Research on Cluster Monitoring and Prediction Platform based on Zabbix Technology

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Abstract. With the rapid development of Internet and computer technology, cluster technology has been widely applied to the explosive growth of network data. With the successful construction of the cluster and the continuous expansion of nodes, the reliability and stability of the cluster itself has become an important factor that cannot be ignored, so various monitoring systems emerge. Based on the above reasons, this paper proposes a real-time monitoring and prediction platform for enterprise users based on Zabbix. The monitoring and prediction platform monitors all kinds of indexes in the cluster in real time and predicts important performance indexes in real time. When monitoring or predicting the abnormal situation, the system can warn the users, which is conducive to the real-time understanding of the cluster operation. The short-term real-time prediction model of cluster monitoring index is introduced in detail in this paper. Finally, the real-time monitoring function of indicators is designed and analyzed based on the prediction model.

1. Introduction
With the rapid development of the Internet and computer technology, the data has an explosive growth trend. Cluster technology is beneficial for enterprises to improve the system response speed, ease of use, scalability and other aspects with less cost. However, the monitoring system is the core of cluster management, which can timely inform the management staff of the failure of hardware and software in cluster nodes. Therefore, it is widely used in the daily security management of clusters.

Considering the successful establishment of the cluster and the continuous expansion of nodes, the reliability and stability of the cluster itself has become an important factor that cannot be ignored, so various monitoring systems emerge. Based on the above reasons, this paper proposes a real-time monitoring and prediction platform for enterprise users based on Zabbix. The monitoring and prediction platform monitors all kinds of indexes in the cluster in real time and predicts important performance indexes in real time. When monitoring or predicting the abnormal situation, the system can warn the users, which is conducive to the real-time understanding of the cluster operation. The short-term real-time prediction model of cluster monitoring index is introduced in detail in this paper. Finally, the real-time monitoring function of indicators is designed and analyzed based on the prediction model.

2. Zabbix system components and architecture
Zabbix system is composed of multiple system components, mainly including: server, server agent, web front end, monitored device and database storage. Not every component needs to be installed and
deployed in a real monitoring system. Users can choose to install certain required components to build their own monitoring platform according to the requirements of actual application scenarios and environments. The relationships among the components in the Zabbix system are shown in figure 1.

![Diagram of Zabbix system](image)

Figure 1. The relationships among the components in the Zabbix system.

In figure 1, the functions of each component in Zabbix system are:

1) **Zabbix server**: This component is the core of Zabbix system. It is mainly responsible for data collection, collection, analysis, processing and storage, and sends warning information according to user definition.

2) **Zabbix server agent**: This component receives monitoring configuration information from Zabbix server. At the same time, data is collected according to the configuration information and the collected data is sent to Zabbix Server at a certain frequency.

3) **Zabbix web front end**: This component receives user requests to configure the monitoring nodes and monitoring items. At the same time, the monitoring data is displayed in a chart according to the request.

4) **Zabbix monitored device**: This component is a monitoring component running on the monitored device, which is responsible for collecting monitoring data and sending the collected data to Zabbix server regularly.

5) **Zabbix database storage**: This component provides data storage and query capabilities, including configured monitoring information and collection of monitored data.

3. Analysis and design of short-term real-time prediction algorithm

The theory and technology of Zabbix have been described above, and the short-term real-time prediction algorithm will be studied in this chapter. After analyzing what the monitoring prediction platform needs to monitor on the cluster nodes. This chapter designs the prediction model by analyzing the characteristics of monitoring data, and designs the short-term real-time prediction algorithm according to the prediction model.

The short-term real-time prediction algorithm is mainly divided into two steps:
1) **Identify the load tracker.** Since the moving average method can effectively eliminate irregular and other changes in time series, the long-term trend of time series can be revealed. At the same time, the method is simple to calculate and suitable for online computing scenarios. Therefore, this paper mainly considers the application of moving average method as the implementation of load tracker.

2) **Deterministic prediction algorithm.** Compared with the existing popular linear prediction algorithms, Trend-Aware Regression (TAR) algorithm has certain advantages in the prediction of system load resources in terms of time complexity and prediction accuracy. Therefore, this paper we use TAR algorithm to obtain the final prediction value.

![Diagram](image.png)

Figure 2. The principle of TAR prediction algorithm.

The principle of TAR prediction algorithm designed for cluster monitoring indicators in this paper is shown in figure 2. Firstly, the simple moving average method is used to realize the load tracker to obtain the overall trend of monitoring data in the sliding window. Then based on the output of the moving average method, the TAR algorithm is applied to realize the short-term real-time prediction of monitoring index.

4. **Design of Zabbix monitoring and forecasting platform**

The above chapter designs a short-term real-time prediction model for monitoring indicators. This chapter will design the monitoring and prediction platform based on Zabbix technology. As shown in figure 3, the architecture of the cluster monitoring and prediction platform can be divided into three layers: presentation layer, business logic layer, and data access layer. The system is based on Zabbix to realize real-time monitoring and prediction of monitoring indicators. Meanwhile, the persistent storage of data is realized by using Mysql technology.
Cluster monitoring is an important part of cluster management, which determines the security and stability of cluster system. The main goal of this monitoring and prediction platform is to monitor all kinds of indicators in the cluster in real time and predict important performance indicators in real time, so as to ensure the stable and robust operation of the cluster. At the same time, the platform can also provide statistical analysis function related to monitoring indicators for cluster managers. Through the monitoring and prediction platform, managers can dynamically adjust the parameters and then adjust the monitoring strategy. Monitoring and prediction platform architecture diagram is shown in figure 3.

The important functional modules are described in detail as follows:

1) **Data acquisition module**. The data acquisition module mainly includes four sub-modules: service startup, configuration management, monitoring data acquisition and monitoring data storage. Mainly responsible for the collection and persistent storage of index information in cluster monitoring nodes according to configuration files.

2) **Real-time monitoring and warning module**. The real-time monitoring and warning module mainly includes three sub-modules: node monitoring, data query and threshold warning. This module is mainly responsible for visualizing the load information in the process of cluster operation and real-time monitoring of monitoring indicators.

3) **Real-time prediction module**. This module mainly includes three sub-modules: real-time prediction, parameter regulation and threshold warning. The module is mainly responsible for short-term real-time prediction of important performance indicators, and timely notifies the cluster manager when abnormal information is predicted. At the same time, it also provides dynamic control of prediction parameters, so that managers can dynamically adjust the relevant parameters of the prediction algorithm according to the actual needs, so as to achieve better prediction effect.

In the Zabbix system, all monitored host and monitoring item configuration information, as well as the collected monitoring data are recorded in the Mysql database. If the performance of the database bottleneck, not only will affect the timely data import, or even a large number of false alarm information or omission. Therefore, Zabbix system is a system that is heavily focused on the database, and the performance of the database server directly affects the performance of the entire system. This paper focuses on improving the performance of Zabbix database. Table 1 shows the detailed design result.
Figure 3. Detailed design result of Zabbix database.

| Serial number | Name of table | Granularity of partitions | Function of the table                                                                 |
|---------------|---------------|---------------------------|---------------------------------------------------------------------------------------|
| 1             | history       | daily                     | Stores numerical historical data for monitoring metrics                                |
| 2             | history_log   | daily                     | Stores log historical data for monitoring metrics                                      |
| 3             | history_str   | daily                     | Stores character historical data for monitoring metrics                                |
| 4             | history_text  | daily                     | Stores text historical data for monitoring metrics                                     |
| 5             | history_unit  | daily                     | Stores numerical historical data for monitoring metrics                                |
| 6             | acknowledges  | daily                     | Record events                                                                        |
| 7             | alerts        | daily                     | Record the alarm data sent by the system                                               |
| 8             | auditlog      | daily                     | Record audit information                                                              |
| 9             | events        | daily                     | Record system event information                                                       |
| 10            | service_alarms| daily                     | Record warning status                                                                |

5. Conclusion
In this paper, we propose a real-time monitoring and prediction platform for enterprise users based on Zabbix. The monitoring and prediction platform monitors all kinds of indexes in the cluster in real time and predicts important performance indexes in real time. When monitoring or predicting the abnormal situation, the system can warn the users, which is conducive to the real-time understanding of the cluster operation. The short-term real-time prediction model of cluster monitoring index is introduced in detail in this paper. Finally, the real-time monitoring function of indicators is designed and analyzed based on the prediction model.

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