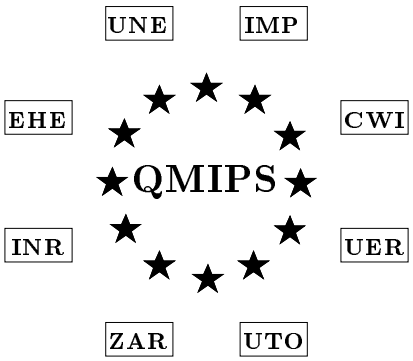

Quantitative
Modeling
In
Parallel
Systems

An Approximate Analysis of Asynchronous, Packet–Switched Buffered Banyan Networks with Blocking

Peter G. Harrison Afonso de C. Pinto
Dept. of Computing Imperial College
180, Queen's Gate, London SW7 2BZ, UK

D W2.T1.10-1.v1

22 September 1994

©IMP

Distribution Level: All partners

Approved by: Peter G. Harrison

Abstract An approximate algorithm is developed for the performance analysis of buffered, packet-switched, asynchronous networks with no feedback. We focus on banyan networks which are important in parallel computer architectures and telecommunication systems to illustrate our approach and our algorithm is tailored to this problem. The networks we consider are organised in a finite number of stages through each of which a task passes successively in its transmission. The components which forward messages in each stage are modelled independently as small subnetworks of queues; these components are crossbars in the case of banyan networks. Blocking can occur on several upstream paths preceding a full component and the inter–state blocking effect is taken into account iteratively, blocking probabilities being computed in terms of results of a previous step. The networks we consider may be non–homogeneous in that different servers may have different

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.

rates and the arrival processes need not be identical. We derive the queue length probability distribution of each switch from which performance measures, such as blocking probability, mean buffer occupancy and mean transmission time, follow.