# Future of ~~Blockchain~~ DLT and Reputation Consensus

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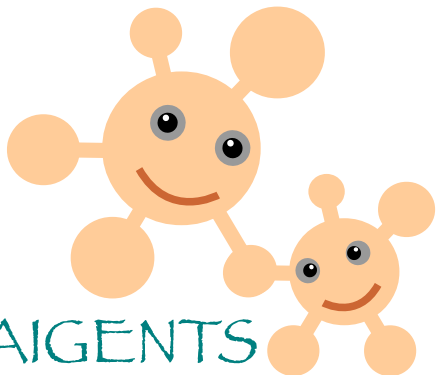


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# ~~Blockchain~~ **DLT** Fundamental Issue

Speed + Cheapness + Security + Decentralization = CONST

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# ~~Blockchain~~ **DLT** Fundamental Issue

Optimistic rollup

Speed + Cheapness + Security + Decentralization = CONST

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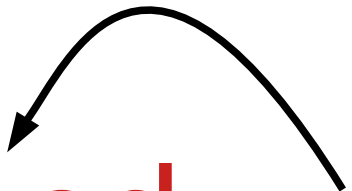
# ~~Blockchain~~ **DLT** Fundamental Issue

Zero-Knowledge Succinct Non-Interactive Argument of Knowledge (ZK-SNARK)



Speed + Cheapness + Security + Decentralization = CONST

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# ~~Blockchain~~ **DLT** Fundamental Issue


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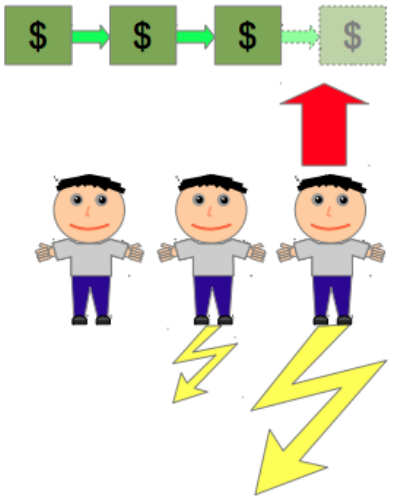
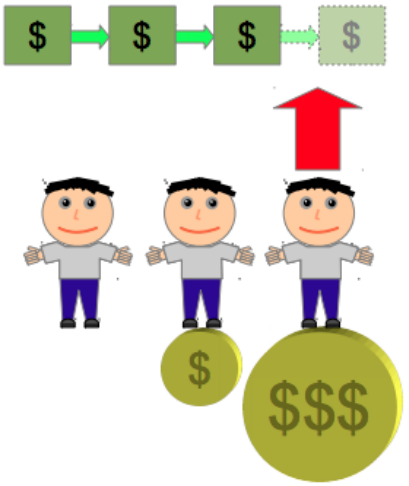
# Reputation Consensus as a Liquid Democracy (2017)

## Proof-Of-Work



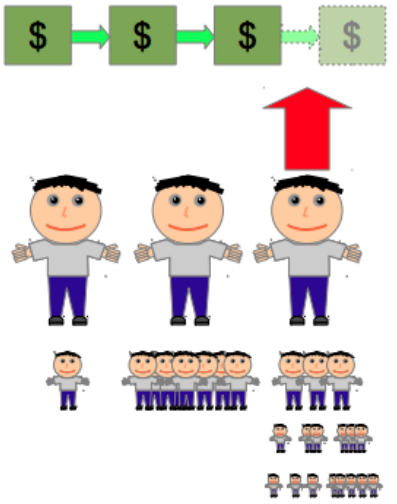

Those who own more computing power govern the network.

## Proof-Of-Stake




Those who have more money govern the network.

## Proof-Of-Reputation




$$R_i = \sum_t \sum_j (R_j * V_{ijt})$$

Those who earn deeper reputation and greater long-term audience base govern the network.

https://steemit.com/blockchain/@aigents/proof-of-reputation-as-liquid-democracy-for-blockchain
https://research.nsu.ru/en/publications/reputation-systems-for-human-computer-environments
https://ieeexplore.ieee.org/document/8109887

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# Reputation Engine

**Algorithm 1** Weighted Liquid Rank (simplified version)

**Inputs**:
1) Volume of rated transactions each with financial value of the purchased product or service and rating value evaluating quality of the product/service, covering specified period of time;
2) Reputation ranks for every participant at the end of the previous time period.
**Parameters**: List of parmeters, affecting computations - default value, logarithmic ratings, conservatism, decayed value, etc.
**Outputs**: Reputation ranks for every participant at the end of the previous time period.

1: **foreach of** *transactions* **do**
2: **let** *rater_value* be rank of the rater at the end of previous period of default value
3: **let** *rating_value* be rating supplied by trasaction rater (consumer) to ratee (supplier)
4: **let** *rating_weight* be financial value of the transaction of its logarithm, if logarithmic ratings parameter is set to true
5: **sum** *rater_value*rating_value*rating_weight* for every ratee
6: **end foreach**
7: **do** normalization of the sum of the muliplications per ratee to range *0.0-1.0*, get *differential_ranks*
8: **do** blending of the old_ranks known at the end of previous peiod with differential_ranks based on parameter of conservatism, so that *new_ranks = (old_ranks*conservatism+N*(1-differential_ranks))*, using decayed value if no rating are given to ratee during the period
9: **do** normalization of *new_ranks* to range *0.0-1.0*
10: **return** *new_ranks*

- $R_d$ - default initial reputation rank;
- $R_c$ - decayed reputation in range to be approached by inactive agents eventually;
- *C* - conservatism as a blending "alpha" factor between the previous reputation rank recorded at the beginning of the observed period and the differential one obtained during the observation period;
- *FullNorm* – when this boolean option is set to *True* the reputation system performs a full-scale normalization of incremental ratings;
- *LogRatings* - when this boolean option is set to *True* the reputation system applies *log10(1+value)* to financial values used for weighting explicit ratings;
- *Aggregation* - when this boolean option is set to *True* the reputation system aggregates all explicit ratings between each unique combination of two agents with computes a weighted average of ratings across the observation period;
- *Downrating* - when this boolean option is set to *True* the reputation system translates original explicit rating values in range *0.0-0.25* to negative values in range *-1.0* to *0.0* and original values in range *0.25-1.0* to the interval *0.0-1.0*.
- *UpdatePeriod* – the number of days to update reputation state, considered as observation period for computing incremental reputations.

**A Reputation System for Multi-Agent Marketplaces**
Anton Kolonin, Ben Goertzel, Cassio Pennachin, Deborah Duong, Matt Iklé , Nejc Znidar, Marco Argentieri
https://arxiv.org/pdf/1905.08036.pdf

https://github.com/singnet/reputation
https://github.com/aigents/aigents-java/blob/master/src/main/java/net/webstructor/peer/Reputationer.java

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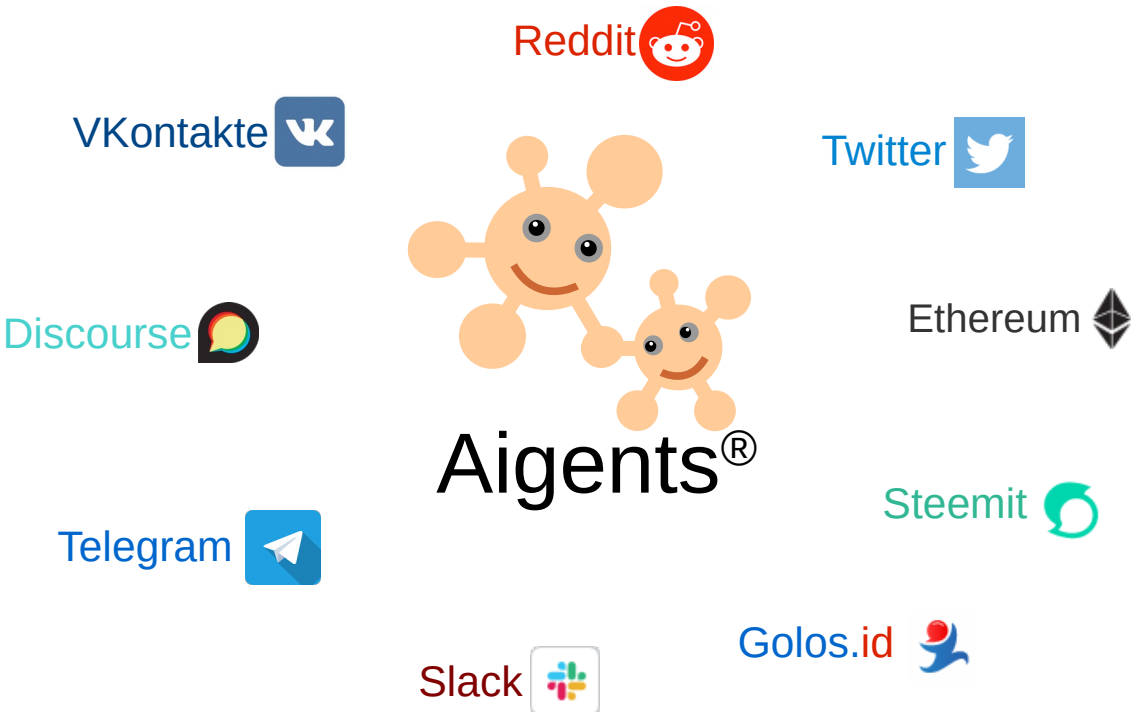
# Reputation System for Social Platforms (2014-2022)

## Unified Liquid Rank Reputation computation across diverse social platforms




https://arxiv.org/abs/1912.00176

https://aigents.medium.com/aigents-bot-for-telegram-groups-1dba32140047

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# “Weighted Liquid Rank” for Fraud Resistance (2019)

Using Reputation System for protection from scam identifying dishonest suppliers on online marketplaces


Ranks of Suppliers, dishonest Supplier (including alias) in red and honest suppliers in blue

https://arxiv.org/pdf/1905.08036.pdf
https://blog.singularitynet.io/minimizing-recommendation-fraud-7dabbee8fc00
https://aiforgood2019.github.io/papers/IJCAI19-AI4SG_paper_28.pdf

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# Reputation Consensus for Distributed Ledger (2021)

International Journal of Network Security & Its Applications (IJNSA) Vol.13, No.4, July 2021

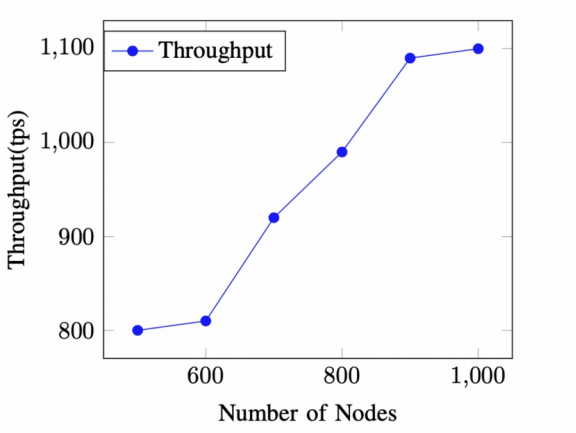


Figure 1: Throughput vs Number of network nodes

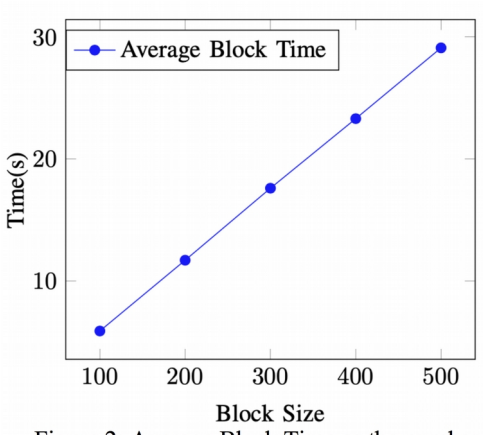


Figure 2: Average Block Time as the number of transactions in a single Block is varied

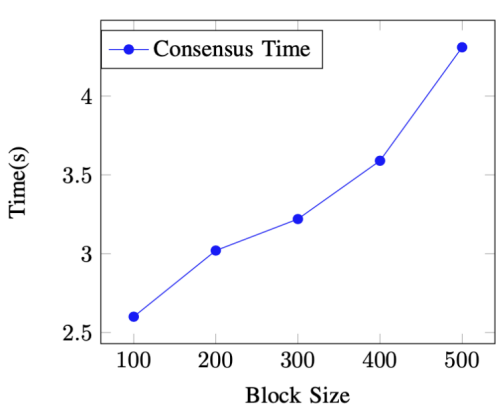


Figure 3: Consensus Time as the number of transactions in a single Block is varied

## Proof-of-Reputation: An Alternative Consensus Mechanism for Blockchain Systems

https://arxiv.org/abs/2108.03542
https://aircconline.com/ijnsa/V13N4/13421ijnsa03.pdf

Table 1 shows the performance of our scheme against other existing consensus mechanisms.

Under certain conditions when the number of participating nodes is increased, our scheme can achieve up to 1,100 transactions per second.

Table 1. Comparison with other consensus mechanisms

| **Consensus Mechanism** | **Throughput(TPS)** |
|---|---|
| Proof-of-Work | 7 |
| Proof-of-Stake | 60 |
| Proof-of-Reputation(Baseline) | 800 |
| Proof-of-Burn | 854 |
| Proof-of-Reputation | 1,100 |

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# Reputation System for Recommendation (2022)

Application of Liquid Rank Reputation System for Content Recommendation

## RESULTS QUALITATIVE ANALYSIS: DECISION SUPPORT

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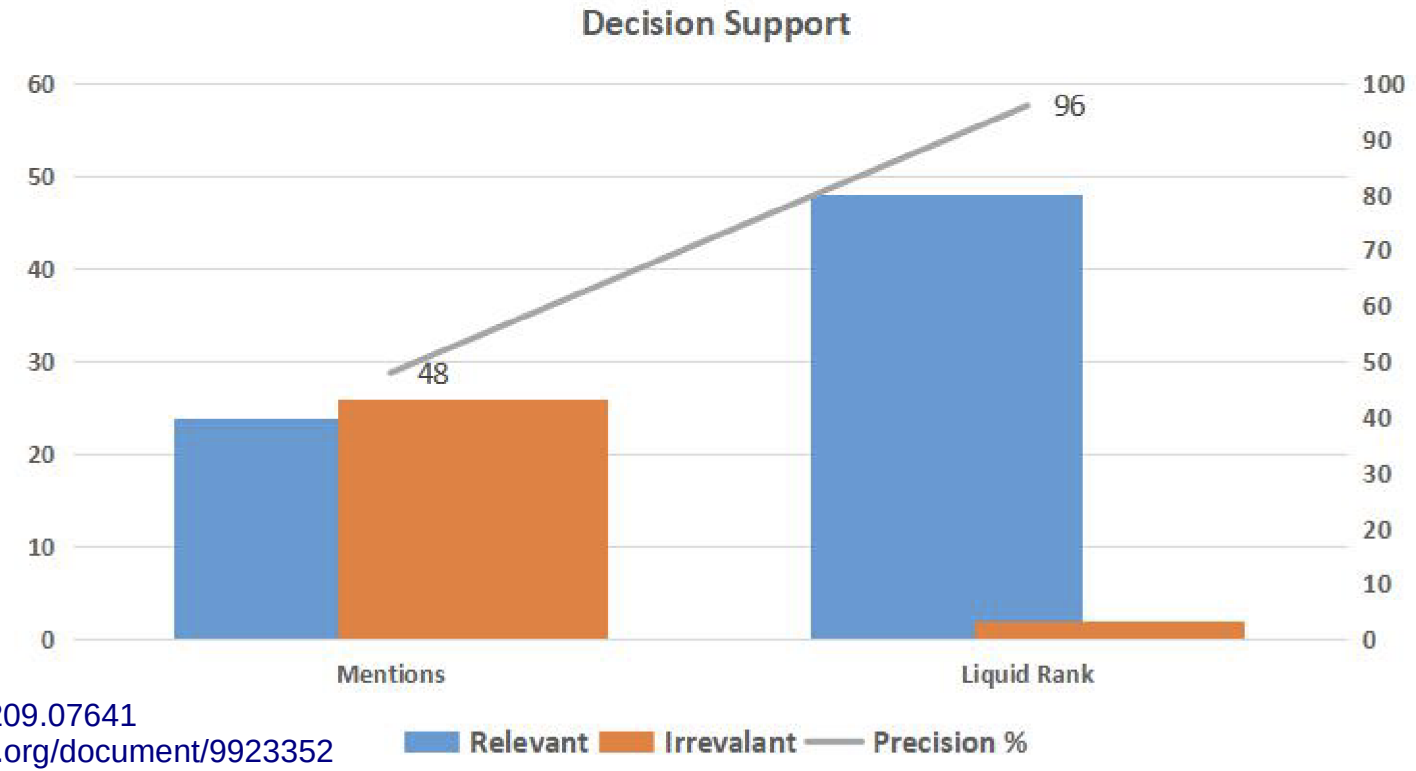


https://arxiv.org/abs/2209.07641
https://ieeexplore.ieee.org/document/9923352

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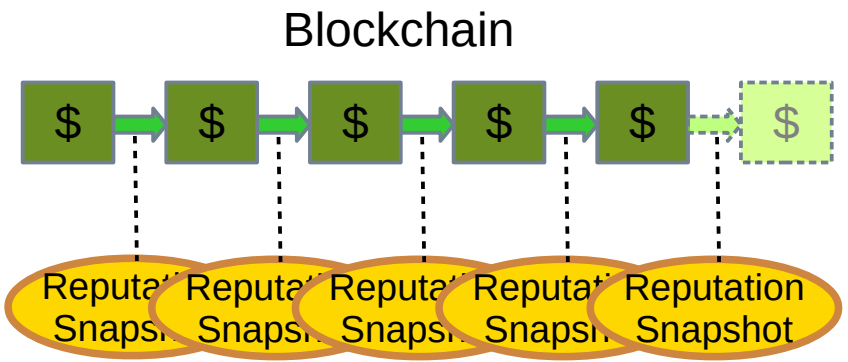
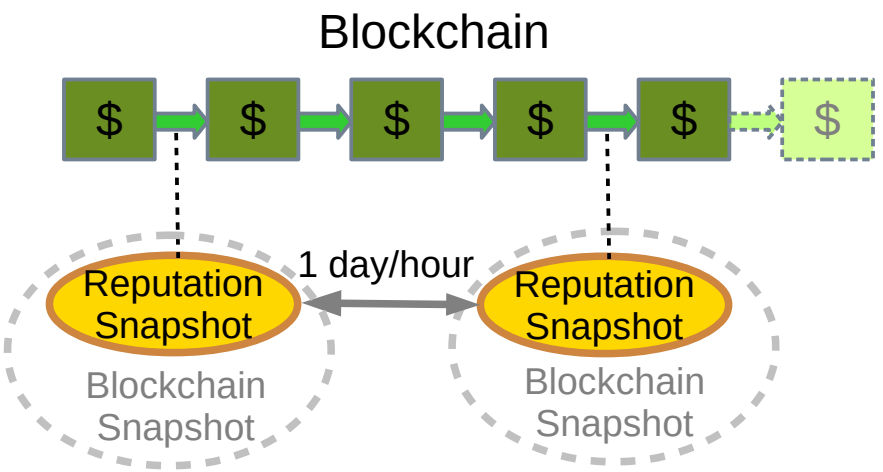
# Reputation Consensus – Synchronization Options




Block-wise
(expensive)




Periodic
(optimal)

**A Reputation System for Artificial Societies**
Anton Kolonin, Ben Goertzel, Deborah Duong, Matt Ikle
https://arxiv.org/pdf/1806.07342.pdf

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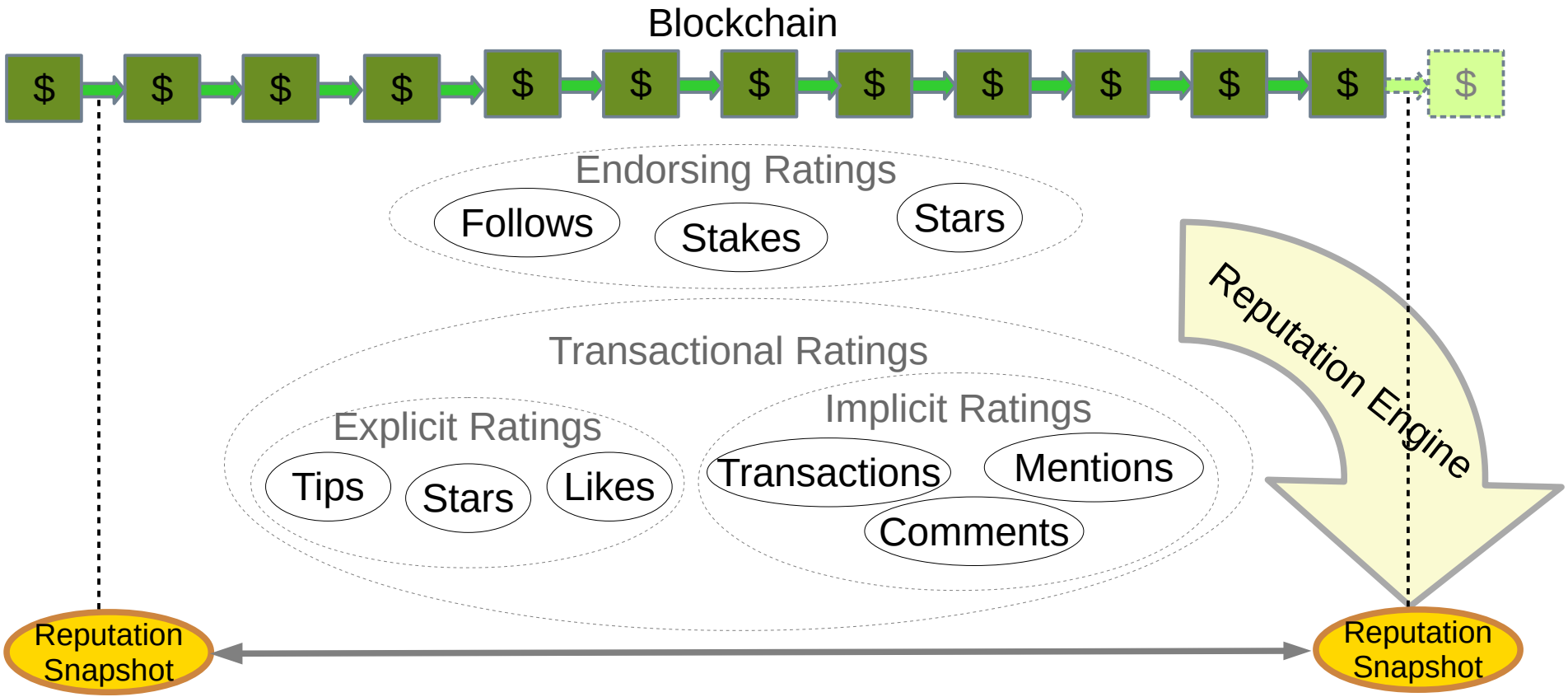
# Reputation Consensus – Rating Sources

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https://arxiv.org/pdf/1806.07342.pdf

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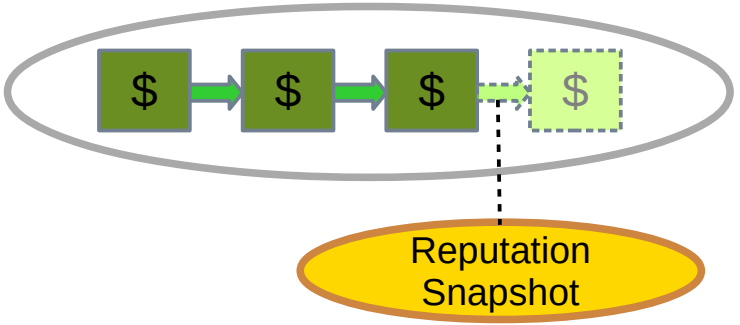
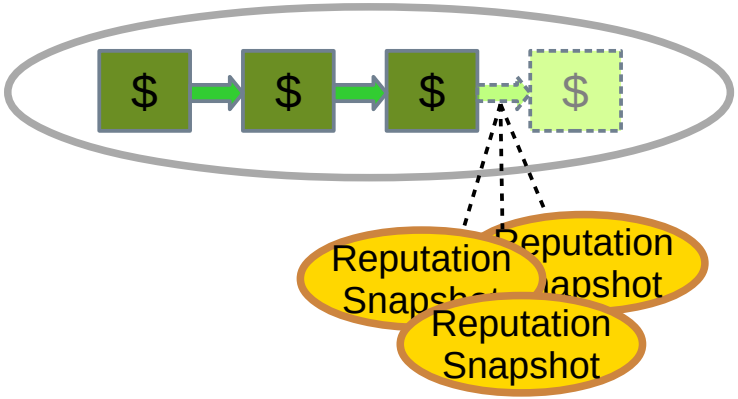
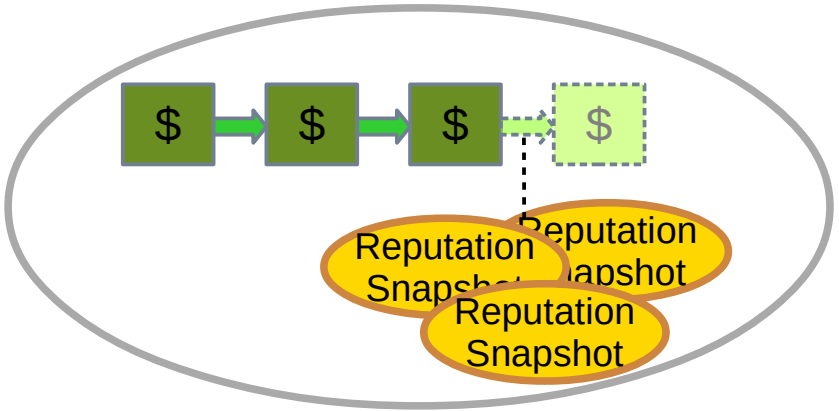
# Reputation Consensus – Engine Design Options



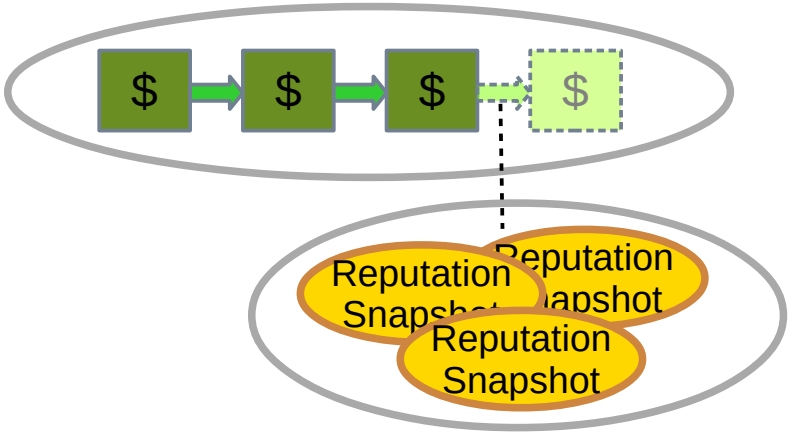

Centralized off-chain




Decentralized off-chain




Decentralized on-chain (reputation mining)




Decentralized side-chain (reputation consensus)

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Anton Kolonin, Ben Goertzel, Deborah Duong, Matt Ikle
https://arxiv.org/pdf/1806.07342.pdf

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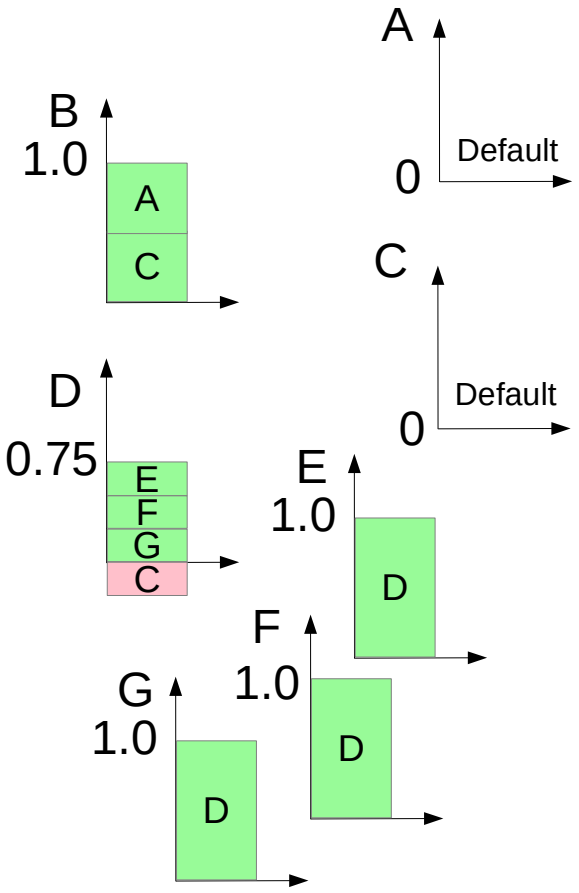
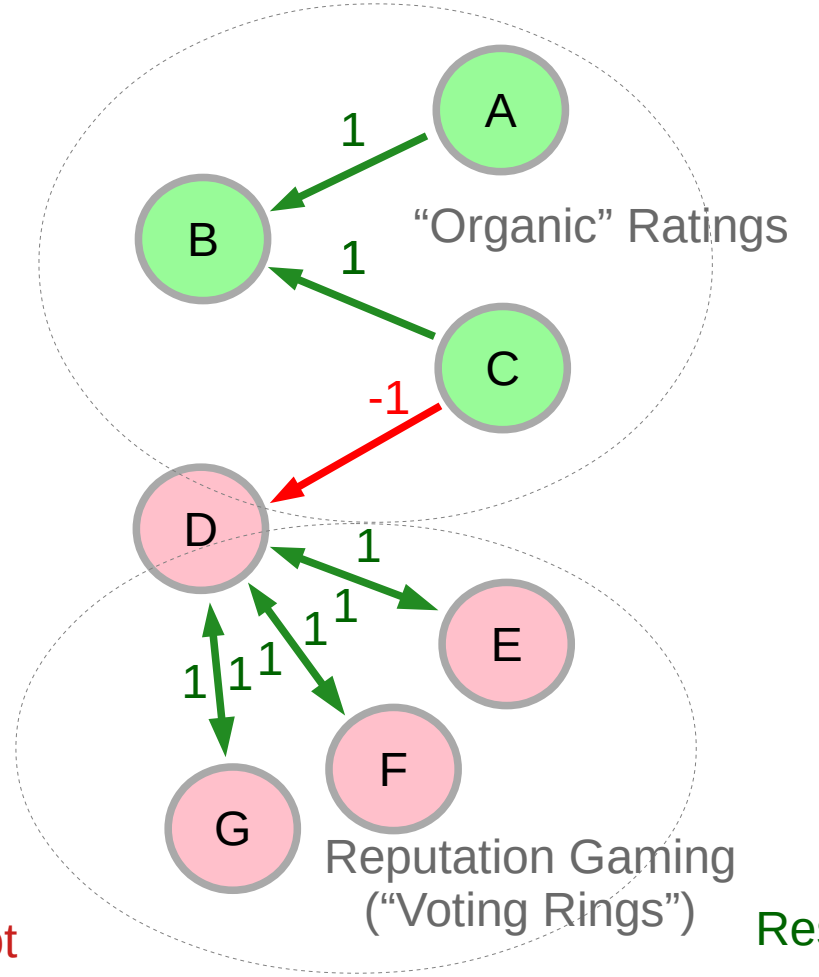
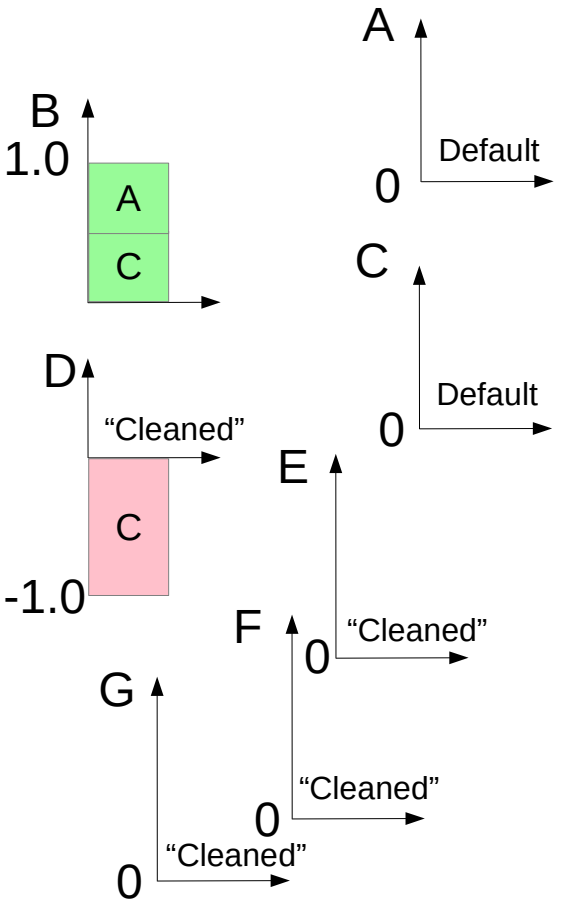
# Next: Resisting Reputation Gaming (Churning) [1.0..-1.0]




Abused Reputation Snapshot




Rescued Reputation Snapshot

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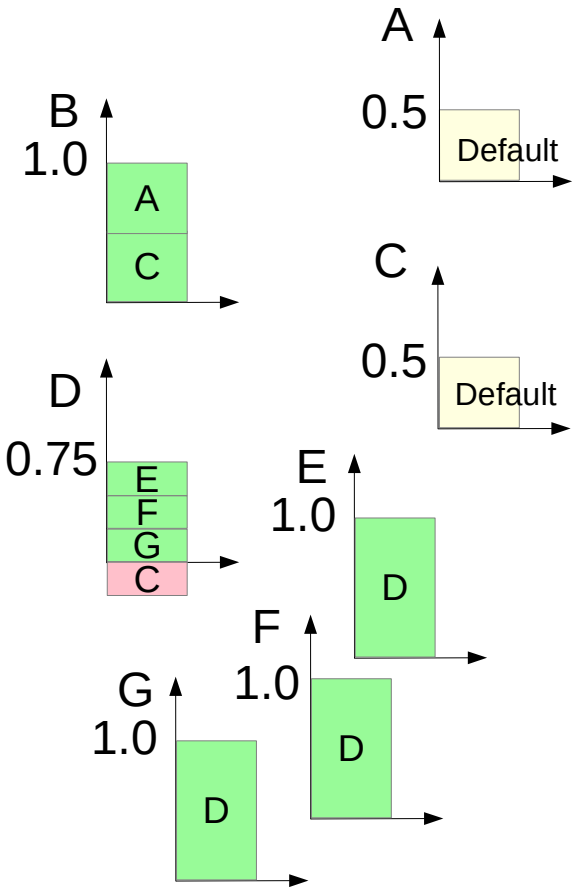
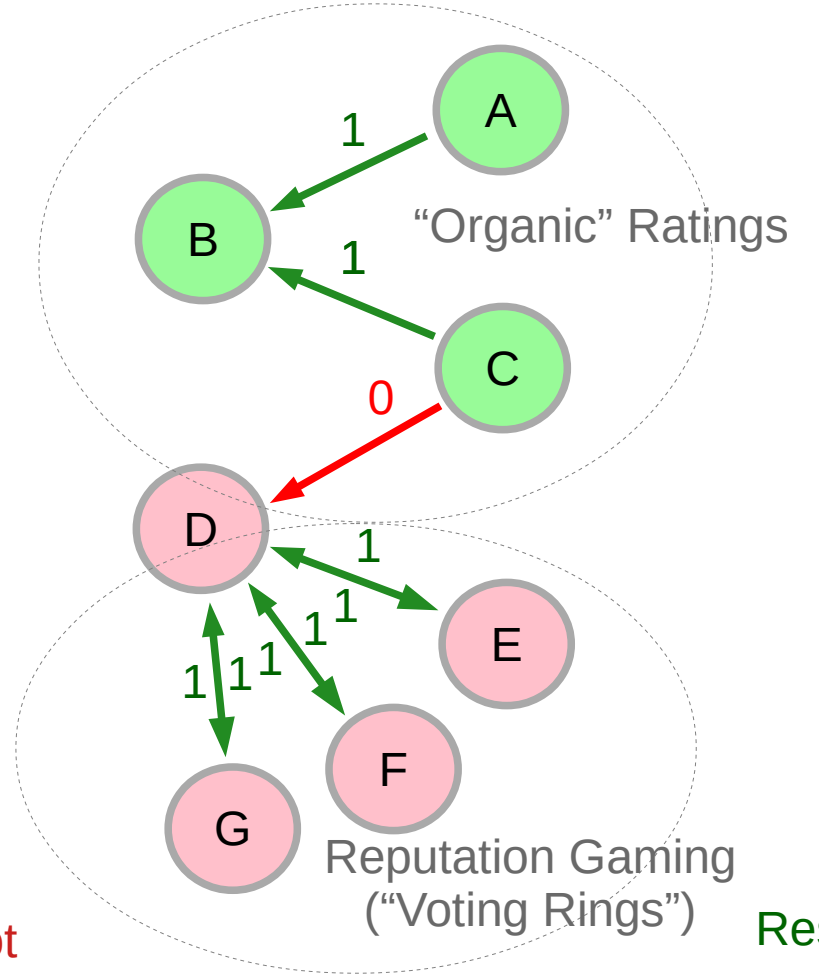
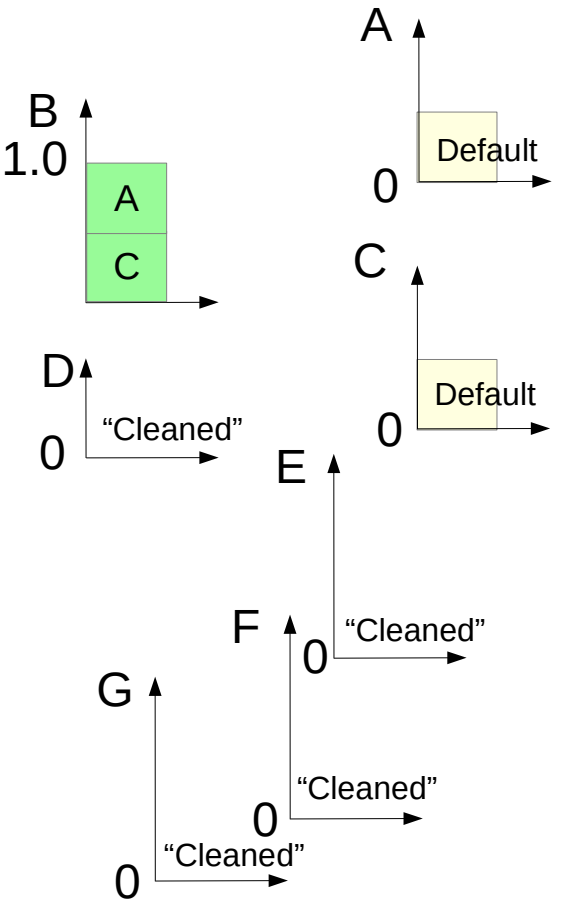
# Next: Resisting Reputation Gaming (Churning)




Abused Reputation Snapshot




Rescued Reputation Snapshot

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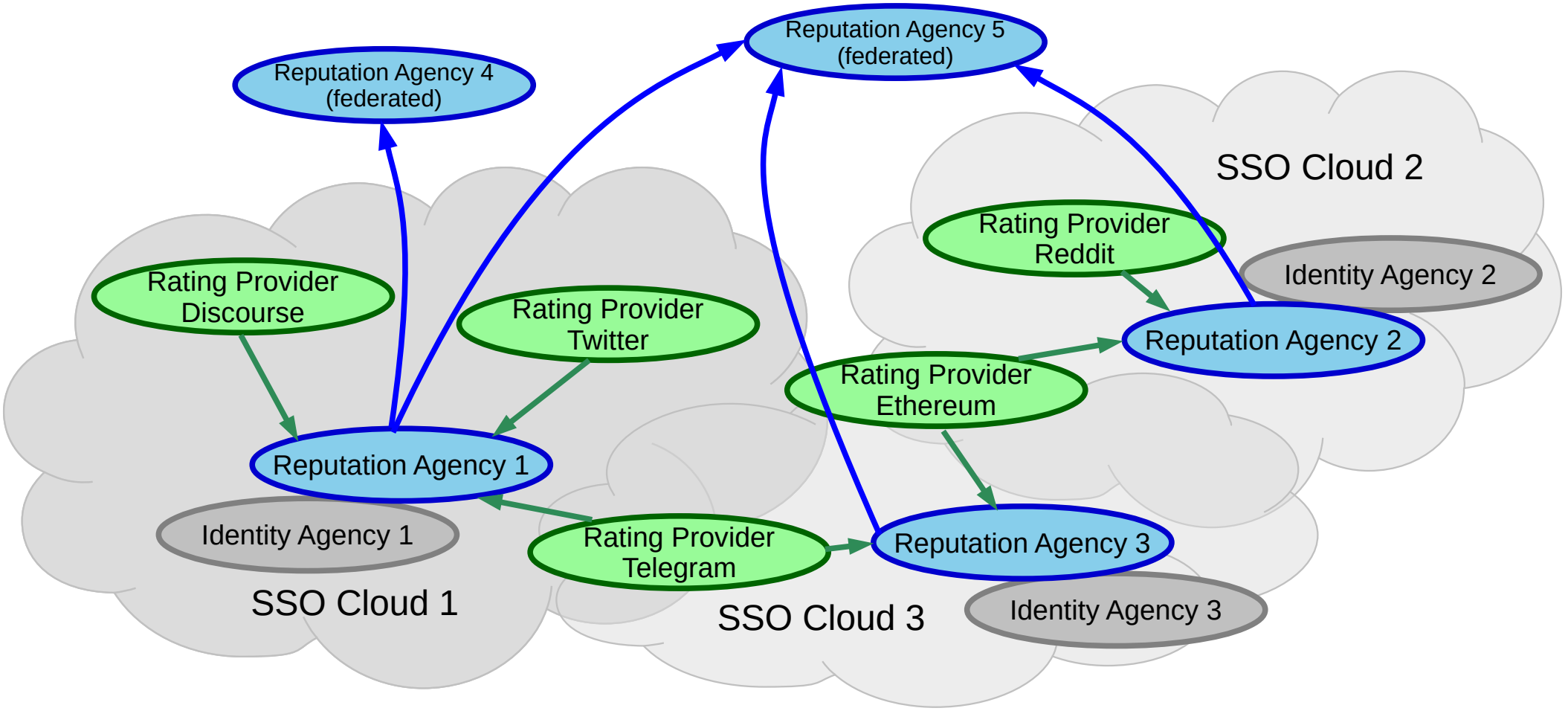
# Multiple Identity and Reputation Agencies

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# Thank You and Welcome!


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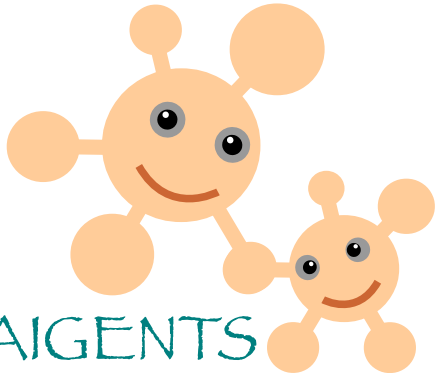


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