An Analysis and Study on Mobile Communication Network's Carrying Requirement for the Internet of Things

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Abstract

This paper mainly analyzes and researches on mobile communication network's carrying requirement for the Internet of Things (IOT). With the brief overview of IOT' Concept and definition, and architecture as a fundamental starting point, the paper expounds on mobile communication network's carrying requirement for IOT in combination with the mobile communication network's specific features of network access ubiquity, broadband carrying and information security, and finally, the paper takes DOCSIS and C-DOCSIS for example and puts forward some views and suggestions on the design of network management system.

Keywords

Mobile Communication Network; IOT; Carrying Requirement.

1. Introduction

As one of the main parts of the Internet, the emergence of IOT has realized the extension of the Internet from the logical information level to the physical entity level in a real sense. Considering that IOT itself belongs to a kind of sensor network, so there is no need to connect it with the Internet compulsively. Anything in IOT is able to connect to the Internet, especially in the birth, popularization and application of the mobile communication network, the interaction and transformation between the information becomes more convenient and quick. As an important trend for the future development of the Internet, the study on mobile communication network's carrying requirement on IOT has extremely important practical significance.

2. A Brief Overview of IOT

2.1 Concept and definition

The so-called Internet of Things, specifically, is combined with communication network, and it has become a specific extension and expansion application of the Internet. The purpose is to perceive the physical world comprehensively and deeply through installing intelligent device with perception technology, and to identify the perceived information, and then it makes use of the transmission and interactive functions of the Internet to help the human-to-thing as well thing-to-thing information interconnection and docking, thus accurately controlling and managing the real physical world. The current network architecture of IOT mainly consists of perception layer, which perceives and identifies the physical world, network layer, which completes information transmission and permutation by making use of IOT-networking docking technology and Internet of Things-communication network docking technology, and the application layer, which makes use of the professional algorithm software and computing software to handle information procession, calculation, integration and practical application[1].

2.2 Architecture

According to the Concept and definition of IOT and through the analysis, we know that IOT is mainly made up of application acquisition control layer or peripheral node, peripheral network or access layer, carrying-network, application control layer and user layer, and among them, the basic business

network is carrying-network, mainly consisting of computer and communication network [2]. The architecture of IOT are analyzed in detail in Table 1.

Table 1 Architecture of IOT

Components	Detailed explanation
Peripheral node layer	Also known as application acquisition control layer, it is mainly composed of all kinds of information acquisition and control modules, such as sensors, two-dimensional code reader and so on. It is used to acquire IOT' application data and control related equipment.
Access layer	Also known as peripheral network, it is mainly composed by the base station node and access network, which is responsible for collecting information, controlling application peripheral nodes networking and forwarding information to the peripheral nodes.
Carrying-network layer	Equal to the communication network at the present stage, including the Internet, mobile communication network, cable TV network, private enterprise network and so on. It is responsible for the realization of information communication between access layer and application control layer in IOT.
Application control layer	Mainly consists of various application servers, database server included. It is responsible for acquisition, reorganization, analysis, user layer rendering adaptation and triggering events, etc.
User layer	It provides customers with IOT application UI interface, including user equipment and Client like mobile phones, personal computers and so on.

3. The Analysis of Mobile Communication Network's Carrying Requirement on IOT

3.1 Access ubiquity

In IOT, comprehensive information data acquisition is the key content. The information acquired by sensor technology is mainly transmitted to the processing unit by way of carrying-network, thus the carrying-network must have a wide coverage and the characteristics of flexible access, so as to enable the free docking between the acquired information and the carrying-network [3]. According to the practical application, IOT can be divided into four types: monitoring, query, control, and scanning, and the application's different characteristics also result in the widely-divergent QoS requirements, as shown in Table 2:

Table 2 Different application characteristics and QoS requirements of IOT

		Mobility	Time delay	Traffic	Online time
Monitoring type	Video monitoring	No	Sensitive	Large	Always
	Environment monitoring	No	Sensitive	Large	Always
Query type	Remote meter reading	No	Insensitive	Small	Short
	Logistics query	Yes	Insensitive	Small	Short
Control type	Intelligent transportation system	Yes	Sensitive	Small	Always
	Street lamp control	No	Insensitive	Small	Short
Scanning type	Mobile wallet	Yes	Sensitive	Small	Short

Given that the mobile communication network has the big advantage of extremely strong mobility itself and the advantage of realizing flexible deployment in a short time, which can effectively help IOT to achieve barrier-free human-thing communication and thing-to-thing communication.

3.2 Broadband carrying

Currently, focusing on carrying the communication between human communications, all of the communication network design and construction are based on human communication mode. But in the development of IOT, in addition to the generation of a large number of communication nodes which are completely different from human communication characteristics, at the same time, a large

number of data information also will be generated, and this will further aggravate the pressure of the carrying-network. As a telecommunication network, mobile communication network can effectively help carrying-network to realize broadband, and optimize the operation and management of carrying-network, etc. To take the communication between CM and CMTS for example, in terms of physical layer, the downlink channel is basically maintained at a frequency range between 88 and 860MHZ, and the bandwidth of each channel is 6MHZ. 64QAM or 256QAM modulation modes are used. At this time, the corresponding data transmission rate is between 30 and 342Mbit/s, or between 42 and 884Mbit/s. The uplink channel is maintained at a frequency range between 5 and 65MHz. But at this time, the bandwidth in each channel can be 200kHz, 400kHz and 800kHz, even up to 3200kHz at the most. The modulation mode is QPSK or 16QAM. At this time, the data transmission rate is basically between 320kpbs and 10Mnps. The corresponding data transmission rate is between 320 and 5120Mbit/s or between 640 and 10240Mbit/s. And within the same bandwidth, the rate of QPSK modulation is higher than that of 16QAM, but it has a good anti-jamming performance and is more suitable for communication environment with larger noise.

3.3 Information security

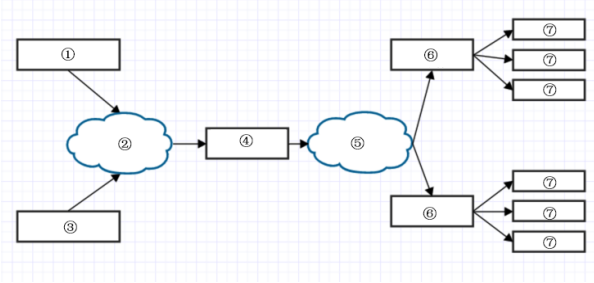
In IOT, human-to-thing and thing-to-thing information transmission and interconnection is often needed, and therefore how to ensure information security and privacy has become a key problem to solve urgently for IOT. If information security cannot be effectively guaranteed, thing information will be deviated, which will affect the whole development of IOT. For example, IOT mainly makes the information sent by infinite annunciator such as sensor as carrier, that is to say, once the signal is interfered or attacked in the process of signal transmission, things may be uncontrollable or even more serious impact will appear [4]. After years of development and application, mobile communication network has scored an achievement in protecting information security and stability, effectively helping promote information security of IOT. Take ensuring the security of access information for example, through the real-name system in the entire network, mobile communication network requires conducting users and network security authentication and stops all access request which has not been authorized. Additionally, mobile communication network can use SIM card technology with a variety of encryption algorithms to encrypt data and signaling data. At the same time, with the help of a variety of ways such as fusion and extension, the technology can add the detection, validation, and conversion and other functions of open interface access information in mobile network, so as to further enhance information access security. In the aspect of ensuring information transmission security, first of all, it is needed to plan and manage the spectrum resources reasonably, and then to open and read. It is through the spectrum sharing, wireless local area network and Bluetooth etc., allow more of the users to expand the application scale with the spectrum and lay a solid foundation for popularizing and using IOT. Meanwhile, it is also needed to strengthen the force of related technologies' research and development, promote the interconnection optimization between the communication and the networking by studying excellent technologies in the aspects of the power control and channel scheduling. On the one hand, it will make information transmission more convenient, and on the other hand, it can also effectively improve the security and reliability of the information transmission.

4. The Design of the Network Management System

4.1 Comparison between DOCSIS and C-DOCSIS

DOCSIS maintains highly consistent with C-DOCSIS in network management requirements, and it has the consistent manifestation with C-DOCSIS in terms of network management protocol. But in terms of network management object, DOCSIS is more detailed and specific, and the C-DOCSIS is slightly reduced.

As shown in Figure 1.



①Network management system; ②Metropolitan area network; ③Configuration system; ④C-DOCSIS head-end; ⑤HFC network; ⑥C-DOCSIS terminal; ⑦User device

Figure 1 DOCSIS and C-DOCSIS

4.2 Detailed design

As shown in Table 3.

Table 3 The design of the network management system

Design levels	Design contents
Data acquisition	Data acquisition module uses SNMP protocol and IPDR together to acquire data to ensure the real-time of data.
Data storage	It uses the data with JSON format to store the acquired data in SNMP protocol, and this approach effectively saves the storage space and optimizes the relationship between data.
Interface display	Front-end display module adopts the separation model of front end and back end to make sure the update of front end and back end is not affected by each other. By adopting the idea of MVVM and Angular framework, single web page is realized.
Backend module	It has carried on the detailed design in the back-end module functions, including the SSH remote login module, alarm module, system control module, log module, user control module and business module.

5. Conclusions

All in all, a complete coverage of mobile communication network has been realized in our country at present stage, and more and more mobile communication operators appear across the country, which has also created favorable conditions for the interconnection between mobile communication network equipment and Internet of Things. Especially, mobile communication network in our country has now universal access to 4G network and is building 5G, and it provides a solid and reliable network security for the development of Internet of Things. But the following fierce market competition will also further intensify the mobile communication network's scrambling for the application of IOT.

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