出席國際學術會議心得報告

計畫編號	H3013
出國類別	參加國際會議
出國人員姓名 服務機關及職稱	伍麗樵 雲林科技大學電通系　　教授
會議時間地點	10 月 22 日至 10 月 24 日, 2008, 大陸、北京
會議名稱	Asia-Pacific Network Operations and Management Symposium (APNOMS2008)
發表論文題目	An adaptive control scheme of reserved bandwidth for RPR in steering mode

一、參加會議經過

Asia-Pacific Network Operations and Management Symposium (APNOMS2008)國際會議於 10 月 22 日至 10 月 24 日在大陸北京舉行，本屆大會的議程安排了如下所示的 Technical Sessions:

- Routing and Topology Management
- Fault Management
- Community and Virtual Group Management
- Autonomous and Distributed Control
- Sensor Network Management
- Traffic Identification
- QoS Management
- Policy and Service Management
- Wireless and Mobile Management
- Security Management

本屆大會有 200 多篇的投稿論文，但只接受 48 篇 Technical papers，論文的接受率如圖 1 所示，筆者的論文” An adaptive control scheme of reserved bandwidth for RPR in steering mode”是被安排在 10 月 24 日的下午，如圖 2 所示。

Message from the APNOMS 2008 General Co-Chairs

The 11th Asia-Pacific Network Operations and Management Symposium
22 - 24 October 2008
Park Plaza Beijing Science Park, Beijing, China
Sponsored by KICS KNOM, IEICE ICM
Technically Co-Sponsored by IEEE Communications Society
Supported by IEEE CNOM, IEEE APB, TMF, IFIP WG6.6, CIC, CCSA

"Challenges for Next Generation Network Operations and Service Management"

You are cordially invited to join us at APNOMS 2008 at Park Plaza Beijing Science Park, Beijing, China. This is the 11th in the series, following the successful APNOMS'97 (Seoul), APNOMS'98 (Sendai), APNOMS'99 (Kyongju), APNOMS 2000 (Nara), APNOMS 2001 (Sydney), APNOMS 2002 (Jeju), APNOMS 2003 (Fukuoka), APNOMS 2005 (Okinawa), APNOMS 2006 (Busan), and APNOMS 2007 (Sapporo). APNOMS 2008 is building on the success of previous APNOMS, the premier technical symposium in the area of network/service operations and management in the Asia-Pacific region. This is the very first time that APNOMS is being held in China.

Research and development on Next Generation Networks (NGNs) have been carried out over the last few years and we are already seeing their deployment and operations in many parts of Asia-Pacific countries. We are also beginning to experience new and interesting services that utilize these NGNs. We are certain that we will see more deployment of NGNs and NGN services in the next few years. Thus, the operations and management of NGNs and their services are very important to the network operators and service providers. At the same time, they are also concerned about new and more effective ways of performing the operations and management. The Organizing Committee has timely selected ***"Challenges for Next Generation Network Operations and Service Management"*** as the theme of APNOMS 2008 and has prepared an excellent 3-full day program with keynotes, tutorials, special sessions, panels, technical sessions, poster sessions, and exhibitions with the theme in mind. This year we have received over 200 submissions of technical paper and we are certain that the selected 48 technical papers will be of high-quality on the latest hot topics in next generation network operations and service management.

On behalf of the Organizing Committee, we would like to extend a warm welcome to all the participants to APNOMS 2008. The APNOMS 2008 venue, Park Plaza Beijing Science Park, is located in the university/science district of Beijing, very close to the 2008 Summer Olympic Stadium. Beijing is the home to the many of the world's most revered treasures, such as The Great Wall, Forbidden City, Temple of Heaven, and Ming Tombs. We sincerely hope that all of you will help make this symposium the most productive and useful with lots of fruitful discussions with other participants. We also hope that you discover and enjoy many things that Beijing and the other parts of China can offer before or after the symposium.

Finally, we would like to sincerely thank all contributors to this symposium, without whom, this symposium would not have been possible. We would also like to thank all committee members, who put their endless time and effort in preparing for the success of this symposium.

APNOMS 2008 General Co-Chairs

Prof. James Won-Ki Hong
POSTECH, Korea

Prof. Luoming Meng
BUPT, China

圖 1. 大會公布之論文接受率

Session 2

Chair: Naoto Miyauchi (Mitsubishi El., Japan)

- **Self-Organized Cluster Based Multi-Hop Routing for Wireless Sensor Networks**
  Hongjoong Sin, Sungju Lee, Jangsu Lee, Seunghwan Yoo, Sanghyuc Lee, Jaesik Lee, Sungchun Kim
- **An Adaptable Method of E-Workflow Composition Based on Distributed Awareness**
  Hongbin Sun, Yongsheng Ding
- **An Adaptive Control Scheme of Reserved Bandwidth for RPR in Steering Mode**
  Wenfong Wang, Yishian Chen, Lihchuyau Wuu
- **Estimating Half-Path RTT in Backbone Network**
  Lisheng Huang, Wenyong Wang, Mingtian Zhou
- **A Radio Network Co-design System for Planning, Operation, and Customer Relations Divisions**
  Kosei Kobayashi, Yasuhiko Matsunaga, Takayuki Nyu, Hiroto Sugahara

圖 2. 論文報告的場次

二、與會心得

從與會的過程中，筆者深刻體會到目前各國對於通訊與網路安全相關研究領域發展的重視和努力，建議政府可以考慮鼓勵國內學校去爭取未來的通訊與網路安全之國際會議在臺灣主辦，除了提昇中華民國在國際間的學術地位外，並方便國內學者與業界可就近在台灣共同思考未來通訊與網路安全可能發展的方向與突破。

攜回大會議程暨大會論文集 CD 一片。

發表之論文如附件。

An Adaptive Control Scheme of Reserved Bandwidth for RPR in Steering Mode

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Abstract. In the RPR steering mechanism, the head stations, counted from the breakpoint on each ringlet, may seize more bandwidth of high priority traffic than their downstream nodes. This study proposes an adaptive control scheme of reserved bandwidth to throttle the add traffic flows of the head nodes and reallocate network bandwidth more fairly. With this scheme, we can control the classA1 and classB reserve rate dynamically, and adjust the downstream rate according to the congestion condition. In our simulations, we see that the classA frame delay can be decreased largely, and the global system throughput can be increased significantly.

Keywords: RPR, Resilient Packet Ring, 802.17, Protection, Steering.

1 Introduction

Resilient Packet Ring (RPR, IEEE 802.17) is a new standard for metropolitan and wide area packet networks based on dual ring topology [1]. RPR networks have multiple advantages such as spatial reuse, resilience, scalability, bandwidth efficiency, and ease of management [2].

Two protection mechanisms are employed in RPR: steering and wrapping. The steering mechanism gives better bandwidth utilization than the wrapping mechanism after a failure occurred. However, in the steering mechanism, the head stations on each ringlet may seize more bandwidth of high priority traffic than their downstream nodes. There is no research on analyzing and improving the frame delay and system throughput under the steering mode as a link failure occurs.

2 Traffic Shapers and the Protection Mechanism of RPR

In [3], RPR defines three-level service priorities according to the demand of ingress traffic. The ClassA traffic is low-latency and low-jitter and can be further divided into classes A0 and A1. The classB traffic has predictable latency and jitters and can be

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divided into classB-CIR (committed information rate) and B-EIR (excess information rate). Finally, the classC traffic is best effort and has unbounded jitter.

All node traffic entering the ring is throttled by rate controllers to maintain service guarantees. These controllers consist of leaky bucket shapers, which utilize credits to produce the send indications to allow the traffic of MAC clients or control messages to be transmitted [3]. The transmission rate of the three service classes is controlled by the shapers in each node. The shapers for one ringlet of a RPR node are ClassA0 shaper (shA0), classA1 shaper (shA1), classB shaper (shB), and fairness eligible shaper (shF). All of them are used to limit the add traffic of each local node for the respective traffic classes. In addition, there is a shaper for all transmit traffic other than the shapers for the add traffic, called the downstream shaper (shD).

The steering mechanism is implemented and combined with the scheme of topology database refreshment. When a link or node failure occurs, the neighboring nodes that discover the error broadcast the topology update messages on the ring to inform other nodes that the ring is broken [4]. When each node receives such a message indicating the failure, it updates its topology database accordingly. Then, steering nodes direct protected frames to the ringlet that still has connectivity to the destination of the frames.

3 Adaptive Control Scheme of Reserved Bandwidth

To resolve the unfair utilization of the classA reserved bandwidth of RPR in the steering mode, it seems that the network bandwidth reallocation by borrowing from the bandwidth of lower level classB and classC can be considered. To allocate more reserved rate to classA1, we need to dynamically adjust the credits of ClassA1 and ClassB according to the congestion situation. Therefore, we adjust the credit for classA1 according to the traffic transmission of classA1. We use two parameters to judge the range of the adjusted rate, one is *classAAccessDelayTimer* and the other is *classAAccessDelayTimerThreshold*. To measure the amount of the classA frame delay, we define a parameter *A1_weight* and assign its value as shown in (1):

$$A1\_weight = classAAccessDelayTimer/classAAccessDelayTimerThreshold \qquad (1)$$

The value *hiLimitA1* is the threshold of the classA1 credit, and thus, we can adjust the classA1 credit through this value. For example, assume that the reserved_ratioA0 = 2, reserved_ratioA1 = 18, and reserved_ratioB = 36. Under these settings, the total bandwidth of the reserved rate is 100 so that the adjustable range of reserved_ratioA1 is 1~2. Therefore, we can control the value of *hiLimitA1* from 1 to 2 dynamically. According to the value of *A1_weight*, we redefine the formula for *hiLimitA1* as follows:

```
if A1_weight ≧ 1
      let New_hiLimitA1 = mtuSize+ addRateA1*MAX_JITTER/2*2
Else
      let New_hiLimitA1 =
                  mtuSize+addRateA1*MAX_JITTER/2*(1+A1_weight)
```

Then, we can set the value *creditA1* as shown in (2):

$$creditA1 = Min(New\_hiLimitA1, creditA1 + addRateA1 * (currentTime - tickTime)) \quad (2)$$

According to the increase of the parameter reserved_ratioA1 in (2), we have to decrease the rate of reserved_ratioB to balance the borrowed bandwidth allocation of the whole ring. We define a parameter named *B_weight*, and let it equal to *A1_weight*. Then, we set the new value of *New_hilimitB* in the same way as *New_hilimitA1*. The formula is as follows:

```
if  B_weight ≧ 1
    let New_hiLimitB =
                    mtuSize+(addRateA1+addRateB)*MAX_JITTER/2/2
Else
    let New_hiLimitB = mtuSize+(addRateA1+addRateB)
                              *MAX_JITTER/2/(1+B_weight)
```

Then, we can set the value *creditB* as:

$$creditB = Min(New\_hiLimitB, creditB + addRateB * (currentTime - tickTime)) \quad (3)$$

Since shD also controls the downstream traffic, we can use it to throttle the add traffic of upstream nodes together with the shA1 and shB. We define a parameter named *Down_weight*, and let it be equal to *A1_weight*. Then, we set the new value of *New_hiLimitDown* in the opposite way of *New_hilimitA1*. The formula is as follows:

```
if  Down_weight ≧ 1
     let New_hiLimitDown = hiLimitD
else
     let New_hiLimitDown = hiLimitD/(2−Down_weight)
```

Then, we can set the value *creditD* as follows:

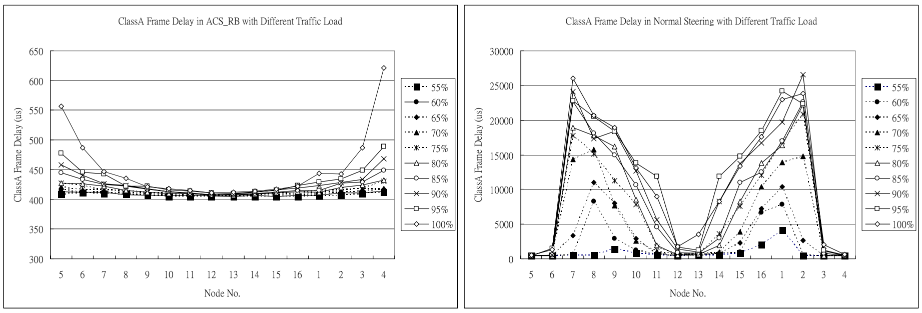
$$creditD = Min(New\_hiLimitDown, creditD + addRateD * (currentTime - tickTime)) \quad (4)$$

4 Simulation Experiments

In this section, we compare the results of the frame delay and the node throughput of classA in the normal steering mechanism and the mechanism we modified. We named it as “Adaptive Control Scheme of Reserved Bandwidth” (ACS_RB) mechanism.

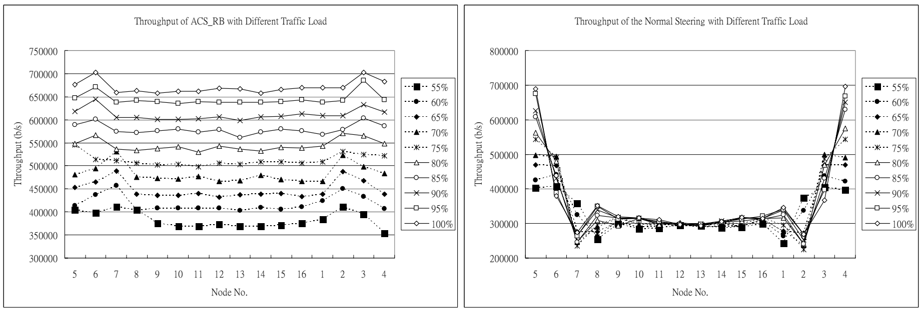
In Fig. 1(a), we find that our proposed mechanism can make shapers shA, shB, and shD reallocate the network bandwidth more fairly. Our scheme can avoid upstream nodes to seize too much bandwidth; therefore, the downstream node may have the chance to get enough bandwidth, and its classA frame delay can be reduced greatly in comparison with Fig. 1(b).

In our scheme, we adjust the credit of three shapers dynamically, so that the classA1 traffic of the downstream node can be sent with lower delay; therefore, the whole ring throughput can be increased (see Fig. 2(a) in comparison with Fig. 2(b)).



(a) (b)

Fig. 1. Average frame delay (a) ACS_RB, (b) Normal steering condition



(a) (b)

Fig. 2. Average node traffic throughput (a) ACS_RB, (b) Normal steering condition

5 Conclusion

We have proposed an enhanced scheme named ACS_RB to improve the system throughput and decrease the classA frame delay. It makes the shA1, shB, and shD control bandwidth dynamically to achieve fairer bandwidth usage in steering mode.

References

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