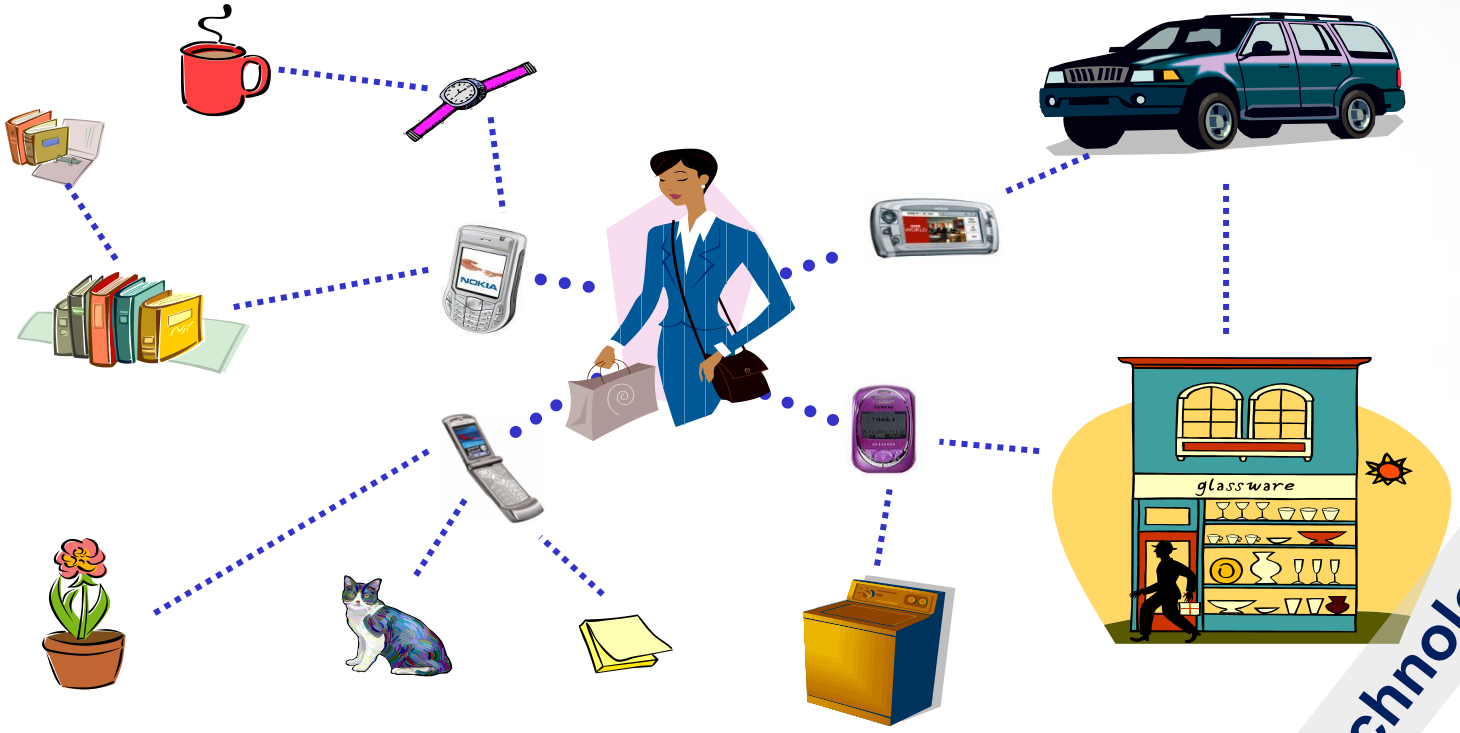
Internet of Things

Make dumb objects smart



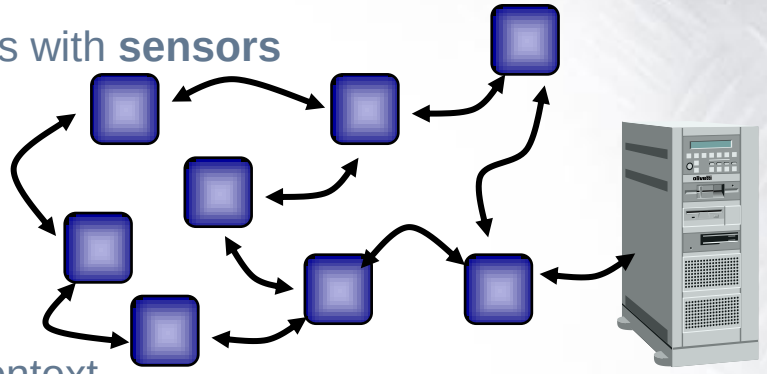
Technology Outlook

Internet of Things

What is it?

The **Internet of Things** refers to uniquely identifiable objects (Things) and their virtual representations in an Internet-alike structure.

In order to make it really interesting we equip the objects with **sensors** that can detect vibrations, temperatures, humidity, light conditions, chemical substances and much more.



An object with this sensor (A smart object)

- Have some **understanding** about its current context
- Knows its own **location**
- Holds its own information about id, history, owner etc.
- Can **communicate wireless** with other objects and reach the Internet. It typically have it's own IP address.

Internet of Things

Background figures and facts

Combining the number of infrastructure sensors with the number of sensors in personal devices, such as cell phones, yields a round number of **1000 sensors per person** that manufacturers will develop and deploy over the **next 10 years**.

- With a world population in the billions, the figure above would translate to **more than 1 trillion sensors**.
- **IPv6**, the new Internet standard allows for more than enough IP addresses that can be assigned to all these objects.
- **Bill Gates:** “Networking makes dumb devices smart”

Internet of Things

Putting it to work

Information and analysis			Automation and control		
Tracking behaviour	Enhanced situational awareness	Sensor-driven decision analytics	Process optimization	Optimized resource consumption	Complex autonomous systems
Monitoring the behaviour of things or persons	Real-time awareness of physical environment	Assisting human decision-making through deep analysis and data visualization	Automated control of ”closed ” systems	Control of consumption to optimize resource use across the network	Automated ontrol in open environements with great uncertainty
Example: Supply chain monitoring and management	*Example*: Detect snipers using direction of sound to locate them	*Example*: Oil field site planning with 3D visualization and simulation	*Example*: Continous, precise adjustments in manufacturing lines	*Example*: Smart meters and energy grids that match loads and generation capacity in order to lower costs	*Example*: Collision avoidance systems to sense objects and automatically apply brake

From McKinsey

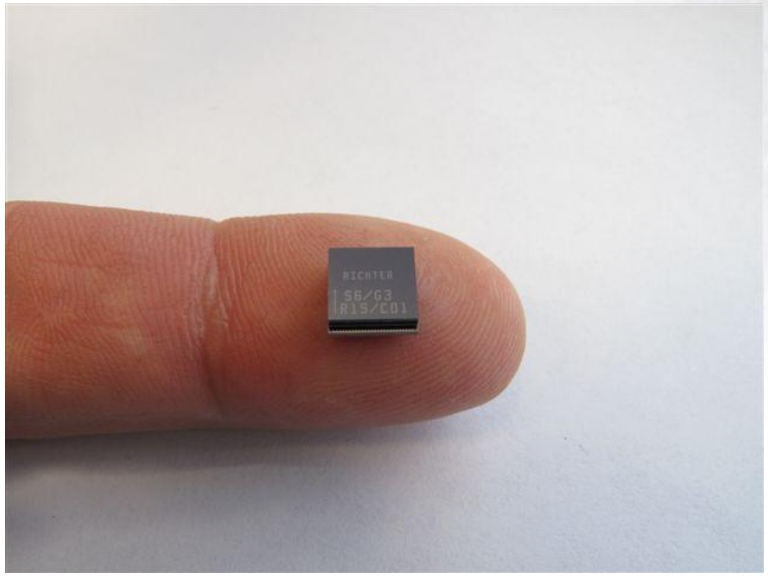
Internet of Things

HP's CeNSE project

CeNSE (Central Nervous System for the Earth) is a project of HP Labs. CeNSE is an intelligent network of billions or even trillion of Nano-scale sensors all over the earth that will **feel**, **taste**, **smell**, **see**, and **hear** what is going on in the world and communicate that information through networks to be analyzed and acted upon in real time by a new breed of business applications and web services.

HP and Shell are collaborating to use this in order to collect and store seismic and geophysical data.

At a typical data rate, 1 billion sensors running 24 hours a day would require 500 hard disks running in parallel to capture 200 petabytes of data that these sensors would create in just six months.



The sensors that HP will use for CeNSE

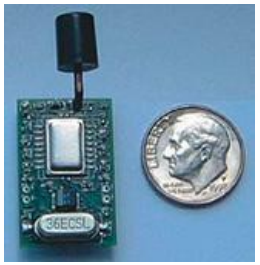
Internet of Things

Scenario for home environment

We **stick sensors throughout the house** to keep watch on things like water pipes, electrical cables, doors, roof, floor, walls and devices.

When sensors detect flooding, for example, **the system can respond** by interrupting the main water supply line and send an alert to the owner.

These tags/sensors have a battery life of about five years.



Internet of Things

Scenario in production environment

Sensors are spread out in the factory and will for instance check temperatures, vibrations, chemical substances and other conditions.

The system can **respond automatically** according to the current situation or just by sending an alert to the one who is concerned.

Picture by http://www.geograph.org.uk/profile/3165

Improved instrumentation of a process, multiplied hundreds of times during its entire life cycle, allows for **major reductions in waste, energy costs and human intervention.**

Internet of Things

Privacy and Security Issues

Assume that somone or something – an individual, a company or a government continously knows the answers to:

- Where are you?
- Who are you?
- What are you doing?

Is it a nightmare or the next step to defining individuals in our society?

Photo by http://www.flickr.com/photos/carbonnyc/

Internet of Things

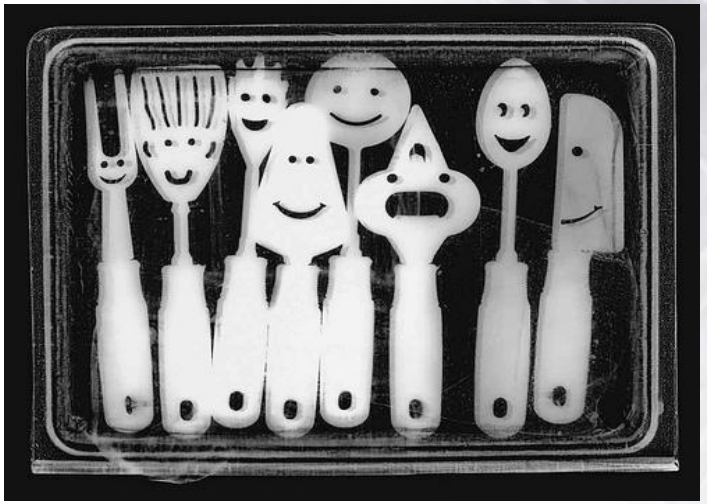
What comes next?

EU 2009

Commission of the European Communities states in the report *Internet of Things — An action plan for Europe* that:

"One major next step in (Internets) development is to progressively evolve from a network of interconnected computers to a network of interconnected objects, from books to cars, from electrical appliances to food, and thus create 'Internet of things'".

The EU ambition is to "define a set of principles underlying the governance of "Internet of things"



Picture by http://www.flickr.com/photos/centralasian/

China 2010

Li Yizhoung (Minister of *Industry and Information Technology*, China)**:**

"China should accelerate the development of the Internet of Things industry so as to create a new platform for economic growth".

As a result, Wuxi, Shanghai and Beijing, among other major cities, have put forward ambitious plans to become leaders in this sector.

Internet of Things

Summing up

The Internet of Things has great promise

- Business, policy, and technical challenges must be tackled before these systems are widely embraced.
- The widespread adoption of the Internet of Things will take time, but the time line is advancing thanks to improvements in underlying technologies.
- Energy consumption efficiency and process optimization are good early targets.

Missing components are

- Common Infrastructure and standards
- Privacy and Security solutions
- Legal liability frameworks are not yet established