Implementation of Computer Telecommunication Network Management and Centralized Monitoring System Based on Genetic Algorithm

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Abstract. With the continuous strengthening of competition in China's telecommunications market, the technology and management of the telecommunications industry have made great strides forward. If the system application, server or network equipment fails and there is no suitable solution, it will have a great impact on the whole business activities of the enterprise. Modern network is no longer simply providing an end-to-end service as reliable as possible, but is committed to providing users with high-quality and reliable communication service quality to meet the bandwidth delay requirements of various applications. The networking of monitoring system is one of the main goals of monitoring system development, which develops with the wide application of information technology represented by Internet. In order to improve the level of operation and maintenance, customer satisfaction and market competitiveness, enterprises undoubtedly need to speed up the construction of integrated network management system. This paper discusses the method of combining genetic algorithm and computer network technology to realize computer telecommunication network management and centralized monitoring, which is of great significance to improve the level of field maintenance and management.

Keywords: Telecommunications industry, Computers, Monitoring system

1. Introduction
With the development of the information age, various kinds of network applications emerge in endlessly, and people have higher and higher requirements for network quality. Telecom network operation and maintenance should be changed from equipment and network oriented to service-oriented and customer-oriented. Therefore, it is necessary to innovate in management, and to carry out comprehensive and centralized maintenance [1]. To improve the efficiency of the whole network management, we need to improve the efficiency of the whole network management [2]. With the development of the national economy, people will gradually enter the information technology, so the requirements for information services will continue to improve. The networking of monitoring system is one of the main goals of the development of monitoring system. It is developed with the wide application of information technology represented by the Internet [3]. Modern network is no longer
simply providing a reliable end-to-end service, but is committed to providing users with high-quality and reliable communication service quality to meet the bandwidth and delay requirements of various applications. The existing telecommunication network is the integration of multi manufacturer and multi professional equipment [4]. Different manufacturers have their own equipment and network element management system. When the network alarm occurs, it is difficult for maintenance personnel to accurately locate the fault from many devices, and it is difficult to find out which customers may be affected by the fault, which will delay fault processing and cause losses to customers [5].

The telecommunication network management and centralized monitoring system is to realize the automatic centralized telecommunication network management by using computers, to implement centralized monitoring on the network elements in the telecommunication network, and to conduct real-time and dynamic analysis and processing of relevant alarm, fault, traffic and other information [6]. The centralized maintenance and management system of network management system adopts the latest achievements of computer and data communication technology to realize the computer management of the whole network. It provides technical means for the management of the telecommunication network and guarantees the full, reasonable and effective utilization of the whole network [7]. To improve the comprehensive centralized maintenance support means, the key is to improve the depth, breadth and strength of centralized maintenance in various fields, and carry out real-time management and monitoring of various fault processing processes to ensure the smooth implementation of the process, and finally realize the unified management and centralized operation of equipment, manpower and cost [8]. In order to improve the level of operation and maintenance, improve customer satisfaction and market competitiveness, enterprises undoubtedly need to speed up the construction of integrated network management system. As a result, new technologies and new services emerge in endlessly [9]. In order to eliminate the fault in time, the equipment maintenance personnel should be informed to repair the fault as soon as possible after the fault is found, and track the whole repair process. At ordinary times, the network maintenance personnel also need to timely understand the network performance and analyze the network operation quality [10]. This paper discusses the method of remote centralized monitoring based on genetic algorithm and computer network and information technology, which is of great significance to improve the level of on-site maintenance and management.

2. System Design Principles and Framework

The accuracy of data acquisition is the premise and guarantee for the normal operation of the whole system, and the accuracy of data acquisition depends on the development of measurement technology to a great extent. Improving the measurement speed and accuracy is an effective guarantee for the accuracy of data acquisition. Secondly, it is an important link for the system to operate according to the requirements to ensure the performance indicators required by the system. By setting and modifying the system parameter database, the scale of the system can be flexibly configured. When the number of management equipment in the system is increased or decreased, the system software is basically not modified. When the management equipment increases and the system capacity is insufficient and needs to be expanded, such as communication receiver, server and user workstation, the software should not be greatly modified, that is, the independence of equipment should be considered in the software design. To design a data acquisition system, the structure of the system should be selected according to the characteristics of the measured signal and the requirements of system performance [11]. When designing the structure, we should mainly consider the change rate of the measured signal and the number of channels, as well as the requirements of measurement accuracy, resolution and speed, in addition, we should also consider the ratio of performance to price. The data received by the combination of distributed processing and centralized management can be distributed on multiple database servers, which is transparent to users, and the system administrator centrally manages the distribution of each server and data.

Centralized data acquisition system is a relatively simple scheme among many acquisition system structure modes, which is low in cost and easy to realize. However, due to the common devices and
high coupling of components, its sampling rate, flexibility, anti-interference ability and reliability are greatly affected, and it is not suitable for the acquisition environment where the measured data changes at high speed and is scattered. With the advent of information age, the rapid increase of information makes distributed database system more and more widely used. As one of the products of the combination of database system and computer network system, distributed database system has the characteristics of data independence, control mechanism combining centralization and autonomy, proper data redundancy and distributed transaction management. Obtaining data from the interface provided by the manufacturer's network management system can ensure the integrity and correctness of the data to the greatest extent. The correlation between alarm and service and network quality analysis need to be based on complete and accurate data. The conceptual model of Internet architecture is hierarchical, as shown in Figure 1.

Distributed data acquisition system is an expansion of structure and function based on centralized data acquisition system. It is the product of computer network communication control technology, and consists of several data acquisition stations, front-end computers, upper computers and related communication lines. Because the data in distributed database system has certain redundancy, which adds a lot of new contents and complexity to query processing, so the optimization of query processing in this system is very important. The front-end processor and the upper computer in the system structure are generally high-grade microcomputers or workstations, which are used to centrally process the data transmitted from each data acquisition station, and can also send the control parameters of the system to each data acquisition station to adjust the working state of the data acquisition station. Compared with centralized acquisition system, distributed acquisition system has the advantages of good real-time, strong adaptability, low hardware requirements and high reliability, and is more suitable for working in harsh acquisition environment with strong interference.

![Figure 1](image_url)  
**Figure 1** The underlying construction model of the Internet

### 3. Design and Application of Centralized Monitoring System

Model-based correlation analysis is to establish different models corresponding to each managed object, and each model is actually a data structure and algorithm. On top of the object-oriented model, it is also necessary to create an event correlator to deal with cooperative events between models. In practical application, the centralized monitoring system is a multilevel distributed computer monitoring network in structure. The whole monitoring system generally adopts the topological structure of cascade connection step by step, which is composed of monitoring center, monitoring station and monitoring module. The structure and functions of the system are classified according to grades, so as to meet the requirements of decentralized data collection and centralized monitoring by network management. In order to provide, save, update and query all kinds of information, it is required that the database structure can fully meet the input and output of all kinds of information. Collect basic data, data structure and data processing flow to form a detailed data dictionary, which lays the foundation for the following specific design. Using multithreading in applications can process lengthy or time-consuming tasks in the background. Even on a computer with a single processor, using multithreading can significantly improve the responsiveness and usability of applications.

The communication between that network management system and the manage network elements
is handled by the event associator, while the communication between the network elements is handled by the direct communication between the network element models, so that the relationship between the model reflects the relationship between the corresponding managed network elements. Using multithreading to develop applications can be very complicated, especially when locking and synchronization problems are not carefully considered, it is necessary to carefully evaluate where and how to use multithreading. Figure 2 is a schematic structural diagram of an intrusion detection system.

![Figure 2](image)

Figure 2 Schematic diagram of the structure of the intrusion detection system

Through the communication between the models, analyze whether the corresponding network element has failed, and the failure of the network element can be marked by the corresponding model and reported to the failure management module for automatic or manual processing. With the rapid development of Internet and the increasingly complex scale of monitoring system, it is more and more popular for people to use Internet to build remote monitoring system and realize data collection and equipment control for scattered equipment. The design of remote monitoring system structure based on Internet is an evolution and expansion of distributed data acquisition system [12]. For centralized alarm monitoring, it is necessary to obtain network element information from resource management system and network element alarm information of various equipment manufacturers from element management system. The agent in the managed device can report the error condition to the network management workstation at any time, such as the pre-established threshold crossing degree and so on. The agent does not need to wait until the management workstation polls him for these error conditions. There are too many threads, which may cause the application to consume some unnecessary system resources, especially if there are a large number of short-term operations, all of which run on separate threads [13]. Although for the rule-based relevance analysis system, when the number of rules is too large, the maintenance of rule base will also become difficult. But for the correlation analysis of alarms, there are usually not many effective rules. The rule-based correlation analysis module consists of two parts: the association rule base and the rule engine. The association rules are manually entered through the system interface, and the rule engine calls the rules to analyze the alarm correlation.

Genetic algorithm uses population to represent the solution set of the problem, which is composed of several solutions, and each solution is called a chromosome. The algorithm starts from a population and reproduces the next generation through crossover and mutation. In this evolution, the optimal solution of the problem is found:

\[
\begin{align*}
\max f(x) \\
\text{s.t. } X \in R \\
R \in U
\end{align*}
\]

(1)

Let \(X = [x_1, x_2, \ldots, x_{n-1}, x_n]^T\) represent a solution to the problem, then in the genetic algorithm, \(X\) is represented as a chromosome, and \(X_i (i = 1, 2, \ldots, n)\) is represented as \(n\) genes of the chromosome. One of the chromosomes is also called an individual in the population, and \(M\) is used to represent the individual in the population. Quantity, that is, the size of the population.

In the system, the network database server is adopted to store data centrally, which can store all the data sets of equipment collected by the PC monitoring station in the database, thus realizing centralized monitoring, maintenance and management of equipment and data.
telemcunication network, when a network element fails, it will often cause the surrounding network elements to generate alarms besides the alarm information generated by itself. The data acquisition layer realizes the functions of resource data acquisition and alarm data acquisition, interfaces with external resource management system and element management system, obtains configuration information, topology information and alarm information of network elements, and provides data sources for the whole monitoring system. In some cases, it may not be necessary to use a separate thread. If an application needs to perform simple UI-related operations regularly, it should consider using a process timer. A single thread executes a series of application instructions and passes through a single logical path throughout the application. All applications have at least one thread, but they can be designed to use multiple threads, and each thread executes a separate logic. In the key technology design part, the alarm database is logically divided into active alarm database and historical alarm database, and the large amount of data is split into each database table.

4. Conclusions
Digital image remote centralized monitoring system is a brand-new monitoring system, which breaks the limitation of traditional closed-circuit television monitoring system, and can coordinate the needs of different devices to ensure seamless communication. Model-based correlation analysis is to establish different models corresponding to each managed object, and each model is actually a data structure and algorithm. On top of the object-oriented model, it is also necessary to create an event correlator to deal with cooperative events between models. The design of remote monitoring system structure based on Internet is an evolution and expansion of distributed data acquisition system. For centralized alarm monitoring, it is necessary to obtain network element information from resource management system and network element alarm information of various equipment manufacturers from element management system. In the key technology design part, the alarm database is logically divided into active alarm database and historical alarm database, and the large amount of data is split into each database table. With the development and maturity of network technology, communication technology and video-on-demand technology, digital image remote centralized monitoring system will be the mainstream application of information superhighway after Internet.

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