

Millicomputing – The Future in Your Pocket

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BIL2010 Talk

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Millicomputers

Millicomputer definition

A computer that uses less than one Watt

Put it in your pocket without burning your leg!

Millicomputer Predictions

First written in the summer of 2007, predicting 2008-2010

Presented at hpts.ws Monterey October 2007

CMG07 San Diego December 2007

Presented at BiL – Monterey March 2008

Presented at eComm08 – Mountain View March 2008

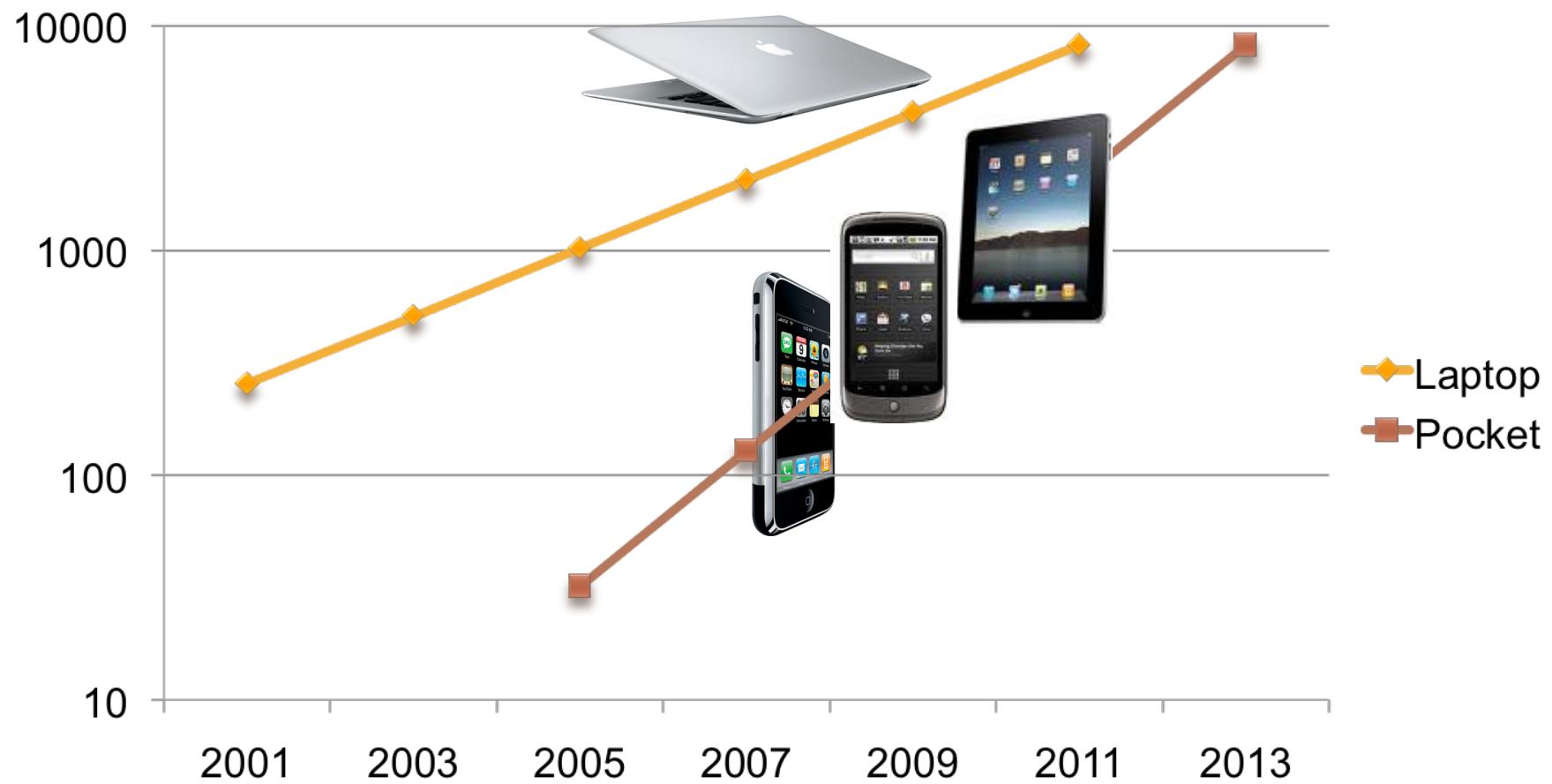
Invited speaker for CMG-UK May 2008

Invited speaker for Usenix – Boston June 2008

lets see what I got right, then adjust the 2010 prediction....

Memory Trends (MB RAM)

(Prediction unchanged since 2007)



What's New – 2007

(Slide written in 2007)



Under the Hood
400MHz CPU
128MBytes RAM
8GBytes storage
Runs cold, no fan
Recharge daily

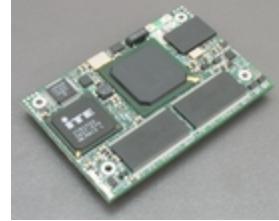
Apple iPhone and iPod Touch

Full function web browser, Multitouch
Powerful, usable, networked applications
Music and video playback
MacOS in your pocket
Applications (hacked and official)

Commercial Millicomputer Modules (2007)



Freescale SoM 76x59mm i.MX31

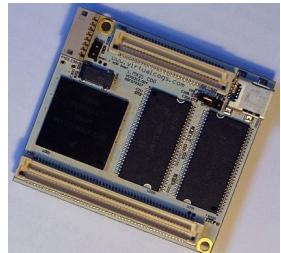
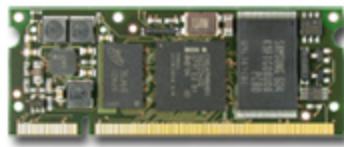


Compulab 68x58mm PXA270



Colibri 68x37mm PXA320

Triton 68x26mm PXA320



Virtual Cogs 50x44mm i.MX21



ADELAIDE 85x54mm i.MX31



Gumstix 80x20mm PXA270



(Most of these support up to 128MB RAM and cost ~\$100)
Specifications and pictures subject to owners copyright

myPhone Mobile Millicomputer (2007)



Goliath board
never made it into
production, I gave
up and started
writing iPhone
apps in 2008...

CAD design shared under creative commons on gumstix site
ABS plastic case manufactured one-at-a-time using 3D Printer
Gumstix millicomputer module mounted on phone-specific I/O PCB
Gumstix “Goliath” homebrew phone board, 4.3” LCD with touch screen
GSM/EDGE, GPS, 3-Axis Accel, 620MHz/128MB, USB Master, WiFi

Interfaces (2008)

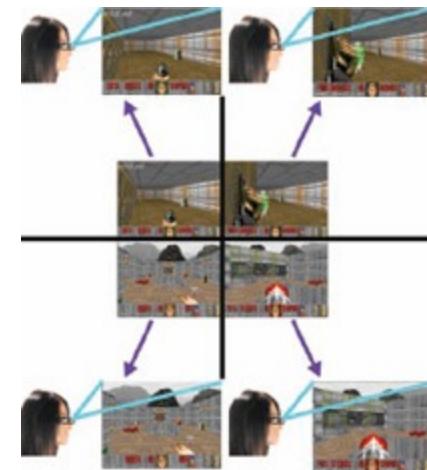
MyVu



Head Mounted Cameras

CAPCAM

Vuzix



NeuroSky
Brainwave input

What's New – 2008

(prediction made in early 2008)



Under the Hood

Double CPU speed
Graphics Accelerator
256MB RAM
16-64GB storage
Faster networking

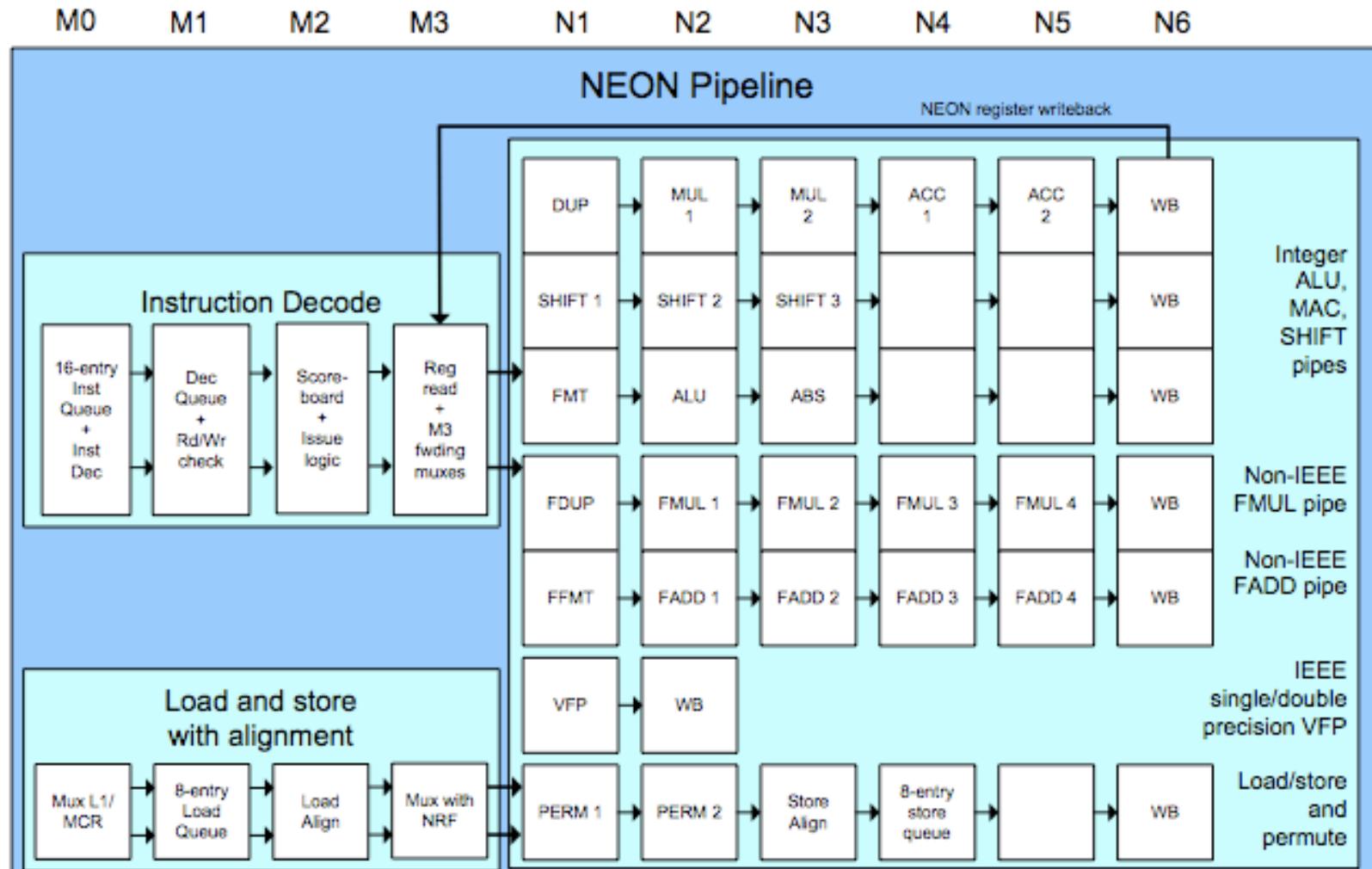
Google Android Takes on iPhone

Similar feature set, flexible implementation
Linux in your pocket
Applications (Open Software and Hardware)
Multiple phone vendors and formats

Android was a bit later, but is now taking off strongly
Some phones did have 256MB and 16GB in 2008, faster networks

ARM Cortex A8 NEON Accelerator

(2007 slide, now inside the iPhone 3GS – e.g. voice control)



Networking Roadmap

(prediction made in early 2008)

- Cellular Network Speeds
 - ATT stated 20Mbit/s 3G HSPA in 2009 for the USA
 - 4G Long Term Evolution (LTE) in 2010 steps up to 100Mbit/s
- Wireless USB – UltraWideBand
 - The next generation – starting to appear in laptops in 2008
 - 480Mbit/s, 10 meter range
 - Wideband network, very low power, secure, low interference
 - Perfect for mobile, video etc.

HSPA upgrade happened for the iPhone 3GS mid-2009

ATT LTE Trials starting in 2010, full rollout in 2010

Wireless USB got stalled in a standards war

Guesses for 2009? (prediction made in early 2008)

Intel based phones begin to ship in 2010
iPhone 3GS has faster graphics 256MB/32GB
Google Nexus One has 512MB RAM
Skype audio app in early 2009
Palm trying to make a comeback



Under the Hood
64bit Intel vs ARM
Faster 3D Graphics
512MB RAM
64-128GB storage
Skype video phone?

Intel x86/x64 In Pocket Phone Format
Low power Intel matches ARM Cortex A8
No fans, no burnt leg syndrome
Multiple vendors and formats
Android open to early x64 adoption
Palm, WinCE, Symbian fading...

Applications 2009

(predictions made in early 2008)

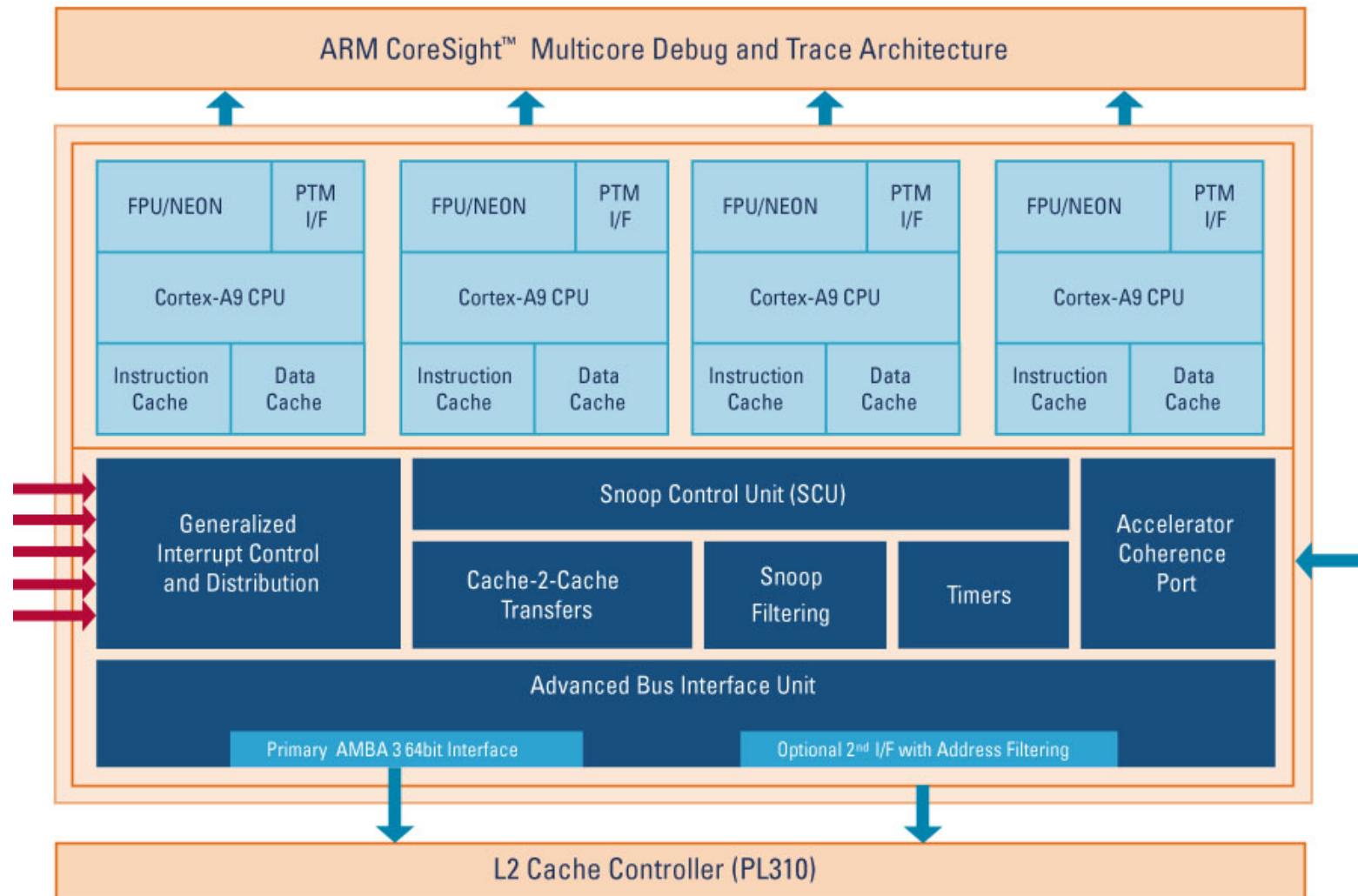
- Networked video out from your pocket over WiFi or UWB
- Wireless display anywhere
 - Play shows to WiFi-TV
 - Present to WiFi-projector
 - Wireless dock desk and pocket
 - Video-chat with friends
 - Head-up display in car



Wireless Internet connected TV sets starting to appear
Wireless video out standards war is well under way....

ARM Cortex A9 Multicore for 2010

(iPhone 3GS is one A8 core, rumor that iPad is A9 dual core, this is four....)



Guesses for 2010??

(predictions made in early 2008)



Under the Hood

- 64bit Intel vs. ARM
- Multi-Core CPUs
- 1GB+ RAM
- 128GB+ storage
- Networked display

Intel and Arm Battle it Out

- ARM Cortex A9 “8x today’s iPhone CPU”
- Pocket device replaces laptop
- iPhone vs. Android is the choice

Need to dial back RAM and Storage sizes a little...
I didn't predict the app store would be such a strong iPhone success factor, but was more optimistic than most.
iPad moves the pocket based interface onto your lap

Predictions for 2010

(predictions updated in mid 2009)



Under the Hood

64bit Intel vs. ARM
Multi-Core CPUs
512M-1GB RAM
64-128GB storage
Networked display
4G LTE 20Mbit/s

Intel and Arm Battle it Out

ARM Cortex A9 “8x original iPhone CPU”
Pocket device begins to replace laptop
Tethered mobile displaces fixed broadband
iPhone will be the dominant platform
Android will take over the non-Apple world

Ambient Presence

- Always on 3D processed audio (OpenAL)
- Ambient “conferencing” in the back of your head
- Video presence
- Virtual world/Second Life integration
- Intimate social interaction – life sharing

Computer Assisted Telepathy!

iPhone OS adds hardware device management and voice control for 3GS, with push notification
Ustream and Qik are live streaming video from mobile
Fring displays Skype video calls on iPhone

Interfaces 2010?



MyVu Crystal

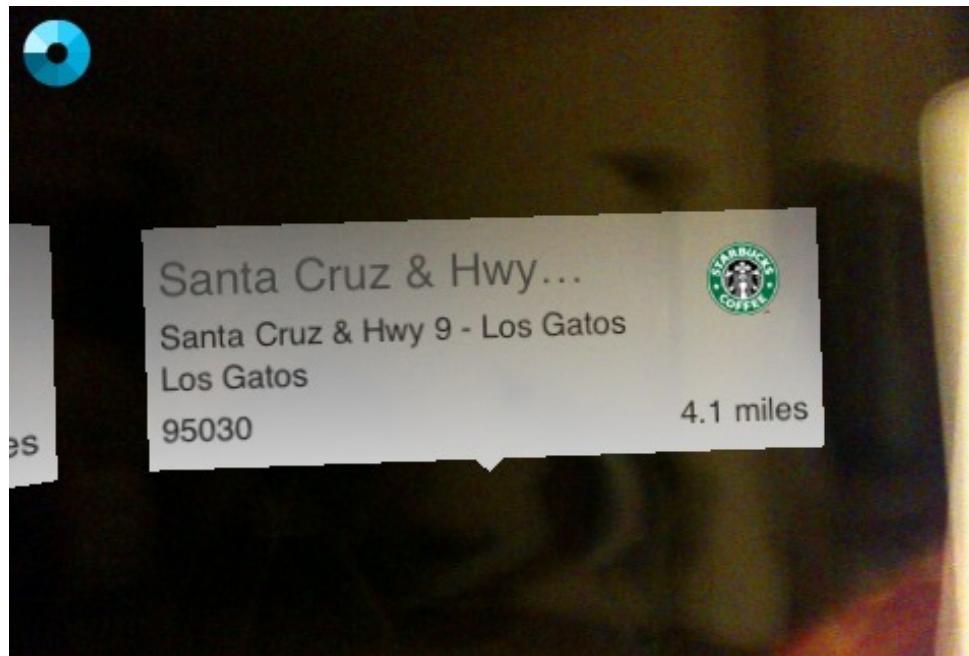
Add voice control to the list...

Combine Everything

- Wireless USB
- 3D Stereo Audio
- Stereo Microphones
- HD Video display
- Split screen
- Head Camera
- Accelerometer
- Compass
- Brainwave Reader

Augmented Reality 2010

- AR is currently getting a lot of buzz
 - Emerging Communications 2010 Conference focus
- iPhone 3GS apps (search for AR in app store)
 - Acrossair, Spyglass, Navigator (I must be missing some)
 - Here is a screenshot from Acrossair



Platform Predictions for 2011

(new predictions made in early 2010)



Under the Hood

ARM will dominate
2GHz 4-Core CPUs
1-2GB RAM
128-256GB storage
Networked display
4G LTE 20Mbit/s

Apple vs. Android will crowd out the rest

iPhone will still be the dominant platform
Intel was too late, too many ARM apps
2GHZ Cortex A9 is 16x original iPhone CPU
Speed optimized in iPad, power opt in iPhone
iPad format will spawn Android me-too's
US mobile data speeds will finally be useful!

Applications in 2011

- Augmented Reality
 - Take the existing AR apps to the limit
 - Then add more network bandwidth
 - Start sharing your augmented reality
 - Another name for Assisted Telepathy...
- iPhone/Android as your only OS?
 - Large and growing population with no-PC/no-Mac
 - Never run virus scan for your kid or mother again!
 - Desktop apps migrate to pocket OS en-masse

Questions? Let's Talk

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Thanks!