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Efficient Route Optimization using Distance Matrices for Generation of Latin Square

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Abstract: Distance matrices are used for measuring the distance between two matrices. Using Distance matrices we can generate a Latin square which is also called as Sudoku code. Latin squares have a variety of different practical applications, for example they can be used to code messages, design tournaments or generate magic squares. The prime objective is to investigate the baseline multistage interconnection network and to measures the distance for their applicability to generate a Latin square. It is to identify, how a distance measure can be chosen, either offline or online again which distance measure take more time to compute. In detail, to show that the selection of distance measure can be decided by its algorithm complexity and time required to compute.

Keywords: Efficiency, Time to execute, Cost, Latin square, Permutation.

1. INTRODUCTION

High-performance interconnects are receiving an increasing amount of attention from the computer industry recently as interconnects are becoming a limiting factor to the performance of modern computer systems. This trend will even continue in the near future as technology improves. In this paper, we will focus on routing permutations in a type of switch-based interconnect.

Adopting an (multistage interconnection network) MIN in a parallel or distributed system enables processors to send their messages concurrently. However, routing must be carefully handled so that there is no conflict during message delivering. In general, there are two types of conflict-free routings in an MIN: routing with link-disjoint paths and routing with node-disjoint paths. Link disjoint paths imply that no two different message paths share the same link in the network at a time, which is a mandatory requirement for routing. Node-disjoint paths imply that no two different message paths pass through the same switch in the network at a time. In this paper proposal, the attempt will be made to optimize the efficient path using distance matrices and latin square. A distance matrix is square matrix (two-dimensional array) containing the distances, taken pairwise, between the elements of a set. Depending upon the application involved, the distance being used to define this matrix may or may not be a metric. If there are N elements, this matrix will have size n×n. In graph-theoretic applications the elements are more often referred to as points, nodes or vertices and a latin square is an n × n array filled with n different symbols, each occurring exactly once in each row and exactly once in each column This paper, we present that an arbitrary permutation can be realized in a baseline (or reverse baseline) network with node-disjoint paths in four passes.

2. LITERATURE REVIEW

From the rigorous review of related work and published literature, it is observed that many researchers have designed a optimization of efficient route on different type MIM for example banyan, omega, baseline etc. we will consider baseline network.

I A parallel routing algorithm on recursive cube of rings networks employing Hamiltonian circuit Latin square

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Recursive cube of rings (RCR) networks can be widely used in the design and implementation of parallel processing architectures. In this paper, we investigate the routing of a message on RCR networks that is a key to the performance of this network. We would like to transmit k+1 packets from a source node to a destination node simultaneously along paths on RCR networks, the ith packet will traverse along the ith path (1< i<k+1). In order for all packets to arrive at a destination node quickly and securely, the ith path must be node-disjoint from all other paths. For construction of these paths, employing Hamiltonian circuit Latin square (HCLS), we present $O(n^2)$ parallel routing algorithm on RCR networks.

II Optimal All-to-All Personalized Exchange in Self-Routable Multistage Networks

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All-to-all personalized exchange is one of the most dense collective communication patterns and occurs in many important applications in parallel computing. Previous all-to-all personalized exchange algorithms were mainly developed for hypercube and mesh/torus networks. Although the algorithms for a hypercube may achieve optimal time complexity, the network suffers from unbounded node degrees and thus has poor scalability in terms of I/O port limitation in a processor. On the other hand, a mesh/torus has a constant node degree and better scalability in this aspect, but the all-to-all personalized exchange algorithms have higher time complexity.

III Routing Permutations on Optical Baseline Networks with Node-Disjoint Paths

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Permutation is a frequently-used communication pattern in parallel and distributed computing systems and telecommunication networks. Node-disjoint routing has important applications in guided wave optical interconnects where the optical “crosstalk” between messages passing the same switch should be avoided. In this paper, we consider routing arbitrary permutations on an optical baseline network (or reverse baseline network) with node-disjoint paths.

IV The Selector-Tree Network: A New Self-Routing and Non-Blocking Interconnection Network

Tripti Jain, Klaus Schneider, and Anoop Bhagyanath Department of Computer Science University of Kaiserslautern, Germany

This paper introduces with the selector-tree network a new self-routing and non-blocking interconnection network: The n× n network is capable of routing any permutation of its n inputs to its n output ports and is therefore non-blocking, and thus, more powerful than - permutation and Banyan networks. In contrast to other non-blocking interconnection networks like the Beneš network, our selector-tree network does not need an additional setup time since the target addresses of the connections directly define the conflict-free routes so that the network is self-routing.

3. PROBLEM DEFINITION

By observing different method for calculating the shortest path they deviate from actual result. The performance analysis of distance matrices and Latin square may bring the required result.

In this paper work, the attempt will be made to investigate the routing of a message on the network that is a key to the performance of the network. The aim of paper is to find an efficient and effective path in route from a source node to a destination node. For construction of these paths or routes, employing the Latin Square, a special class of (n × n) matrices is suggested O(n2) parallel routing algorithm on baseline networks, also can be used to improve performance.

4. PROPOSED WORK

For routing one network is required where we can route the data. In this case we will consider multistage interconnection network for routing the data. In multistage interconnection network there are number of networks for example banyan, omega, baseline etc. we will consider baseline network.

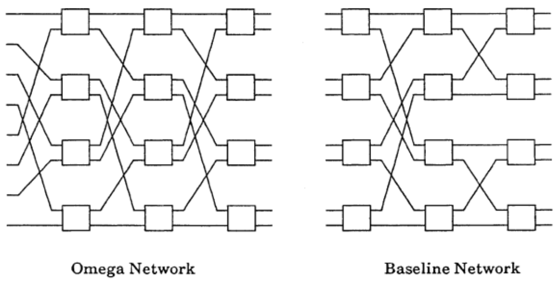

Fig. 1 structure of omega and baseline network

Permutation is used in baseline network for one-to –one mapping of input to output. In baseline network routing is done by self routing and Latin square is used to remove the deadlock / conflict in routing. A permutation is a one-to-one mapping between the network inputs and outputs. For an n×n network, suppose there is a one-to-one mapping ρ which maps input i to output d_i (i.e. $\rho(i) = d_i$), where $d_i \in \{0, 1, \dots, n-1\}$ for $0 \le i \le n-1$, and $d_i \neq d_j$. Let

$$\rho = \begin{pmatrix} 0 & 1 & \dots & n-1 \\ d_0 & d_1 & \dots & d_{m-1} \end{pmatrix}$$

denote this permutation.

In baseline network routing is done by self routing and Latin square is used to remove the deadlock / conflict in routing. The below Fig. 2 shows the construction of latin square. The set of basic permutations $\Phi_i (1 \le i \le m)$ and the Latin Square are closely related to the class of self-routable multistage networks under consideration. In fact, we can generate admissible permutations for the class of networks in a generic way to form the Latin Square needed in all-to-all personalized exchange algorithm in Fig. 2. To do this, we can simply let each stage permutation σ_i be Φ_i or I. Recall that Φ_i is the permutation (0, 1) (2, 3) . . . (n-2, n-1) and I is the identity permutation. Accordingly, all switches in each stage of the network are set to either cross or parallel. We will apply the algorithm Latin Square to actually construct this Latin Square.

5. TIME COMPLEXITY AND COMPARISONS

In this section, we first summarize the time complexity of the proposed work for the class of multistage networks. Constructing a Latin Square using the offline algorithm Latin Square described takes $O(n^2)$, which is also optimal

for this problem. Note that the off-line Latin Square construction algorithm needs to be run only once at the time a network is built, and the Latin Square associated with the network can be viewed as one of the system parameters. Thus, the time complexity of this proposed method is not included in the communication delay.
The newly proposed method for the class of self-routing multistage networks achieves the minimum time complexity for all-to-all personalized exchange, all-port model. Due to its shorter communication delay and better. On the other hand, in terms of node degree, which reflects the scalability of a network in terms of I/O port limitation. By observing different method the proposed work considered in this paper will be comparable to (in fact, better than) a mesh or a torus, while a hypercube has a node degree of log n. Thus, a multistage network could be a better choice for implementing all-to-all personalized exchange.

6. CONCLUSION

In this paper, we have presented an efficient route optimization work using distance matrices for generation of Latin square, self-routable multistage networks, such as baseline. The new proposed work is based on a special Latin Square, which corresponds to a set of admissible permutations of a multistage network and can be viewed as a system parameter of the network. We have given the methods for constructing the Latin Square. The time complexity for an n × n network, which is optimal for all-to-all personalized exchange. By taking advantage of fast setting of self routable switches and the property of single input/output port per processor in a multistage network, we believe that a multistage network could be a better choice for implementing all-to-all personalized exchange due to its shorter communication latency and better scalability.

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