Abstract

In this thesis we present results of our investigations pertaining to multiconnected distributed loop interconnection network (MCDL) topology. We focus on the following key issues of MCDL in both the shared medium and direct network applications.

1. Algorithms for computing inter node distance, diameter and average path length.
2. Packet transfer delays in MCDL when used in shared medium applications with multiple token media access protocol.
3. Routing algorithms under node and edge faults when the faulty component location is known globally or in the neighbourhood only.
4. Deadlock-free routing algorithms using virtual channels in direct network multicomputer interconnection applications.

The inter node distance, diameter and average path length in MCDL are important factors in the design of an interconnection network. It is an open problem to obtain a closed form expressions for these parameters in MCDL. Although we also do not have a closed form, we give algorithms to compute these parameters which t run in a time that is independent of diameter and number of node in MCDL. From these algorithms we tabulate optimal loops, their diameters and average path lengths. Some properties of these optimal loops are conjectured from these results. We also discuss and try to explore why these parameters have no closed form expressions.

In the study of multiple token media access communication protocol, we consider three routings: *hop to loop*, *loop to hop* and *no switching*. In these three routings, packet transfer delays are obtained analytically for different values of hop sizes using queueing theory techniques. These results are compared with single token and multiple ring delays. This study shows the effect of hop size of MCDL and intermediate stage queueing in the media access protocol. We have developed a discrete event simulator to verify our analytic results and assumptions there in.

While developing algorithms for the fault-tolerant routing in MCDL, we consider node and edge faults. We consider the cases that the address of the faulty node or edge is either globally available to all the nodes in MCDL or only to the nodes with in the neighbourhood of the fault. We conclude that the shortest path increases is by no more than two in either of the cases of the fault knowledge.

We study MCDL in wormhole routed direct networks applications. In wormhole routing, packets are forced to travel through intermediate nodes which can lead to *dependency* loops and consequently *deadlocks*. Deadlocks in direct networks are avoided using *virtual channels*. We consider *directed ring*, *undirected ring* and *MCDL* topologies, and first show that they have cyclic channel dependencies. Later we introduce virtual channels to remove cyclic channel dependencies. Then the hop to loop and loop to hop routings in MCDL are shown to be deadlock-free.