Millicomputing – The Future in Your Pocket (and Your Datacenter)

Adrian Cockcroft @adrianco
ex-Sun (1988-2004) Performance Guru
ex-eBay (2004-2007) Research Labs
Netflix (2007-Now) Scalable Personalization
Mobile sideline (2006-Now) Homebrew and iPhone apps

Ignite! Talk

Millicomputers

Millicomputer definition

A computer that uses less than one Watt

Put it in your pocket without burning your leg!

http://www.millicomputing.com @adrianco acockcroft@netflix.com

Millicomputer Predictions

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

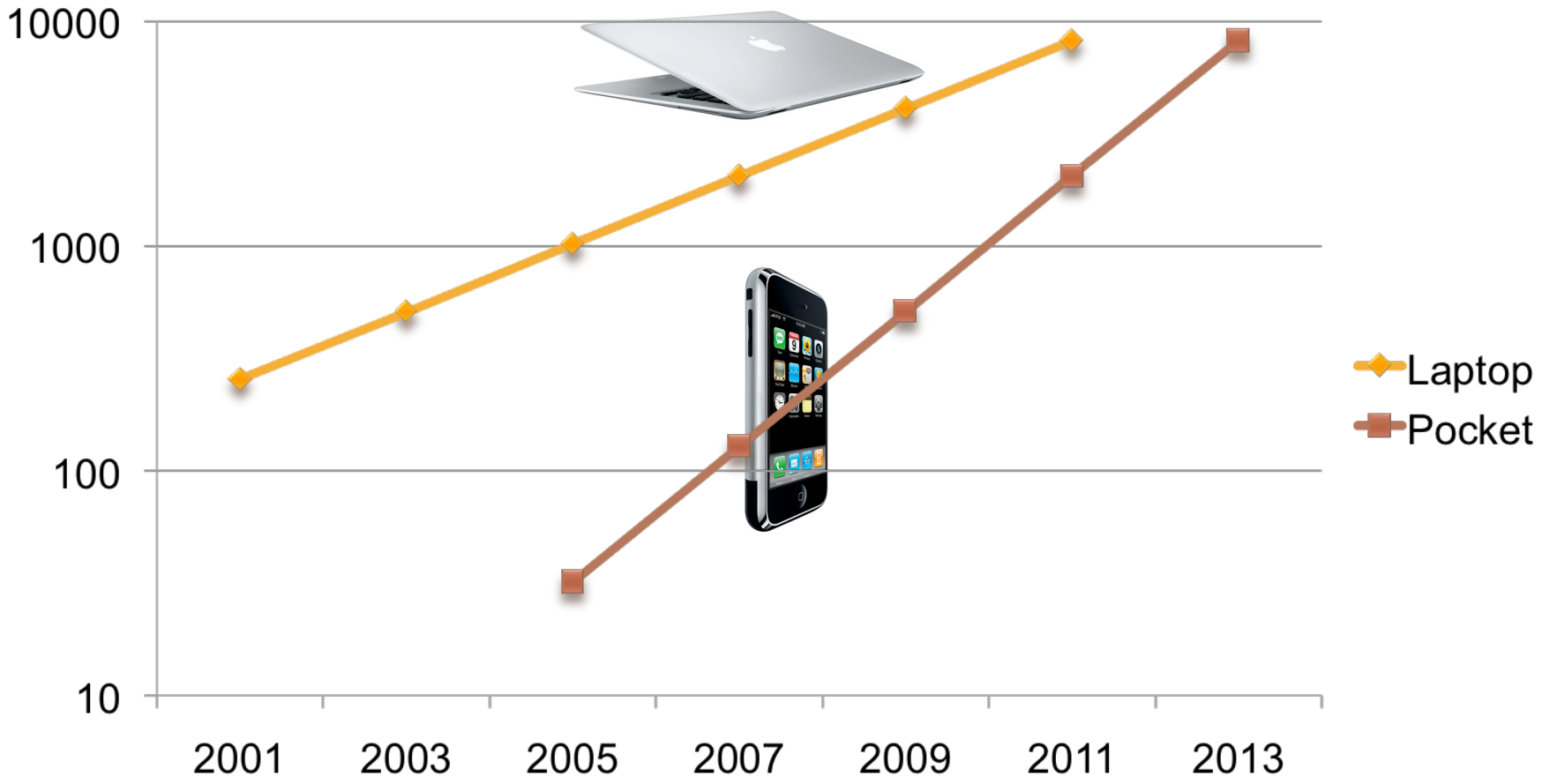
Presented at hpts.ws Monterey October 2007
CMG07 San Diego December 2007

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….

http://www.millicomputing.com @adrianco acockcroft@netflix.com

Memory Trends (MB RAM)
(Prediction unchanged since 2007)



http://www.millicomputing.com @adrianco acockcroft@netflix.com

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

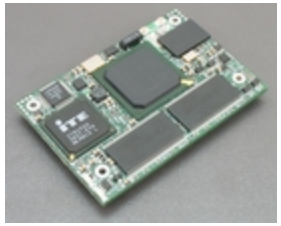
MacOS in your pocket

Applications (hacked and official)

http://www.millicomputing.com @adrianco acockcroft@netflix.com

Commercial Millicomputer Modules (2007)

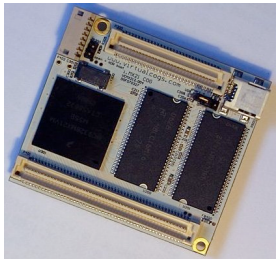
Freescale SoM 76x59mm i.MX31



Compulab 68x58mm PXA270

Colibri 68x37mm PXA320

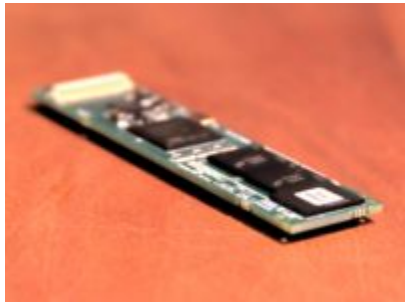
Triton 68x26mm PXA320



Virtual Cogs 50x44mm i.MX21

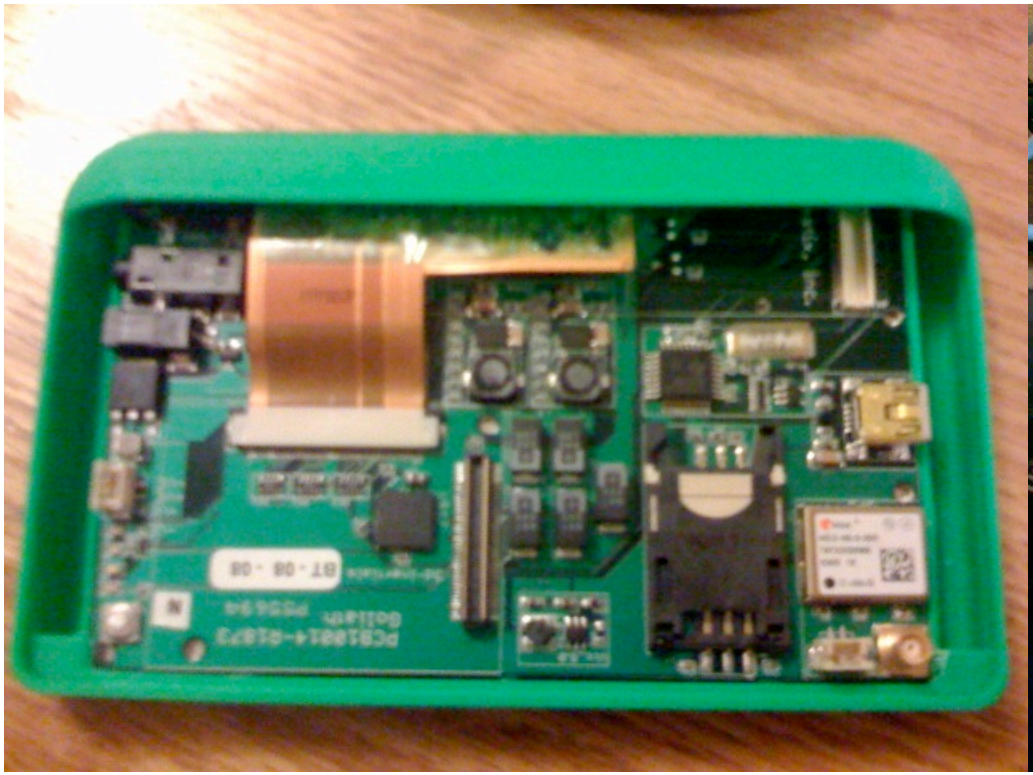
ADELAIDE 85x54mm i.MX31

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…

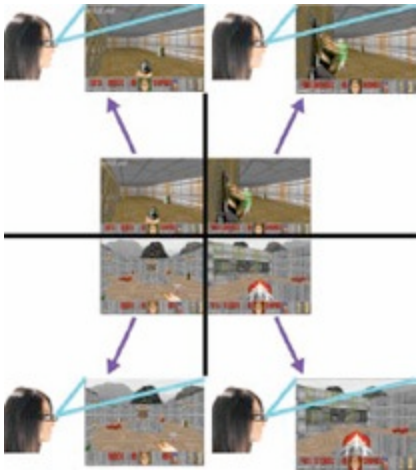
CAD design shared under creative commons on gumstix site
ABS plastic case manufactured one-at-a-time using 3D Printer
Gumstix millicomputer module mounted on phone-specific I/O PCB
Gumstix “Goliath” homebrew phone board, 4.3” LCD with touch screen
GSM/EDGE, GPS, 3-Axis Accel, 620MHz/128MB, USB Master,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

http://www.millicomputing.com @adrianco acockcroft@netflix.com

Interfaces (2008)

MyVu

Vuzix



Head Mounted Cameras

NeuroSky
Brainwave input

CAPCAM

What's New – 2008
(prediction made in early 2008)

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

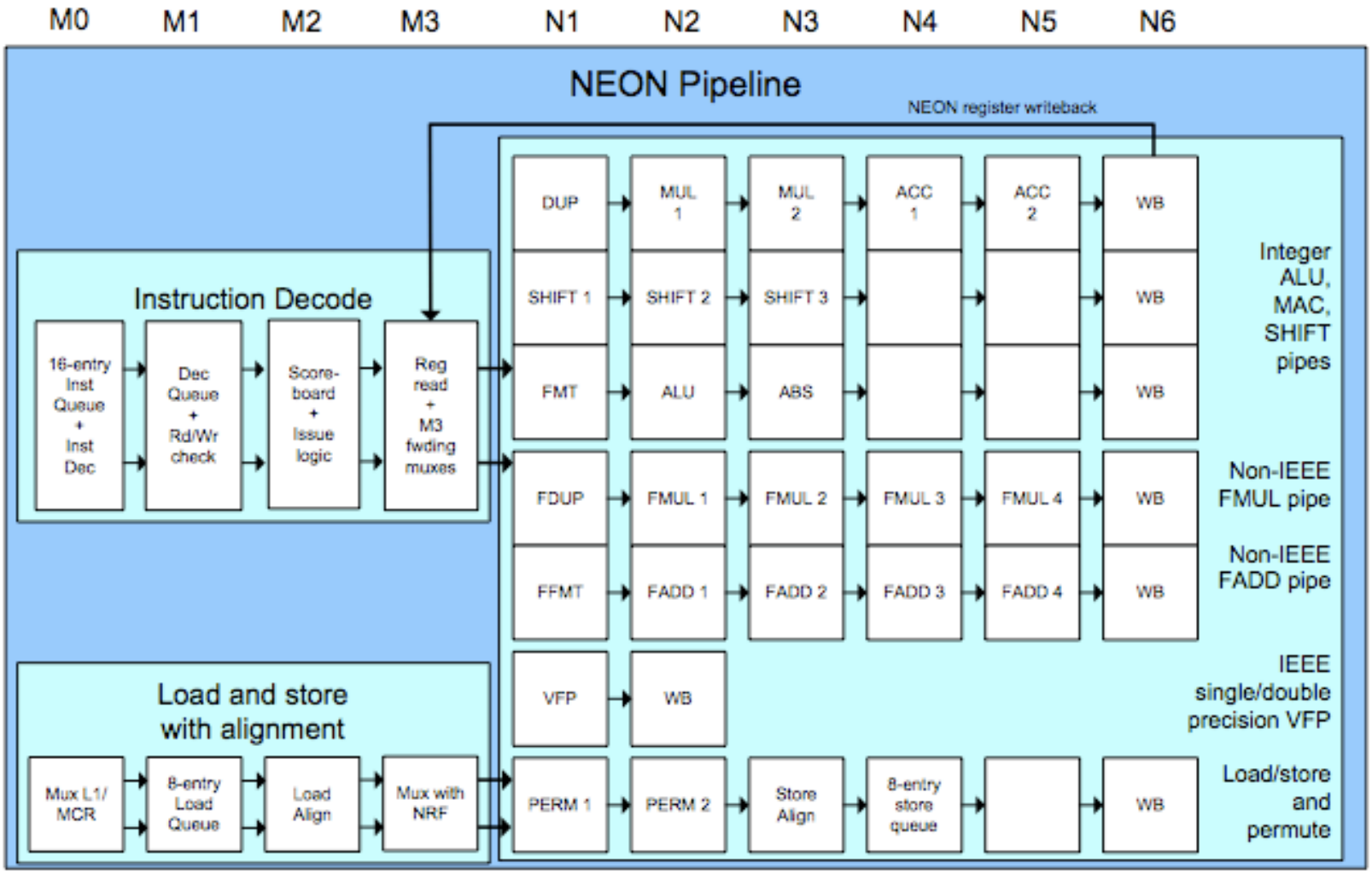
Google Android Takes on iPhone
Similar feature set, flexible implementation
Linux in your pocket
Applications (Open Software and Hardware)
Multiple phone vendors and formats

Android was a bit later, but does seems to be a success
Some phones did have 256MB and 16GB in 2008, faster networks

http://www.millicomputing.com @adrianco acockcroft@netflix.com

ARM Cortex A8 NEON Accelerator

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



http://www.millicomputing.com @adrianco acockcroft@netflix.com

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
Wireless USB seems to have got stalled in a standards war

http://www.millicomputing.com @adrianco acockcroft@netflix.com

Guesses for 2009?
(prediction made in early 2008)

Intel based phone rumors for 2010 timeframe
iPhone 3GS has faster graphics 256MB/32GB
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...

http://www.millicomputing.com @adrianco acockcroft@netflix.com

Applications 2009
(predictions made in early 2008)

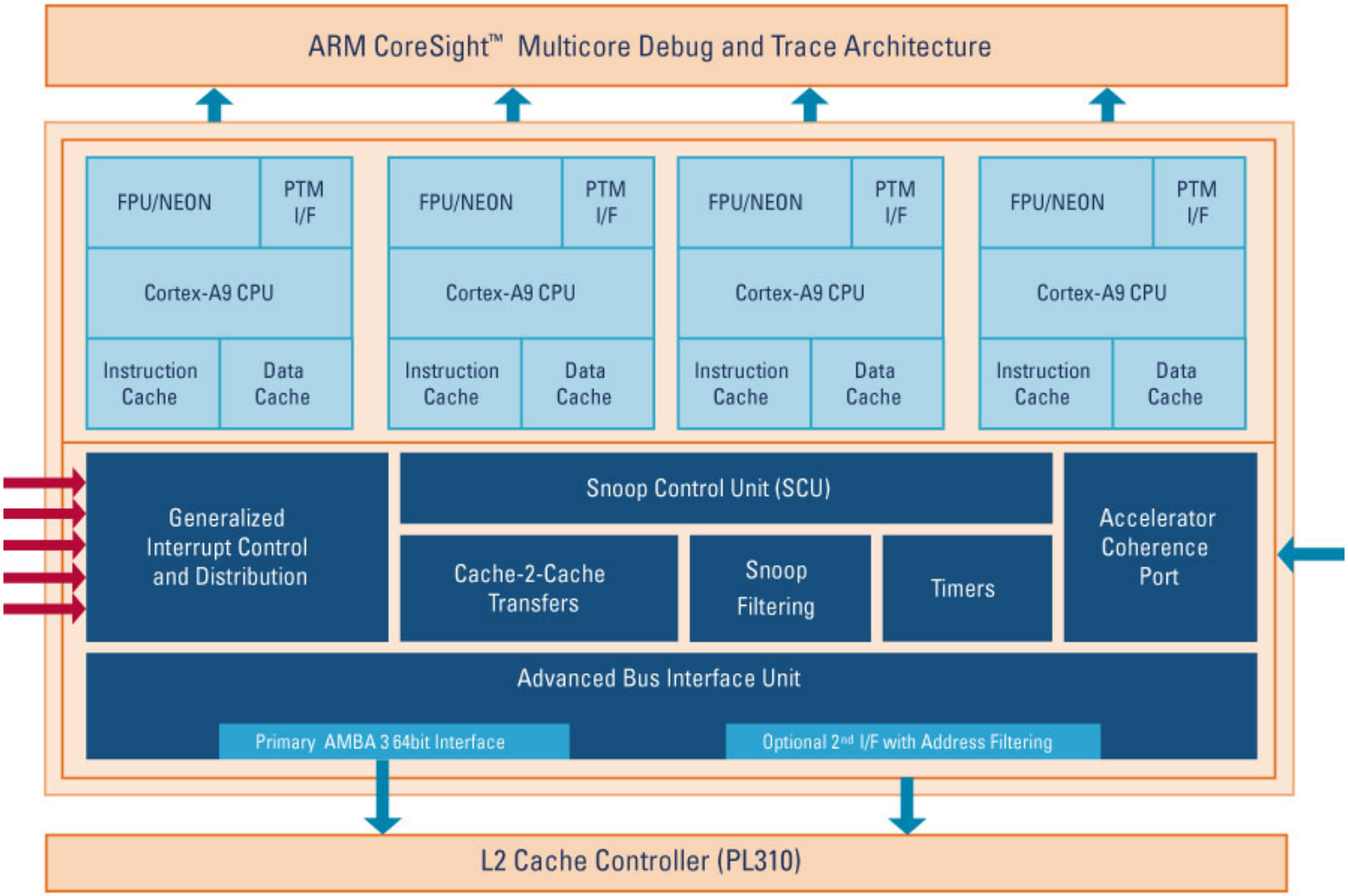
- Networked video out from your pocket over WiFi or UWB
- Wireless display anywhere
  - Play shows to WiFi-TV
  - Present to WiFi-projector
  - Wireless dock desk and pocket
  - Video-chat with friends
  - Head-up display in car

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

http://www.millicomputing.com @adrianco acockcroft@netflix.com

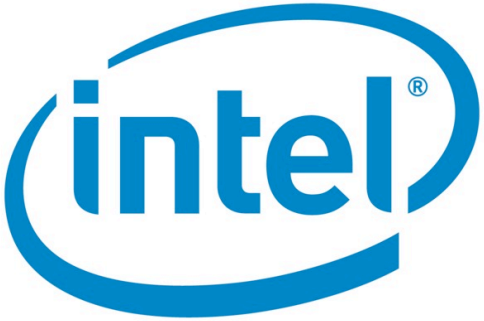
ARM Cortex A9 Multicore for 2010

(iPhone 3GS is one A8 core, this is four….)



http://www.millicomputing.com @adrianco acockcroft@netflix.com

Guesses for 2010??
(predictions made in early 2008)



<u>Under the Hood</u>
64bit Intel vs. ARM
Multi-Core CPUs
1GB+ RAM
128GB+ storage
Networked display

<u>Intel and Arm Battle it Out</u>
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.

http://www.millicomputing.com @adrianco acockcroft@netflix.com

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

http://www.millicomputing.com @adrianco acockcroft@netflix.com

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, this is what I’m working on getting into my pocket this year…

http://www.millicomputing.com @adrianco acockcroft@netflix.com

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

More Millicomputing Questions

- Do these CPUs have enough capacity to be useful for general purpose enterprise computing tasks?
- What is the price/performance, Watts/performance, rack density?
- How can vendors package tiny cheap machines into products?
- Will we be seeing Intel Atom or ARM Cortex A8/A9 in the green datacenters in 2010? That's another talk…

Let's Talk

Twitter: @adrianco and #millicomputing

Email: acockcroft@netflix.com

Slides: http://www.slideshare.net/adrianco

I'm attending Velocity all three days

Thanks!