

Ubiquitous and Secure Networks and Services

Redes y Servicios Ubicuos y Seguros

Unit 1: Introduction to Ubiquitous Services

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UNIT 1: Introduction to Ubiquitous Systems

UBIQUITOUS/PERVASIVE COMPUTING

Ubiquitous Computing

Mark Weiser

(1952-99, Xerox PARC)

“Ubiquitous computing is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user.”

[CoACM 1993]

Pervasive Computing

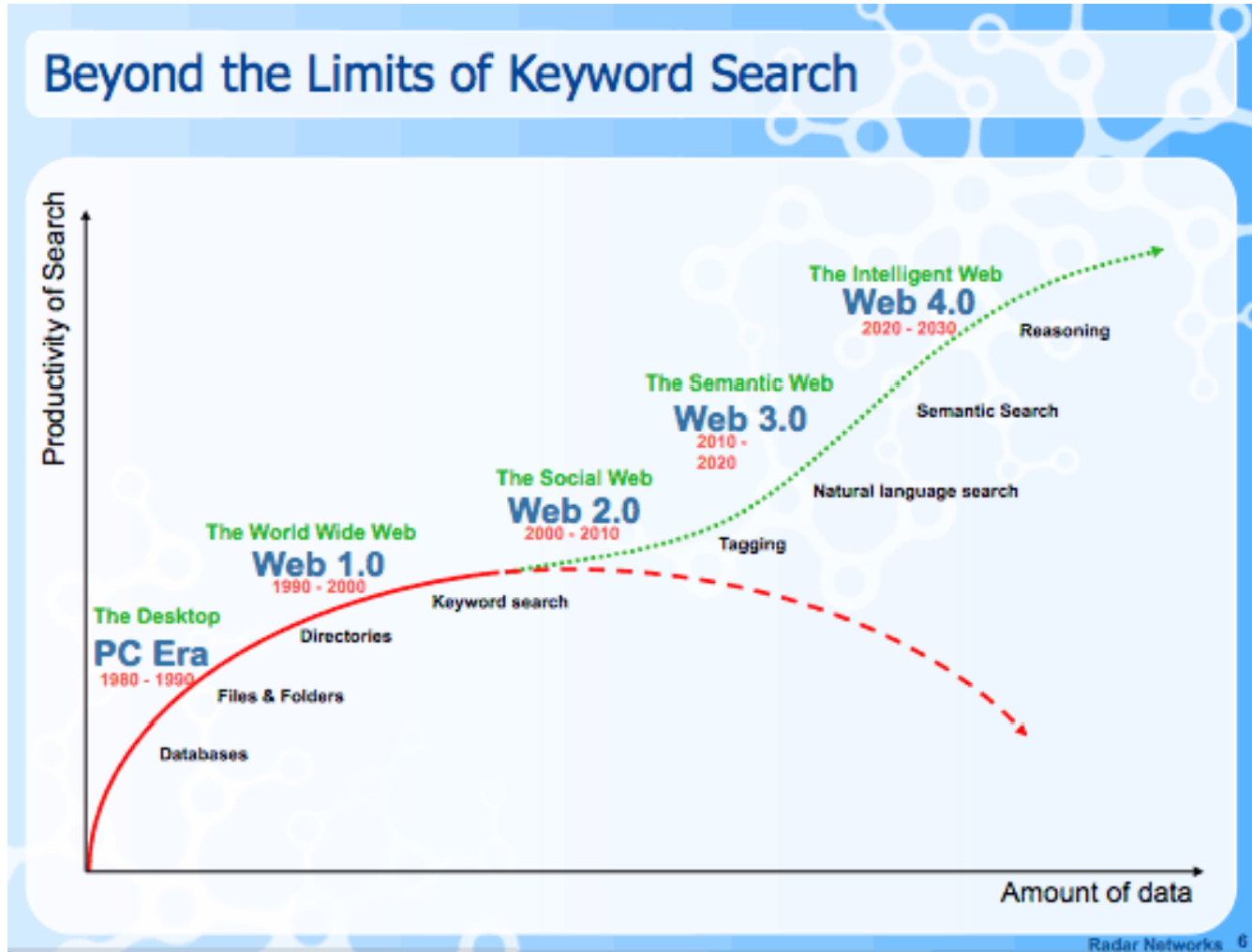
Definition

Pervasive computing is the trend towards increasingly ubiquitous (another name for the movement is *ubiquitous computing*), connected computing devices in the environment, a trend being brought about by a convergence of advanced electronic – and particularly, **wireless** - technologies and the Internet.

[SearchNet]

Pervasive computing devices are not personal computers , but very tiny - even invisible - devices, either mobile or embedded in almost any type of object imaginable, including cars, tools, appliances, clothing and various consumer goods - **all communicating through increasingly interconnected networks.**

Internet Evolution



Nova Spivack. Making Sense of the Semantic Web.
<http://www.slideshare.net/syawa/nova-spivack-semantic-web-talk>.
 Used under the Creative Commons License.

[Spivak]

Internet Generations

1st Generation <i>Research Network</i>	Early 1970 - 1995	Networks for professionals (researchers and computer engineers). Defense (ARPANET) in the late 70s. Academia (CSNET/NSFNET) in the late 80s. Commercial
2nd Generation WWW & QoS	1995 - 2005	Information infrastructure for general people QoS control, Mobility, Multicast, Security, Terabit routers
3rd Generation QoL	2005 -	Ultra-broadband Ubiquitous computing Robust and secure

Technology Issues of Current Internet

Technology	Description
Broadband	Photonic network, IP over WDM
High-performance Router	Tera-bit router
QoS Control	DiffServ, MPLS, Traffic engineering, Queue management
Multicast	QoS IP Multicast, Multicast using AP layer
Address-space Extension	IPv6 including security and QoS control
Mobility Control	Mobile IP + Service continuity/Media handover
Security	Encryption, AAA (Authentication, Authorization and Accounting), Security Protocols (IPSec, SSL, PKI, S-MIME)

Thechnology Issues of 3rd Generation Internet

Technology	Description
Ultra broadband	Petabit routers
Ubiquitous Computing	PAN (Personal Area Network) HAN (Home Area Network) Seamless connectivity <ul style="list-style-type: none"> • Heterogeneous networks • Terminals Adaptively-customized/personalized services Contest awareness
Robust and secure	Autonomous network management at fault occurrences Protection against cyber attacks

Ubiquitous Systems features

- ❑ Computers extremely more ubiquitous than persons
 - Pervasive Computing
- ❑ Not Aware of Computers
 - Calm, Invisible, Implicit, Proactive Computing
- ❑ Sensing
 - Sentient, Perceptual, Ambient Computing
- ❑ Mobility Support
 - Mobile, Nomadic Computing

UNIT 1: Introduction to Ubiquitous Systems

NETWORK ASPECTS AND DEPLOYMENT IN US

Ubiquitous Networks

Definition

- Computing devices embedded in almost everything around us.
 - Platforms and networks which interconnect them.
 - User devices which make use of and act on the available information.

[JapanMPM]

Network technologies for Ubiquitous Systems

- Wide-area cellular network.
- Wireless LAN.
- Home network.
- Short range/ad hoc network (Bluetooth, IR, DSRC).
- Wireless Sensor Network.

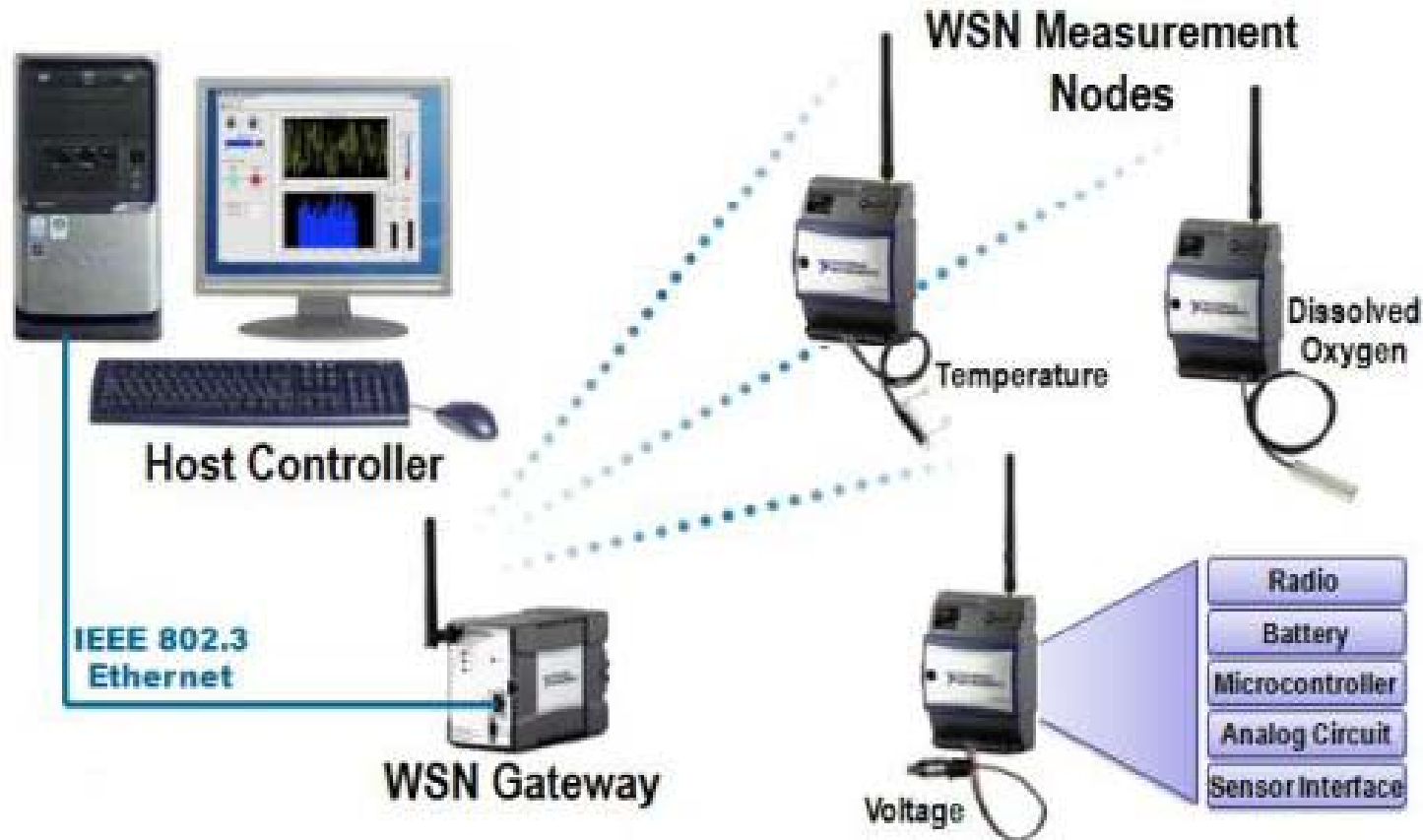
Terminal technologies for Ubiquitous Systems

□ Terminal

- Note PC/PDA.
- Cellular phone.
- Home server and terminal/appliances.
- Robot.
- Wearable terminal with various sensores.
- Car terminal.

□ Server-terminal middleware.

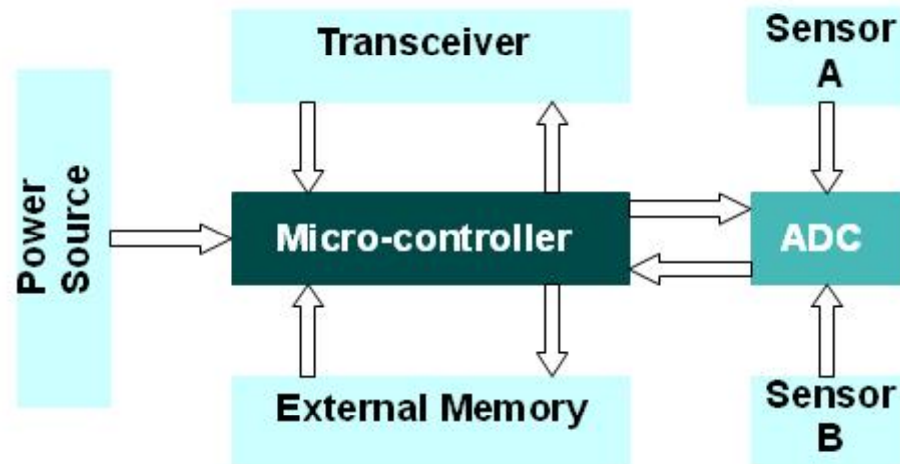
Wireless Sensor Network



National Instruments. Figure 2. Common Wireless Sensor Network Architecture.. "What is a Wireless Sensor Network? ". <http://zone.ni.com/devzone/cda/tut/p/id/8707..> Used by kind permission of National Instruments.

[Ni]

Motes



Types of motes



WSN Power and Network Standards

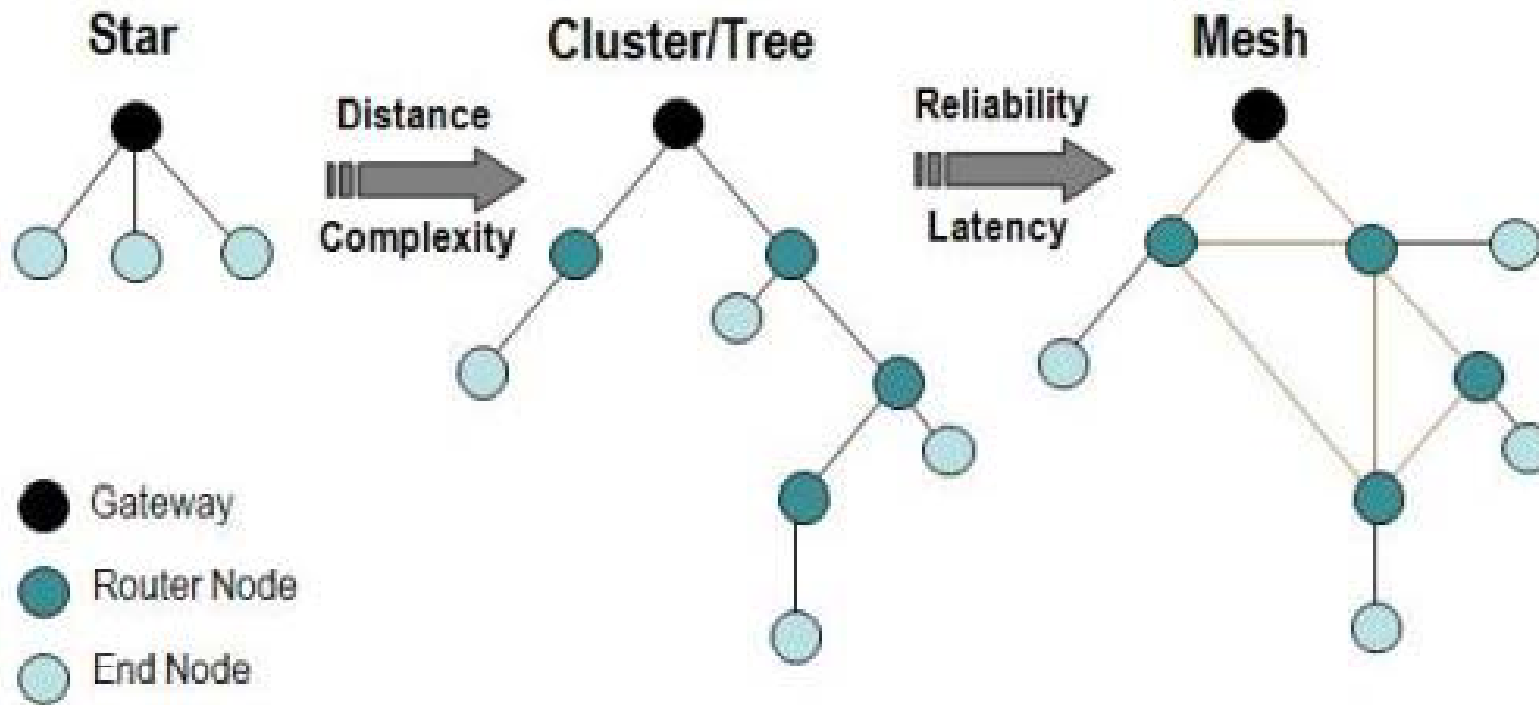
□ IEEE 802.15.4 LR-WPAN

- Physical Access Control layer.
- Medium Access Control layer.
- Communication in the 868 to 915 MHz and 2.4 GHz ISM bands.
- Data rates up to 250 kb/s.

□ ZigBee

- Builds on the 802.15.4.
- Application Support layer.
- Network/Security layer.

WSN Topologies



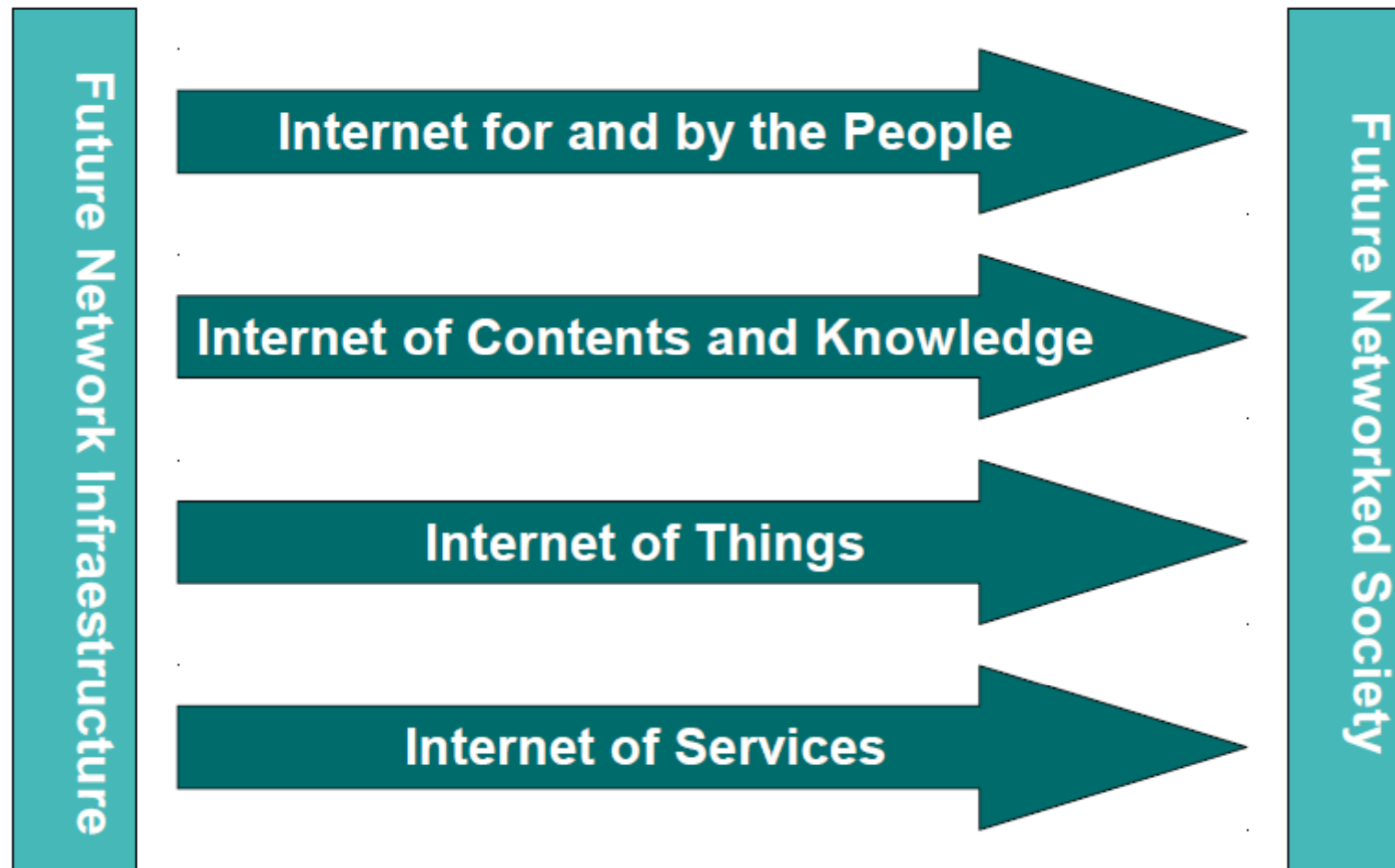
National Instruments. Figure 3. WSN Network Topologies. "What is a Wireless Sensor Network? ". <http://zone.ni.com/devzone/cda/tut/p/id/8707>. Used by kind permission of National Instruments.

[Ni]

UNIT 1: Introduction to Ubiquitous Systems

FUTURE INTERNET

Future Internet



Future Network Infrastructure

- ❑ Based on an ubiquitous, high-capacity network.
- ❑ The network will provide us with communication services in a way that will be both transparent and user-focused.
- ❑ Its network infrastructures will provide mass services while adhering to security and privacy standards as well as with keeping context and personalization in mind for each case.
- ❑ The network will allow the Internet of the Future by bridging the gap between the digital and non-digital worlds.

What is the Internet of People?

□ Definitions

- (1) A hyper-connected society, in which the option to communicate with others will be not only permanent and universal, but also available through different kinds of media and by using numerous devices.

Telefónica

- (2) Communication services will support one-to-one, one-to-many and many-to-many forms of communication, combining voice, text, images, video, telepresence, 3D video and even holograms, and allowing the above methods to complement one another.

Telefónica

What is the Internet of Contents and Knowledge?

Definition

- The access by advanced search means and the interaction with multimedia content (for example, 3D and Virtual Reality). This can then be created and manipulated by professionals and non-professionals for distribution and sharing everywhere, on any terminal.

[AtosCon]

What is the Internet of Things?

□ Definitions

- (1) The Internet of Things, also called The Internet of Objects, refers to a network among objects that will usually be wireless and self-configuring, such as household appliances.

[WikIoT]

- (2) By embedding short-range mobile transceivers into a wide array of gadgets and everyday items, enabling new forms of communication between people and things, and among things themselves.

[WSIS 2005]

For more information: [Rdiego]

What is the Internet of Things?

□ Definitions

- (3) The term "Internet of Things" has come to describe a number of technologies and research disciplines that enable the Internet to reach out into the real world of physical objects.

IoT 2008

- (4) “Things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts”.

IoT in 2020

For more information: [Rdiego]

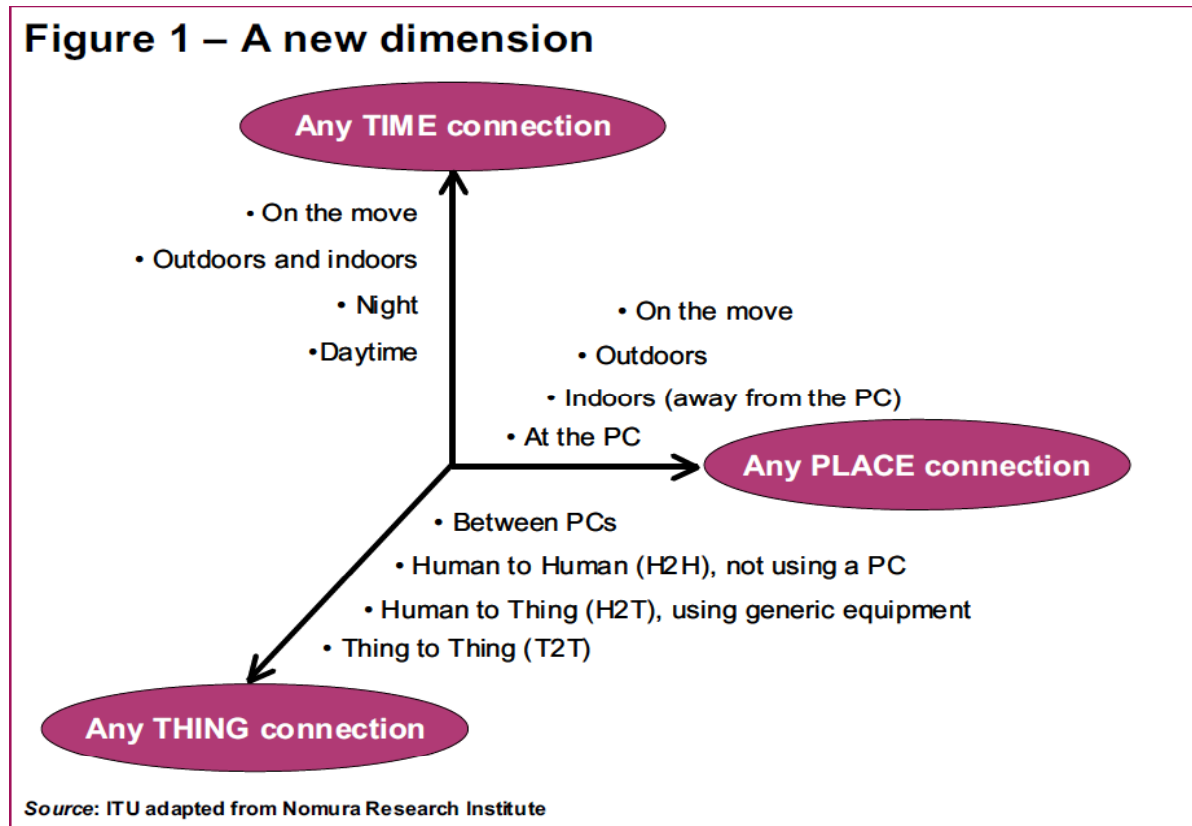
What is the Internet of Things?

□ History

- **1997**, “The Internet of Things” is the seventh in the series of ITU Internet Reports originally launched in 1997 under the title “**Challenges to the Network**”.
- **1999**, Auto-ID Center founded in MIT
- **2003**, EPC Global founded in MIT
- **2005**, Four important technologies of the internet of things was proposed in WSIS conference.
- **2008**, First international conference of internet of things: The IOT 2008 was held at Zurich.

What is the Internet of Things?

“From any time, any place connectivity for anyone, we will now have connectivity for anything!”

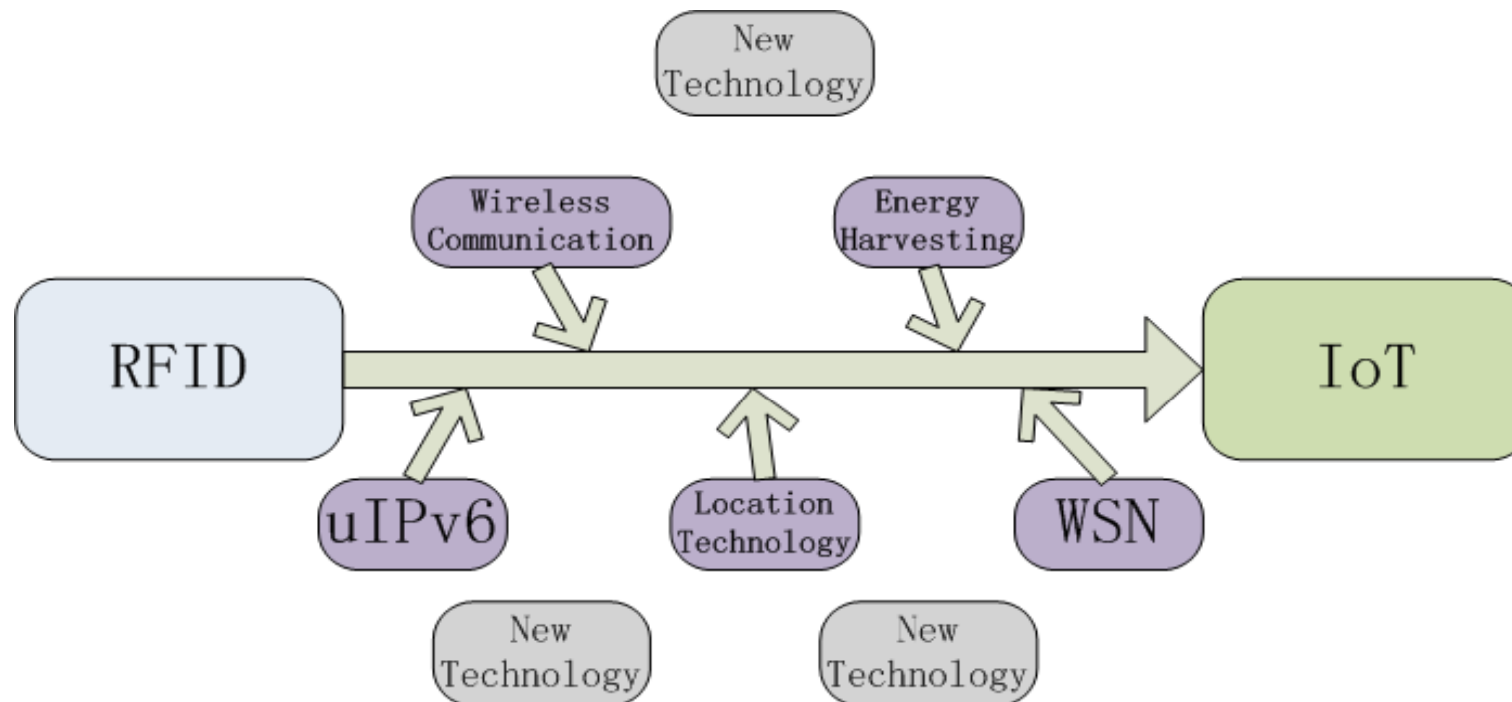


International Telecommunication Union. Figure 1. A New Dimension. International Telecommunication Union. "ITU Internet Reports 2005: The Internet of Things. Executive Summary". November, 2005. Used by kind permission of the International Telecommunications Union.

[ITU]

State of The Art of IoT

From RFID to IoT:



Why Internet of Things?

- ➔ **Dynamic control of industry and daily life**
- ➔ **Improve the resource utilization ratio**
- ➔ **Better relationship between human and nature**
- ➔ **Forming an intellectual entity by integrating human society and physical systems**

Why Internet of Things?

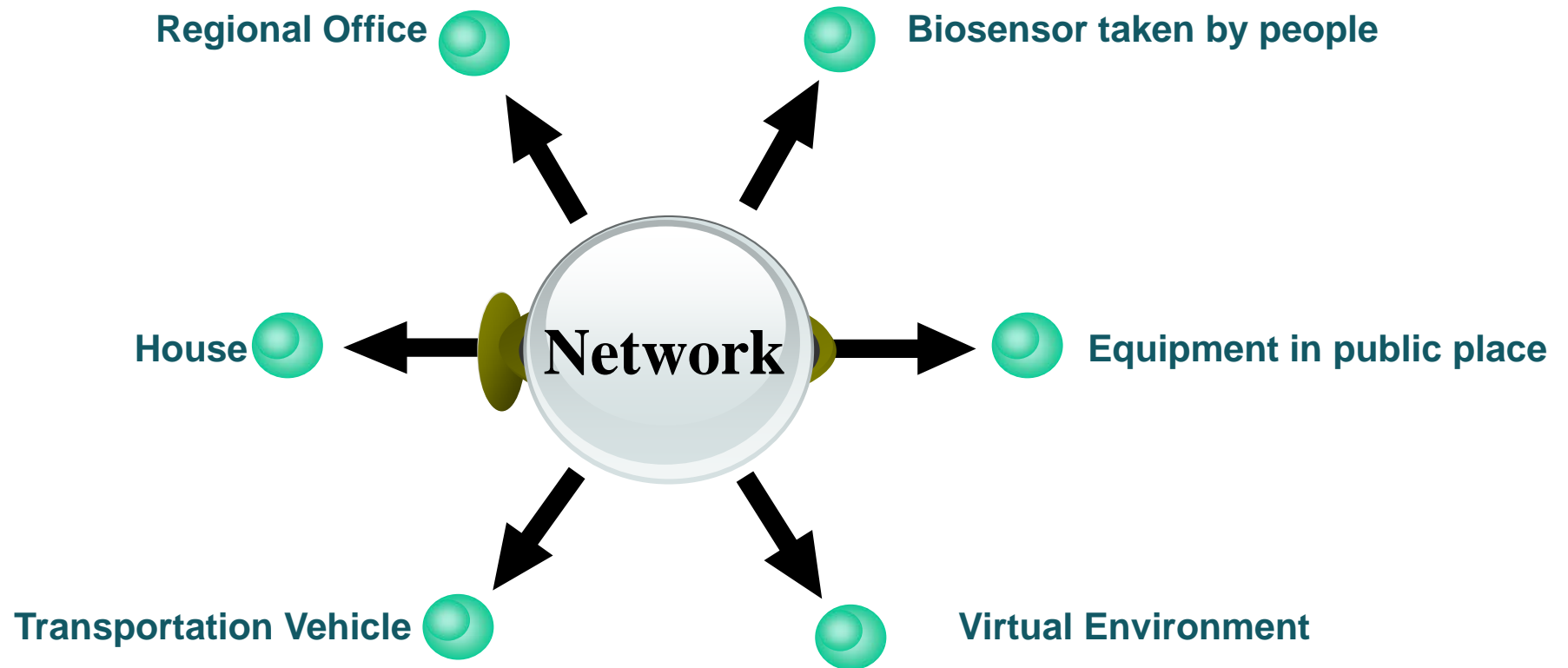
➔ **Flexible configuration**

➔ **Universal transport & internetworking**

➔ **Accessibility & Usability**

➔ **Acts as technologies integrator**

The Applications of IoT

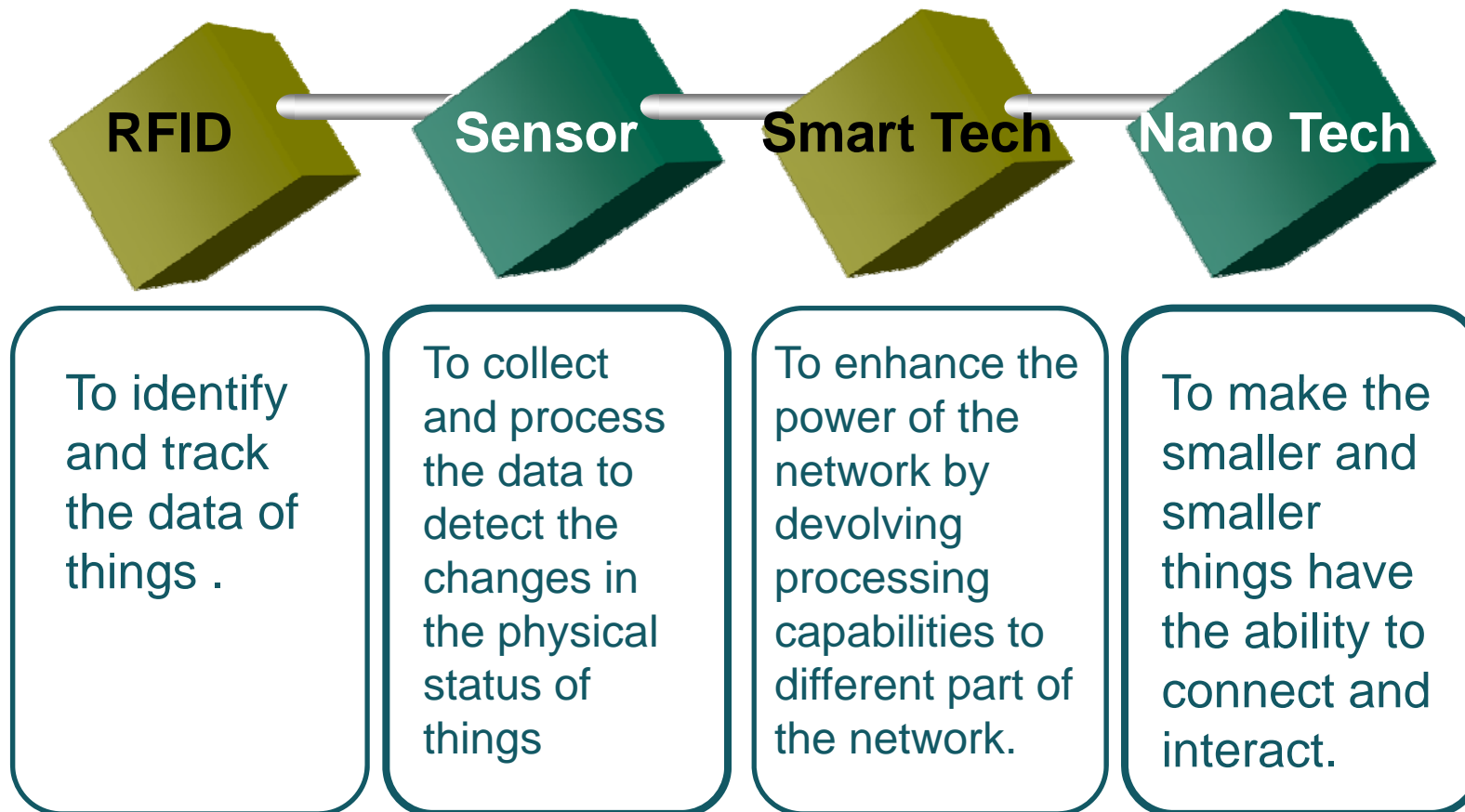


IoT: A Practical Example

Shopping

- ❑ When entering a shop, scanners located in the doors will identify the tags on the customer's clothing.
- ❑ As the customer walks through the location, the goods will introduce themselves.
- ❑ On placing goods in the cart the reader will tell the staff to place a new one in the shelf.
- ❑ When payment for the items is due, the credit card's microchip will communicate with checkout reader.

Enabling Technologies



Sensor Technology

- ❑ The ability to detect changes in the physical status of things is essential for recording changes in the environment.
- ❑ Wireless sensor technology plays a pivotal role in bridging the gap between the physical and virtual worlds, and enabling things to respond to changes in their physical environment.
- ❑ Sensors collect data from their environment, generating information and raising awareness about context.
- ❑ **Example:** sensors in an electronic jacket can collect information about changes in external temperature and the parameters of the jacket can be adjusted accordingly.

What is the Internet of Services?

Definitions

(1) A new and elaborate vision for next-generation services provided via the Internet is known as the Internet of Services. The creation of these services is facilitated by an open platform and interface architecture, as provided by the Enterprise Service-Oriented Architecture (enterprise SOA).

[IoS]

(2) A service-oriented architecture (SOA) is essentially a collection of services. These services communicate with each other. The communication can involve either simple data passing or it could involve two or more services coordinating some activity. Some means of connecting services to each other is needed

[SerArc]

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