THE INTRODUCTION OF MACHINE-TO-MACHINE (M2M) COMMUNICATIONS IN CELLULAR NETWORKS

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Abstract

For Machine-to-Machine (M2M) communications in cellular networks packet scheduling and distributing resources among users is still the main challenge due to unfairness and low performance which occur when allocating resources to users. In this paper, the above mentioned challenges are studied and analyzed, focusing on three schedulers. Simulink is used to compare between the mentioned schedulers and our propoed in terms of throughput, goodput, fairness index, packet loss ratio and spectrum efficiency.

In cellular networks, the introduction of M2M creates new problems due to the maintenance requirements of M2M and the properties of the devices themselves.

The Internet of Things (IoT) provides connectivity for anyone at any time and place to anything. With the advancement in technology, we are moving towards a society, where everything and everyone will be connected [1]. The IoT is considered as the future evaluation of the Internet that realizes machine-to-machine (M2M) learning. The basic idea of IoT is to allow autonomous and secure connection and exchange of data between real world devices and applications [2]. The IoT links real life and physical activities with the virtual world [1,2].

The numbers of Internet connected devices are increasing at the rapid rate. These devices include personal computers, laptops, tablets, smart phones, PDAs and other hand-held embedded devices. Most of the mobile devices embed different sensors and actuators that can sense, perform computation, take intelligent decisions and transmit useful collected infor-mation over the Internet IoT promises a future where billions of smart devices will be connected and managed through a range of communication networks and cloud-based servers, enabling the emergence of a broad spectrum of monitoring and control applications. Machine to Machine (M2M) communications represent the IoT bridge supported by cellular networks. They are also known as Machine Type Communications (MTC) and are a key technology for partially enabling IoT. M2M communication is a new paradigm that facilitates the ubiquitous connectivity between a myriad of devices without or with limited human intervention.

The growing demand for connectivity has challenged network operators to design new radio resource allocation algorithms to handle the massive scale of MTC at affordable costs [2].

In the uplink, one of these problems is radio resource management due to the low productivity of the injustices that occur when allocating resources to users. Long Term Evolution and LTE-Advanced are promising technologies to support M2M connectivity. They have their own IP connectivity, as well as scalability for various devices. Therefore, LTE schedulers can meet the needs of M2M devices, namely time constraints, special QoS requirements. eduling or resource allocation is one of the major challenges facing M2M communications over Long Term Evolution (LTE) networks. M2M traffic has unique characteristics; it usually consists of a large number of small data packets, with specific delays, generated by a potentially large number of devices competing on scarce radio resources. Currently, LTE is an internationally recognized mobile communication standard for 4G. With the advent of M2M devices and network capabilities, an appropriate uplink scheduling strategy is strongly needed for such systems. Scheduling method is one of the hot topics among current research for M2M on LTE. There are major differences between M2M communications and Human to Human (H2H) communications. In this paper, an indepth research on the allocation of M2M communication resources and LTE scheduling is performed and a method for M2M uplink scheduling based on the existing LTE scheduling algorithms is introduced. This proposed scheduler provides increased system throughput and reduces the average system service time by using the appropriate scheduler depending on the type of service Real Time (RT) or Non Real Time (NRT).

M2M communications characteristics differ from those of H2H communications in several aspects. 3GPP TS22.368 makes a detailed prediction and classification for the prospective M2M services [26]. By analyzing we summarize the main characteristics of the M2M services in LTE as follows:

a.The number of M2M terminals is so huge that it has at least two more orders of magnitude than that of the traditional H2H terminals.

b.Most of the M2M communications traffic occurs in the uplink direction from the MTCDs to the eNB.

c.M2M terminals initiate sessions frequently, but each session only lasts for a short time.

d.Each M2M session sends only one or a few packets, and the length of each packet is very short.

e.Many MTC applications have strict data transmission deadlines. Abiding by deadlines is necessary to report an alarm for a disaster, to maintain a certain data rate or a certain QoS and to send data before they become useless or obsolete.

f.There are numerous types of Machine Type Communication Devices(MTCDs) and they are used in a wide variety of applications. Hence, MTCDs vary widely in terms of requirements of deadlines and needed QoS..

Is described the M2M system architecture, the M2M traffic characteristics and the scheduling process for M2M communications. Deals with the procedure and the mathematical modeling of the problem of allocation of radio resources in LTE uplink, as well as the algorithms considered in this article and our solution proposed .Is to evaluated and analyze the performances of the existing algorithms as well and we indicate the best scheduler in term of throughput, goodput, fairness index, spectral efficiency and Packet Loss Rate (PLR).

In this thesis, these constraints are studied and analyzed, focusing on three schedulers. These methods do not provide QoS to users who use different types of traffic flows. A compromise is proposed as a model of interaction between two schedulers. To meet the QoS criteria, one of them is the best planning solution for a real-time service, and the other is for a non-real-time service. They provide maximum throughput and minimal packet loss, respectively. For real-time traffic of video and VoIP are investigated. For non-real-time mode, the best effort. Simulation results show that with this approach, uplink scheduling has low packet loss rate (PLR), high throughput, and good performance.

Conclusion

This paper described briefly the eval-uation of Internet, the generic structure for IoT, described possible future applications and addressed some key challenges associated with the IoT technology. The IoT deployment could be hard and require large research efforts to tackle with the challenges but it can provide significant personal, professional and economic benefits in the near future.

References

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