G-IOTA/E-IOTA
Fair and Efficient Aware Tangle

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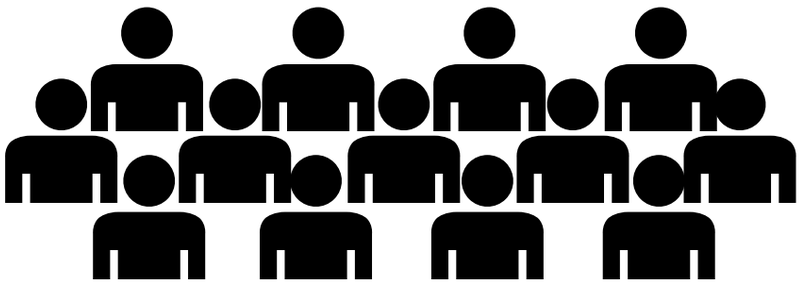
Fairness

?

IOTA

IOTA

Bitcoin

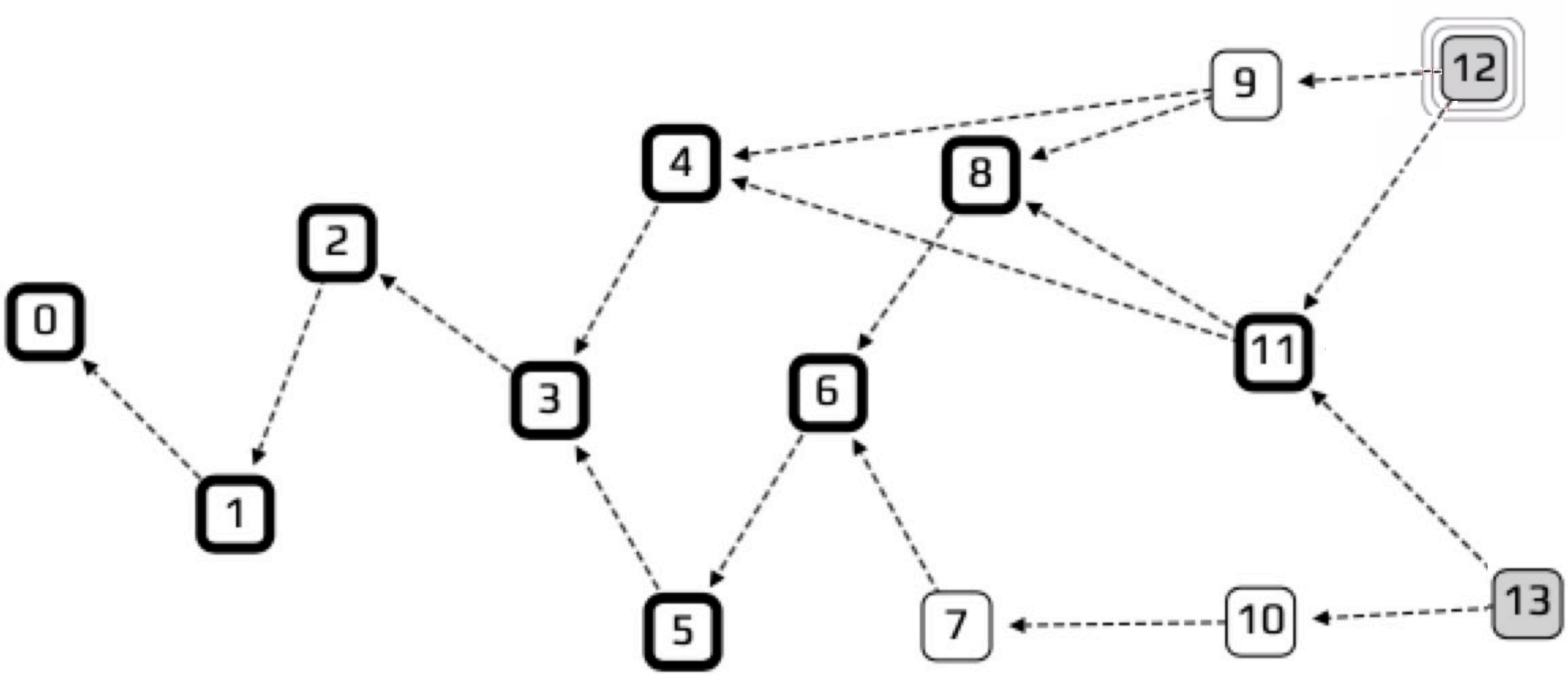


Users

Miners

IOTA-Tangle: a Transactions-DAG [1]

(DAG: Directed acyclic graph)



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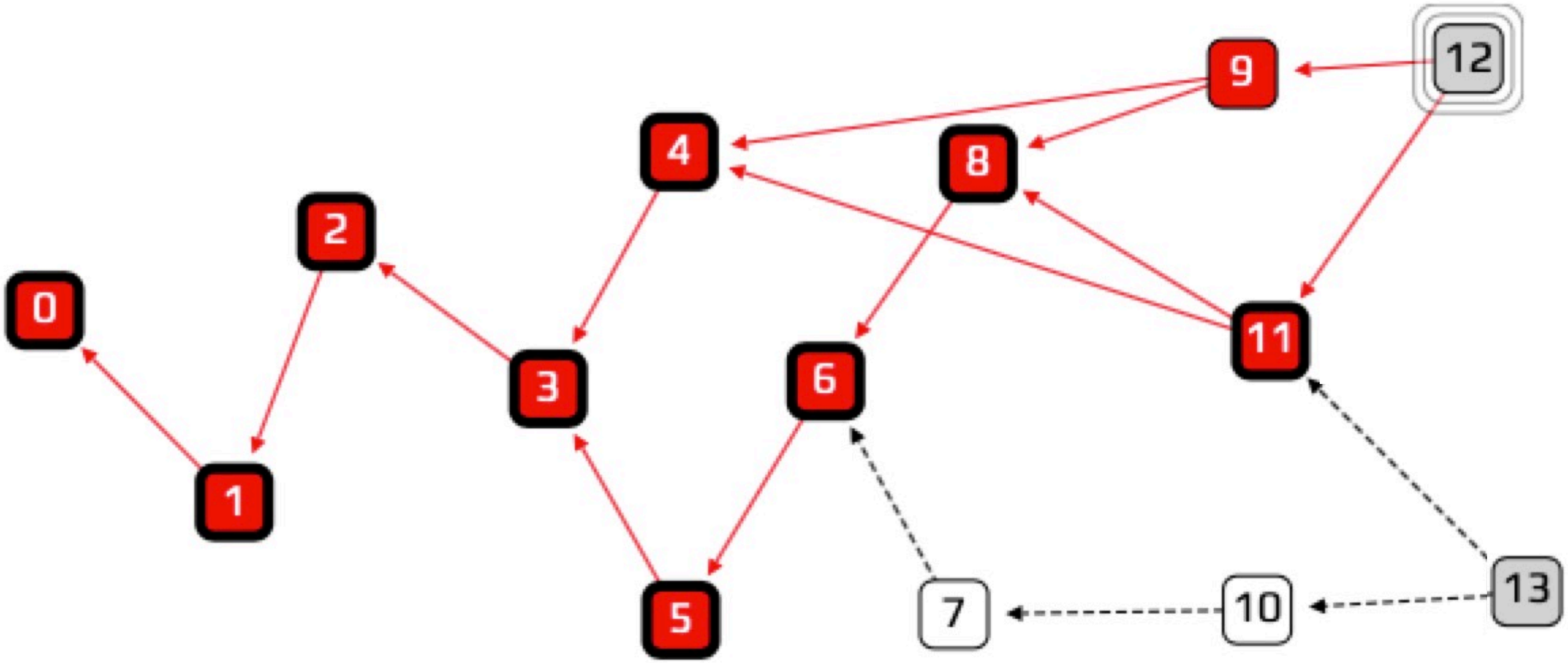

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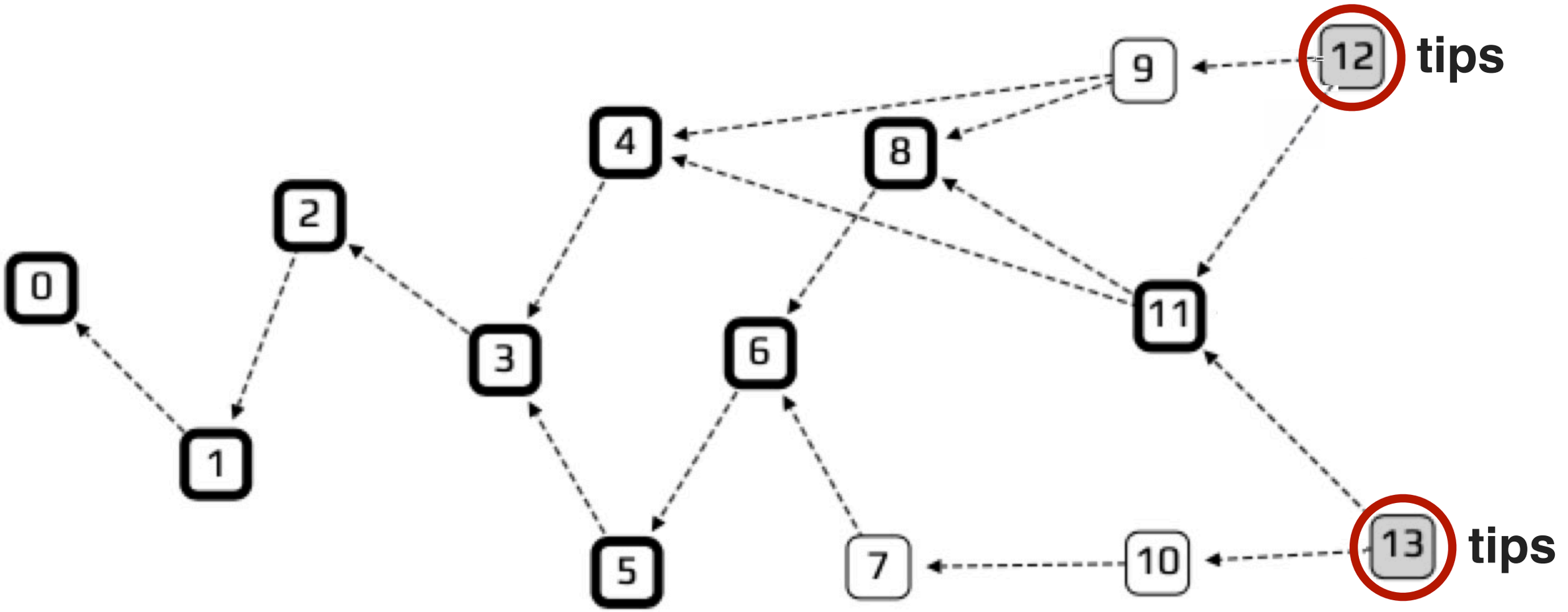

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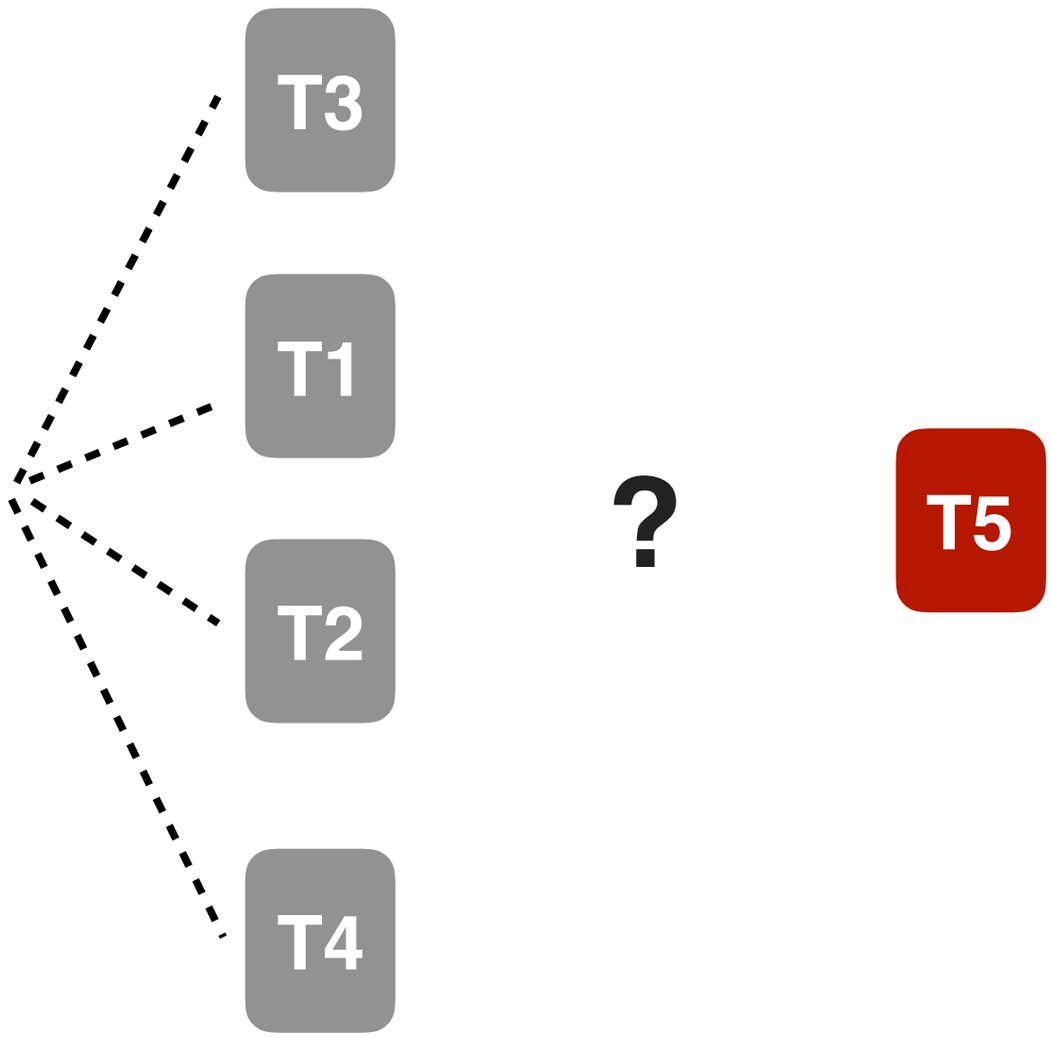
Tips selection Algorithm[1]

(TSA)



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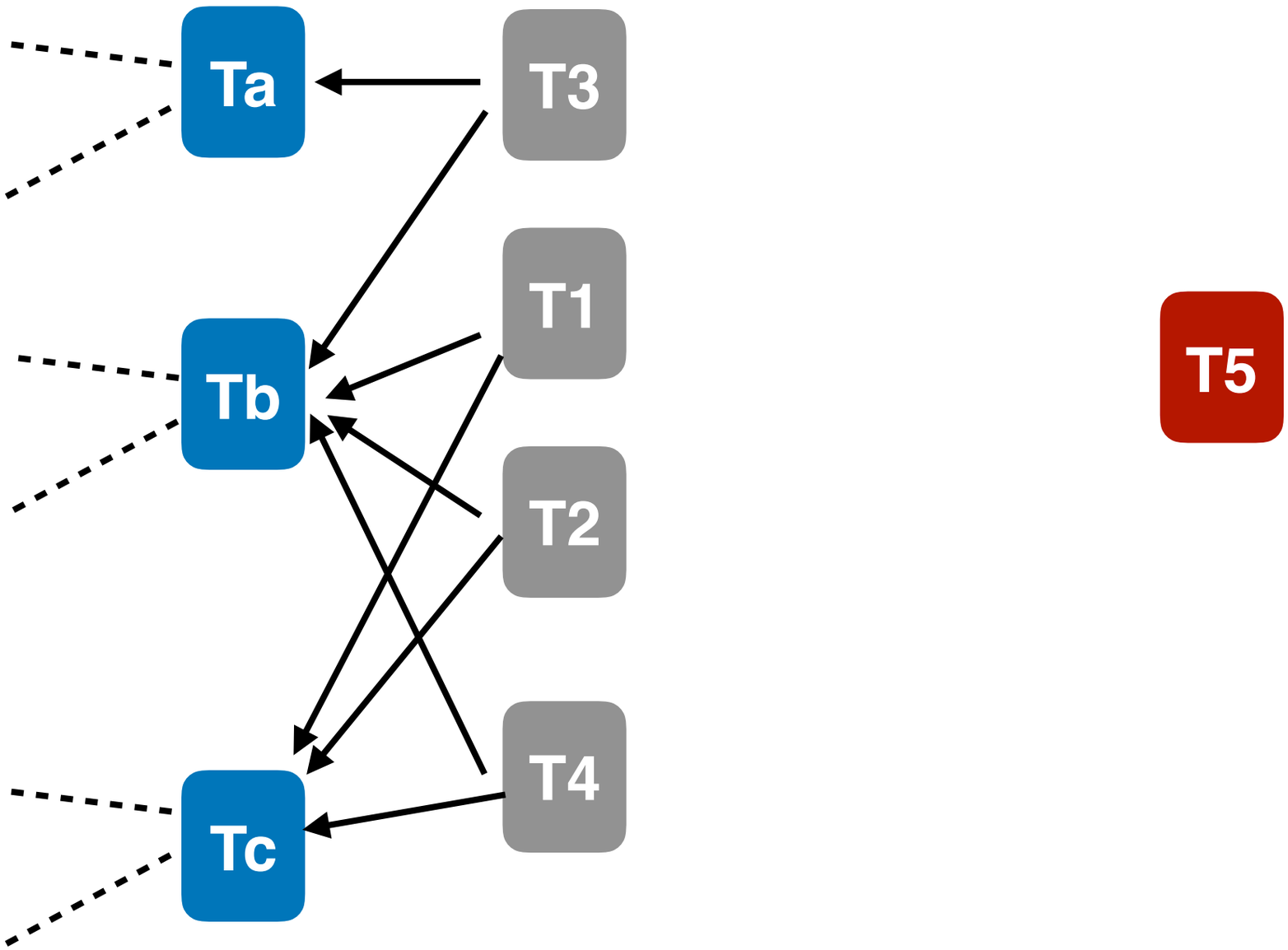
Level of Confidence [1]



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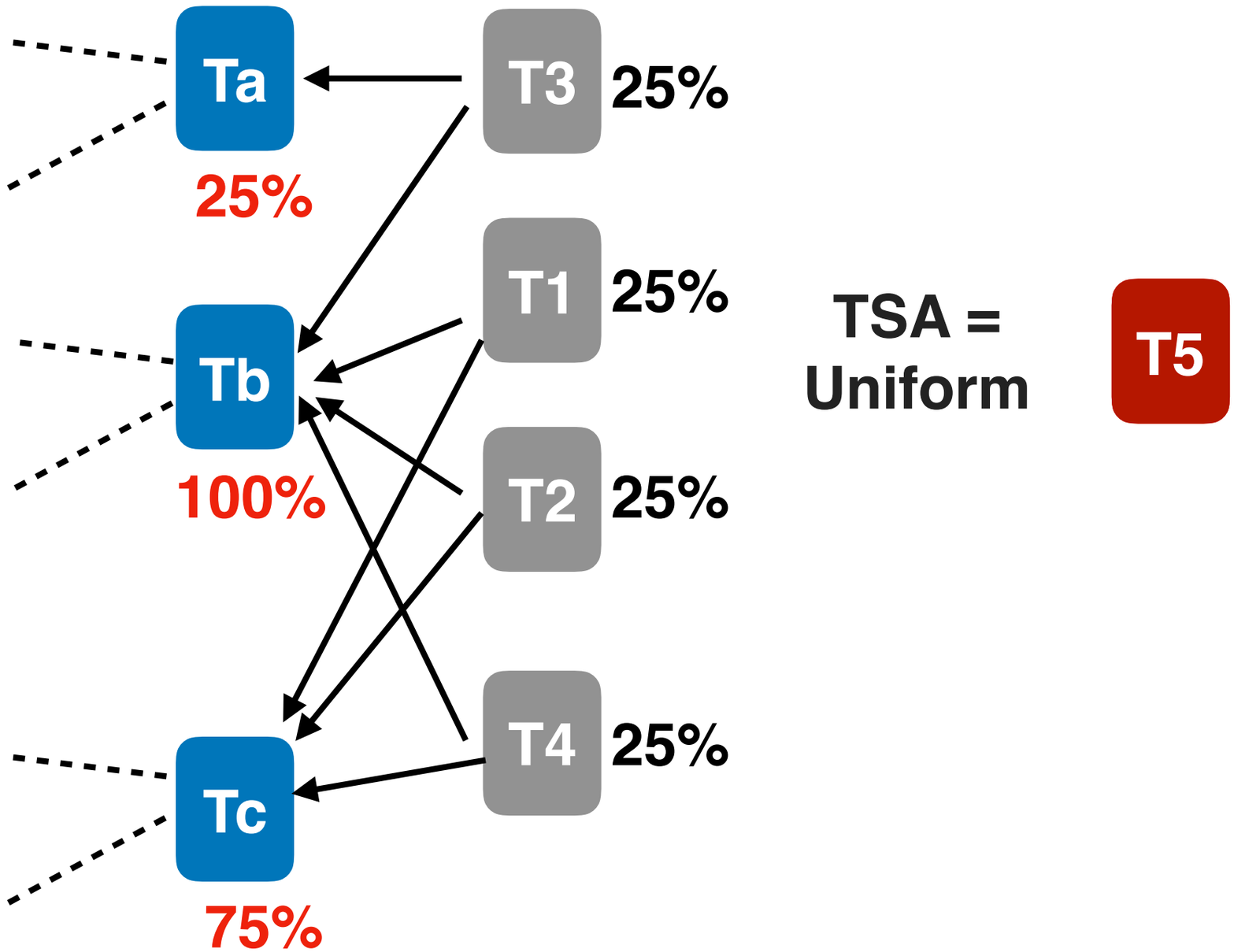

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Weighted Random Walk TSA [1]

Fairness

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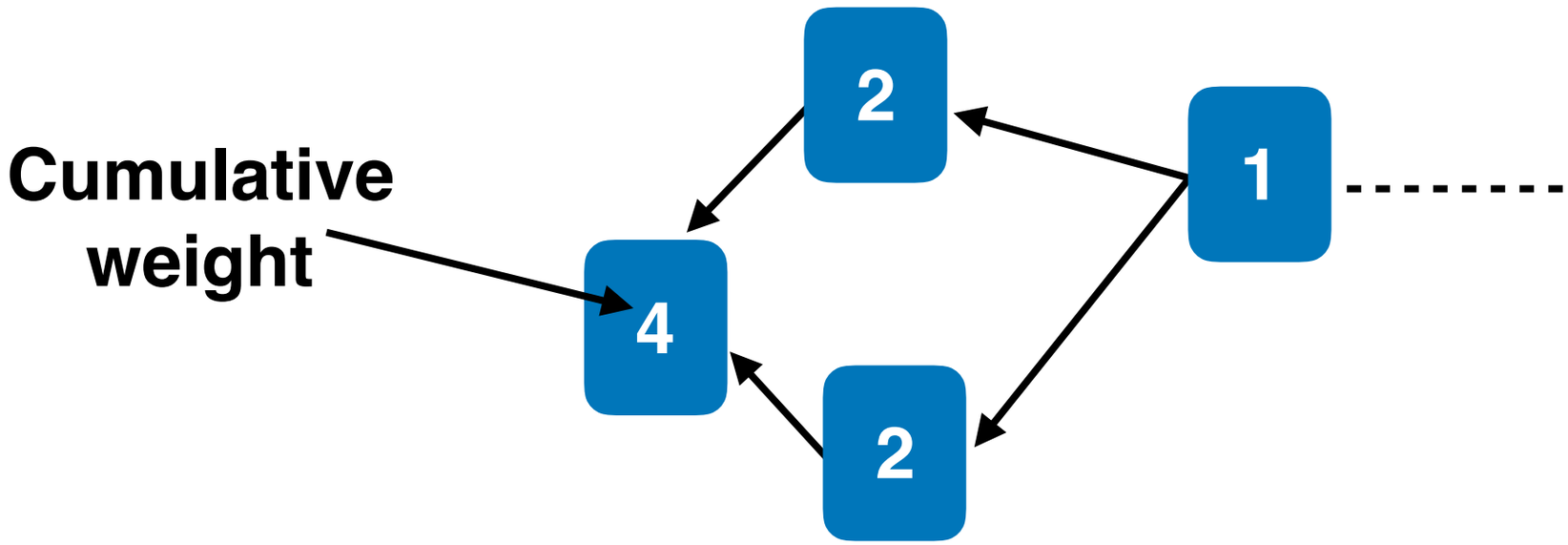
Weighted Random Walk TSA [1]



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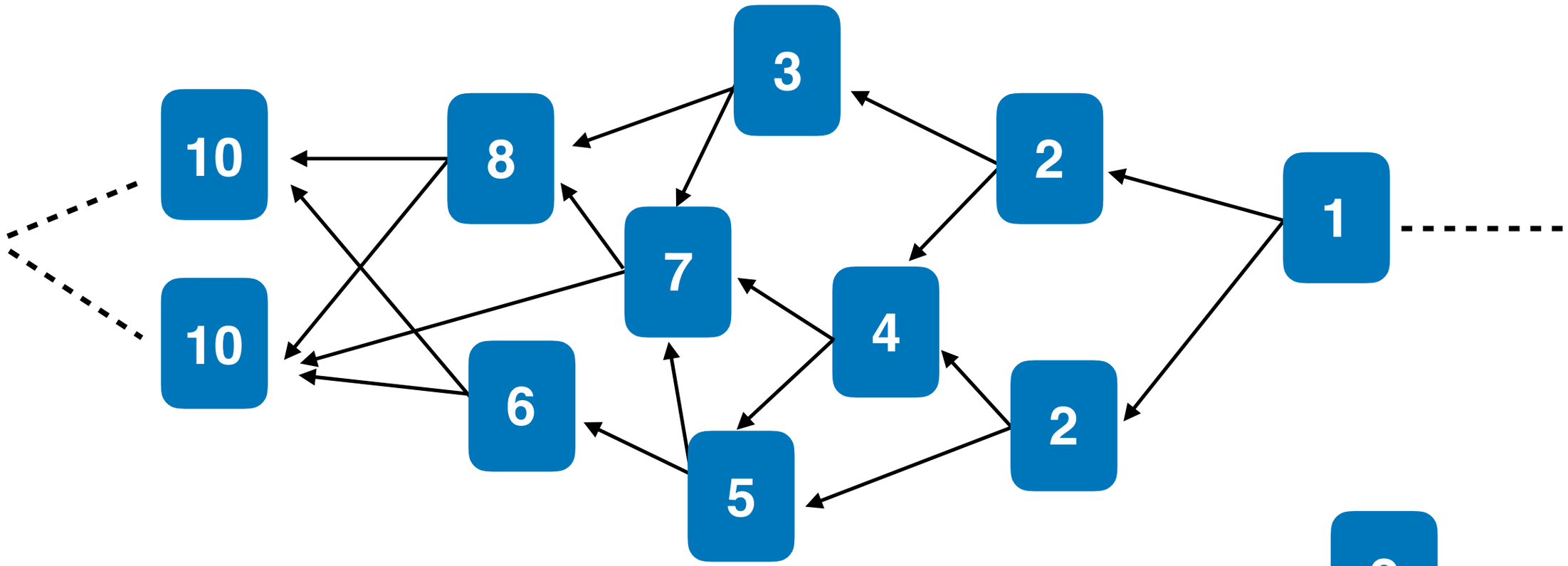

Cumulative weight

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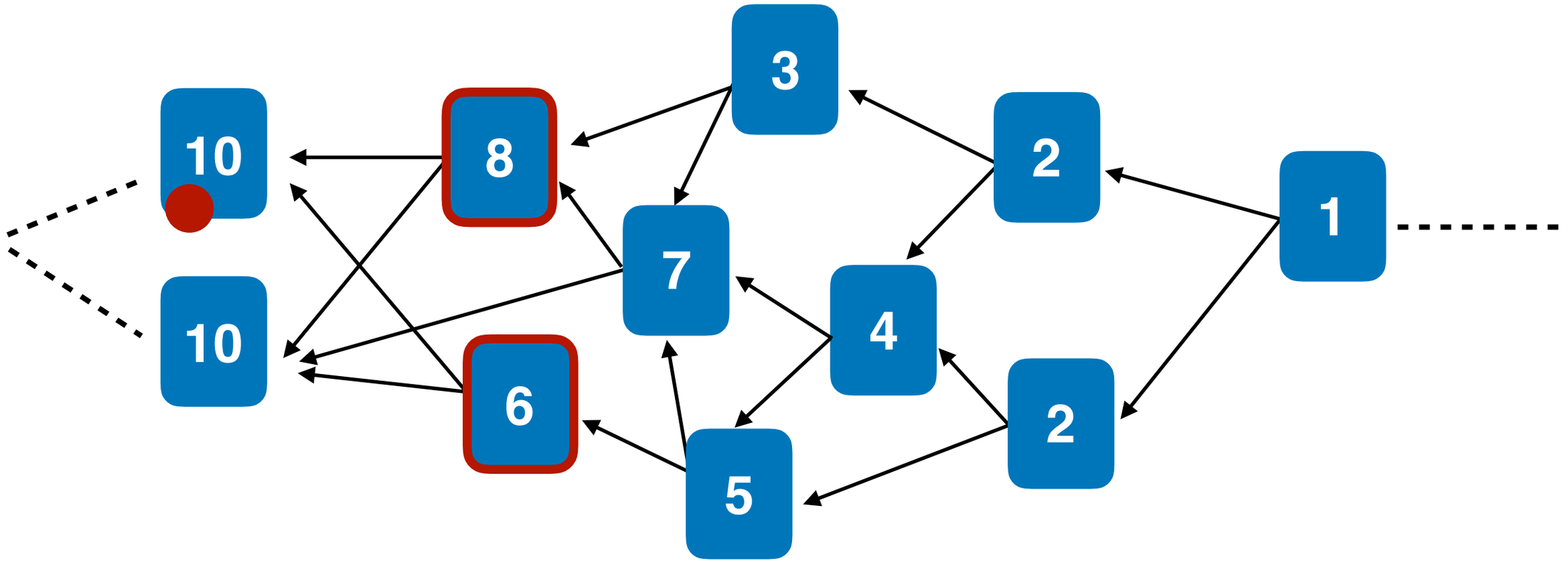
Weighted Random Walk TSA [1]



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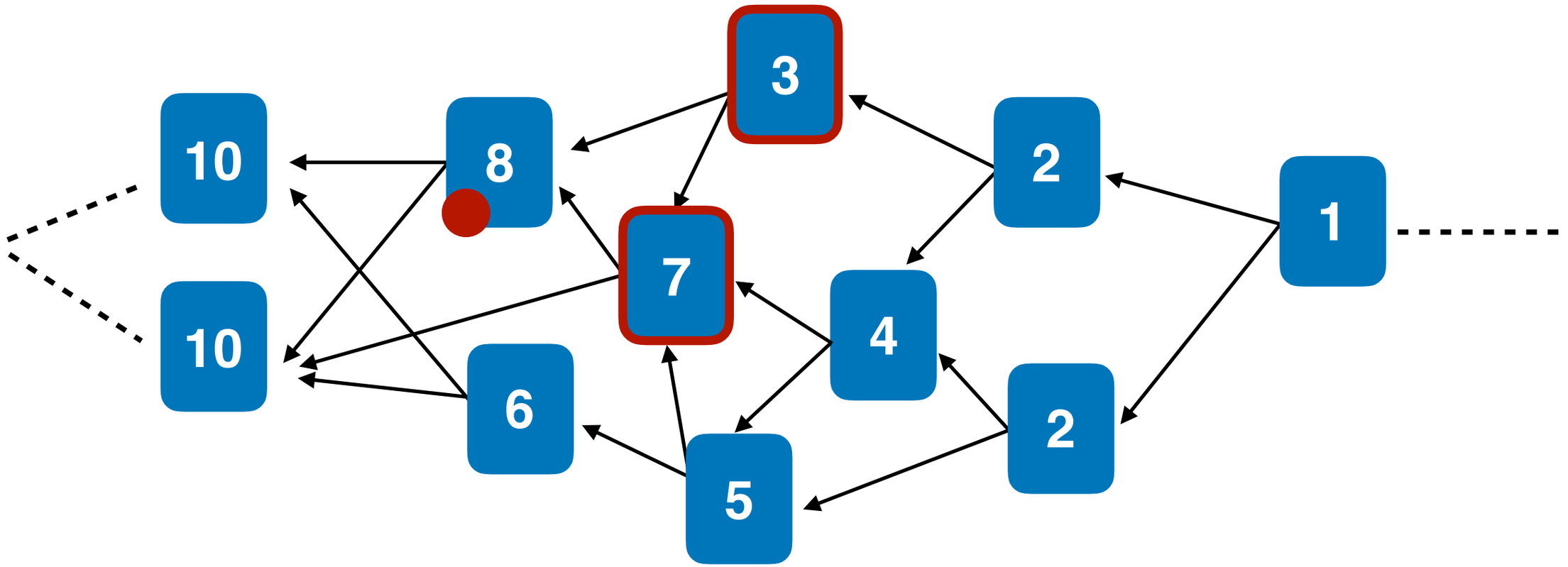

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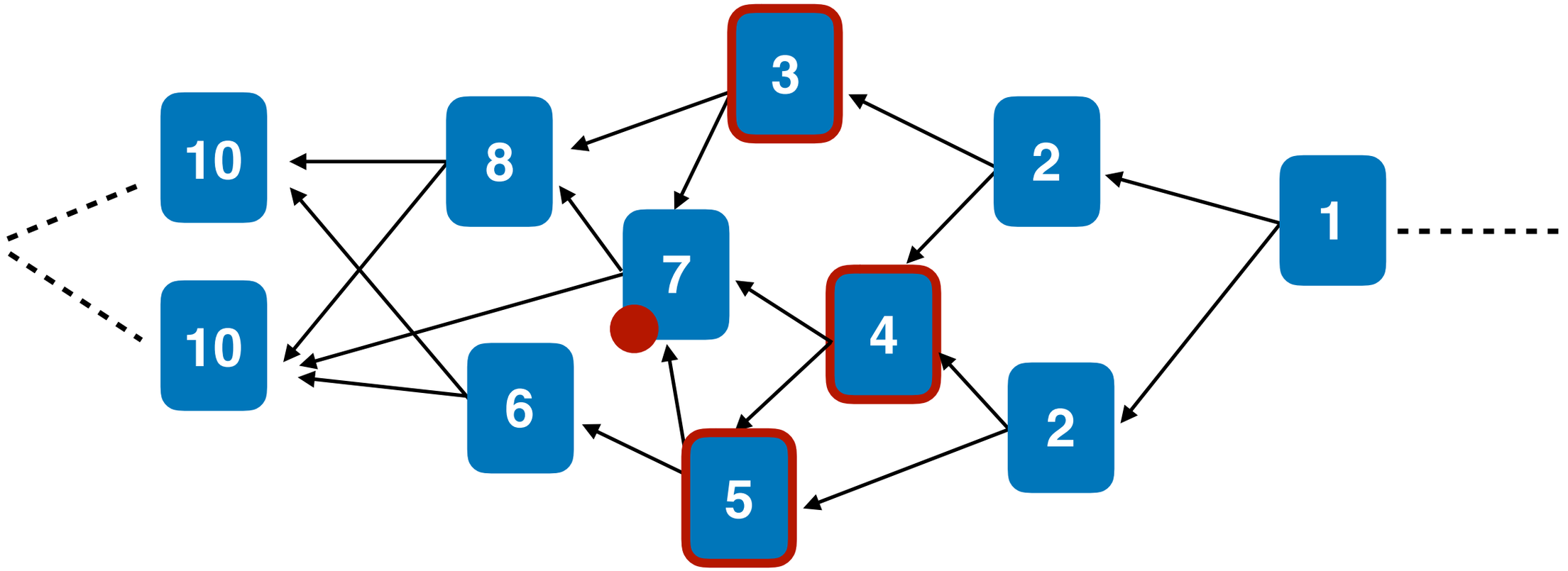

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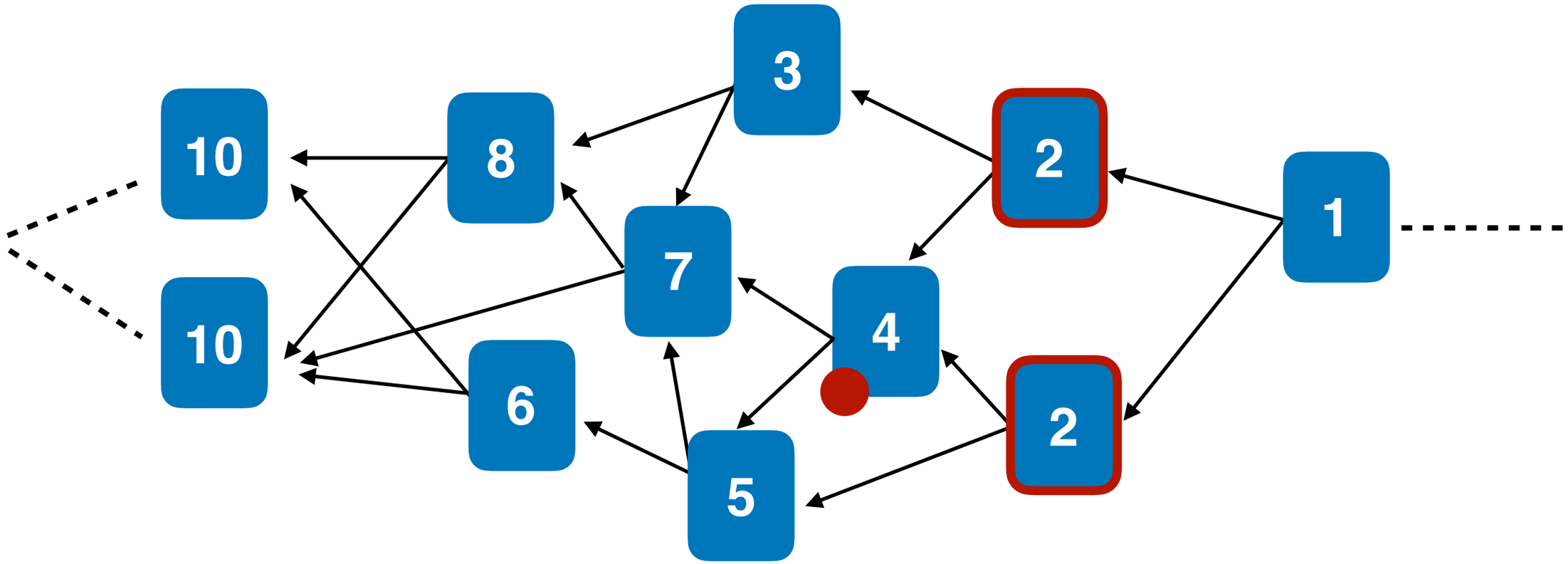
Weighted Random Walk TSA [1]



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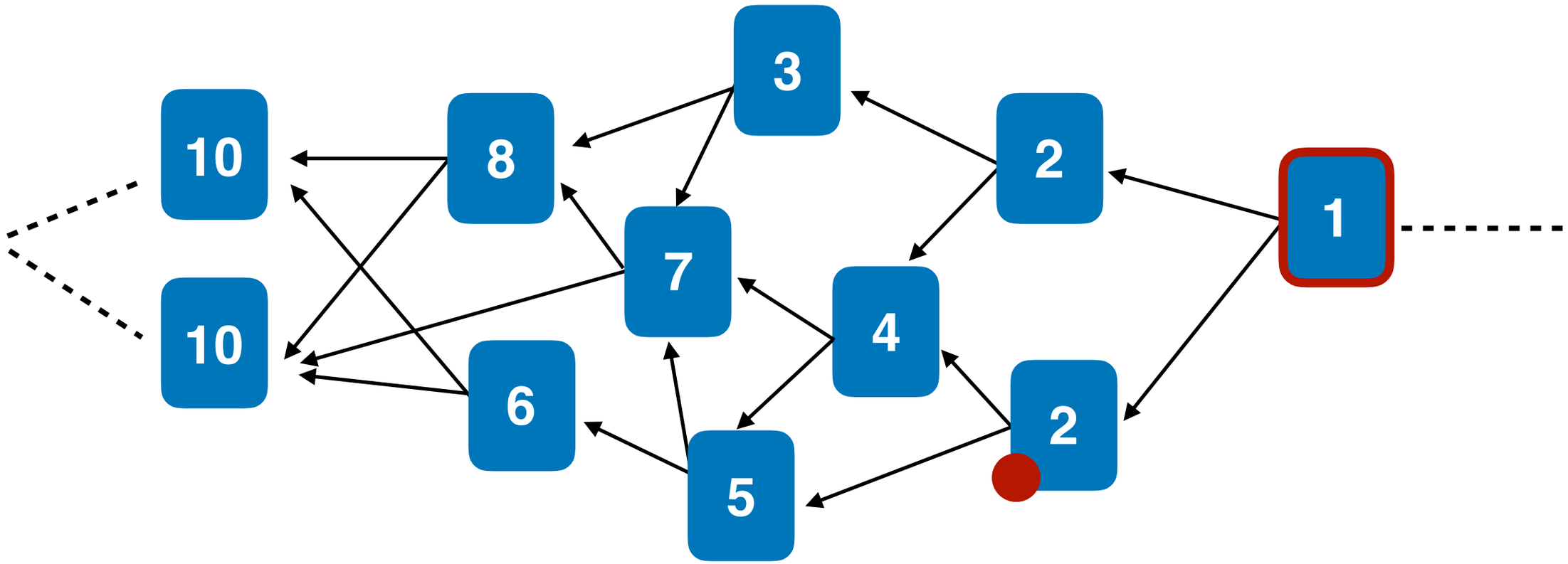

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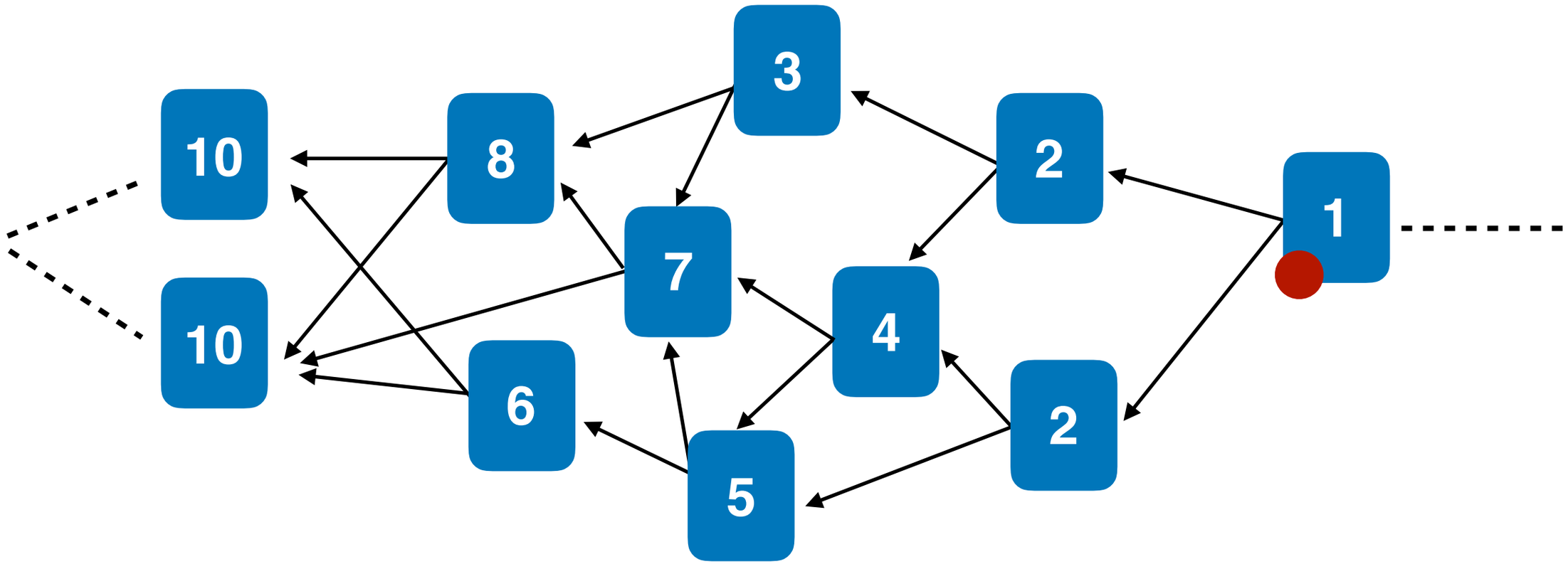

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Rapidly Decaying parameter α [1]

α -> Infinity

To the next hop having the maximal CW

α -> 0

Weighted Random Walk -> Unweighted Random Walk

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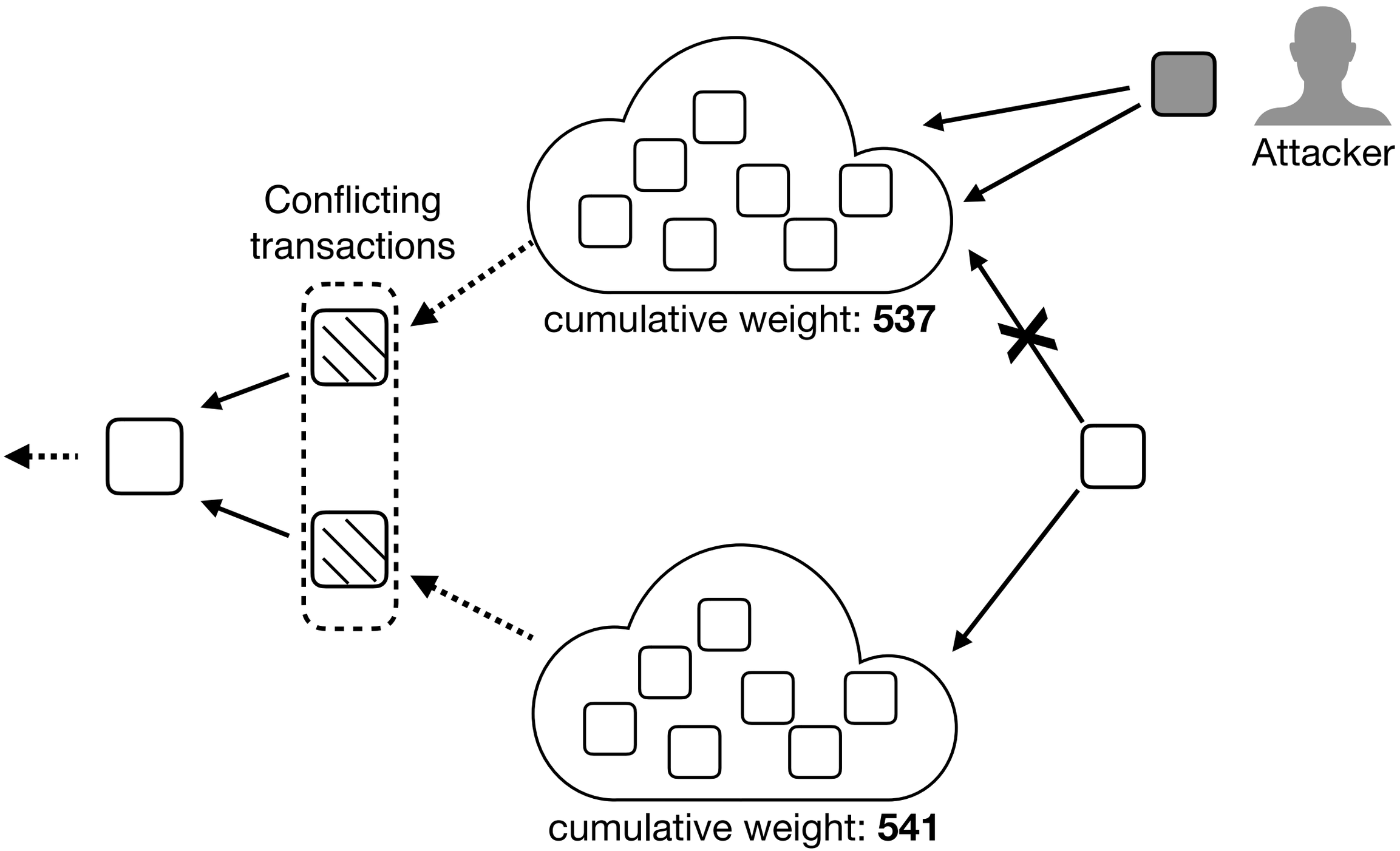
Splitting attack [1]



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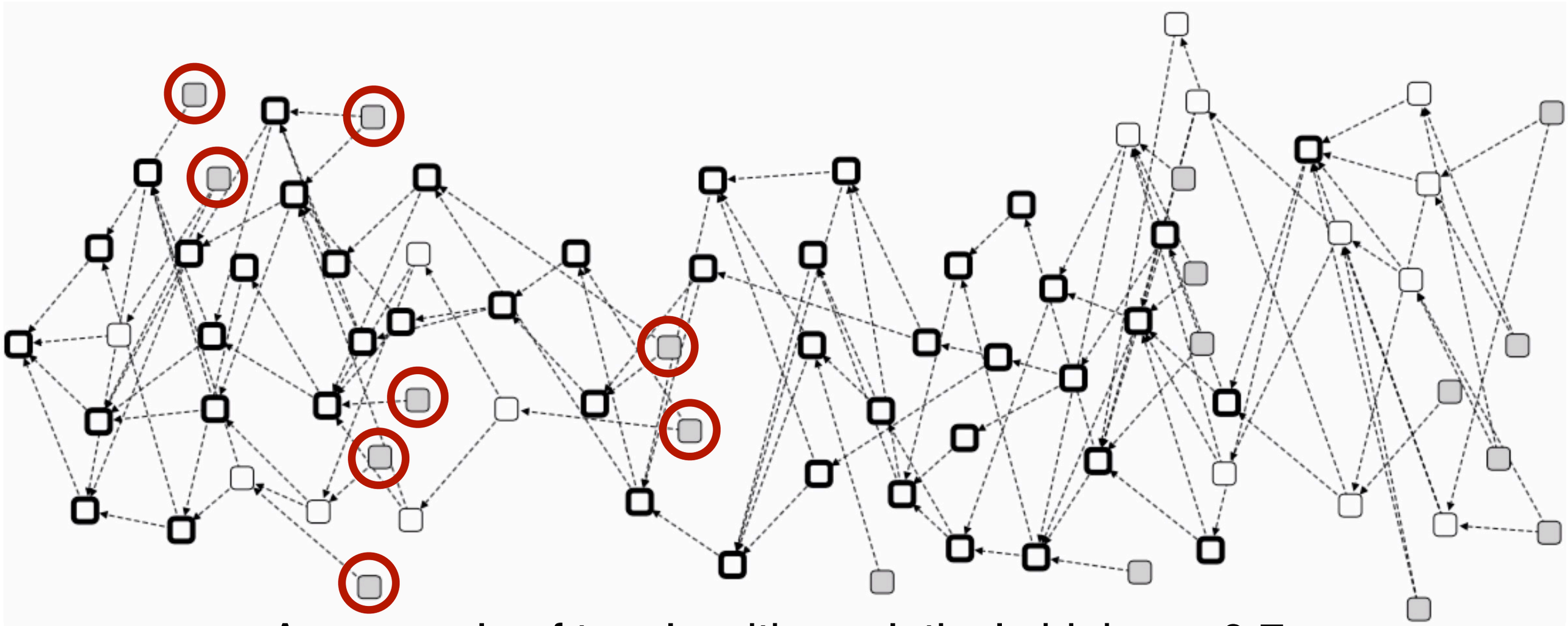
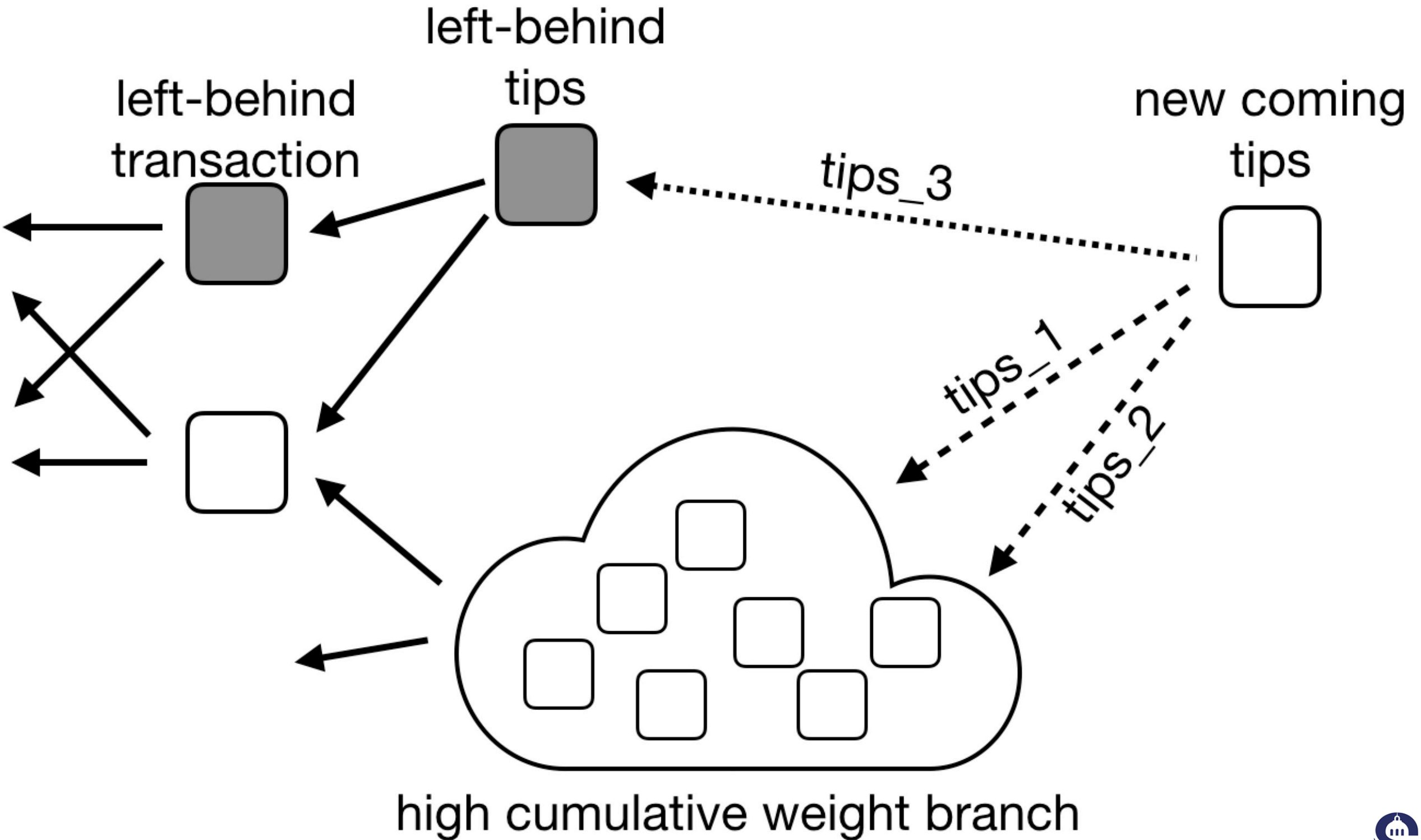
Fairness issue



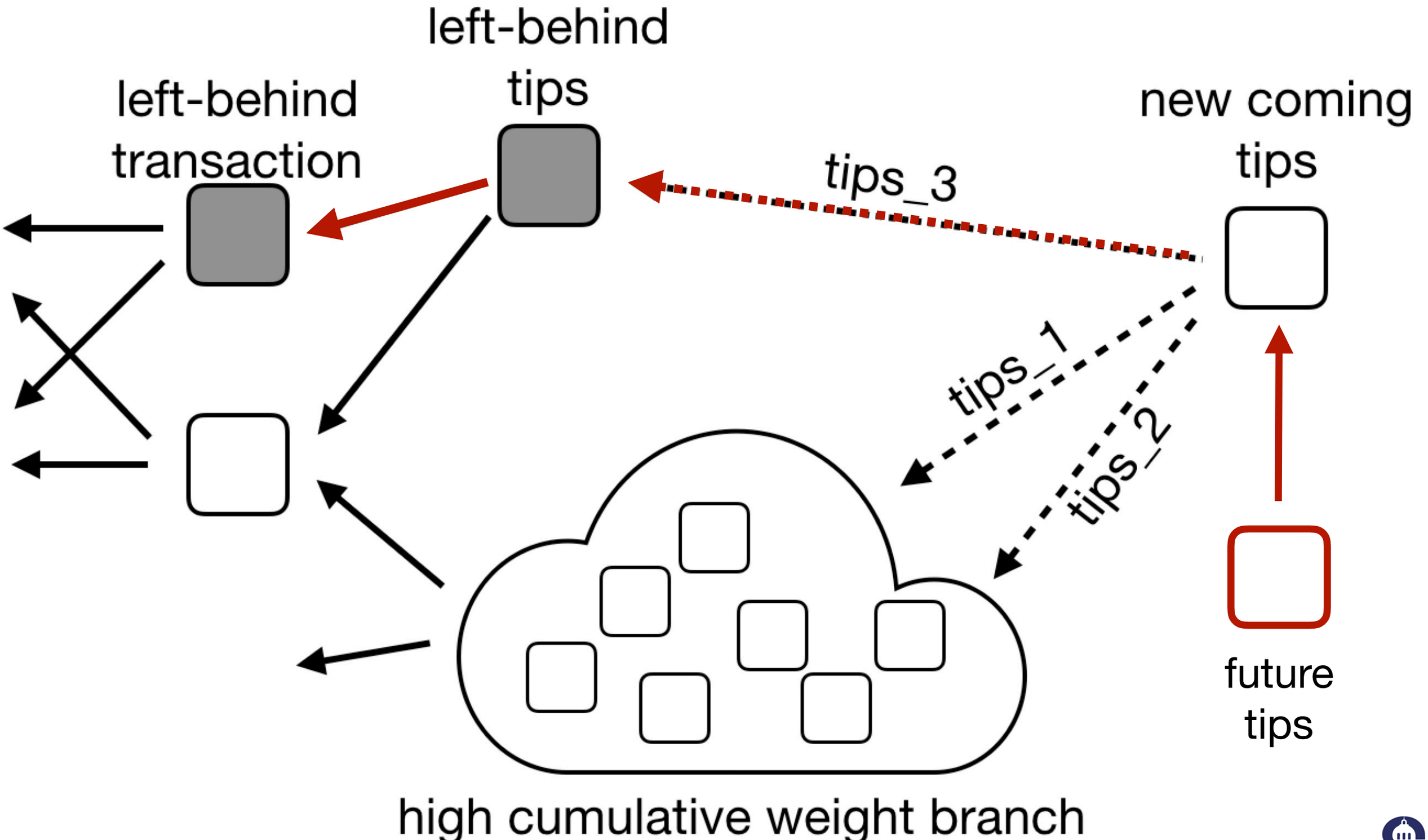
An example of tangle with a relatively high α = 0.7.

Many tips are left behind.

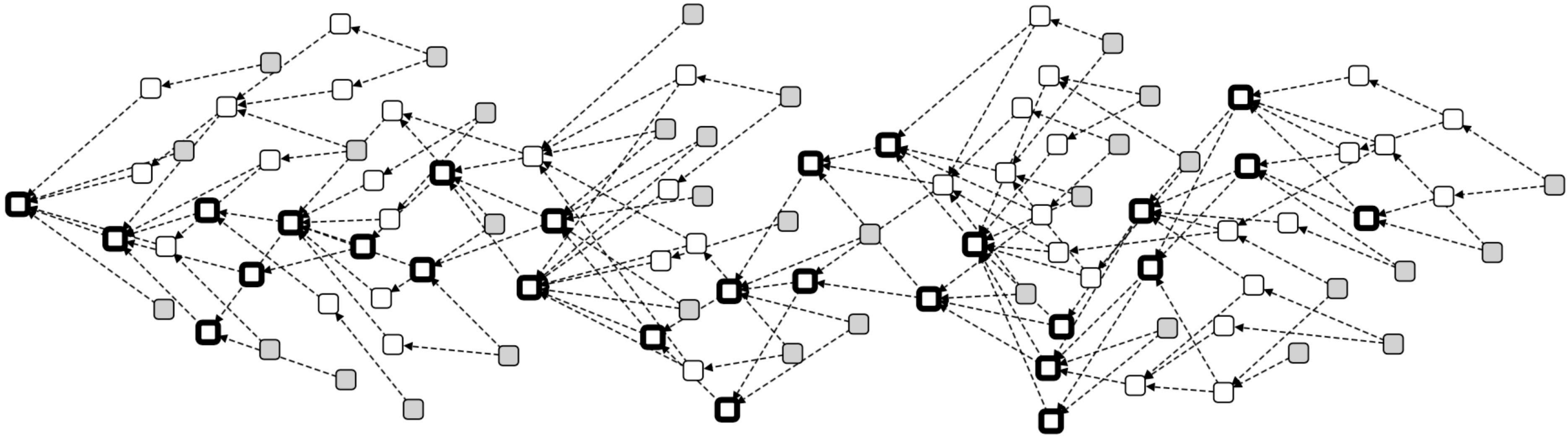
G-IOTA


left-behind
tips
left-behind
transaction
new coming
tips
tips_3
tips_1
tips_2
high cumulative weight branch

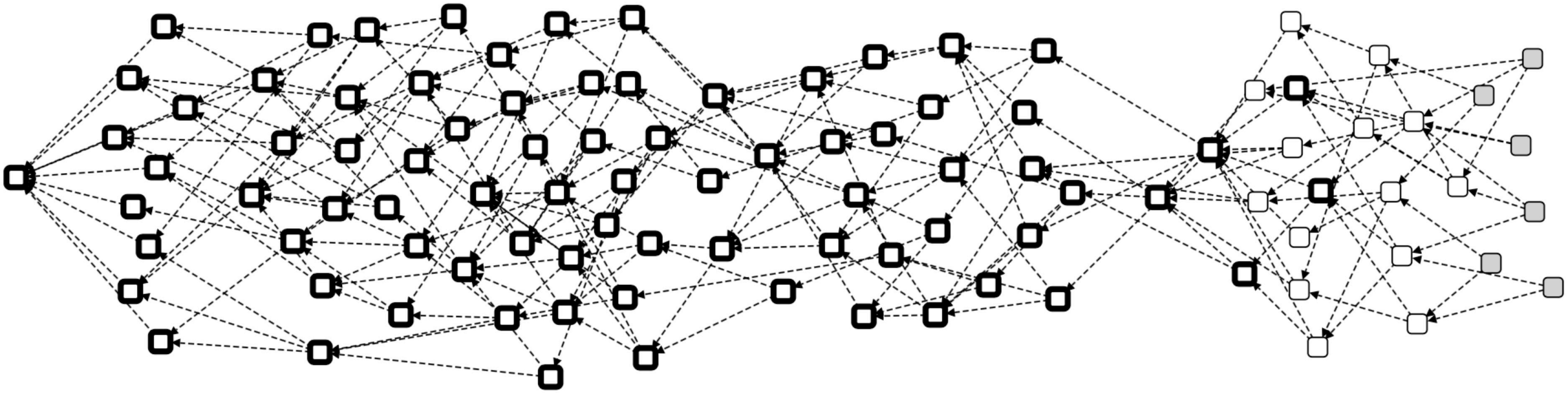
G-IOTA


left-behind
tips
left-behind
transaction
new coming
tips
tips_3
tips_1
tips_2
future
tips
high cumulative weight branch

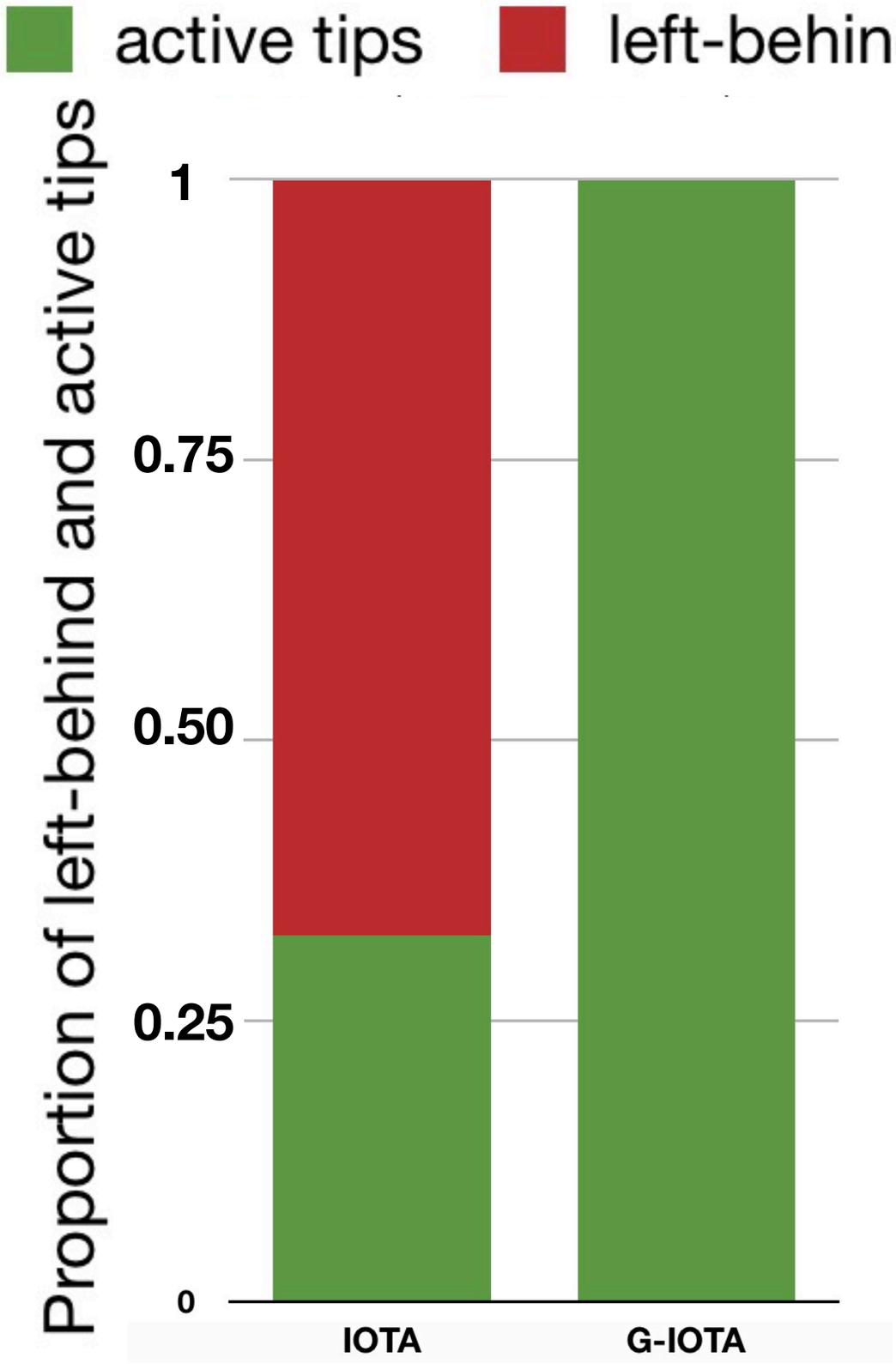
IOTA

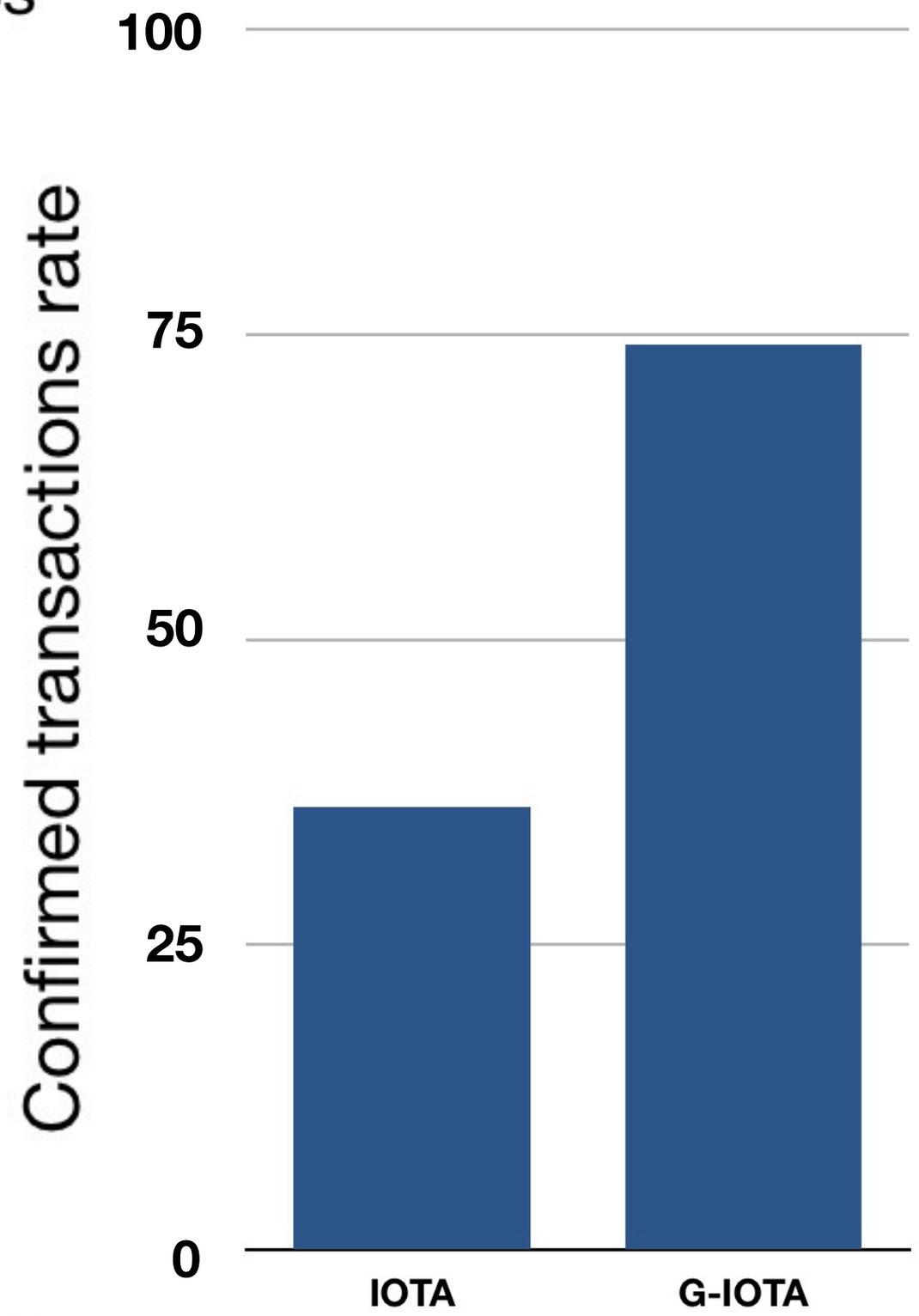


G-IOTA



G-IOTA vs IOTA

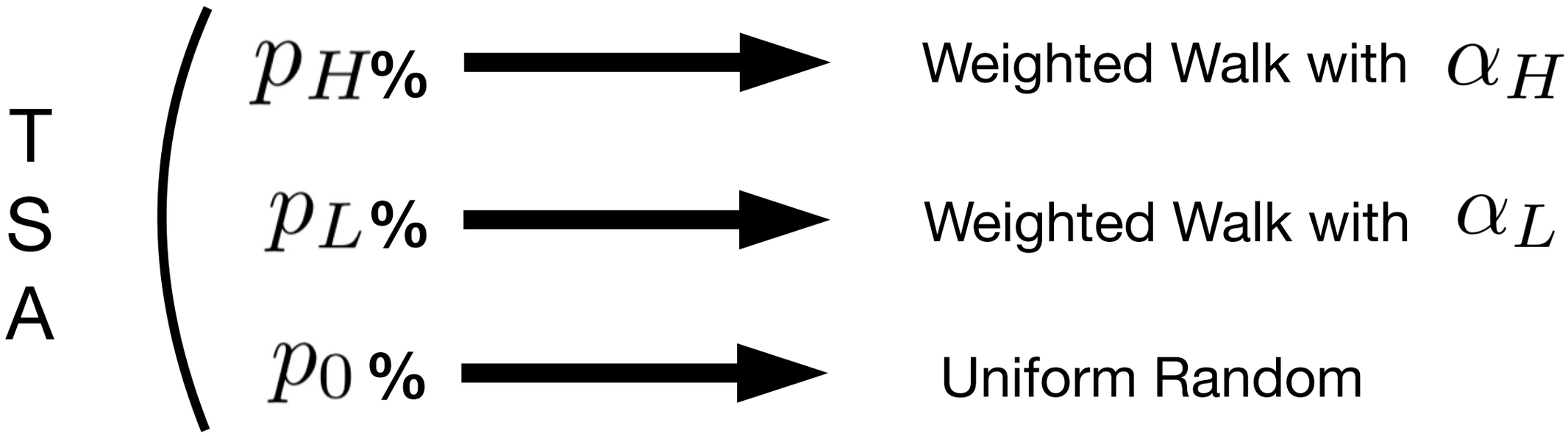




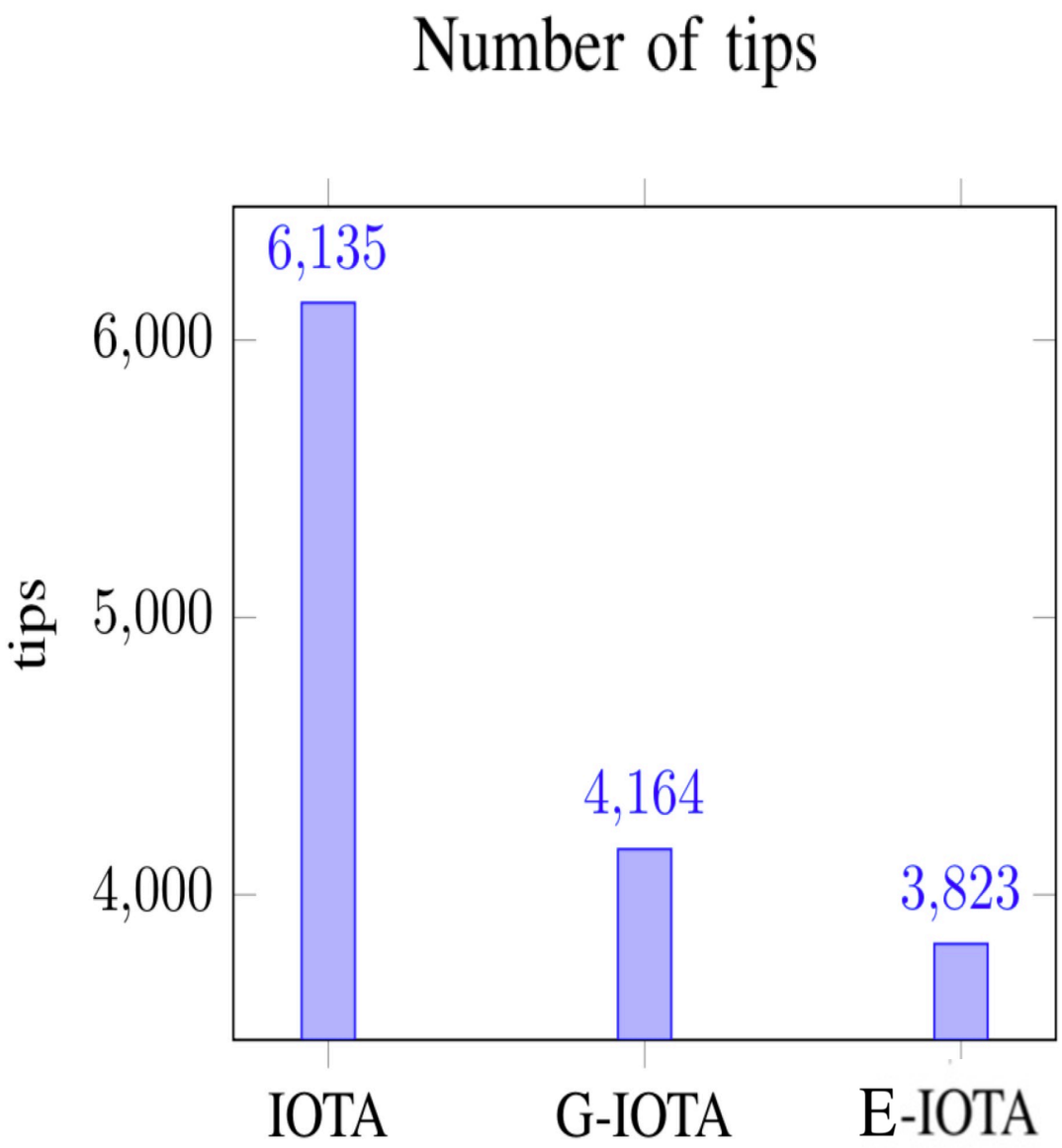
Is 3rd tips necessary?

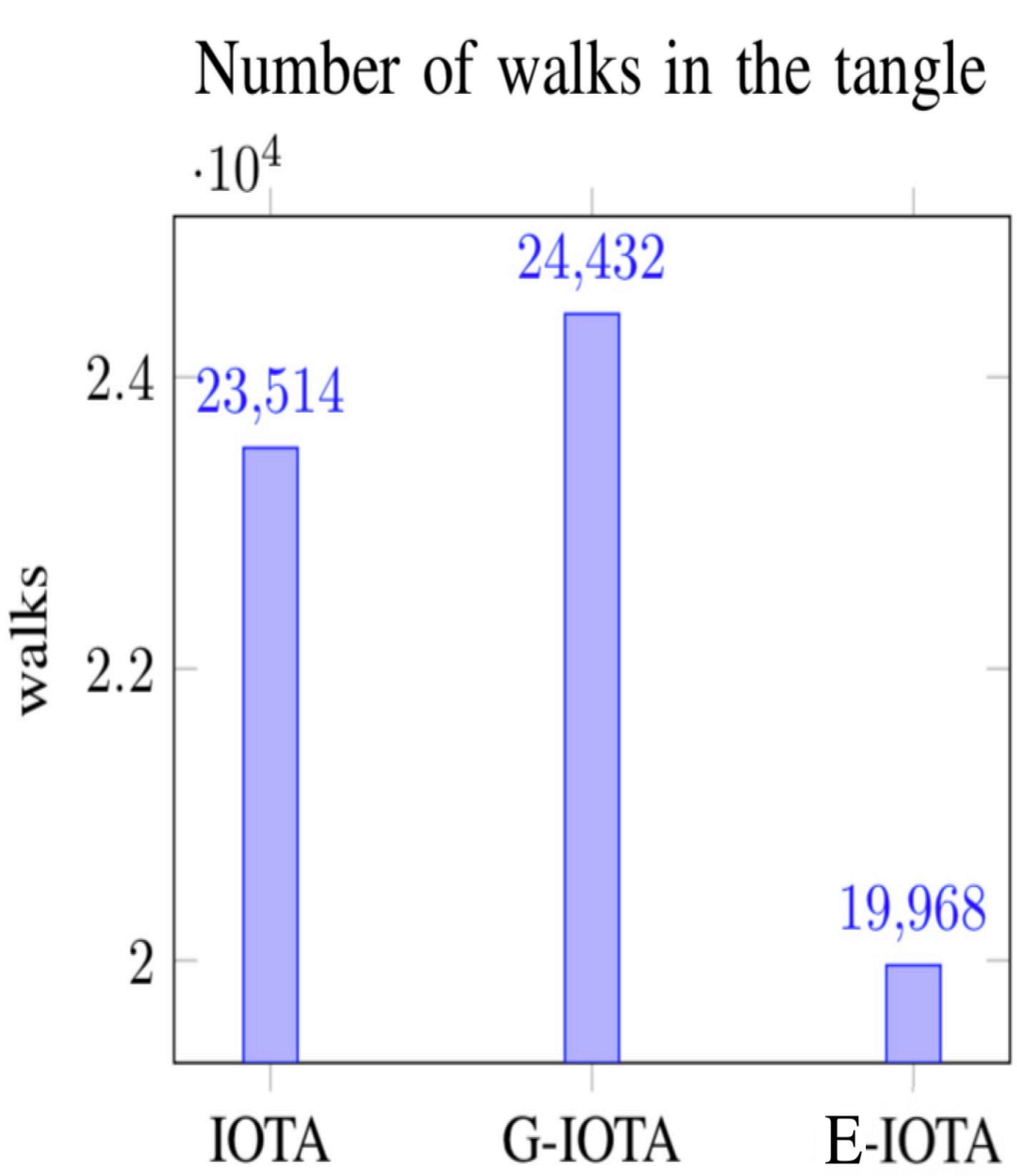
→ **E-IOTA**

E-IOTA : choosing two tips



VISA transaction case: 2000 tps, 8000 transactions





G-IOTA/E-IOTA

Large Weight Attack ✓

Parasite Chain Attack ✓

Splitting Attack ✓

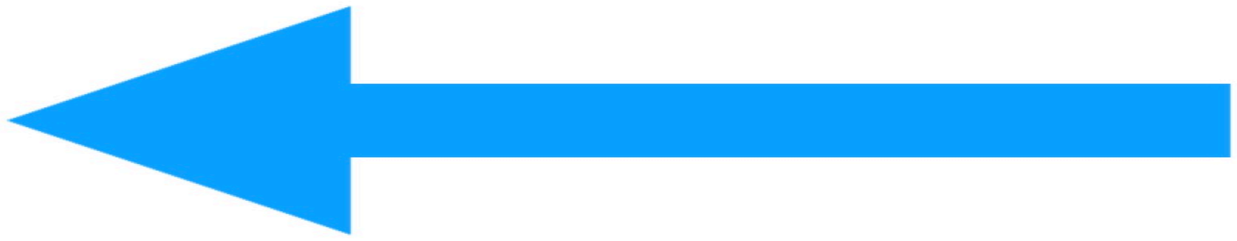
G-IOTA/E-IOTA
Fair and Efficient Aware Tangle

Thank you :)

BlockChain Day

12 Juin 2019

Registration



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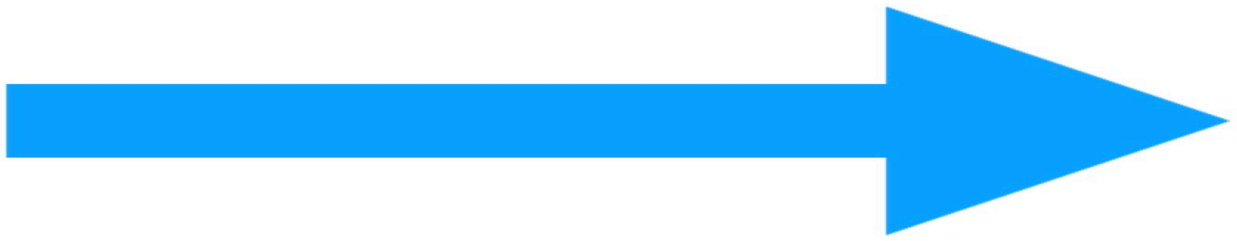

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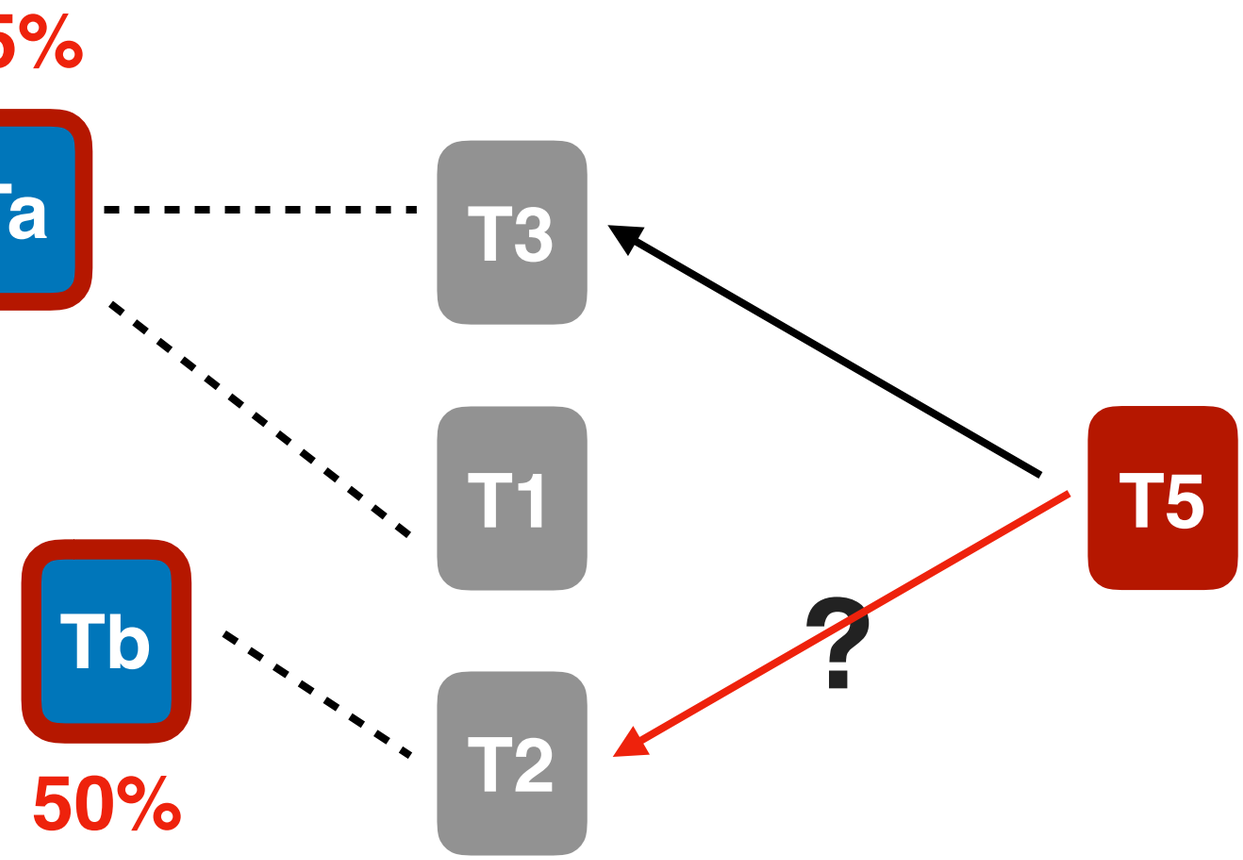
INSTITUT DE RECHERCHE TECHNOLOGIQUE

Conflicting Transactions[1]



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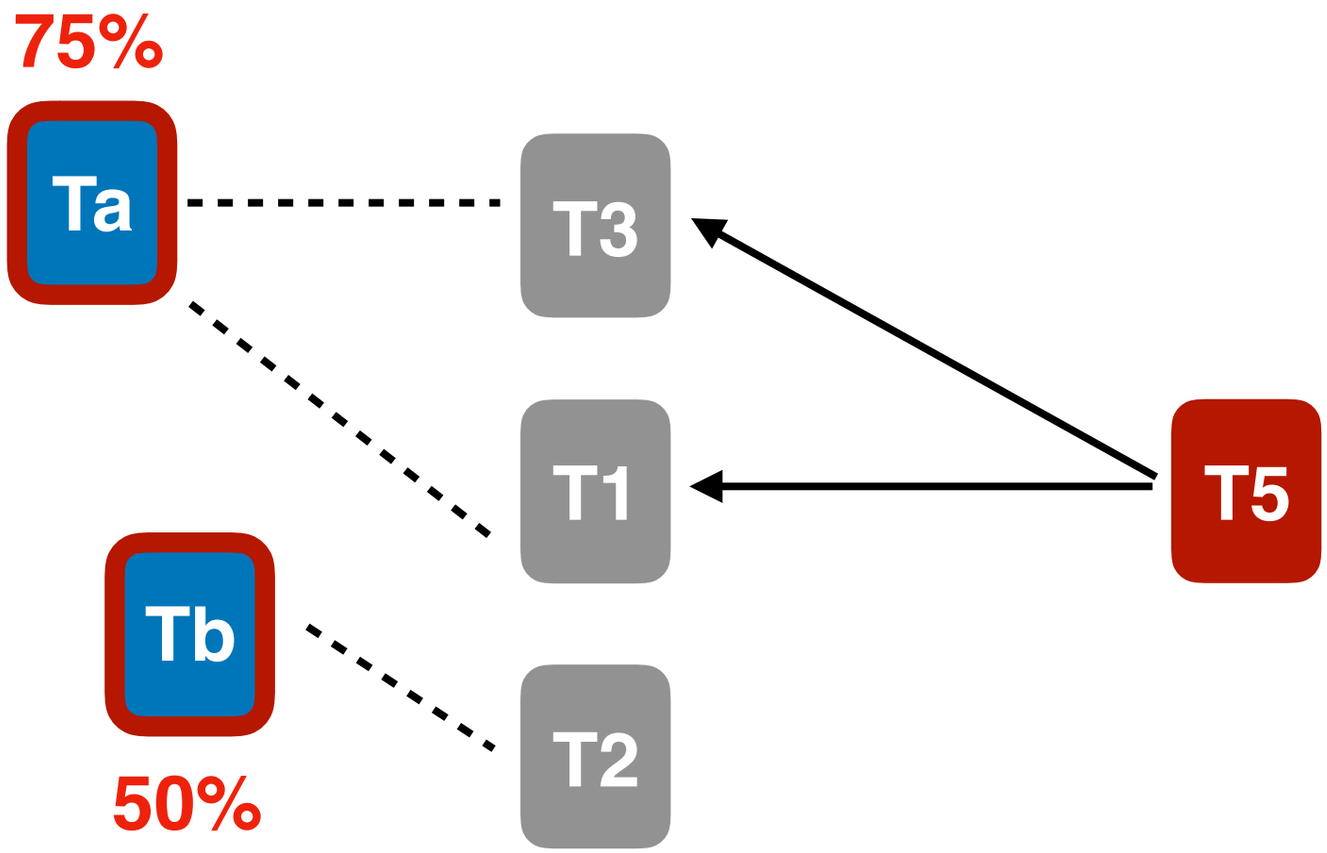

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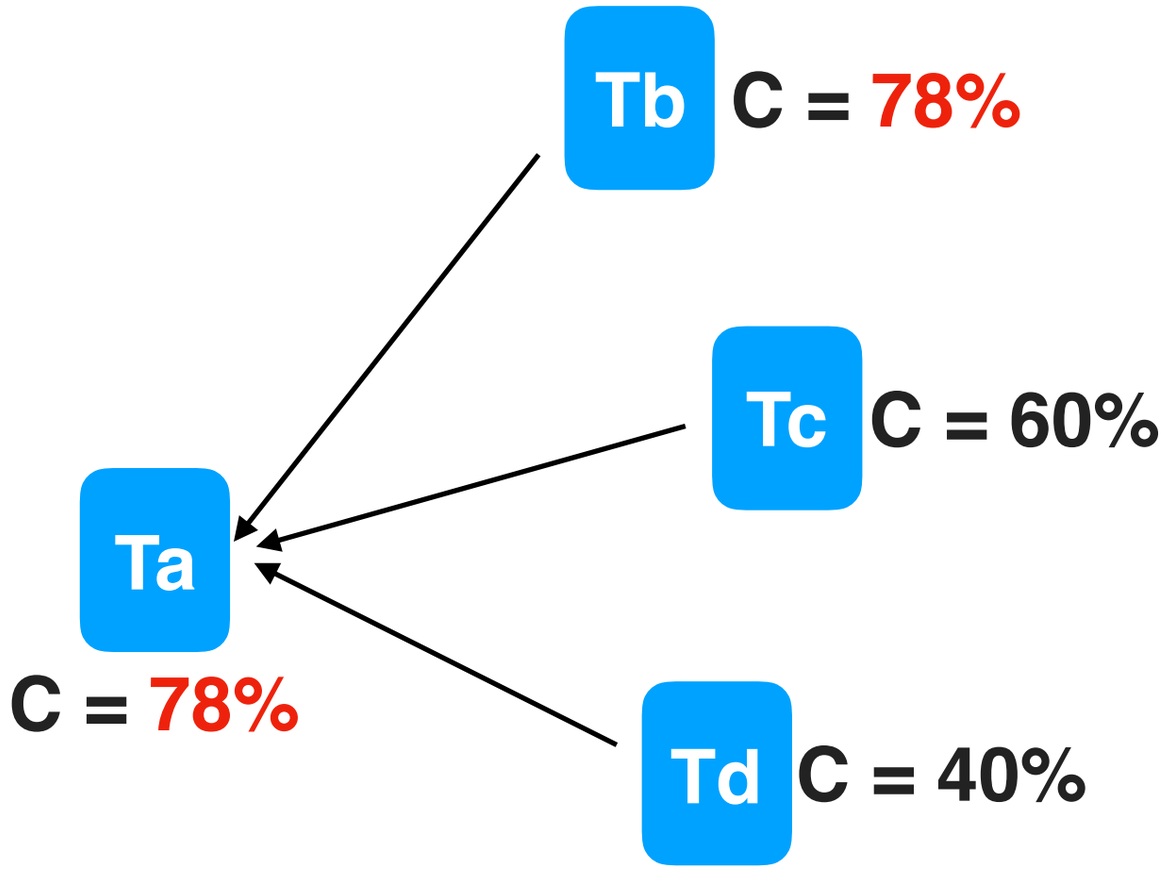
Fairness issue

Left-behind tips: tips who have not been approved for a time ***D_tips***.

Left-behind transactions: non-tips transactions who have not been confirmed for a time ***D_tran***.

Observation

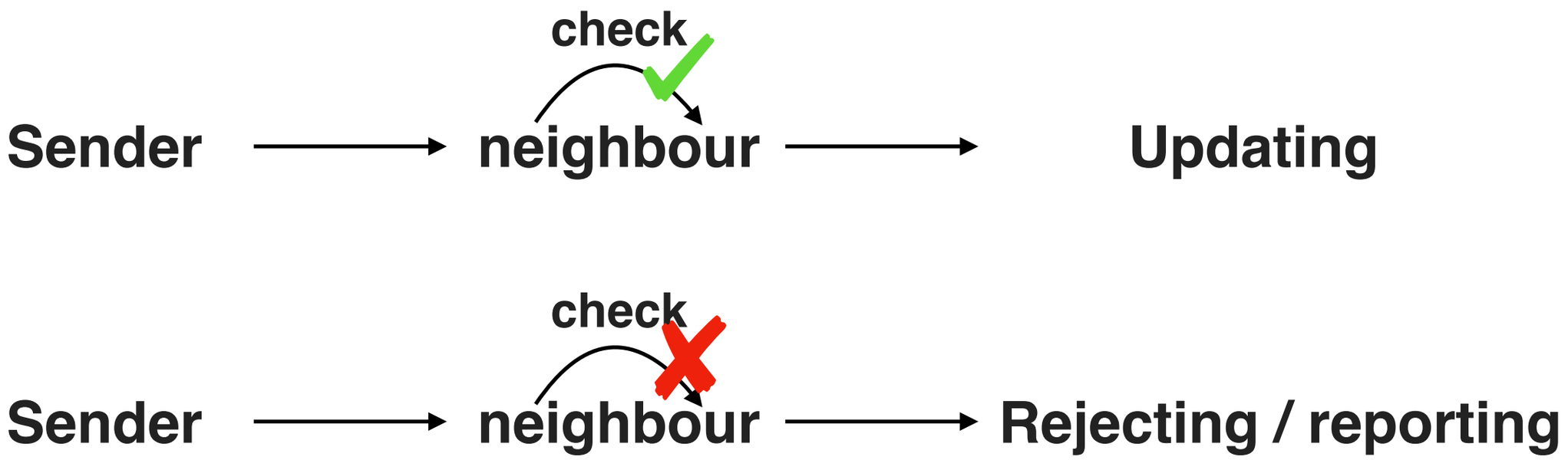
The confidence of a transaction is at least equal to the maximal confidence among all its son transactions.



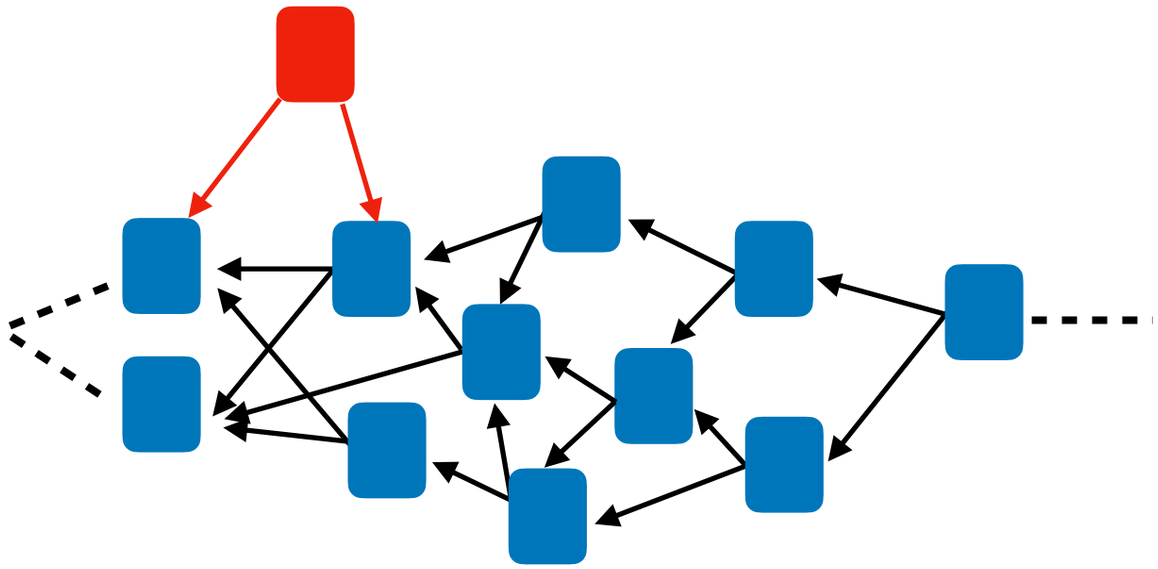
Mutual Supervision Mechanism

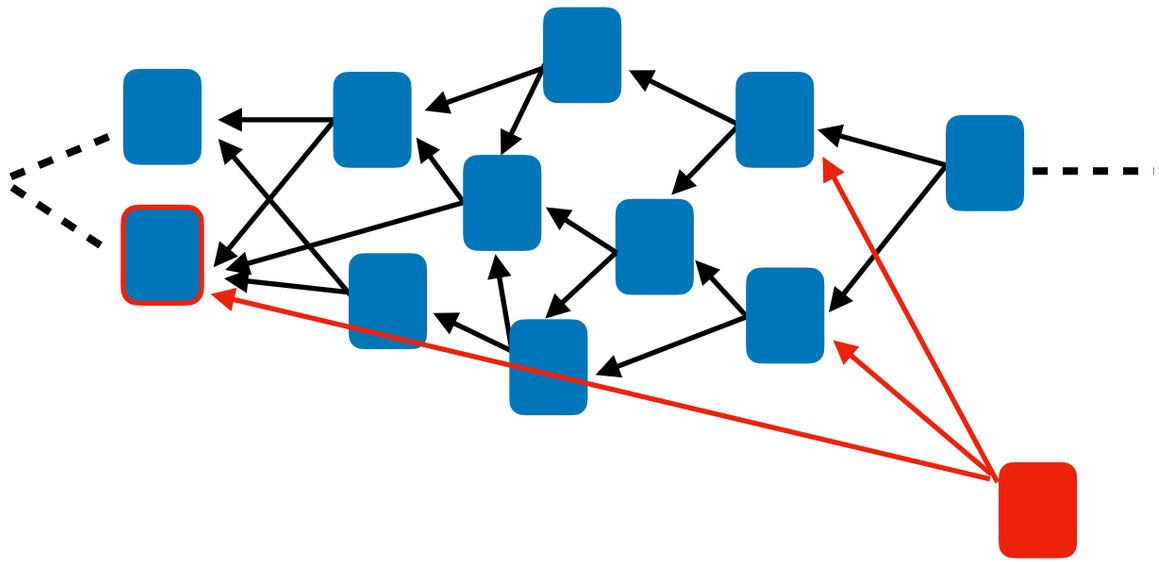
1) What if a speculative user always verifies a third tips, a non-left-behind tips, to pretend that it works hard for helping the others?

2) What if a lazy user only chooses old conformed transactions to verify and pretends his transaction has been left-left-behind and waits others saving his transaction?



Mutual Supervision Mechanism





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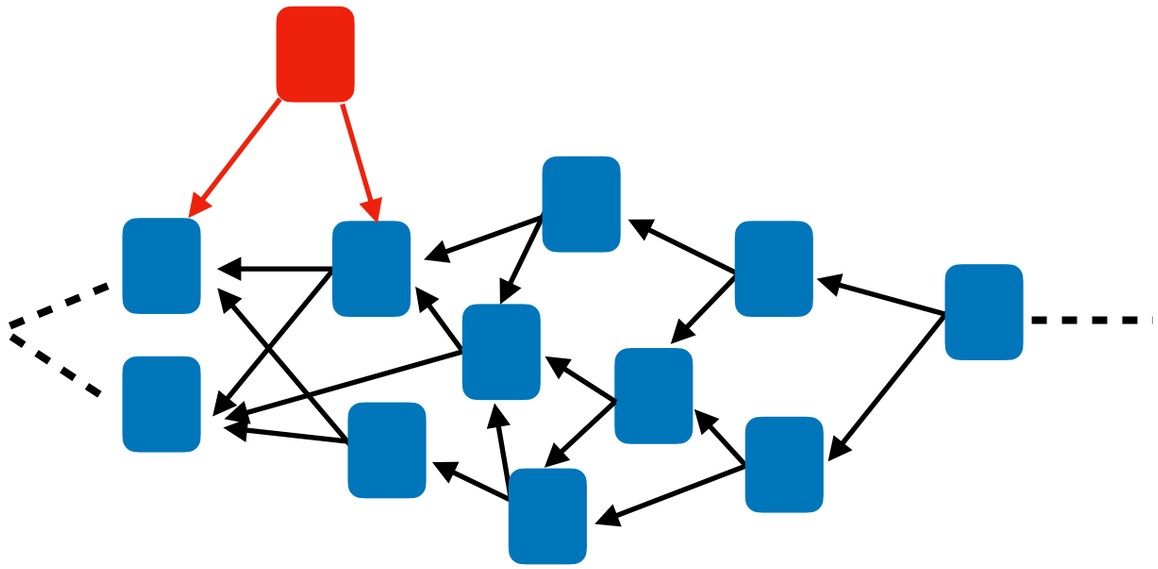

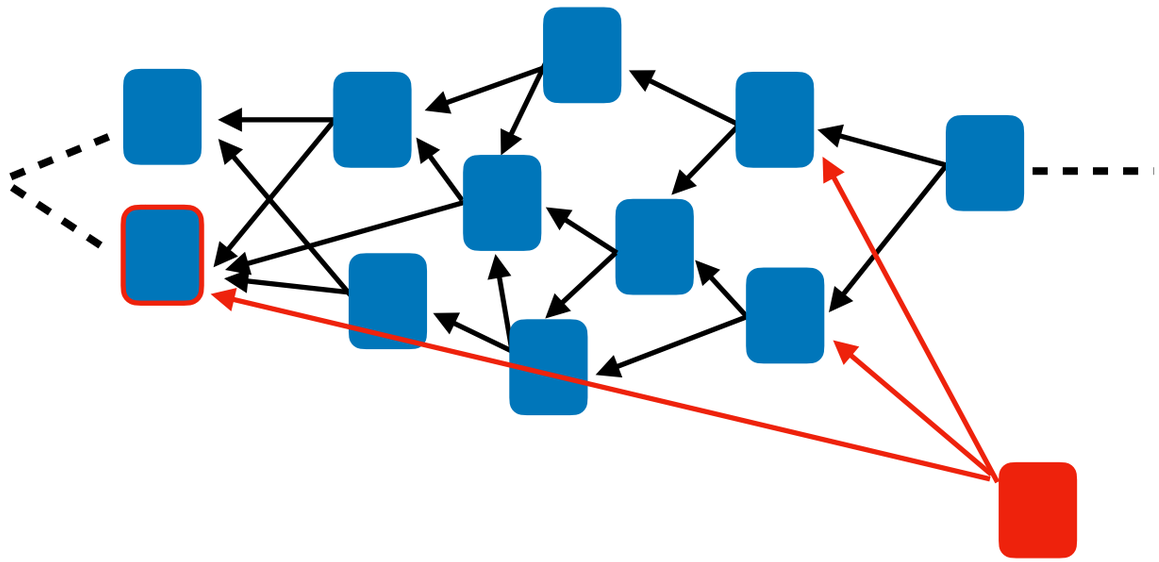

Networking layer effect

- **Benefit of choosing the 3nd tips**

  → **Game theory Proof**

- **G-IOTA has at lest the same security level than IOTA**

  → **Formal proof**

- **Is 3 tips necessary?**

  → **New deign**

IOTA	G-IOTA
Computation	More
Left Behind Tips	No

IOTA	G-IOTA	E-IOTA
Computation	More	Less
Left Behind Tips	No	No

E-IOTA

honest: *1* **unit** **attacker:** P_a**%**

Large Weight Attack

weight of a transaction is limited

Parasite Chain Attack

$$p_L + p_H > p_0$$

Splitting Attack

$$p_H > P_a$$