

---

# Design and Implementation of Ten Gigabit Network Upgrading Scheme for Teaching Building

Guoqiang Hu <sup>a</sup>, Xiaoling Li <sup>b</sup>

Network & Education Technology Center, Northwest A&F University, Yangling, Shaanxi, 712100, China

<sup>a</sup>hgq@nwsuaf.edu.cn, <sup>b</sup>lxl@nwsuaf.edu.cn

---

## Abstract

With the rapid development of education informationization, the existing multimedia classroom network can not carry many new applications, so it is urgent to upgrade the multimedia classroom network. In order to solve many problems in the network application of multimedia classroom, this paper takes No. 3 Teaching Building of North Campus of Northwest Agricultural and Forestry University as an example, designs a specific network upgrade scheme and tests the designed scheme. The test results show that the scheme greatly improves the network bandwidth and network performance, and should be able to meet the network requirements of the existing multimedia classroom.

## Keywords

Network upgrade scheme; Multimedia classroom network.

---

## 1. Introduction

Background and significance of network upgrading of teaching buildings

After more than ten years of development, multimedia teaching has become a basic teaching mode, and the number of multimedia classrooms in Colleges and universities has increased year by year. According to incomplete statistics, the average number of multimedia classrooms in Colleges and universities reaches 180. The Ten-Year Development Plan of Education Informatization (2011-2020) points out that the popularization rate of multimedia classrooms in Colleges and universities reaches 80%. However, compared with the level of deep application and integration and innovation in developed countries, there is still a big gap. The understanding of the construction of digital information classroom in university teaching environment needs to be deepened. The phenomenon of mismatch between informatization and education and teaching still exists. The enthusiasm of Promoting Informatization in education needs to be improved and the strength needs to be strengthened [1]. In the Outline of the National Medium and Long Term Educational Reform and Development Plan (2010-2020), it is pointed out that the development of information technology has revolutionary influence on the development of education, and colleges and universities must attach great importance to it. The Ten-Year Development Plan of Educational Informatization (2010-2020) clearly defines the development goals of educational informatization: to establish and implement the development concept of innovation, coordination, green, open and sharing, to build a network, digital, personalized and lifelong intelligent education system, and to build an informatization learning environment in which everyone can enjoy high-quality educational resources [2].

Education informationization has become an important part of national informationization [3]. As an important part of educational informatization, multimedia teaching environment is also an important place for the construction and management of educational informatization. It plays an important role in disseminating, demonstrating, analyzing, discussing, processing, producing and exchanging information. It is also an important place for collecting, processing and storing data and information.

Northwest University of Agriculture and Forestry Science and Technology has many media classrooms. The existing network is difficult to meet the increasing demand for new business. Network bandwidth has become a bottleneck restricting the development of new business of multimedia classroom network. In order to effectively carry out new business based on network technology in multimedia classroom of teaching building, better integrate information technology into teaching, serve teaching and improve management level and efficiency, it is urgent to upgrade the existing teaching building network in order to change the status quo of small bandwidth and low performance of the original network.

## 2. Upgrading Scheme taking Teaching Building No. 3 in North Campus for example

Based on the requirement of multimedia classroom network application, campus information construction, network security and management, and network export, the network of No. 3 teaching building in North Campus is upgraded to optimize the existing network performance. After upgrading, the link bandwidth from the first floor equipment of No. 3 teaching building in North Campus to the computer room of No. 3 teaching building in North Campus can reach 10,000 megabytes.

### 2.1 Specific Implementation

Replace the existing four (RG-S2928G-E) with two (S2910-48GT4XS-E) and after replace, enable VSU of the two (S2910-48GT4XS-E). VSU (Virtual Switching Unit) is a network system virtualization technology that supports the combination of multiple devices into a single virtual device. Compared with traditional networking methods, this kind of networking can simplify the network topology, reduce the cost of network management and maintenance, shorten the time of application recovery and business interruption, improve the utilization of network resources, and support the configuration of local priority forwarding. After replacement, the connection interface of No. 3 teaching building (IP: 192.168.85.16) of North Campus will be transferred from the original convergence of the North Campus Office (IP: 10.33.0.10) Gigabit Optical Port 3/0/14 to the expansion of the North Campus Office (IP: 192.168.85.254) Gigabit Optical Port 0/4, and then the communication module of both ends will be replaced by the original Gigabit Module.

### 2.2 Comparison of main parameters of equipment before and after upgrading

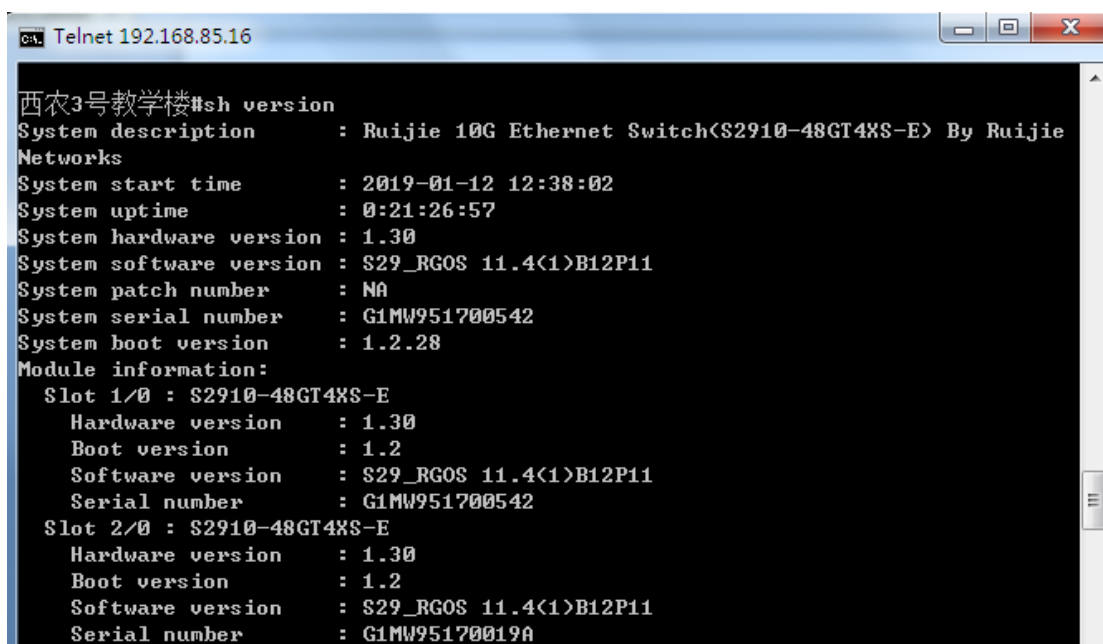
Comparison of main parameters of RG-S2928G-E S2910-48GT4XS-E as shown in Table 1.

Table 1 Comparison of RG-S2928G-E and S2910-48GT4XS-E parameters

	Before upgraded RG-S2928G-E	After upgraded S2910-48GT4XS-E
Product model	RG-S2928G-E	S2910-48GT4XS-E
Application level	The second level	The second level
Backplane	208Gbps	336Gbps/3.36Tbps
Packet forwarding	51Mpps	144Mpps/166Mpps
Hardware parameters	24 Gigabit ports; 4 Gigabit SFP ports	48 Gigabit Ports; 4 1G/10G SFP+Optical Ports

### 2.3 Operation of Upgraded Equipment

After the upgrade, two stations (S2910-48GT4XS-E) are running normally, and remote Telnet 192.168.85.16, the device information displayed after login is shown in Figure 1.



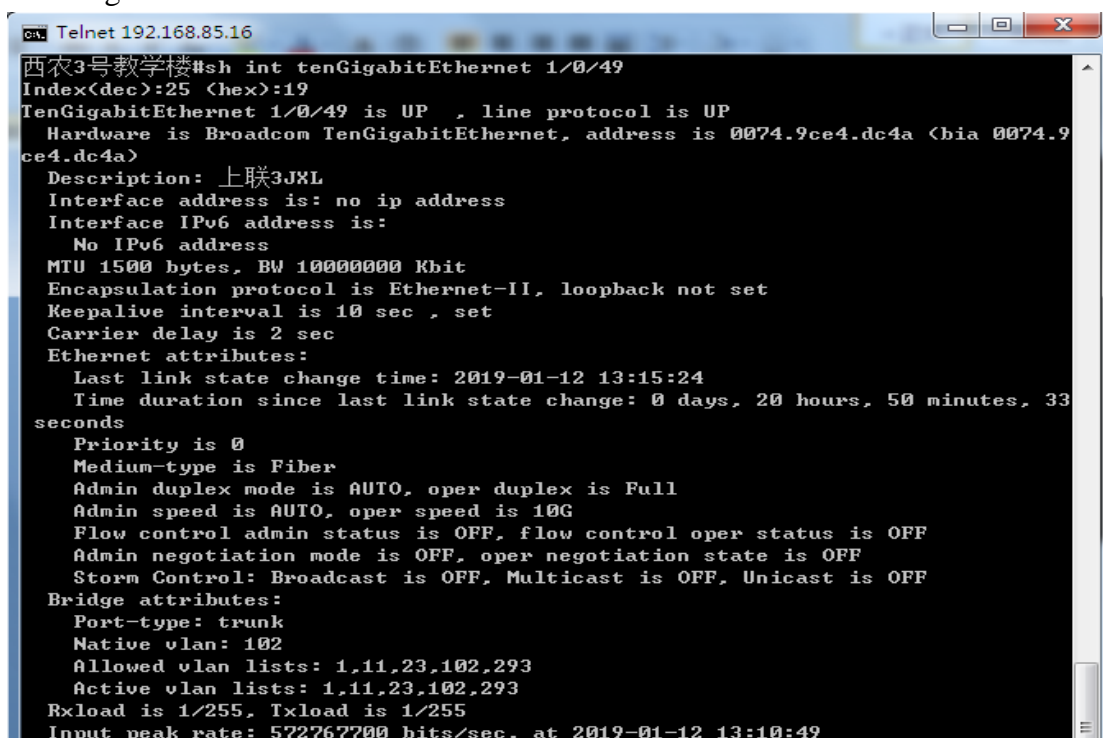
```

西农3号教学楼#sh version
System description      : Ruijie 10G Ethernet Switch(S2910-48GT4XS-E) By Ruijie
Networks
System start time       : 2019-01-12 12:38:02
System uptime           : 0:21:26:57
System hardware version : 1.30
System software version : S29_RGOS 11.4(1>)B12P11
System patch number     : NA
System serial number    : G1MW951700542
System boot version     : 1.2.28
Module information:
  Slot 1/0 : S2910-48GT4XS-E
    Hardware version : 1.30
    Boot version     : 1.2
    Software version : S29_RGOS 11.4(1>)B12P11
    Serial number    : G1MW951700542
  Slot 2/0 : S2910-48GT4XS-E
    Hardware version : 1.30
    Boot version     : 1.2
    Software version : S29_RGOS 11.4(1>)B12P11
    Serial number    : G1MW95170019A

```

Figure 1 Device Information after Upgraded

Input “show interface tengigabit Ethernet 1/0/49” to view the status information of up-link port 1/0/49, as shown in Figure 2.



```

西农3号教学楼#sh int tenGigabitEthernet 1/0/49
Index(dec):25 (hex):19
TenGigabitEthernet 1/0/49 is UP , line protocol is UP
Hardware is Broadcom TenGigabitEthernet, address is 0074.9ce4.dc4a (bia 0074.9ce4.dc4a)
Description: 上联3JXL
Interface address is: no ip address
Interface IPv6 address is:
No IPv6 address
MTU 1500 bytes, BW 10000000 Kbit
Encapsulation protocol is Ethernet-II, loopback not set
Keepalive interval is 10 sec , set
Carrier delay is 2 sec
Ethernet attributes:
Last link state change time: 2019-01-12 13:15:24
Time duration since last link state change: 0 days, 20 hours, 50 minutes, 33 seconds
Priority is 0
Medium-type is Fiber
Admin duplex mode is AUTO, oper duplex is Full
Admin speed is AUTO, oper speed is 10G
Flow control admin status is OFF, flow control oper status is OFF
Admin negotiation mode is OFF, oper negotiation state is OFF
Storm Control: Broadcast is OFF, Multicast is OFF, Unicast is OFF
Bridge attributes:
Port-type: trunk
Native vlan: 102
Allowed vlan lists: 1,11,23,102,293
Active vlan lists: 1,11,23,102,293
Rxload is 1/255, Txload is 1/255
Input peak rate: 572767700 bits/sec, at 2019-01-12 13:10:49

```

Figure 2 1/0/49 Port Information after Upgraded

As can be seen from Figure 2, 1/0/49 port has data receiving and receiving, and the bandwidth is 10G, that is, 10,000 Mbps. From Figure 1 and Figure 2, we can see that the newly upgraded equipment of No. 3 Teaching Building in North Campus is running normally and the 10,000 Mega upgrade is successful.

### 3. Contrast test before and after upgrade

#### 3.1 Content of Test

In order to compare and analyze the network performance before and after the upgrade of No. 3 teaching building in Beijing Campus, this paper adopts the active test method. According to the

situation of our school's access network operators, it mainly tests the download speed of the intranet and the upload speed, download speed, delay and jitter of the access to educational network nodes, telecommunication nodes and Unicom nodes.

### 3.2 Test Scheme

#### 3.2.1 Test download speed of Intranet

Before and after the upgrade, Eagle Get (also known as EG Download Accelerator) download tools were used to download resources from FTP in the No. 3 Teaching Building of North Campus to test the download speed after the upgrade.

#### 3.2.2 Test the network performance of access education network node, telecommunication node and Unicom node

Before and after upgrading, test the network performance of No. 3 Teaching Building in North Campus to Sichuan Telecom and Jinan Unicom by using <http://www.speedtest.cn> speed measurement website, and test the network performance of No. 3 Teaching Building in North Campus to Northeast University by using <http://speed.neu.edu.cn>.

### 3.3 Test Machine Hardware Configuration

Computer model: TravelMate P249-MG laptop

Operating System: Windows 10 Professional 64-bit (DirectX 12)

Processor: Intel Core i7-6500U@ 2.50GHz dual core

Motherboard: Acer Lynx\_SK (100 Series Chipset Family/eSPI Controller-9D48)

Video card: Nvidia GeForce 940MX (2GB)

Memory: 8 GB (Hailishi DDR4 2400 MHz)

Main hard disk: Pocket PX-128M9PeGN (128 GB/SSD)

Display: Chimei CMN14A7 (14 inches)

Network Card: Intel Dual Band Wireless-AC 3168

### 3.4 Results of Test

Table 2 Comparisons of Node Performance of Northeast University Visiting Educational Network before and after Upgrading of Teaching Building 3 in North Campus

	Download Bandwidth (Mbps)	Upload Bandwidth (Mbps)	Jitter (ms)	Delay (ms)
Before upgraded	51.775	16.505	2.35	51.05
After upgraded	70.85	18.954	6.404	46.16
Promotion	36.84%	14.84%	Increase	Decrease

Table 3 Performance comparison of accessing Sichuan Telecom Nodes before and after upgrading of No. 3 Teaching Building in North Campus

	Download Bandwidth (Mbps)	Upload Bandwidth (Mbps)	Jitter (ms)	Delay (ms)
Before upgraded	74.425	74.78	89.6	40.755
After upgraded	202.538	90.11	90.514	31.134
Promotion	172.14%	20.50%	Increase	Decrease

Table 4 Performance comparison of visiting Jinan Unicom node before and after upgrading of No. 3 teaching building in North Campus

	Download Bandwidth (Mbps)	Upload Bandwidth (Mbps)	Jitter (ms)	Delay (ms)
--	---------------------------	-------------------------	-------------	------------

Before upgraded	76.63	73.05	74.08	69.435
After upgraded	269.638	78.61	32.23	39.84
Promotion	251.87%	7.61%	Increase	Decrease

Table 2-4 shows that after the implementation of the upgrade scheme, the speed of visiting the Northeast University node, Sichuan Telecom node and Jinan Unicom node of the Education Network has been improved, and the network jitter and delay have been reduced. This shows that the network stability has been improved, the network performance is higher than before the upgrade, and the network communication quality is better than before the upgrade.

#### 4. Conclusion

Through the above network optimization and upgrading, the network of the teaching building has formed a reasonable campus network structure, expanded the bandwidth of the links, and provided a stable, reliable, efficient and flexible business bearing platform, which can meet the needs of multimedia classroom network and business development.

#### Acknowledgments

This work is supported by CERNET Innovation Project (NGII20170310).

#### References

- [1] F.Li, Targeted Poverty Alleviation System of Compulsory Education in Contiguous Destitute Areas: Based on Talcott Parsons's Social Theory[J]. Journal of East China Normal University (Educational Sciences), 2019, 37(02): 116-126.
- [2] W.Y. Zhang, L.Xu, S.J. Nie, The role of continuing education in constructing learning cities in the Internet era[J]. Distance Education in China, 2019(02): 1-6, 92.
- [3] Y.F. Song, On Community Education Informatization Development——based on the National Informatization Development Policy Documents in the Last Decade [J]. Contemporary Continuing Education, 2018, 36(01): 20-26.