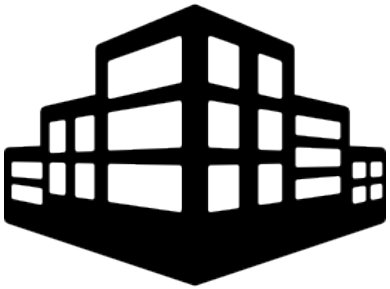
Avoiding Over-Fitting in Region-Based Process Discovery

AIS Meeting
S.J. van Zelst
March 19, 2015

TU/e Technische Universiteit Eindhoven University of Technology

Where innovation starts

Setting the Scene
Process Discovery



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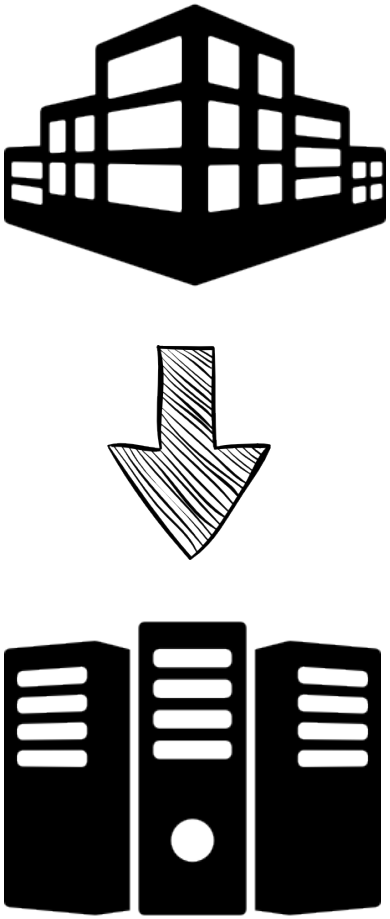

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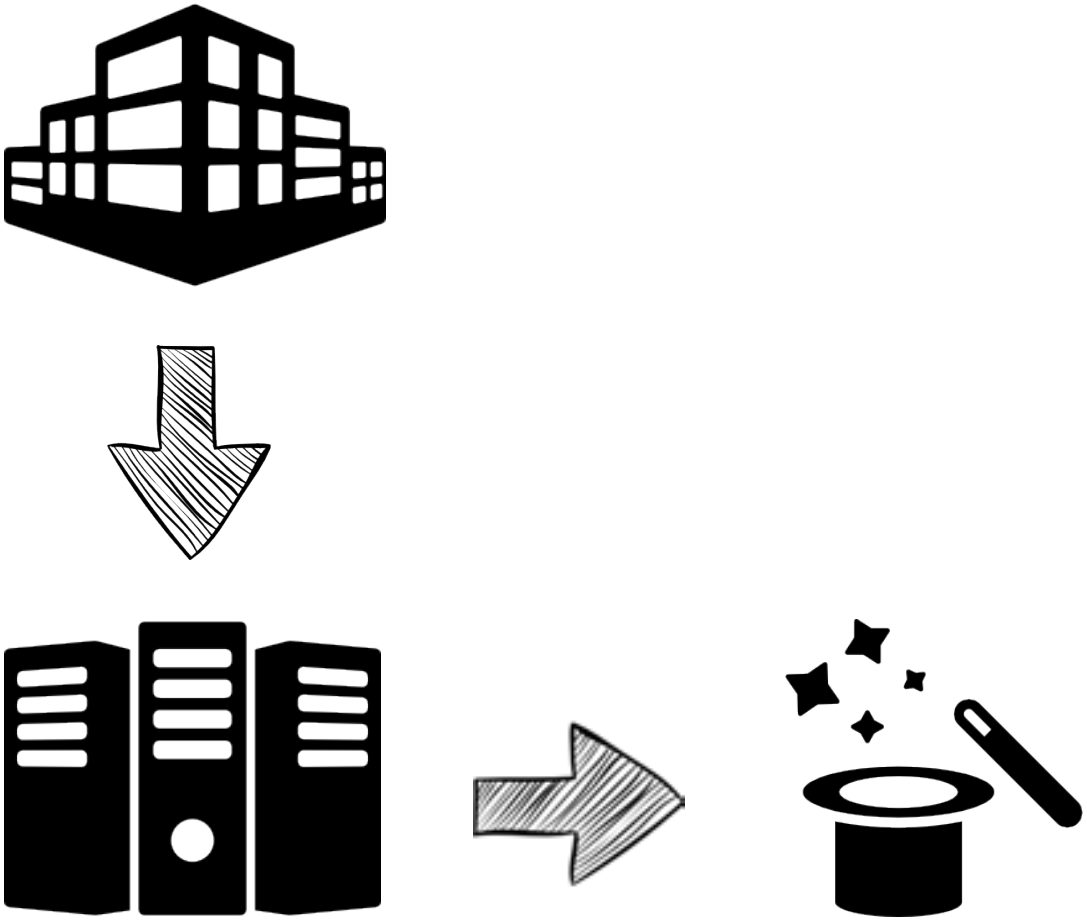

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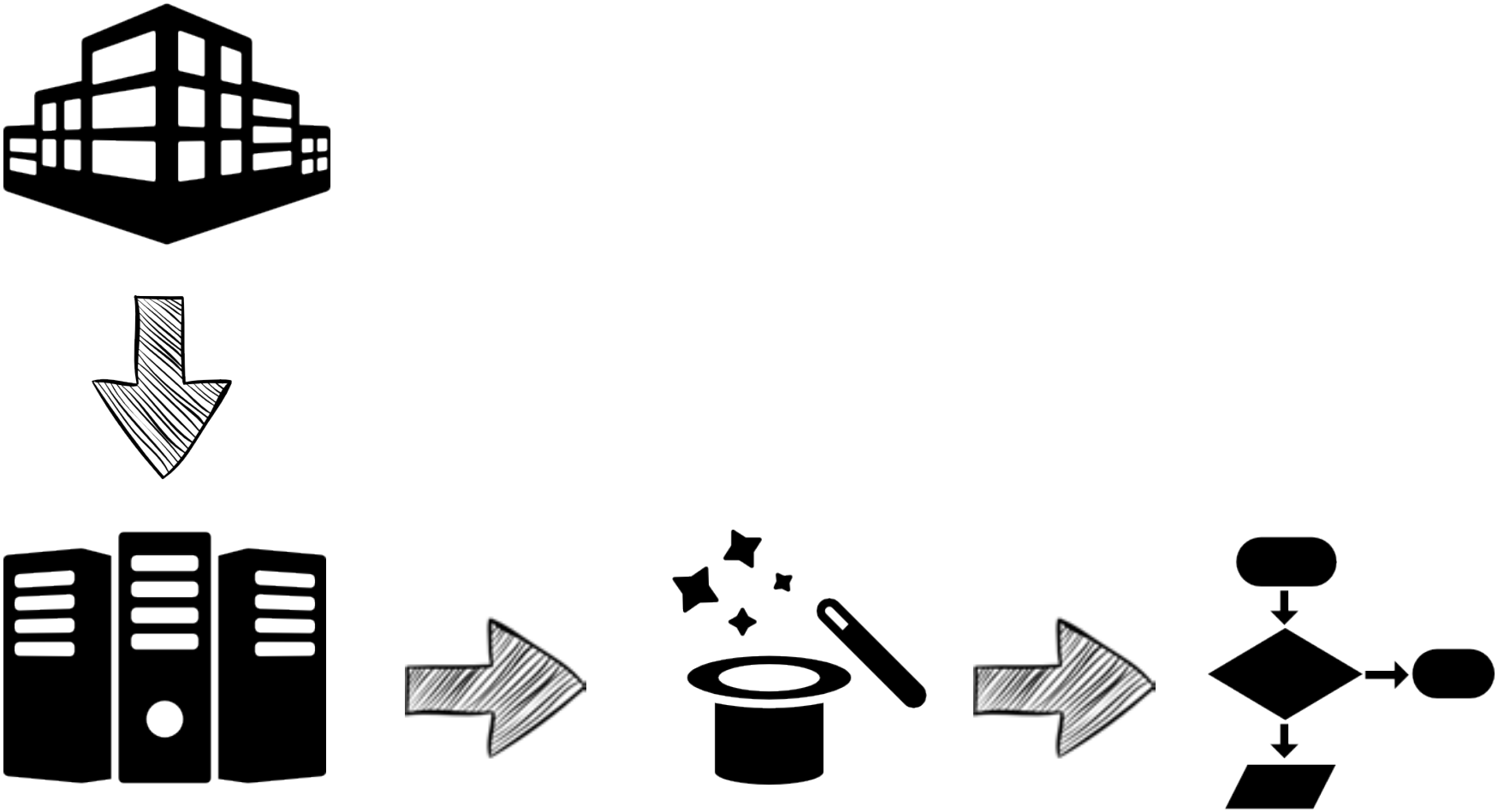
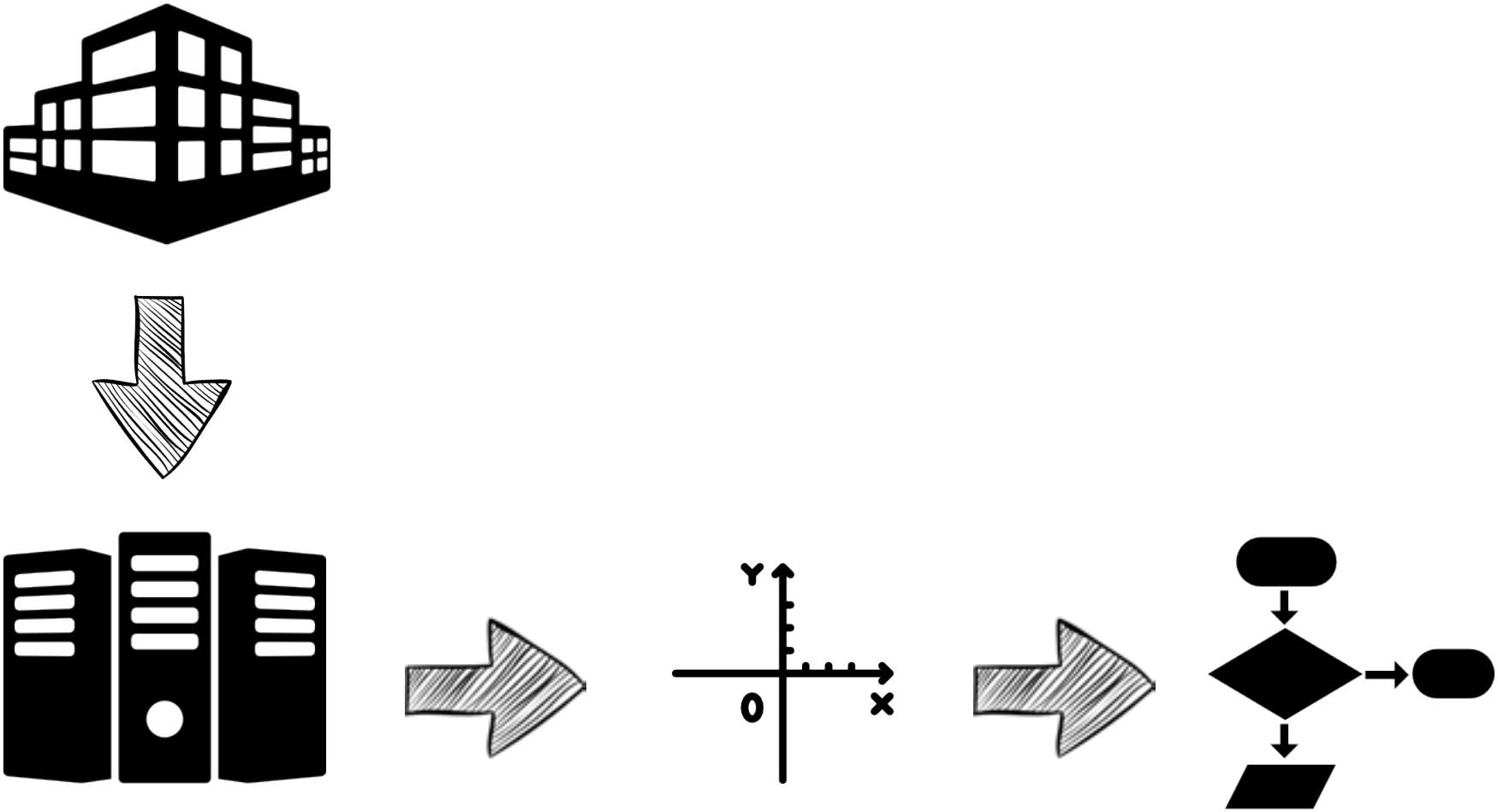


Setting the Scene
ILP-Based Process Discovery



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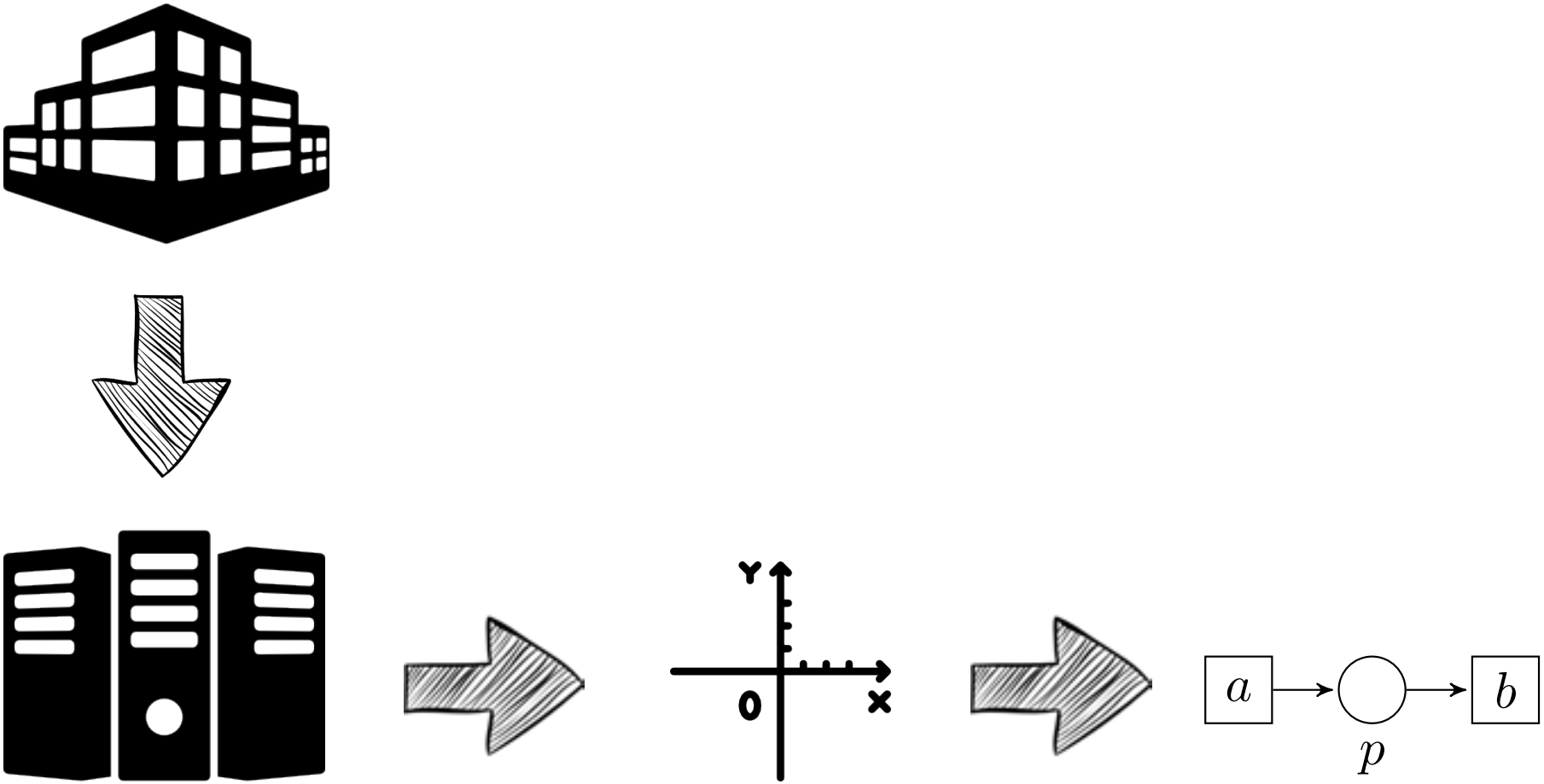
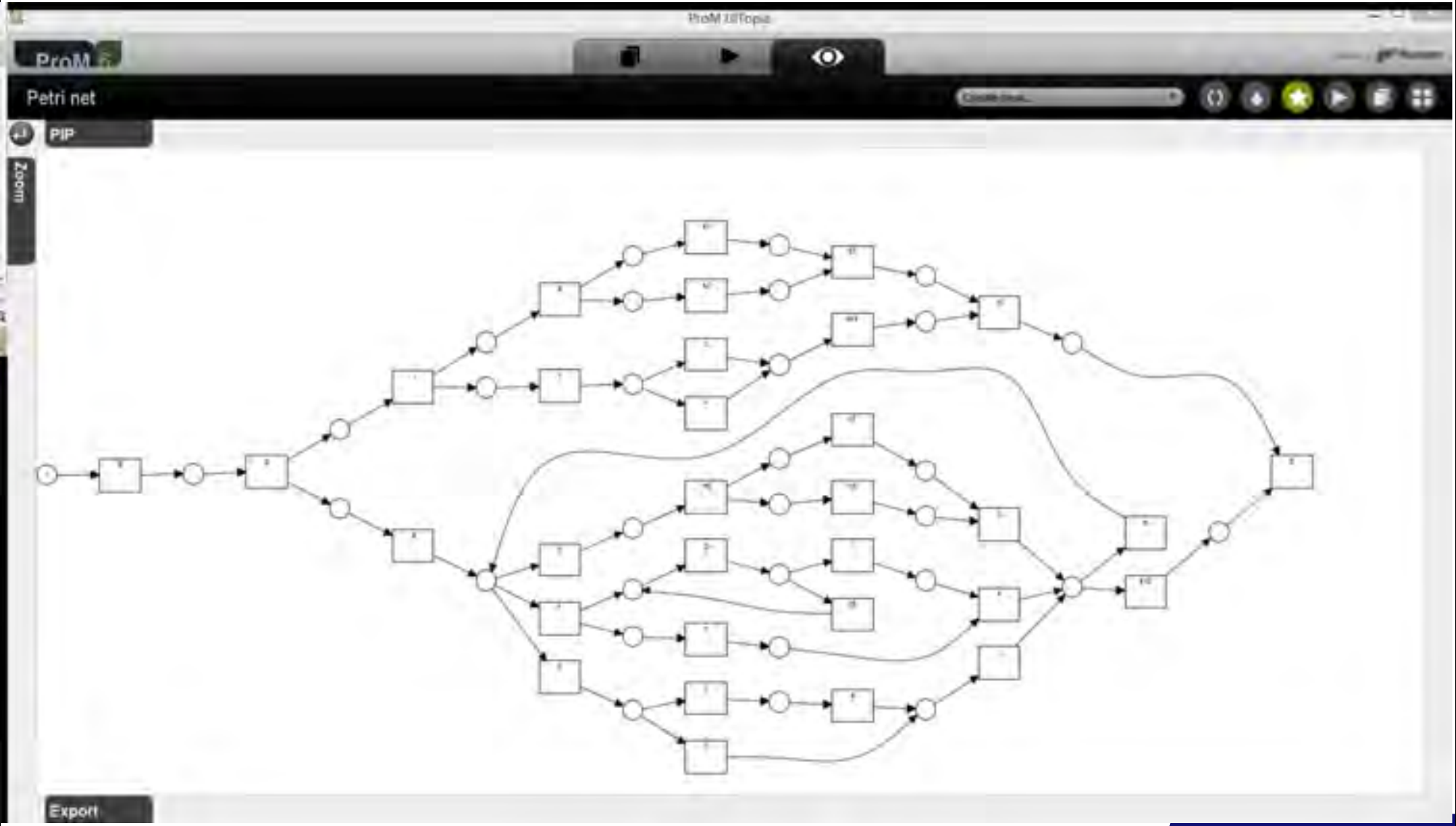


Motivation
The Impact of Exceptional Behavior



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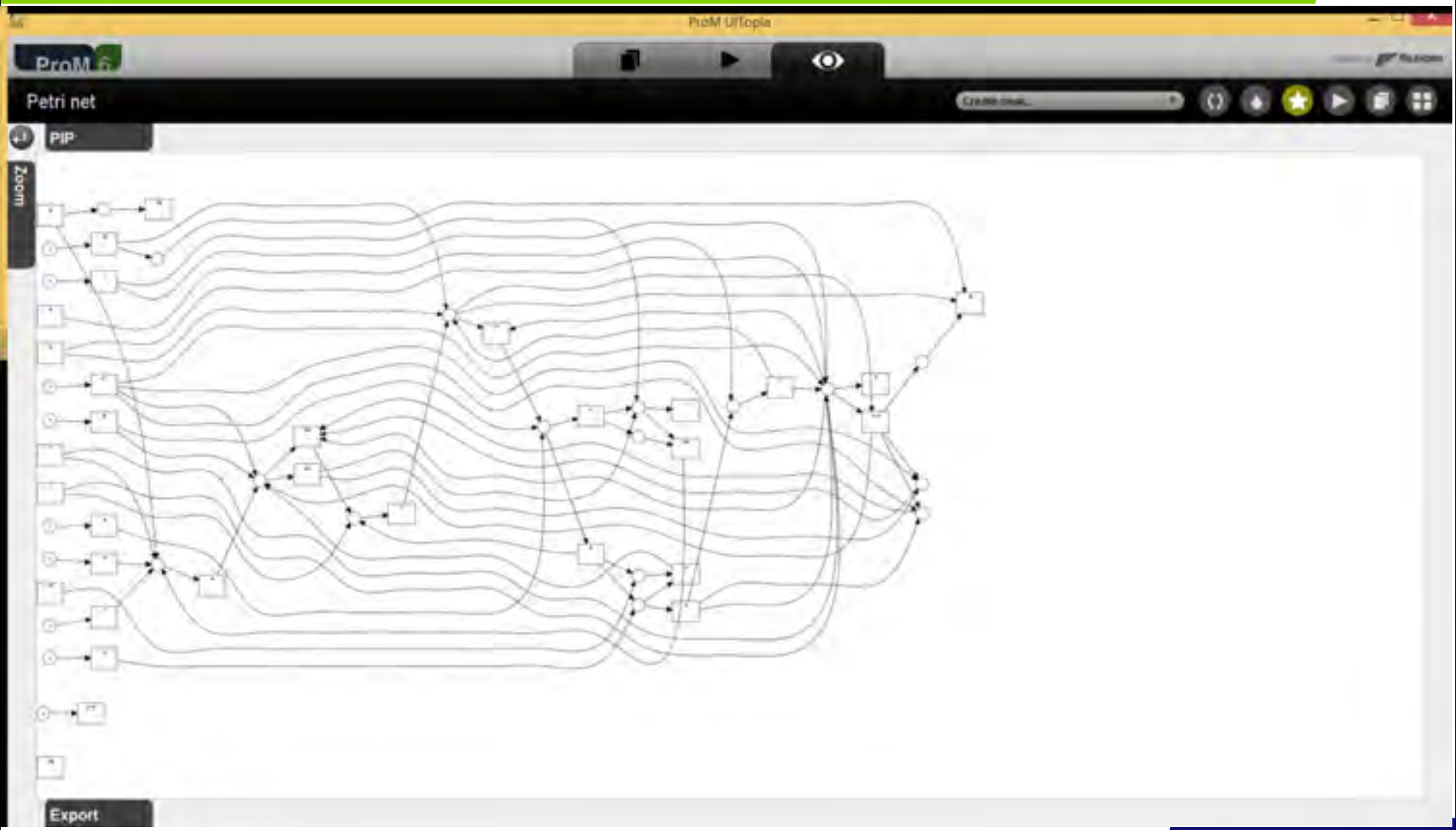

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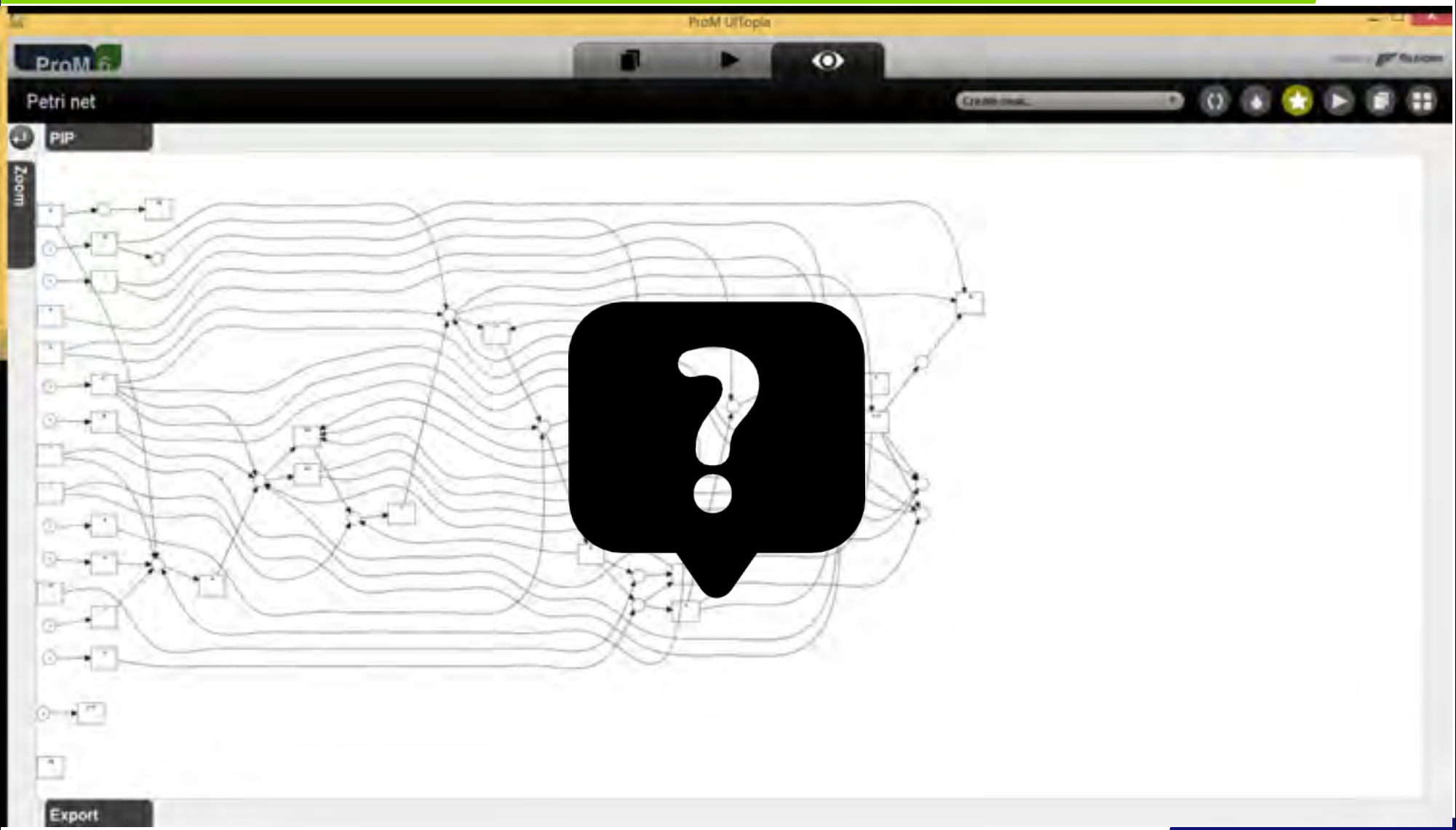
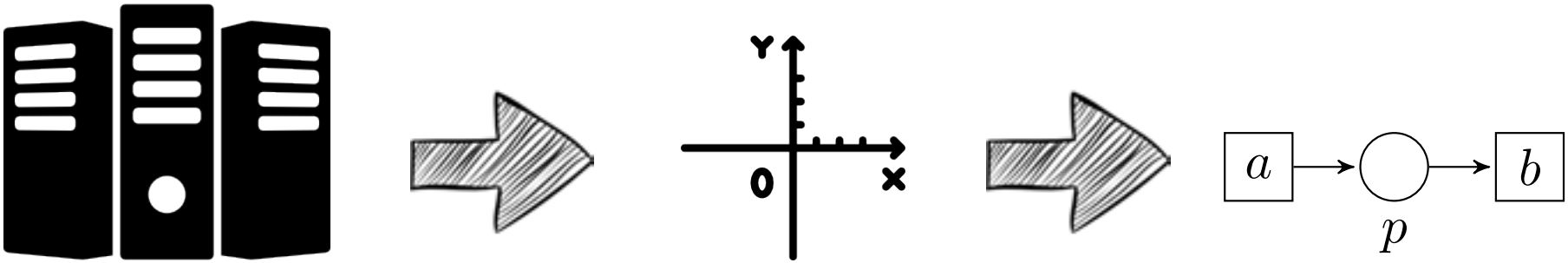


Historical Perspective
Petri net Synthesis



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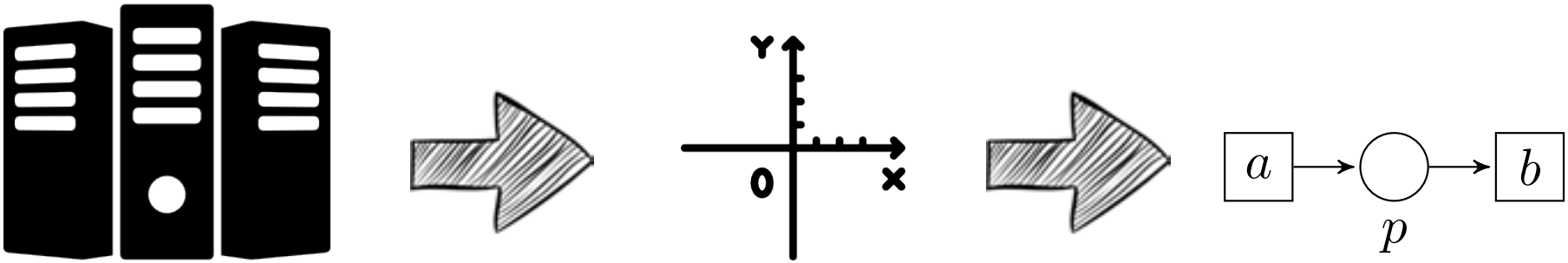

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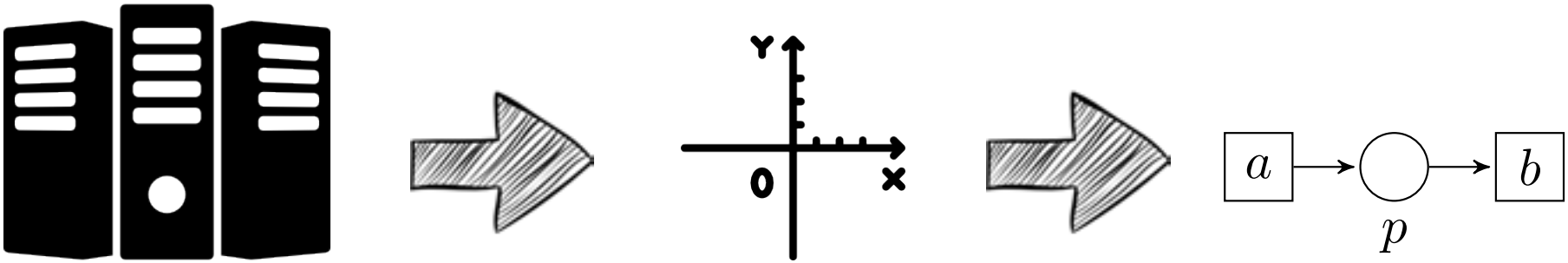

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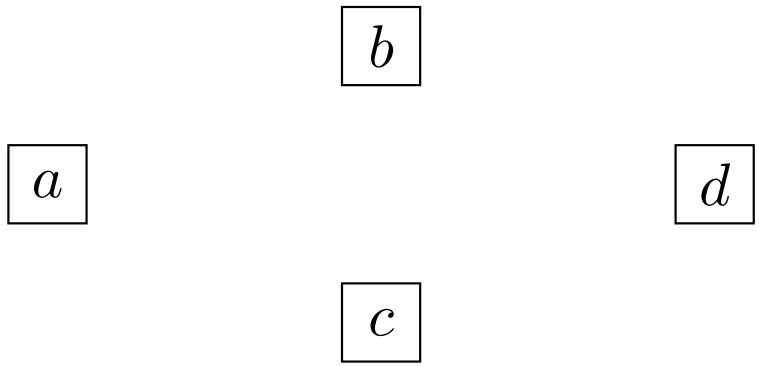

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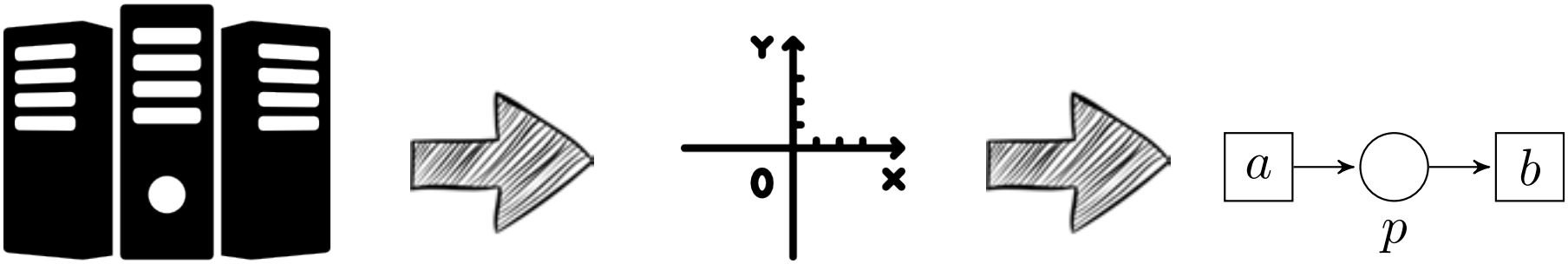

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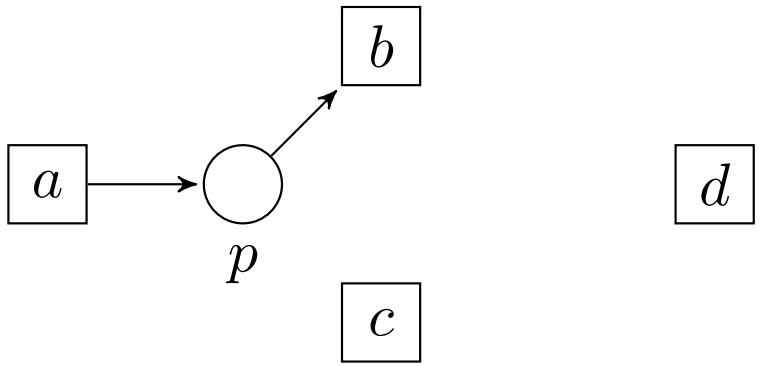

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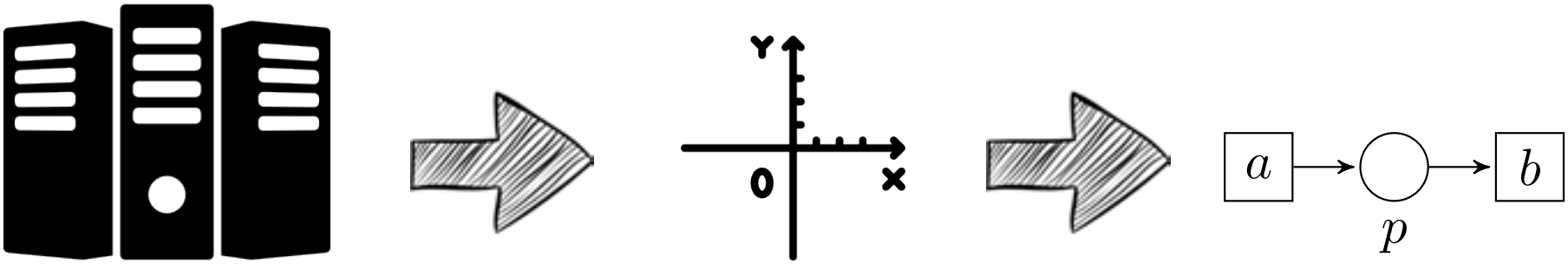

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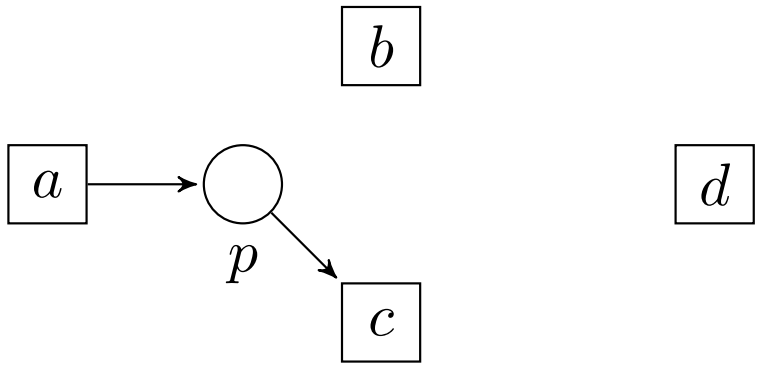

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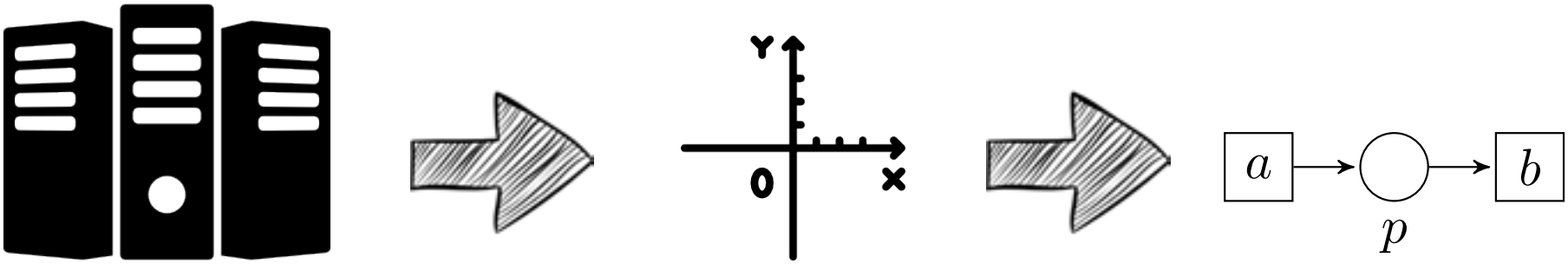

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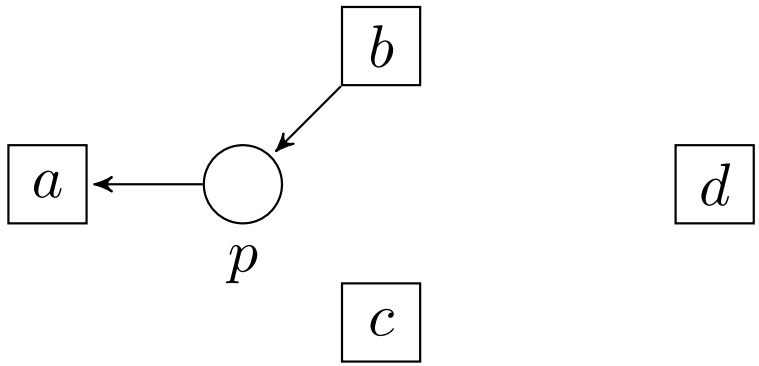
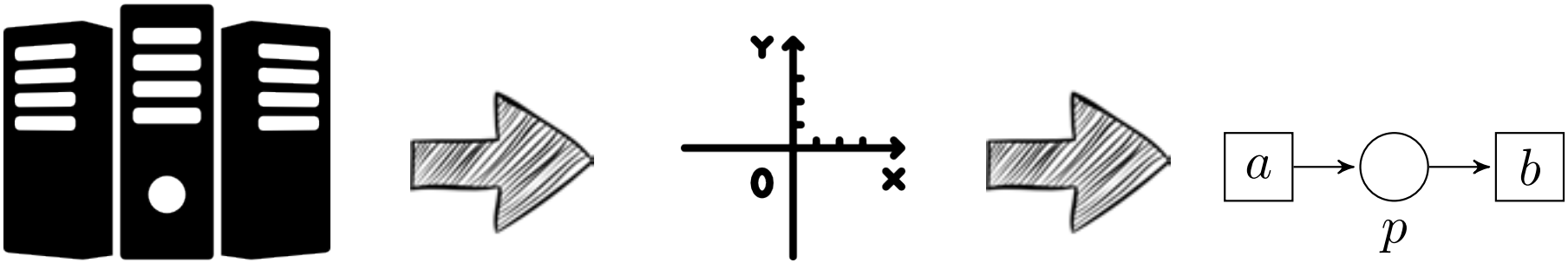


Process Discovery
Integer Linear Programming



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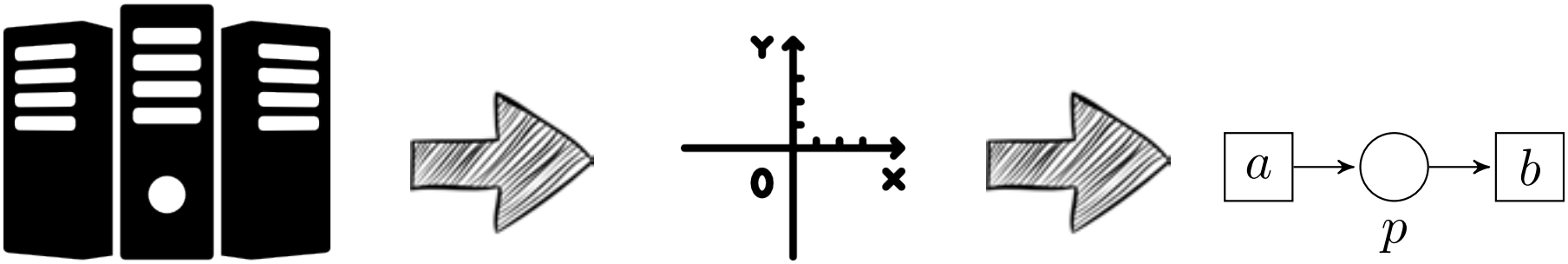

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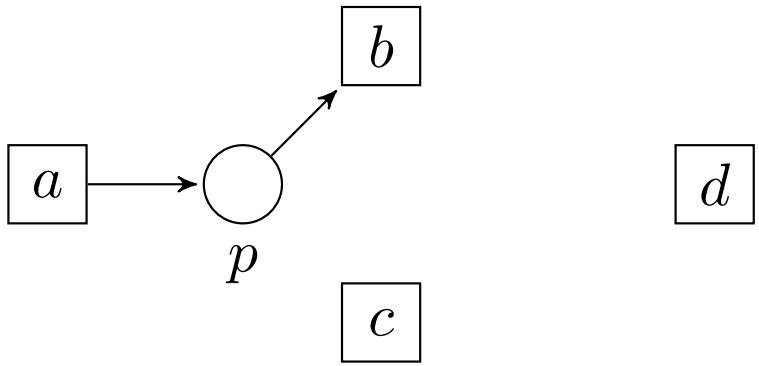

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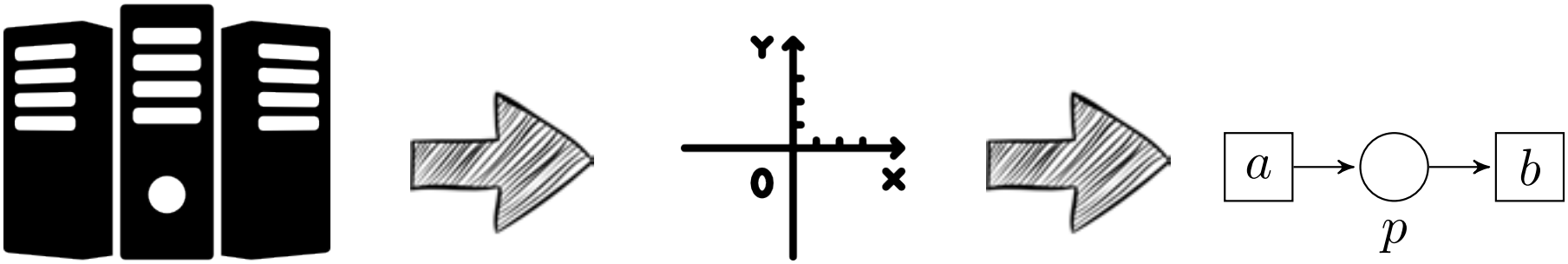

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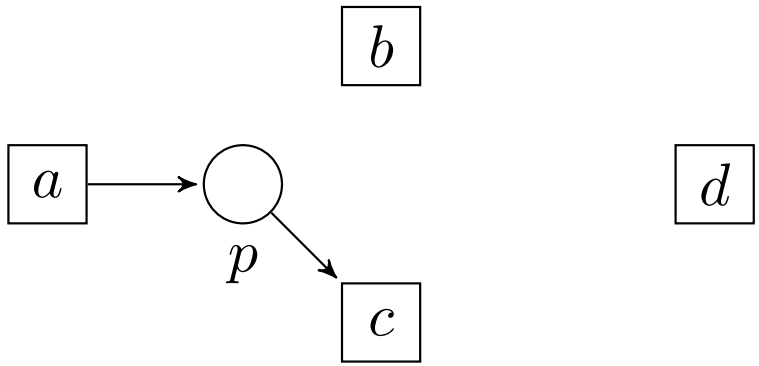

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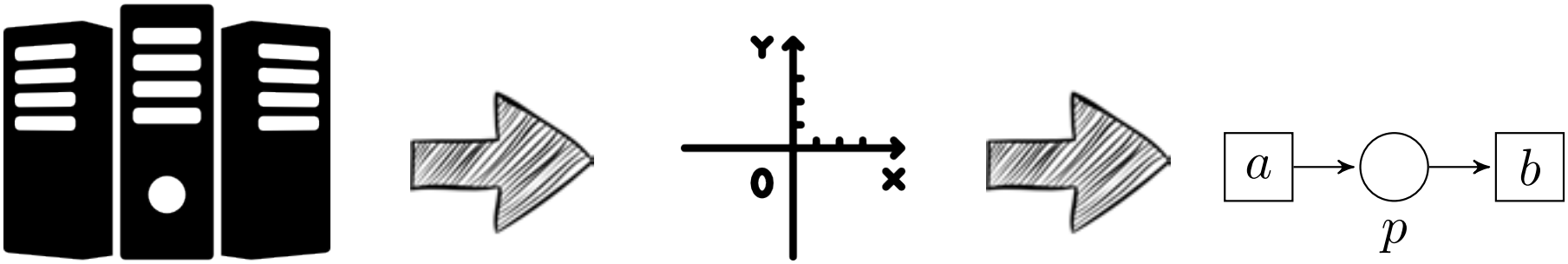

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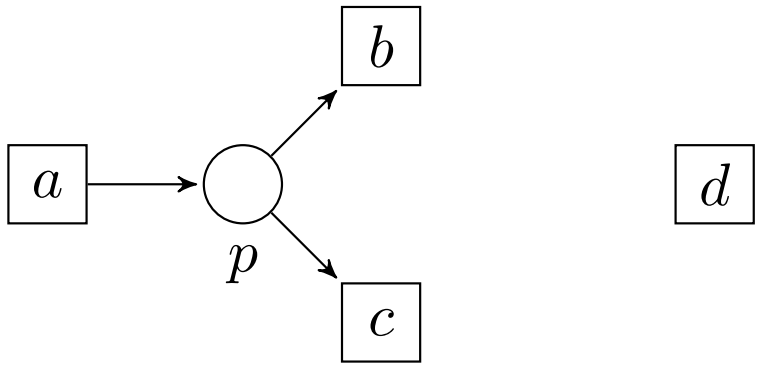

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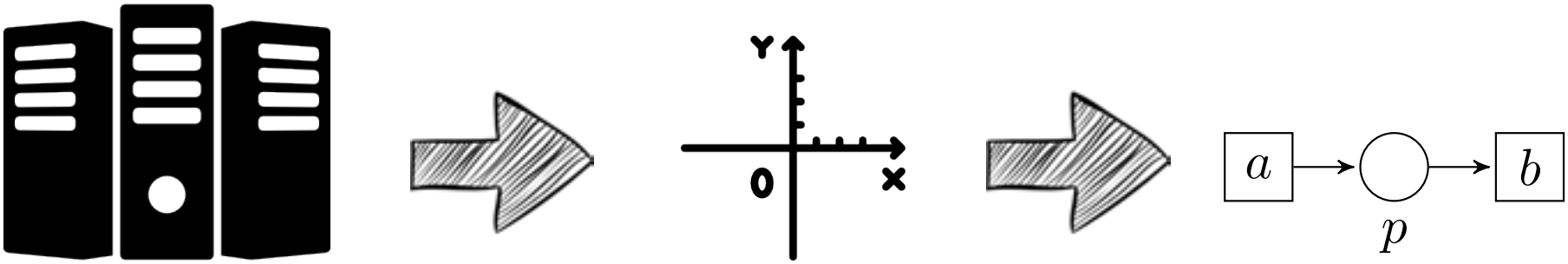

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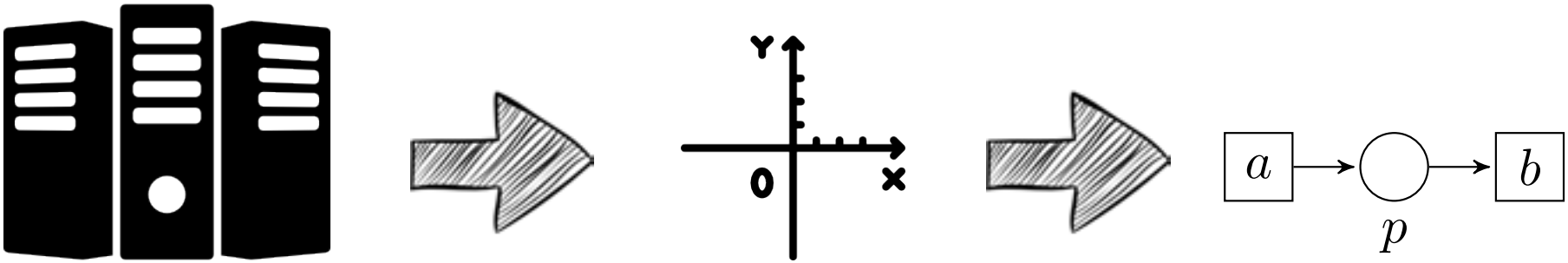

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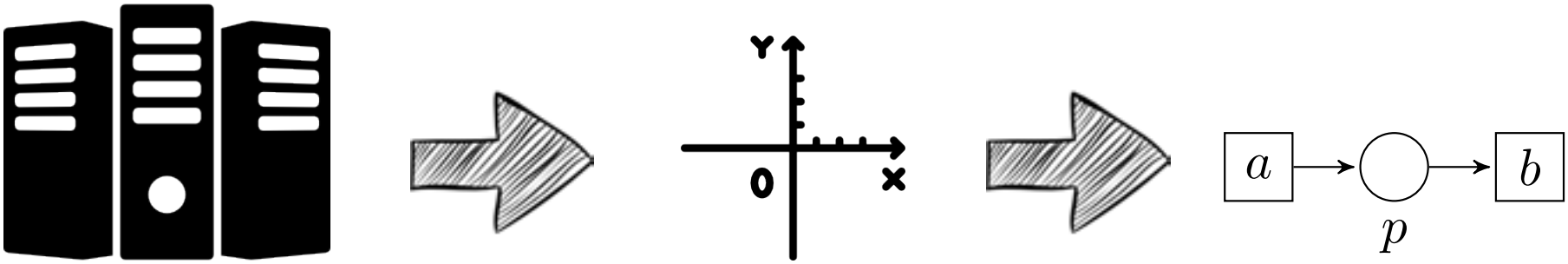

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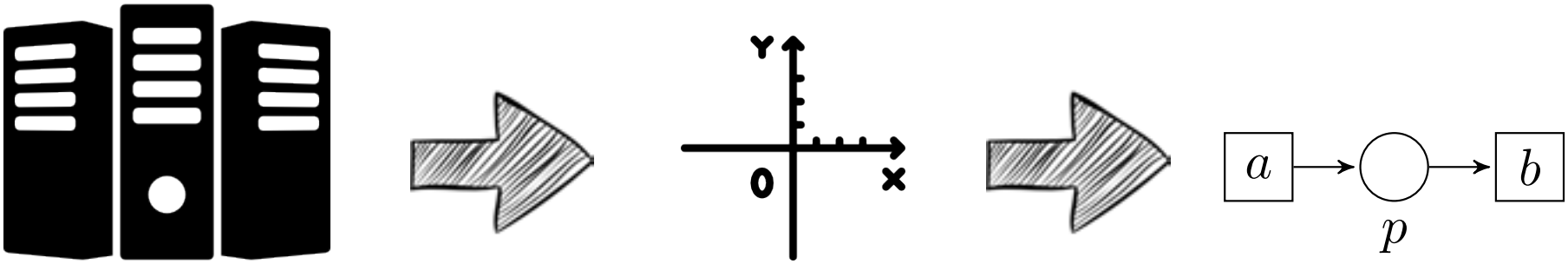

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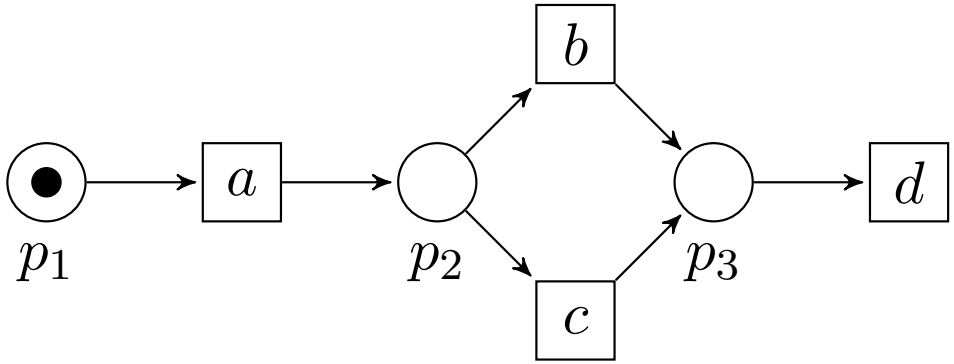

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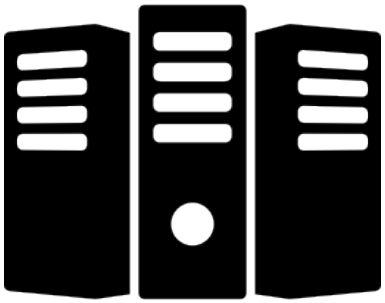

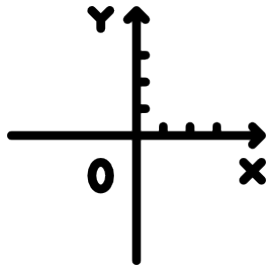

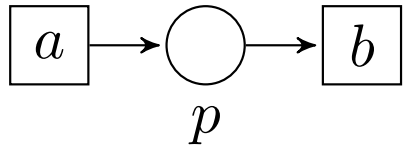

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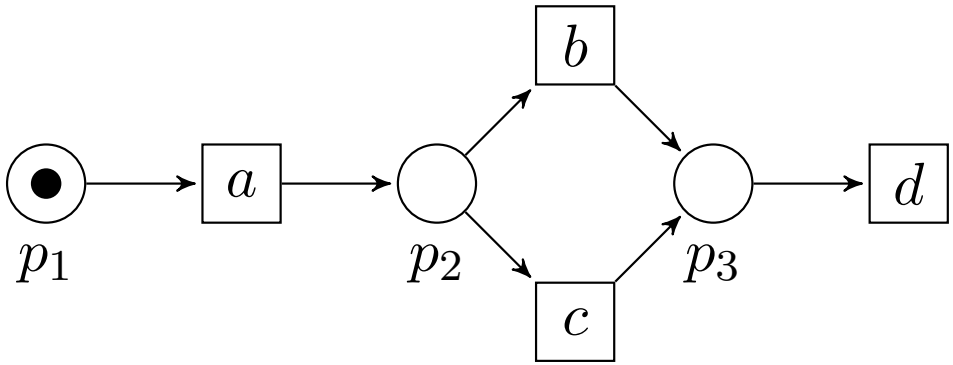

Language-Based Regions
Impact of Exceptional Behavior

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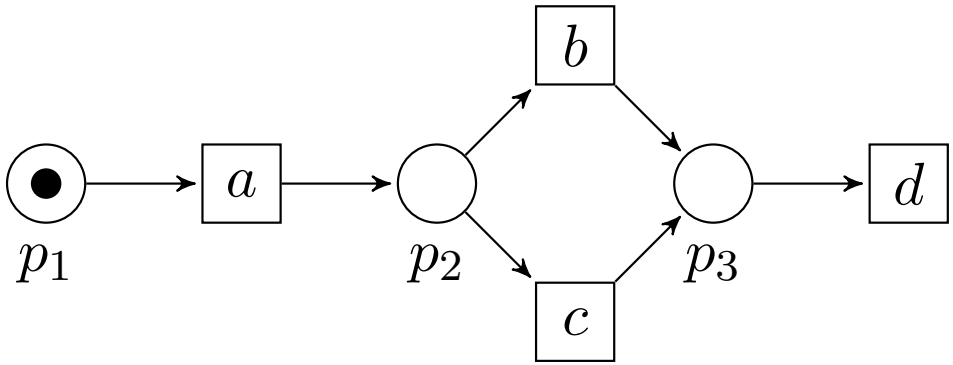

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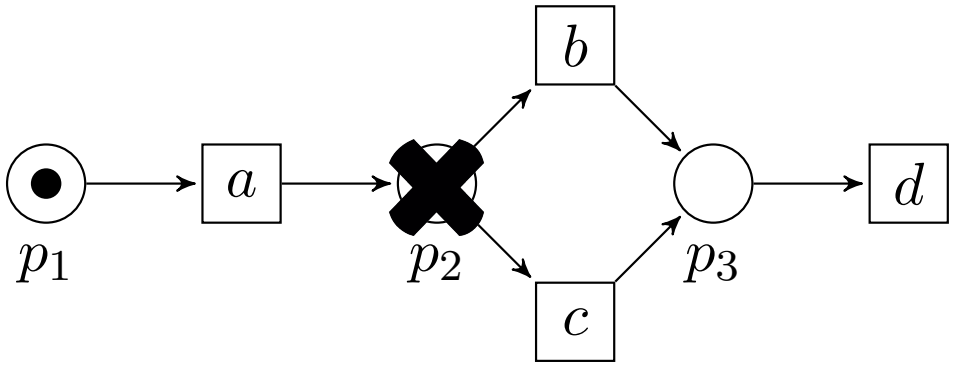

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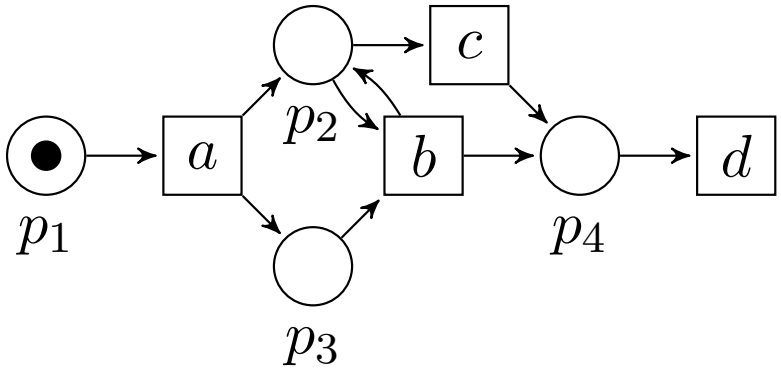

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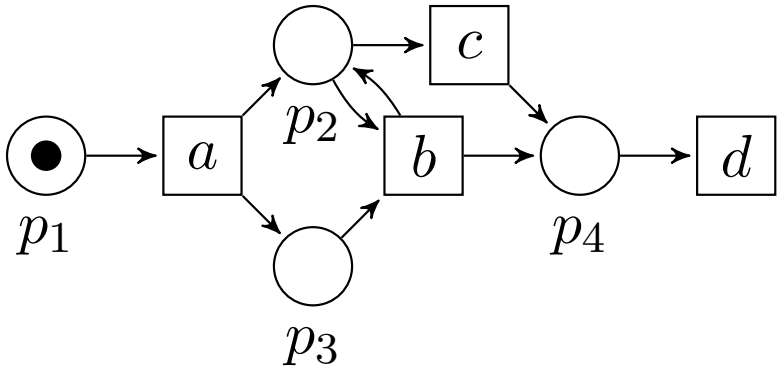

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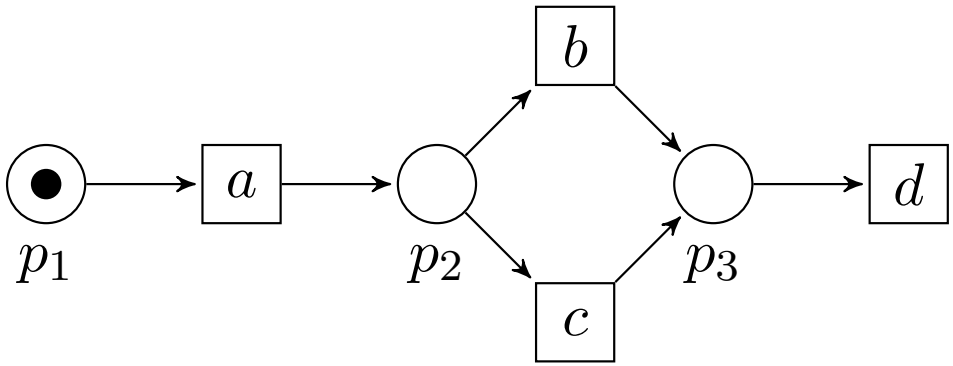

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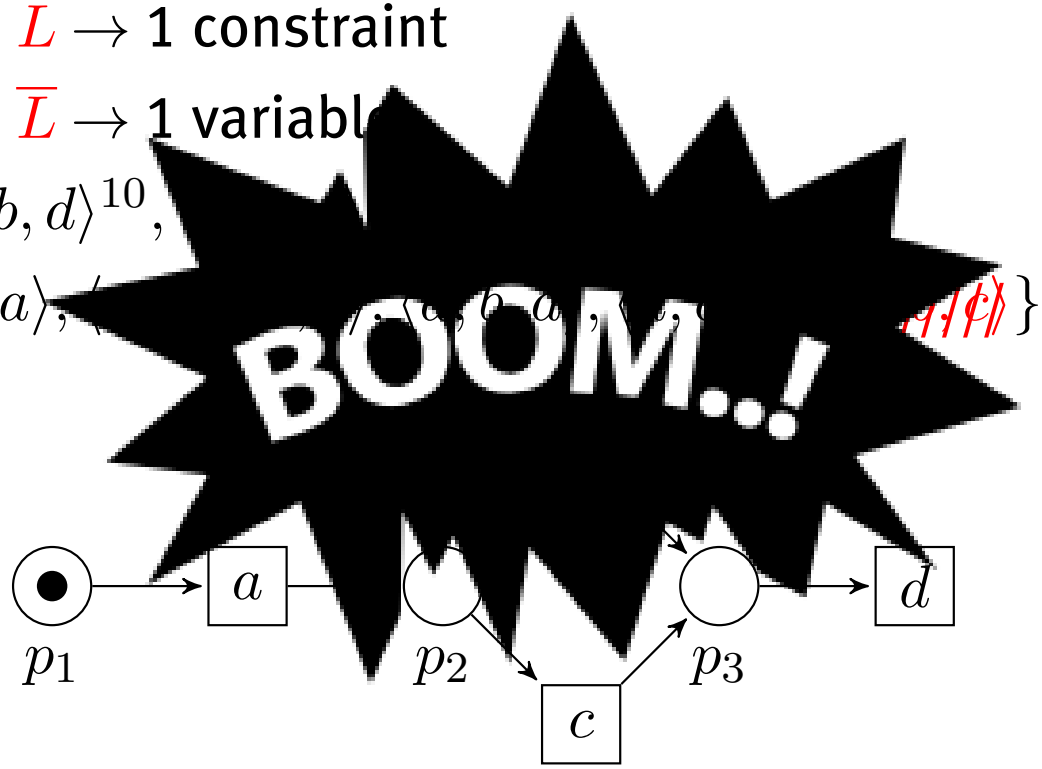

ILP-Based Process Discovery Sequence Encoding Filtering

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- $\langle a \rangle = ([], a)$

ILP-Based Process Discovery
Sequence Encoding Filtering

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$\vdots$

- $\langle a, b, c \rangle = ([a, b], c)$

ILP-Based Process Discovery
Sequence Encoding Filtering

- $\langle a \rangle = ([], a)$
- $\langle a, b \rangle = ([a], b)$
- $\langle a, c \rangle = ([a], c)$

$\vdots$

- $\langle a, b, c \rangle = ([a, b], c)$
- $L = [\langle a, b, d \rangle^{10}, \langle a, c, d \rangle^{10}, \langle a, b, c \rangle]$

ILP-Based Process Discovery
Sequence Encoding Filtering

- $\langle a \rangle = ([], a)$
- $\langle a, b \rangle = ([a], b)$
- $\langle a, c \rangle = ([a], c)$

$\vdots$

- $\langle a, b, c \rangle = ([a, b], c)$
- $L = [\langle a, b, d \rangle^{10}, \langle a, c, d \rangle^{10}, \langle a, b, c \rangle]$
- $\overline{L} = [\epsilon^{21}, \langle a \rangle^{21}, \langle a, b \rangle^{11}, \langle a, c \rangle^{10}, \langle a, b, d \rangle^{10}, \langle a, c, d \rangle^{10}, \langle a, b, c \rangle]$

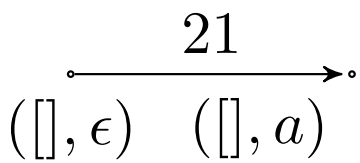
ILP-Based Process Discovery
Sequence Encoding Filtering

- $\overline{L} = [\epsilon^{21}, \langle a \rangle^{21}, \langle a, b \rangle^{11}, \langle a, c \rangle^{10}, \langle a, b, d \rangle^{10}, \langle a, c, d \rangle^{10}, \langle a, b, c \rangle]$

$$([\overset{\circ}{]}, \epsilon)$$

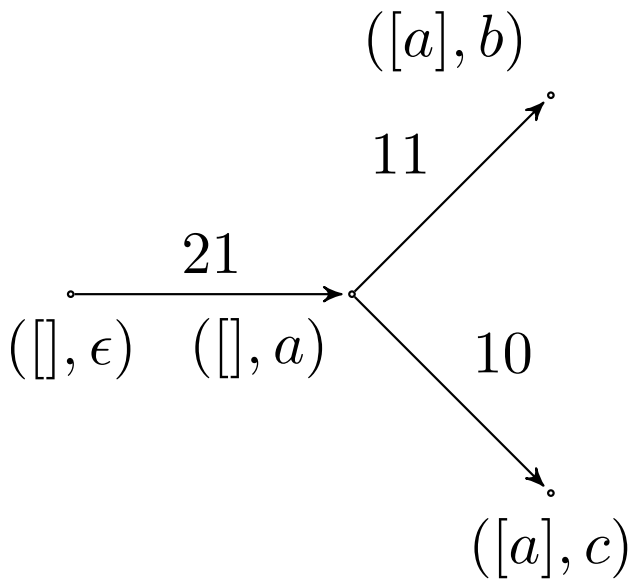
ILP-Based Process Discovery
Sequence Encoding Filtering

- $\overline{L} = [\epsilon^{21}, \langle a \rangle^{21}, \langle a, b \rangle^{11}, \langle a, c \rangle^{10}, \langle a, b, d \rangle^{10}, \langle a, c, d \rangle^{10}, \langle a, b, c \rangle]$



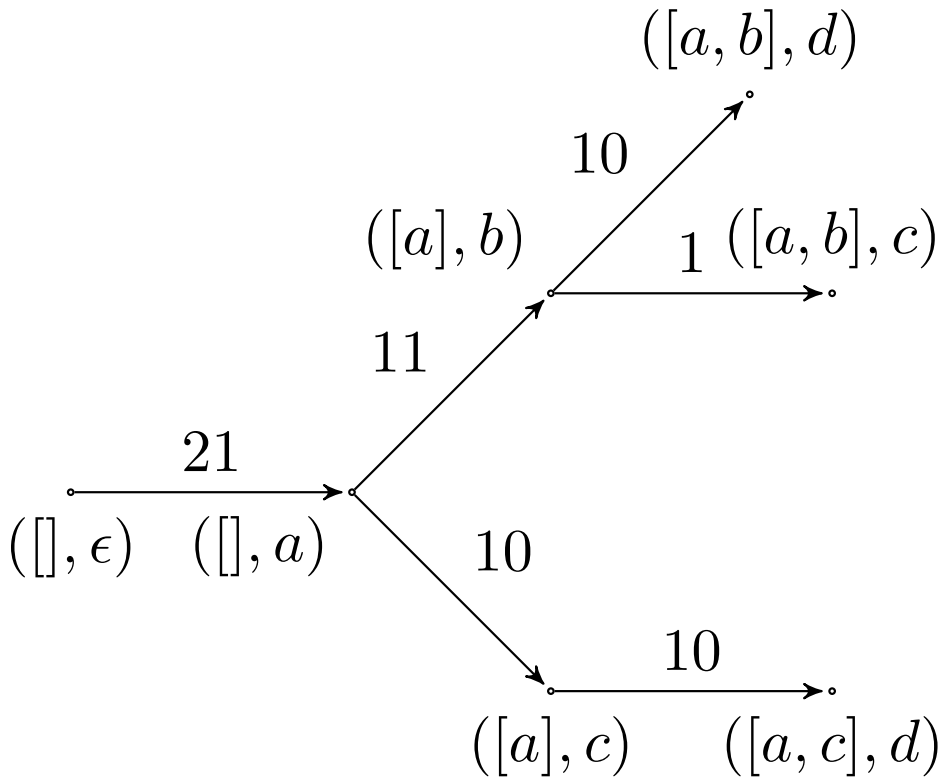
ILP-Based Process Discovery
Sequence Encoding Filtering

- $\overline{L} = [\epsilon^{21}, \langle a \rangle^{21}, \langle a, b \rangle^{11}, \langle a, c \rangle^{10}, \langle a, b, d \rangle^{10}, \langle a, c, d \rangle^{10}, \langle a, b, c \rangle]$

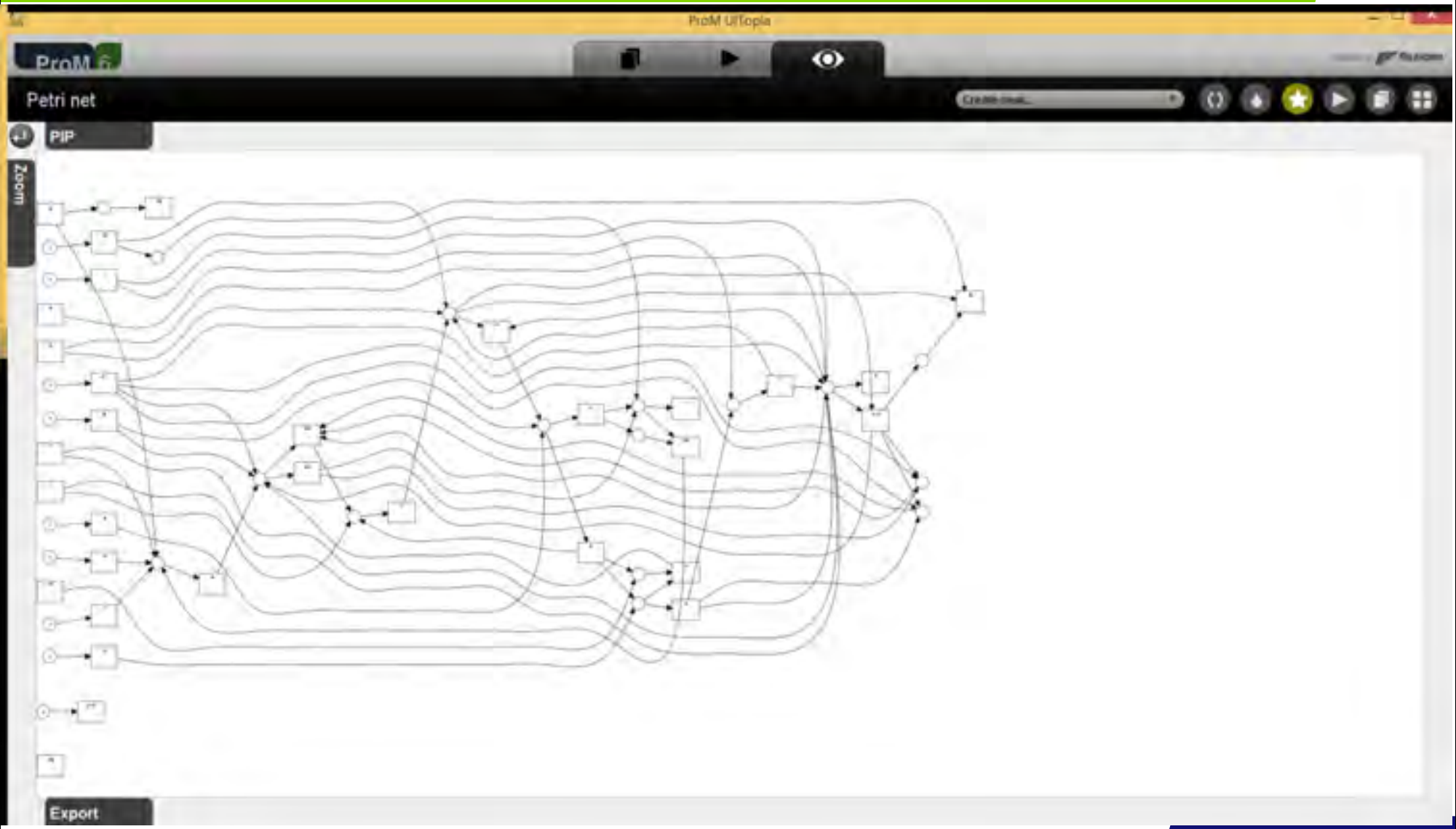


ILP-Based Process Discovery
Sequence Encoding Filtering

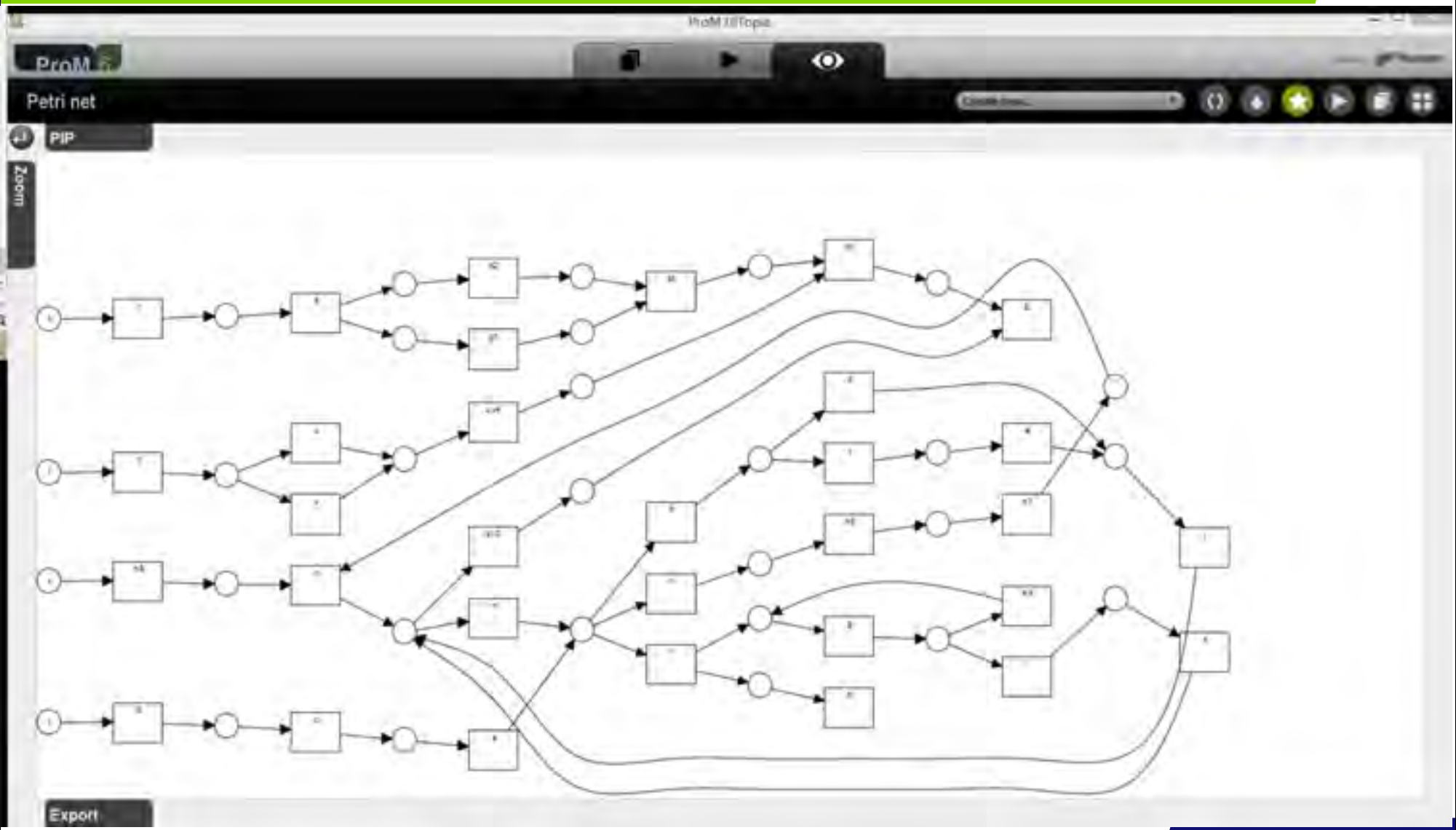
- $\overline{L} = [\epsilon^{21}, \langle a \rangle^{21}, \langle a, b \rangle^{11}, \langle a, c \rangle^{10}, \langle a, b, d \rangle^{10}, \langle a, c, d \rangle^{10}, \langle a, b, c \rangle]$



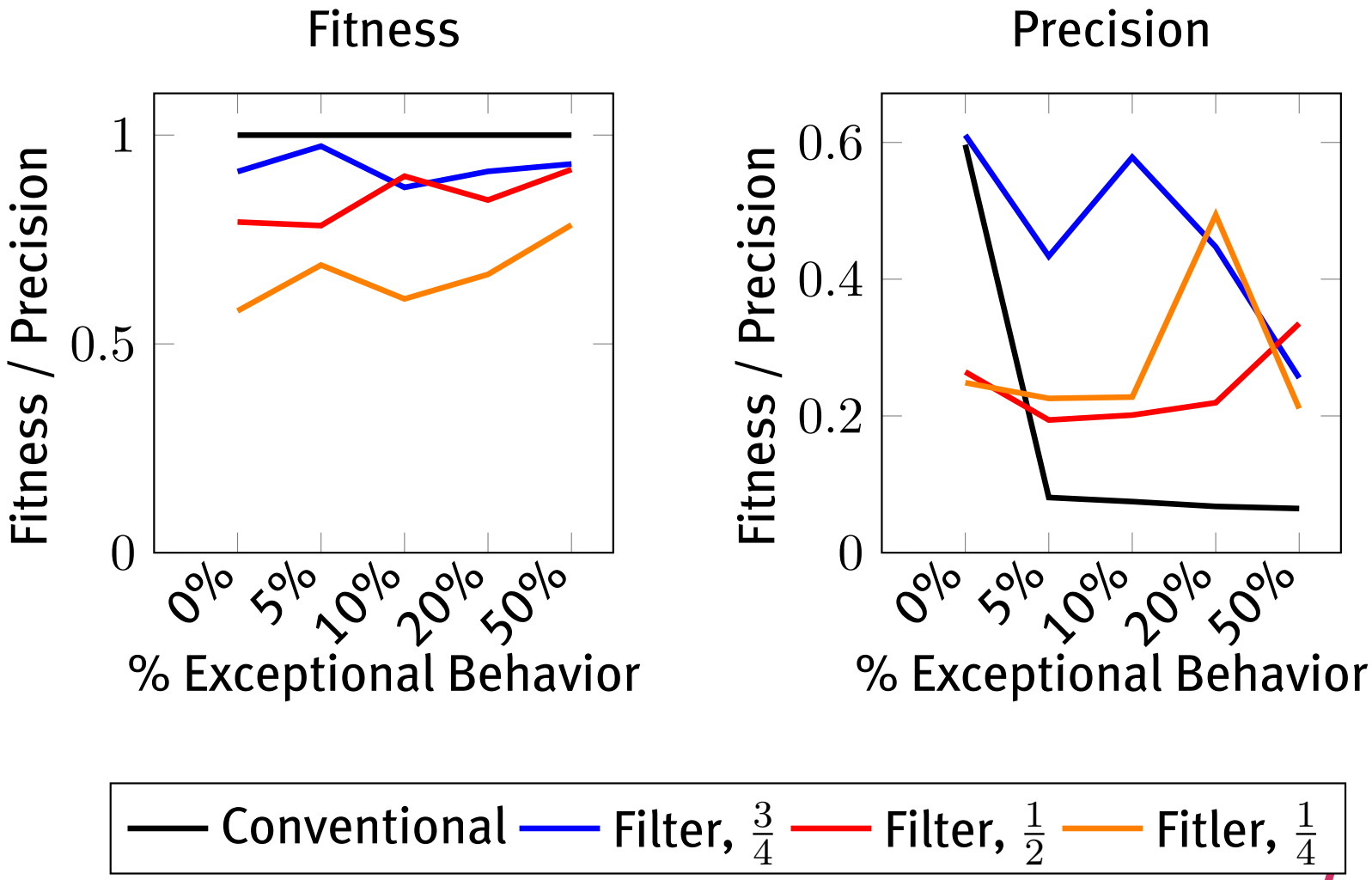
Evaluation
Qualitative



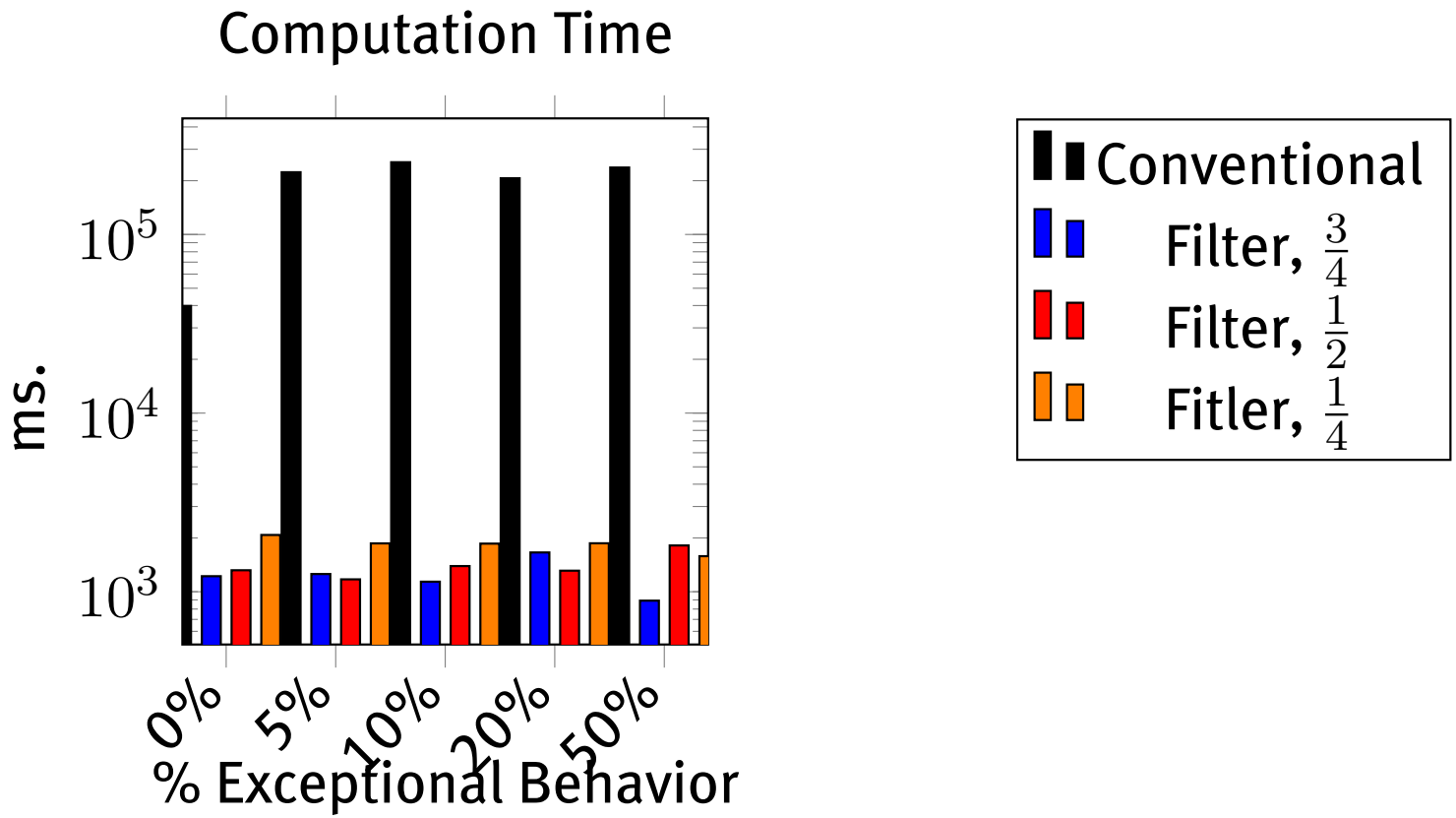
Evaluation
Qualitative



Evaluation
Quantitative - Replay Fitness / Precision



Evaluation
Quantitative - Computation Time



Conclusion

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Questions