Research on Twice Single-Direction Negotiation Process on Single-layer User-data Switching Platform Architecture

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***Abstract*—This paper studied Quality of Service Negotiation Protocol(QoSNP) consultation process based on Single physical layer User-Platform (U-platform) Architecture(SUPA), discusses Twice Single-Direction Negotiation (TSDN) work process, and the timing diagram as tool, respectively for processing of intermediate nodes, mid-side nodes and end-system in the negotiation process are separately discussed at different levels of detailing.**

Keywords-SUPA; PFTS; QoSNP; TSDN.

I. INTRODUCTION

SUPA, by simplifying user-platform and improving different users data transmission quality of service, combined with Ethernet-oriented Physical Frame Timeslot(FPFTS)[1,3,4], achieves physical layer high real-time requirement of user data flow transmission. With respect to the lack of credit control and credit control of management platform as well as management of data flow high-speed transmission support in the first stage, the second phase adds SUPA S&M-Platform to FPFTS exchange primary level, and S&M-Platform is simplified from the Internet five layers into four layers, achieves physical layer high real-time requirement of user data flow transmission quality of service to meet the "three-in-one network" of large data stream communication, by retaining the non- SUPA pattern of traditional Internet protocol on the S&M-Platform to realize compatibility with existing networks[2,5,6,7].

This article takes QoSNP as the object to discuss QoS negotiation mechanism, mainly discuss related issues from the perspective of process flow.

II. GENERAL PROCESS OF QOSNP NEGOTIATION

QoSNP is an end-to-end negotiation protocol between SUPANET end two end systems, but its negotiation process is carried out hop-by-hop, until SUPANET two end systems requested quality of service can satisfy service transmission nodes. Figure.1 shows the schematic of QoSNP general negotiation process.

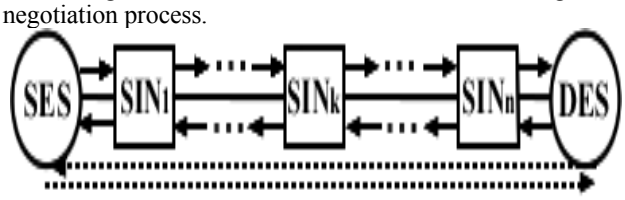

Figure 1. Schematic of QoSNP general negotiation process

The right direction of solid arrow represents service request, and the left-directional arrow represents confirmation message; the left-direction dashed arrow represents DES to SES end-to-end confirmation, and the right-direction represents SES-DES end-to-end confirmation. SUPANET end systems (SUPANET host or gateway between SUPANET and the Internet) service request information starts from source edge mid-side node, via each intermediate node, implements service quality negotiation resource hop-by-hop. If the intermediate node can satisfy user request, the negotiation is successful, and the relevant resource is reserved, add new data items in the switching table. This current node transmits the negotiation request to the downstream node, upon receipt of confirmation from downstream nodes, relevant information upon confirmation will be stored in corresponding switching table, and then return confirmation message to higher level nodes. This process has been pushed towards SUPANET destination end system, if the negotiations on all the nodes in the path are successful, a quality of service warrantable end-to-end virtual path is established; otherwise, as long as there is a node is not satisfied in the path, the negotiation fails, and the reserved resource will be returned to the node, related data items within the switching table are deleted.

After the virtual path is established, user can exchange data on single physical layer. Since PFTS adopts HFS (Half-Step Forward) exchange policy, among messages returned to upstream node after successful negotiation, in addition to the node containing the confirmation message, there are output port number and output wavelength number of downstream node needed to establish the switching table. This information will be used by upstream node to construct table items related to the quality of service negotiation in the switching table (see Table 1)[2]:

Taking into account the possibility that both single-direction service and two-direction services exist, QoSNP adopts two negotiation processes: TSDN(Twice Single-Direction Negotiation) and TDSN (Two-Direction Simultaneous Negotiation). When the requesting party only knows forward QoS parameters and need the counter party to provide reverse QoS parameters, only TSDN negotiation method can be used. If the requesting party knows QoS parameters of both sides, the TDSN negotiation process is used. T-NW flag bit, when receive positive confirmation from downstream nodes in the negotiation phase, is set at "1", when the first user data's EPF look up the switching

table of the connection, this bit is set at "0", indicating the end-to-end negotiation has been completed.

TABLE I. TABLE ITEMS RELATED TO THE QOS NEGOTIATION IN THE SWITCHING TABLE

Downstream node output port number (NOPN):	Downstream node output wavelength (NOLN)	Virtual connection identifier index (VCII):	Negotiation waiting clock(T-NW)

III. TSDN

A. *TSDN negotiation process timing diagram*

TSDN is a negotiation process used under the premise that the source end system (SES) requested to be established only knows forward transmission user data quality of service, and therefore needs back and forth twice negotiation. Only the first QoS negotiation is successful, it may establish a single-direction transmission connection and negotiation in the opposite direction. Due to the dynamic nature of network state, the reverse negotiation passing nodes may be consistent or inconsistent with positive connection passing nodes. In order to identify that connection of the two negotiations belong to the different connections between the same pair of end system communication process, the relationship between the two must be established in QoSNP, as distinct from several communication relationships in the same pair of end system. In QoSNP, two-direction connection identifier will be used to uniquely identify this relationship.

Figure 2 is the information exchange timing diagram of complete successful negotiation in the TSDN negotiation process.

In Figure 2, solid arrows identify forward or reverse partial request, partial confirmation in QoS negotiation process, and the information exchange timing chart before request forward transfer process; dashed arrows identify end-to-end confirmation and timing diagram of end-to-end confirmation. Note:

i) Figure 2 describes only two successful single-direction negotiation processes, however, whether forward or reverse negotiation process, as long as any one SUPANET node (SIN) negotiation fails, the subsequent negotiation process will not continue.

ii) Since PFTS adopts HFS exchange technology, when the node is successfully negotiated, it is not immediately confirmed to the upstream node, but wait until downstream node is successfully negotiated and returned to the output port and wavelength number of downstream node, then conduct affirmative confirmation to the upstream node, otherwise send negative confirmation.

iii) Only forward negotiation is successful, then reverse negotiation process in Figure 2 be carried out.

iv) Only when two-direction negotiation processes are successful, the negotiation process of quality of service is considered a complete success.

It should be pointed out that: Since negotiation in two directions are independent, therefore, the nodes on the virtual path established in both directions may be different, or although the passing nodes are the same, two-direction VCI are not in the same pair of ports. Due to space limitations, this article will not draw the timing diagram of the failed negotiation process.

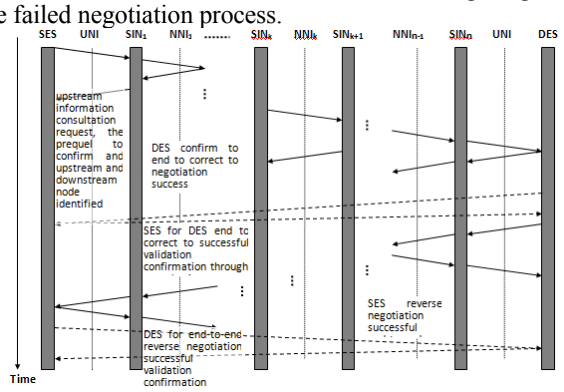

Figure 2. Negotiation information exchange timing diagram of two single-direction

B. *QoS negotiation process flow of SUPANET intermediate node*

As shown in Figure 2, the negotiation process of SUPANET is a hop-by-hop negotiation advance process, and the processing process of SUPANET intermediate nodes includes the following functions:

i) According to the destination end system address and IP routing function, find the next node and select the wavelength that can meet the quality of service at the corresponding port. The principle to judge whether it can meet appropriate quality of service requests is: find a wavelength from the selected port, the wavelength specified priority remaining output quota is sufficient to meet the quality of service requested. If the wavelength is found, in the wavelength specified priority remaining output quota, subtract the required quota, and then forward transmit the negotiation request to the downstream node; otherwise send negative confirmation to the upstream node.

ii) In the selected port and wavelength, assign VCII for the virtual connection, as part of VCI for future identify between user data transmission platform and downstream nodes, also as index for downstream node to search switching table.

iii) After downstream nodes return a positive confirmation, store downstream port number and wavelength number in returned confirmation message, together with VCII, into the appropriate PFTS switching table.

iv) If the downstream node sends back negative confirmation, the reserved resources will be returned to the system (quota allocated to the VCI), delete corresponding data items in the switching table, and sent back negative confirmation to the upstream node. This negative confirmation process will keep reverse confirmation relay in the direction opposite to request negotiations direction, until the request negotiations SUPANET end system. So far, the negotiation process fails.

v) To prevent loss of negative confirmation resulting in waste of reserved resource, T-NW (Negotiation Waiting

Timer) will be set in each node to establish connection. When end-to-end negotiations confirmation is completed in both directions, EPF can be transferred on user data transmission platform, upon receipt of EPF, T-NW bits will be reset to "0"; therefore, if T -NW clock expires on the credit control layer, while T-NW bit in PFTS switching table is "1", indicates the negotiation fails, and the corresponding SUPANET intermediate nodes will subject to unsuccessful processing.

C. Negotiation process of SUPANET mid-side nodes and end systems

It should be pointed out that there are actually two types of nodes in SUPANET: mid-side nodes interconnected by UNI with SUPANET end system and intermediate nodes interconnected by NNI interfaces with other SUPANET nodes. Although the processing process of these two types of nodes are basically the same, mid-side nodes need some special processing. Mid-side nodes at source end system need to determine the priority level of the transmission based on user data requested quality of service parameters to avoid the shortcoming that data priority level is determined by the client system itself, but also to avoid several intermediate nodes repeated identifying priority level processing. Mid-side node negotiation process at the destination end system is different from intermediate nodes. As the downstream node of the node is SUPANET computer or SUPANET / Internet gateway, HFS exchange technology is no longer applicable, and therefore, the corresponding switching table no longer needs downstream node port number and wavelength number (NOPN and NOLN).

Processing of SUPANET end system is divided into two cases:

1) SUPANET host

Because it supports server or client of SUPANET protocol set, it only needs to request QoS to negotiate or accept or reject the other party's quality of service request based on known quality of service parameters. Because the request is carried out by UNI interface directly connected, there is commonly no output port selection problem like mid-side node. It should also support HFS exchange technology in data forward transfer direction. If a computer is connected with different mid-side nodes through multiple ports, the computer itself can be viewed as mid-side node, which should be subject to mid-side node negotiation process.

2) Internet/SUPANET gateway

When SUPANET end system is Internet and SUPANET gateway, negotiation process at SUPANET side is the same with mid-side node processing process, but as it relates to the Internet service mapping issue, but also have to deal with the protocol mapping and conversion problems must also be dealt with. Due to space limitations, mapping and conversion problems between different protocols will not be discussed in this article.

IV. CONCLUSION

Considering the extensive application of traditional routing protocols, in node routing, this article uses routing table established by traditional routing protocol, so that when carry out QoS negotiation for traditional path, the failure rate of negotiation is relatively large. In SUPA, TSDN and TDSN exist at the same time to satisfy QoSNP, TDSN will be discussed later.

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