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User Requirements for IoT

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Speaker Background

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Outline

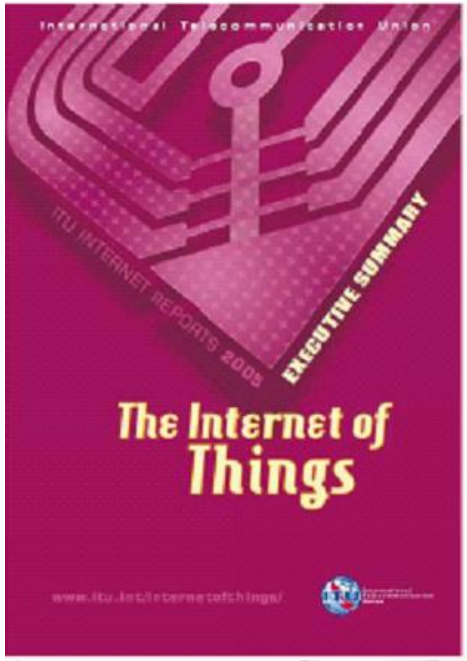
- Overview
- IoT Characteristics
- Functional Requirements
- Network Requirements
- Conclusion and Future work

◆ Overview

➢Internet of Things (IoT) are dependent on specific application areas. The exiting solutions used in these individual application domains hinder the uptake and penetration of specific tailored services for IoT applications, in particular for innovative business processes.

➢The goal of this draft is to discuss the basic requirements for IoT applications from a user's perspective that will provide guidance to the IoT standard and for the development and deployment of IoT technologies and products to fulfil the users' needs

➢The minimum requirements to be met by the technology and equipment involved are described.

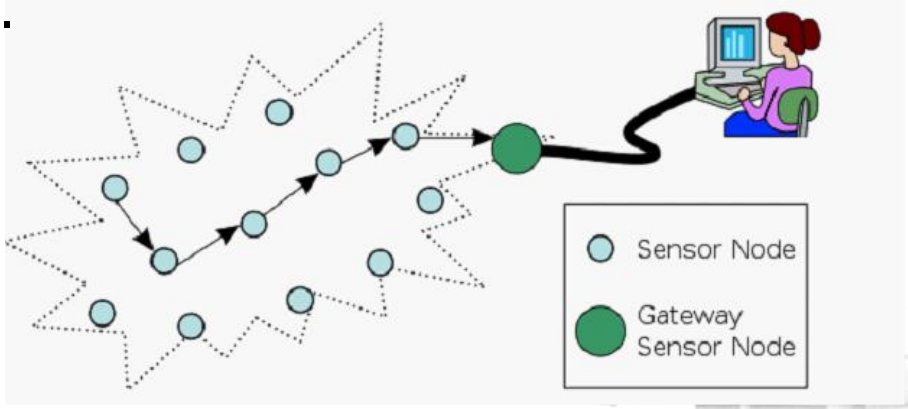


◆ IoT Characteristics

IoT technology opens up new areas of application which cannot be realized with conventional, wired technology. These primarily involve areas of application which require flexibility and mobility.

➢ **Flexibility**

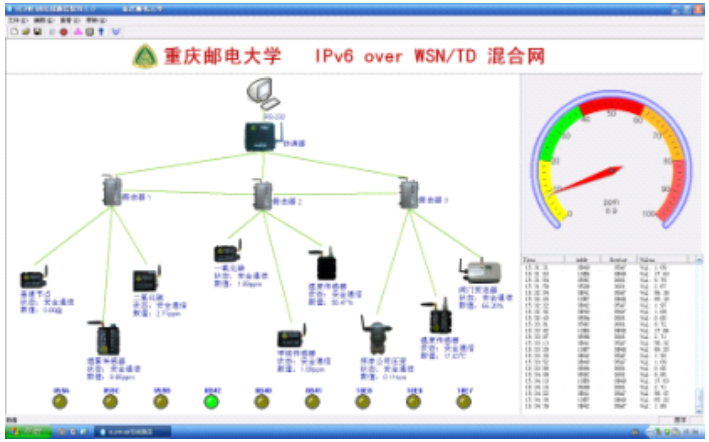
Temporary, flexible and rapid use of automation solutions is one of the core features of IoT applications using wireless communication technology. Flexibility enables the multiple use of IoT systems at different locations.



◆ IoT Characteristics

➢ Mobility

Mobile, transportable automation solutions form the second area of emphasis involving wireless technology in IoT applications. Mobility enables the user to access all necessary information in real-time, regardless of the location. Consideration should be given to all systems in this respect, including mobile display and control terminals, diagnostic units and wireless field devices.



◆ IoT Characteristics

- Micro-embedded devices with limited resource, such as energy, the capabilities of storage, calculation and communication are limited.
- large-scale deployment in an open environment, and may be vulnerable to many types of threats;
- Traditional mechanisms and methods are not applicable;
- Gathered from the physical world
- Operate for a long period of time without maintenance or technical support, and it may self-adapt to changed conditions, which ensure robustness and reliability of networks.
- Coexistence of radio technologies, multi-protocols and applications in the heterogeneous or large-scale networks.
- The application scenarios are diverse, and the frequency of data exchange is higher than traditional data networks.
- …….

◆ IoT Characteristics

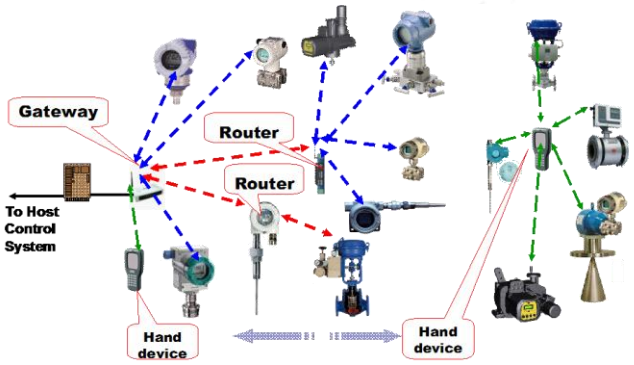
Specific areas of IoT applications are classed as follow:

➢**Application class A: functional safety**

Time-critical applications in the area of functional safety, process interventions and interaction with other applications and systems are governed by the requirements of critical safety applications.

➢**Application class B: process management/control**

Time-critical, deterministic applications which must meet high requirements with regard to availability and reliability. Interactions with other applications and process interventions are included.

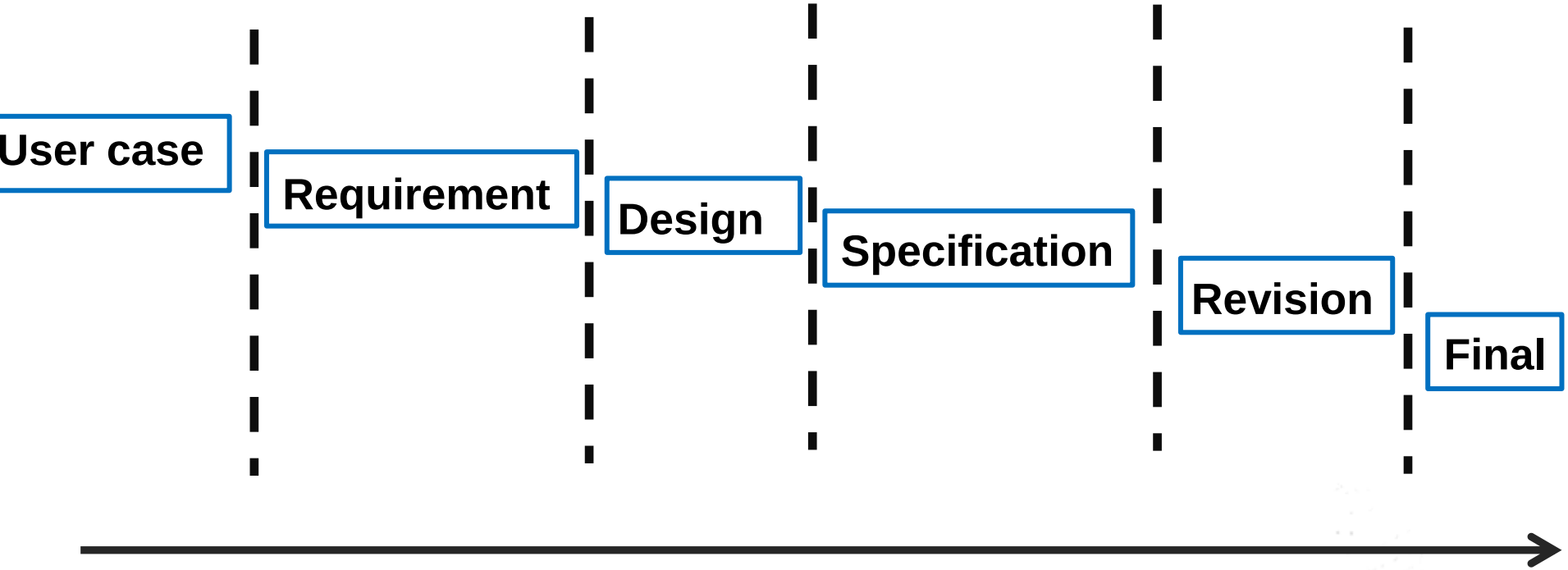


◆ IoT Characteristics

➢**Application class C: display/monitoring**

Applications which are not time-critical and exclusively provide additional information. Interactions with other applications and systems are excluded.

The possible roadmap for IoT standard



◆Functional Requirements

➢ Communication Architecture

IoT is emerging a variety of solutions for specific applications:

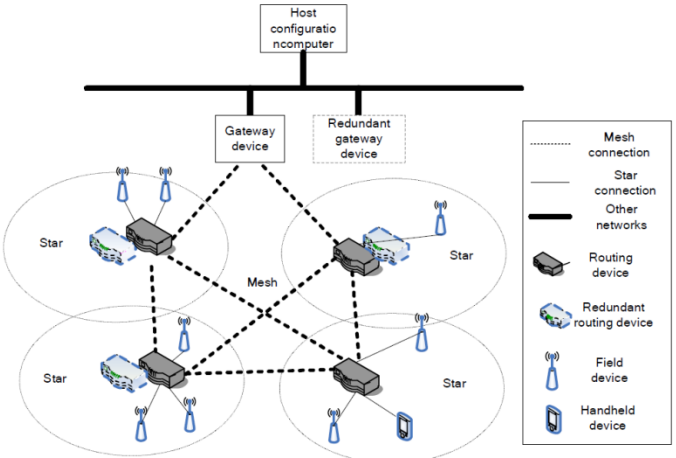
- ➢ No interoperable at the communication layer, and often not even at the service layer;
- ➢ Do not address the scalability of a future IoT;
- ➢ Fundamentally neglect privacy and security.

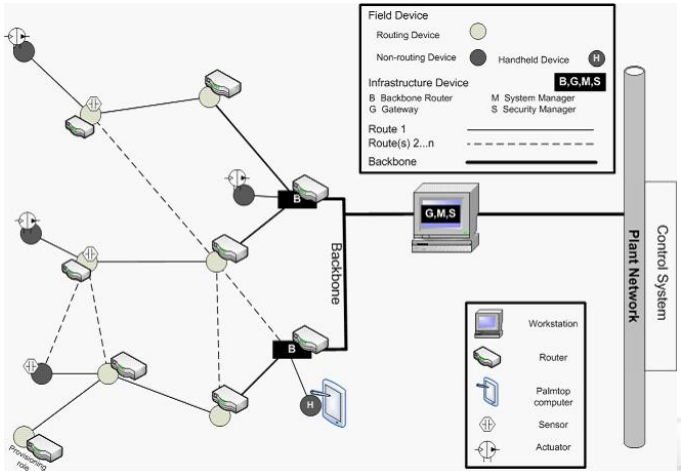
➢An architecture can:

- ➢ Promote a common understanding of IoT domains;
- ➢ Supported businesses that want to create their own compliant IoT applications.

◆Functional Requirements

- **System network management process:**
  - Governs the network, the devices, and the communications;
  - Monitors and reports on configuration, performance, and operational status;
  - Provides time-related services.
- **System security management process:**
  - Works in conjunction with the system network management process and optional external security systems to enable secure system operation.





◆Functional Requirements

➢Device Functions

- **Field device functions:**

  •Sensing, data collection, and actuation via an I/O connectivity process.

  • Field device nodes may be optimized for low energy for completely wireless operation.

  • Can optionally be mains powered for increased performance and where communication wire elimination is beneficial.

  • Can be stationary or mobile with a limited range of operation (such as an overhead crane). Mobility can impact battery life and/or latency and latency variability.

- **Router functions:**

Wireless function to forward network traffic on behalf of neighbouring nodes by utilizing network layer protocols. Routers move infrequently if at all.

➢Device Functions

➢ **Gateway function**: providing connectivity between one or more field devices on the wireless network and one or more IoT applications via a protocol translation process.

◆ Hosting of embedded processes, including those required to perform generic IoT applications, security management, and network management;

◆ Operation of multiple gateways in a single system for the following purposes:

- Redundant operation to eliminate single points of failure;
- Symmetric parallel operation for improved bandwidth from IoT networks to external systems;
- Asymmetric parallel operation for multiple protocol translations .

➢ Device Functions

➢Gateway function:

Hosting of protocol translations:

- Primary protocol translation to carry foreign protocol traffic across the IoT network;
- Secondary protocol translation to convert from one foreign protocol to another foreign protocol.

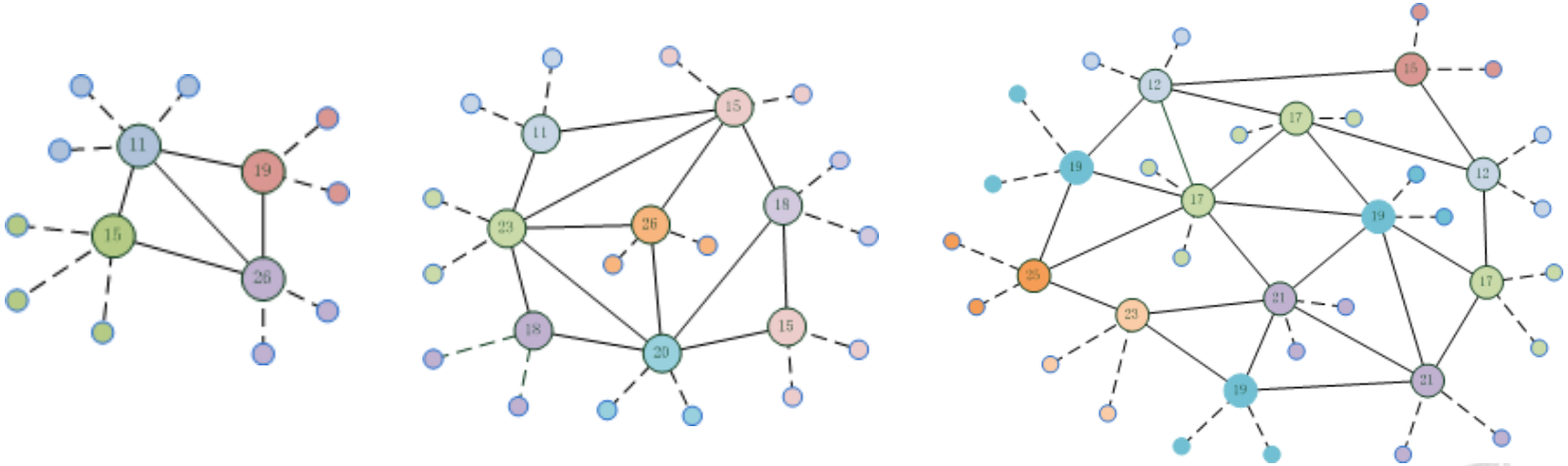
➢ Device Functions

➢Handheld function:

Wireless function to enable wireless workers to interact with the wireless network via a display-oriented process/device. Nodes are nomadic -- moving to a location, establishing a local connection to the network, communicating with one or more network nodes, and when finished, disconnecting from the network.

◆ IoT network Requirements

Flexibility： Temporary, flexible and rapid use of solutions for wireless communication technology in IoT applications. Flexibility enables multiple uses of systems at different locations and, consequently, a reduction in investment and installation costs.

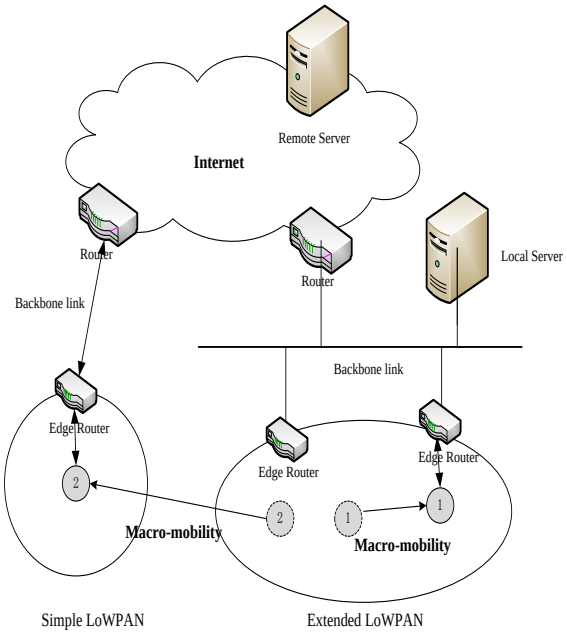


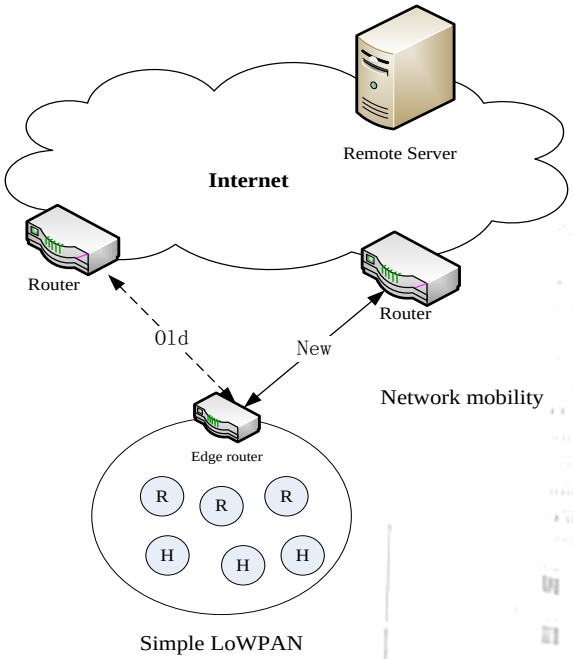
◆ IoT network Requirements

Mobility: Mobile, transportable solutions form the second area of emphasis involving wireless technology.

Use case 1: Moving nodes within a wireless network.

Use case 2: Moving nodes between different wireless networks.





◆ IoT network Requirements

- **Real-time capability:** Uniform, unequivocal and non-proprietary parameters (e.g. latency, deterministic) should be defined for characterizing real-time capability relative to IoT applications
- **Quality of service**
  - To support multiple IoT applications within a network along with diverse needs, the requirement for multiple levels of quality of service (QoS) must be met.
  - A device's application requests the level of QoS needed;
  - If the necessary resources can be made available for the requesting application, the system management function will allocate those resources in response to the requested QoS.

◆ IoT network Requirements

● Security

Common security requirements include:

- External attack, similar to a denial of service (DoS) attack on IP networks;
- Corruption of data;
- Disruption of a wireless device's ability to maintain the required response time;
- A security manager design that allows for multiple isolated point-to-point IoT networks connected to a centralized security manager;
- A "backdoor" to other systems through bridging or gateways to other networks.

◆IoT network Requirements

● Security

IoT security attributes that should be available include the following:

- Authentication and access management;
- Use control including authorization, access rights, and legitimacy of the person or device and its function, action, and privileges (e.g., read, write, delete);
- Integrity ;
- Assured availability (confidence, related to timing);
- Time sensitivity (e.g., to avoid replay attacks);
- Encryption;
- Event logging/auditing/reporting;
- Validation or verification of specific safety-related events;
- Differentiation of critical vs. non-critical data and its impact on vulnerability assessment.

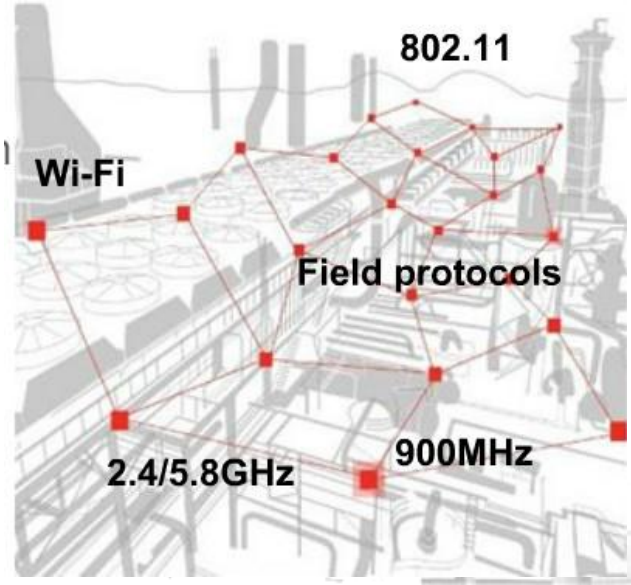
◆IoT network Requirements

- **Coexistence**
  - ◆ To ensure the coexistence of basic technologies uniform and non-proprietary parameters must be defined to characterize the coexistence of IoT solutions.
  - ◆ IoT standard must ensure the coexistence of the basic technology employed with other radio technologies, taking international standards (e.g. IEEE 802.15.4, IEEE 802.11) into consideration.

The standard has to be designed as a radio environment friendly technology with attention paid very carefully to

a) Maintaining coexistence with other radio Technologies

b) Minimizing coexistence impact on other existing radio technologies.



◆IoT network Requirements

● Interchangeability

- Proprietary, manufacturer-dependent expansions which impact the interoperability of the devices on the IoT network must be strictly avoided.
- The user must be able to add or remove wireless devices to their IoT applications, irrespective of which vendor supplies them.
- Additional vendor specific features must not have any negative impact on the basic function of the IoT applications.
- The communication regulations utilized by the manufacturer must be accessible for all users.

◆IoT network Requirements

- **Test**
  - Conformance testing is to confirm the consistency of Implementation Under Test (IUT) and standard;
  - Interoperability testing is accomplished by evaluating the correctness of protocol standard specified for interoperation between target implementation and the connected relative implementation under network interoperating environment;
  - Functional testing verifies that the Device Under Test (DUT) will correctly perform its intended logical functions;
  - functional testing is to verify that IoT within a constraint condition are required to achieve the basic functions and application functions;
  - Performance testing and system testing.

◆IoT network Requirements

●Diagnostic

- User-friendly diagnostic tools and integrated diagnostic routines should contribute to the targeted and efficient narrowing down of error causes. These tools should enable simple status identification and provide unequivocal status messages;
- Diagnostic tools should be supplied with equipment by the manufacturer. In addition, monitoring of the quality of wireless communication and the components used should be possible using integrated tools of this nature. It should be possible to ascertain and check defined requirements using key performance indicators in this context.
- Diagnostic functionality should also be employable locally in IoT applications.

- **Conclusion and Future work**

  - User Requirements is very important for the IoT standard
  - This IoT standard has to provide a common architecture that will afford the greatest diversity of wireless nodes applications that can now, or in future, be available to the end users.
  - It is expected by users that the IoT standard covers and integrates state of the art technologies and developments.
  - Users require a scalable architecture that can be constructed in a flexible manner and support a variety of environment and application requirements.
  - Functional requirements and non-functional Requirements need to be satisfied
  - We will push the works in the IoT SWG

Thanks for Your Attentions!