Interplay between social and financial interactions in a crypto-currency

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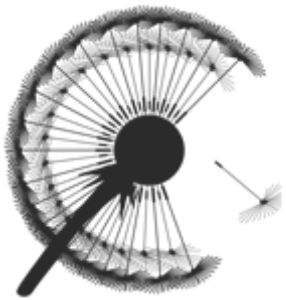
Overview

Context

The team

- *Complex Networks* team (LIP6).
- Internet measurements, random graphs, temporal networks
- Social network analysis, spreading phenomena, graph algorithms

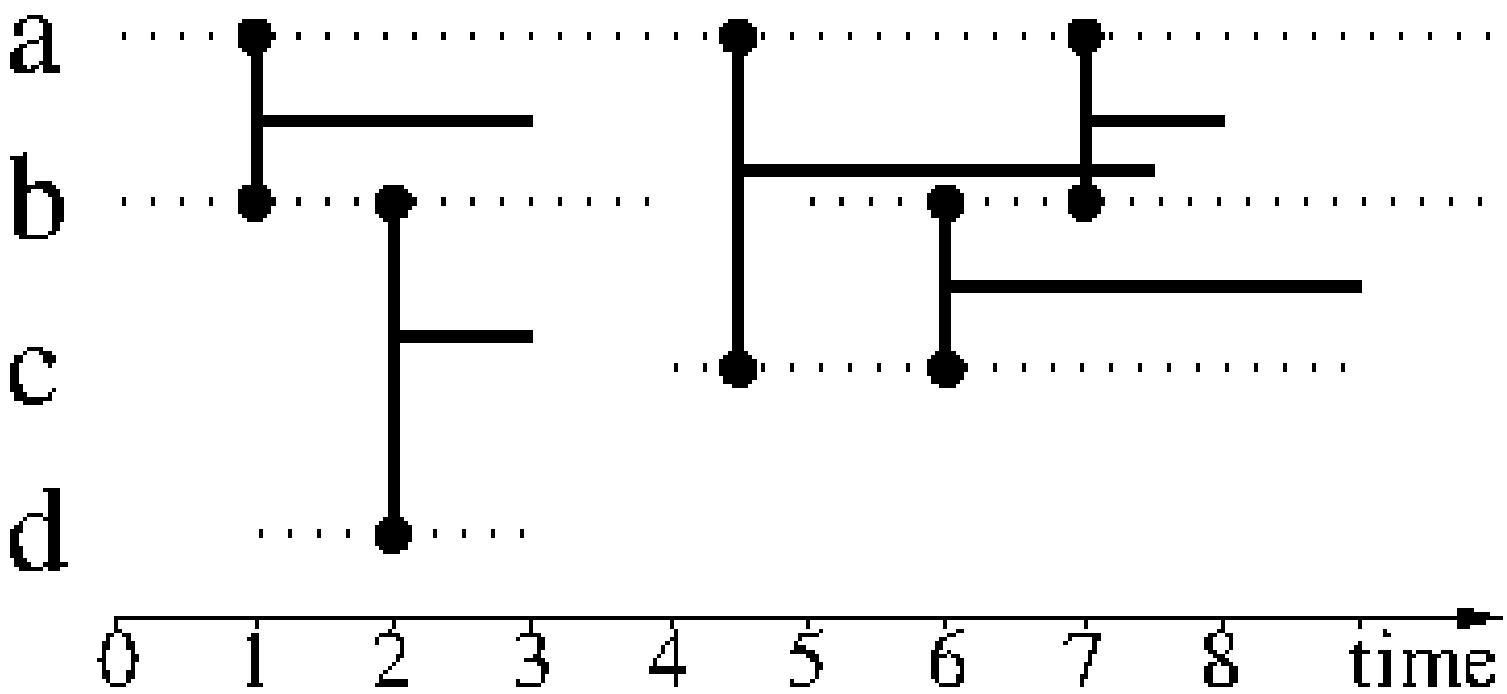


complexnetworks.fr

We are interested in all aspects of real-world networks and their models, from internet measurements to random graphs, from social network analysis to spreading phenomena, and from graph algorithms to biological networks.

Our main research topics

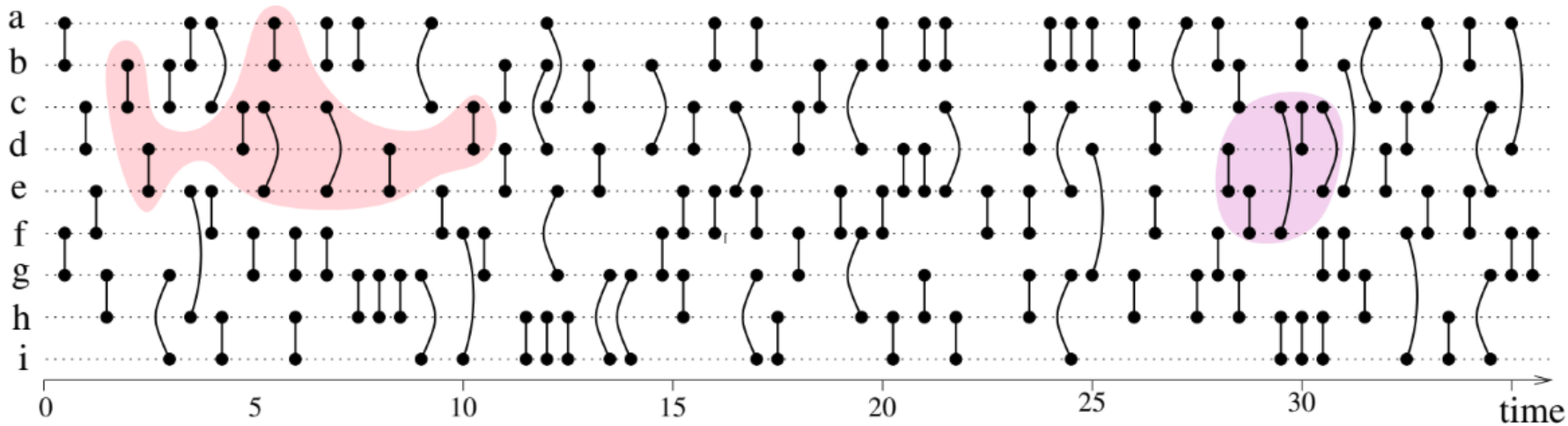
Stream Graphs [1]



[1] *Stream Graphs and Link Streams for the Modeling of Interactions over Time* Matthieu Latapy, Tiphaine Viard and Clmence Magnien Social Networks Analysis and Mining, 8: 61, 2018

Our main research topics

Anomaly detection



The $\tilde{G1}$ crypto-currency - **Transactions**

Enables transactions between members

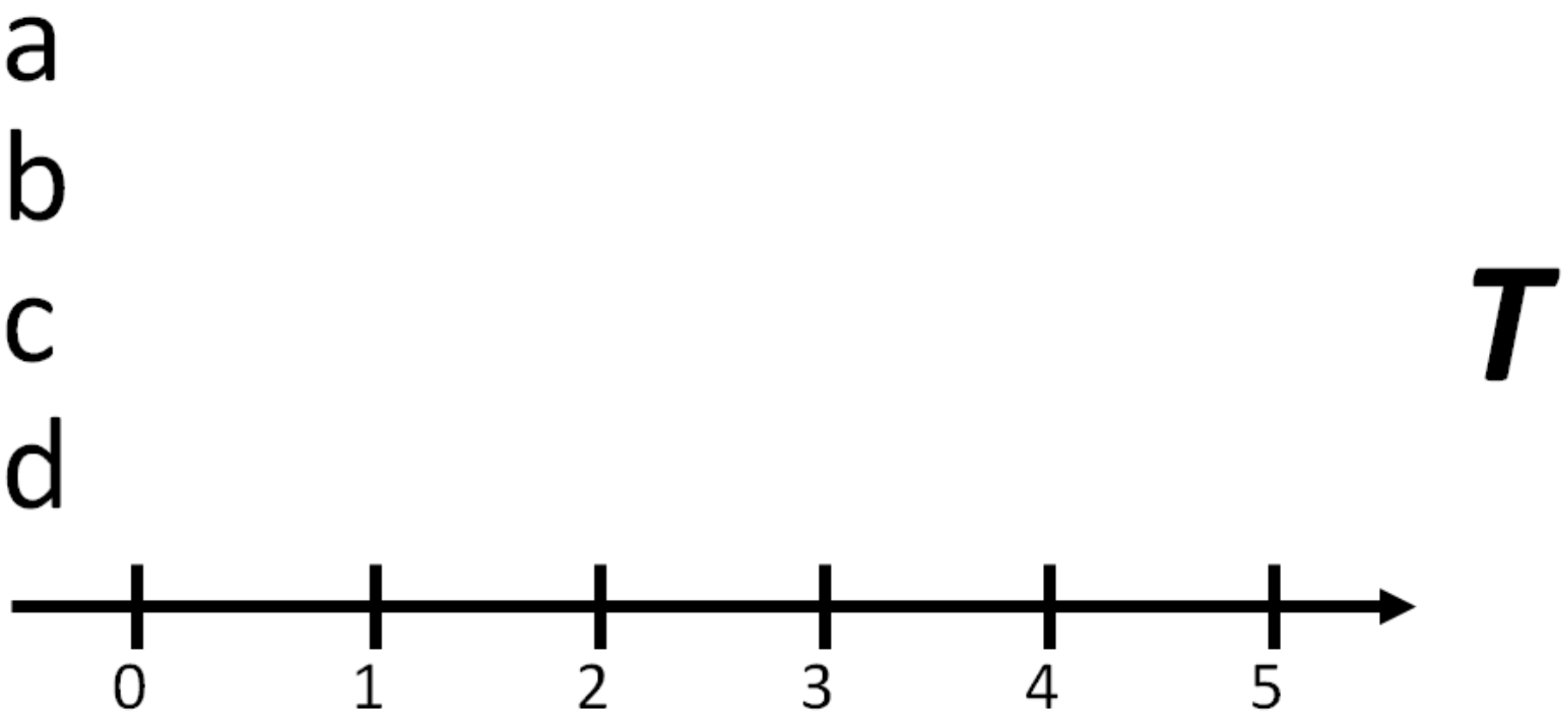
Enables transactions between members

A transaction (t, u, v): *Entity u sends money to entity v at time t.*
Transaction link stream: $\mathcal{T} = (T, V, E_{\mathcal{T}})$

The $\tilde{G}1$ crypto-currency - **Transactions**

Enables transactions between members

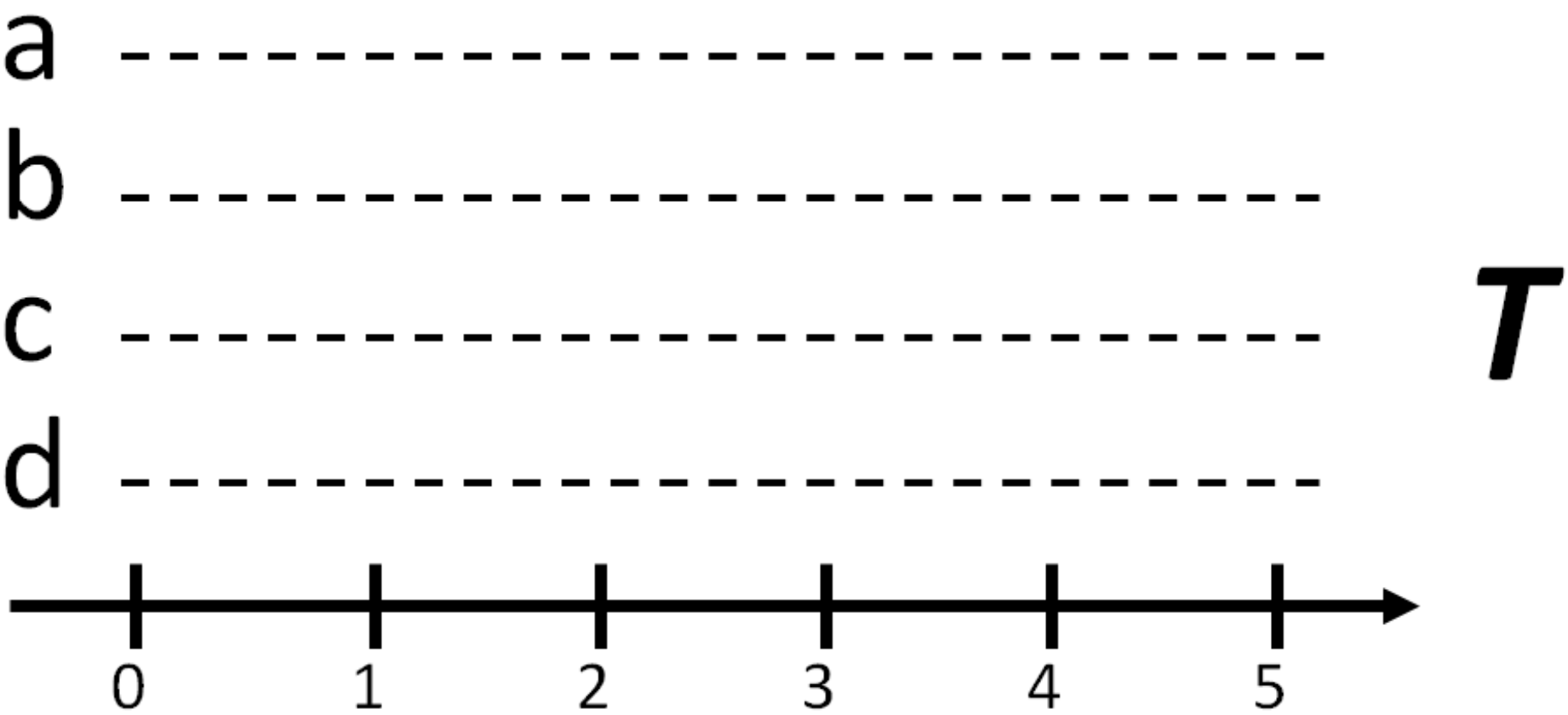
$$T = [0, 5],\ V = \{a, b, c, d\}$$



The $\tilde{G}1$ crypto-currency - **Transactions**

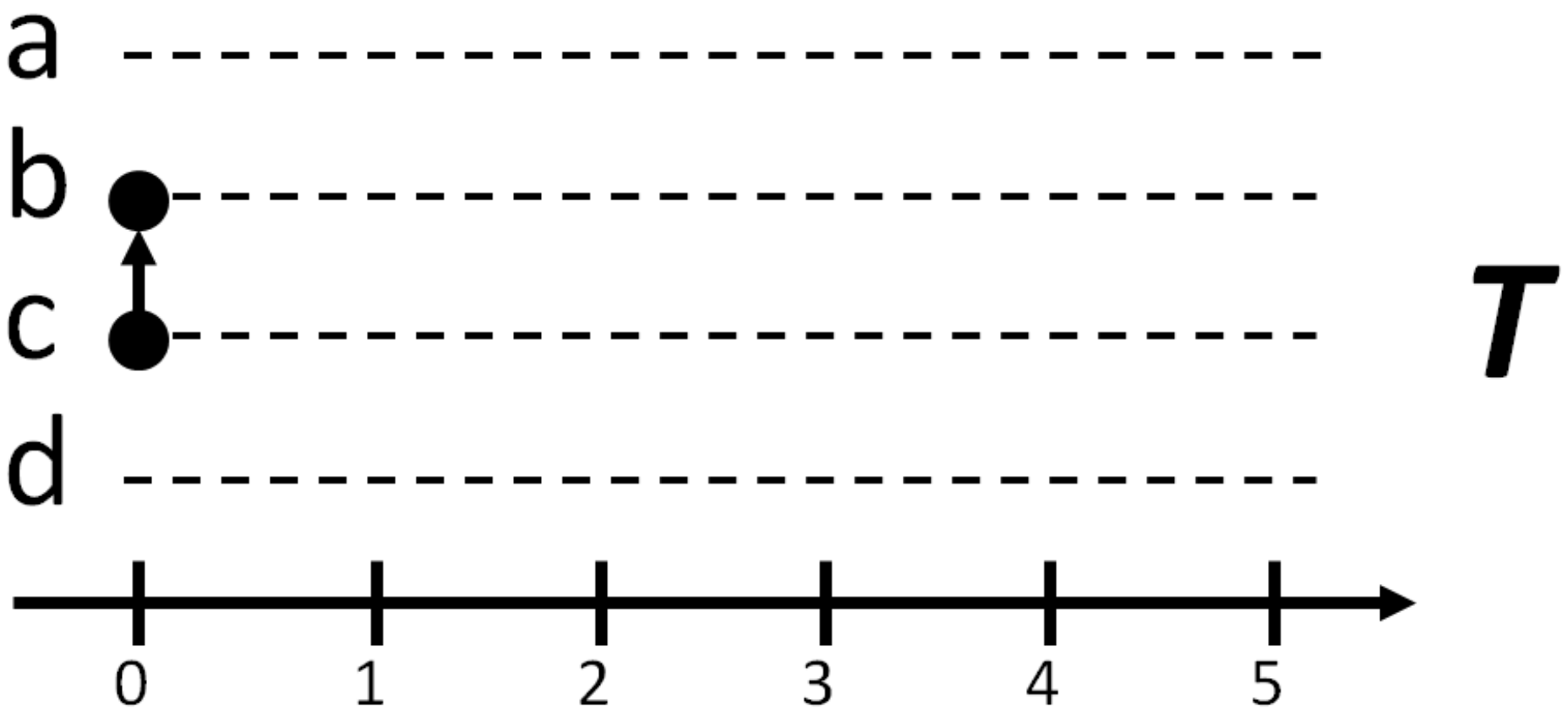
Enables transactions between members

No dynamics on the nodes



Enables transactions between members

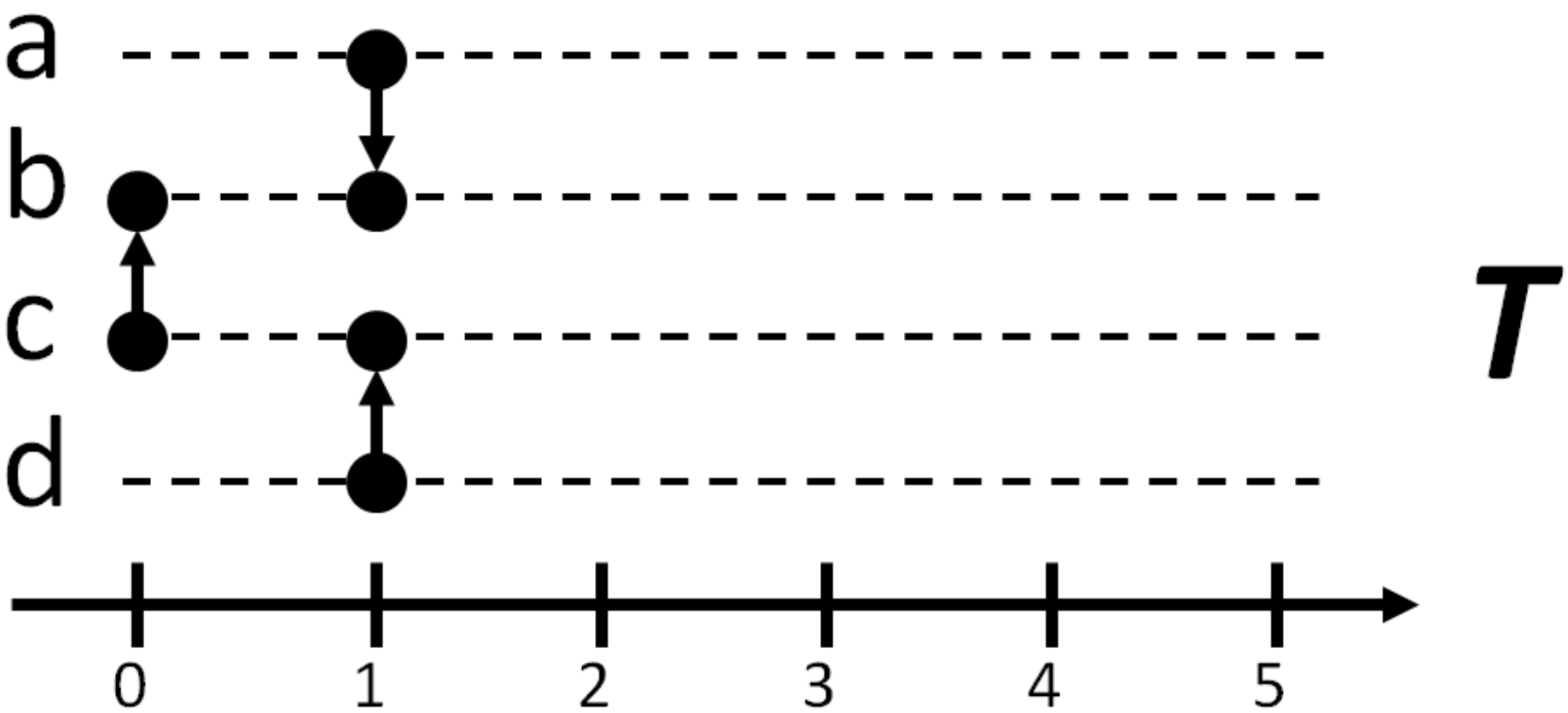
$$(0, c, b)$$



The $\tilde{G}1$ crypto-currency - **Transactions**

Enables transactions between members

$$(1, a, b), (1, d, c)$$



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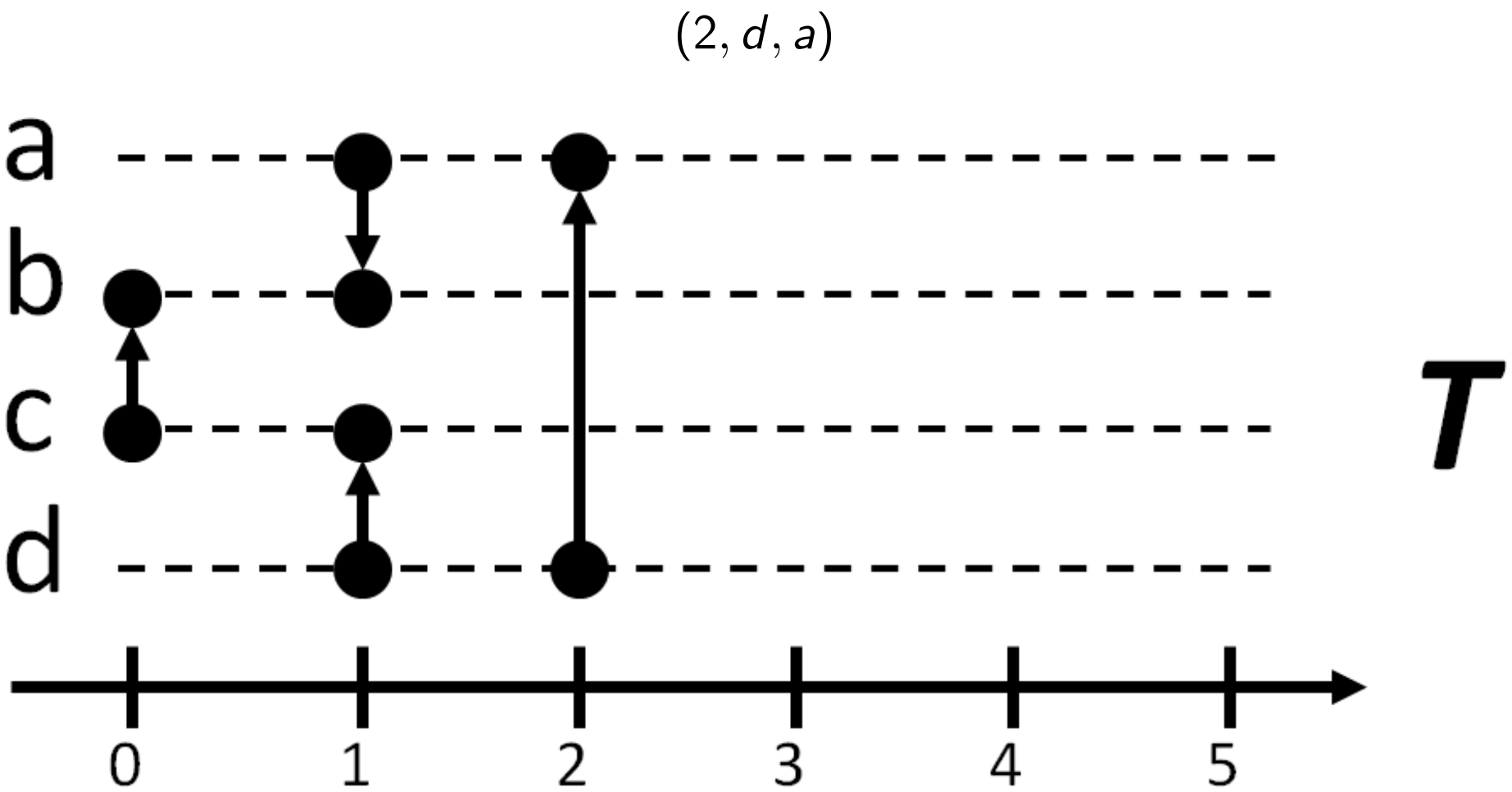
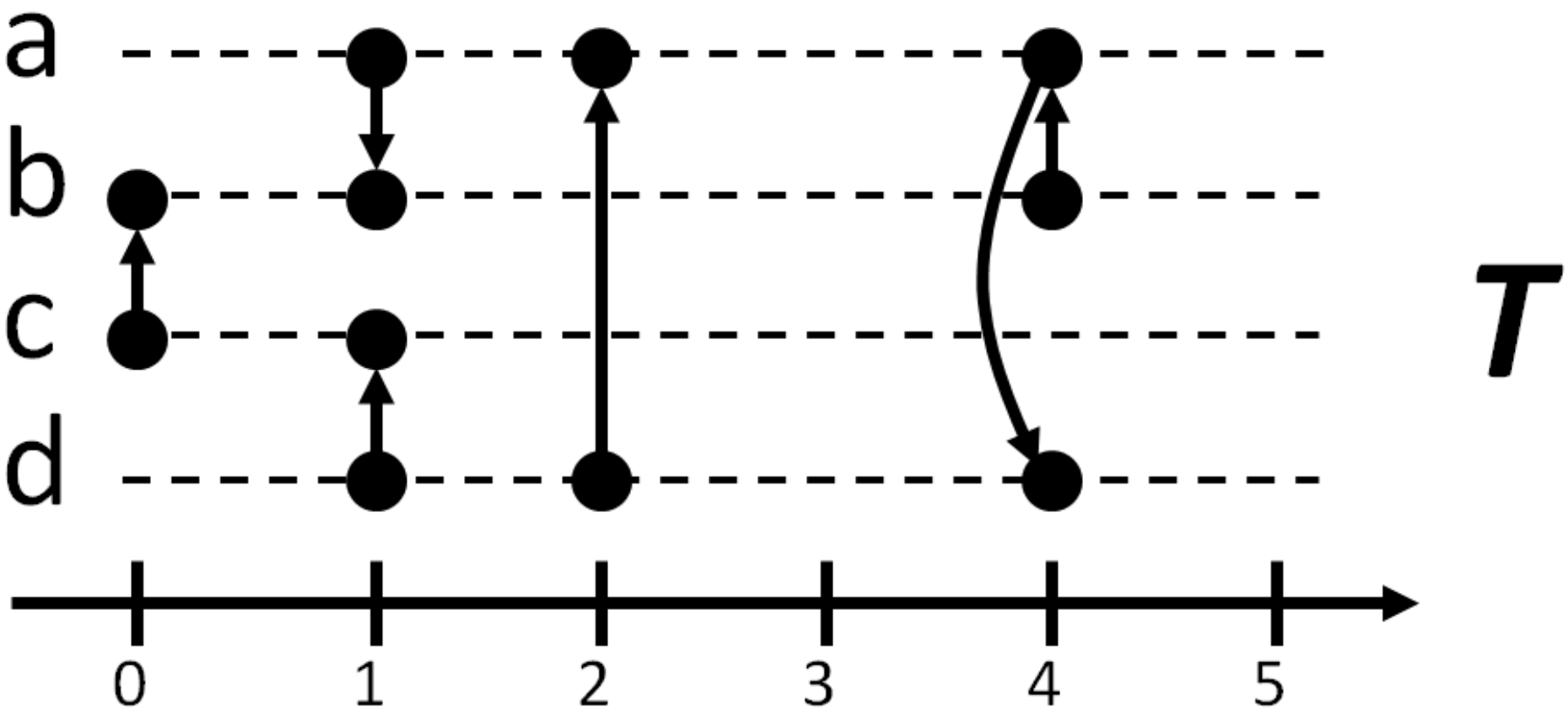


The $\tilde{G}1$ crypto-currency - **Transactions**

Enables transactions between members

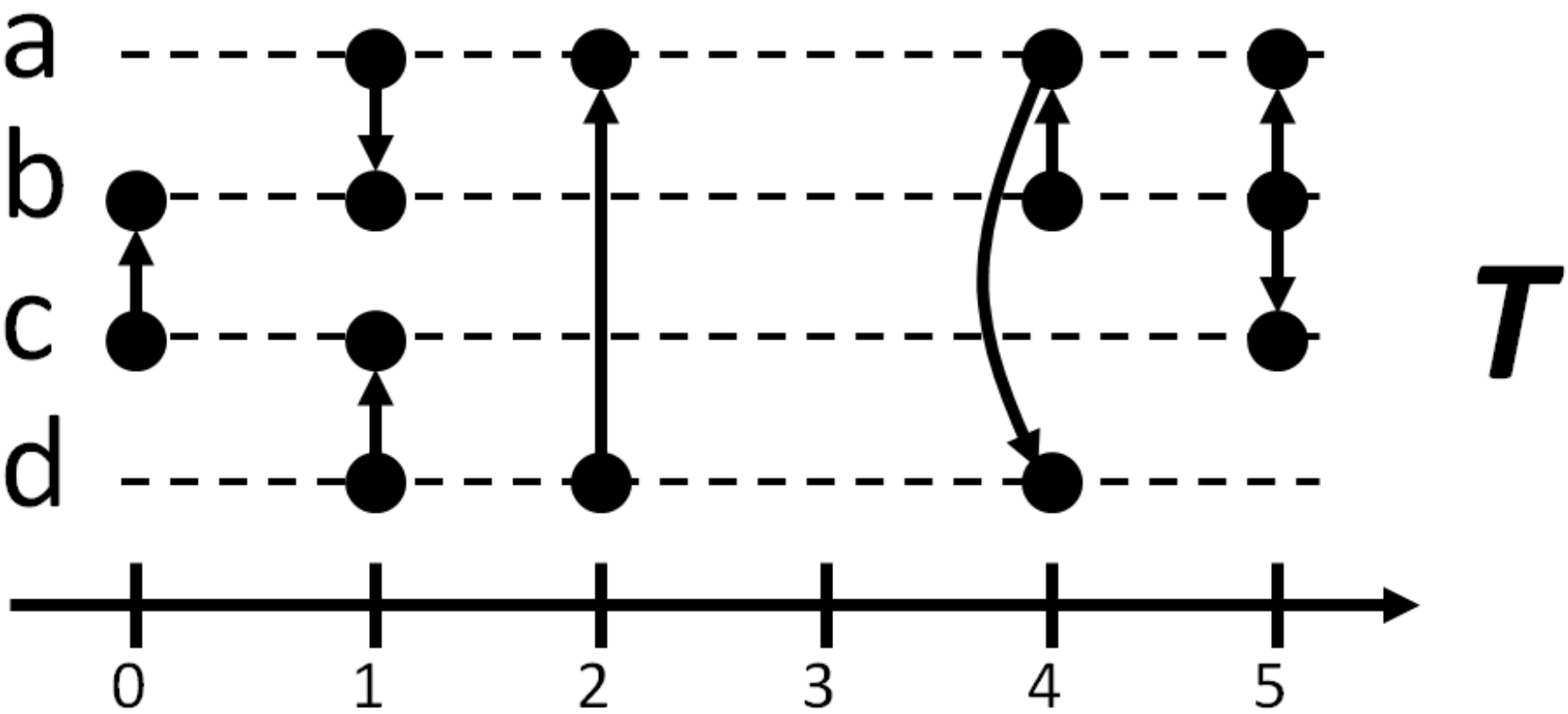
$$(4, a, d), (4, b, a)$$



The $\tilde{G}1$ crypto-currency - **Transactions**

Enables transactions between members

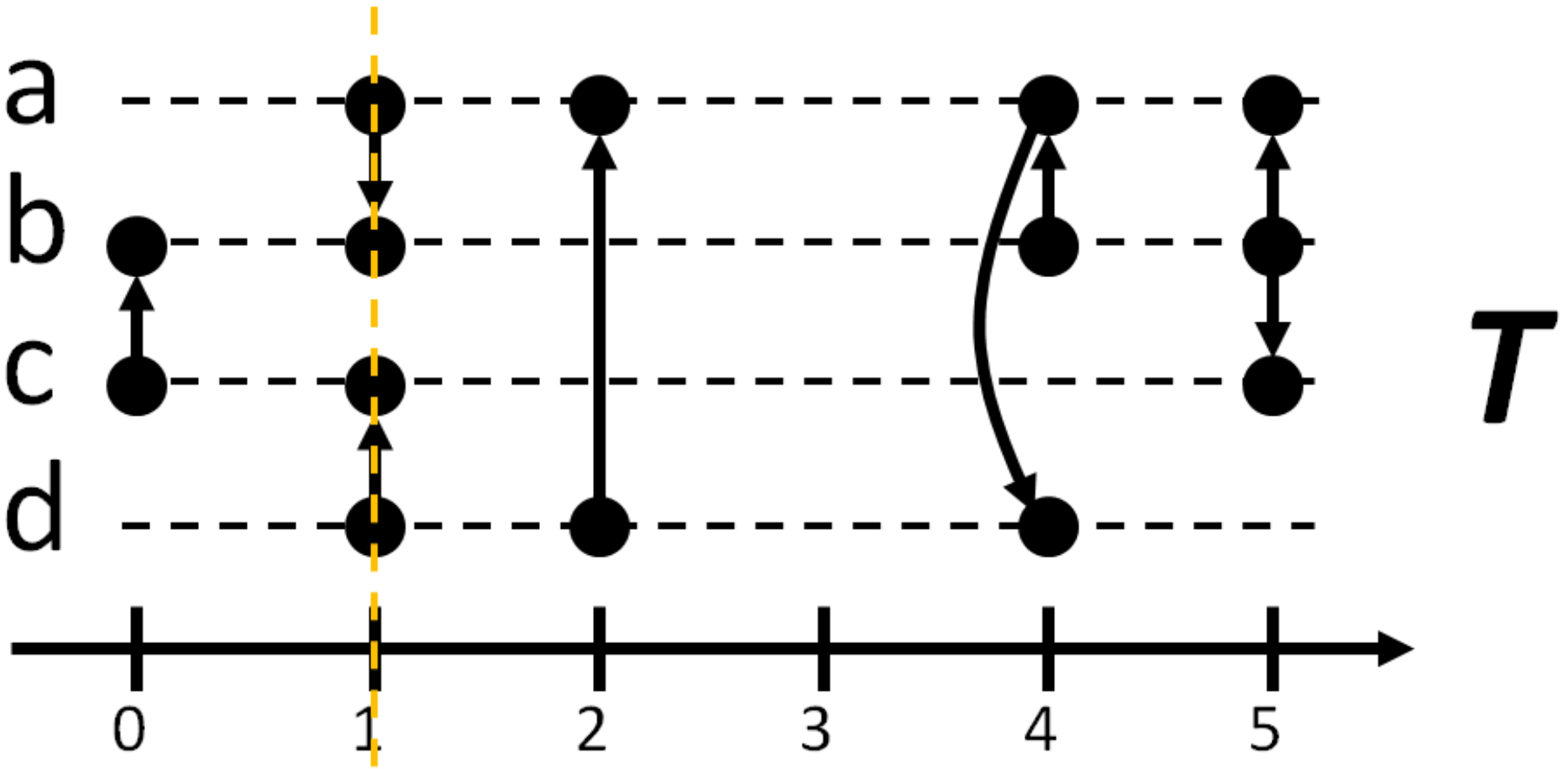
$$(5, b, a), (5, b, c)$$



The $\tilde{G1}$ crypto-currency - **Transactions**

Enables transactions between members

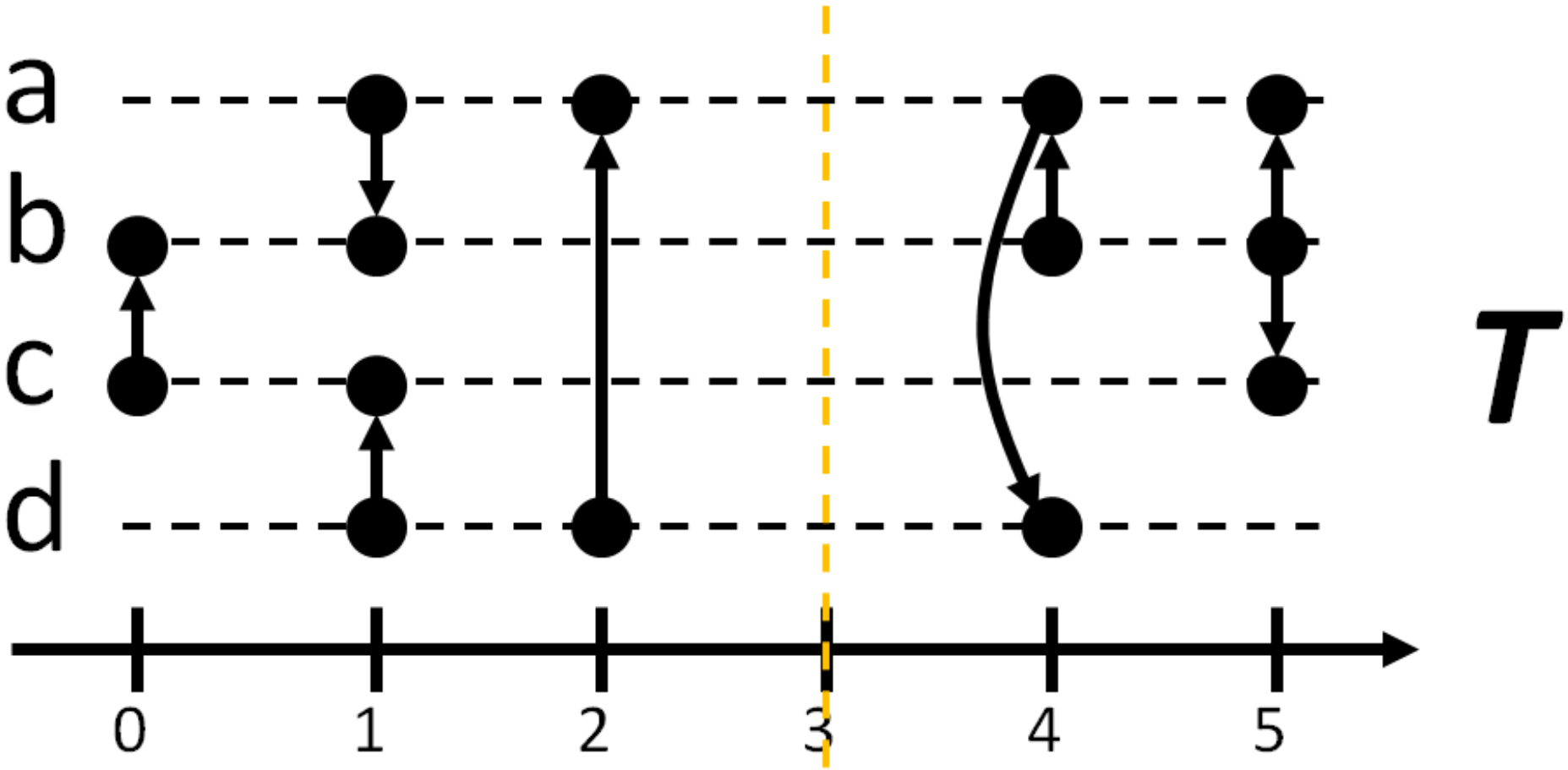
$$E_{\mathcal{T},1} = \{(a,b),(d,c)\}$$



The $\tilde{G1}$ crypto-currency - **Transactions**

Enables transactions between members

$$E_{\mathcal{T},3} = \emptyset$$



The $\tilde{G}1$ crypto-currency - **Certifications**

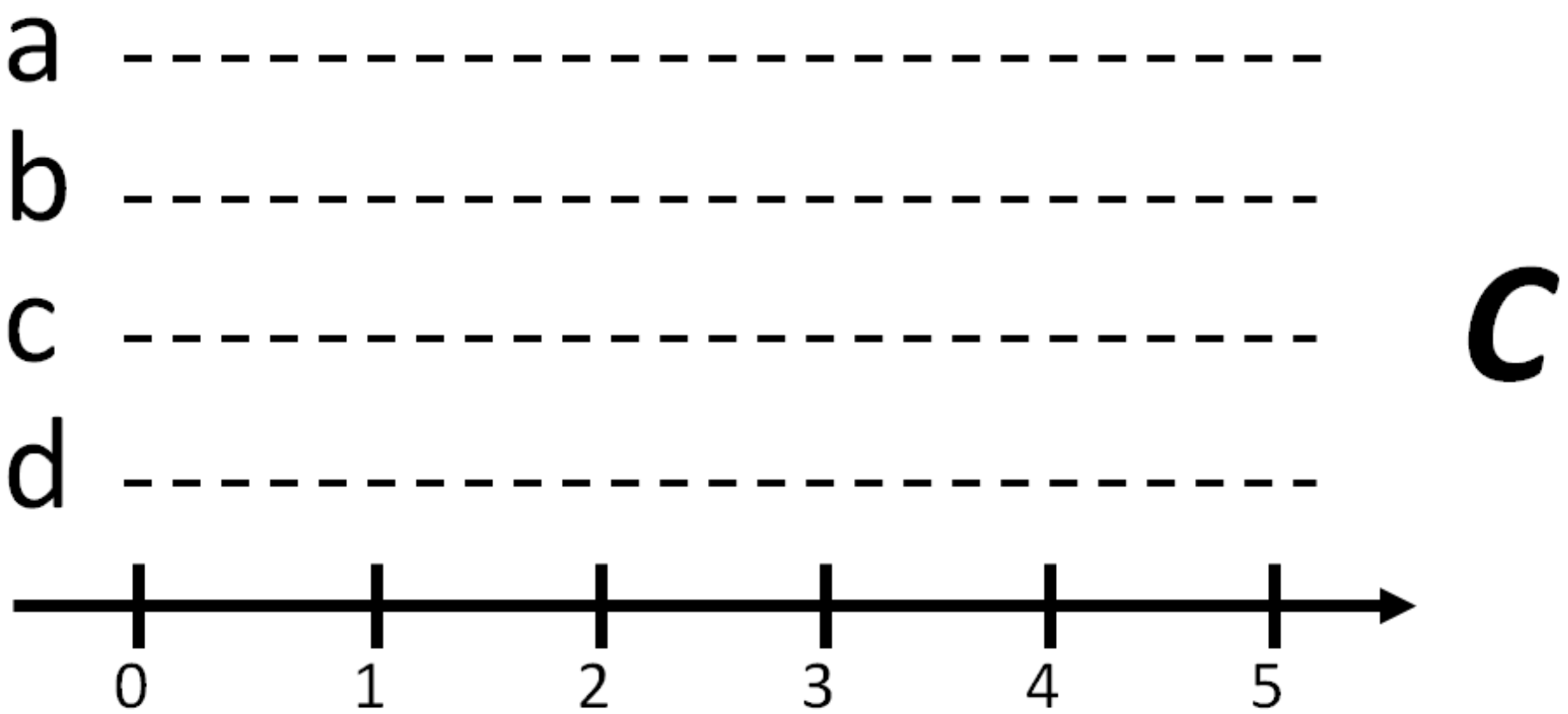
Identification of the members with a Web of Trust mechanism

Identification of the members with a Web of Trust mechanism

A certification (t, u, v): *Member u certifies identity of member v at time t.*
Certification link stream: $\mathcal{C} = (T, V, E_{\mathcal{C}})$

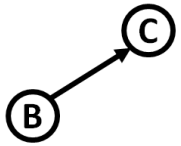
Identification of the members with a Web of Trust mechanism

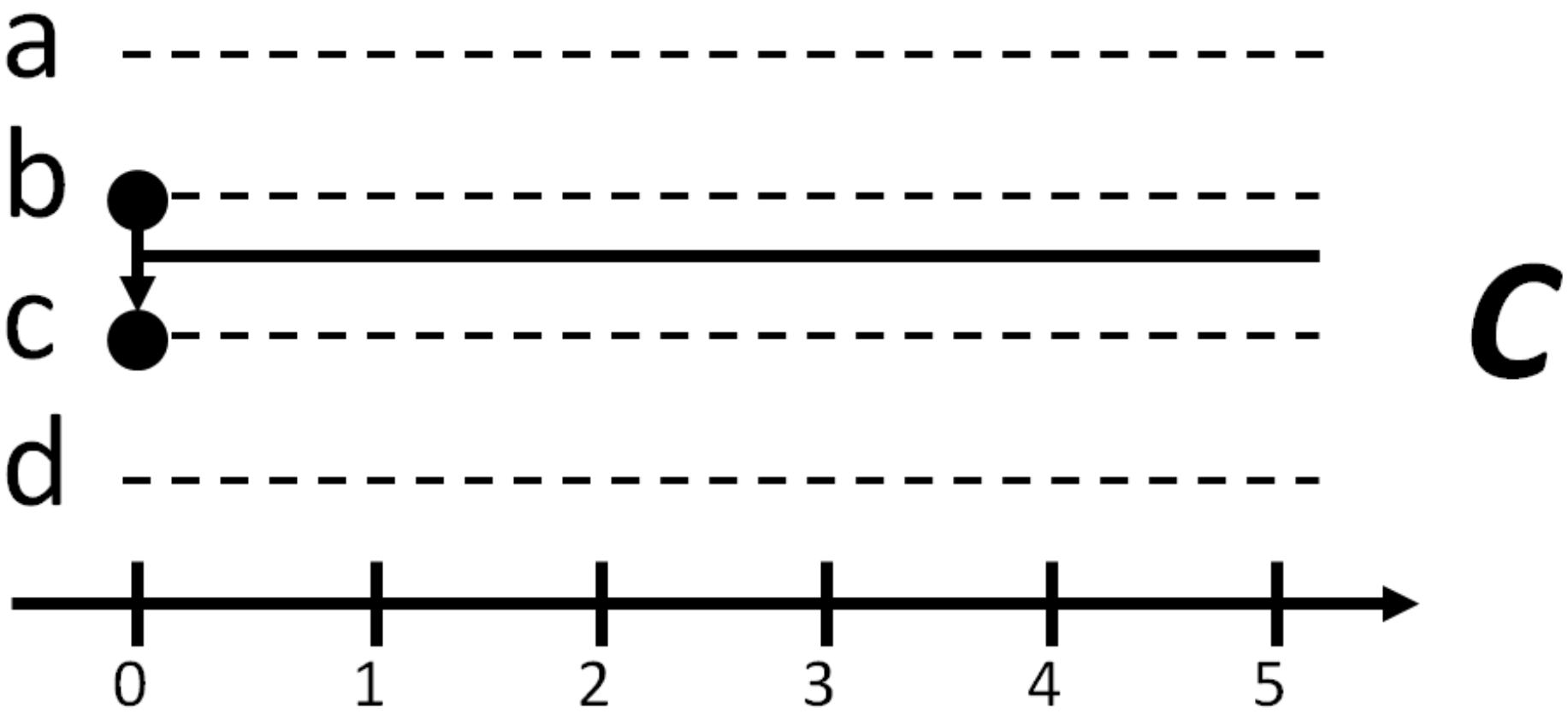
$$T = [0, 5],\ V = \{a, b, c, d\}$$



Identification of the members with a Web of Trust mechanism

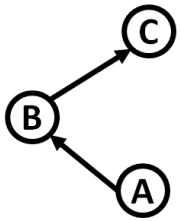
$(0, b, c)$

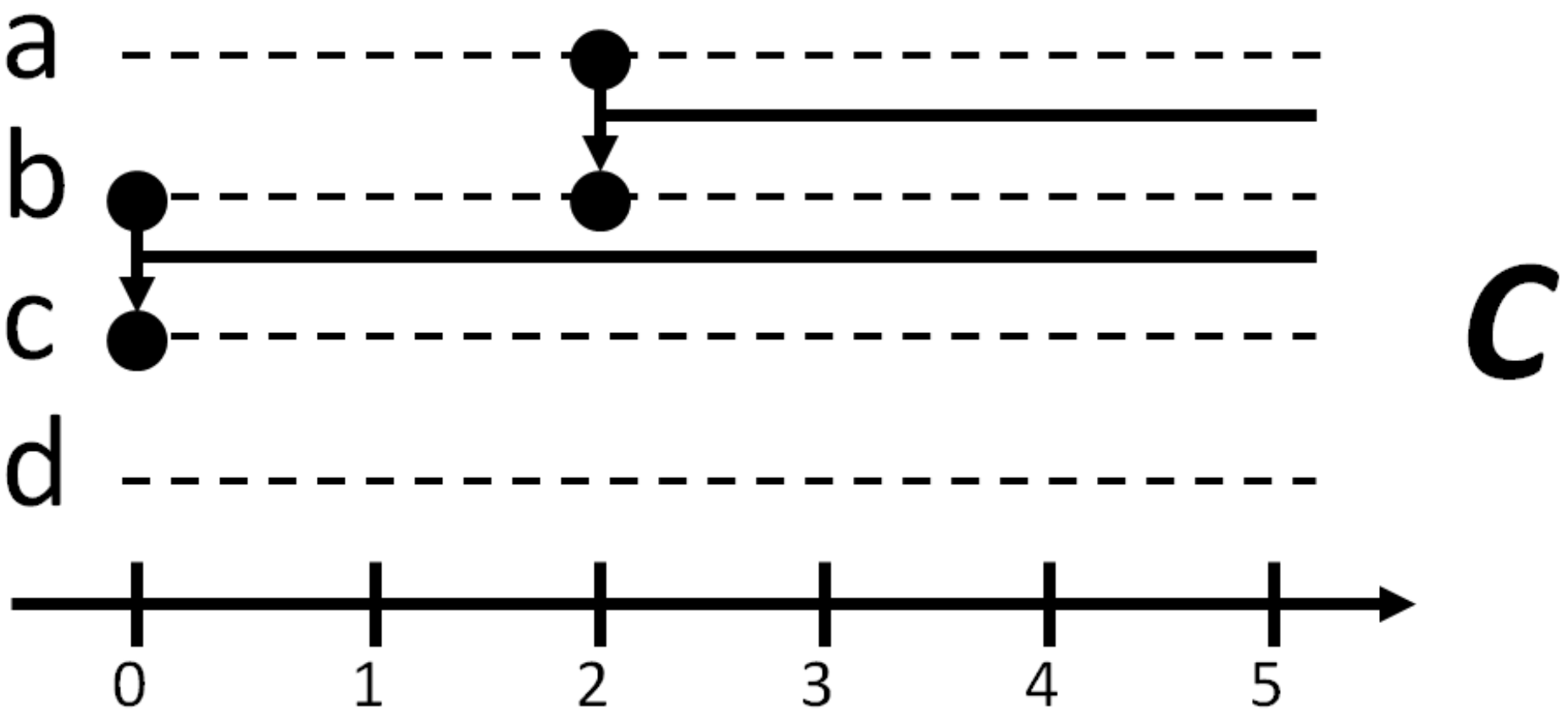




Identification of the members with a Web of Trust mechanism

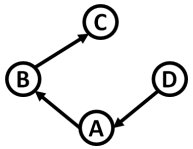
$(2, a, b)$

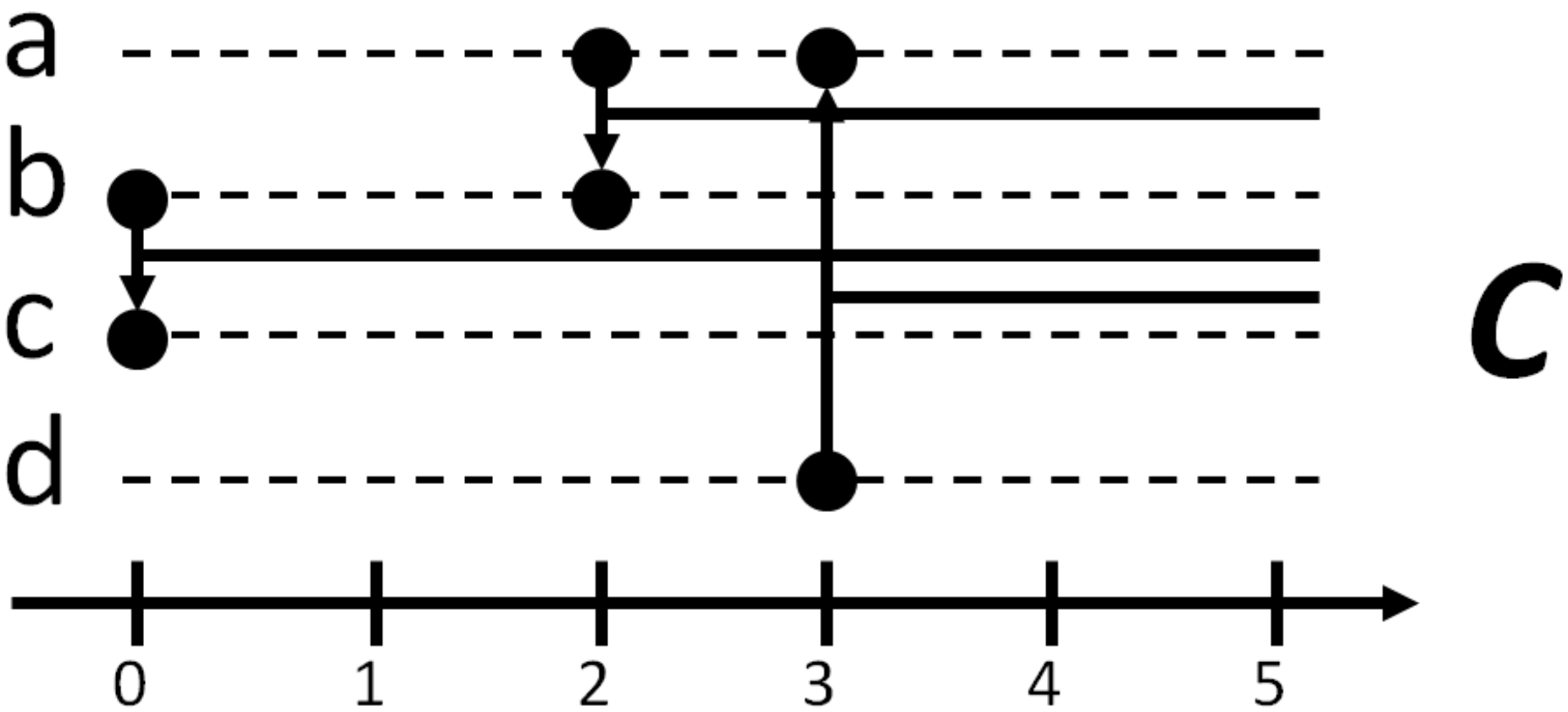




Identification of the members with a Web of Trust mechanism

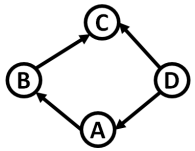
$(3, d, a)$

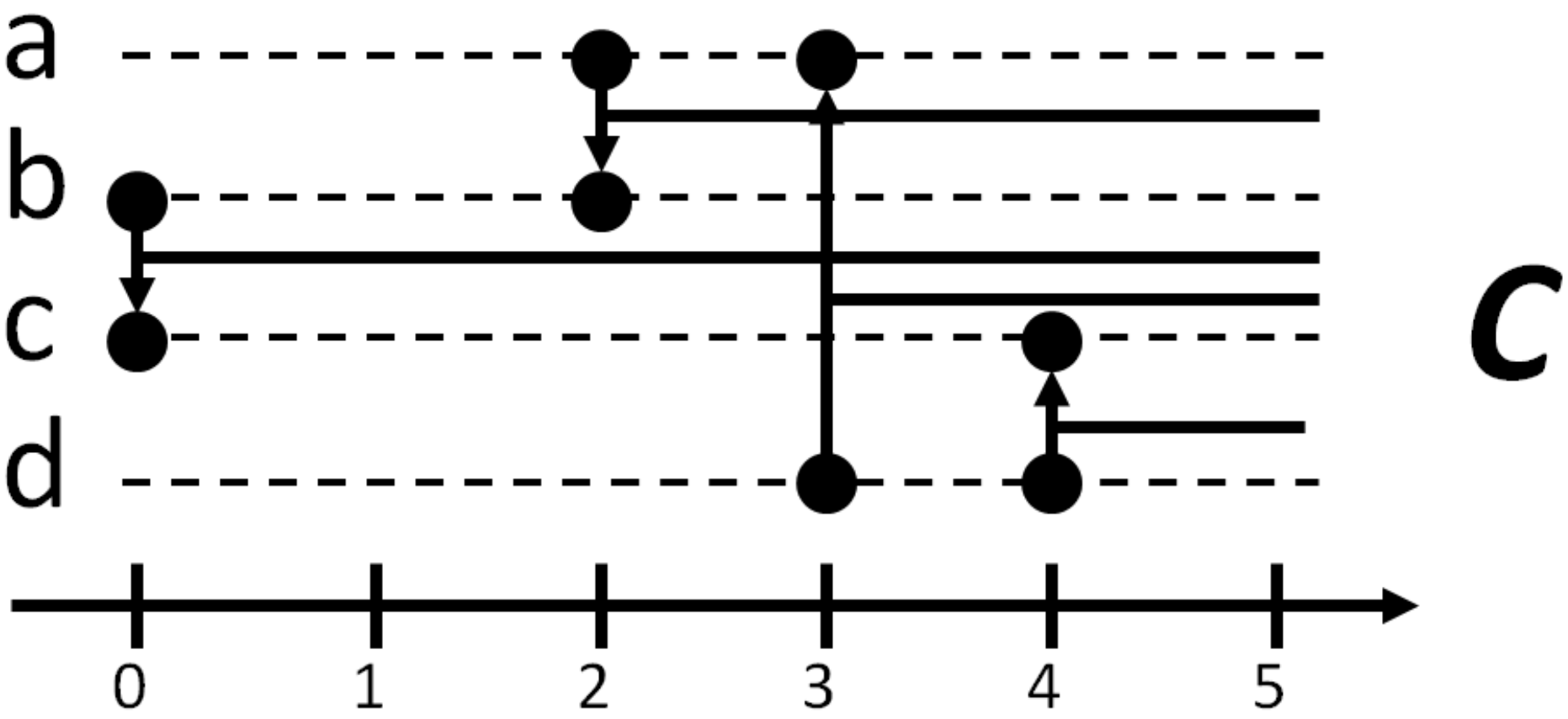




Identification of the members with a Web of Trust mechanism

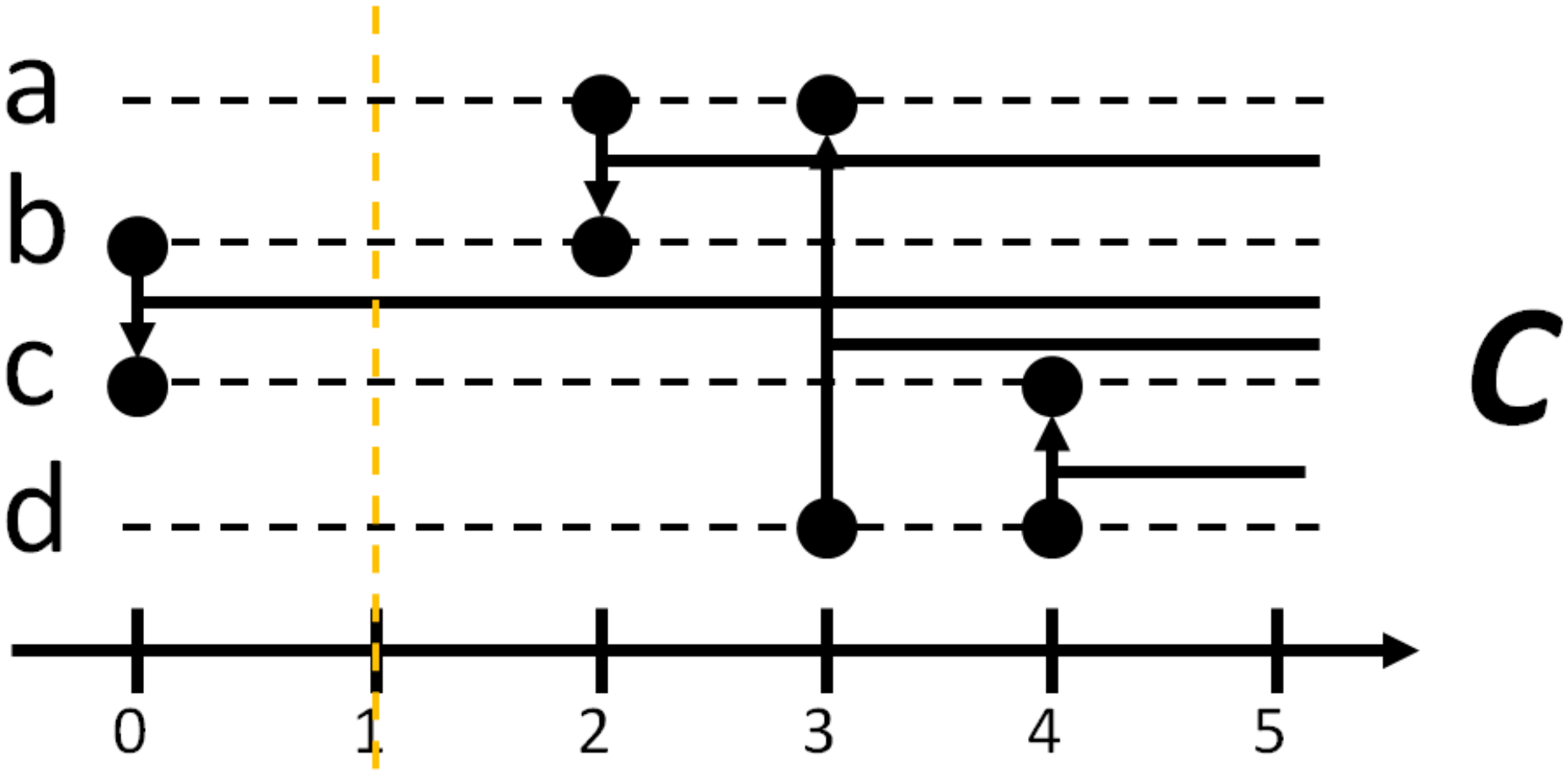
$(4, d, c)$





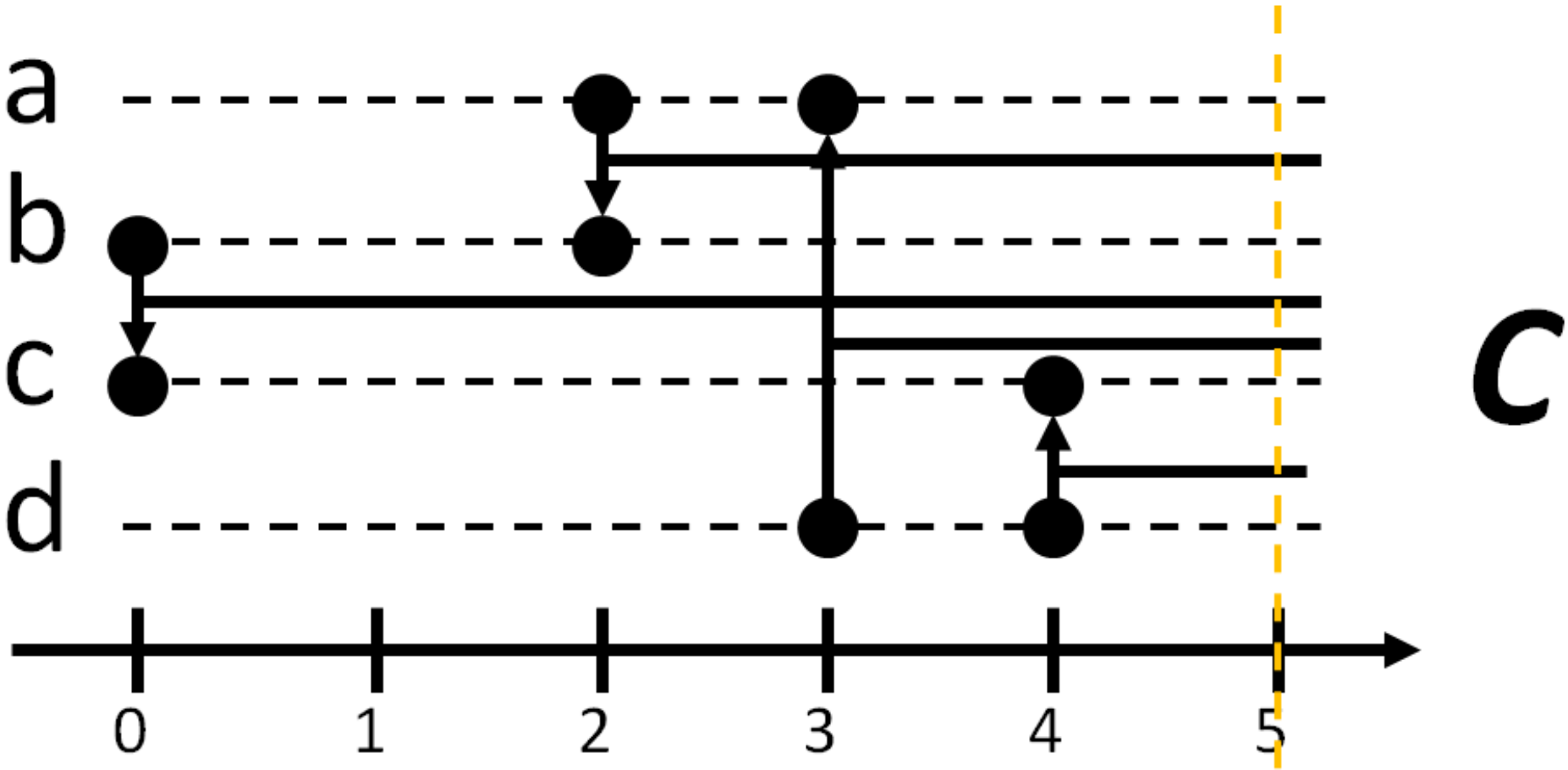
Identification of the members with a Web of Trust mechanism

$$E_{c,1} = \{(b, c)\}$$



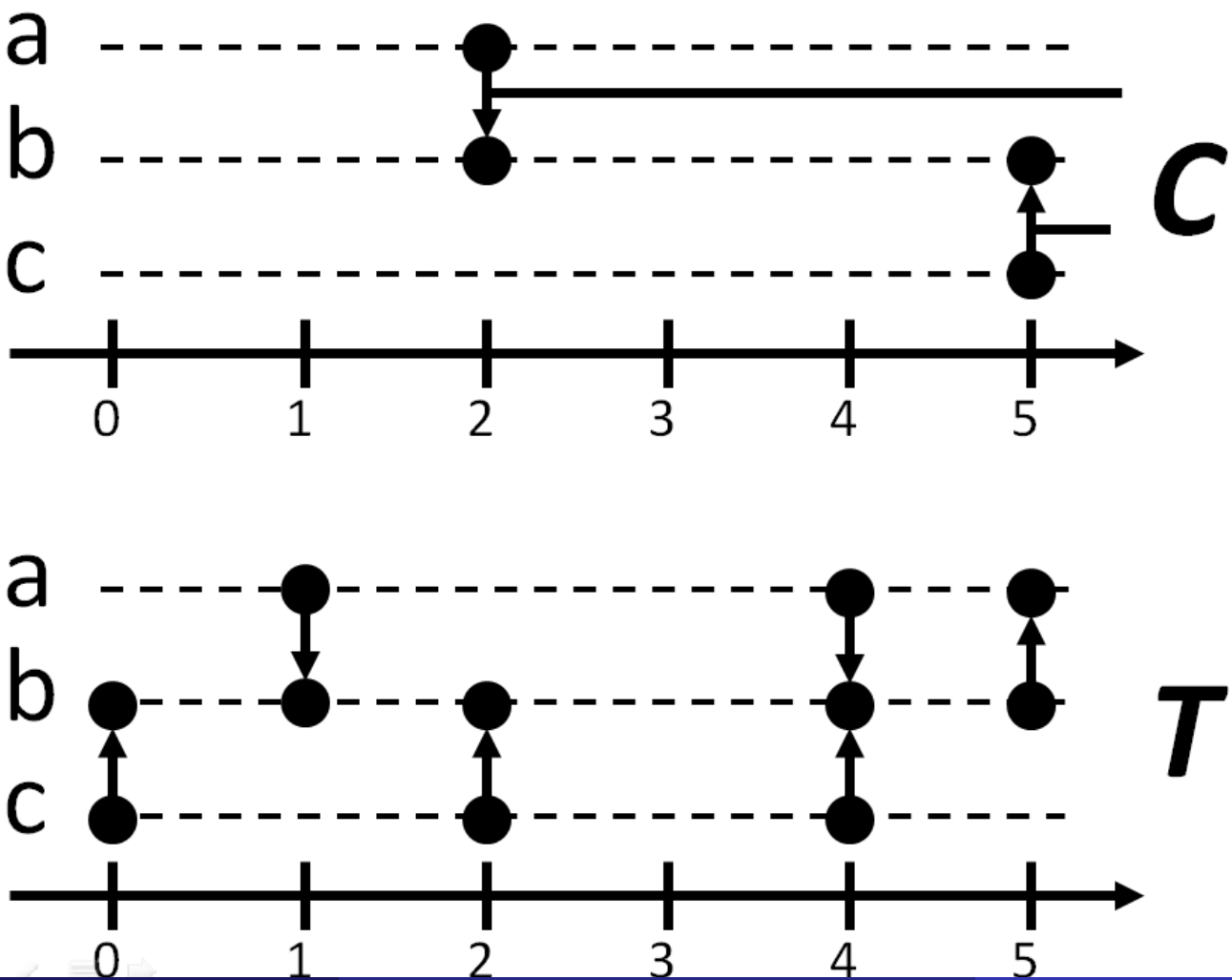
Identification of the members with a Web of Trust mechanism

$$E_{\mathcal{C},5} = \{(b,c),(a,b),(d,a),(d,c)\}$$



Why is this great?

We have a dynamic network of **social ties** and **financial transactions** between **identified human beings**!



Results

Questions:

- If a and b are certified, did/will they make transactions?

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- How much time separate the certification from the closest matching transaction?

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- If *a* and *b* make a new transaction, are/will they certify?

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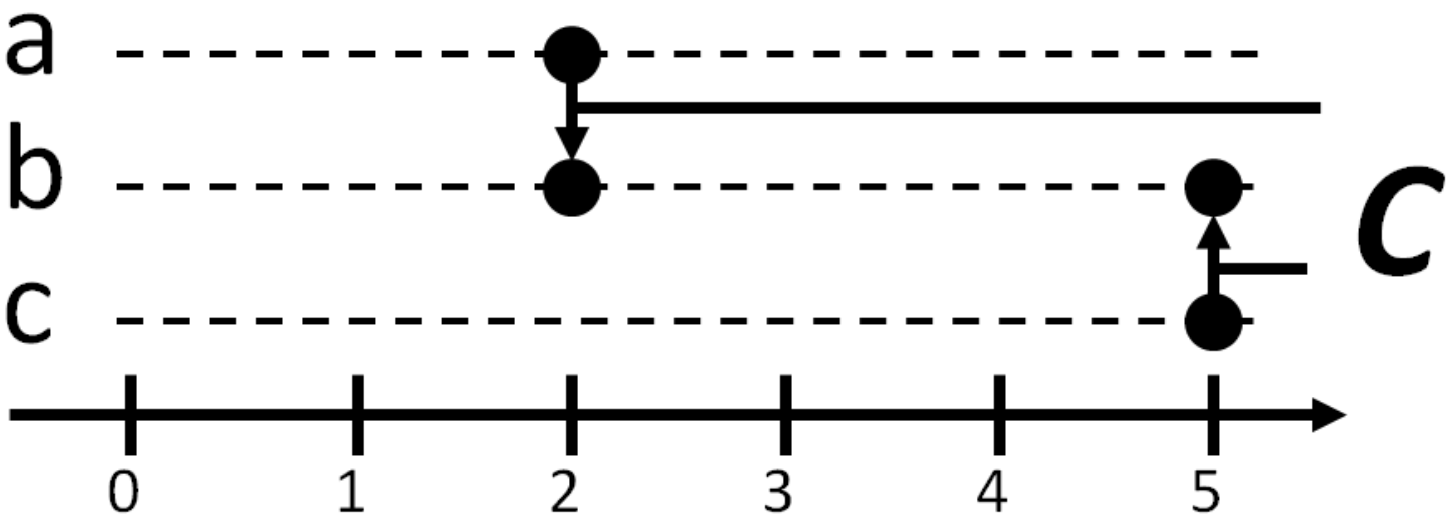
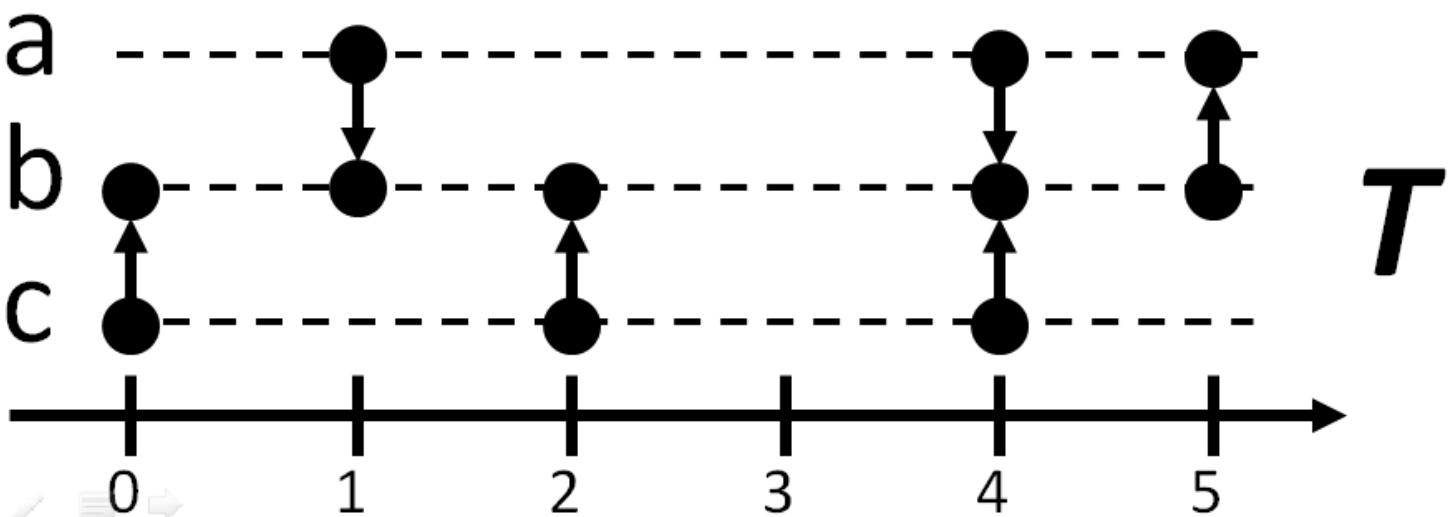
- If a and b make a new transaction, are/will they certify?
- How much time separate the transaction from the closest matching certification?

Time between transactions and certifications - **Method**





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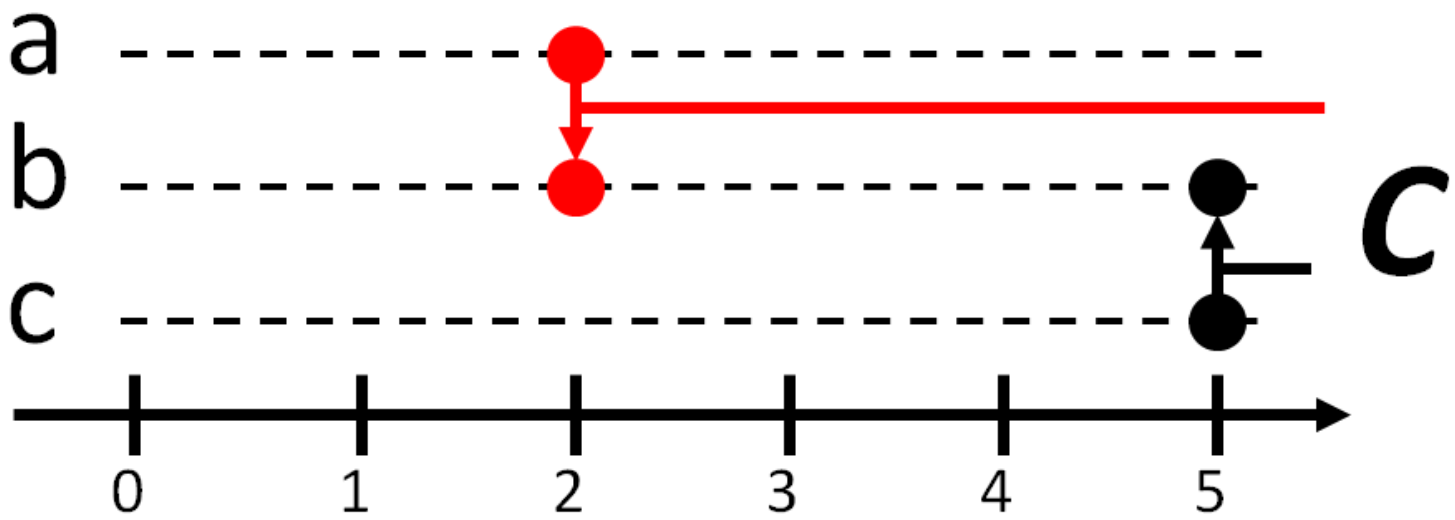

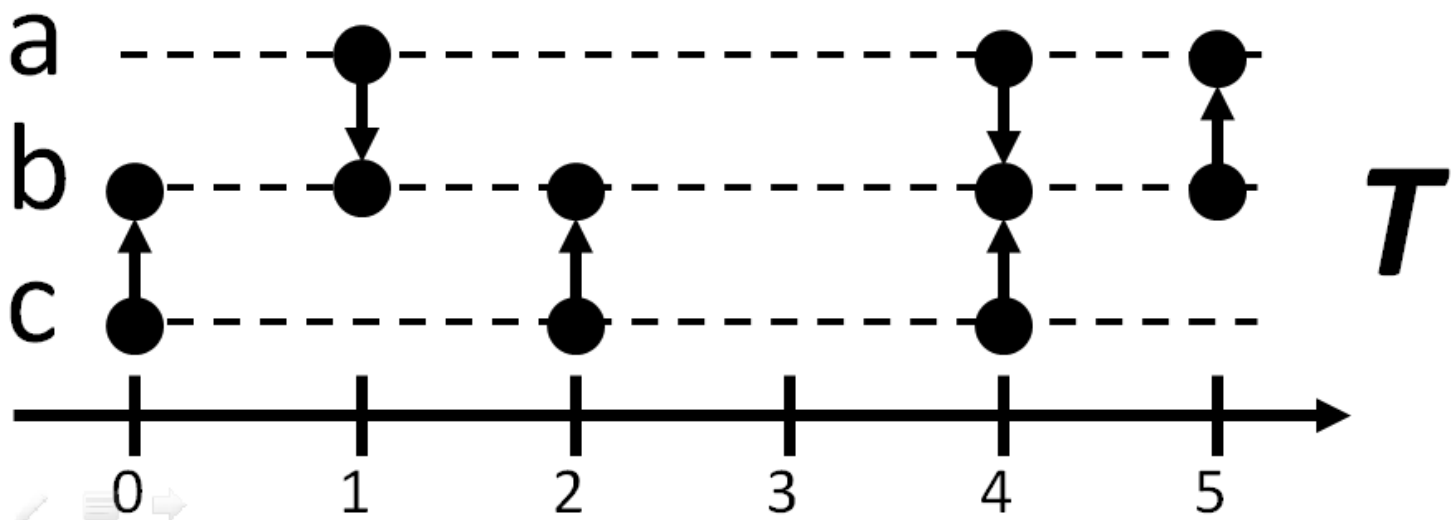

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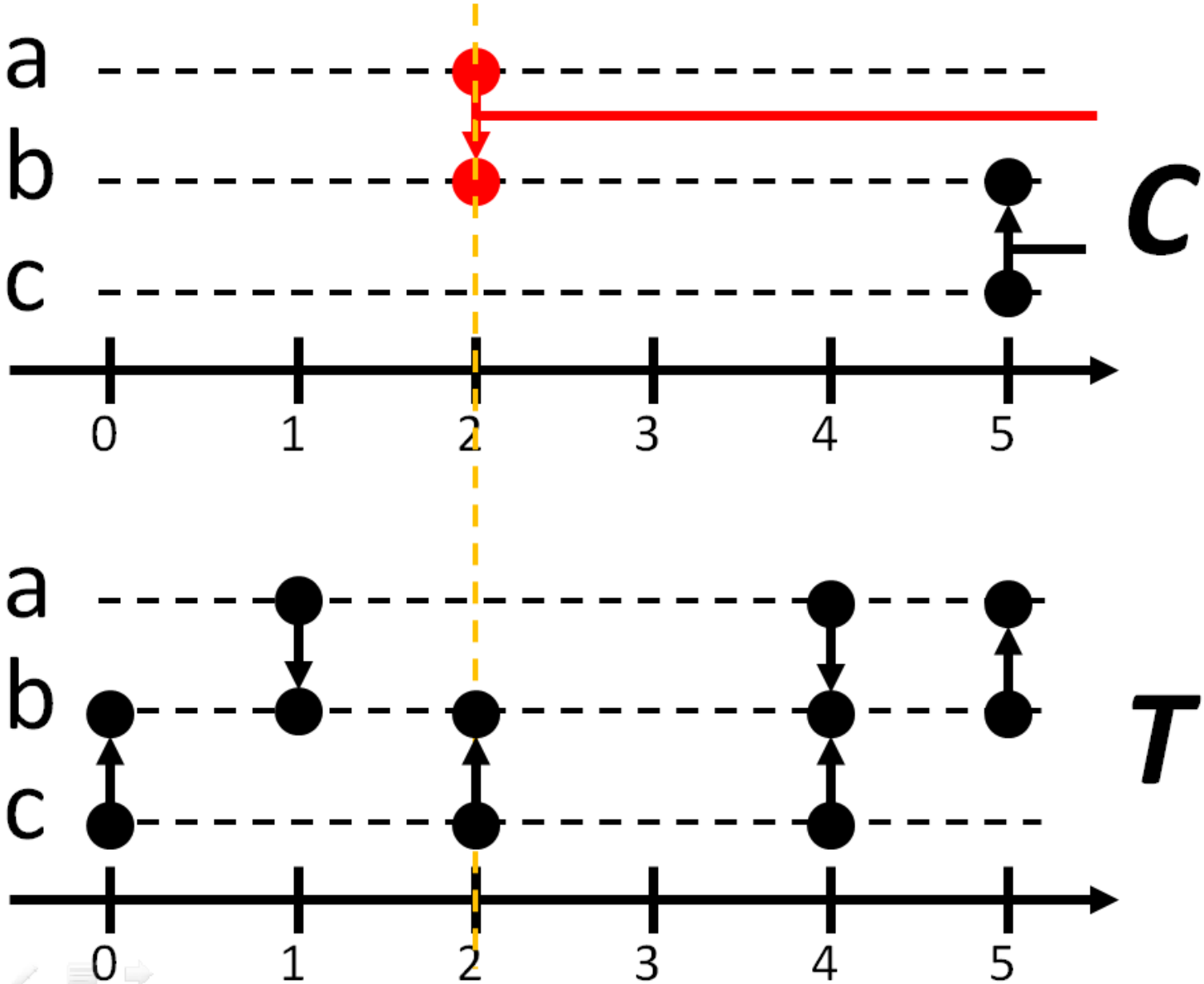

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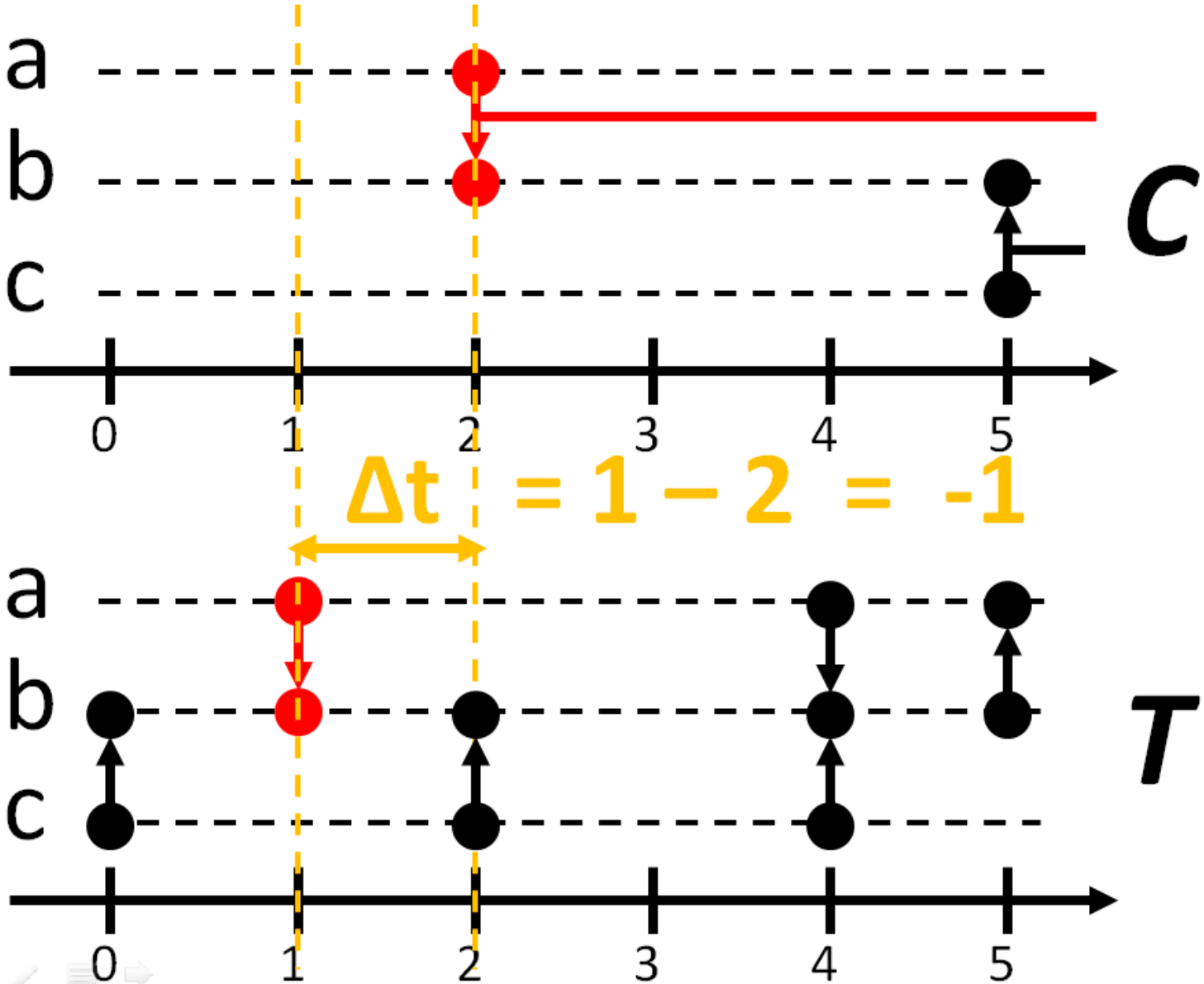

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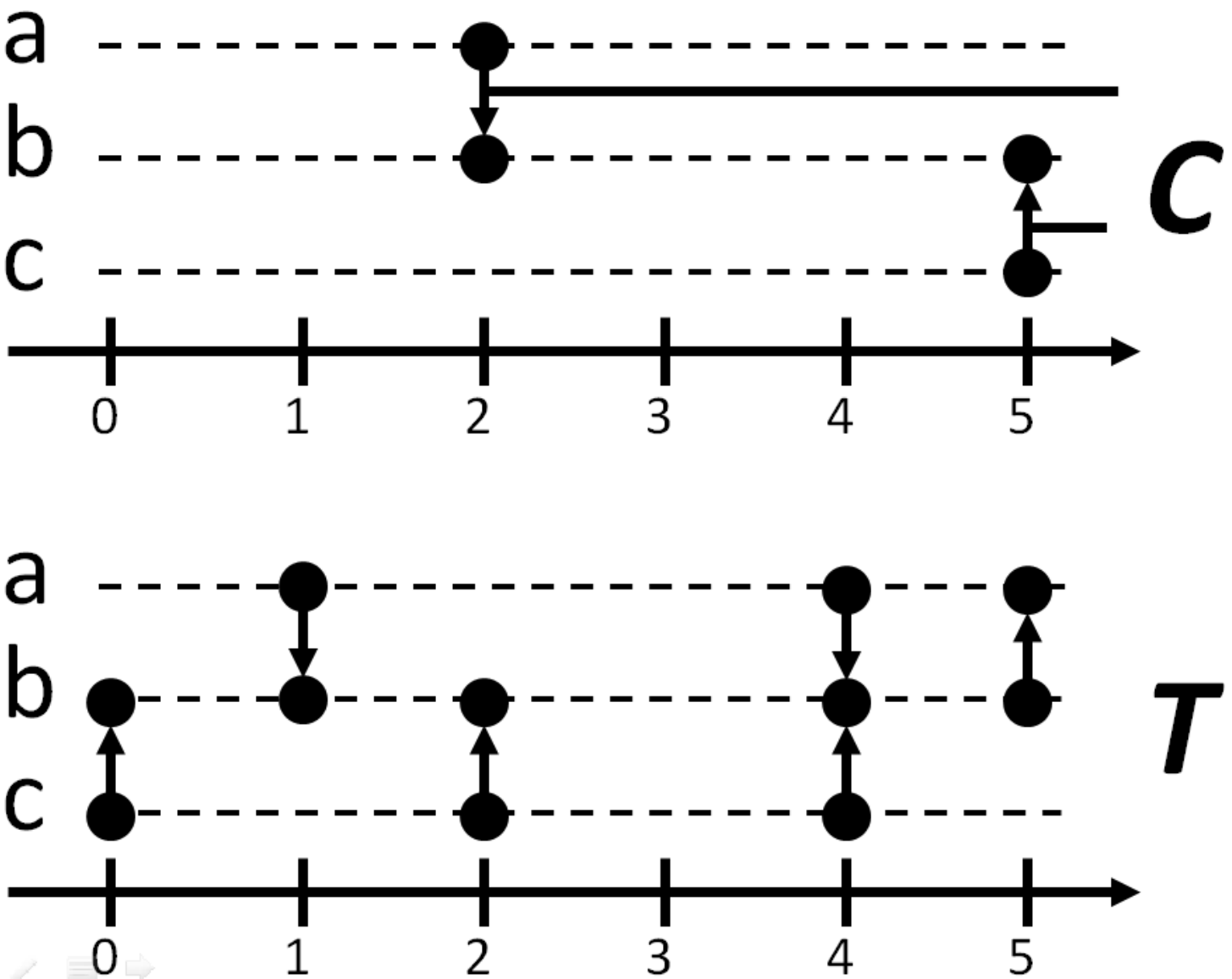

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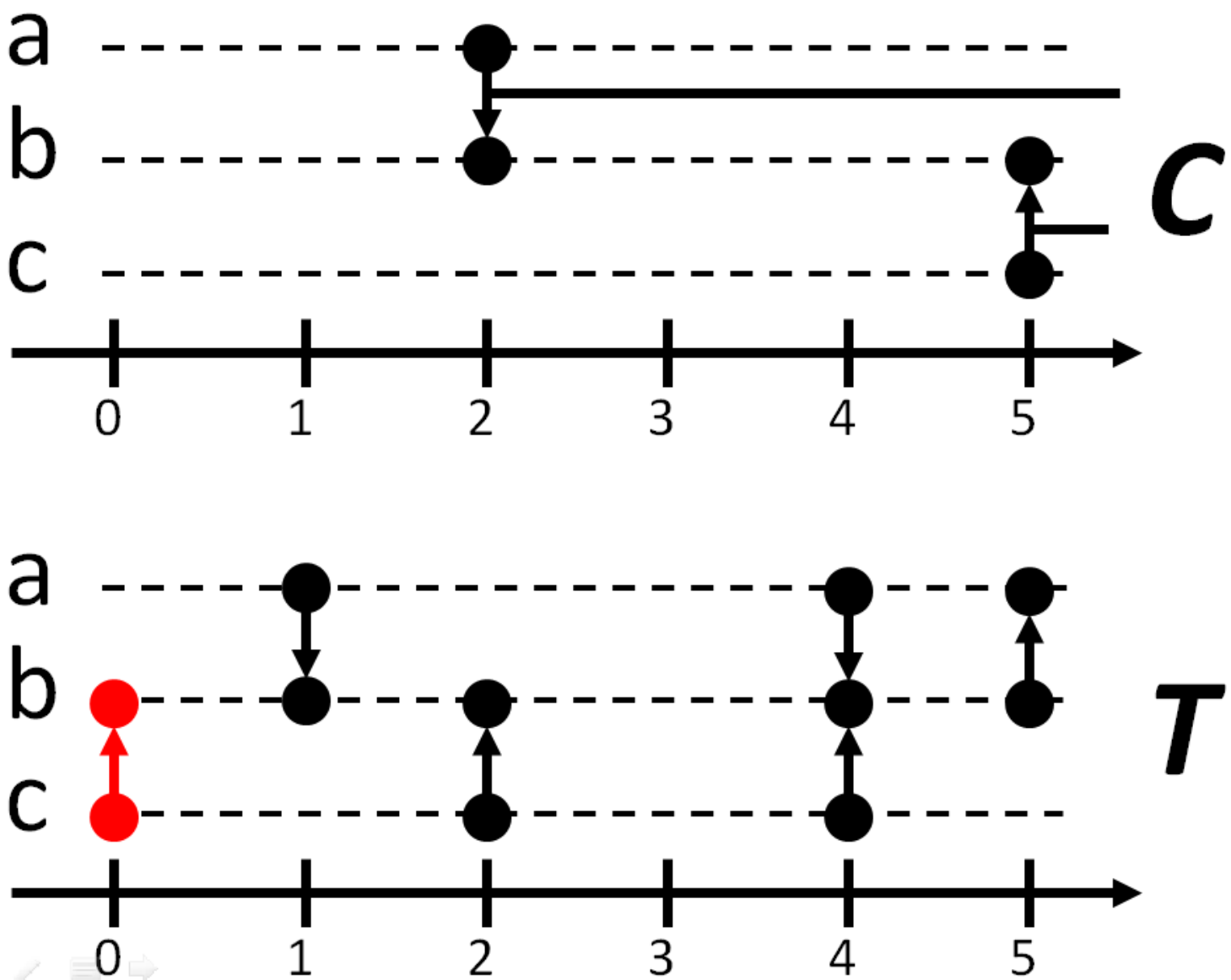

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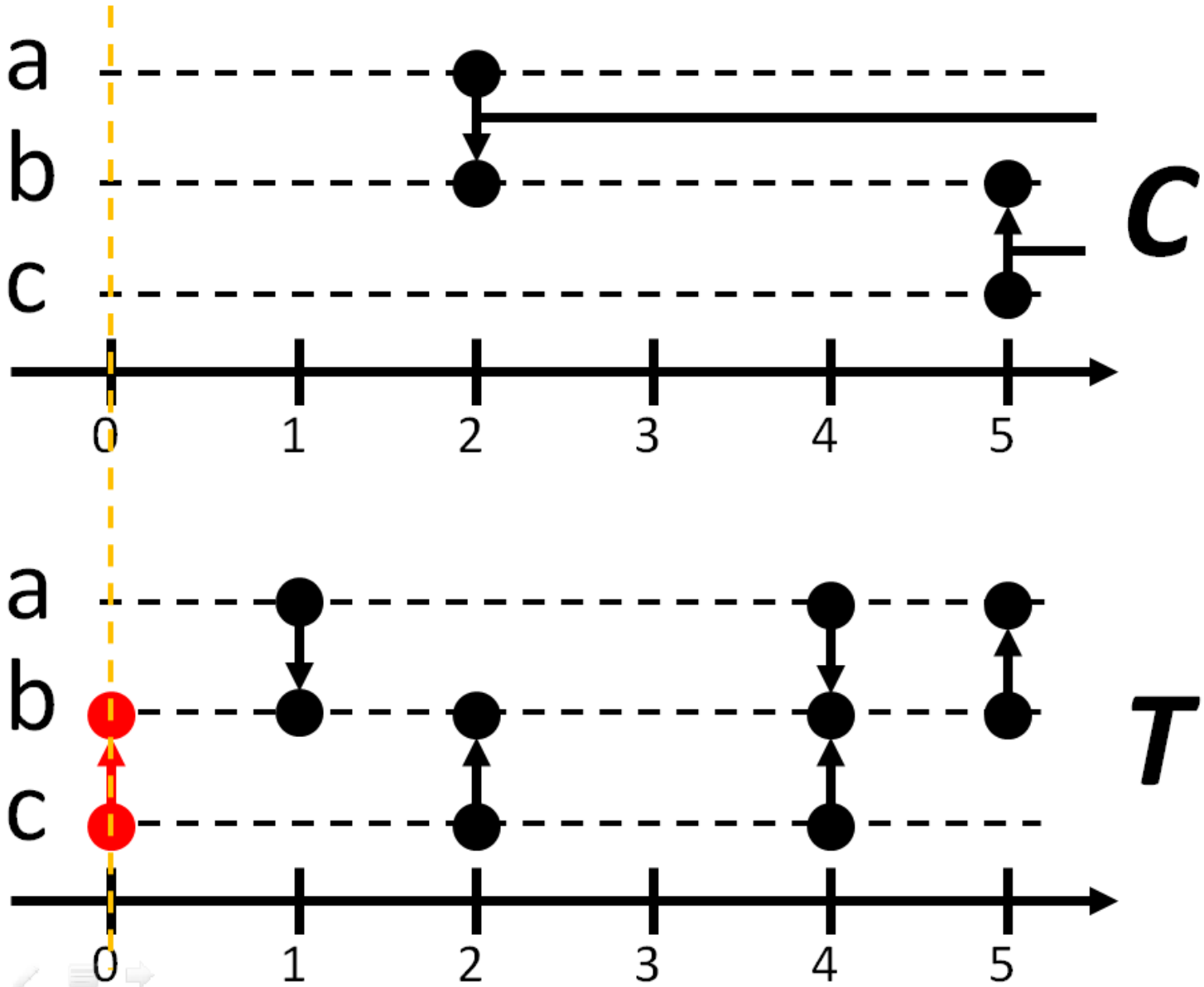

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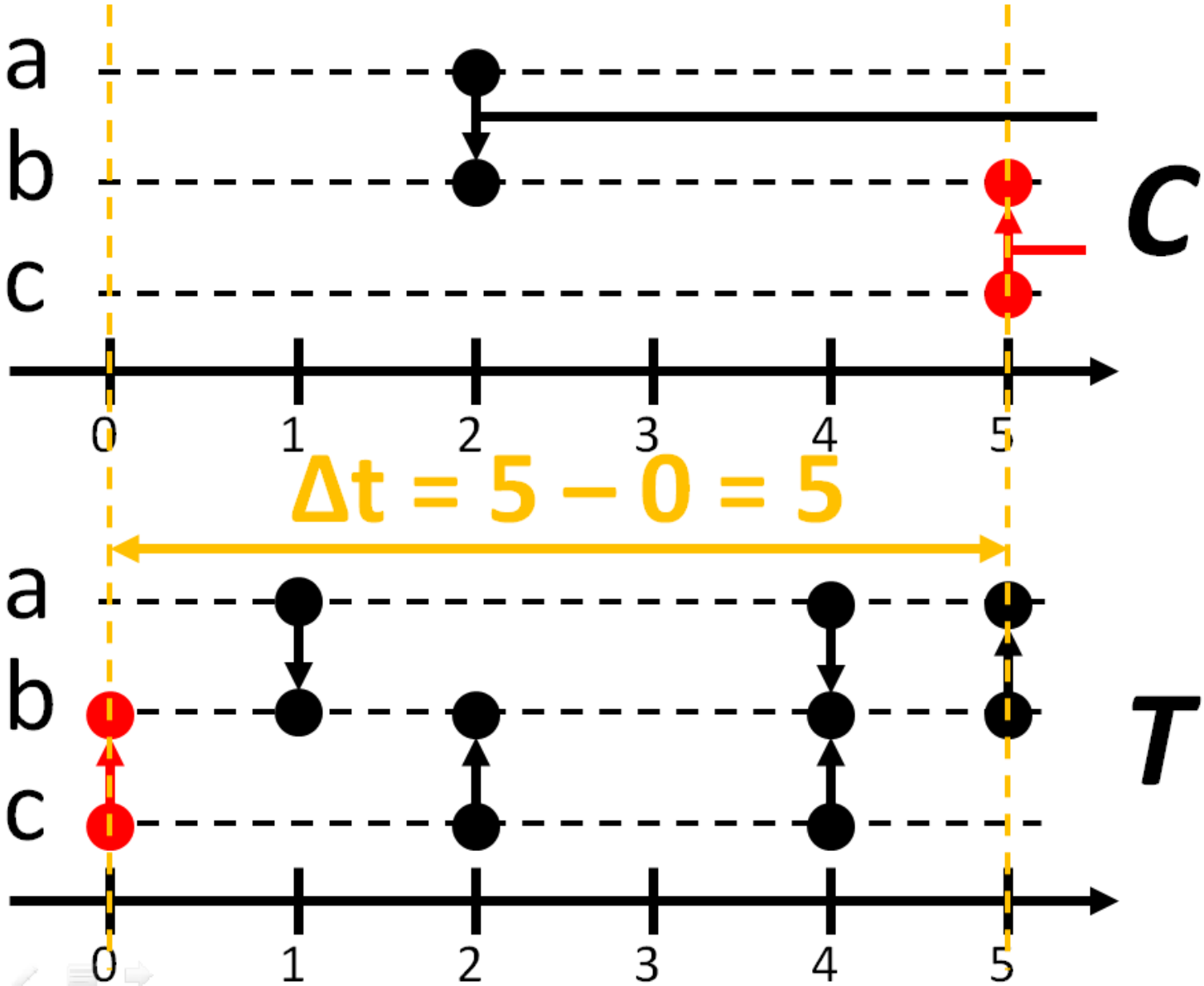
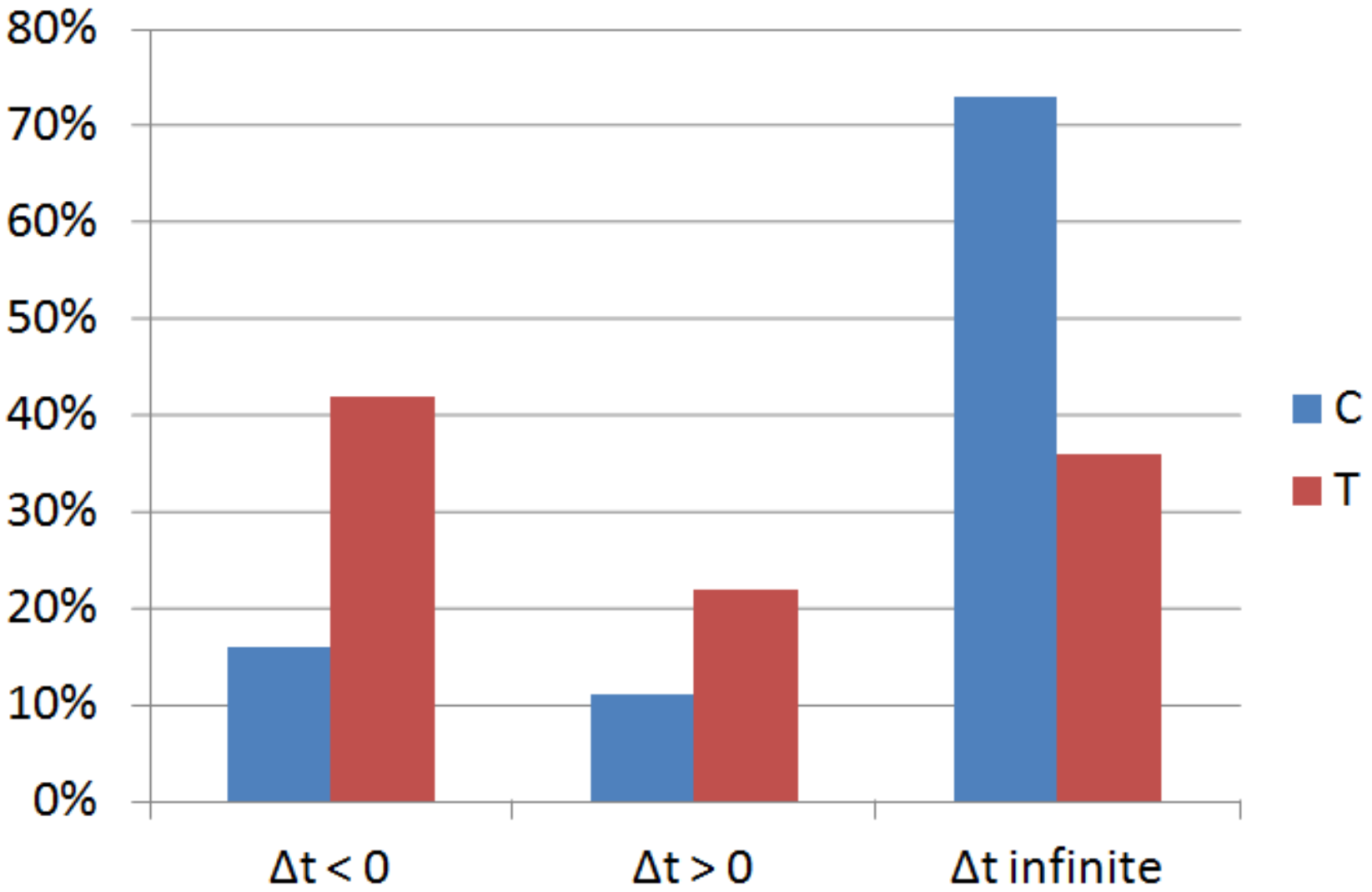
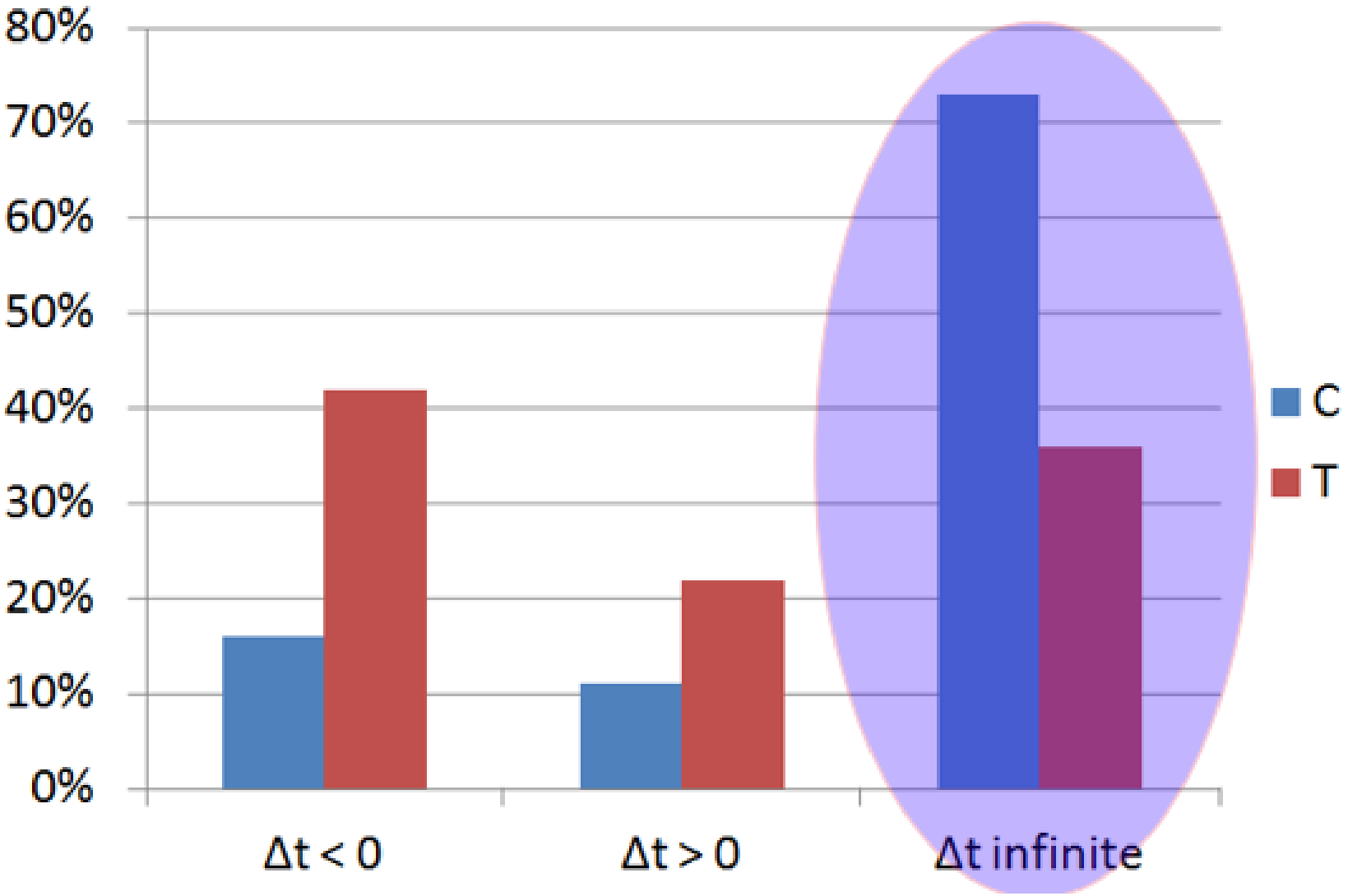


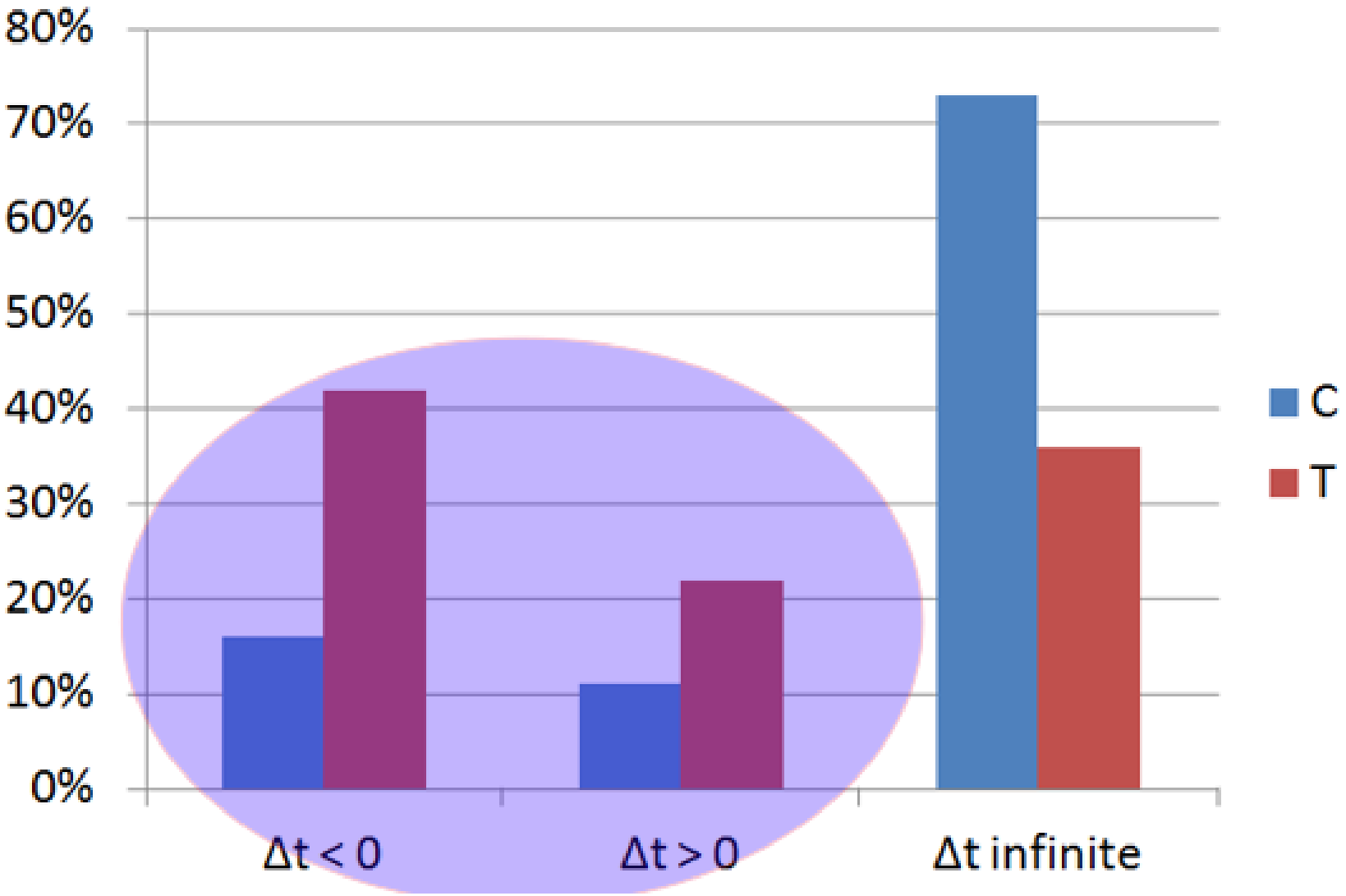
Time between transactions and certifications - **Results**



Time between transactions and certifications - **Results**



Time between transactions and certifications - **Results**



Time between transactions and certifications - **Results**

Reciprocity - **Questions**

Questions:

- Are certifications/transactions reciprocal?

Reciprocity - **Questions**

Questions:

- Are certifications/transactions reciprocal?
- How long does it take to get the opposite certification/transaction?

Reciprocity - **Questions**

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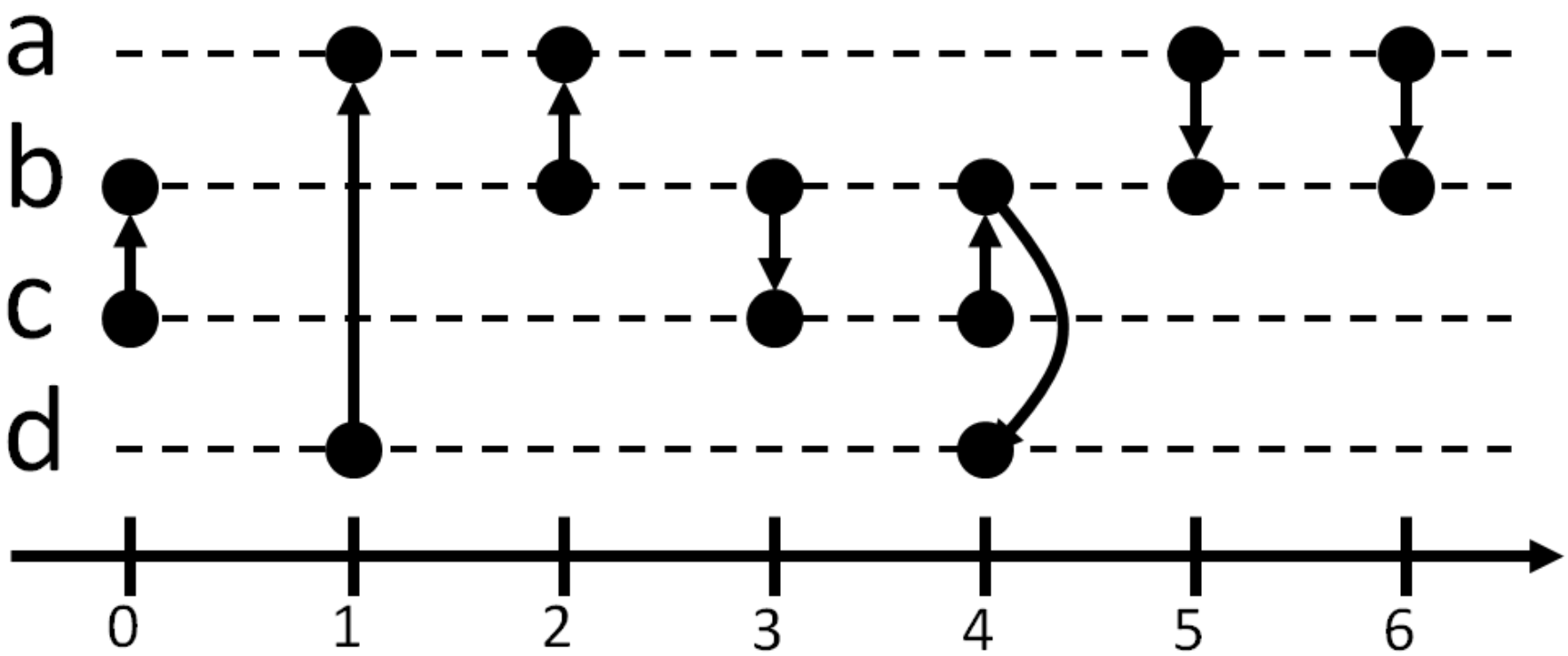
- Are certifications/transactions reciprocal?
- How long does it take to get the opposite certification/transaction?
- How fast is the money cycling?

Reciprocity - **K-Closures** of links - Ex: 2-closure



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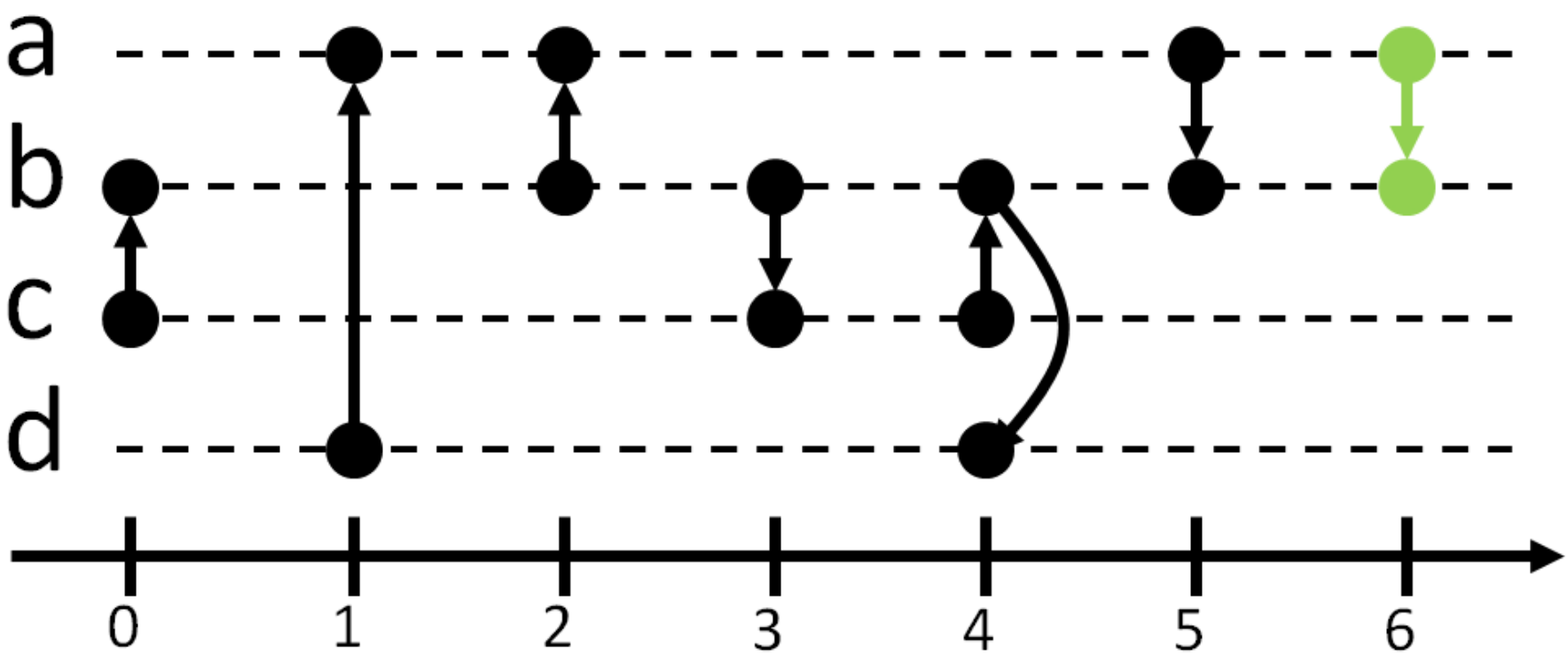

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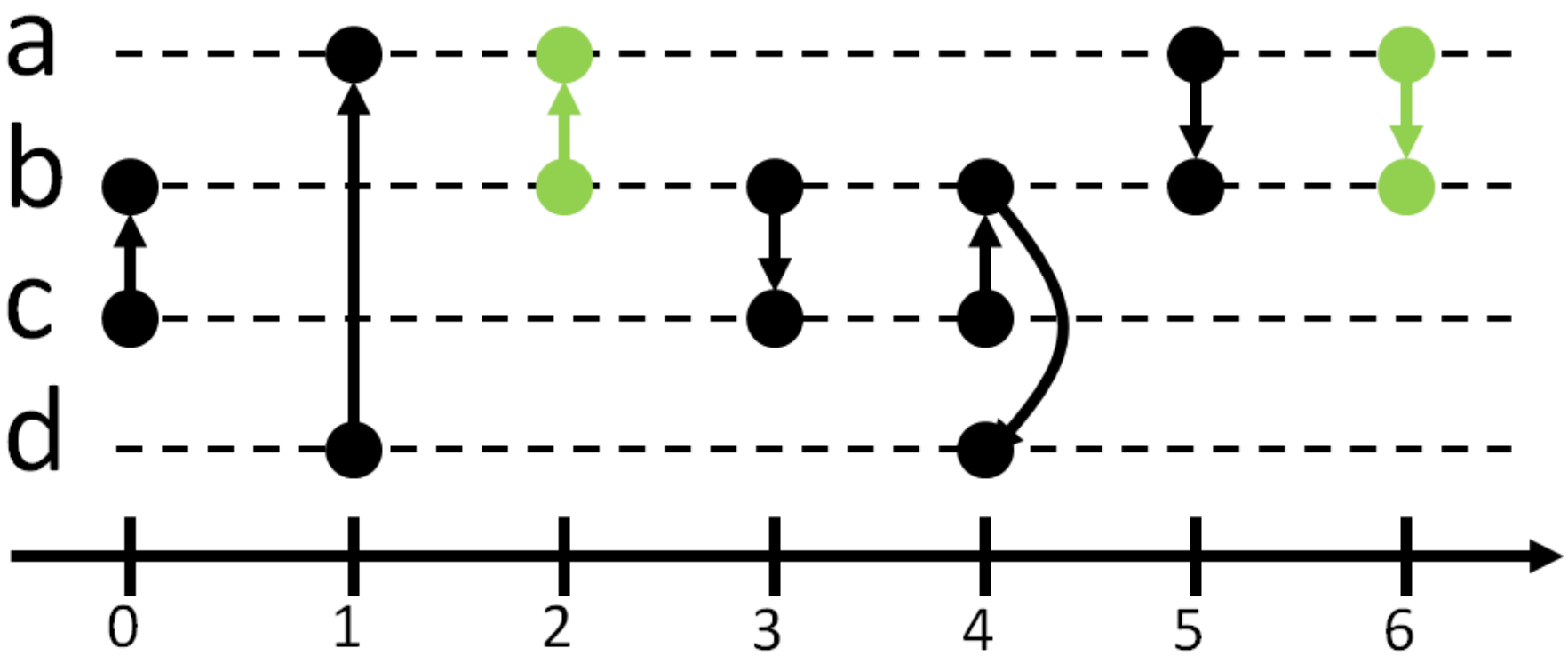

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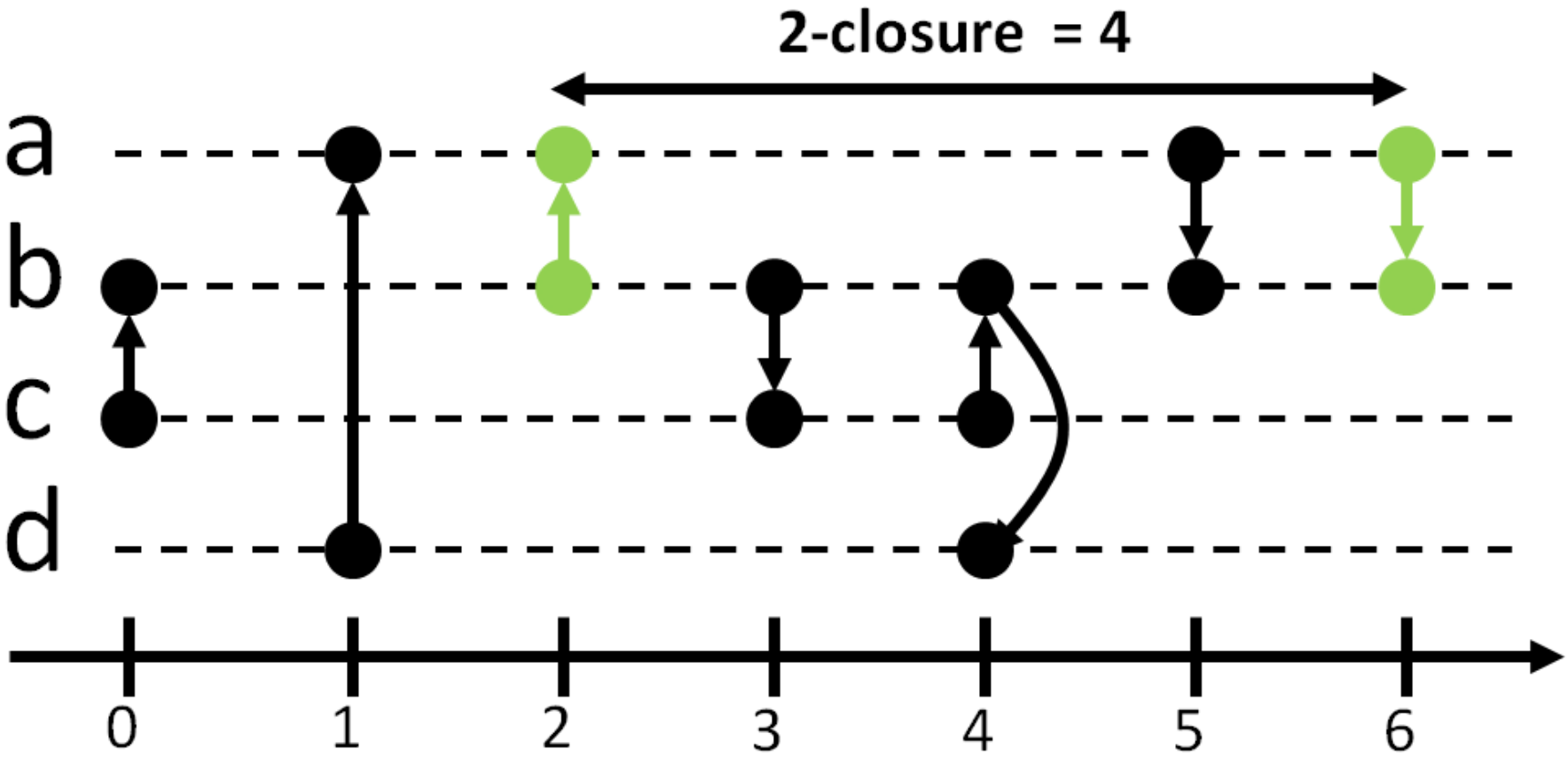
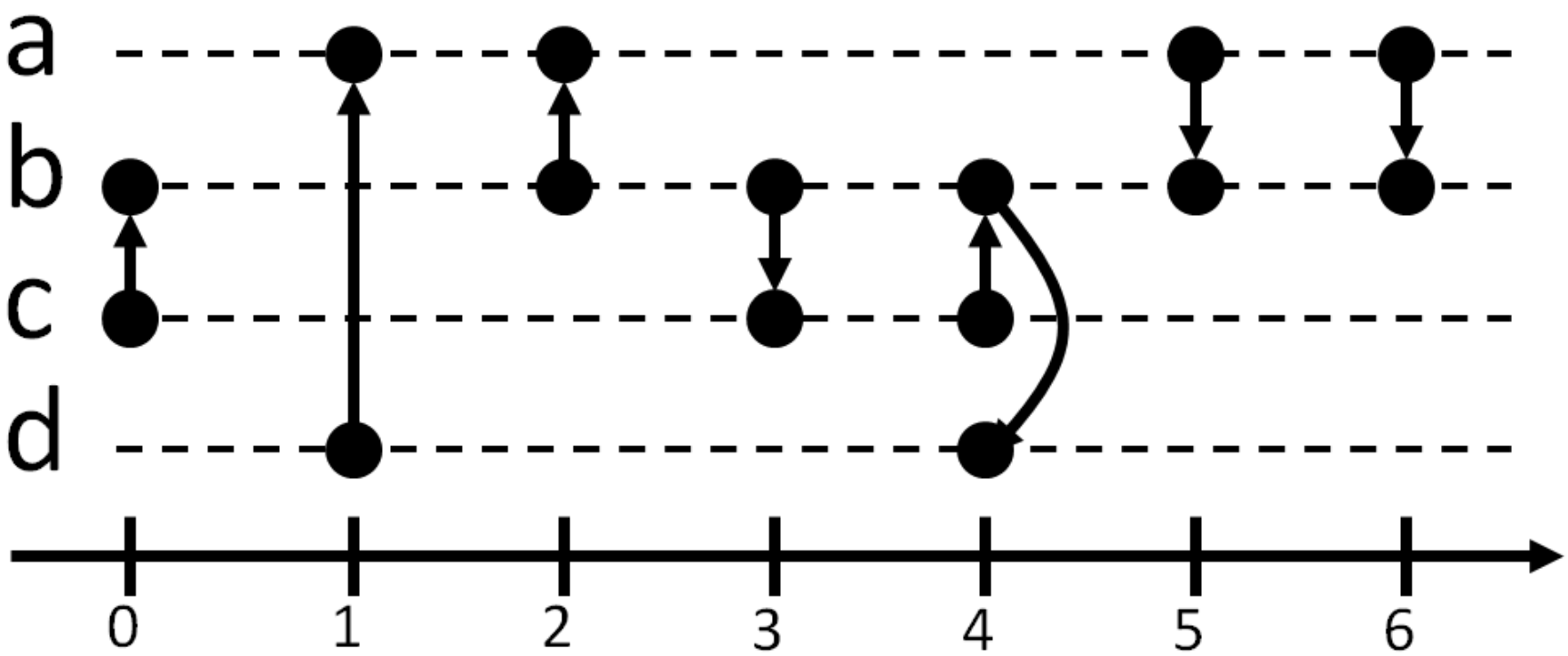


Reciprocity - **K-Closures** of links - Ex: 3-closure



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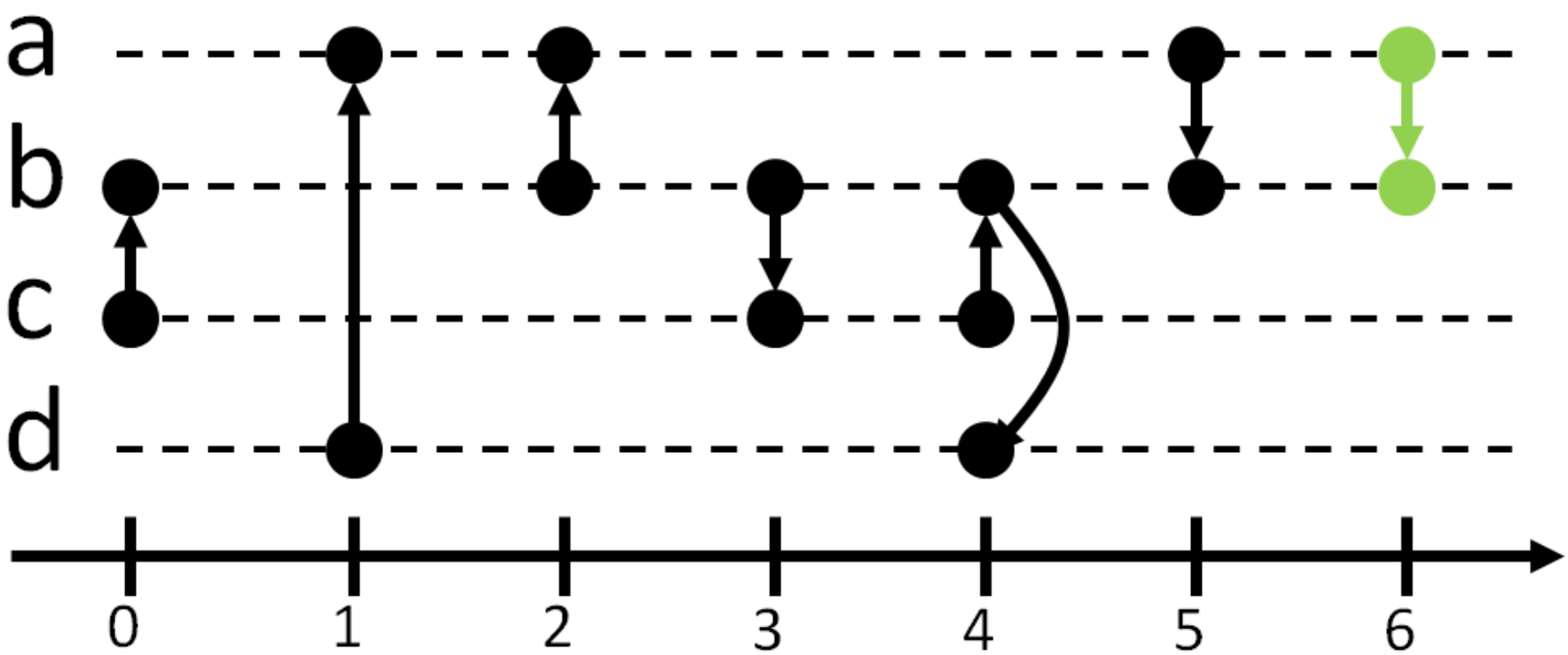

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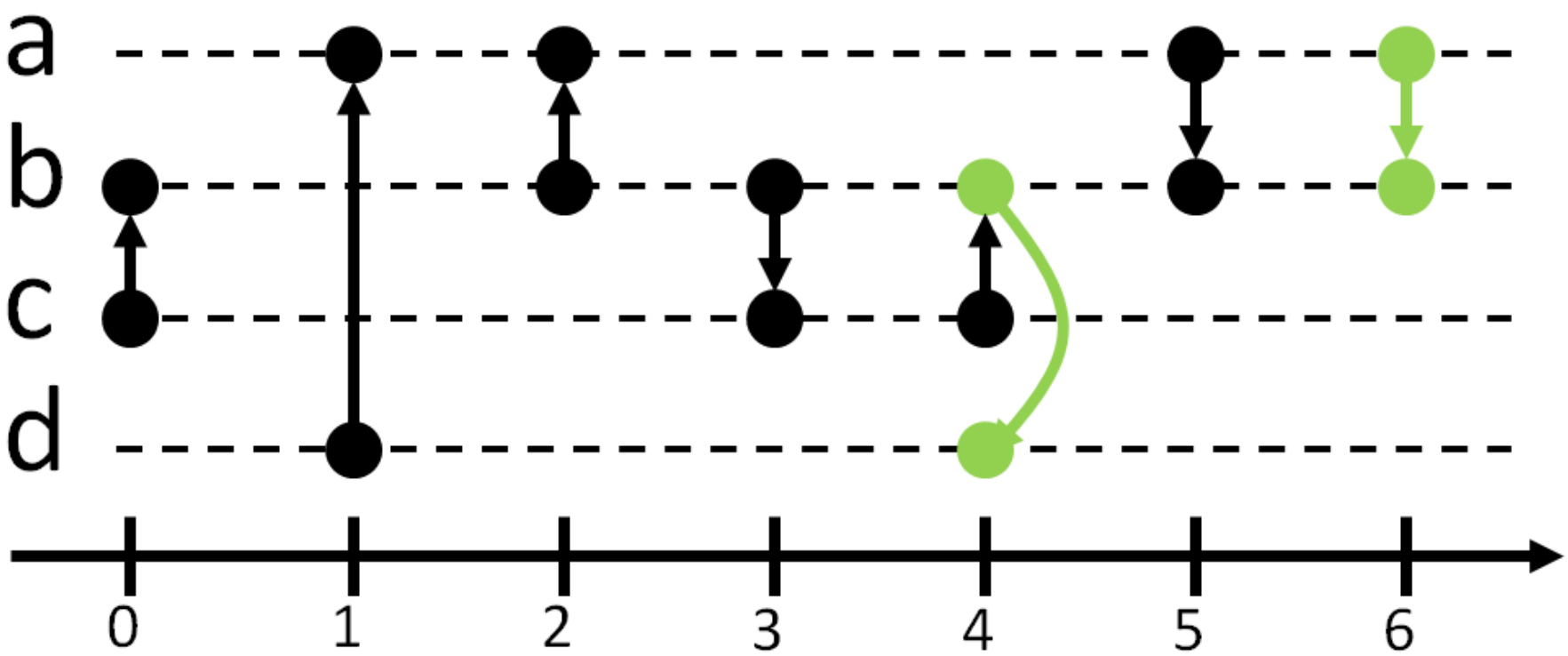

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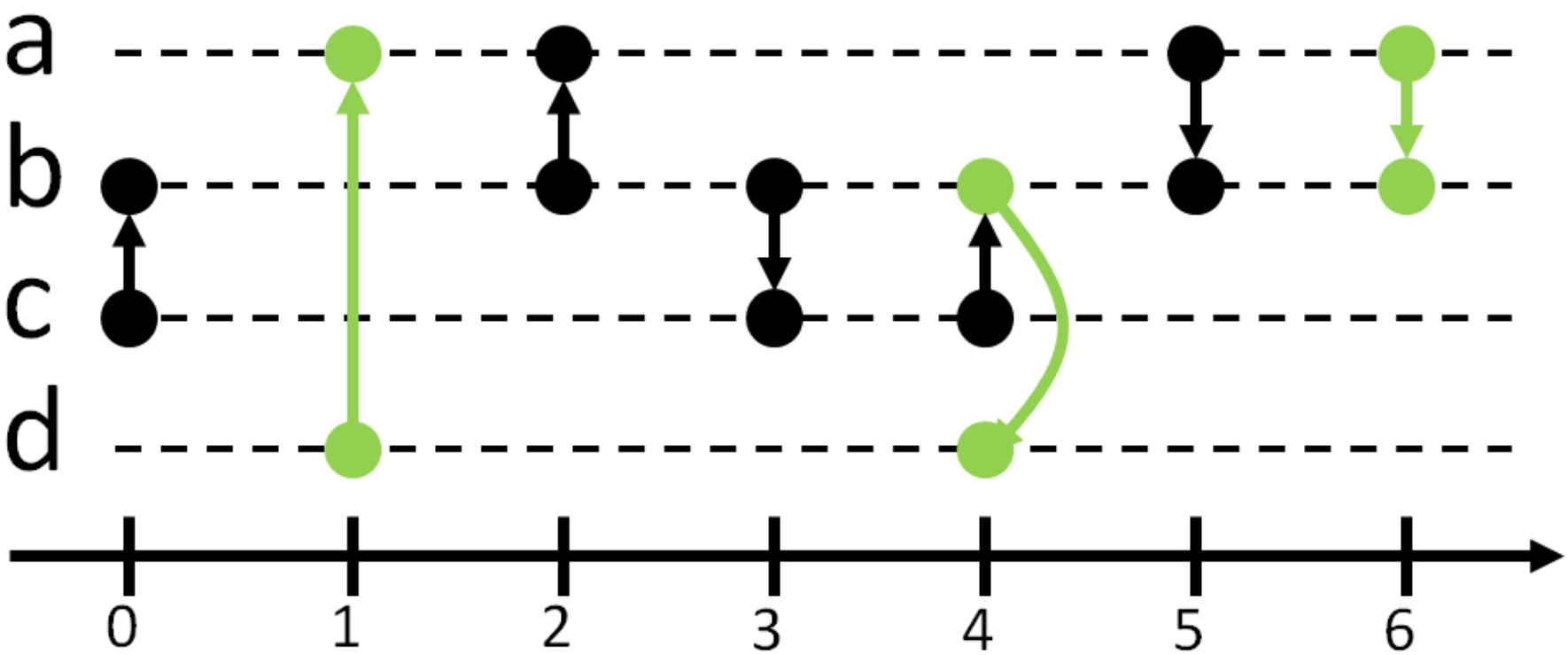

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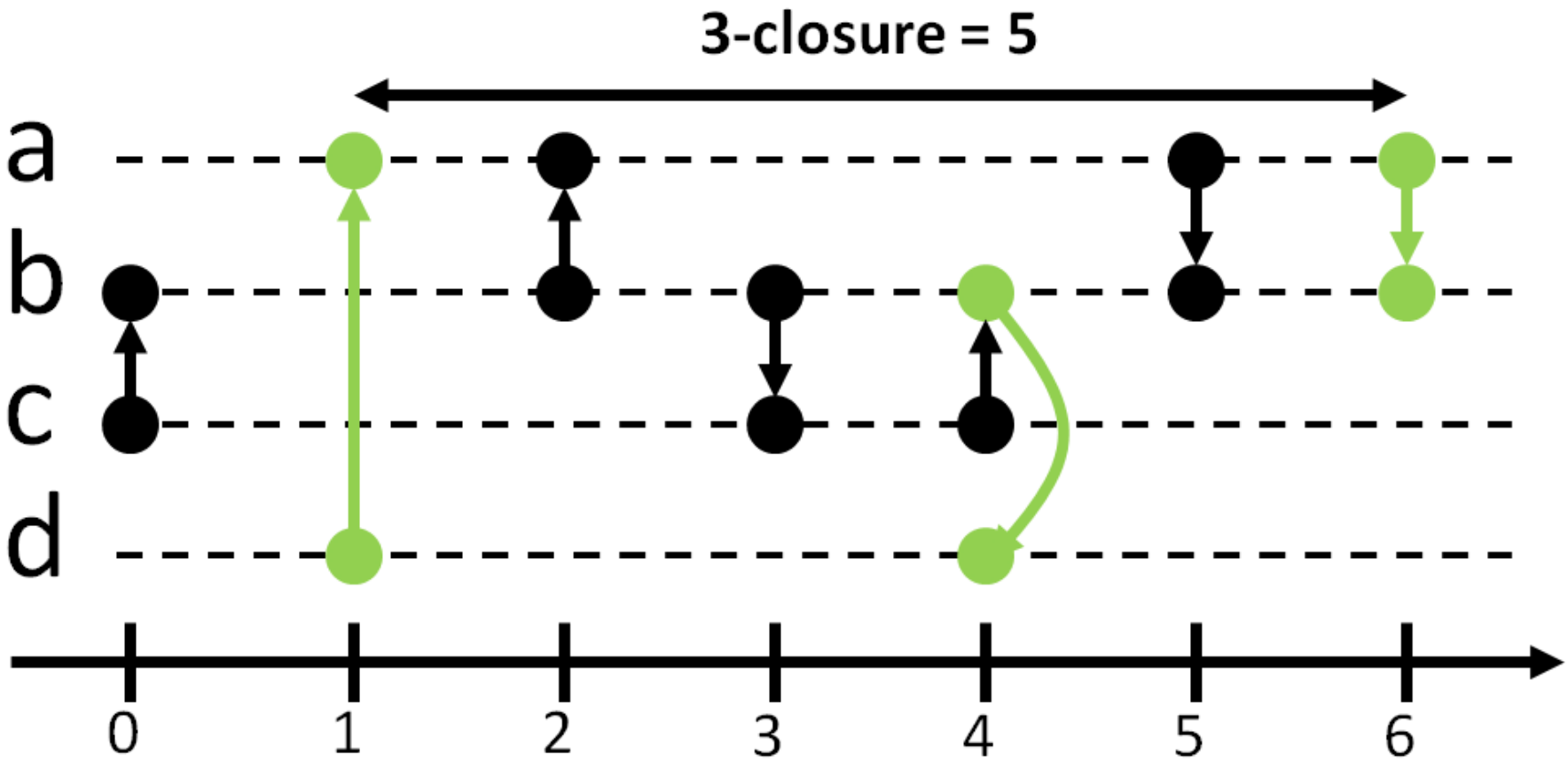
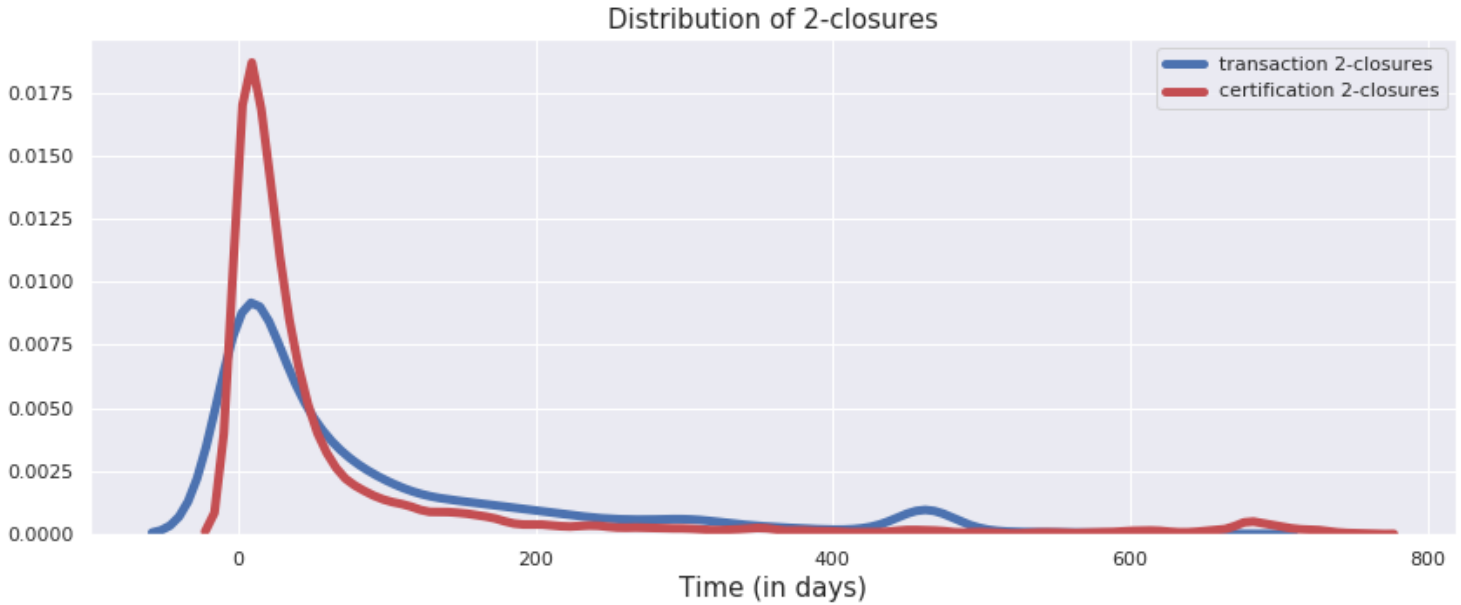
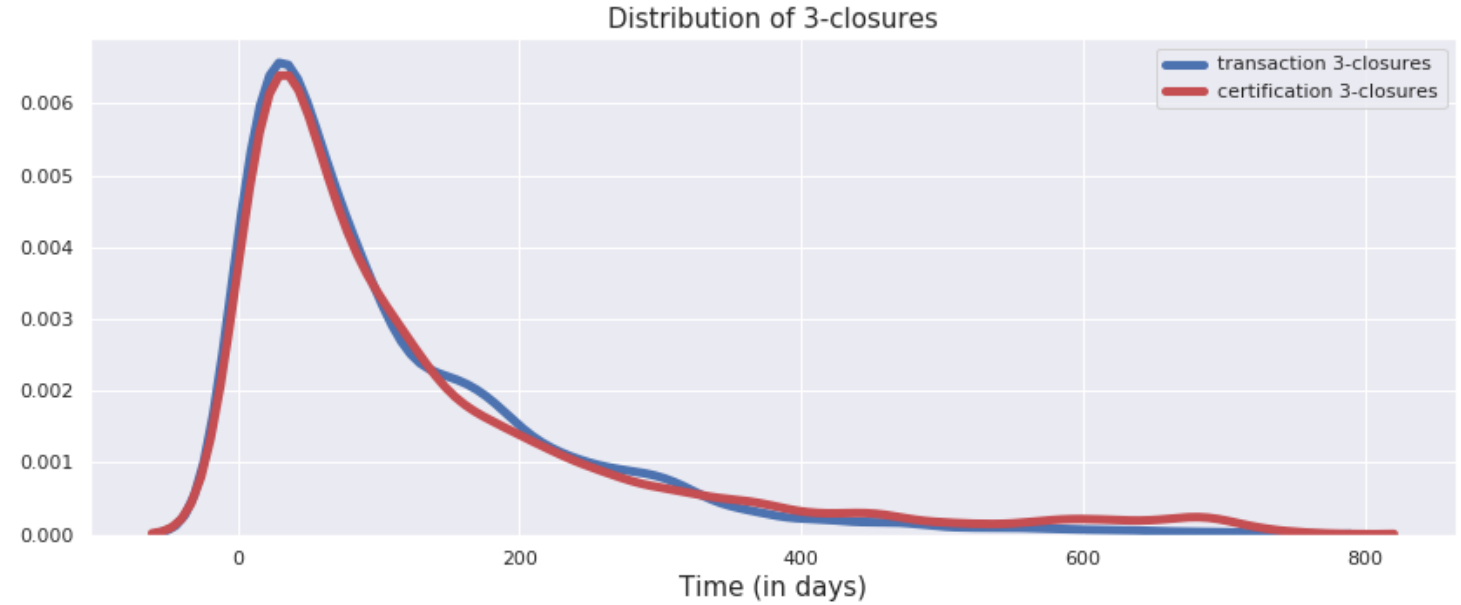


Reciprocity - **Results**





Conclusion and Takeaways

- $\tilde{G}1$ offers a **unique dataset** to study the interplay between **social ties and transactions**
- The data is naturally well modeled by **stream graphs**

- Members tend to certify people they never make transactions with
- But they tend to make transactions with people they are socially connected to
- When an interaction occurs in both streams, there is a clear time proximity
- Interactions tend to become reciprocal in short periods of time

Questions?

Slides available on GitHub:

https://github.com/NicolasGensollen/presentation_marami_2019

nicolas.gensollen@lip6.fr