

# Appendix K: DIDO Consensus

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## Consensus

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**Consensus**, in DIDOs, is when the entire distributed system agrees upon the state of the data within the system. In other words, the data within the entire system can be relied upon and reflects the *“truth”*. However, although the data within the DIDO is immutable, it does not mean it is static. Every proposed change in state to any data held within the DIDO is allowed when there is **Consensus** that the new data state is valid and verified.

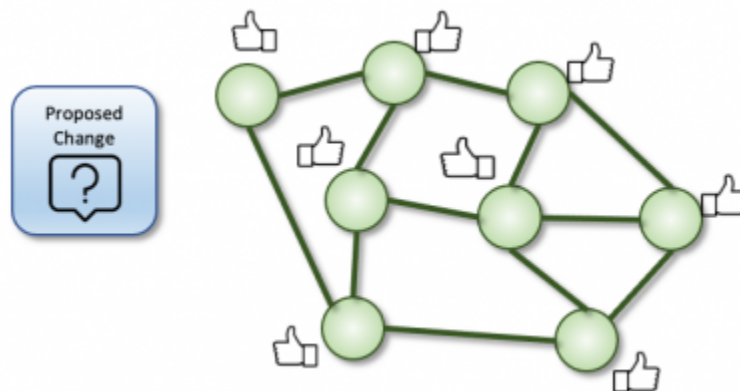


Figure 1: The DIDO Network Nodes have Consensus the data state represents *“truth”*.

## Notes

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There is a difference between a **DIDO Consensus** and a **Community of Interest (CoI) Consensus**. The **DIDO Consensus** concerns the way Consensus for propagating transactions throughout the DIDO Network. DIDO Consensus is generally inherent to the DIDO Platform. When there is a preference for a particular Consensus Mechanism for a particular project, the preference needs to be addressed as part of the functional requirements for the project.

**CoI Consensus** is concerned with how decisions are made in the CoI. The details of how Consensus is reached within a CoI are generally captured in the Community's (i.e., [Ecosphere's](#)) [Policies and Procedures \(P&P\)](#).

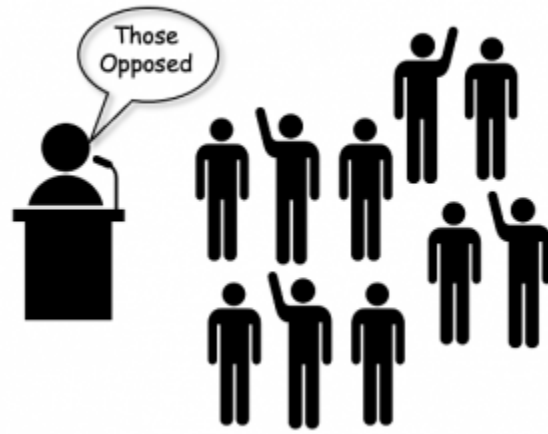


Figure 2: The COI Consensus.

- [K.3 Consensus Mechanisms](#)

## Directed Acyclic Graphs (DAG)

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## Consensus Protocol

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**Consensus Protocol**, in DIDOs, is developed by a specific DIDO platform to implement **Consensus Mechanism** over their DIDO network to achieve **Consensus**.

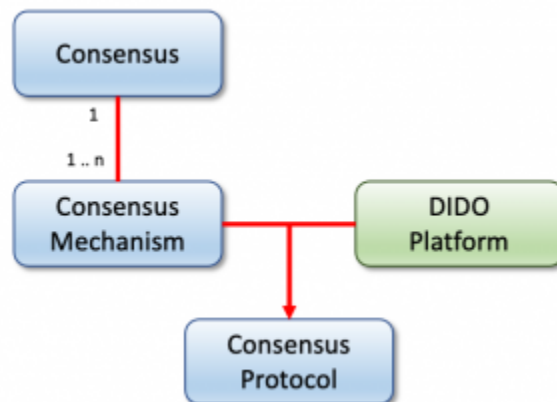


Figure 3: The relationship between Consensus, Consensus Mecahnism, and Consensus Protocol.

# Transaction

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All data within the DIDO are immutable with newer values (i.e., data states) being posted using a transaction that provides instructions on how to migrate the original data state to a new data state. Over time, the chain of history of data state changes (i.e., **Journal**) for one piece of data can become quite long. Given a known data state at a particular time, the current state of the data can be reconstructed using the journaled transactions.

In addition, the new data state also includes references back to the original data state. This allows the navigation of the journal back to the original data state (i.e., **Genesis Data**).

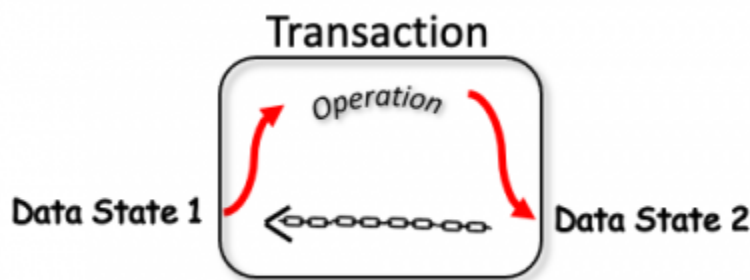


Figure 4: Transaction move the Data from one state to the next and remember the precious data state.

The following are some examples of Data State change commands. These are not Transactions because they do not include a reference to the original data to be changed (i.e., altered).

```
CHANGE EmotionState FROM HAPPY TO GLAD
CHANGE AccountBalance BY +5.00
```

- **Note:** In the example above, to be a transaction, the GLAD data state also has a reference back to HAPPY data state.

## Why is it important

[Consensus Algorithm](#) are essential in establishing confidence in a DIDO.

Thus there are various types of consensus algorithms in blockchain prospect, some of them are explained below<sup>1)</sup>

- [K.1 Definition of Terms](#)
- [K.3 Consensus Mechanisms](#)
- [K.4 Consensus Platforms](#)
- [K.5 Consensus Algorithm References](#)
- [platform](#)

Table 1:

Consensus Alorithym	Description	Platform Examples	Pros	Cons	Type
<b>Proof of Work (PoW)</b>		Bitcoin, Litecoin, ZCash, Primecoin, Monero, Vertcoin	Less opportunity for 51% attack Better Security	Greater energy consumption Centralization of Miners	Competitive Consensus <a href="#">Webpage: SAINI</a>
<b>Proof of Stake (PoS)</b>		Ethereum, Dash, Peercoin, Decred, Reddcoin, PivX	<ul style="list-style-type: none"> <li>Energy efficient <a href="#">Webpage: SAINI</a></li> <li>More expensive to attack for attackers <a href="#">Webpage: SAINI</a></li> <li>Not susceptible to economies of scale <a href="#">Webpage: SAINI</a></li> </ul>	<ul style="list-style-type: none"> <li>nothing-at-stake problem <a href="#">Webpage: SAINI</a></li> </ul>	Competitive Consensus <a href="#">Webpage: SAINI</a>
<b>Delegated Proof of Stake (DPoS)</b>		<ul style="list-style-type: none"> <li>Steem, EOS, and BitShares <a href="#">Webpage: BHARDWAJ</a></li> <li>BitShares, Steemit, EOS, Lisk, Ark <a href="#">Webpage: SAINI</a></li> </ul>	<ul style="list-style-type: none"> <li>Energy efficient. <a href="#">Webpage: SAINI</a></li> <li>Fast. Steemit, a high traffic blogging site uses it. EOS has a block-time of 0.5 sec. <a href="#">Webpage: SAINI</a></li> </ul>	<ul style="list-style-type: none"> <li>A bit centralized. <a href="#">Webpage: SAINI</a></li> <li>Participants with high stakes can vote themselves in to become a validator. Something which is seen recently in EOS. <a href="#">Webpage: SAINI</a></li> </ul>	Collaborative consensus <a href="#">Webpage: SAINI</a>
<b>Leased Proof of Stake (LPoS)</b>		Waves			
<b>Proof of Elapsed Time (PoET)</b>		Hyperledger Sawtooth, Resource-Efficient Mining (REM)			
<b>Practical Byzantine Fault Tolerance (PBFT)</b>		Stellar, Ripple, Hyperledger Fabric <a href="#">Webpage: BHARDWAJ</a>			
<b>Simplified Byzantine Fault Tolerance (SBFT)</b>		Chain			
<b>Delegated Byzantine Fault Tolerance (DBFT)</b>		NEO <a href="#">Webpage: BHARDWAJ</a>			
<b>Directed Acyclic Graphs (DAG)</b>		Iota, Hedera Hashgraph <a href="#">Webpage: BHARDWAJ</a>			
<b>Proof of Activity (PoA)</b>		<ul style="list-style-type: none"> <li>Espers and Decred <a href="#">Webpage: BHARDWAJ</a></li> <li>Decred <a href="#">Webpage: SAINI</a></li> </ul>			Collaborative consensus <a href="#">Webpage: SAINI</a>
<b>Proof of Identity (PoI)</b>					
<b>Proof of Importance (PoI)</b>		NEM			
<b>Proof of Capacity (PoC) Proof of Space (PoS)</b>		Burstcoin and SpaceMint <a href="#">Webpage: BHARDWAJ</a>	<ul style="list-style-type: none"> <li>Similar to PoW but uses space instead of computation. Thus much environmental friendly.</li> <li>Can be used for malware detection, by determining whether the L1 cache of a processor is empty (e.g., has enough space to evaluate the PoSpace routine without cache misses) or contains a routine that resisted being evicted.</li> <li>Can be used for anti-spam measures and denial of service attack prevention.</li> <li>PoC can use any regular hard drives including those with Android-based systems.</li> <li>It is reportedly up to 30-times more energy efficient than the ASIC-based mining of the bitcoin cryptocurrency.</li> <li>There is no need for dedicated hardware or constant upgrading of hard drives.</li> <li>Mining data can be easily wiped-off and the drive can be reused for any other data storage purpose. <a href="https://www.investopedia.com/terms/p/proof-capacity-cryptocurrency.asp">https://www.investopedia.com/terms/p/proof-capacity-cryptocurrency.asp</a></li> </ul>	<ul style="list-style-type: none"> <li>Not many developers have adopted the system.</li> <li>It is possible for malware to affect mining activities.</li> <li>Widespread adoption of PoC could start an "arms race" to produce higher capacity hard drives. <a href="https://www.investopedia.com/terms/p/proof-capacity-cryptocurrency.asp">https://www.investopedia.com/terms/p/proof-capacity-cryptocurrency.asp</a></li> </ul>	Collaborative consensus <a href="#">Webpage: SAINI</a>
<b>Proof of Burn (PoB)</b>		Slim Coin <a href="#">Webpage: BHARDWAJ</a>			
<b>Proof of Weight (PoW)</b>		Algorand, Filecoin, Chia	<ul style="list-style-type: none"> <li>Energy efficient. <a href="#">Webpage: SAINI</a></li> <li>Highly Customisable and scalable. <a href="#">Webpage: SAINI</a></li> </ul>	<ul style="list-style-type: none"> <li>Incentivization can be hard. <a href="#">Webpage: SAINI</a></li> </ul>	Competitive consensus <a href="#">Webpage: SAINI</a>

1)

Coinjoker, [Consensus Algorithms in Blockchain](https://www.cryptonexchangescript.com/blockchain-consensus-algorithms), Accessed: 9 July 2021, <https://www.cryptonexchangescript.com/blockchain-consensus-algorithms>

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