Mobile Cloud Computing
trends and challenges

Patrick Blouet

ST-Ericsson

DISCLAIMER

Outline

- Introduction
- Mobile : What does it mean?
- Cloud : What and How?
- Computing : More than ever challenging
- Conclusion

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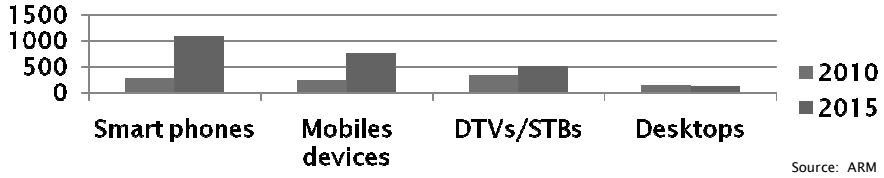
Introduction

- **Mobile systems will outperform all others devices in volume**



Source: ARM

- **A lot of complex technical challenges must be solved at the same time in the mobile area**
- **Emerging of Mobile Cloud Computing linked to problems solving in other areas**

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Mobile : What does it mean?

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MOBILE = No wire

- **Broadband Radio connection**
  - **From short voice conversation to continuous data connection**
- **System autonomy**
  - **A lot of new features are very power hungry**

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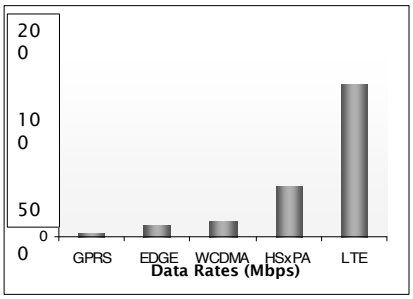
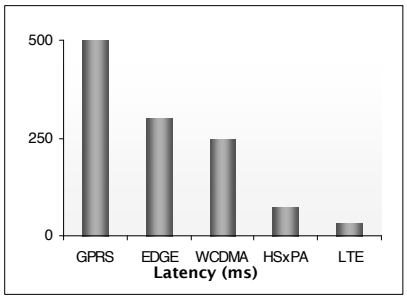
A continuous and fast evolution





- **new cellular mode is added every 3 years, a new frequency band is added every year, and a new auxiliary radio service added every 2 years**
  - **➔ Higher capacity, higher data rates, increased connectivity**

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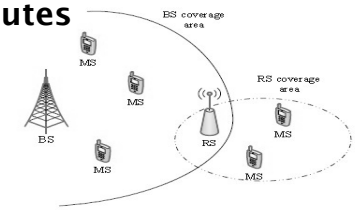
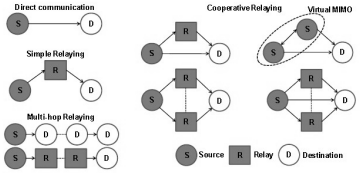
New interaction modes

- **Sharing of antennas providing multiple signal routes**





- **Cognitive radios**
  - **Spectrum sensing**
  - **Dynamic behavior**

Radio sub-system is already heavily multi processors with specialized DSP's

- **intelligent and adaptive systems**
  - **Optimization of Radio power based on content**
  - **Understanding the environment**

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A lot of interfaces

- **Diversity of standards**
  - **Highly computing intensive**
  - **Not possible to have a single interface per standard**
  - **Re-configurability is key: hardware and software**

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Squaring the circle

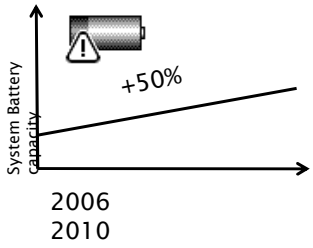
Source : APPLE

- Moore's Law

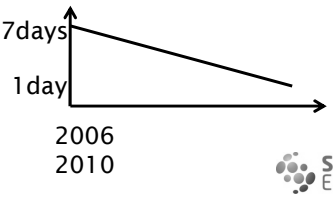
  From 2006 to 2011 : 4 times more transistors in the same power budget

- Form factor

- Battery capcity



- **System autonomy**



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Cloud: What and Where

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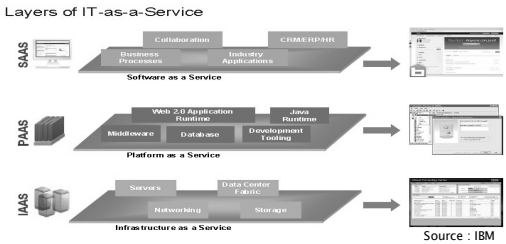
The “CLOUD” but which one?

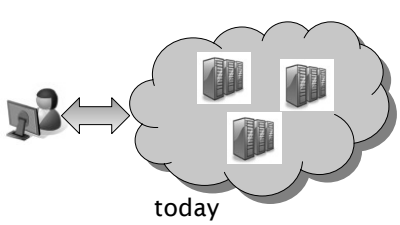
- **Which flavour of the Cloud?**

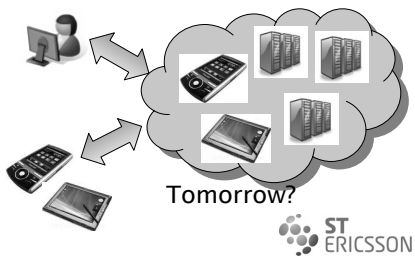


Source : IBM

MAAS
Mobility as a Service ?

- **Where is the cloud?**





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Security in the Cloud

- **One of the main issue for the cloud**
- **Terminal security is KEY**
- **Need strong authentication**
- **Data in the cloud must be protected**
- **Data location could be controlled**
- **Need to be forgotten**

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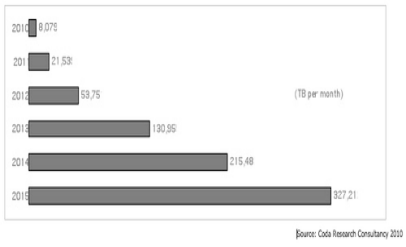
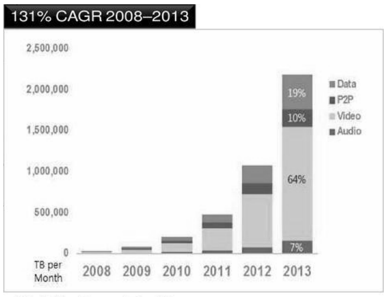
The "data deluge"



Handset data traffic per month, 2010-2015



Mobile Data Traffic

- **Squaring the circle regarding energy efficiency and processing power**
- **Need for standards (HTML5, oneAPI,…) and application compliancy for the cloud**
- **Strong pressure on infrastructure and operators**
- **Needs for very efficient data mining techniques.**

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Computing : More then ever challenging

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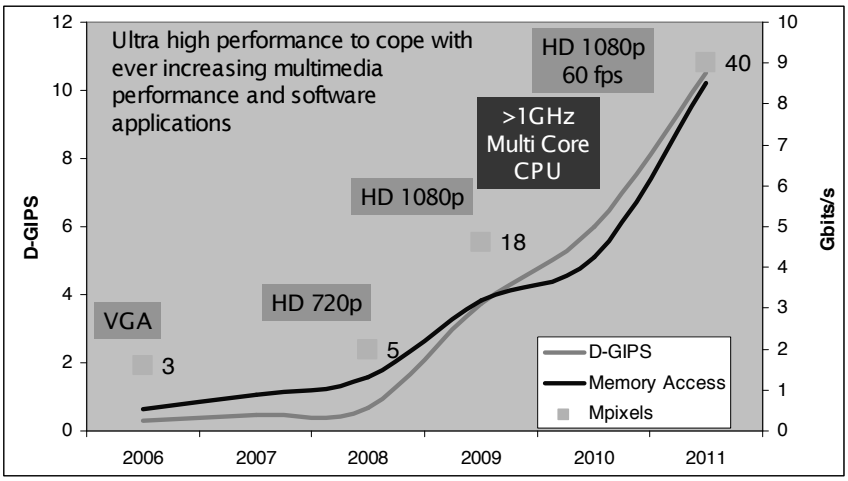
Multimedia Performance

Multimedia Processor Performance Requirements



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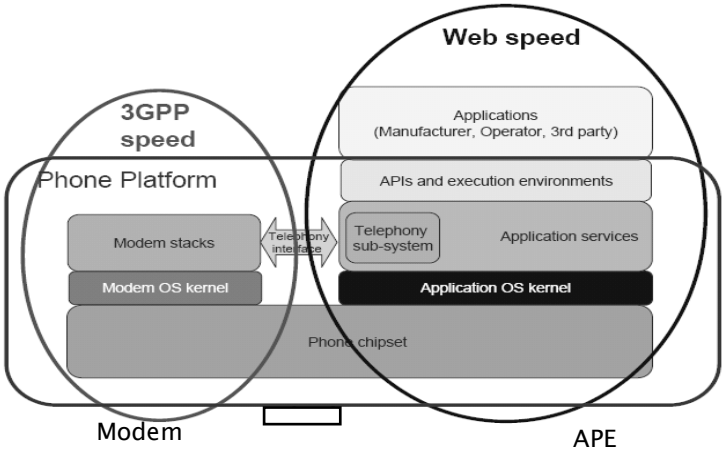
Change at web speed



- Modem certification and integration is tacit know-how intensive
- APE is the CORE of the user experience

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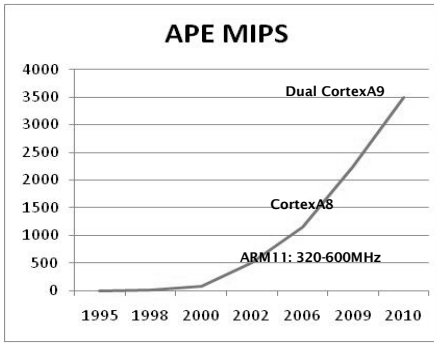
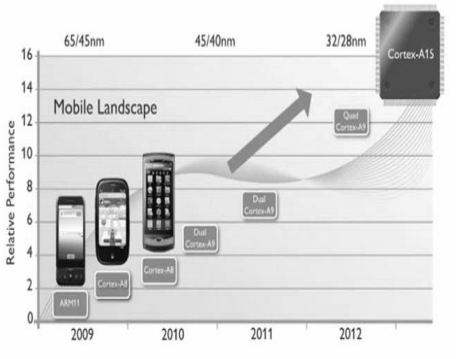
Never enough processing power





- More and more APE processing power dedicated to applications
- Additionally, HW-Accelerated 2D/3D graphics, Video, Imaging and Audio Engines

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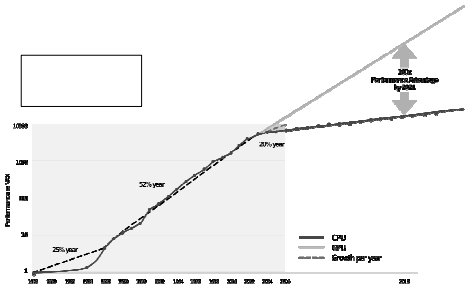
The Gap Between CPU and GPU

- **GPU evolution is very rapid**
- **One of the biggest IP block in modern systems**
- **Must be used not only for graphic**



ref: Tesla GPU Computing Brochure

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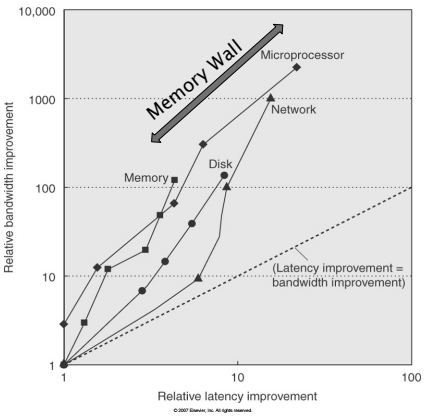
Memory is not on the same pace

- A single problem to solve : **"brings data to CPU in the power budget, but… "**



- Memory evolution not aligned with CPU needs
  - More than 12GB/s needed
- Multiple channels
- DDR2 => DDR3 => DDR4
- LPDDR1 => LPDDR3 => WideIO

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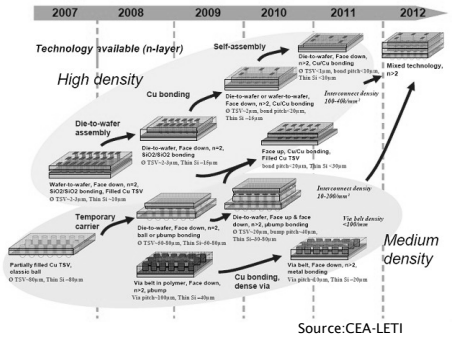
WideIO and 3D Integration : The holy Grail ?

- A lot of 3D flavors alrea
- Virtuous regarding performance and therm management



Source:CEA-LETI

- Standards for WideIO I/F in progress (Jedec JC42.6, JC11)
- The most promising solution to reach very high bandwidth for smartphones

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But still a long way to go !

- Mass production in TSV for imaging module or memories
- Thermal budget with very strong constraint
- Lack of strong standardization: The MtM problem
- Testing is becoming a very complex issue
- Big issue in the supply chain
  - Same supplier of different dies
  - Logic and memory
  - Several dies from various suppliers

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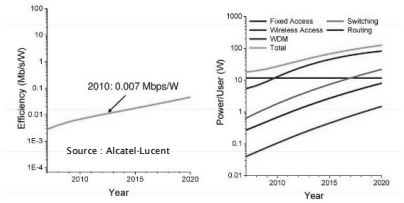
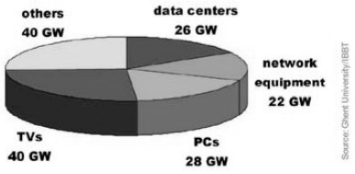
The Cloud power efficiency : A major issue

- **Mandatory to improve cloud power efficiency**
- **16-20% YoY increase for overall ICT power consumption**
- **Data centers hitting the power wall**
- **Energy consumption becoming big part of OPEX for operators**





Global energy consumption by ICTs

earth GreenTouch™

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Conclusion

- **Very promising approach especially for mobile devices**
- **Embrace all the difficult problems of high-tech industry**
- **Mobile cloud computing still in infancy even if already in the cloud**
- **Highly dependant of problems in other domains.**
- **Economical issues may slow down its pervasion**

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THANK YOU
for your attention !

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