Chapter 31
Fault Elimination in Campus Network

Hong Ye, Yuanyuan Liang, Mingyong Li and Wenshu Duan

Abstract The campus network of Chongqing Yuzhong vocational education center was the background for this paper, from campus network troubleshooting model, troubleshooting of tools, combined with the troubleshooting case to discuss common faults and eliminating methods of the campus network. The purpose is to help the personnel maintenance of the campus network to troubleshoot network problems quickly, Troubleshooting steps, which is proposed in this paper, is obtained by long-term practical experience of the author, it has practical value and operability.

Keywords Campus network · Troubleshooting · Troubleshooting tools

31.1 Introduction

The campus network is popular to understand as a LAN, which consists of the campus computers, connected to the Internet via a router and become a part. The campus network is mixture of protocols, technology, media and topologies, with the development of information technology, the use of campus network is becoming more wide [1]. In the application process, due to hardware and software, it fails more frequently, the school's teaching and dealing with daily work and affairs more

H. Ye (✉)
Chongqing Yuzhong Vocational Education Centre, Chongqing 400042, China
e-mail: yehong_126@126.com

Y. Liang · M. Li · W. Duan
College of Computer and Information Science, Chongqing Normal University, Chongqing 401331, China
e-mail: liangyuanlucky@126.com

Z. Zhong (ed.), *Proceedings of the International Conference on Information Engineering and Applications (IEA) 2012*, Lecture Notes in Electrical Engineering 219,
DOI: 10.1007/978-1-4471-4853-1_31, © Springer-Verlag London 2013

and more dependent on network, Once a network failure cannot be immediately removed, Damage done to schools may be large, even catastrophic [2].

The network failure can be quickly and accurately locate the problem and troubleshooting, is a challenge for our network maintenance and management personnel [3], It not only requires a strong understanding of network protocols and technologies, It is more important is to establish a troubleshooting ideas of the system, and reasonably applied in practice, isolate, decomposed complex problem, or reduced troubleshooting range, in order to timely repair the network failure.

31.2 The Classification of Common Fault

Although the network failure phenomenon is manifold, network failure also have some relevance [4]. Network failures can generally be divided into two categories: connectivity issues and performance issues.

The connectivity problem is easy to notice. The main form of connectivity problems are the following:

Hardware, media, power failures—network infrastructure, hardwares such as routers, switches, hubs, servers, terminal equipment, transmission media, power equipment, as use time of Internet goes on, or vandalism, leading to equipment problems.

Software configuration error—software configuration error is a common network failure. As network protocols is too many, and configuration is complicated, if a parameter of a particular protocol is not configured properly, it is likely to cause network connectivity problems.

Compatibility issues—the establishment of computer network requires a lot of network devices, from the PC terminal to the network core routers and switches, is likely to be composed by network equipment of multiple vendors. At this time, the interoperability of the network equipment is very necessary. If the network device is not well compatible, it also can lead to network connectivity issues.

Computer network performance problems as follows:

Network congestion—the performance of any node in the computer network has problems can lead to network congestion.

To the destination is not the best route—The design issues of routing protocol will lead to the data reach the destination network by sub-optimal route.

Insufficient power supply—ensure that the power of the network equipment can achieve the required voltage level; otherwise it will result in equipment handling performance issues, which affect the entire network.

Routing loops—distance vector routing protocol may produce routing loops, cause broadcast storms and reduce network performance.

31.3 The Troubleshooting Steps

The paper uses systematic troubleshooting method. Troubleshooting systematic is reasonable,to find out the general principles of the cause of the malfunction and troubleshooting step by step, and its basic idea is systematically reduced by the large collection (or isolation)consist of the possible cause of the failure into several small subset, so that decline the complexity of the problem rapidly.

The ordered ideas can help resolve any difficulties encountered while troubleshooting. The following steps shows the general network troubleshooting processes.

Step one: the failure phenomenon observed—first of all, I have to complete and describe clearly the phenomenon of network failure, marked the failure location and failure consequences. For example, a PC in Office 201 at 10:30 on May 16 can not access, can not access all site.

Step two: the collection of failure information—first look for the situation of network topology, a variety of running protocols and configuration; then, according to description of the problem feedback user, ask users that affected by the failure about the details, while using network device to diagnostic information. Protocol analyzer tracks and records information collect useful information, understand the operation of the relevant network equipment.

Step three: the empirical judgment and theoretical analysis—based on experience and technical theory of network failure mastery, make preliminary analysis to rule out some obvious points of nonfailure.

Step four: list of all possible reasons—develop a troubleshooting plan according to the remaining potential sticking point, list every possible cause of the malfunction according to the order of the failure possibility's level, start with most likely fault cause, each time only one change.

Step five: implemented troubleshooting program for each plan—implementation debugging program for each possible cause gradually according to troubleshooting plan. In the troubleshooting process, if a possible causes proved invalid, be sure to return to the state before the troubleshooting, and then verify that the next possible reason. If the possible reasons you listed all is invalid, that means it has not collected enough failure information, did not find the failure point, return to the second step, and continue to collect the fault information, until you find the cause of the malfunction and troubleshoot network problems.

Step six: documentation of troubleshooting the process—when eventually ruled out after a network failure, do remember recording the work you have done. Document the process is not a trivial task for the following reasons:

Document is a summary of troubleshooting valuable experience, is the most important reference data of this process of judgment and theoretical analysis; document records the changes the network parameters have made in this troubleshooting;

This is relevant information the next network failure should collect.

Documented record including the following aspects:

The description of the fault phenomenon and the collection of relevant information;

Network topology mapping;

Equipment list and media list in the network;

Protocol list and inventory in the network;

Possible causes of failure;

Develop the program and the results for every possible reason;

The feelings and experiences in the troubleshooting;

The other, such as reference data use in the troubleshooting list and so on.

31.4 Troubleshooting

There are three common troubleshooting ways of campus network: stratification, block method, substitution method.

Layering idea: all the models follow the same basic premise, when the lower structure of the model is working properly, its high-level structure can work properly. Layered troubleshooting method according to the OSI reference model, from physical layer to application layer, troubleshooting layer by layer, and ultimately solve the troubleshoot problems. Specifically each time should be concerned about the following problem while using the layered troubleshooting.

Physical layer—cables, connectors, signal levels, coding, clock, and framing, these are all factors contributed to the link, state is down.

The data link layer—package inconsistency is the most common cause that leads to the failure of data link layer. When use the interface command to displays the ports and protocols, if the port up is agree with down, there is a fault on the data link layer. Data utilization is related to data link, port and protocol is good, but the link bandwidth may be excessive use, then causing intermittent connection failures or network performance degradation.

The network layer—the wrong address and subnet mask error is the most common causes of network layer failure; routing protocol is part of the network layer, and a very complex part is the important content of trouble shooting, while troubleshooting, along the path from source to destination to view the router's routing table, check the IP address of router interface. Typically, if the route does not appear in the routing table, you should check whether entered the appropriate statement, the default, or dynamic routing, and then manually configure the missing route or exclude the failure of the selection process of the dynamic routing protocol to update the routing table.

Senior—is likely to be terminal fault of the network, and then it should check the computers, servers and other network terminal ensure the normal work of the application and software and hardware of terminal equipment running well.

Block method divided network into blocks:

Block network is divided into blocks:

Management section—router consists of name, password, service, and logs.

Part of the port—address consists of packaging, cost, and certification.

Routing protocol consists of section—static routing, RIP, OSPF, BGP, and import-route.

The strategy part—routing policies consists of security configuration and so on.

Access part—the main console consists of Telnet, login or dumb terminal, etc.

Other part of the application—language configuration consists of VPN configuration, QoS configuration.

The substitution method is the most commonly method I will choose when I check the hardware. Replace a cable that is a good one to try when suspected cables problem; replace an interface module to try when suspected interface module's problem.

31.5 Troubleshooting Tools

Network products of H3C series provide a complete set of commands, can be used to monitor working conditions of network interconnection, and troubleshoot basic network failure. The following is diagnostic command:

Ping command—used to check the connection of IP network and host readability, in order to determine whether network connectivity is good.

Tracers command—used to test the gateway that the data packet via from the sending host to the destination, it is mainly used to check network connection, and analysis where the failure occurred in the network .

Display command—used to display the basic information, configuration information and parameters of the router's hardware and software.

Reset command—used to clear the current statistics and exclude the interference of the previously accumulated data.

Debugging command—used to obtain the details of the exchange of packets and frames in the router.

The H3C network management tools—Quid view, it is unified management and maintenance software for data communications equipment, such as routers, switches, there are the following fault management functions:

Alarm real-time monitoring, provide alarm sound and light tips, support external alarm box;

Support alarm switch to Email, SMS;

Support alarm filtering, allowing users to focus on important alarms, query results can generate reports;

Support redefines alarm base level, support alarm dump to ensure the efficiency and stability of the system operation;

Support alarm topology location, locate the focus to the topology objects;

Support alarm correlation analysis, including shielding the repeat alarm, shielding the flash alarm, shielding the root-cause alarm.

31.6 Troubleshooting Examples

Three LAN in school, including 192.11.56.0 network for a user segment, 192.11.56.118 server as a log server; 192.15.0.0 is a centralized application server segment. A day, the user reflects the log server 192.11.56.118/16 and backup server 192.15.254.153/16 encountered a backup problem (Fig. 31.1).

The survey collected the following information:

Recently, the 192.11.56.0 segment clients continue to increase;
FTP transfer speed between the machine and the backup server is 7 Mbps, FTP transfers speed between the machine and the log server is slow, only 0.6 Mbps.

Between the nonpeak of the log server and backup server, the FTP transmission speed is about 6 Mbps.

According to my own past troubleshooting experience, I am sure this is a problem of network performance degradation, so where is the problem? Between the machine of 129.9.0.0 segment and the backup server, FTP transfer speed is normal, so we can exclude 192.15.0.0 segment performance fault.

Based on the empirical judgment and theoretical analysis, summed up the possible reasons as follows:

The reason of the performance of the network segment 192.11.56.0 may be:

Log the server performance issues;
Performance issues of 192.11.56.0 segment gateway;
Performance issues of 192.11.56.0 segment.
Cloud performance issues, the route from the network segment 192.11.56.0 to the network segment 192.15.0.0 are not the best route.

Possible reasons 1: the route from network segment 192.11.56.0 to network segment 192.15.0.0 is not the best route.

Test program: use the "tracer 192.15.254.153" command on the gateway of the network segment 192.11.56.0, found that to returning length of probe packet is only 10 ms, indicating that the reason of the possible reasons is not failure cause. I entered the circulation troubleshooting process again.

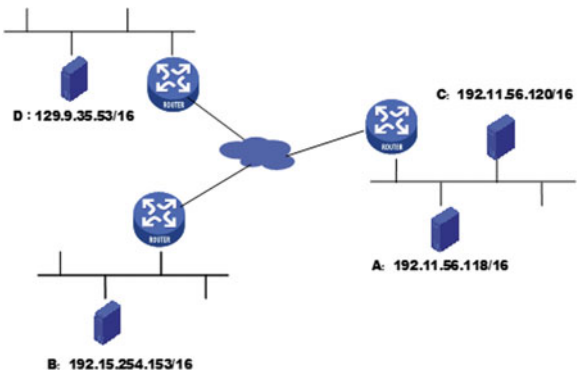

Fig. 31.1 The routing table of school LAN

Possible Reason 2: log server a performance problems.

Test program: test the FTP transfer speed between the host C and log server of the same segment is 6 Mbps, normal. It shows that the problem has nothing to do with the server A.

Possible reason 3:192.11.56.0 segment gateway performance issues.

Test program: test FTP transfer speed between host C and backup server B is 7 Mbps normal. Exclude the gateway factors, because B, C is in a different segment while and the speed is normal.

Possible reasons 4: the performance problems of 192.11.56.0 segment its own.

Test program: using the command "display Mac-address" on Ethernet switch of the network 192.11.56.0, the output is as follows:

Possible causes, I develop a testing program as follows:

Port	Rcv-Unicast	Rcv-Multicast	Rcv-Broadcast
6/32	10317812	0	8665

Port	Xmit-Unicast	Xmit-Multicast	Xmit-Broadcast
6/32	6667987	286652	2474038

Port	Rcv-Octet	Xmit-Octe
6/32	14094829358	1516443041

Using the command "the display Mac-address" on the Ethernet switch of Network 192.15.0.0, the output is as follows:

Port	Rcv-Unicast	Rcv-Multicast	Rcv-Broadcast
6/36	55780287	0	285

Port	Xmit-Unicast	Xmit-Multicast	Xmit-Broadcast
6/36	27879749	190257	119430

Port	Rcv-Octet	Xmit-Octe
6/36	67172587081	4998816809

Thus, the proportion of the broadcast packets and uncast packets on the network segment 192.11.56.0 is 1:3, indeed too big. Asked again what is the mainly business the user segment runs, and arrive the ultimate failure cause as follows: 192.11.56.0 network segment is a common user network segment, for business reasons, each user needs to send a large number of broadcast packets and multicast packets, with more and more users access the network recently, the network server in this segment need to spend more resources to deal with a growing number of broadcast packets and multicast packets, naturally slow down the transmission speed of its service.

Since this is a network layout inappropriate, then rearrange the location of the server, move the server to the 192.15.0.0 network segment, then troubleshooting.

Acknowledgments This work is sponsored by Chongqing Higher Educational Reform (NO: 102118).

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