A QUEUE SCHEDULING AND MANAGEMENT SYSTEM BASED ON IXP2400 NETWORK PROCESSOR

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ABSTRACT

Multidimensional queue management and scheduling system based on IXP2400 network processor ，is used for network flow of many attribute to manage and schedule. The system has N queues as well as the number of network package attribute .Each queue set as equal Mi queue as i attribute value ,reached the packet is allocated by attribute and attribute type to manage and schedule in order to supply different servers. The system at most need MN queue complete classify and control detailed granularity, and make it simpler than current technology. The system can apply for many aspects, for example QoS guarantee, classified servers, band share, classified rate control and filter, etc.

Keywords: *Network Processor, Multi-dimension, Schedule, Queue Service*

1. INTRODUCTION

With the Internet backbone flow increasing in recent years, the treatment speed of the backbone router has already reached 10Gbps grade, this puts forward higher requirement to network equipment of future generation: Have excellent performance, support to divide into groups and deal with at a high speed; Have high flexibility, the network service on the senior level supported to vary constantly. The traditional one, because of GPP (General Purpose Processor) Network equipment piece meet flexibility requirement; The network equipment based on ASIC only meets the high-performance requirement; And network processor NP (Network Processor) Have the characteristics of high performance and flexibility concurrently, can offer the treatment performance of grade of the hardware through the flexible software system, and it influences one of the key technology of IP network development in the future to become with its excellent cost performance and high-level flexibility. The processor of the network is a particular application order processor facing application of network, face data, divide into groups, deal with, have the intersection of system and structural characteristic and particular circuit, software programming device. It is that one kind is specialized in the common chip of the communication equipment of the network; its flexible software system is offered the key characteristic that the treatment performance of grade of the hardware is NP. The processor of the network can finish various value-added services,

such as the service quality of the network, virtual private network (VPN), VoIP. It can help the business supplier to pay distinguishing in serving too, reduces at the same time and develops and disposes the cost served. Including the application of future generation that services such as the video on demand are inside, and have stricter requirements on the flow is optimized and service level, QoS acts on among them greatly. Low development cost and programmable characteristic of the processor of the network make it become first-selected hardware which realizes the router QoS[1].

Realize QoS of the network requires the network and distinguish different business and flow, thus demand to carry on different treatment to the grouping flowing in different business according to QoS. For this reason, require the router to classify the grouping arriving, put different kinds of grouping into different buffer memory to rank, through certain flow controlling mechanism, make the grouping that sends meet certain delay and requirement for shaking while dividing into groups and sending. These QoS mechanisms include management and formation of the formation of dividing into groups output the deployment mechanism. So, study QoS which canvasses the processor of the network to realize that there is a great meaning of theory and practice in the mechanism. This text will design and realize that manages and manages the system in multidimensional formation of a kind of network dataflow.

2. QUEUE MANAGE AND SCHEDUL TECHNOLOGY

2.1 Concept and Classification Of Formation Management

The queue system is managed to transmit the nodal squadron and list and buffer the management of resources to the network. In the course of dividing into groups and transmitting, its network flowed through transmits the node and usually adopts the formation and buffers, delays the service method that is transmitted in order to improve and outputs the bandwidth utilization ratio of the chain. It determines while dividing into groups and reaching the front of formation that allow to should divide into groups and enter and buffer the formation according to certain tactics and information to buffer the mechanism of management, from a different perspective, that is whether to abandon the decision that should divide into groups or not, called abandoning controlling.

Manage plays a quite great role in the network transmits and controls in formation, it is a service quality of the network (QoS) One of the key technology that controls, it is the important means to realize congested control of network too. The router in the network is the apparatus based on that the bag exchanges; each port adopts bandwidth statistics to reply and use. Internet data happen suddenly essence make in the router must dispose certain formation of size in order to improve the utilization ratio of the chain, reduce and throw the bagging. The formation manages the formation length by losing and wrapping up when the network happens congested to manage algorithms. Congested control ability and QoS ability to manage formation length and influence the router directly.

The present mechanism of management of formation can be divided into two major kinds: The formation of the passive form is managed (Passive Queue Management, PQM) Manage (Active Queue Management, AQM) with the active formation. [2]

2.2 Concept And Classification Of The Deployment Technology Of The Queue Manage

Deployment is one of the key mechanisms of systematic resource management; it is to solve the problem effective means of shared resource of a plurality of business competitions. The resources of the network system roughly include three parts: Buffering area, chain bandwidth, processor resource. Divide into groups deployment realize control over chain bandwidth, mean, decide, choose where one divide into groups, go on, send in

waiting for formation according to certain rule, make all input business can share and output the chain bandwidth to flow according to the way to book. It influence it parameter it is main performance including bandwidth assign, when prolong and when if you can't prolong, shake, etc., it is one of the key technology of realizing quality control of the network service. Typically, divide into groups deployment take place person who produce go next router or output interface of the host computer in way, but can any that exist inside router take place resources competition and need, line up, wait for place of deployment potentially. After dividing into groups and reaching the node of the network in one, the classifying device, according to dividing into groups (or the business) Context and granularity formation of confirming and belonging to it, it is if you can't last formations corresponding, line up to be waited not to divide into groups, until deployment device sends its choice. How to flow importing to the business in different formations correspondingly, there are different methods under the environment of different networks in different deployment algorithms, need categorized function and regular cooperation of deployment. But more complicated deployment algorithm will flow importing to the business into different formations correspondingly according to certain rule, thus carry on the discriminating service in inputting the business and call CQS (classification, queuing, scheduling) Structure.

Commonly used the intersection of formation and the intersection of deployment and tactics, key question it's how realize fair bandwidth assign and dynamic bandwidth share, and avoid the influence of the abnormal business. Distribute the bandwidth what is called fairly, it is each business type that obtained the same bandwidth, or some business types obtained the bandwidth more than other business types according to the administrator's intention. Share the bandwidth what is called rationally, will distribute to the surplus bandwidth of a type of business, and share for other business types. What is called influence of avoiding the abnormal business type, it is when some business types behave abnormally, guarantee other business types get the normal service. The function of deployment of formation is that the router selects the next grouping to be transmitted from several formations; the complete formation deployment algorithm is the assurance that data obtain the necessary service quality in different PRI formations.

The existing daily formation deployment tactics are as follows, FIFO (first-in first-out), PQ (PRI formation), FQ (fair formation), WRR (weighting is circulated), WFQ (the fair formation of weighting), DRR (deficit is circulated). [3,4]

3. IXP2400 NETWORK PROCESSOR

With the constant progress of technology, Internet bandwidth of having backbone presenting one grade of growth of index, its growth rate has already exceeded the growth rate of the operation speed of the processor. In order to meet the demand for increasing day by day, the key apparatus provider of network has turned attention to ASIC from the common processor. However, the increase of the network bandwidth not merely means the enormous flow of data, still impel various new business to produce constantly, business such as network meeting, video on demand, VPN have already come into people's life. The emerging constantly of new business must require the network equipment to offer faster support, and ASIC is relatively deficient in flexibility. This needs a kind of apparatus, there is data handling capacity of higher networks, again can offer to new corresponding support of business in a flexible way, and network processor happen characteristic with these two respects.

IXP2400 network processor is that the second generation of Internet that Intel was put out in 2002 exchanges the framework (IXA) Processor of the network. Among them, IXP2400 is the network processor that high side employs in facing, can be used for realizing the network route of OC-48 exchanges the apparatus.[5]
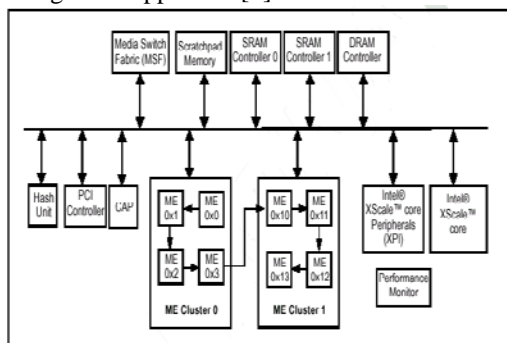

Figure 1: IXP2400 Hardware Framework

As shown in Fig. 1, IXP2400 network processor structure of Intel has fully reflected SoC (System on Chip) Thought. Its inside mainly includes 8 little engines (Mev2) of 8 threads that can totally be programmed With a XScale core. In addition, there is unit MSF used for connecting outside MAC apparatus, connecting the interface units of different

memories and buses. These units, through the internal high-speed data bus and controlling buses cooperates each other.

4. DESIGN MULTI-DIMENSION AND SCHEDULING SYSTEM

Existing technology according to a certain attribute of data packet, flow, the intersection of business and type go on, distinguish to them, then send into corresponding formations and line up to wait for the service. This kind of differentiation method is not suitable for the situation of many attribute. If a data packet has n attribute at most, each attribute has M a value at most, by existing method of lining up of classification, the biggest need (M +1) The intersection of N-1 and pieces of formation, can realize, classify, line up control! For example, if we offer IP data in the network according to attribute such as its protocol field, port field, length and pay and distinguish, by MAWI [31] (Measurement and Analysis on the WIDE Internet) The intersection of Japan and actual statistical data at backbone of U.S.A. that offer Can see: Classify according to protocol, is divided into 6 kinds at least; Offer the length and distinguish according to the data, can divide into 7 pieces of Section; Classify according to port, can divide into 19 at least.

Two bags that can be separated in an attribute may be mixed in another attribute together. For example, divide into two bags of tcp and upd according to protocol, their port may be all 53 (dns), Wrap up the length perhaps all among 128-255. So when we register paying classifying to the data through all these and three pieces of attribute, will need to be divided into 24 (protocol: Port) *7 (length section) =168 queues.

When for example controlling the running situation of the network under some situations, the system needs to confine the proportion that every weight accounts for in the network to normal range through deployment of formation and management, as the form above shows, the danger caused to the network in order to prevent the abnormal state of some weight from increasing. The typical example that some weight unusually increases is to suffused with attacking bigly, to kill server, send a large amount of TCP SYN divide into groups and HTTP GET ask and DNS inquire and over lengthy bag, or port scan bag. assailant. If adopt existing formation deployment and administrative skill, as to the above-mentioned example, the system will need to set up 168 formations stood side by side, will classify and line up to control the data packet reached. If adopted serial formation dispatcher and

management way, introduced successively in proper order artificially among every attribute. Some bags with more attribute, may meet the bottleneck in the serial formation, probably abandoned; The route where some bags with less attribute walk in the serial formation is short, therefore can pass fast. Therefore, adopt existing technology to carry on serial formation managing and management, priority and weight losing the formation of running side by side are controlled, important characteristic of serving etc. of lining up of first-in first-out in the same formation. So, existing formation deployment and administrative skill, are not suitable for much attribute (or multi-dimension) Situation lined up to control.
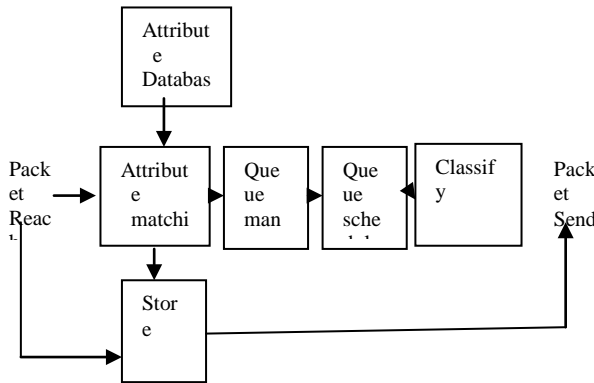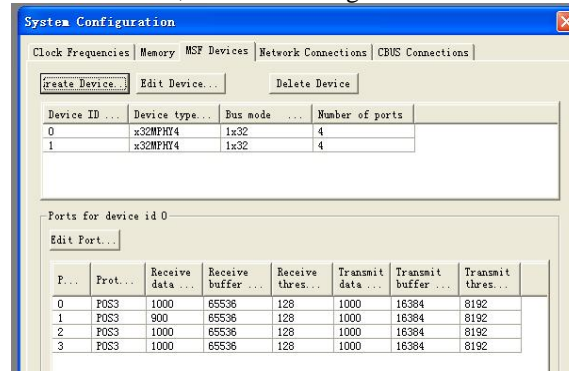

Figure 2: System Architecture

The systematic structure herein is shown as in Fig. 2, the characteristic value of every field about floor of every agreement interested in the system at first is stored in the attributive character storehouse, prepare to use when much attribute is matched. When arriving in a data packet, the system stores it in the storage area, and writes down it to annotate address or here. Then begin to match many attribute to this data packet. Write down the attribute and attribute values corresponded to. Find the multidimensional formation and manage a plurality of corresponding formation groups in the module according to the attribute, and then find a formation in each formation group according to attribute value, therefore get the probability that each formation abandons this data packet. And then abandon probability by all these things and get total abandoning probability equally. Total abandoning probability equally determines that abandons or accepts this data packet. If determine to abandon, remove this data packet from memory, and clear empty other records about this data packet; If determine to admit, send the identification or address of this data packet into the deployment module of multidimensional formation and rank and serve. Formation of corresponding to attribute

value in the formation group that every attribute that formations entered are this data packet corresponds to. After this data packet is in every formation group entered is served right, this data packet can leave the deployment module of multidimensional formation, also, identification or store address, give, classify, serve module of data packet this, it takes out this data packet from memory, and offer service of classifying. Classify, it serves tactics to be can different and different according to application system. For example, the simplest service method is to send this data packet out. This way can guarantee every weight proportion in the network within the specific limits with aforesaid formation management and formation deployment tactics, prevent some weight from unusually increasing, can apply to, guarantee the intersection of business and quality, guarantee every business share the intersection of network and bandwidth, guarantee network run, dissolve, attack person who shed various application systems harmoniously while being fair. The comparatively complicated service method is to provide the discriminating service for data packet with some attribute. Except this way have the characteristics that the above-mentioned assurance network run harmoniously, can also realize the control on detailed granularity of the data packet, find the possible anomaly or known or new attack. For example can find the common characteristic of the data packet abandoned from the association mode of the formation of the high overflowing rate, therefore can adopt the corresponding tactics defense, prevent what attacks and reduces to the normal data packet is abandoned.

4.1 System Simulation

MSF apparatus is divided into receiving and sends two parts, Device 0, in order to receive the apparatus, Device 1 sends the apparatus, the two set up as MPHY mode, every 4 ports received and sent in simulation, as shown in Fig. 3:

Figure 3: MSF Device Simulations

Utilize apparatus emulation of Workbench and artificial function of dataflow, according to needing to presume the dataflow of the corresponding form. In the experimental design, port0 of Device 0 that it is MSF sets up the dataflow, the data packet is sent from port2 of Device 1 out after dealing with. Have designed 11 kinds to flow here and test whether every part of the system operate normally altogether. It shows IP head agreement field that should flow is tcp, tcp head purpose port is 21 that tcp_21 flows.
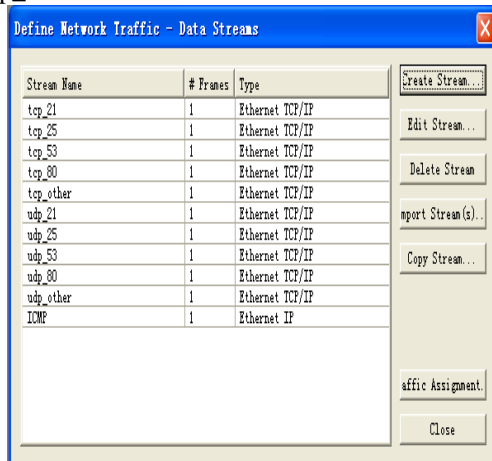

Figure 4: Simulation Data Flow

The categorized module of systematic midstream quantity distributes to class_id of various data packets as follows.

Table 1 Class_ Id

class_id	destination port	class_id
0	21	3
1	25	4
2	53	5
	80	6
	other_port	7

Set up after the good dataflow, flow, tie definitely at the port 0 of Device 0 tcp_21. At Workbench it is main it last emulation interface debug, it utilize [Debug] / [Breakpoint] if you can't insert; break a bit at the place where the categorized module of flow in the procedure finishes. In menus main, it choose [Debug Windows] / [Data Watch],it can if you can't turn on by register, last window. The system is shown as in Fig. 5-3 the categorized result that tcp_21 flows. Flow tcp_other and udp_53 flow, udp_other flow, ICMP flow, tie the test result at the port 0 of Device 0 is shown as in Fig. 5 to 6 definitely.
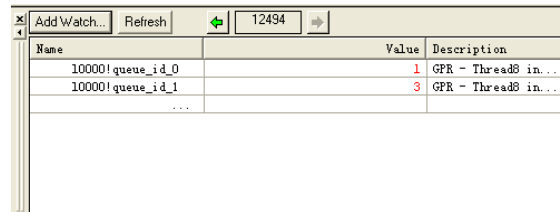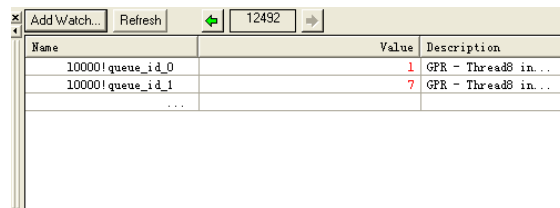

Figure 5 Tcp_21 Result

Figure 6 Tcp_Other Flow Result

From the above-mentioned charts, the dataflow with many attribute has all got correct class id. Queue_id_1 that ICMP flows is 0, show this id is invalid, proves ICMP has wrapped up and only matched a attribute. The result that categorized module obtains flows and is in full accord with design in advance, operate normally.

5. CONCLUSION

With Internet commercialization develop and bear the weight of total amount and explosion type of type of the business to increase to the service quality in IP environment, respects such as security, predictability, can be measured. have put forward higher requirement. The traditional network develops to the network of future generation progressively too at the same time. The processor of the network has had at a high speed handling capacity of ASIC, and there are complete programmable characteristics. Because NP obvious advantage in data processing of network, it will become the component that high-speed network equipment supports networks such as business management, security, network monitoring, QoS. to be with essential function. Realize formation manages and it manages systems to be meaningful work very much in order to meet all kinds of demands at the intersection of network and processor.

While managing and managing technology in the traditional formation, generally line up to wait for deployment and service in a formation in a data packet, want, realize detailed classification of granularity line up to serve and need more formations, the requirements for resource of the system are relatively high too, and it is limited to buffer resources. The purpose of this system lies in

overcoming the deficiency of existing technology, offers the multidimensional formation of a kind of network dataflow to manage and manage the system. This system corresponds to n attribute of the data packet through formation group n, each formation group sets up most M a formation; each formation corresponds to an attribute value. Manage algorithms through formation deployment tactics and formation that this system offers, only need NM a formation to realize the classification of the detailed granularity is lined up to be controlled biggest. And this system, can realize many kinds of application systems, for example QoS guarantees, there are service, bandwidth sharing, categorized speed controlling and filtering, web invasion defenses, unusually flowing and filtering etc. distinguished, have wide adaptability.

There are many present systems to need improving and place of development. Check two attribute of data packet only in being at present systematic, how about been chosen more attribute, how is it chosen more attribute values (involve the formation that the formation group needs to count), That is to need the thinning attributive character storehouse. The more complicated the realization with the multi more system attribute that certainly needs to match is. Need more ingenious method to set up of counter. If it is not feasible to make the counter with the register, first, the register in the little engine is limited in quantity, second, the registers cannot be all used for making the counter either, because the operation of the procedure also needs a large number of registers, three is that the register in each little engine is basically independent. The counter is put in SRAM, although SRAM is a shared resource its capacity is limited too, need to consider the memory and covering the question. List, manage algorithm, realize the intersection of WRED and algorithm only at present in the intersection of system and squadron this, formation deployment DRR in whom tactics used. How to choose the formation is suitable for each formation characteristic to manage algorithms, how to confirm the formation deployment tactics of the characteristic suitable for the attribute that the formation group corresponds to, need further research and experiment. Formation parameter (such as the maximum length of every formation) OK dispose best. How to combine this system with other application systems to need further improving too.

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