

L1: Introduction To Smart Objects

IT3779
Smart Object Technologies

Outline

- Introduction to Smart Objects
- Smart Objects Applications
- Enabling Technologies for Smart Objects
- Case Studies

Introduction to Smart Objects

- What are **Smart Objects**?
 - **Smart Objects** is the evolving vision of billions of smart devices connected to the internet and interacting with humans and with each other.
 - Smart Objects and its applications also have names such as the *Internet of Things* & *Web of Things*



Introduction to Smart Objects

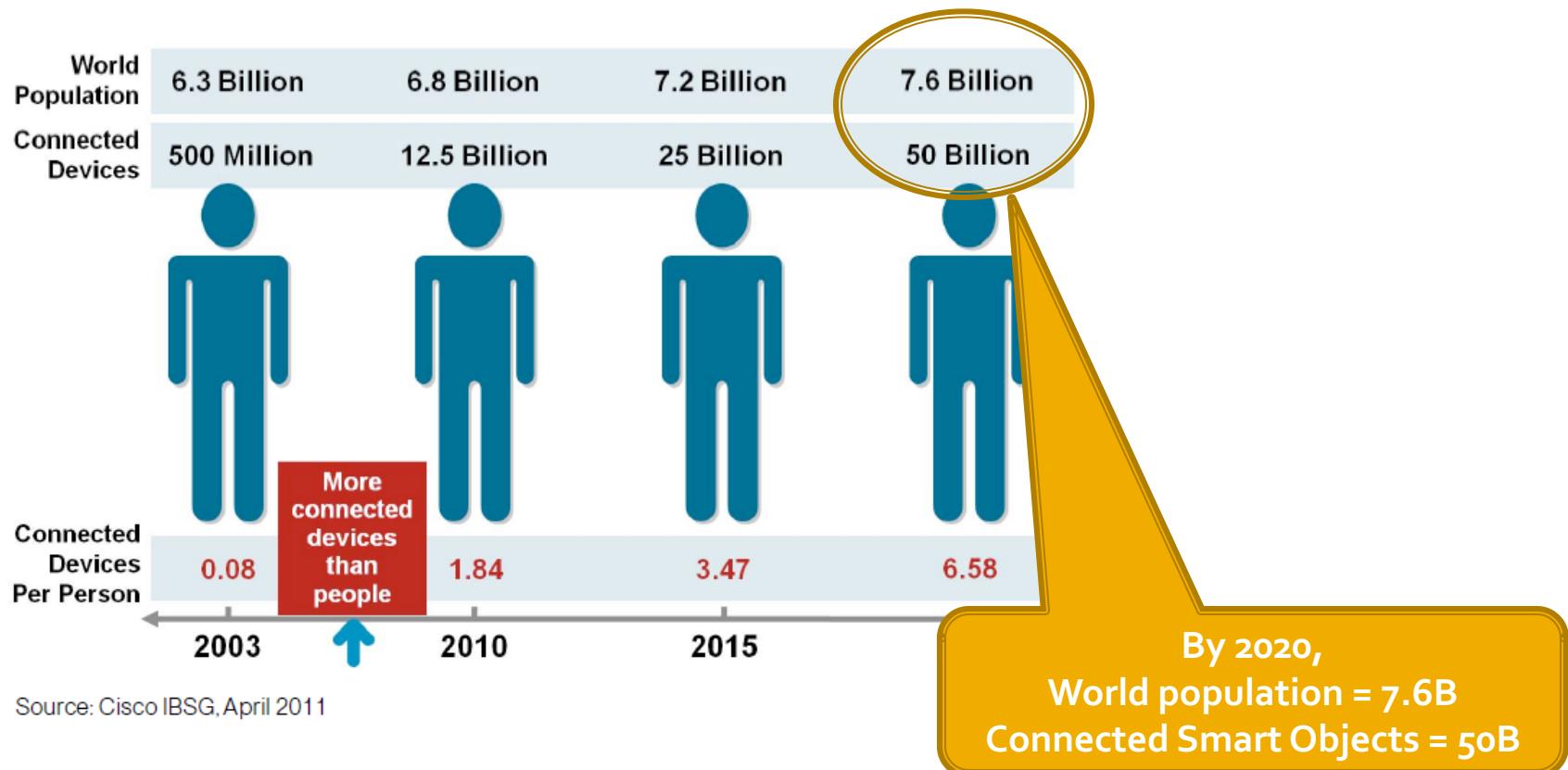
- A Smart Object “knows” about itself
 - has a unique identifier
 - where and how it was made
 - what it is for
 - who owns it
 - how they use it
- Smart objects also
 - Sense and collect info from the environment.
 - Communicate with other objects or systems over network
 - Report their own info and status
 - Receives information to update their own status
- Smart objects are the link between the virtual world and real world.



Examples of Smart Objects

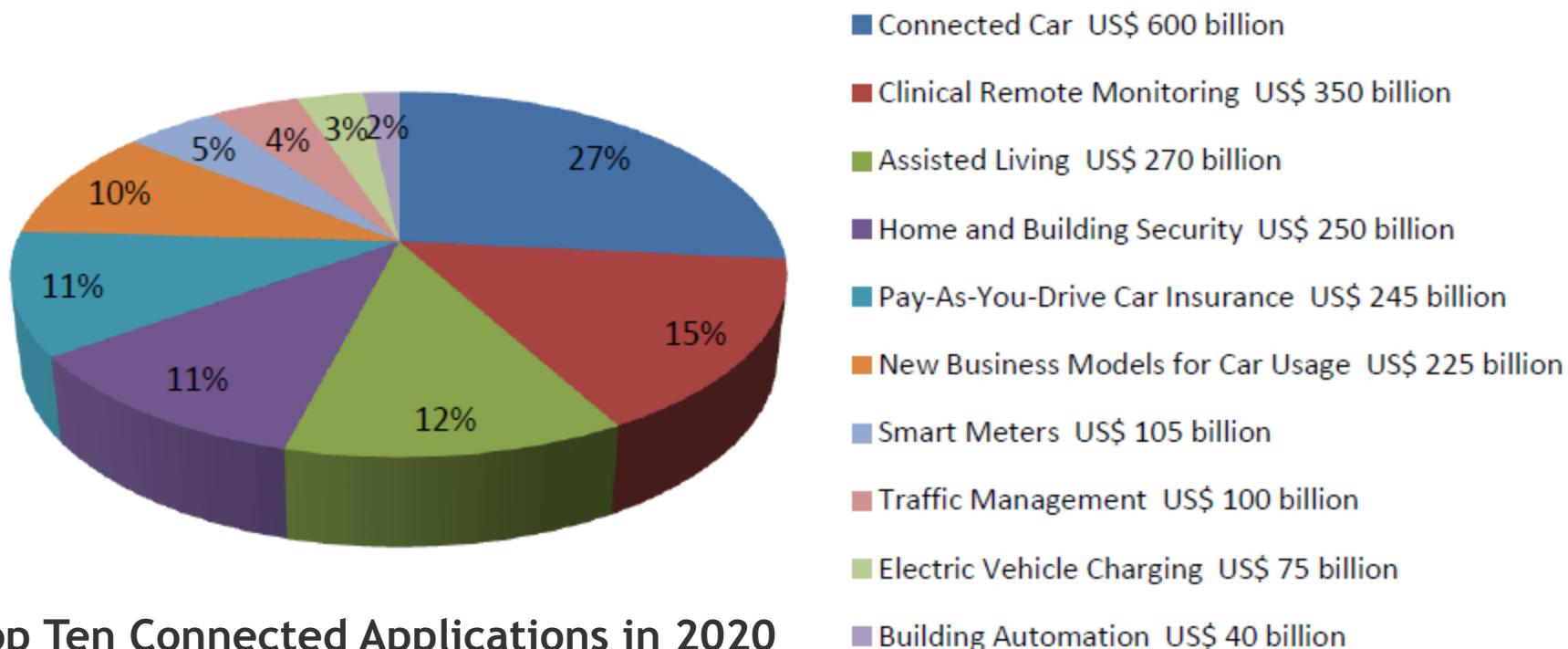
Introduction to Smart Objects

- How many connected Smart Objects are there?



Introduction to Smart Objects

- How many connected smart objects are there?



Top Ten Connected Applications in 2020

Source: Mobile Connectivity in Cars Will Be the Top Connected Application in 2020, GSMA, February 2012 - www.gsma.com/newsroom/gsma-announces-the-business-impact-of-connected-devices-could-be-worth-us4-5-trillion-in-2020/

Smart Objects Applications

■ How will Smart Objects change our world?



Smart Health Care

More personalised healthcare

- Healthcare is shifting toward remote self-monitoring for patients
- Self-monitoring benefits patients by giving them greater freedom and independence in monitoring their health and frees up hospital equipment for the treatment of emergencies.



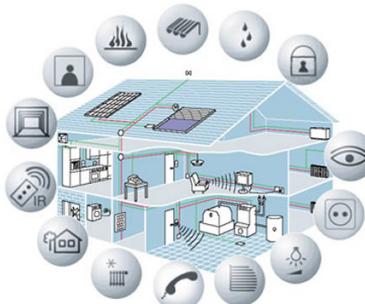
Smart Retail

Hassle free shopping

- Hassle free shopping applications can be used to locate appropriate items for shoppers & provide recommendations of products based on consumer preferences.
- RFID tagged items on shelf offers hassle free self check out when making payment

Smart Objects Applications

- How will Smart Objects change our world?



Smart Home

Personalised home services

- Personalised preferences can pre-set
- Centralised control using common device e.g. smartphone



Smart Logistics

Efficient planning & transportation

- With use of smart object technologies e.g. RFID, goods may be transported without manual intervention from manufacturers to suppliers.
- Forwarding of goods will be made, using intelligent decisions based on information received via readers and positioning systems to optimise transiting routes.

Smart Objects Applications

- How will Smart Objects change our world?



Smart Cities

Efficient use of roads & public facilities

- Vehicles will be equipped with dedicated short-range communication to provide vehicle-to-vehicle (V2V) communications to improve vehicle safety and provide better road visibility for traffic management. See [Video](#)
- In a traffic jam, a car may signal those behind if there is an accident; Intelligent navigation systems will re-route paths to another other crowded roads.



Smart Environment

Environment Monitoring

- Smart Objects equipped with sensors monitors pollution levels and alerts users

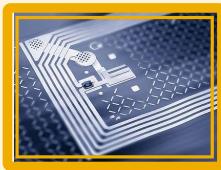
A connected future with IoT



Enabling Technologies for Smart Objects



Miniaturisation of devices



Radio Frequency Identification (RFID)



Big Data & Analytics



Increasing Speed of Communication



Cloud Computing



Internet Protocol (IPv6)

Enabling Technologies for Smart Objects

□ Miniaturisation of devices

① The accelerating pace of change...

Agricultural Revolution → 8,000 years → Industrial Revolution → 120 years → Light-bulb → 90 years → Moon landing → 22 years → World Wide Web → 9 years → Human genome sequenced

10^{16}
 10^{20}
 10^{24}

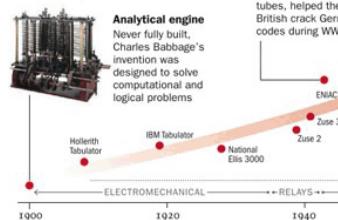
② ...and exponential growth in computing power...

Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years

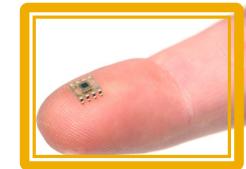
COMPUTER RANKINGS

By calculations per second per \$1,000

Analytical engine
Never fully built, Charles Babbage's invention was designed to solve computational and logical problems



③ ...will lead to the Singularity

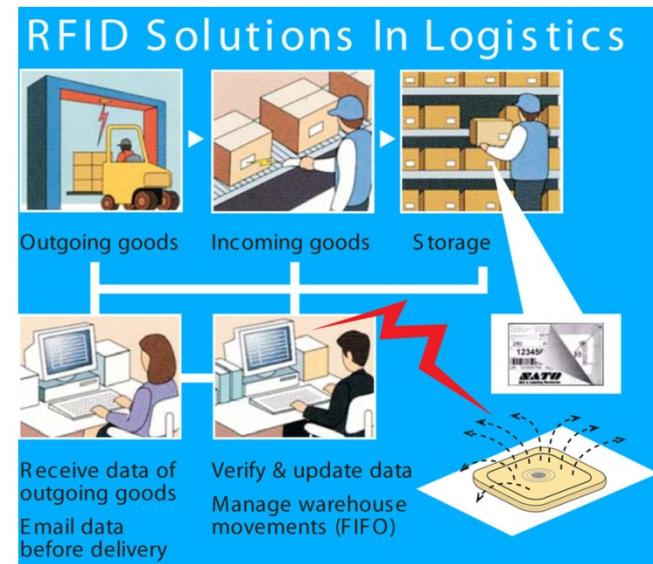
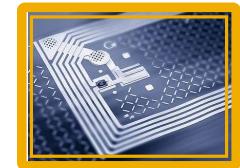


Smart objects are now even embedded in thousands of cows to monitor their health & feeding patterns!

- Doubling transistor density every two years (Moore's Law), making electronics smaller & cheaper
- Small enough to be hidden in physical objects

Enabling Technologies for Smart Objects

- Radio Frequency Identification (RFID)
- Radio Frequency Identification (RFID) sensor technology is used to track and monitor goods in the logistics and supply chain sector.
- With technology developments, new ways of RFID usage will emerge for applications such as automatic meter reading, remote home automation and real-time vehicle tracking.



Enabling Technologies for Smart Objects

□ Big Data & Analytics

- With the growing volume of data from smart objects, good decision making relies heavily on advances in analytic capability technologies to bring out the intelligence in data.
- For example, perform *predictive analytics* on road traffic data could predict with confidence what will happen next so that you can plan and carry out strategies that improve traffic conditions

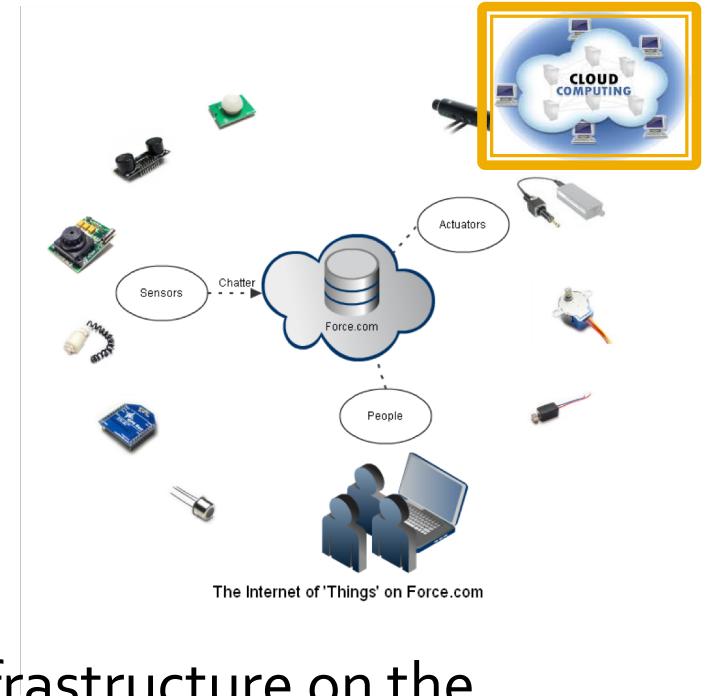


Enabling Technologies for Smart Objects

□ Cloud Computing

□ Billions of data generated by smart objects need to be easily captured and stored, before it can be transformed into valuable knowledge and actionable intelligence

□ Cloud Computing provides an infrastructure on the internet where stored data can be accessed and analysed to improve decision-making and optimization for Internet-connected interactions.



Enabling Technologies for Smart Objects

- ❑ Increasing Speed of Communication
 - ❑ Smart Objects rely on a pervasive communication network to allow “everything and everywhere” connectivity to occur.

- ❑ Internet Protocol (IPv6)
 - ❑ The IPv4 address pool is effectively exhausted, according to industry accepted indicators.
 - ❑ IPv6 is the next Internet addressing protocol that is used to replace IPv4.
 - ❑ With IPv6, there are approximately 340 trillion, trillion, trillion unique IPv6 addresses, allowing the Internet to continue to grow and innovate.



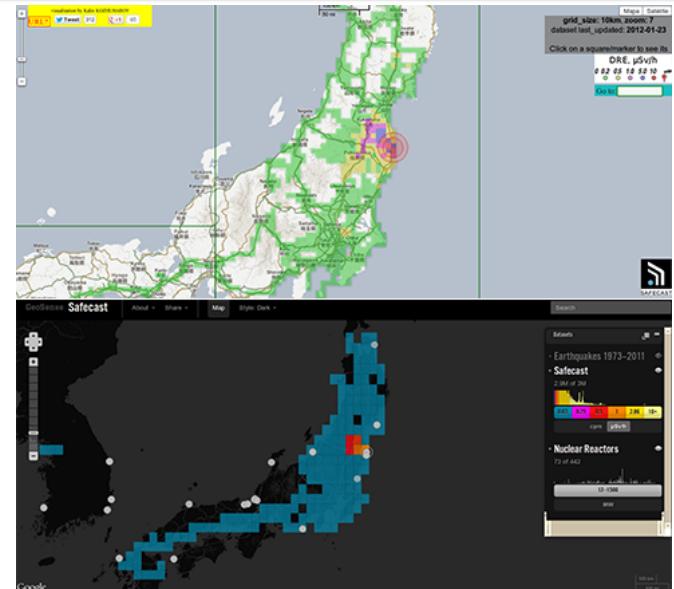
Case Study #1: Fukushima Daiichi nuclear disaster

- **Background:** On 11 March 2011, a 8.9 magnitude earthquake set off a devastating tsunami. The [death toll](#) from the tsunami and earthquake reached 18,000 and the number of disappeared people climbed to over 7,000.
- **Need :** High radioactive releases were recorded in the first few days; 100,000 people had to be evacuated from their homes. There is a urgent need to measure the radiation levels in the surroundings



Case Study #1 : Fukushima Daiichi nuclear disaster

- **Solution:** In just 4 days, [Safecast](#), a global sensor network founded by a group of people started to deploy smart object sensors in Japan to measure the radiation levels.
- The data collection by the sensors would be sent over the Internet, which would then be displayed as data points on a Google map



Smart Object with Radiation Sensor mounted

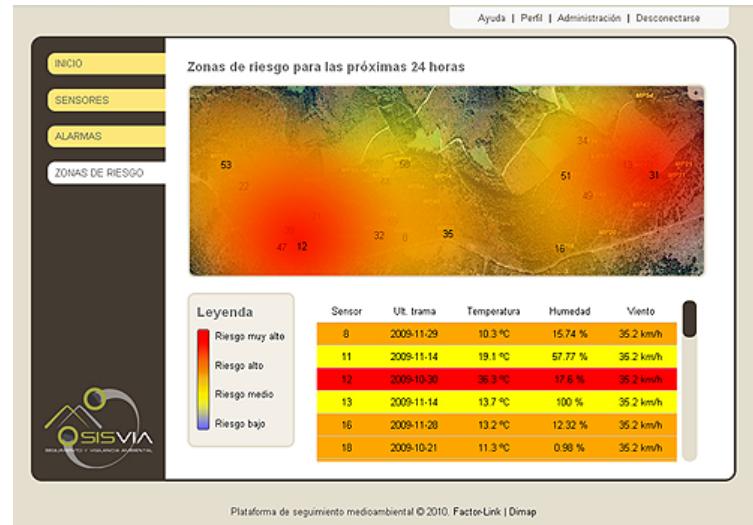
Case Study #2: Detecting Forest Fires

- **Background:** In the summer of 2007, there were more than 80 people died [in Greece](#) and 670,000 acres ($2,711 \text{ km}^2$) burned because of fires.
- **Need :** Apart from preventive measures, early detection of fires is the only way to minimize the damages and casualties.



Case Study #2 : Detecting Forest Fires

- Solution: A company DIMAP-FactorLink developed and integrated a forest fires detection system using the products of Smart Objects. The covered area is about 210 hectares in the North Spain region .The aim was to provide to different organizations of an **environmental monitoring infrastructure**, with capability to have alert management and to deliver early warning alarms.



Data collected from Smart Object shown graphically on map



Smart Object with sensors to measure Temperature, Relative humidity, Carbon monoxide (CO), Carbon Dioxide (CO₂)²⁰

End