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Quantitative
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Response Time Distributions in Packet–Switched Banyan Networks

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Abstract An approximation for the distribution of time delays experienced by tasks in finite buffered multistage interconnection networks is presented. We focus on asynchronous packet–switched banyan networks which are important in ATM telecommunication systems as well as in parallel computer architectures although our method is applicable to any feed–forward network. The networks we consider are organised in a finite number of stages through each of which a task passes successively in its transmission. The method presented considers successive pairs of switches in a task's path, the queue (output) joined on arrival at the second having length dependent on that which existed previously on arrival in first. The transient period between arrivals at successive nodes is modelled in two ways; by solving the appropriate Kolmogorov equations and by an approximation which considers the net change in the queue length at the second. The networks may be non–homogeneous in that different servers may have different rates and the arrival processes need not be identical. Numerical results are obtained for an range of network parameters and both analytical methods are compared with simulation results.

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