Internet of Things in the Field of Communication

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***Abstract-* The Internet of Things (IoT) is a promising technology which tends to revolutionize and connect the global world via heterogeneous smart devices through seamless connectivity. The current demand for machine-type communications (MTC) has resulted in a variety of communication technologies with diverse service requirements to achieve the modern IoT vision. More recent cellular standards like long-term evolution (LTE) have been introduced for mobile devices but are not well suited for low-power and low data rate devices such as the IoT devices. To address this, there is a number of emerging IoT standards. Fifth generation (5G) mobile network, in particular, aims to address the limitations of previous cellular standards and be a potential key enabler for future IoT. In this paper, the state-of-the-art of the IoT application requirements along with their associated communication technologies are surveyed. In addition, the third-generation partnership project cellular-based low-power wide area solutions to support and enable the new service requirements for Massive to Critical IoT use cases are discussed in detail, including extended coverage global system for mobile communications for the Internet of Things, enhanced machine-type communications, and narrowband-Internet of Things. Furthermore, 5G new radio enhancements for new service requirements and enabling technologies for the IoT are introduced. This paper presents a comprehensive review related to emerging and enabling technologies with main focus on 5G mobile networks that is envisaged to support the exponential traffic growth for enabling the IoT. The challenges and open research directions pertinent to the deployment of massive to critical IoT applications are also presented in coming up with an efficient context-aware congestion control mechanism.**

Index Terms- Internet of Things, Long-term evolution, machine-type communication, 5G new radio.

I. INTRODUCTION

Now a days Internet of Things (IoT) gained a great attention from researchers. Since it becomes an important technology that promises a smart human being life, by allowing a communication between objects, machines and everything together with people IoT represents a system which consists a things in the real world, and sensors attached to or combined to these things, connected to the Internet via wired and wireless network structure.

The Internet of Things (IoT) is an emerging and promising technology which tends to revolutionize the global world through connected physical objects. IoT deals with low power devices which interact with each other through the Internet. The concept of the IoT [1]–[6] has drawn the attention of the research community with the end goal of ensuring that wearables, sensors, smart appliances, washing machines, tablets, smart-phones, smart transportation system, etc., and other entities are connected to a common interface with the ability to communicate with each other. IoT interconnect‘‘Things’’ and enables machine-to-machine (M2M) communication, a means of data communication between heterogeneous devices without human intervention [7].

The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy and economic benefit.

In the Internet of Things (IoT), devices gather and share information directly with each other and the cloud, making it possible to collect, record and analyze new data streams faster and more accurately. That suggests all sorts of interesting possibilities across a range of industries: cars that sense wear and tear and self-schedule maintenance or trains that dynamically calculate and report projected arrival times to waiting passengers.

But now here does the IoT offer greater promise than in the field of healthcare, where its principles are already being applied to improve access to care, increase the quality of care and most importantly reduce the cost of care. At Free scale, we're excited to see our embedded technologies being used in applications like telehealth systems that deliver care to people in remote locations and monitoring systems that provide a continuous stream of accurate data for better care decisions.

As the technology for collecting, analyzing and transmitting data in the IoT continues to mature, we'll see more and more exciting new IoT-driven healthcare applications and systems emerge. Read on to learn what's happening now—and what's on the horizon—for healthcare in the age of the IoT.

II. MOTIVATION

1. The volume of data transacted by devices grows exponentially. In several vertical markets there are more and more devices that communicate with each other to accomplish tasks. The amount of data generated by these devices is huge and there is a need to develop new M2M communications platforms flexible enough to accommodate a wide range of markets, each with its own specificities. The use of open technologies and interoperable distributed platforms is then a necessity. The present work aims to contribute to the development of a platform for M2M communications and presents a comparative study of technologies under M2M communications area. The research design is a qualitative, exploratory case study. The cases are three Flemish startups: Partheas, Healthy and Ectosense. An overview of these companies is given alongside a description of their application. Semi-structured inter views were used to collect the data since this provides some advantages for the research.
2. The analysis of the data is based on the interview guide which offered an overview to discover differences, similarities and trends in the interviews. To finish this chapter, some remarks about the reliability and validity of the research are discussed.

III. LITERATURE SURVEY

The IoT section first discusses the necessary technologies for IoT. This is followed by a definition that includes some key components a system should possess to label it as IoT.An IoT application that fits the definition connects heterogeneous objects that are embedded with intelligence This allows the autonomous interaction of these objects. The created data is integrated and analyzed by a cloud structure. During this entire process, the focus is on automation Then some related concepts are compared with IoT: smart devices, a wireless sensor network, machine to Machine communication and cyber-physical systems. An illustration of a future IoT application is given at the end of this section. A section on business models is included since this concept is an important topic when introducing new technologies. The nine building blocks of the Business Model Ontology by Oster walder, Pigneur ,& Tucci(2005)are used as a framework to describe a company's business model. This section starts with a description of this framework, followed by the reasoning why this one is chosen. Next, the use of business models for IoT is outlined, based on the current (limited) literature on this topic. Three perspectives are discussed.The business models of companies that will implement IoT in other companies or create IoT systems, the transformation of current business models by the impact of IoT and the creation of completely new business models. To finish this section, three current challenges for IoT are identified: interoperability of smart objects, regulatory restrictions of the government and finding the right business model.

IV. SYSTEM DESIGN

Layers: - L.1 Physical Device Layer. This layer consists of wireless sensors, actuators, and controllers, which actually are the "things" of IoT. Physical devices are a common layer in all the architectures. In this layer, small size devices such as Nano-Chips are to be employed to increase computational processing power and to reduce power consumption. Nano-Chips are able to produce a high amount of initially processed data which is suitable for Big Data at data analytic layer L2. Communication Layer. This layer consists of two sublayers. D2D Communication and Connectivity layers. Direct Device to Device (D2D) Communication Sub-Layer. Due to the increasing processing power and intelligence of physical devices (nodes), they contain their own identity and personality and generate their own data. To increase the efficiency and capabilities of the IoT systems, these devices should form a HetNet to communicate

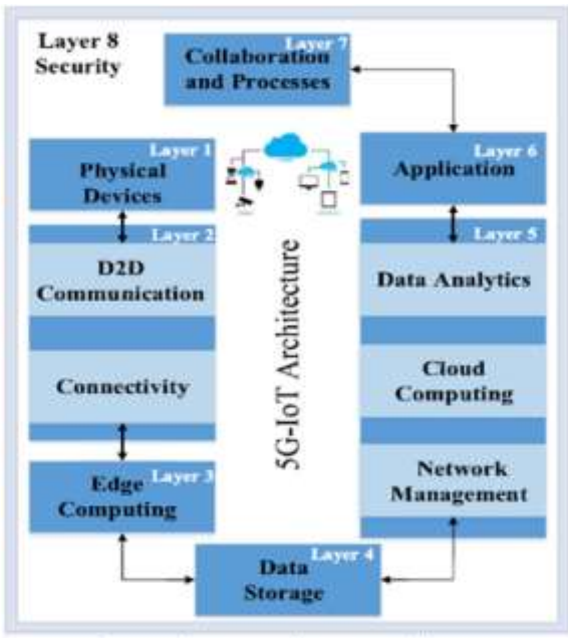

Fig. System Design

Connectivity sub-layer. In this sub-layer, devices are connected to communication centers, such as BSs. In addition, they send and analyze their data through the centers by the Intranet connection to the storage unit. At the moment, this sub-layer of the IoT has some specific problems: only limited number of device connections can be handled; in applications, such as autonomous vehicle, data exchange for a variety of data types are not applicable; high volume data can hardly be processed in real-time due to large communication latency. In near future, deployment of the 5G makes a great evolution at this sub-layer in the sense of reliability, performance, and agility. Another technology of this sub-layer is Advanced SSIM as explained in the last section. By this technology, the IoT devices attain the capability of choosing suitable spectrum (frequency bands) with sufficiently low interference. In fact, the SSIM techniques are beneficial to take the opportunities of spectrum sharing based on cognitive radios as well.

L4. Data Storage layer. This layer contains data storage units in which the information obtained from edge processing of the physical devices are stored as well as raw data. This layer requires special protection in terms of security, and also should be responsive to the huge data volume and traffic of future applications.

L5. Management Service layer. This layer consist of three sub-layers as follows: Network Management Sub-Layer. Network management involves changing the type of communication between devices and data centers. The most important technology involved in this sub-layer is WNFV. The WNFV is able to update topology of the network and type of communication protocols, such as 5G-IoT or ZigBee, simultaneously to improve the quality of the IoT structure. Another useful technology at this Figure 1. The proposed 5G-IoT architecture. sub-layer is WSDN. The WSDN manages the IoT network and enables network reconfiguration instead of traditional network monitoring for performance enhancement. Cloud Computing Sub-Layer. In this sub-layer, data and information from the edge computing are (re)processed in the cloud so that final processed information can be derived. By implementation of 5G technology, the mobile devices are capable of performing this type of computing, which is referred as MCC, in real-time. Hence, the processing operations will be distributed among mobile devices in parallel to make the IoT system more efficient, sustainable, scalable, and faster. Data Analytics Sub-Layer. In this sub-layer, new methods of data analytics [4] are employed to produce value (manipulatable information) from raw data. Any improvement in Big Data algorithms will enhance the data processing at this sub-layer. In fact, the role of this sub-layer is dominant in near future when the amount of collected information is increased due to the integration of 5G and the IoT.

L7. Collaboration and Processes Layer. The IoT system and the information arrives from the previous layers are not useful unless it produces an act. People are empowered by applications performing business logic. People use applications and associated data for their particular needs. Sometimes, multiple individuals use the same application for different purposes. In fact, individuals must be able to collaborate and communicate to make the IoT serviceable.

L8. Security Layer. Like many architectures [23], [24] this layer is considered to be a separate layer. In fact, this layer covers and protects all previous layers but each section (the intersection of this layer with another layer) has its own functionality. The security layer of the proposed architecture entails various terms of security features including data encryption, user authentication, network access control and cloud security [6]. In addi- tion, security layer also prevents and anticipates the dangers and cyber-attacks, including the forensics to detect the type of attack and fail them.

V. CONCLUSION AND DISCUSSION

Internet of Things is the concept in which the virtual world of information technology connected to the real world of things. The technologies of Internet of Things such as RFID and Sensor make our life become better and more comfortable.

The lesson learned through conducting this survey highlight several areas for further research. In terms of sensors, much progress has been made but there are still no available devices that match the accuracy of hospital-grade devices without compromising energy efficiency or wearability. This is especially true of complex devices such as blood pressure and respiratory rate sensors, both of which would be invaluable to the field of medicine. As such, further research efforts should be made towards improving the quality of these sensors until they are highly accurate, reliable, and comfortably wearable. In our own future works, we will be placing particular focus on developing a blood pressure monitor that is more wearable than the works presented in this paper, without compromising accuracy. We will also look at reducing the impact of motion on sensors, particularly for respiratory rate and pulse sensors. In terms of communications standards, it would be worthwhile to develop wearable healthcare systems that are reliant on the emerging NB-IoT standard. As this is an extremely new standard, no known work has implemented it into a healthcare environment despite its obvious advantages for this field. future works, we will be implementing NB-IoT into healthcare devices to confirm its suitability, before using it as the foundation communications standard for a health care system that is being developed in accordance with the model proposed by this paper. Data storage using cloud technologies has been extensively considered, but data processing is an area in which further research should be conducted. The development of cloud-based algorithms that are capable of processing raw data from complex sensors and extract meaningful information about a person's health should be continued. Machine learning is another branch of data processing that would be extremely valuable in healthcare scenarios.

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