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MULTISERVICE TRAFFIC PERFORMANCE OF SMALL CELLS

Loreno Menezes da Silveira

School of Technology
State University of Campinas
R. Paschoal Marmo,1888,
Limeira 13484-332, SP, Brazil

ABSTRACT

The objective of this paper is to present a study of the reaction of selected performance parameters, such as carried traffic and blocking probability, in a wireless cell environment with fixed capacity, under multiservice intense traffic variation, as in mass communications events of unexpected traffic growth, by means of simulation experiments.

1 INTRODUCTION

This work aims a research on the performance of small cells trunking under multi-service heavy traffic, investigating effective measures to deal with radio channels congestion over the access link. The general model was extensively tested in wireless picocells and microcells environment, although it could be easily extended to macro cells. Small cells capacities were assumed accordingly to 5G carriers and subcarriers dimensioning, as in 3GPP TS 38.306 (2019).

An additional contribution of this paper is to propose a simulation model to analyze the behavior of the different traffic flows, requiring different bandwidth, when they compete each other for resources in a loss system consisting of a link with a fixed number of channels. Although this is a well-known problem, simulation results were surprisingly interesting, and simulation has proved to be a very useful tool in the investigation of the solution, making possible the detailed analysis of queuing processes which have not been analytically solved yet.

2 EXPERIMENTS

The objective of the experiments is to study the small cells performance when arrival and service processes are non Poissonian, for example, following a Gamma, Weibull or Log-Normal distribution. Markovian models were run for validation purposes, using Kaufman formula (Kaufman 1981).

As investigation method, we chose a system simulation approach, expecting to research new insights in the core network dimensioning. The simulation model includes various definitions and parameters, among which, the following: number of different services, required bandwidth, probability distributions of arrival and service processes, cell bearable throughput and a traffic increasing criterion. Three or four types of service, requiring a bandwidth of one to four channels were studied. Standard holding times were adopted for service, but in some models, other holding times were chosen as a further investigation.

3 RESULTS AND CONCLUSION

Figure 1 illustrates results achieved after a simulated time of a 100 hours, in a picocell with a cell trunking of 22 channels, where three services are supposed to be of the streaming type (e.g. voice, video streaming, video download) and one service is of the elastic type (data applications using TCP/IP). Streaming service requests are lost in case of congestion, but not the elastic service requests, which enter in a proper waiting line. In Figure 1, traffic is measured in Erlangs (Erl) and blocking probability in percentage.

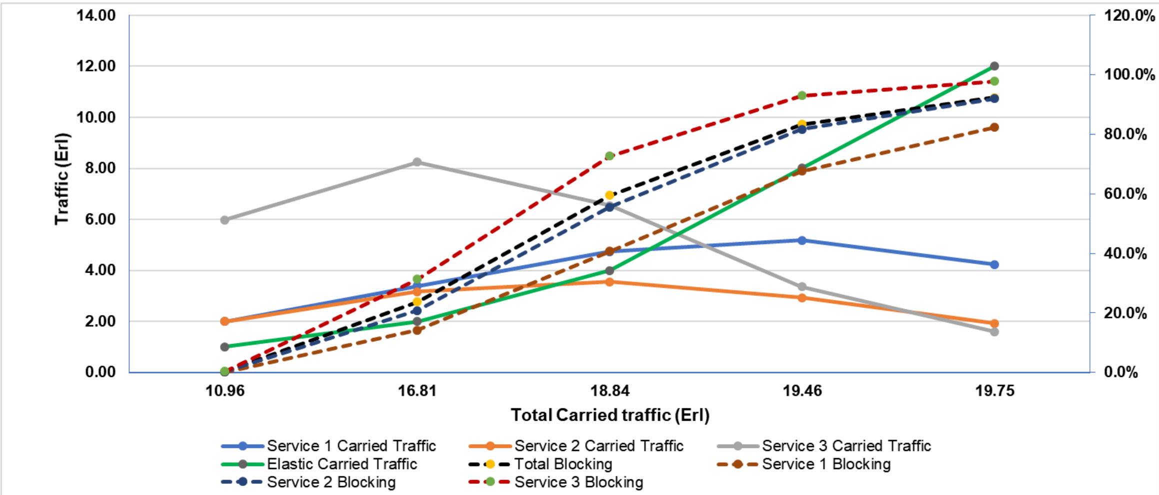

Figure1:Blocking and carried traffic per service.

We noticed that cell blocking rate grows with no bounds, whereas streaming services carried traffic decreases after reaching a peak, due to a continued increase in total offered traffic. Elastic traffic increases monotonically in the interval.

As a conclusion of the simulation experiments, in normal traffic conditions of a loss system without priorities, when requests for service compete each other for a common shared resource, services that require a greater bandwidth use a greater amount of resources. When traffic grows and the system congests, services requiring less bandwidth, are the ones that use the major amount of resources. Elastic traffic offered to the system is carried after a delay, even when the system is congested.

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