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Application of ATM Asynchronous Transfer Mode Intellectualization in Civil Aviation System

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Abstract: The so-called ATM technology refers to asynchronous transmission technology, which is a highly efficient communication transmission technology. At present, it is widely used in many communication technology fields. Now this paper mainly analyzes its application in the field of civil aviation communication. At first, the paper analyzes and introduces ATM technology and civil aviation communication environment, points out the application advantages of ATM technology in civil aviation communication field, and finally makes a simple discussion on its application direction and mode. With the development of civil aviation communication business, the requirements for the traffic and reliability of data communication network are increasing. Civil aviation relies on ATM technology to build a basic network platform that can cover all airports of civil aviation and has carrier level reliability and availability. This paper introduces the working principle, system composition and workflow of ATM, improves the business level of maintenance and repair technicians, and ensures the safe operation of civil aviation air traffic control equipment.

Keywords: ATM technology, Civil aviation communication, Data transmission, Application.

1. Introduction

ATM (asynchronoustransfermode) is a data transmission technology. Suitable for LAN and WAN, it has high data transmission rate and supports many types of communication such as sound, data, fax, real-time video, CD quality audio and image. ATM is a broadband technology that transmits sound, video images and data over LAN or WAN. It is a cell relay technology. The size of data packets is fixed. Using cells of the same size can provide a method to predict and ensure the bandwidth required by applications. Just as cars have to wait for a long truck to turn at a busy intersection, variable length data packets are easy to cause communication delay at the switching equipment.

In the daily operation management of civil aviation enterprises, the communication system is the most important and core management content. It can be said that whether the civil aviation communication system can work normally is directly related to the operation and development of civil aviation enterprises. If the civil aviation communication system fails, it will inevitably have a great impact on the normal take-off, landing and in-flight communication of civil aviation aircraft, bring inconvenience to passengers, and even cause safety accidents. Therefore, the development of advanced communication technology has always been the most concerned scientific research topic of civil aviation enterprises. At present, ATM technology is used in many civil aviation systems for data transmission in the communication system to achieve communication between departments, so as to promote the smooth development of civil aviation workflow and ensure the safety and reliability of civil aviation transportation. The following article will briefly discuss the application of ATM technology in the field of civil aviation communication[1].

With the development of computer communication and civil aviation transportation in China, the civil aviation communication data network of China is constantly updated. As the carrier and guarantee of good dedicated line service and data transmission of civil aviation airports across the country, the civil aviation data network of China undertakes important services such as National Airport dedicated line service network, voice dialing, program-controlled telephone exchange networking, virtual private networks with different scales and service quality requirements, etc. [1].

Different civil aviation departments need to adopt a variety of different technologies, and the characteristics of internal network construction from the perspective of their own needs put forward higher requirements for civil aviation communication data transmission technology.

2. ATM Technology Introduction

ATM (asynchronous transfer MOD), an asynchronous transfer mode, is a new connection oriented network technology based on cell switching and statistical multiplexing [2]. As the key core of implementing broadband integrated services digital network (B-ISDN), it integrates the advantages of packet switching and circuit switching, adopts reserved transmission resources and asynchronous time division multiplexing working mode, and transmits user data information in cell (cel1). It can reduce the processing time of the converter to the maximum. Its flexible characteristics can meet the requirements of different business types and provide satisfactory services to users and operators[2].ATM differs from ordinary IP in that it is a connection oriented switching mode. The asynchronous transfer mode switch is determined according to the information of the cell header. ATM uses the method of virtual connection to separate the logical subnet from the physical subnet.

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The general network access mode of ATM is a router or ATM subnet that can be directly connected to the network and supports the ATM protocol. In a specific physical link, there

can be multiple virtual circuits carrying different services at the same time, such as pictures, voice, files, etc. ATM reference mode mainly has three layers: ATM adaptation layer (AAL), ATM layer and physical layer. Among them, the adaptation layer is responsible for interfacing with higher-level protocols, and the ATM layer is responsible for ensuring the information transfer between the last time and the ATM layer. The ATM layer is bi-directional transmission. It can convert the last information into ATM cells and the received information into the last identifiable data. The above process is called segmentation and reorganization (SAR). Different AALS are used to support different traffic or service types used on ATM networks.

There are two main networking modes of asynchronous transmission mode: the first is frame relay extended access; The second is xdsl+ dedicated line access. The first method is usually applied to areas not covered by ATM networks, and users use frame relay networks to extend access. The most common user port is g 703 and V 35, etc. Generally speaking, xDSL can be accessed within 5km. Users can use xDSL equipment to directly connect to ATM network through twisted pair copper wires. 2. Optical fiber access mode. Optical fiber access is to cope with high requirements, such as users whose distance exceeds 5km, or whose speed exceeds 2Mbps, or who require high reliability.

ATM has many advantages of broadband communication, and will be more and more used in video, teaching, civil aviation and other fields. Due to its own limitations, Ethernet has a great impact on ATM in local area networks. I hope that later researchers will continue to conduct in-depth research on ATM Technology

As an advanced transmission, switching, multiplexing and cross connection technology, ATM technology, characterized by cell switching, has made considerable development and application. Building a multi-level local area network with ATM switch as the backbone network is one of the network types established within large enterprises and institutions at present, which realizes the wide sharing of resources in the real sense.

ATM protocol reference model is divided into three layers: physical layer (PHY); ATM layer; ATM adaptation layer (AAL) [3].

physical layer

It is mainly used to transmit information. The physical media sublayer realizes the correct sending and receiving of bits on the physical media, and the transmission convergence sublayer converts ATM cell streams into bits that can be transmitted on the physical media.

ATM Layer

By Managing ATM cell headers, routing selection and multiplexing are completed.

The ATM Layer processes the cell data transmitted by the upper layer as information fields and headers into 53 bytes of cells and transmits them to the physical layer; At the same time, it removes five message header bytes from ATM cells transmitted at the physical layer, and transmits the remaining bytes to the upper layer protocol.

ATM adaptation layer

AAL (ATM adaptation layer) adapts different types of applications to the information format that can be transmitted by ATM network to meet different service requirements, so as to realize the compatibility of different transmission protocols.

ATM works in a connection oriented manner. Before data transmission, first apply for virtual path, and set parameters such as priority, burst, peak bit rate, average bit rate, etc;

Secondly, after receiving the application, the network checks the occupation of resources, and then determines whether it can provide virtual paths for users;

Finally, the bandwidth is dynamically allocated according to users' needs, and the network resources are fully utilized through statistical multiplexing technology.

The ATM switch is the carrier for unit exchange and transmission of cell information. The ATM switch transparently reads the routing information contained in the cell header without any modification of the information, and the network terminal equipment completes the work of flow control, error control, etc.

3. System Composition

As the air traffic control branch is located in the access layer and has no network management system, the access layer ATM switch mgx8800) adopts the mode of dual power input and dual master control board hot backup, with two frsmhs2 / B frame relay cards, two pxm1e l6-tle1ti / E1 interface cards and one disabled MPSM board.

3.1. pxmie-16-tiei Board

Pxmie-16-tiei is the process switch module. Pxm1 is the main control board of MGX. There are two active and standby boards, which are in the hot backup state. Main functions of pxm1e module: (1) architecture management: monitor and control module units on the switch. (2) Cell switching: the pxm1 shared memory switching unit receives and sends ATM cells from the network trunk line and service module. (3) Bus control: all ATM cells generated by the service module are sent to the pxm1 main control board and then switched to other service modules or connected ATM networks. Pxmi manages the flow of cells on the MGS switch bus. (4) Network management: service module configuration information and firmware image storage: the configuration database and firmware image backup files of each installed service module are saved in the IDE disk of pxm1. If the service module is replaced, the configuration file can be automatically downloaded from pxmi. RPM configuration cannot be automatically saved in pxm1, but can be manually saved on disk[4]. (5) Timing: extract the clock signal from the external clock source or the trunk line of the ATM network, and pxm1 propagates the clock signal on the clock bus of the switch. (6) Environmental alarm: chassis temperature, fan and power status can be monitored through pxm1. Use the dspshelfalm command to view the environmental alarm report. (7) Local alarm: the local main alarm can be seen from the LEDs on the front panel. (8) Support user network interface: pxm1 implements all ATM interface functions, including connection permission control, policy, and queuing.

3.2. frsm Module

The frsm module is a frame relay service module that provides access to the ATM network for frame relay services. Frsm uses AAL5 to convert frames in frame relay format into ATM cells. Frsm performs policy and congestion management functions for all incoming user services. Functions of frsm module: (1) use all5 to split, reload frames in frame relay format, and convert them into ATM cells for transmission in ATM network. (2) Signaling protocol, supporting all frame relay signaling protocols, including enhanced local management interface. (3) Policy. It supports

the admission policy predictability function based on configurable burst capacity and data rate. Frsm uses the predictability function to support congestion management. (4) Support ATM frame relay interleaving, including transparent interleaving and transform interleaving. (5) For frame transparent transmission, one frsm port supports one frame transparent transmission connection. It transparently transmits HDLC, SDLC, X.25 and other data frames to the destination frame relay interface. This function only supports a single connection, that is, one port can only open one PVC permanent virtual circuit for users. (6) Support physical layer functions.

3.3. ui-s3 / b Backplane

Pxm1e back card provides three-level clock and console port and Ethernet port for management. The ports on it are: (1) control port: rj-48 DTE port, 17

Western China Science and technology, October 2011 (Shangdian), Volume 10, issue 28, total issue 261 f connect vtio0 terminal or PC running terminal simulation software for command access. (2) Modem~:rj-48dte port supports slip (serialline internetprotoco1) for command access. (3) LAN port: rj-48802.3lan connection unit interface, providing access to Cisco Wan management workstation for network management; Other LAN devices can also be accessed remotely through this port. (4) External clock port: rj-48 or small BNC port receives TL or E1 signals as the external clock source of the switch. (5) Alarm relay port: port B-15 provides local main alarm reports.

3.4. Fault Detection

First, insert the console cable into the PC port of the pxm1e back card, open the HyperTerminal, click <enter>~ to log in to the local ATM switch using the default settings of the HyperTerminal, then input the node alarm check instruction dspndalms to check the node operation status, then input the board alarm check instruction dspcdalms to check the board operation status, and finally use the environment alarm check instruction dspenvalms to check the environment alarm.

4. Application Analysis of ATM Technology in Civil Aviation Communication

In the actual civil aviation communication work, different civil aviation departments need to transmit asynchronous information data through different communication data networks, so there are various internal networks that can be updated and upgraded at any time in the civil aviation communication system. As a network type of high-speed information transmission and QoS support, ATM can be used as a backbone network to form a civil aviation multi-level communication system, The realization of effective compatibility with various communication transmission technologies, coupled with ATM's ability to integrate multiple services, dynamically allocate bandwidth and connect management, has become the object of consideration when building the civil aviation communication backbone network [5].

On the other hand, ATM faces the characteristics of connection, which determines that establishing a connection and authenticating the identity of network users is the premise for ATM network to transmit data and information. Unauthorized users will not be able to obtain any network services, which, to a certain extent, will face the network attack of illegal users.

At the same time, when the network is attacked by illegal users, the user information can also be quickly identified through the connection information of active users.

There are various network technologies in the civil aviation system, and they still need to continue to play a role in the future. In view of this, the interconnection / integration of ATM and traditional civil aviation communication network is particularly important. The connection between ATM backbone network and traditional LAN can be realized through LAN simulation, IP over ATM and MPOA. In the network, the flexible routing is realized by switching virtual circuits (SVC), and the network performance is improved through virtual LAN technology to achieve efficient resource management.

The complex enterprise internal network needs to build an internetwork structure of high-speed local area trunk, including the traditional fast Ethernet, Ethernet and FDDI (fiber distributed data interface) to form different levels of LAN (local area network) structure. FDDI, as the local area network trunk, realizes the connection between the central switch and the main server.

However, FDDI only optimizes the traditional data communication and cannot meet the development requirements of multimedia integrated transmission. In contrast, the ATM network can be connected to and compatible with each local area network in the civil aviation system by virtue of the lane interface of the ATM edge switch. With the absolute advantages of higher communication rate and expandable bandwidth, it can replace FDDI as the local area network trunk to form the civil aviation communication system [6].

The informatization of air traffic control is an important part of China's modernization. The construction and operation management of air traffic management communication system has always been an important construction of national concern. Especially in recent years, there are more and more civil aviation flight routes, and the air transport passenger flow is also increasing, which puts forward higher requirements for the safety management of air transport, especially for the internal communication system construction of civil aviation system. The use of ATM technology can ensure the operation quality of civil aviation communication system to a great extent and improve the level of civil aviation communication technology. Firstly, ATM technology is widely used in civil aviation communication system. It is the key and core technology to realize broadband integrated services digital network (B - ISDN). During the application of ATM technology in civil aviation communication system, it has good compatibility with the application of various technologies, and the speed of data transmission is very fast, so it has high application advantages. At present, the application of ATM technology in civil aviation communication system is becoming more and more important. From a professional point of view, the data transmission service of B-ISDN using ATM technology is wider and faster than the service provided by narrow broadband network. And when it is connected with other communication technologies, it can be connected according to the corresponding technical standard protocol, with high reliability [7]. Secondly, in the civil aviation communication environment, the requirements for data transmission technology are very high, because the data to be transmitted

is complex. First, in the daily communication management of civil aviation enterprises, information and data transmission between multiple functional enterprises or units is required, and the work of these functional departments is directly related to the safety and smoothness of air transport. For example, the aviation administration, airlines, oil enterprises, computer centers, airport companies, ground service departments, etc. only with close and orderly cooperation can these departments ensure the normal operation of air transportation. Therefore, this requires smooth communication between departments, including communication between various units and within the unit. It can be seen that the communication system environment in civil aviation is extremely complex. In addition, many relevant civil aviation departments are not in the same geographical location, and even the same department is not all in the same place. In many cases, their distribution is relatively scattered. Therefore, when setting the communication system for civil aviation work, a special communication data network is required to meet the communication requirements between various functional departments. At the same time, different functional departments are required to have different communication data networks for internal communication. The upgrading and improvement of the communication network should serve the development of the Department. In the actual application of communication system, different civil aviation departments need to use different information needs, and generally not synchronized. Therefore, in the design of communication network system between departments, it is not necessary to use synchronized communication network. In fact, due to the different development speed between different departments, the requirements for the communication network are also different, and the updates are not synchronized, which makes a variety of network forms appear in the civil aviation work communication system, and the communication technologies used also show a diversified development trend. Therefore, when introducing new technology, the technology must be compatible with all kinds of communication transmission technologies. Only in this way can it give full play to its functional role, and the new technology can be more widely used in the civil aviation communication system [8].

5. Application Analysis of ATM Technology in Civil Aviation Communication Field

From the above analysis, we can know that the operation environment of civil aviation communication system is relatively complex, and the compatibility requirements for new technologies are relatively high. ATM technology is such a communication technology with high compatibility, strong adaptability and superior performance. It is more and more widely used in civil aviation communication system, and can be applied in the backbone network and transition scheme of civil aviation communication system. 2.1 building the backbone network of civil aviation communication system with ATM at present, the biggest feature of civil aviation system is that multiple technologies appear in one organization at the same time. Different departments will adopt different technologies to build their internal communication networks according to their own needs in different development periods. However, the backbone network within the civil aviation system must be compatible with the departmental networks based on multiple technologies at the same time. In this case, ATM is the preferred communication technology. The LAN emulation technology standard of ATM network can be connected with multiple LANs currently existing in the civil aviation system through the lane interface of ATM edge switch, and has good compatibility with multi-mode traditional LANs, such as Ethernet, fast Ethernet, FDDI network, etc., which promotes the stable position of ATM as the backbone network in the civil aviation field. In the process of introducing ATM technology, it can realize the seamless transition between the old and new data transmission networks. For the end users in the civil aviation system, it presents transparent ATM characteristics. The relevant user interface and operation mode do not need to be changed, which is more convenient to use.

6. Conclusion

As far as the current situation is concerned, the existing communication network of the civil aviation system, including various technologies and the former narrow-band data transmission network, will continue to play a role in the future. Therefore, when ATM infiltrates the civil aviation data transmission environment, efforts should be made to fully consider the existing data transmission network. Generally, two methods can be adopted to infiltrate ATM into the existing data transmission network. One is to build a parallel ATM broadband transmission network with the original narrowband data transmission network. When users use it, they can switch to different networks for actual control according to the actual needs of data transmission. This method is more applicable to the relatively historical civil aviation system, A perfect narrowband data transmission system has usually been established in such civil airports and is relatively mature. This scheme is conducive to giving full play to the role of narrowband data transmission system and saving costs. Since relevant personnel are familiar with the corresponding system interface, the implementation of step-by-step replacement is conducive to the smooth penetration of ATM. The other is to support narrowband services in broadband access network by means of ATM circuit simulation, and the corresponding information enters ATM switch through simulation interface to realize ATM high-speed transmission. This scheme is relatively applicable to new large international airports or comprehensive service buildings, and can effectively integrate narrow-band data system and ATM broadband data system. Conclusion the greatest advantage and opportunity of the application of ATM technology in civil aviation system lies in its good compatibility with previous technologies and its great advantage in data transmission rate. This overall state is conducive to the seamless connection of the communication network, and it is convenient for the end user to smoothly convert the operation object. Therefore, it has good applicability in the civil aviation communication business.

With the development of civil aviation communication services, the requirements for the traffic and reliability of data communication network are increasing. Civil aviation relies on ATM technology to build a basic network platform that can cover all airports of civil aviation and has carrier level reliability and availability. This platform takes ATM technology as the core, high-speed digital circuit and data satellite network as the transmission trunk, and has a hierarchical network structure based on the existing system of

civil aviation. It can simultaneously provide access to various services, including ATM services, IP services, circuit simulation, LAN interconnection, program-controlled telephone exchange interconnection, and better meet the requirements of data transmission. Through the introduction of ATM system structure, boards and simple detection methods, this paper improves the business level of maintenance and repair technicians and ensures the safe operation of civil aviation air traffic control equipment.

References

[1] Innovating General Aviation MRO's through IT: The Sky Aircraft Management System - SAMS[J] . Caglar Ucler,Orhan Gok. Procedia - Social and Behavioral Sciences . 2015

[2] Design of a flight management system to support four-dimensional trajectories[J] . Manuel Angel Amaro Carmona, Darius Rudinskas, Cristina Barrado. Aviation . 2015 (1).

[3] Energy Efficient Packet-Duration-Value Based MAC Protocol for Wireless Sensor Networks[J] . Abayomi M. Ajofoyinbo. Wireless Sensor Network . 2013 (10).

[4] Development of a Hybrid Artificial Neural Network Model and its Application to Data Regression[J] . EricW.M. Lee,L.T. Wong,K.W. Mui. Intelligent Automation & Soft Computing . 2012 (4).

[5] Similarity measure based on piecewise linear approximation and derivative dynamic time warping for time series mining[J] . Hailin Li,Chonghui Guo,Wangren Qiu. Expert Systems With Applications . 2011 (12).

[6] Fast outlier detection for very large log data[J] . Seung Kim,Nam Wook Cho,Bokyoung Kang,Suk-Ho Kang. Expert Systems With Applications . 2011 (8).

[7] Temporal data mining using shape space representations of time series [J] . Erich Fuchs,Thiemo Gruber,Helmuth Pree, Bernhard Sick. Neurocomputing . 2010 (1).

[8] Indexing Multidimensional Time-Series[J] . Michail Vlachos, Marios Hadjieleftheriou, Dimitrios Gunopulos, Eamonn Keogh. The VLDB Journal . 2006 (1).