Intel Mobile Innovation

Intel's Next Generation Atom Platforms

Designed for Smartphone

Danny Zhang 2012
Intel Mobile and Communications Group

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Agenda

Intel Mobile Innovation

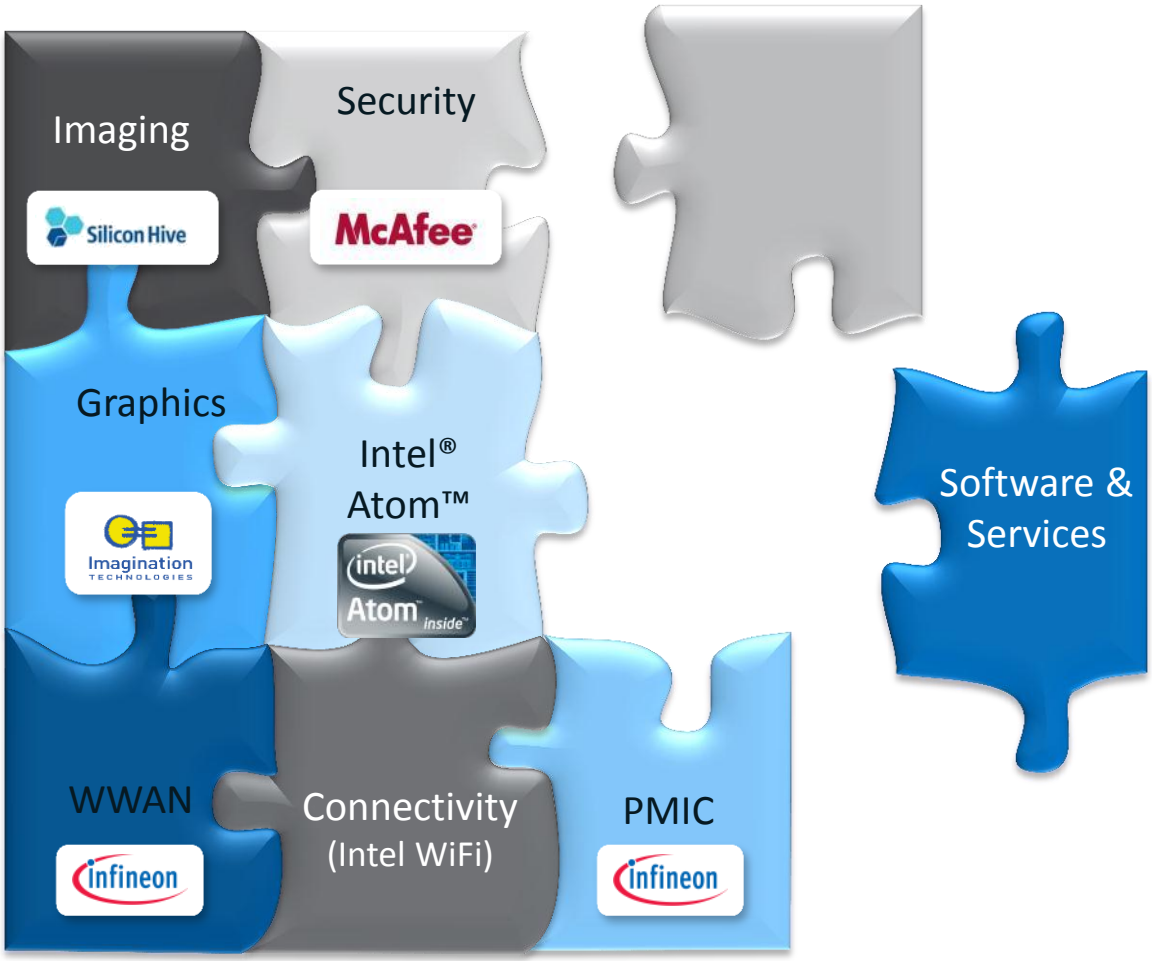
Android* on IA

- Optimizing Dalvik, NDK, Renderscript, OpenCL execution
- Development tools and emulation
- HTML5 Endeavor

Call for Actions

Building Computing Experiences Across The Continuum

Building A Comprehensive Mobility Portfolio



MOMENTUM from CES…

Re-energized Intel Roars Back @ CES

MarketWatch

January 12, 2012

Intel kicked some desert sand back in the face of the powerful forces in mobile, and showed it is still Charles Atlas in PCs

CES 2012:

Its Intel, not Microsoft that offers a vision for computing

The Telegraph

January 10, 2012

How Intel's Medfield Will Dismantle ARM

ARM is in an unenviable position… Intel now has a beachhead

EXTREMETECH

January 10, 2012

Something important happened in Vegas

…today's announcements mark an important turning point in addressing the persistent investor concern about Intel's ability to expand into the smartphone/tablet market

Bank of America Merrill Lynch

January 11, 2012

c|net

January 14, 2012

Intel will be a force to reckon with in the smartphone and tablet markets in the years to come.

VIZIO M-Series

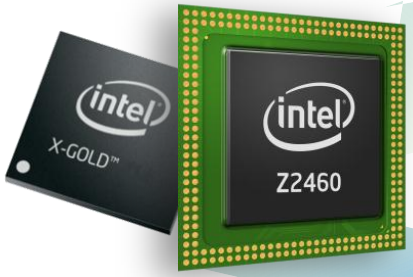
"…zippy and responsive… it's certainly got the most enviable design of any Android tablet I've seen."
– Gizmodo 1/9/12

Intel® Atom™ SOCs Platforms for Smartphones

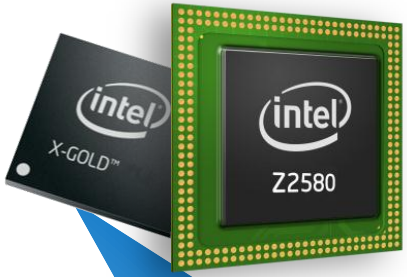
Intel Process Technology Leadership 32 nm → 14 nm in ~3 YEARS

PERFORMANCE SMARTPHONE

Up to 2.0GHz CPU with Intel® HT Technology
HSPA+ 21Mbps/5.7Mbps modem



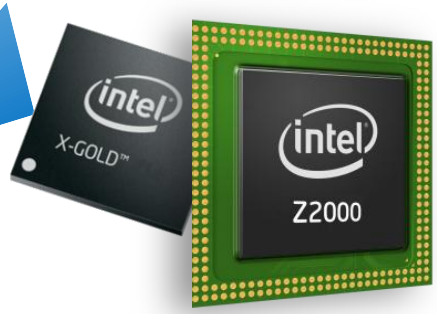
PERFORMANCE



Atom™ Z2580
Intel XMM™ 7160

Dual Core 1.8GHz CPU with
Intel® HT (4 Threads)
Dual Core Graphics @ 533MHz
Advanced Multimode LTE/3G/2G Modem
4G LTE: 100Mbps/50Mbps modem
HSPA+ 42Mbps/11.5Mbps modem

COST



Atom™ Z2000
Intel XMM™ 6265

IA Smartphone Experience at a Glance

Engaging
Rich media and imaging experiences

Aware
Anticipating my needs

Seamless
Flawlessly transitioning between devices and contexts

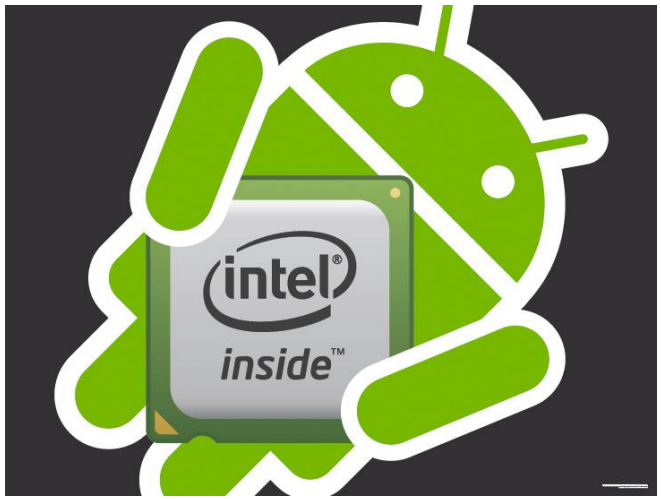
Protected
Protecting my digital life

.

Android* on IA Smartphone

IDF 2011: Intel, Google team to optimize Android for Smartphones

- Optimize Android for Intel
- Native support for x86 architecture in Android Ice Cream Sandwich
- Growing x86 Android application ecosystem
  - Optimizing top tier mobile apps
  - Porting NDK & Dalvik apps
  - Support for 'legacy' apps



Android* on IA Smartphone

High Touch Engineering & Account Mgmt

intel Software Partner

Intel® Software Network
Connecting Developers.
Building Community.

Application Developer Tools

- HTML5 Portability
- Native compiler
- Native libraries
- Analysis Tools

Intel® System Software Tools for Android* OS

Empowering Developers with Tools and Programs to Deliver a Great Android Experience on IA based Phones

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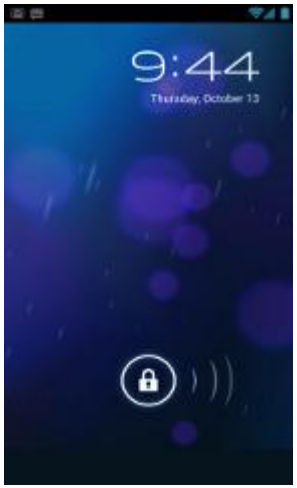
Key ICS Messages

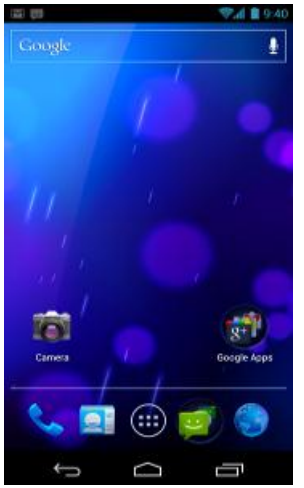
Simple, beautiful, beyond smart
Rich Notifications, customizable live home screens, resizable widgets and deep interactivity

Roboto voice control
New font designed to suit high resolution screens; voice input engine with "open mic"

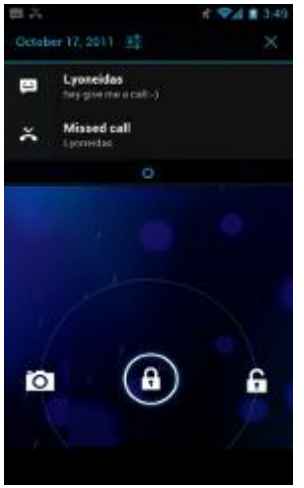
Evolved UI (blue background matches HC)
Common actions more visible, animated screen, new typeface

No buttons; Easy multi-tasking
System bar and virtual buttons across apps; Jump to recent apps from system bar





Recent Apps



ICS Android 4.0 Key Features

Design principles:

- *Enchant me:* Live Wallpaper, take pics when locked
- *Simplify my life:* Google+ now built in
- *Make me awesome:* Android Beam, Voice typing

Jump to camera, notification from locked screen

Roboto – new typeface

Catch up

- "Beam": Share via touching devices
- Screen capture
- Multi-tasking (HC)
  - Flick to close
  - 16 tabbed browser, offline tabs (reading)
- Widgets (same as HC)
- Notifications on lock screen;
- Wi-Fi Direct, BT HDP[1]: Connect seamlessly

Gmail: 2 line previews; Offline search.

Calendar: Pinch to zoom for more detail.

[1]Health Device Profile

"We want everything to be smooth as butter,"
--- Andy Rubin, Oct 19th 2011 <Link>

Touch to share data (Beam)

Voice to text

"I don't believe that your phone should be an assistant. Your phone is a tool for communicating. You shouldn't be communicating with the phone; you should be communicating with somebody on the other side of the phone."
--- Andy Rubin, Oct 19th 2011 <Link>

Key BSP Features at a Glance

Android CTS / CDD Compliant

Multimedia

- HW-accelerated graphics
- VP8 video decode optimizations
- HW-accelerated video decode
  - H.264 1080p @ 30fps
  - MPEG-4 Level L3, L5
  - H.263 baseline L70
  - WMV9 Simple Profile Level Medium, Main Profile Level High
  - VC1 1080p @ 30 fps
- HW-accelerated video encode
  - H.264, MPEG-4, H.263
- HW-accelerated audio decode
  - HE-AACv1, HE-AACv2, MP3, PCM/Wave
- HW-accelerated Flash / AIR

Security / DRM / Power

- HW-assisted secure boot and full disk encryption)
- Netflix
- Power Management and Energy Management

2nd Screen

- HDMI 1.3a
  - Clone mode
  - 2 channel LPCM audio @ 44.1kHz
  - Hot Plug support
  - Logo compliancy testing
- WiDi
  - Wireless 2nd screen display (clone mode)

Sensors

- Accelerometer
- Gyroscope
- Ambient Light
- Barometric pressure
- Magnetometer
- Temperature

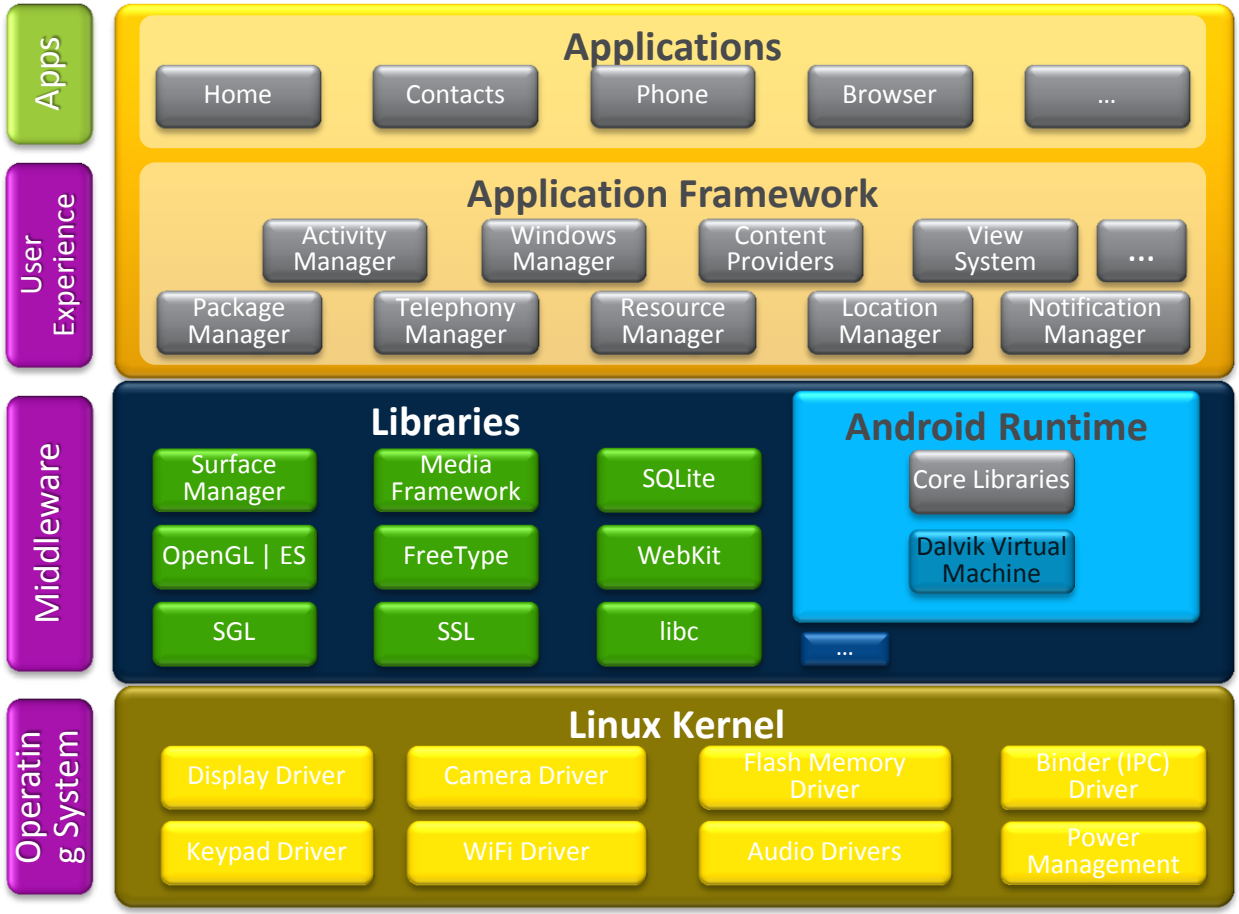
Imaging

- Front and Rear-Facing cameras, LED Flash
- Color correction, red eye removal
- Video & image stabilization
- Burst mode still capture
- Take snapshots while recording video
- Auto white balance / focus / exposure
- Geo tagging support
- Single-Motion Panorama Mode
- Setting Custom Metering regions
- Zero Shutter Lag Exposure

Connectivity

- Bluetooth 2.1 + EDR’
  - 6 profiles
- WiFi
  - WiFi Direct
  - WEP; WPA/WPA2 PSK
  - 802.1x Enterprise
  - EAP-TLS
- GPS (A-GPS & standalone)

Optimizing the Android* stack for Atom



Intel continuously invests in new web app technologies such as HTML5 and JavaScript, to ensure they perform best on IA.

Intel's extensive experience optimizing Java VMs has been applied to Dalvik VM with impressive results.

Intel is the second largest contributor to the Linux code base in the world and employs many of its top software talent. This work manifests itself in the libraries and kernel.

Drivers optimized for power and memory footprint.

Atom optimized fast interpreter

Improved garbage collection

SSE offloads for faster Jpeg

Source: http://developer.android.com/guide/basics/what-is-android.html

Android * Programming Models

Language	Description	Intel
Dalvik	This is the Virtual Machine in Android that runs all apps. It uses a dialect of Java and apps are compiled to bytecode (.dex). Existing Dalvik only apps work as is on x86 architecture. **Portable Interpreter** - Compiles on any system that supports GCC **Fast Interpreter** - Uses hand-coded assembly fragments	Intel trace JIT optimizations yield a ~5x performance improvement.
NDK	Native Development Kit. This is a toolset that allows developers to embed native code within an Android application. It requires the code to be compiled for a particular processor architecture.	Intel and Google released the NDK for x86 in July of 2011 on android.com
RenderScript	Low-Level, cross-platform API targeting 3D and computer operations to execute native code agnostically	Atom optimizations to LLVM code generator.
OpenCL	Standard API similar to OpenGL that allows using any supported CPU/GPU to do computational workloads.	Intel doing POC implementation in Q1. Also working on Java "glue code generator" for tighter integration with Dalvik apps.

Android* Optimizations

Performance Tuning

- Dalvik VM runtime optimization
  - x86 trace-based JIT and Native Code Generation
  - Enriched memory management (e.g., garbage collection)
  - JNI streamlining
- Tuning of native libraries
- Bionic optimizations
- Javascript & HTML5 optimization

Power Reduction

- Power Management for Android
- OpenGL ES 1.1/2.0 Driver
- HW Overlay
- HW Accelerated Media decode/encode
- Library to integrate w/ Android & reference implementation (MIX)
- Standard SoC drivers, middleware and applications optimized for power

Operating System are embracing HTML 5

Platforms are designed to share information with other platforms e.g. Android, OSX Tablet OS's, Desktop integration of other platforms

HTML 5 is making it easier to share applications and it data across different platforms via the internet.

HTML 5 is targeting "platforms" not just browsers anymore

Google – Android / Chrome Experiments

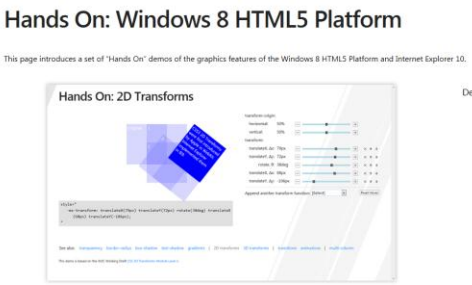
Microsoft – Internet Explorer / Windows 8 Metro / Microsoft Store

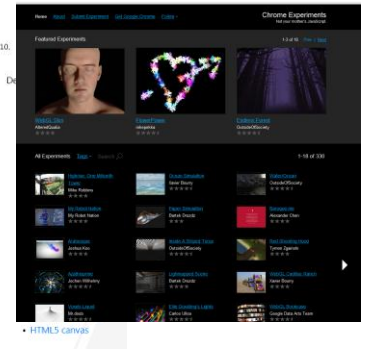
Mozilla – Firefox Apple – Safari / iTunes

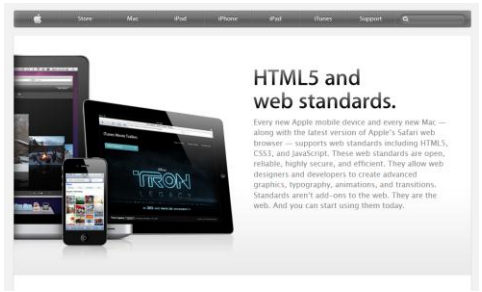
Smart TVs

Smart phones and tablets



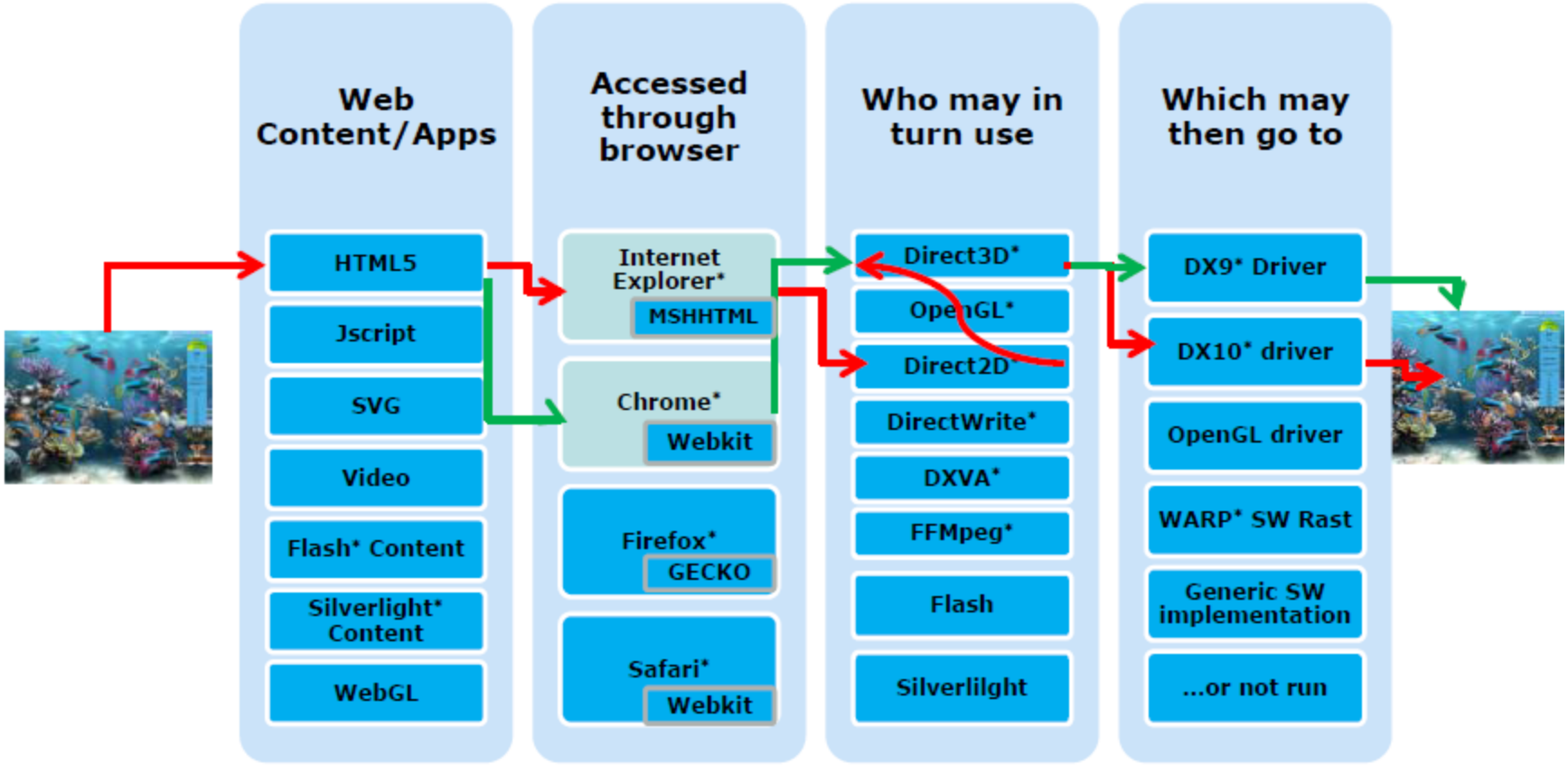







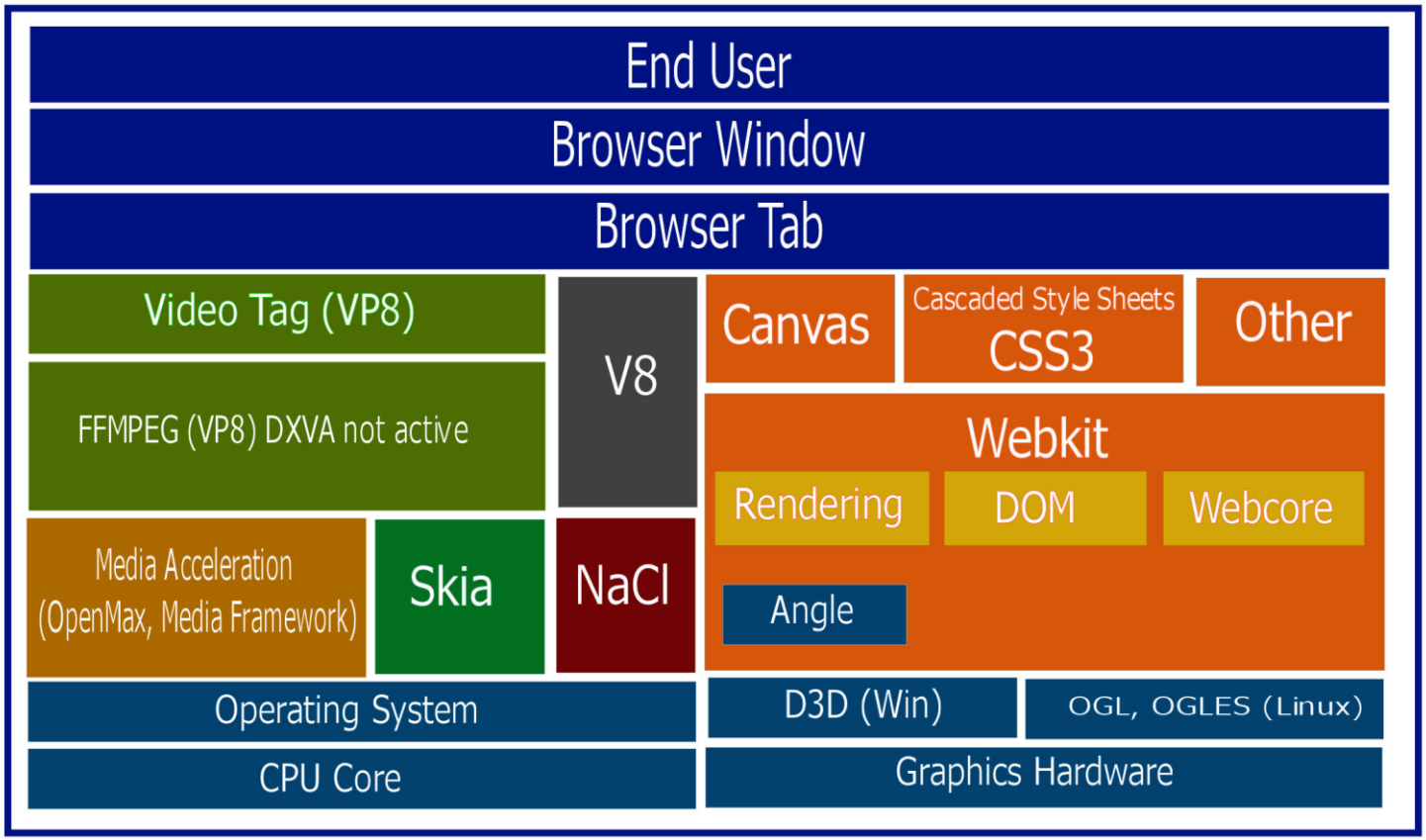
HTML 5 is making it easier enable the compute continuum

Variance across Implementation



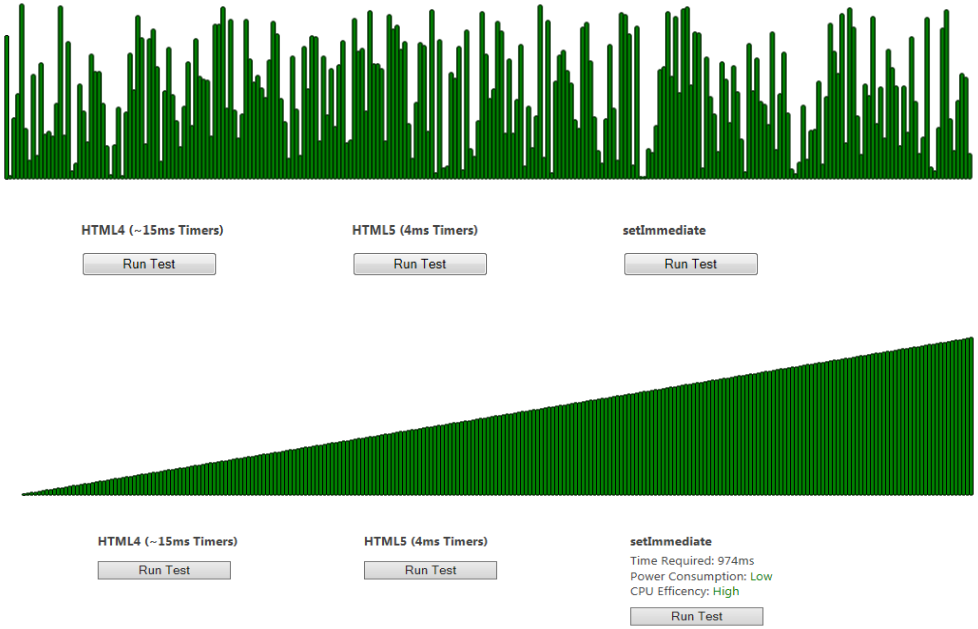
- Policies on code path followed vary per browser, content, OS, platform, device
- Need to ensure graphics & device support, optimal policy per content type

Browser architectures are more complex than ever (Chrome architecture)



Component implementing HTML 5 is integrating more hardware specific software

HTML 5 API are designed for performance

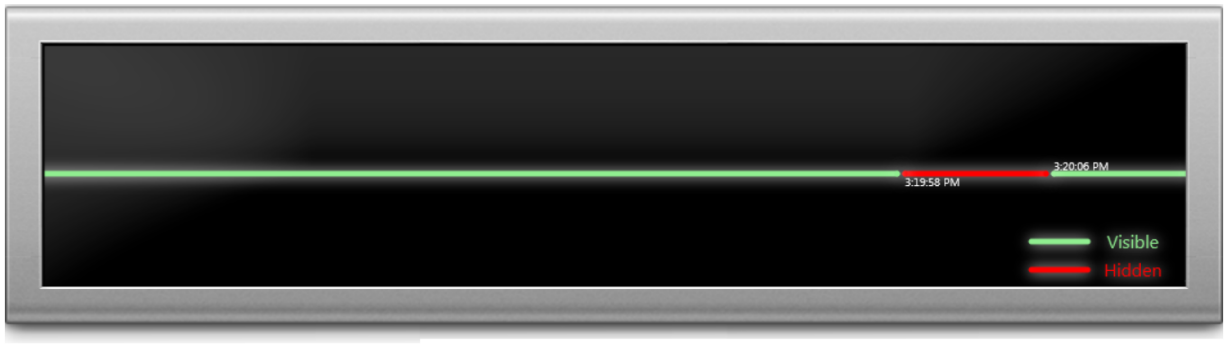


http://ie.microsoft.com/testdrive/Performance/setImmediateSorting/Default.html

Intel continues to work with the standards group to improve HTML 5 on our platforms

HTML 5 designing API's for Multi-Applications

Page Visibility API



About the Page Visibility API
The Page Visibility API defines a means for site developers to programmatically determine the current visibility of a document and be notified of visibility changes. To view the Page Visibility history of this page, try minimizing the browser.

Capabilities that was once only available in lower level (C/C++) API's are now available in HTML.

http://ie.microsoft.com/testdrive/Performance/PageVisibility/Default.html

"80 percent of application on Apples iTunes and Google Marketplace could be written in HTML 5" - Google

Intel® Graphics Performance Analyzers

- Useful tool for debugging/analyzing graphics performance in applications
- Now support browser-based applications, as well as Android platforms

Intel® System Software Tools for Android* OS

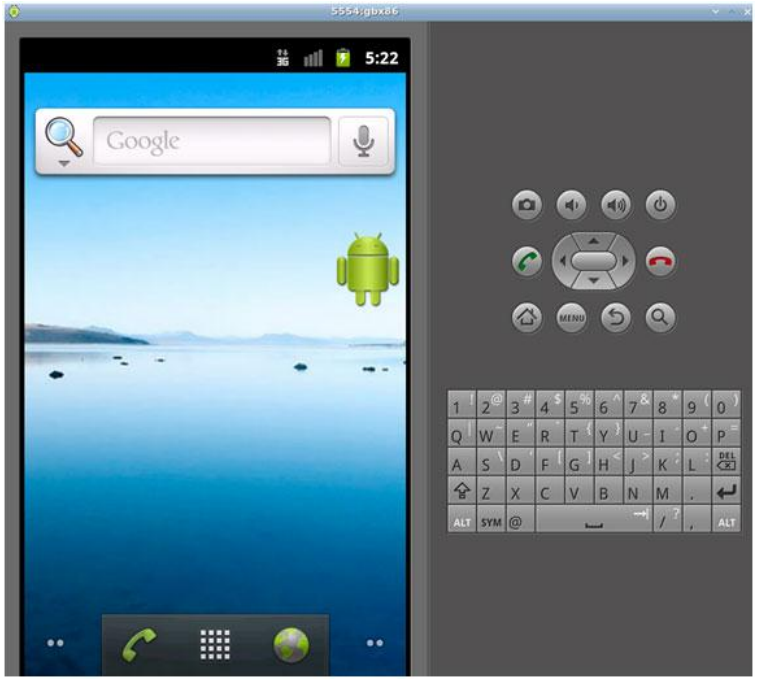
Optimized Performance and Power Efficiency

System & Silicon ODMs Ecosystem enabling tools Android Atom-based Smartphone and Tablets		Feature	Benefit
Value Vectors	Performance	Intel® C++ Compiler	Enhanced Performance
		Intel® VTune Amplifier ME Performance Profiler & Processor state tools	Most widely used tool in the industry now supports Android
		Graphics Performance Analyzer	Better Gaming. Longer video playback.
	Debugging	JTAG Debugger	Atom-based debugger solution
	Support	System Reference Builds, Recipes, Documentation	Technical expertise for best performance results

x86 Emulation

Current Situation

- Android emulation is slow
- Android SDK only contains ARM images
  - X86 emulation supported
  - Instructions for building x86 Gingerbread system images for the emulator http://www.intel.com/software/android



Intel Value Add

- Working to get x86 binary images on Intel website first and then as an SDK addon.
- HAX driver (Mac and Windows) coming in Q1 that will use VT to accelerate x86 emulation by an order of magnitude. VT is already supported in Linux.

Faster emulator and prebuilt x86 images will excite developers

Call to Action

Intel is committed to delivering a competitive Android* solutions on Intel® Atom™ processor based platforms as part of our "port of choice" strategy

Intel® Atom™ processor based devices running Android will be in the market in 2012

- Lenovo launched K800, Orange, Lava launched IA Phone
- Significant efforts are being put in to ensure Atom/Android solutions are highly optimized

Android Open Source Project (AOSP) now includes x86 support and Join IA development

- Android NDK as of version r6b (Aug 2011 release) supports x86
- Android SDK as of version r12 (July 2011 release), supports x86 Emulation

Thank You