Lecture 23 (Routing)

koi bhi chiz ratna bilkul bura nahi hai, quote me on this - SR Sarangi

1 Turn Graph

1. Both CDGs and RDGs lose orientation information of the channels
2. Consider any path C in the channel graph
3. The TG contains all the nodes and channels belonging to C
4. This preserves the orientation of the channels
5. TG does not contain any other channels
6. We insert new nodes called channel node in middle of each edge/channel
7. Cycle in channel nodes of TG $\iff$ cycle in CDG

1.1 Properties

1. Every edge in the CDG translates to either a set of collinear nodes or turns in the TG
2. Every cycle in CDG is a cycle in TG
3. Every cycle in the CDG can be translated to a sequence of straight paths and turns in the corresponding TG

1.1.1 Aim

From above we get that ensuring that there are no cycles in routing algorithm ensures that there will be no deadlock

2 Cycle-Free Routing Algorithms

2.1 Dimension-Ordered Routing

1. First move along one axis, then the other and so on
2. However, no path diversity
3. Cannot handle congestion

2.2 Oblivious Routing (Valiant's Algorithm)

1. Select a random point P
2. Perform Dimension-Ordered routing from A to P and then from P to B
3. Low congestion because of high path diversity
4. However, the routes can be very long

2.3 Minimally Oblivious Routing

1. Restrict the domain of P around B
2. Reduces path diversity

2.4 Adaptive Routing

1. Out of all possible turns, use maximal subset of turns such that they can never form a cycle
2. For each cycle, remove one turn

2.4.1 Examples

1. West-first
2. North-last
3. Negative-first

2.5 Data Line based Routing

1. Explained for 2 VCs
2. Assume that each VC has its own deadlock free channel
3. Inject packet into VC0
4. If it crosses the "date line", it moves to VC1

3 Causes for Deadlock

1. MutEx
2. Circular wait
3. No preemption
4. Hold and wait