

## Seamless Vertical Handover in Software Defined Radio Terminal

Hwan-Souk Yoo<sup>1</sup>, Byungjoo Park<sup>3\*</sup>, Sang-Ha Kim<sup>2</sup>

Chungnam National University, Daejeon, Korea<sup>1,2</sup>

Hannam University, Daejeon, Korea<sup>3</sup>

\*Correspondent Author

grep@cclab.cnu.ac.kr<sup>1</sup>, shkim@cnu.ac.kr<sup>2</sup>, bjpark@hnu.kr<sup>3\*</sup>

### Abstract

*Recently, through the development of the mobile network, a user was offered various services. The SDR technology is accessible to various mobile networks in the environment. In various wireless network services such as the ubiquitous and Convergence environment, it can provide the user an optimum radio environment. It is acceptable the various services like this as the SDR terminal of one through the Waveform Application, and more developed wireless network technique is applicable. Particularly, the processing speed of a processor developed exponentially with the growth of the semi-conductor technology. Furthermore, as the conversion technique between the digital signal and the analog signal developed rapidly, the introduction of SDR was available in the high speed data transfer system including 3rd generation wireless internet service. It has to be seamless vertical handover executable so that the SDR terminal can provide internet access service in which it is various to a user. In this research, we propose a method for supporting the Seamless VHO in the SDR terminal and the VHO-SCA for interoperate a SDR Middleware and IEEE 802.21 MIH.*

### 1. Introduction

The SDR technology provides the flexible service, in addition it is possible to transplant the upgrade technology and performance as the open architecture signal processing technique which the SDR technology can reconstruct to the application software (wireless protocol standard) in which a user wants in one common hardware platform in order to manage with the various wireless communications networks (the multi-mode, multi-standard, multi-band, multi-function) flexibly in the multiple normalizing era. Particularly, the frequency use efficiently increases and an improvement and QoS base service providing of QoS will be possible.

The SDR terminal means the Seamless VHO that it is impossible to perform. This kind of a problem limits the application in which it is available in the SDR terminal, especially, the use of the Application in which it is sensitive to a delay like VOIP is impossible. The problem like this lowers the availability of the SDR terminal and it is unable to provide the Seamless service in the Mobile environment.

In order that the problem like this is solved, the SDR terminal predicts Handover an occurrence in advance, the execution procedure of the Waveform Application in which the latency time is very much required is performed in advance, and The SDR terminal is activated to the Dual-Mode terminal. And it is reconfigured to the Single-Mode terminal after Handover for the efficient use of a resource.

## 2. Related Works

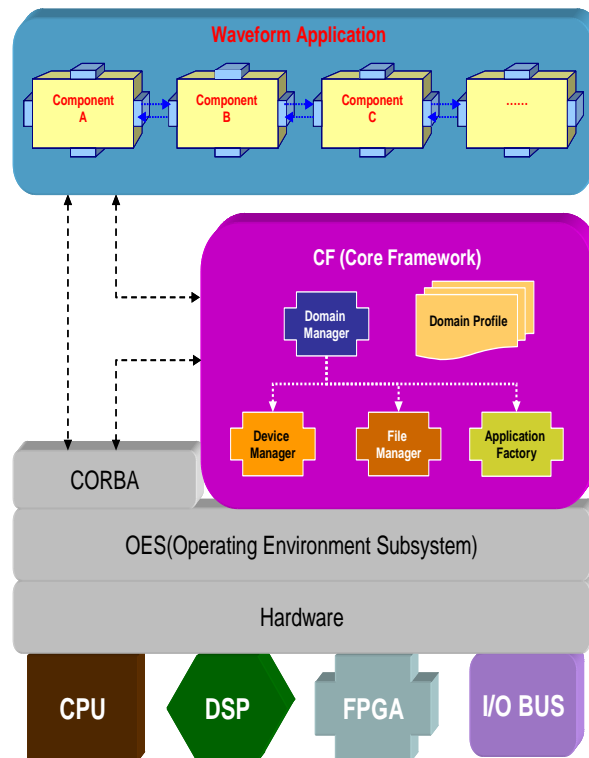
### 2.1. Software Defined Radio and Software Communication Architecture

The SCA CF is standardized for the application component and provides an open standards interface and the service. The CF was the help in the design of the application component designer through an abstraction, the lower part software and hardware hierarchy.

The SCA CF interface and services divided as follows:

- BAI (Base Application Interface): This application component should provide an interface and must be implemented interface. (Port, LifeCycle, TestableObject, PropertySet, PortSupplier, ResourceFactory)

- FCI (Framework Control Interface): The interface used in the SCA CF inside for the system control, and is an offer or an used interface and the service between CF inside functional elements. (Application, ApplicationFactory, DomainManager, DeviceManager)



**Figure 1. Software Defined Radio Architecture**

- BDI (Base Device Interfaces): It is the interface in which it provides the management and implementation of the logical device within a domain. (Device, LoadableDevice, ExecutableDevice, AggregateDevice, DeviceManager)

- FSI(Framework Service Interface): The interface used by the external application program like the core framework part inside application, or the download management, and the application component. (File, FileSystem, FileManager, Timer)

- Domain Profile: There is the Software profile for the Device Profile in which we define the hardware attribute of the SDR terminal device and software component definition. This profile was written in XML form.

- The Waveform Application consists of one or more Resources. The Resource interface provides a SCA common API for the control and configuration of a software component for Waveform Application. The application developers can extend these definitions by creating specialized Resource interfaces for the application.

The Waveform Application consists divided as follows.

- Assembly Controller : Assembly Controller for Resource Control
- FPGA Resource : Implement for Baseband, RF
- DSP Resource : Implement for RF and Multimedia Signal Processing
- Kernel Resource : Implement for L1 Driver and L2 MAC
- GPP Resource : Implement for User Interface and L3

Each Resource has an Adapter corresponding to itself. The Assembly Controller mutually works with the Adapter of an individual in order to perform the start, stop and property control about the Resource of the Waveform Application.

Waveform application components are performed by the Executable Device with the fork() and exec(). And they go by Application with Initialize() and are performed. Moreover, the getPort() and connectPort() are used for the port information reference and attach of each component.

In an application, the query(), and the configure() interface are used in order to inquire the attribute of the Waveform application component and change.

### **3. Problem Definitions**

#### **3.1. Vertical Handover Based on Software Communications Architectures**

After stopping the existing waveform application and carrying out the uninstall procedure, the case of doing Handover by Single-mode executes a new waveform application.

While the installation of the new waveform application in the time when the preexistence waveform applications stops and uninstall is performed, and an execution is completed, a connection the SDR terminal is impossible in a network. In this procedure, the SDR terminal performs the Hard Vertical Handover and a user loses all information of connected session. As to this time, the SDR terminal is the time to certainly need for a reconfiguration and the software performed in FPGA, DSP, GPP is changed in these procedures.

#### **4. Proposed Mechanism (VHO-SCA)**

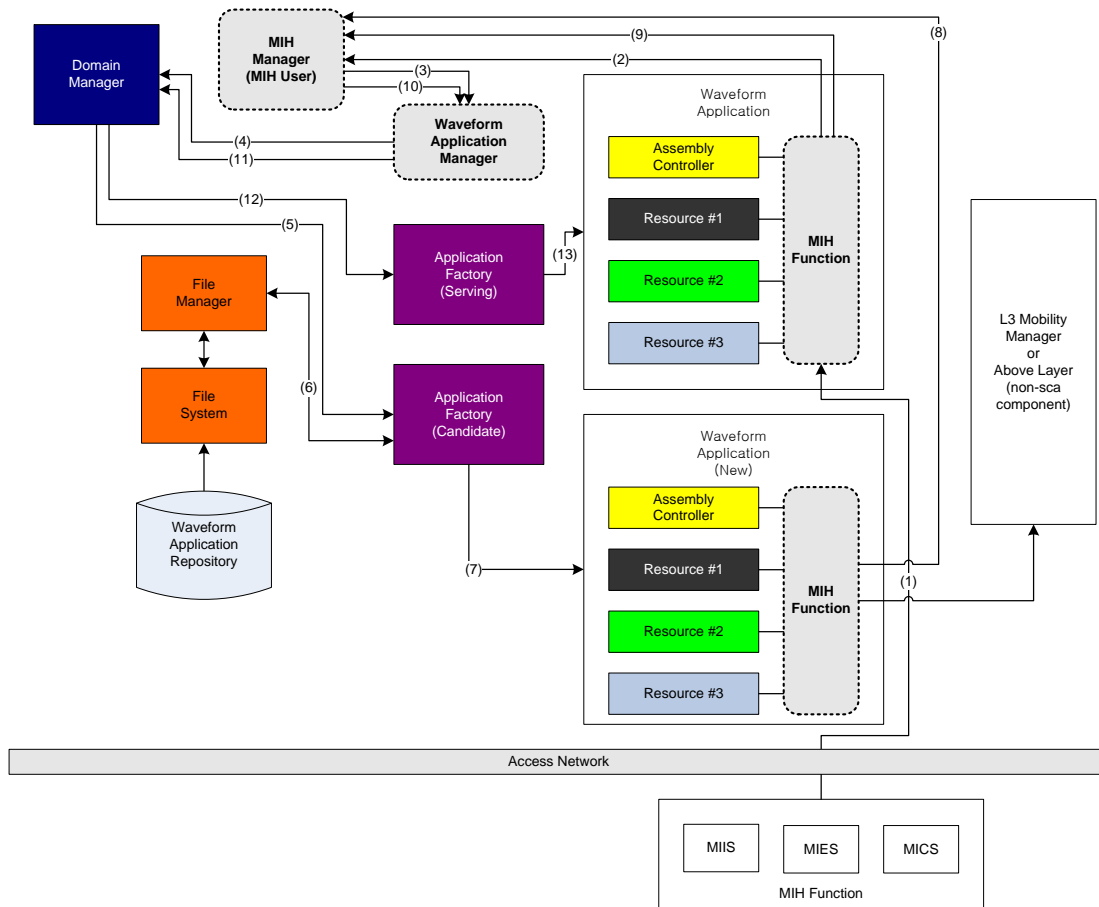
In this section we will show and discuss our proposed scheme the Seamless Vertical Handover in the SDR Terminal, Our scheme is the enhanced SCA Reconfiguration Procedure that Vertical Handover support will be possible. We will discuss in detailed our proposed scheme the VHO-SCA.

##### **4.1. Proposed VHO-SCA**

In this section we will show and discuss our proposed scheme the Seamless Vertical Handover in the SDR Terminal, Our scheme is the enhanced SCA Reconfiguration Procedure that Vertical Handover support be possible. We will discuss in detailed our proposed scheme the VHO-SCA.

The MIH Manager received the Access Network Information through the MIIS server of MIHF. The Waveform Application Manager with the corresponding waveform application exists on the Waveform Application Repository to retrieve. If it doesn't exist, it approaches to the Waveform Application Repository Server defined as the Information Element of MIIS and the new Waveform Application file is downloaded. It stores in the Waveform Application Repository.

The MIH Function delivered the information elements of a neighboring through MIIS. The MIIS message in which the MIH Function receives is delivered to the MIH Manager and the IE\_NETWORK\_TYPE information element of MIIS is delivered to the Waveform Application Manager. The Waveform Application Manager searches for whether the Waveform Application described on IE\_NETWORK\_TYPE information element exists in the Waveform Application Repository or not. If there is no usable Waveform Application, the corresponding Waveform Application get a transmission of from the Waveform Application Repository Server in which it comes to the Waveform Application Server Specific Information Elements of MIIS and The Waveform Application file in which it receives is stored in Waveform Application Repository. Figure 2 show the process where the SDR terminal operates with Multi-Mode for the Seamless VHO. The detail process is as follows.



**Figure 2. The SCA Architecture for Supporting Vertical Handover**

The delivery of the event in which it relates to a handover from MHIF in the waveform application and this event will be forwarded to the MIH Manager. MIH Manager based on information from the MIIS install a new need to select the Waveform Application, the Waveform Application Manager searches for it has the selected the Waveform Application File.

The Waveform Application Manager confirms whether there is the corresponding Waveform Application in the Waveform Application Repository or not, Domain Manager is requested to install the Waveform Application. The Domain Manager produces the Application Factory for being created with the new Waveform Application and the Application Factory creates the Waveform Application. It delivers to the MIH Manager if the MIH Function of the newly created Waveform Application receives the MIH\_Link\_Event including MIH\_Link\_Detected or MIH\_Link\_Up.

If the MIH Manager determined that handover was the completed, it requests to uninstall the Waveform Application in which it uses in a preexistence to Waveform Application. The Waveform Application Manager requests that it gives the corresponding Waveform Application to the Domain Manager with uninstall. The Domain Manager requests that the Application Factory uninstall the old Waveform Application. The Application Factory uninstalls Waveform Application and the Domain Manager uninstalls the Serving Application Factory.

### 4.2. Using Virtual Interface for PMIPv6 in the SDR Terminal

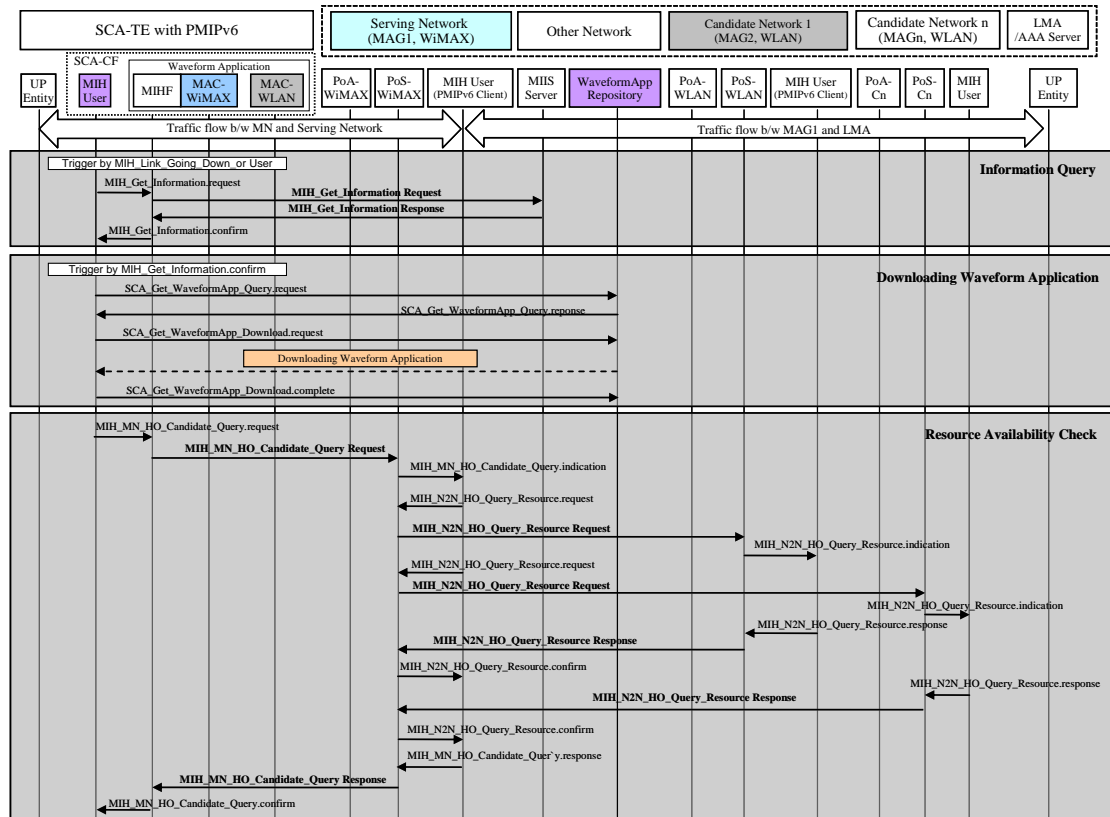


Figure 3. Procedure with VHO-SCA

Figure 7 shows a mobile-initiated handover flow chart in which PMIPv6 and VHO-SCA operate.

In the SDR terminal, if the uninstall of the waveform application is performed, the state of the SDR terminal is initialized. This is to prevent from an effect on the new waveform application in which previously the performed waveform application is performed in a next. Therefore, in the Reconfiguration procedure of the SDR terminal, the serving network interface is deleted and the ipv6 address information in which set up by the Router Advertisement disappears.

### 5. Conclusions and Future Works

This paper has described Seamless Vertical Handover Software Communication Architecture (VHO-SCA) as new architecture using IEEE 802.21 MIH. The process for operating the SDR terminal with Dual-Mode was explained in order to support the Seamless Handover and it was seen to IP Mobility could support by applying the SDR terminal to PMIPv6.

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## Authors



Hwan-Souk Yoo received the B.S. and M.S. degree in Computer Science from Chungnam National University, Daejeon, Korea, in 2001 and 2003. He has joined Electronics and Telecommunications Research Institute(ETRI) as a visited assistance researcher between 2001 and 2002. He went on for a Ph.D. program in Computer Science from Chungnam National University, in 2003. He was with SDR Middleware Research Team(ETRI) as a researcher and R&D for SDR Technology, between 2007 and 2009. His current research interests include wireless communication network, software defined radio, SCA, network simulator, IPTV Qos, and inter-domain routing. His email address is [grep@cclab.cnu.ac.kr](mailto:grep@cclab.cnu.ac.kr).



Byungjoo Park received the B.S. degree in electronics engineering from Yonsei University, Seoul, Rep. of Korea in 2002, and the M.S. and Ph.D. degrees (first-class honors) in electrical and computer engineering from University of Florida, Gainesville, USA, in 2004 and 2007, respectively. From June 1, 2007 to February 28, 2009, he was a senior researcher with the IP Network Research Department, KT Network Technology Laboratory, Rep. of Korea. Since March 2, 2009, he has been a Professor in the Department of Multimedia Engineering at Hannam University, Daejeon, Korea. He is a member of the IEEE, IEICE, IEEK, KICS, and KIISE. His primary research interests include theory and application of mobile computing, including protocol design and performance analysis in next generation wireless/mobile networks. He is an honor society member of Tau Beta Pi and Eta Kappa Nu. His email address is [vero0625@hotmail.com](mailto:vero0625@hotmail.com), [bjpark@hnu.kr](mailto:bjpark@hnu.kr).



Sang-Ha Kim received the B.S. degree in chemistry from Seoul National University, Seoul, Korea, in 1980, and he received the M.S. and Ph.D. degrees in quantum scattering and computer science from the University of Houston, Houston, TX, in 1984 and 1989, respectively. He was with the Supercomputing Center, SERI, Korean Institute of Science and Technology (KIST) as a senior researcher between 1990 and 1991. He has joined Chungnam National University, Daejeon, Korea, since 1992, where he is a Professor. His current research interests include wireless networks, ad hoc networks, sensor networks, QoS, optical networks, and network analysis. Prof. Kim is a member of ACM, IEEE Communications Society, IEEE Computer Society, KICS, KIPS, etc. His email address is [shkim@cnu.ac.kr](mailto:shkim@cnu.ac.kr).