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2004

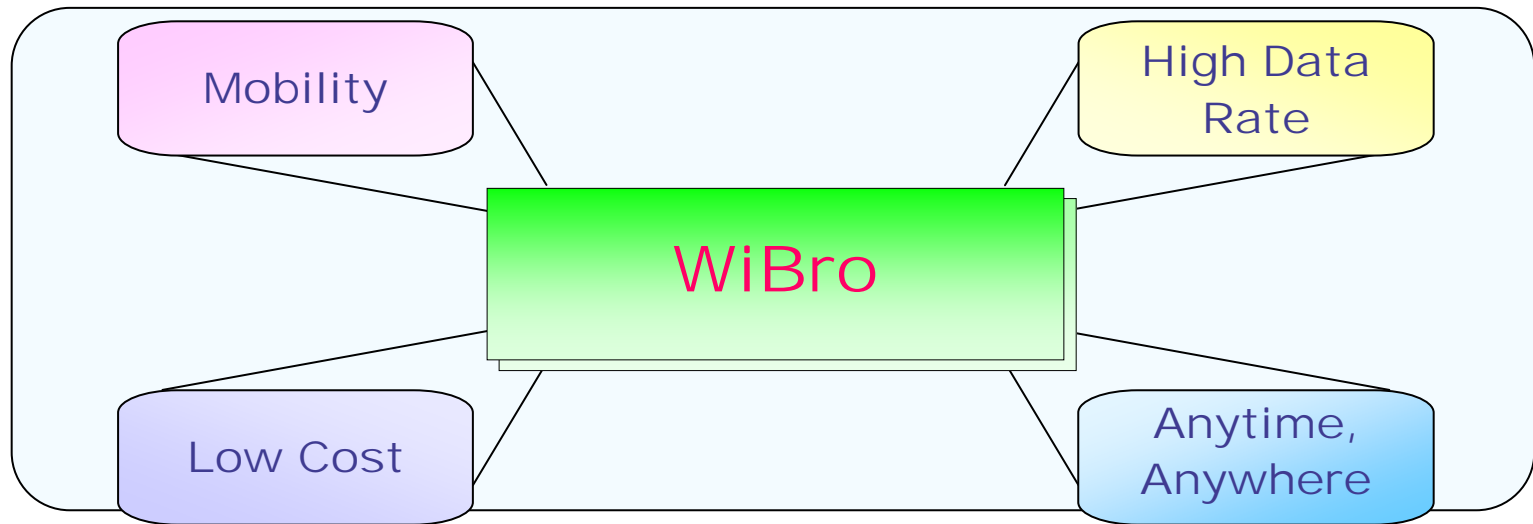
Portable Internet Services

Chaehag (Steve) Yi

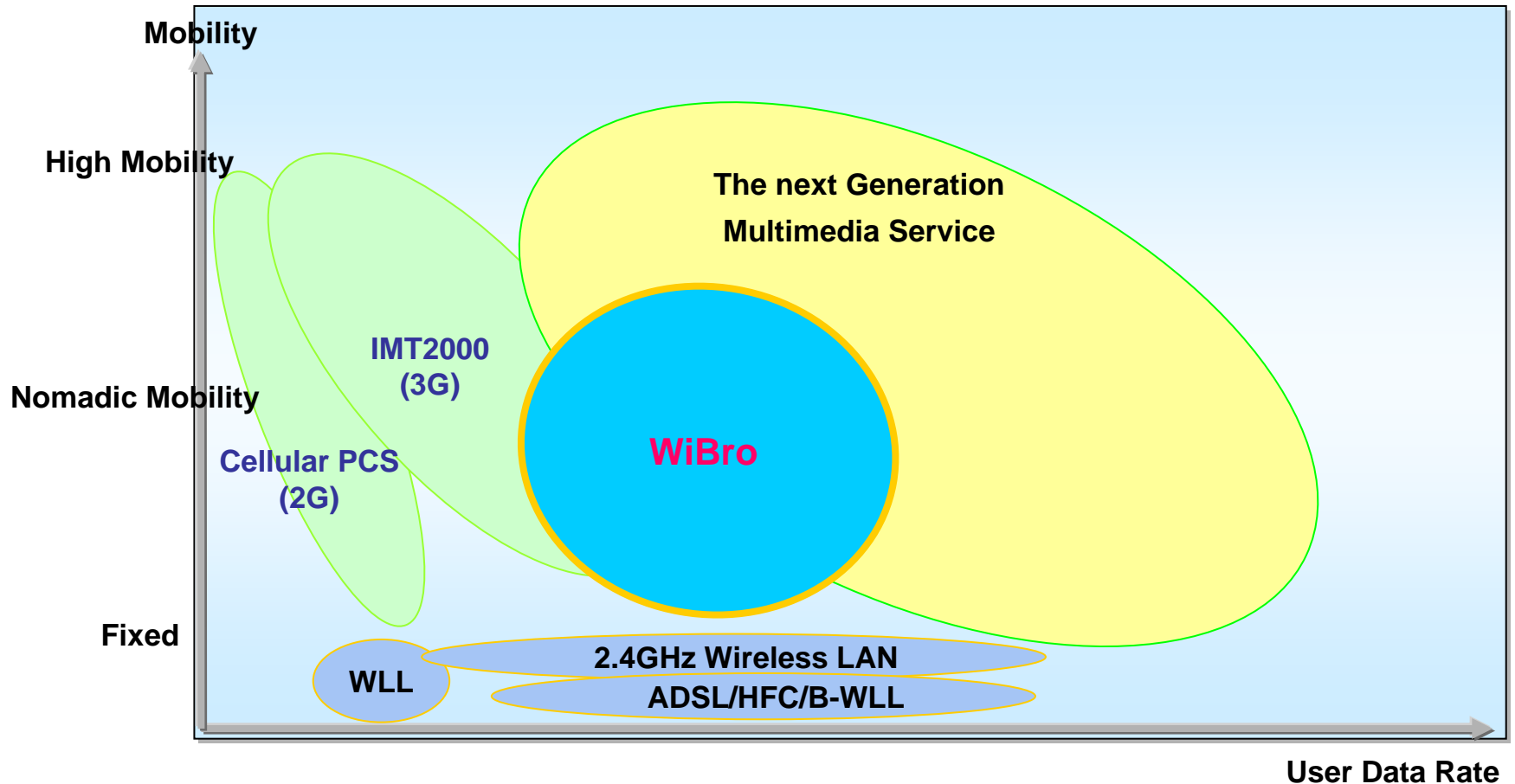
SOLiD Technologies, INC

Portable Internet - Definition

- It's a High-Rate wireless internet access services that can be provided to any user, while moving as well as stationary, with a portable terminal anywhere, anytime.
- 『 Portable Internet 』 was named to 『 WiBro 』 . (End of April, 2004)
- **WiBro** : Wireless Broadband



Portable Internet - positioning

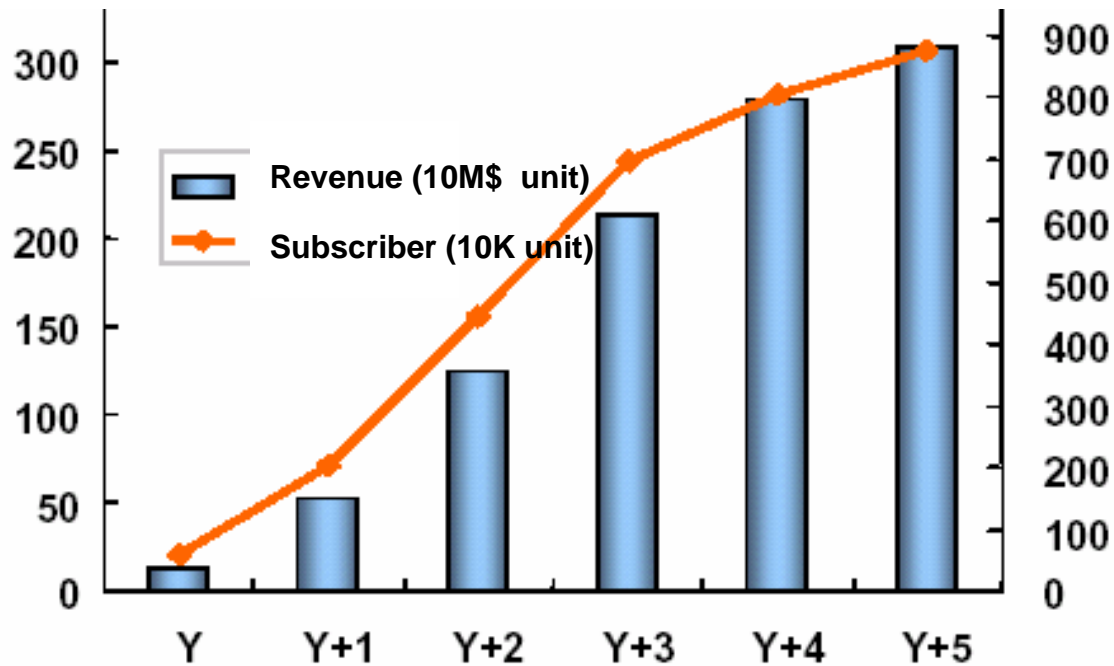


Portable Internet Market Forecast

■ Background

- Demand on (Wire/Wireless) Internet services in Korea has risen
- An efficient frequency band was sought by Industries; the government reallocated 2.3GHz, once allocated for FWA (WLL), for Portable Internet service (Dec. 2002)
- Why Portable Internet ? => Korean market wants Portable Internet service

Portable Internet Market Forecast



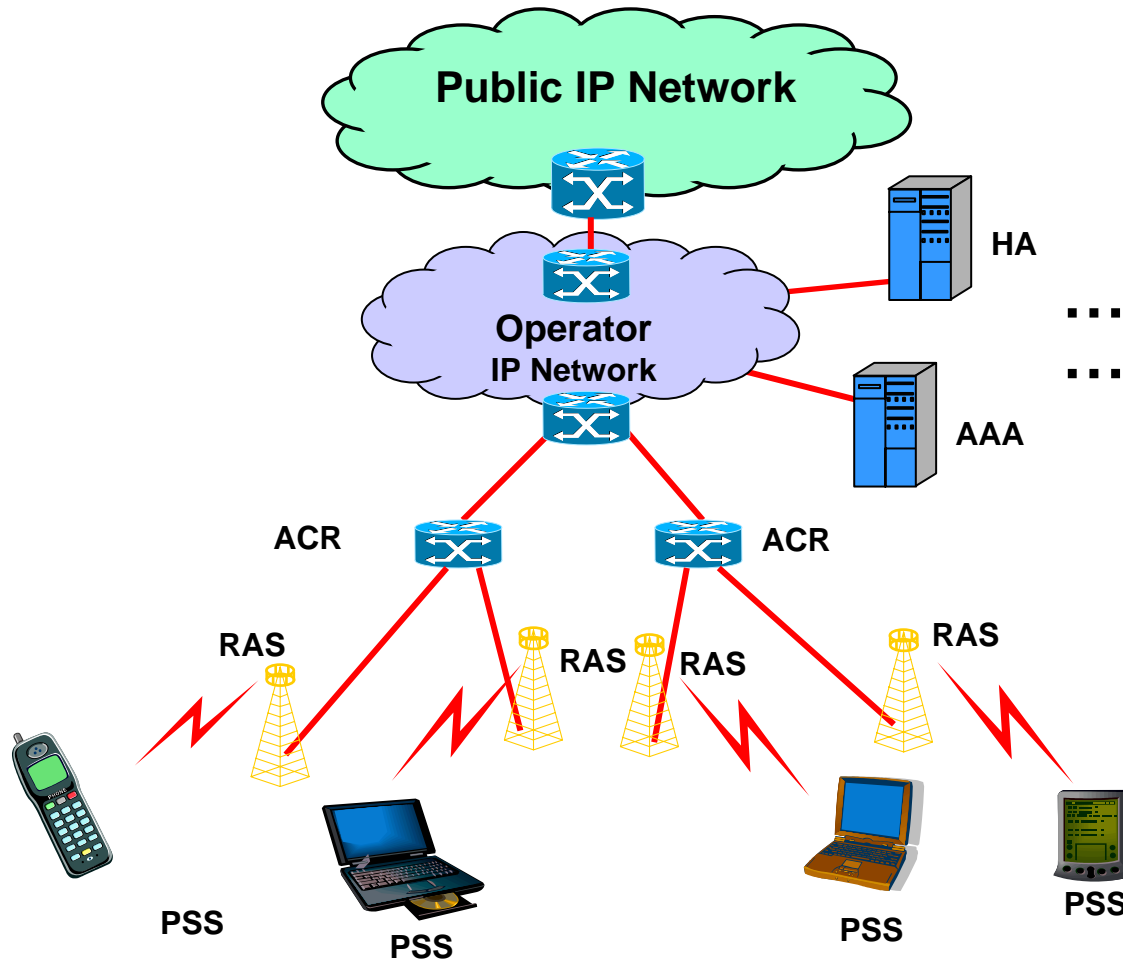
*Y+5 years from beginning : 8.9M
subscribers, 3 billion dollars revenue*

Standardization by TTA

Major System Parameters	
Duplexing	TDD
Multiple Access	OFDMA
Channel BW	10MHz

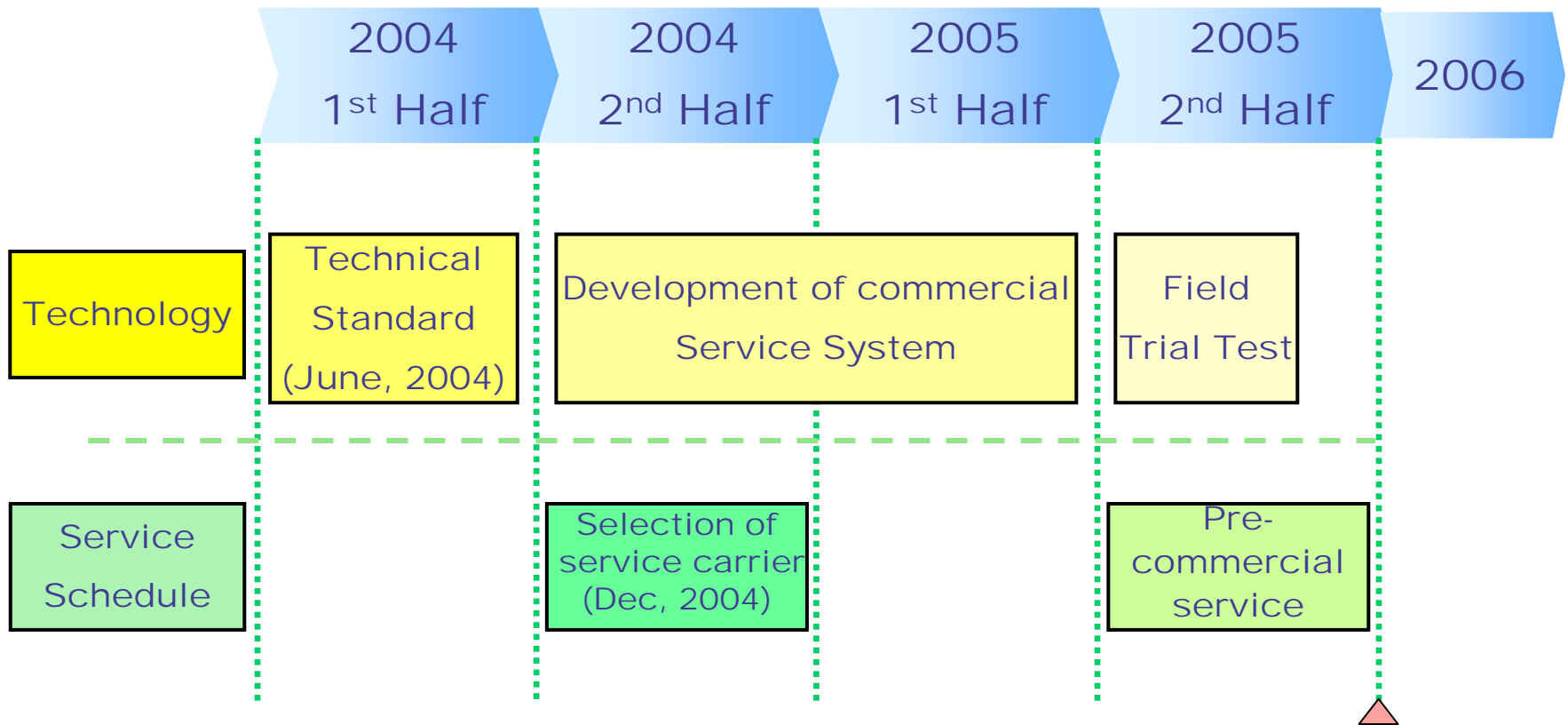
Radio Access Requirement	
Frequency Reuse Factor	1
Mobility	60 Km/h
Service Coverage	1 Km
Frequency Efficiency [bps/Hz/cell(sector)]	max. DL / UL = 6 / 2 aver. DL / UL = 2 / 1
Handoff	Between cells, sectors & Frequency : $\leq 150\text{ms}$
Throughput (per a User)	max. DL / UL = 3 / 1 [Mbps] min. DL / UL = 512 / 128 [Kbps]

Network Architecture of Portable Internet



- ✓ ACR : Access Control Router
- ✓ RAS : Radio Access Station
- ✓ PSS : Personal Subscriber Station

Schedule for Portable Internet Service



Key component technologies

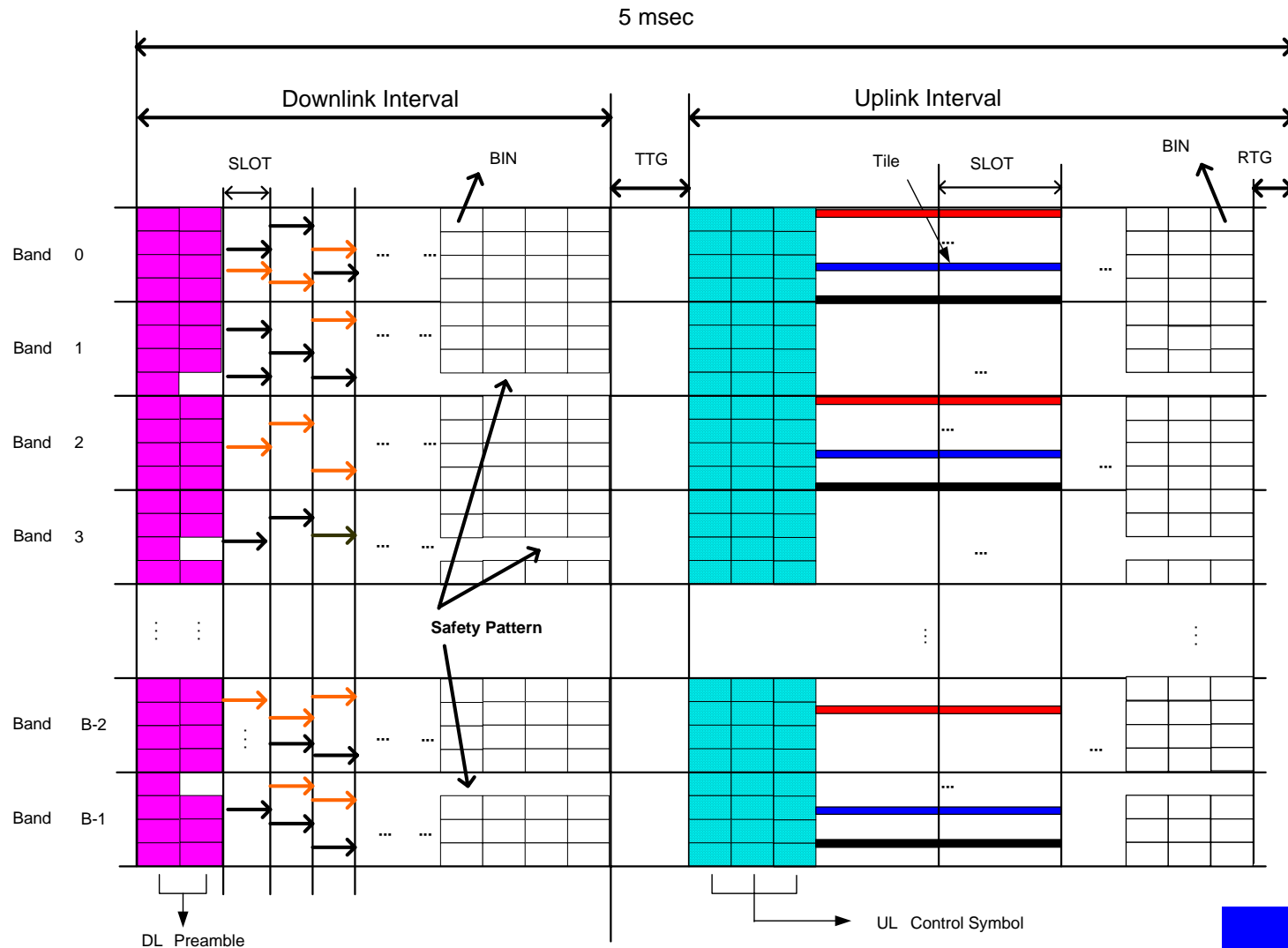
- Mobility Support with High Spectral Efficiency
 - Frequency reuse factor 1 operation
 - Sub-channel allocation method to minimize RAS interferences
 - Cell edge – Low rate FEC
 - Safety Channel
 - Fast AMC by CTC with QPSK/16/64 QAM based on channel quality reporting
 - Battery life saving by sleep mode

Key component technologies

■ Genuine Internet Access

- Hybrid ARQ for high quality and low latency
Guarantee enhanced link performance
- Various QoS support
Best effort/Real time polling/Non-real time polling
- Enhanced handoff
Seamless connection for mobile user

Frame Structure



Parameters for OFDMA Signal

Parameter	Value
System Bandwidth	10 MHz
Sampling Frequency (F_s)	10 MHz
Sampling Interval ($1/F_s$)	100 nsec
FFT Size (N_{FFT})	1024
# of used sub-carriers	864
# of data sub-carriers	768
# of pilot sub-carriers	96
Sub-carrier spacing	9.765625KHz
Effective symbol duration ($T_b=1/\Delta f$)	102.4 μs
CP period ($T_g= T_b/8$)	12.8 μs
OFDMA symbol period ($T_s= T_b+T_g$)	115.2 μs
TDD frame length	5 ms

Technical Issues in Portable Internet

- RAS vs. Repeater
- Terminal Type
- Modem Implementation

RAS vs. Repeater

- RAS vs. Repeater

 - Capacity or Coverage

 - TDD Repeater Feasibility

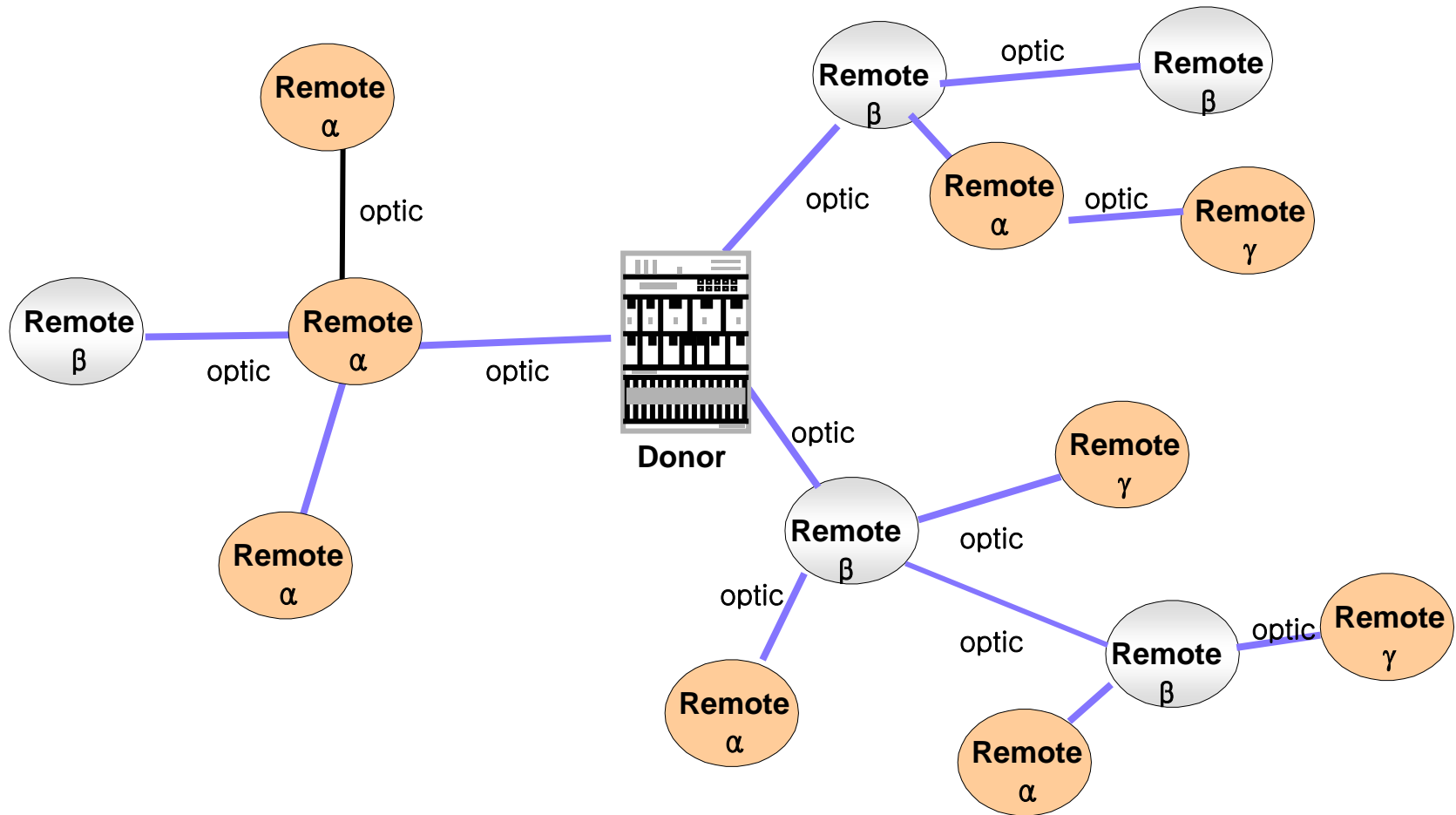
- RAS Architectures

 - Normal RAS + Pico RAS

 - Normal RAS + Repeater

 - Centralized RAS digital part with multiple RF parts

Centralized RAS Architecture



Terminal – Requirements

■ Legacy Data Terminals

	Pros	Cons
Note PC	Abundant software Good multimedia environment	Difficult to use for mobile user Long time for ON/OFF
PDA-like	Portability Cheap price	Poor multimedia environment No Killer application
Mobile Phone	Portability and Mobility	Expensive Solution

■ Portable Internet Terminal

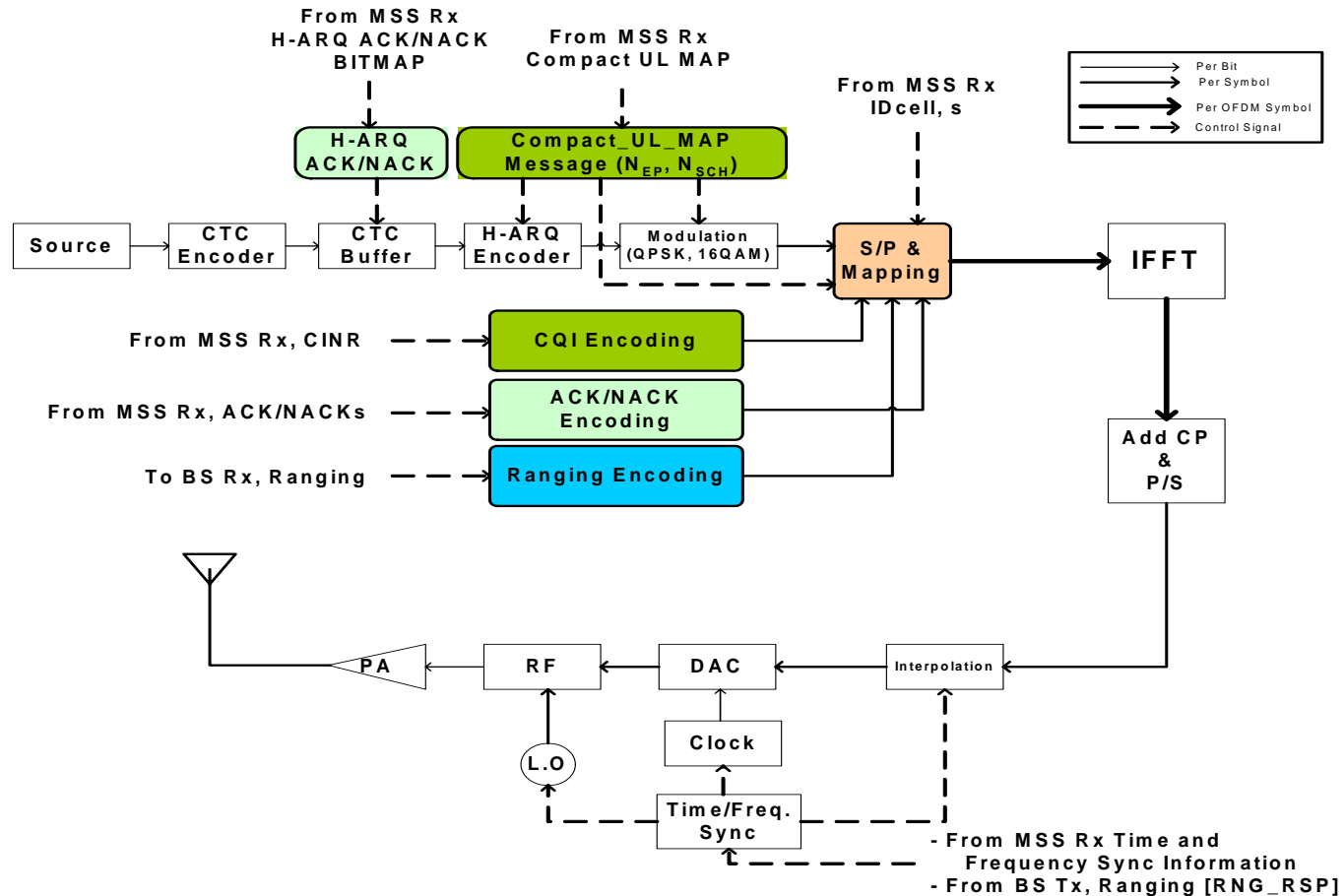
Portability and Mobility (like Mobile Phone)

Good Multimedia Environment (like Note PC)

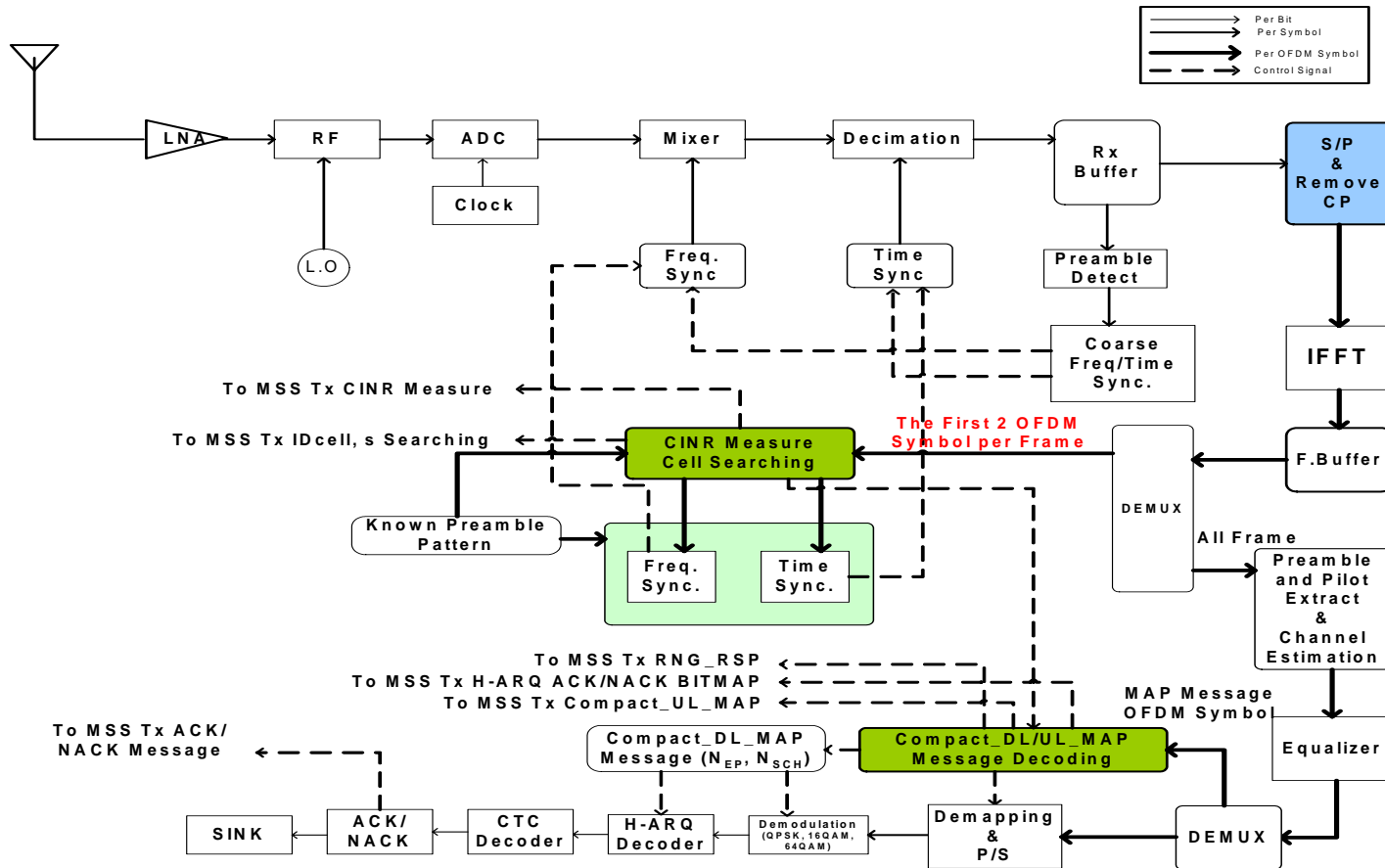
Terminal – Component Devices

- Application Processor
 - Various Multimedia Codec,
 - 2D/3D Graphic Engine
 - Low Power Consumption
- Communication Module
 - Multi-mode: Bluetooth, WLAN, Cellular
- Display: High Resolution, Low Power Consumption
- Storage
- Keyboard

Terminal Modem Block Diagram - Tx



Terminal Modem Block Diagram - Rx



How FPGA can help

- Implementation Issues

DSP vs. Logic

Time to market