AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
Electronics and Communication Engineering Department

Wireless Network Traffic Modeling for Different Channel Holding Time Probability Distributions

A Thesis

Submitted in Partial Fulfillment of the Requirements
For the Degree of Master of Science in Electrical Engineering
(Electronics and Communication Engineering)

Submitted By

Eng. Fadi Hassan Ahmed El-Ghitani

Supervised By

Prof. Dr. Hadya El-Hennawy
Associate Prof. Dr. Hesham El-Badawy

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AIN SHAMS UNIVERSITY
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Examiners Committee

Name: **Fadi Hassan Ahmed El-Ghitani**

Thesis: **Wireless Network Traffic Modeling for Different Channel Holding Time Probability Distributions**

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Approved by:

Name and Title	Signature
1- Prof. Dr. Magdy Saeed El Soudani Professor in Electronics and Communication Dept., Faculty of Engineering, Cairo University	.... (Examiner)
2- Prof. Dr. Magdy Mahmoud Ebrahem Professor in Electronics and Communication Dept., Faculty of Engineering, Ain Shams University	.... (Examiner)
3- Prof. Dr. Hadya El Hennawy Professor in Electronics and Communication Dept., Faculty of Engineering, Ain Shams University	.... (Supervisor)
4- Associate Prof. Dr. Hesham El Badawy Network Planning Department, National Telecommunication Institute, Ministry of Communications & Information Technology	.... (Supervisor)

STATEMENT

This dissertation is submitted to Faculty of Engineering, Ain Shams University for the degree of Master of Science in Electrical Engineering (Electronics and Communications Engineering).

The work included in this thesis was carried out by the author at the Electronics and Communications Department, Faculty of Engineering, Ain Shams University, Cairo, Egypt.

No part of this thesis was submitted for a degree or a qualification at any other university or institution.

Name: Fadi Hassan Ahmed El-Ghitani

Signature:

Date: / /2012

To my mother who loved me, and to my father who inspired me

ABSTRACT

FADI HASSAN AHMED EL-GHITANI
MASTER OF SCIENCE THESIS, AIN SHAMS UNIVERSITY

The aim for the current work is to investigate and derive a model for the channel occupancy time. This had been done as well as the teletraffic performance assessment as well. Teletraffic performance (for both fixed and mobile systems) depends mainly on channel occupancy distribution and number of channels. Earlier assumptions assumed that the channel occupancy time can be modeled by exponential distribution. This will greatly simplify the problem and the system can be modeled as an M/M/c queueing system. However it has been proved that for the channel occupancy time to be strictly exponentially distributed, cellular dwell time and call duration should be exponentially distributed too. This is a very unrealistic assumption, for at least cellular dwell time distribution which depends on user mobility profile and cell geometry.

In this thesis, an algorithm for analytical modeling of mobile teletraffic performance is developed. This algorithm works for any cell dwell time distribution (distribution of time spent by users inside a cell). In order to validate the proposed analytical model, simulation model is built to compare its results to that of the analytical model. The impact of mobile system parameters such as cell radius and user speed is also investigated.

In order to test the proposed algorithm, blocking and forced termination probabilities were taken as performance metrics and were calculated under various traffic loads. To validate the obtained results, they were compared to that of a (DES) model. The results worked as expected, the more the number of phases used, the more accurate results obtained.

Key Words: Teletraffic performance, dwell time, heavy-tailed distribution, phase distribution, channel occupancy time

Thesis supervisors:

- Prof. Dr. Hadya Mohammed El-Hennawy
  Ain Shams University,
  Cairo, EGYPT.
- Associate Prof. Dr. Hesham Mohammed El-Badawy
  National Telecommunication Institute,
  Cairo, EGYPT.

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a	Demand for service
A	Offered traffic
A_c	Carried traffic
A_l	Rejected traffic
C	Number of channels available in a system or cell
C_h	Number of channels reserved for handoff calls only
$\bar{h}$	Average number of handovers per call
$p_{ij}\,(n)$	Single-step transition probability from state i to state j
P_B	Blocking Probability
P_{FT}	Forced Termination Probability
$P(n)$	Single-step transition probability matrix
$q_{ij}\,(t)$	Average transition rate from state i to state j
$Q(t)$	Average transition rate matrix
R	Cell radius
T_{Ch}	Channel Occupancy Time for handoff calls
T_{Cn}	Channel Occupancy Time for new calls
T_D	Cellular Dwell Time
T_{DN}	Cellular Dwell Time for new calls
T_S	Unencumbered session time
T_r	Residue of session time
V_{max}	User maximum speed
α	Maximum drift
λ	Average arrival rate
λ_h	Average arrival rate for handoff calls
λ_n	Average arrival rate for new calls
μ	Mean service rate
μ_C	Channel release rate
π	Steady-state probability distribution