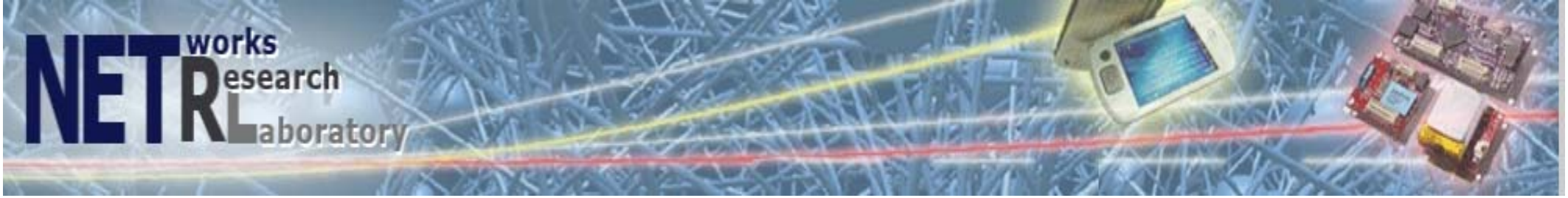


Internet of Things: a glimpse overview

Andreas Pitsillides, Networks Research Lab, Dept. of Computer Science, University of Cyprus

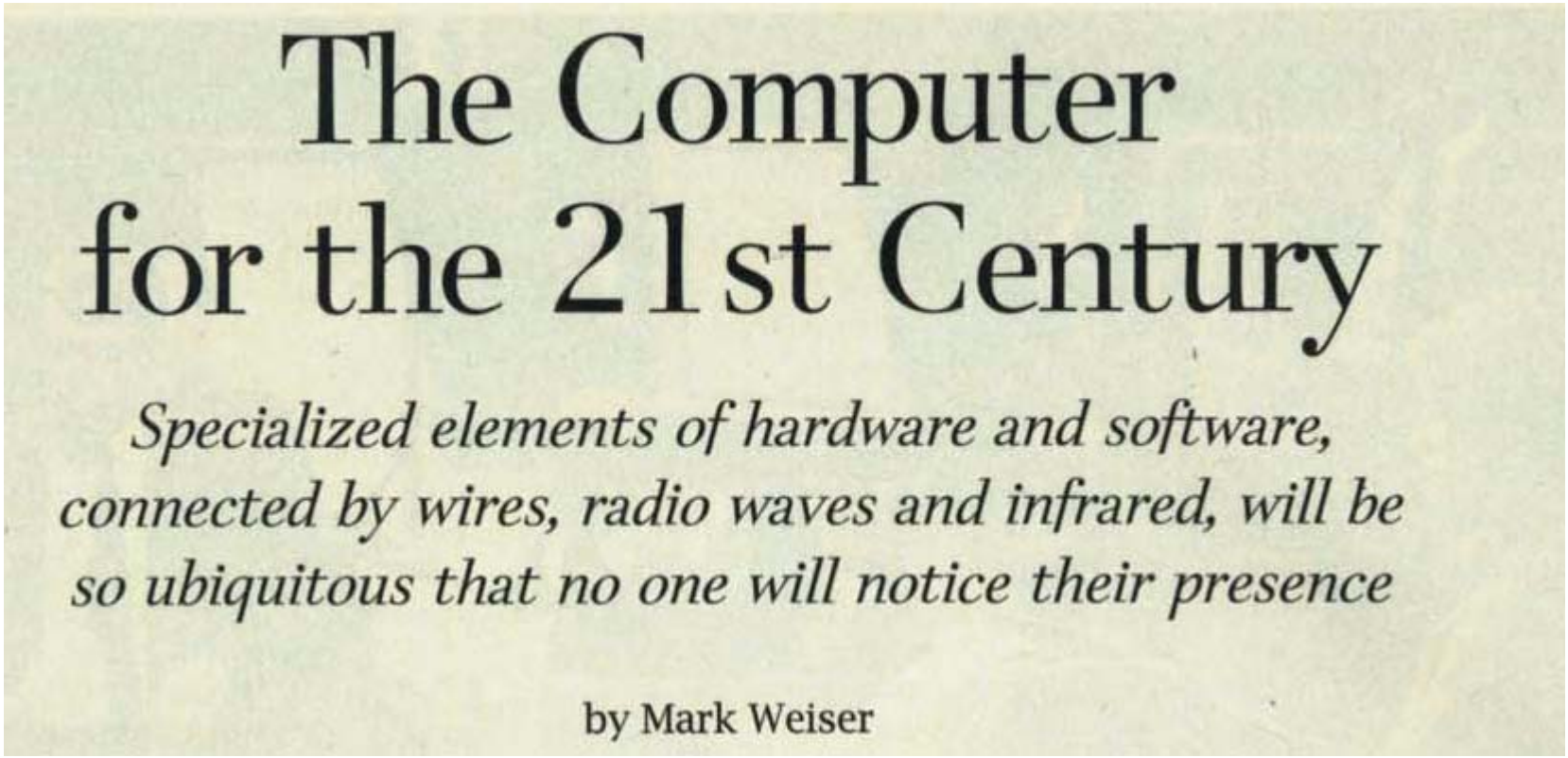
The Second Cyprus Symposium, 'Pathways to Indefinite Lifespans', University of Nicosia, 24 May 2014

Talk Schedule

- Motivation
- The Internet of Things (IoT)
- Indicative Application Domains and real life scenarios
- Concluding Remarks
- Future Challenges

Motivation

Motivation



The Computer for the 21st Century

Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence

by Mark Weiser

SCIENTIFIC AMERICAN *September 1991*

25 years on, Vision or Reality?

Motivation

It's a smart world?

‘The real and the digital worlds are converging, bringing much greater efficiency and lots of new opportunities’ 2010, Nov. http://www.economist.com/node/17388368?story_id=17388368

WHAT if the two worlds exist, the real one and its digital reflection?

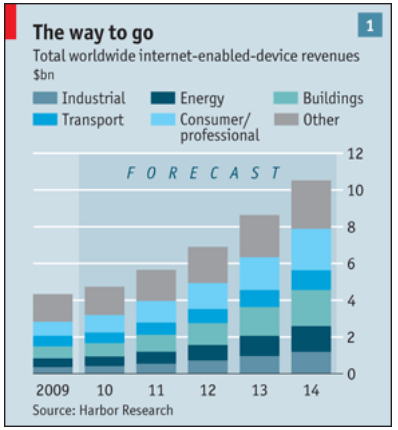
- A Real world - full of sensors, picking up everything from movement to smell.
- A Digital world, a construction built of software - takes in all that information and automatically acts on it.
  - E.g. If a door opens in the real world, so does its virtual equivalent. If the temperature in the room with the open door falls below a certain level, the digital world automatically turns on the heat. Vision of Prof David Gelernter, Yale University, in early 1990s in his book “Mirror Worlds”.

Two decades later that still sounds like science fiction. But does it? Second Life, Google Glass, Cloud

Motivation

The real and the digital worlds are converging fast due to:

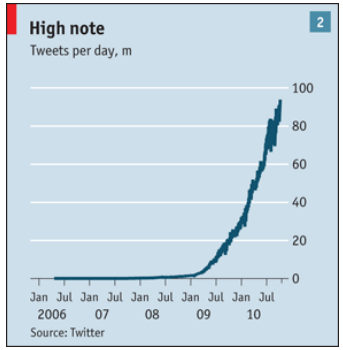
- emergence of connected sensors and embedded devices (currently, mostly living in their microcosm, but could be interconnected in the 'big web', sensing and acting on the environment)



http://www.economist.com/node/17388368?story_id=17388368

- new ubiquitous wireless networks (e.g. WSNs, Smart Phones) and communication techniques and standards

- activities of humans themselves.



'For e.g. the micro-blogging service Twitter's 160m users send out nearly 100m tweets a day.
When they see, hear or read something, they type it into their computer or smartphone, 140 characters at a time.'!! And now Tweeting Things

Motivation

So,

- Smart devices and sensors are becoming an integral part in our life, interconnected and embedded everywhere.
- New sensor and communication technologies are appearing, some with Internet support. (e.g. sensor networks, smart phones, RFIDs, short-range wireless communications, NFC, real-time localization, …)
    - New communication paradigms:
        - More things are being connected
        - People are connecting to Things
        - Things are connecting to Things
- Prices for embedded computer hardware have effectively dropped.

Motivation

But

- High heterogeneity is present in pervasive environments.

How do we bridge these technologies together?

How can heterogeneous physical things communicate and interact?

Motivation

The Internet is a solution!

- **An increasing number of embedded devices are supporting the IP protocol, thus many physical objects now have direct connectivity to the Internet.**

thus **the Internet of Things (IoT).**

which includes technologies and research disciplines that enable the Internet to **reach out into the real world of physical objects.**

The Internet of Things: a glimpse

Internet of Things (IoTs)

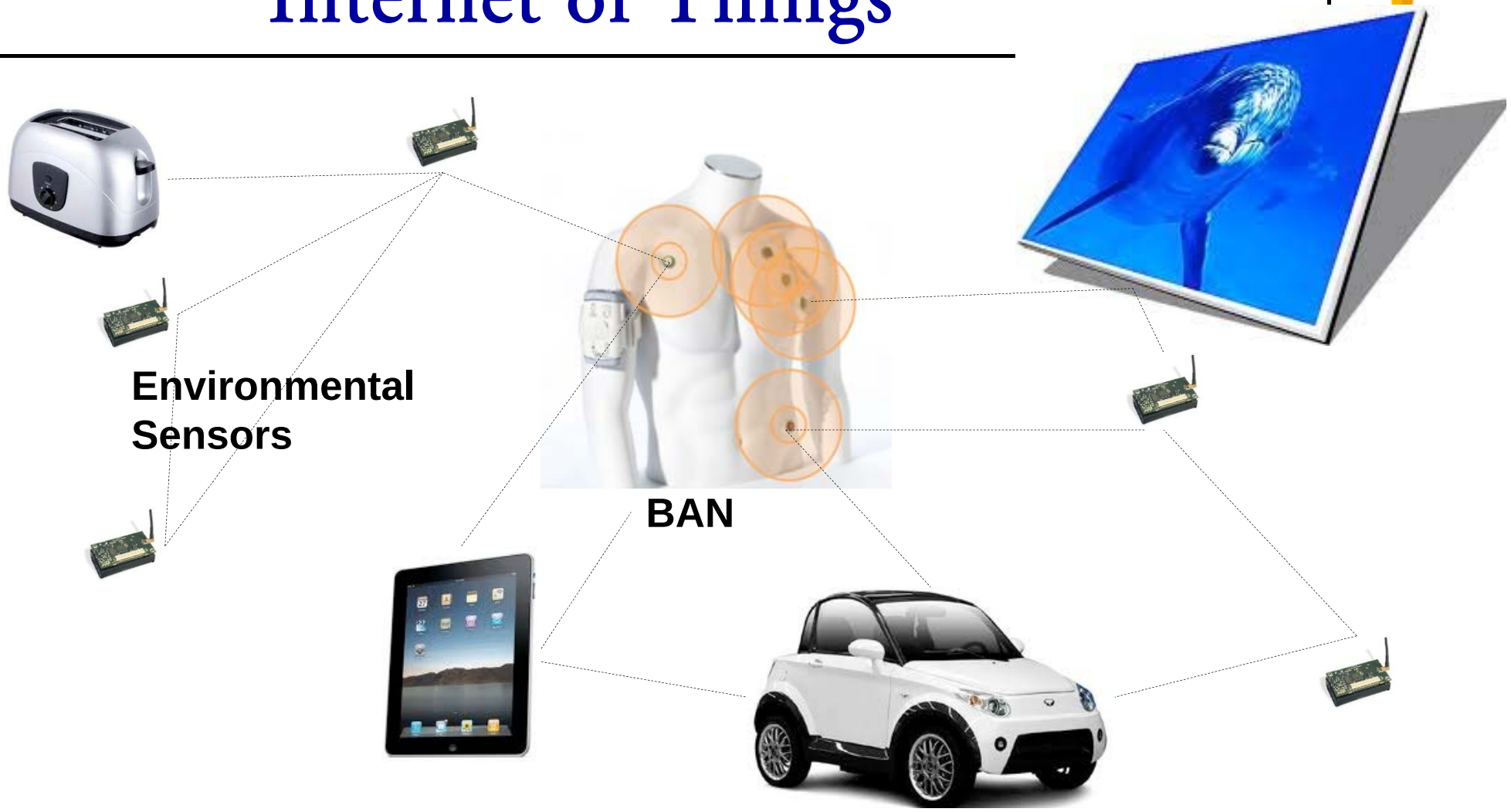
Thus,

As we equip people, places, and commodities with Internet-connected embedded devices that can sense information about the environment and subsequently take action, we are creating the Internet of Things (IoT).

The IoT is speculated that it will improve society and quality of life

BUT, will it?

Internet of Things



- Physical Interconnection of devices, objects……integrated with virtual interconnection of services
- **A large number of these devices are MINITIARIZED devices (sensors, BAN)!!!**

Motivation: Is there a need?

Large sums spent on smart-infrastructure projects; some countries made smart systems a priority of industrial policy. E.g.

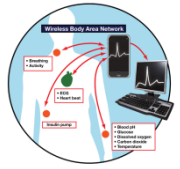
- IoT is central to European Union's "Digital Agenda" & recently concluded a public consultation and China announced a plan with clear guidelines for IoT.

There is real need for such systems

- physical infrastructure is ageing
- **health-care costs are exploding**
- money is tight, ...

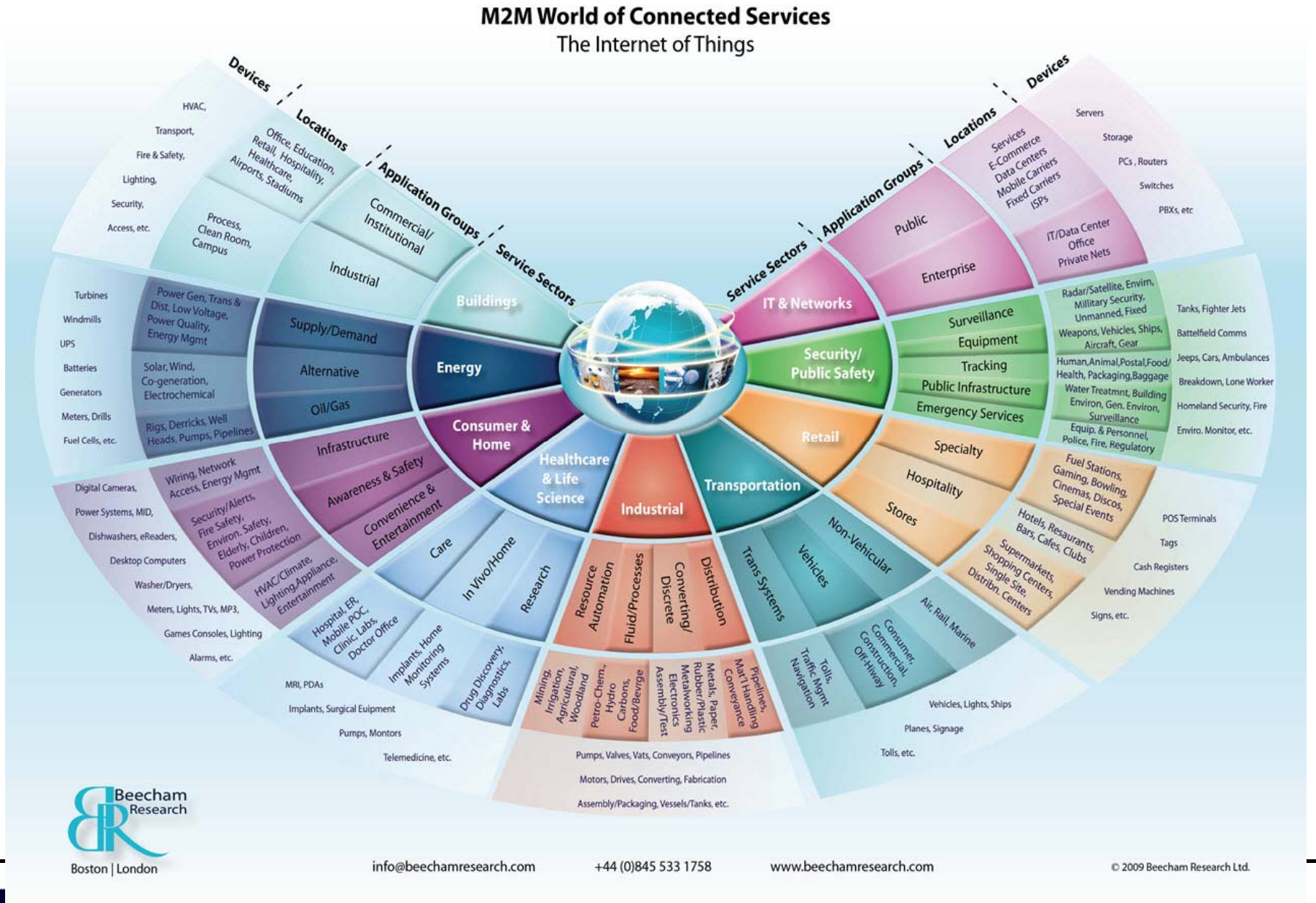
Can use resources more intelligently, e.g.

- Monitoring patients remotely → can be much cheaper and safer than keeping them in hospital.
- A bridge equipped with the right sensors → can tell engineers when it needs to be serviced.
- Today power grids, transport systems and water-distribution systems are essentially networks of dumb pipes → make smart.
  - If power grid in America were 5% more efficient, it would save greenhouse emissions equivalent to 53m cars.
  - congested roads cost the country, e.g. in 2007 in US 4.2 billion working hours lost and 10.6 billion litres of wasted petrol.
  - utilities around the world lose between 25% and 50% of treated water to leaks



Applying the IoT in Real-Life Scenarios

Wide spectrum of applications



From Smart objects:

Nabaztag Personal friend – assistant – can speak ‘common sense interesting bits, read web text, communicator, ...

chumby takes your favorite parts of the internet and delivers them to you in a friendly, always-on, always-fresh format.

http://www.nabaztag.com (left)

http://www.chumby.com/ (right)

Big and small smart objects

a small smart object

DIGITAL DENTAL: The Beam Brush responds to the mouth and wirelessly sends a record of your oral hygiene habits to your smartphone.

And a big smart object ..