SinBerBEST Annual Meeting '13

Efficient Information Network for Intelligent Buildings

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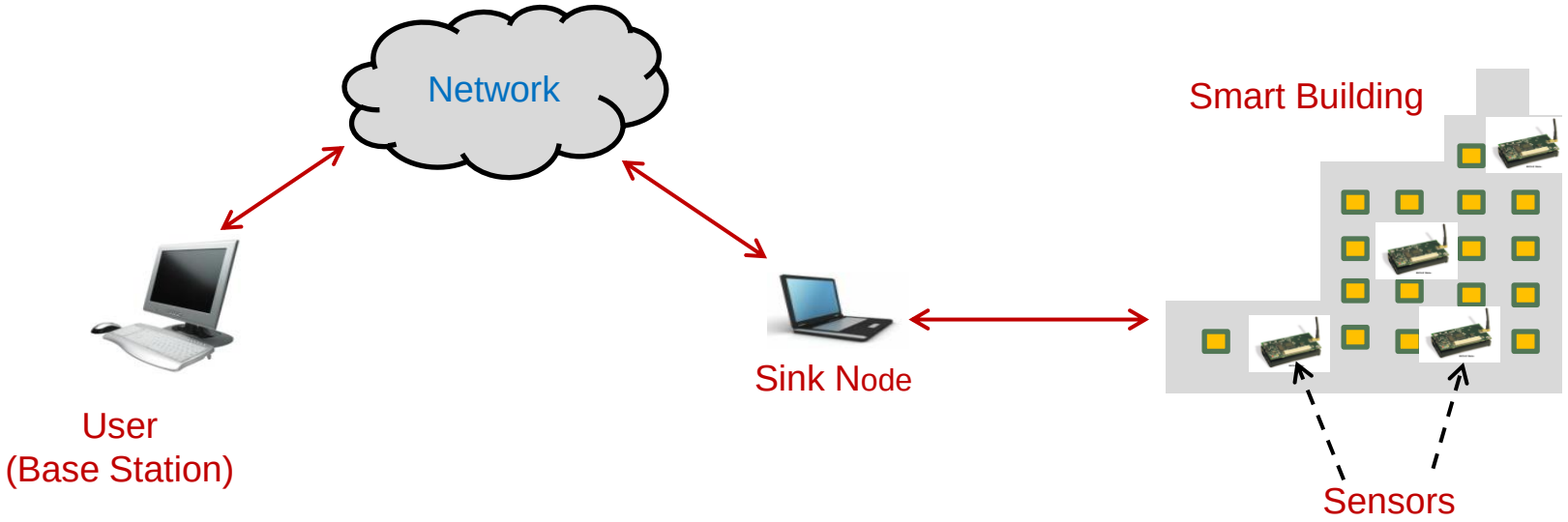
OUTLINE

1. Motivation & Objectives
2. Background
3. Technology Involved
4. WSN Test-bed
5. Conclusions

MOTIVATION

- Recent development of wireless communication protocol for building automation applications and the availability of low-cost sensing and processing module of wireless sensor devices bring current interest to develop the smart building.



WHAT IS SMART/INTELLIGENT BUILDINGS?

- Energy management is becoming a key concern in all aspects
- Make new/ existing buildings:
  - More energy efficient
  - More economical to operate
  - Easier to manage with centralized controls
  - Increase operating efficiency
- Monitoring the energy consumption of the building and all households within the building.
- Know where consumes more energy and where to save energy
- Turn on appliances during low-price periods.
- Adjust heating/air-con to optimize the use of energy

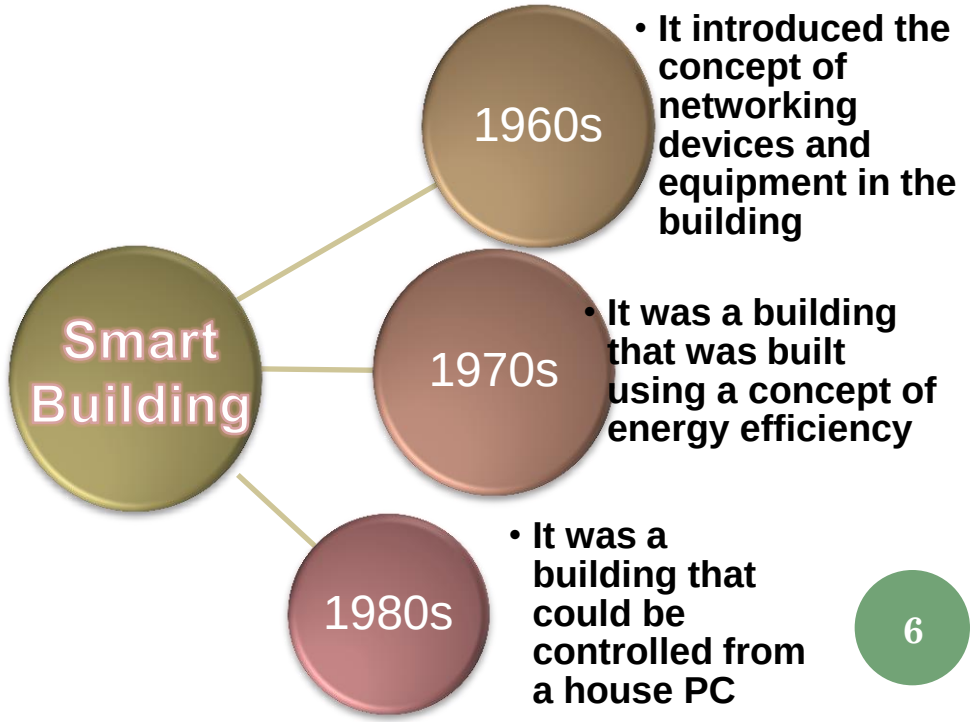
OBJECTIVES

- Design Efficient Information Network to make Buildings ‘greener’ and ‘smarter’.
  - Monitor and control the fun functionalities inside, according to the building structure, indoor and outdoor environment.
  - Optimize the energy consumption.
  - Improve safety and security.
  - Reduce operating expenses.

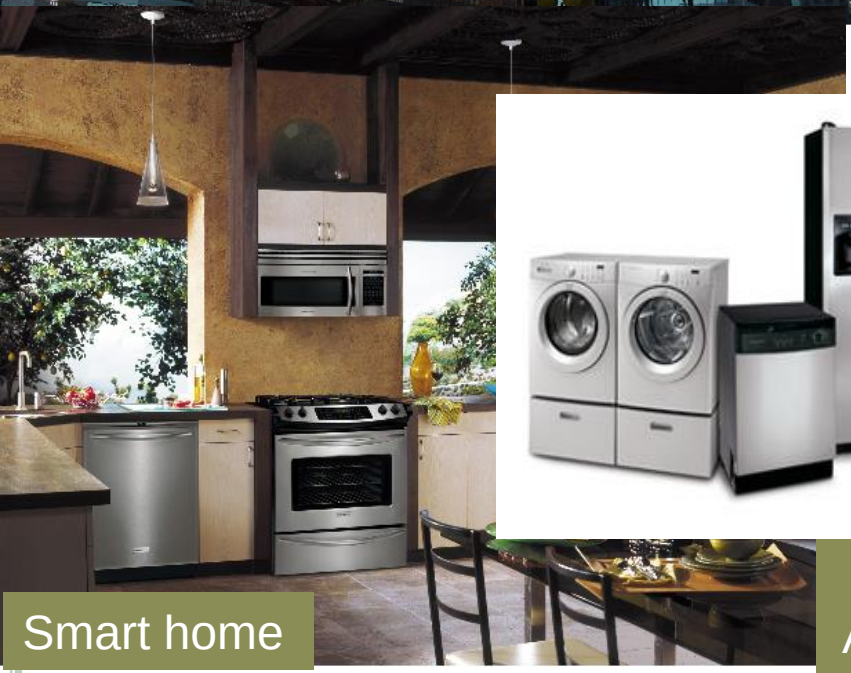
BACKGROUND

- Information communication technology (ICT) enables smart buildings to communicate both with its inside devices and appliances, which they can also control, and with its surroundings. Furthermore, they can adapt to grid's conditions and communicate with other buildings, hence creating active micro grids or virtual power plants.

Today, smart buildings comes with additional subsystems for managing and controlling renewable energy sources, house appliances and energy consumption using wireless communication technology.



WIRELESS TECHNOLOGIES MAKE THIS ACHIEVABLE



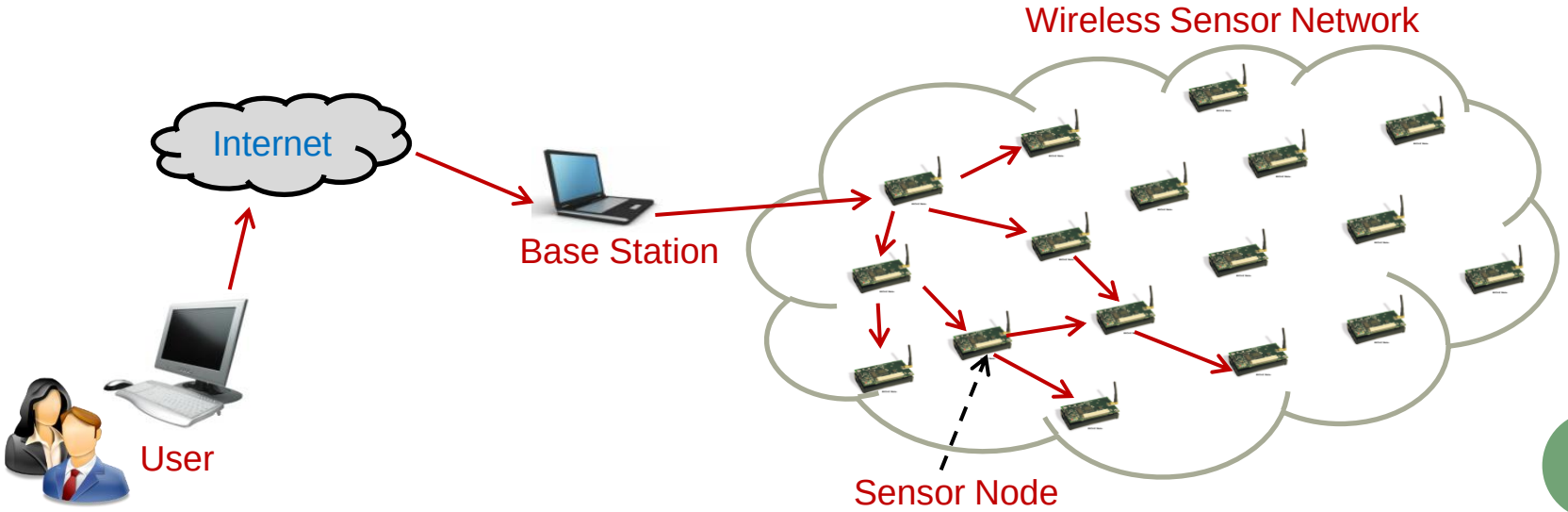
TECHNOLOGIES INVOLVED

- Wireless Sensor Network
  - can be used to reduce energy consumption of HVAC (heating, ventilation, air conditioning, lighting and other related equipment) systems by exploiting the context-aware capability of sensors
- Internet of Things
  - focuses on interactions between humans and physical objects rather than on sensing and reporting low level information such as temperature data.
- Machine-to-Machine Communication
  - is a combination of various heterogeneous electronic, communication, and software technologies.

WIRELESS SENSOR NETWORK (WSN)

What is WSN?

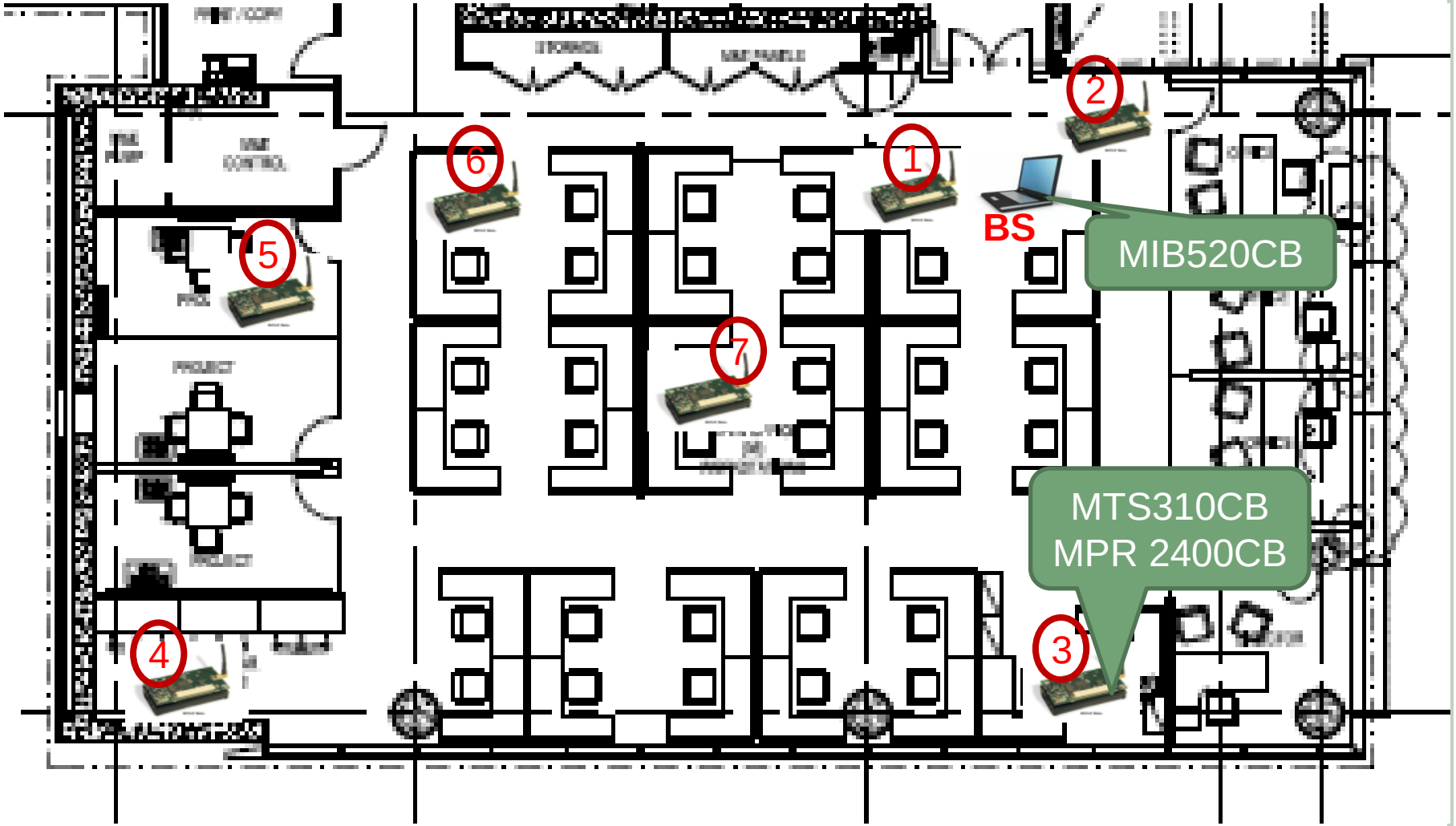
- The WSN used in smart building management systems consists of different types of sensor nodes measuring parameters such as temperature, humidity, light, asphyxiating gases/smoke, occupancy, and power consumption.



IDEAS OF USING WSN

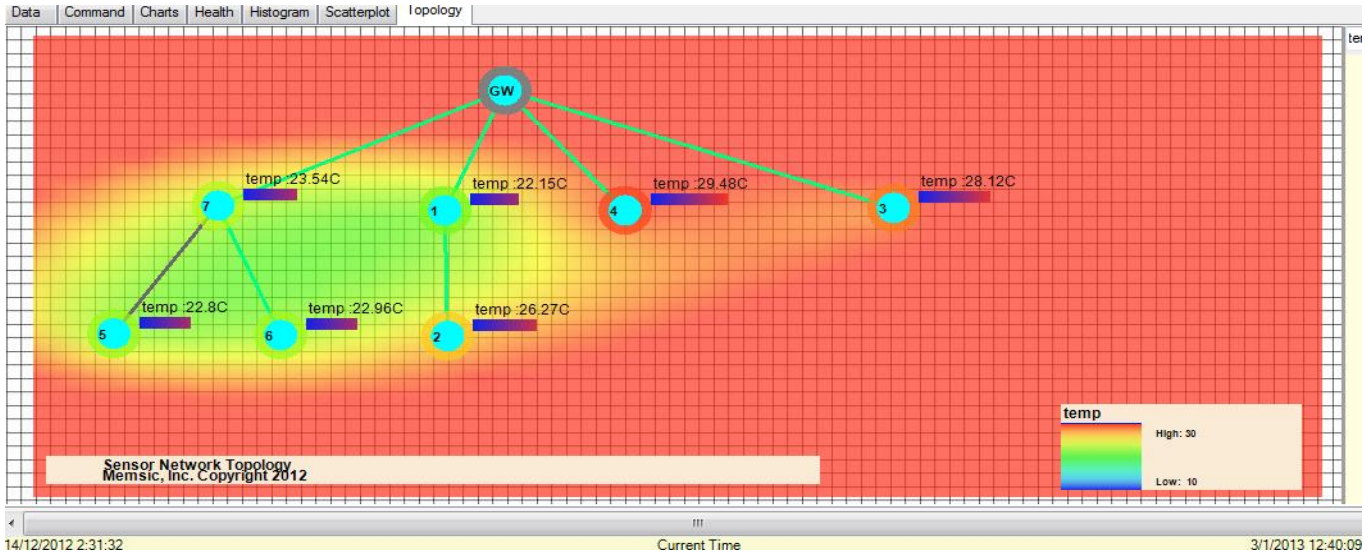
- To reduce energy consumption of HVAC (heating, ventilation, air conditioning, lighting and other related equipment) systems by exploiting the context-aware capability of sensors.
- To design efficient Information network to make Buildings 'greener' and 'smarter'.
  - ✓ Monitor and control the fun functionalities inside.
  - ✓ Optimize the energy consumption.
  - ✓ Improve safety and security.
  - ✓ Reduce operating expenses.

WSN TESTBED IN CREATE



User Interface for WSN Data Gathering

25 November 2013



File Settings Tools Units Help

LIVE

Nodes

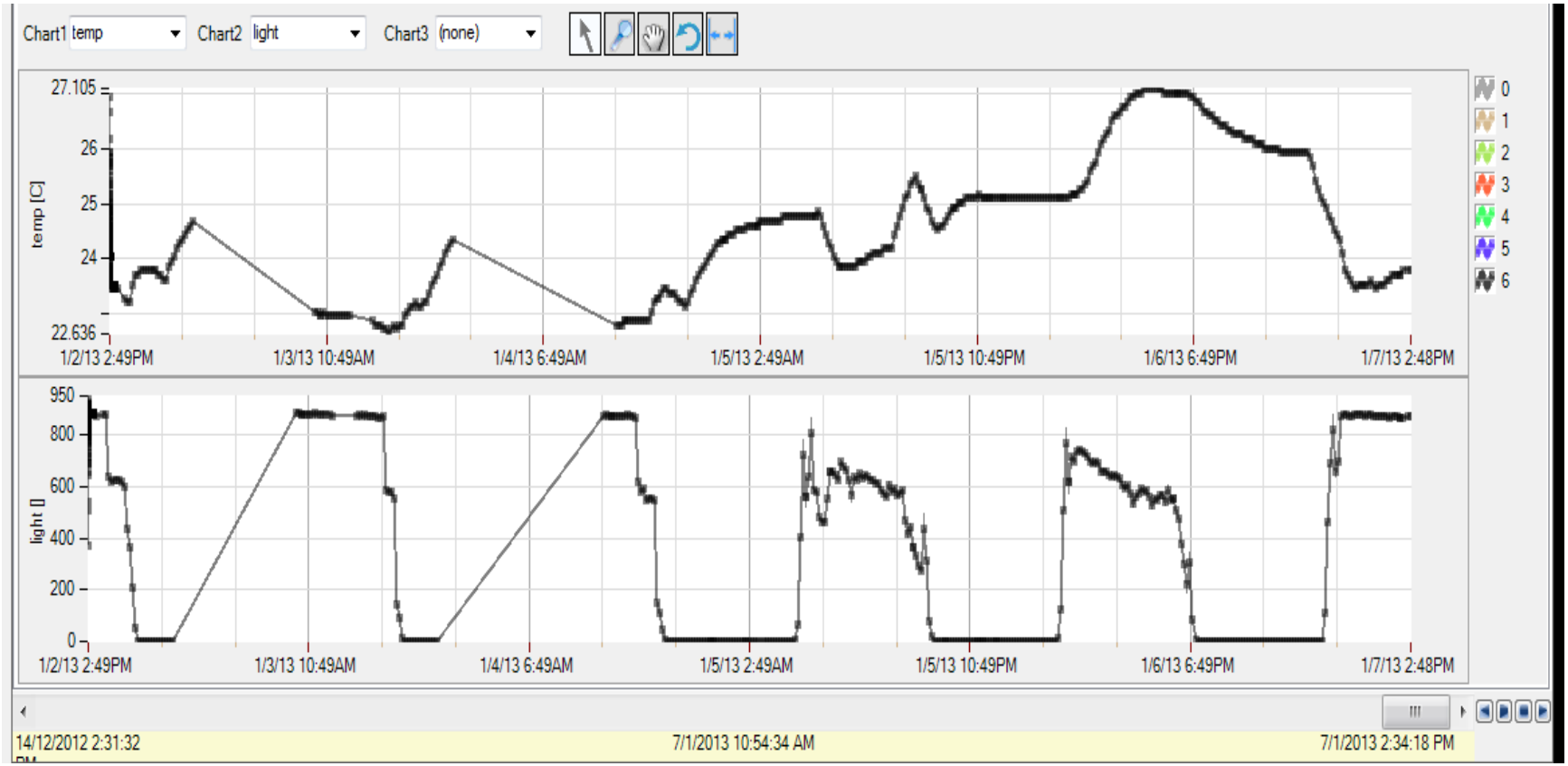
Id	Name
00	Gateway
01	Node 1
02	Node 2
03	Node 3
04	Node 4
05	Node 5
06	Node 6
07	Node 7

Data | Command | Charts | Health | Histogram | Scatterplot | Topology

Node Data

Id	voltage	temp	light	accel_x	accel_y	mag_x	mag_y	mic	Time
1	2.73 V	22.23 C	728	-2 g	-0.46 g	28.49 mga	28.63 mga	388	3/1/2013 12:54:44 PM
2	2.72 V	26.35 C	899	0 g	0 g	27.95 mga	27.95 mga	382	3/1/2013 12:54:44 PM
3	2.72 V	28.2 C	941	-0.1 g	0.06 g	27.95 mga	27.95 mga	387	3/1/2013 12:54:45 PM
4	2.76 V	29.48 C	967	-0.08 g	0.02 g	27.68 mga	106.15 mg	386	3/1/2013 12:54:46 PM
5	2.64 V	22.8 C	756	-1.62 g	0.8 g	28.9 mgau	28.76 mga	384	3/1/2013 12:50:52 PM
6	2.76 V	22.96 C	874	-0.22 g	0.24 g	28.49 mga	28.22 mga	379	3/1/2013 12:54:47 PM
7	2.68 V	23.54 C	896	-0.06 g	-0.08 g	28.36 mga	28.22 mga	383	3/1/2013 12:54:48 PM

EXAMPLE OF WSN DATA GATHERING



INTERNET OF THINGS (IOT)

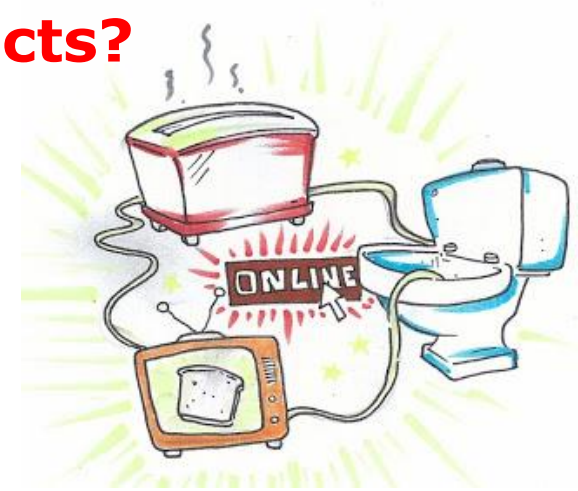
➢ What is IoT?

- IoT involves with a huge number of tiny, battery-powered, independent and intelligent things/objects to do the followings:

	Required Technologies
Talk to each other	Communications
Perform one or several tasks	Hardware/electronics
Make decision	Optimization/Control theory Data/video analytics

➢ What are these things/objects?

- RFID
- Wireless sensors
- Smart phones
- RFID sensor
- NFC



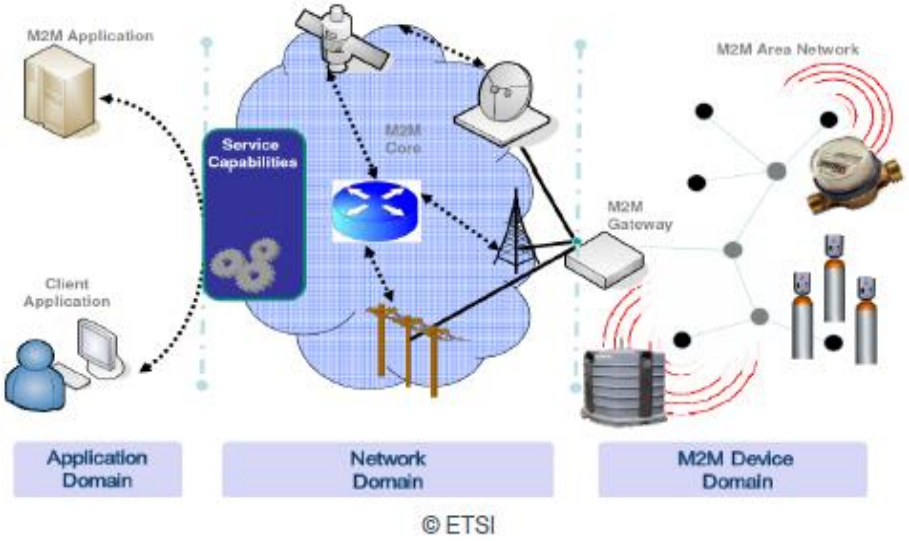
Machine-to-Machine Communication (M2M)

➢ What is M2M?

- M2M means no human intervention whilst devices are communicating end-to-end.

➢ What are the characteristics of M2M?

- Multitude
- Variety
- Invisibility
- Criticality
- Intrusiveness



WSN

M2M

IoT

Intelligent Application

Appliances talk with each other

Everything connect to Internet

Build up Efficient Network for Intelligent Building

CONCLUSIONS

- Design Efficient Information Network to make Buildings 'greener' and 'smarter'.
  - ✓ Monitor and control the fun functionalities inside,
  - ✓ Optimize the energy consumption.
  - ✓ Improve safety and security.
  - ✓ Reduce operating expenses.
- Utilise the advanced technology in order to develop energy efficient applications/ services for 'smart' building
- Optimize the energy efficiency in 'smart' building
  - ✓ Use energy only when it is necessary
  - ✓ Use the exact amount of necessary energy
  - ✓ Apply the energy in the highest possible efficiency


Thank you!