

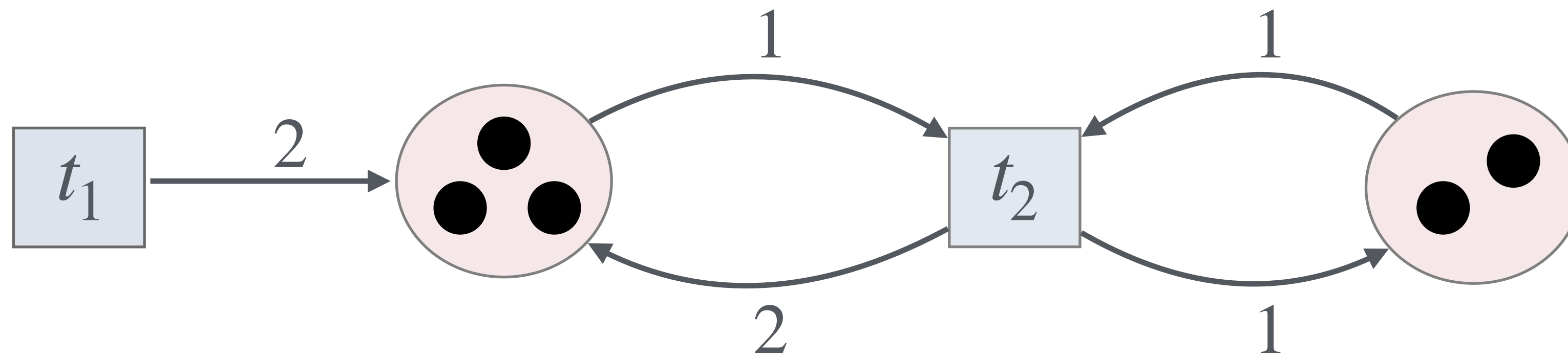
Bi-reachability in Petri nets with data

Łukasz Kamiński

University of Warsaw

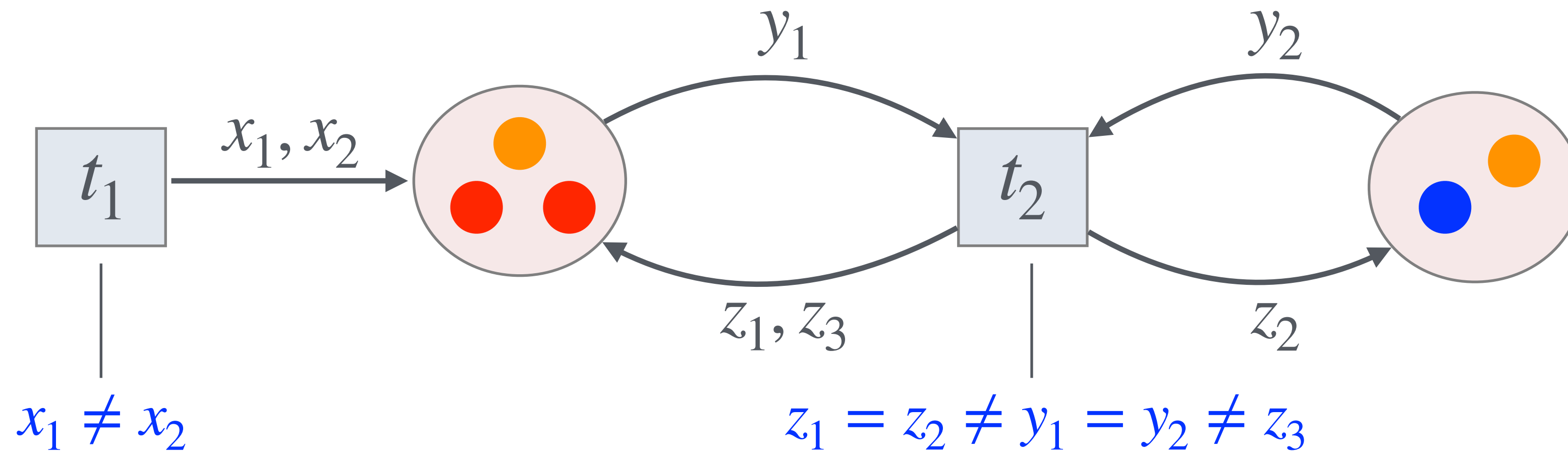
Highlights, 18th Sep 2024

Petri nets



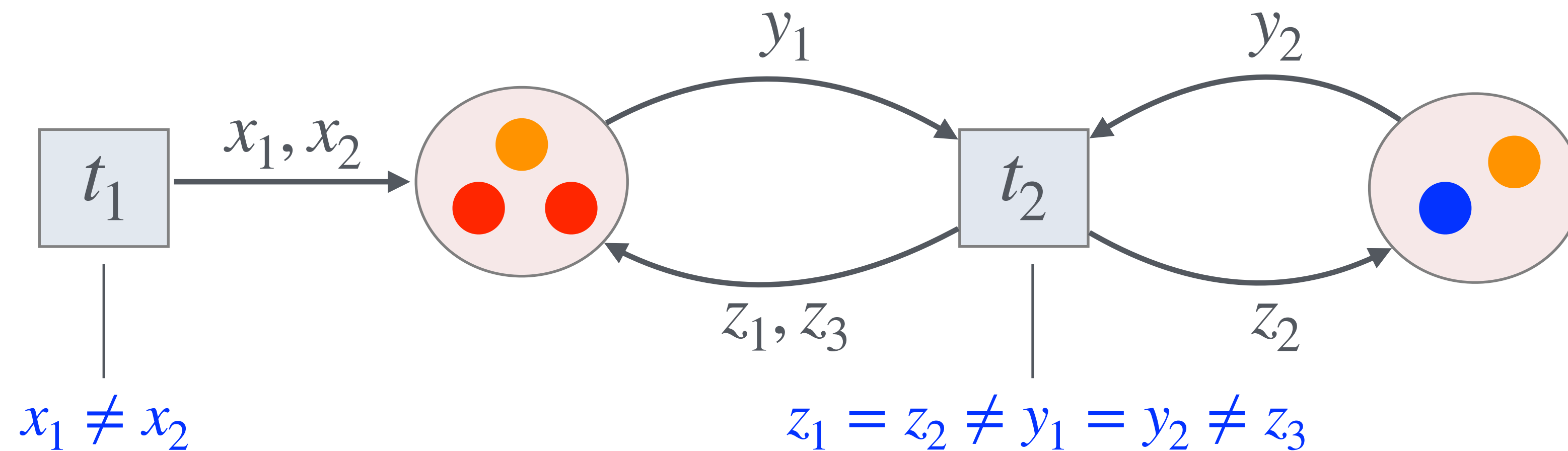
Petri nets with equality data

Let $\mathbb{A} = \{ \text{orange}, \text{red}, \text{blue}, \text{green}, \dots \}$ be an infinite set of data.



Petri nets with equality data

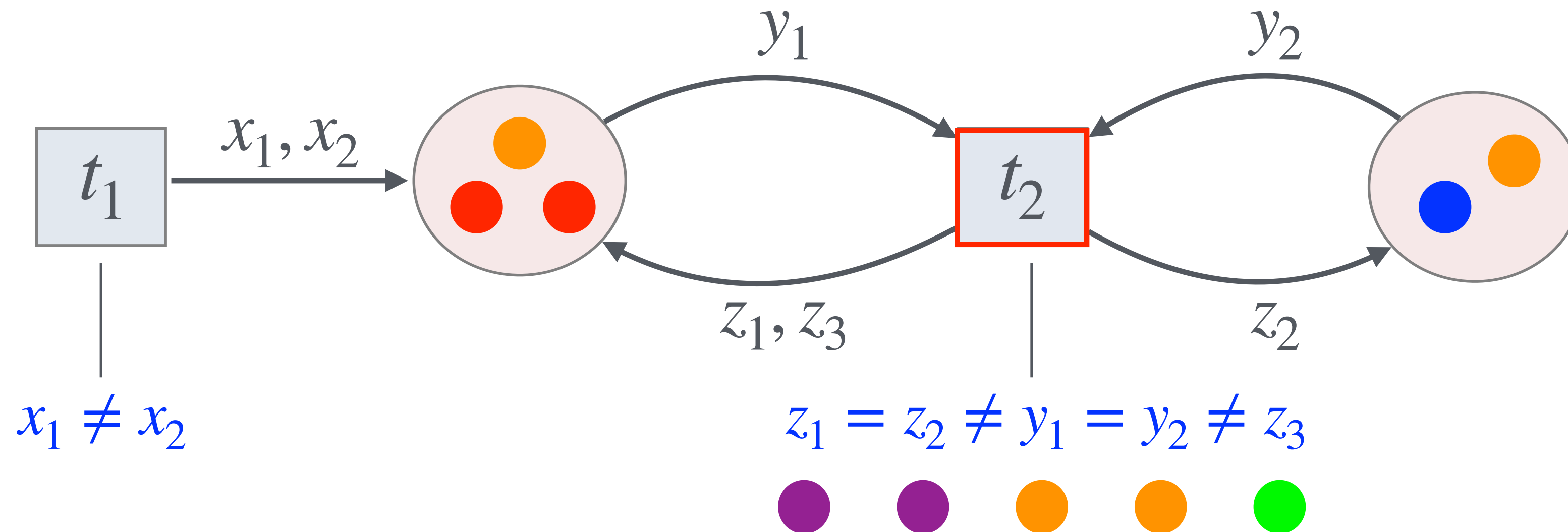
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Configuration = distribution of tokens over the places

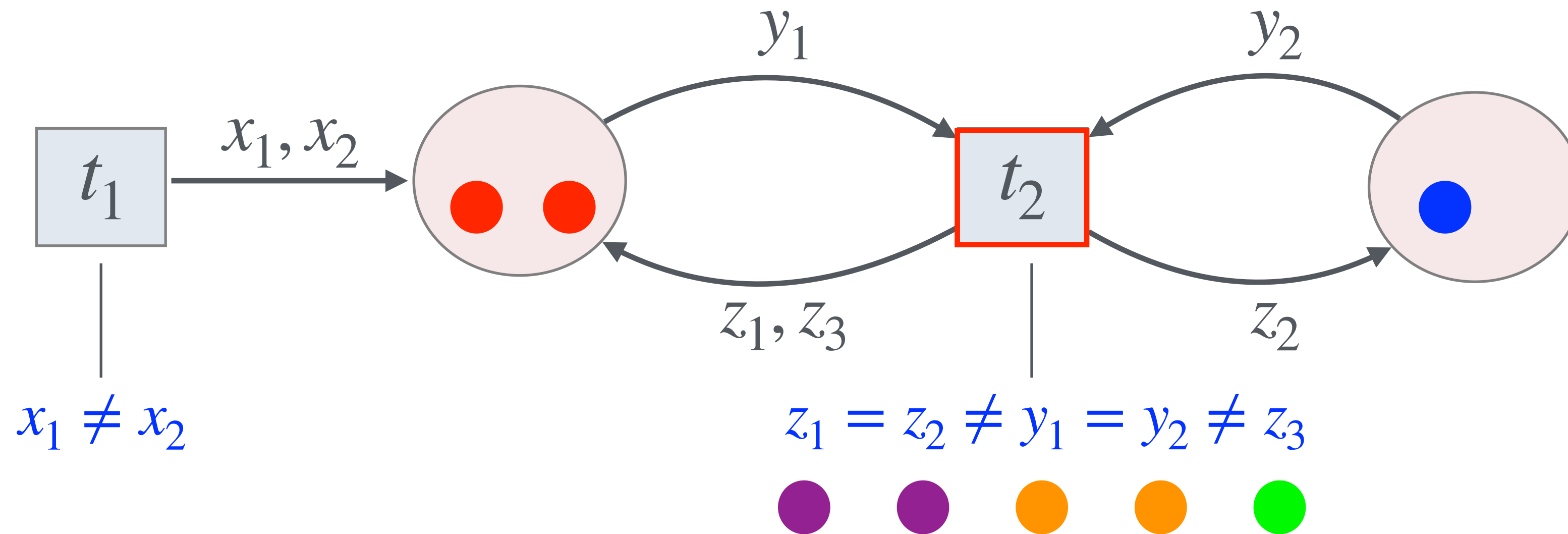
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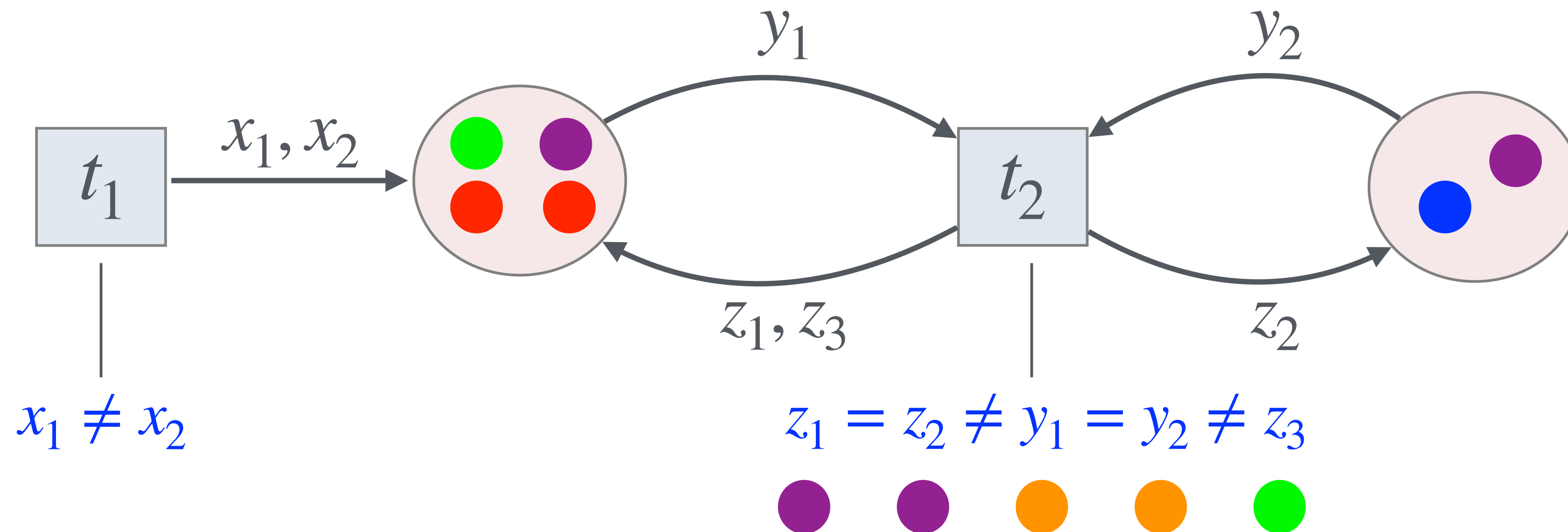
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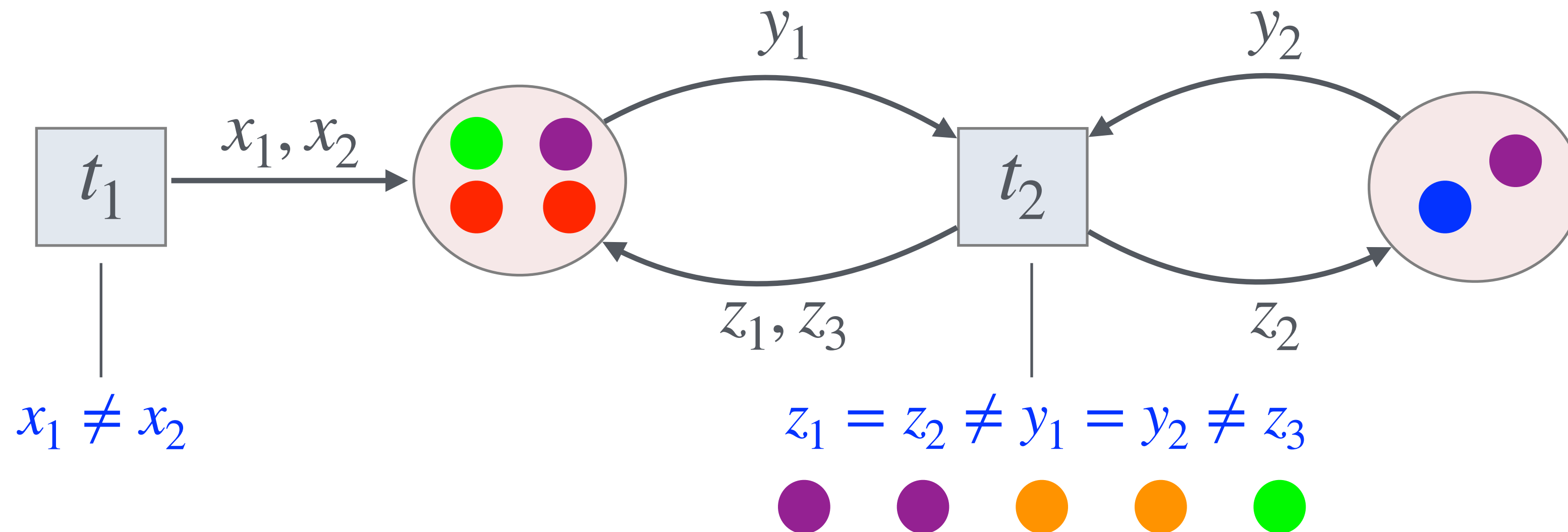
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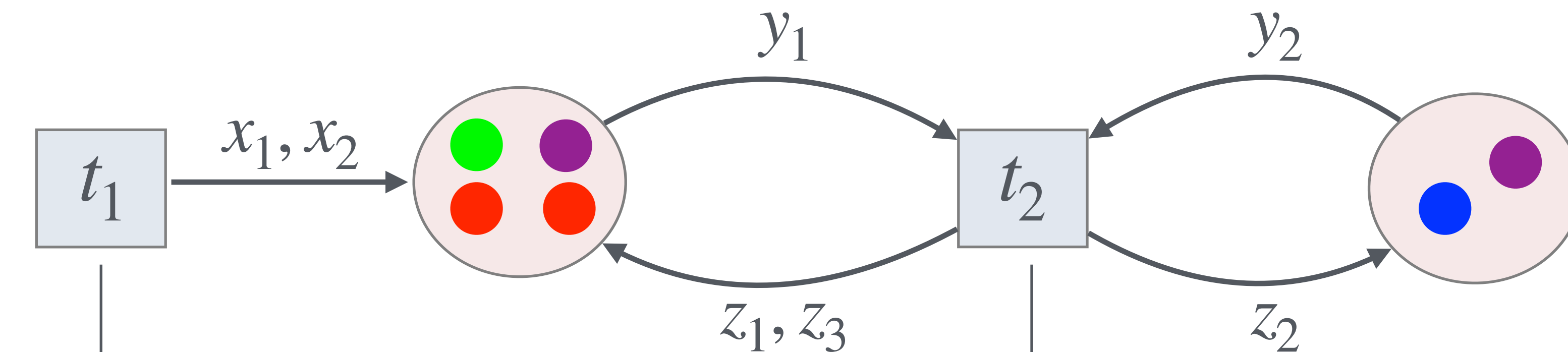


Consider a permutation σ that swaps

● and ●

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$$x_1 \neq x_2$$

$$z_1 = z_2 \neq y_1 = y_2 \neq z_3$$

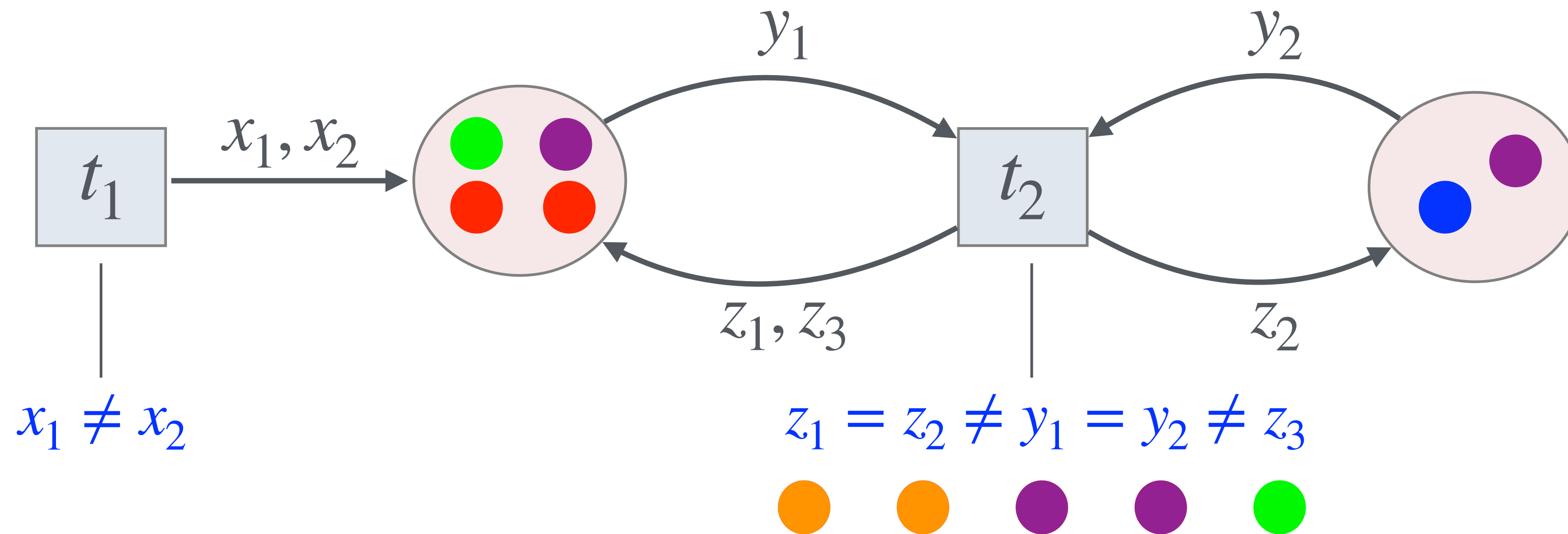


Consider a permutation σ that swaps



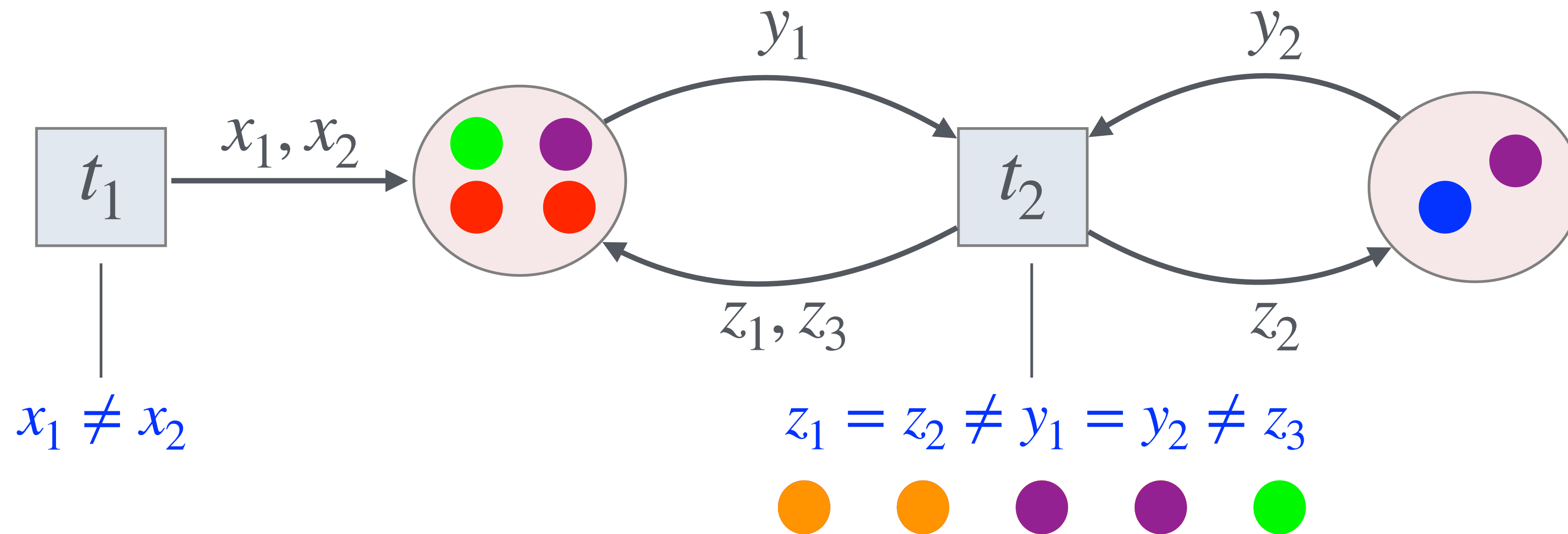
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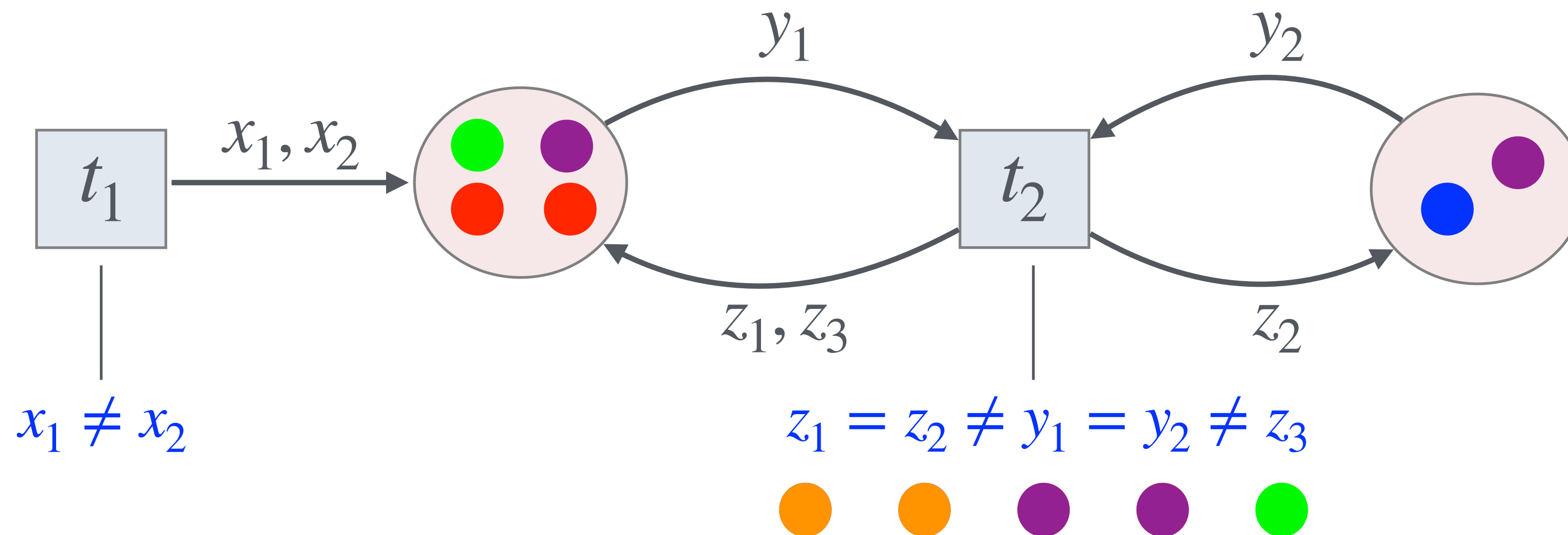
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Orbit of a transition = equivalence class w.r.t. actions of permutations

Petri nets with equality data

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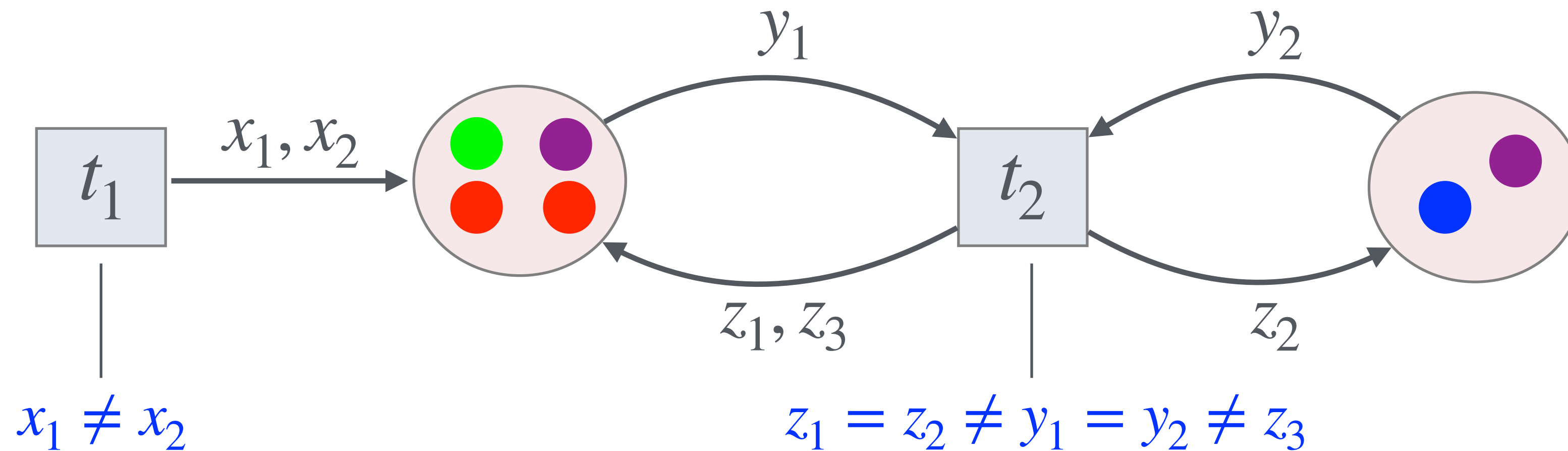
The set of transitions is infinite, but **orbit-finite**

[Bojańczyk, Klin, Lasota, Toruńczyk, '13]

[Bojańczyk, Klin, Lasota, '14]

Petri nets with equality data

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High-level Petri nets

[Genrich, Lautenbach, '81]

Coloured Petri nets

[Jensen, '81]

Constrained multiset rewriting

[Cervesato, Durgin, Lincoln, Mitchell, Scedrov, '99]

[Delzanno, '05]

Petri nets with data

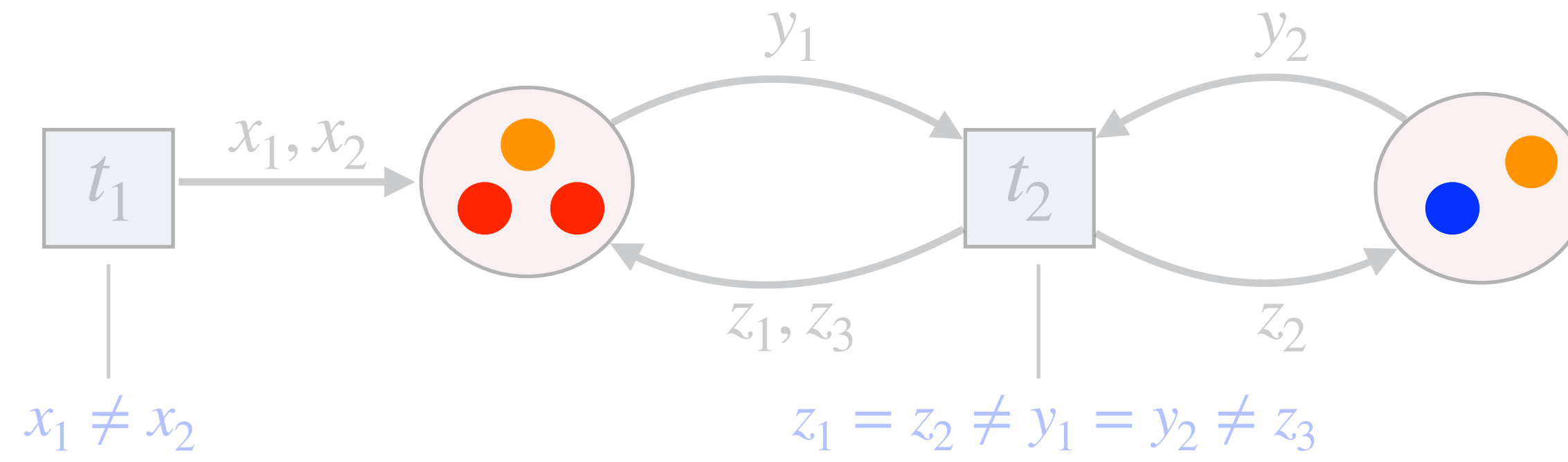
[Lazic, Newcomb, Ouaknine, Roscoe, Worrell, '07]

[Rosa-Velardo, Frutos-Escrig, '11]

[Lasota, '16]

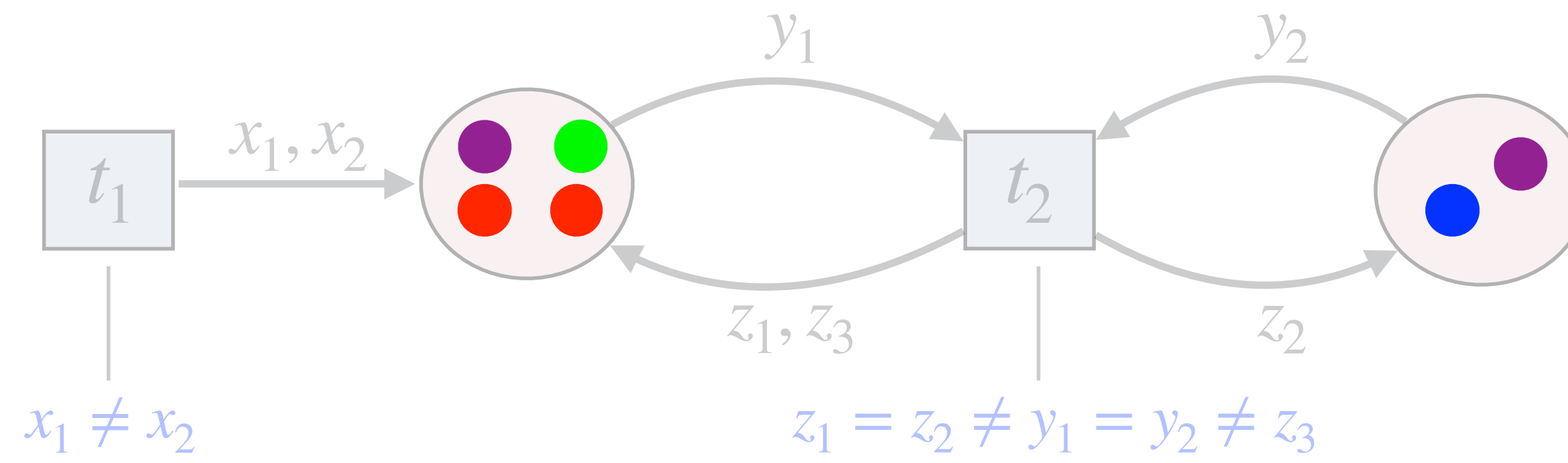
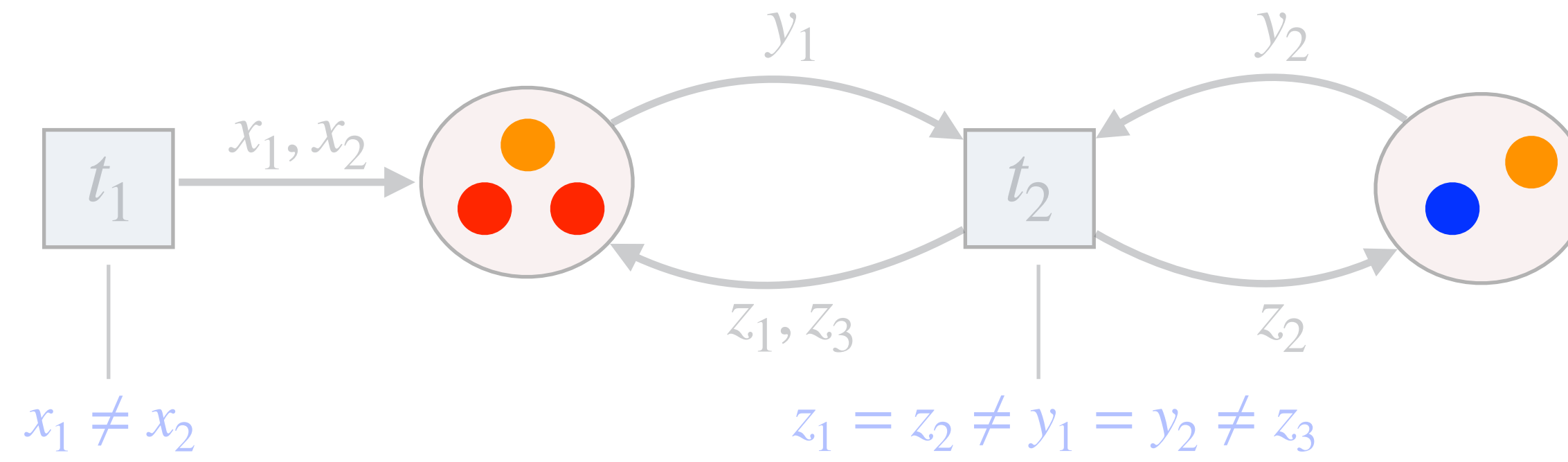
Runs

Source



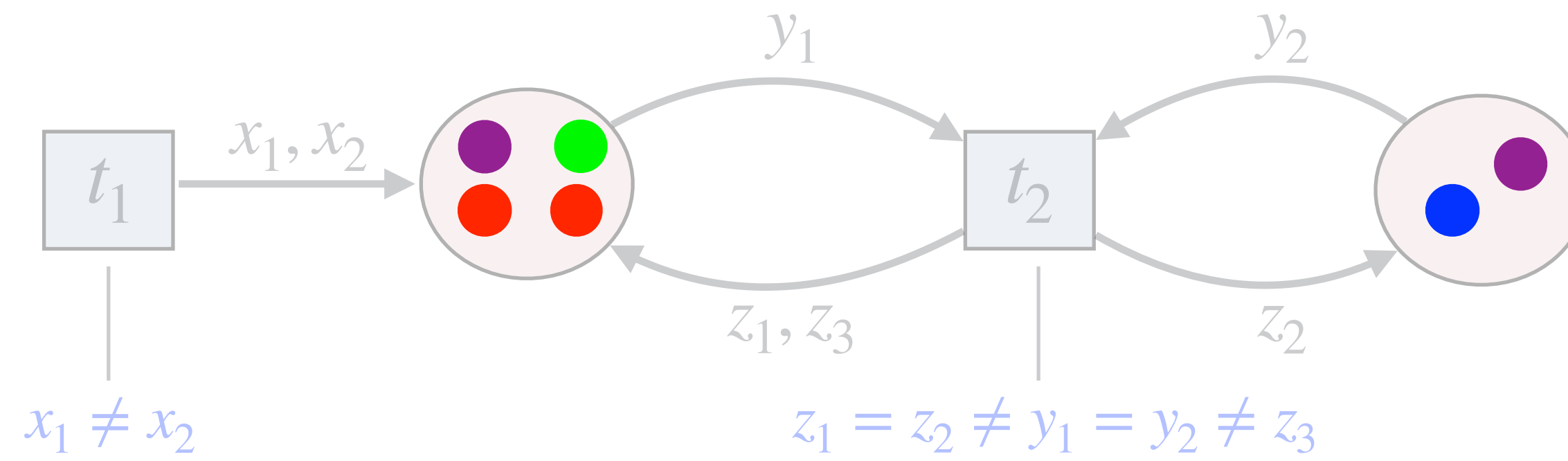
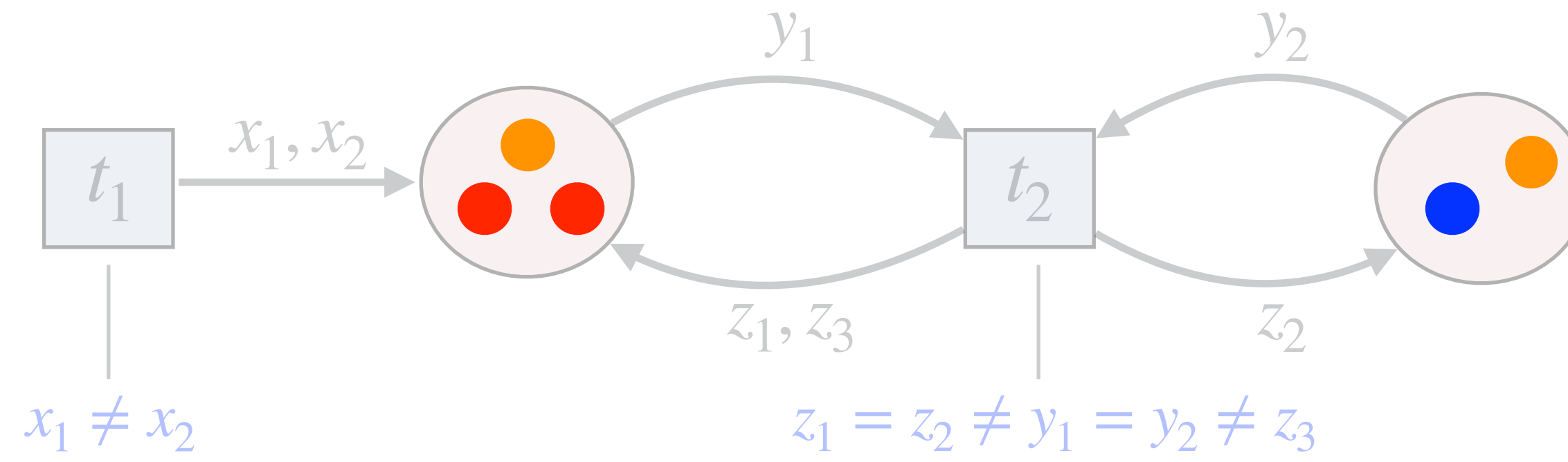
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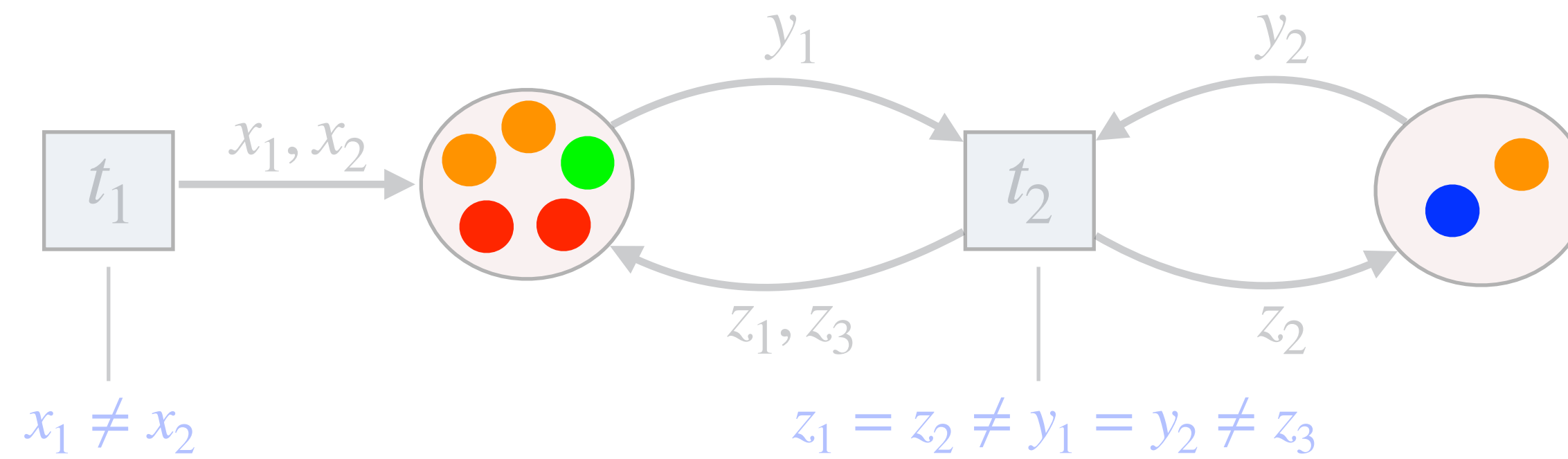


Runs

Source



Target



Decision problems

Input: a (data) Petri net, source and target configurations

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Reachability

Is there a run from source to target?

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Is there a run from source to target or a greater configuration?

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Reachability in reversible Petri net

Assuming that all transitions are reversible, is there a run from source to target?

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Bi-reachability (mutual reachability)

Are there two runs, from source to target, and from target to source?

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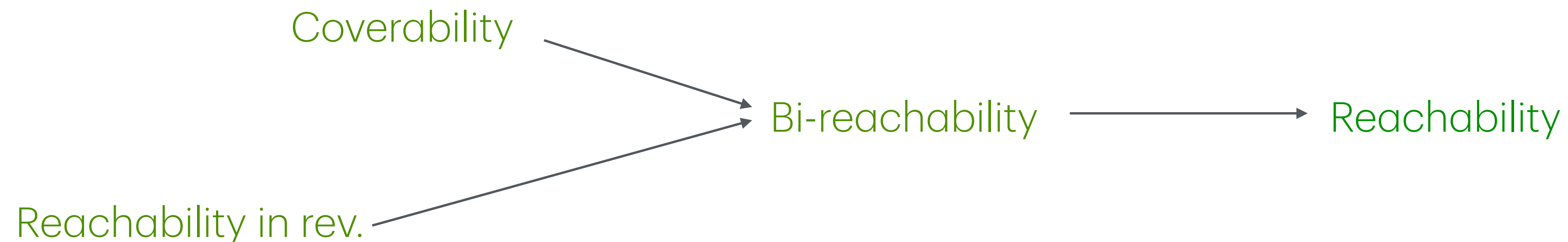
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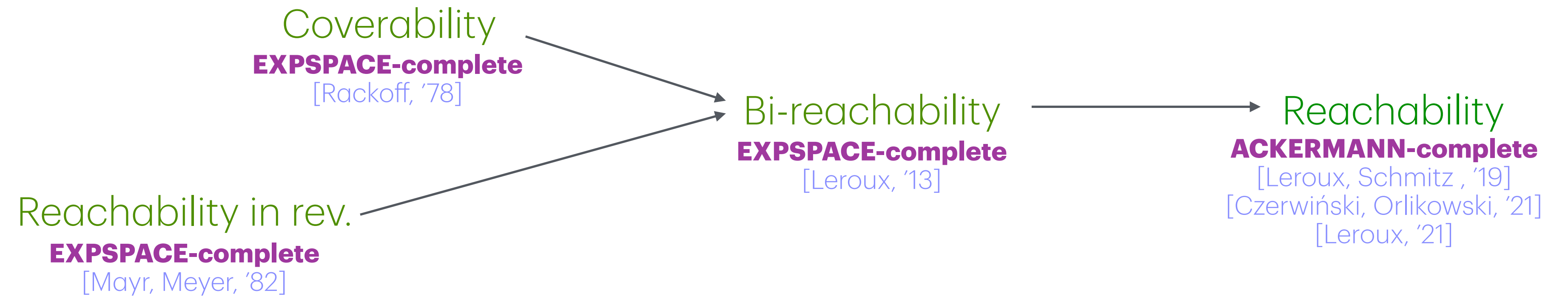
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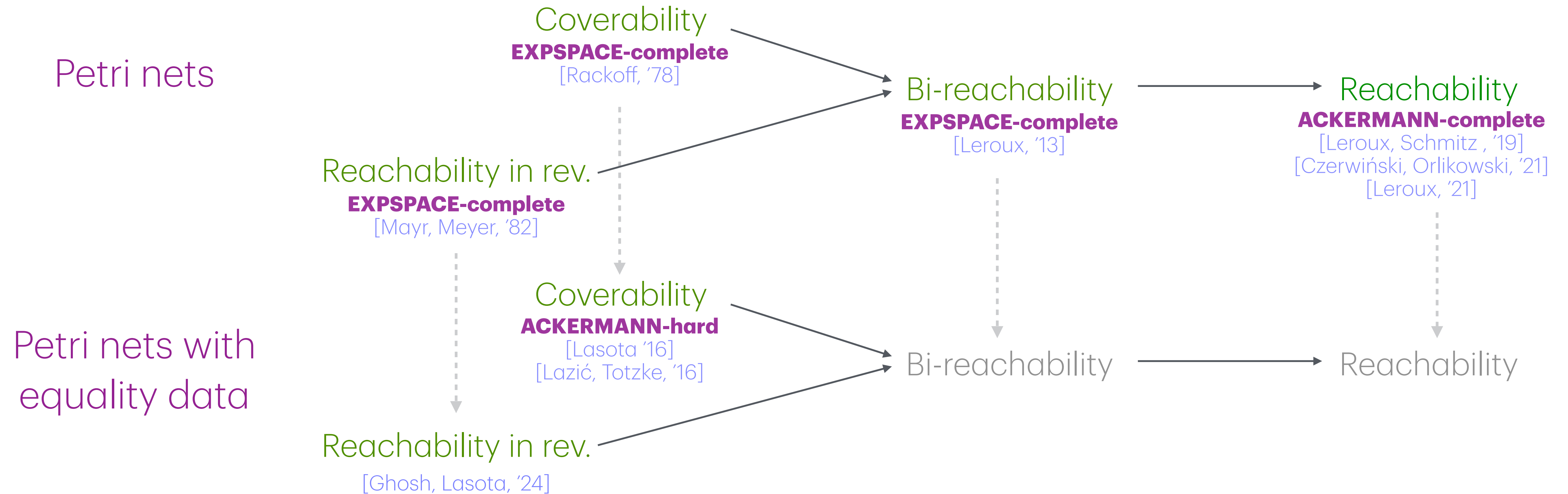


State of the art

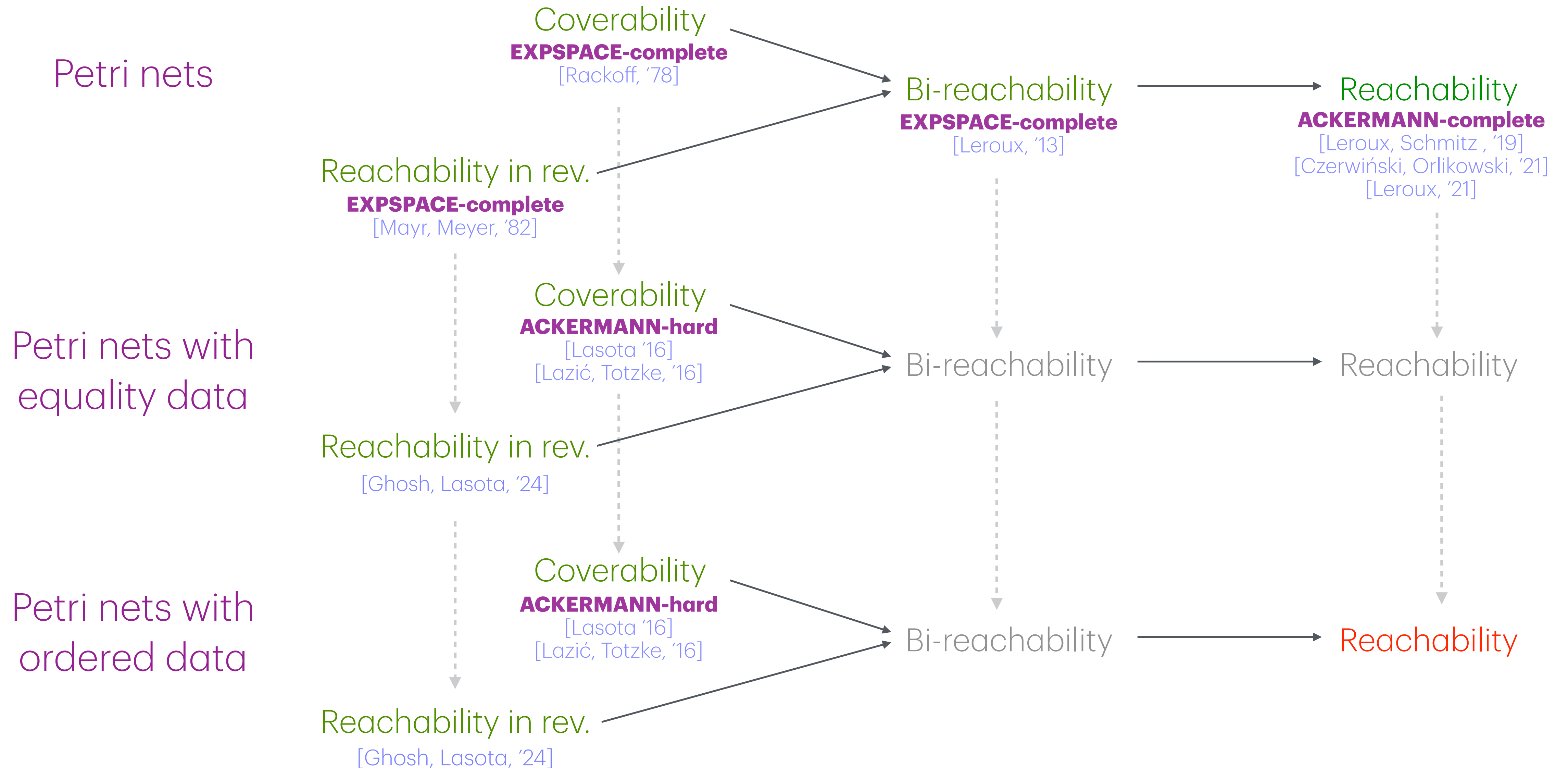
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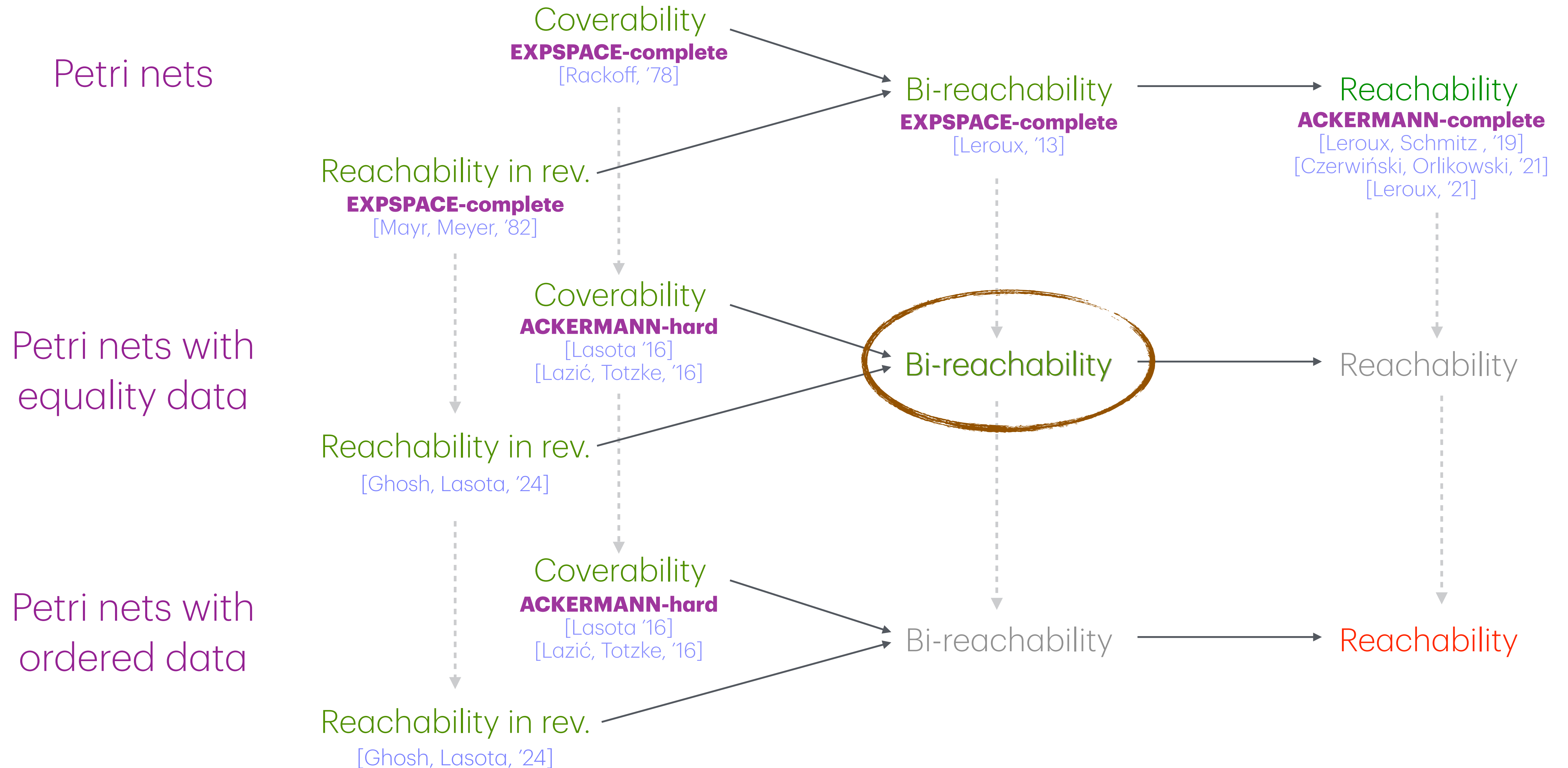
State of the art



State of the art



State of the art and the result



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Thank you!

