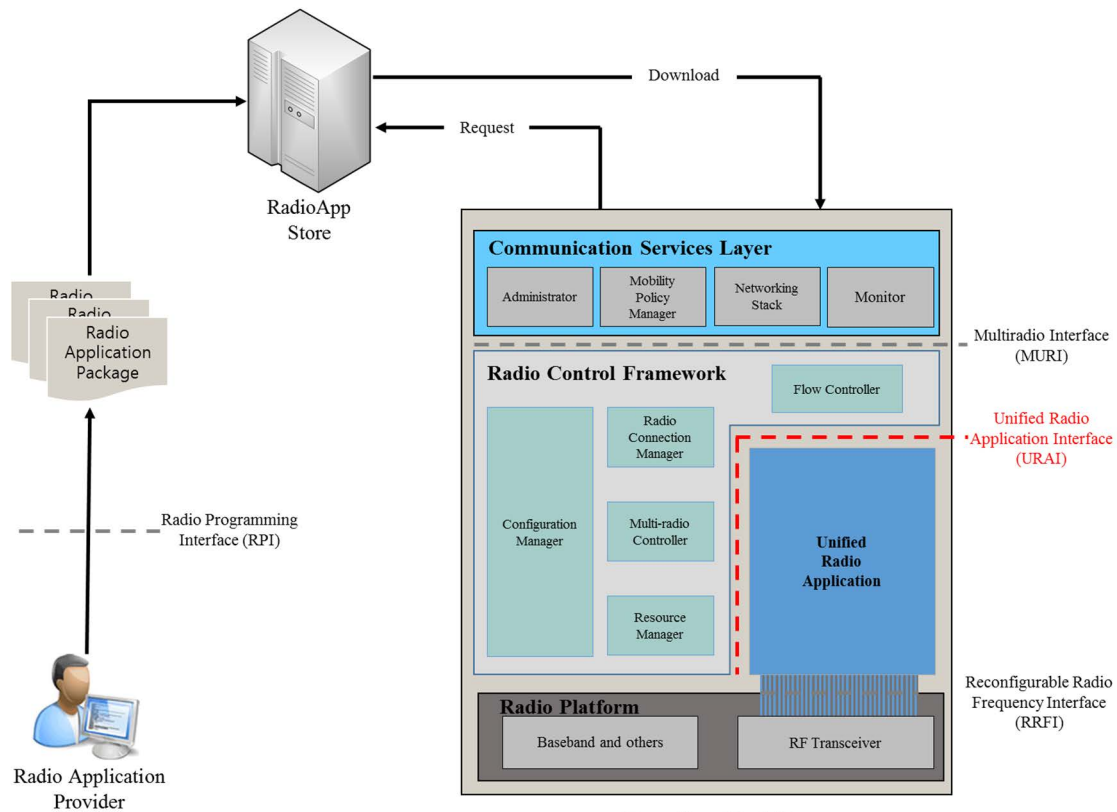
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Figure 4.1: Four sets of interfaces for Reconfigurable MD

Figure 4.1 illustrates the Reconfigurable MD architecture with the 4 sets of interfaces, i.e.:

- MURI for interfacing CSL and RCF [i.3];

- RRFI for interfacing URA and RF Transceiver [i.4];

- URAI for interfacing URA and RCF which is the scope of the present document;

- RPI for allowing an independent and uniform production of RAs [i.5].
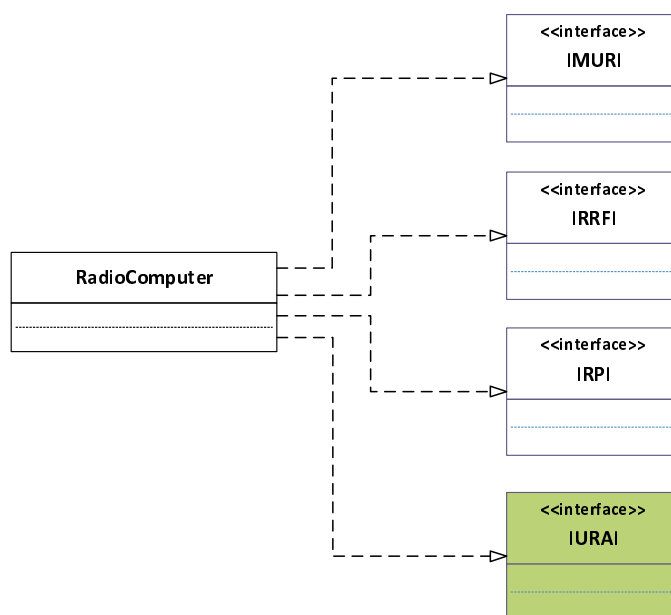
The present document defines URAI.

Figure 4.2: UML class diagram for Radio Computer interfaces

Figure 4.2 illustrates UML class diagram for Radio Computer interfaces. The reconfigurable MD may be seen as a Radio Computer where individual URAs are engineered as software entities [i.2].

The present document is organized as follows:

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- clause 5 describes the system identification;

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- clause 6 describes the notational tool for defining both information model classes and interface classes;

- clause 7 describes the information model for radio computer; and

- clause 8 describes the interface definition.

While UML is used for defining the information model and protocol related to URAI, other modelling languages could be used as well.

5 System Identification

5.1 Radio Computer Structure

Figure 5.1 illustrates how RCF and URA interact with each other using URAI.
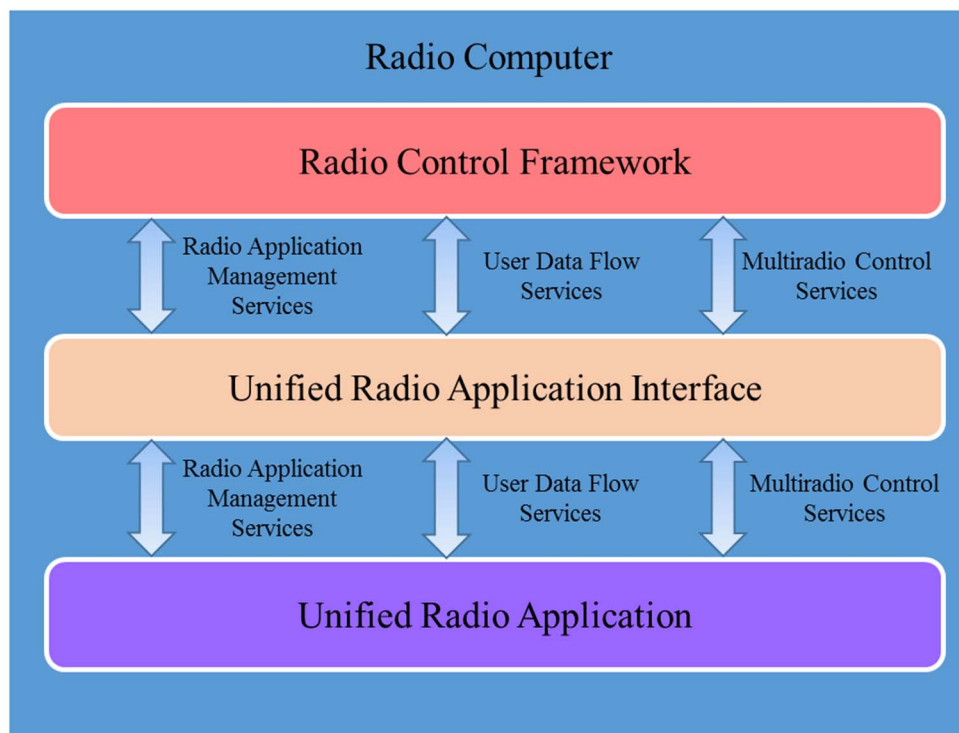
Figure 5.1: Interconnection between RCF and URA using URAI for Reconfigurable MD

As shown in figure 5.1, URAI supports 3 kinds of services:

- **Radio Application Management Services**

These services are used by Radio Connection Manager (RCM) which is included in the RCF, to control URA functions such as reporting of discovered Peer Equipments, creating/terminating association with Peer Equipment, starting/stopping communication with Peer Equipment, etc.

- **User Data Flow Services**

These services are used by Flow Controller (FC) which is included in the RCF, to transmit user data to URA, or used by URA to transmit received user data to FC. These services also include management of data flow, which is provided by FC.

- **Multiradio Control Services**

These services are used by Multiradio Controller (MRC) which is included in RCF, to manage spectral resource usage.

The RCF and URA are defined in ETSI EN 303 095 [i.2].

5.2   URAI System Requirement Mapping

The Radio Computer components above described shall support the URAI system requirements shown in table 5.1 and described in clause 6 of ETSI EN 302 969 [1].