Broadcasting in bus interconnection networks

A. Ferreira* A. Goldman vel Lejbman** S. W. Song***

Abstract. In this paper we study parallel architectures where the communication means are constituted *solely* by buses. These promising architectures can use the power of bus technologies, providing a viable way to interconnect much more processors in a simple and efficient manner. We study the *hyperpath*, *hypergrid*, *hyperring*, and *hypertorus* architectures, which are the bus-based versions of the well used point-to-point interconnection networks. We give optimal algorithms for broadcasting a message from one processor to all the others in such architectures, using a tool called *simplification*.

1 Introduction

Point-to-point interconnection networks are commonly used in distributed memory multiprocessor systems. Such interconnection schemes frequently cause serious communication bottlenecks, thus motivating the investigation of alternate ways to interconnect the processors of a MIMD multiprocessor system. One promising scheme uses multiple bus systems to improve the communication efficiency. In particular, this paper studies interconnection schemes constituted solely by buses, that provide a viable way to connect more processors in a simple and efficient manner. A desirable feature of the multiple bus architecture is the capability to expand. Hence, *bus interconnection networks* (*BIN*s, for short) represent an important issue in the design massively parallel computers, where full connectivity is clearly not possible.

Previous work Point-to-point networks are usually represented by a graph, with processors modeled by nodes and communication links modeled by edges. *BIN*s are best modeled by a *hypergraph* [3], in which an edge is a subset of nodes. Each bus in the network is thus represented by an edge of the hypergraph [4, 17]. Some previous works proposing models and new classes of interconnection networks for massively parallel computers include the following. In [15], Scherson

* CNRS - Laboratoire de l'Informatique du Parallélisme, École Normale Supérieure de Lyon, 46, Allée d'Italie, 69364 Lyon Cédex 07 - France. Partially supported by the PRC PRS and ANM of the French CNRS.

** Department of Computer Science, Institute of Mathematics and Statistics, University of São Paulo, C.P. 20570 - São Paulo, SP 01498-970 - Brazil. Supported by FAPESP - Proc. No. 92/3991-0

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