# Improved Layout for Data Flow Diagrams with Port Constraints

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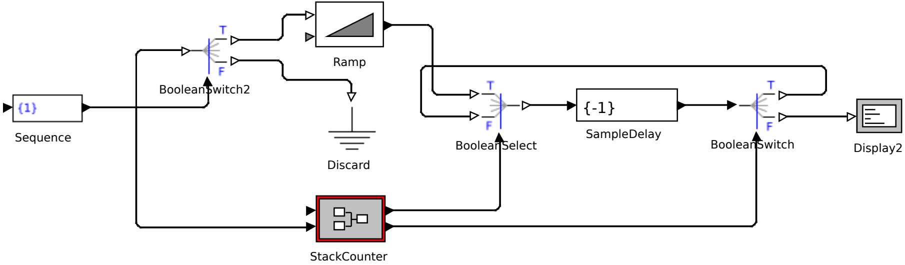
July 3rd / Diagrams 2012

# Port-Based Data Flow Diagrams

## A Ptolemy Actor Diagram (Edward A. Lee, UC Berkeley)



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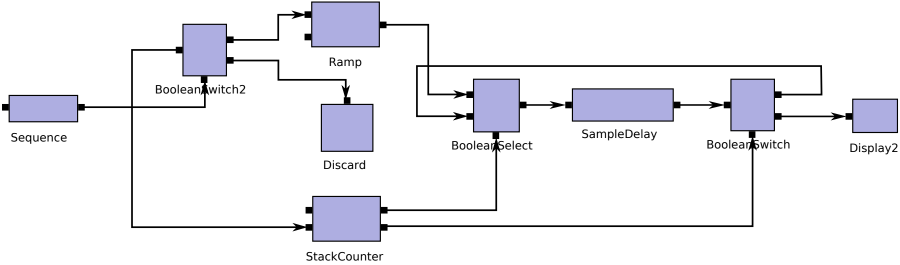

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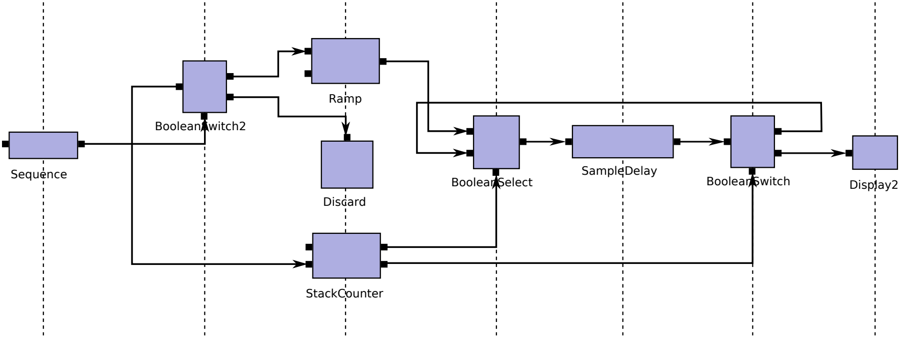

# Outline

1. The Importance of Port Support
   - Preliminaries
   - Inverted Ports
   - Side Ports
   - Putting It All Together
2. Demo Time!
3. Evaluation
4. Conclusion

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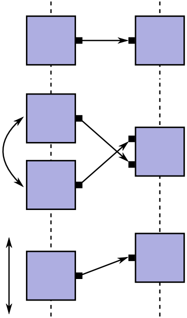
## Based on Sugiyama et al. (1981)

Five phases:

2. Layer assignment
3. Crossing reduction
4. Node placement



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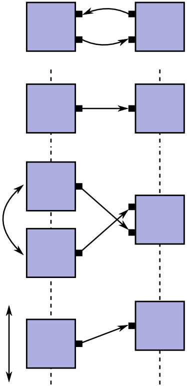

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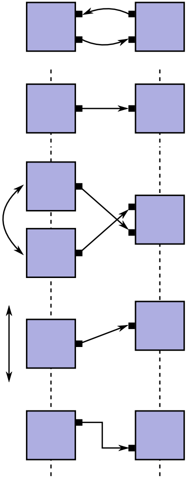

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Based on Spönemann, Fuhrmann, von Hanxleden, Mutzel (2009)

Five levels of freedom:

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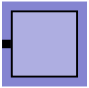

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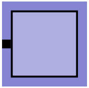

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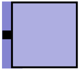

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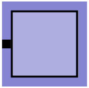

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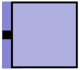

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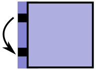

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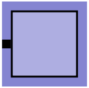

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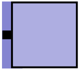

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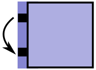

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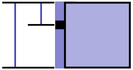

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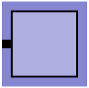

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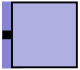

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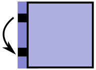

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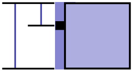

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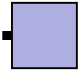

# Related Work on Port-Based Diagrams

## A Selection of Publications

- Gansner, Koutsofios, North, Vo (1993)
  - Ports considered during node placement, not crossing reduction
- Sander (1994)
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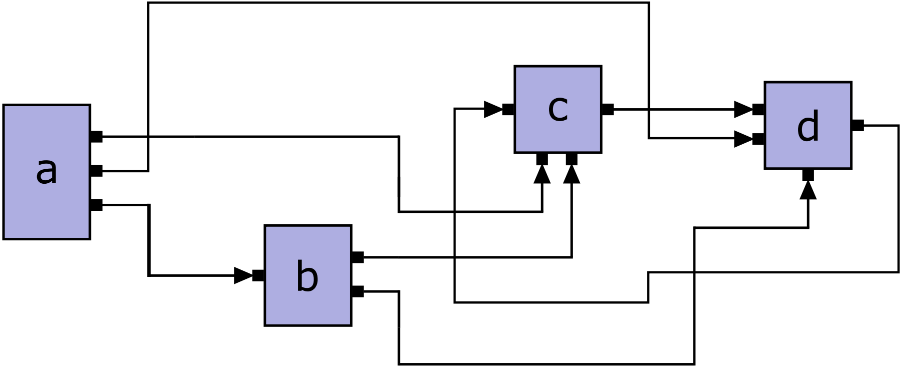
- Wybrow, Marriott, Stuckey (2012)
  - More targeted towards network diagrams
  - However, application to data flow diagrams could be interesting

# Challenges With Port-Based Diagrams

## A Layout Produced by Our Previous Algorithm



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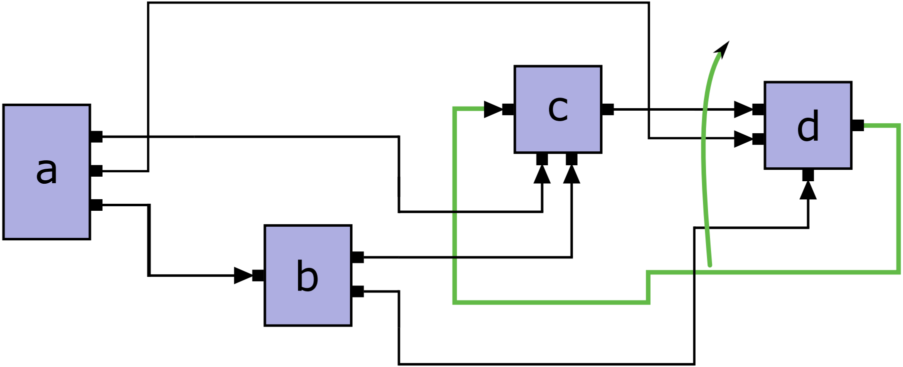

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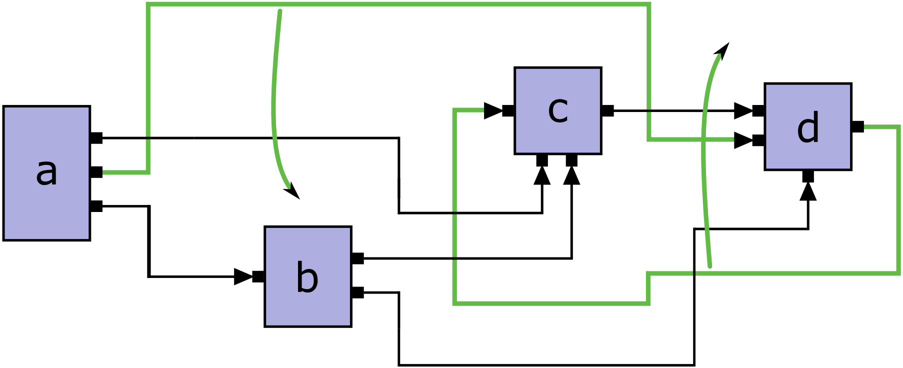

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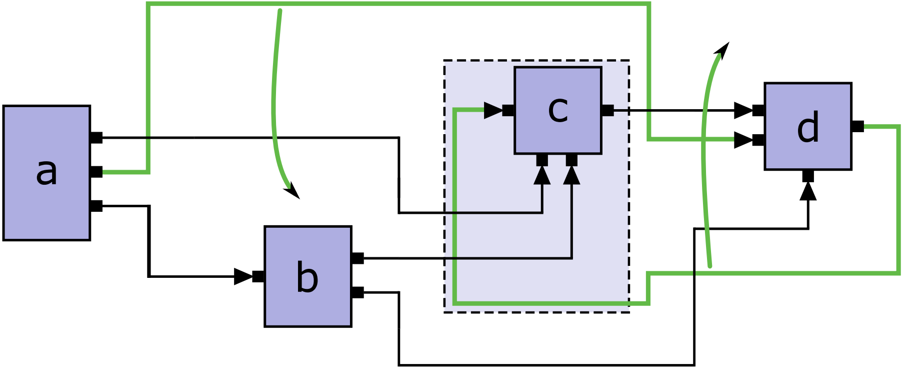
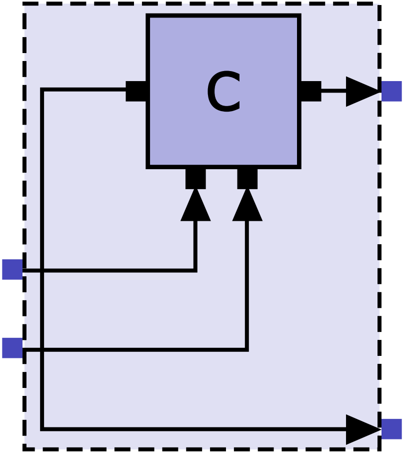


# The Problem: Node-Local Edge Routing

## Making Strange Nodes Look Perfectly Ordinary



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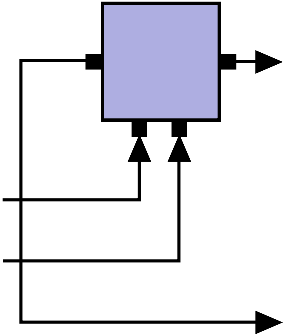
## An Approach Based on Dummy Nodes



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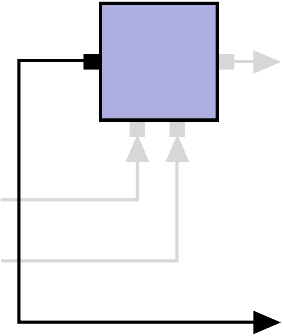

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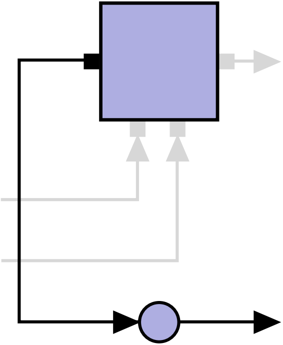

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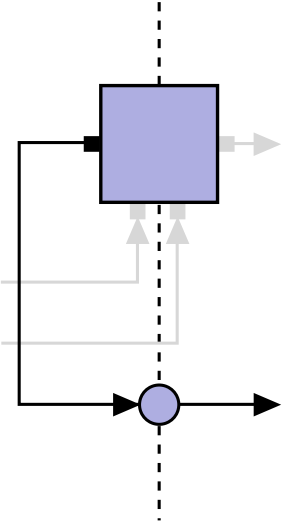

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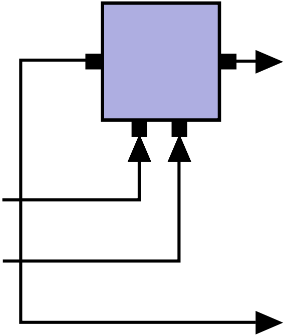
# Basic Handling of Side Ports

## Again Based on Dummy Nodes



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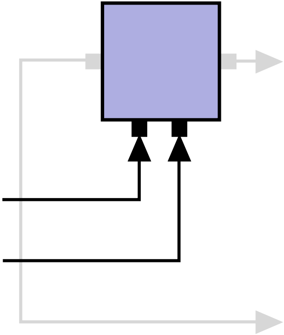

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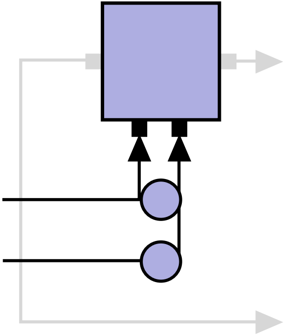

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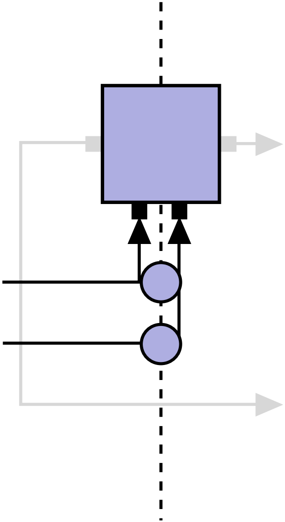
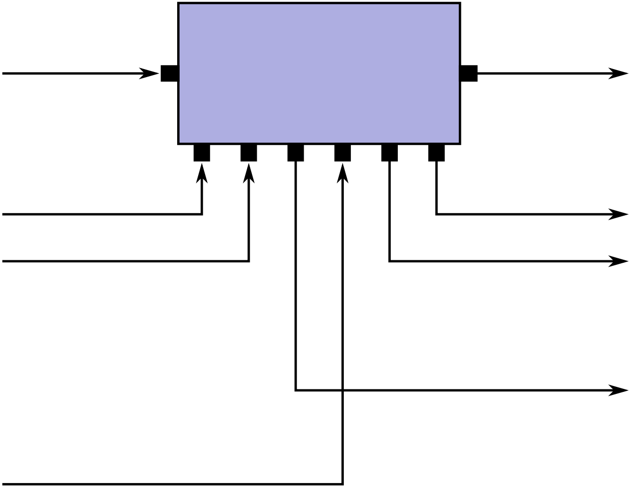


# Creating Dummy Nodes for Side Ports

## Local Optimization of Edge Crossings



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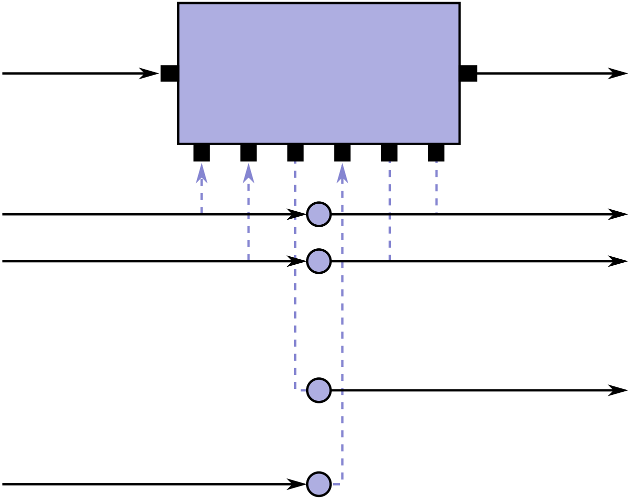

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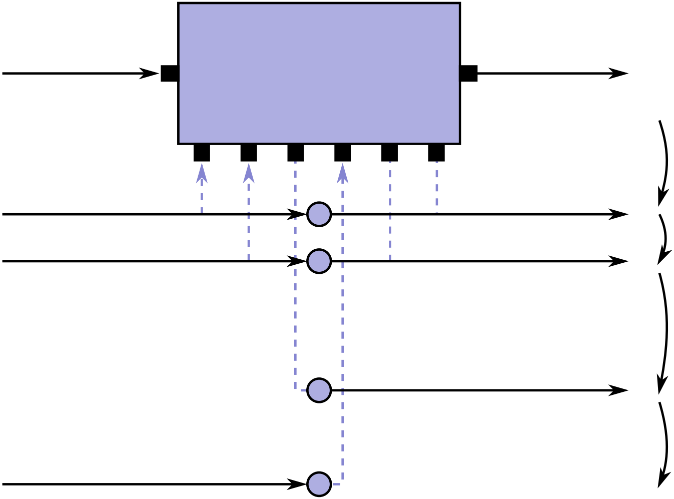

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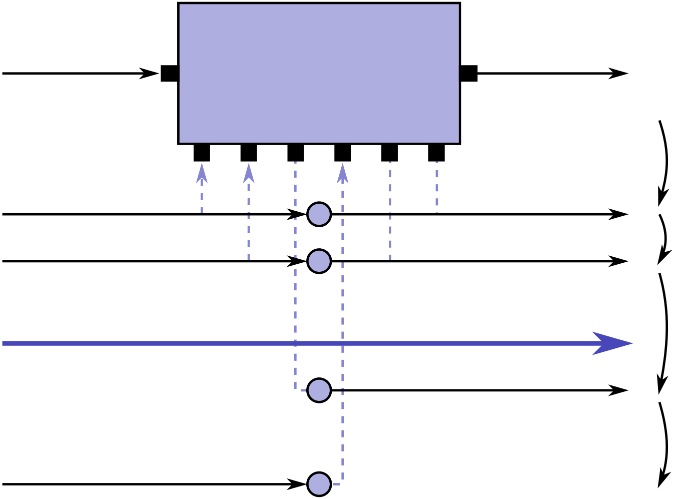

# Getting the Order of Dummy Nodes Right

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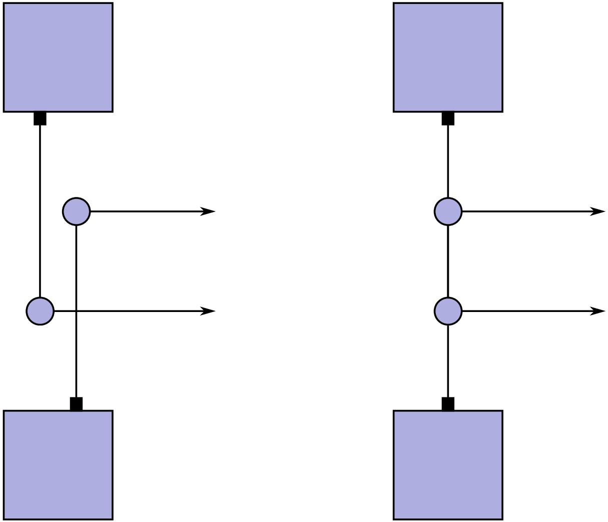

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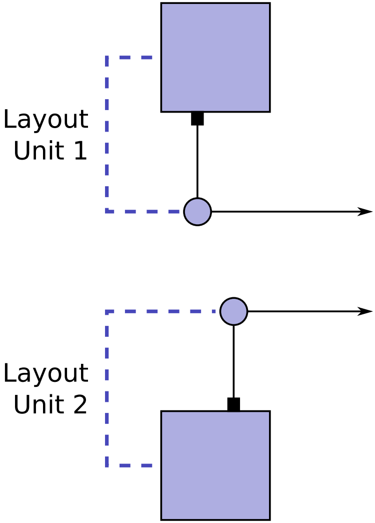

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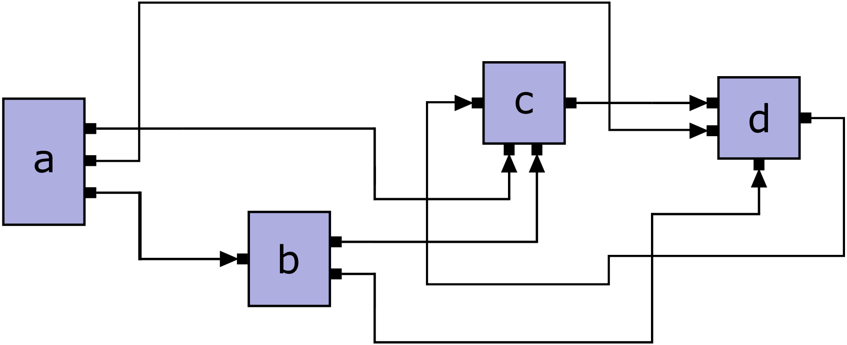

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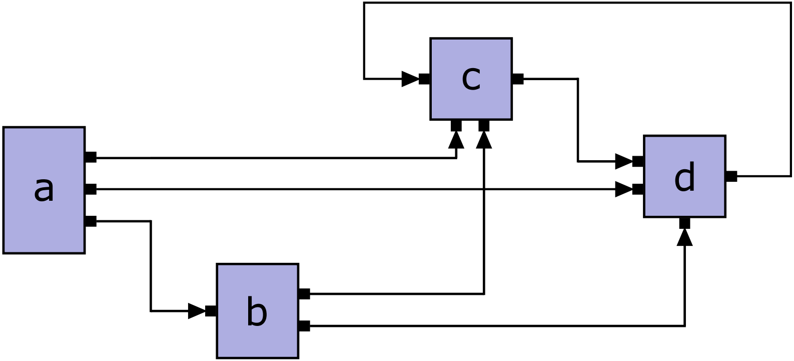

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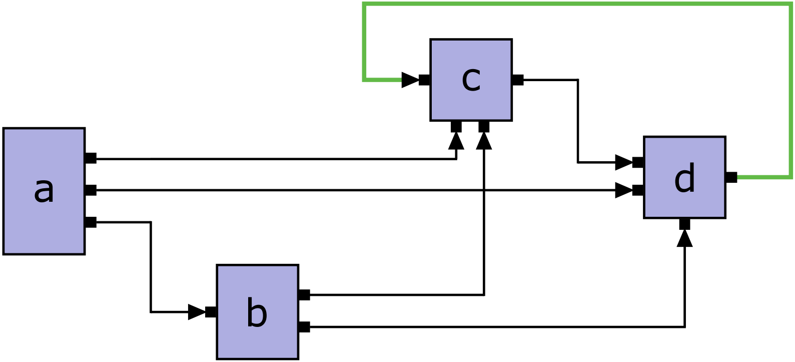

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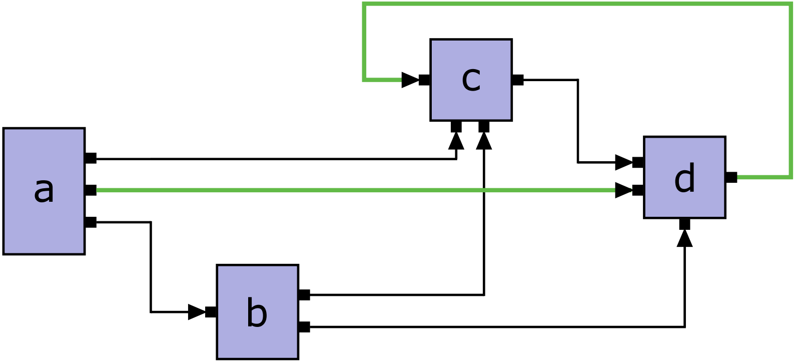

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# See the Algorithm in Action!

Please stand by for the KIELER tool to appear. . .

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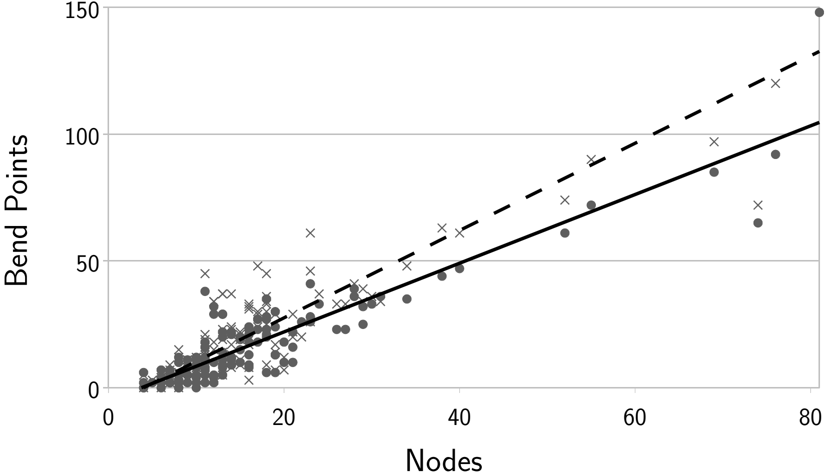

141 Ptolemy demo models, up to 43 nodes per hierarchy level (avg. 8.98)

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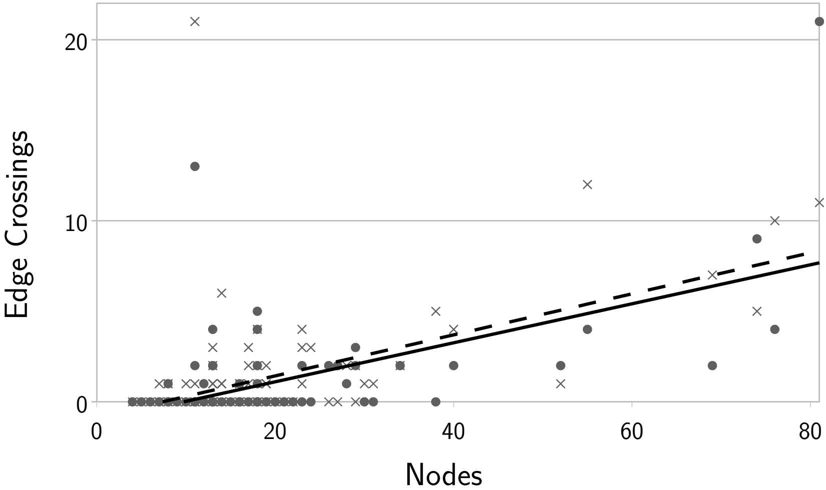

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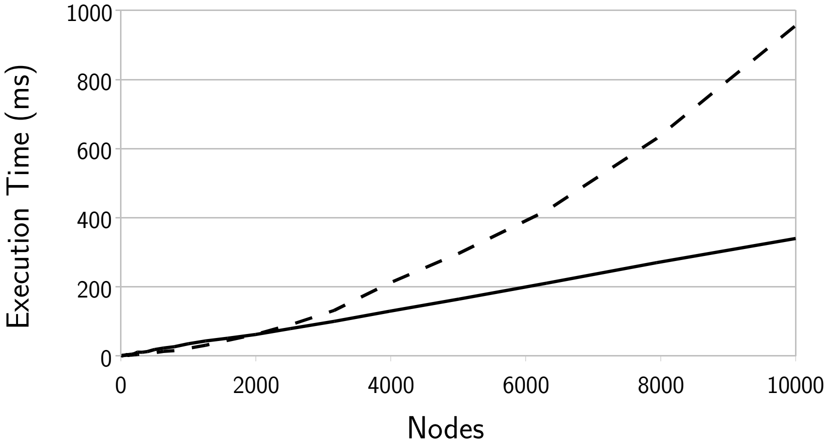

Random graphs with 10 to 10,000 nodes, 0 to 2 outgoing edges each

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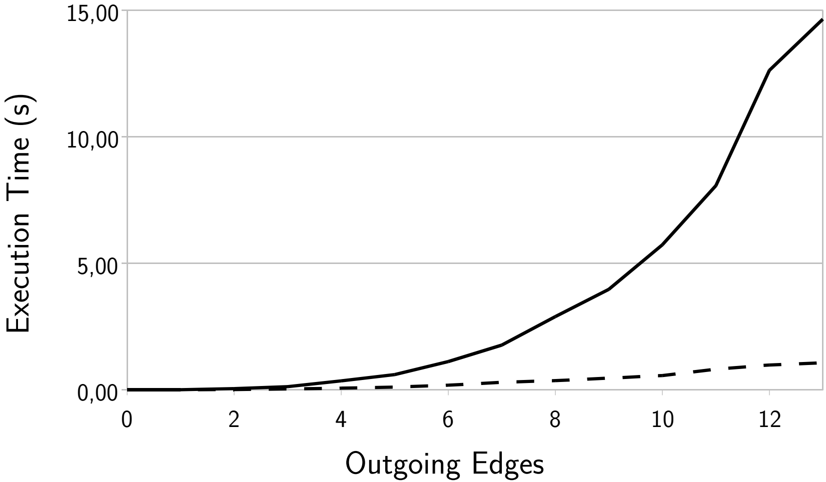

Random graphs with 100 nodes, fixed number of outgoing edges

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Feel free to pay us a visit and look at our KIELER platform at
`www.informatik.uni-kiel.de/rtsys`

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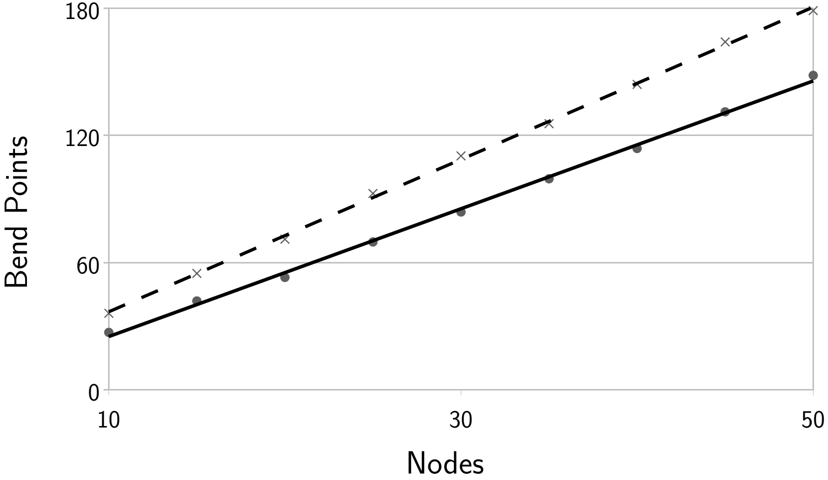

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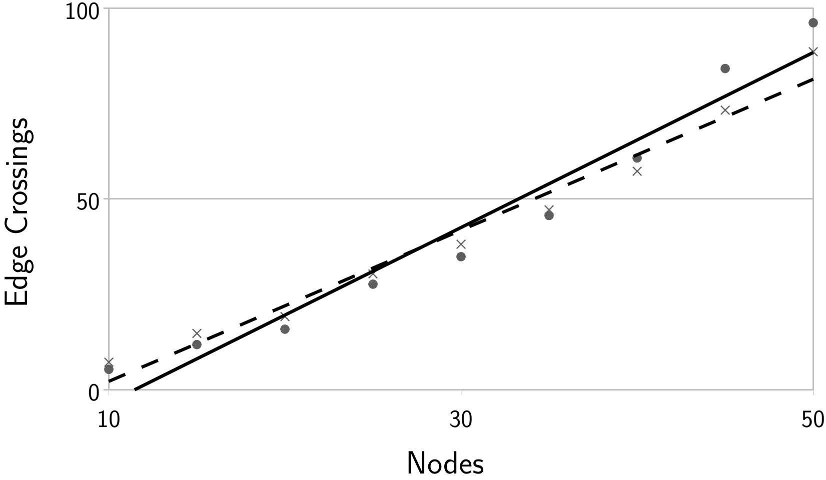

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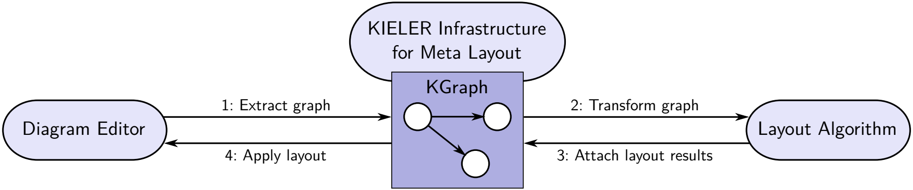
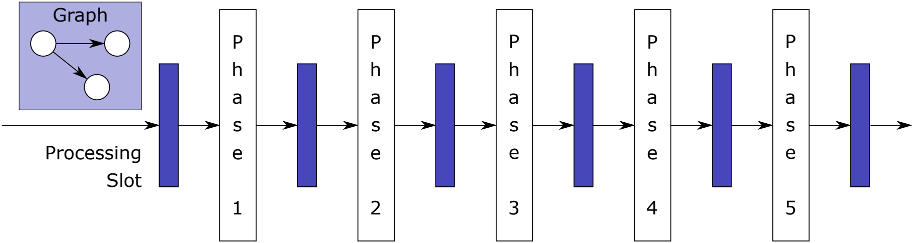
# Connecting Editors and Layout Algorithms

## The KIELER Infrastructure for Meta Layout



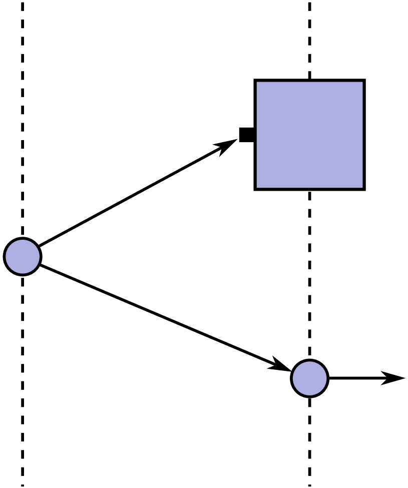
# The Algorithm’s Architecture

## Interchangeable Phases and Intermediate Processors



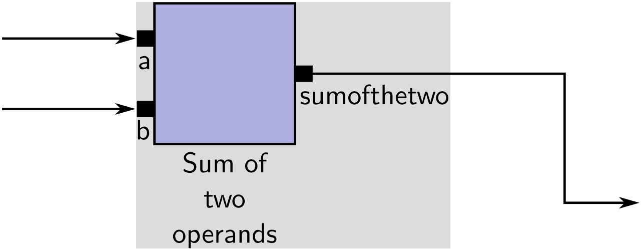
# Inverted Ports

A Solution with Two Dummy Nodes



# Basic Support for Node and Port Labels

## Reserving Space through Bounding Boxes


a
b
sumofthetwo
Sum of
two
operands