

# MIM - Modular Memory Mechanisms

17-01-2022

## Communication in parallel processing, interaction networks & their properties

Performance: is affected due to communication speed

↳ i.e. speed of  
computation in MIM

Speed: It has limits due to complexity of networks  
& due to switching speed of the devices.

The performance of parallel computing system also depends  
on following:

① Routing: It is controlled by routing algorithms.

② Flow control: it is done by flow control  
algorithms.

③ Network topology: It is not controlled by  
algorithms, but can change dynamically.

out of the above factors, (1) & (2) are built-in the system.

The (3) is chosen at user level, & can be changed dynamically.

Consider the following network with four processors, connected through links/edges.



When edges 4, 5, 6 are removed, the remaining are 1, 2, 3 which converts into a Tree topology.

Modeling of a network

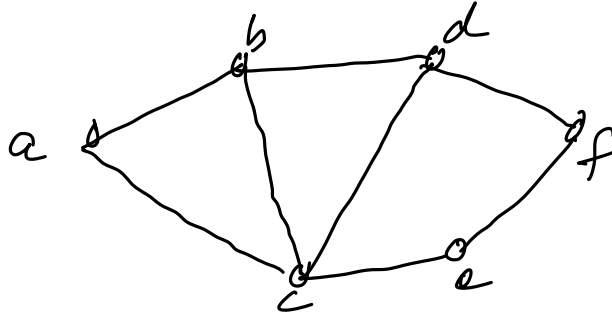
can be modeled as a graph

$$G = (V, E)$$

nodes/vertices/processor/  
members

Edges/Channels

An Example of a distributed & parallel system:



$a, b, \dots, f$ : Processes/  
memories

$(a,b), (a,c), \dots$   
are links.

We can decide certain properties of  
these interconnection networks, when modeled as  
a graph.

① - degree of a node ( $d$ ) = ? no. of connections

② - if all nodes have same degree  $\Rightarrow$  Regular Network

③ - if view of network is same from all nodes, symmetric network

④ - hop count  $\Rightarrow$  no. of jumps to reach from source to destination in a graph (network).  
 $= 2$

$L_{max}$  = max hop counts between two nodes  
(min. of all lengths)

$L_{avg}$  = av. no. of hop counts

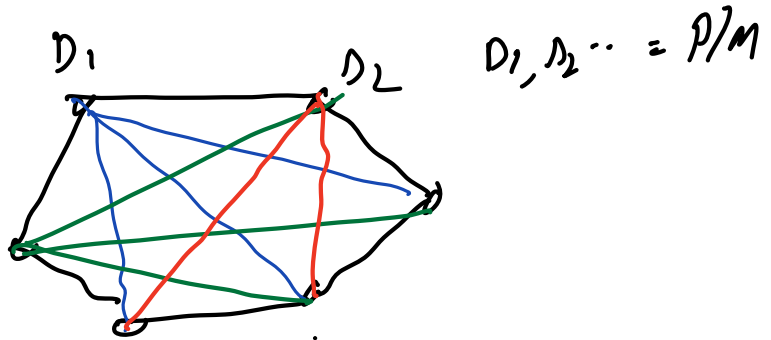
$l_{max} = \text{diameter of the graph}$

⑤ → diversity of the path?  
(no. of options are there to choose the paths)

⑥ Scalability - no. of devices P/M can be added, without much sacrifice of the performance.

### Networks

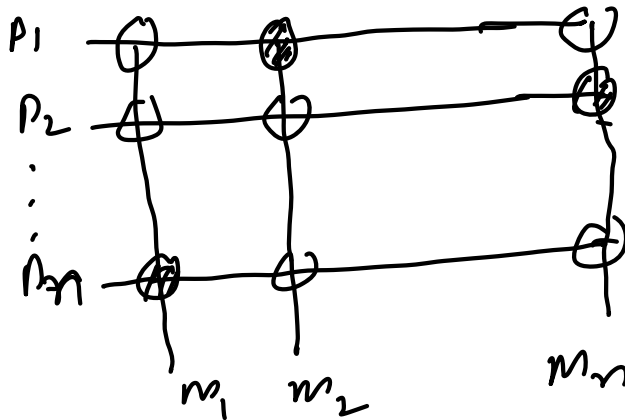
① - Direct network



n no. of components  $\Rightarrow$  paths

$$\frac{n \times (n-1)}{2} = O(n^2)$$

(2) Indirect - Switches  ON  
 OFF



$n \times n$   
 $1000 \times 1000$   
 $= 10^6$   
connections

✓ fully connected crossbar network

