OUTLINE

From the book:

1. Overview
2. Interconnection Networks and Parallel-Machine Models
3. Single-Stage Network Comparisons
4. Partitioning Single-Stage Networks
5. Multistage Cube/Shuffle-Exchange Networks
6. Data Manipulator Network

Additional network material:

Dynamic Redundancy Network

Parallel Algorithms

Parallel Machine Case Studies

Associative Processing

Interconnection Networks for Parallel Processing

Chap. 1: Overview

Large-Scale: $\sim 2^6$ to 2^{16} processors

Parallel Processing: collection of computing devices working together on a single task } everything in one room, not a LAN

"Need for Speed"

- computational complexity
  Ex. nuclear simulations, 3-D
- large data sets
  Ex. satellite images, $4K_{\text{pixels}} \times 4K_{\text{pixels}}$
- time requirements -
  Ex. weather; defense

Networks:

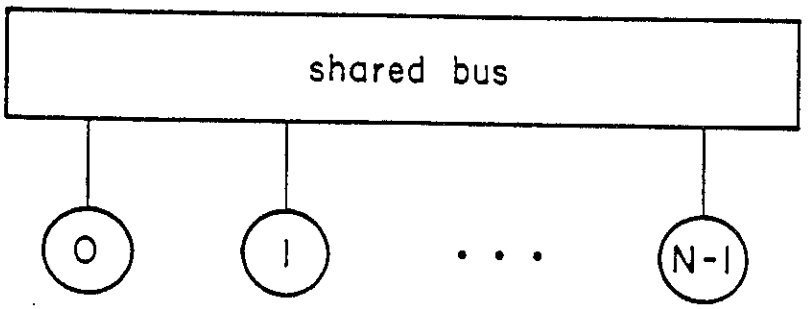
vehicle for processors and memories to communicate with each other in order to do computation

One extreme -

single shared bus

cheap: 0(N) cost

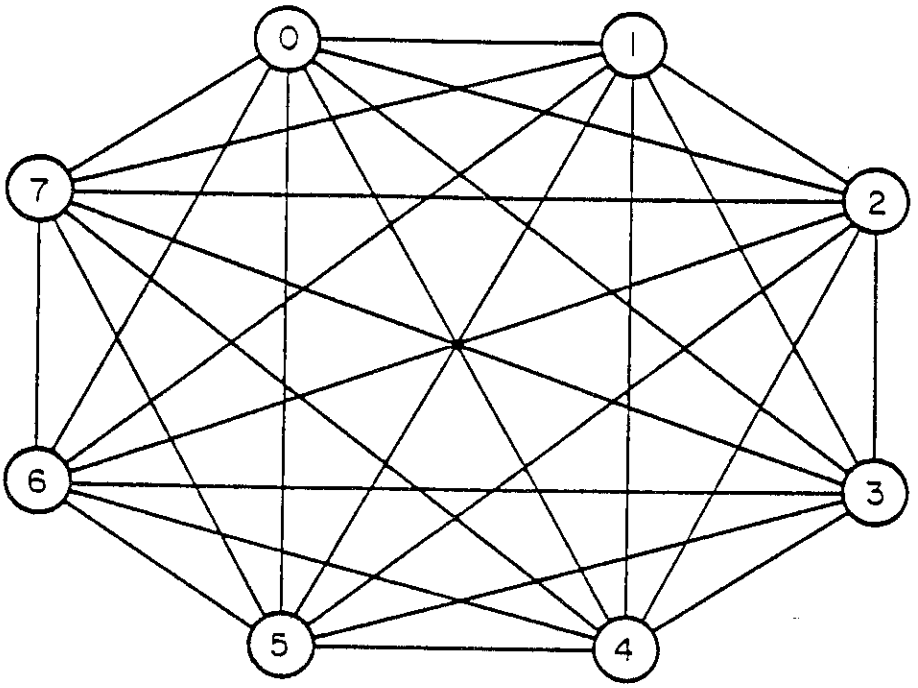
speed: 0(N) if all processors send
want proc. i $\rightarrow$ proc. i+1 $\forall$i



for N large and somewhat frequent communication — too slow

Other extreme —

completely connected
each proc. connected to all others



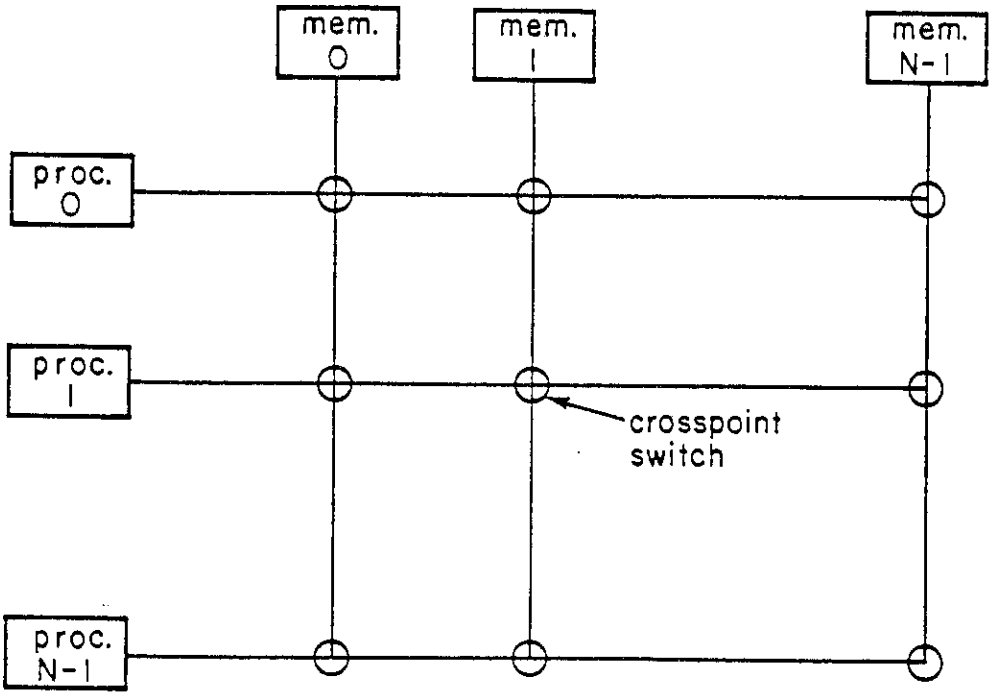
speed: 0(1) constant (fast)

cost: $0(N^2)$ $N*(N-1)$ links

for large N too expensive

Alternative to completely connected —

crossbar network — each cross pt. switch can form connection



Can connect any proc. to any unique memory simultaneously

speed: $0(1)$ constant
cost: $0(N^2)$ # switches

for large N too expensive

Discuss important class of networks based on

both single + multi-stage
- PM2I (Plus–Minus 2^i)
- Cube
- Shuffle-Exchange

Illiac (nearest neighbor)

Network designs using above:
(references in book)
data manipulator
ADM
IADM
gamma
omega
perfect shuffle
mesh
hypercube
generalized cube
extra stage cube
SW-banyan
delta
flip
indirect binary m-cube
Benes
baseline

Machine designs using above:
(references in book for most)
MPP
DAP
CLIP4
Illiac IV
Novel Multiproc. Array
Omen
SIMDA
RAP
STARAN
DISP
CHoPP
PASM
Ultracomputer
data flow machines
IBM RP3
NCUBE
Intel cube
cosmic cube
BBN butterfly
Connection Machine

∴ This class of networks is important