Research of Real-time Intensive Monitoring and Alarm Platform for Meteorological Business

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Abstract

Along with the swift development of China's meteorological service and gradual improvement of meteorological information construction level, meteorological department has had higher requirements for timeliness, accuracy and reliability of data transmission. Qinghai Meteorological Information Center, the master node of meteorological data transmission and storage, is mainly responsible for transmission guarantee and data storage of meteorological observation and product data. However, Qinghai meteorological information transmission monitoring system has such defects as weak integrated monitoring capacity, scattered business, low guarantee efficiency and fault analysis deficiency. The above-mentioned problems are analyzed deeply in this paper. Besides, real-time intensive monitoring alarm platform for meteorology is studied and realized. The platform can automatically monitor meteorological data transmission. Meanwhile, it also can analyze and discriminate alarm information, and effectively identify alarm device and fault source, etc. Thus, alarm service is provided for business personnel and intensive monitoring is also realized.

Keywords

Meteorological data, monitoring data.

1. Introduction

Along with the development of meteorological service, meteorological information network system plays an increasingly important role in modernization of meteorology. As an important constituent part of meteorological information system, meteorological information network is mainly responsible for communication guarantee of real-time business systems of various meteorological data such as collection, forwarding, data share, service, video and government affairs. The increase in business also causes several problems[1]. For example, the business process is more and more complicated and there are more and more data transmission nodes and links. It is vital to guarantee the accelerated development of business and improve business management ability through modern measures and achieve efficient management, intensive system, rapid response to realize meteorological modernization.

Qinghai real-time meteorological communication system is comprised of many parts such as communication network, data collection, important information transmission system, data storage system and machine room environment[2,3], each of which is also comprised of many subsystems. For example, the communication information network is comprised of many subsystems such as ground meteorological line, VPN line and Beidou communication system. It is responsible for meteorological data transmission. Due to the difference in automatic station, the data is collected to soil moisture automatic station center station, Huayun automatic station center station, Wuxi automatic station center station and Huayun Beidou center station, etc. There are many links for information transmission system including CTS communication system, new-generation communication system and front-end processor, etc. Meanwhile, machine room environment, data storage system and gradually increased real-time business system (like CIMISS) [4,5] are basically the systems monitored in a scattered way and running independently.

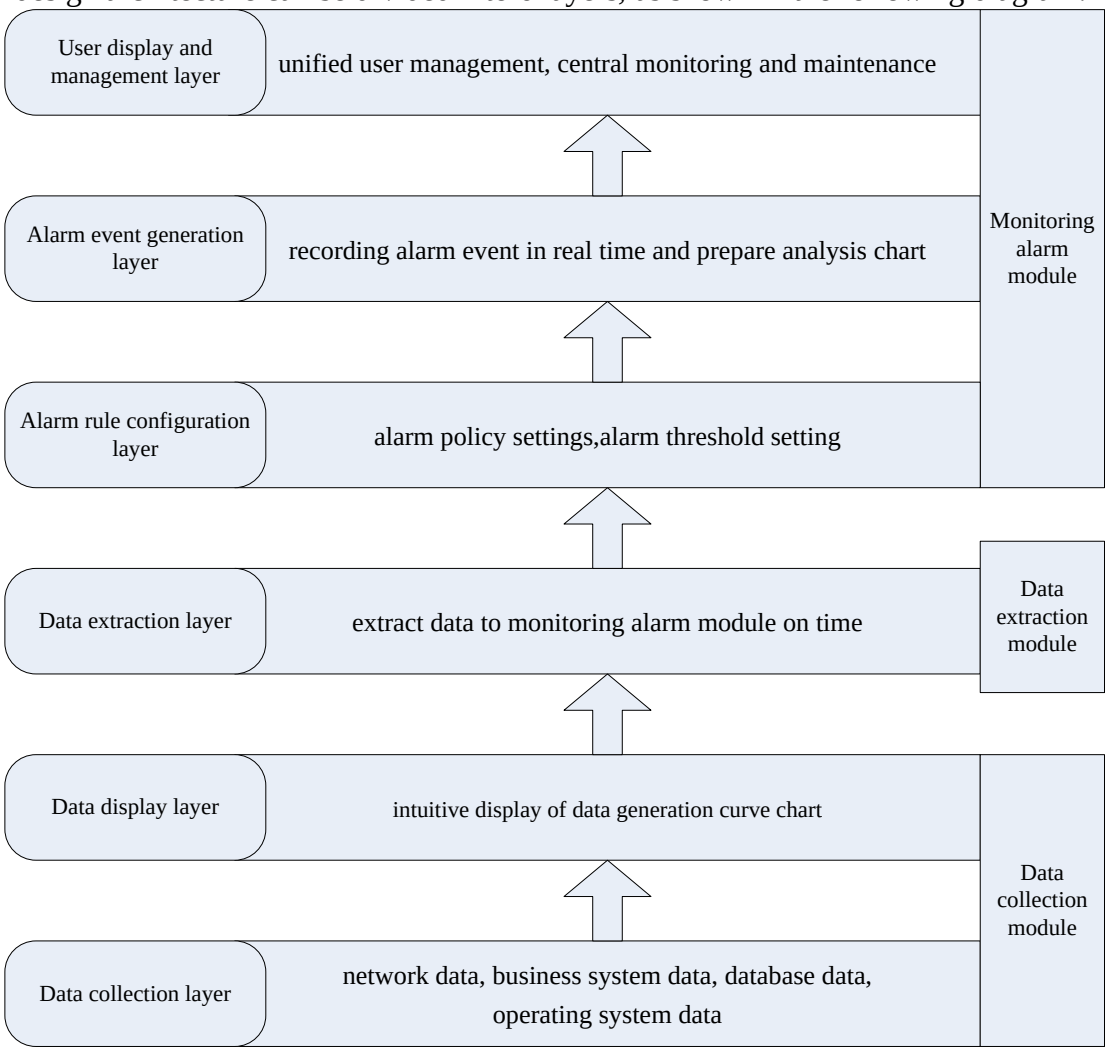
Due to these systems with complicated links, diversified technologies and isolated monitoring, the difficulty in response efficiency and troubleshooting of business maintenance is increased. In the

meantime, there are practical transmission monitoring and real-time data display system for the city and county, which is the prominent problem at the present. If not solved soon, it will severely restrain the rapid development of Qinghai meteorological information service.

2. System architecture design

To build a monitoring alarm platform, network resource, hardware resource, software resource and database resource involved in all business systems are mainly included into the unified monitoring alarm platform. In addition, by eliminating the difference in business software and data collection measures, it is necessary to realize unified management, standardization, disposal, manifestation, user login and access control for different data sources so as to ultimately realize standard, automatic and intelligent monitoring management

System design architecture can be divided into 6 layers, as shown in the following diagram:



Data collection layer: Located on the bottom layer, mainly collecting network data, business system data, database data, operating system data, etc., and then standardizing and storing the collected data.

Data display layer: located at the second layer, a web display interface, displaying the data obtained on the data collection layer in a unified way. The way of display can be curve chart, histogram and pie state, etc. Through data graph, the business personnel can know about the meteorological data transmission and device system running state within a period of time and basis for troubleshooting or solving problems can be provided for the business personnel.

Data extraction layer: located on the third layer, mainly standardizing and filtering the data obtained on the data collection layer, and extracting the necessary data to the monitoring alarm module, which is the junction of monitoring and alarm modules.

Alarm rule configuration layer: located on the fourth layer, setting alarm rules, alarm threshold value, alarm contact and way for the data obtained on the third layer.

Alarm event generation layer: located on the fifth layer, mainly recording the alarm event in real time and store alarm result in the database for standby use and form analysis report on alarm result to make statistics of fault rate and occurrence tendency within a period of time.

User display management layer: located on the top layer, a web display interface, mainly displaying the monitoring statistics result and alarm fault result in a unified way and realizing multi-user and right management, unified user and right control.

From the perspective of functional realization, these 6 layers are divided into three modules, including data collection, data extraction and monitoring alarm, each of which has following functions:

Data collection module: the module is mainly used to complete collection and graphic display of basic data. There are many ways of data collection. The basic data of equipment system is realized through SNMP, agent module or defined script. The meteorological data is obtained through meteorological business system interface or log and by using Ganglia.

Data extraction module: the module is mainly used to complete screening, filtering and collection of data and extract the necessary data to the monitoring module from data collection module. Data extraction can be realized through interface provided by the data collection module or defined script.

Monitoring alarm module: the module is mainly used to monitor the setting of monitoring script, alarm rule, alarm threshold value and contact of monitoring script, and centrally displaying and recording the alarm result. The common monitoring alarm tools include Nagios and Centreon, etc.

3. System realization function

To be adapted to the construction and business requirement of Qinghai meteorological information, B/S structure is mainly used for the platform. Linux is used for the operating system of server.the database used for the platform and most functional modules are operated on Linux system. Very little monitoring information can be collected and processed on the client software of windows platform. It is mainly used to realize province's network operation status monitoring module, important business system monitoring module, message transmission monitoring module, data processing monitoring module and monitoring alarm module.

(1) Real-time monitoring of province's meteorological ground bandwidth network system: monitoring province's meteorological ground special network device operation status in real time, analyzing information of core network device and automatically sending maintenance information of device to the data center of meteorological bureau. Besides, under the circumstance of disconnected network, meteorological data can be monitored and alarm information can be obtained in different areas according to the actual situation. Many ways including "voice, horse race lamp or pop-up windows at the web page " and SMS can be used for alarm information. Additionally, monthly statement can be formulated for the convenience in management.

(2) Real-time monitoring of important business system: real-time monitoring of provincial-level business systems such as center station software, CTS system, meteorological information service platform. In case of fault in equipment and system software, alarm can be given through many ways such as "voice, horse race lamp or pop-up windows at the web page". additionally, monthly analysis report can be prepared so that user and business management departments at all levels can check it.

(3) Whole process business monitoring of meteorological data: whole process business monitoring of meteorological data including production, transmission, storage and application can be built through technical development. Data collection, hand-out and storage state can be displayed through web page. The alarm can be given through many ways such as "voice, horse race lamp at the web page or pop-up window and SMS" under the circumstance of abnormal data transmission. In addition, various statements can be prepared in real time according to business standard for the sake of convenience in inquiry and management. All data sources of the system is from CIMISS system.

4. Conclusion

Effective process and intensive monitoring and application system can be built by rationally analyzing systems with complicated and diversified links. Besides, the platform integrating communication transmission monitoring, message quality control, business duty, network monitoring, transmission efficiency statistics, real-time data display and automatic alarm, etc. Can be formed for the province, city and county so as to realize scientific and information-based management of real-time communication guarantee of Qinghai meteorology and earnestly improve maintenance & repair guarantee ability and efficiency of Qinghai meteorological information. The paper has mainly made contributions in three aspects: Firstly, transmission device alarm information of observational data of automatic meteorological observation station, regional automatic meteorological observation station, soil moisture observation station and radar observation station will be integrated into unified monitoring platform according to the real-time monitoring business of provincial-level meteorological information center. Thus, miscellaneous monitoring software and situation that the alarm information is not processed timely and properly is effective improved. Besides, the duty efficiency of worker is also enhanced. Secondly, functional modules including duty log and department management are added to the unified monitoring platform. The worker can record log, check duty and alarm on this module. Meanwhile, the unified management of department staffs, business and equipment information can be realized and working process is also optimized. Thirdly, data mining technology is deeply studied. In addition, related alarm model of meteorological information is designed based on data mining theory. The associated alarm model is used to mine associated rules of historical alarm information. The knowledge base between alarm and fault is built and gradually updated. Then, alarm information with maximum matching degree is output by matching real-time alarm information with knowledge base. Lastly, alarm threshold is optimized through threshold optimization model. Thus, false alarm is reduced, etc.

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