

Fine network operation and maintenance management method based on telemetry

Jia Wang^{1*}, Jingyuan Li², Ke Zhang³

¹Shaanxi Normal University, Xi'an 710119, China ; ²Shaanxi Normal University, Xi'an 710119, China;

³Shaanxi Normal University, Xi'an 710119, China

*Corresponding Author

Abstract: Aiming at the disadvantages of high delay, pull mode and affecting device performance when SNMP reads network device data, this paper proposes a refined network operation and maintenance management method with high timeliness based on Telemetry technology, which can collect and analyze data at sub-second level and dynamically adjust network parameters to send data to network devices in a unified manner. Forming a positive feedback closed-loop network tuning mechanism to achieve intelligent and efficient network operation and maintenance.

Keywords: Telemetry, Refinement, Network operation and maintenance, Flow control

1. Introduction

With the expansion of campus network data center scale and the application of Internet of Things, artificial intelligence, VxLAN and other technologies, the traditional OPERATION and maintenance method based on SNMP protocol cannot meet the operation and maintenance requirements of IDC, and the management and maintenance of computer cluster and large-scale campus network are facing great challenges. How to find a fine, timely and intelligent operation and maintenance method has become a big problem for data center network managers. Telemetry network Telemetry technology based on efficient, timely monitoring network operation and maintenance scheme for the majority of managers have brought light, compared with SNMP, Telemetry realized the ability of network equipment to actively push status information, has a stronger timeliness, relying on the traditional network monitoring means can not solve the problem of "invisible". Telemetry solves such problems as delay, forward path, cache and packet loss perfectly. Telemetry is a remote technology that collects data at high speed from physical or virtual devices. The device actively pushes device data to the collector in Push Mode, providing real-time and efficient data collection capabilities[1,2].

SDN network equipment scale increasing, bearing more and more business users for SDN network intelligence operations put forward higher request, including the monitoring data with higher precision in order to timely detection and quickly adjust the micro flow, at the same time monitoring process to small impact on the functionality and performance with the device itself in order to improve the utilization rate of equipment and network. The traditional SNMP protocol reads the MIB library of switch devices on the campus network, realizing the delay of resource utilization such as CPU, temperature and memory at the level of minutes. Because SNMP proactively initiates access to network devices such as servers to read status information, reading device status too frequently will increase the pressure on devices. For a short period of time of intermittent packet loss of the SNMP protocol to monitor operational system administrator can't accurate warning, can't timely failure analysis and solution, the purpose of the network node demand for high performance, large scale, be badly in need of a new and efficient network monitoring solution, which can support many fine management of the brand switch and server, network equipment, It can also achieve high precision, timeliness and minimum impact on equipment performance, and provide real-time and effective big data analysis data support for network optimization and quality improvement[3,4].

Telemetry technology based on the agreement with the server and other devices after the device actively push their own status, to ensure the quality of device status and realize fine network operation and maintenance monitoring. In recent years, the school of switch equipment procurement generally begin to support Telemetry protocol, the late new generation operational system management personnel must be liberation hands[5], rely on information means the performance of the real-time monitoring equipment status, early warning to replace obsolete equipment, as well as the LOG all the flow analysis

network problems, with the fastest speed solve restore network fault, Minimize the negative impact of network failure on teachers and students.

2. Telemetry Concept

Telemetry is a remote technology that collects data at a high speed from physical or virtual devices. The device periodically sends interface traffic statistics, CPU or memory data and other information to the collector in Push Mode. Compared with the traditional Pull Mode, Telemetry is a remote technology that collects data at a high speed from physical or virtual devices. Provides more real-time and high-speed data acquisition function[6]. With the rapid increase of campus network data center and access switch equipment, the rapid development of informatization makes the campus business carrying capacity more and more large, and the monitoring data in the campus network needs to respond to the failure time more quickly, detect the time of failure and quickly adjust the negative impact of sudden traffic. In addition, the intelligent and refined o&M monitoring process must minimize the impact on device performance to improve device utilization and network reliability[7].

At present, the most widely used network monitoring methods are mainly SNMP, CLI and SYSLOG. Compared with Telemetry proposed in this paper, there are three shortcomings:

- (1) The traditional monitoring method is still to read the monitoring data of the MIB database of network devices by pulling, which makes it more difficult to monitor the network monitoring nodes. It is not applicable to the network of large-scale device nodes.
- (2) The interval between reading monitoring data can be as low as minutes. In order to refine management intelligence, the frequency of active query of network devices can be improved, which will virtually increase the memory and processor resource occupancy rate of network devices and affect normal network service flow.
- (3) There is a minute-level delay in reading data, which leads to a lag in the network node device status of the operation and maintenance system, and difficult network problems such as sudden packet loss and ping failure cannot be analyzed.

Table 1 Differences between Telemetry and traditional monitoring methods

Comparison item	Telemetry	SYSLOG	SNMP Get	SNMP Trap	CLI
Working mode	Push mode	Push mode	pull mode	Push mode	pull mode
Timeliness	Subsecond	second	second	second	second
Structure Mode	YANG Model defines structure	unstructure	MIB defines structure	MIB defines structure	unstructure

3. Telemetry Workflow

The system architecture of Telemetry is mainly composed of an automated closed-loop operation and maintenance system on the equipment side and OSS side. As shown in Figure 1, the components are mainly composed of analyzer, collector, controller and device node. The functions of each part are as follows:

- (1) Analyzer: reads the data collected by the collector, analyzes the data using various algorithms, and sends the results to the controller for the next command.
- (2) Collector: collects and stores the data collected by the terminal on the device side, and then sends it to the analyzer for further data processing.
- (3) Controller: make commands to operate the results sent by the analyzer, such as adjusting network parameters to achieve the optimal state of the system.
- (4) Device nodes: switches, servers, storage and disk recorders and other hardware equipment network nodes that ultimately provide services to users, are an important part of the campus network.

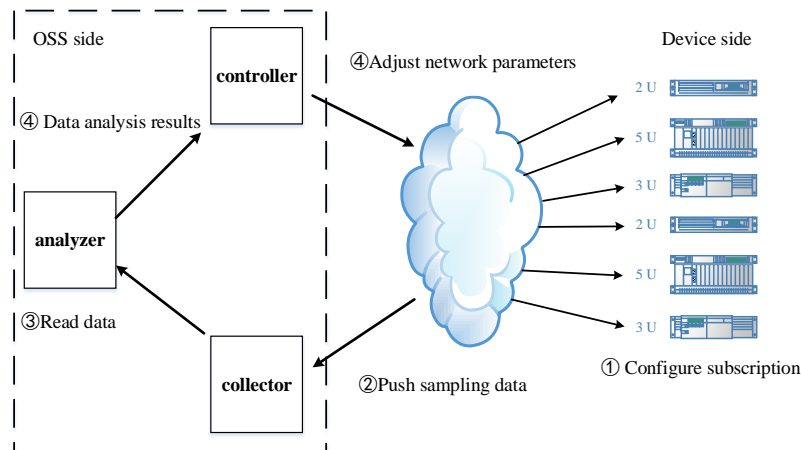


Figure. 1 Telemetry workflow

Telemetry has a total of five steps, which require the device side and OSS side to work together to complete the closed-loop business process:

(1) Subscription configuration: Subscription configuration needs to be completed on the device side, which is divided into static subscription and dynamic subscription. Static subscription is to configure the data source of data collection through the command line. The application scenarios are some simple situations that do not need console refinement, and it is flexible and convenient. Dynamic subscription requires The remote procedure call protocol of Google to complete the relevant configuration, and the related tasks are also configured on the command line. The collector can send the dynamic configuration to the device.

(2) Push adoption data: The device collects data according to the network configuration parameters sent below and reports the data to the collector for storage.

(3) Reading and analyzing data: The analyzer reads the device data stored in the collector, uses the algorithm to analyze the results, and returns the results to the controller, which dynamically configures network optimization according to the analysis results of the collected data.

(4) Adjusting network parameters: The controller sends the adjustment parameters of network optimization to the device side. After the configuration takes effect, the newly collected data of the device is sent to the collector again to form a closed work process and finally achieve the purpose of network optimization.

4. Implementation Of Fine Network Operation And Maintenance

Traditional network monitoring methods cannot solve "invisible" problems, such as delay, forwarding path, cache and packet loss. For example, THE SNMP protocol initiated by external applications to obtain network status information cannot reflect the network status in real time. Compared with SNMP, Telemetry realizes the ability of network devices to actively push status information and has stronger timeliness. Telemetry technology to achieve refined network operation and maintenance needs to use gRPC (Google Remote Call Program), which is Google open source high-performance cross-language RPC framework, after the integration of the framework in the switch can realize the flexible definition of data format. As well as the definition of the threshold of data push, the switch proactively pushes its own status data, such as the information of device CPU, Memory and Buffer Usage, to the monitoring platform. When packet loss occurs or the device goes offline, the monitoring platform gives real-time alarm notification, achieving network refinement and visual operation and maintenance management. The emergence of gRPC has solved the problem that real-time data cannot be effectively transmitted to the monitoring server, and its interaction mechanism flow is as follows:

- (1) After the gRPC function is enabled on the switch, the monitoring server acts as the gRPC server.
- (2) The switch initiates gRPC channel connection to the monitoring server.
- (3) The switch proactively reports Buffer Usage, CPU, memory and other information to the monitoring server. When Buffer packet loss occurs, the switch will also report the packet loss event to

the monitoring server in real time.

GRPC is a high-performance, open source and general RPC framework based on HTTP/2 protocol, among which the most important and most difficult implementation is the establishment of the unified YANG model. Although OpenConfig defines a large number of standard YANG models and solves the problems of unification and compatibility, such a standard working group approach cannot meet the needs of rapid iteration in current basic network operation and maintenance. Therefore, we call on the Internet companies to take the lead in organizing the unified YANG model to form facts, and we will continue to supplement and improve it on this basis. From now on, the cost of multi-party docking of the operation and maintenance platform is reduced, and the target is focused on the operation and maintenance capacity demand itself.

5. Conclusion

Based on Telemetry's new application in campus network, this paper analyzes the advantages of Telemetry and traditional SNMP as well as its application advantages in large-scale network nodes. It changes the disadvantage of traditional SNMP to read data with high delay, and analyzes abnormal behavior in real time through traffic real-time tuning and microburst detection. And quickly deliver the configuration and adjustment of network nodes to achieve fine, intelligent network management.

References

- [1] Wang YF, Sun SH, Zhang GY. Fine network management based on flow control[J]. *Radio & TV Broadcast Engineering*, 2013, 40(5):72-74.
- [2] Zhou CG. Network fine and hierarchical operation and maintenance management based on user perception improvement [J]. *Information & Communications*, 2020, (9):226-228.
- [3] Zhou CG. User-Oriented 4G Base Station Maintenance Method and Network Operation and Maintenance Recommendations[J]. *Mobile Communications*, 2019, 43(4) :93-96.
- [4] Pan FN. Research on campus network operation and maintenance management[J]. *China CIO News*, 2021, (1) :128-129.
- [5] Liao ZG. Construction of network operation and maintenance management platform based on riil[J]. *Computer Programming Skills & Maintenance*, 2021, (4):79-81.
- [6] Li Y, Deng X, Wang ZC, et al. Practice and exploration of intelligent network operation and maintenance management platform[J]. *China CIO News*, 2019, (12), 64-65.
- [7] Liu HM, Cheng G. Innovative research and practice of network operation and maintenance system based on centralization and intelligence[J]. *China New Telecommunications*, 2015, (2) :68-71.