

Future Mobile Devices Based on Software Based Platform



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. **Future Mobile Device**

- Convergence Trend
- Service Trend
- Network Evolution
- Handset Trend
- Future Mobile Requirements

. **Software Based Platform**

- Need for software based platform
- Multiband Multimode feature
- Reconfigurable feature
- Standard Interface feature
- Advantages of Software Based Platform
- Reconfigurable Platform
- Software driven hardware

. **LG Electronics' R&D**

- Korea IT 839 Project
- Vision



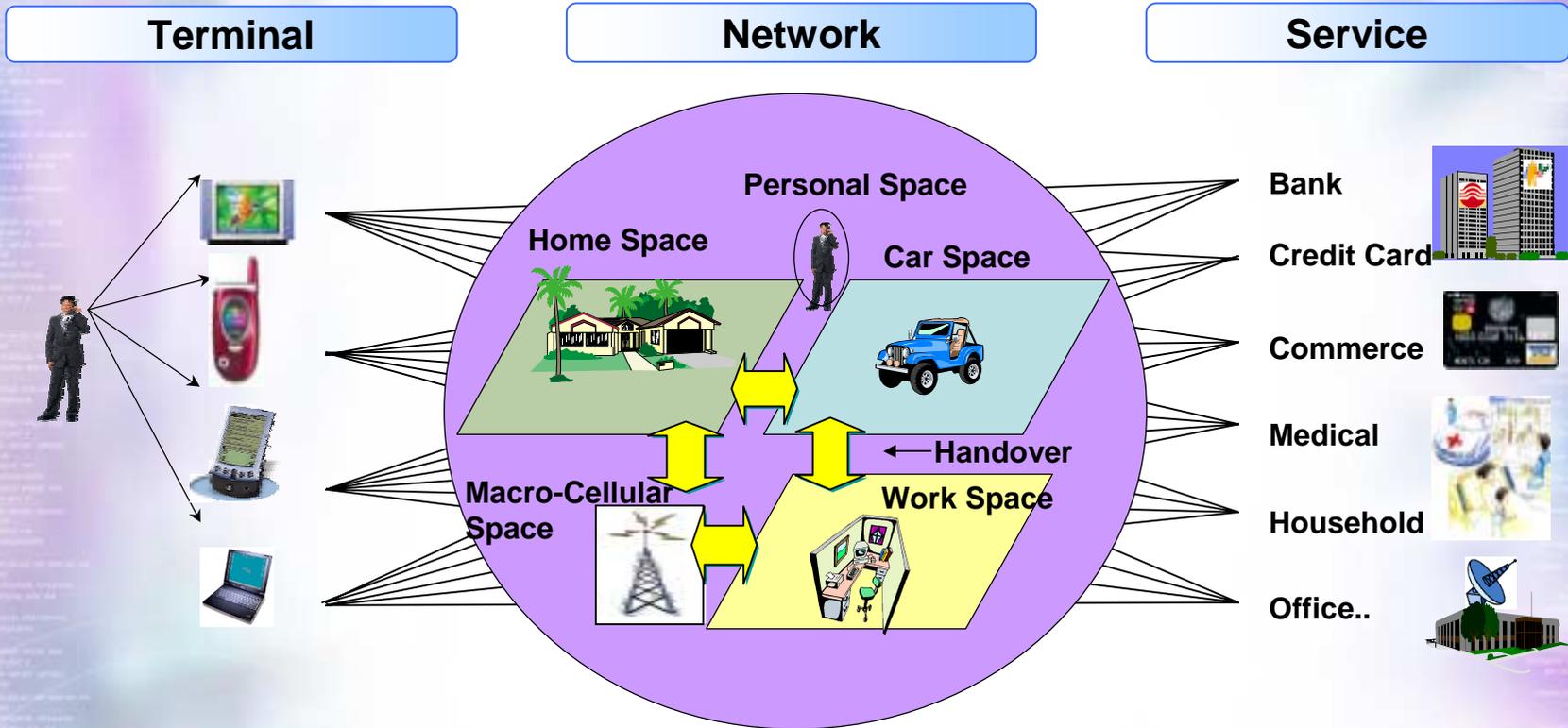
. Future Mobile Device

- Convergence Trend**
- Service Trend**
- Network Evolution**
- Handset Trend**
- Future Mobile Requirements**

Convergence Trend



Convergence is taking place in each area for the Ubiquitous Commun. Era



- Terminal Convergence
- Advanced Sensing Technology

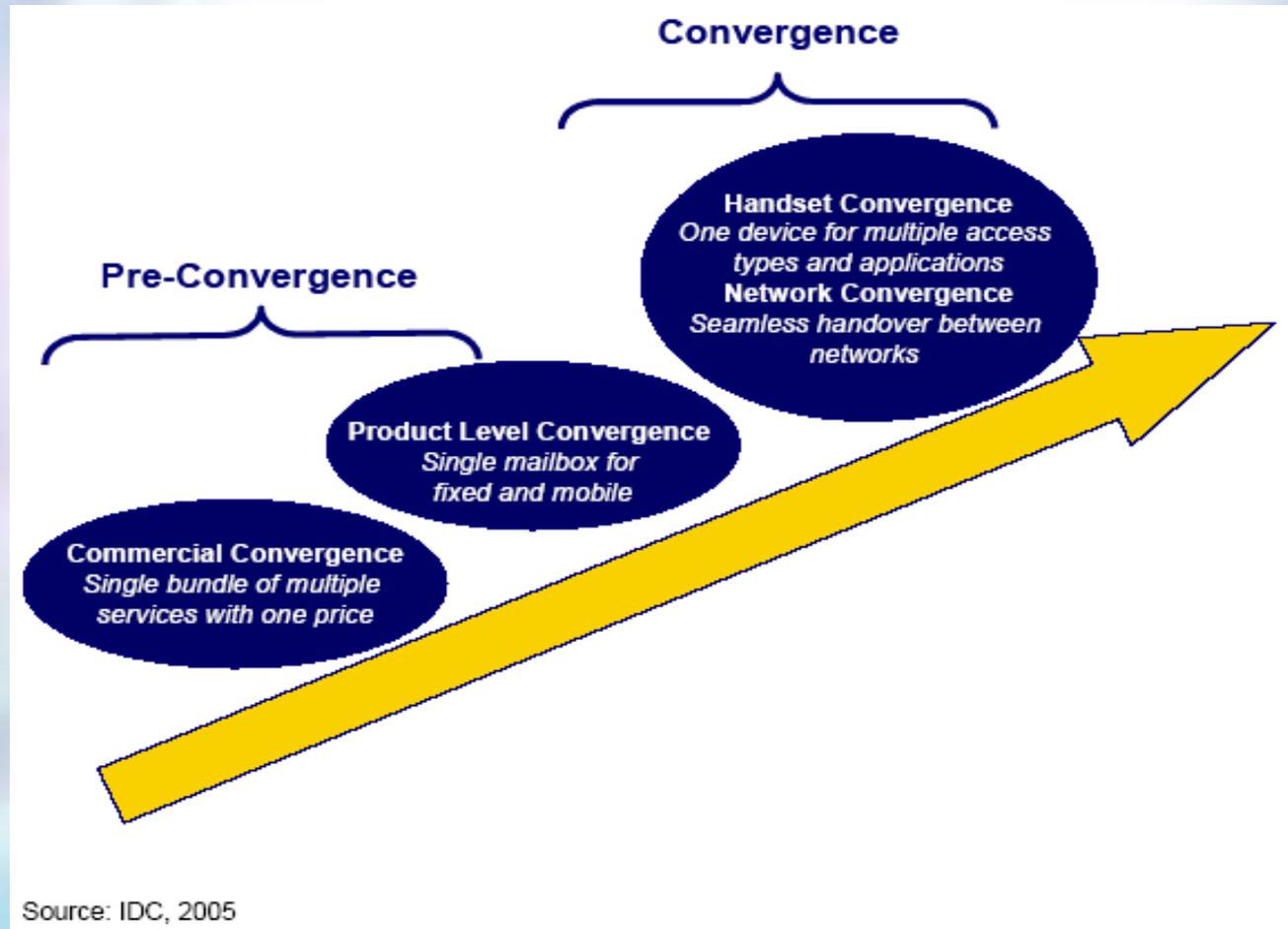
- Nomadic Network
- All IP Network
- Broadband

- Intelligent & Customized
- Multi-Device Interface

Convergence Trend



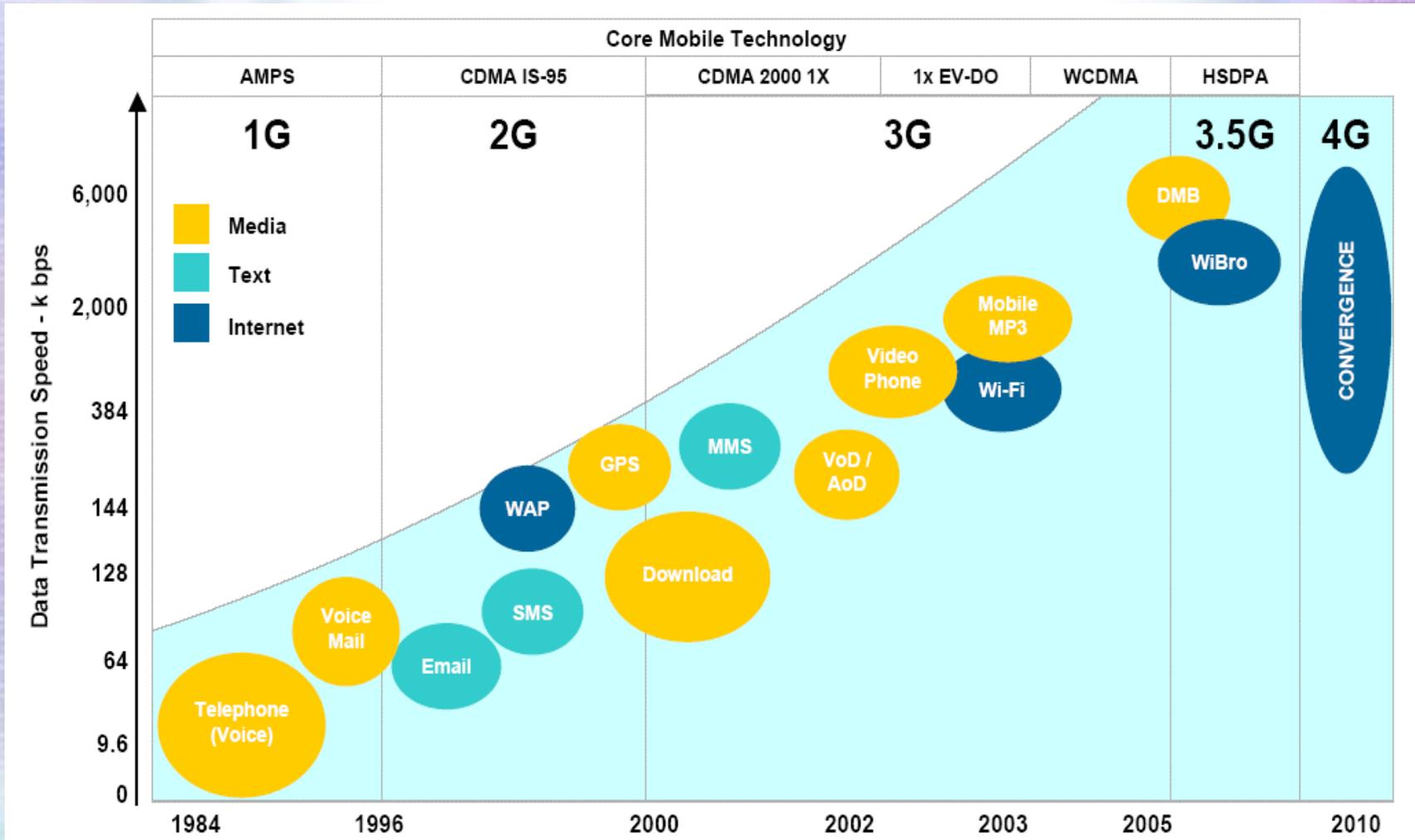
The Stages of Convergence



Service Trend

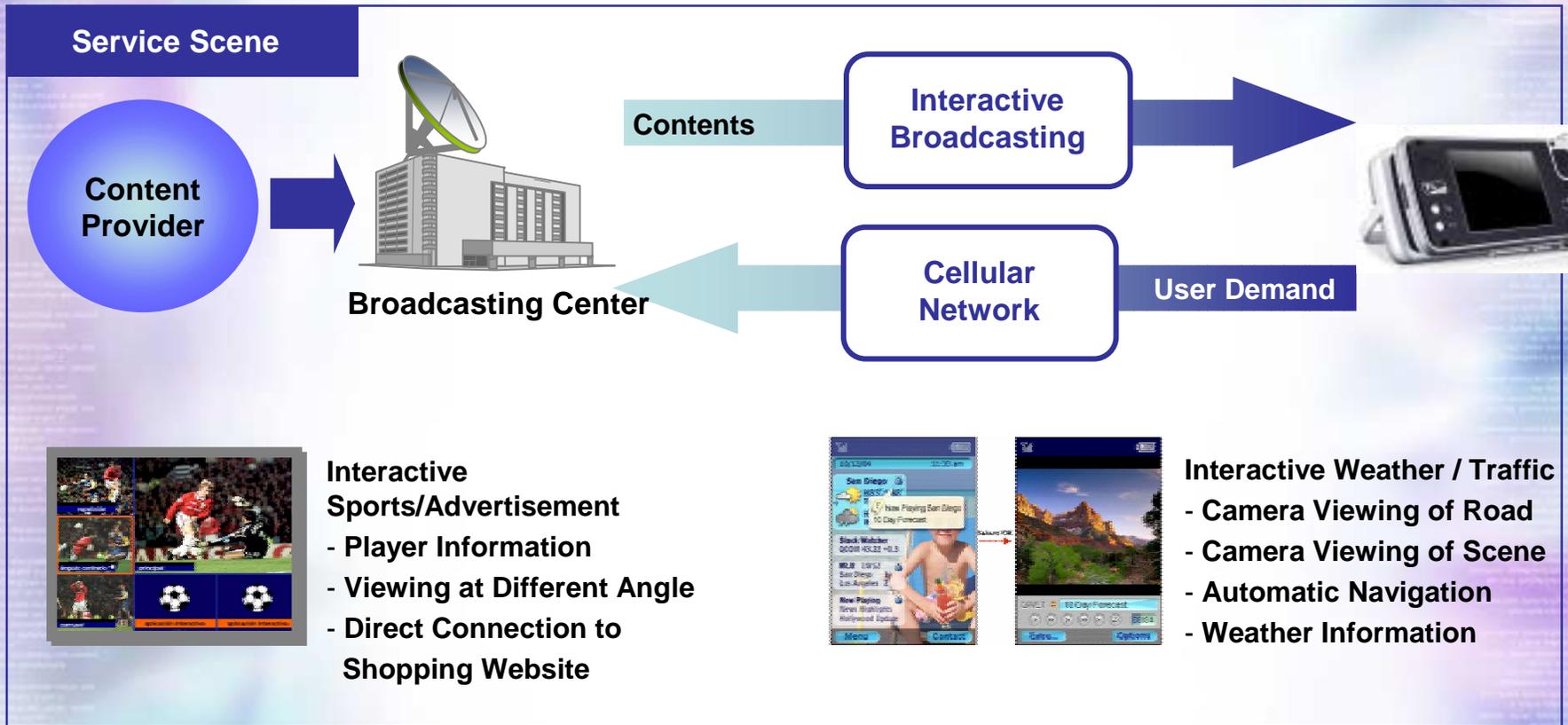


Service trend goes toward convergence





Communication/Broadcasting Convergence is Next Generation Killer Application





RFID/NFC

•Payment & Electronic Wallet



Pay the bill



e-Money Transfer

•Smart Poster



Movie Poster



3G



Movie Web Site

•Ubiquitous Sensor Network

- Tagging to All Stuff / Handset as Reader

UWB

•Wireless USB



USB

•Wireless High Quality Video



HD Video



HDTV

•Wireless High Quality Audio



Music Portal

Internet D/L of
purchased
music



Speedy Transfer

Transfer Speed
Of 15 Songs
(~ 60MB)

Bluetooth

~ 1min

UWB

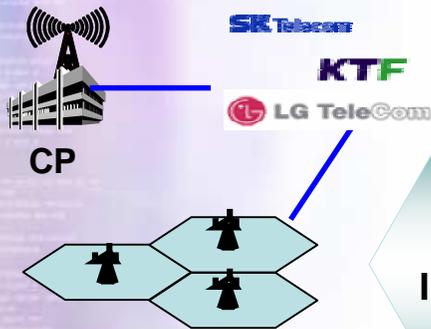
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Service Trend



Telematics will serve diverse converged services such as Navigation, Security, Information Service

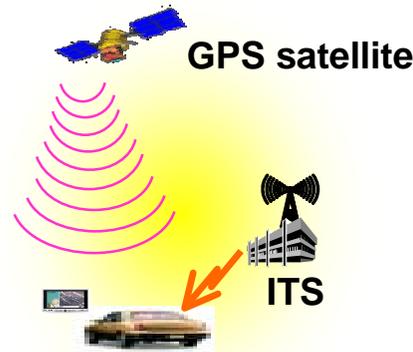
Cellular Network



- ◆ Ubiquitous service with convergence

Data Interactive

Telematics/Data



- ◆ Emergency control
 - Rescue, Auto Location Search
- ◆ Convenience in drive
 - Traffic Information
 - Navigation
- ◆ Auto diagnostics
 - Auto diagnostics, ACN
 - GPS

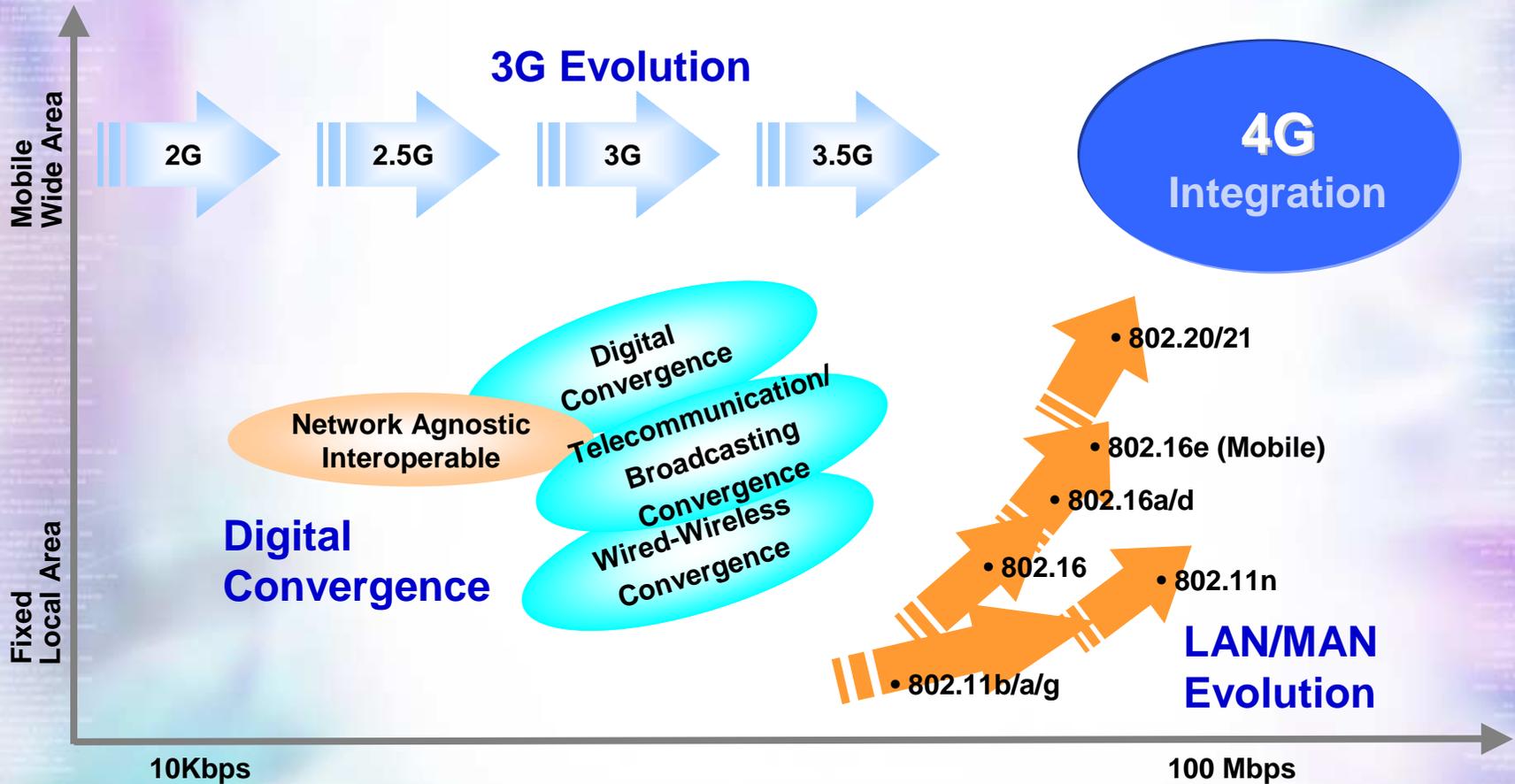
Telematics Device trends

- ◆ Service trends
 - Traffic Information, Navigation service enhancement
 - ITS enhancement
 - After market to Before market (value added for car)
- ◆ Security service enhancement
 - Voice recognition, Bio recognition
 - e-Trading, Interactive Multimedia Service
- ◆ u-Environment Service
 - Interoperability between Heterogeneous Networks
- ◆ Car Entertainment, Car Office oriented device

Network Evolution



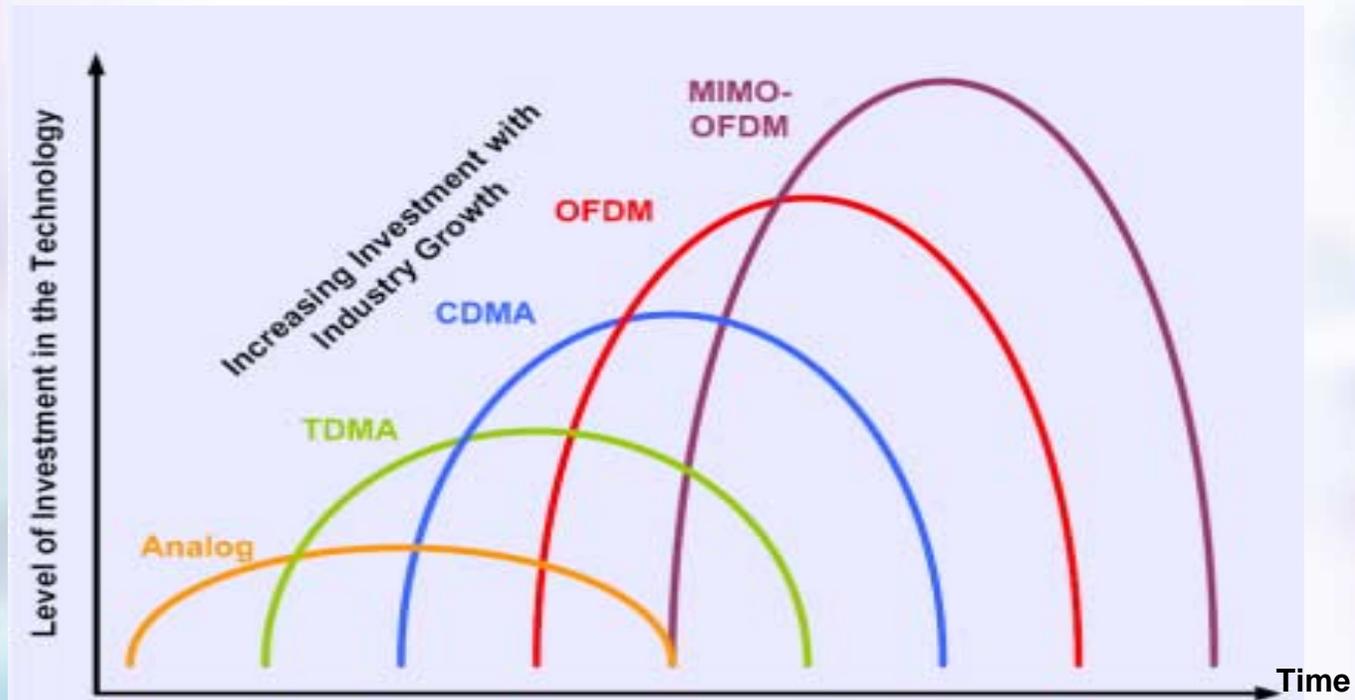
Each path of 3G evolution, LAN/MAN evolution, and digital convergence will be integrated to be 4G system in 2010~2015





Possible Evolution to MIMO-OFDM

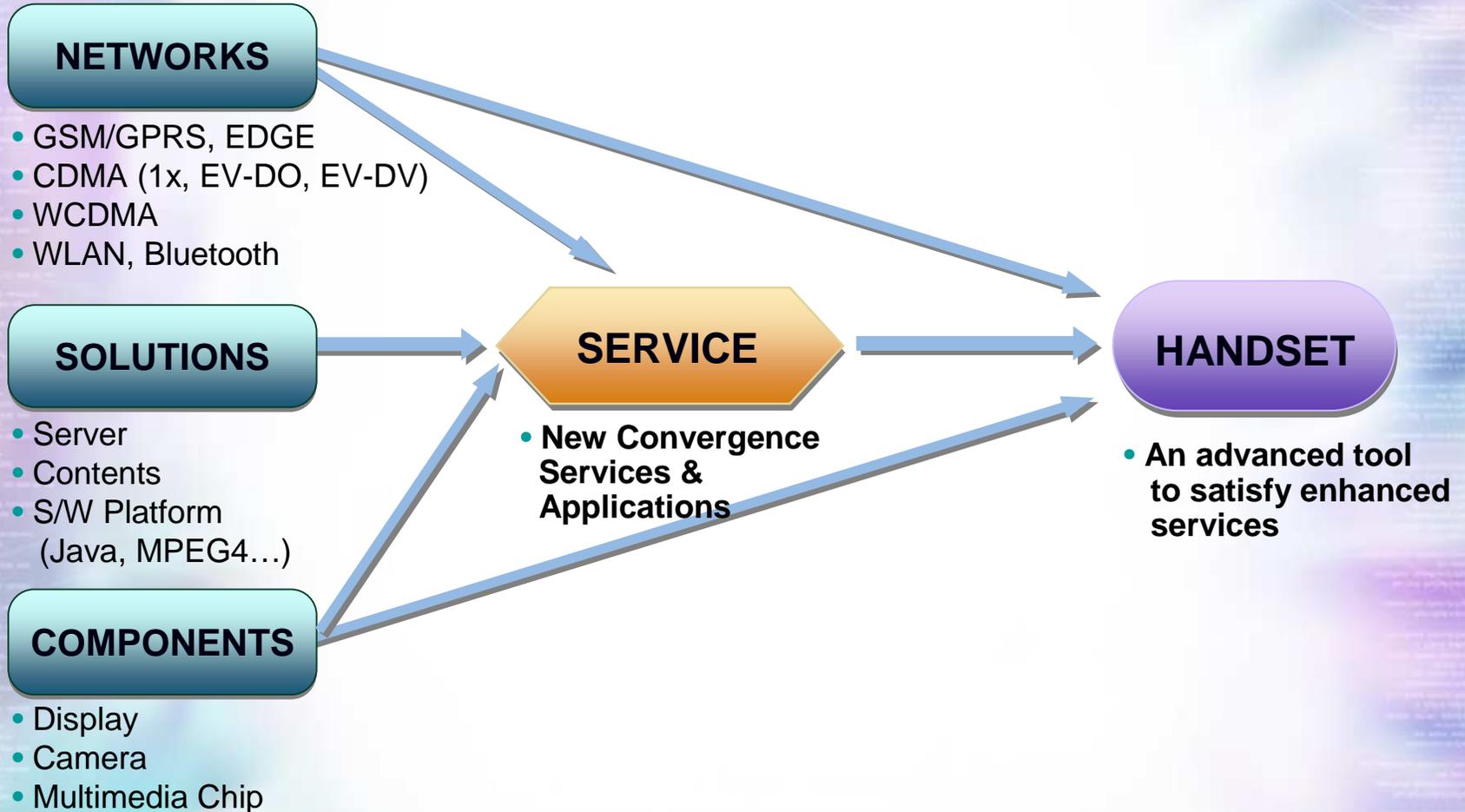
- OFDM/OFDMA may lead the next generation technology
- CDMA evolution can be extended



Source: Rysavy Research, Datacomm Research



Handset is evolving to fulfill service requirements





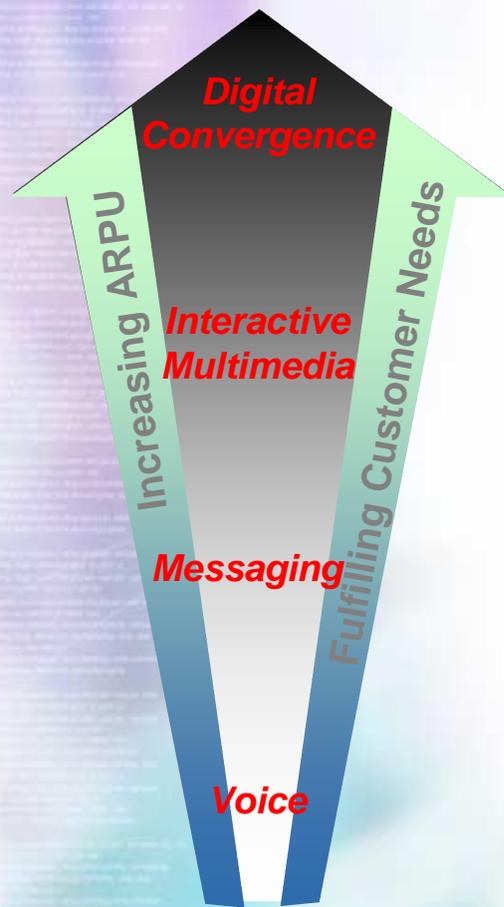
Drivers & requirements for handset evolution

Driver

Service

Core Segments

Requirement



- Video Telephony
- Digital TV
- M-Commerce
- WLAN

- Early Adaptor

- High-resolution image with no disturbance
- Broadcasting reception
- Security
- Hybrid network roaming

- VOD/MOD
- LBS
- Network Game

- Infotainer

- Realistic image/sound
- Large screen
- Large memory

- MMS
- E-Mail/Chatting

- Social Communicator

- Image capture device

- Voice
- SMS

- Penny Wise

- Call quality
- Portability

Handset Trend



Handset is evolving toward converged device form



Voice Centric

- Plain phone

- ✓ B/W Screen
- ✓ Mono Tone



Messaging

- Camera phone
- MMS phone

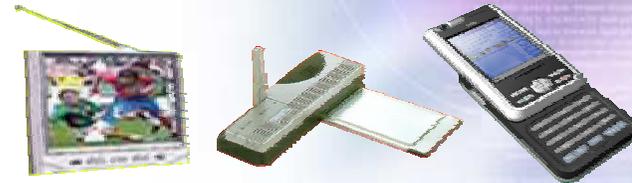
- ✓ STN/TFT Color
- ✓ 120x160, 1.8"
- ✓ 100K pixels CMOS
- ✓ 16 Polyphonic



Interactive Multimedia

- Camcorder phone
- VOD/MOD phone
- MP3 phone
- Game phone

- ✓ TFT Color
- ✓ QCIF, 2~2.2"
- ✓ 100K~300K pixels
- ✓ 40~64 Poly, AAC/MP3
- ✓ 3D Graphic Engine



Digital Convergence

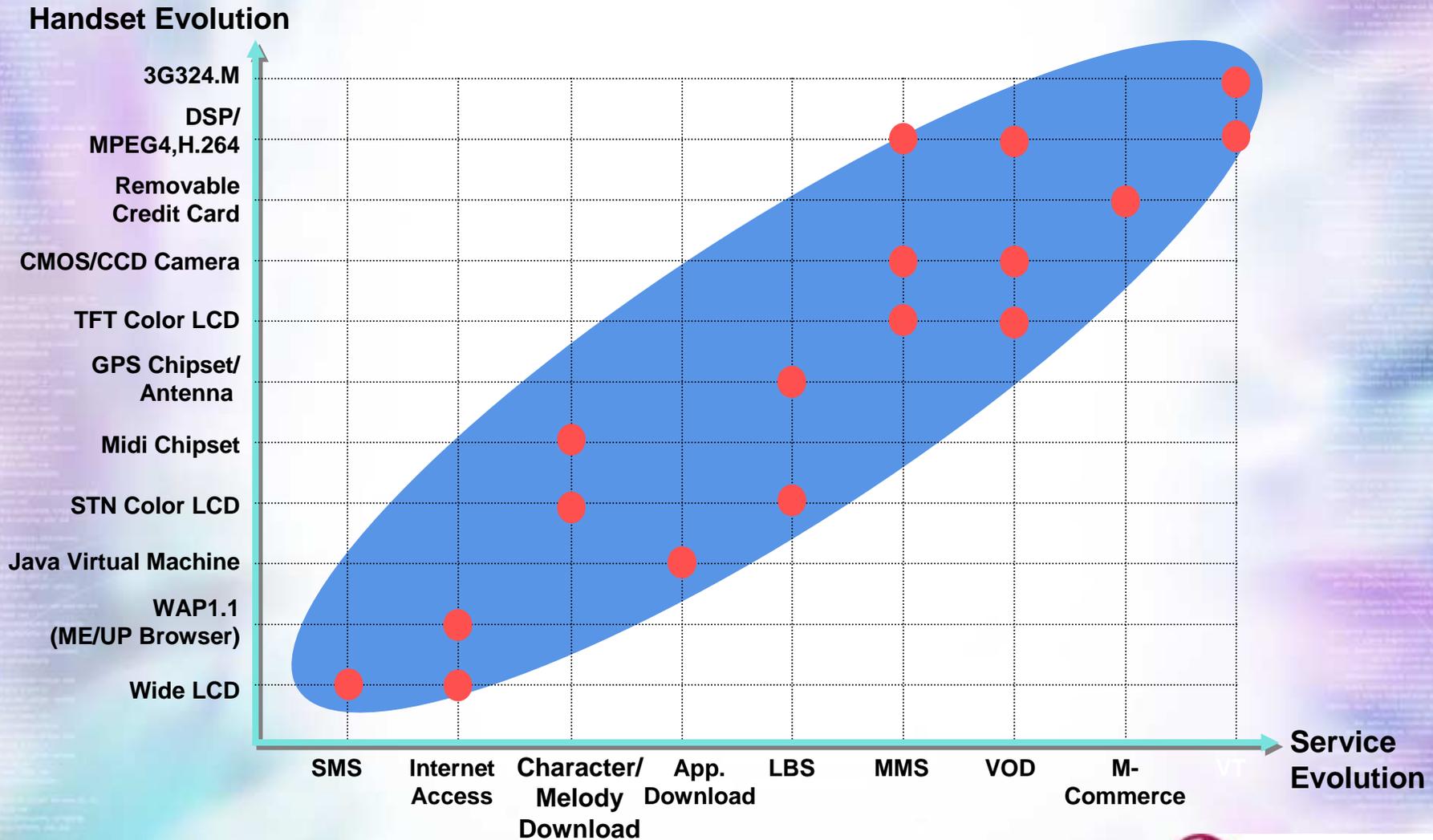
- Video telephony phone
- Digital TV phone
- WiFi phone
- Smart phone

- ✓ TFT/OLED Color
- ✓ QVGA, VGA
- ✓ 300K~ pixels CCD
- ✓ 128 Polyphonic 3D sound
- ✓ External Memory
- ✓ TV Tuner
- ✓ WiFi/Bluetooth
- ✓ Finger print recognition

Handset Trend



Handset evolution is positively(+) related to service evolution





Multimedia/ Digital Convergence

- MP3 Player
- Camera/Camcorder
- DMB/Radio
- 3D Video Game
- PDA



Ubiquitous/ Personalized Service

- User-specific service
- Location Based Service
- Machine-to-Machine Communication ...

Fast Evolution/ Network Convergence

- Horizontal Evolution
 - GSM/GPRS → WCDMA → HSDPA → HSUPA
 - cdma2000 → EV-DO → EV-DO rev. A
 - 802.11b → 802.11a/g → 802.11n/UWB
 - New Accesses

- Vertical Convergence
 - Broadcasting
 - Cellular
 - Hot Spot
 - Fixed



Provision of Ubiquitous Environment

- Convergence of computing and communication
- Not constrained to places, devices or contents

High Quality Services

- Guaranteeing service continuity
- Delivering broadband wireless contents
 - Same extent to current wired
 - Regardless of user location
- Supporting a variety of user intension
 - Broadcasting, Cellular, WLAN, WMAN, etc.
 - Easy access

User-friendly Cost

- Low service charge
- Low cost infrastructure, mobile device

More feasibility

- Better spectrum utilization
- low-power, adaptivity and flexibility



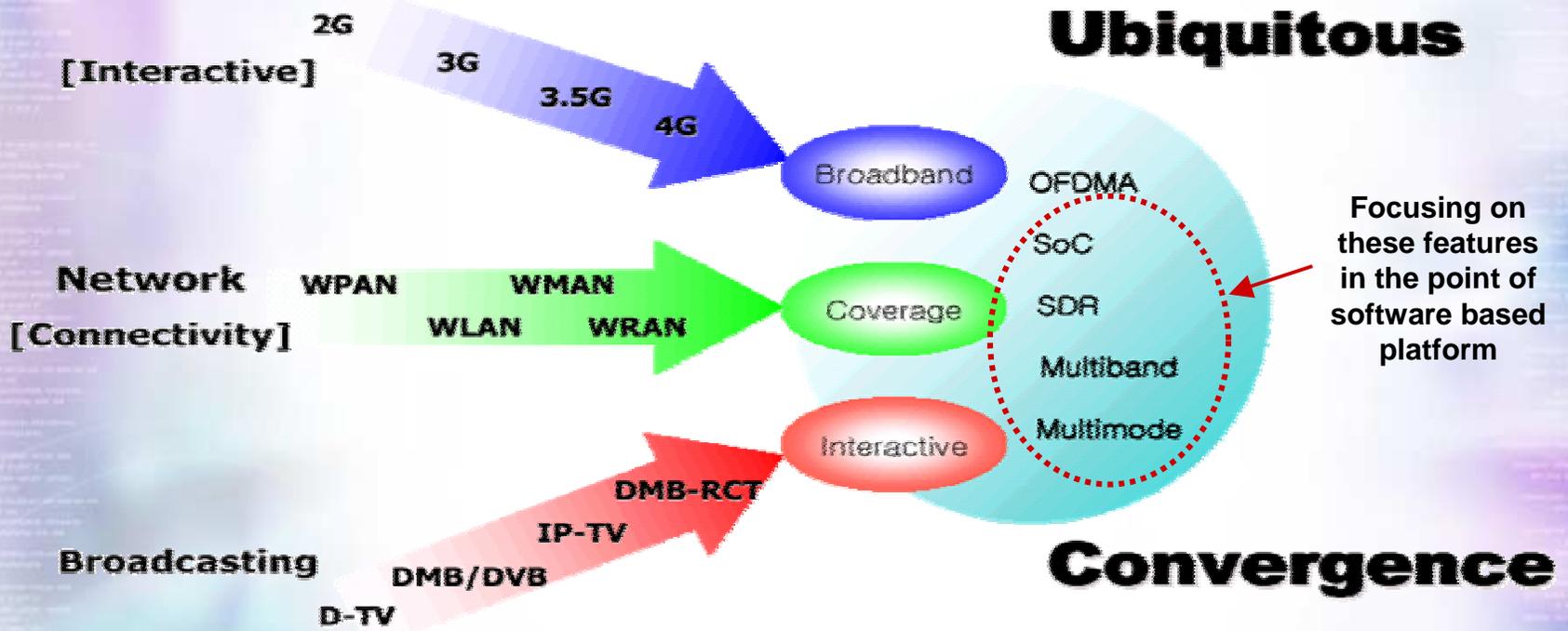
. Software Based Platform

- Need for software based platform
- Multiband Multimode feature
- Reconfigurable feature
- Standard Interface feature
- Advantages of Software Based Platform
- Reconfigurable Platform
- Software driven hardware

Need for Software Based Platform



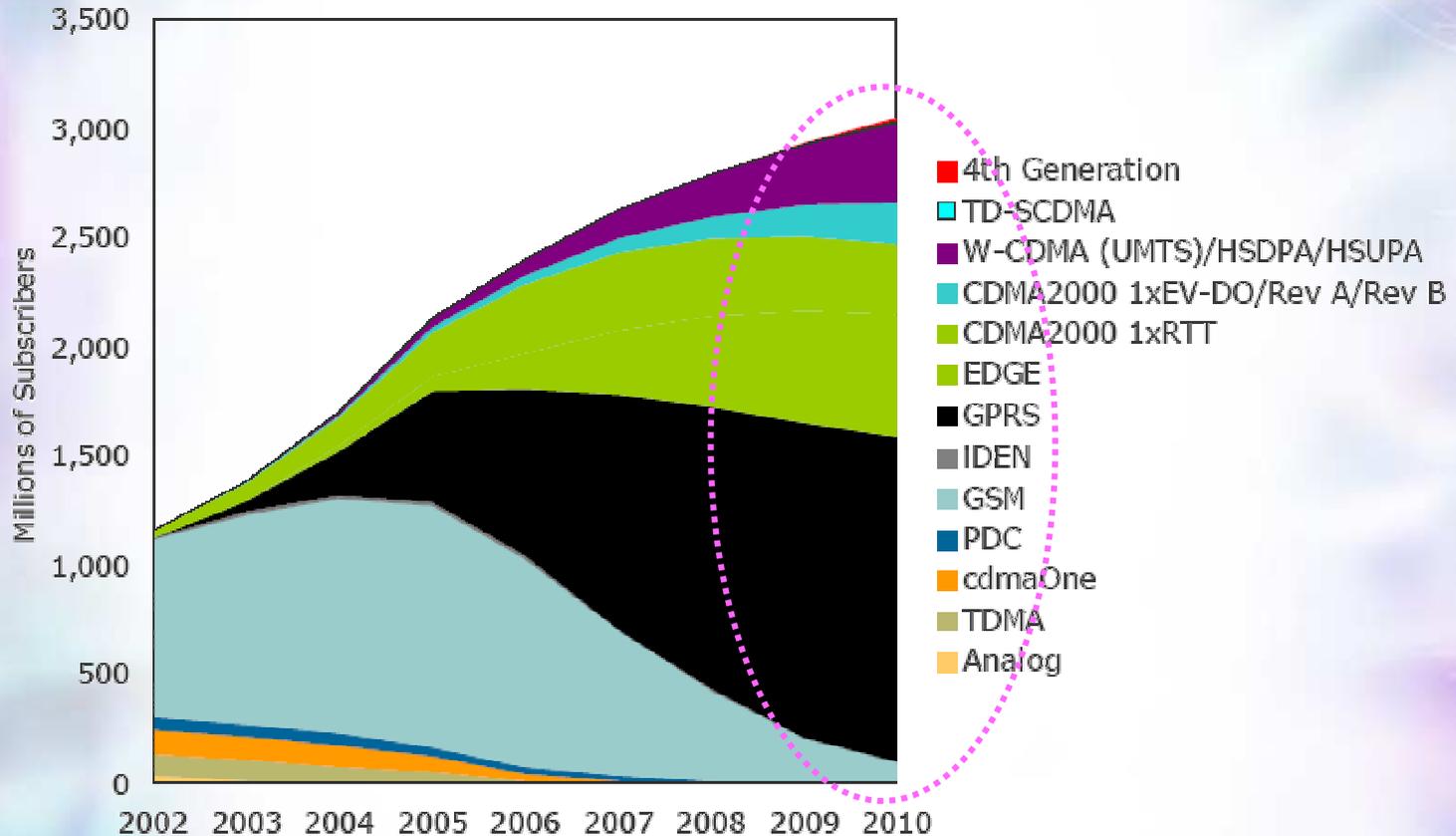
Considering the future mobile requirements,
Software Based Platform would be the best solution



Multiband Multimode feature



Software based platform should support Multiband MultiMode



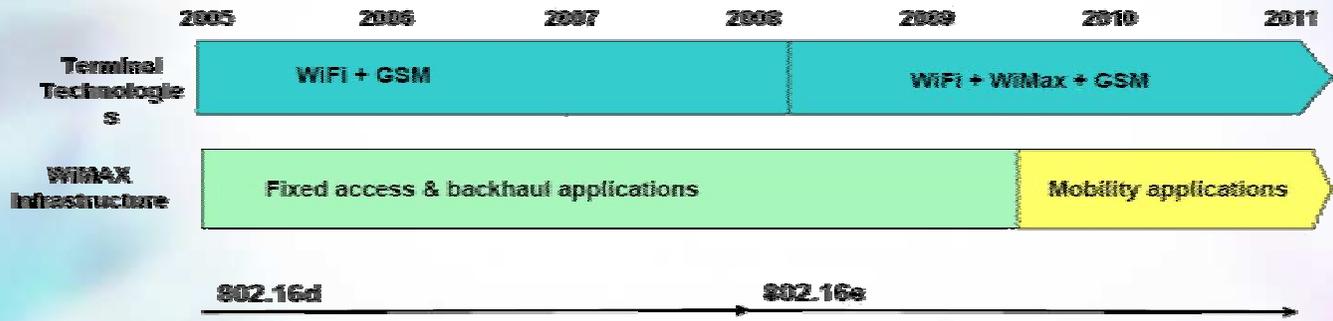
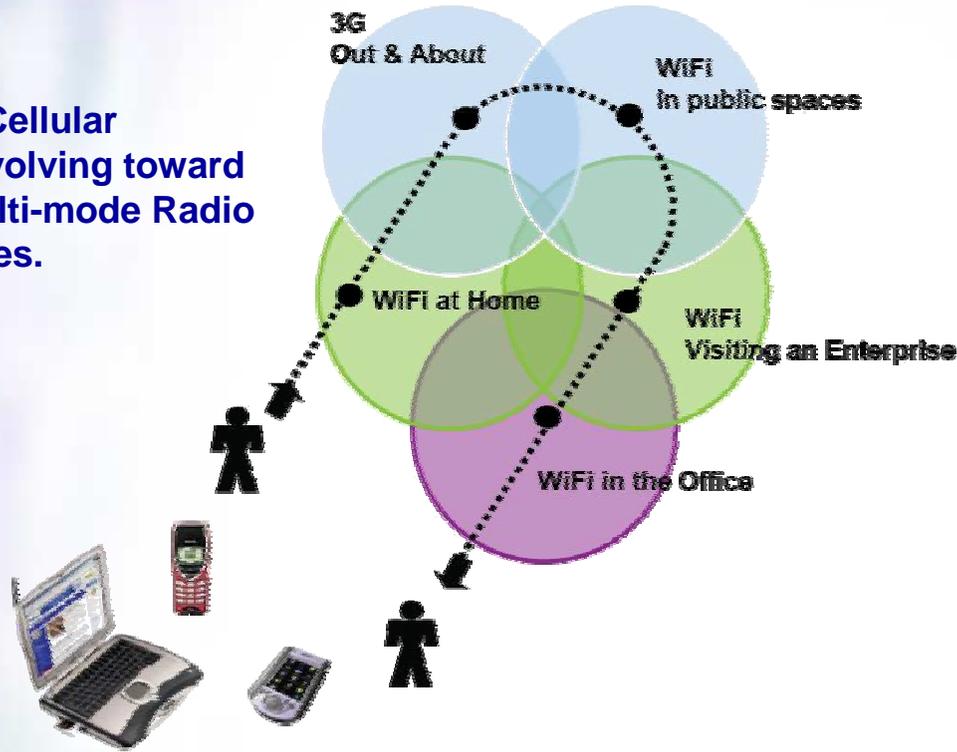
Global Mobile Handset Subscribers by Standard

Source: iSuppli Corporation *Wireless Systems Service, 2006*

Multiband Multimode feature



Single Radio Cellular Devices are evolving toward Multi-band Multi-mode Radio Cellular Devices.



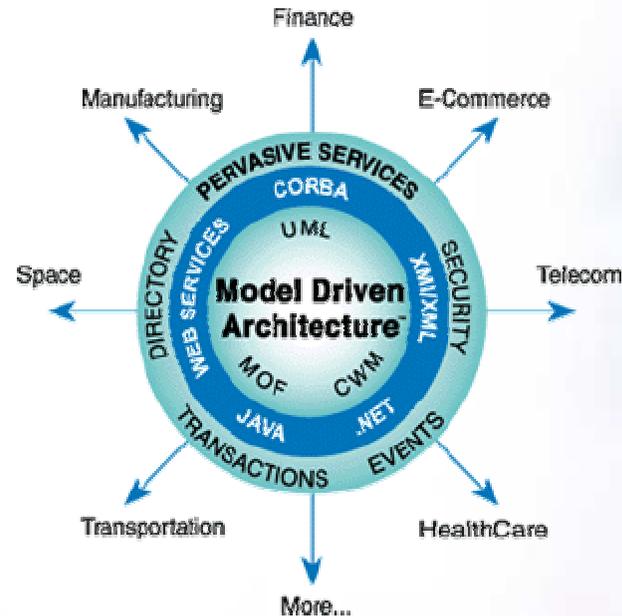
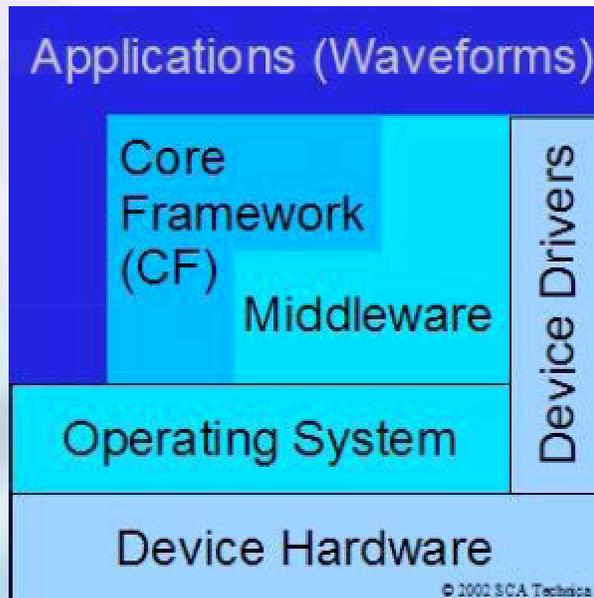
Reconfigurable feature



Software based platform should be reconfigurable

The components or intellectual properties (IP) should be reused to reconfigure the mobile device.

Software based platform can be integrated into various mobile devices with reusable hardware, software and related IPs.



Component Portability



End-to-End Reconfigurability Rationale

Mobile Operators

Scalable and reconfigurable infrastructure

- That optimizes resource usage
- New applications and technologies offered more efficiently. High return on investment, reduction of CAPEX and OPEX costs

Service and Application Providers

Open flexible platforms

- And associated execution environments.
- Deployment of enhanced features in reduced Time-to-Market

End users

Integrated telecommunication environment

- Variety of services and applications at affordable prices
- Ability to use reconfigurable equipments to reach required services at times and places when / where they

Manufacturers

Wider markets by offering customized solutions

- Development of “plug and play” technology will ease migration to new standards, protocols and applications unknown as for today

Regulators

Consolidated framework

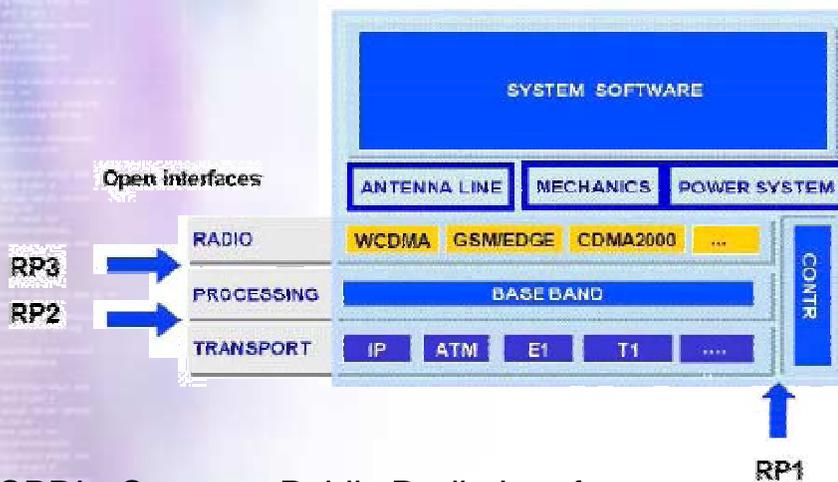
- Wherein the wireless environment should evolve
- Easier access, better spectrum management, follow-up of ethical and technological rules

Standard Interface feature

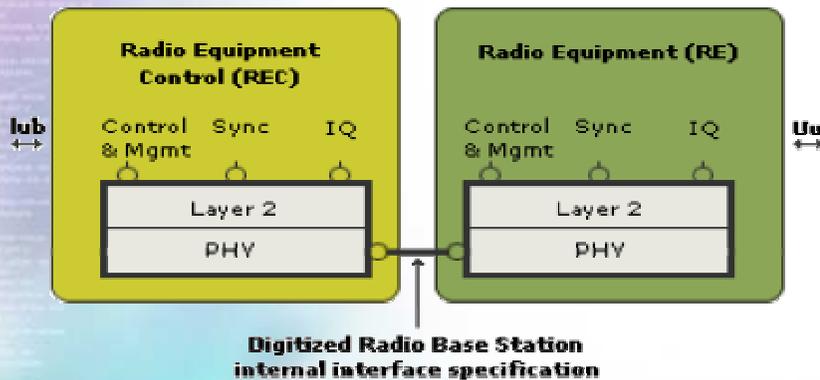


Platform Interface Standards

OBSAI – Open Base Station Architecture Initiative

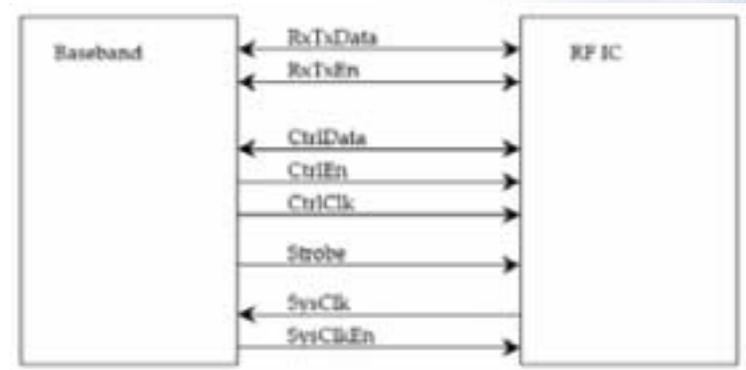


CPRI - Common Public Radio Interface



Platforms and standard interfaces are being specified at the subsystem and module level to facilitate multi-vendor sourcing

Handset RF Digital Interface Standard

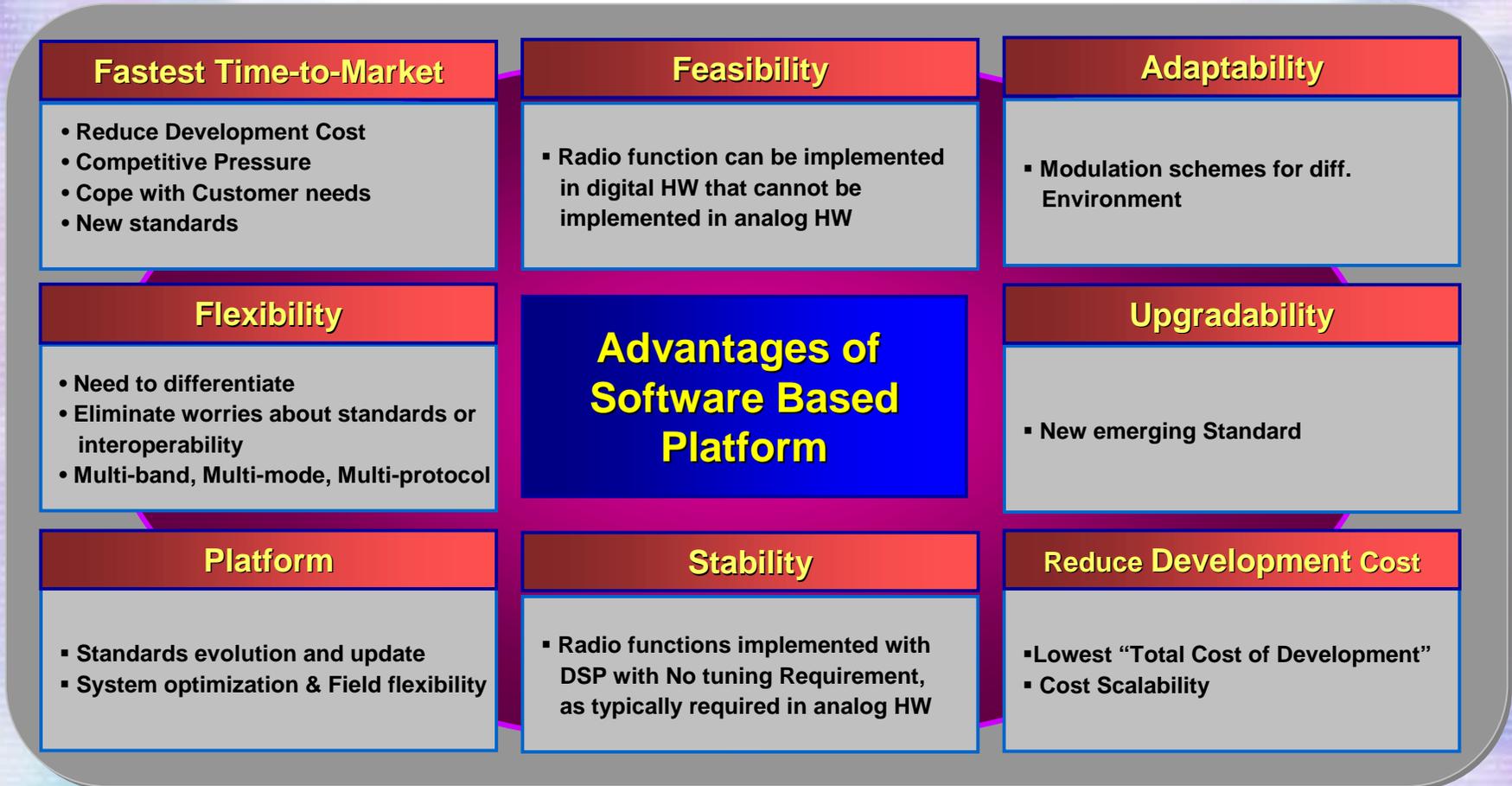


(Sources: OBSAI: www.obsai.org; CPRI: www.cpri.info; Handset RF Digital Interface Standard: DigRF Baseband/RF Digital Interface Specification, EGPRS Version; Digital Interface Working Group; Version 1.12, 2/2/2004.)

Advantages of Software Based Platform



Software Based Platform has many advantages





Components of Reconfigurable Terminal Modem

- Direct Conversion/Very Low IF Transceiver
- Fast AD/DA Converters
- Reconfigurable Baseband Modem

Reconfigurable Baseband Processor

- Processors: Programmable

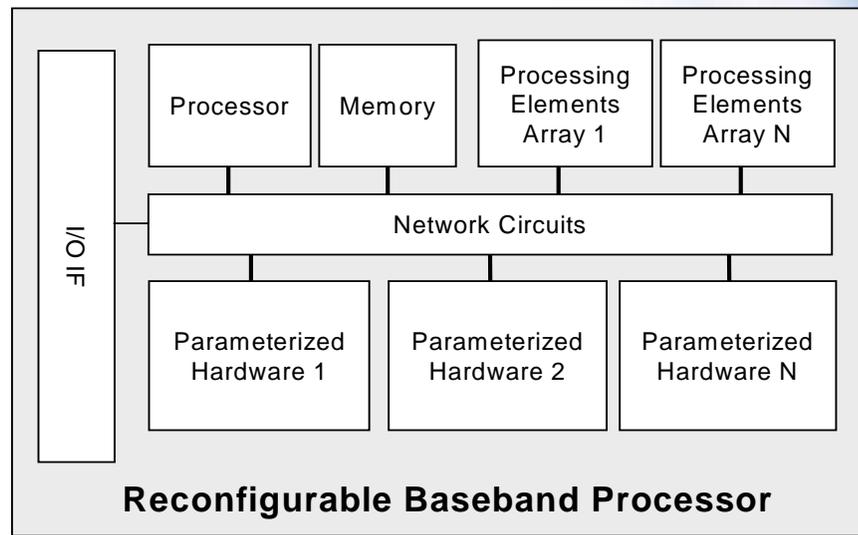
- General Purpose Processor: Comm. Protocol, Control (ARM, x86 ..)
- Application-Specific Instruction Processor
- DSP: Fixed/ Floating Data Processing

- Parameterized Hardware

- Viterbi/Turbo Decoder..
- FFT/FIR filter

- Processing Element Array

- Multi-Core DSP
- ALU-Farm



Source: Draft of ITU-R WP8F PDNR IMT.SDR



Technical Issues

■ Multithreaded baseband processor

- High-performance and low-power
- DSP, Java and Control Processing

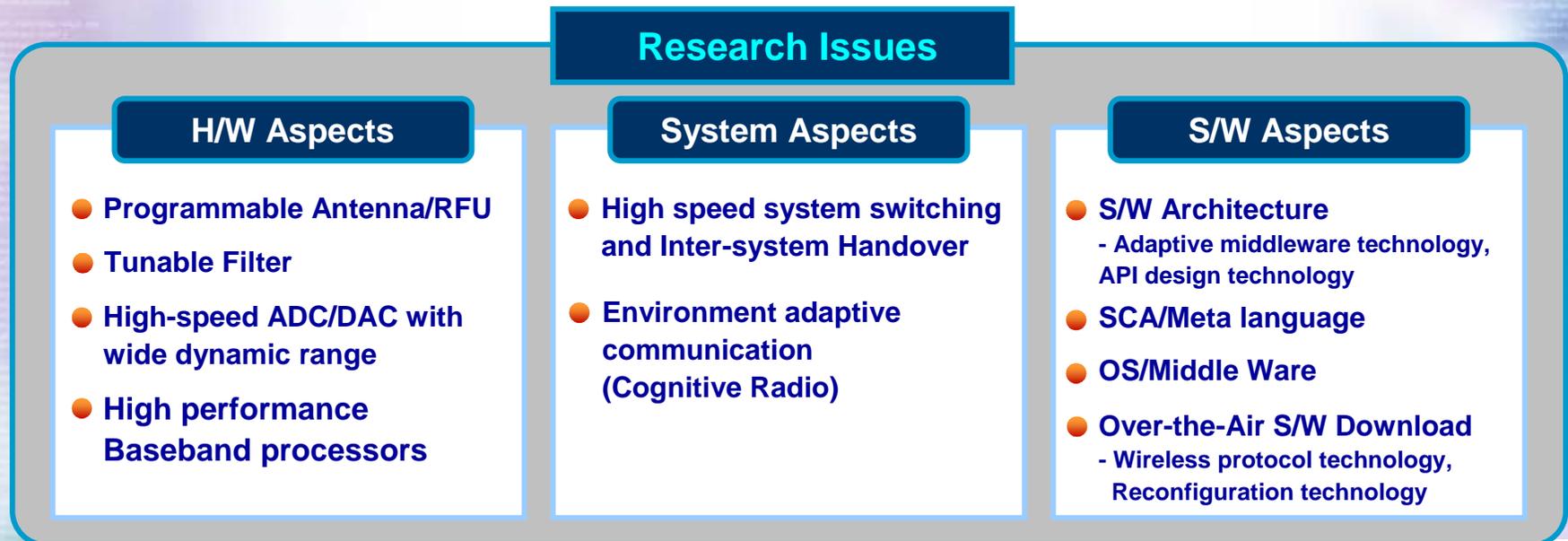
■ Sophisticated compiler technology

- Automatically generates DSP operations
- Automatically multithreads applications
- Hand coded performance

■ Reconfigurable terminals :

Fully adaptive software reconfigurable system

- Flexible and adaptive RF front end
- Programmable High Power BB signal Processing



Research Issues

H/W Aspects

- Programmable Antenna/RFU
- Tunable Filter
- High-speed ADC/DAC with wide dynamic range
- High performance Baseband processors

System Aspects

- High speed system switching and Inter-system Handover
- Environment adaptive communication (Cognitive Radio)

S/W Aspects

- S/W Architecture
 - Adaptive middleware technology, API design technology
- SCA/Meta language
- OS/Middle Ware
- Over-the-Air S/W Download
 - Wireless protocol technology, Reconfiguration technology

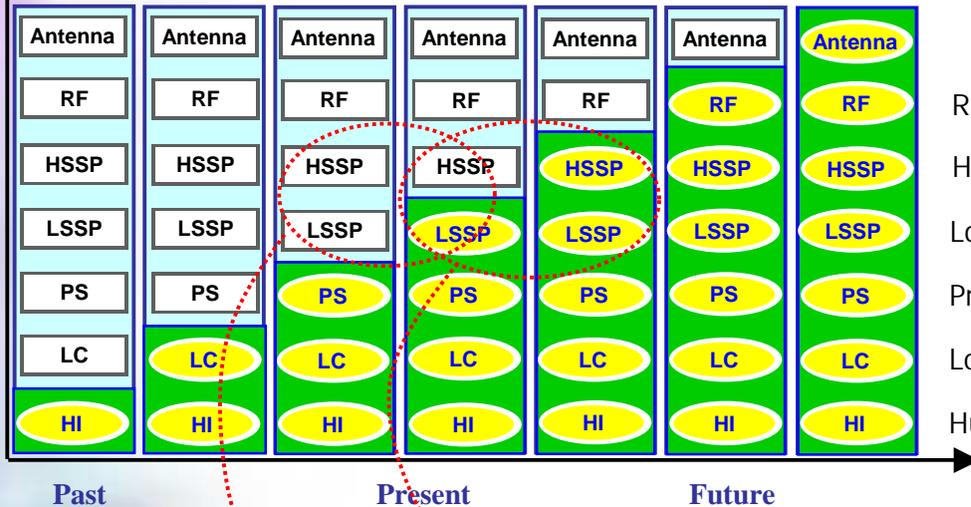
Software-driven hardware



Evolution of wireless systems to software-driven hardware

Easy to design, upgrade & manage,
Small size, Low cost & power consumption ...

Software
-driven
Hardware
Portion



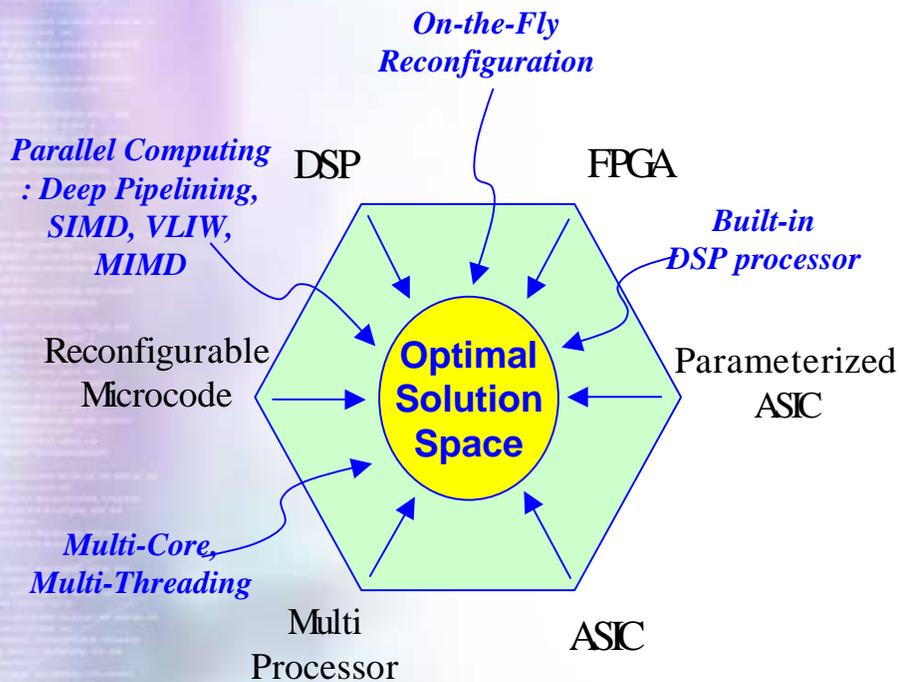
- RF Front-end : Up/Down Converter, Amp, Filter
- High Speed Signal Processing : Modulation
- Low Speed Signal Processing : Coding
- Protocol Stack : Call setup
- Local Control : H/S & S/W resource management
- Human Interface : Speaker, MIC, Keypad, LCD



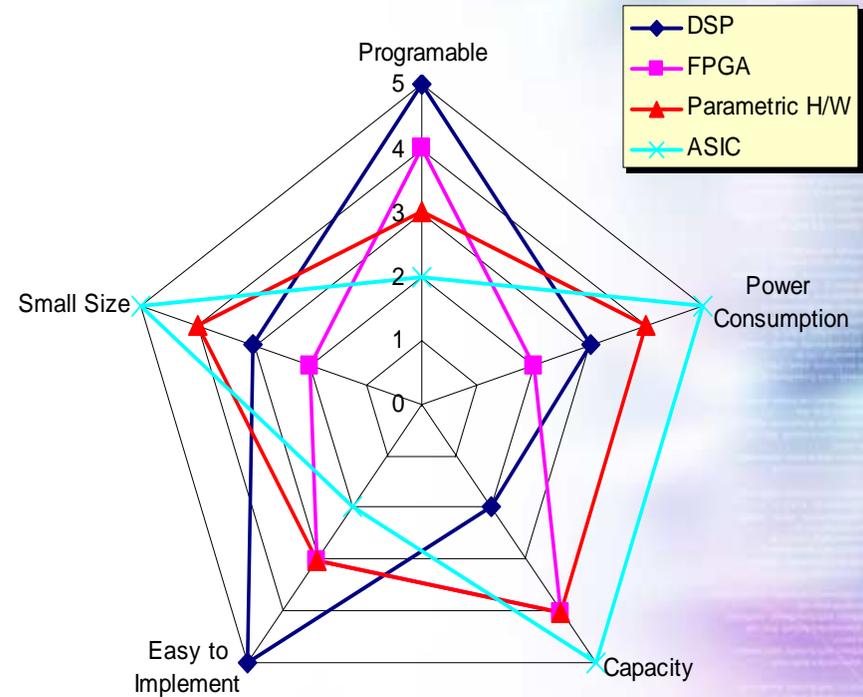
: Software-driven Hardware



Multimode Baseband Solution space



Multi mode Baseband Solution Space



Selection Criteria



Software controlled RF solution

- Flexible transceiver
 - : Each circuit is digitally configurable and can be optimized for each protocol
 - NF, input match, output match, linearity, etc.
- The transceiver must be a software configurable RF to Digital Transceiver which addresses the Different Performance Requirements of Multi-Band, Multi-Standard Applications



. LG Electronics' R&D

1. Korea IT 839 Project

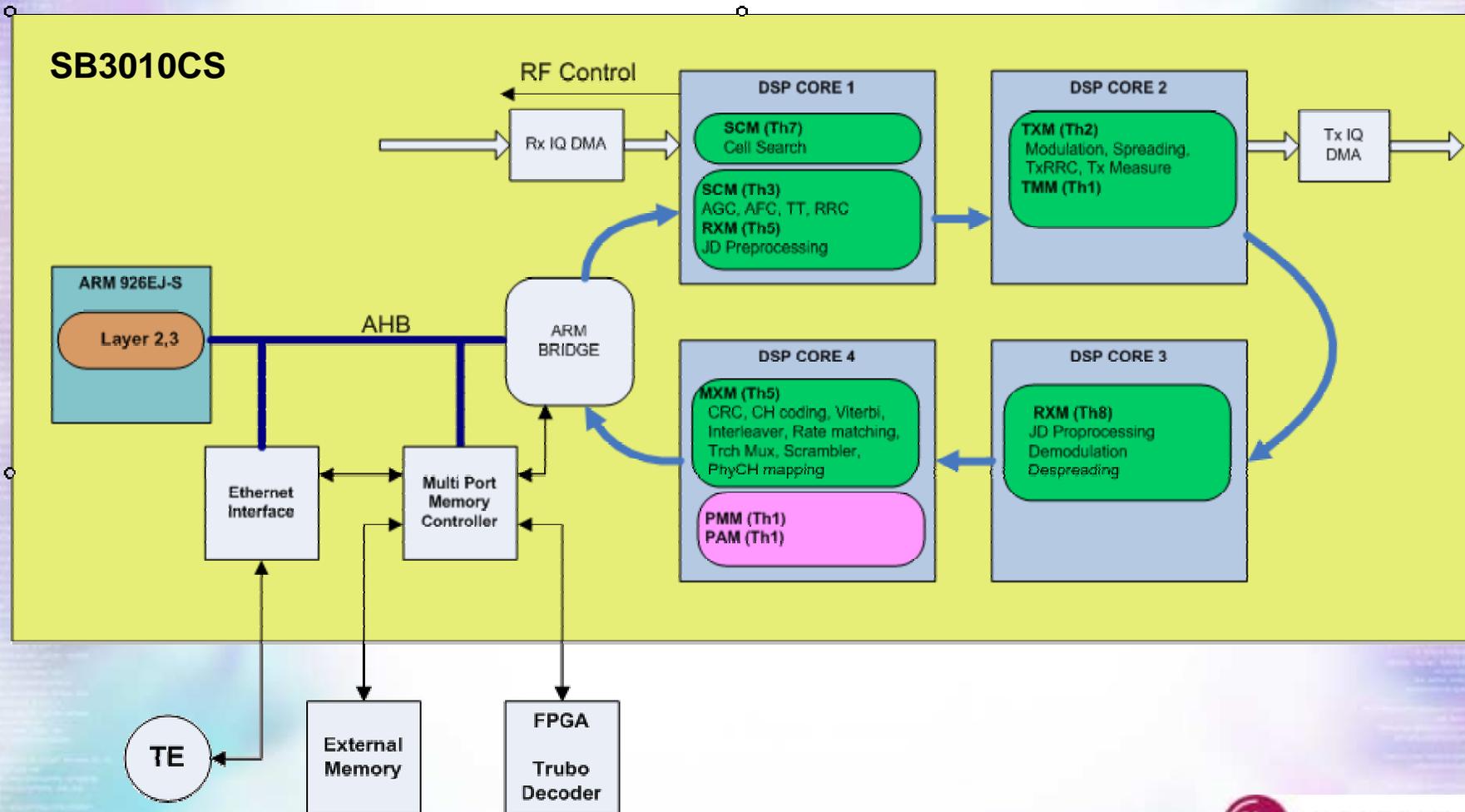
2. Vision

Reconfigurable Terminal Modem Development Project – Korea IT 839



UE L1 S/W partitioning and Optimization

- Multi-core DSP
- Multi-thread programming

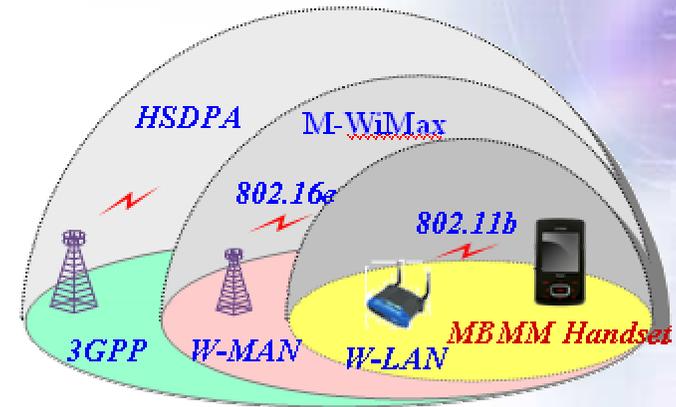




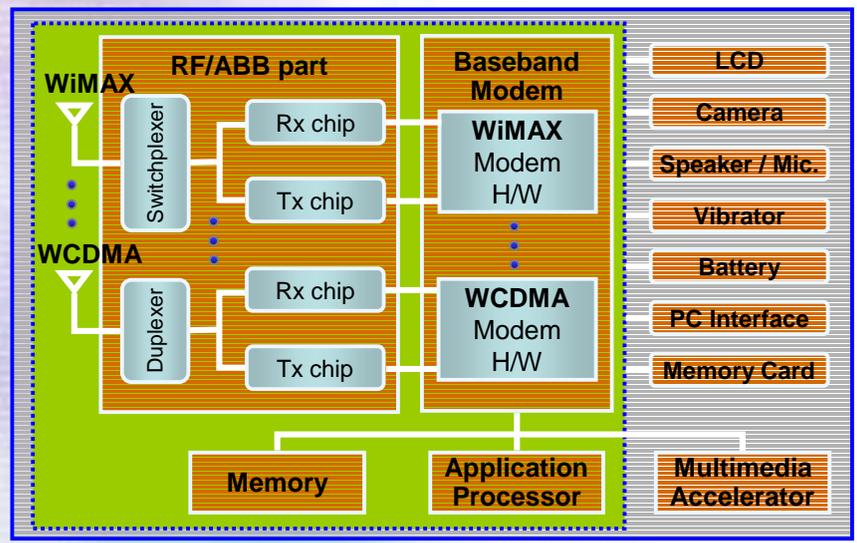
S/W based Multi-mode Common Mobile Platform Project – Korea IT 839

S/W based Multimode Common Mobile Platform

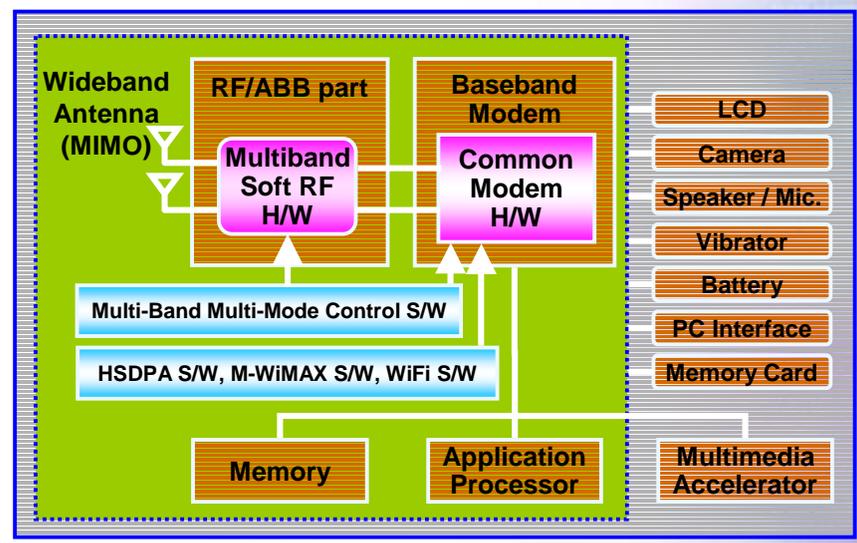
- Reconfigurable baseband Modem
- Soft RF/ABB
- HSDPA, Mobile WiMAX, WLAN
- Spectrum sensing for Inter-RAT HO



MBMM mobile service application



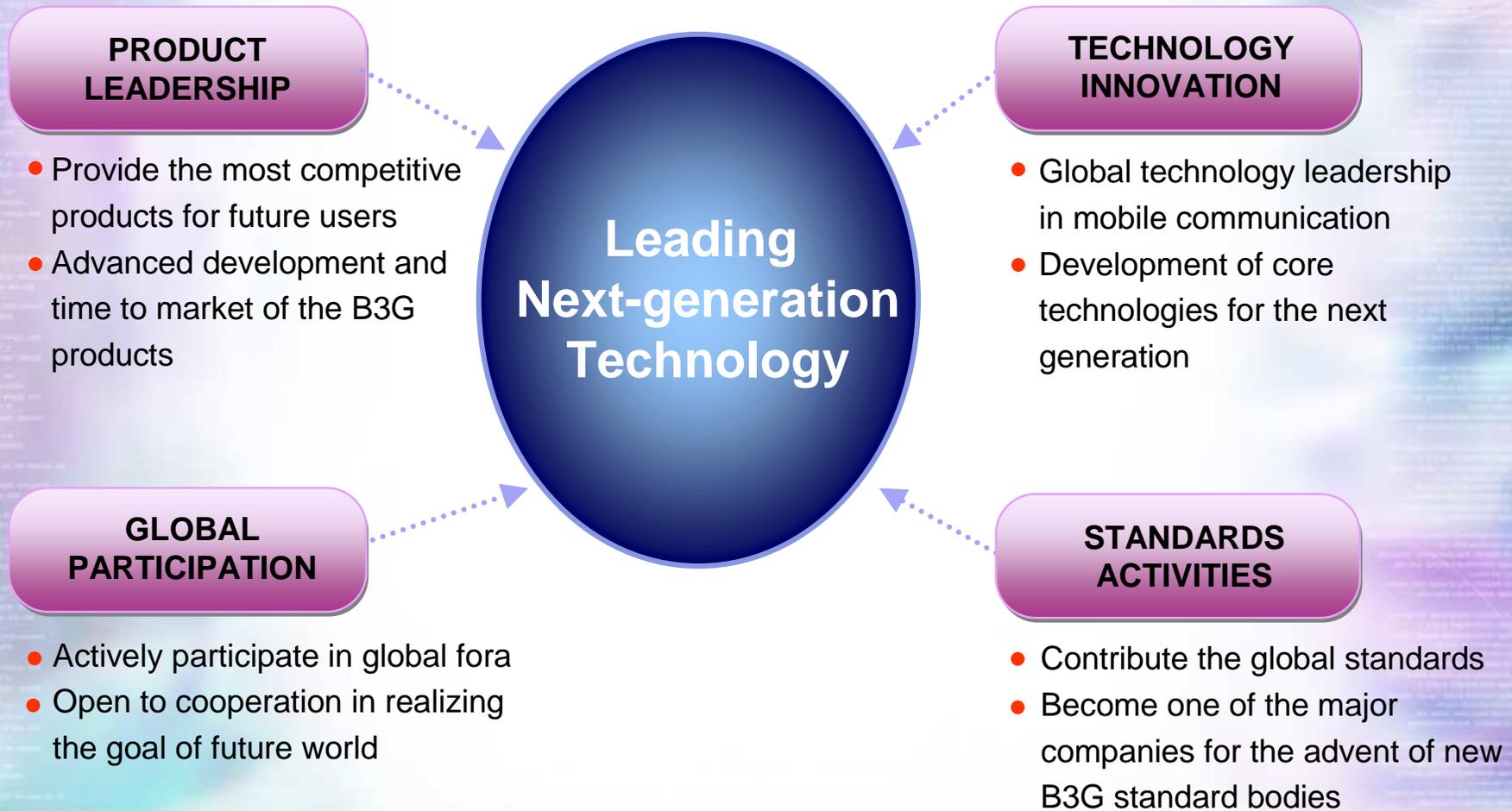
Existing Multi-mode Handset With multiple modem hardware



S/W based Multi-mode Common Mobile Platform



LGE focuses on key technologies for enabling future user demands





<http://www.lge.com>