Mobile Applications and Web Services

Part II

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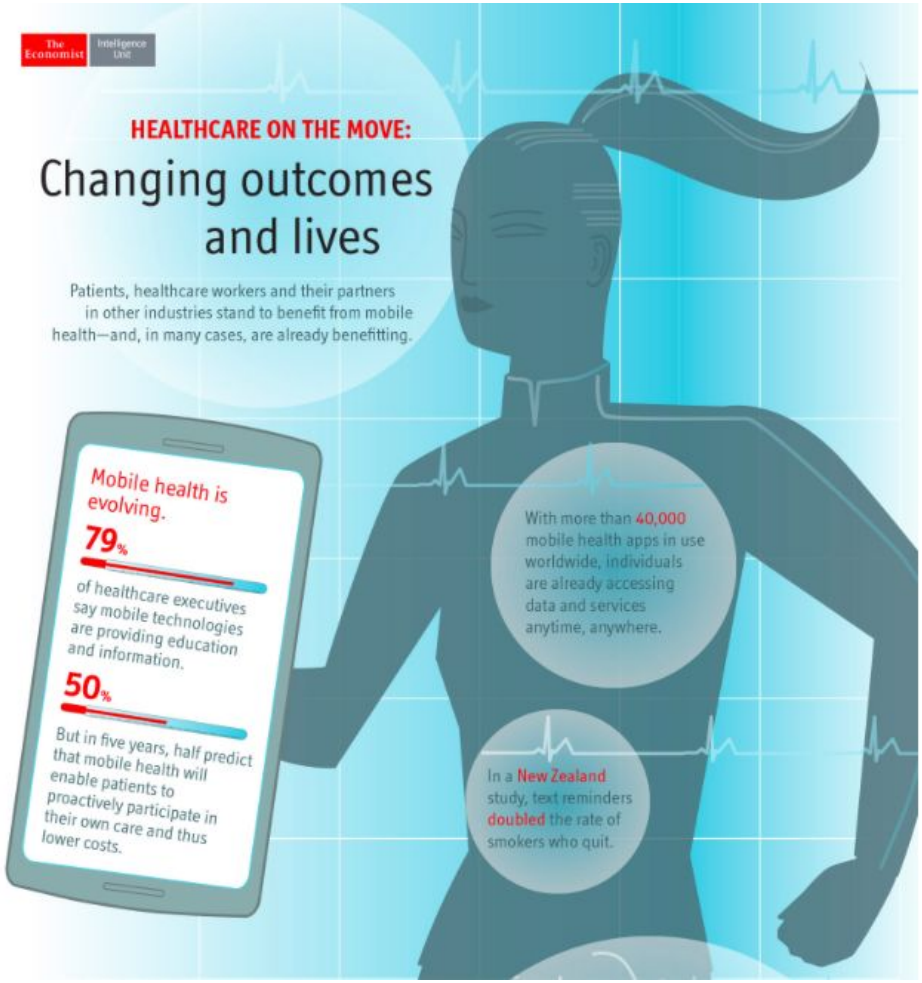
Module Aims

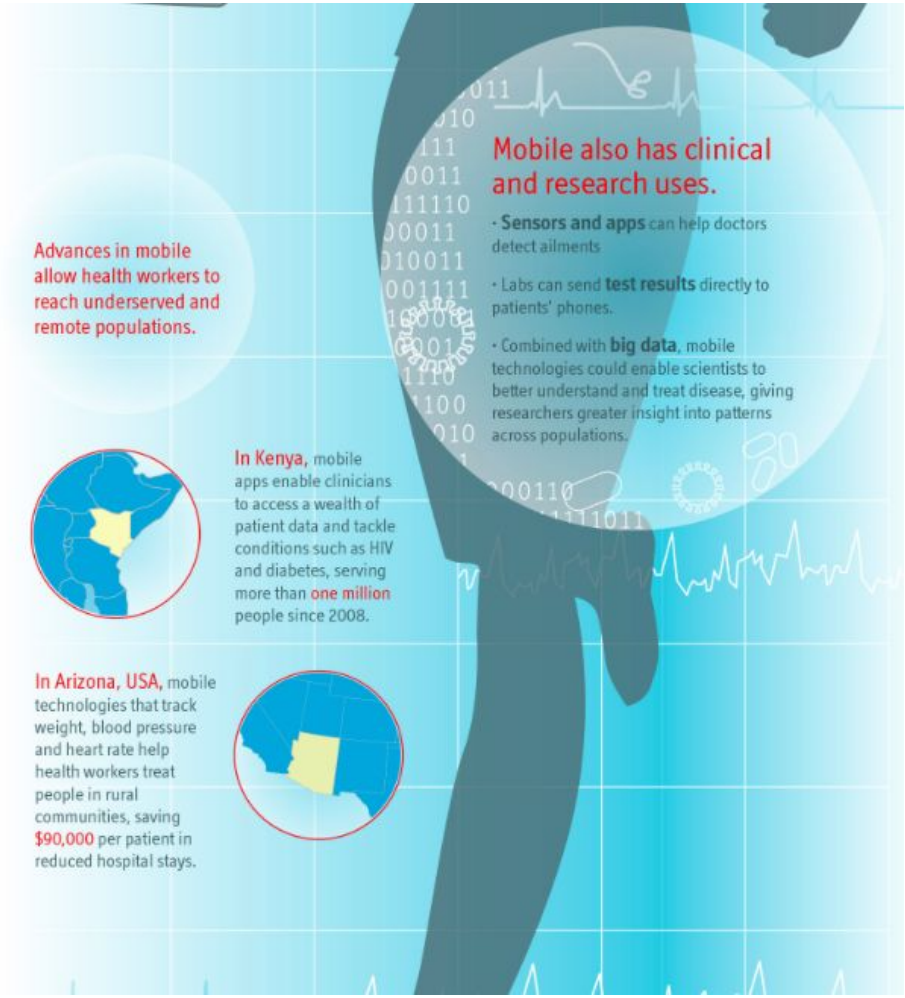
- The aim of the course is to introduce the basics of mobile Web service development, to discuss Web service technologies and how they are building into and are integrated in distributed mobile and Web applications.

- The second aim is introducing the mechanisms for representing, manipulating and querying structured data (XML) and semantic data (RDF/s, OWL), it also includes data mining techniques and the concept of connected services.

- Related toolkits and applications and their use will be discussed.

Mobile technologies in health





Source: The Economist

Wearable technologies

Source: The Economist

Mobile technologies in Business

Communication Networks

- There are large volumes of data,
- Functionalities to process data, and capabilities to interact with entities in the physical and virtual worlds. (services)
- Communication Network:
  - AT&T network as an example[1]
    - Currently carries 18.7 Petabytes of data traffic on an average business day (PB = 10 ^15 bytes),
    - Nearly 5 Billion calls per day.

- Cisco Prediction[2]:
  - 295 Petabyte per month (mobile-to-mobile communications) by 2015,
  - By 2020 this will be 1000 more compared with 2010.

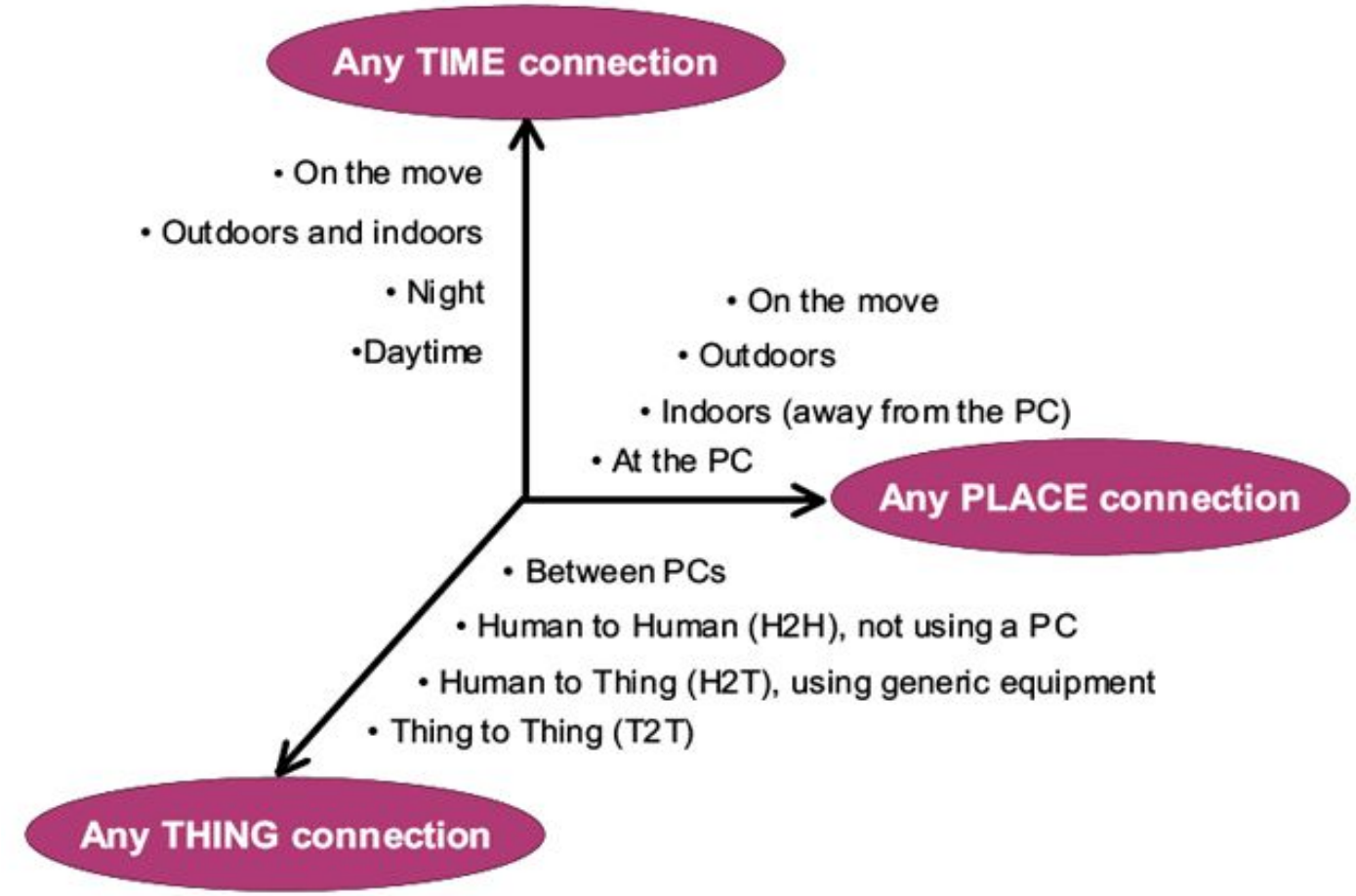
- Challenges include volume, volatility, complexity, reliability, privacy, security, and processing.

[1] source: Mahmoud Daneshmand, AT&T, Intelligent Network Operations and Management, Keynote Talk, IEEE ISCC 2011.
[2] source: DoCoMo and Huawei.

Networks of the Future - Challenges

- Large-scale networks, huge volumes of data, dynamic and sometimes unreliable resources;
  - more dynamic and transient resources and subject to quality changes
  - scalability of the solutions
  - heterogeneity and interoperability issues - more devices are contented, more diversity
  - express-ability and extensibility of semantics and metadata
  - more autonomous processes (integration, aggregation, filtering, ...) are required
  - management of the resources
  - scarcity of: bandwidth, power, energy, addressing and naming schemes, and operation cost.

Future Networks



Source: ITU adapted from Nomura Research Institute

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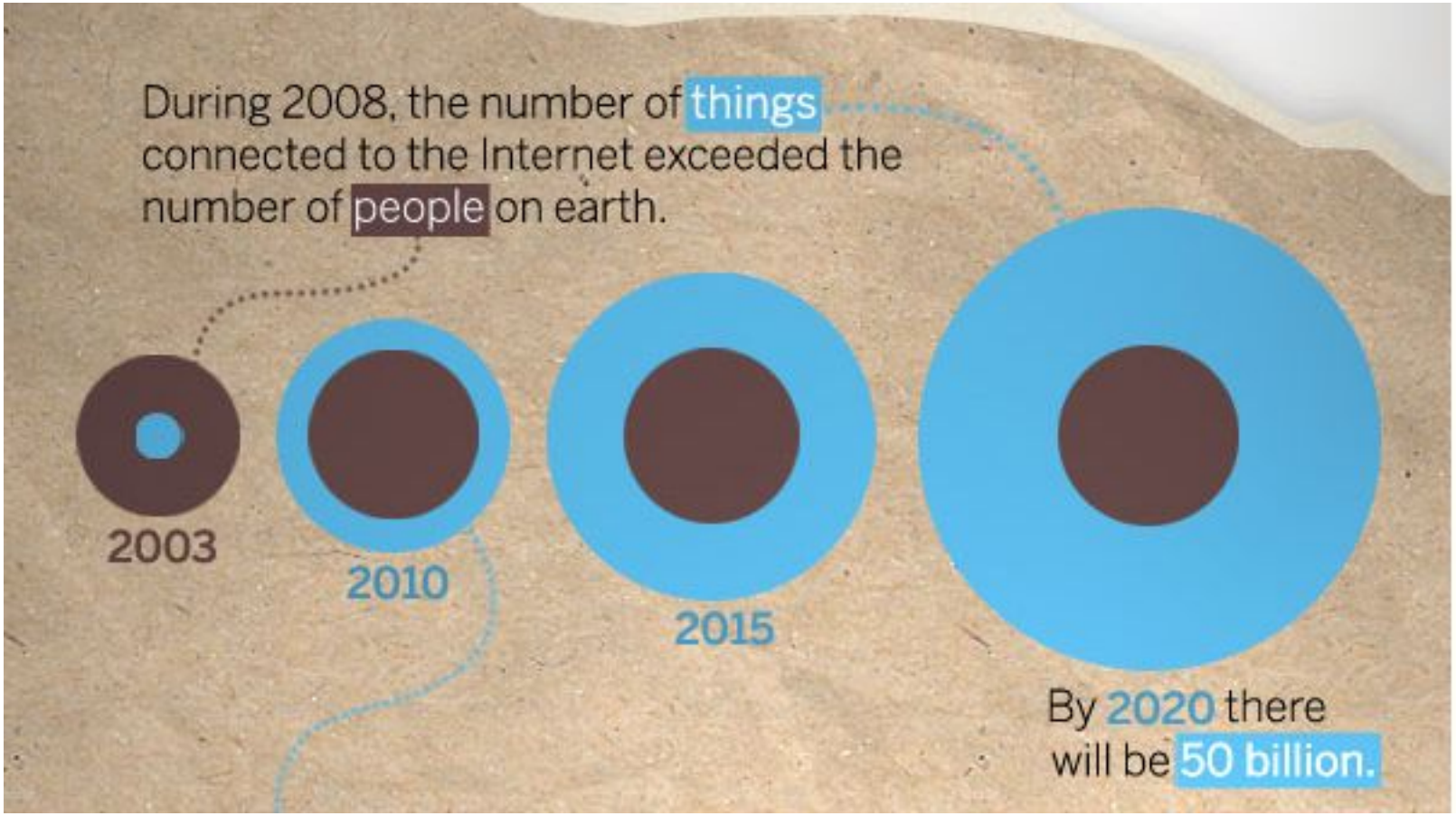
"Thing" connected to the internet



Source: CISCO

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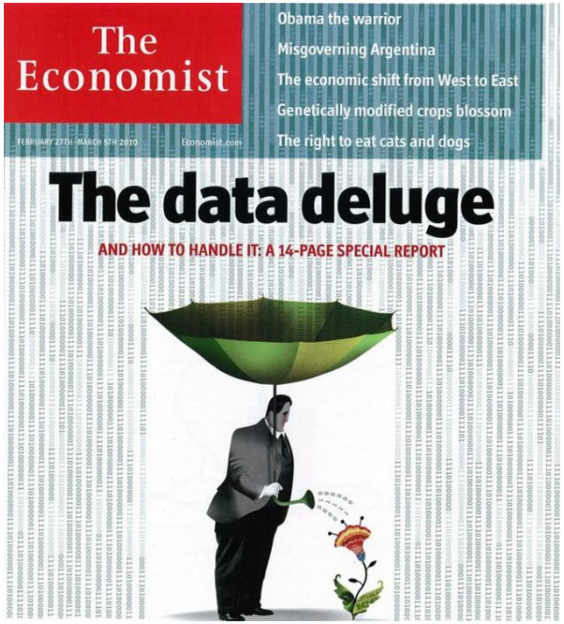
Big Data



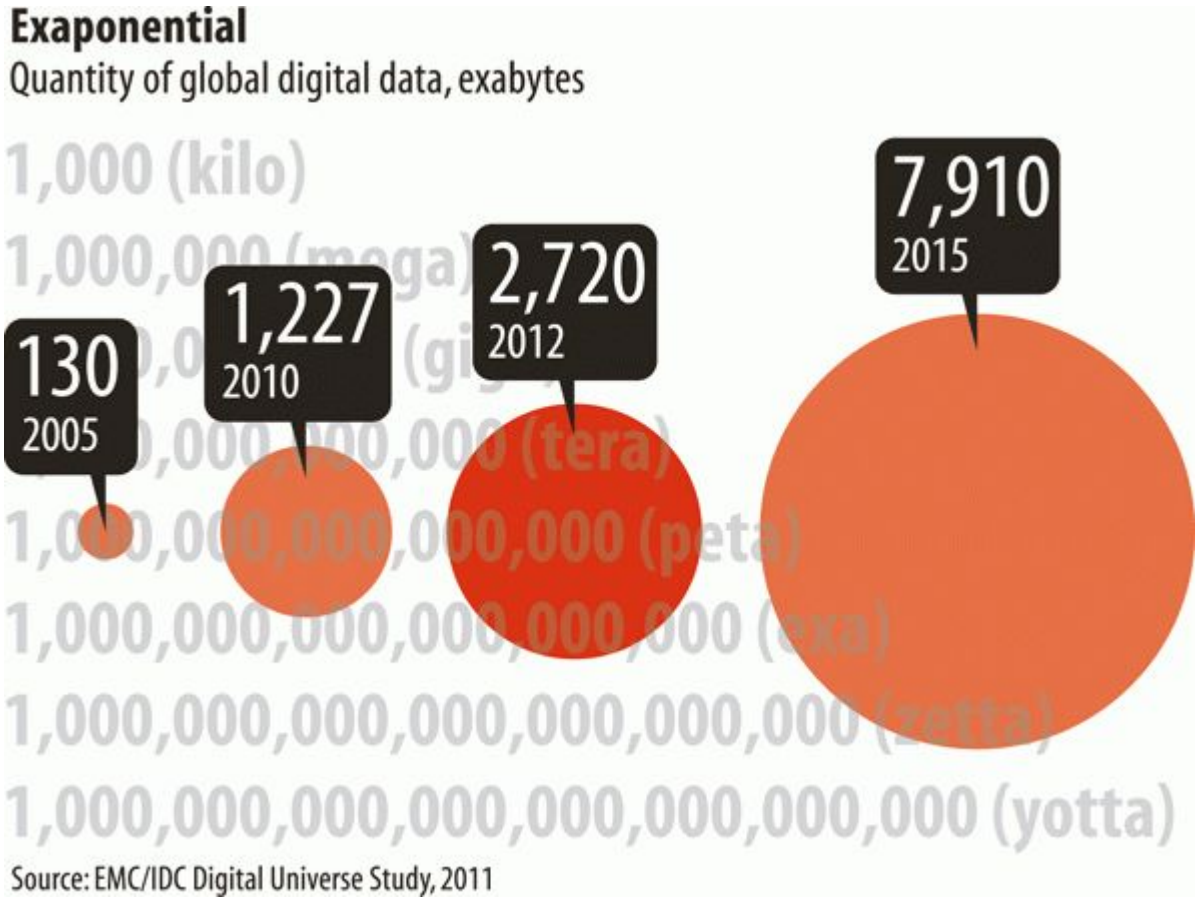


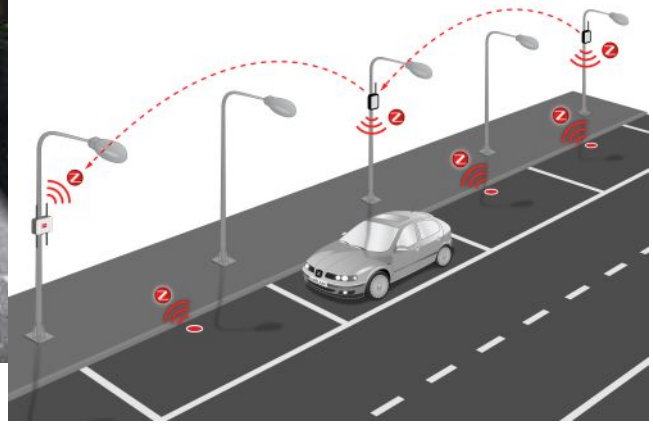
Image courtesy: the Economist

Large number of services

Image courtesy: FTW Forschungszentrum Telekommunikation Wien

But it is not just about volume

… but also Dynamicity and Quality:



How can we efficiently deal with:

- *Large amounts of (heterogeneous/distributed) service?*
- *Both static and dynamic data/service?*
- *In a re-usable, modular, flexible way?*
- *Integrate different types of services*
- *Provide quality-aware and context-aware solutions*

Adapted from: M. Hauswirth. A. Mileo, Insight, National University of Ireland, Galway.

"intelligence is becoming ambient"

Satya Nadella, Microsoft CEO

Services

- We need mobile and pervasive services that are:
  - Flexible
  - Interoperable
  - Reliable
  - Discoverable
  - Support different QoS requirements
  - …
- To support future data/functionality requirements information communication networks

Services on the Web

- Web Services provide data and services to other applications.
- Thee applications access Web Services via standard Web Formats (HTTP, HTML, XML, and SOAP), with no need to know how the Web Service itself is implemented.
- Web services provide a standard means of interoperating between different software applications, running on a variety of platforms and/or frameworks.

The role of metadata

- semantic tagging
- (machine-interpretable) data annotation and resource descriptions
- re-usable descriptions and vocabularies
- resource description frameworks
- structured data, structured query

Motivations- reusability and cost

"To keep my Web site going
I had to sell the building."

Source: Jerry King @ http://www.jerryking.com

Motivations- maintainability

Source: gettyimages

Motivations- interoperability

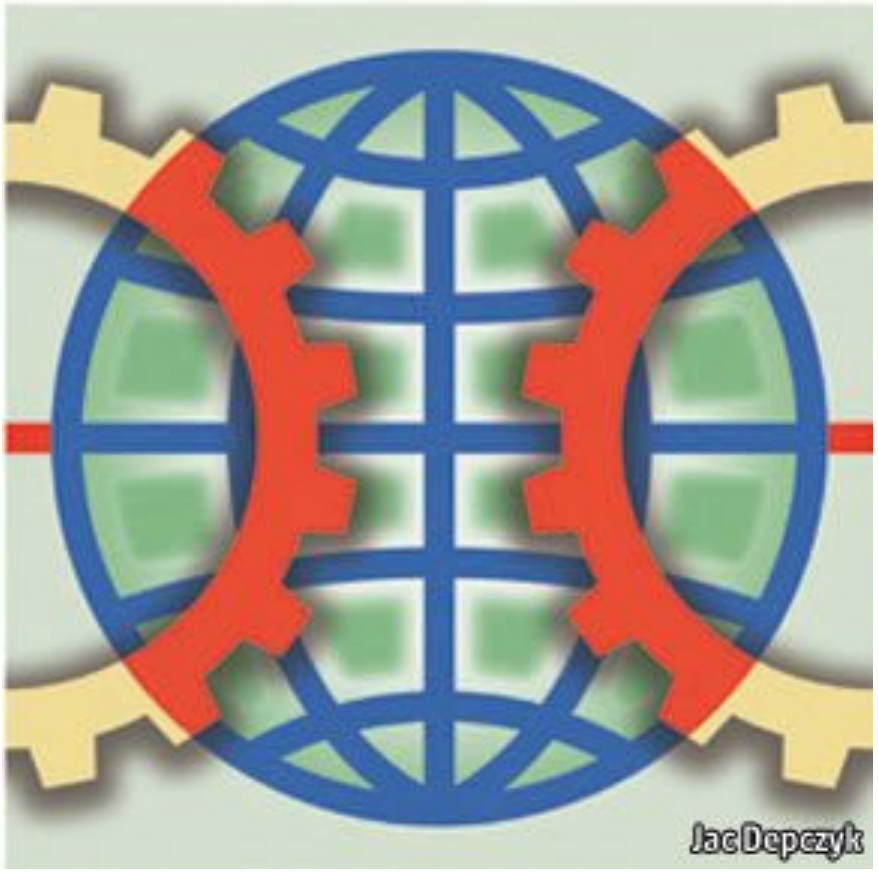


Image: courtesy: Economist

Traditional C/S vs. Web Services

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Traditional C/S

- Within enterprise
- Tied to a set of programming languages
- Procedural
- Usually bound to a particular transport
- Tightly-coupled
- Efficient processing (space/time)

Web Service

- Between enterprises
- Program language independent
- Message-driven
- Easily bound to different transports
- Loosely-coupled
- Relatively not efficient processing

source: Web Services Overview, Sang Shinn, javapassion.com

Cloud-based services

Image courtesy: Economist

Cloud Computing Services

Software
as a service (SaaS)

Platform
as a service (PaaS)

Infrastructure
as a service (IaaS)

Image courtesy , IBM, http://www.ibm.com/cloud-computing/us/en/what-is-cloud-computing.html

Mobile services

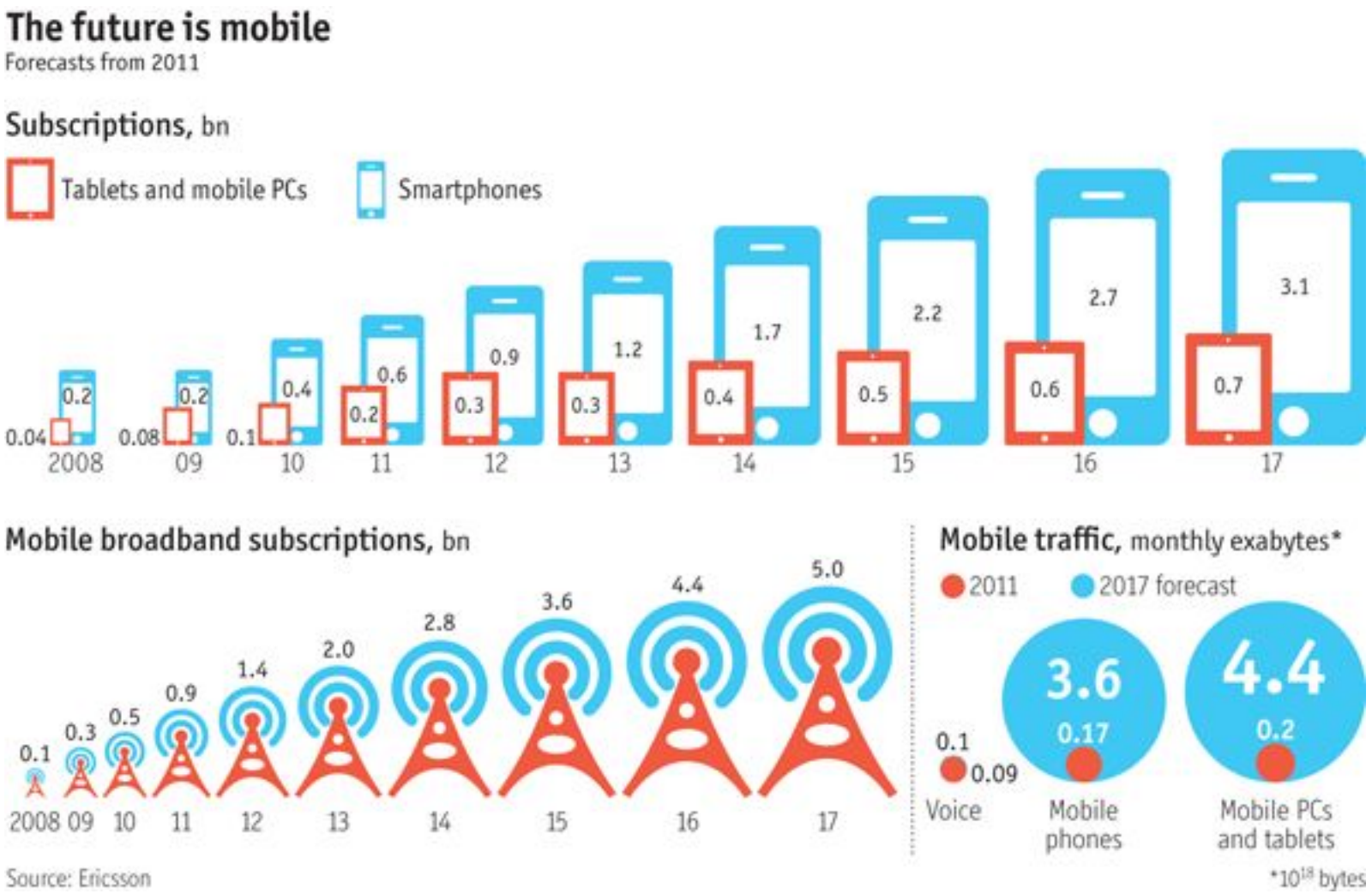

Image courtesy: Economist

Location-based services

Image courtesy: Economist

Topics

- Introduction to Semantic Web and metadata frameworks
  - Semantic web
  - Metadata
  - Ontologies and common vocabularies
  - RDF
- Ontology languages, ontology design and management and Linked-data
  - What is an ontology?
  - Ontology representation
  - Web Ontology Language (OWL)
  - Ontology design and engineering
  - Linked Data
  - RDF/JSON, Turtle

Topics

- Ontology Querying
  - SPARQL query language
- Semantic Web Services and Service Platforms
  - Semantic Web services
  - Service modelling
  - Service composition and business logic
- Cloud-based data and services
  - Software-as-a-service (SaaS)
  - Operator platforms and Network-as-a-Service (NaaS)

Topics

- Mobile Web Services
  - RESTful services
  - Service evolution and delivery in mobile communication systems
  - Wireless Application Protocols
    - Constrained Application Protocol (CoAP)
  - Location-based services
  - Examples and Applications

Questions?