Design and research of computer room communication system based on electronic information technology

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Abstract. No new building can be built without the computer room. The computer room is just like the soul of the information system. The construction of any large-scale information system is inseparable from the support of network, host and other communication equipment. This paper studies the optimization of the whole communication system. From the five aspects of practicality and advanced nature, safety and reliability, standardization, flexibility and extensibility, and manageability, the paper introduces the principles of building the communication system of electronic information room, and forms a complete set of communication system design for electronic information room. At present, serial communication is commonly used in electronic information room. The communication mode is half duplex communication of fd-mac layer protocol to improve the communication throughput. It is suitable for communication in electronic information room because of its fast transmission speed and space saving.

1. Research background and significance

1.1. Background
The rapid development of science and technology makes real-time data transmission more important. This kind of real-time data transmission needs a large-scale facility as the basic carrier, which gathers many computer servers here, so as to build an information system [1]. A large infrastructure like this is called the Internet data center.

Each unit needs to build its own computer room in order to cooperate with its own business, such as government, hospital, school, operator, etc. The long-term stable and reliable operation environment of network, host and storage equipment is very important, which is the basic bridge of all large-scale information system construction, and the machine room provides the working environment for these equipment, so the machine room is the necessary assembly field of large-scale information system.
the rapid development of computer technology, the traditional computer room design has gradually failed to meet the diversified needs of functions. Therefore, the design of computer room also needs to innovate, and the optimization of electronic information room has been paid more and more attention.

1.2. Significance

Internet plus, industry 4, big data, cloud computing, AI and so on are now very hot concepts cannot do without computer science and technology. A large number of computer servers need to be served here. It is impossible for any new building to be built without the computer room. However, the computer room undertakes the task of high-intensity computing and multi-threaded computing, and the proportion of energy consumption is very large. The energy consumption of computer equipment is about 30%. It can be seen that the consumption and heat dissipation of server equipment also account for a large proportion [2]; the energy consumption of UPS power supply is 18%; the energy consumption of other equipment is 7%. The equipment power of the electronic information room is more and more large, which makes the design and operation of the electronic information room appear many contradictions, reducing the availability of the equipment, wasting the floor space, reducing the operation of the refrigeration system and so on.

With the continuous improvement of the integration and networking of IT equipment, in order to ensure high reliability and uninterrupted operation of the information system in the electronic information room, it is necessary to restrict all aspects of the room, such as environment, fire protection, power environment detection, electromagnetic shielding, energy consumption environment monitoring, and optical fiber communication and so on.

2. Design principle of computer room communication system based on electronic information technology

When designing the communication system of electronic information room engineering [3], the following principles shall be followed:

(1) **Reliability**. The electronic information room needs to provide reliable guarantee for various businesses, and there must be no operation failure. No matter in terms of equipment layout and line layout, or in terms of hardware backup and redundancy of key equipment, reliability technology is designed. The following three ways can be used to improve the safety and reliability of the communication system in the computer room: first, the strong management mechanism and technical measures provided by relevant software are adopted. Second, take control measures and technical measures. Third, take technical measures such as accident monitoring and security.

(2) **Practicality and advanced nature**. On the one hand, we must satisfy the present and future development requirements, and on the other hand, we must meet the transmission requirements of high-speed data. This requires that the technology and equipment of the communication system of the computer room should be mature enough to ensure the practicability and advanced nature of the communication system technology.

(3) **Standardization**. Adhering to international standards and national standards is the principle of computer room communication system design. In order to lay a solid foundation for the development of future business and equipment capacity, the design of computer room communication system will adhere to the principle of unified specifications.

(4) **Flexibility and scalability**. Good flexibility and expansibility are the essential functions of the communication system in the computer room. Its expansibility is manifested in expanding the capacity of equipment, increasing the number of users, improving the quality of users, etc., which can meet the needs of the continuous in-depth development of the communication system. Its flexibility function supports a variety of functions and equipment updates, including the ability of network transmission, multiple physical interfaces, technical upgrades, equipment updates and other flexibility.

(5) **Manageability**. The computer room communication management and monitoring system is the necessary condition for the manageability of the computer room communication system, which should have comprehensive and perfect functions. In order to monitor the change of the whole computer room,
it is necessary to use the advanced equipment and software of the management and monitoring system to realize the intelligent and manageable functions of the equipment. The purpose of doing so is to monitor and determine the occurrence of the accident and deal with it in time, ensure the safety and reliable operation of the machine room, improve the operation performance and reliability of the machine room, reduce the engineering pressure of the maintenance staff in the machine room and simplify the working procedures.

3. Design of computer room communication system based on electronic information technology

3.1. General design

Electronic information communication system refers to the data terminal equipment in each position within the communication range, which is connected with each other through the data link to realize the data transmission and exchange function. At present, most of the electronic information communication systems are interconnected by a large number of independent computers, which can be interconnected on the terminal equipment. Generally, such systems include data link, data terminal equipment and central computer system.

The core part of the electronic information system is the central computer system, including communication controller, computer host and other equipment. Thus, all kinds of information input from the data terminal equipment can be effectively processed, and then the relevant results can be output. In this system, the user terminal usually includes transmission controller, output device and data input. For transmission channels, the common types mainly include digital, analog, switching and dedicated channels. Due to the different transmission direction, the communication mode includes full duplex, half duplex, simplex and other different types; if it is for the differences in transmission mode, the specific types include asynchronous, synchronous, serial and parallel transmission modes.

There are many reasons for the distance change between the channel and the equipment in the electronic information room. Among them, there are many ways to cool the electronic communication equipment. At present, the most effective way to help heat dissipation and energy conservation of the equipment is forward air or backward air. At the same time, there are two ways to arrange the electronic information communication equipment: one is face-to-face arrangement; the other is back-to-back arrangement, which adopts different ways to arrange the channel between the electronic information room and the equipment the distance is also different. When face-to-face arrangement is adopted, the distance between electronic information and communication equipment is greater than or equal to 1.2m; when back-to-back arrangement is adopted, the distance between the back of electronic information and communication equipment is not less than 0.8m. In consideration of the need to transport electronic communication equipment, the clear width of the channel shall not be less than 1.5m; the maintenance distance between the machine room wall and electronic communication equipment shall be greater than or equal to 1.0m.

3.2. Transmission mode of electronic information system

The synchronous transmission mode is adopted, and the clock beat used in the data transmission process is the same. Therefore, for the serial data stream, it has a fixed relative position of the signal symbols; in order to make the data stream can distinguish the signal symbols reasonably, the receiver needs to build up a reasonable clock signal. Therefore, compared with asynchronous transmission, this kind of transmission is more complex. For this kind of transmission mode, the group is usually used as the unit to send the relevant data information. In the above data, several bits and character codes are included. According to different transmission control procedures, termination and start sequence will have different forms. HDLC (high level data link Contr01) is a bit stream oriented communication protocol. According to the specific synchronization mode of characters, there are binary synchronous communication protocol (BSC), which is called character oriented communication protocol. If several data information are transmitted continuously, the time sequence in the graph will be adopted.
3.3. Communication mode of electronic information system

A half-duplex communication based on fd-mac protocol is adopted. It can receive and send data at the same time. This means that the two parties involved in the communication process can receive and send data at the same time. This design of fd-mac layer protocol can realize shared random avoidance. When two devices have data sent to each other at the same time, a temporary avoidance counter will be opened. Comparing the size of data to be transmitted by the two devices, the two devices generate a 10 bit length SRB domain to coordinate the backoff interval of both parties, so as to maintain the synchronization of both parties, and release other idle wireless channel resources, which can provide wireless access possibility for other devices.

In addition, compared with the half duplex mode, this mode can effectively alleviate all kinds of delay or congestion in the process of data transmission. Because it can use the wireless way to receive data information, it has higher carrying capacity, so that all kinds of communication conflicts can be effectively contained. Generally, this kind of communication mode is widely used in the related communication between different computers.

In the serial transmission mode, data is transmitted bit by bit in a certain channel according to the specific time sequence. In general, the parallel port used will be connected with eight different data lines, and then these data lines will complete the data transmission at the same time, so it has a relatively high efficiency. For the conventional serial port, there is only one data line, so it will have a relatively lower data transmission efficiency. Although the speed of serial transmission is slow, only one transmission channel is needed. At the same time, differential line is generally used in serial transmission, which can reduce the use of signal line and save the number of I/O ports. Because of its low cost and simple structure, it is widely used in the field of data transmission.

When carrying out parallel transmission, it is necessary to ensure the transmission of data signals through the same time sequence, and the reception of signals should also have the same time sequence. It is very difficult to keep the timing and clock in sync when the clock frequency is raised too fast. Generally, the transmission cable is very long, which will make the time sequence of data transmission out of sync with the clock. As a result, it will lead to the phenomenon of data interference, which cannot effectively improve the transmission speed.

3.4. Configuration of communication optical cable of electronic information system

In terms of data setting, an Ethernet switch is configured according to the standard of one backup port and one backbone port, and the optical port backbone port is configured according to the standard of one to two core optical fiber capacity. Assuming that the user optical cable is set according to the low configuration, each user unit is configured with at least one 2-core optical cable. If the user optical cable is set according to the high configuration, each user unit needs two 2-core optical cables. The horizontal users from the floor optical fiber distribution box to the user unit information distribution box are set according to the optical cable (G.657 optical fiber), so the whole residential building needs 500 or 1000 2-core optical cables, that is, each floor needs 10-20 2-core optical cables. From the equipment room of
building user access point to the information distribution box of user unit according to the vertical user optical cable level.

The total capacity (20 or 40 cores) of the user's optical fiber, plus an appropriate amount (such as 10%) of optical fiber backup (take 2 or 4 cores), and the specification configuration of the optical cable, one 24 core or one 48 core user's optical cable (G.652 optical fiber) is required for each layer. Floor optical cable distribution box: it is only used as the place where the user's optical cable optical fiber is welded and reserved, without the function of jumper management, and can be installed in the weak current room or telecommunication room in the way of wall embedding or external hanging. According to the standard of 10 or 20 2-core incoming user optical cables and 1 24 or 48 core outgoing user optical cables, the optical cable distribution box of each residential building shall be configured to meet the needs of optical fiber coil reservation and welding.

Compared with electrical interconnection technology, optical fiber communication technology can better meet the needs of electronic information room for transmission delay bandwidth, network scalability, fault tolerance, etc. When a single building is used as an independent distribution area, the user access point shall be located in the premises distribution system equipment room or communication room of the building, but the telecommunication business operator shall have independent equipment installation space, and the system is shown in the following figure:

At the end of the user terminal, all passive components, optical cables and line auxiliary facilities constitute a complete optical cable network. The cable section of the whole optical cable network is divided into three sections: feeder light, distribution light and home line light. There are four nodes in OLT office, optical cable distribution point, user access point and ONU user terminal.

The function of optical fiber distribution point is to distribute optical power of optical fiber, which is composed of optical fiber centralized convergence point at OLT office. The feeder cable starts from the OLT office and extends to the optical cable distribution point, which is the beginning of the whole optical cable network section. The distribution optical cable is close to the feeder optical cable section, which is the middle part of the whole optical cable network cable section, extending from the optical cable distribution point to the distribution access point. The lead optical cable section is close to the distribution optical cable section, which is the final part of the whole optical cable network cable section, extending from the user access point to each ONU terminal. In EPON optical fiber network, when the user access point adopts the design scheme of multi-level splitting, the network can always be set with placement splitter.

4. Conclusion
As a basic information carrier, real-time data transmission requires a high level of electronic information room. Electronic information room is just like the soul of information system. The construction of any large-scale information system is inseparable from the support of network, host and other communication equipment. This paper forms a set of perfect design background of communication system in electronic information room, and optimizes it. It can be used for reference for the choice of communication mode and wiring scheme in electronic information room in the future.

References
[1] Tan Chunmei. Application of electronic information technology in building intelligent engineering [J]. Agricultural staff, 2020 (09): 180.
[2] Zhang Dandan. Research on Key Technologies of full duplex communication. Beijing: Research Center of network and ubiquitous business engineering technology, Beijing University of science and technology, August 2014.
[3] Zhu Ling. Research on multi-path parallel transmission scheme. Shanxi: Xi'an University of Electronic Science and technology, November 2014.