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Trends and Issues in Smart Homes and Cities

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Trends and Issues in Smart Homes and Cities

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Time: 10:30 a.m. to 11:50 a.m.

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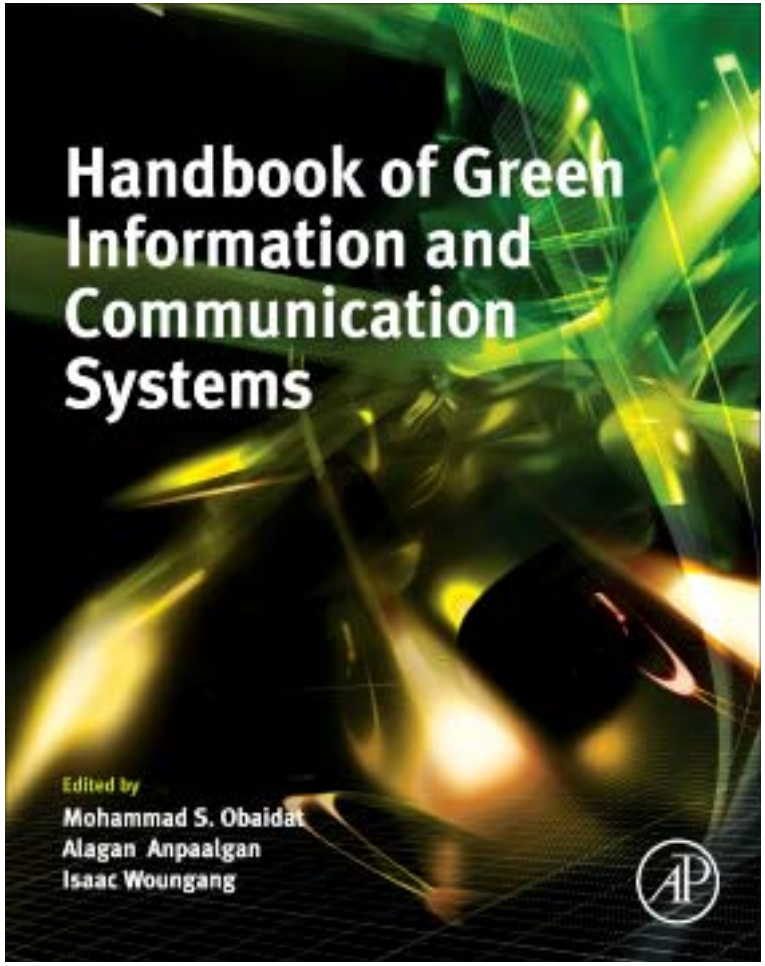
Our Recent Related Book

- **M. S. Obaidat, A. Anpalagan, and I.Woungang," Handbook of Green Information and Communication Systems," Elsevier, 2012.ISBN: 978-0-1241-5844-3. Released on Oct 24, 2012.**



Professor Mohammad S. Obaidat

Background

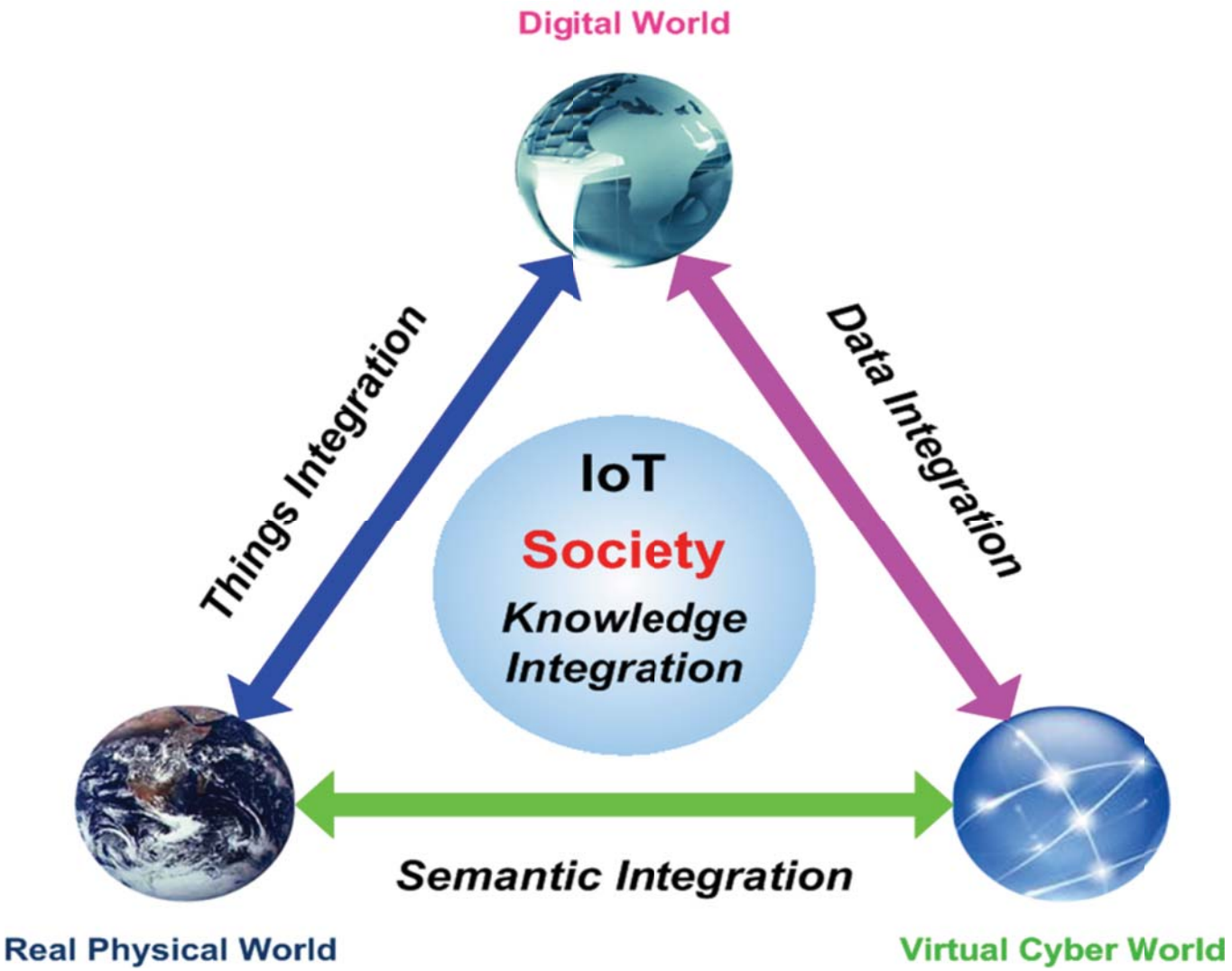
- Interest in Smart Homes and Cities has increased in recent years due to:

1. Impressive economic development in populous countries like China, India and Brazil. China and India make for 40% of the World Population
2. Increased use of ICT devices and technology by individuals and organizations worldwide
3. Greater interest in environment protection and in reducing CO2 emission; Green Economy
4. Noticeable rise in the number of elderly/senior citizens over 65 years old in many countries, especially in Japan, Europe and even China who need smart homes and smart cities to make their life comfortable, and healthy at affordable cost.
5. Rapid increase of the population of big cities

Introduction

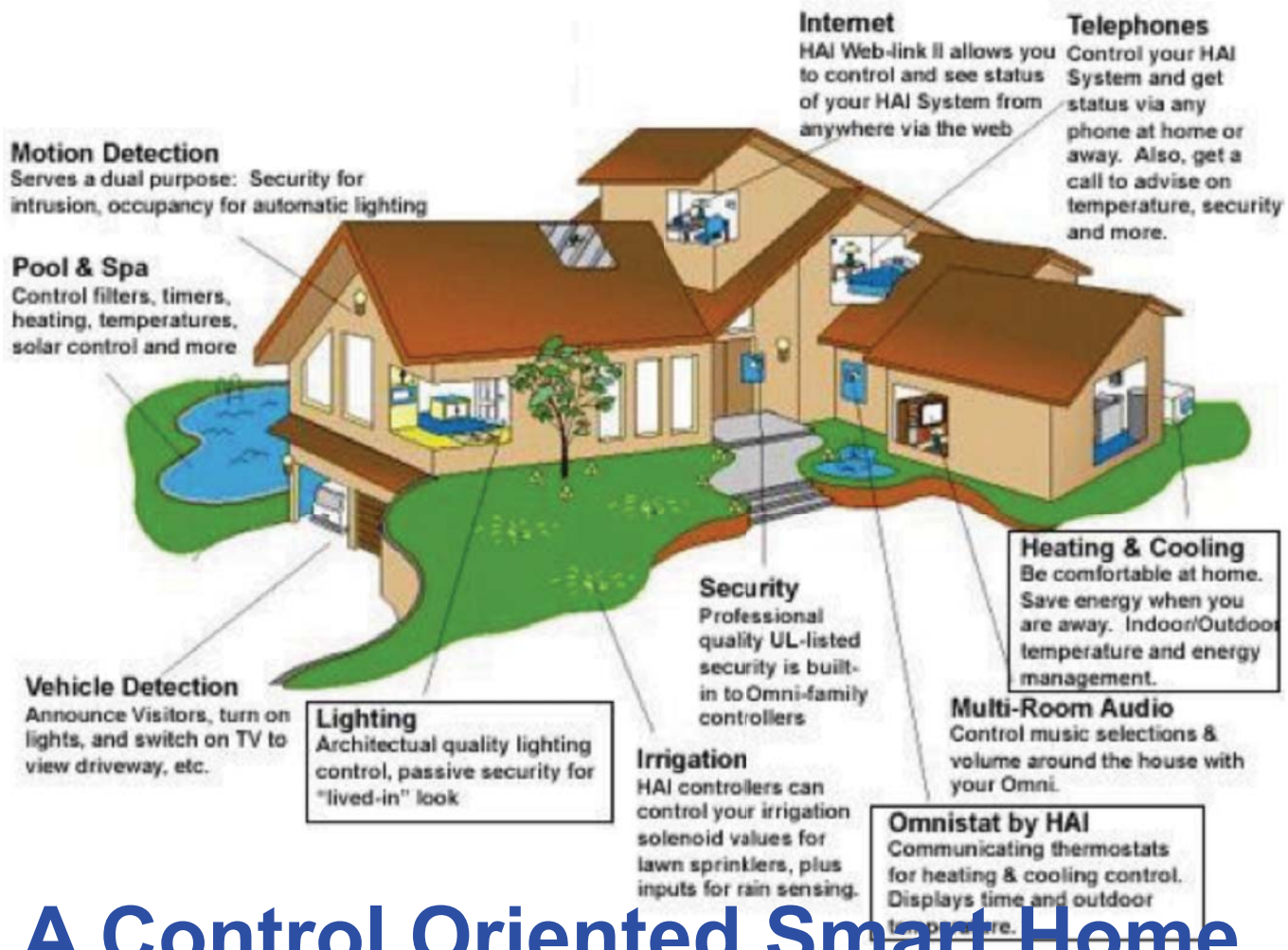
- Smart and Digital Homes rely heavily on IoT and ICT technologies and systems.
- The increase of senior population worldwide is one factor that pushed forward research in this fascinating field; **Digital and Smart Homes and Cities.**
- **The global aged population over 65 years old is expected to double up to about 761 million by the year 2025 from a mere 375 million in 1990.**
- **A recent study predicts that the world of smart and digital homes market to reach about $13.5 billion by 2014; an increase of about 16.5% from 2009 to 2014.**

Introduction



Introduction

Functional Composition of a Control Oriented Smart Home

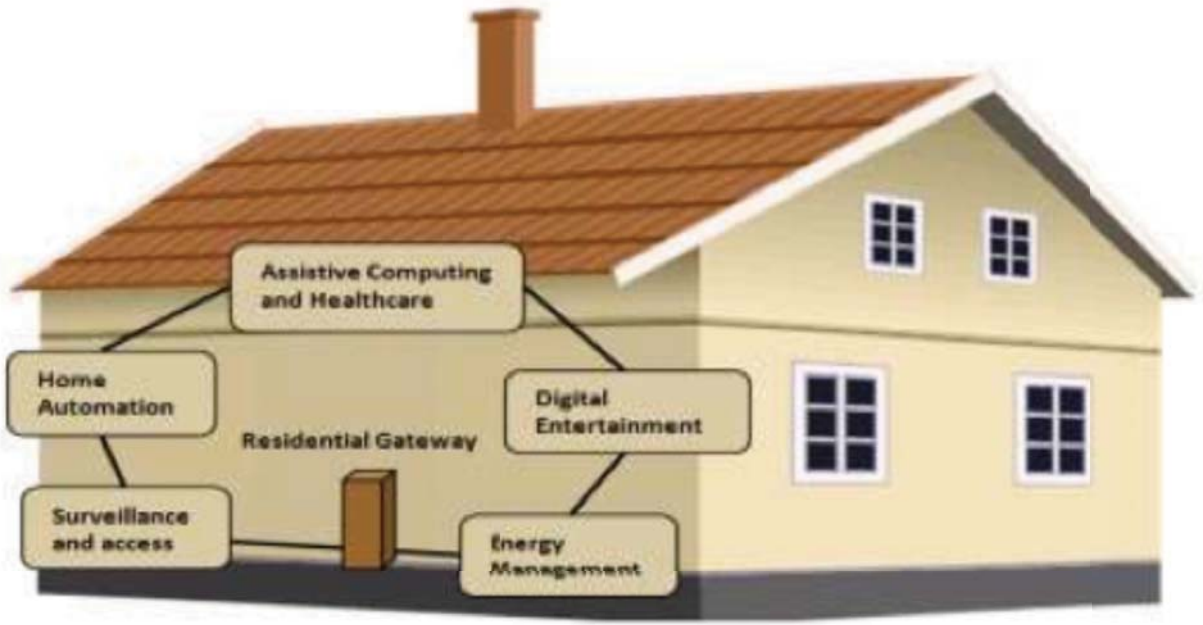


A Control Oriented Smart Home

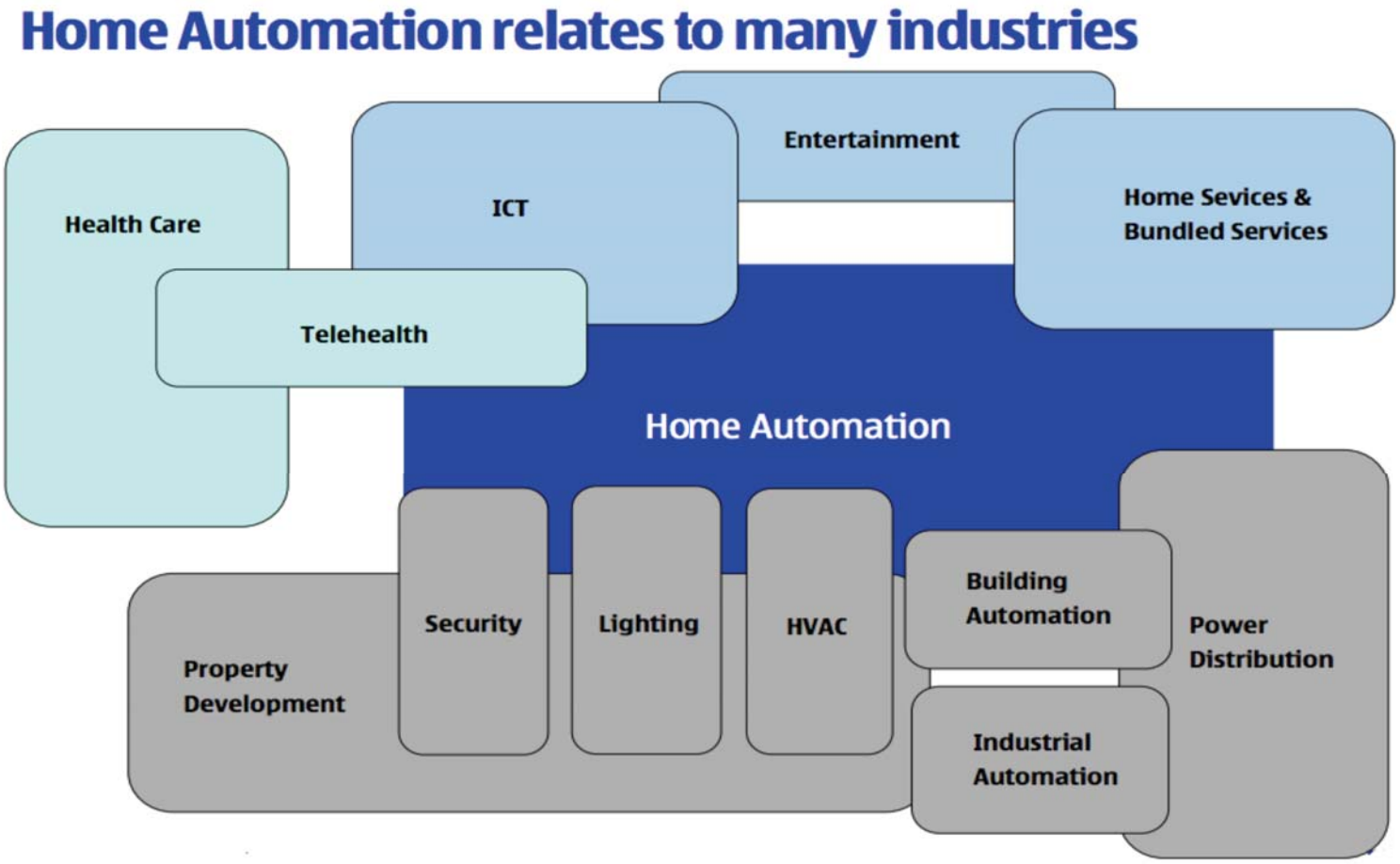
Professor Mohammad S. Obaidat

Smart Home Subsystems

- According to Perumal, **the smart home environment is divided into five subsystems that are illustrated in the figure below: (a) assistive computing and healthcare, (b) digital entertainment, (c) energy management, (d) surveillance and access, and (e) home automation.**



Relations of Digital Home to other Industries



Digital Home to other Industries

Update

- The overwhelming majority of the current smart home projects focus on maximizing:

1. Resident's comfort using home automation and control

2. Leisure using home entertainment

3. Safety through home surveillance

Update

A Smart Home means:

- **A Home that 'Listens' to you**
- **A Home that 'Communicates' with you**
- **A Home that safeguards you and your investment.**
- **A Home that 'modifies and fine-tune' to your lifestyle and needs**

Ingredients of a Smart Home include:

Sensors, Interfaces, Networks, Actuators

Central Units Controllers

Trends: Management of Energy

- **Energy Management** is one of the chief benefits that consumers can enjoy by using smart homes. **A smart home system can reduce electricity by a margin of 30% depending on the home.**

-Savings can be obtained from optimizing the use of Lighting, Heating and Air Conditioning, Energy Usage Monitoring, Use of Renewable Energy Sources.

Trends

Cognitive Radio Technology

- Cognitive radio is a new technology that has received a lot of attention in recent days. It aims at utilizing the radio spectrum efficiently through adjustments in **modulation, coding & radiated power**.
- Dynamic spectral access may be divided into four cases: (a) dynamically moving users into particularly active bands from other bands to allow radio network equipment in those other bands to be switched off when possible, (b) **dynamic sharing of spectrum** to take advantage of better propagation bands and reduce required transmission power, (c) sharing of spectrum to allow channel bandwidths to be increased, hence, allowing transmission power to be significantly decreased, and (d) improved hierarchical management of spectrum in cases where different cell types coexist.
- **Dynamic spectral access can contribute to energy savings of up to 50%.**

Trends

Health Smart Homes

- The "Health Smart Homes" is a variant of the "Smart Homes" notion, which already incorporates sensors and actuators "to follow" the people, to interconnect among themselves, and to reinforce intelligently the occupants in the realization of the daily and recurring tasks.
- Utilizing the wearable biomedical sensors and other tools to log vital and physiological signs would aid in tracking the status of the patients regularly.
- One of the medical journals reported that chances of surviving a stroke, heart attack, or fall are six times more if the person gets help in the immediate hour.

Trends

Remote Digital Health (Contd)

- One of the ways to meet the rising healthcare carrying out in digital homes is remote health observation.
- As an example, Globus, the US based company makes use of the Paradigm Diabetes Management System; a blood glucose monitor and insulin pump that work together to manage diabetes wirelessly.

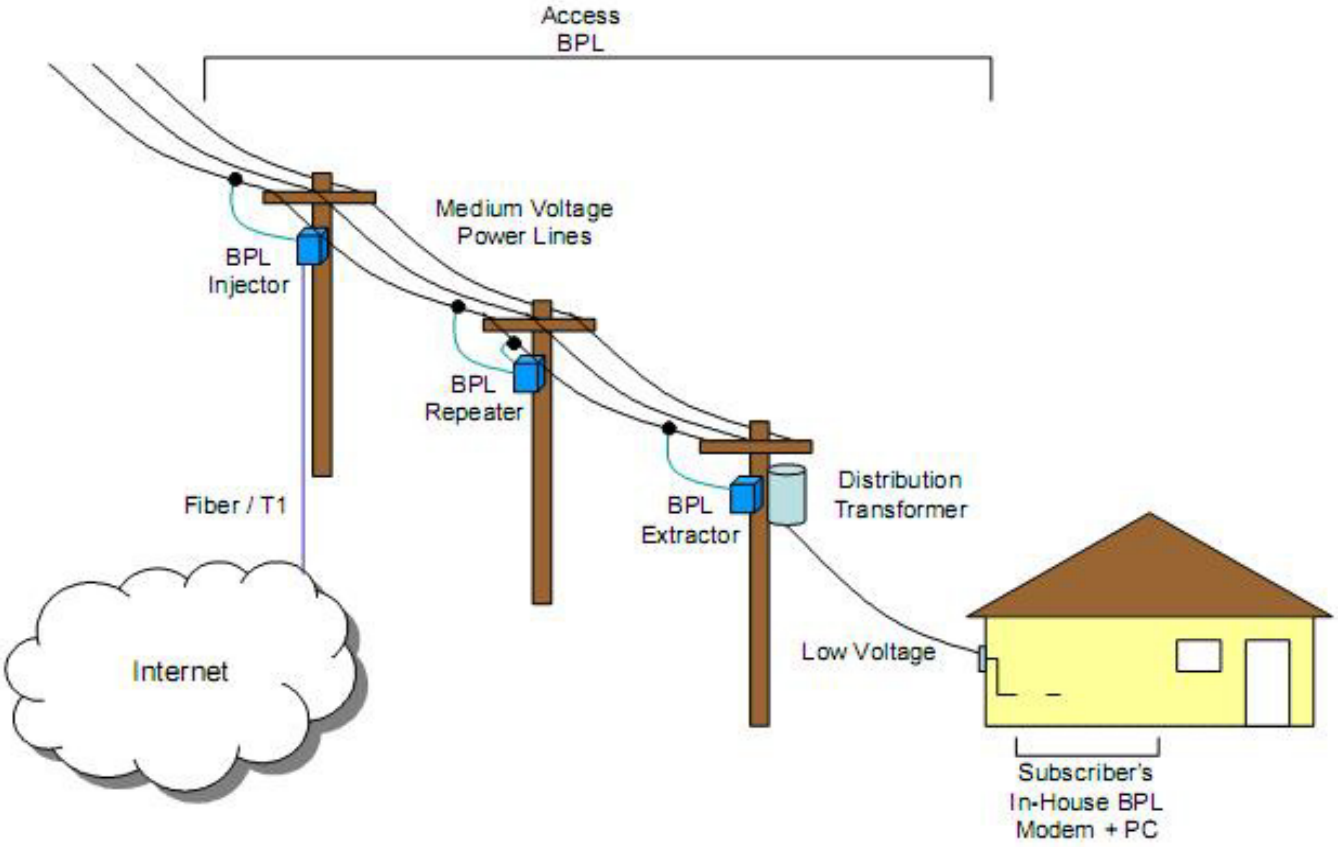
Trends

Smart Appliances: **Here, we mean energy efficient appliances which use less power and less water. Clearly, this can reduce carbon footprint in the world and save money.**

Heated Floors: **Although some people consider heated floors a luxury, heated floors are a very common item in homes today. They can lower heat costs and keep feet and body in general comfortable in winter.**

Trends

Broadband Over Powerline (BPL) Communication



Trends

Broadband Over Powerline Communication

- These days, Internet access is offered to residential and small-business customers through DSL, Cable Modem, Wireless Wi-Fi and WiMax, optical fiber, or satellite systems. Broadband over Powerline, or BPL, is an alternative scheme of broadband access.
- It utilizes electric power distribution wires for high-speed transmission of data by transmitting high frequency data signals through the same power distribution network used for carrying electric power to household users.

Trends

Upgrading Power Grid to be a Smart Power Grid: This involves a two way communication between our homes and the power grid using our electric meter.

Smart Refrigerator: In addition to its obvious basic food storing function, the smart fridge can be provided with a shopping and storage application that permits the person to follow individual food items expiration dates as well as control shopping inventories. Of course, a smart refrigerator is supposed to be energy-efficient.

Trends

Interest in Cable TV is Decreasing in Favor of Internet TV

- Costs of cable subscriptions are becoming too high when compared to what they offer. It seems that there is a new trend; people prefer to select their TV content and pay for only what they watch.
- Regrettably, the cable companies can still control many of the Internet connections to the home. At some point they may start charging more for the Internet service.

Trends

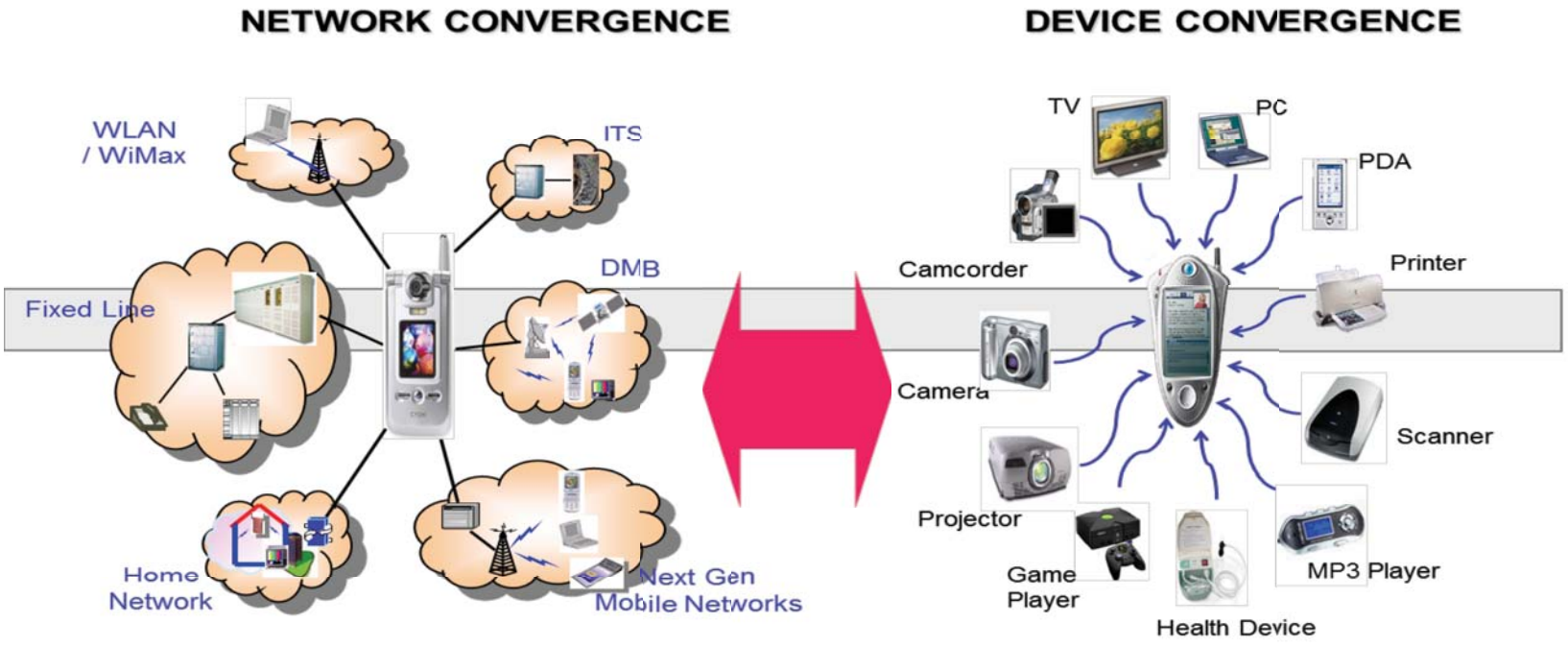
ICT Users Will Increasingly Look to Non-PC Secure Storage Solutions

- **The trend is towards having a single storage platform that is networked and can share resources with both fixed and mobile PC and smart phone devices. This platform will back not only PC and consumer electronic data storage and sharing, it will advance to automatically backup all networked fixed and portable gadgets, in addition to enabling the storage and transfer of huge multimedia data files.**

Trends
Convergence of Networks and Smart Home Devices

Drivers

Network Evolution *Multimedia* *Component Innovation*



Trends

RFID Use for Digital Door Lock

- RFID can also be used as a Digital Door Lock. By just tapping the RFID card or keyfob to the reader button you can activate, authenticate and unlock your door.
- A key fob is a type of security token: a small hardware device with built-in authentication mechanisms)
- By using the PIN pad, the resident will not lock himself out ever again. No need to call a locksmith to unlock the door or to change the lockset because the resident misplaced his key. If the user forgot or lose his PIN, then he can reprogram the RFID cards; no need to change locks.

Trends

Smart Television

- The term smart TV means the integration of Internet into a television set or a set-top-box, so as to achieve interactivity and include cutting-edge features to the traditional television systems.
- It might be capable of video-on-demand, e-commerce, Internet browsing, e-mail, chat, among others.
- More Intelligence is being added to devices and things, IoT

Trends

Enhanced Connectivity Using Internet of Things (IoT)

Trends

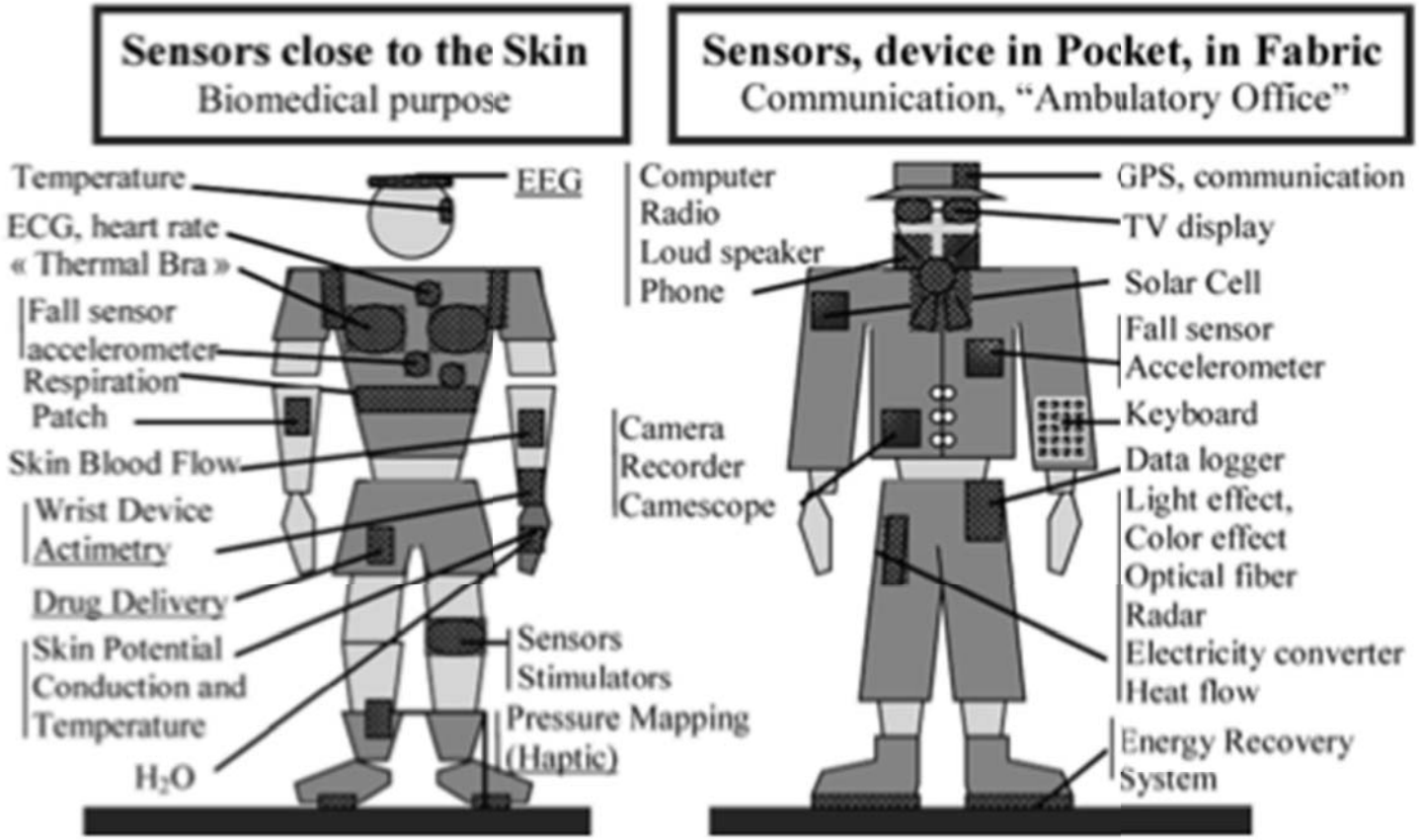
Biomedical Smart Clothing

- The biomedical smart clothing has several benefits: (a) it is placed automatically in the correct location (avoiding the necessity of placing the sensors on the patient by a nurse or physician) and (b) it is discreet, nonvisible, well protected, and user friendly.
- It is particularly well adjusted for the observing chronic diseases of the handicapped, and the elderly persons. In addition, it is also used during professional, sport, and military activities.
- You even can have Body Area Sensor Networks (BASNs).

Trends

Biomedical Smart Clothing (Contd)

Two Types of smart clothing



Trends

- **Smart Cities can be identified and categorized based on six main dimensions: a smart economy; smart mobility; a smart environment; smart people; smart living; and, smart governance.**
- **Top worldwide smart cities include: Vienna, Toronto, Paris, NYC, London, Tokyo, Berlin, Copenhagen, Hong Kong and Barcelona.**

Trends

Use of Wireless Sensor Networks for Smart Cities

- **Wireless sensor networks is becoming very important to develop Smart Homes and Cities. The goal is to deploy a distributed network of intelligent sensor nodes, which can sense/measure many parameters that are essential to manage and run cities efficiently.**
- **The data can be delivered live to the citizens and related entities.**
- **For instance, citizens can monitor the pollution level (CO_2 as well) in every suburb or street of the city.**
- **Citizens can get automatic alarms when the radiation level increases to a certain degree.**
- **In addition, this can be employed to optimize the irrigation of parks or the lighting of the streets.**

Trends

Use of Wireless Sensor Networks for Smart Cities (Contd)

- **Garbage containers can send an alarm when they are about to be filled.**
- **Traffic density in streets can be monitored so as to optimize the operation of traffic lights in an adaptive manner.**
- Drivers can get timely information **so they can locate a parking slot/lot ASAP; saving time and fuel. Of course, this can minimize traffic jams, and pollution as well reduce accidents, which result in improving the quality of life of citizens.**

Trends

Smart Cities and Homes

- **Smart cities require the use GIS and GPS for efficient city and urban planning. You get needed info about various facilities including health centers and hospitals, tourist offices, post offices, sport clubs, ATM machines, banks, gas stations, hotels, tourist attractions, among others, in an easy and smart way.**

Trends

Smart Cities

- **Citizen participation in democratic decisions for the evolution of the city using ICT devices and technologies**

- **Ways to collect efficiently the data to be broadcast, or to be used to analyze and "sense" the status and the dynamics of the city**

- **Free Wireless Internet access**

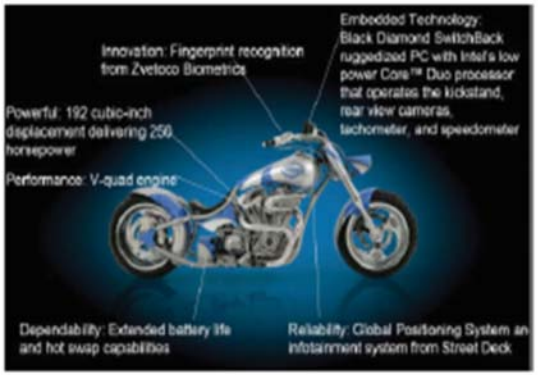
Trends

- **Citizens Centric Cities (CCC):** To implement the CCC model, ICT can provide tools to offer facilities and features for citizens such as:

1. Optimized data management, identification, security and privacy
2. Provision of distributed schemes for scalable systems aiming at large numbers of participants
3. Customized and new intelligent services
4. Intelligent/smart and ergonomic Human Machine Interface
5. The business and innovation model is based on engaged citizens supported by the digital cities open foundation for service creation.

Trends

Embedded Intelligence



Challenges

- **Accidentally Smart Home**
  The accidentally smart home is an already existing home that cannot accommodate and integrate the new technologies.
- **It is basically a phenomenon in which technological apparatuses are inserted step by step in the environment rather than the new smart homes which are purpose-built to back technologies.**
- **For instance, if a person brings Bluetooth-enabled speakers to home and set those to the nearest sound source, then he/she may get other programmers that are originally set by a neighbor.**

Challenges

Unprepared Interoperability

The skill to integrate different components that were acquired at different times and are from different manufacturers without any proper planning may create issues related to interoperability.

Challenges

- **Social Implications of Smart Homes and Cities**

There can be social consequences that can arise with the technologies implemented into the smart home environment. The challenge of the designer is to deal with these social issues in an efficient manner. The main social aspects to be considered are: privacy, labor saving and good parenting.

- **Adaptability and flexibility**

The programmability of the smart systems is crucial. It must be able to interface with other suppliers' devices and accept add-ons and be scalable, especially for future expansion.

Challenges

Misunderstanding about Who is in Charge of the Service

- **Customers have the understanding that the service providers can solve their networking problems, however, operators only own and are interested in their own home equipment: the gateway and set-top box.**
- **Operators risk getting calls from unsatisfied customers that have installed the various consumer devices. Clearly, such calls affect the operators' bottom line.**

Challenges

Standardization

Standards are crucial for making a complex infrastructure work. Standardization in this regard will safeguard: (a) interoperability of products helping specific service markets, so as to permit variety and innovation without mix-up in the delivery of multimedia services, (b) inter-changeability of products from sellers providing the same applications so as to support price contest, and (c) interoperability among various different networks comprising the multimedia platforms, (d) interoperability between domestic networks as multimedia services and (e) continuous end-to-end services offered on a national and international scales.

Challenges

Bandwidth

- **Video and multimedia applications necessitate considerable bandwidth, and very low delay, jitter (delay variation) and bit error rate.**
- **The mean estimated bandwidth is about 70 Mbps for the digital home.**
- **Every signal or stream needs full access to its necessary bandwidth at all times so as to sustain adequate service levels.**

Challenges

Bandwidth (Contd)

- Service operators are looking to have at least 75 Mbps of bandwidth within the home network.
- The good news is that we are currently witnessing a wild unleashing of bandwidth, mainly driven by progress in both optical networking and wireless networking/communications.
- The needs of digital network applications, which generally include high degrees of visualization as well as sensory streams is motivating the move for such a large a huge bandwidth.

Concluding Remarks

- Digital and smart homes as well as smart cities are becoming an important area of research and development in the 21st century.
- As **life expectancy is increasing these days more and more senior/elderly people need home care and digital and smart homes and cities can make their lives more comfortable and much easier. In addition this will make the cost of care lower.**

Concluding Remarks

- ICT technologies play a **vital role in designing efficient and cost effective smart homes and cities.**
- Fiber To the Home **(FTTH) and advances in wireless networks and communications are vital enabling technologies** for smart homes and cities.
- Moreover, **advances in consumer electronics and cloud computing have produced smart home gadgets and efficient and reliable computing paradigms.**
- **Discoveries in smart home and city technology may be seen soon, because, the society is seeing drastic changes in several socio – cultural and economic factors.**

Concluding Remarks

- **In addition to the worldwide demographic shift owing to a upsurge in the ageing population, other reasons are believed to contribute to the increase interest in smart homes and cities, which include government programs in digital homes & cities and their related areas as well as the rising personal income in the newly industrialized countries, especially in populous countries like China, India and Brazil.**

Concluding Remarks

- There are challenges in front of the progress and wide spread of smart homes and cities such as privacy and security, cost, interoperability, standards, cost, but I am optimistic that this technology will be moved to the mainstream in order to improve the quality of lives of humans in a cost-effective manner.

Thank You