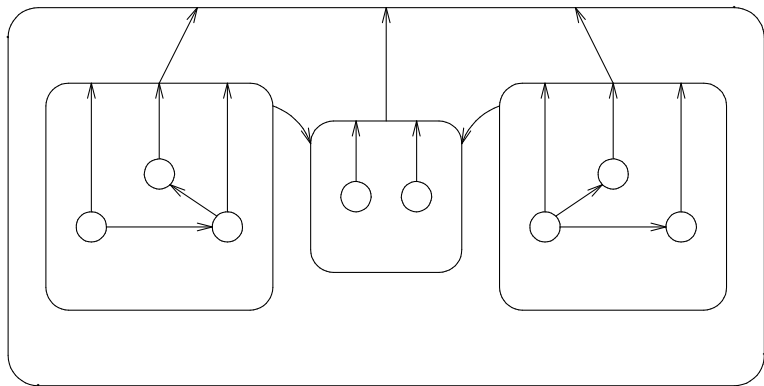


Multigraphical Membrane Systems revisited

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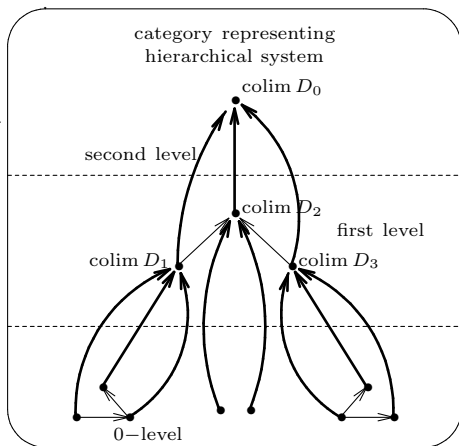
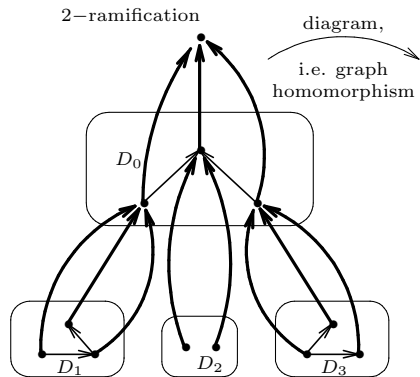
Multigraphical membrane systems

Multigraphical membrane system corresponding to 2-ramification:



nodes—membranes, edges—objects,
neurons—membranes, synapses—objects.

Categorical semantics



the fat arrows are colimiting injections,
i.e. the elements of colimiting cocons,
respectively

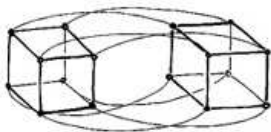
Thiel's presentation of multidimensional hypercubes

standard representation
of a 4D hypercube, a
cube within a cube:

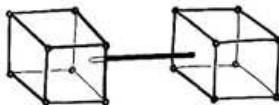


4-D

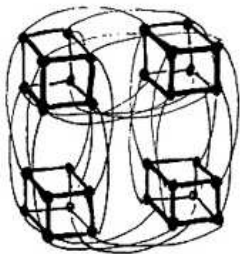
I unfolded the standard
representation into this form ...



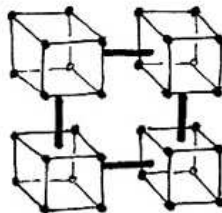
... and then simplified it into this
symbolic representation



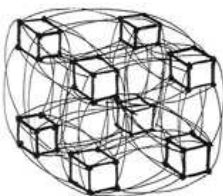
4th dimension of a hypercube



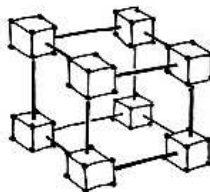
5-D cubes



5th dimension of a hypercube



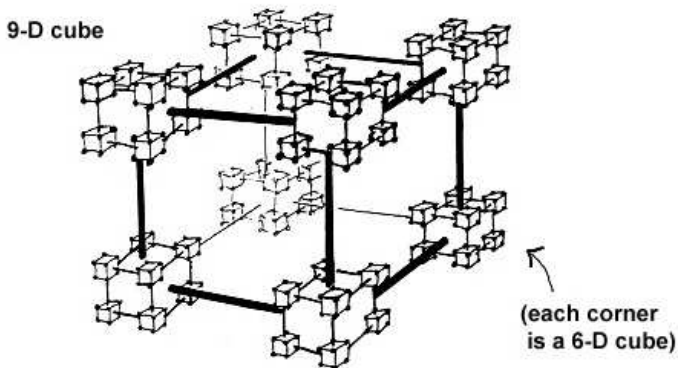
6-D cubes



6th dimension of a hypercube

9th dimension of a hypercube

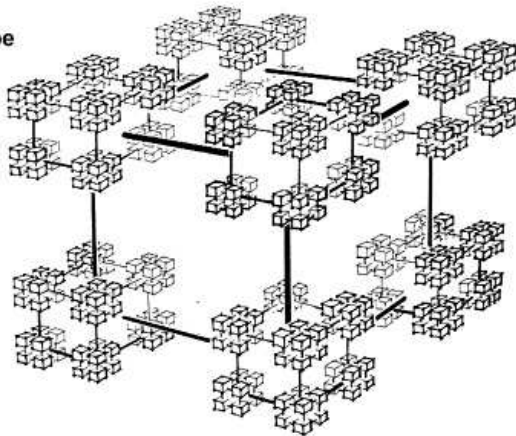
A 9-D hypercube is a cube of 6-D hypercubes:



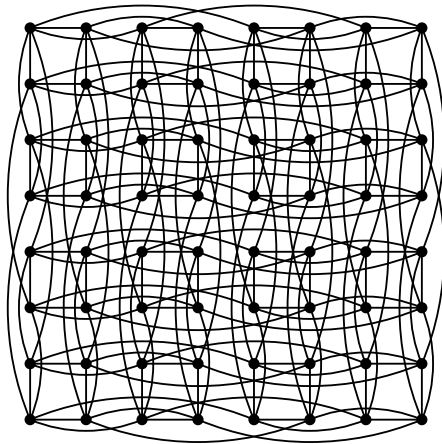
12th dimension of a hypercube

and a 12-D hypercube is a cube of 9-D hypercubes:

12-D cube



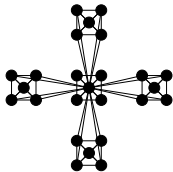
A large cube whose corners are smaller cubes can be treated as a large membrane, where smaller cubes are treated as smaller membranes contained in this large membrane.



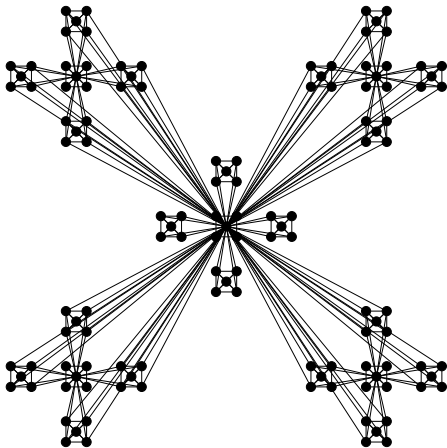
A hypercube connects $N = 2^n$ small computers, called nodes, through point-to-point communication channels in the Cosmic Cube. Shown here is a two-dimensional projection of a six-dimensional hypercube, or binary 6-cube, which corresponds to a 64-node machine.



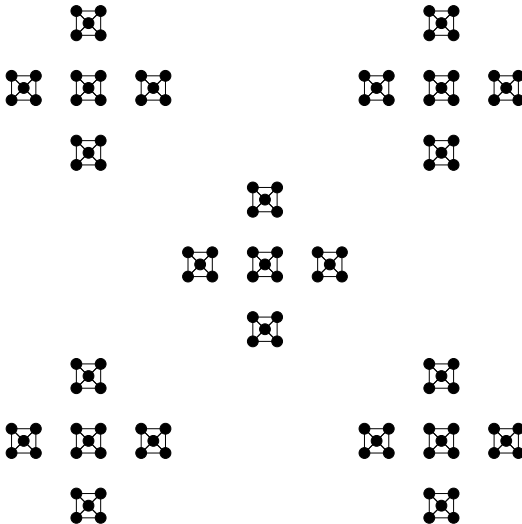
(a) $n = 0, N = 5$



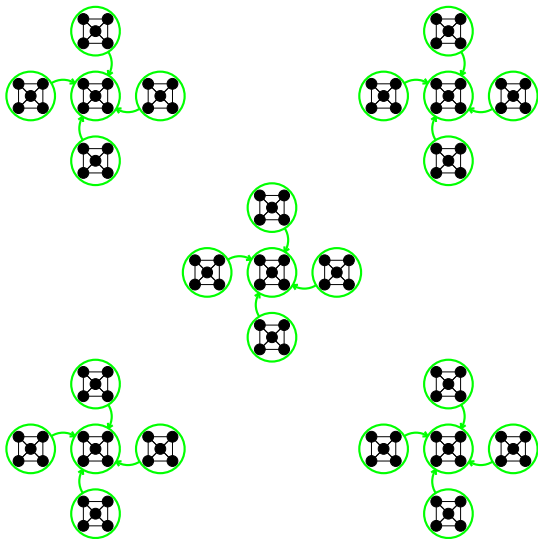
(b) $n = 1, N = 25$



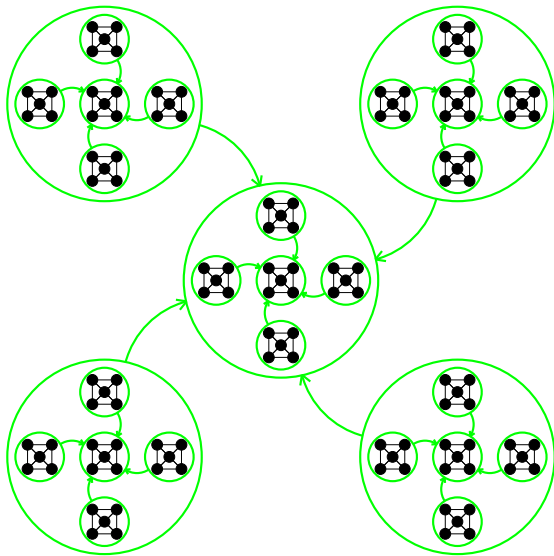
(c) $n = 2, N = 125$



Extracting a multigraphical membrane system from hierarchical networks



Extracting a multigraphical membrane system from hierarchical networks



Extracting a multigraphical membrane system from hierarchical networks

The arcs (links) from the peripheral nodes of each cluster to the central node of the original cluster are compressed to the arcs between non-elementary membranes corresponding to the clusters. The skin membrane (root) is omitted.