# Concept of Admission Control in Packet Switching Networks Based on Tentative Accommodation of Incoming Flows

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**Abstract.** We propose a novel admission control strategy called the Tentative Accommodating and Congestion Confirming Strategy (TACCS). The main idea is to accommodate incoming flows tentatively and confirm congestion after a certain period. TACCS makes it possible to control admission without collecting resources information in advance. Our simulation results demonstrated that TACCS enabled a domain to control admission without a centralized management agent.

## 1 Introduction

Admission control is becoming an essential technique for Internet Protocol (IP) networks to provide full-fledged multimedia streaming services. The integrated services (Intserv) or the differentiated services (Diffserv), which were standardized by the Internet Engineering Task Force (IETF), can be used to achieve admission control in IP networks. However, these architectures achieve this based on the same idea as the concept of circuit switching networks, i.e., a signaling-based resource reservation.

In circuit switching networks, reserved resources cannot be used by other connections until these are released, even if no data is transferred using it. The concept of packet switching networks was originally produced for eliminating such inefficiency in circuit switching networks and to gain the effect of statistical multiplexing. Considering such background to producing the concept of packet switching networks, we notice that the resource reservation based idea leads packet switching networks back to the same problems as those of circuit switching networks. Therefore, we insist on that strict resource reservation is not adequate for packet switching networks and should not be aimed. Based on this point of view, we propose a new admission control scheme which does not strictly allocate resources to each flow and does not guarantee QoS for them, but prevents congestion by controlling admission of newly incoming flows.

## 2 Concept of Tentative Accommodation

Where resources are not strictly allocated to each flow, it is generally necessary for controlling admission to determine the resources remaining after new incoming flows have been accommodated. However, in general packet switching networks, it is difficult to achieve this because of the following.

1. It is necessary to observe the resources in every node or link and to know the network topology and the complete routing information in the domain.

2. It is necessary to determine not only the remaining bandwidth for every link but also the remaining power of each node's packet-processing unit.

Moreover, in general packet switching networks, whether remaining resources are sufficient or not cannot be determined only by the bit-rate of incoming traffic but also depends on the probabilistic distribution of packet arrival. This means that the queueing delay or packet loss probability cannot be estimated even though the mean amount of remaining resources is determined. Furthermore, although the distribution of packet arrival could be determined by observing incoming traffic, it is still difficult to predict the distribution after new incoming flows have been accommodated. Therefore, we can see that it is difficult to achieve strict admission control taking all these things into consideration with the signaling-based idea in packet switching networks.

Having considered these things, we propose the Tentative Accommodating and Congestion Confirming Strategy (TACCS). Let us assume that Congestion Detect Agents (CDAs) are installed on bottlenecked points in a domain and these can observe the number of dropped packets (Fig. 1). Let us also assume CDAs advertise this information to ingress nodes at certain intervals by multicasting. Based on the information from CDAs, ingress nodes control admission as follows in TACCS. When flows arrive at a domain,

(1) Ingress nodes tentatively accommodate them and assign a higher drop precedence than for previously accommodated flows (tentative accommodation).
(2) After receiving information from the CDAs, ingress nodes check whether packets with a higher drop precedence have been dropped or not (congestion confirmation).
  (2)-a If packets with a higher drop precedence have been dropped, ingress nodes decide tentatively accommodated flows caused the congestion and drop them.
  (2)-b Otherwise, the ingress nodes accommodate them and reduce their drop precedence to the same level as the previously accommodated flows.

Note that we here assume flows are multimedia streaming flows and these are isolated from best effort traffic such as TCP flows.

The drop precedence is a differentiation between packets. The higher the drop precedence, the more packets with this designation are dropped when congestion occurs. By utilizing this mechanism, accommodated flows are protected from being affected by tentatively accommodated flows. With the Diffserv architecture, drop precedences are achieved by marking different Diffserv Code Points (DSCPs) for packets and utilizing Multilevel Random Early Detection (MRED) schemes on routers. For the purposes of drop precedence in TACCS, we recommend using the Multilevel Drop Tail (MDT) instead of MRED because we found that MDT can more effectively protect packets with lower drop precedence from ones with higher ones than MRED in previous work [1].

The main premise behind TACCS is that it is easy to know whether congestion is occurring after incoming flows have been accommodated by observing the queue length in the nodes' packet buffer or the number of dropped packets although it is difficult to predict in advance. Its benefits are summarized as follows. Since tentative accommodation of new incoming flows enables to generate the same situation as if they had been accommodated, it is possible to control admission reflecting the remaining bandwidth, the remaining power in each node's packet-processing unit, and the properties of packet arrival, without collecting resource information in advance. Moreover, the recognition of each flow or a centralized management agent are both unnecessary with TACCS.

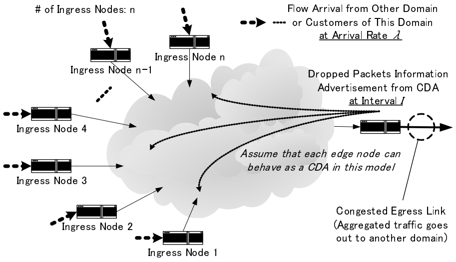

**Fig. 1.** System Image

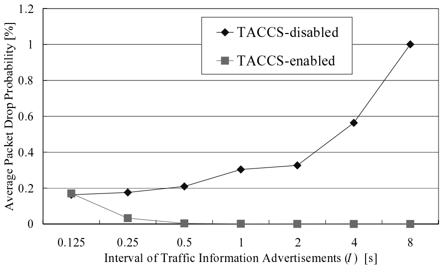

**Fig. 2.** Average Packet Drop Probability

## 3 Evaluation

For confirming the effects of TACCS, we simulated same kind situation as in Fig. 1 and compared TACCS enabled case with a case where only traffic advertisements were done without TACCS.

Figure 2 shows the results. In this figure, the x-axis represents the interval of traffic advertisements from CDAs and the y-axis is the average drop probability of the accommodated flows. We can see from Fig. 2 that congestion could be avoided and the packet drop probability was maintained a low level in the case of TACCS-enabled. This means that TACCS enables a network domain to control admission even though each ingress node independently admit incoming flows without a centralized management agent.

## 4 Conclusion

We proposed TACCS, which could control admissions reflecting the properties of packet arrival without collecting resources information in advance. To investigate the characteristics of TACCS further and reveal guidelines for configuring parameters, we will mathematically analyze TACCS in future work. The future work also involves to compare TACCS with signaling-based schemes and to study issues of CDA placement. After these, we will integrate TACCS into a dynamic class assignment method for stream flows [2] which we proposed in our previous work.

## Acknowledgements

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## References

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