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Systematic Mapping Study on the Congestion Control Problem in TCP/IP

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Abstract

Traffic congestion of the Internet is one of the major communication problems lived by millions of users. Many works have been devoted to improve the internet congestion control performance [1]. In this paper, we will apply a Systematic Mapping Study to the congestion control problem in TCP/IP, in order to build a classification scheme and measure the field interest. The analysis of results focuses on frequencies of publications for categories within the scheme. Thereby, the coverage of the research field can be determined. Different filters of the scheme can also be combined to answer more specific research Questions.

Keywords: SMS (systematic mapping study),publication, paper, relevance, publisher, content type, congestion control, Active Queue Management(AQM),Transmission Control Protocol(TCP), Internet Protocol(IP), controller

1.Introduction

[7,8] As a research area matures, there is often a sharp increase in the number of reports and results made available, and it becomes important to summarize and provide overview. Many research fields have specific methodologies for such secondary studies, and they have been extensively used in for example evidence based medicine.

A systematic mapping study provides a structure of the type of research reports and results that have been published by categorizing them. It often gives a visual summary, the map, of its results.

In this paper, we apply the systematic mapping study on the congestion control problem in TCP/IP, and analyze the results. In Section2 we describe the process for systematic maps. Section 3 presents the results, before we analyze these results and conclude in Section 4.

2.Process of Systematic Mapping Study

[x] The essential process steps of our systematic mapping study are definition of research questions, conducting the search for relevant papers, keywording of abstracts and data extraction and mapping. Each process steps has an outcome, the final outcome of the process being the systematic map.

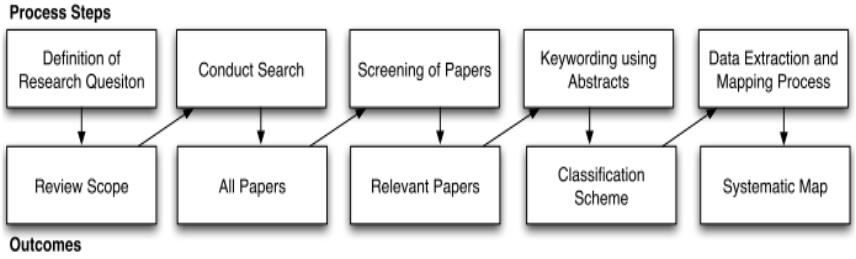


Fig 1. The systematic Mapping Process

We used the following terms to find relevant papers:
Primary terms: congestion; control; TCP.
Secondary terms: AQM; algorithm; controller.

We used Boolean OR to join secondary terms and Boolean AND to join primary words. The search was applied on digital libraries accessed via IEEE Xplore, and ACM Digital Library.

The First set for primary studies (all papers) contains 10506 and 2983 papers in ACM Digital and IEEE Xplore respectively (results on August, 21st,2014).
We analyze the different publishers (about 100) in ACM (figure 2)

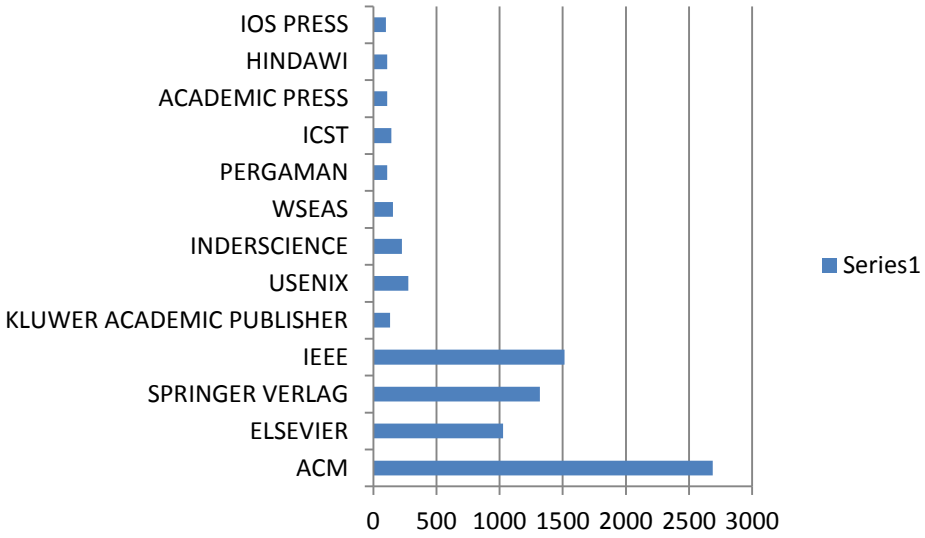


Fig.2 publishers in ACM Digital Library via number of publications

We see that13 of 100 publishers have 75% of the number of publications. We decide to limit our search on one database to execute our map and we choose IEEE Xplore.
We conduct the search for studies in IEEE database for both the entire set (major terms) and the relevant papers using key wording abstracts.

3. Results

We see in Fig 3 that frequencies of publications increase linearly over time between 1991 and 2014. The first publication was by Wilder, R. on Military Communications Conference, 1991. MILCOM '91, Conference Record, Military Communications in a Changing World., IEEE, and the title of publication is "Fairness issues for mixed TCP/OSI internets", the author explains The slow start congestion control mechanism as a fairly standard for TCP…

And in fig. 4, we see that conferences present about 86% of the total number of publications; journals come in the second position with just about 13% of 2983 publications about congestion control problem.

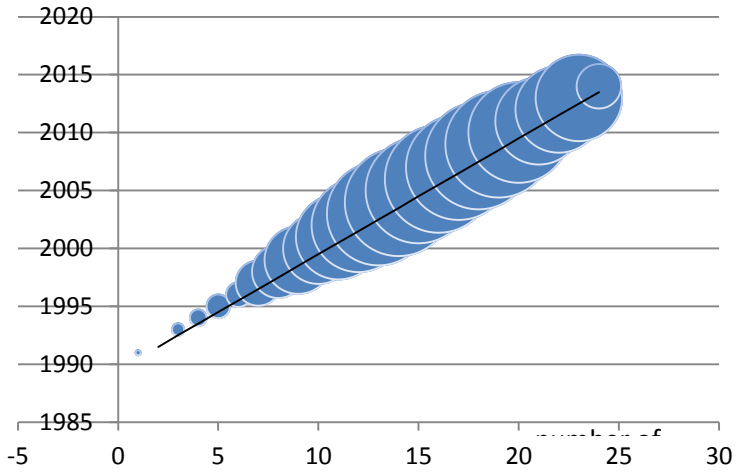


Fig.3 frequencies of publication over time

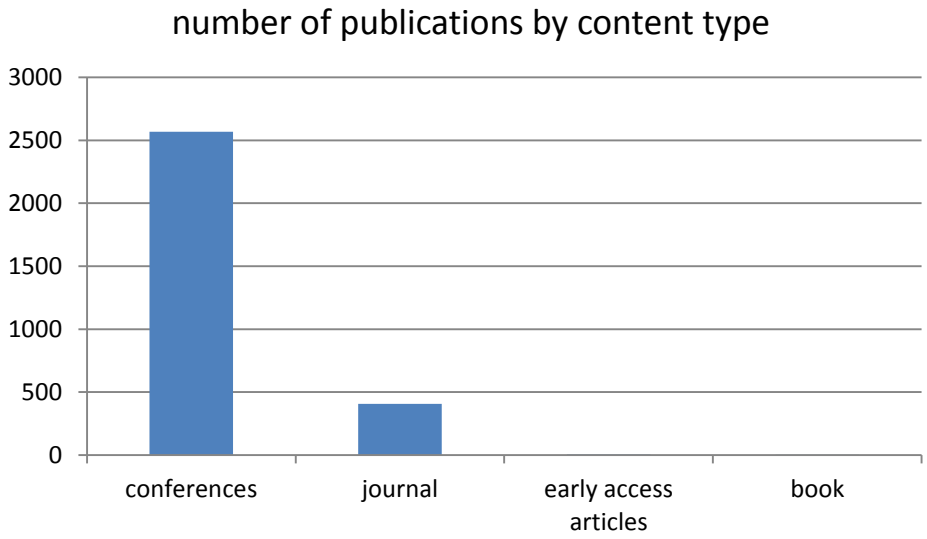
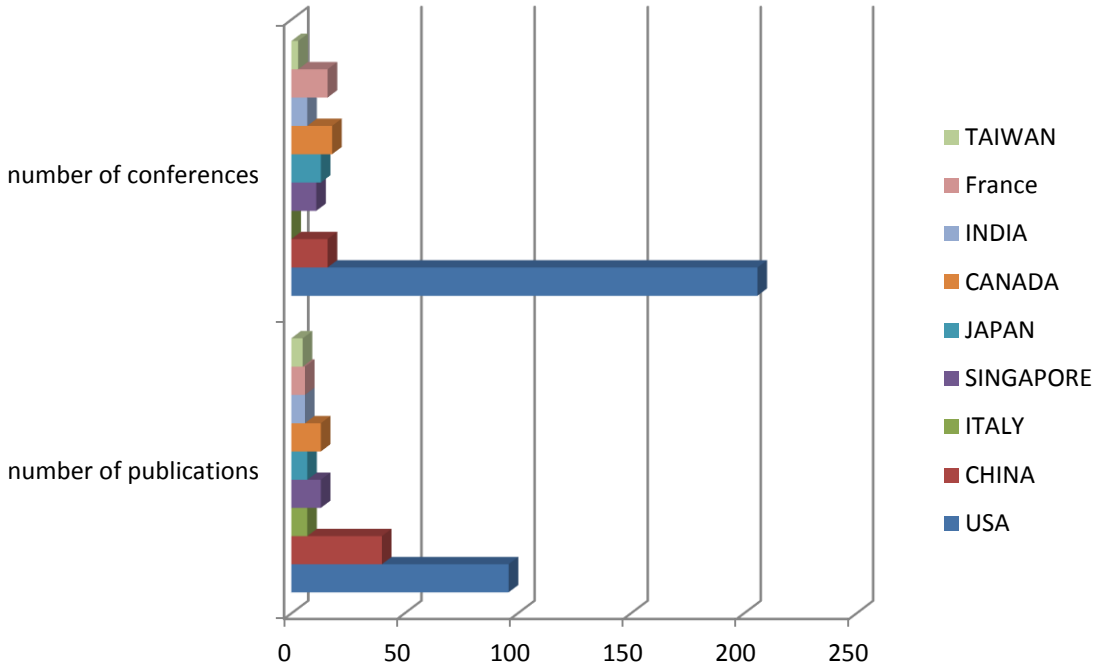


Fig.4 number of publications by content type

The figure 5 presents the number of conferences and the number of publications by country, and this over time (1991 to 2014). We see that most of conferences (71% :206 on a total of 290) are in USA, with about 50% of publications; in the second range in terms of publications, we find China with about 20% , and just 5% of conferences were located in China.



Next we specify more our criteria by integrating the secondary terms in the search. These terms were founded in abstracts and keywords of relevant papers. The choice of these terms reflects the orientation of contribution of each paper and the context of research. The set (AQM OR controller OR algorithm), gives a high level understanding about the nature of contribution.
We find 51 relevant papers whose 50 were published in conferences between 2002 and 2013 that explains the recent interest of automatic community to the computer network problems solving using automatic tools.

4. Conclusion and Recommendations

We presented the results of an initial scoping study (Systematic Mapping Study) to identify the form and the interest of literature within congestion control problem in TCP/IP. The analysis of the results shows that there is a gap in publication in journals and books. It is recommended that future research include that type of publication. Also, the number of publications via the location of conferences has to be balanced.

Future Work extends the presented results into a systematic literature review, in order to evaluate the content of the papers.

References

[1] Ichrak TOLAIMATE, Nourredine EL ALAMI, "Kharitonov approach and Padé Approximation applied to the robust controller design of Active Queue Management routers for Internet Protocol", WSEAS,International conferences in Corfu Island, Greece, July 14-17, 2011

[2] Ichrak TOLAIMATE, Nourredine EL ALAMI,"Robust Control Problem as H2 and H∞ control problem applied to the robust controller design of Active Queue Management routers for Internet Protocol", INTERNATIONAL JOURNAL OF SYSTEMS APPLICATIONS, ENGINEERING & DEVELOPMENT Issue 6, Volume 5, 2011

[3] Ichrak TOLAIMATE, Nourredine EL ALAMI,"Basic control design applied to the TCP IP model", 12 International Conference on Multimedia and Control Systems (ICMCS), Tangier, May 10-12,2012

[4] Ichrak TOLAIMATE, Nourredine EL ALAMI,"Quantitative Feedback Theory applied to the state model of congestion control", the 2nd International Conference on Systems and Control, Marrakech, Morocco, June 20-22,2012

[5] Ichrak TOLAIMATE, Nourredine EL ALAMI,"Fragility via robustness of controllers dedicated to the congestion control in internet protocol; Applied Mathematical Sciences, Vol. 7, 2013, no. 88, 4353-4362
http://dx.doi.org/10.12988/ams.2013.3528

[6] Ichrak TOLAIMATE, Nourredine EL ALAMI,"Pade and Laguerre approximations applied to the Active Queue Management Model of Internet Protocol", Applied Mathematical Sciences, Vol. 7, 2013, no. 126, 6263 – 6273(Hikari),http://dx.doi.org/10.12988/ams.2013.39499

[7] Ichrak TOLAIMATE, Nourredine EL ALAMI,"Fragility analysis of controllers for the congestion problem in Internet Protocol EMI, 8th International Conference on Intelligent Systems: Theories and Applications (SITA), 08-09 May 2013, EMI, Rabat,

[8]Kai Petersen1, Robert Feldt, Shahid Mujtaba, Michael Mattsson,"Systematic Mapping Studies in Software Engineering", proceeding '08EASE of the 12TH international conference on Evaluation and Assessement Pages 68 – 77

[9]Wasif Afzal, Richard Torkar and Robert Feldt, "A Systematic Mapping Study on Non-Functional Search-Based Software Testing", http://www.torkar.se/resources/A-systematic-mapping-study-on-non-functional-search-based-software-testing.pdf

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