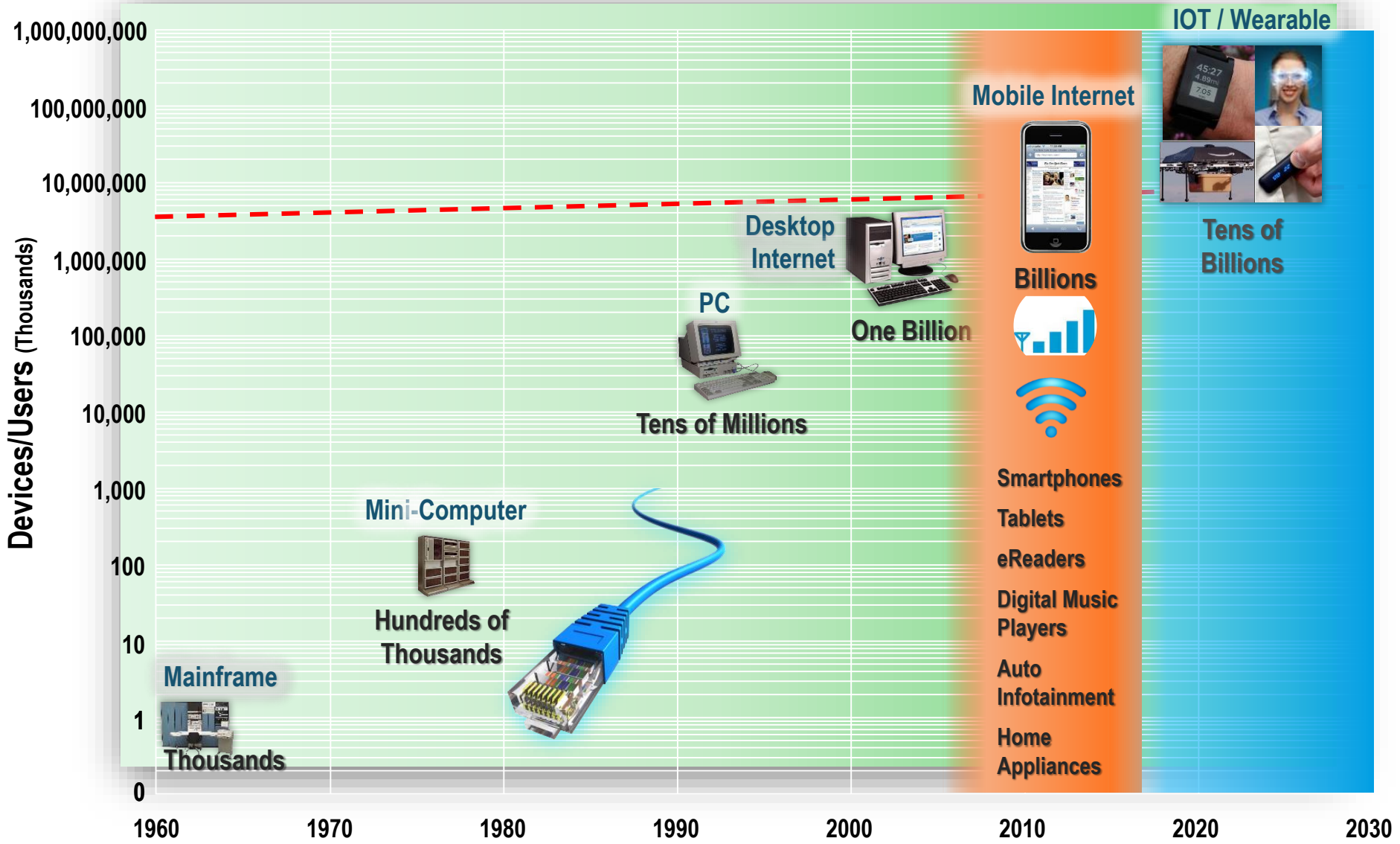
PPP
(PRICE, POWER AND PACKAGE)

OPPORTUNITIES FOR INNOVATION IN MOBILE COMPUTING AND IOT

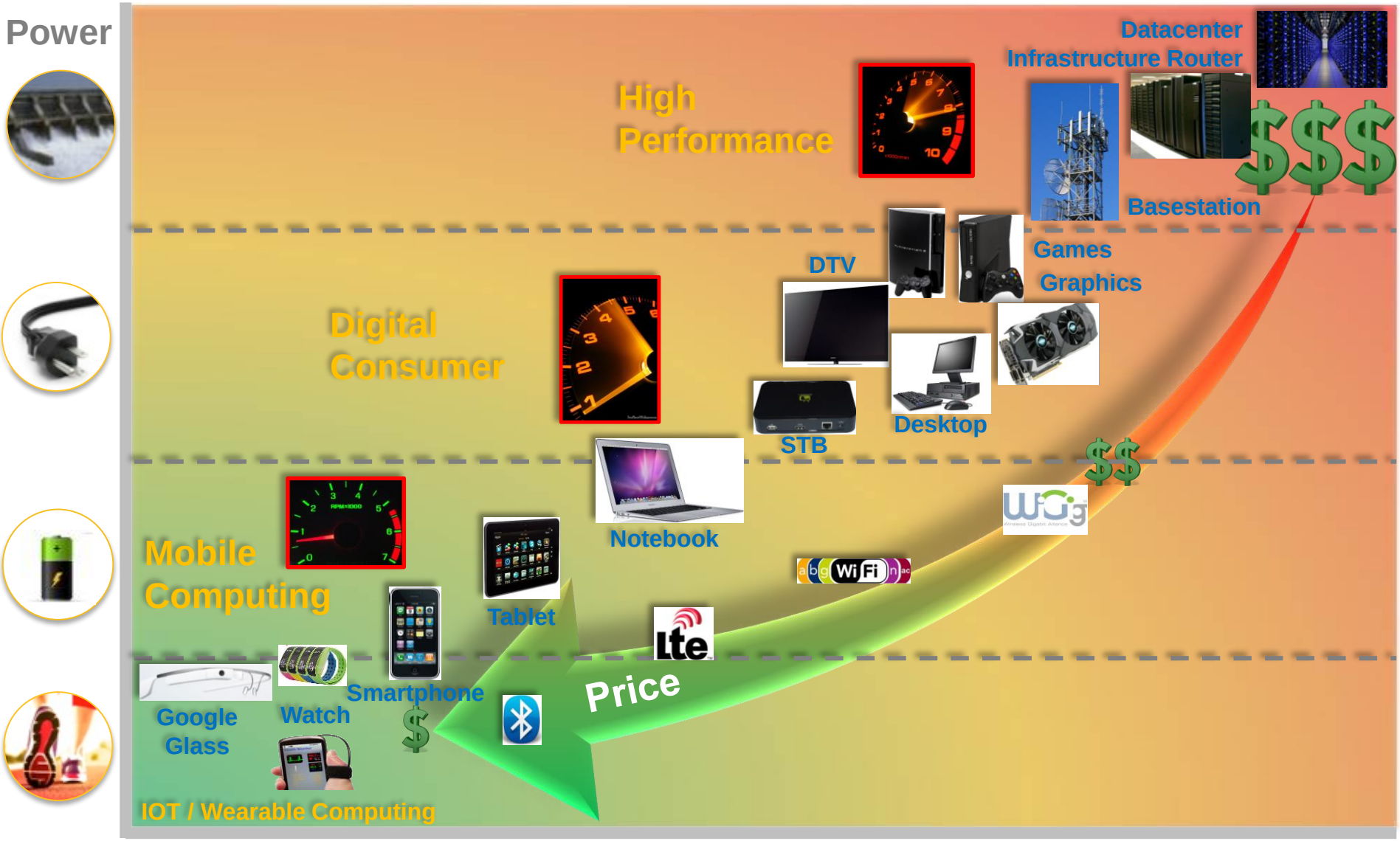
FCCM 2015
May 3, 2015

MOBILE COMPUTING – ENABLING IOT



FPGAs in: PCs | Internet/Wireless | Devices/Things

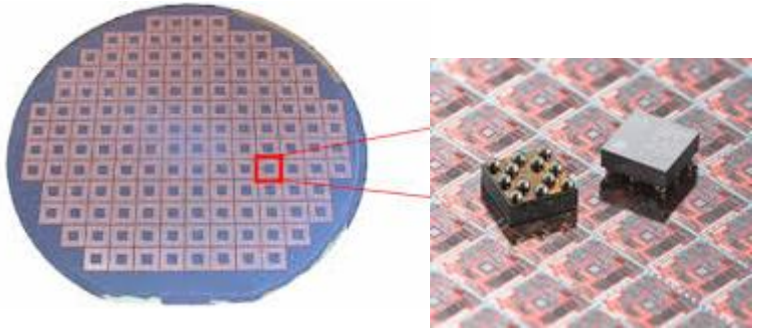
IOT – REDUCED PRICE, POWER & PACKAGE



PACKAGING INNOVATIONS FOR MOBILE / IOT

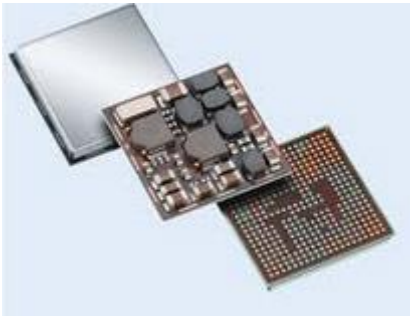
1.4 x 1.4 x 045 mm
Ultra

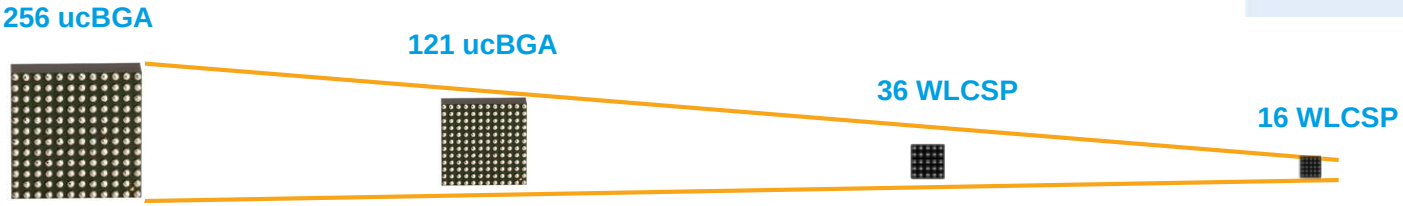
IOT PACKAGING – SMALLER THE BETTER



Contributors to Packaging

- Packaging Technology
  - Wire bonding … migrating to
  - Wafer Level Chip Scale Packaging
- PCB Technology Limits Scaling
- Multi-chip Modules offer opportunities





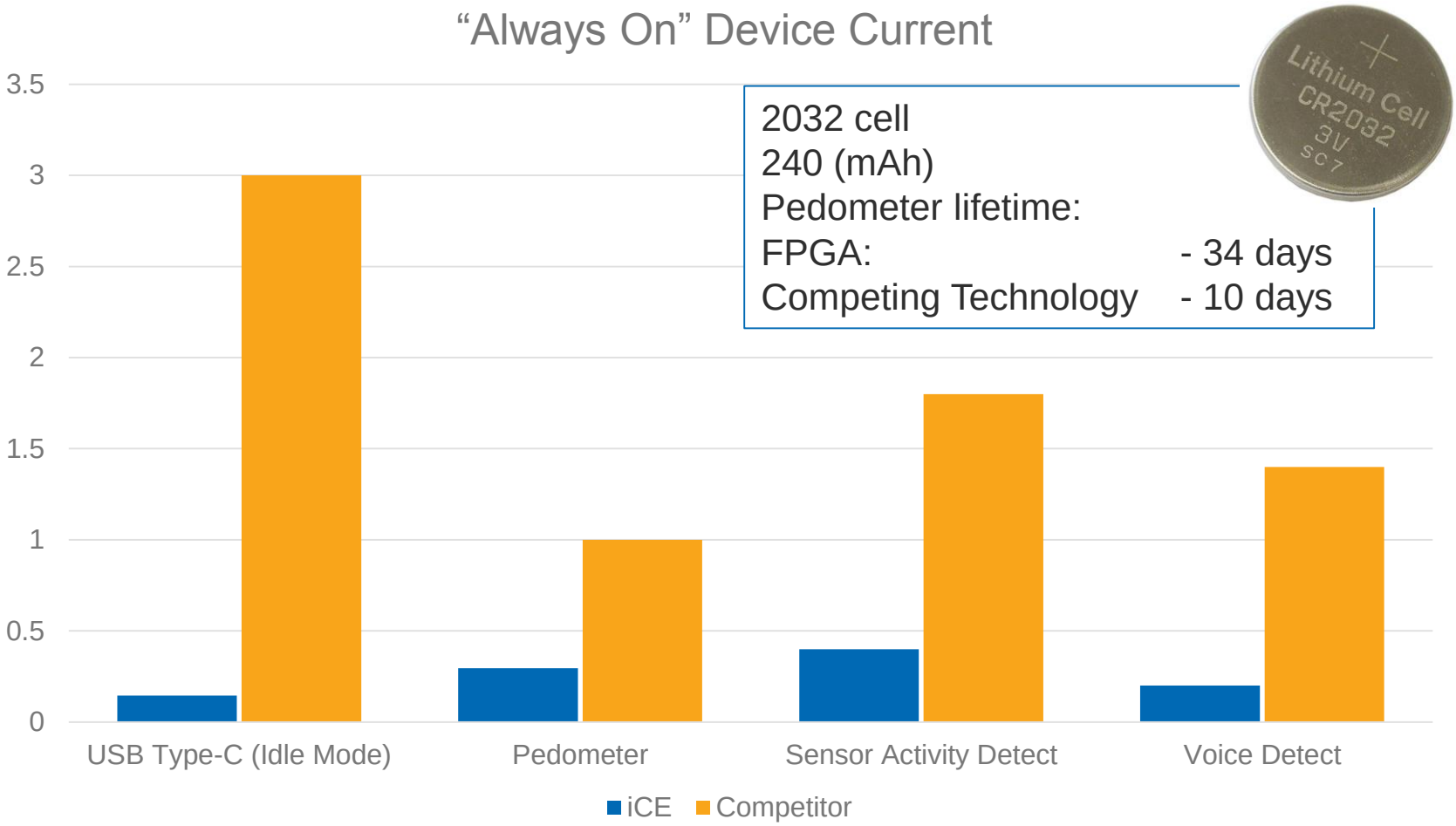
iCE LP
7.0 x 7.0mm
1.0mm tall
0.5 mm pitch
7680 LCs

iCE LM
3.0 x 3.0mm
1.0mm tall
0.4 mm pitch
3620 LCs

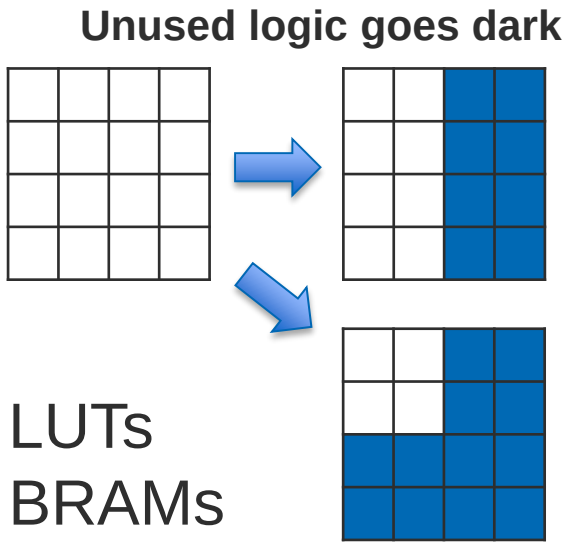
Ultra
2.5 x 2.5mm
0.615mm tall
0.35 mm pitch
3620 LCs

UltraLite
1.4 x 1.4mm
0.45mm tall
0.35 mm pitch
1280 LCs

IOT - LIABILITY OF POWER



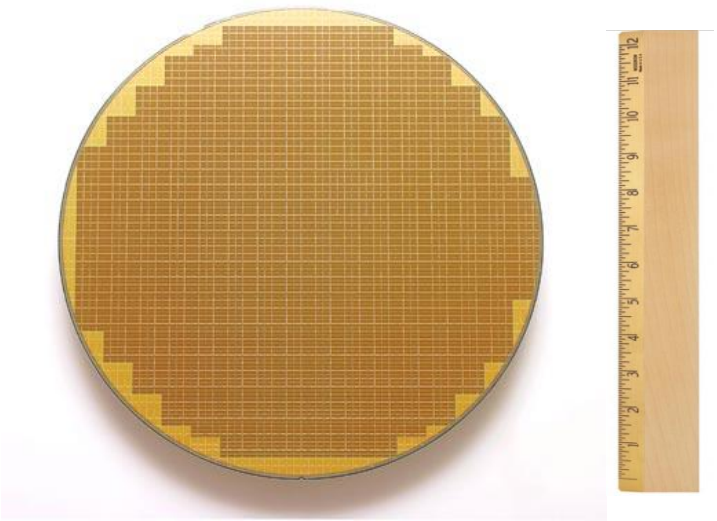
POWER – MOBILE FPGA INNOVATIONS



Organic Contributors to Power
- Device technology
- Device geometry
- Power optimized design tools
  - Shut down routing to unused LUTs
  - Shut down routing to unused BRAMs
  - Shut down routing to unused Carry Logic
  - Buffer free interconnects.

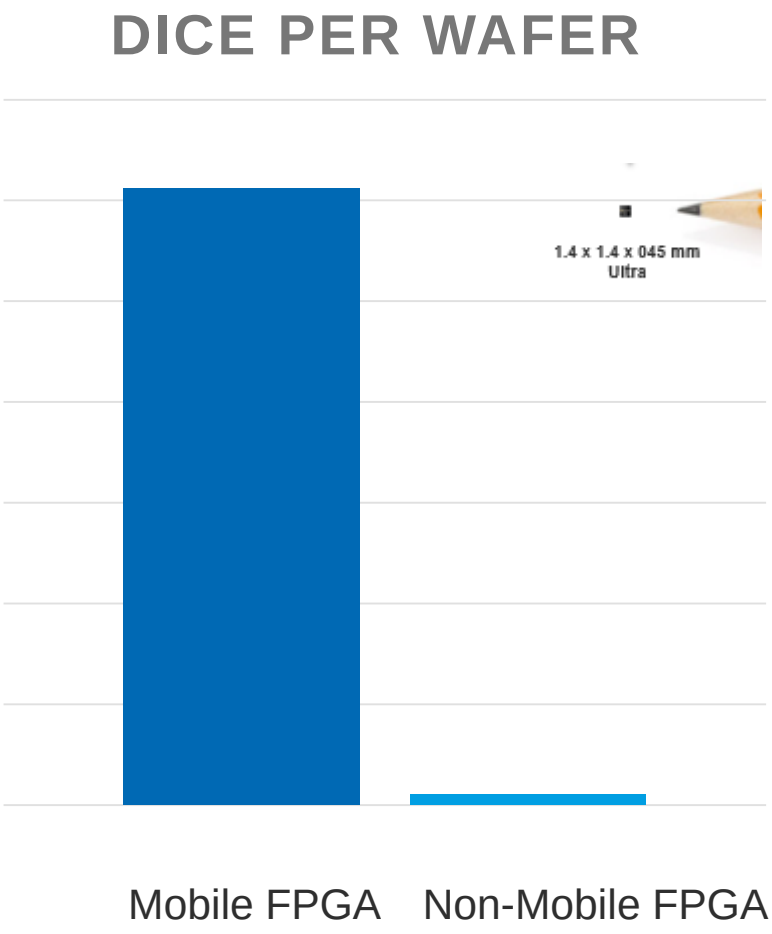
Application Related Contributors to Power
- Clock Gating
- Parallel State Machines
- Design Constraints

IOT / MOBILE – COST IS KING



Contributors to Price

- Economies of Scale
  - 1M per day
- Operational efficiencies
- Device geometry
  - Presently 40nm node
  - Targeting 1 -2 nodes down



FPGAs IN MOBILE – APPLICABILITY TO IOT

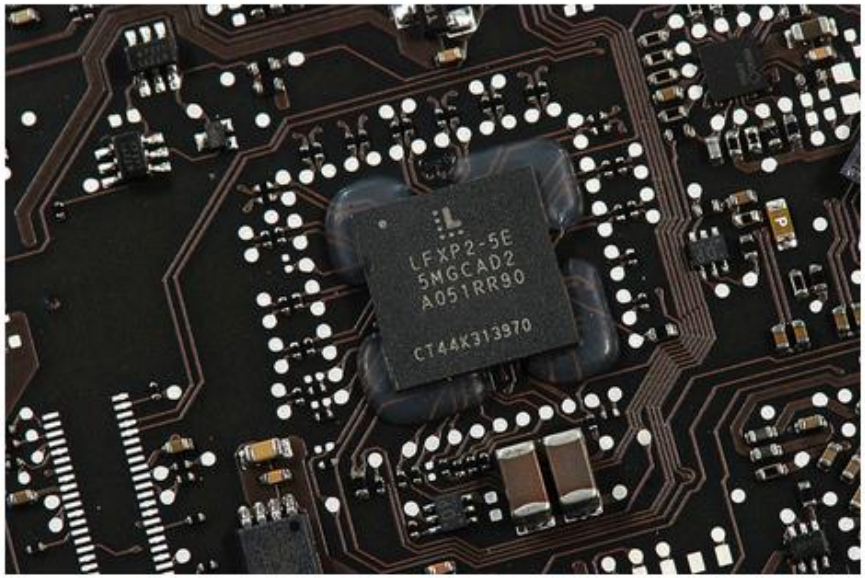
Products	Function	Application
Smartphones / Wearables	Bridge Chips	• RFFE bridging for antenna tuning, SDIO, USB Type-C • SLIMbus to I2S, 1 to many I2C
	Timing Critical Offload	• IR LED remote control • Indication and LED control
	Sensor Management	• Low power “always on” sensor management
	Peripherals	• Control logic (Headset control, etc.) • Fingerprint Authentication & Security
Cameras	Video Management	• CSI2/DSI to Parallel bridge • Image rotation, Overlay • Custom logic (ASIC companion)
Laptops / Tablets	Panel Interface	• TCON, Display Translation
	Sensor management	• Low power “always on” sensor management
Smart Batteries/ Ink Cartridges	Authentication	• Security and authentication • MIPI BIF / Custom interface

FPGAs IN MOBILE – TEARDOWNS

FPGAs IN MOBILE – TECHREPUBLIC

Apple MacBook Pro Quad-core i7 teardown

By Bill Detwiler , April 5, 2011, 8:03 AM



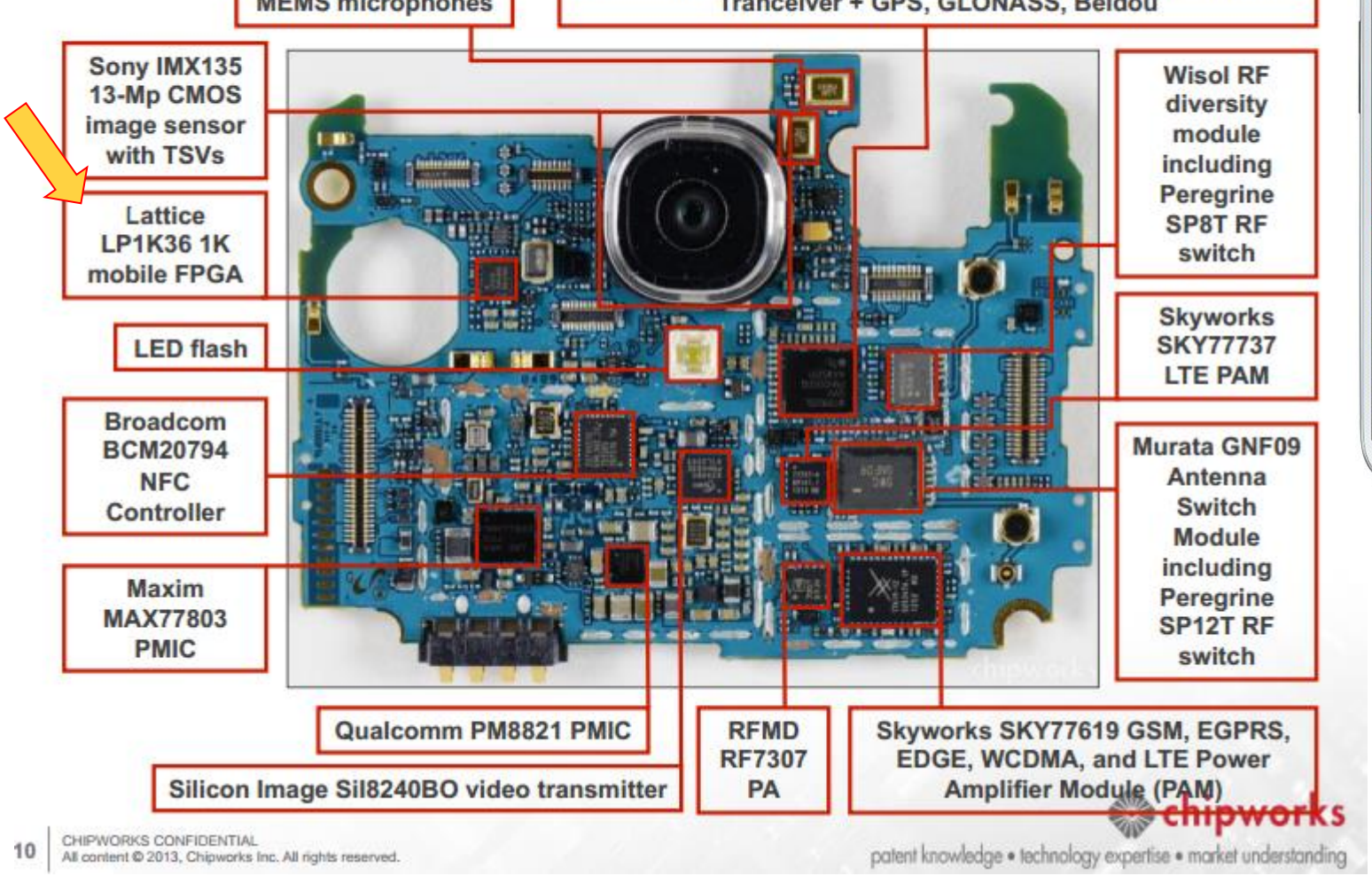
Apple MacBook Pro (2011 Quad-Core i7): Lattice Semiconductor LFXP2-5E

Photo by: Bill Detwiler / TechRepublic
Caption by: Bill Detwiler

FPGAs IN MOBILE – CHIPWORKS

Samsung Galaxy 4S – Side 2

The ConFab



chipworks
patent knowledge • technology expertise • market understanding

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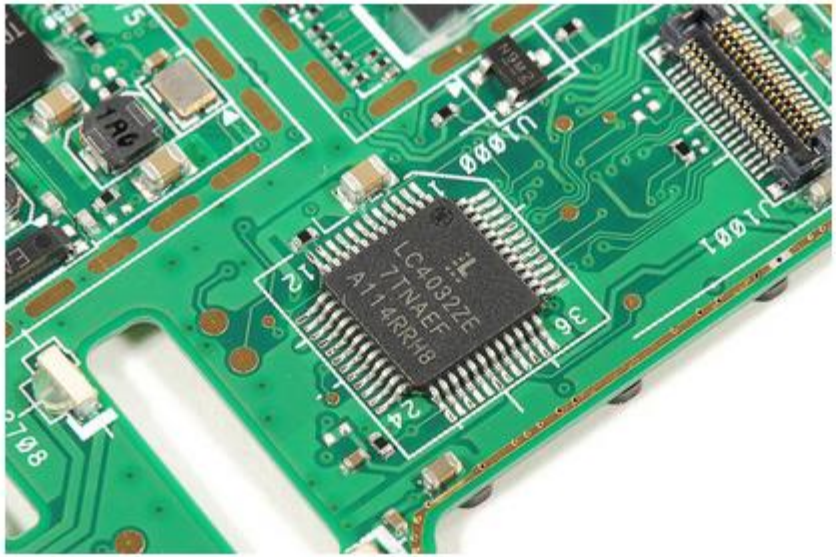
FPGAs IN MOBILE – TECHREPUBLIC

Cracking Open the 2011 Barnes & Noble Nook e-book reader (Wi-Fi)

By Bill Detwiler , June 8, 2011, 8:22 AM



Cracking Open the 2011 Nook: Lattice Semiconductor ispMACH 4032ZE CPLD

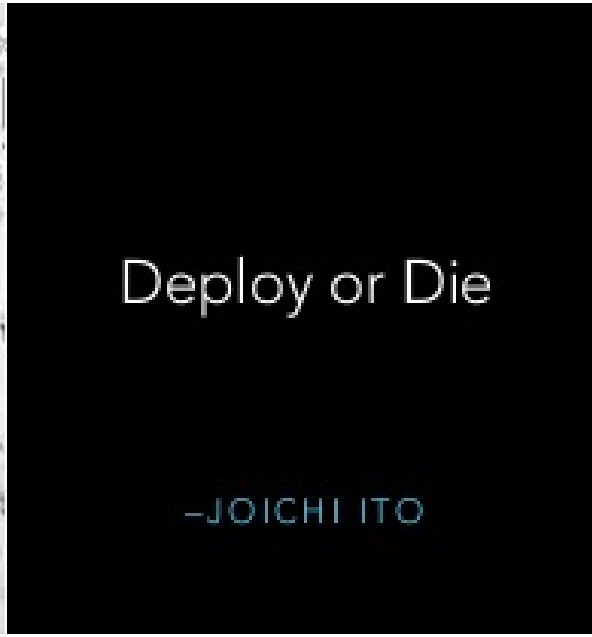
Photo by: Bill Detwiler / TechRepublic
Caption by: Bill Detwiler

FPGAs IN MOBILE – INDICATORS FOR IOT

IOT / MOBILE – PRODUCT INNOVATION

FPGA Perception	*FPGA Reality*	*Notes*
Big **P**ackages	Extremely Small	• FPGAs are as small as 1.4 mm^2
High **P**ower	Very Low Power	• Standby Power as low as 21 µW
High **P**rice	Up to 30K Die Per Wafer	• FPGAs that are priced as low as $0.50 in high volume
	High Volume	• Shipped over 1M units / day

FPGA PRICE, POWER, PACKAGE
Enable Deployment in Mobile and IOT

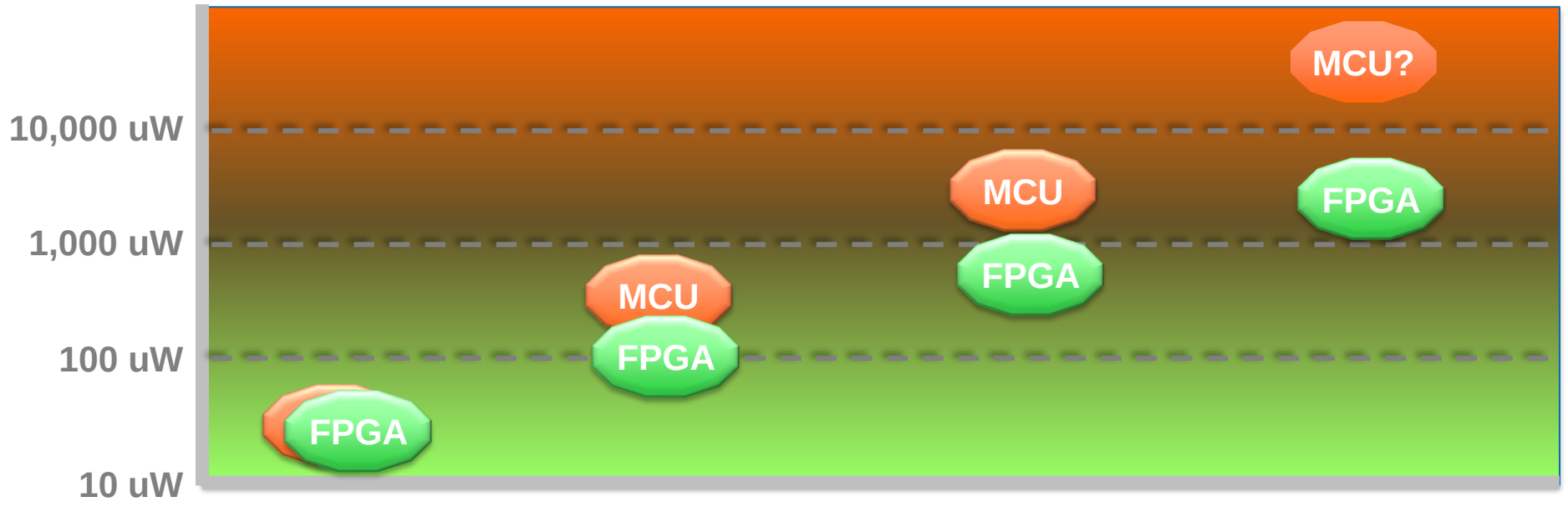


Building a working demo enabled research on critical pain-points

Form-factor compliant IOT deployment will uncover newer pain-points and research fields

THANK YOU!

FPGA STRENGTH – PARALLELISM



Always-on Examples

Gestures
- Tap-to-wake
- Raise-hand

Context Awareness
- Is Running
- In Car

Voice Trigger
- "OK Google"
- Commands With Noise Cancellation

Advanced IOT
- Health/Wellness
- Indoor Navigation
- Biometrics
- New Ideas/Concepts

Reducing FPGA usage barriers for non-RTL algorithm researchers
Within the Mobile and IOT Price/Power/Package