

Symposium: “Internet of Things (IoT) & Wireless Symposium

- Organized by: Federation of Hong Kong Industries 香港工業總會
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Fuelling Sustainable Future Smart Buildings with Internet of Things

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Outline

1. Introduction
2. What's hot, what's not and what's next
 - Economy
 - Development and applications
3. Challenges
4. Conclusion

Introduction

Internet of Things Special Users Group Hong Kong (IoT SUG-HK)

- The IoT SUG-HK aims at training up more qualified and well-trained architects, engineers and students, nurturing wireless innovations, performing more interoperability tests to benchmark protocols performance as well as IP sharing





智慧城市聯盟
Smart City Consortium

שחוקלסוּת הָעִיר הַחִכּוּמָה
Smart City Consortium



Founding Board Members together with the guests at the inauguration ceremony



The signing ceremony of the Memorandum of Understanding (MOU) between the SCC and Austria Technology Corporation (ATC)



The signing ceremony of the Memorandum of Understanding (MOU) between the SCC and Smart City Development Alliance (SCDA)

Definition of Smart City

- “Smart city is first and foremost a city – one that pushes the **quality of resource management and service provision** to the limit possible at the time. In such an integrated understanding of the smart city concept, smart city projects are part of a general concept of **city modernization**. While the potential contribution and benefits of Information and Communication Technology (ICT) to modernization can be considerable, smart city projects should **never be seen in isolation**, but as **one element in a city’s** (or a region’s) **continuous effort** to find the next best way of operations.”



Ref: EU-China Smart and Green City Cooperation,
“Comparative Study of Smart Cities in Europe and
China” – White Paper, Mar. 2014.

EU-China Policy Dialogues Support Facility II
中国 - 欧盟政策对话支持项目二期

What is IoT?

- Definition:
 - IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications.

Ref: J. Holler, V. Tsiatsis, C. Mulligan, S. Karnouskos, S. Avesand, and D. Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence,” Elsevier, 2014.

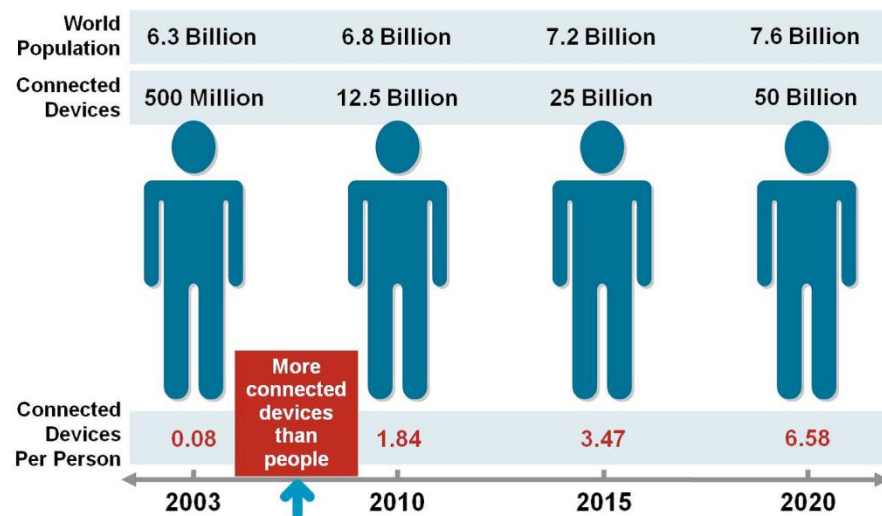
WHAT IS IoT

- Applications of inter-connected devices ~ facilitate user interactions
- Advanced connectivity of devices ~ systems and services within the existing



Why IoT?

- CISCO's Prevision:
 - In 2008, the number of things connected to the Internet was greater than the people living on Earth.
 - By 2020, the number of things connected to the Internet will be about 50 billion.



IoT Creates \$14.4 Trillion of Value at Stake for Companies and Industries

- between 2013 and 2022, \$14.4 trillion of value (net profit) will be “up for grabs” for enterprises globally — driven by IoE
- over the next 10 years, the Value at Stake represents an opportunity to increase global corporate profits by about 21 percent.

Smart Buildings

- What's hot

Building Smart, Building Green...

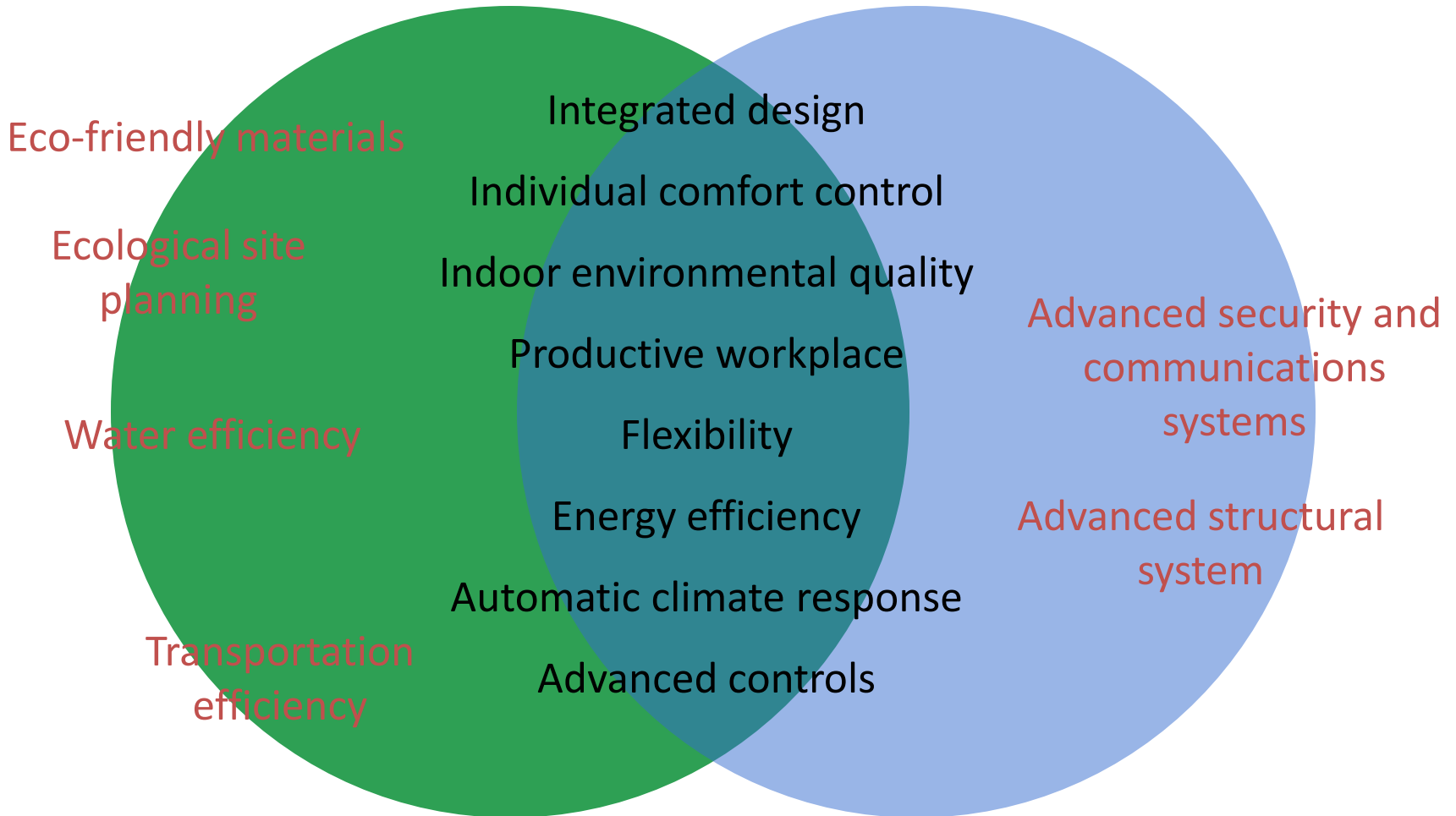
- Smart building technologies can improve buildings' energy efficiency and indoor environmental quality.



Commonalities

Green Building

Smart Building



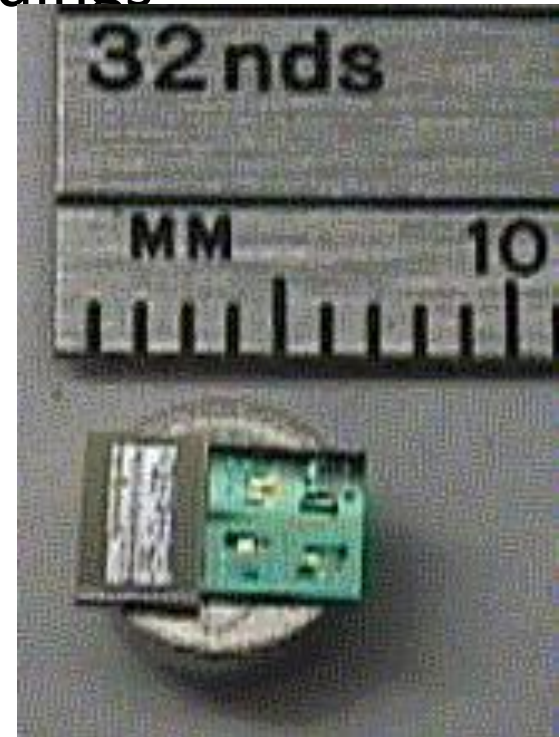
Wireless Measurement & Control

- Objective:

- Study how small multi-modal sensing technology could affect the operation of buildings

Motivation

- ♦ Wireless (50-90% of sensor cost due to wiring)
- ♦ Small, could be embedded or attached to furniture, ceiling tiles, walls (“smart dust”)
- ♦ Self locating, could also be used to keep track of furniture and equipment
- ♦ Low cost (>\$5 possible)



Future smart buildings

- More energy efficient
- More life style experience
- More operationally efficient
- More sustainable
- Safer and more secure
- Health caring

Applications

- Smarter apartments
- Smarter hotels
- Smarter offices

Relationship

- Technology, people, and decision
- Social experience
- Technology experience

Smart Buildings:

What's hot

Smart Offices



smart office

SF Public Utility Building

Leading US Smart Office Building. Top 10 AIA Green Buildings.

LEED Platinum Certified
13 Level 277,000 sq feet.
\$146M

- Solar PV cells (7% of needs)
- Blackwater treatment plant
- Wind turbines
- Daylight harvesting
- Floor cooling distribution
- Automatic shading
- Automatic ventilation
- Lobby video screen
- Energy monitoring
- Extensive submetering
- Real time monitoring
- Building dashboards
- Fault detection & diagnosis

meld.

20

Light balancing ® Philips

...Because energy savings is required

for lower operational cost, meeting regulations, green certifications, CO2 targets, etc...

Integrated lighting & blinds systems strongly:

Reduce building operation cost

Up to 70% reduction on Lighting electricity bill

Up to 60% reduction on HVAC energy

Source: UTC Power Energy Efficient Building Seminar' Beijing, China

- **Increases building value & rental rates**
- *Up to 5% higher asset valuation*
- *Up to 3% higher rental rates*
- Reference: The Economics of Green Building



Micro Computing



User Experience



Interconnected Devices

internet of things

50B devices connected by 2020

WiFi, Zigbee, BLE, RFID
light, temperature, movement,
moisture, volume, salinity

Personal tracking, whitegoods,
hardware, lightbulbs
things

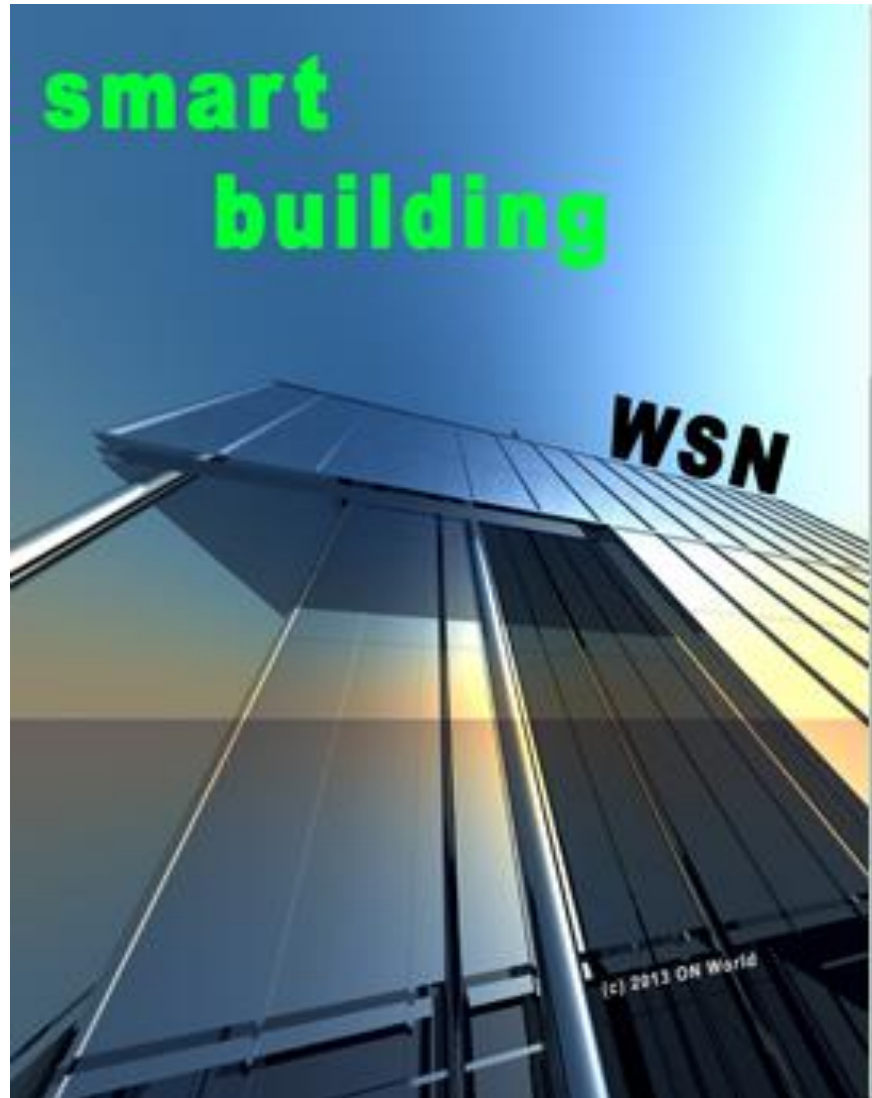
meld

(Source: Giesandesign)

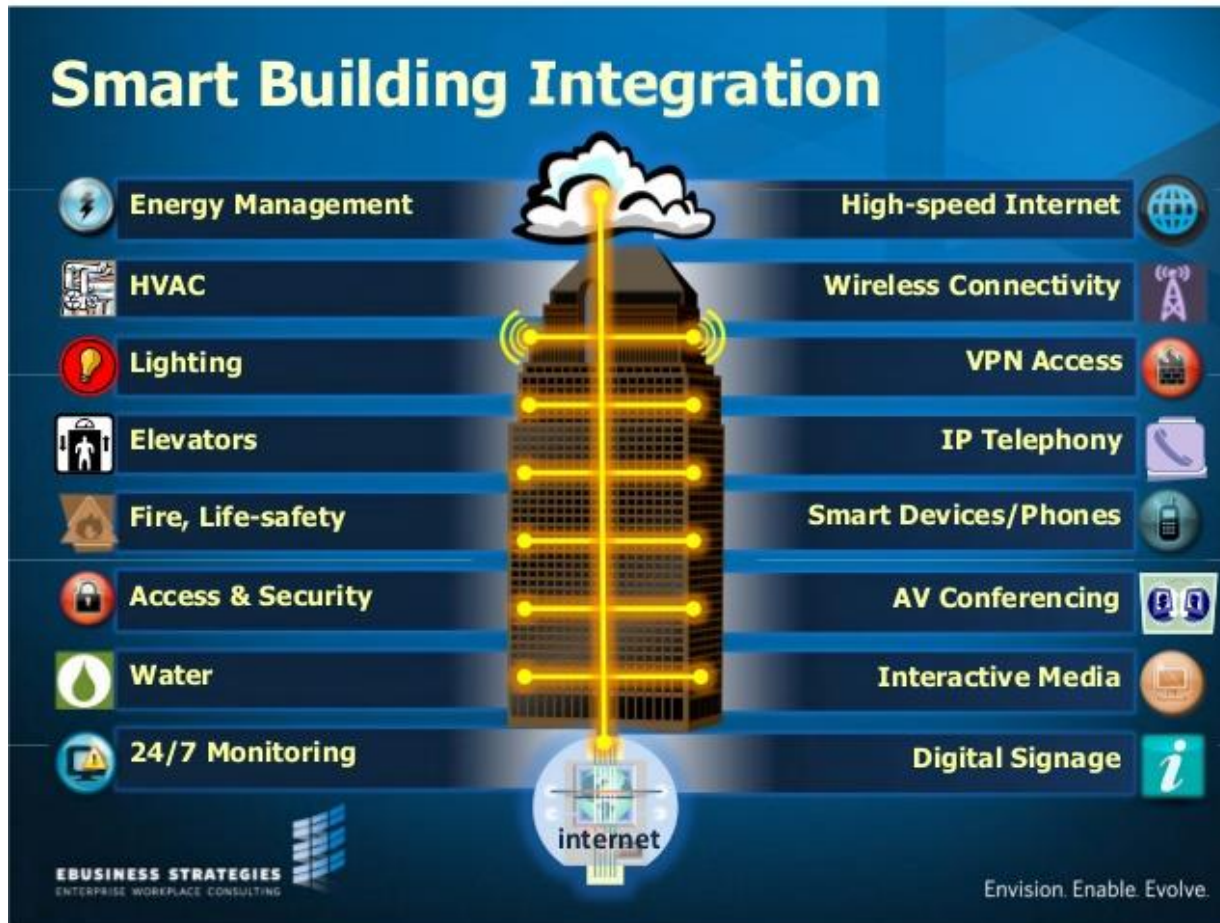
Smarter



Smart Building and Wireless Sensor Networks



Even smarter



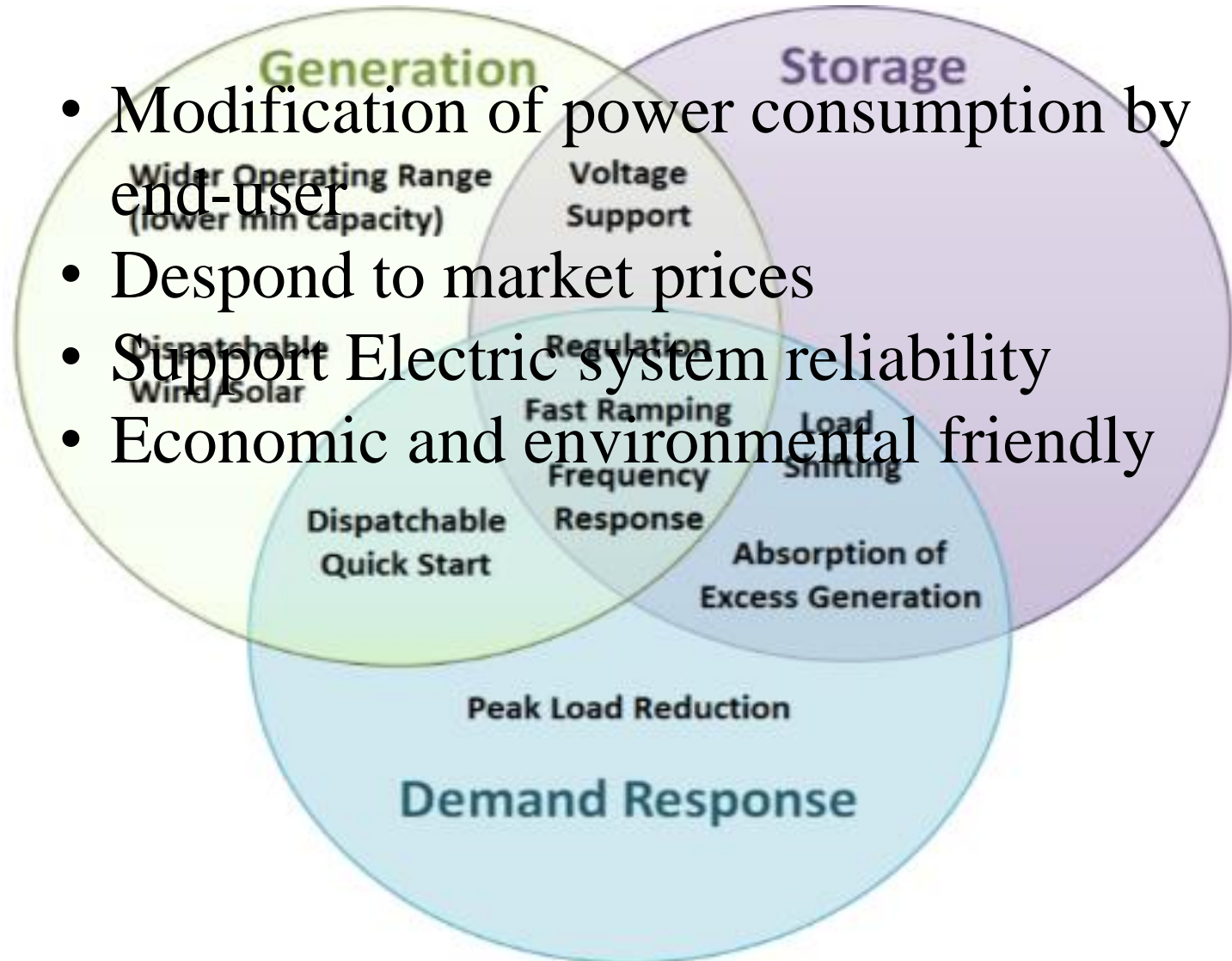
Key Technology Drivers

10 key technology drivers

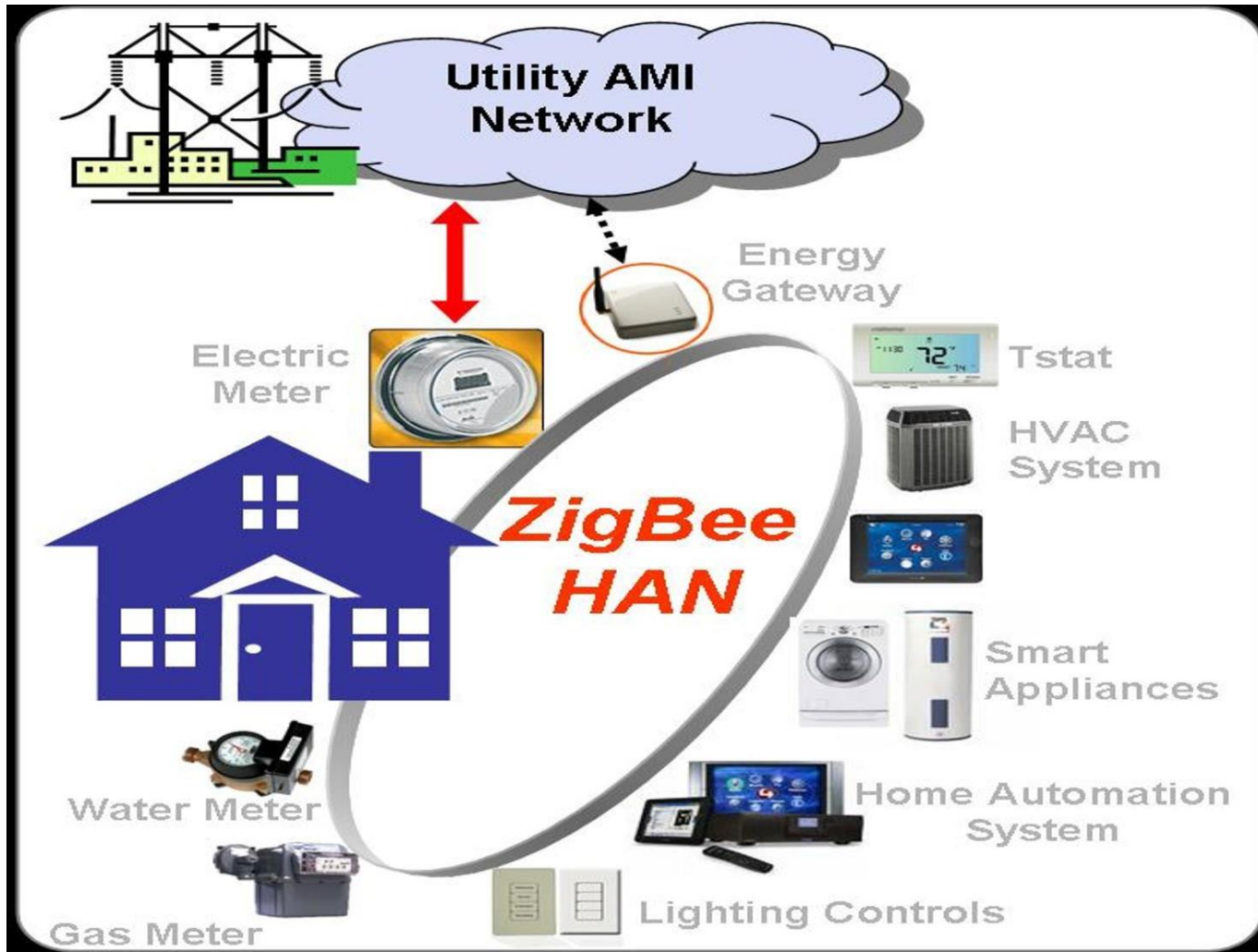
Network connectivity
Business continuity
Cloud computing
Mobile & personal computing
Internet of things
Data & analytics
Mapping
BIM
User experience
Social Media

Emerging Integrated Services & Applications

Demand Response



Smart Metering



Smart Grid

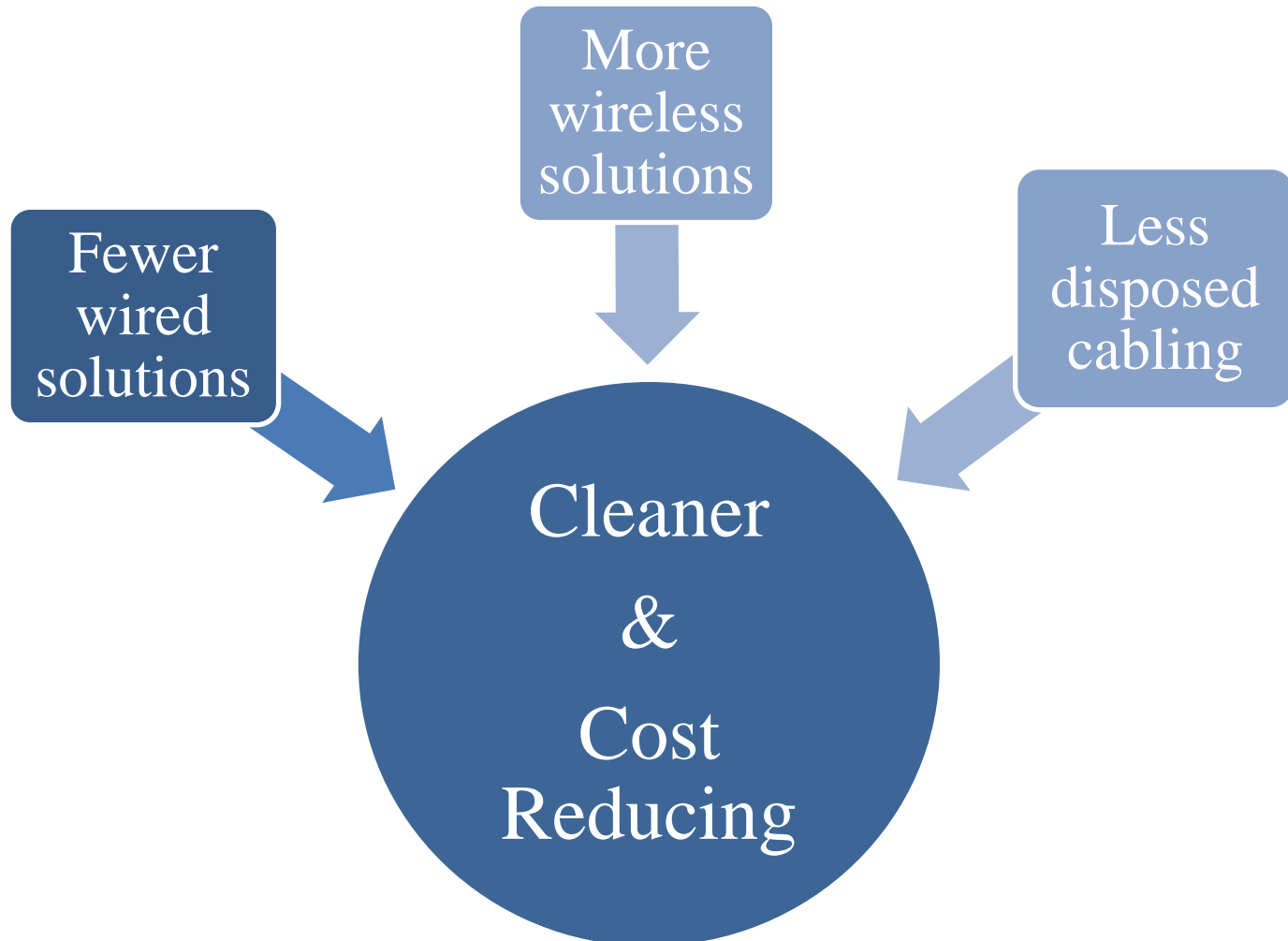
- Providing smart features for better power management
- Increasing the energy efficiency and to reduce CO₂





Innovative, efficient and money-saving workplaces.

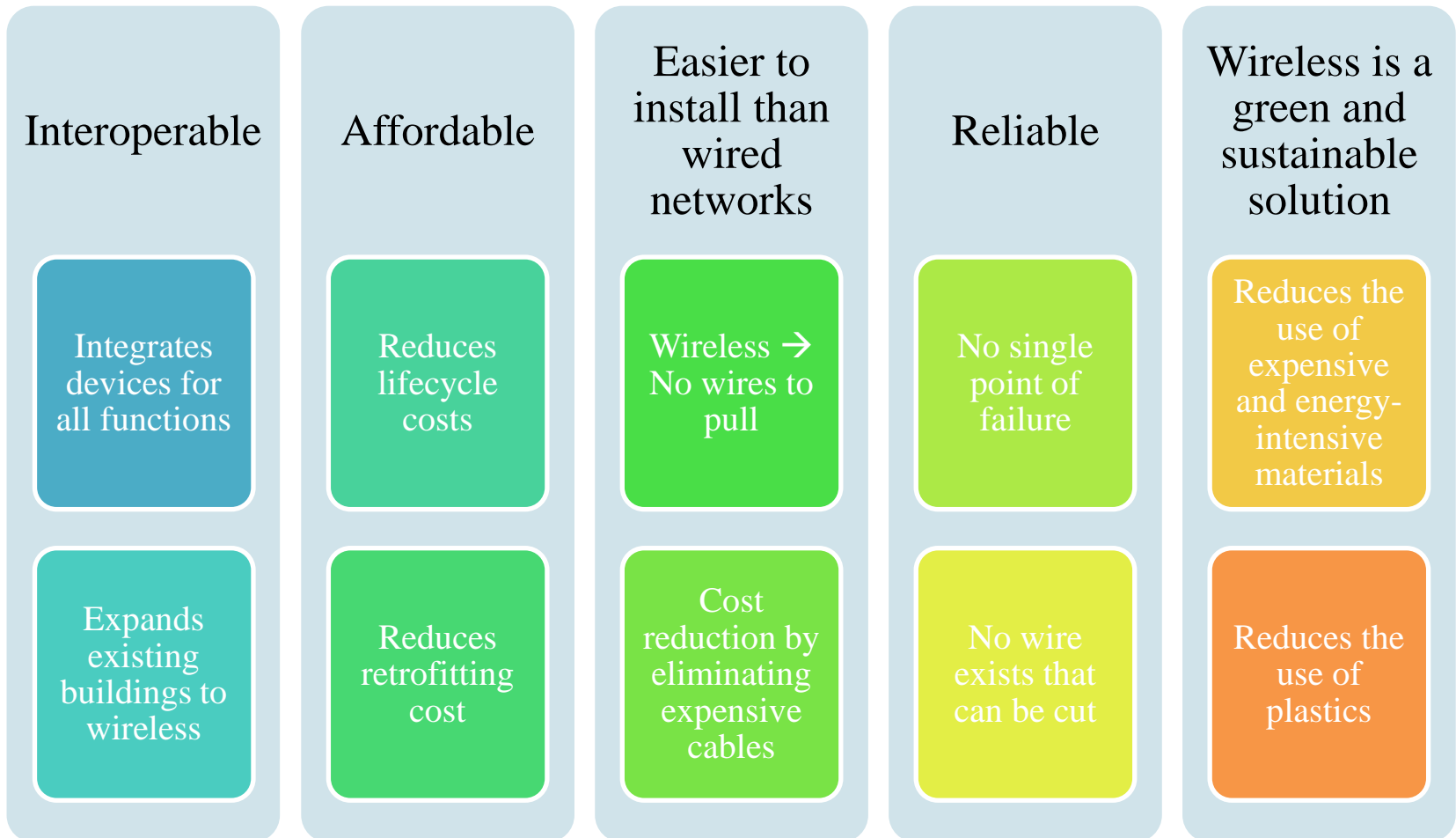
Building Automation Scenarios





Innovative, efficient and money-saving workplaces.

Building Automation Scenarios





Smarter, more energy-efficient and secure homes.

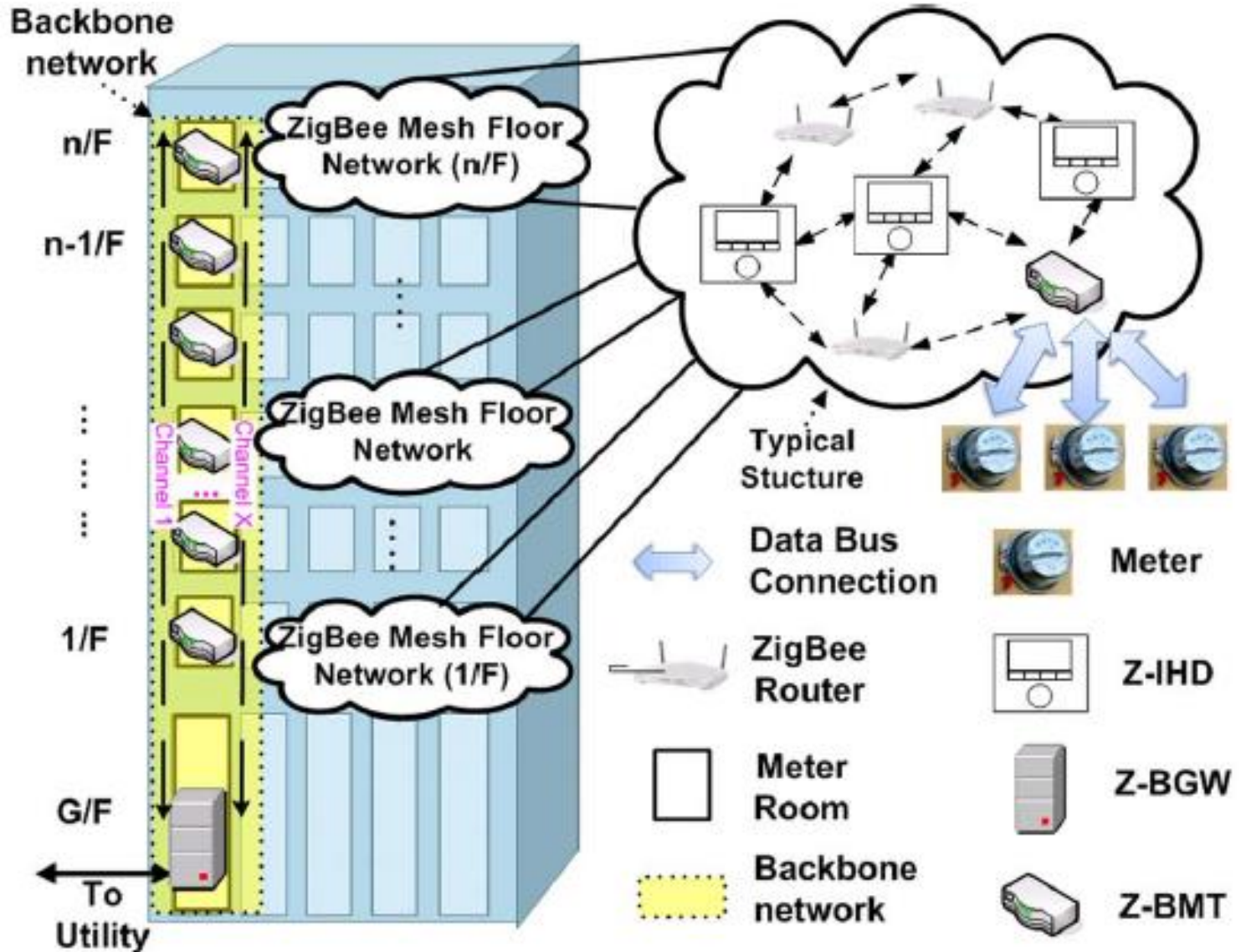
ZigBee Home Automation Overview

- A industry leading global standard to create smarter homes
 - To enhance the comfort, convenience, security and energy management for the consumer
- several important new features

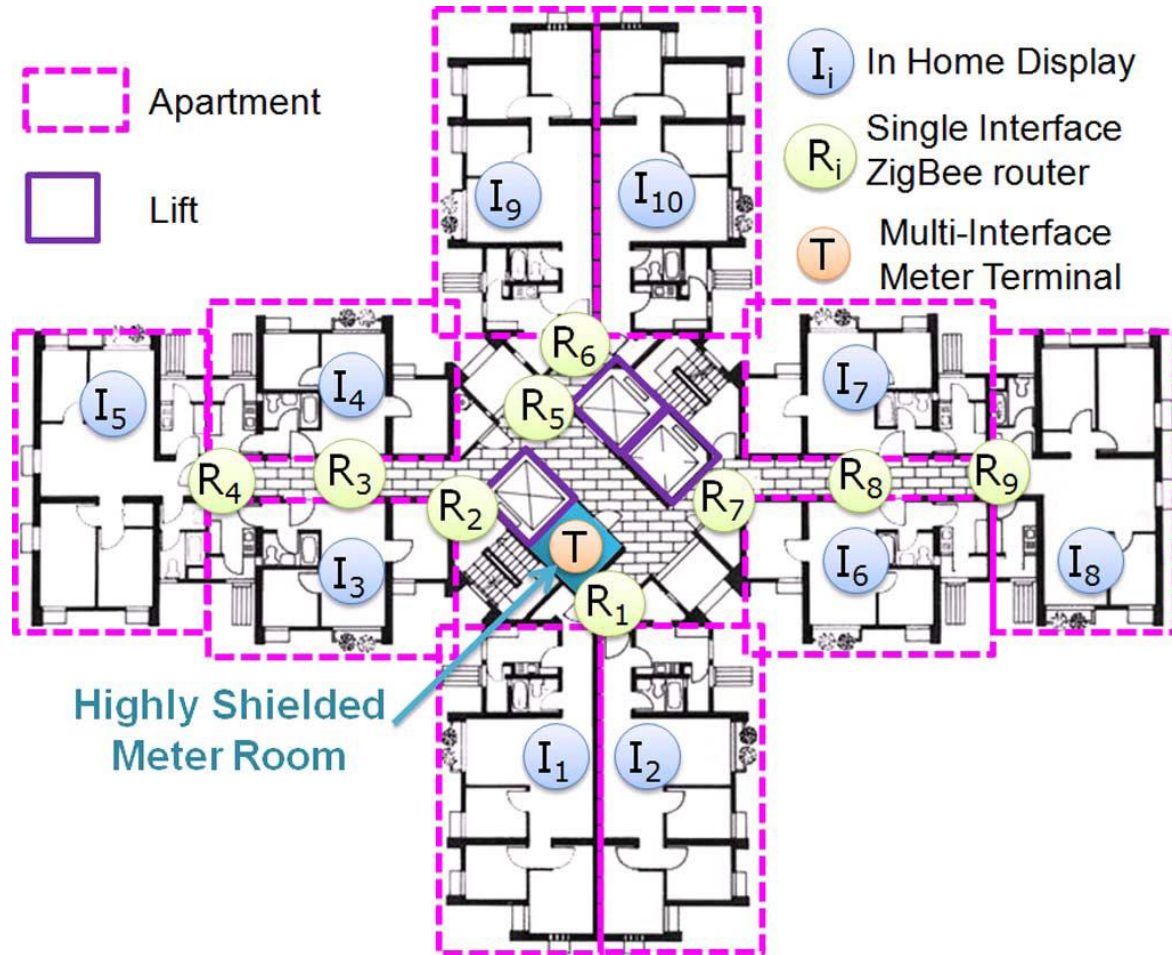
A significant impact on operational and device costs to service providers and quality of service to consumers!!!

consumers and custom installers alike

Home Area Network



ZigBee mesh floor network



- User experience

Home Automation experience

- Home Automation

Master Bedroom and Washroom



Smart Buildings:

What's not addressed

What's not.....

- Smart Design - Building a structure that can survive an earthquake

- Is it a good or bad idea to put two buildings right next to each other? **Maybe?**

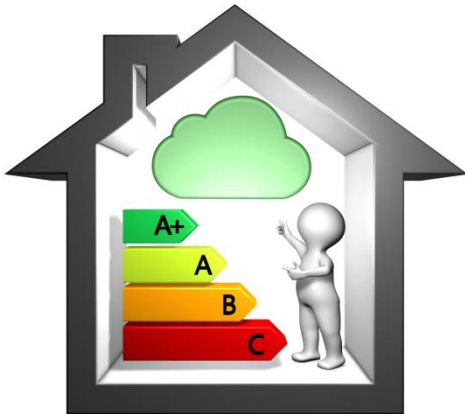
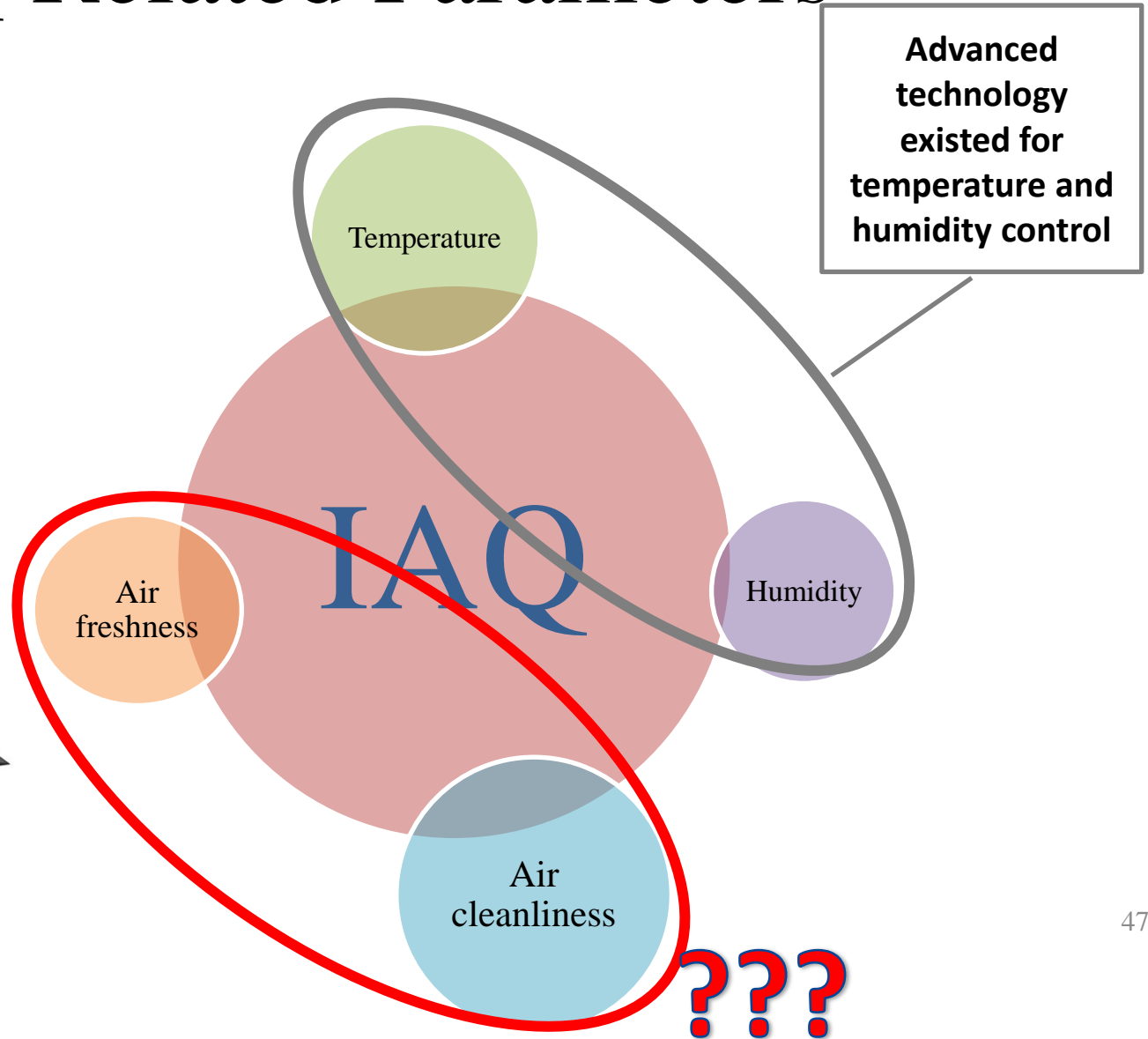




IAQ – not addressed

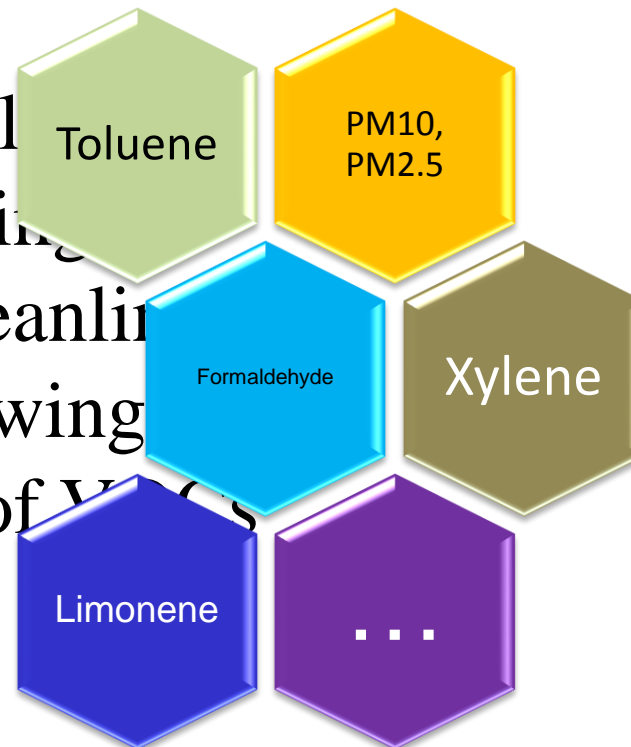
- Indoor Air Quality (IAQ) may be a serious problem in the USA

IAQ Related Parameters



VOCs

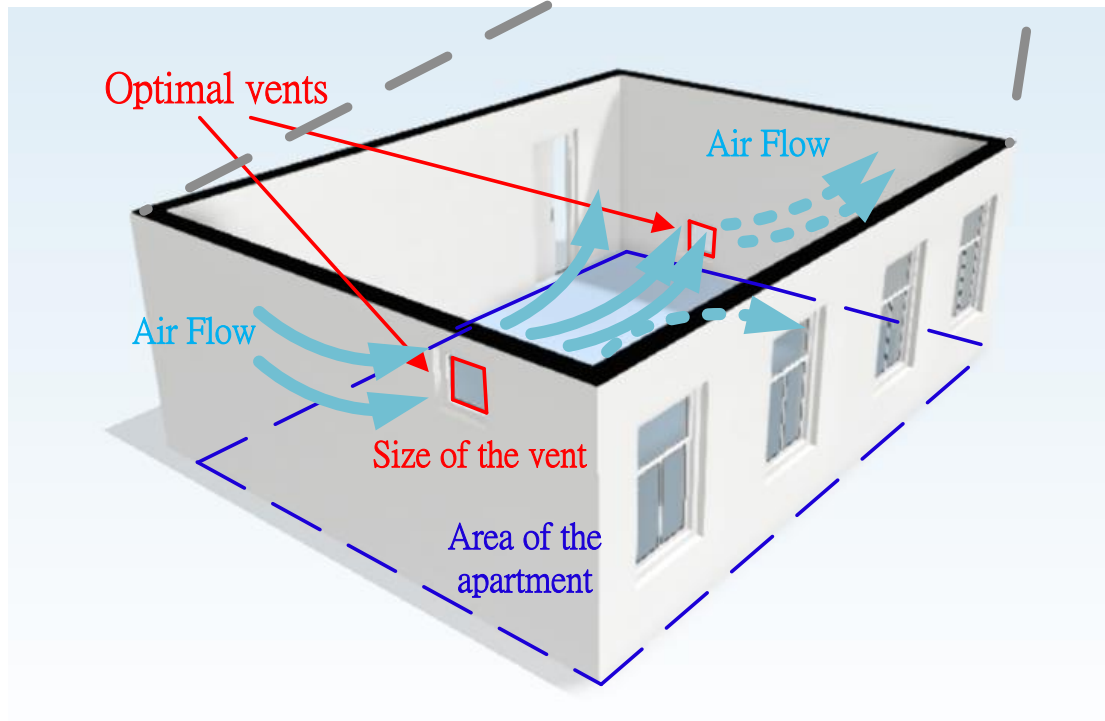
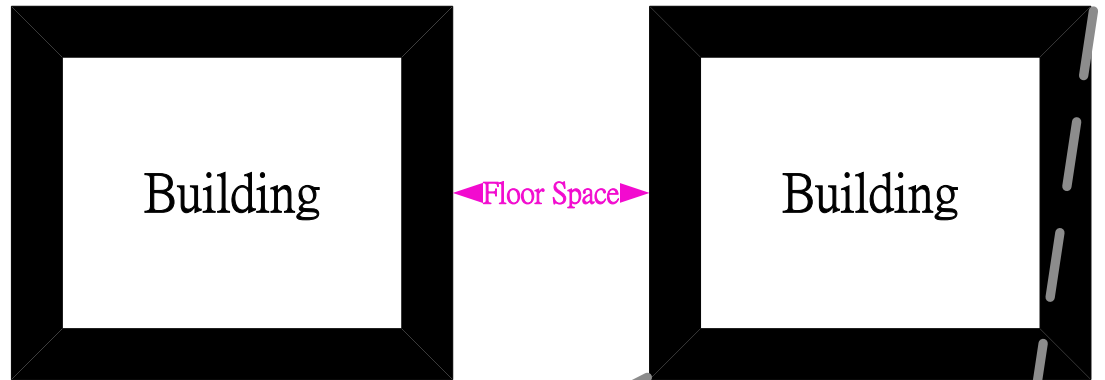
- Volatile Organic Compounds (VOCs)
 - Gaseous, carbon-containing chemical compounds
 - Indoor air contains a **broader** variety and **higher** levels of VOCs than outdoor.
 - More than **22** chemicals
- Directly and significantly degrades IAQ by affecting the air freshness and cleanliness
- Scientific evidence showing **adverse** health effects of VOCs



Optimal Vent Design

optimization considers:

- Floor space
- Area of the apartment
- Indoor and outdoor temperature
- VOC releasing speed by construction materials



Smart Buildings:

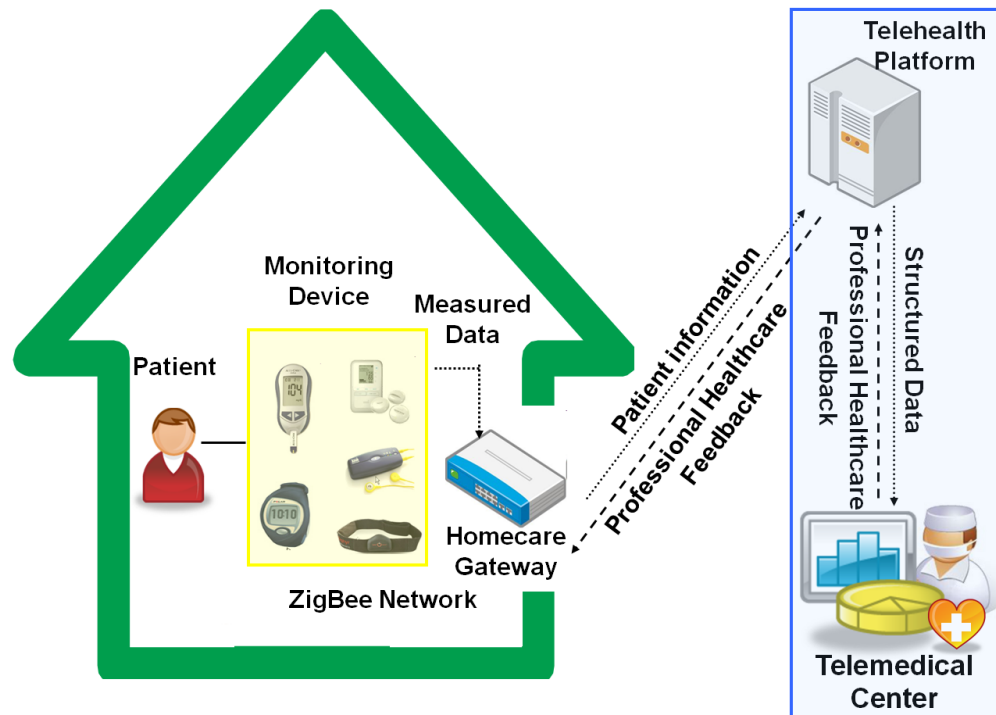
What's more

Smart Buildings:

Remote patient monitoring

Background of home telehealth

- Corrupted and delayed data may cause a life or death issue
- Homecare gateway is different from other consumer electronics.
- Reliability is the first priority in lieu of the “low price” requirement

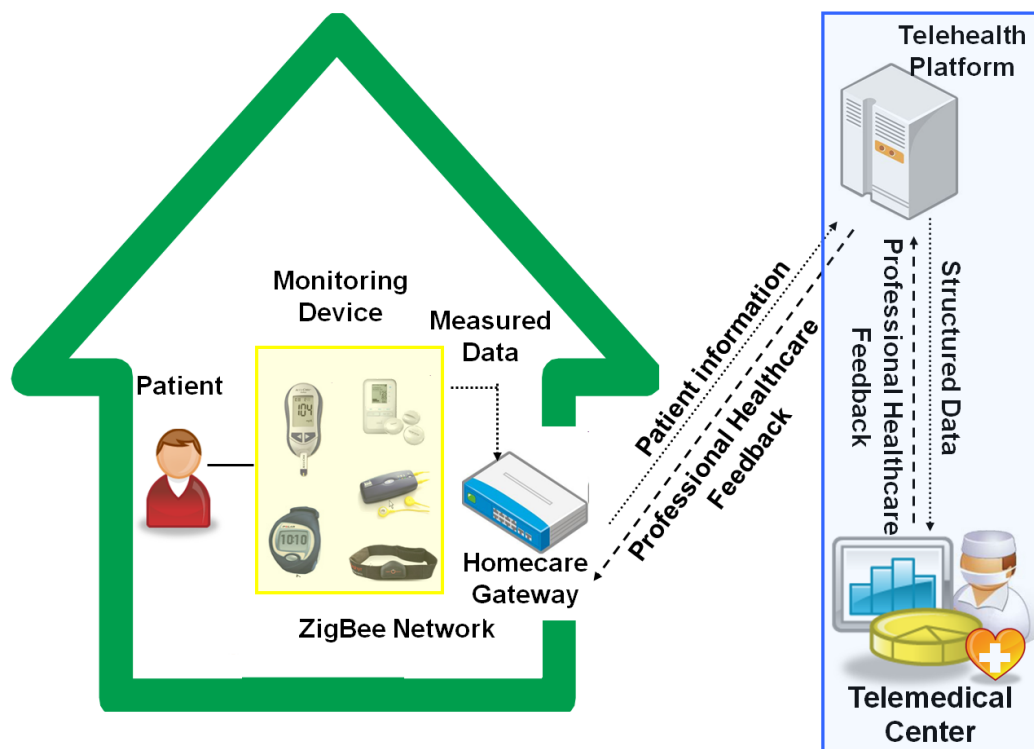


Commonly measured signals

| DEVICE | DEVICE FUNCTION |
|----------------------|--|
| Pulse Oximeter | Indirectly measures the amount of oxygen in a patient's blood. Expected frequency of measurement is typically once a day. |
| ECG | Measures electrical activity of the heart over time to provide 1 to 3 channel electrocardiographic waveforms or derived heart rate. |
| Blood Pressure Meter | Measures a patient's blood pressure. Expected frequency of measurement is several times a day. |
| Thermometer | Measures the body temperature of a patient. The expected frequency of measurement is several times a day. |
| Weight Scale | Measures the weight of a patient. Expected frequency of measurement is from once per week to several times a day. |
| Glucose Meter | Measures the approximate concentration of glucose in a patient's blood. It is used by disease (e.g. diabetes) management applications. For current generation devices, the expected frequency of measurement is several times a day. Future generation devices are expected to function in continuous mode and as such, the frequency of measurement ⁵³ is application dependent. |

Remote patient monitoring system

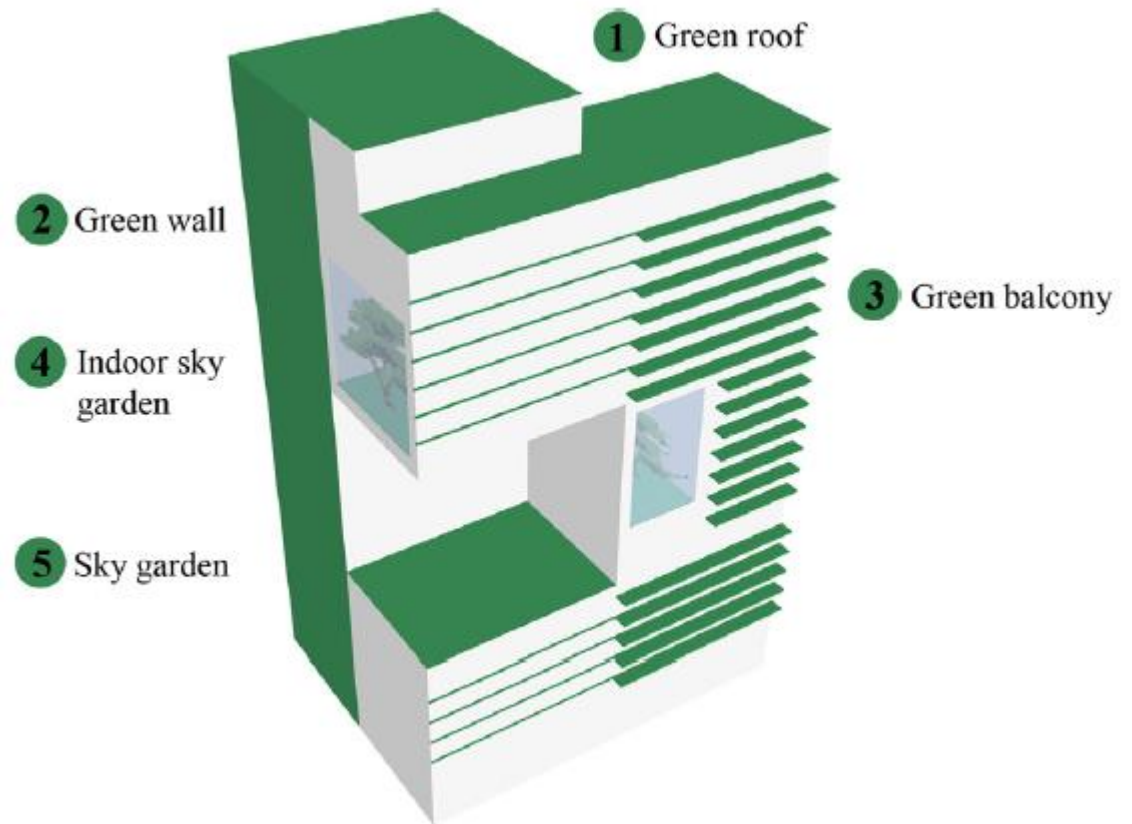
- Simultaneously track the status of long-term patients at home by using mobile medical sensors [12]
- Sensors collect medical data from patients and feedback the data to the doctors.
- Doctors may reschedule patients' follow-up appointments according to their latest conditions.



Challenges

Smart concept

- Green roof ?
- Green wall ?
- Sky garden ?



IoT challenges

- Interferences
- How to ensure IoT development is energy efficient ?
- How to ensure IoT development create less unwanted outcome (unwanted outcome may be energy inefficient !)

- Others.....

Q & A

Thank You

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