10.Introduction to Data-Parallel architectures

- SIMD {Single Instruction Multiple Data}
- 10.1 Introduction
- 10.2 Connectivity
- 10.3 Alternative architecture

- e.g. add: (c1=a1+b1), (c2=a2+b2), (c3=a3+b3)

TECH
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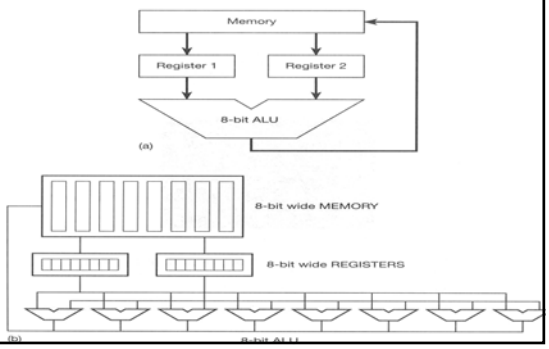
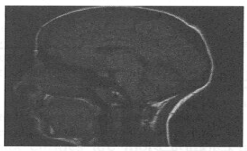
Data-parallel computation (bit parallel)



Application of Data-parallel Architectures: One data entity processed by one PE

64	16	4	2	1	0	0	0
8	32	8	4	2	1	0	0
8	16	64	16	8	4	2	1
2	4	8	32	8	4	2	1
2	4	8	16	64	16	8	4
0	1	2	4	8	32	8	4
0	1	2	4	8	16	64	16
0	0	0	1	2	4	8	32

(a)

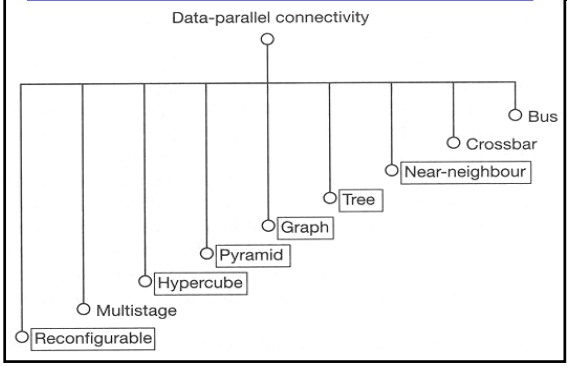


(b)

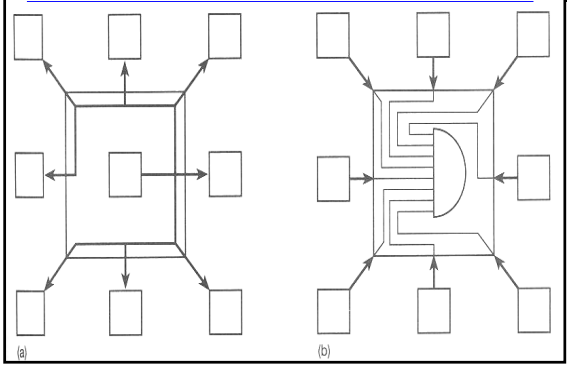
Doe	Joe	M	36	B.Sc.	30,000	1982	1991
Peterson	Mary	F	42	M.Sc.	42,000	1977	–

(c)

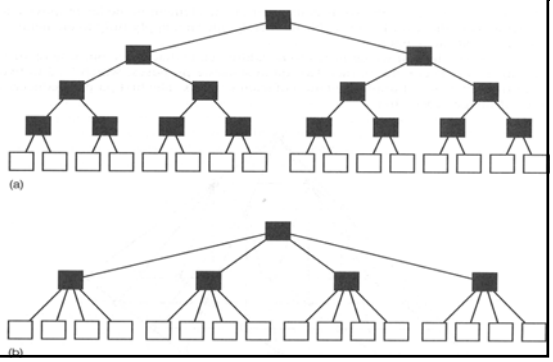
Mapping Problem space into Architectural Space: Data entity onto PE (1-to-1 mapping)



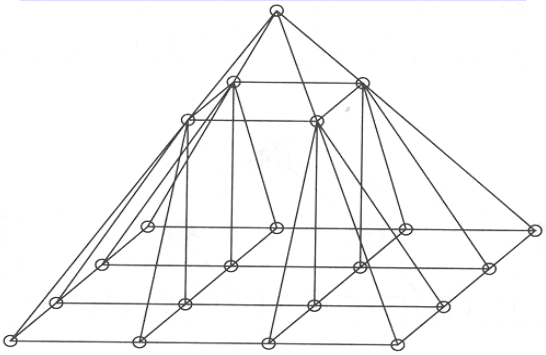
Near-neighbor connectivity (2-D: Mesh)



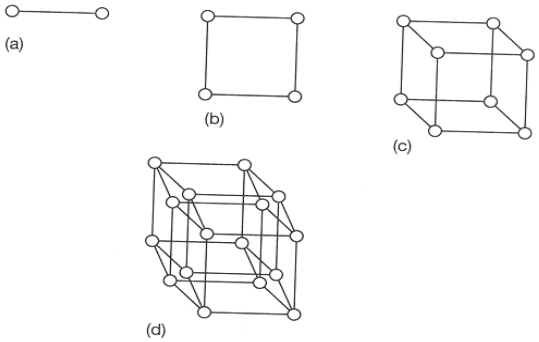
Tree: 2-D hierarchy



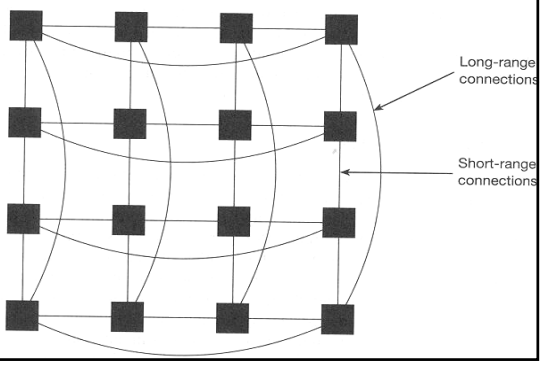
Pyramid: 3-D hierarchy



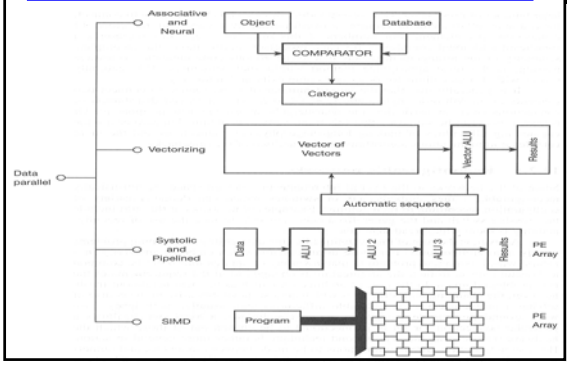
Hypercube: 2^N nodes in N dimension



Hypercube: 4-D
Long and short-range connections



Data-parallel approaches



Principal characteristics of data-parallel systems

Property	*SIMD*	*Systolic*	*Pipeline*	*Vectorizing*	*Neural*	*Associative*
Programmability	Good	Fixed	Fixed	Good	Poor	Good
Availability	Good	Poor	Poor	Good	Poor	Poor
Scalability	Good	Fixed	Fixed	Fixed	Fixed	Good
Applicability	Wide	Narrow	Narrow	Wide	Narrow	Wide