# Analysis of Maximum-Size Matching Scheduling Algorithms in switches under uniform traffic

Team Members:*

Varun S. Malhotra, Wooyul Lee

## MOTIVATION

*In the design of switches, good scheduling algorithms play a very pivotal role in deciding the throughput of the switch and giving some delay guarantees for the packets. Although various algorithms which achieve* 100% *throughput have been proposed and analysed, most of these scheduling algorithms are variants of Maximum-Weight Matching (MWM) algorithms in bipartite graphs. Different MWM algorithms use different criteria for assigning the weights to the edges using some parameters dependent on the queue lengths of the Virtual Output Queues (VOQs). Similar class of algorithms, Maximum Size Matching Algorithms, have also been studied. It has been shown that Maximum-Size matching (MSM) scheduling algorithm doesn't give* 100% *throughput under non-uniform traffic pattern [1]. There have been results which have used some specific MSM for scheduling traffic and which have been proved stable, i.e., they give* 100% *throughput. But the question of how it performs under uniform traffic remains open. Although simulations suggest the stabiltiy of MSM algorithms under unform traffic but there have been no analytical results proving the same. We plan to work on this problem and hope to study the structure of MSM scheduling algorithms so as to figure out the inherent hardness in this problem.*

## 1. COURSE OF ACTION

After going through the available relevant background literature, we hope to start from the simplest possible example, i.e. analysis of 2x2 Input Queued Switch under uniform traffic, and hopefully this case should throw some light into the structure of the Maximum Size Matching Scheduling Algorithm. It is very hard to outline the schedule for this project, however, we will be holding regular brain-storming sessions and will try to use different approaches for solving this problem.

---

* EE384Y Project Proposal

## 2. IDEA

- Find the characteristics of MSM which can be used in the stability proof.
- Finding a suitable Lyapunov function for proving the stability of the switch.
- Coming up with an approach or model where we can compare MSM scheduling algorithm with another *stable* algorithm and proving that MSM performs better.

## 3. TENTATIVE SCHEDULE

- Read the related background literature. $[4/14 - 4/23]$
- Analyze the dynamics of 2x2 switch under simple traffic patterns. Comparing MSM and MWM under uniform traffic. $[4/24 - 5/5]$
- Using insights gained to define a suitable Lyapunov function. Review the whole process and *hopefully* finish the proof. $[5/5 - 5/22]$
- Preparation of the final report and the presentation. $[5/23 - 6/2]$

## References

[1] Achieving 100% Throughput in an Input-Queued Switch, *N. McKeown*, *A. Mekkittikul*, *V. Anantharam* and *J. Walrand*, *IEEE Transactions on Communications*, Vol. 47, No. 8, August 1999.

[2] Maximum Size Matching and Input Queued Switches, *S. Iyer* and *N. McKeown*, *Proceedings of the* 40*th Annual Allerton Conference on Communication, Control and Computing*, 2002.

[3] Scheduling non-uniform traffic in a packet-switching system with small propagation delay, *T. Weller* and *B. Hajek*, *IEEE/ACM Transactions on Networking*, 5(6) : $813 - 823$, 1997.