

Design and Implementation of Information and Communication Dispatching System Based on FreeSwitch Platform

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Abstract: The thing of information and communication dispatching is a decision-making process and the core work of command centre. The accuracy and efficiency of information and communication dispatching work directly affect the service quality and corresponding social benefits. This paper first introduces the technology of FreeSwitch, a soft switch solution, including a soft phone and a soft switch to provide voice and chat product drivers. On the basis of demand research, the information and communication dispatching system based on IMS architecture, and the upper application based on SG-UAP platform were developed to realize voice dispatching, cooperative dispatching, recording, traffic service, configuration service and other functions. The system has also been deployed online. After continuous testing and drilling, the platform has been used in actual combat, marking the initial completion of the construction of the information and communication dispatching command system based on the FreeSwitch platform.

1. Introduction

With the accelerating pace of power grid construction and the further strengthening of the information communication dispatching function, the information communication dispatching and commanding work puts forward higher requirements in dispatching business types, dispatching business scope, dispatching resource use and dispatching instruction accuracy. In order to build a flexible, efficient and unified information communication dispatching and commanding platform, this paper designs and establishes a set of information communication dispatching and commanding system based on FreeSwitch. The system is designed with consideration of security, compatibility, reliability and scalability. It realizes five module functions such as voice dispatching, cooperative dispatching, recording and recording, call service and configuration service, and realizes communication. The development of dispatching automation, integration, centralization and intelligence provides a strong communication guarantee for the formation of large-scale operation and overhaul.

These data are not completely independent, they are interrelated and influence each other, there is a more complex relationship. For example, meteorological conditions and socio-economic situation will affect the power consumption of users, and the power consumption data will affect the power market transactions. The power market data can provide the basis for relevant public service departments to make decisions, while the GIS data of power enterprises must be based on the municipal planning data. In addition, these data structures are complex and various. In addition to the traditional structured data, they also contain a large number of semi-structured and unstructured data, such as the voice data of the service system, the waveform data in the detection data, and the image data taken in the helicopter patrol inspection. And the sampling frequency and life cycle of these data are also different, from microsecond



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level to minute level, even to annual level. In this context, it is urgent to build an information communication dispatching and command system to control the information communication among the headquarters, disaster recovery centre and provincial companies, so as to ensure the integrated operation of information communication dispatching. This paper designs and implements a set of information communication dispatching command system based on Freeswitch platform, which realizes the automation, integration, centralization and intelligent development of communication dispatching, promotes the vertical contact and horizontal cooperation of information communication dispatching in power companies, and promotes the rapid development of power communication business.

2. Technology of FreeSwitch

Freeswitch is a soft switch solution for telephone, including a soft phone and soft switch to provide product drivers for voice and chat. Freeswitch can be used as switch engine, PBX, multimedia gateway and multimedia server. Freeswitch is a cross platform open-source telephone exchange platform with strong scalability. Designed to provide routing and interconnection communication protocols for audio, video, text, or any other form of media. It fills many gaps in business solutions. Freeswitch also provides a stable phone platform, and many widely used free phones are developed using it. The main function of dial plan is similar to the routing table in traditional router, which provides the function of telephone routing. The implementation of its routing function mainly depends on files. The end point is the edge of the Freeswitch system. Exceeding the end point means breaking away from the control of Freeswitch. It is mainly composed of a series of call control protocol interfaces. Audio and video codec module provide a wide range of audio and video codec functions. The widely supported codec mainly depends on the module to realize the system flexibility, an important embodiment is that its communication with the outside world is usually realized by several apps. These apps provide convenience for us to use, and play a more important role in communication with the outside world. The log module is mainly used to record the operation, maintenance, user operation and many other information of the system, which can be output to the console, log file or remote log server. The existence of the embedded language module makes it possible to control the communication process with Lua, JavaScript and other script languages. Using script language can make the communication process more flexible and the function of Freeswitch more abundant. The structure of Freeswitch can be summarized by "one body with multiple wings". The "one body" mainly refers to its stable core. The core code has been carefully designed and strictly tested to ensure the stability of Freeswitch. "Multi wing" mainly refers to many peripheral modules, which ensure the scalability of Freeswitch. The integration and multi wings communicate through the public API, while the low coupling degree between peripheral modules ensures the independence between modules and increases the flexibility.

3. Design of information and communication dispatching system based on FreeSwitch platform

During the architecture design of the system, the construction of the basic platform for information communication dispatching and commanding (SG-I6000 dispatching and commanding module) is strengthened, and functions such as voice, collaborative dispatching, group management, statistical analysis are realized. Core services are deployed at the level of headquarters. Terminals such as disaster recovery and provincial IP phones are deployed to support the dispatching of information communication failure handling, mode release, dispatching liaison and emergency command and coordinate the work, promote the vertical contact and horizontal cooperation of dispatching, and improve the quick response ability of information communication dispatching. The overall framework of the system is shown in Figure 1, including external system, SG-I6000, basic information communication dispatching and command platform and other modules. Among them, the basic information communication dispatching command platform includes MCU, FreeSwitch, EgoUCServer, EgUC, SSIL, etc.

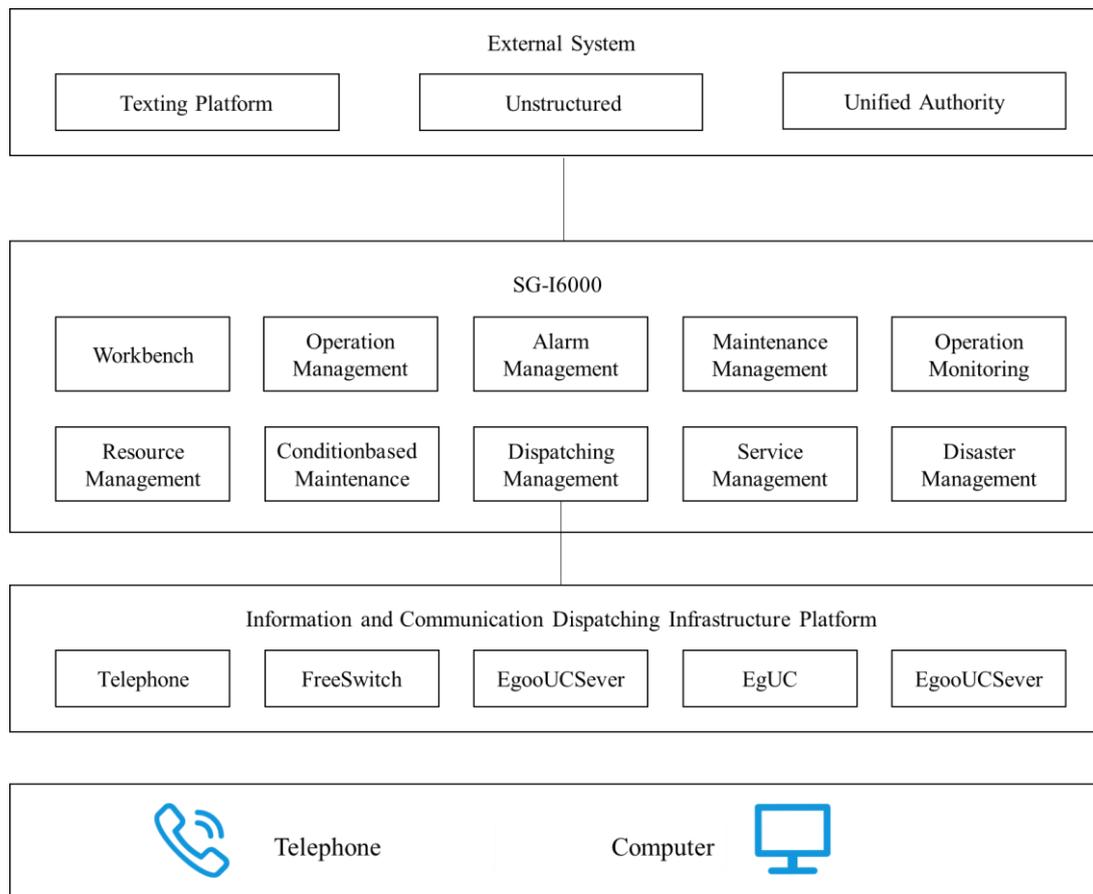


Figure 1. Architecture of information and communication dispatching system

3.1 Command and dispatching module

The information and communication dispatching system divide the information system into high-level applications to guide the construction and implementation of the whole information system. Operation monitoring and other functions, among which the related systems cooperating with external applications include unified authority platform, short message platform, unstructured platform, etc. According to the plan matching and plan calling, the plan is composed of one power order. Through the data transfer between the modules, the contents of the power instruction plan can be generated orderly in the command and dispatching module. The power command can be added through the command adding interface. At the same time, the priest command common words can help the power operator to quickly select the required power command. There are two ways to deal with power orders: sending the instructions to the relevant units, and the system will automatically distribute the power orders to the relevant responsible units according to the unit field in the list. The sending button can be used to send, and the instruction can be modified before sending. Once the sending is successful, the system will prohibit the modification of the instruction. Record the instructions in the processing flow of the machine, considering that some power instructions do not need to be sent, but only record some processing processes of the machine, such as notifying the leader of the unit. These processes record the power command through the record button. Once the power command is recorded, the system will prohibit the modification of the command. For the disposal of a case by the electric power personnel, there are daily account records. Daily account records can be input into word documents through the account button. The content of this word document includes: header, case description, daily account information, settlement, time and other information, which is called account information.

3.2 Control scheme module

Power system measurement equipment is the basis of building smart grid. The implementation of smart grid depends on the application and deployment of sensors. At present, the sensors in smart grid include two types: operation and maintenance measurement system and personal user measurement system. The power grid operation and maintenance measurement system are mainly used to collect the electrical information of power system units such as transmission and distribution lines, power plants and motor sides. The positioning of control points is one of the most commonly used functions of the control scheme module. When the event module takes over a case, the control scheme module will automatically extract the information of the case and send it to the corresponding subsystem after sorting out the text information of the address of the control point. The subsystem describes the geographical location of the control points on the map by analysing the location of the control points, and returns the geographical location information to the control plan module, which records the information and takes it as a part of the case information. After that, the graphic and text information of the control point in the relevant system is unified. The layout control scheme module mainly completes the graphic and text interaction between the plan terminal and the terminal, including the acquisition of the layout control points between the plan terminal and the terminal, the sending of the layout control command, the feedback of the layout control content, the synchronization of the layout information, the update of the layout control content and so on. When the dispatching resources have equipment that can communicate, the communication of telephone, mobile phone and radio station can be realized in the control scheme module through the softphone module. Click the resource information on the GIS terminal to make voice call with it. Based on the data of different electric equipment and the operation of power grid, this paper analyses the data and provides suggestions for users to save electricity and energy.

3.3 Video conferencing module

In the teleconference, there must be a logical structure similar to the link to connect the members. In the FreeSwitch system, the meeting module defines this logical structure. Each terminal will connect to the server through the link and be responsible for the transmission of message packets. Voice packets are transmitted by multicast mechanism. The teleconference function is a very practical function provided by the FreeSwitch system, which is mainly implemented according to the default configuration. However, in order to fit the more humanized design concept and facilitate the relevant personnel to organize the conference materials, the recording function is added to the original teleconference function, which can record the entire conference. Firstly, a group of key functions are defined. This function is mainly to complete the corresponding functions by the key of each member during the meeting, which plays a role of simple control of the meeting. More complex control of the conference call process requires a series of APIs provided by FreeSwitch. As the main technology of voice network to data network, soft switch is getting more and more attention. At present, the telephone which is based on the traditional telecommunication technology is under the violent impact of Internet technology. On the other hand, all kinds of new Internet technologies are in the rising stage of development. The call centre based on FreeSwitch can provide a new contact way and build a home school contact platform, which has become an urgent need. At present, the traditional call centre has some defects, such as inflexible installation, high price and special maintenance. Based on the above reasons, this paper develops a new call centre with simple structure, strong flexibility and easy to expand. The system is based on the soft switch platform, and takes the protocol as the signalling protocol, and adds the function of conference recording according to the actual needs.

4. Implementation points of information and communication dispatching system based on FreeSwitch platform

In the function construction of this system, we should strengthen the construction of basic platform and application sub module of information communication dispatching and command, realize the communication basic platform of voice, video and integrated data service based on FreeSwitch technology, and realize the integration of dispatching and command module and bottom communication

basic platform in SG-I6000 system, so as to comprehensively improve the command coordination, safety management and control, analysis and pre-warning. The six capabilities of measurement, resource allocation, emergency response and panoramic display can realize the integrated operation of information and communication dispatching and support the highly intensive demand of information and communication dispatching in the future. The system builds dispatching and command module to realize individual call, abbreviated dial-up, traffic restriction, call waiting, telephone transfer, hotline service, call out restriction, three party call, call keeping, no interruption, recording and video recording, video playing, video conference, forced insertion, call group answering, point call group calling, text sharing, instant communication, electronic whiteboard, call record, etc Data function.

The information communication dispatcher can perform voice dispatching operations such as outbound call, answer, hold, restore, hang up, transfer, forced insertion, forced removal, meeting, etc. on the dispatching object through the dispatching desk. When the dispatcher needs to talk with someone, if the person is in the talking state, the forcible removal of the conversation can be realized through the forcible removal command. The dispatcher can directly insert the advanced permission into the calling session to form a three-party call. The dispatcher can directly insert the advanced permission into the calling session to monitor. The information communication dispatcher can hold a video conference with the dispatching object through the dispatching desk to carry out collaborative scheduling. Instant message, the characteristic function of partial collaborative scheduling, can realize point-to-point information exchange or information exchange between groups, support the function of large attachment and breakpoint continuation, and can scan the attachment safely and filter the sensitive words. The dispatcher can draw and write freely on the electronic whiteboard, support multiple people to operate at the same time, or open multiple electronic whiteboards at the same time, and the controller can switch between multiple electronic whiteboards. It can present the status of personnel in real time, including online, offline, busy, leave and call. Support multi person video conference, including conference invitation, management, personnel invitation, personnel kick-out, regular meeting, instant meeting, etc. Integrated with the large dispatching monitoring screen, it can realize the unified analysis and functional display of the state of key its components.

The recording and recording function include audio recording, audio management, audio retrieval, audio playback and other sub functions, which can realize audio conference among multiple people. Traffic statistics is mainly used for statistics of call records and traffic volume. Call records can be generated into call lists through the traffic statistics module, including the main and called, start time, end time, call duration, call in and call out records and other information. Through traffic statistics, the online rate of dispatchers and the call rate of the whole system can be obtained. The configuration management function can realize the configuration management of interface information and terminal IP, so as to ensure the normal operation of the whole scheduling module. The interface configuration includes department management, role management, user management and other functions in the standardized resource management system, which can allocate the user's permission in the system. Terminal IP management includes data resource management, space usage, log view and other functions in the standardized resource management system, which mainly manages the database information used by the system.

5. System deployment and test

5.1 System deployment scheme

In order to ensure the maximum reliability of the system, we fully consider various redundant backup measures in the scheme design. Redundancy of equipment, link, two-layer switching network, three-layer routing protocol and core equipment virtual gateway protocol. For the database layer, Oracle double link redundancy mechanism is adopted for the database, heartbeat detection and other technologies are adopted for the application layer, and server cluster is used to solve the redundant backup of storage and application deployment. The video image information carried by this system is very sensitive to the network transmission delay, so the requirements of congestion control and quality

of service are very high. We carefully calculate the bandwidth needed for video applications, and provide a detailed guarantee scheme, which can fully guarantee the quality of video applications. Because of the hierarchical design idea, the network scalability and scalability can be improved. In the future, under the existing hierarchical structure, the scale of the network can be easily increased. In addition, when we configure the network device port, we also fully reserve space, which can facilitate the expansion of information points. For the software system, it provides the access mode, which enriches the expansion ability of the system. Different from the traditional enterprise system, the security of the command and scheduling system is an important consideration of the system. In addition to the basic requirements of anti-attack, anti-illegal invasion and anti-virus, the security of the command and dispatching system also needs to ensure that only legitimate users can access and use the services provided by the system, ensure that users can only manage the devices within their own authority, and adjust the resources; ensure the security of the video files saved in the system by users, and will not be even by other users The system administrator views it privately. In order to achieve the above requirements, the command and dispatching platform system based on unified communication needs to design a perfect security mechanism to ensure the security of the system from many aspects.

5.2 System test

As the command and dispatching system belongs to the private network system, the main test is functional test. The following mainly introduces the testing methods of Web GIS based on architecture and GPS positioning data. It can be seen that when the time interval of sending data is a little longer, such as about 10 seconds, the communication success rate can be guaranteed to be more than 90%.

Table 1. Success rate in interval time of 1 s

Number of senders	Sending number	Receiving number	Success rate	Interval time	Test time
1	240	2	0.8%	1 s	5 min
2	442	560	63.3%	1 s	10 min
3	456	1320	96.5%	1 s	10 min
4	468	1598	85.4%	1 s	12 min
5	452	1962	86.8%	1 s	12 min

Table 2. Success rate in interval time of 5 s

Number of senders	Sending number	Receiving number	Success rate	Interval time	Test time
1	211	5	2.4%	5 s	10 min
2	326	456	69.9%	5 s	10 min
3	362	933	85.9%	5 s	10 min
4	390	1367	87.6%	5 s	15 min
5	415	1950	94.0%	5 s	15 min

Table 3. Success rate in interval time of 10 s

Number of senders	Sending number	Receiving number	Success rate	Interval time	Test time
1	305	290	95.1%	10 s	12 min
2	406	800	98.5%	10 s	12 min
3	377	1081	95.6%	10 s	18 min
4	421	1599	95.0%	10 s	18 min
5	422	2019	95.7%	10 s	20 min

6. Conclusions

With the accelerating pace of power grid construction and the further strengthening of the information communication dispatching function, the information communication dispatching and commanding work puts forward higher requirements in dispatching business types, dispatching business scope,

dispatching resource use and dispatching instruction accuracy. In order to build a flexible, efficient and unified information communication dispatching and commanding platform, this paper designs and establishes a set of information communication dispatching and commanding system based on Freeswitch. The system is designed with consideration of security, compatibility, reliability and scalability. It realizes the module functions such as voice dispatching, cooperative dispatching, recording, call service and configuration service. The development of dispatching automation, integration, centralization and intelligence provides a strong communication guarantee for the formation of large-scale operation and overhaul.

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