Quantitative
Modeling
In
Parallel
Systems

Routing in the Presence of Breakdowns

Isi Mitrani
Computing Science Department
University of Newcastle
Newcastle upon Tyne, NE1 7RU, England

Paul E. Wright
Mathematical Sciences Center
AT&T Bell Laboratories
Murray Hill, NJ 07974-0636, USA

D W2.T1.5-5.v1

September 1993

Distribution Level: Public

Approved by: I. Mitrani

Abstract Jobs generated by a single Poisson source can be routed through N alternative gateways, modelled as parallel $M/M/1$ queues. The servers at those queues are subject to random breakdowns and repairs. When a breakdown occurs, all jobs present in the corresponding queue are lost; moreover, no incoming jobs are directed to that queue during the subsequent repair period. The marginal queue size distributions are determined by finding the roots of a polynomial inside the unit disk, and solving a set of simultaneous linear equations. In the case $N = 2$, it is also possible to find the equilibrium distribution of the numbers of jobs in the two queues, by a reduction to a Dirichlet boundary value problem on a circle.

The QMIPS Project: The QMIPS project is a collaborative research project supported by the CEC as ESPRIT-BRA project no 7269. It is being carried out by the following organisations: CWI (Amsterdam), EHEI (University of Paris V), Imperial College (London), INRIA (Sophia-Antipolis), University of Erlangen, University of Newcastle, University of Torino and University of Zaragoza.