

# **IMPLEMENTATION OF MCP-BASED WIMAX RECEIVER TEST-BED FOR RECONFIGURABLE MOBILE DEVICE CONSIDERING ETSI RRS STANDARD**

**Hyungsub Lee**

**2013. 01. 10.**

**Hanyang University**

School of Electrical and Computer Engineering, Hanyang University  
17 Haengdang-Dong, Seongdong-Gu, Seoul 133-791, Korea  
Tel : 82-10-8528-9713, Fax : 82-2-2299-6263  
E-mail : wassub1024@dsplab.hanyang.ac.kr

# CONTENTS

- I. What is being standardized?
- II. Why should we standardize now?
  - 1. MD Manufacturer's Viewpoint
  - 2. Baseband Chip Manufacturer's Viewpoint
  - 3. Possible Network Operator's Opportunities
- III. Implementation of Prototype

# I. What is being standardized?

## **I. What is being Standardized?**

### 1. Objective (1/2)

❖ To define BB function blocks and BB interfaces of Mobile Device.

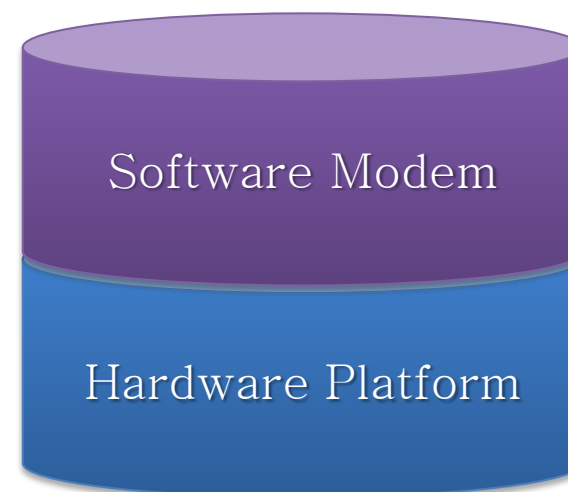
← MD is not restricted by algorithms, hardware platform, or communication standards.

## **I. What is being Standardized?**

### 1. Objective (2/2)

- Separation between software modem and hardware platform using the BB Interface
- Radio Application becomes independent of hardware platform architecture

← Resolve Portability problem !

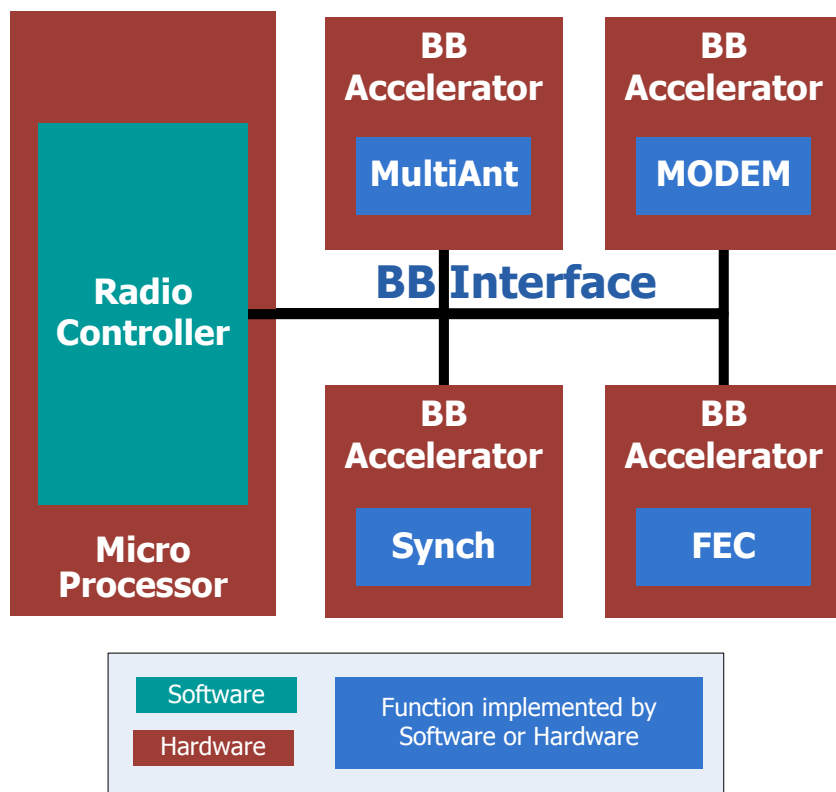


***S/W and H/W are decoupled!***



## I. What is being Standardized?

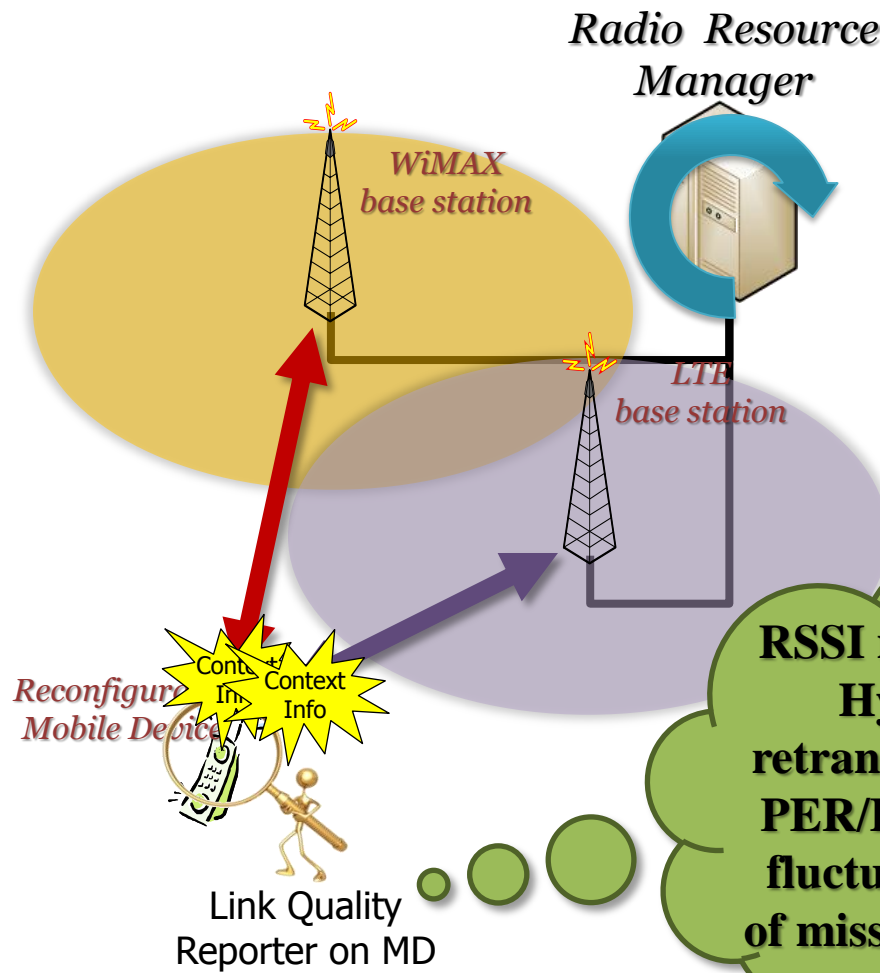
### 3. Structure of MD adopting the BB Interface



- Radio Controller, which operates in a general Mobile Microprocessor such as ARM, is a S/W for managing context information and user data packet.
- BB Accelerator is a H/W whose function can be either fixed or programmable.
- Since Radio Controller accesses each BB Accelerator through the BB Interface, it is independent of BB Accelerator architecture.

## I. What is being Standardized?

### 4. Link Selection of Reconfigurable MD



- Link quality is measured using Context Information provided from the Baseband interfaces and sent by the MD to the Radio Resource Manager
- Radio Resource Manager determines the link selection.
- The link selection may be evaluated considering the Context Information.



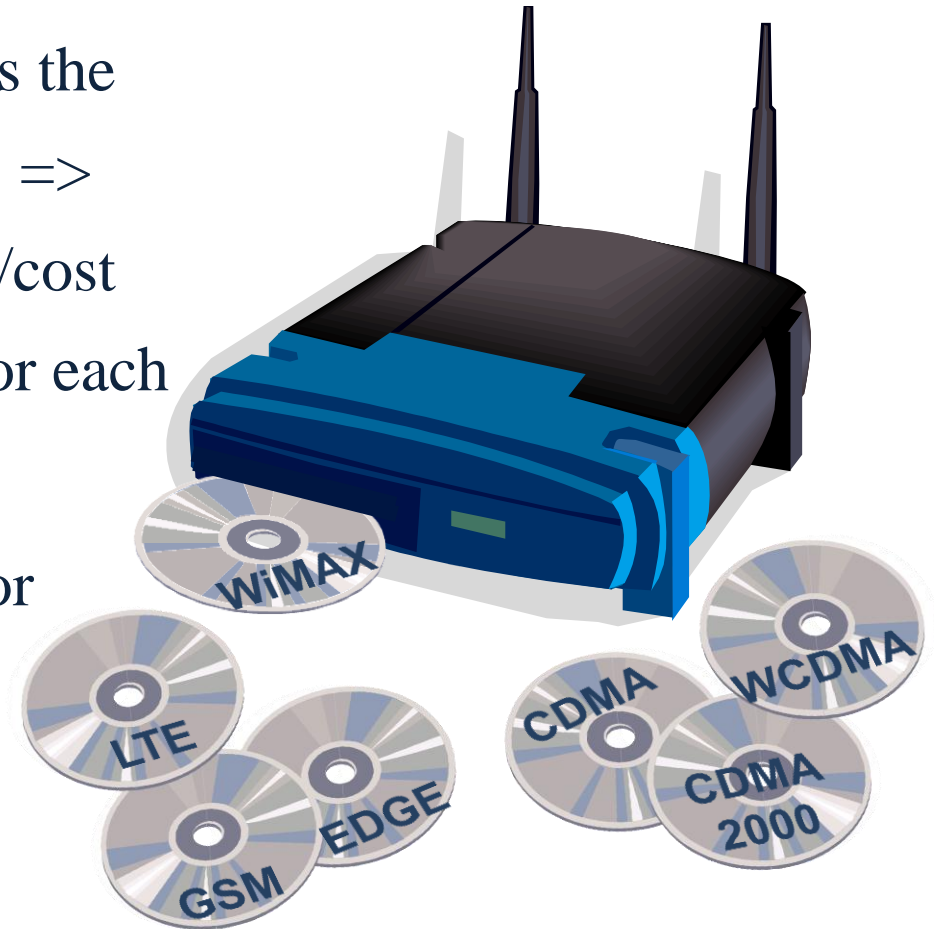
## II. Why should we standardize now?

# 1. MD Manufacturer's Viewpoint

## II. Why should we standardize now?

### 1. MD Manufacturer's Viewpoint (1/3)

- Every RA\* provider adopts the **STANDARDIZED** interface. =>  
No need to extra efforts/time/cost for matching the interfaces for each new waveform.
- Win a common platform for various waveforms

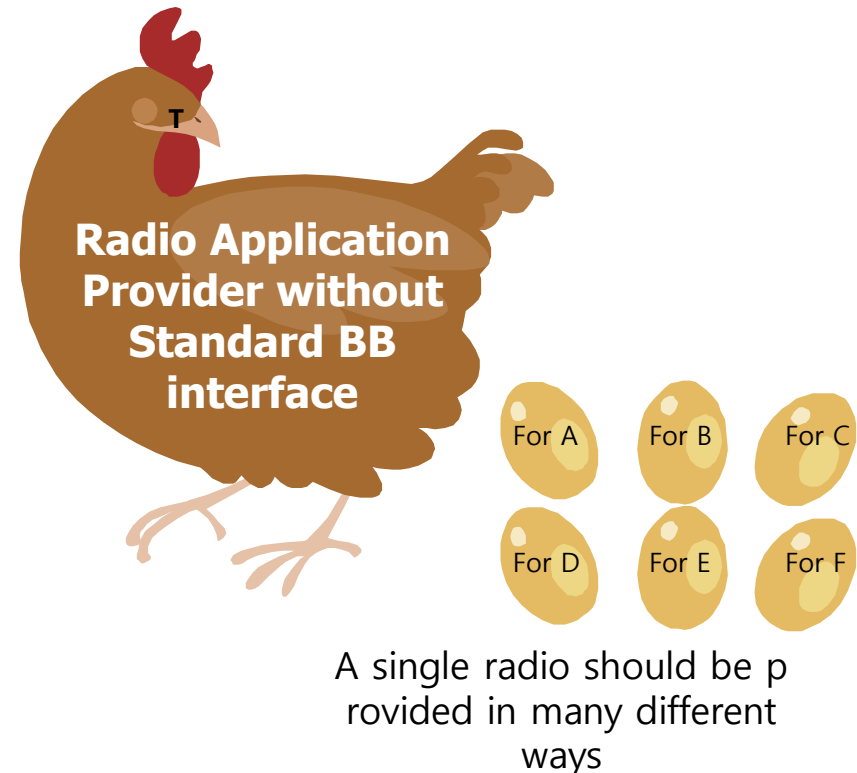
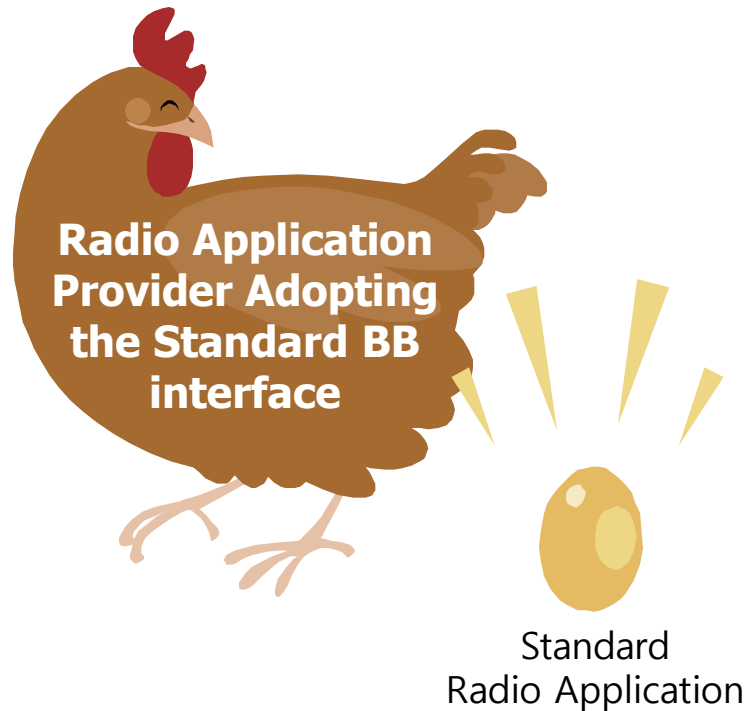


\*RA: Radio Application

## II. Why should we standardize now?

### 1. MD Manufacturer's Viewpoint (2/3) (+ RA Provider's Viewpoint)

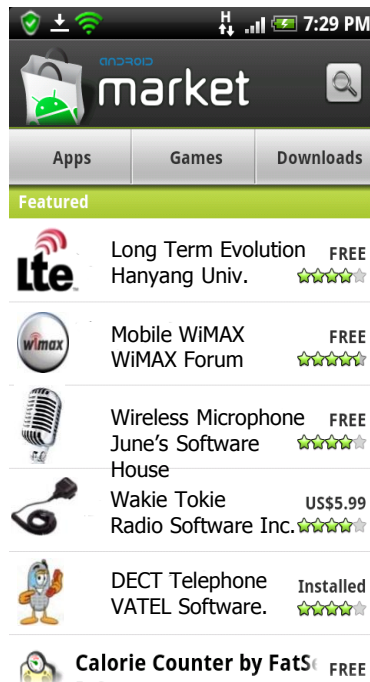
- A single radio application can be used to all MDs of different vendors, if the standard BB Interface is adopted in the MDs.



## II. Why should we standardize now?

### 1. MD Manufacturer's Viewpoint (3/3)

- Radio applications come from RadioApps Store  
← RA is provided by 3<sup>rd</sup> party !



<App Store>



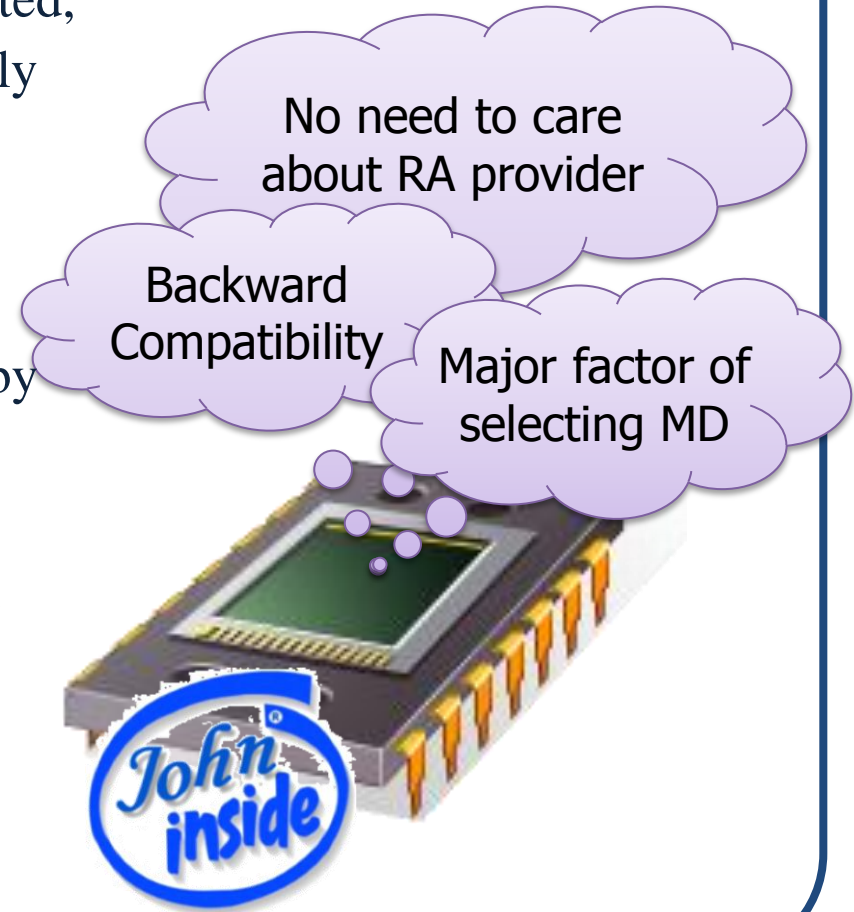
## 2. Baseband Chip Manufacturer's Viewpoint

## II. Why should we standardize now?

### 2. Baseband Chip Manufacturer's Viewpoint (1/2)

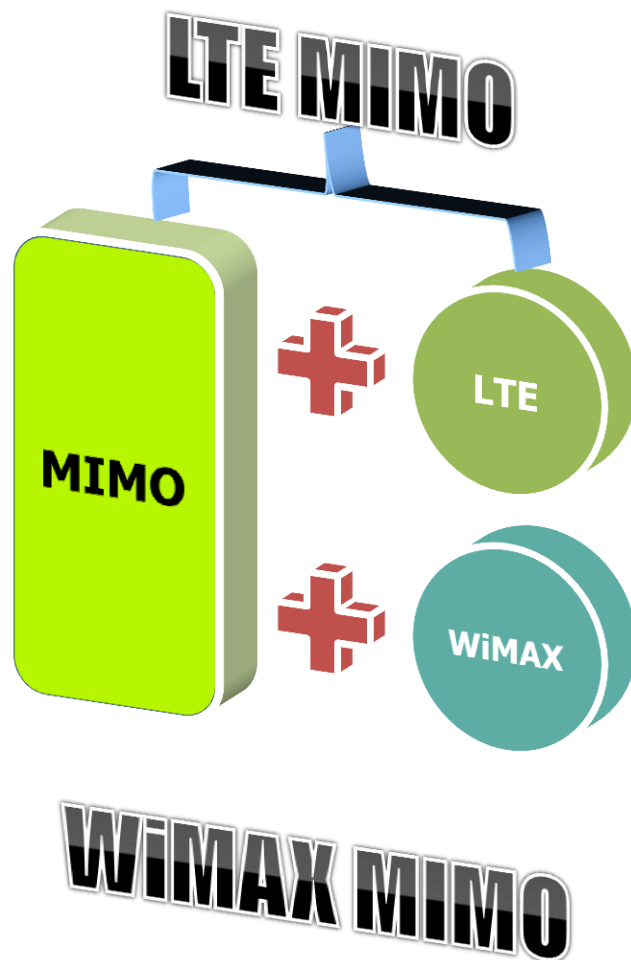
- Once the standard BB interface is adopted, BB chip can be developed independently of RA\* providers, for RA operates independently of each block of BB processor, i.e., BB Accelerator.
- Backward compatibility is guaranteed by the standard BB interface.
- BB chip can be a major factor of determining MD's competitiveness, for the better network performance, multi-radio application capability, etc can be provided by the better BB chip.

\*RA: Radio Application



## II. Why should we standardize now?

### 2. Baseband Chip Manufacturer's Viewpoint (2/2) (+ RA Provider's Viewpoint)



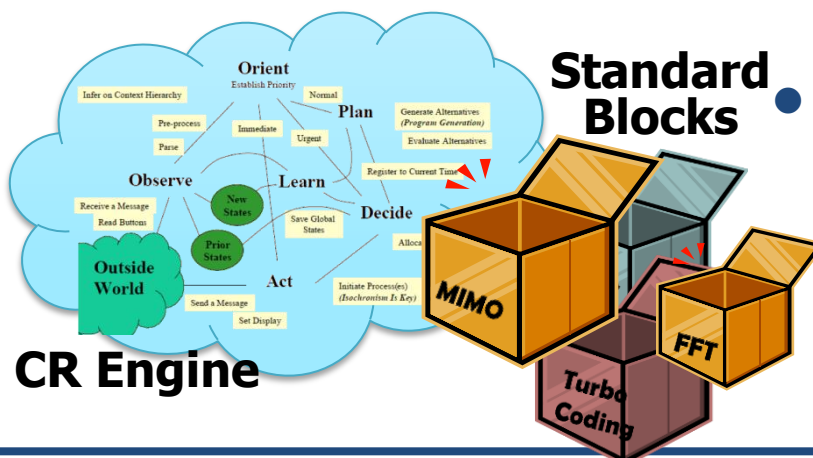
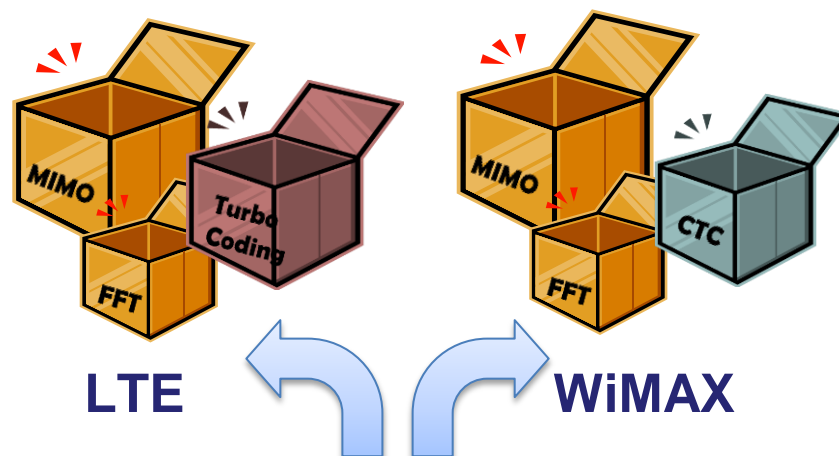
- Maximization of Block Reuse
  - Multi Antenna Technology can be combined with various kinds of waveforms, for it is independent of modem architecture
  - Without standardizing the interfaces of MIMO, modem should be redesigned whenever it is to be combined with MIMO technology.  
=> Maximizes the reuse of MIMO & modem codes



### 3. Possible Network Operator's Opportunities

## II. Why should we standardize now?

### 3. Possible Network Operator's Opportunities (1/2)



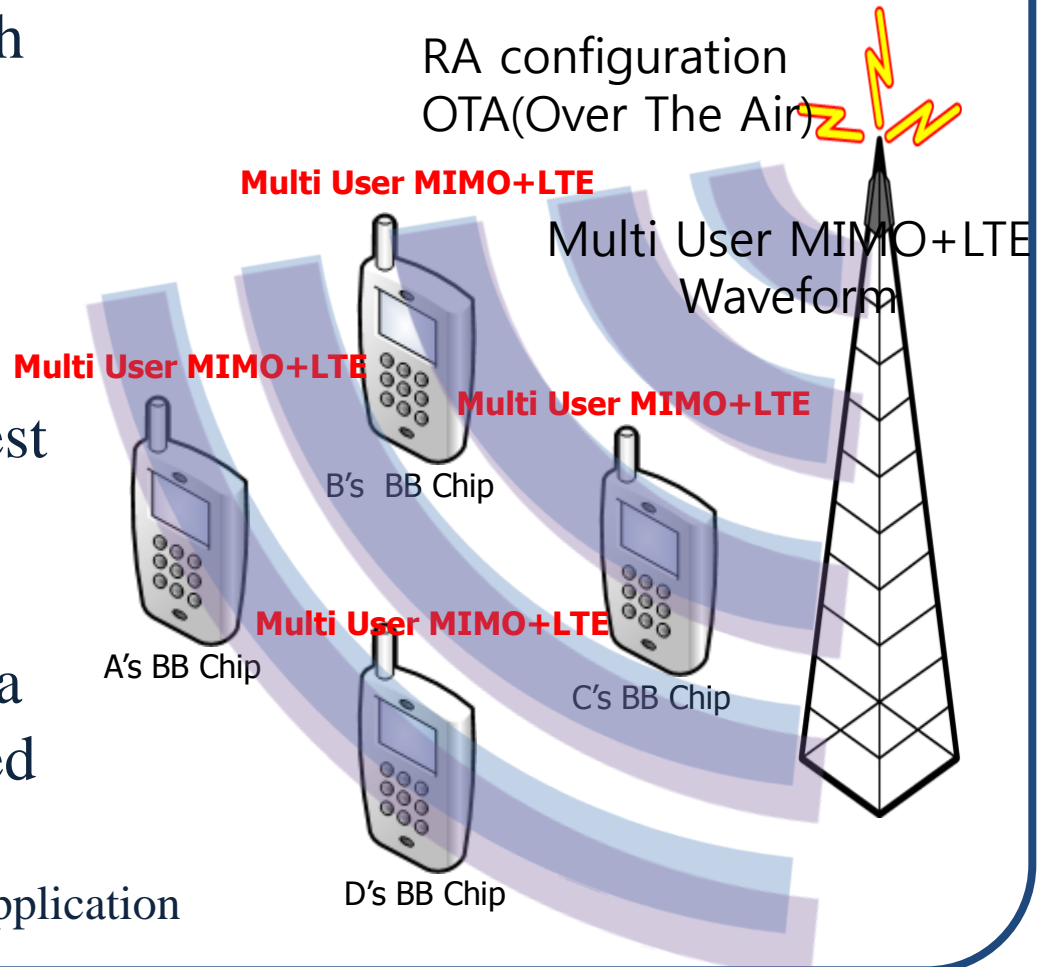
- SDR is a necessary condition for CR.
- CR Engine generates an optimal waveform according to cognized radio environment.
- The optimal waveform can be provided by combining the standardized blocks.

## II. Why should we standardize now?

### 3. Possible Network Operator's Opportunities (2/2)

- Operator can provide both network-driven link selection and network-driven RA\* selection.
- Operator can adopt a particular RA which is best appropriate to its own network.
- Operator can even adopt a new RA that is customized to its own network.

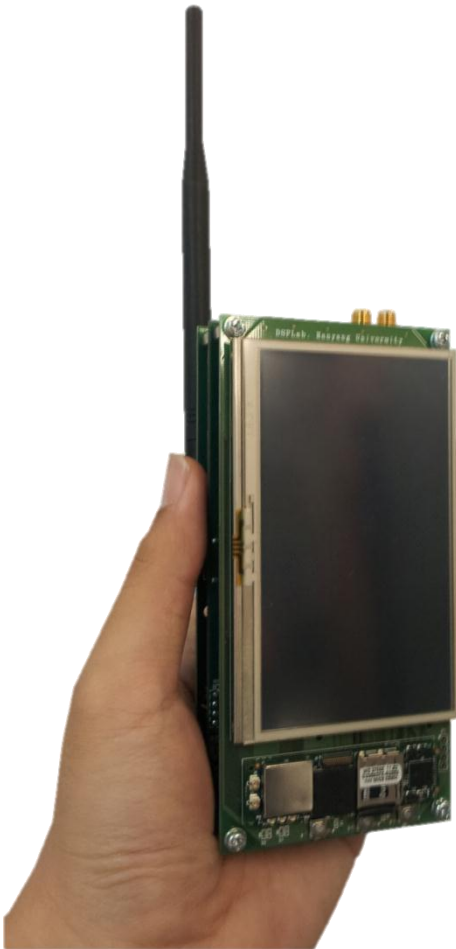
\*RA: Radio Application



# III. Implementation of Prototype

### **III. Implementation of Prototype**

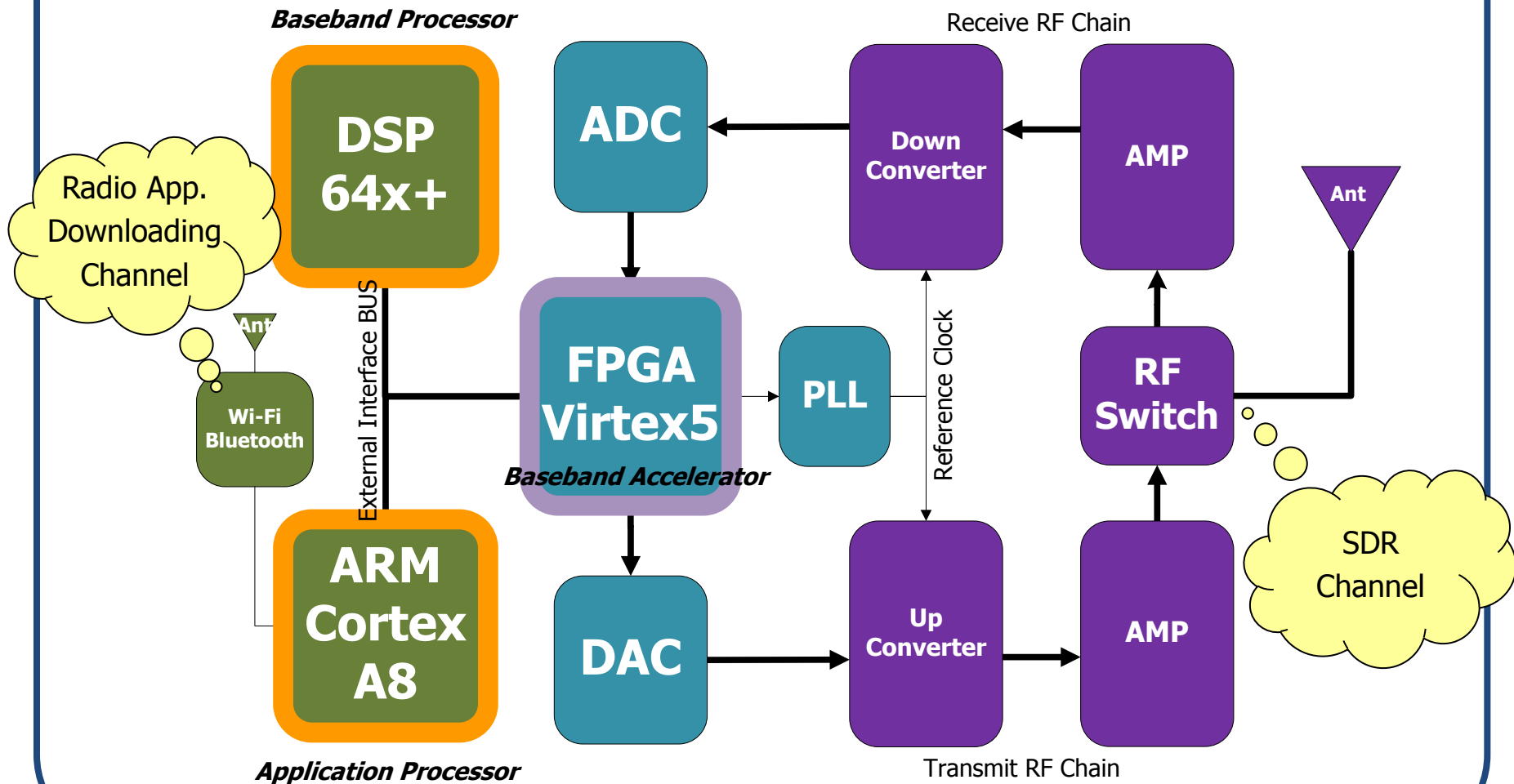
#### **1. Handset Platform of Hanyang Univ.**



- AP: ARM Cortex-A8
- BP: TI 64x+ DSP, Xilinx Virtex5 FPGA
- Memory: DDR 256MB, NAND 256MB
- OS: Android
- Connectivity: Wi-Fi, Bluetooth, SDR Channel
- SDR Channel RF Range :  
400MHz ~ 4.4GHz

## III. Implementation of Prototype

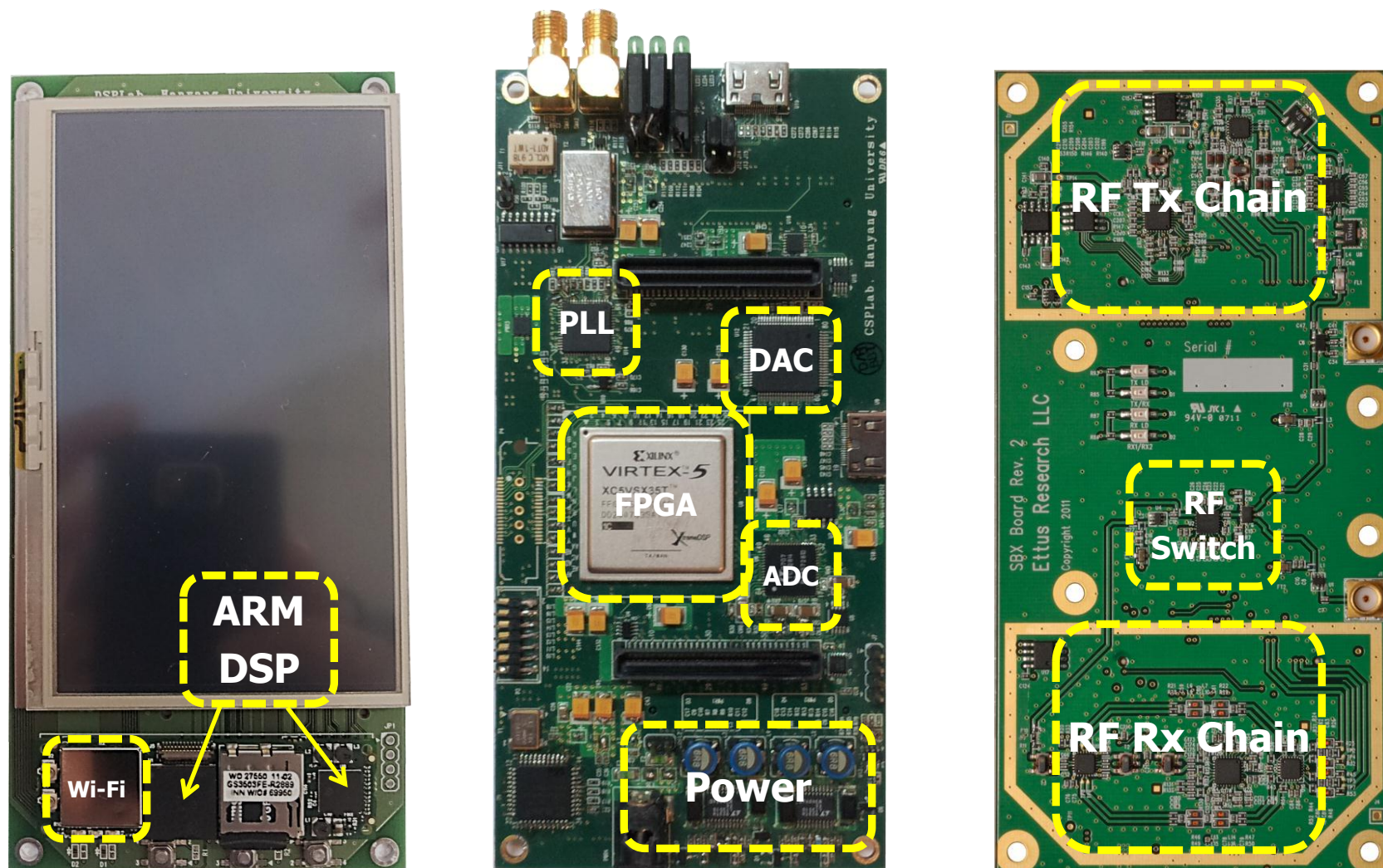
### 2. Hardware Platform (1/2)





## III. Implementation of Prototype

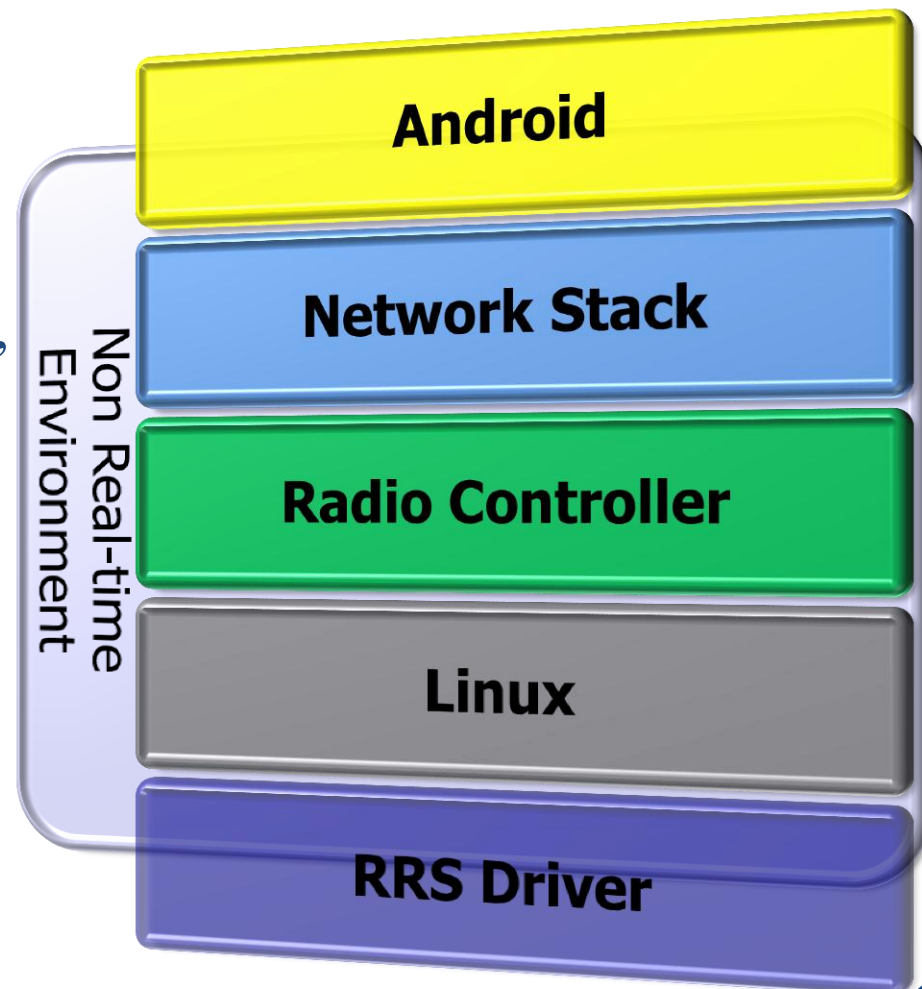
### 2. Hardware Platform (2/2)



## III. Implementation of Prototype

### 3. AP Side

- Non Real-time  
Environment : Linux  
Kernel without RT patch
- RRS Driver: DSP interface,  
Loader, Standard Function  
Block Pool,
- Radio Controller

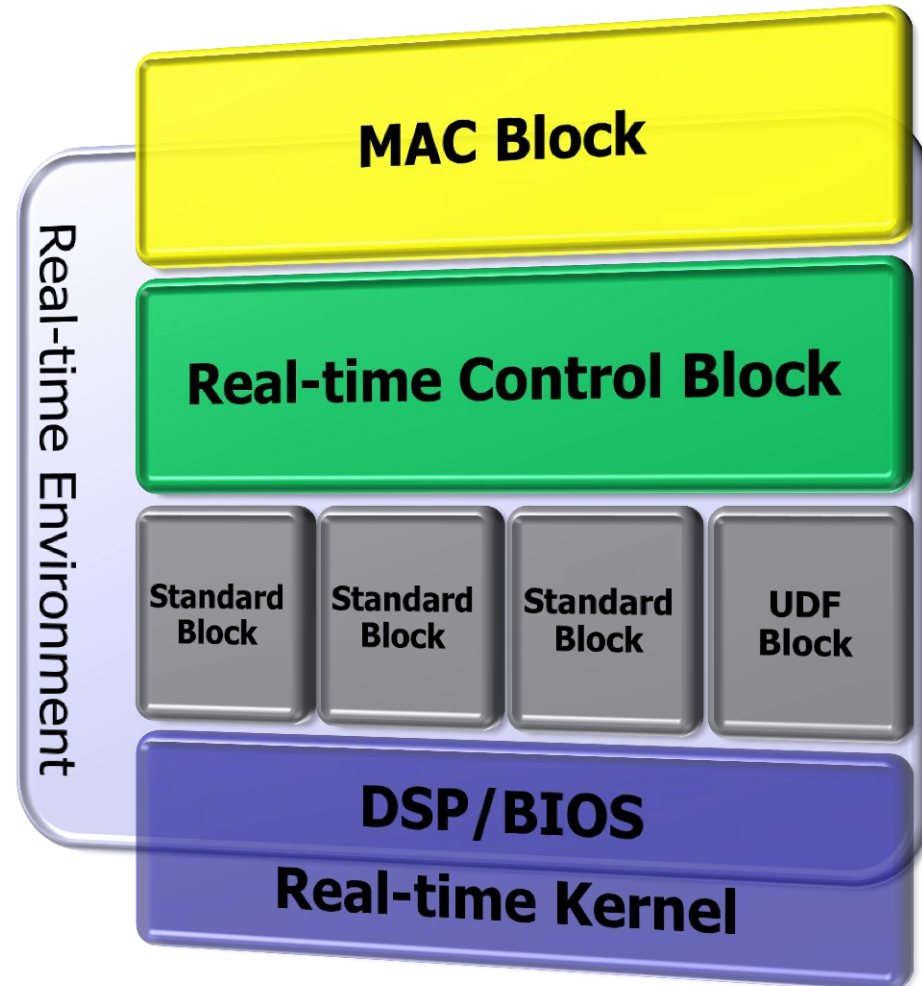




### III. Implementation of Prototype

#### 4. BP Side

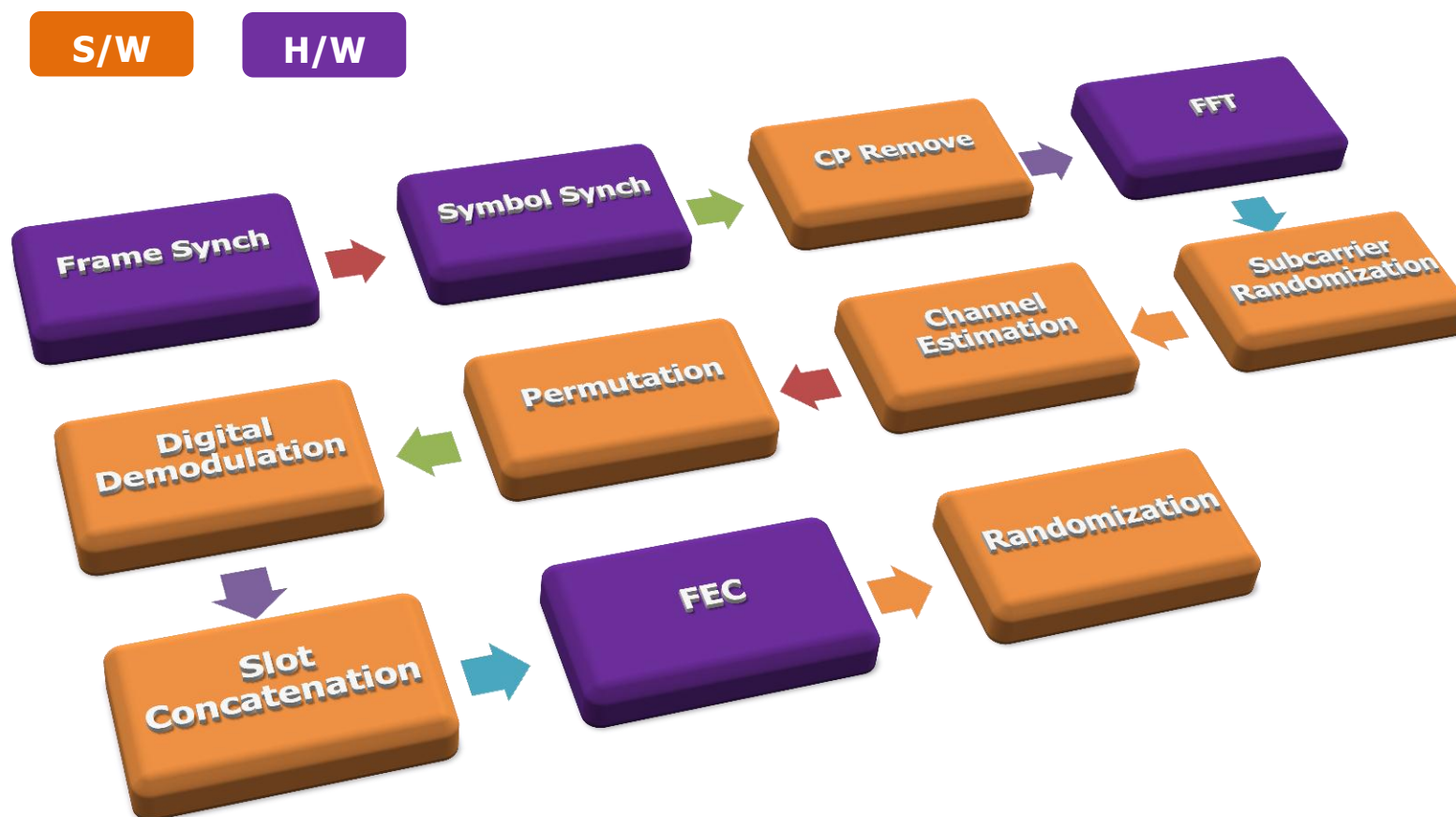
- Real-time Environment :  
DSP/BIOS
- Loader to load the Block



### III. Implementation of Prototype

#### 5. Mobile WiMAX Radio Application (1/3)

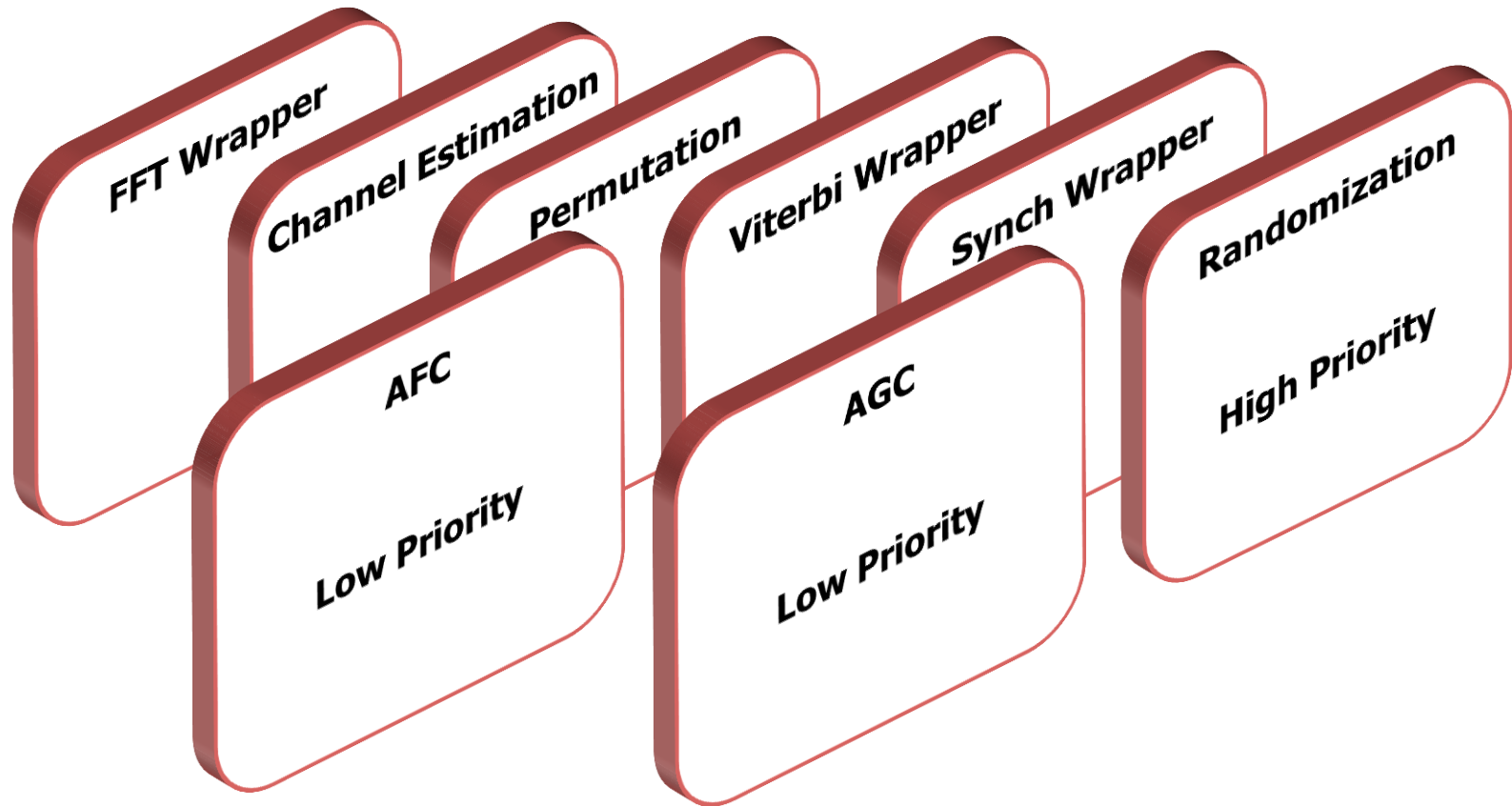
- Function Blocks for Mobile WiMAX



### **III. Implementation of Prototype**

#### **5. Mobile WiMAX Radio Application (2/3)**

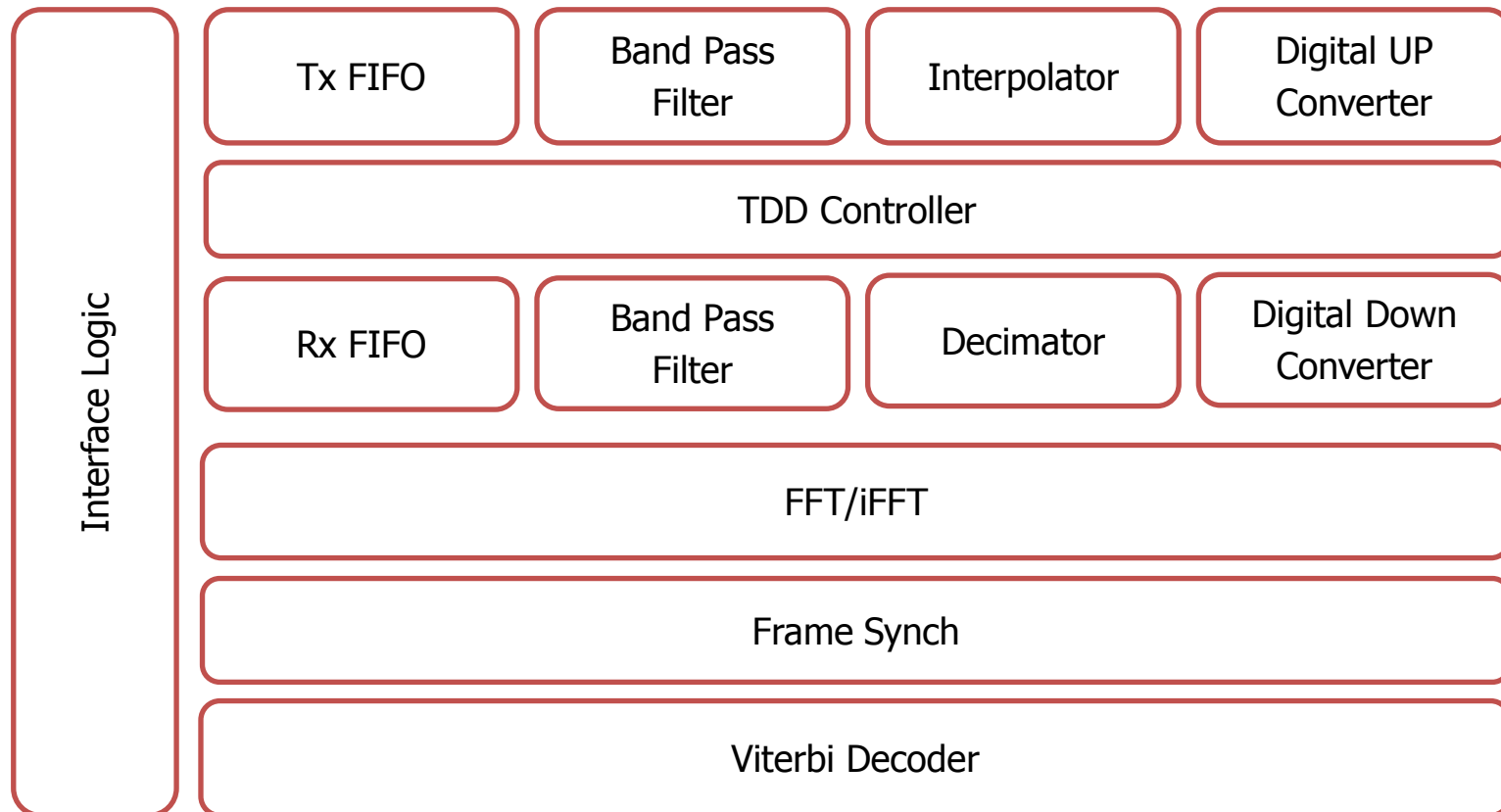
- Inside DSP : Real-time Scheduling



### III. Implementation of Prototype

## 5. Mobile WiMAX Radio Application (2/3)

- Inside FPGA





**Thank you**