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[招待講演]携帯機器向けアプリケーションプロセッサOMAPの変遷

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あらまし 近年小型化・省電力化とともに高性能化の要求が高まる携帯機器向けのアプリケーション・プロセッサの一つである OMAP の世代ごとの進化を紹介する。アプリケーション・プロセッサは昨今の携帯電話に見られるようにマルチメディアの性能要求の高まりと、低消費電力の要求を同時に実現することが課題となる。これら市場要求を取り込み問題解決するための幾つかの工夫を重ね変遷したアプリケーション・プロセッサ OMAP の世代の移り変わりと代表的な技術を紹介する。

キーワード 携帯機器、アプリケーション・プロセッサ、マルチメディア、低消費電力

Evolution of application processor OMAP for mobile products

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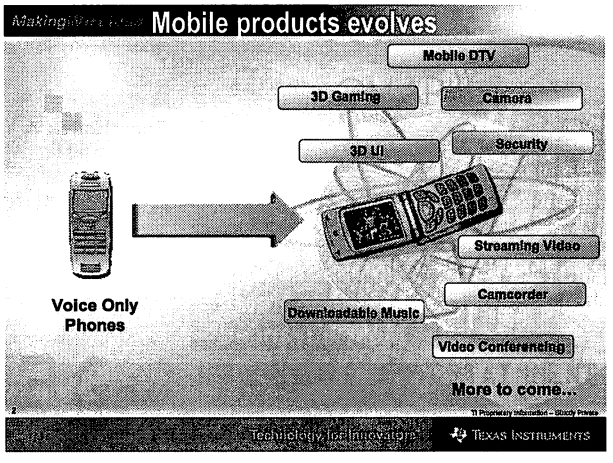
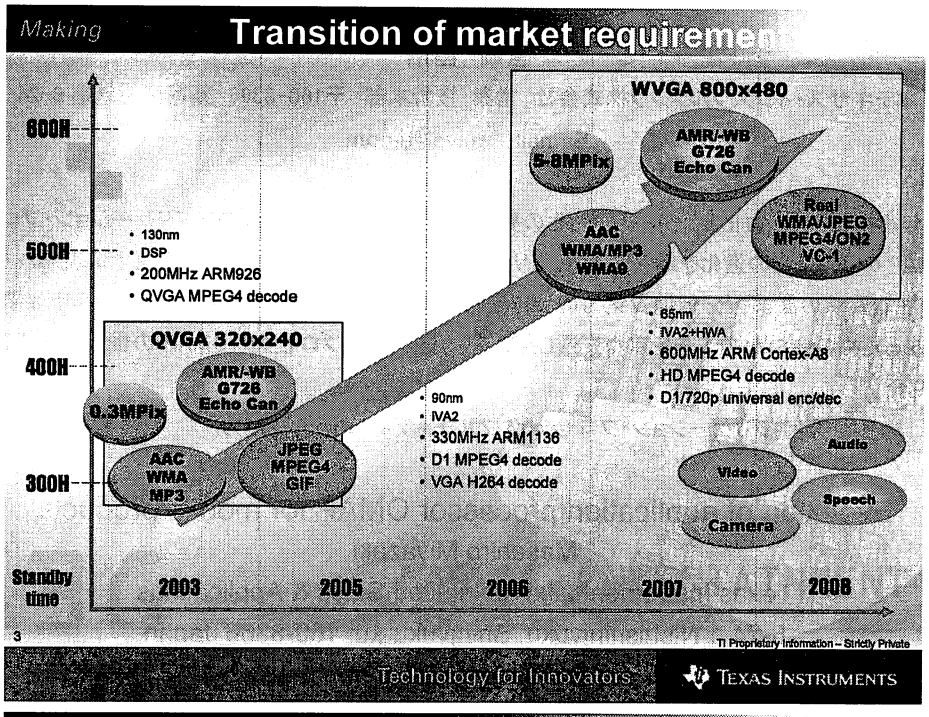
Abstract This presentation shows the evolution of application processor OMAP. Recently, high performance multimedia and low power consumption for application processor are requested in the mobile market coinstantaneously. The application processor OMAP evolves with some techniques which support the required high multimedia performance and low power consumption. This paper explains above techniques enhanced through several generations of OMAP.

Keywords mobile products, application processor, multimedia, low power consumption




Making
Transition of market requirement
WVGA 800x480
5-8MPix
AMR/-WB
G726
Echo Can
Real
WMA/JPEG
MPEG4/ON2
VC-1
AAC
WMA/MP3
WMA9
600H
500H
400H
300H
• 130nm
• DSP
• 200MHz ARM926
• QVGA MPEG4 decode
QVGA 320x240
AMR/-WB
G726
Echo Can
0.3MPix
AAC
WMA
MP3
JPEG
MPEG4
GIF
• 90nm
• IVA2
• 330MHz ARM1136
• D1 MPEG4 decode
• VGA H264 decode
• 65nm
• IVA2+HWA
• 600MHz ARM Cortex-A8
• HD MPEG4 decode
• D1/720p universal enc/dec
Audio
Video
Speech
Camera
Standby time
2003
2005
2006
2007
2008
3
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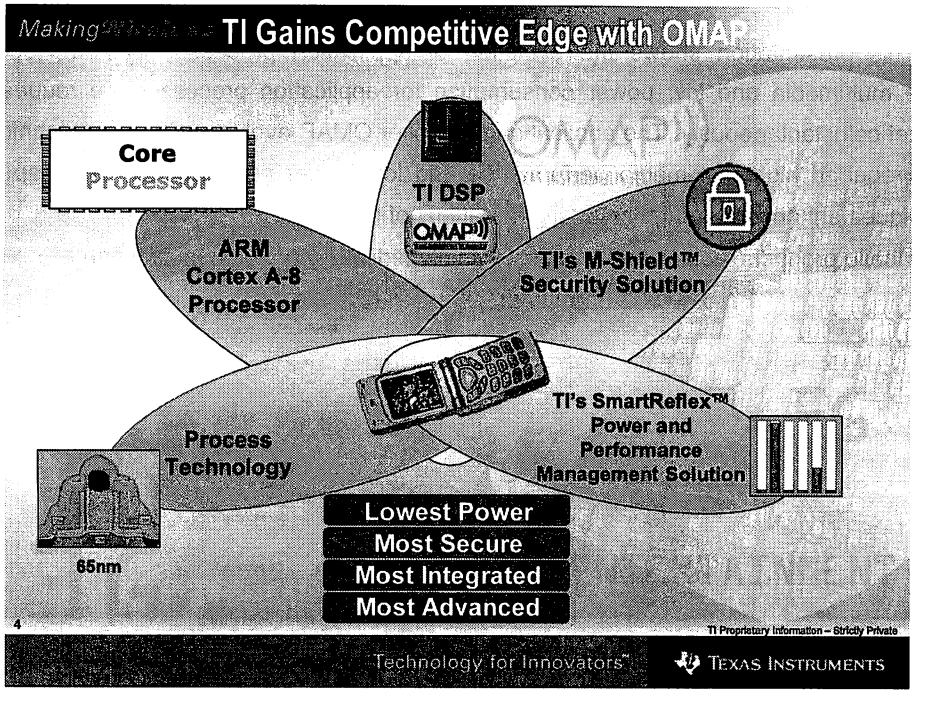
Making
TI Gains Competitive Edge with OMAP
Core
Processor
TI DSP
OMAP
ARM
Cortex A-8
Processor
TI's M-Shield™
Security Solution
TI's SmartReflex™
Power and
Performance
Management Solution
Process
Technology
65nm
Lowest Power
Most Secure
Most Integrated
Most Advanced
4
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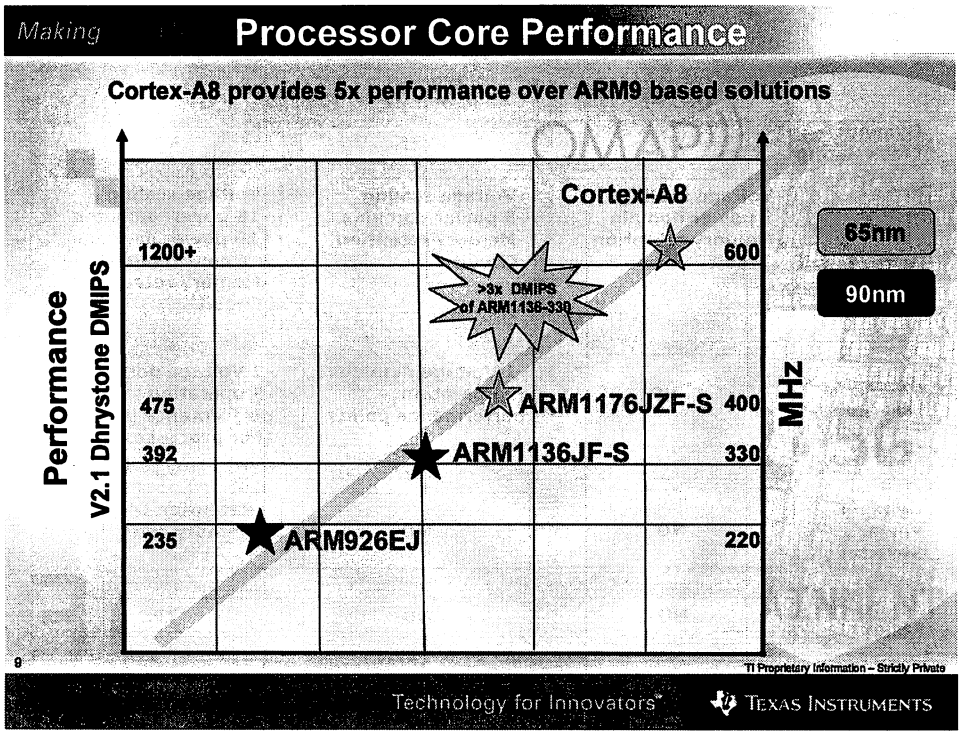
Making
Processor Core Performance
Cortex-A8 provides 5x performance over ARM9 based solutions
Performance
V2.1 Dhrystone DMIPS
1200+
475
392
235
Cortex-A8
600
>3x DMIPS of ARM1136-330
ARM1176JZF-S
400
ARM1136JF-S
330
ARM926EJ
220
MHz
65nm
90nm
9
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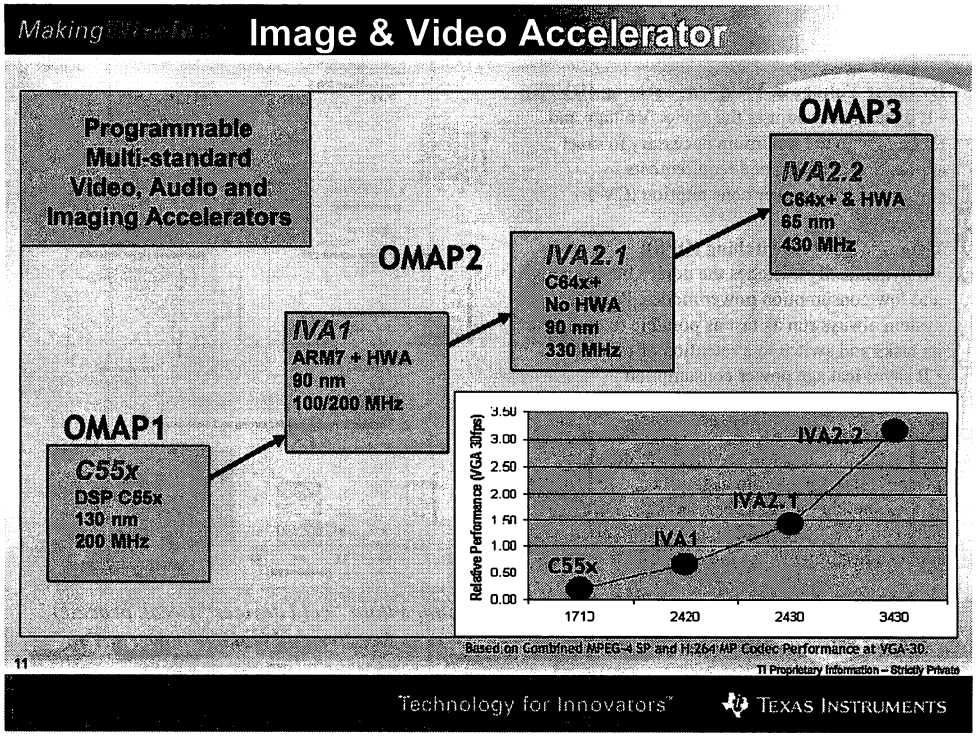
Making
Image & Video Accelerator
Programmable Multi-standard Video, Audio and Imaging Accelerators
OMAP1
C55x
DSP C55x
130 nm
200 MHz
OMAP2
IVA1
ARM7 + HWA
90 nm
100/200 MHz
IVA2.1
C64x+
No HWA
90 nm
330 MHz
OMAP3
IVA2.2
C64x+ & HWA
65 nm
430 MHz
Relative Performance (VGA 30fps)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
C55x
IVA1
IVA2.1
IVA2.2
1710
2420
2430
3430
Based on Combined MPEG-4 SP and H.264 MP Codec Performance at VGA-30.
11
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Making

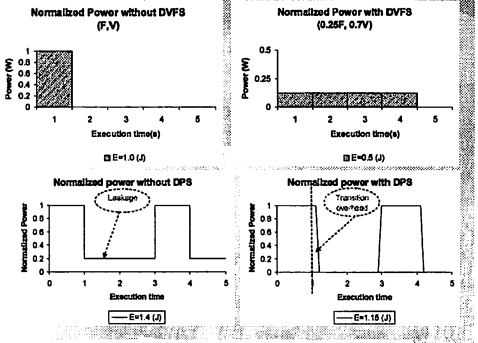
Power management in OMAP devices

	OMAP1	OMAP2	OMAP3
Dynamic Clock Gating	YES	YES	YES
Standby Leakage Management	-Voltage scaling -1 power domain -Memory retention Circuit	-Voltage scaling -5 power domains -Memory retention Circuit	-Voltage scaling -18 power domains (10 power domains are controllable) -Memory retention Circuit
Dynamic Voltage Frequency Scaling	NO	-1 Voltage domains -2 operation performance points	-2 Voltage domains -5 operation performance points (For processors)
Dynamic Power Switching	NO	NO	- Retention DFF - Memory retention
Smart Reflex	NO	NO	YES

Making

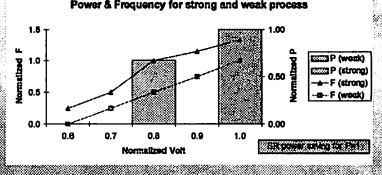
Power Management Techniques

Dynamic Voltage & Frequency scaling (DVFS):
- It dynamically adjusts the device Voltage and Frequency to the minimum necessary to meet application performance requirements.
- It saves active power consumption (CV^2F)



Dynamic Power Switching (DPS):
- It dynamically switches the device between high and low consumption power modes. Processor or system always run as fast as possible to complete its tasks and switch to a retention or off states
- It saves leakage power consumption

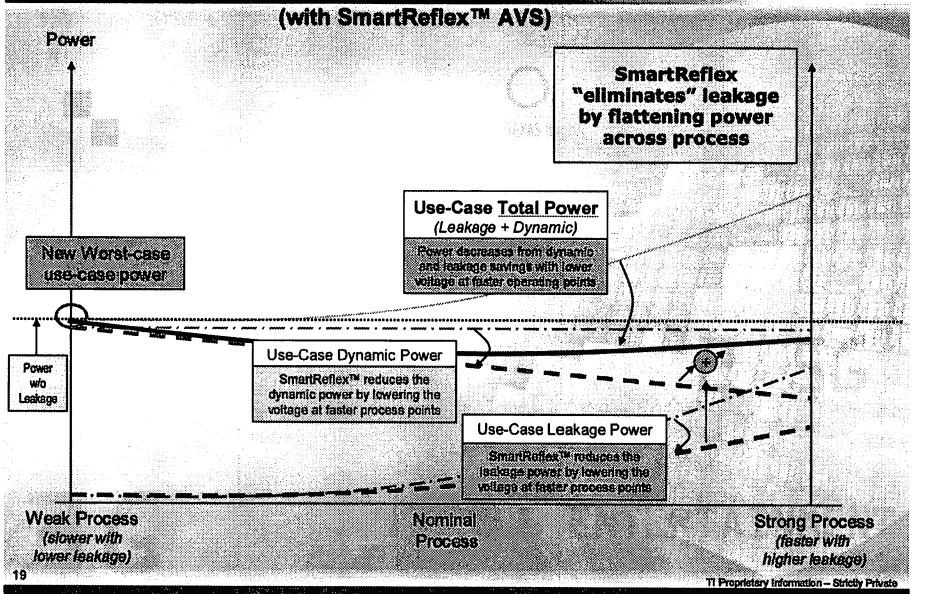
SmartReflex (SR):
- SmartReflex adjusts the voltage to the silicon performance either from a static sense (e.g. adapted to the manufacturing process of a given device), or a dynamic sense (e.g. adapted to the temperature induced performance of the device).



"hot devices" (strong process) runs at a lower voltage than "cold devices" (weak process) for the same frequency of operation. This results in both active and leakage power saving

Making

Power vs. Process (with SmartReflex™ AVS)



Making

Summary & Next Step

Summary

-Application processor OMAP evolutes with market trend that are high performance multimedia and low power techniques

- Multimedia engines

DSP + Hardware accelerators, iME, iLF, iVLCD

- Power management techniques

Dynamic Clock Gating, SLM, DVFS, DPS, SmartReflex

-Other intelligent sub systems

Display, Camera ISP, Memory controller

Next step

- Process technology evolving to next step
- Symmetrical Multi-Processing Dual Core
- Multi-standard HD-1080p playback and record
- Low power audio playback via virtual audio chip
- TI DSC quality imaging improving
- High Bandwidth Memory Interfacing
- Industry Standard Peripherals and Interfaces
- Larger, color rich display support
- SmartReflex™2 for advance power management