Stability Analysis of MNCM Class of Algorithms

EE384Y Project Proposal
By Nima Asgharbeygi
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Motivation and Project Description

In a recent work presented in INFOCOM 2003, Tabatabaee and Tassiulas [1] introduced a new class of scheduling algorithms for IQ switches with no speedup called MNCM. They used fluid model to prove the efficiency of these algorithms under general traffic, but a recent counter example invalidated their argument.
Now I want to further analyze the stability of MNCM by:

- Considering different arrival conditions: uniform, iid Bernoulli, etc.
- Examining standard methods: Lyapunov functions, Foster's criteria
- Using novel ideas and extended simulations

The result would be in form of stability proof or counter examples under some arrival conditions.
I'm also interested to figure out exactly why the fluid model gives an invalid result in this case and what are the constraints on use of fluid model approach. This may be helpful to establish an improved version of MNCM class of algorithms.

Tabatabaee et al. introduced maximum first matching (MFM) algorithm which belongs to MNCM and has a complexity of $O(N^{2.5})$. They also introduced another maximal deterministic matching algorithm with complexity $O(N^2)$; the maximal sorted matching (MSM). It turns out that MSM is a generalization of iLPF algorithm described in [2].
By the same counter example it's clear that MSM is not efficient under general traffic. In the case that I achieve the desired results soon, I'd like to try on stability of MFM and MSM algorithms.

Best Predicted Schedule

- *Week 1 – Week 3:* Stability analysis on MNCM
- *Week 4 – Week 7:* Further investigation on fluid models and its constraints
  Possibly trying stability of MFM and MSM
- *Week 8:* Wrap up and prepare final report

References

[1] V. Tabatabaee, L. Tassiulas, “MNCM a new class of efficient scheduling algorithms for input-buffered switches with no speedup”, *INFOCOM ’03*

[2] A. Mekkittikul, N. McKeown, “A Practical Scheduling Algorithm to Achieve 100% Throughput in Input-Queued Switches”, *INFOCOM ’98*