



# The CyberMiles DPoS Protocol

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## 1. What is the mission of CyberMiles?

CyberMiles aims to build a smart contract platform that is similar to Ethereum but heavily optimized to facilitate e-commerce transactions. Our blockchain enables people to construct and execute business contracts enforced by computer code. Our goal is to build an e-commerce ecosystem that is native to the network era:

- 1) no rent-seeking centralized monopoly;
- 2) more fair allocation of network rewards; and
- 3) stronger network effects through economic incentives.

The result will be a new generation of e-commerce network that is more affordable to buyers (both in merchandise prices and financing options) and more revenue streams for the sellers (such as monetizing data, supply chain financing, and consumer loans).



## II. What is PoS?

When Satoshi Nakamoto invented the Bitcoin, a key insight was an economic system that is more profitable to join the network than to attack it. In the Bitcoin system, the barrier to attack the system is called Proof-of-Work, or **PoW**, consensus. However, over the years, it has also become apparent that the PoW consensus is too slow and wastes too much energy.

To solve PoW's problems, a new consensus mechanism called Proof-of-Stake, or **PoS**, was proposed. A PoS system allows a vote for each new block by the network's token holders. The proposer of a new block is randomly chosen. Each account's voting power is proportional to the tokens held in it. The idea is that token holders, especially large token holders, are incentivized to vote to ensure the network's security. With voting, the blockchain can validate blocks with minimal amount of computation. The proposer of an accepted new block receives award in the blockchain's cryptocurrency. This process is called "**minting**" new cryptocurrency as opposed to PoW's "**mining**". A PoS system is typically much more performant than a PoW system.

However, a traditional PoS system also suffers from two significant problems: the first problem is still performance. All token holders can run a blockchain node to propose and vote on blocks, but most token holders have no expertise or budget to run computer hardware and software required for a high-performance node. Therefore, blockchain network is as slow as its slowest node. The second problem is the "nothing at stake" problem, where a token holder can cheat by simultaneously voting on two competing proposed blocks.



### III. What is DPoS?

Delegated Proof-of-Stake (DPoS) is an improvement to the PoS mechanism. It is similar to a representative democracy with land suffrage in human society. In DPoS, the token holders vote for a small number of representatives (we call those elected representatives “**validators**” throughout this article) to represent all token holders to run network operations. The validators run *super nodes*, which are professionally run network servers to ensure the performance and security of the blockchain network. This solves PoS’s performance problem.

The votes are casted in the form of staking one’s tokens. The staked tokens are locked by the network as collaterals and can be confiscated when the validators misbehave. The staked tokens are never transferred to the validators who they voted for. They are simply used as a proof of voting power and incentive for the token holders to choose responsible and capable validators to maintain the blockchain. The potential punishment solves the “nothing at stake” problem.

At CyberMiles, we believe DPoS is the future of high performance and secure blockchain consensus. CyberMiles



## IV. How CyberMiles DPoS works?

Delegated Proof of Stake is a crucial economic mechanism in the CyberMiles blockchain network to reward token holders who help to maintain the security and integrity of the network protocols. There are two roles in the CyberMiles DPoS protocol: *delegators* and *validators*.

### A. Delegators and validators

CMT holders who choose to be delegators lock up, or *stake*, their CMTs to participate in the blockchain network's governance through a voting mechanism. The staked CMTs are held by the network and cannot be traded or transferred because they can be confiscated when governance errors occur. In exchange, the delegators receive CMTs minted through systematic inflation and transaction fees in every new block created by the network. These CMTs are called *block award*.

The delegators themselves typically cannot or will not run the computer servers that actually power the blockchain network. Instead, delegators hire, or *elect*, other CMT holders, or *validators*, for this task by staking their CMTs to specific validator candidates. Validators are responsible for maintaining crucial network infrastructure, and making rule changes and governance decisions on behalf of its delegators. Since there are only 19 validators in the CyberMiles system, validators must compete for delegators' votes (staked CMTs) in order to be hired by providing secure servers running up-to-date software, sufficient computing power and network bandwidth to power the global blockchain network.

Delegators pay validators with a portion of their block awards. Each validator's share of the block award is called the *validator's compensation*. A validator's compensation is determined at the time of staking. It is recorded and enforced by the network itself.

If a validator misbehaves and tries to harm the network, the network might confiscate its staked CMTs causing a loss for its delegators. So, the delegators are incentivized to only stake for reputable and trustworthy validators, therefore improving the security of the whole network.

In the CyberMiles protocol, 10% of a validator’s stake must come from this validator’s own CMT holding. This ensures that each validator has skin in the game because its own CMTs are also at risk for confiscation. Hence, a validator is always also a delegator for itself.

The following table shows the responsibilities, risks and rewards for validators and delegators to participate in the network governance through DPoS mechanism.

	Rewards	Responsibilities and Risks
Delegator	Receive block awards for the CMTs it stakes in the network.	Have to give up trading for staked CMTs. Small risk of confiscation if its staked validator misbehaves.
Validator	Receive validator’s compensation from delegators’ block awards and block awards from self-staked CMTs, by validating blocks. Participate in network governance.	Have to give up trading for self-staked CMTs. Responsible for sophisticated IT system operations with risks of hacking and confiscation.



## A1. Examples of validator and delegator compensation

The following formula compute the annual incomes for validators and delegators respectively, for each CMT staked from one's own account.

$$V_{income} = \frac{I}{TS} \cdot \left( 1 + \left( \frac{1}{SS} - 1 \right) \cdot VC \right)$$

$$D_{income} = \frac{I}{TS} \cdot (1 - VC)$$

The symbols are as follows.

- $V_{income}$  and  $D_{income}$  are validator's and delegator's income from each of its own staked CMT every year.
- $I$  is the system inflation rate, per year.
- $TS$  is the total staked CMTs as a percentage of total circulating CMTs.
- $SS$  is self-staked ratio (for the validator only).
- $VC$  is the validator's compensation rate.

The following table shows how to apply the above formula to compute the block award for delegators, and validator's compensation, in different scenarios. The validator and delegator incomes listed in the table are per 100 staked CMTs per year.



Validator’s compensation as a percentage of block awards (VC)		If 50%		If 20%	
Total staked CMTs (TS)	Validator’s self-staking ratio (SS)	Validator (CMT)	Delegator	Validator	Delegator
25%	10%	176	16	90	26
25%	20%	96	16	58	26
25%	40%	56	16	42	26
50%	10%	88	8	45	13
50%	20%	48	8	29	13
50%	40%	28	8	21	13
75%	10%	59	5	30	9
75%	20%	32	5	19	9
75%	40%	19	5	14	9

Note: :

1. The “total staked CMTs” column is the percentage of total CMT supply that is staked for DPoS. For example, initially there were a total supply of 1 billion CMTs, so a 25% means overall 250M CMTs are staked by their holders to participate in the DPoS mechanism.
2. We are assuming a system wide inflation rate of 8% per year, which is the source of block award.
3. Validator income = validator compensation + block award from self-staked CMTs
4. Delegator income = block award from staked CMTs – validator compensation
5. The validator does not stake more than 12% of the “total CMTs staked”. The income drops for if the validator exceeds that threshold. See B4 for why this threshold exists.





As we can see from the table, the delegator's income is determined by the total CMTs staked and the validator's compensation rate. That provides relative certainty for a delegator to estimate his "minting" income when staking a validator. It is possible for a delegator's income to drop below the system inflation rate of 8% per year. Such cases are colored in orange in the table.

Incomes for both validators and delegators go up when fewer people stake their CMTs, as the 8% inflation is divided up amongst fewer parties. The validator's per-staked-CMT income goes up when it stakes less of its own tokens and gets compensation from other delegators' stakes. However, as we discussed, each validator must self-stake at least 10% of its total stake.

## B. Ongoing validator election

Once the network is up and running, validators can be voted in and out at real time. At all times, the top 19 validator candidates that have the most staked CMTs are "hired" as validators by the delegators.

### BI. Declaration of candidacy

A validator candidate declares its candidacy to the network. It will give out 3 pieces of information in the declaration:

1. Details of its operation and credentials, including jurisdiction, data center location, security setup, and technical setup. The CyberMiles Foundation will evaluate all validator candidates, and publicly indicate the candidates that meet the Foundation's standards (i.e., information accuracy, technical competency, and hardware / network setup). However, the token holders are free to stake for any candidate regardless whether it meets the Foundation standard or not.



2. The maximum amount of CMTs it is willing to accept as stakes. In order to prevent any single validator from growing too big and therefore risking monopoly, the network protocol punishes very large validators and their delegators. (see the “B4. Block award and validator’s compensation” section for details).
3. The validator’s compensation rate it requires from delegators. For example, a 40% rate means that 40% of the block awards earned by delegators who staked this validator, will be paid to this validator as compensation.

## **B2. Acceptance of candidacy**

Upon a new candidate declaration, the network immediately takes 10% of the declared maximum amount of stake from the candidate's own account, and keep it as stake. If the candidate does not have 10% of the max, the declaration will fail. The validator can, of course, stake itself with additional CMTs later.

The CyberMiles Foundation will review the candidate's information. If the foundation can verify the accuracy of the information, it will denote on-chain that the candidate is “verified”. CMT holders can stake any validator candidate they like, including the unverified ones, but verified candidates from the foundation give CMT holders more confidence to stake.

## **B3. Staking and unstaking**

The validator candidate campaigns in the community and asks people to stake it (i.e., to hire it for the job of the validator).

CMT holders (delegators) stake their CMTs to the validator candidate. It is important to note that staked CMTs cannot be traded, and once staked, a



delegator must request unstaking and then wait a week before he can trade them again.

The waiting period of unstaking is to guard against something called “long range double spend attack”.

*Note: During the first year of the network, all delegators must stake their CMTs through a specialty hardware device known as the CMT Cube. That is to ensure network stability and fund safety during the crucial period of network startup. The CMT Cube will be free and the blockchain staking protocol will be open to all after the first year. See more details in the last section herein.*

#### **B4. Block award and validator’s compensation**

Once the validator candidate receives enough stake to make the top 19, it becomes a validator, and all its delegators start to receive block award (about every 10 seconds). The block award includes two parts.

1. The system has an annual inflation rate of 8%. This inflation is distributed as newly minted CMTs to delegators.
2. The delegators also receive transaction fees paid by heavy users of the blockchain.

The total block award from the system is first assigned to the delegators proportional to each delegator’s stake. The system then automatically distributes the block award to the validators and delegators based on the validator’s compensation rates. The awards are added to the stake by default. For delegators and validators to withdraw the CMTs for trading, they need to request unstaking and wait for a week.

The CyberMiles protocol disincentives any validator from growing too big. If a single validator’s stake grows above 12% of total stake of the network, this validator could cause instability in the network. So, when the network assigns



the block award, all its delegators will receive reduced block award for stakes that goes above the 12% threshold. This threshold incentivizes large CMT holders to diversify and stake in multiple validators, and it incentivizes validators to limit their max accepted stake. Algorithm to compute voting power for each validator is as follows.

1. Distribute voting power to validators according to each validator's stake amount, but capped at 12% for each. For example, if validator A has 5% of the outstanding stake, he gets 5% voting power; if validator B has 20% of the stake, he gets 12% voting power.
2. If there is remaining voting power, distribute a second round based on actual stake amount of each validator.

A validator can withdraw its candidacy at any time. Once a validator withdraws, the next candidate with the most staked CMTs in line will become a validator. When a validator withdraws, all its staked CMTs will be automatically unlocked after the one week unstake waiting period. During the whole staking period, there is no transfer of ownership of the delegators' CMTs.

### **B5. Slashing and punishment**

When a validator becomes unavailable or produces results that are different from the rest of the validators, the system will slash and burn 0.1% of its total stake (i.e., the validator itself and all its delegators will lose CMTs) every block (every 10s). After 12 consecutive slashes, the system removes the validator and promotes the next validator candidate as a validator.

The removed validator will no longer suffer slashing loss, but none of its delegators will earn any block awards either. Its delegator can request to unstake from it, and then re-stake their CMTs after the one week unstake waiting period.



## B6. Backup validators

Beyond the 19 official validators, there are validator candidates whose staked CMTs are less than the 19<sup>th</sup> validator. They are backup validators. There are always possibilities for the backup to accumulate enough stakes in the future to overtake the 19<sup>th</sup> validator. An existing validator might also be punished or simply withdraw, or stop functioning as a validator completely. In those cases, the backup becomes a validator, and the previous second candidate in line becomes the backup.

Backup validators do not earn CMT awards for the CMTs staked in them. They are typically new entrants into the ecosystem or opportunistic players. The Foundation will run multiple backup validator candidates in order to maintain the network stability.

### C. Initial validators election

When the CyberMiles main net goes online, it needs to start with 19 validators, known as genesis validators. However, the chicken and egg problem is that there is no way to stake before the main net goes online.

To solve this problem, prior to the main net launch, the CyberMiles Foundation will select genesis validators based on their contributions to the community.

The selection and scoring criteria include:

- The initial amount of CMTs the candidate is willing to stake (at least 10% of its declared max – see below)
- Soft commitment of CMT stake from its community.
- The reputation of the operation entity
- Size and activities of its community (i.e., twitter and telegram followers and interactions)



- Geopolitical diversity of the validators (i.e., candidates from under-represented countries will have higher weight)
- Commitment to run the validator nodes according to the technical standards set by the Foundation

We estimate that a genesis validator will require at least 20M staked CMTs from a combination of its self-stake and commitments from the community.

Each foundation selected genesis validator must

- Declare its maximum accepted staking CMTs
- Fund its own account with 10% of the max to be staked at genesis by the network
- Declare its validator's compensation rate
- Disclose detailed information about the organization or individual

Once the CMT Cube devices are distributed to CMT holders, the continuous validator election starts. CMT holders will use the CMT Cube to vote (stake) for validators they want to hire.

#### D. About the CMT

The CMT Cube is a home-based device specifically designed to facilitate validator election during the first year of CyberMiles network operation. It is a hardware device that acts both a CMT wallet (i.e., stores and manages a CMT account), and an easy-to-use user interface, or UI, for staking the CMTs in the wallet to elect validators. Its UI also displays the up-to-date earnings (delegator's block award) the account receives over time. The hardware wallet at home is much safer than web-based or phone-based software wallets, and hence is ideal for holding and staking significant amounts of CMTs.

The CMT Cube hardware consists of an LED touch screen for managing CMTs



in the associated account, a secure chip for storing private key information, and a mobile computer running a customized version of Android. It uses very little electricity, and only need to be turned on when the user needs to make changes to the account (e.g., to check account balance, to deposit or withdraw CMTs, to stake or unstake a validator etc.)

In the long run, any CMT account holder will be able to stake his or her CMTs via an open software API provided by the network. However, during the crucial period of network startup period, the network is vulnerable to attacks and the CyberMiles Foundation must take an active role in making sure that the validator elections are free from attacks and frauds. The requirement for a hardware device creates additional safeguards for the validator election process. For example, as the device has an upfront cost (it will be reimbursed over the year and eventually it is free) and has an upper limit for CMTs it can hold (100,000 CMTs), it is very hard for a large stake holder to split into hundreds of CMT accounts to secretly manipulate the election. The device also has a lower limit of 1000 CMTs it must hold and stake to prevent DDoS attacks that use small amounts of stakes to abuse the system.

The block award distributed to the delegators will automatically show up on the CMT Cube UI. Since the CMT Cube is the only way to participate in validator staking, it is currently the only way for CMT holders to earn delegator awards.

As shown in the “validator and delegator compensation” table, the expected income of each CMT Cube (delegator’s income) is proportional to the amount of CMTs staked, and is related to the network-wide total staked CMTs and validator’s compensation rate. We generally expect the delegator’s income will be higher than the system inflation rate (currently at 8% per year).

The CMT Cube device will be sold exclusively on the cybermiles.io web site, and it will be priced in CMTs.

## V. Key parameters

Term	Value	Description
Annual inflation	Up to 8%	The amount of new CMTs “minted” by the system as block award for delegators and validators. The actual inflation rate is determined by a vote by validators, but should never exceed 8% per year.
Minimum self-staking ratio	10%	The amount of CMTs in a validator’s stake that must come from its own funds.
Validator’s size threshold	12%	The threshold (soft cap) a single validator can take in total network stake before the system diminishes the block award for this validator and its delegators.
Number of validators	19	The top 19 candidates with the most stake become validators. Their delegators will earn block awards.
Block time	10s	Time for a new block to be created. Once a block is created, all the transactions in the block are confirmed and finalized.
Slashing	0.1% of stake every block for 12 blocks	The system slashes and burns a validator’s stake (including all the delegators who stake in it) when a validator misbehaves.
Unstake waiting period	7 days	The amount of time a delegator must wait to reclaim its funds when it unstakes a validator.
CMT Cube	100,000 CMTs	The maximum amount of CMTs a single CMT Cube device can hold and stake.
CMT Cube	1,000 CMTs	The minimum amount of CMTs a single CMT Cube device must hold and stake.