

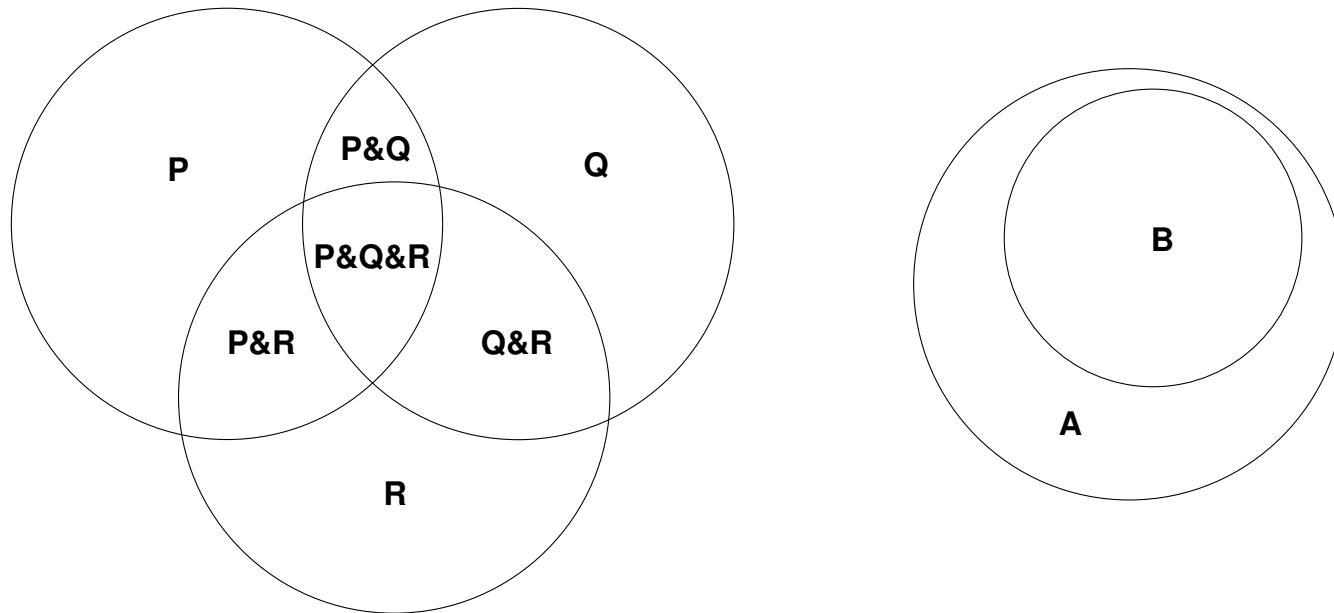
Statecharts aka Harel Charts

- visual formalism
- application of higraphs
- diverse applications;
in particular: concurrent, reactive systems behaviour modelling

Visualising Information

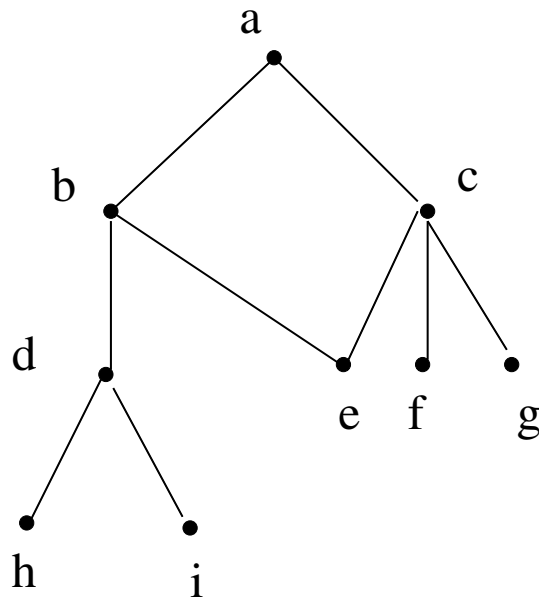
- complex
- non-quantitative, structural
- topological, not geometrical
- Euler
 - Venn diagrams (Jordan curve: inside/outside): enclosure, intersection
 - graphs (nodes, edges: binary *relation*); hypergraphs

Venn diagrams, Euler circles

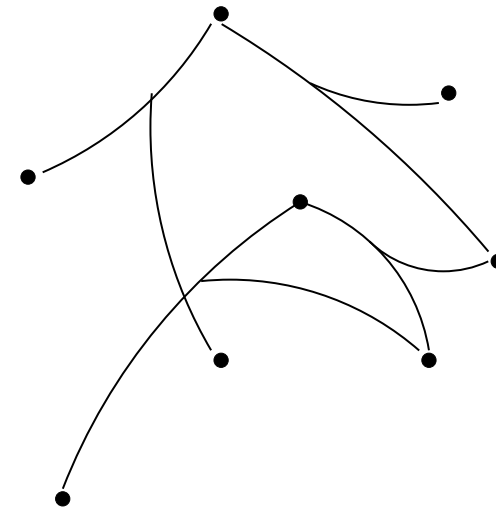


- *topological* notions:
enclosure, intersection, exclusion
- Used to represent *mathematical set operations*:
union, intersection, difference

Hypergraph



a graph



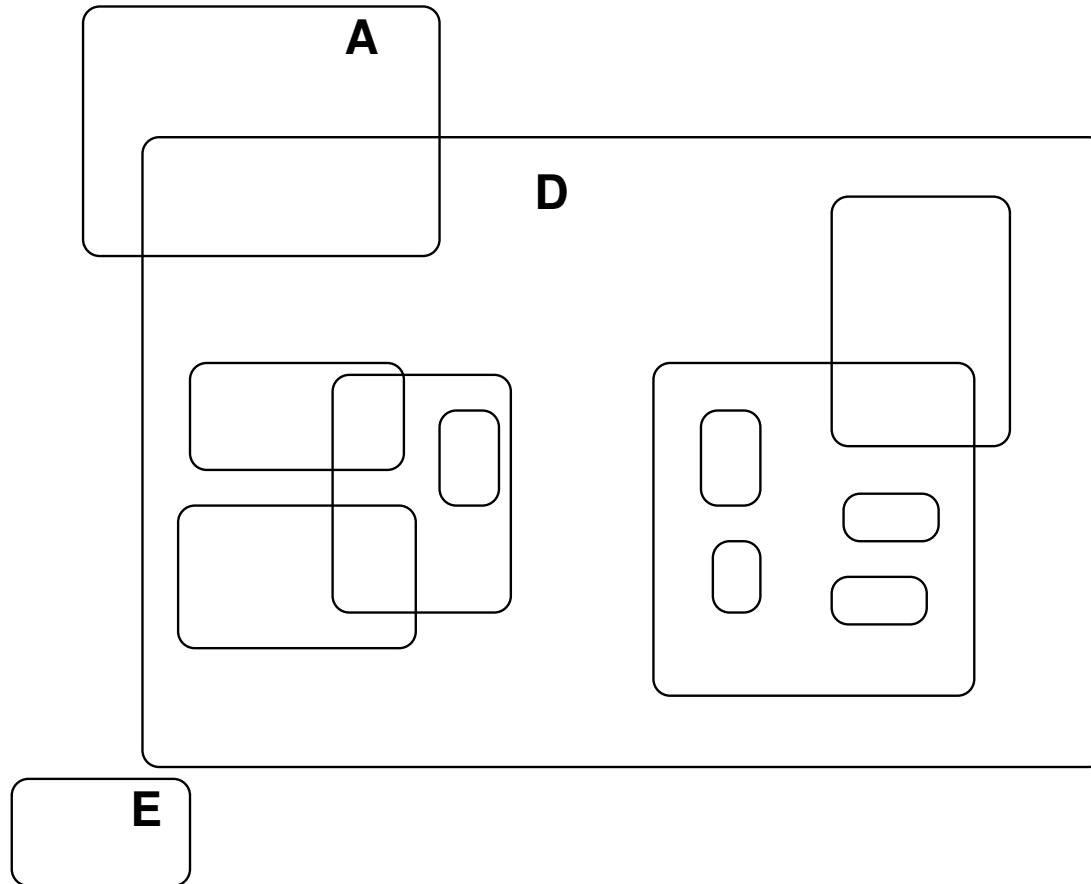
a hypergraph

- *topological* notion: connectedness
- Used to represent *relations* between sets.
- Hyperedges: non longer binary relation ($\subseteq X \times X$):
 $\subseteq 2^X$ (undirected), $\subseteq 2^X \times 2^X$ (directed).

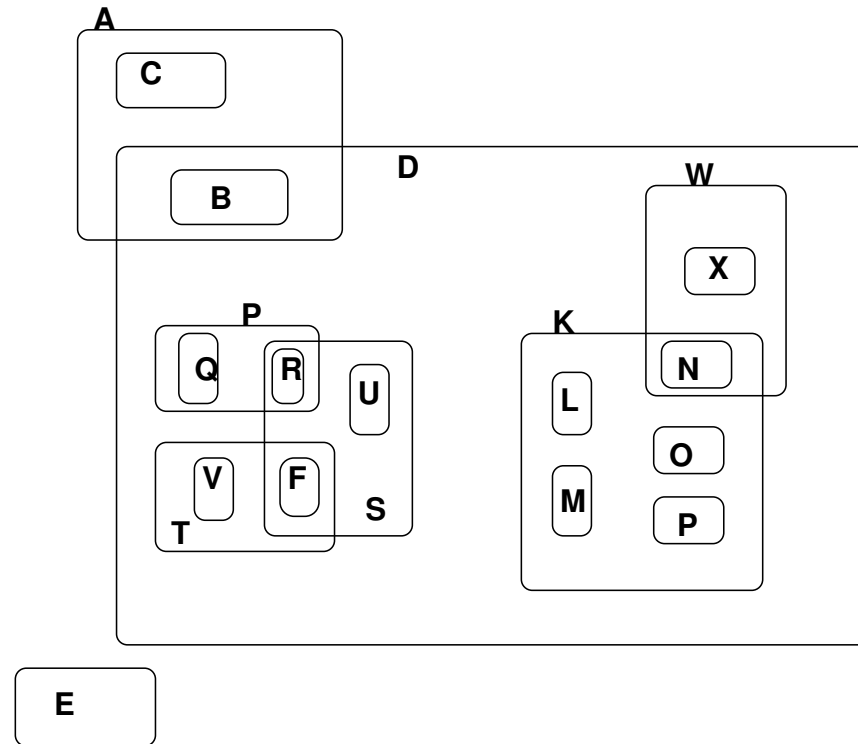
Higraphs: combining hypergraphs and Venn diagrams

- sets + cartesian product
- hypergraphs

Blobs: set *inclusion*, not membership

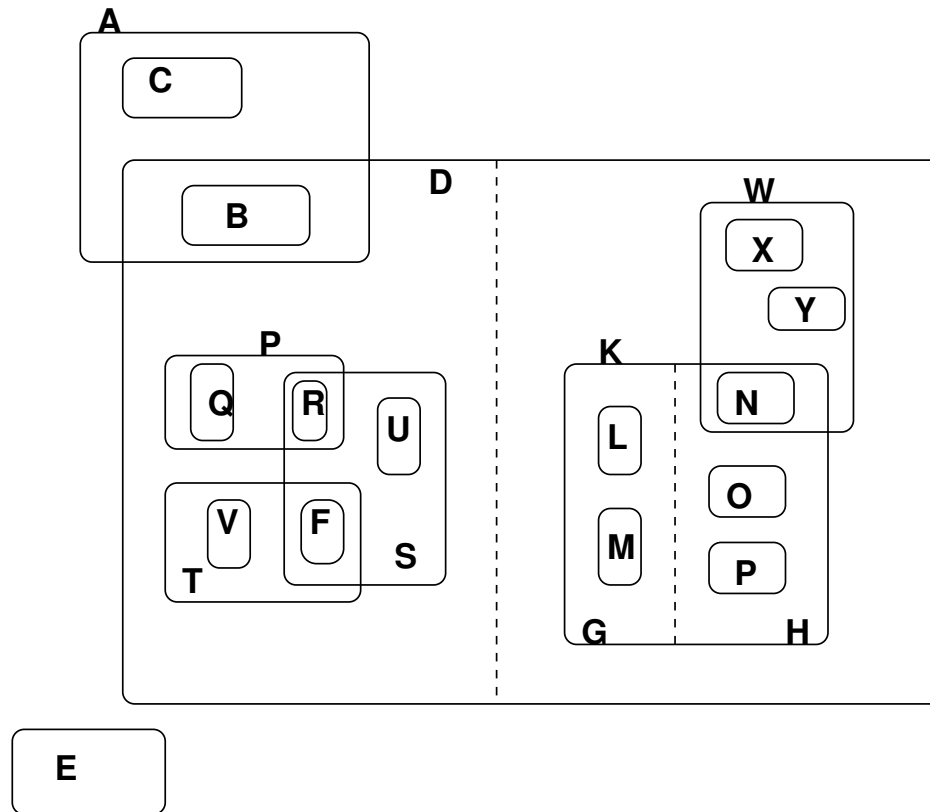


Unique Blobs (atomic sets, no intersection)



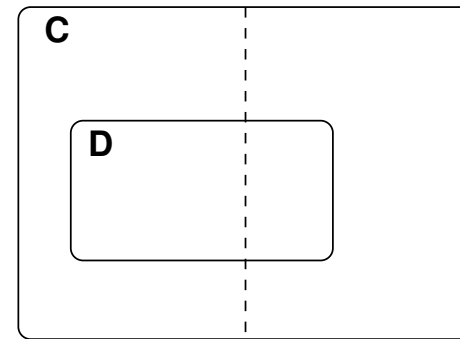
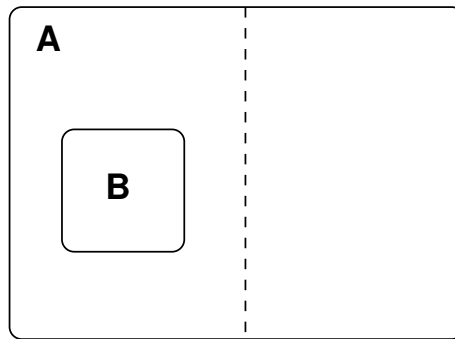
- empty space has no meaning, intersection must be identified
- atomic blobs are identifiable sets
- other blobs are union of enclosed sets

Unordered Cartesian Product: Orthogonal Components

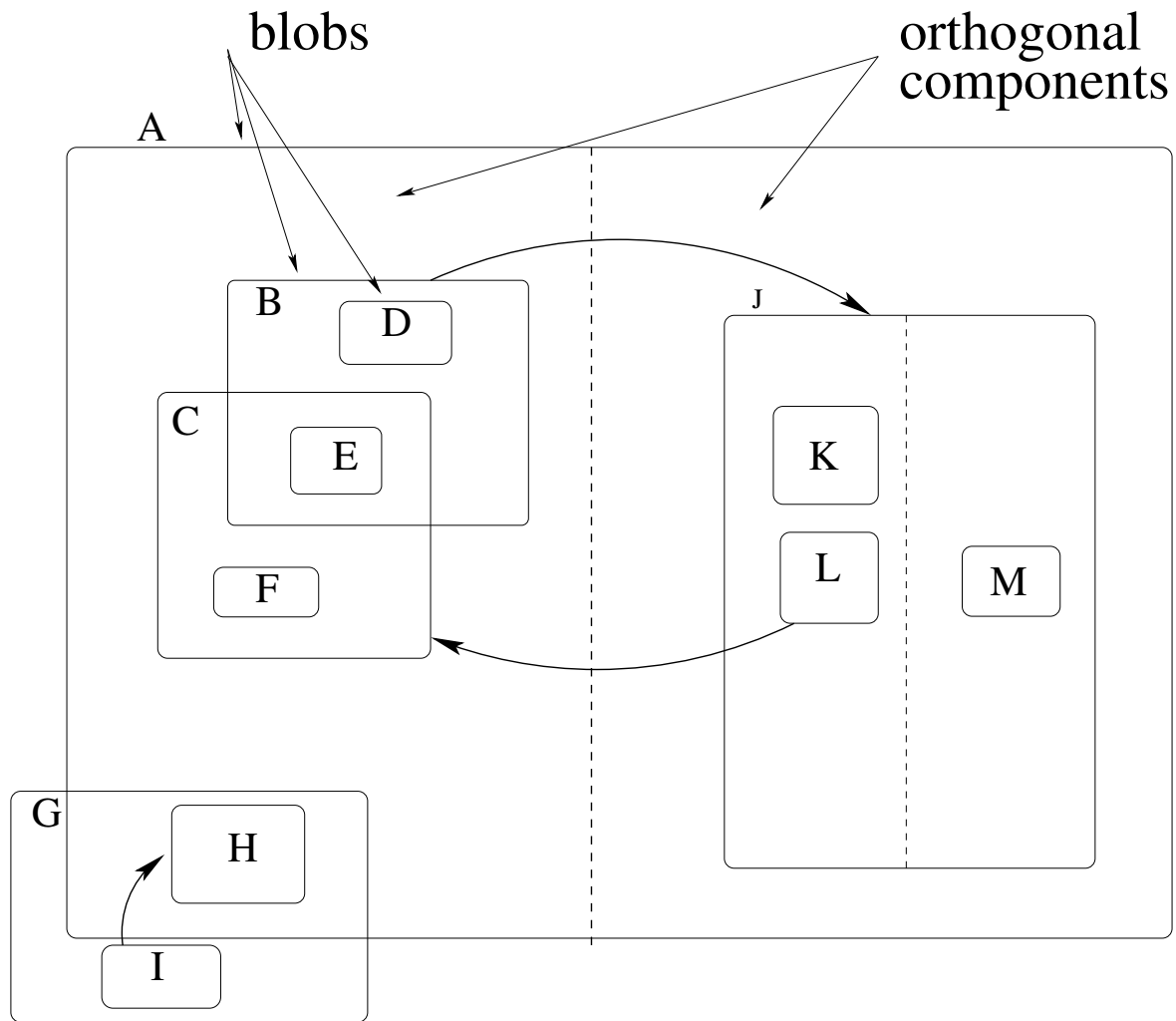


$$K = G \times H = (LUM) \times (NUOUP)$$

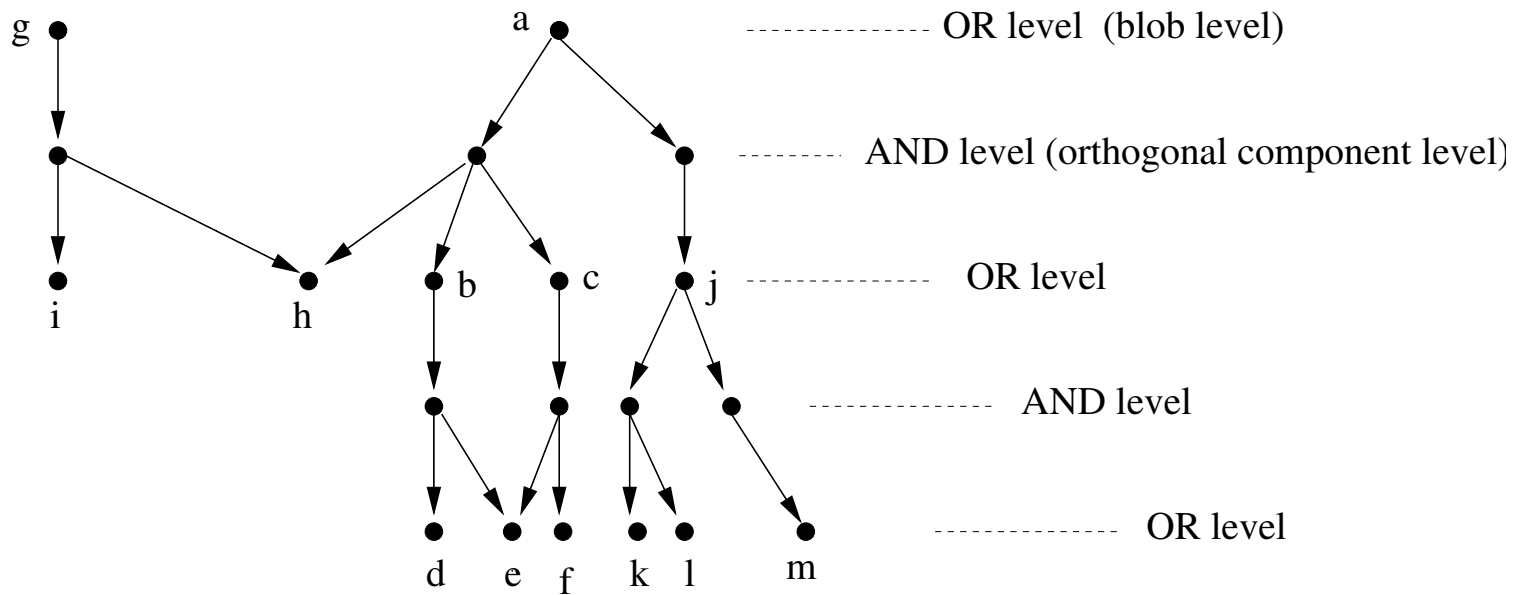
Meaningless constructs



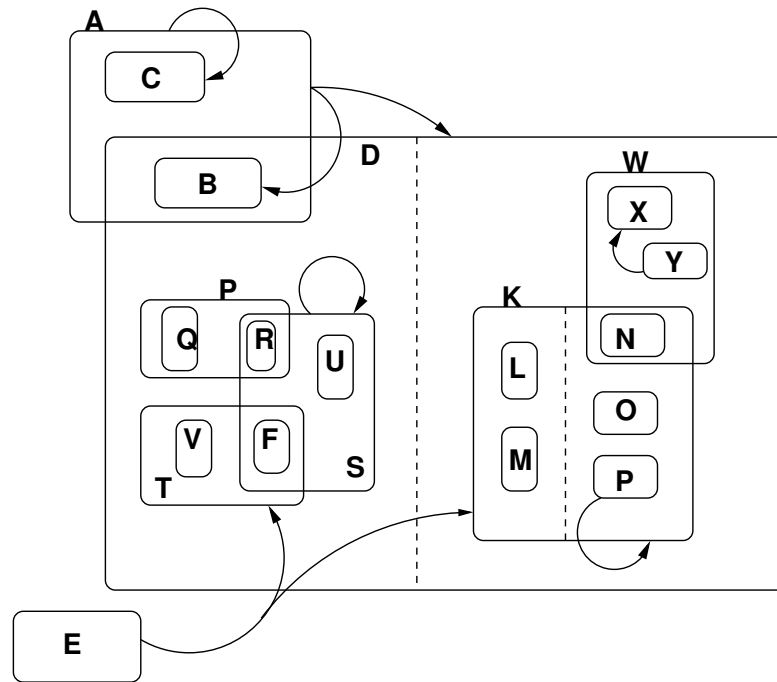
Simple Higraph



Induced Acyclic Graph (blob/orth comp alternation)

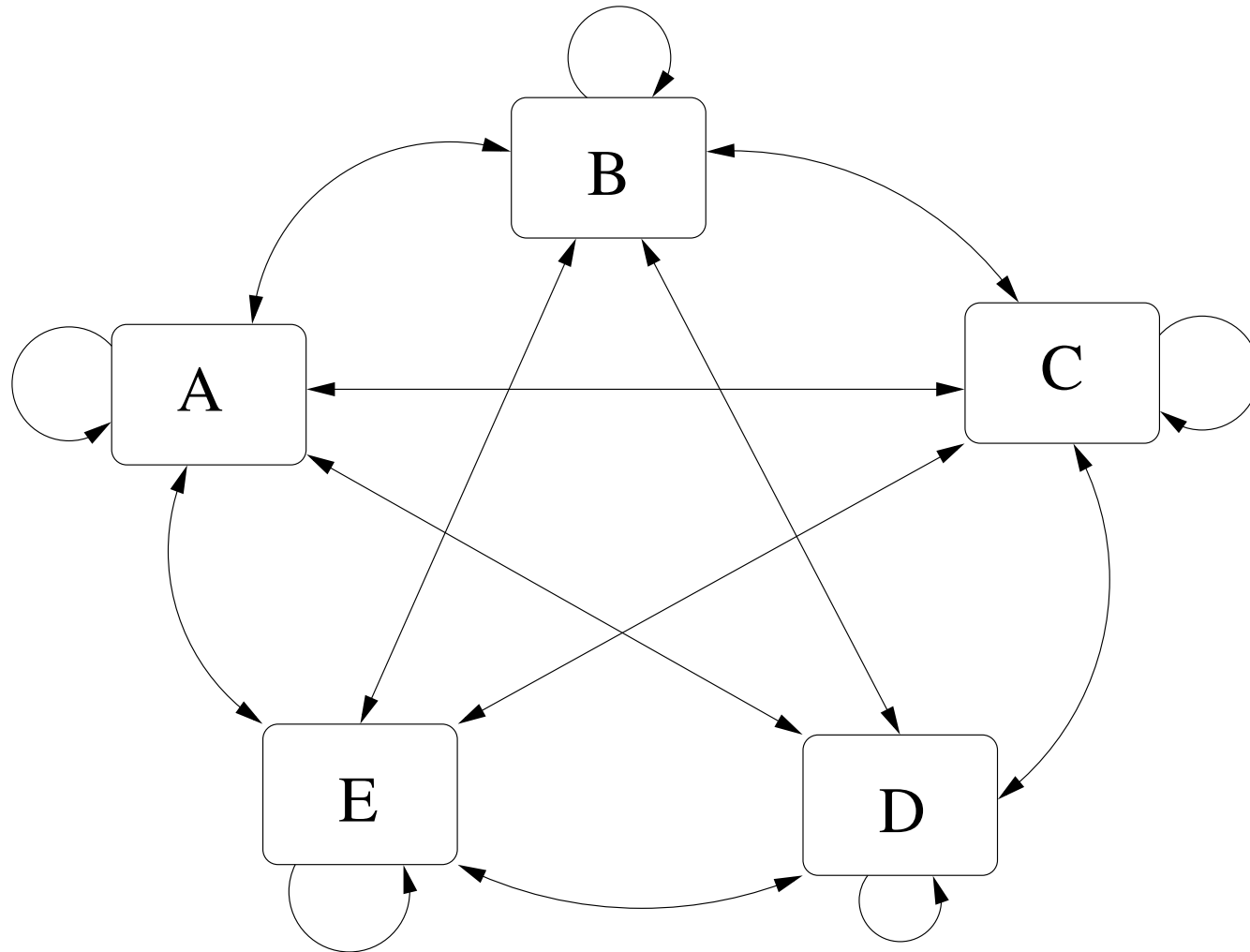


Adding (hyper) edges

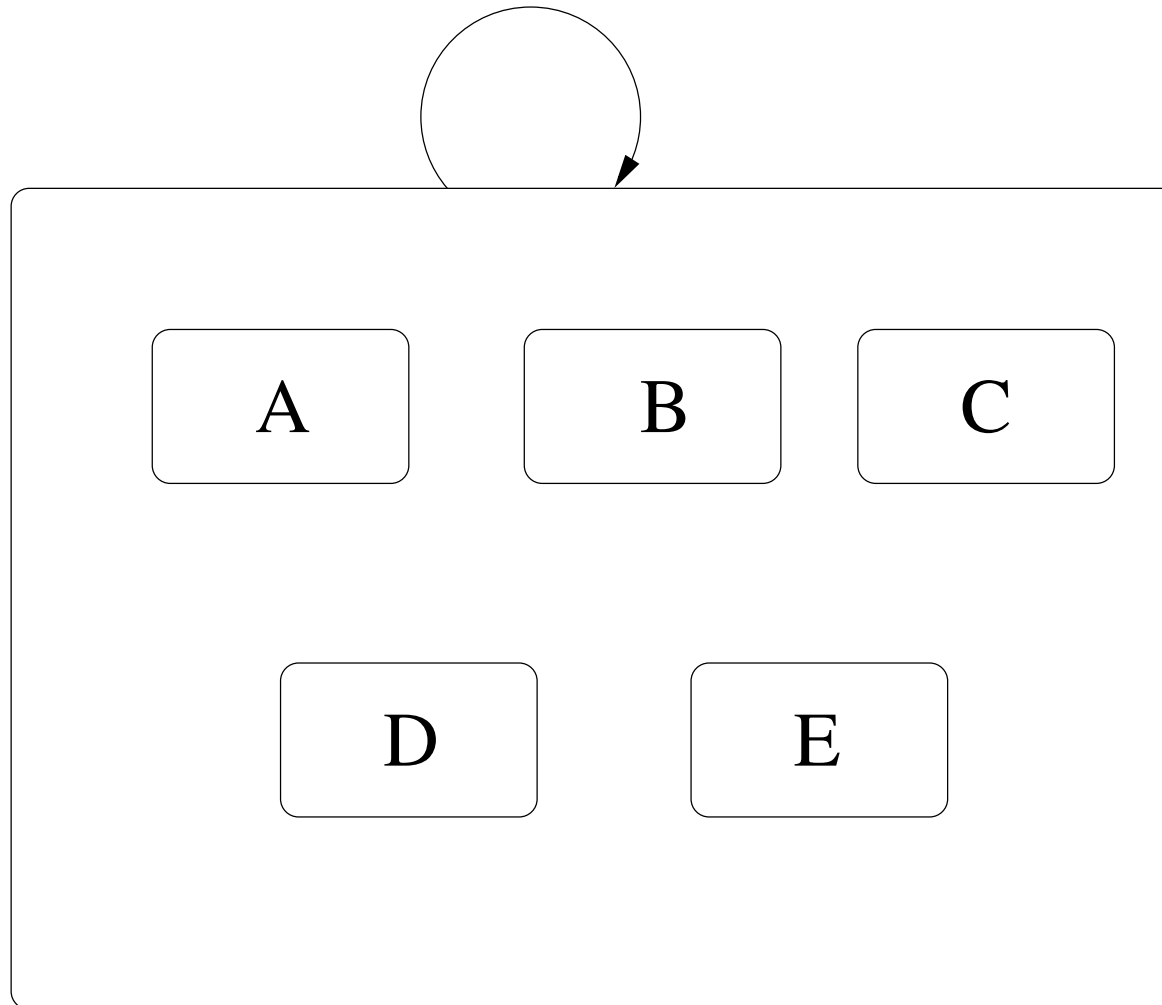


- hyperedges
- attach to contour of any blob
- inter-level possible

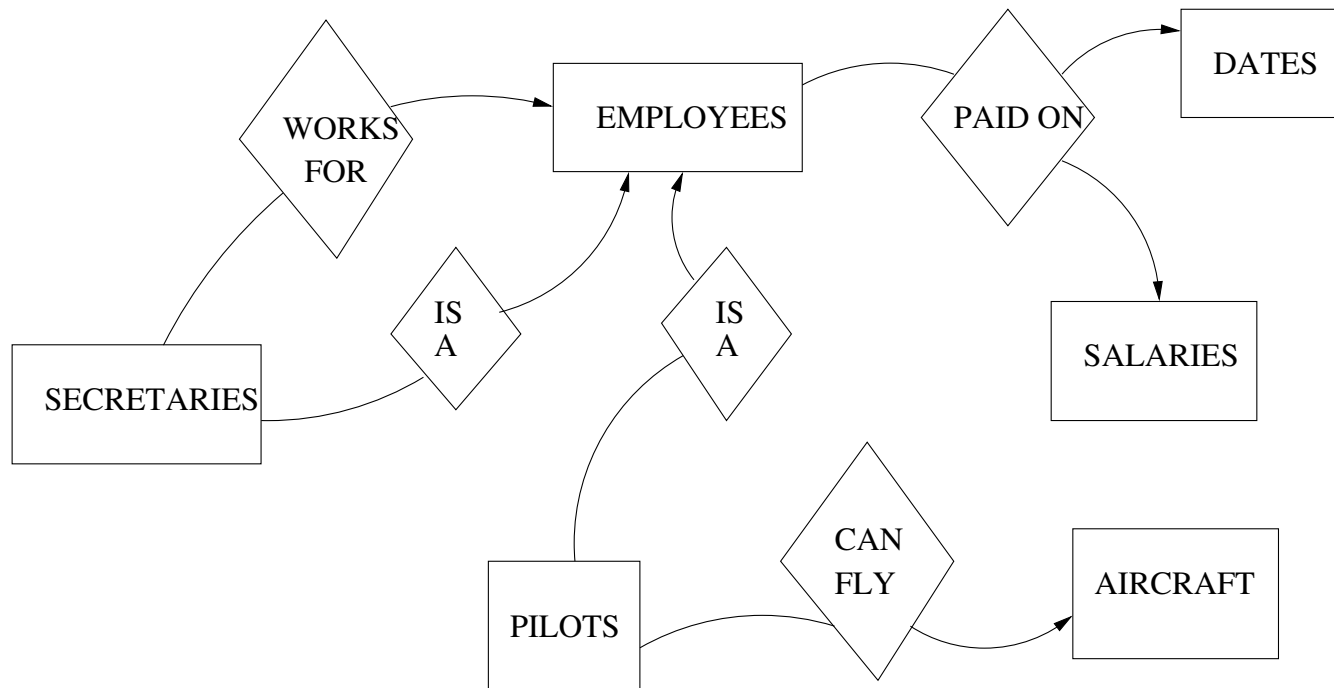
Clique Example



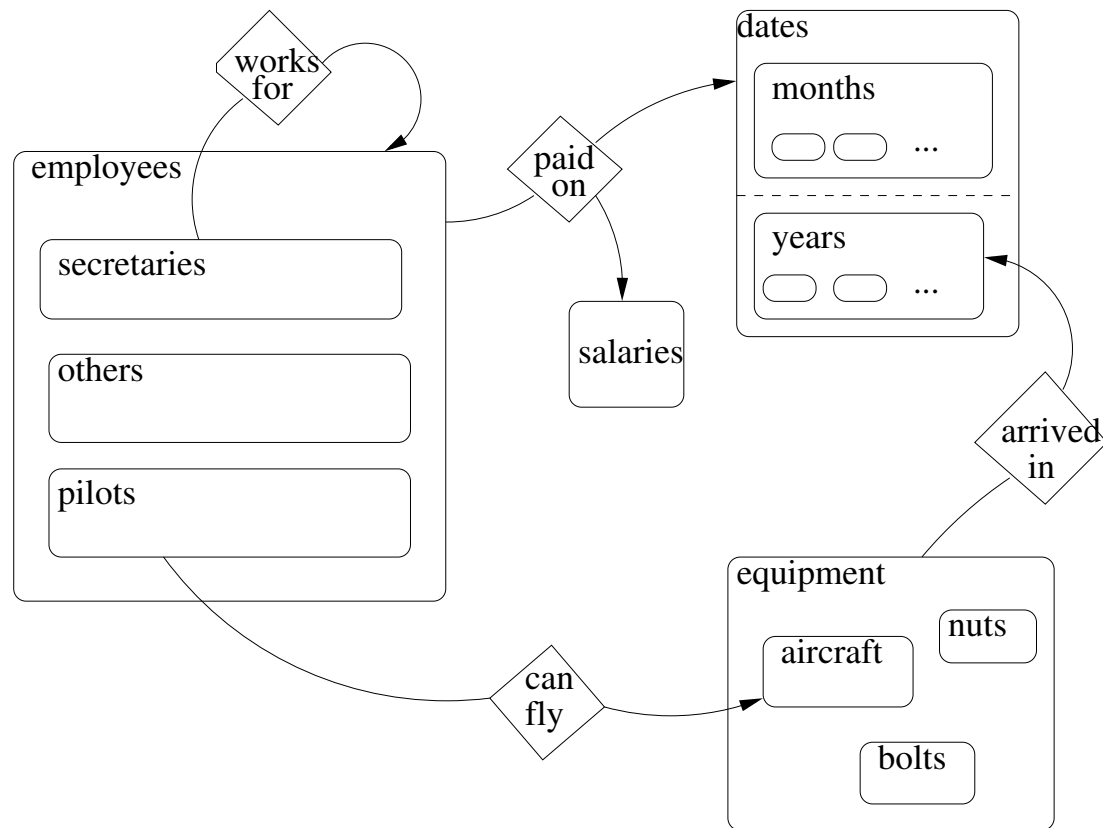
Clique: higraph with fully connected semantics



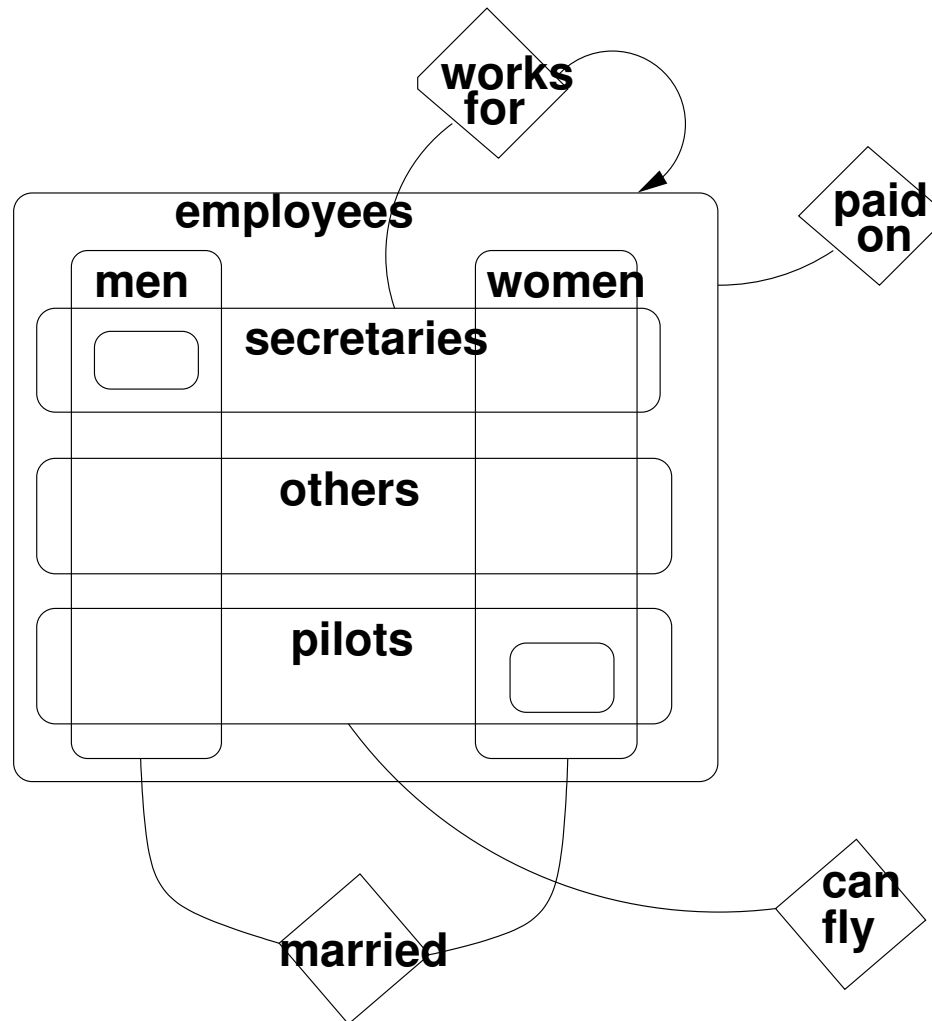
Entity Relationship Diagram (is-a)



Higraph version of E-R diagram



Extending the E-R diagram



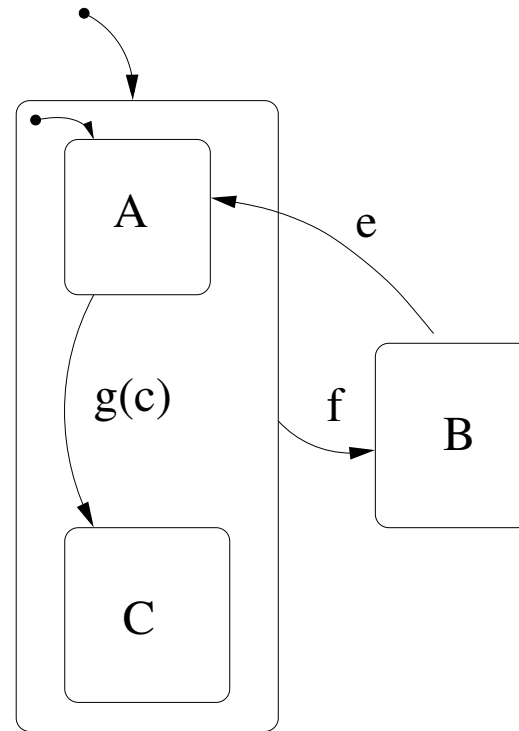
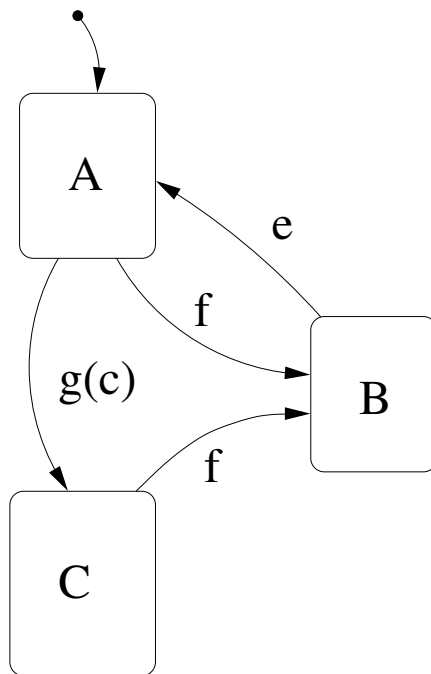
Higraph applications

- E-R diagrams
- data-flow diagrams (activity diagrams)
edges represent (flow of) data
- inheritance
- Statecharts

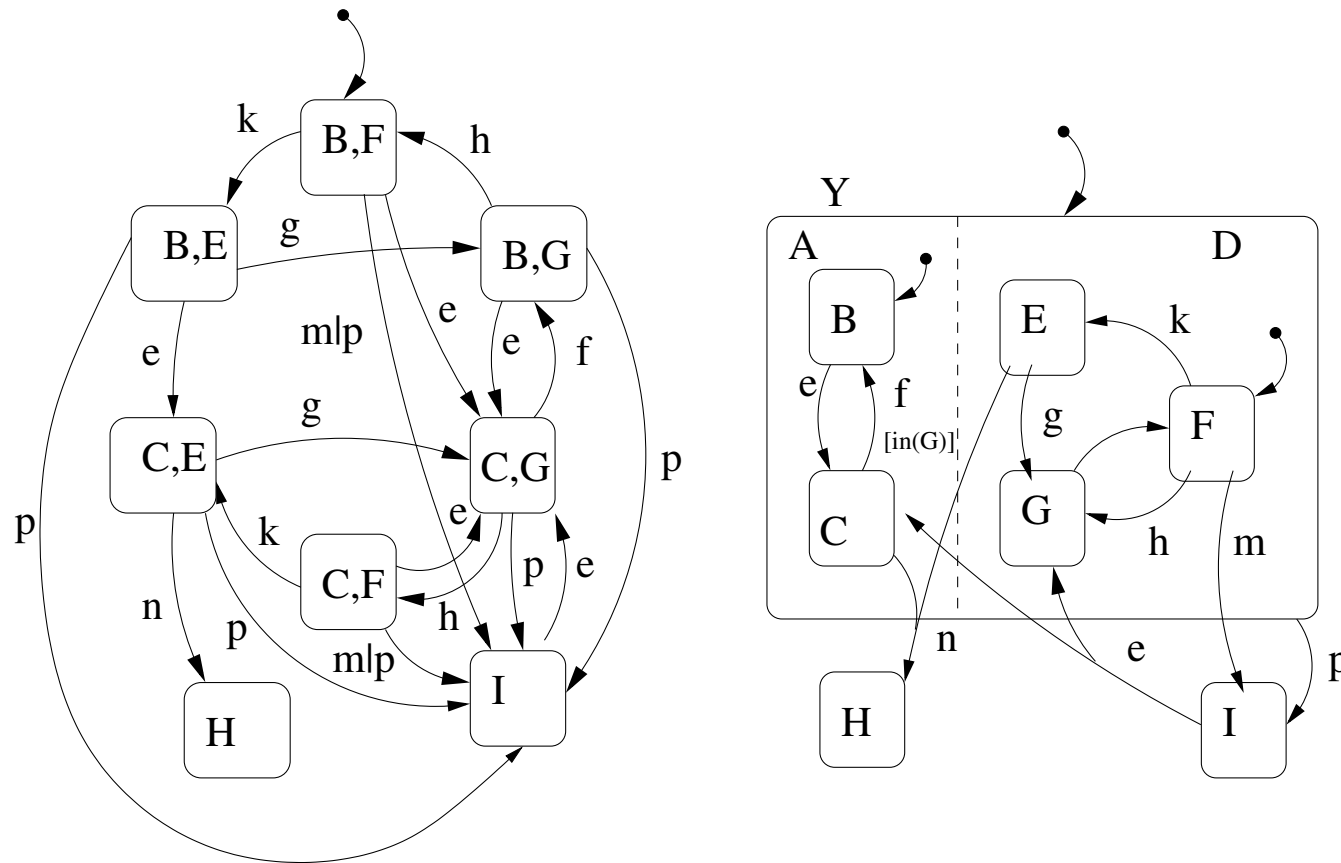
StateCharts = state diagrams + depth + orthogonality + broadcast

- Reactive Systems (event driven, react to internal and external stimuli)
- like Petri Nets, CSP, CCS, sequence diagrams, ...
- graphical but formal and rigorous for
 - analysis
 - code generation
- solve FSA problems:
 - flat \Rightarrow hierarchy \Rightarrow re-use
 - represent large number of transitions concisely
 - represent large number of states concisely
 - sequential \Rightarrow concurrent

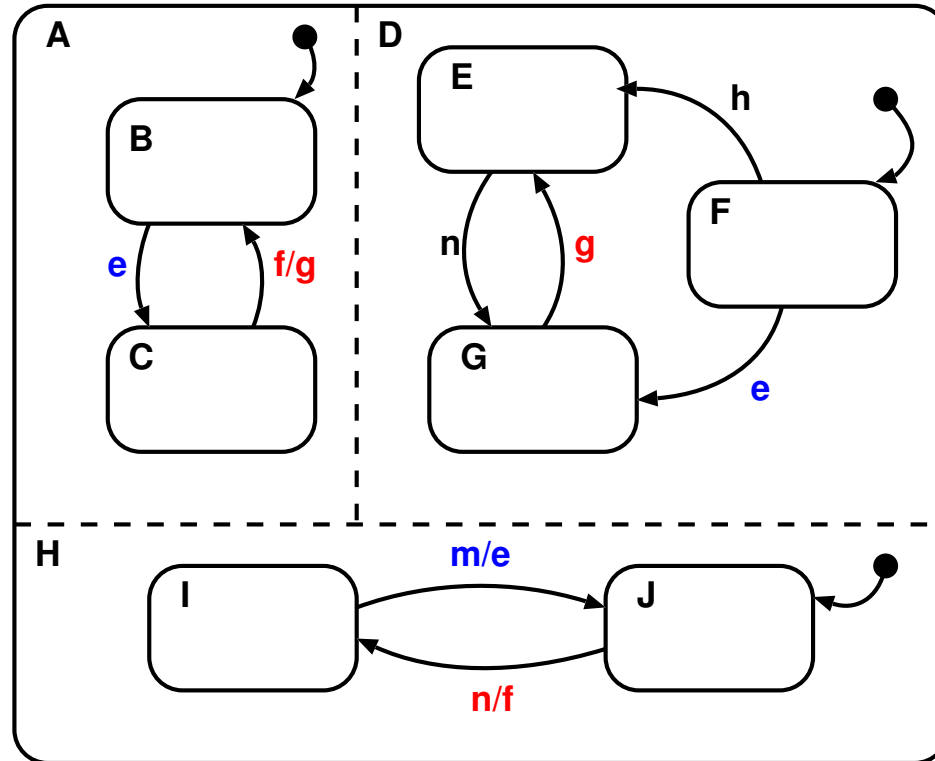
Depth (XOR)



Orthogonality (AND), flattening \Rightarrow semantics

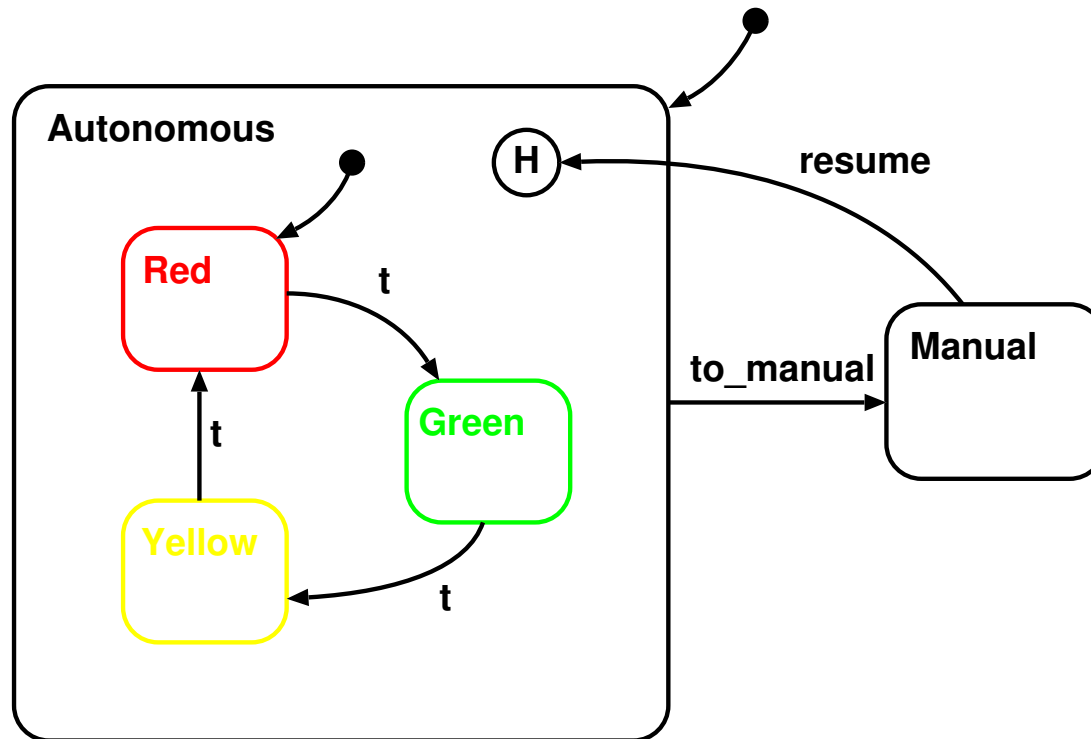


Broadcasting (output events)

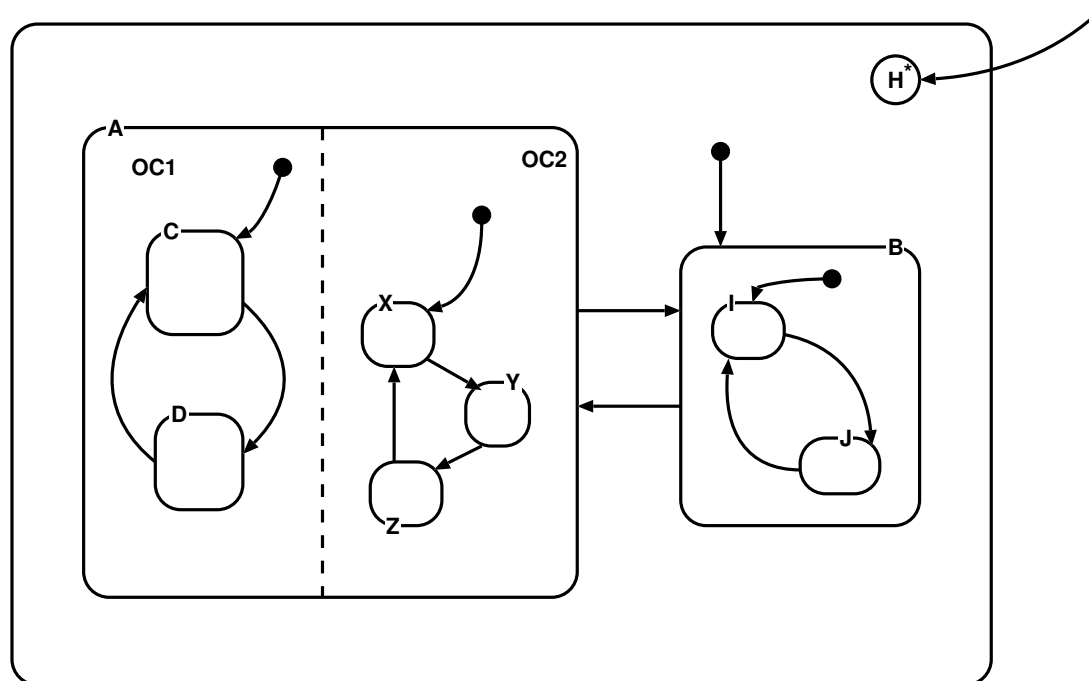


Input Segment: **nmnn**

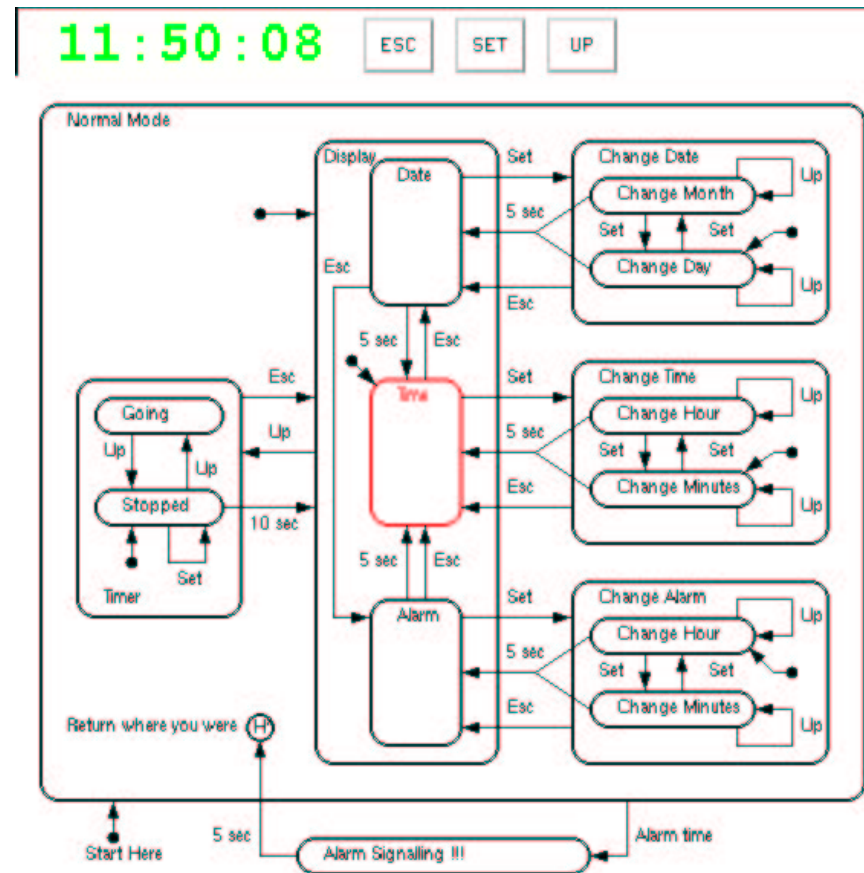
History States



Deep History

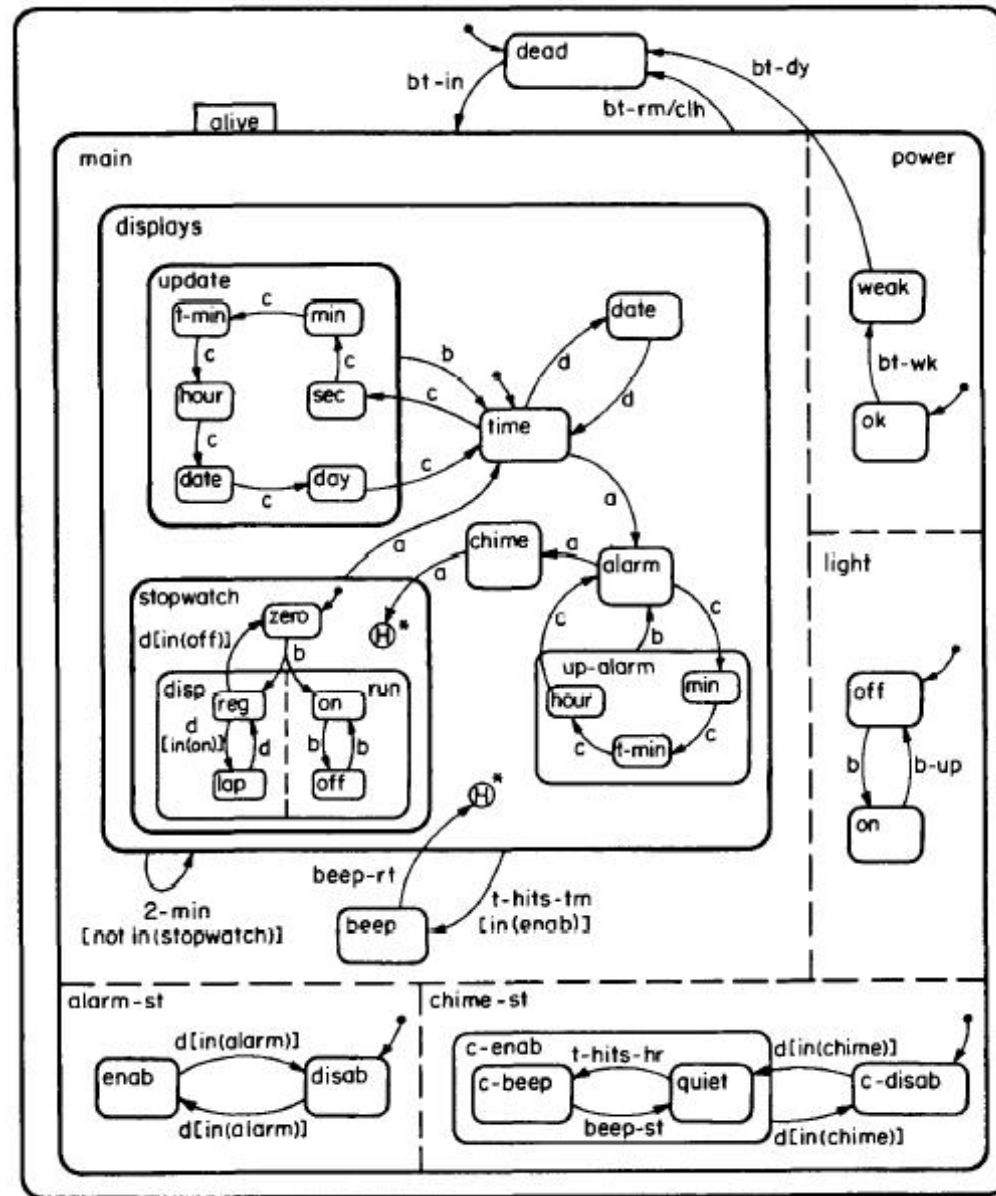


Simple Stopwatch Example



<http://www.xjtek.com/products/xjcharts/demo/>

Stopwatch Example



Messages

- `object.method(...)` synchronous method invocation
- `object->method(...)` queued, a-synchronous