



The evolution of SoC platform in the new mobile paradigm

**Ki Soo Hwang
Jan. 23. 2008
Core Logic Inc.**

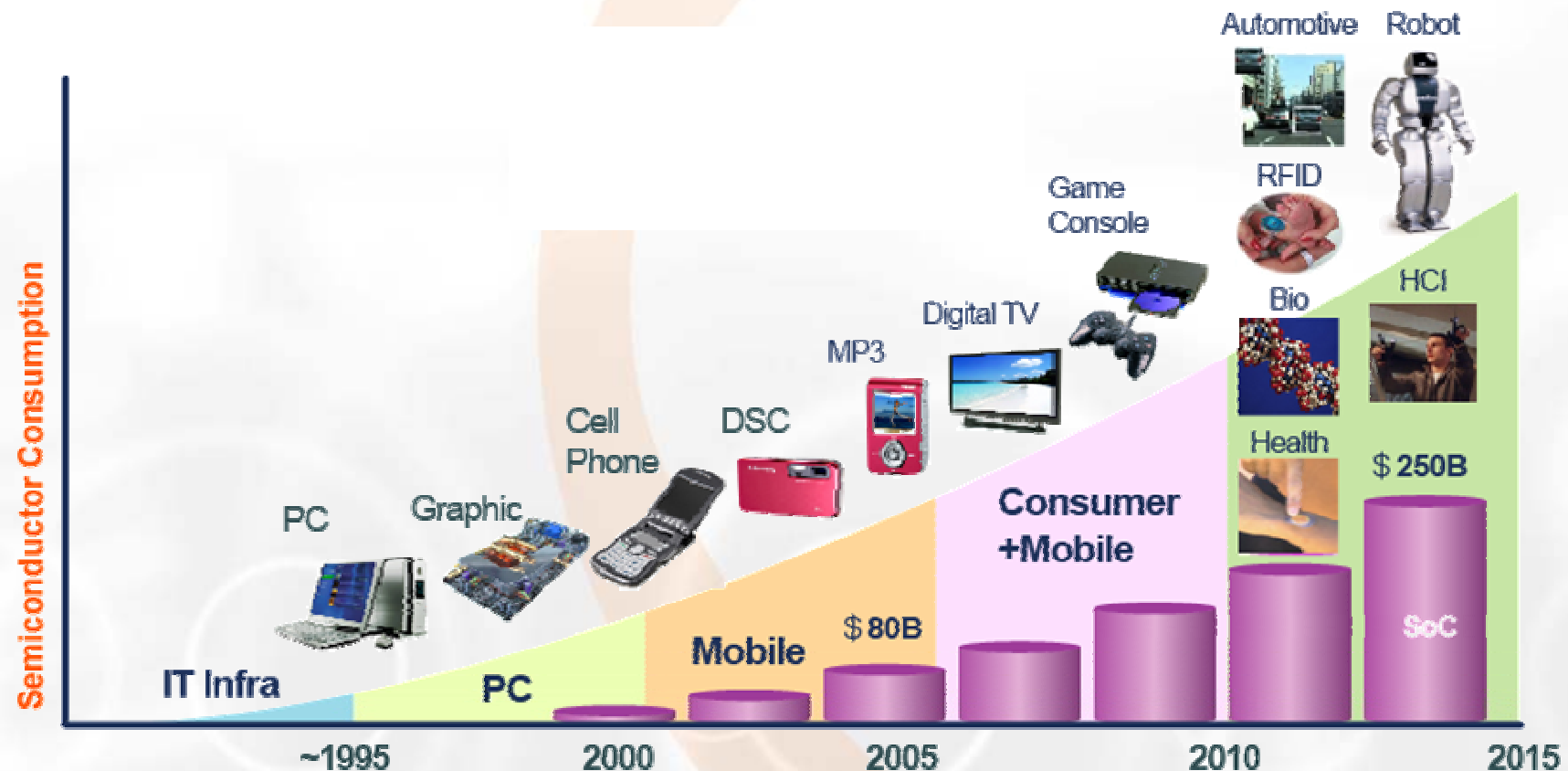
Contents

- Mobile Device Market & Technology Overview
- Case Studies
- Future Directions

Semiconductor market is growing



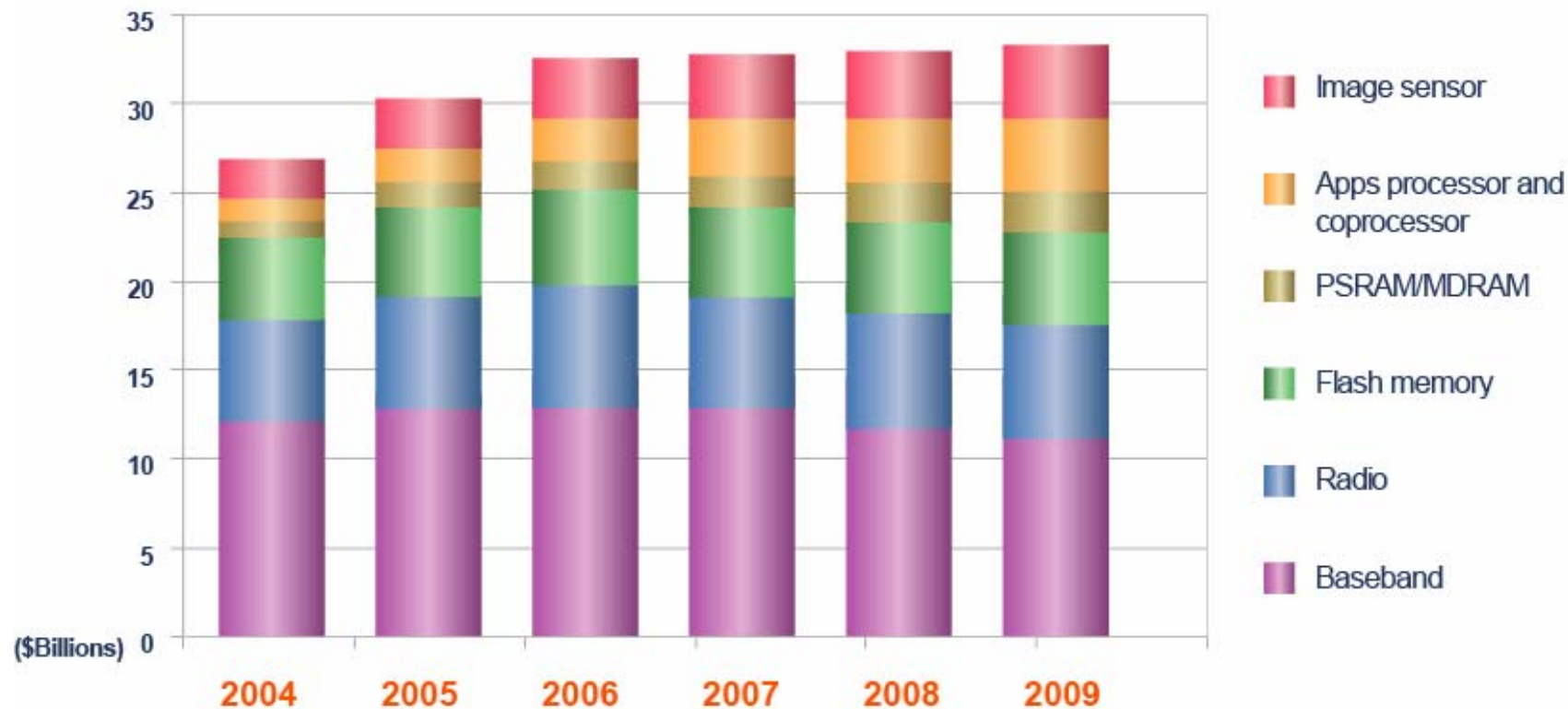
- Semiconductor market has grown continuously through new market creation...and in 2015 we expect...



Semiconductor market for cellular phones

Core Logic

Mobile TV and additional connectivity drive incremental growth in 2H07 and beyond



<Source: Gartner 2007>

Consumer semiconductor market



DVD - \$3.7B



Digital TV - \$4.4B



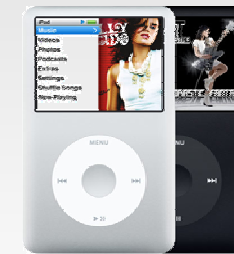
Digital Camera - \$4.0B



STB - \$2.5B



Video Game - \$4.0B

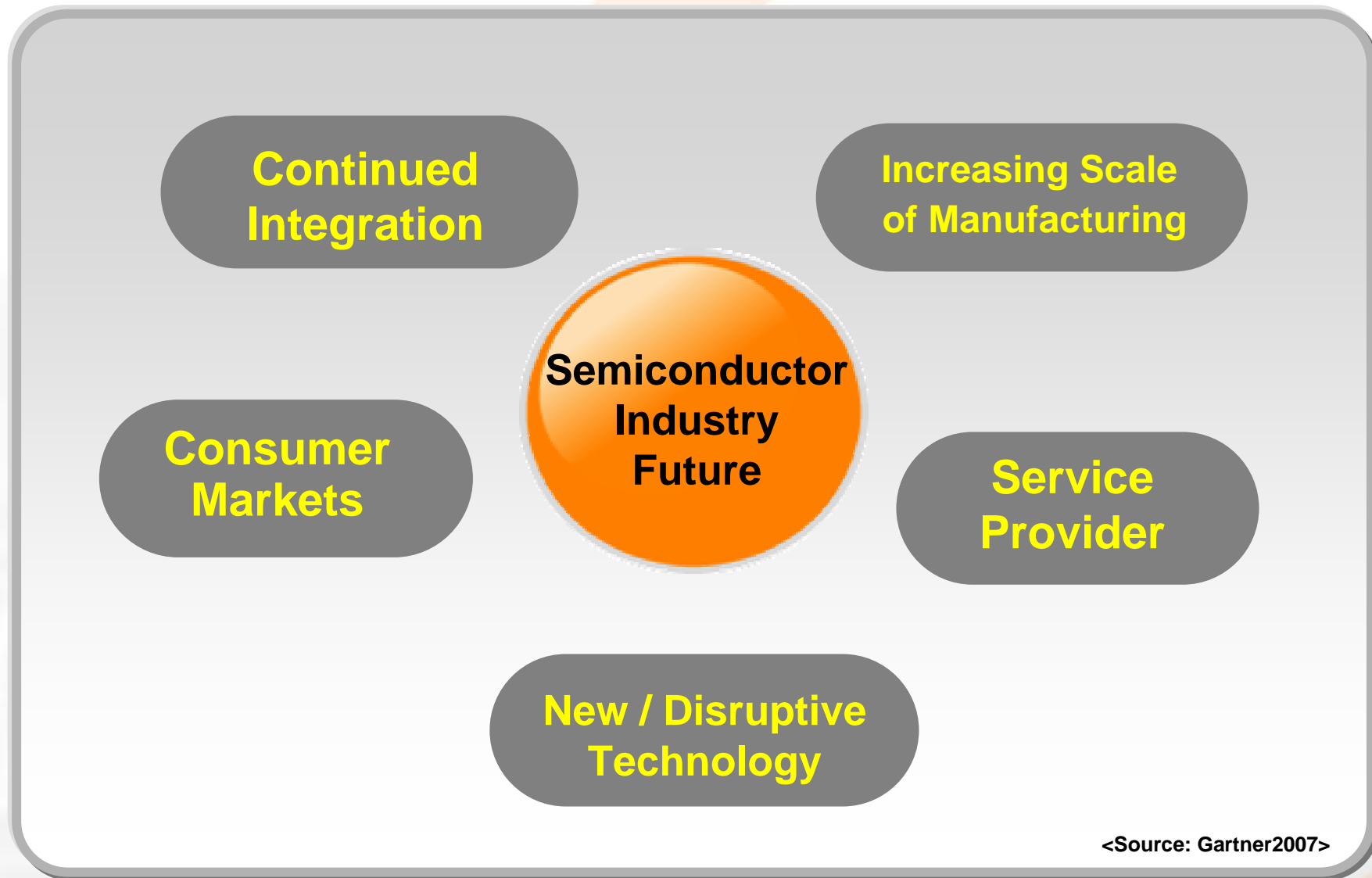


Compressed Audio - \$3.5BZ

\$22 B Total Market in 2006

<Source: IDC 2007>

Semiconductor industry by five drivers

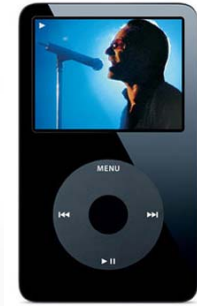


<Source: Gartner2007>

Mobile phones



Mobile consumer device



Mobile semiconductor companies



Baseband



Application Processor



Media Processor



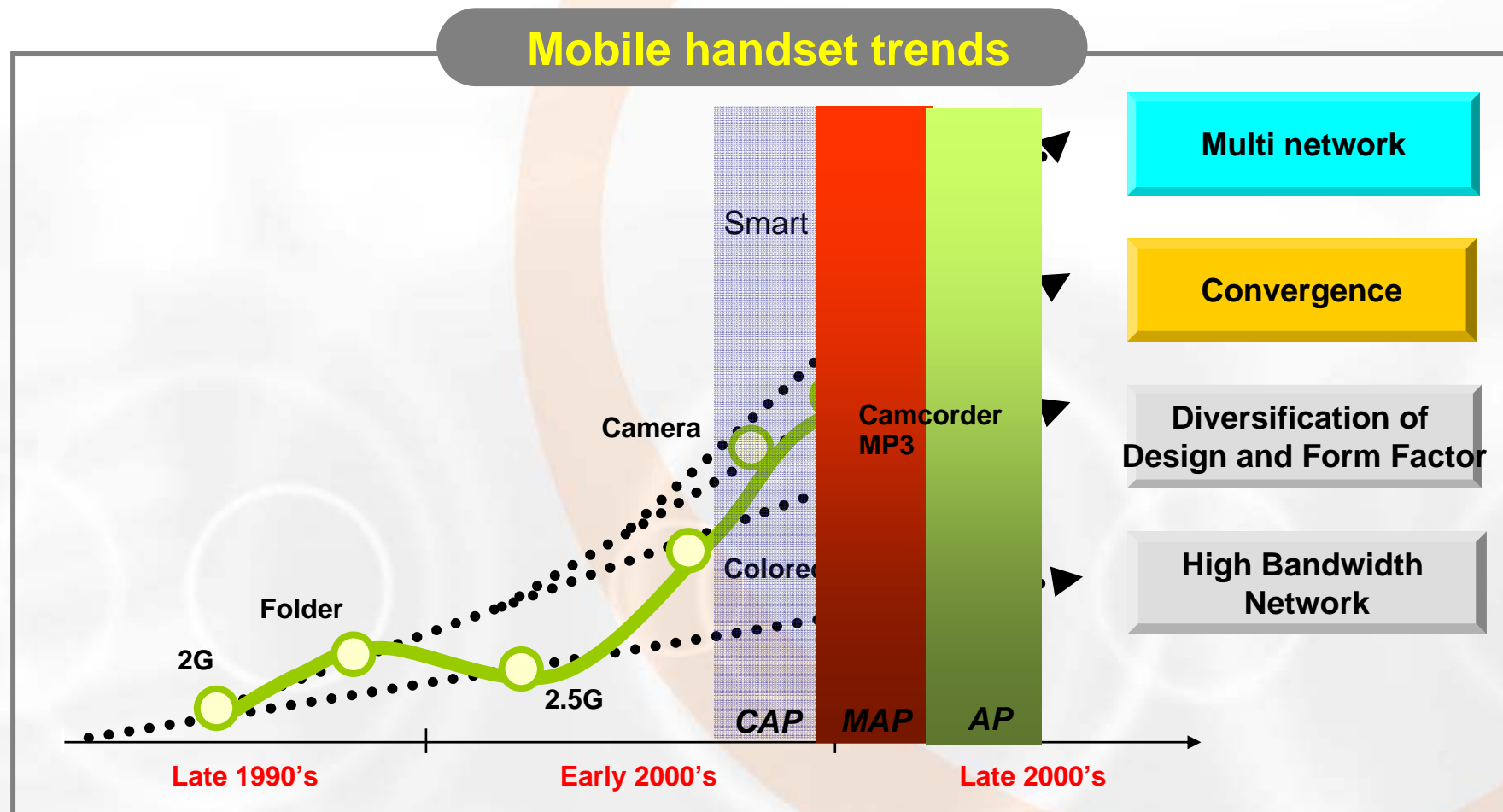
CPU



Mobile handset trends

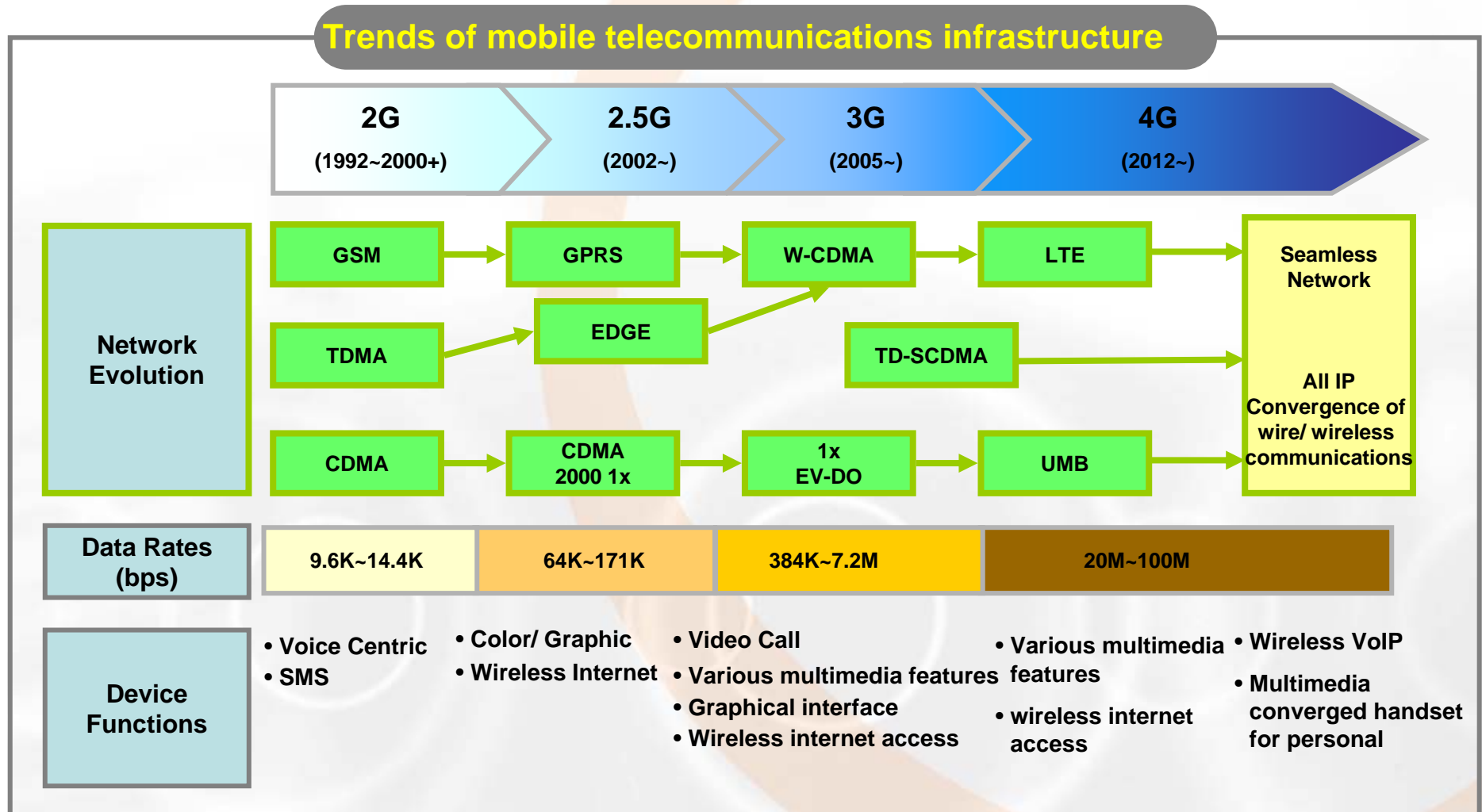


- Multimedia phones are leading the market
- Convergence and multi network devices will be dominant in the market











Trends of mobile telecommunications infrastructure

- With the network evolution, various multimedia applications are applied



Multimedia Trends



	Value	Multimedia	Enhanced	Convergence
Music 	CMX TH / MP3 / AAC+	CMX / MP3 / WMA / REAL / AAC+ / E-AAC+	CMX / MP3 / WMA / REAL / AAC+ / E-AAC+	CMX / MP3 / WMA / REAL / AAC+ / E-AAC+
3D Gaming&GUI 		400k 3D pixels/sec	7M 3D pixels/sec	133M 3D pixels/sec
Camera 	2Mpixel	3Mpixel	5Mpixel	8Mpixel
Video 	15 fps@QCIF	Record: 15 fps@QCIF Playback: 15 fps@QCIF	Record: 15 fps@QCIF Playback: 30 fps@QCIF	Record: 30 fps@QCIF Playback: 30 fps@QCIF
Location 	A-GPS Mode	A-GPS Mode Standalone Mode Enhanced Navigation	A-GPS Mode Standalone Mode Enhanced Navigation	A-GPS Mode Standalone Mode Enhanced Navigation
Mediacast Peripherals 	Bluetooth1.2	Bluetooth1.2	Bluetooth1.2 WLAN Mediacast	Bluetooth2.0 EDR WLAN Mediacast
Display 	QCIF [176x144]	QCIF+ [176x220]	QVGA [320x240]	VGA [640x480]
uPROCESSOR / QDSP 	CPU – 50-180MHz QDSP®-75MHz	CPU – 150-225MHz QDSP-75MHz	CPU – 225-300MHz QDSP-90MHz	Dual CPUs 400MHz-1GHz QDSP-250MHz
	2002	2003	2004	2005
				2006 ~

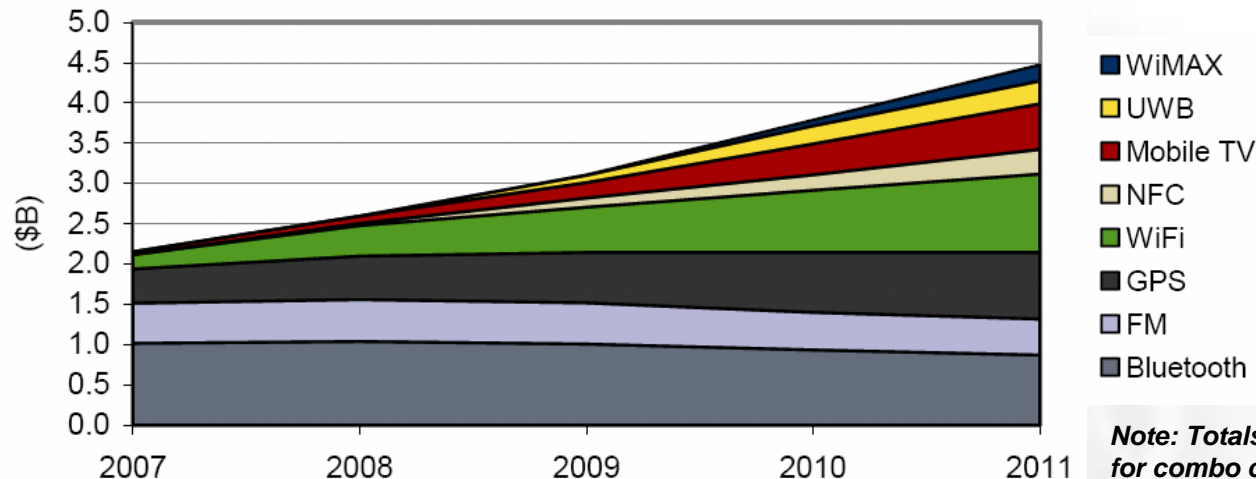
<Source: Qualcomm 2006>

Connectivity



- Why **connectivity** is so important?
 - Connectivity is the fastest-growing semiconductor revenue segment, 2007-2011
 - WiFi is gaining traction in mobile phones and is expected to have 20% penetration in 3G phones by 2011

**Worldwide Mobile Phone Semiconductor Revenue
by Connectivity by type, 2007-2011**



Note: Totals also include consideration for combo chips
Source: IDC 2007

- Chipset vendors will continue to combine radio subsystems into various combo chip solutions

CDMA (Qualcomm) BB



		MULTIMEDIA All GSM /GPRS Capable							
		CDMA2000	CDMA2000 + GSM - GPRS				WCDMA(UMTS)		All Air Modes
		1X	1X	1xEV.DO (Rev.0)	1xEV.DO (Rev.D)	1xEV.DO (Rev.A)	GSM/GPRS	EDGE/HSDPA	
Convergence Platform	Dual CPU, Single Chip					QUALCOMM 7500 1Q '05		QUALCOMM 7200 4Q '05	QUALCOMM 7600 2006
	Enhanced Platform	QUALCOMM 6150 2Q '04		QUALCOMM 6550 2Q '04	QUALCOMM 6700 4Q '04	QUALCOMM 6800 1Q '05		QUALCOMM 6280 2H '05	
Multimedia Platform	Enhanced Multimedia & Graphics							QUALCOMM 6275 4Q '04	
	Multimedia & 2D/3D Graphics	QUALCOMM 6100 3Q '02	QUALCOMM 6300 3Q '02	QUALCOMM 6500 2Q '03			QUALCOMM 6250 2Q '03		
Value Platform	Integrated gpsOne Voice&Data Voice	QUALCOMM 6000 1Q '02					QUALCOMM 6225 MID '04		
		QUALCOMM 6025 Q '03							
		QUALCOMM 6050 1Q '02							
							QUALCOMM 6200 2Q '02		

<Source: Qualcomm 2006>

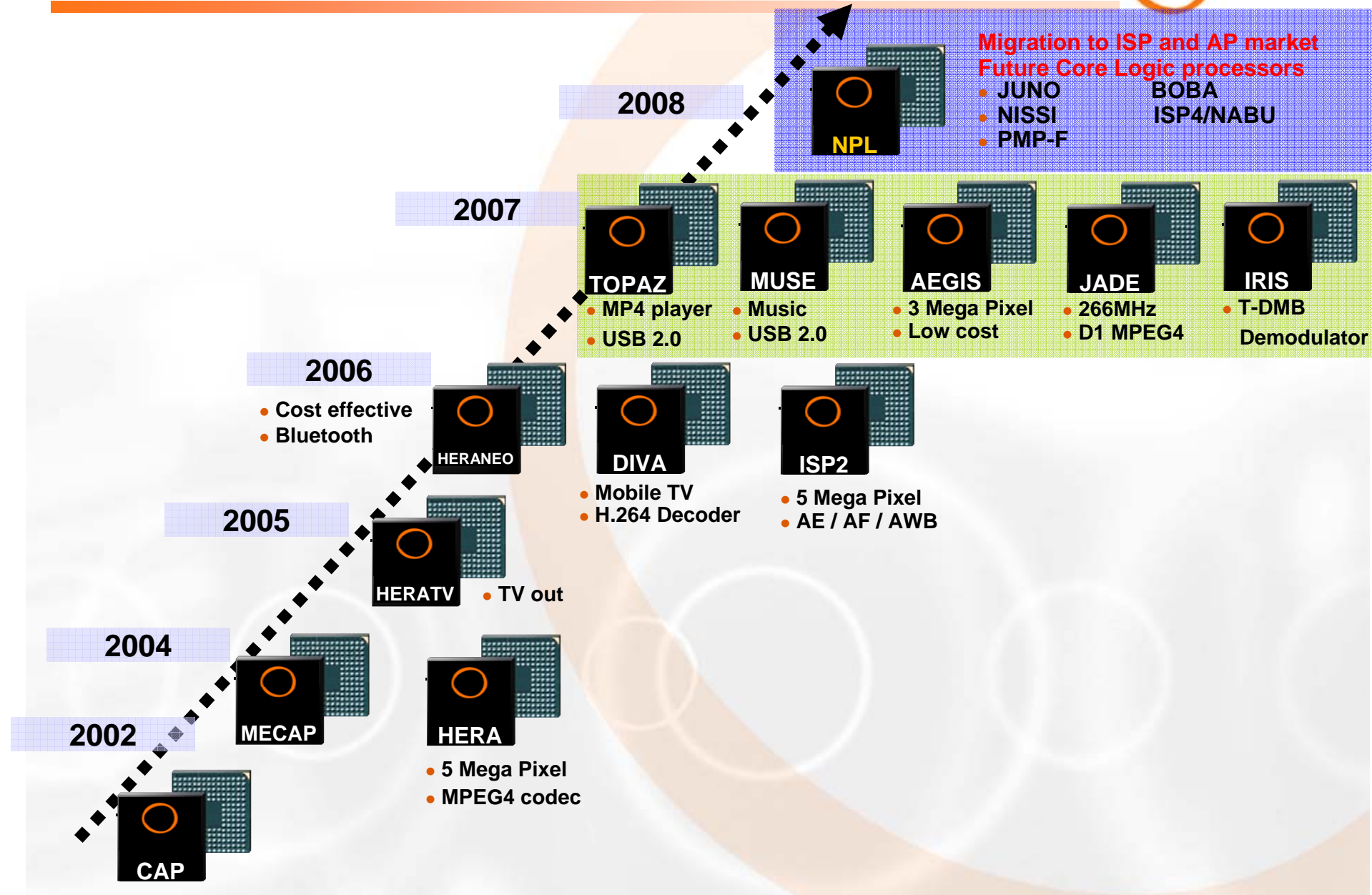
TI OMAP AP Roadmap



	OMAP 1.1	OMAP 1.2	OMAP 1.3	OMAP 2.0	OMAP 3.0
Multimedia Enhanced AP	OMAP151X	OMAP161X	OMAP3430	OMAP2410 Helios 1 OMAP2420 Helios 2 OMAP2430 Helios 3 Apollo 1	OMAP1710 Future OMAP Processor
ARM-centric AP	OMAP310	OMAP331		Pluto 1	Future OMAP Processor
Integrated device: Modem + AP(3 cores)	OMAP710	OMAP730 OMAP750 OMAP850		Nereid	Future OMAP Processor
Modem AP (2 cores)			Neptune		
OMAP-DM MMP		OMAP DM270	OMAP DM275	OMAP DM280	

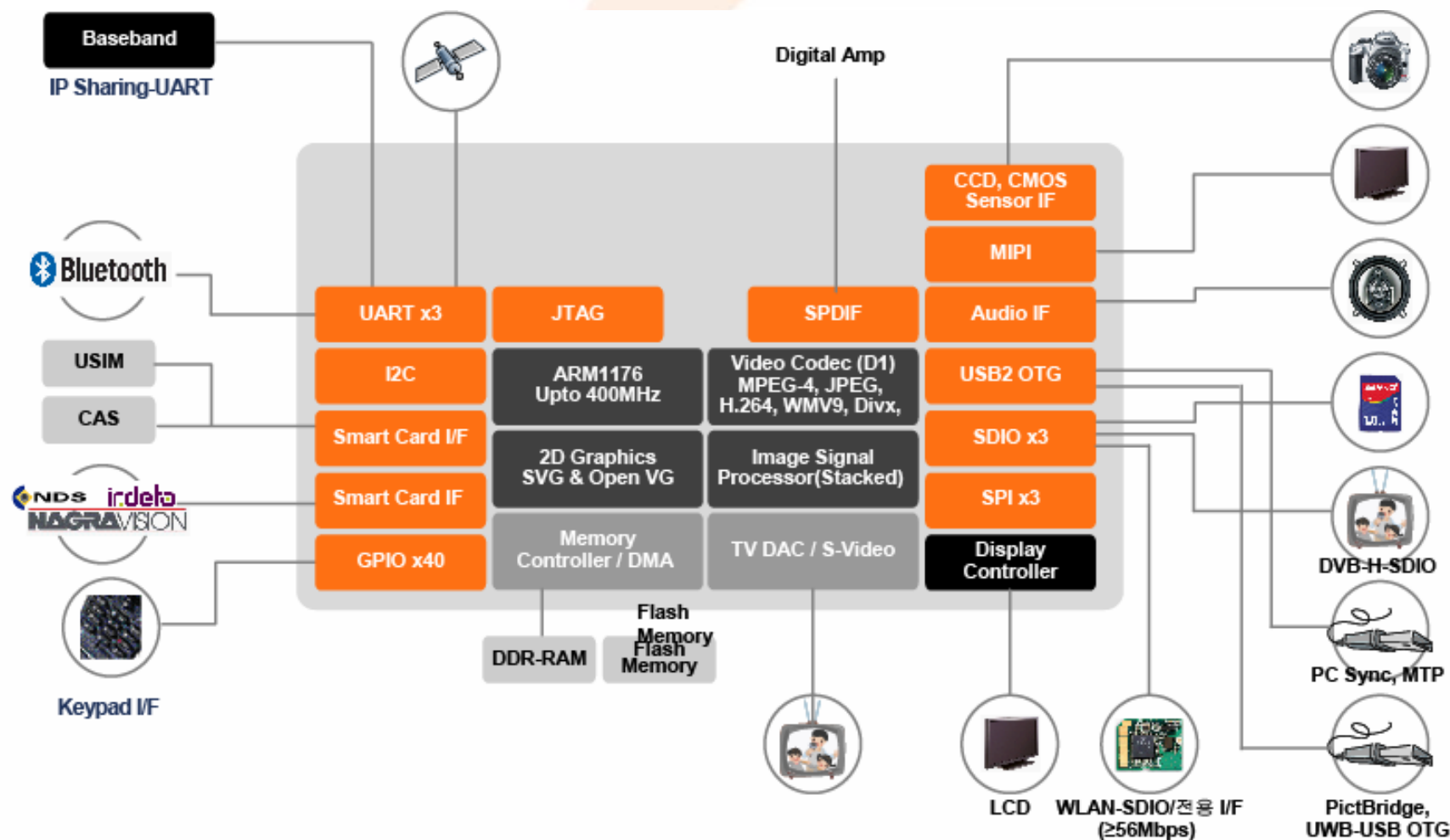
Source : TI Presentation (2005)

Core Logic Product Roadmap



■ ***Case Studies***

Block Diagram – Smart phone



Software Block Diagram – Smart phone



Input Device	Key Input		Touch Panel
	Command set		
UI	Phone platform UI		UI Engine
	Font		
Application	Camera	Camcorder	Music
	Radio	Recorder	E-book
	M-TV	Navigation	Phone App.
Mobile-TV MW	T-DMB	CMMB	CAS
	DAB-IP	IP-TV	Data Service
Player	JPEG	MP3	AVS
	H.263	A. Encoder	RMVB
	H.264	A. Decoder	WMV
Driver	Bluetooth	M-TV Demodulator	GPS module
	SD Card IF	NAND IF	USB MSC
	LCD	Codec	Camera
OS Layer	WinCE	Linux	RTOS
Boot	Master Mode		Slave Mode
	NAND Boot		HIF Boot

Apple * iPhone – Key features



Hardware features



High Technology

Technical Specifications

Screen size	3.5 inches
Screen resolution	320 by 480 at 160 ppi
Input method	Multi-touch
Operating system	OS X
Storage	4GB or 8GB
GSM	Quad-band (MHz: 850, 900, 1800, 1900)
Wireless data	Wi-Fi (802.11b/g) + EDGE + Bluetooth 2.0
Camera	2.0 megapixels
Battery	Up to 5 hours Talk / Video / Browsing Up to 16 hours Audio playback
Dimensions	4.5 x 2.4 x 0.46 inches / 115 x 61 x 11.6mm
Weight	4.8 ounces / 135 grams

[Return to High Technology](#) >

Overview



UI multi-touch functions

Flick

- For scrolling lists

Stop

- Tap and hold to stop the moving list, while scrolling up/down

Double click

- Zoom-in and -out (all apps), zooms in (maps)

Click

- Selecting items

Pinch in

- Zoom-out of photos, maps, Safari

Spread out

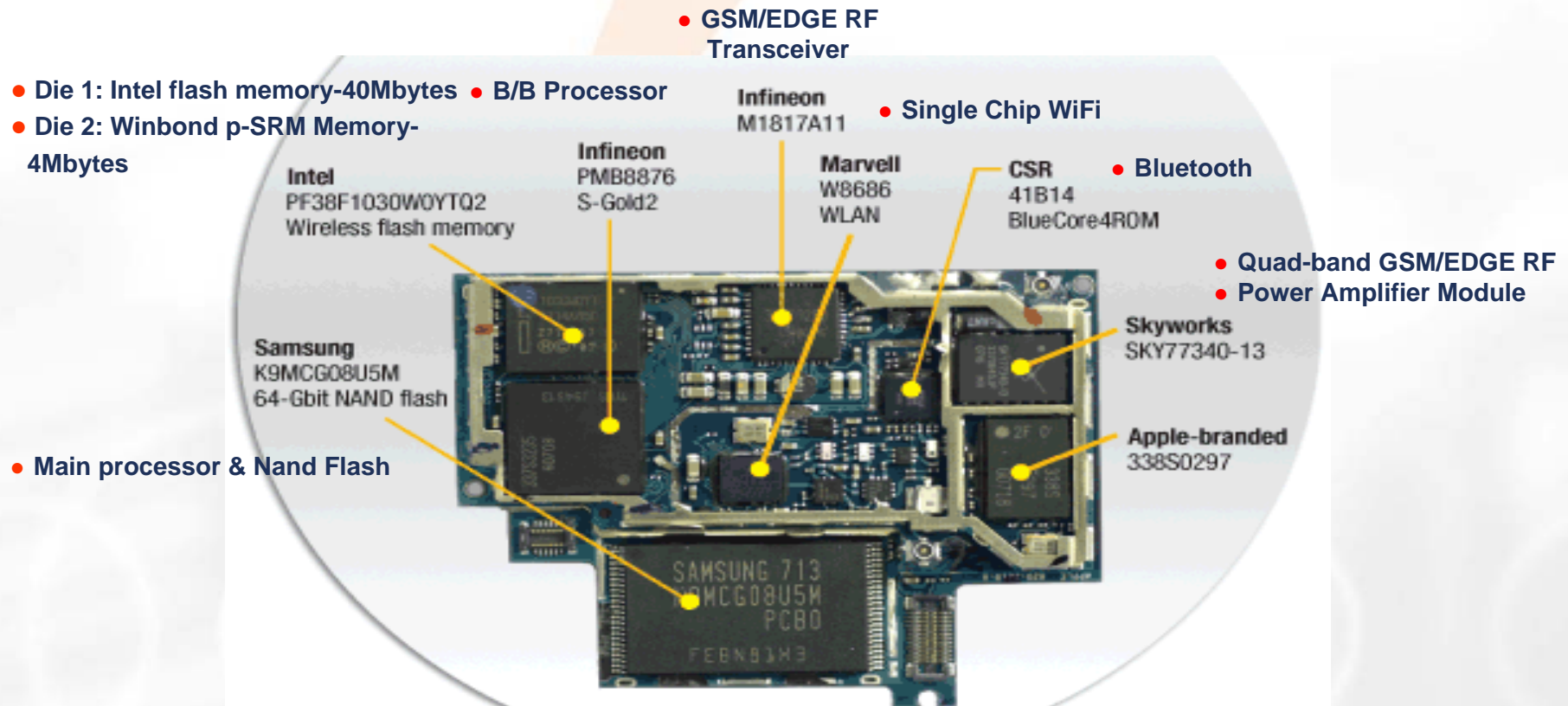
- Opposition of pinching, for zoom-in

- Four major buttons at the bottom of the screen:
 - call, e-mail, Safari, iPod
- Multitasking support:
 - fire up a song on the iPod
 - return to the home screen and check some e-mail
 - go load a few web pages in Safari and while those are loading
 - go back and make a phone call
- **iPhone always saves whatever you are doing**

Apple * iPhone – Key features



- Hardware features



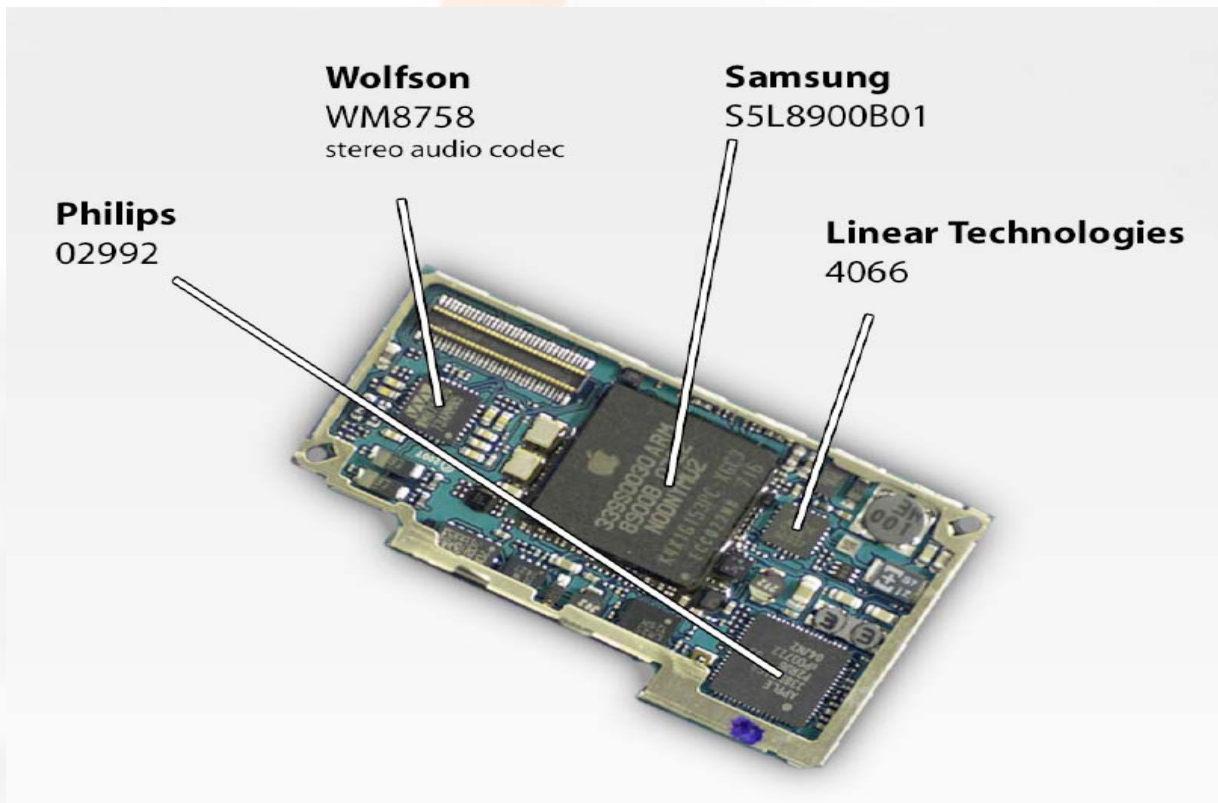
<Source : <http://www.embedded.com>>

Apple * iPhone – Key features



- Hardware features

- Functional layout II of the Apple 339S0030 (Samsung S5L8900B01) application processor founded in the iPhone



<Source : <http://www.embedded.com>>

Google * Android – Key features



- Hardware features



Qualcomm MSM 7X00



Wistron, Chinese design house announced GW4 runs on Android GW4 is based on a **TI OMAP 1710** with

- A 216 MHz processor
- 64MB of program memory



- **Graphic: NVIDIA**
- **Touchscreen: Synaptics**
- **Voice Recognition: Nuance**
- **Webbrowser: Open-source WEBKIT application framework**



- **Google Map – SiRF**
- **Connectivity- WiFi**

What is Android Platform?



- **Android** is a software stack for mobile devices that includes an operating system, middleware and key applications. This early look at the Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language.
- **Android –The first complete, open, and free mobile platform**
 - **An Open Handset Alliance Project** (30 mobile companies)
 - **Application framework** enabling reuse and replacement of components
 - **Dalvik virtual machine** optimized for mobile devices
 - **Integrated browser** based on the open source engine
 - **Optimized graphics** powered by a custom 2D and 3D graphics
 - **Media support** for MPEG4, H.264, MP3, AAC, AMR, JPG, PNG, GIF
 - **Bluetooth, EDGE, 3G, and WiFi** (hardware dependent)
 - **Camera, GPS, compass, and accelerometer** (hardware dependent)
 - **Rich development environment**



<Android Architecture>

iPhone Vs. Gphone : Overview



iPhone

- Available: 2007 June
- Price: 500~600 USD
- Size: 4.5H x 2.4W x 0.46T
- Display: 3.5 inch, WVGA (480 x320)
- EDGE/ Wifi (AT&T)
- Multi touch screen
- Max OS
- 2MP camera
- Accelerometer
- 5GB/8GB internal memory
- BT 2.0
- A.P: S3C 2443



GPhone

- Available: 2008 1Q
- 3G/ WiFi (multi network)
- Linux OS (Openmoko)
- Wider display w/ touch screen
- High resolution camera editing feature
- External memory
- BT2.0 a2DP, USB 2.0(OTG)
- A.P: OMAP, MSM7xxx for next model

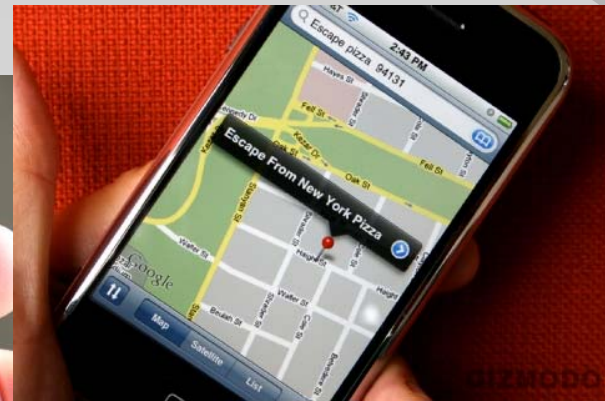
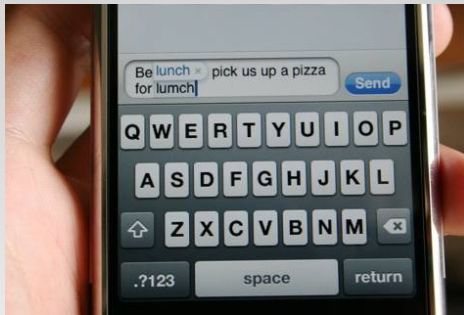


■ ***Future Directions***

User Interface (UI)



- It is all about **UI**
 - UI = Quality of product



Qualcomm Vs. Intel



Pocketable computer

Anchorage

Snapdragon Processor



<Nokia's N800 Internet Tablet>

Vs.



MID

Menlow Architecture

Silverthorne Processor



<Menlow-based UMPC platform>



Intel Core 2 Duo
Standard size In MacBook Air

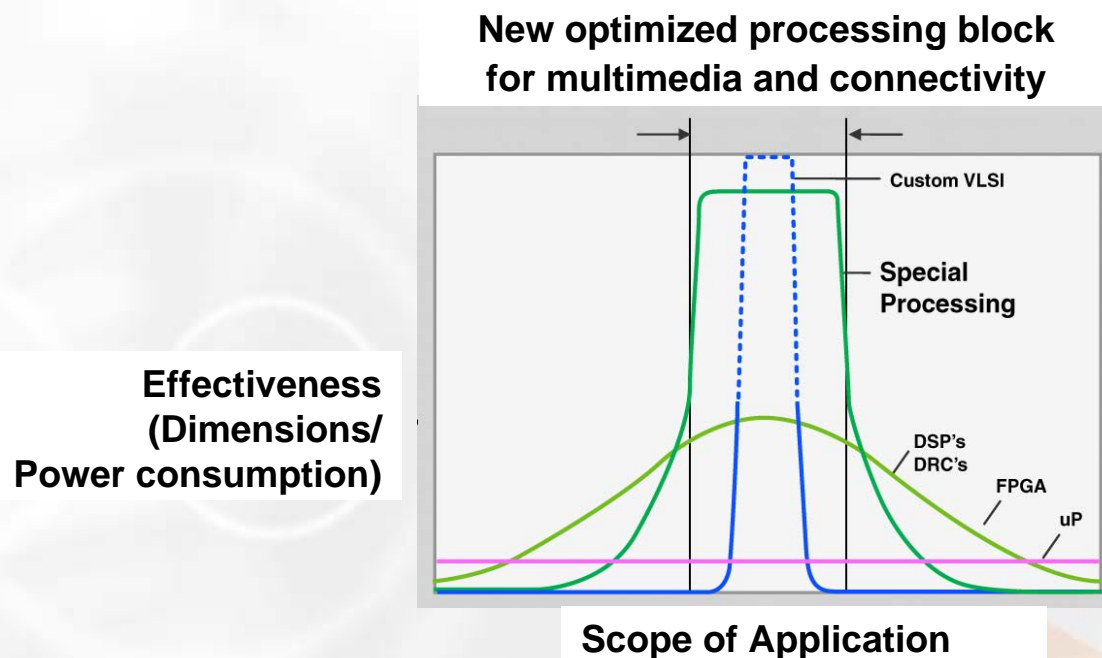


<Mac Air>

The evolution of SoC platform



- **System level design for faster time to market** and efficient products
- Increasing Verification complexity and time
- **Development of standard platform solution with flexible architecture**
 - Semiconductor companies need to be able to move fast with flexibility – need reuse based on **standards at all levels in development flow**
- **Ideal Core development**



Multi-core applications



- Multi-core application on a single chip platform solution

Podwatch



Wireless iPod



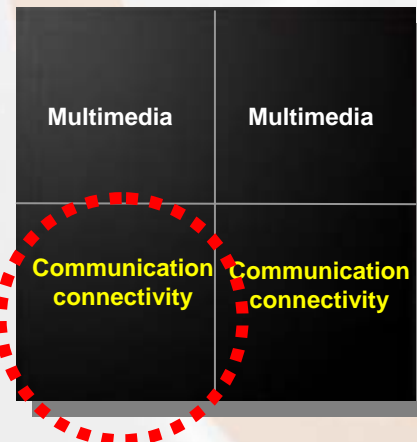
Video iPod



iPhone



iBook



Conclusions



Tradeoff factors

- Power consumption
- Performance: CPU, Multimedia Codec, Connectivity
- Architecture

UI

- Multimedia for last 10 years, UI for next 10 years

Complete SoC Platform for System Solution

- Time to Market
- More Software for applications and services

More PC-like functions into Mobile Devices

- UMPC vs. Smart Phones
- Mobile Internet Devices



Thank you