

Bounds on the order fill rates for an inventory system of service tools

I.M.H.Vliegen

i.m.h.vliegen@tue.nl

*Department of Technology Management, Technische Universiteit Eindhoven,
P.O. Box 513, 5600 MB Eindhoven, the Netherlands*

A. Bušić

ana.busic@imag.fr

*INRIA Grenoble - Rhône-Alpes
51, Av. J. Kuntzmann, 38330 Montbonnot, France*

A. Scheller-Wolf

awolf@andrew.cmu.edu

*Graduate School of Industrial Administration, Carnegie Mellon University,
5000 Forbes Ave., Pittsburgh, PA 15213, USA*

G.J van Houtum

g.j.v.houtum@tue.nl

*Department of Technology Management, Technische Universiteit Eindhoven,
P.O. Box 513, 5600 MB Eindhoven, the Netherlands*

January 11, 2008

In this talk, we deal with the analysis of a single-location, multi-item inventory model for service tools. Multiple service tools are kept, with different stock levels, at the warehouse. Independent Poisson demand streams arrive at the warehouse requesting different *sets* of tools. Those tools from the requested set that are in stock are then released; they are in use for an exponential amount of time, after which they are returned together. (Requested tools that are not on stock are delivered via an emergency channel; for the warehouse they may be considered as lost sales.) Thus our model features coupled demands and coupled returns - sets of tools are released and returned together. We are interested in the order fill rates, i.e., the percentage of demands for which *all* requested tools are delivered from stock. As the Markov chain describing the original system is of extremely high dimension, we introduce two, more tractable, approximate models. By combining Markov reward theory and aggregation we prove that the order fill rates of these approximate models lead to a lower and an upper bound on the order fill rate in the original model.