Research on Design of Program - Controlled Switches

Xiaoyan Du,Lei Qiu,Yaqing Zhao

Electronic Information Engineering Institute, Jinhua University of Technology, Zhejiang, China

Abstract: In the 1990s, the development of program-controlled switches in our country has experienced the development process from the scratch; especially the successful development of large-scale program-controlled switches has brought great vitality to our information industry. This time, I mainly introduced to ZTE ZXJ10 program-controlled switchboard to design distributed modularization in program-controlled switch. ZXJ10 digital program-controlled switching system is distributed between modules, module classification control, centralized management of the open architecture, based on general computer platform, LAN technology as the support, client/server mode to control the basic form of structure, in order to make the system has flexible networking ability, strong call processing capability, high reliability, good compatibility and expansibility.

Key words: program-controlled switches, relay configuration, self-loop configuration

1 Introduction

1.1 Design purpose

Program-controlled exchange course design aims to improve our theoretical understanding and practical ability in the field of communication, and develop our ability to use the theoretical knowledge to solve practical problems. To consolidate and deepen the knowledge and understanding of the basic control theory of the instrument, the cultivation of innovation ability, through collecting data, preliminary design, system form, the process of writing the design report, to get a preliminary training of scientific research work, and improve the comprehensive quality of scientific research.

1.2 Overview of ZXJ10 program-controlled switch

ZXJ10 program control digital switch for ZTE independently developed large integrated business platform, its technical performance and parameters fully comply with ITU-T, ETSI and the new national standard book of "Technical specification of the Ministry of Posts and Telecommunications telephone switching equipment" (YDN 065-1997) and a number of technical standards required by the specification, to fully meet the current network capacity, less bureau, highly integrated, and multi-function requirement.

ZXJ10 system front module includes: peripheral switching module PSM, the remote switching module RSM, message switching module MSM, switching network module SNM.

ZXJ10 system structure: an 8K peripheral switch module up to 5 racks, of which # 1 rack for the control cabinet, equipped with all the public resources and two digital relay, a user unit, which can work independently. The other four racks are pure user cabinets (rack number 2 to 5) as shown in Figure 1-28, only with subscriber units. According to the number of subscriber lines, single module structure is divided into single rack, 2 rack to 5 rack.

1.3 Research status

The rapid development of communication technology makes the bottleneck of high-speed communications network performance are now concentrated in high speed switching system; research, design and manufacture of high-speed switching system for high speed communication network has very important significance. Exchange algorithm research and implementation is the old topic for many years, but due to the switch in constantly update now, so the demand for new exchange algorithm is also increasing, to make us more pay more attention in respond to these basic things. With the high speed development of telecommunication network and computer network, high speed large capacity of the cross connection or exchange equipment and the performance of the chip are also greatly improved.

Program-controlled digital switching technology, computer technology and large-scale integrated circuit products, is the digital telephone network, mobile communication network and integrated business digital network the key to the integrated services digital network equipment, which plays a very important role in telecommunication network. Digital telephone networks based on digital switching and digital transmission have been able to provide users with good voice and related services. With the continuous development of digital switching network technology, digital switching network is a kind of scale scalable program-controlled switching system of large capacity digital switching components; currently the digital switching network which is operated in the exchange office mainly adopts the replication type T time division switching. Dedicated communications chip is often used in the implementation. Nowadays, digital network has played a

business capabilities become strong, and have a strong network of intelligent management. Now the digital switching network has also increased a lot of personalized business, it is believed that digital switches are only equipment which can not be replaced in digital communications community. The birth of the digital switch not only makes the telephone exchange to a new level, but also provides favorable conditions for the opening of the non telephone service.

2 Programmable Switch Configuration

2.1 Relay configuration

2.1.1 Physical connection

When doing self-loop, the use of self-loop link to make relay board corresponding to a reliable 2M port connection. In the docking practice, use of coaxial cable to the board of the corresponding 2M port and the switch to be connected to the reliable 2M port connection.

2.1.2 Adjacent switching configuration

1. Select [Data Management → Basic Data Management → Switch Configuration] menu and make [Adjacent Switching Configuration] in the [Switch Configuration] interface.

2. Select the [adjacent switch] sub-page and click the <Add (A)> button to enter the [Add Adjacent Switching] interface.

3. Select [Adjacent Switching Bureau], starting at 1, up to 255; type [Switching Name].

2.1.3 Physical configuration

1. In the [physical configuration] interface, select, click < unit configuration >, enter [unit configuration] interface

2. Select the digital relay unit, modify the sub-unit, the 4 PCM is initialized with the channel signaling.

3. The analog signal units, modify the sub-units, defined two sub-units to one sound unit or soundboard, another sub-units defines as MFC multi-frequency register.

2.1.4 Relay data production

1. To add the relay circuit groups: select [Basic Properties] sub-page, click < add > button, enter [increase relay group] into the interface. Select the module number 2, enter relay group number in the data plan, for a single module, the system supports a maximum of 250 relay group.

2. Circuit Allocation: Go to the [Relay Circuit Allocation] sub-page, select the relay group of the previous step. Click the <Allocation> button to enter the [Relay Circuit Allocation] interface, and select the relay circuit to be assigned to the relay group in the Data Planning sub page. Click the <Allocation (A)> button to display the circuit that has just been assigned in the relay circuit interface in the group.

3. To add the outgoing route: enter [Outbound route] sub-page and click the <Add (A)> button, enter the [Add outgoing route] interface. System displays [route number], here is 1, choose [module], click [relay group number] to select domain dropdown arrow, the system displays all of the two-way relay group. Select the two-way relay group number, click < increases (A) > button, increase a road out of here [Outbound exit number transform] with the objects and purposes of relay Group [inbound number transform] are the same, is called transformation, is designed especially for cooperation with the peer-side signaling. But outbound exit number transform is after the bureau number analysis, number of exit flow before to relay the transformation; and the number of inbound flow transform is on from the received data stream transform in the former, after the bureau's number in the analysis. In order to make the ring can be born later, need to be here to transform the outbound code into the inbound code.

4. To add Outbound Routing Group: Select the [Outbound Routing Group] sub-page and click the <Add (A) >button, enter the [Add Outbound Routing Group] interface. The sequence of system gives [Routing group number], which is 1. A routing group consists of up to 12 routes. In the selection field of [Routing Number 1], click the drop-down arrow to select the routes added in the previous step. Click the <Add (A)> button to create a routing group.

5. To add the outbound routing chain: Select the [outbound routing chain] sub-pages, click <Add (A)> button, and enter the [Add outbound routing chain] interface. The sequence of system is given [Route chain number], where is 1. A routing chain consists of up to 12 routing groups. In the selection field of [Routing group 1], click the drop-down arrow to select the routing group added in the previous step. Click the <Add (A)> button to create a routing chain.

6. Add the outbound routing chain group: Select the [outbound routing chain group] sub-page, click the <Add (A)> button to enter the [Add outbound routing chain group] interface. The system supports up to 512 outbound routing chain groups, where [Routing chain] is 1, and one routing chain consists of up to 20 routing chains. Click the drop-down arrow in the selection field of [Routing 1] and select the route chain added in the previous step. Click the <Add (A)> button to create a routing chain group.

2.1.5 Number Analysis and Signaling Tracking

Number analysis using the analysis of the two analyzer, which including the new service and the local network, generally known as 1, and increase the analysis of peer-side code in the local network analyzer.

Follow the track with the signaling as shown in Figure 2-1, including: Select the [Service Management → Log Signaling Trace] menu, enter the [Signaling Signals] page. Click the <Register> button, pop-up [with the road signaling registration parameters] small screen. In the small screen, click the <Add> button, and pull out the editing interface in the system interface below. Select the "bureau to" (i.e. adjacent exchange in adjacent to the name of the Bureau), [relay group] field shows two relay group production management as "module: 2, index: 1" and "modules: 2, index: 2", choose one of them, click < edit confirmation >, back to the small screen, click <confirm >, then the registration of signaling tracking is complete.

随路信令跟踪

登记　终止　关联　版本　退出

#	1 2-3-1-1 收发时间	前向线路	后向线路	前向记发	后向记发
1	5:39:24.57	1011	1011		
2	5:39:24.57	0011			
3	5:39:24.57		1111		
4	5:39:24.91			8	
5	5:39:24.91				1
6	5:39:25.12			8	
7	5:39:25.12				1
8	5:39:25.37			8	
9	5:39:25.37				1
10	5:39:25.60			8	
11	5:39:25.60				1
12	5:39:25.81			1	
13	5:39:25.81				1
14	5:39:26.00			2	
15	5:39:26.00				1
16	5:39:26.22			10	
17	5:39:26.22				1
18	5:39:26.43			2	
19	5:39:26.43				3
20	5:39:26.65			3	
21	5:39:26.65				1
22	5:39:27.45	1011			
23	5:39:27.45		1011		
24					

Figure 2-1 Track with the signaling

2.2 NO.7 signaling system self-loop configuration

2.2.1 Dynamic Data Management

1. Procedures: Select [Data Management → Dynamic Data Management → Dynamic Data Management Menu], enter the No.7 management interface, which includes [Circuit (Group) Management], [No.7 Self-loop Request] and [MTP3 Man-machine command], in order to achieve the circuit group of the closure, No. 7 signaling and speech path's self-loop application, and No. 7 signaling links and routing status checking respectively.

2. NO.7 self-loop request: Enter [No.7 self-loop Request] sub-page, in [No.7 relay self-Loop] field [PCM Line 1:] for Module 2 Unit 3 Sub-unit 1 , and [PCM Line 2:] for the module 2 unit 3 sub-unit 2, click <self-loop request(R)>, the system lists the two PCM lines from the loop, to achieve the self-loop application. Select 'link number 1' and 'link number 2' in the 'No.7 self-loop' field, to differentiate the <self-loop request (R)>. Click <self-loop query (Q)>, the system shows the self-loop signaling, to achieve the self-loop signaling application.

3. MTP3 command: Enter [MTP3 HMI command] sub-page, and select [Link No. 1] and [Link No. 2] in the [Link Operation] field, and click <Activate this link (A)>, system will shows the link 1/2 activation succeeded in the [return result:] field, then observe the STB board, there can see the running of lights flash.

2.2.2 NO.7 signaling trace

1. Select the [Service Management → No. 7 Signaling Track] menu and go to the [No.7, V5 Maintenance] page.

2. Select [Signaling Tracking → No. 7 trace setting → according number] menu, enter the [TUP, ISUP Trace Settings] screen, select [Type of number] as the calling subscriber number, and type the number in the [User Number], Click the <confirm (O)> button to complete the signaling trace setting. And then click the green start to track the icon, that is, enter the tracking status.

3. Call out the outbound number, there can see the signaling trace window appears a series of signaling messages, as shown in Figure 2-2, and also can determine the situation of signaling docking according to these signaling messages.

2.3 Billing system configuration

2.3.1 User billing configuration

1. Delete the original data in the billing system: the billing system and the operation and maintenance system are two separate systems. In the laboratory, the computer may retain some of the previous experimental data; we need to delete the old data before we start the experiment. As shown in Figure 2-3, select [Billing System → Billing Summary → Data Backup and Restore → System Data Delete]. Select [User Profile] and [Billing Settings], the other can be temporarily not to be selected, and then click <Start>. In the pop-up dialog box, enter the super password 'PROMINENT' (note: all capital letters), and then click <OK>. Delete the bill data according to the above method - [Billing System → Billing Summary → Data Backup Recovery → Bill Data Delete].

2. Fees setting: Select [Billing System → Billing Requirements Setup → Billing Category → Billing Category Settings]. Increase the billing class that does not exist on the existing interface. As shown in Figure 2-4, if the planned billing category 'Local' already exists, there is no need to increase.

3. Auxiliary table management: before increase a single phone billing file, some of the necessary auxiliary table need to be defined, such as the monthly rent category table, branch name, payment category table, user type table. For the other forms, such as the monthly rental table, the type of relief, the phone number table, no archive user table can be selected according to requirement, temporarily no need to configure in this case.

4. Phone files Single input: When entering the phone file, we need to apply with auxiliary table that have edited previously, and to define the user's billing group number. We can use the single input method and batch input method for phone file.

3 System Debugging

3.1 Data transmission

At first, do the number analysis, as shown Figure 3-1, in the background of maintenance system, open the [Data Management → Basic Data Management → Number Management → Number Analysis], as shown, select the [Analyzer Portal] page, click the <Delete> button, pop-up a window for deletion confirmation, click <OK> button to confirm, delete the analyzer number. Click the <Cancel> button to discard the deletion. Select an analyzer, click the <Modify name> button, enter a new name, click <OK> to complete the operation, and click <Cancel> to discard the operation. Select an analyzer and click the <Analysis Number> button to browse the numbers being analyzed in the Analyzer.

And then do the data transfer, the purpose is to send the configuration data in the background to the foreground of MP, select [data management] → [data transfer], enter the data transmission interface, select the transmission mode as [send all the table], then click <send>.

3.2 Relay data configuration failure analysis

1. Phenomenon: background to the foreground data transmission failure.

Analysis: the background ping cannot reach to the MP foreground, and cannot see the communication with the MP foreground when use combination of hotkey of Ctrl + Alt + F12, this prove that front and background communication failure. Possible point of failure:

Ping129 servers IP address, check if the background of TCP / IP is normal.

Check if the background of HUB cable is normal, the connection is correct.

Check if HUB is working properly.

Check if HUB cable which connects to the MP foreground is normal, the connection is correct.

Check if MP is running properly.

2. Symptom: system does not allow deleting the board when configuration board error occurs.

Analysis: If the card has been assigned a sub-unit or has been assigned a HW or has been assigned a communication port or is in use, the system will protect the resources in use, and will not be allowed to delete the board.

Exclusion: Remove the unit in the unit configuration / interface of unit delete and then delete the board.

3. Phenomenon: ASIG board light fault, light of two sub-units do not on or light of either one of the sub-unit does not on.

Analysis: Configurations errors of one or two sub-unit of ASIG will cause the corresponding sub-unit light do not on. If both sub-units are configured correctly, both the running lights and that two subunit lights will be on.

Exclusion: wear anti-static bracelet, pulled out the ASIG board when the traffic is small, check the two label of DSP, 'CMDRT' can be configured to DTMF or MFC sub-unit, TONE can only configured sound sub-unit , CID can only be configured to caller sub-unit. We can modify the sub-unit configuration according to the label.

4. Phenomenon: alarm background map is incomplete; only show part of the board, but the communication with the MP normal.

Analysis: in the laboratory, when MP frequently accepts different configuration data, the data table confusion may be occur, resulting in alarm display background is not normal.

Exclusion: do the transmission through all the tables, and reset MP after the MP is fully activated, check the background alarm after the MP is back to normal; alarm should be normal. If there is a board that can not be seen on the alarm map, the steps above can be repeated one more time; the MP can be reset up to 2 times, and the data table in the MP will be clean.

3.3 NO.7 data signaling configuration fault analysis

1. Phenomenon: background to the foreground data transmission failure.

Analysis: the background ping cannot reach to the MP foreground, and can not see the communication with the MP foreground when use combination of hotkey of Ctrl + Alt + F12, this prove that front and background communication failure. Possible point of failure:

Ping129 servers IP address, check if the background of TCP / IP is normal.

Check if the background of HUB cable is normal, the connection is correct.

Check if HUB is working properly.

Check if HUB cable which connects to the MP foreground is normal, the connection is correct.

Check if MP is running properly.

2. Symptom: system does not allow deleting the board when configuration board error occurs.

Analysis: If the card has been assigned a sub-unit or has been assigned a HW or has been assigned a communication port or is in use, the system will protect the resources in use, and will not be allowed to delete the board.

Exclusion: Remove the unit in the unit configuration / interface of unit delete and then delete the board.

3. Phenomenon: ASIG board light fault, light of two sub-units do not on or light of either one of the sub-unit does not on.

Analysis: Configurations errors of one or two sub-unit of ASIG will cause the corresponding sub-unit light do not on. If both sub-units are configured correctly, both the running lights and that two subunit lights will be on.

Exclusion: wear anti-static bracelet, pulled out the ASIG board when the traffic is small, check the two label of DSP, 'CMDRT' can be configured to DTMF or MFC sub-unit, TONE can only configured sound sub-unit , CID can only be configured to caller sub-unit. We can modify the sub-unit configuration according to the label.

4. Phenomenon: alarm background map is incomplete; only show part of the board, but the communication with the MP normal.

Analysis: in the laboratory, when MP frequently accepts different configuration data, the data table confusion may be occur, resulting in alarm display background is not normal.

Exclusion: do the transmission through all the tables, and reset MP after the MP is fully activated, check the background alarm after the MP is back to normal; alarm should be normal. If there is a board that cannot be seen on the alarm map, the steps above can be repeated one more time; the MP can be reset up to 2 times, and the data table in the MP will be clean.

4 Conclusions

With the gradual opening of the national information network infrastructure and telecommunications business, telecom operators are facing a comprehensive transition of operation, management and technology, it has the superior level of service which is a prerequisite for future competition in an invincible position, and it has an advanced information network which is the basic of network management. Exchange as the core of the information network has been integrated into more advanced technologies. Modern switch must have a full range of open, flexibility network as well as multi variety of business, multi variety of network integration and eventually should be able to achieve integration and broadband switch platform. ZTE ZXJ10 as the second generation of digital program-controlled switchboard with the above requirements above which represents the development of modern exchange technology trends. Curriculum of design is an important part of cultivating students' comprehensive application of knowledge, discovering, proposing, analyzing and practical problems solving and

exercising practical ability, it is a specific training and investigation process for students' practical ability. Curriculum of design, on the one hand is to check our learning results in one semester, on the other hand is also in order for us to master and apply it, while still allowing us to recognize our own deficiencies and weaknesses, and then to make up and strengthened.

Through the curriculum design, I have enhanced the understanding of program-controlled switches, and I learned the data search, data configuration and so on. To further improve my ability to analyze and solve the practical problems, this help me create training with brain and hands analysis. The actual ability of technical problems solving of program-controlled switchboards, realized by transformation of textbook knowledge to practical abilities, it deepen the understanding of the basic principle and enhanced my practical ability.

References

[1] Zhu Shihua. Program-controlled digital switch principle and application. Xi An Jiaotong University Press   1993

[2] Ye Min. Program-controlled digital switch and switch network. Beijing University of Posts and Telecommunications Press   1999

[3] Gui Haiyuan. Luo Yaanguo. NO.7 Signaling System. Beijing University of Posts and Telecommunications Press   1999

[4] Gao Zhigang. Modern high-speed switching LAN and its application. Defense Industry Press   2001

[5] Shang Shu Ming. Digital program-controlled switch technology and application. Polytechnic University Press   2007