Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

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i.MX 6 Series Portfolio Overview

AMF-CON-T0060

Pat Stilwell
Product Marketing

August 2013

i.MX

Your Interface to the World

i.MX families offer some of the most versatile platforms for multimedia and display applications, bringing personality and interactivity to a whole new world of products

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Objectives

- Learn about the Freescale i.MX 6 series of application processors' key features, capabilities, uses and market segment targets
- Learn about the Development Ecosystem available for the i.MX 6 Series family of processors
- Understand the power and performance advantages of the 6 Series family

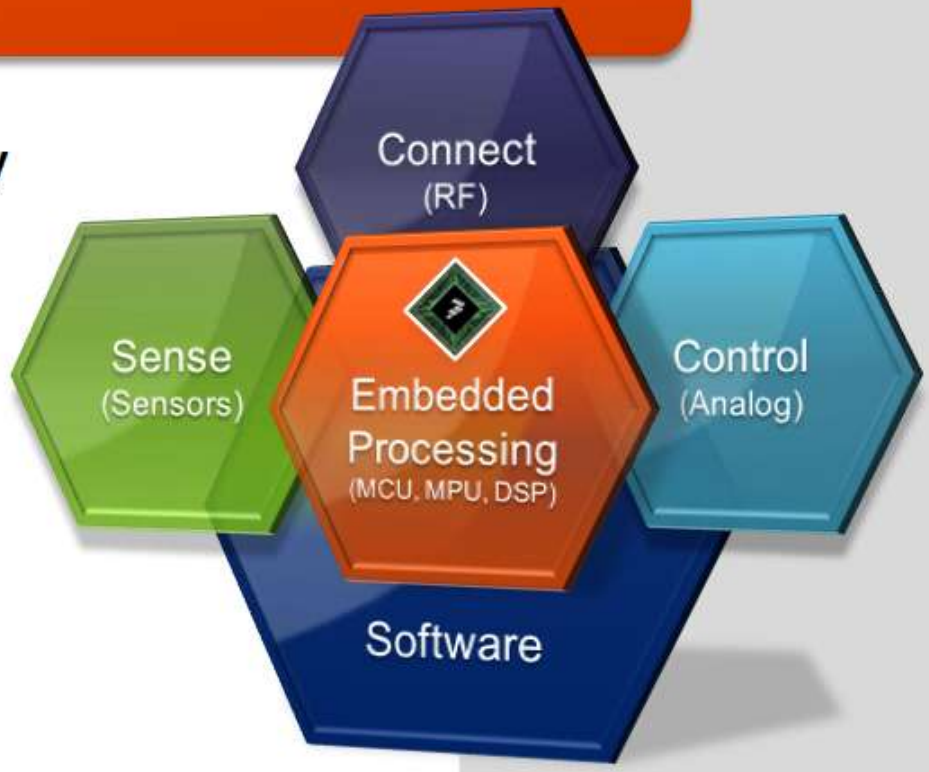
A Global Leader of
Embedded Processing Solutions

Two Core Product Groups

- Automotive, Industrial & Multi-Market Solutions
  - Microcontrollers
  - Sensors
  - Analog
- Networking and Multimedia Solutions
  - Communications Processors
  - Applications Processors
  - RF Power

Four Primary Markets

- Automotive
- Industrial
- Networking
- Consumer



Platform-Level Solutions

>50 Year Legacy

>5,500 Engineers

>6,000 Patent Families

>18,000 Customers

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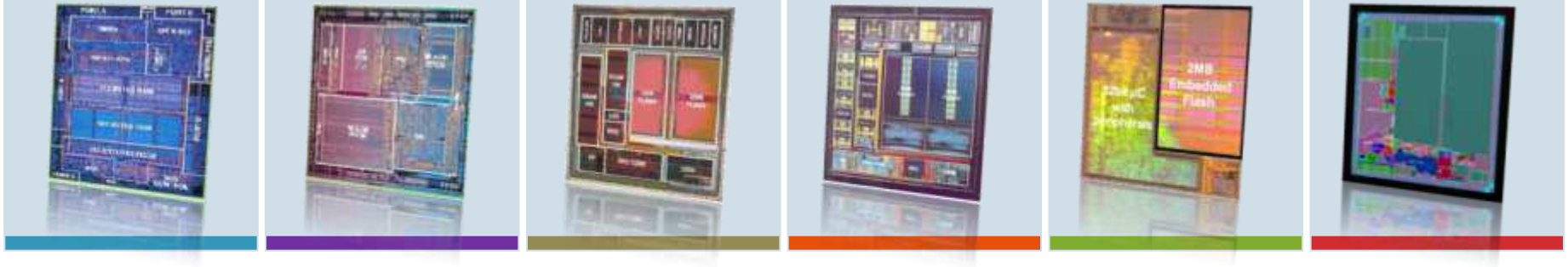
Six Generations of Application Processors

1995	2001	2003	2005	2009	2011
Dragonball 1st FSL Apps Processor	**i.MX1** 1st FSL ARM9 Apps Processor	**i.MX2 Series** 90nm LP HW Video Accel Analog Integration	**i.MX3 Series** ARM11 GPU Integration	**i.MX5 Series** 65nm LP/GP ARM Cortex-A8 >1GHz	**i.MX 6 Series** 40nm LP ARM Cortex-A9 Multi-core family



50+ Products
>150M Units

- **Clear market leader** for eReader apps processors (IDC)
- **No. 1** in Apps Processors (IDC 12/2011)
- **No. 2** in Auto Infotainment (Strategy Analytics)

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i.MX Smart Devices

Giant Waterproof Tablet – i.MX53

Honeywell Lynx Touch security panel with the i.MX25

Icephone, Medical Phone with i.MX31

Navico Marine Navigation i.MX51

Maxtrack tablet for Brazilian Police with i.MX51

Avaak Vue Personal Video Network With the i.MX25

Invoxia IP Phone - i.MX503

Gigaset DECT phone with i.MX233

Sophia systems' non-contact card Reader/Writer for DoCoMo with i.MX51

i.MX233 based i'mWatch

AMX 20.3" Modero X Series Panoramic Table Top Touch Panel with i.MX53

Televic in Belgium trams using MX51

Line6 "Stagescape" audio mixing system with i.MX51

Japanese Boarding Gate Pass Reader with i.MX27

Self service touch screen terminal

Sharp e-Dictionary with i.MX28

Harris military communication equipment with i.MX27

Freescale i.MX Applications Processors

i.MX 6Quad


High Performance Tablet


Media Box


Luxury Infotainment


Advanced HMI

i.MX 6Dual
i.MX 6DualLite

i.MX53


Color eReader


Business Tablet


Mainstream Infotainment


Medical

i.MX 6Solo
i.MX 6SoloLite

i.MX28, i.MX233, i.MX25, i.MX35, i.MX50


Monochrome eReader


Single Function Tablet


Connected Radio


Smart Energy Meter

Performance/ Multimedia Capability

Content Creation, Technology Driver

Good, Better, Best Differentiation

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i.MX 6: One Platform, Differentiated Products

Saves **development costs** and **improves time to market**.
Scalability with multiple cores is **key** to implement this strategy.

Smart Device Design

Quad Core

High-End

IPTV
High Performance Tablet
Auto Infotainment

Dual Core

High-End

Smart Monitor
Business Tablet
Media Tablet
IP Phone
Tablets for Kids
Mainstream Infotainment

Low-End

Color eReaders

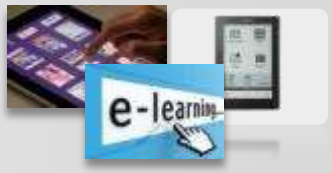
Single Core

High-End

Smart Energy
eReaders

Low-End

Entry Infotainment



i.MX 6 Series At a Glance

Red indicates change from column to the left

i.MX 6SoloLite

- Single ARM® Cortex™-A9 at 1.0GHz
- 256KB L2 cache, Neon, VFPvd16, Trustzone
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400MHz
- Integrated EPD controller

i.MX 6Solo

- Single ARM Cortex-A9 at 1.0GHz
- **512KB** L2 cache, Neon, VFPvd16, Trustzone
- **3D graphics** with 1 shader
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400MHz
- Integrated EPD controller

i.MX 6DualLite

- **Dual** ARM Cortex-A9 at 1.0GHz
- 512KB L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with 1 shader
- 2D graphics
- **64-bit** DDR3 and 2-channel 32-bit LPDDR2 at 400MHz
- Integrated EPD controller

i.MX 6Dual

- **Dual** ARM Cortex-A9 at 1/**1.2GHz**
- **1 MB** L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with **4 shaders**
- **Two** 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at **533MHz**
- Integrated **SATA-II**

i.MX 6Quad

- **Quad** ARM Cortex-A9 at 1.2GHz
- 1 MB L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with 4 shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533MHz
- Integrated SATA-II

i.MX 6 Series Highlights

- ARM Cortex-A9 based solutions ranging up to 1.2GHz
- HD 1080p encode and decode (except 6SL)
- 3D video playback in High definition (except 6SL)
- Low power 1080p playback at 350mW Integrated IO's that include HDMI v1.4, MIPI and LVDS display ports, MIPI camera, Gigabit Ethernet, multiple USB 2.0 and PCI-Express
- SW support: Google Android™, Windows® Embedded CE, Ubuntu, Linux®, Skype™

Features vary by product family

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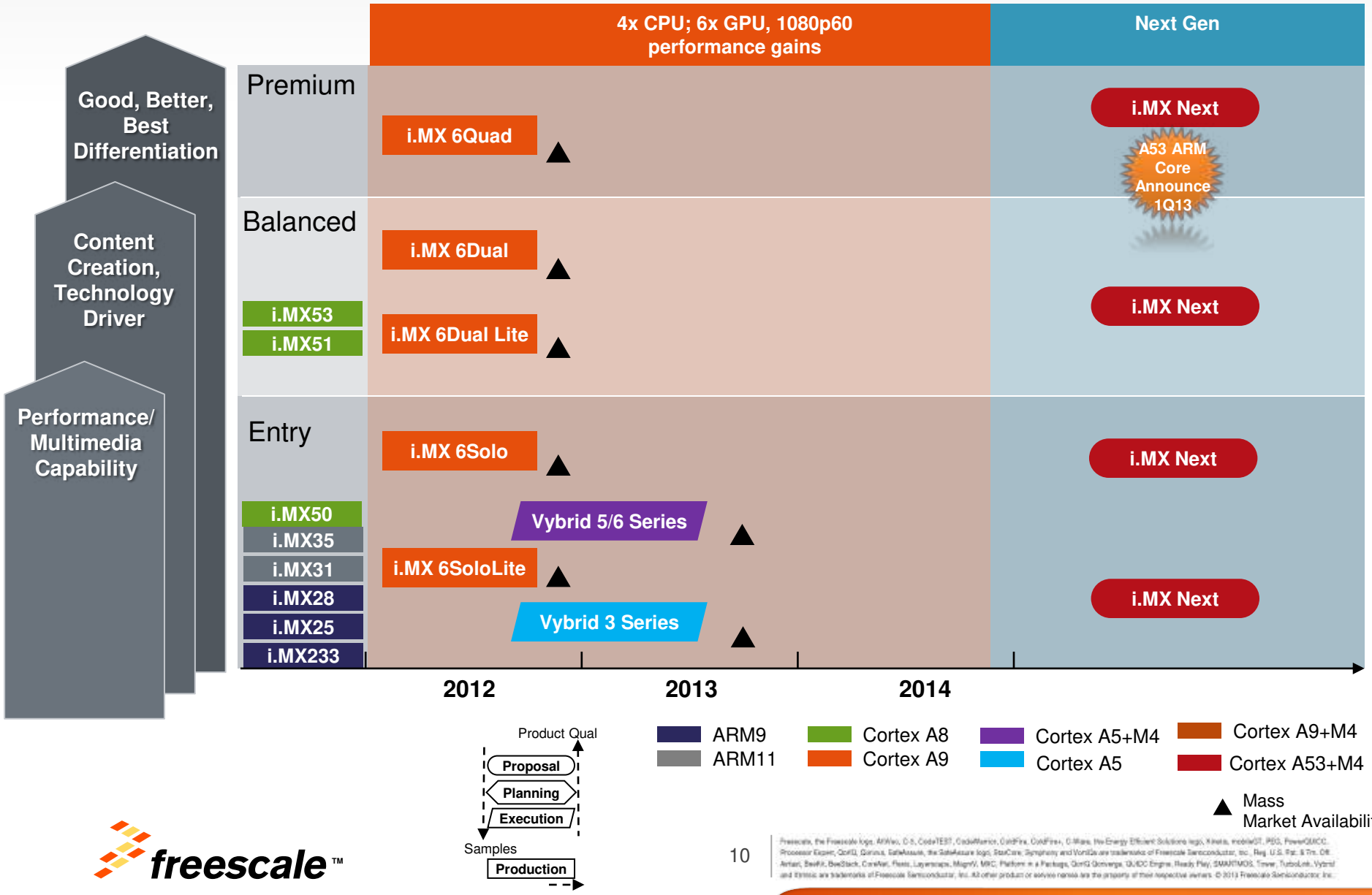
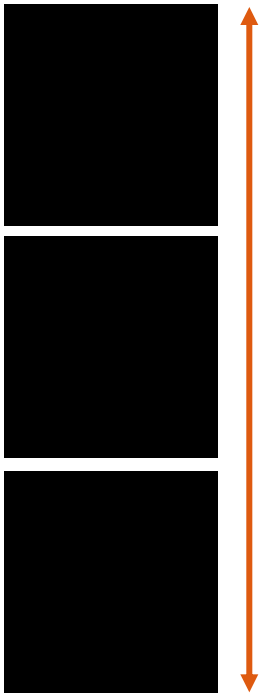
Applications Processor Family Roadmap



Freescale i.MX 6: unmatched pin-compatibility

Competitors



Pin-compatibility
inside a family
(typically frequency scaling)

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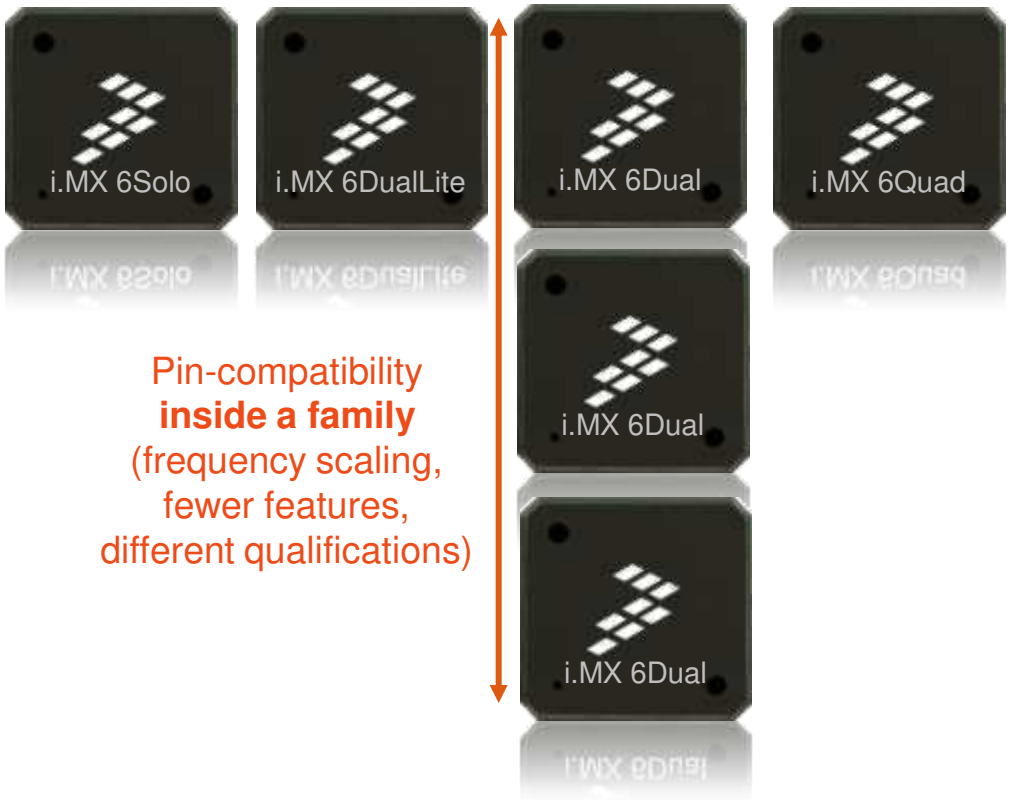
Pin-compatibility
between families



Pin-compatibility
inside a family
(frequency scaling,
fewer features,
different qualifications)

i.MX 6 Series Overview

Scalable series of five ARM Cortex A9-based SoC families

i.MX 6SoloLite

- 1x 1GHz
- x32 400MHz DDR3
- No HW video accel.
- 2D graphics (2 GPUs)
- LCD, EPD

i.MX 6Solo

- 1x 1GHz
- x32 400MHz DDR3
- **HD1080p video**
- 2D+**3D** (2 GPUs), 53Mtri/s
- LCD, EPD

i.MX 6DualLite

- **2x** 1GHz
- **x64** 400MHz DDR3
- HD1080p video
- 2D+3D (2 GPUs), 53Mtri/s
- LCD, EPD

i.MX 6Dual

- 2x 1/**1.2GHz**
- x64 **533MHz** DDR3
- **Dual** HD1080p video
- 2D+3D (3 GPUs), **176 Mtri/s**
- LCD

i.MX 6Quad

- **4x** 1/1.2GHz
- x64 533MHz DDR3
- Dual HD1080p video
- 2D+3D (3 GPUs), 176 Mtri/s
- LCD

Pin-to-pin Compatible

Software Compatible

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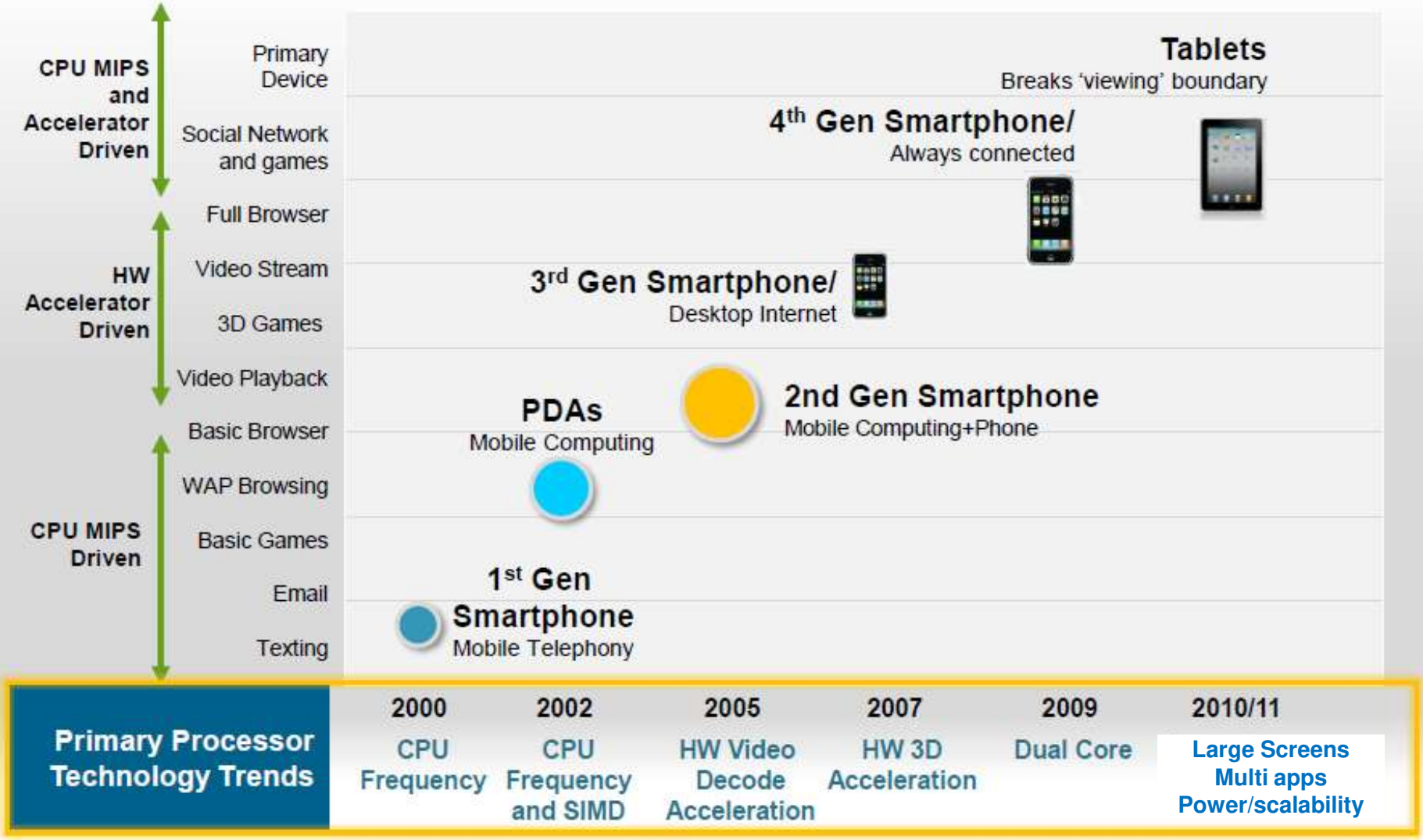
Optimizing the Processor Platform



Android Support Quad Core

The Good News: Heavy Lifting Already Done

The work required to go from 1 to 2 cores was much greater than to go from 2 to 4 (or more) cores… Android 3.0 (Honeycomb) natively supported Quad core out of the box in June 2011

If you have 4 threads and 4 cores, Android will schedule a thread per core

Intelligent Integration of Multi-Media

i.MX 6Dual/6Quad VPU

-H.264 MVC1080p60 decode
-H.264 MVC 720p60 encode
- 350mW power consumption for single video!

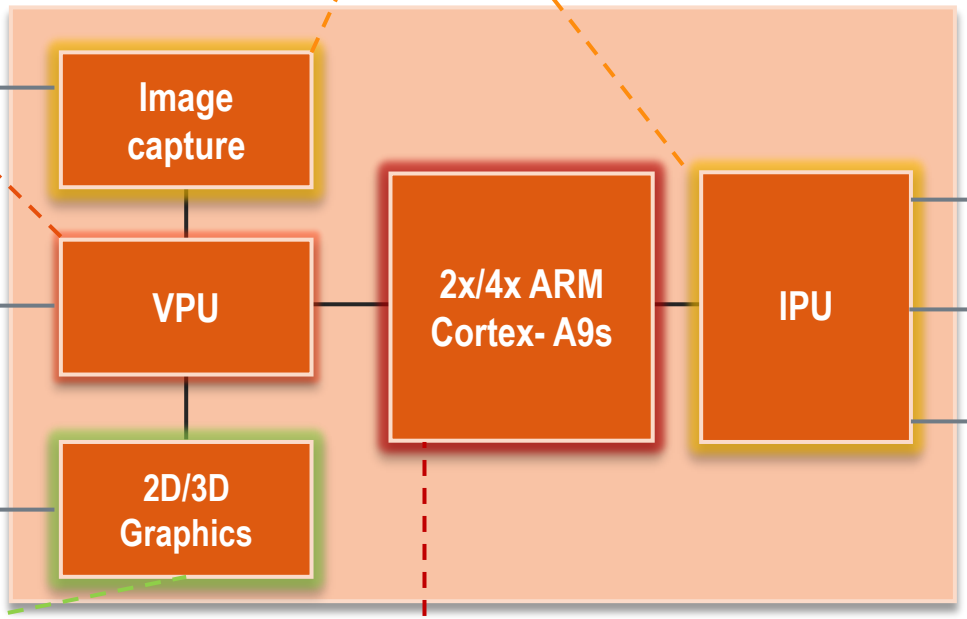
i.MX 6Dual/6Quad IPU

- Four Display support (2x MIPI-DSI, Parallel, HDMI v1.4a)
- Stereoscopic camera input
- Color adjustments and gamut mapping
- Gamma correction and contrast stretching
- Compensation for low-light conditions & backlight reduction

Recording Video

Movie Content

Game Content



3D LCD

Publish

3D Television

i.MX 6Dual/6Quad Triple-Play Graphics

- 3 engines: 3D, OpenVG and BLT
- 200 MT/s, 4 shaders, 3 separate engines
- High quality 3D games optimized for mobile
- Augmented reality views (real world + 3D objects)
- Advanced 3D video formats (source/depth format)

i.MX 6Dual/6Quad– 2x/4x cores

- Create, transform, enhance, & publish multimedia fast!
- Intuitive User Interfaces for content viewing
- Scalability for 'the next big use case'

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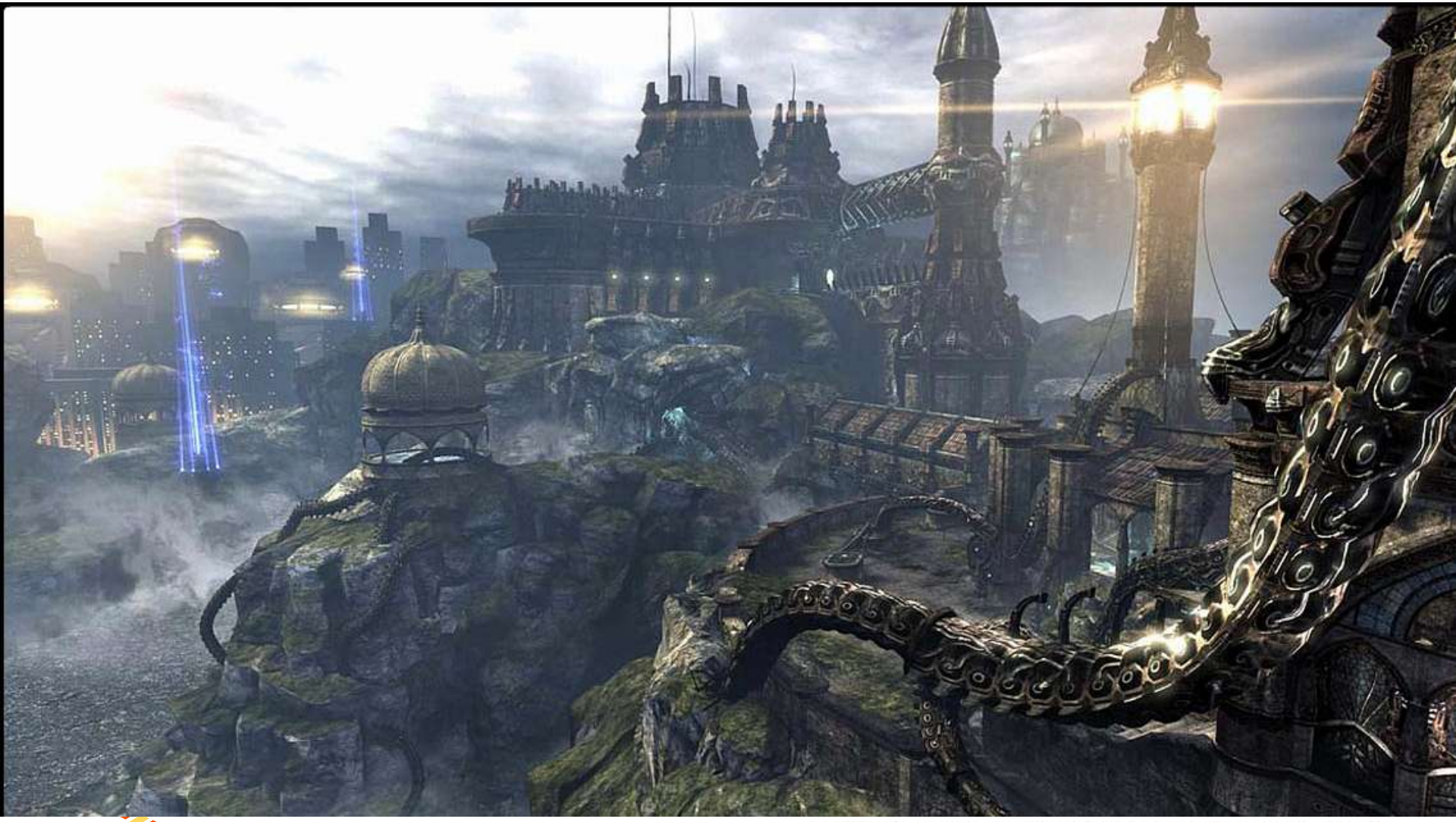
Vivante GC2000 Ultra-threaded GPU



i.MX 6 Series Triple-Play Graphics support

i.MX 6Solo / i.MX 6DualLite	i.MX 6Dual	i.MX 6Quad
		
Composition (2D BLIT)	Composition (2D BLIT)	Composition (2D BLIT)
		
	Vector Graphics	Vector Graphics
		
3D + GP GPU 1 shader core	3D + GP GPU 4 shader cores	3D + GP GPU 4 shader cores

Same GPU drivers for all i.MX 6 Processors

Why Dual or Quad Core?

Webkit Browser page rendering and scrolling

2D 'Fish Tank' (HTML5)

JPEG decode + encode 1024x768

- All workloads implemented on CPU
- Does not use HW accelerators at all
- Done in order to test CPU capabilities

CPU Utilization (1, 2 and 4 cores)

Android Honeycomb Application	1 Core	2 Core	4 Core	Quad speedup vs Dual Core
JPEG	.2 fps	~1fps	~4.5 fps	4x faster
Browser Scroll Time	289	36.25	15	>50% faster
Browser FPS	3.45	27.58	64.4	>2x higher
Fish Tank FPS	~14-20fps	~18-25fps	~22-30fps	~25% higher

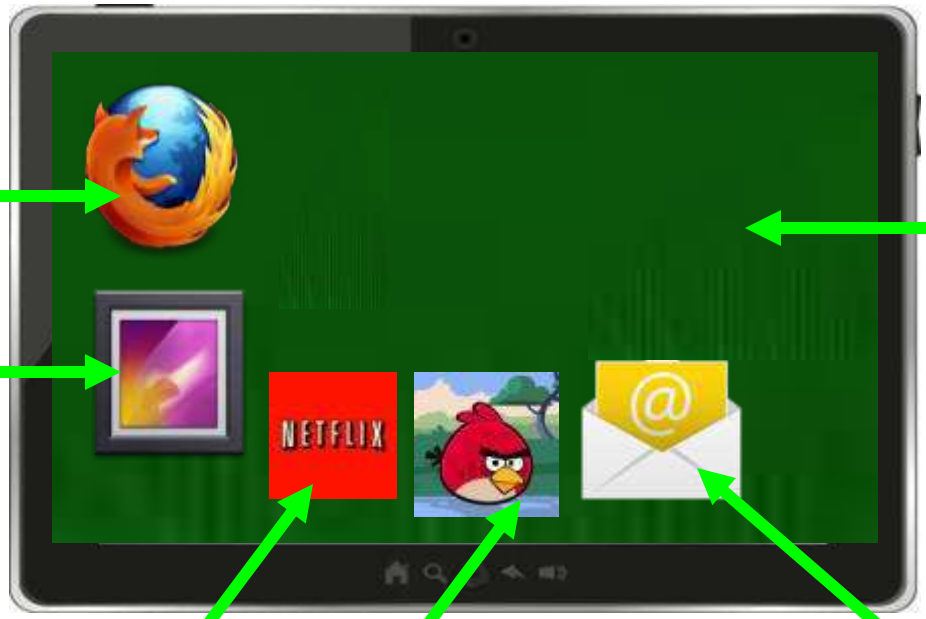
Watch it live! http://www.youtube.com/watch?v=JYFmBIk3itI#t=2m49s

Good tablet application performance requires a balanced processor architecture (CPU speed, Memory BW, HW Accelerators)

Application
-HW Dependency #1
-HW Dependency #2
-HW Dependency #3
-**User satisfaction 'metric'**

Browsing
-CPU speed (rendering)
-Video HW unit
-Memory bandwidth
-**Fast page draw**

Imaging
-JPEG HW dec
-Memory bandwidth
-2D perf (swipe)
-**Fast image viewing**



User Interface
- CPU speed (geometry)
- 3D HW unit
- Memory BW
-**Responsiveness**

Video Playback/Streaming
-HW video unit
-Memory bandwidth
- **jitter-free video**

Games
-CPU speed (geometry)
-3D HW unit (TPS)
-Memory Bandwidth (complexity)
- **Richer graphics, no 'lag'**

Email/IM
- CPU speed
- Memory Bandwidth
-**Responsiveness**

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User Interfaces – Characteristics and Implications

- **UI content is inherently dynamic**
  - Unlike Games (which use pre-cached images/textures)
  - User content can/will change at any time
  - Therefore UI must refresh continuously in case new content emerges
  - Requires high speed (533Mhz) and wide (64-bit) memory bus to ensure high frame rates

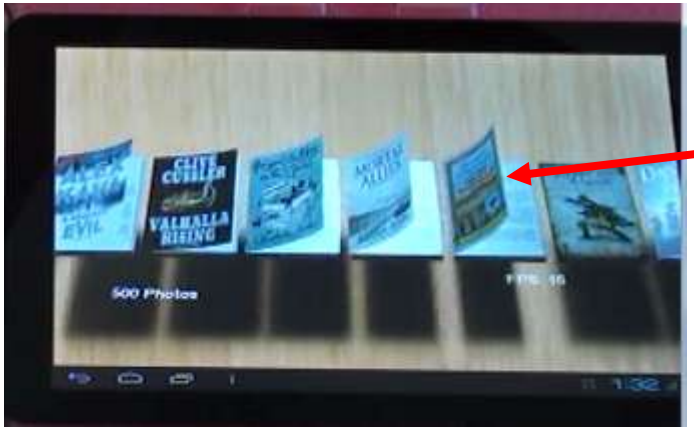
Recommend Dual Core + 64-bit Memory Bus

User Content is dynamic and (potentially) always changing. Especially true of streaming movies, YouTube, pictures, home moviews

User expects their 'latest' content to be instantly visible when scrolling (either touch or via remote with TV)
Thumbnails must be visible and smooth as they scroll left to right.

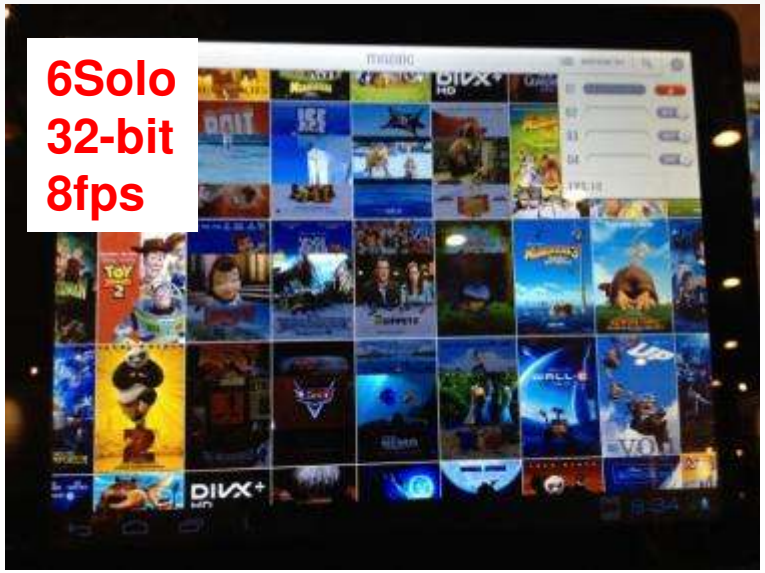
User Interfaces – Characteristics and Implications

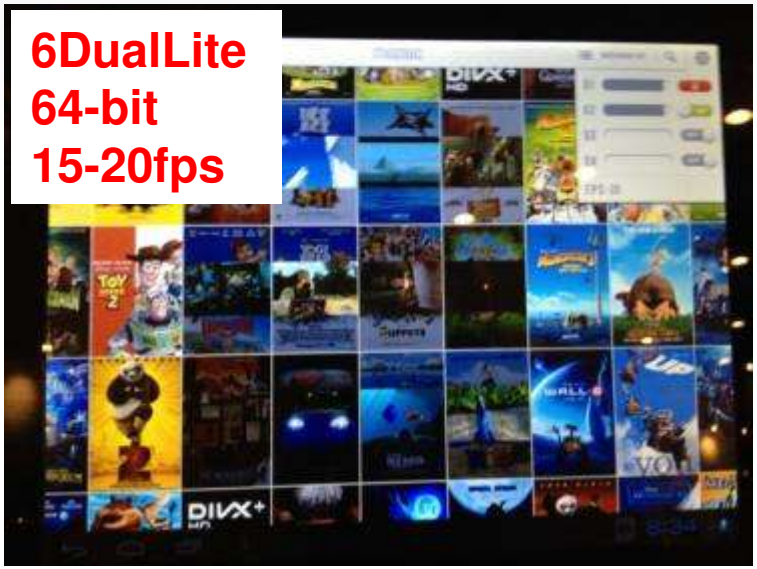
- **UI requires high resolution support → 1080p TV or LCD is now the norm**
  - 1080p30 fps content is becoming a standard offering from websites and streaming
  - 1080p60 is around the corner
  - Must be able to decode h.264 High Profile 1080p at high bitrates (for user content decode as well as for video streaming over the net)
  - Must be able to support newer 1080p TVs. Consumer devices starting to hit >1080p LCDs (iPAD HD) Requires large memory space, fast display capabilities, in hardware rotation/scaling
  - Advantage Freescale i.MX 6: up to 4XGA, dual display engines, 64bit memory space @ 533Mhz
- **Access to fast CPU MIPS → used for complicated transforms to augment visual experience**
  - CPU cores useful to add in additional transforms that don't map well to 3D unit
  - Morphing effects and some fluid dynamics for innovative UI effects
  - CPU cores can also be used to augment 3D unit and act as a 'secondary' 3D unit
  - Advantage Freescale i.MX 6: up to Quad core Cortex A9 at 1.2Ghz → nearly 5Ghz of CPU horsepower

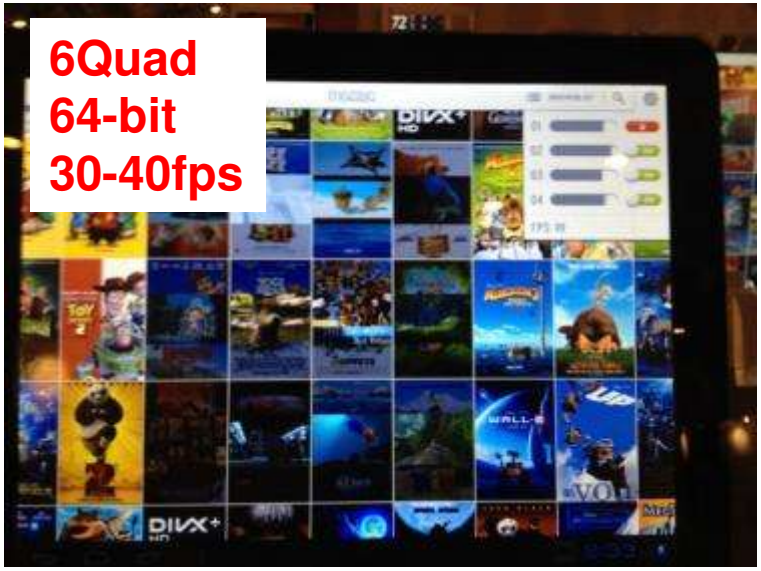


Book cover icon "blowing in the wind" when scrolling fast to visually indicate speed. Can use CPU power to calculate

User Interfaces in Action – Dual Core + 64-bit matters







Browsing and Image Viewing

Webkit Browser page rendering and scrolling

JPEG decode + encode 1024x768

- All workloads implemented on CPU
- Does not use HW accelerators at all
- Done in order to test CPU capabilities

App	1 Core	2 Core	Dual Core vs Single Core	4 Core	Quad Core vs Dual Core
JPEG	.2 fps	~1fps	5x faster	~4.5 fps	4x faster
Browser Scroll Time	289	36.25	>87% faster	15	>50% faster
Browser FPS	3.45	27.58	8x higher	64.4	>2x higher

Watch it live!
http://www.youtube.com/watch?v=JYFmBIk3itI#t=2m49s …

Gaming Performance

- **Benchmarking 3D game performance is tricky**
  - Dependent upon the 3D HW, the CPU speed and memory BW
  - Must balance all three to get best performance
- **Review websites use generally available benchmarks to rate tablets**
  - Example: Basemark, NenaMark, Antutu, Quadrant

Taiji Girl (Basemark ES2)

NenaMark2 3D Benchmark

AnTuTu Benchmark

Quadrant Benchmark

	6Quad	6DualLite	6Solo	Tegra2
Taiji Girl	25.65 fps	9.2 fps	7.67 fps	6 fps
NenaMark	49.2	30.5	27.2	21
AnTuTu	9605	5583	4531	4904
Quadrant	4011	3005	2414	2559

Video Playback and Streaming

- **Video Playback or Streaming performance is highly dependent upon screen resolution**
  - 1080p playback on a 1024x768 screen takes less bandwidth than 1080p on a 1920x1080 LCD
- **Available Memory bandwidth on 32bit DDR is ~1600MB/s**
  - 64bit memory is up to 3200MB/s
  - This assumes 50% utilization of the interface (generous)
- **Total Memory B/W required for 1080p playback**
  - On 1024x768 screen: ~800MB/s
  - On 1920x1080 screen: ~1100MB/s
  - If performing parallel tasks, will add to memory bandwidth needs
  - System activity+screen size Can vary memory bandwidth by up to 500MBs

Recommend Dual Core + 64-bit Memory Bus for 1080p Playback