Constraint-Based Network Layout

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Constraints and Network Layout

- **Constraints** allow us to capture **layout conventions** in drawings
- For example, in SBGN:
  - Prevent node-node overlaps
  - Prevent node-edge crossings
  - Directional information (subsequent processes)

Dunnart : A Constraint-based Network Diagram Authoring Tool

Tim Dwyer, Kim Marriott, and Michael Wybrow.

Lecture Notes in Computer Science, 5417:420-431, Springer, 2009.

InfoVis08 - Interactive Network Exploration.mov

[Exploration of Networks Using Over view+Detail with Constraint-based Cooperative Layout. Tim Dwyer et al.

IEEE Transactions on Visualization and Computer Graphics, 14(6):1293-1300, 2008.]

Dunnart (cont.)

Second movie, Michael Wybrow:

TopologyClusters.mov

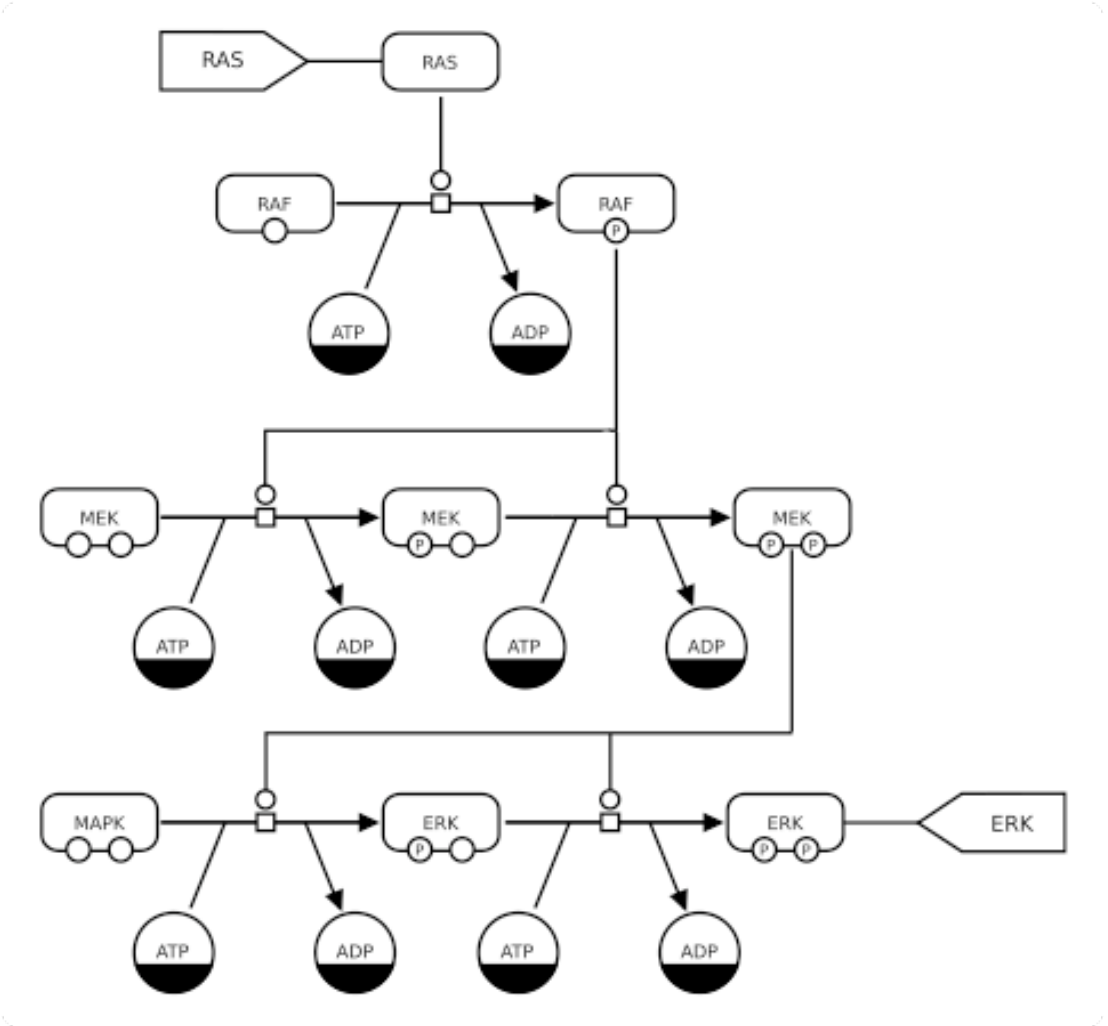
Interactive visualisation and authoring

- Author has control over layout and topology
- Author can improve the layout:
  - use placement constraints, e.g. alignment and distribution
  - tailor layout style and guide layout by
    - repositioning diagram components
    - rerouting connectors

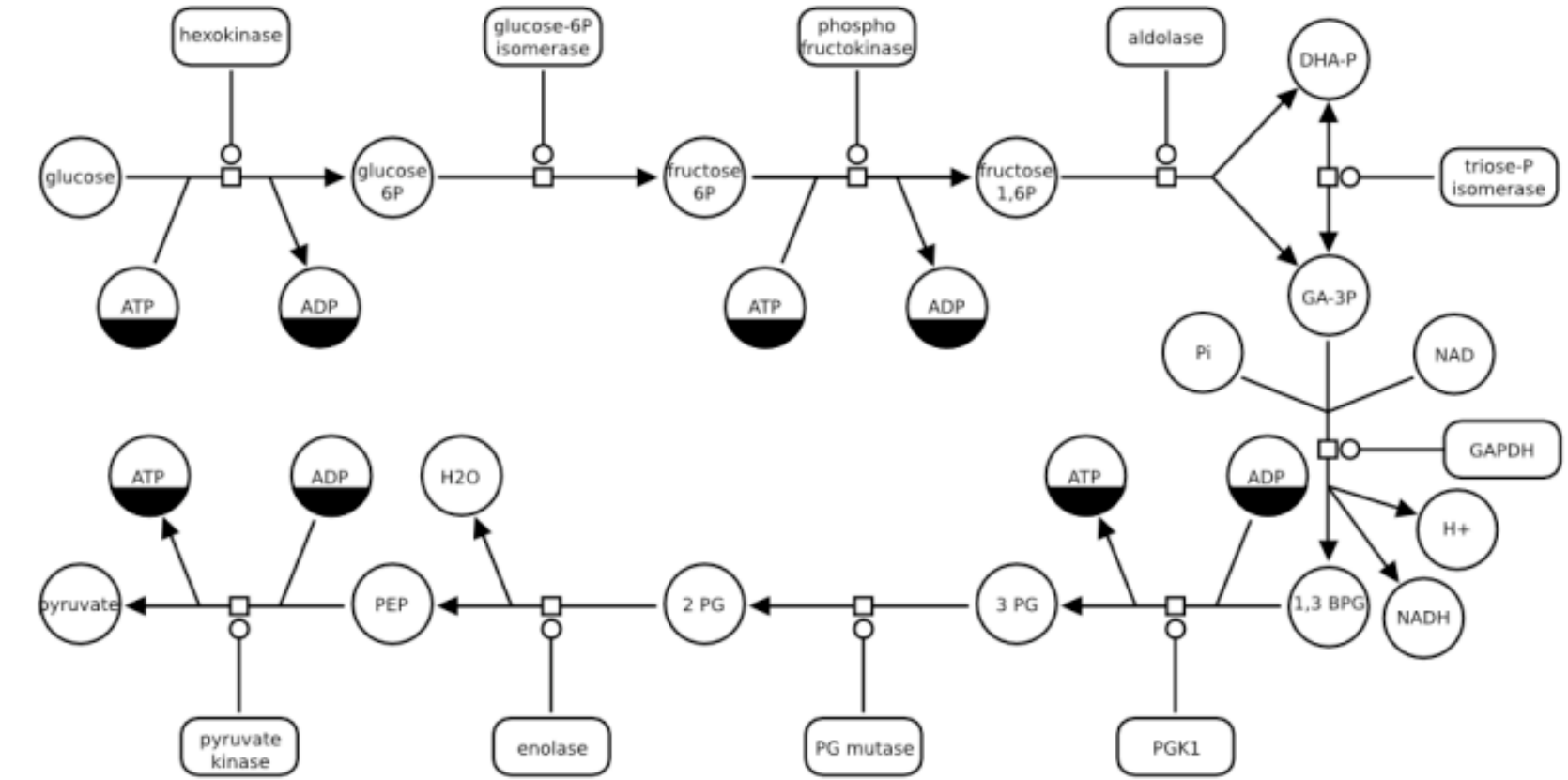
Continuous network layout

- constrained graph layout algorithm
- topology preserving, smooth predictable changes
- *Separation constraints* on nodes must be satisfied
- *Refinement constraints* must be satisfied:
  - no two nodes overlap
  - nodes inside bounded region are exactly the nodes in the cluster
  - every path is valid (no segment passes through a node) and tight (the path wraps tightly around each node corner in path)

SBGN example 1



SBGN example 2



SBGN examples in Dunnart …

Dunnart, Constraints and SBGN

We use constraints to automatically:

- Prevent of node-node overlap
- Prevent node-edge crossing
- Constrain drawing area
- Minimise edge length
- Minimise edge crossing
- Minimise edge bends (esp. orthogonal routing)
- Handle directional information (subsequent processes)
- Locate substrates and products of transitions
- ...

Dunnart Research and Systems Biology

- Identify layout conventions appropriate to SBGN*
- Automatically infer constraints from SBML and other notations ***
- Encode these as constraints, extending the algorithms and layout engines as necessary*
- Wrap layout libraries in Java, design interface**

*Falk Schreiber, *Christian Klukas (IPK)

*Tim Dwyer (Microsoft Research Labs)

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Links

http://www.dunnart.org/

http://www.csse.monash.edu.au/~marriott/