Raisecom MSTP

ABSTRACT

Combining and based on the current requirements of dedicated network customers and carriers’ network analysis, this white paper expounds our solutions, ideas, function and related technologies of Raisecom Multi Service Access products’ family.

REQUIREMENTS ANALYSIS OF DEDICATED NETWORK CUSTOMERS

Currently, information technology application has come to life in diverse areas and industries, i.e. e-government, e-finance, and e-manufacturing. All these network platforms have been taken as the supporting platform of dedicated customers for their daily work and business. Along with the further utilization of telecom network and e-business, “Triple Play” which includes voice business, broadband data business and video business is becoming the main network-based business, and there are high-level requirements to the features like security, reliability, QoS assurance, bandwidth efficiency, and manageability.

Generally speaking, E1 is the main way for voice business in dedicated network. To VoIP, use Ethernet and to data & video services, E1, V35, or Ethernet are widely used. So to the situation within the network, there are many different services and interfaces. If still to follow the traditional way for network access: every single business, interface has its own access equipment based on multiple access links, definitely it will lead to a network complication or even make management and maintenance troublesome. So most customers hope that they can use one access equipment, even one single link to achieve service access of dedicated network.

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1 CURRENT NETWORK ANALYSIS

Along with the improvement of information technology application of key accounts, there are even higher requirements of network access to telecom carriers. Both the investment cost and the maintenance cost are too high if to use multiple networks and multiple links to meet the customers’ requirements for multi-service access. IP, SDH, ATM networks are the main measures to provide multi-service access among various networks. Compared to others, SDH has several key features like high reliability, manageability, flexible bandwidth configuration, and flexible network configuration, and it can cover fairly large area. SDH can provide perfect support to voice, data and video business, so SDH is the best choice for telecom carriers for their multi-service access.

2 CURRENT SOLUTION ANALYSIS

SDH based multi-service access is a perfect solution, it is a new platform based on SDH network, and can carry E1, Ethernet (GFP, LAPS, PPP encapsulation) or ATM data service on VC tunnel of SDH.

Among current MSTP solutions, industrial giants provide total solutions target to the service from core layer to access layer, but they fail to get satisfactory solutions for the services of access layer and edge-access layer. So what are the problems in access layer and access-edge layer?

1. First, most of MSTP equipments of industrial giants are applied as a ring in access layer. But it is very difficult to fulfill the requirements of most general key accounts, especially to the middle and small size enterprises in the urban areas and to some dedicated network customers for their network coverage in suburban areas.

2. Second, because the access layer have some special characteristics like large network coverage, huge amount of network nodes, to the decision of telecom carriers, the total cost generated from equipments in access layer and edge-access area is very important. Low cost and high performance will become the prerequisite to most telecom carriers. To the access layer equipments of those big manufacturers, most of them are module-based design, but this kind of design will increase the equipment cost and thus leads to a negative impression on equipments’ price.

3. Third, flexibility issue. The situation and structure within Metropolitan Area Ethernet network is very complex, and network design is very difficult because it may add more network marginal notes at any time, it also means that there are different requirements to physical ports and capability: port capability are from low to high; ports include E1, V35, FE and at the same time equipments are needed to be as small as possible.
3 RAISECOM SOLUTIONS

Based on above analysis and long-term industrial experience in terms of Ethernet access services, Beijing Raisecom Science & Technology Co., Ltd designed MSTP products that could combine Ethernet service, E1 and V35 service. Raisecom’s MSTP products target to access layer of communication network, and maturely take customers’ requirements into consideration such as low cost, fast access, and easy to use. MSTP products use key international vulgate technology GFP, LAPS, VCG and LCAS, by taking SDH STM-1 optical interfaces to access SDH/MSTP network to realize the transition of Ethernet, E1, V35 over SDH network. It can access dedicated network or IP network with a link topology or a Metro-ring topology. The main idea of this solution is as following:

Network access equipments of Raisecom MSTP can utilize existing SDH transmission network resources, and maximize the extension of network access nodes. MSTP equipments can provide various solutions like 4FE+16E1+8FE+16E1+4FE+4E1+32E1 to meet the requirements of multi-service access for marginal nodes. MSTP equipments employ 1U standalone structure, and it can meet the low cost requirement of access network layer and marginal access layer; realize the fast implementation of node equipment. All the service ports are physical isolation, which meet customers’ requirements for security at dedicated network level.

4 RAISECOM SOLUTIONS

4.1. Standard EOS encapsulation
Raisecom’s MSTP products employ international standard encapsulation technology GFP/LAPS/PPP, which ensures users’ high bandwidth Ethernet network access over existing SDH MAN Ethernet network, and Raisecom’s MSTP products can work with existing similar products or interconnect MSTP MAN Ethernet equipments.

4.2. Virtual concatenation technology
To fulfill customers’ needs for the differentiation of bandwidth, Raisecom EOS products employ industrial leading virtual concatenation technology. Every single Virtual Concatenation Group (VCG) can bundle several VC12, i.e. every VCG of 155M MSTP device can bundle 63 VC12 or 3 VC3 to 622M MSTP device as the maximum, every VCG can bundle 4 VC4 or 12VC3 or 252 VC12 as the maximum (refer to technology introduction at the end of the White Paper for detail technical description).
4.3. Link Capacity Adjustment Scheme (LCAS) technology
In order to enable the bandwidth be customized and adjusted without loss to customers’ premises, MSTP products support LCAS technology, which can achieve link capacity adjustment; customers’ bandwidth can be adjusted on demand.

4.4. Absolutely secure Ethernet data processing mechanism
In order to ensure the service security, MSTP devices shield the MAC address study function, so data can be transmitted transparently. There is no data switch function within the device.

4.5. Liable transmission mechanism
In order to ensure the reliability and wire speed transmission, the design of MSTP equipments is based on hardware only, no associated running software when equipments are running. MSTP equipments provide two uplink interfaces that can realize 1+1 path protection, so the equipments are highly reliable and can achieve wire speed transmission.

4.6. E1 gathering function
Each Raisecom MSTP product can achieve 32 E1 access and transmission as the maximum; by the concatenation of two optical interfaces, each product can realize the access and transmission of 63 E1 as the maximum. 63 E1 can be gathered to a standard STM-1 optical interface for uplink.

4.7. Flexible management and professional interface
Besides local console management, MSTP product can provide SNMP interface for out-band management, and DCC channel uplink for in-band management. In addition to standard telnet, products can be managed by Raisecom network management software RC NView to realize several functions like management, surveillance and alarm etc.

5  INTRODUCTION OF PRODUCTS’ OVERVIEW AND SPECIFICATION

OPCOM3100-155 is a compact SDH Multi-Service access equipment, technical feature and index meeting every norm of ITU-T and national SDH. It deploys 1U structure, and it can provide E1 and Ethernet service. It is suitable for the access of end business of Telecom. OPCOM3100-155 is mainly applied to service access and transmission of access layer in communication networks. It is the expansion and extending of MSTP technology, it decreases the cost of access for subscribers, and increases the network resource utilization for operators, as well as provides carrier with secure, effective, easy and simple solution for access of MAN Ethernet dedicated line and E1 service.
Features

- Versatile service: E1 service and Ethernet service
- Flexible topology: Support point-to-point, chain and ring topology.
- Stable transportation: 126X126 VC12 non-blocking cross capability, support 1+1 low path protection, re-routing time is less than 5ms, guarantee high reliable transportation.
- Security: all service is physically isolated, providing leased line features.
- Customized Bandwidth: Ethernet service over SDH supports GFP, LAPS encapsulation, and VCG/LCAS. The bandwidth can be controlled and assigned as per the customer’s need. And it makes no damage to adjust.
- Central network management: Standard SNMP network management, realizing centralized standard SNMP network management through in-band or out-of-band network management channels.

Specifications

Basic
- Network interface:
  Provide 2 STM-1 interfaces, with options of either two individual STM-1 or 1+1 path protection.
- Customer interface: Provide 16 E1 interface
- Extension module: Provide 4/8 Ethernet interfaces or 16 E1 interfaces.

Advanced
- Network Element Type: TM, ADM or REG
- Clock mode:
  Master/slave mode supports clock holding, locking, free running.
- Management: SNMP/Telnet/Console
- Network management channel: in-band/out-of-band
- Update: Support local and remote on-line update.
- Performance monitor:
  Support end-to-end performance test and near-end/far-end fault alarm, optical interface and E1 interface provide loop back function of line and equipment, convenient equipment maintenance.
- EOS service: Support VCAT, VCG, LCAS
  VC increment: VC12/VC3/VC4
- Encapsulation: GFP / LAPS
6 NETWORK CONFIGURATION

OPCOM3100-155 has flexible capacity for Network configuration, which can provide 1+1 linear channel protection and two fiber single-way protection. When configured as 1+1 protection mode, the two optical interfaces can protect each other to enhance service reliability.

1. Point-to-point topology
Point-to-Point topology is made of two OPCOM3100 products, which can utilize the existing SDH/MSTP transmission network resource of carrier, and easily realize the point-to-point transmission of user’s Ethernet service and E1 service. It can complete the expansion and extending of MAN access network with low cost and high-efficiency.

2. Chain topology
Network of chain topology is available for the service flow distributed in chain form and tributary networks in chain form. Chain topology is made up of two TMs and several ADMs. Principally, services are double-way transmitted, only limited fiber needed.

3. Ring topology
Network of ring topology is available for distribution of network elements in ring form, which can realize service distribution and high availability.
OPCOM3100-155 itself can compose ring topology in STM-1 speed. It can also achieve two-fiber single-way channel protection.

![Ring topology](image)

### 7 TYPICAL APPLICATION

**Key account network access solution:**
Generally speaking, Multi-service of dedicated network users include voice、video (Video conference) and data service. Terminal equipments can provide V35 interface、FE、E1 interface etc. In this solution, we use OPCOM3100 to realize voice、video、data service.

There are several patterns within this solution:

1. To multi-service nodes, we lay standalone unit OPCOM3100 at client site directly. It provides several FE、E1 interfaces to realize the access of voice、video and data services.

2. To situation with multi-service nodes, we may also lay slide-in module OPCOM3100 at operator site to realize influx of dedicated network notes. It can provide several Ethernet interfaces and E1 interfaces, and extend network link to terminal end by RCMS Ethernet multiplexer, which aid at client side and operator side. Then it can achieve the uploaded data、voice and video services. RCMS device itself can provide physically isolated service and non-scathing transmission.

3. To single service note we can also extend network link to terminal end
by fiber converter or optical multiplexer and provide the access of FE. E1.

4. To mini-type note or to the node that only needs the access of E1 service, we can lay SDH optical multiplexer OPCOM3101 near to the standalone site to provide single or multiple E1 service access.

In this solution, the OPCOM3100 from client site and operator site form a influx at the headquarter site, which can process diverse service of offshoot notes at headquarter, thus the network access of dedicated network users is realized.

All the devices we mentioned in this solution can be managed in-band and our-band over network by our RC NView network management software.
White Paper

Characters of Configuration Solution:
- Fully utilize current network resources, establish a network access platform for low-cost, fast and secure Metropolitan Ethernet service and E1 service.
- Can realize secure isolation, customized bandwidth and non-scathing transmission of diverse services.
- To telecom operators, the service requirements in diverse aspects and diverse level of many dedicated network users can be settled. Their investment cost and maintenance cost are reduced.
- To MSTP users, there is no access problem for different network connection, so network is simplified.

8 INTRODUCTION TO ASSOCIATED TECHNOLOGY

8.1. Concatenation technology

Concatenation technology is to combine several virtual containers to establish a logical entity for transmitting services, it guarantees the integrity of a bit sequence, and actually, this is the combining process of virtual containers. Principally, there are two kinds of concatenations methods, contiguous concatenation and virtual concatenation. At the terminal end of transmission channel, both contiguous concatenation and virtual concatenation can provide bandwidth capacity that is much bigger than C-n with the difference lying in the transmission method of logical entities.

8.1.1 Contiguous concatenation technology

The concatenated signals are obtained by “gluing” together the payloads of the constituent signals. They come in fixed sizes, and each concatenated signal is transported as a single entity to multiplex, switch and transmit signals across the SDH network. The containers of contiguous concatenation are transmitted over the same path with a single path expense; there is no time-delay between different parts of data. So the transmission quality is good enough and do not need any signal back out and installation, it is very easy to realize.

However, there is limitation to some extent for contiguous concatenation technology, it needs the whole network of transmission network to support this concatenation method. Theoretically, it is possible but in the real life it may be inconvenient, because if the transmission channel will be employed with the original network, some equipment cannot support contiguous concatenation, they must be upgraded or be replaced, otherwise they cannot achieve service transmission for the whole process and the associated capital investment will be extremely expensive. Even if these equipments support contiguous concatenation, there are cases when
it is also very difficult to find continuous timeslots available in operators’ network, which will lead to the increased associated service cost. At the same time, the data speed of customer’s application cannot match SDH nominal speed very well, and there are big differences between continuous SDH speed level, the contiguous concatenation may lead to an ever much waste of bandwidth.

8.1.2 Virtual concatenation

Virtual concatenation is a reverse multiplex technology, and it has obtained ITU-T G.707 suggested criterion and definition. Virtual concatenation is good for the full utilization and load equilibrium of the resource; it can combine several physical flows into a single logical flow to realize the link influx of transmission layer. Generally speaking, virtual concatenation needs two kinds of function on both sending direction and receiving direction: on the sending direction, the terminal equipment can separate and encapsulate customer signals into several high-degree or low-degree virtual containers, which can translate concatenation service into virtual concatenation service; on the receiving direction, recombining the virtual concatenation services uploaded from link into concatenation service and obtaining original customer signal.

The virtual containers that take part in virtual concatenation logically form so-called VCG; each virtual container has its own path overhead (POH), it can transmit individually over network without the limitation from different routers, which can lead to a time difference between different virtual containers when arrived at receiving end, definitely, it makes trouble to signal recovery. So, in order to distill original customer signal correctly, receive end must check and synchronize the virtual concatenation signal. To normal customers, virtual concatenation technology is good for their service selection based on actual requirement; to telecom operators, it can utilize existing resource of transmission network, improve the utilization rate of resource. Virtual concatenation technology can handle low network utilization rate problem of traditional SDH network. Virtual concatenation can logically connect any number of virtual containers, establish bit synchronization channel with appropriate capacity to better match service transmission speed, at the same time, it allows gradual adjustment of link bandwidth.

8.2. The Generic Framing Procedure - GFP

GFP defines a common framing approach that enables multiple traffic types to be carried across a SONET/SDH network with a high degree of interoperability between network elements from different manufacturers. GFP works hand in hand with VCAT to provide the means to map commonly formatted services into a properly sized transport path. GFP supports traditional data applications as well as storage applications, and
has found tremendous traction within the service provider community primarily due to its flexibility, extensibility and ability to deterministically allocate bandwidth unlike older layer 2 protocols based upon the HDLC framing protocol.

Two modes of GFP have been defined: GFP-F and GFP-T. GFP-F describes a set of procedures for encapsulating variable length packets belonging to several protocol types into a variable length frame. Defined encapsulations for IP/PPP, and Ethernet protocols are standardized and the specification also provides a large set of uncommitted code points for carrying additional protocols. GFP-T is the method by which delay sensitive traffic such as SAN or digital video is carried across the transport network. It achieves low latency by breaking the blocks of information from an ESCON or Fiber Channel device into smaller segments for transmission into the network. GFP-T also supports the transparent carriage of a Gigabit Ethernet signal across the SONET/SDH network.

8.3. Link Capacity Adjustment Scheme

Virtual concatenation allows the flexibility of creating SONET/SDH pipes of different sizes. The Link Capacity Adjustment Scheme or LCAS [ITU-T01a] is a relatively new addition to the SONET/SDH standard. It is designed to increase or decrease the capacity of a Virtually Concatenated Group (VCG) in a hitless fashion. This capability is particularly useful in environments where dynamic adjustment of capacity is important. The LCAS mechanism can also automatically decrease the capacity if a member in a VCG experiences a failure in the network, and increase the capacity when the fault is repaired. Although autonomous addition after a failure is repaired is hitless, removal of a member due to path layer failures is not hitless. Note that a “member” here refers to a VC (SDH).

LCAS and virtual concatenation add tremendous amount of flexibility to SONET and SDH. Although SONET and SDH were originally designed to transport voice traffic, advent of these new mechanisms has made it perfectly suitable for carrying more dynamic and bursty data traffic.
Vision

Beijing Raisecom Technology Co., Ltd (RAISECOM) was founded in 1999 when data communication was still popular with the base modem, ISDN and DDN. Since then, RAISECOM had found data communication a promising and glorious futures. Expanding the bandwidth continuously to provide broadband access based on fiber and Ethernet technology would be the next generation of data communication. So, RAISECOM started with Ethernet copper to fiber media converters and rapidly got the majority of marketing share with its own advanced technology, high stability and customer awarded service. Now RAISECOM has become the leader in R&D, manufacturing, and marketing of data communication equipment and network edge devices in China. Vision creates future.

Versatility

Raisecom have designed and developed diversified product lines, including inverse multiplexers, interface converters, protocol converters, mode converters, PDH optical multiplexers, SDH terminal multiplexers, CWDM systems Ethernet over SDH and L2/3 Ethernet Switches, after Ethernet copper to fiber media converters has gained significant success. The solutions, applications and combinations of these products can satisfy different customer needs, and are flexible, scalable and adaptable for the changing needs of the market. Versatility makes continuous development.

Victory

Over 1,000,000 units of media converter installation, versatile product lines, and over 100 R&D people, plus perfect marketing, sales and service systems make RAISECOM become the NO.1 annual installation vendor in the field of fiber optical access. RAISECOM has achieved 500% total sales volume increase for 4 consecutive years and enjoy more than 45% marketing share on the Chinese fiber optical access market. RAISECOM feels very proud of being an important part of the legend and having brought great value to our customers. Raisecom keeps on dedicating and contributing our best talent with the drastic growth of this marketing. In 2003 and 2004, RAISECOM was recognized as one of the Deloitte Touche Tohmatsu Asia Pacific Technology Fast 500 for two consecutive years. Victory leads us to the next Victory.