IoT Prospects of Worldwide Development and Current Global Circumstances

Dr. Bilel Jamoussi

Chief Study Groups Department

Telecommunication Standardization Bureau, ITU

www.itu.int/ITU-T/go/IoT

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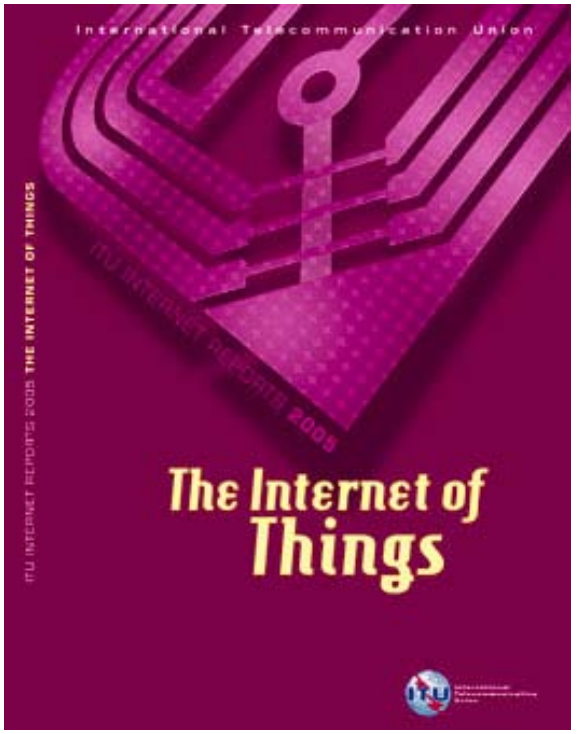
IoT in ITU – already many years experience…

- *ITU 2005 Report The Internet of Things*
  - Describes the visions underlying the IoT
  - Examines enabling technologies
  - Explores the market potential
  - Contemplates the challenges and wider implications
  - Sets out some of the benefits of IoT for developing countries
- ITU-R: Global management of the radio-frequency spectrum
- ITU-T: Global ICT Standards
  - Leading the IoT international coordination



Executive summary available at www.itu.int/internetofthings

The concept

The status of global connectivity

A few examples of applications

The challenges ahead

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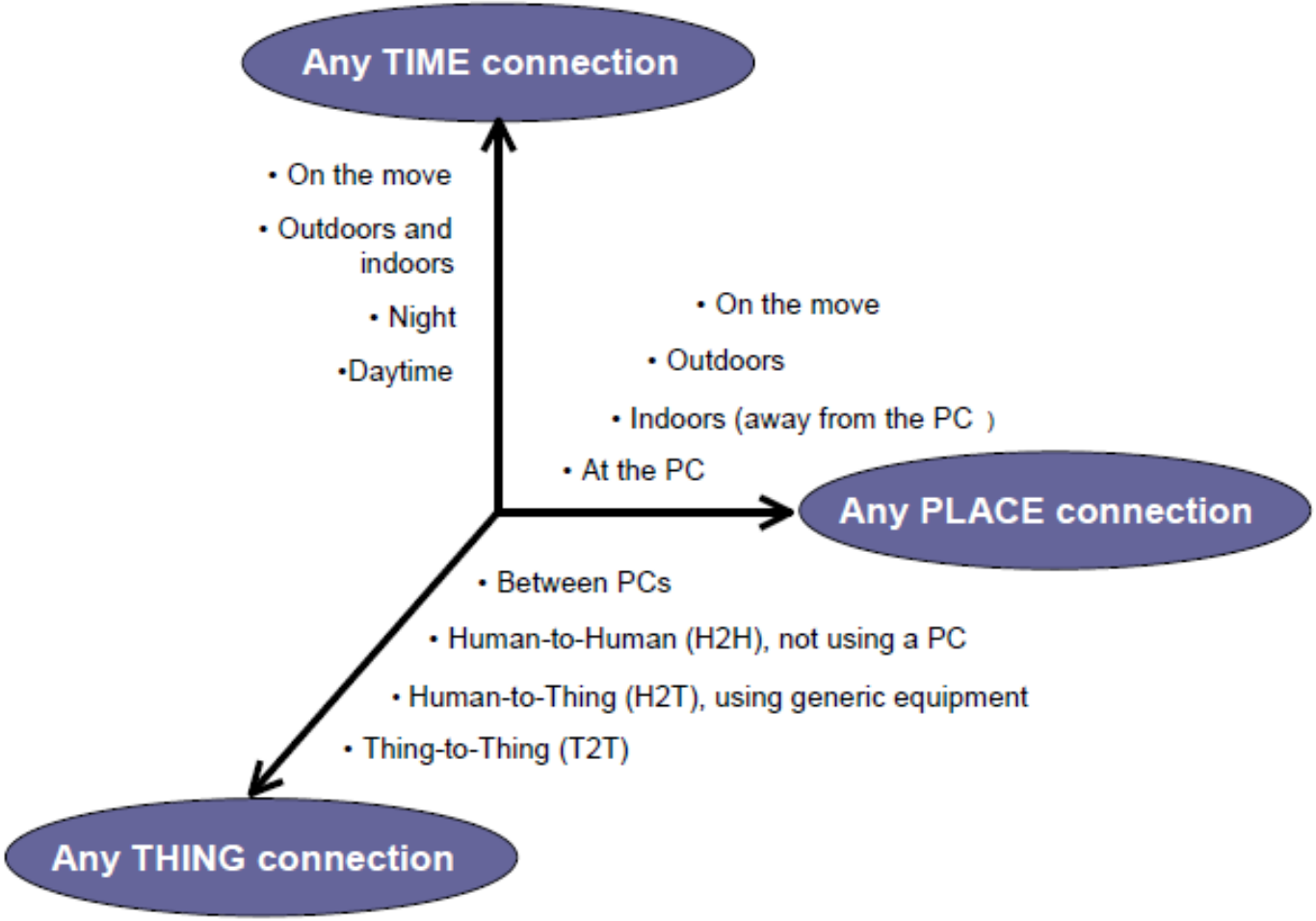
The promise of an "Internet of Things" has been on the spotlight for a long time

- A few definitions:
  - *In computing, the Internet of things, also known as the Internet of objects, refers to* ***the networked interconnection of everyday objects****.* (Wikipedia)
  - *In the 2000s, we are heading into a new era of ubiquity, where the "users" of the Internet will be counted in billions and where humans may become the minority as generators and receivers of traffic. Instead, most of the traffic will flow between devices and all kinds of "things", thereby* ***creating a much wider and more complex Internet of Things****.*
    (From "The Internet of Things", ITU Internet Report 2005)
- The concept is attributed to Auto-ID Center (1999), a research group at the Massachusetts Institute of Technology (MIT).
- Alternative names: "*Ubiquitous computing*" (1991, Mark Weiser) and the "*Internet of objects*"

“The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.”

Dr. Mark Weiser, “father of ubiquitous computing”

The basic idea behind the IOT is the connection of any THING – at any TIME – from any PLACE (…)



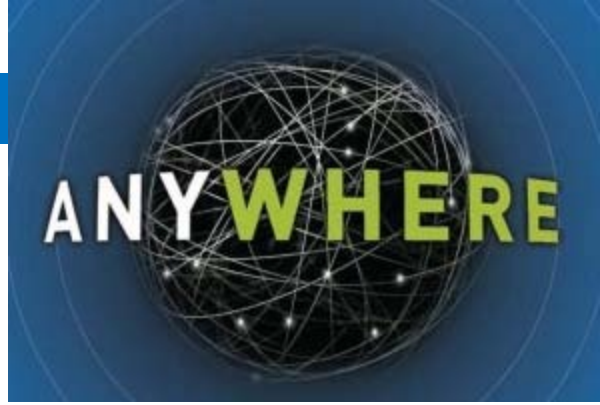
Source: ITU, adapted from the Nomura Research Institute, "Ubiquitous Networking: Business Opportunities and Strategic Issues", August 2004

(…) enabled by a number of technologies that needed to be further developed and deployed at affordable costs

- In particular:
  - ***Connectivity:*** *Ubiquitous access to broadband (e.g. deployment of 3G and 4G networks)*
  - ***Object identification:*** *A simple, unobtrusive and cost-effective system of item identification (e.g. RFID technologies);*
  - ***Real-time information:*** *Authomatized data collection from devices (e.g. sensors);*
  - ***Smart devices:*** *Embedded intelligence in devices (e.g. smart technologies);*
  - ***Small scale****: Advances miniaturization (e.g. nanotechnology)*

The implementation of the Internet of Things has advanced notably from its initial concept

- Over the past years the work of ITU has enabled the advance of the technologies that will enable the Internet of things, mainly:
  - Overseeing the use of wireless spectrum;
  - Working on new standards for networks and services;
  - Promoting affordable access to ICTs at the global level;
- ***In this presentation we will take a look at some of the lessons learned from ITU in relation to the advance of the IOT***



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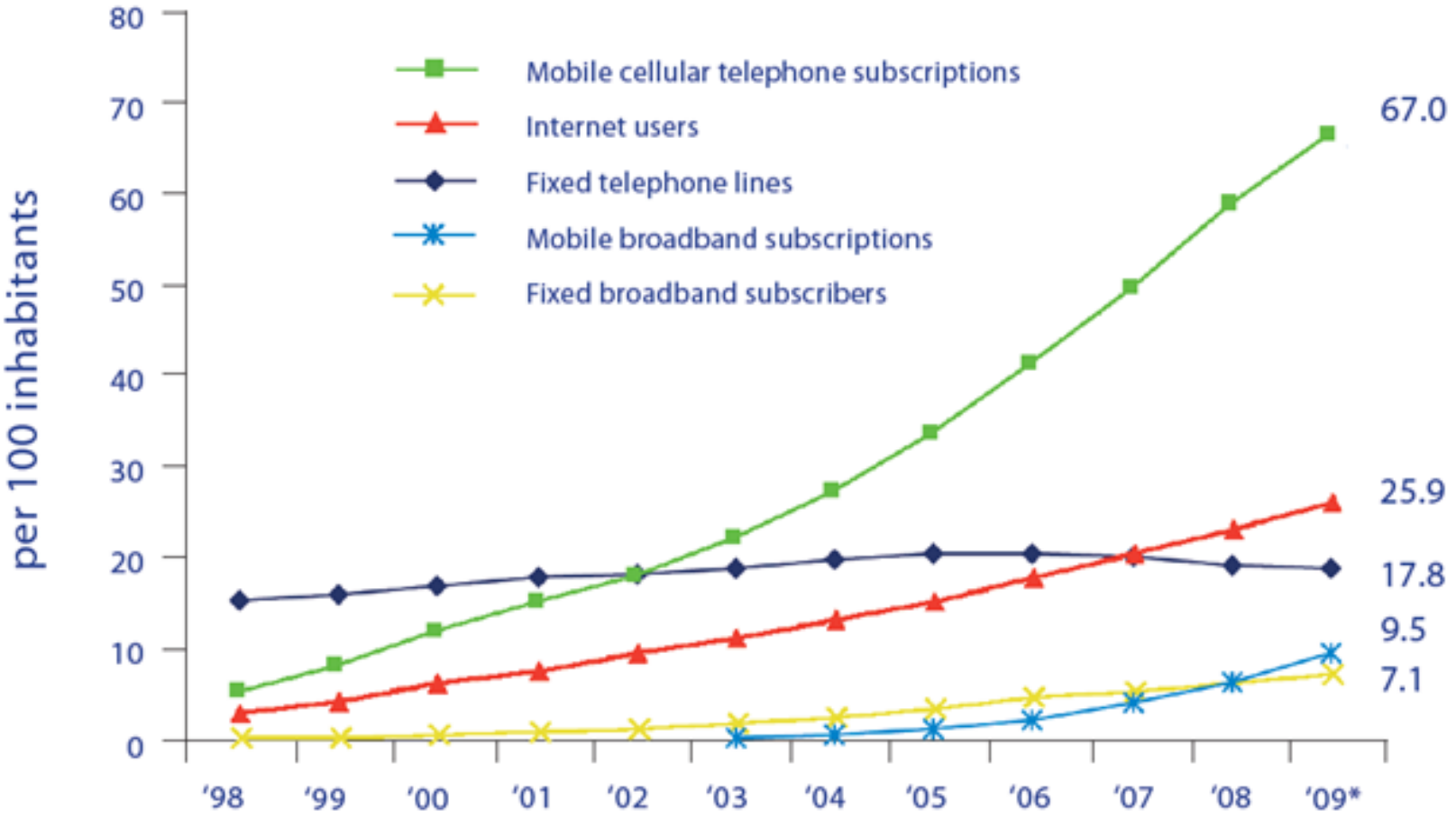
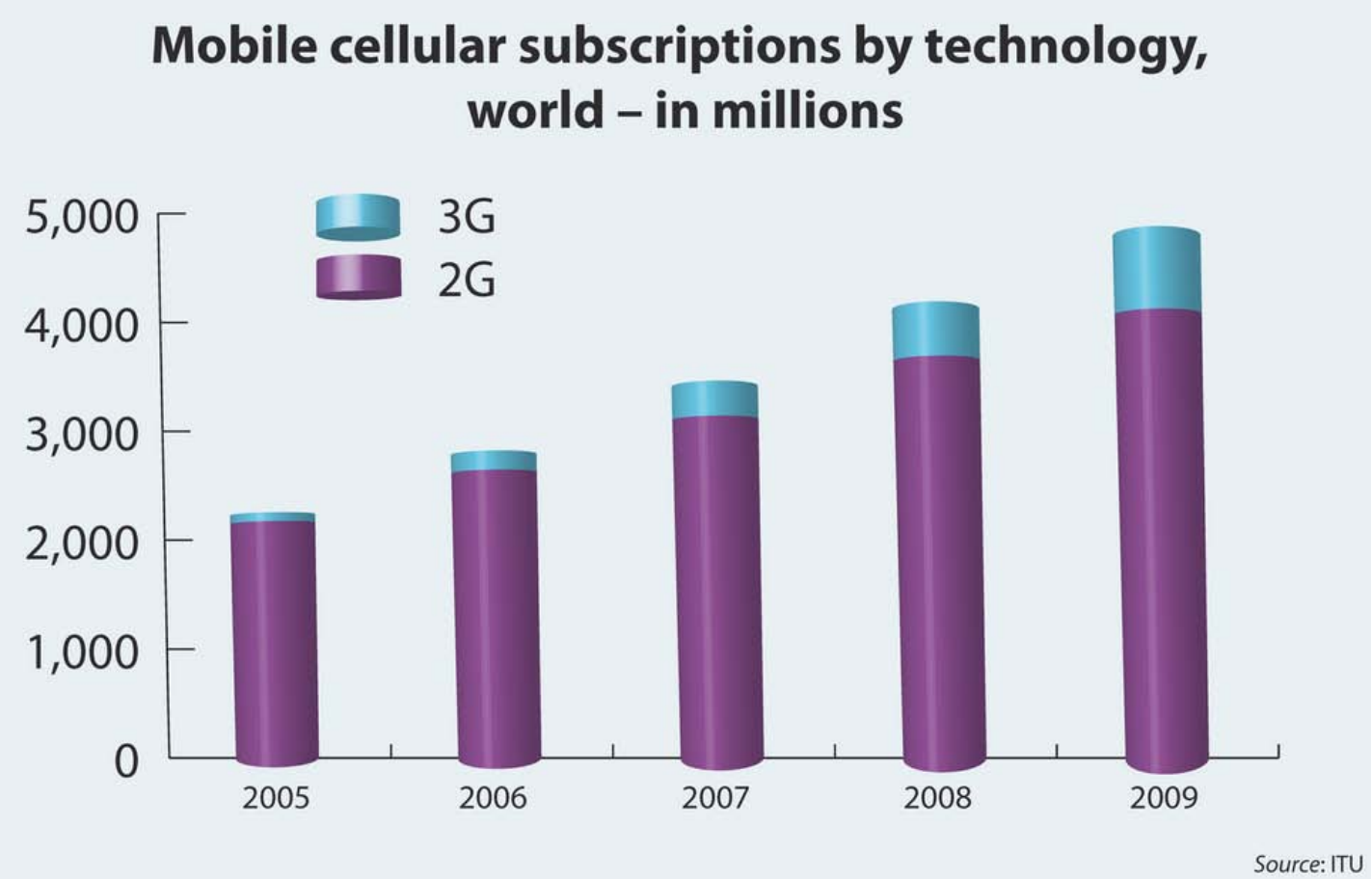
The "mobile miracle" has enabled the connection of 5 billion people worldwide



Source: ITU World Telecommunication/ICT Indicators Database.
* Estimates.

This connectivity is already being used to provide basic wireless communication to enable machine to machine (M2M) communication



(e.g. SMS notifications)

Making of the M2M market one of the fastest growing segments of the mobile industry

- Several telecom regulators are already registering M2M lines as a separate segment, evaluating the introduction of future specific regulations for this segment.

Summary of mobile telephone lines in Spain

(Total population Spain 46.9 M)	**Total lines August 2010** *(millions)*	**Year variation** *(Aug 09 - Aug 10)*
Prepaid	20.2	-4.1%
Postpaid	33.3	6.7%
M2M	**2.0**	**18.9%**
Total mobile lines	55.5	2.9%

Growing 3 times faster than postpaid lines

Source: CMT, Spanish Telecommunication Regulator

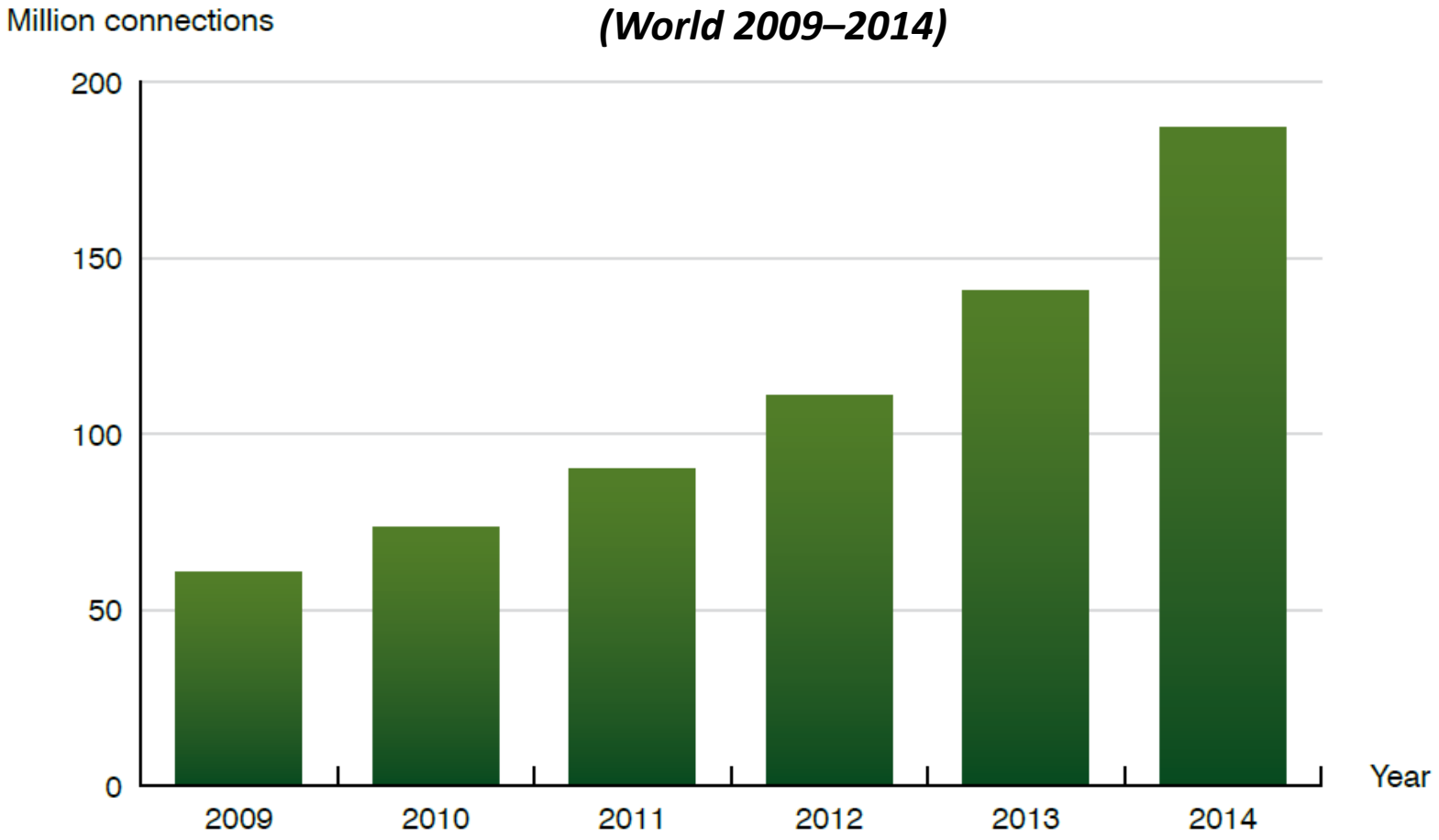
Summary of 2G and 3G technologies used for machine to machine (M2M) communications

	2.5G	3G	Post-3G / 3.5G	Pre-4G / 3.9G	4G
Technologies	GPRS CDMA-2000 1xRRT	UMTS (W-CDMA) CDMA-2000 1x EV DO CDMA-2000 3x TD-SCDMA TD-CDMA WiMAX	HSPA HSPA+ WiMAX	LTE WiMAX	LTE-Advanced WiMAX
Data rate (Max limit)	144kbps	7.2Mbps	21Mbps	Dwn:100Mbps Up: 50Mbps	Dwn:1Gbps Up: 100Mbps
Channel	Voice / data (Single Channel)	Voice & data (Dual Channel)	Data	Data	Data

Source: ITU, internal research

The expected growth in M2M connections shows that the connectivity aspect of the Internet of Things is already resolved and being used by the industry

Cellular M2M network connections (World 2009–2014)



Source: Berg Insight

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Areas of IoT Investment

M2M

RFID

USN

Ambient Intelligence

NFC

Nanotechnologies

Access network, air interfaces, applications and services, data encoding, data exchange, data protection and privacy, data synchronization, device interfaces, environmental regulations, frequency allocation and regulation, health and safety regulations, Internet technologies, interoperability, location protocols, middleware, mobility support, naming and addressing protocols, network security, RFID tags, routing protocols, sensors, smart cards, *and many more*

Logistics and Supply Chain Management

Transport

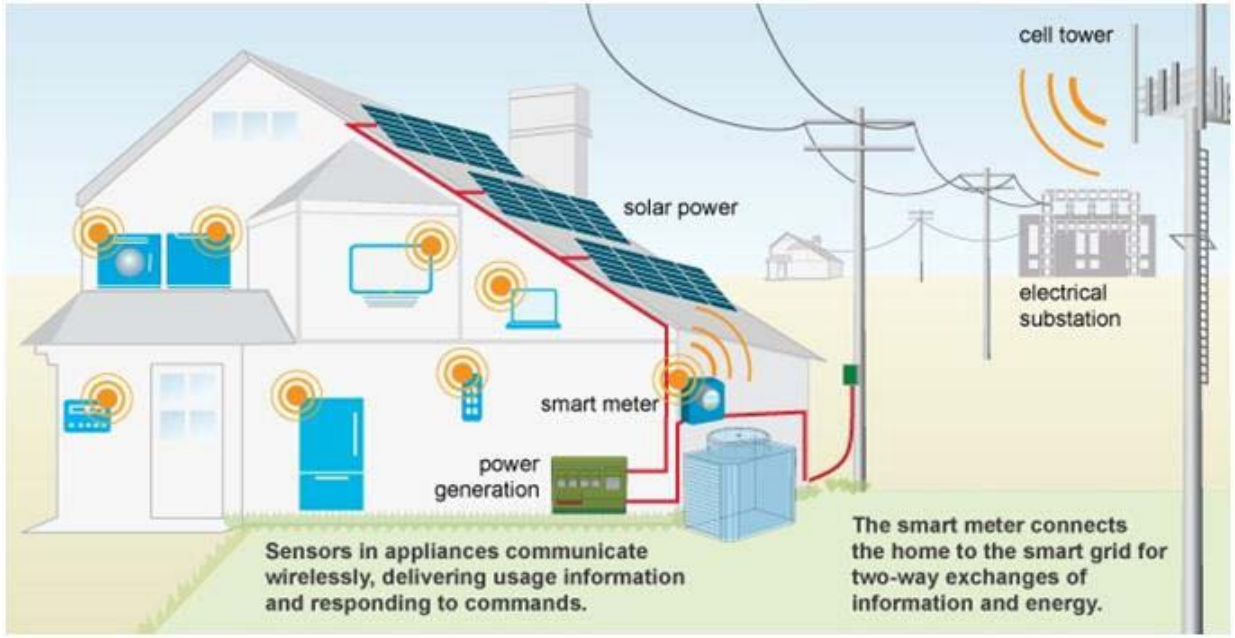
Health

Environment

Consumer electronics and appliances

Smart grids is one of the most expected applications of the IOT

- Smart grids can be defined as electricity networks that can intelligently integrate the behavior and actions of all users connected to it - generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies.
- Through the use of smart grids buildings can be made more energy efficient, reducing CO2 emissions.



ITU-T is already working on smart grids

- Scope of the ITU-T Focus Group on Smart Grids (FG Smart).
  - identify potential impacts on standards development;
  - investigate future ITU-T study items and related actions;
  - familiarize ITU-T and standardization communities with emerging attributes of smart grid, and
  - encourage collaboration between ITU-T and smart grid communities;
- Fourth meeting: Chicago, USA, 29 November – 3 December 2010
- More information at: http://www.itu.int/en/ITU-T/focusgroups/smart/

Significant work is also being done on intelligent transport systems

- The use of ICTs in transport system can enable some of the following applications:
  - Effective journey management, avoiding congestion and improving traffic control and navigation;
  - Automatic emergency calls in case of accidents , saving lives in emergency situations;
  - Remote diagnostics of systems, improving fleet management and reducing maintenance costs;
  - Tracking of vehicles, improving logistics and reducing stolen vehicles.
  - Reducing drivers distraction, improving road security;

ITU-T is already working on car communications, an area that can prepare the field for intelligent transport systems

- Scope of the ITU-T Focus Group on Car Communication (FG CarCom).
  - In car communication: Quality parameters and testing methods
  - Interaction of car hands free systems with the radio channel
  - Special requirements/testing procedures for speech recognition systems in cars
- Next meeting: Kyoto, Japan, 11-12 November 2010
- More information at: http://www.itu.int/en/ITU-T/focusgroups/carcom/

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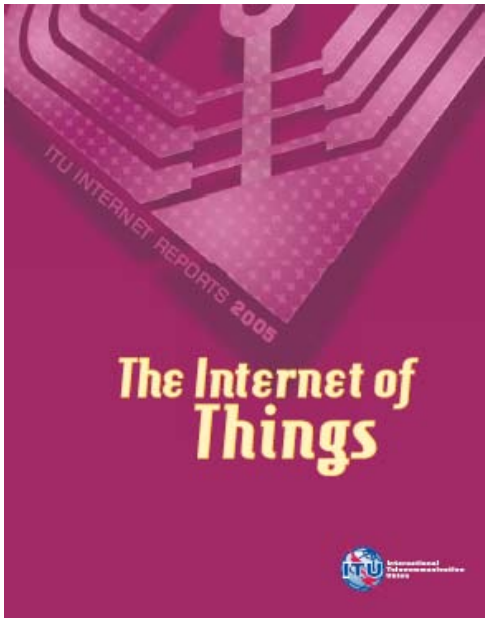
Despite the advances made in networks and services, there are many challenges that still need to be addressed

- ***Technology is fragmented:*** global collaboration is needed to advance standardization and harmonization;
- ***Users are concerned*** about privacy and socio-ethical implications of the the use of tracking and geo-location: users have to be made aware of the benefits of the IOT.
- These challenges were already identified by ITU in 2005



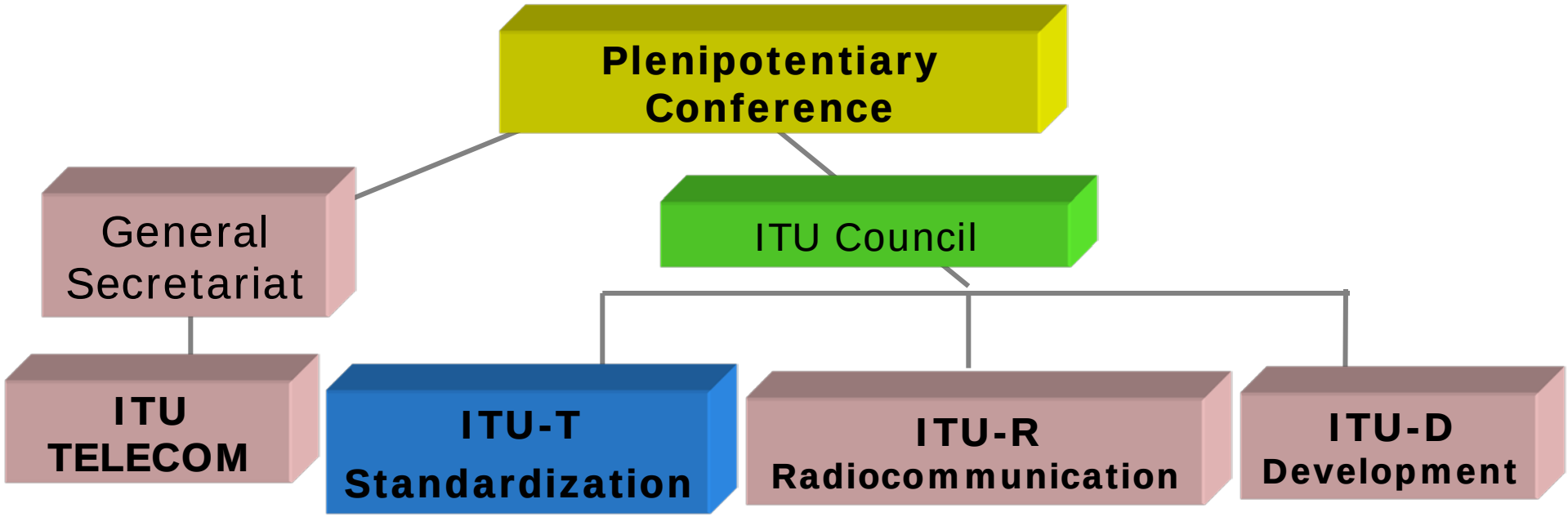
IoT standardization landscape

→ Increasingly fragmented IoT standardization landscape

ITU-T for all your IoT needs

- IoT experience over many years Leading the international coordination with relevant IoT standards bodies
- Where private sector meets government - developing standards and policy together
- The place to drive and influence new global standards
- Standards making the fast way… with well established policies and processes
- One-stop-shop solution

ITU Structure



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Introduction to ITU

- Founded in 1865, it is oldest specialized agency of the UN system
- Standards making one of the ITU's first activities
- 192 Member States, 700+ private sector entities
- HQ Geneva, 11 regional offices, 760 staff / 80 nationalities
- Named as one of the world's ten most enduring institutions by Booz Allen

Joint Coordination Activity (JCA-NID)

More information at www.itu.int/ITU-T/jca/nid

- High-level coordination group on IoT standardization
  - Coordination of all IoT activities within ITU
  - External coordination with key players in IoT standards, including liaisons with

- Deliverables to harmonize and facilitate work among the key players:
  1. Generic architectural model
  2. Standardization roadmap
  3. Terms and definition documents

- Deliverables have assisted to close gaps in standardization and contributed to facilitate harmonization

- Name change: JCA-NID → JCA-IoT (proposed to next TSAG)

IoT in ITU-T

	ITU-T Study Group	Study Group name	Activities related to IoT
Current Standards Activities	SG 2	Operational aspects of service provision and telecommunications management	Numbering, naming and addressing
	SG 3	Tariff and accounting principles including related telecommunication economic and policy issues	
	SG 5	Environment and climate change	
	SG 9	Television and sound transmission and integrated broadband cable networks	
	SG 11	Signalling requirements, protocols and test specifications	Testing architecture for tag-based identification systems and functions
	SG 12	Performance, QoS and QoE	
	SG 13	Future networks including mobile and NGN	NGN requirements and architecture for applications and services using tag-based ID
	SG 15	Optical transport networks and access network infrastructures	
	SG 16	Multimedia coding, systems and applications	Requirements and architecture for multimedia information access triggered by tag-based ID
	SG 17	Security	Security and privacy of tag-based applications
Pre-standards	Focus Groups	Smart Grid	Smart metering, M2M
		Cloud Computing	Cloud network requirements , e.g., for IoT
		Future Networks	Describe future networks underlying the IoT
		Car Communication	

Sample list of ITU-T work related to IoT standardization

SG13	**Y.2213**, NGN service requirements and capabilities for network aspects of applications and services using tag-based identification	**Approved**
SG13	**Y.2016**, Functional requirements and architecture of the NGN for applications and services using tag-based identification	**Approved**
SG16	**F.771**, Service description and requirements for multimedia information access triggered by tag-based identification	**Approved**
SG16	**H.621**, Architecture of a system for multimedia information access triggered by tag-based identification	**Approved**
SG17	**X.1171**, Threats and Requirements for Protection of Personally Identifiable Information in Applications using Tag-based Identification	**Approved**
SG16	**H.IDscheme**, ID schemes for multimedia information access triggered by tag-based identification	**On going work**
SG16	**H.IRP**, ID resolution protocols for multimedia information access triggered by tag-based identification	**On going work**
SG11	**Q.nid-test-arch**, Testing architecture for tag-based identification systems and functions	**On going work**

ITU can provide a forum to discuss these challenges, produce global standards and find global solutions to advance the Internet of Things and extend its benefits globally.

To Join ITU-T:

http://www.itu.int/ITU-T/membership/

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Bilel Jamoussi
Chief, Study Groups Department
ITU Telecommunication
Standardization Bureau

Please feel free to contact me!
E-Mail: Bilel.Jamoussi[at]itu.int
Tel: +41 22 730 63 11