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Design of Hospital EMR Management System

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Abstract

In order to eliminate the drawbacks of EMR system management, this paper proposes an EMR system management model based on SNMP. The data of network management, which is stored in the Web page or Web server database, is collected by SNMP from MIB library. The information resources of the system, can not only be monitored by the management station through reading the values of the information database, but can be controlled by modifying certain values. The network and system can be managed, monitored, maintained and reported by using the Internet technologies of Web server, browser, and so on, so that the main control room of the hospital can communicate with other departments in computers and finally to achieve overall monitoring and integrated management. It can not only protect the EMR system to operate secure and stable, but also can reduce the cost of network management.

Keywords: *EMR; SNMP protocol*

1. Introduction

With the development of informatization, departments of most hospitals in China have already communicated with network and it is more convenient to get the access to electronic medical records [1]. However, although the Internet brings convenient, it produced some negative effects, so the management of EMR in hospital has become the hot issue which is concerned by many people. This paper proposes a management method of hospital EMR system based on SNMP protocol, with safety and reliability, this method is simple to use, and can reduce the cost of network management at the same time.

2. The Introduction of EMR

2.1. The Summary of EMR

EMR is a part of medical information technology, it is absolutely not a simple computerization of original existing paper records [2]. EMR, which not only includes the original content of the paper medical records of patients, but also reacts overall medical process of them, besides, it stores the whole medical information of the patients. The information includes medical history, various inspection and image data, which is a reaction of the integration of personal medical information and related care process.

2.2. The Advantages of EMR

The biggest advantage of EMR is that it beyonds the traditional medical record management mode and provide functions of electronic storage, query, statistics, electronic data exchange and interoperation, etc., some of them cannot be provided by traditional medical records at all[3]. To sum up, the biggest advantages is especially outstanding in three

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aspects: Firstly, full information sharing, the information is shared by different doctors, different departments, different hospitals and even related links. For example, whenever and wherever, the overall medical records can be accessed to the patient himself, insurance institutions, payment mechanism, management departments, and scientific research institutions as long as with permission. Secondly, EMR is the basic of intelligent medical treatment, it can provide warning functions of the taboos of drug preparation, and the prompts of inappropriate medical treatment and so on [4]. Thirdly, EMR can provide the electronic books, magazines and the new treatment methods and other related information. With these advances, EMR will play a positive role in improving medical efficiency, avoiding repeated examination, achieving convenient of saving and transferring of information, achieving information sharing, and improving the medical quality, reducing medical accidents and cost and the like [5].

3. SNMP Network Management Protocol

3.1. The Brief Introduction of SNMP Protocol

SNMP (Simple Network Management Protocol), which is ruled by IAB (Internet Activities Board), is a management standards of various Internet based on TCP /IP protocol [6]. The fundamental purpose of SNMP is to define a uniform interface and protocol for different types of equipments, different manufacturers of equipments, different types of equipments, so that the administrator can use the unified appearance to manage the networks that need manage. Through the network, the administrator can manage the equipment located in different physical spaces, thus improve the efficiency of the network management greatly and simplify the job of network administrators.

SNMP has become the favorite of many network manufacturers and become the industry standard in use, for the reason of its simple, relatively easy to achieve, occupying less system resource. It has been widely accepted and now almost all the network products, including switches, routers, HUB, UPS, MODEM and other hardware and software support SNMP [7]. Almost all of the network management system, which is used to manage hardware, introduced by network manufacturers, support SNMP such as the Openview of HP, the NetView of IBM, the Spectrum of Cabletron, are all designed based on the SNMP standard.

The network equipment is divided into two big classes by network management system based on SNMP: Network Management Station, which is the host of a network management software application and is responsible for monitoring and managing network elements, is the core of network management. Network Element, which refers to the network equipment managed in the network, such as switches, routers, hubs, *etc*. A SNMP agent process, which runs in the network elements that support the SNMP protocol and is response to the management request of various network management workstation [8]. Logic structure of the SNMP protocol is shown as Figure 3.1.

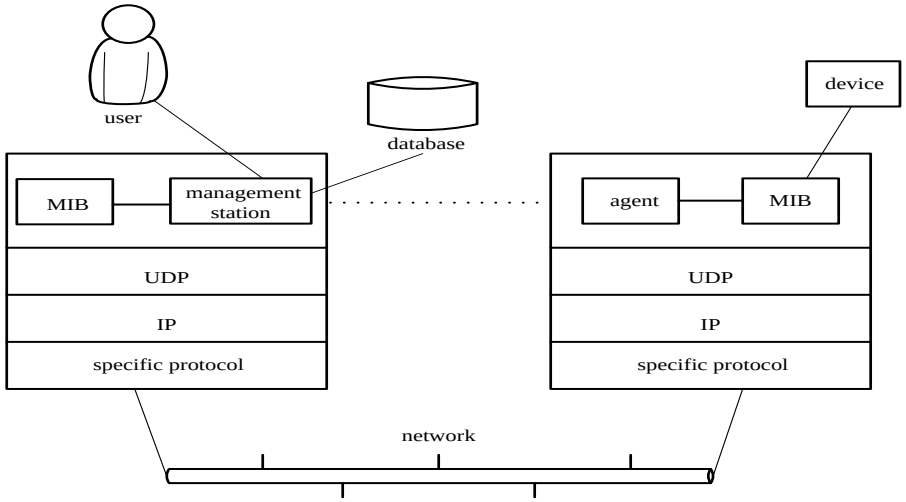

Figure 3.1. Logic Structure of the SNMP Protocol

Communication between management station and nodes that are managed includes the following operations: Get operation, management workstation reads the object value of MIB nodes. Set operation, management workstation remotely sets the object value of MIB node. Trap operation, managed nodes automatically report event which is previously setted to the management workstation.

Under normal operating conditions, management workstation uses the method of automatically query to monitor working status information of all of subsidiary managed nodes. In order to find and handle the abnormal conditions of the equipment under monitoring, we preset thresholds in the managed MIB nodes [9]. When over the thresholds, managed nodes report abnormal conditions to the management workstations, and after the management station receives exception report, it can directly inquiry the management nodes which post the report of the event or their neighboring nodes, to diagnose the event to obtain more information about the abnormal situation. In addition, we can also use the Set operation to change the system parameters of equipments under monitoring. Communication process between management station and agent is shown as Figure 3.2.

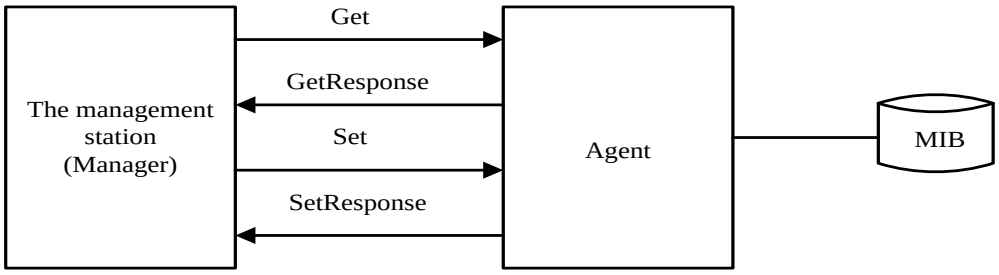

Figure 3.2. Communication Process between Management Station and Agent

3.2. SNMP Network Management Model based on Web

As a new mode of network management, network management based on Web model has demonstrated strong vitality since it was appeared, with its unique flexibility, easy operation and so on, it acquires some special favorites of many technical experts and users, network management information data is collected by SNMP from MIB libraries, after filtration, analysis, processing of the application of network management system, and then stored in a Web page or text or database server in Web [10]. Through the Web technology we can view locally or access remotely, so that we can better grasp and control the operation conditions of network devices. Network management technology based on Web mainly provides two functions: using Web server, browser and other Internet technologies to manage, monitor, maintain and report the network and system; using system management function of Web browser.

Compared with traditional network and equipment management system, WBM technology has unique advantages in distribution, user interface, etc. The structure of traditional network management system is focus on centralization, its advantages are simple and easy to achieve. But there are many serious problems, such as scalability and extendability is poor, can not meet the requirements of large-scale network management, ect, but WBM technology overcomes these shortcomings [11].

3.3. MIB Management Information Database

The basic of TCP/IP network management system is a database which has information of managed elements and which is called MIB in the environment of TCP/IP and OS. Each resource is represented by an object, MIB is the organizational collection of these objects [12]. MIB is a tree like database. Every system in the network maintains an information database which can reflect the state of managed resources in the system. By reading the object values from the information database, the management station can monitor resources in the system and also can control the resources in the system by modifying some values. The types and meanings of the object in the information database are defined by the MIB, the management station and agent set the same MIB as the communication interface, so they can mutually understand the meaning of the data, to achieve the management. The main flow chat of MIB access is shown as Figure 3.3.

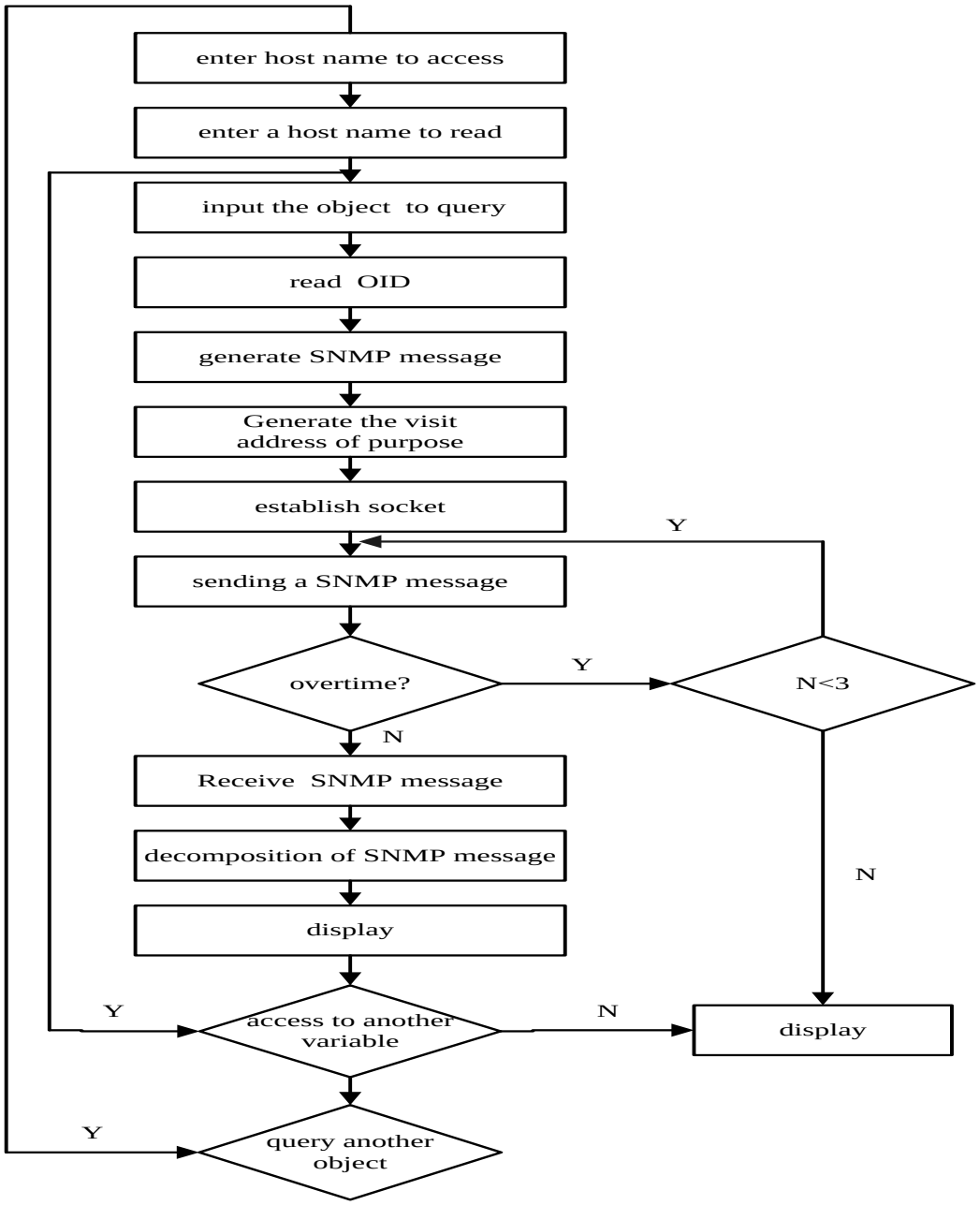

Figure 3.3. The Main Flow Chart of MIB Access

4. Solution of EMR Aystem based on SNMP Protocol

The Web network management model based on SNMP protocol can effectively solve the current problems of EMR management, to achieve an overall monitoring and integrated management of the various departments in the hospital, so that effectively ensuring the safe and stable operation of the system, the diagram is shown as Figure 4.1.

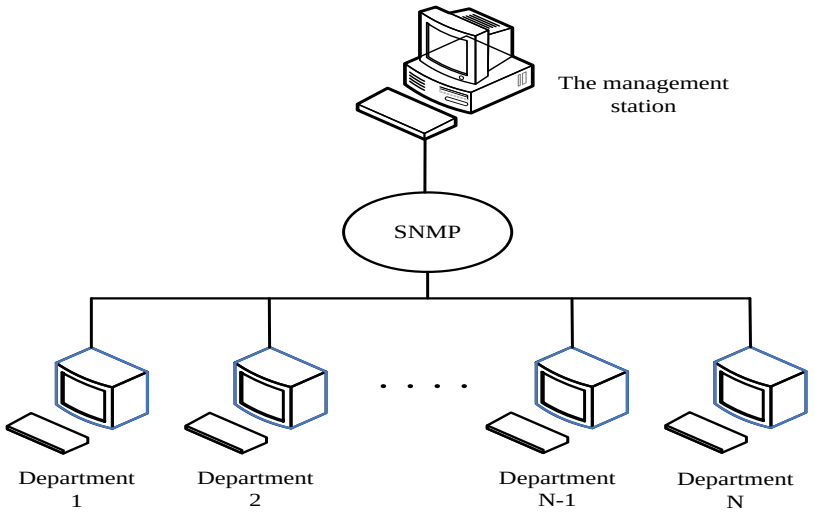

Figure 4.1. The Web Network Management Model based on SNMP Protocol

Realization method of each department is divided into 6 levels, as shown in Figure 4.2.

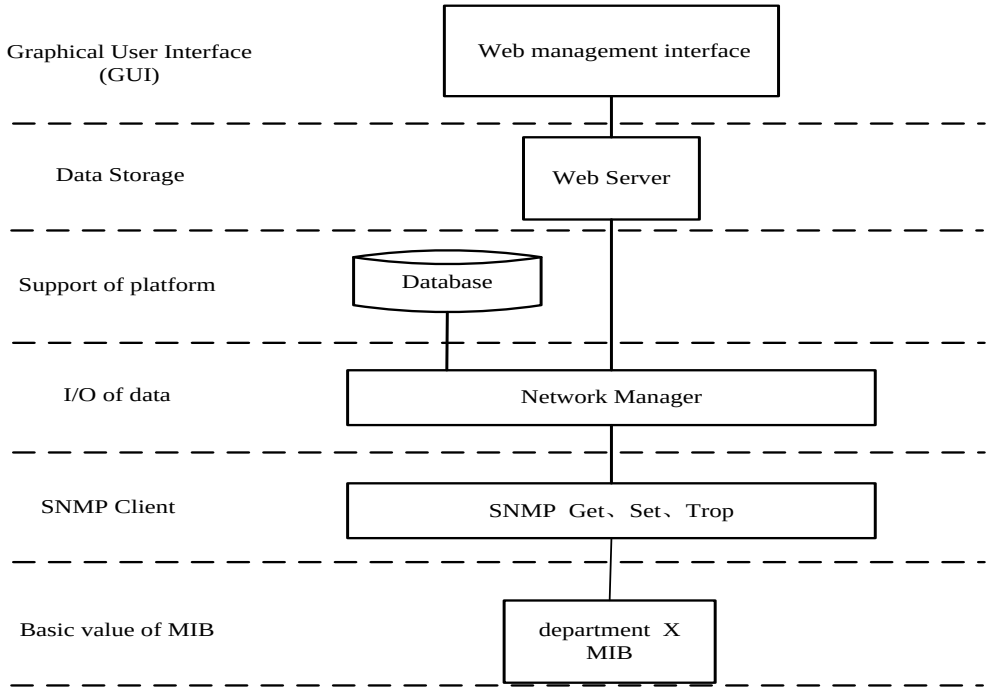

Figure 4.2. Realization Method of each Department

4.1. Basic Value of MIB

The basic data required for configuration, operation of the whole system, can be text or database.

4.2. SNMP Client

This part is complied with standard SNMP Client of SNMP V1/2, operations like Get, Set, Trop and so on are completed by executing the SNMP command script or a single SNMP instruction.

4.3. I/O of Data

It is accomplished by Network Manager to read and write network devices. The Network Manager, which is the standard CGI procedures which contain the Web interface, reads the data of network equipment through the SNMP Client.

4.4. Support of Platform

All of the development of modules can be completed in the platform of Windows or UNIX. Network Manager can accomplish the function of automatic alarm of fault information through gateway of the short messages or the way of Modem messages.

4.5. Data Storage

Database is used for data storage. The data, which is collected and stored in the database by Network Manager, is the basic information of diagnosis of the system fault, upgrading hardware system and analysis of the quality of digital resource service.

4.6. Graphical User Interface (GUI)

This layer is consist by the Web interface management interface, it passes data which is collected from the layer of reading and writing to the network administrator in the formation of Web page, and the administrator can do some related configure operations through the GUI. Landing interface is shown as Figure 4.3.

Figure 4.3. Landing Interface

5. Conclusion

Through the study and research on SNMP network management protocol, aiming at solve the disadvantages of EMR system management mode of modern medicine, this paper proposes an EMR system management mode based on SNMP protocol, illustrates the foundation theory of EMR management in the way of overall monitoring of departments and integrated management, to ensure the system operate secure and stable. The SNMP protocol has considerable practical prospect in the hospital EMR system.

Acknowledgements

These should be brief and placed at the end of the text before the references.

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