Comments on "Call Blocking Probability and Bandwidth Utilization of OFDM Subcarrier Allocation in Next-generation Wireless Networks"

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***Abstract*—We claim that the markovian model proposed in [1] is not suitable for the intended physical system. A more adequate model is proposed that additionally offers important advantages which are discussed in this letter.**

***Index Terms*—OFDM, subcarrier-allocation, multiclass Erlang loss model.**

In a recent letter [1], Chen and Chen propose an $M^X/M/c/c$ model for studying a subcarrier-allocation scheme in an OFDM system. The system has a total of c subcarriers and each subcarrier has the same average bit rate, R_b. In order to support multirate calls, multiple subcarriers are assigned to each arriving call depending on its class.

In [1] we read: *"A new call requesting kR_b can be regarded as a group arrival with size k. Furthermore, a call served with kR_b can be seen as k subcarriers released simultaneously."*, which makes perfect sense. However, in the $M^X/M/c/c$ model carriers are allocated in groups but released one by one.

A more adequate model is the well-known multiclass Erlang loss model that additionally offers important advantages like: i) Numerical efficiency: the Kaufman-Roberts recursion formula (KRF) [2], [3], allows efficient numerical computation. ii) Generality: the model is known to be insensitive with respect to call duration distributions [4]. Thus the performance results hold for a general distribution of the call duration and not only when it is exponentially distributed. Moreover, Delbrouk's generalization of the KRF [5] allows to consider a mixture of traffic flows which can be poissonian but also smother or burstier. iii) Grade of service differentiation and protection: if the network provider wishes to offer a grade of service differentiation across call classes and/or protect nominally loaded classes against overloaded ones, an admission control strategy must be exerted. There is a wealth of studies addressing admission control disciplines applied to the multiclass loss system [6], [7], [8] (just to name a few).

Even if we consider the proposed model in [1] as an approximation, which is by no means necessary in the light of the above arguments, such approximation is remarkably inaccurate. Table I displays the call blocking probability when the group size is uniformly distributed (see Sec. III-A in [1]).

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TABLE I
ACCURACY OF THE APPROXIMATION.

		Results provided in [1]			
ρ	P_b	Simulation	Ω	$\widehat{P}_b$	ε_r
0.51	0.0619	0.0587	0.0275	0.0278	55.6
1.14	0.2754	0.2662	0.2290	0.2282	16.8
1.65	0.3989	0.3853	0.3522	0.3521	11.7
2.16	0.4822	0.4657	0.4333	0.4336	10.1
2.67	0.5412	0.5229	0.4902	0.4906	9.4
3.05	0.5749	0.5555	0.5230	0.5233	9.0

Similar results have been obtained for GEOM group-size distribution. The exact values, P_b, have been computed using the KRF. Columns 3 and 4 are the simulation and the numerical (Ω) results of the approximate model given in [1]. We also checked the numerical results for Ω by using two independent implementations of Eqs. (7)-(9) in [1]. Our results are reported in column 5 ($\widehat{P}_b$). The percentual error, $\varepsilon_r = 100 \cdot \frac{|\Omega - P_b|}{P_b}$, indicates that the accuracy of the approximation is in general poor. Moreover, accuracy decreases as load decreases and reaches remarkably low values for configurations which are of practical interest. Note that blocking probabilities beyond 10%, or even less, are unacceptably high for real networks.

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