ARM in Trondheim

- Graphics technology design centre
- From 2006 acquisition of Falanx Microsystems AS
- Origin of the Mali GPUs

Main activities today
- GPU HW development
- Driver SW development
- Systems (ASIC/FPGA)
- Performance analysis
ARM in Trondheim

ARM Norway

Nidarosdomen

NTNU Gløshaugen

The Architecture for the Digital World®
Growing Mali Penetration

- Mali is the most widely licensed graphics processor
  - ~30 licenses; 4 subscription licenses
  - 61 partners
- Mali share gains continue as multiple Partners ramp to volume
- 2013 market penetration
  - >70% of DTVs
  - >50% Android tablets
  - 25% Android smartphones

### Mali Processor Licenses

<table>
<thead>
<tr>
<th>Year</th>
<th>Licenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>~30</td>
</tr>
<tr>
<td>2011</td>
<td>+19</td>
</tr>
<tr>
<td>2012</td>
<td>+17</td>
</tr>
<tr>
<td>2013</td>
<td>+12</td>
</tr>
<tr>
<td>H1 2014</td>
<td>96</td>
</tr>
</tbody>
</table>

### Mali Royalty Shipments (m, units)

<table>
<thead>
<tr>
<th>Year</th>
<th>Shipments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>&lt;50m</td>
</tr>
<tr>
<td>2012</td>
<td>150m</td>
</tr>
<tr>
<td>2013</td>
<td>400m</td>
</tr>
</tbody>
</table>

Source: Samsung Galaxy Alpha

The Architecture for the Digital World®
What is the Internet of Things

Deeply embedded
- Power, cost, and size constraints

Connected
- Many unconnected devices becoming connected
- Opportunities for cost savings, smarter living
- Devices everywhere

Heterogeneous
- Many / varied applications
Gartner has IoT at peak hype
Most inflated expectations now
Trough of Disillusionment ahead
5-10 years to Plateau
How many ARM cores shipped in 2013?

10,400,000,000

Per Day: 28,493,151
Per Hour: 1,187,215
Per Minute: 19,787
Per Second: 330

The Architecture for the Digital World®
ARM in IoT

- ARM processors span sensors to servers
  - Big data starts with little data – intelligence and energy efficiency to the sensor node is vital
  - Cortex-M devices start at 50 cents, 2mmx2mm - any product can now become smart & connected

- Standards essential for scalable, secure IoT proliferation
  - Bringing the web paradigm to IoT (6LoWPAN, CoAP and OMA Lightweight)
  - ARM Sensinode software efficiently and securely connects low-power nodes to the cloud

- ARM mbed: Collaborative project to accelerate IoT device innovation
  - Open-source components allow easy integration of MCUs, sensors and cloud services
  - ARM Sensinode clients being integrated to mbed
ARM IoT Architecture – ARM Offering

ARM SENSINODE

ARM Mbed
IoT Technology

ARM Cortex
Low-Power Leadership from ARM

OMA LWM2M, CoAP/HTTP, TLS

Local Processing

Security
Communication
Discovery

Data Storage & Analytics
Management
Applications

End-to-End Security, Web, Data Objects & Management

Little Data

BIG DATA

The Architecture for the Digital World®
The “Internet of Things” Drives Opportunities

Safer Automotive

Fitness / Healthcare

Portable and Wearable Electronics

Resource Management

Industrial Internet

Smart Appliances

Smart Farming

Smart Lighting

Machine to Machine

and Challenges

- Always on
- Increased connectivity
- Confidentiality
- Security
- Regulations
- New users
One Size Does Not Fit All

30Bn connected objects = Solutions built for the lowest cost and the lower power
End To End: Linking Devices to Cloud

Edge Devices

Low Energy e.g. BT Smart, 6lowpan, Ant+ etc

Smartphone
My Personal Hub

Access Network

Wi-Fi, 3G, LTE

Access Network:
e.g. 3G, LTE

Device Provisioning and Diagnostics

Management Platform

Access Services

‘Big Data’ Storage

Cloud Hosting

Apps

The Architecture for the Digital World®
The IoT Opportunity Gap

The IoT Opportunity is much larger

Analysts predictions for connected devices (2020):
- 30 billion?
- 50 billion?
- 75 billion?

Current trends show strong growth

IoT is not new
It has been around for >20 years

2010: Number of connected things > world population (6.8B)
Data Ownership and Privacy

- Handling sensitive or large amounts of data requires responsibility
- Clear agreements on who can store and use the data is key
- Customers should own their data in an IoT world
- Proper Data Privacy Policies are fundamental to IoT success
Knowledge in Data

https://jawbone.com/blog/napa-earthquake-effect-on-sleep/
Security

- Valuable control and data will attract attackers

- Odds are on the attackers side
  - Are more focused
  - Have more time
  - Only need to find one weakness

- Security must be given high priority end-to-end
  - Focus, Collaboration and Standards
Thank You!