

Ontology Staking Incentive Calculation

Version 2.0.0

The Ontology Team

June 2020

Contents

1	Staking Incentive Structure and Overview	1
1.1	Staking Incentive Structure	1
1.2	Staking Incentive Overview	1
1.2.1	Network Fee Incentive	1
1.2.2	Released ONG Incentive	2
1.2.3	Ontology Foundation Bonus	2
2	Notations	3
3	Calculation Formula	3
3.1	Node Incentive Calculation	3
3.1.1	Network Fees Incentive and Released ONG Incentive	4
3.1.2	Ontology Foundation Bonus	4
3.1.3	Expected Total Node Incentive	5
3.2	Stakers' Incentive Calculation	5
3.2.1	Network Fees and Released ONG	5
3.2.2	The Foundation Bonus	5
3.2.3	Other Incentives Promised by the Nodes	5
	Appendix	6
A.	The Ontology Incentive Curve	6

1 Staking Incentive Structure and Overview

Neither the incentive rules nor the distribution methods of the network fee incentive and the Ontology Foundation bonus have changed for nodes and stakers.

The only change is that the released ONG of the entire network will now only be distributed to staked ONT instead of both staked ONT and regular ONT through ONG unbinding. From July 7, 2020 (UTC) onwards, this change will take place and Ontology will release 1 ONG per second into the released ONG incentive pool. This incentive will adopt the same rules and calculation methods as the network fee incentive and will be distributed to the nodes and stakers along with the network fees at the beginning of each consensus round.

1.1 Staking Incentive Structure

Ontology **Triones nodes**, including consensus nodes and candidate nodes, will receive three types of staking incentives:

1. Network fee incentive: This incentive's rules remain unchanged. This incentive will be shared amongst all 343 Triones nodes.
2. Released ONG incentive: This incentive's rules will be the same as the network fee incentive rules. This incentive will be shared amongst all 343 Triones nodes.
3. Ontology Foundation bonus: This incentive's rules remain unchanged. This incentive will be shared amongst the top 49 nodes and distributed manually by the Ontology Foundation.

Users can earn staking incentives by staking to the Triones nodes and receiving a share of the nodes' staking incentives under rules set by the nodes. For instance:

1. Nodes can promise to distribute network fees and released ONG to their stakers according to a set sharing ratio.
2. Nodes can promise to distribute the Foundation bonus to their stakers according to a set sharing ratio.
3. Nodes can promise to distribute their own OEP-4 tokens to stakers according to their own set of rules.

1.2 Staking Incentive Overview

We shall explain Ontology's staking incentive calculation method from a high level below. The concrete calculation formula can be found in Section 3.

1.2.1 Network Fee Incentive

The network fee incentive rules remain unchanged.

All the consensus nodes collectively receive 50% of the total accumulated network fees in a consensus round, and all the candidate nodes collectively receive the other 50%. The consensus nodes and candidate nodes split the received fees amongst each node according to specific rules in their respective sets.

The consensus nodes calculate an incentive coefficient for each node according to the Ontology Incentive Curve, and then linearly distribute the fees according to their incentive coefficients. That is, the larger the incentive coefficient of a consensus node, the more network fees will be allocated to that node. According to the current Ontology Incentive Curve, the maximum incentive coefficient is reached when the staked amount of a consensus node reaches twice the average staked amount of a consensus

node. When the staked amount is too high or too low, that node's incentive coefficient will be reduced, which means they will receive a reduced allocation of the network fees.

For candidate nodes, the network fee incentive is linearly allocated according to the total staked amount in each node. The higher the total stake a node has, the more network fees are allocated to it.

Stakers will receive a share of the network fees according to the sharing ratio set by the consensus or candidate nodes they are staking with.

1.2.2 Released ONG Incentive

As mentioned earlier, the released ONG of the entire network will now only be distributed to staked ONT instead of both staked ONT and regular ONT through ONG unbinding. Once the change takes place, Ontology will release 1 ONG per second into the released ONG incentive pool. This incentive will **adopt the same rules and calculation methods as the network fee incentive** and will be distributed along with the network fees at the beginning of each consensus round.

The consensus nodes collectively receive 50% of the total ONG released in a consensus round, and the candidate nodes collectively receive the other 50%. The consensus nodes and candidate nodes split the received released ONG amongst each node according to specific rules in their respective sets.

The consensus nodes calculate an incentive coefficient for each node according to the Ontology Incentive Curve, and then linearly distribute the released ONG according to their incentive coefficients. That is, the larger the incentive coefficient of a consensus node, the more released ONG will be allocated to that node. According to the current Ontology Incentive Curve, the maximum incentive coefficient is reached when the staked amount of a consensus node reaches twice the average staked amount of a consensus node. When the staked amount is too high or too low, that node's incentive coefficient will be reduced, which means they will receive a reduced allocation of released ONG.

For candidate nodes, the released ONG incentive is linearly allocated according to the total staked amount in each node. The higher the total stake a node has, the more released ONG is allocated to it.

Stakers will receive a share of the released ONG according to the sharing ratio set by the consensus or candidate nodes they are staking with.

Since the duration of each consensus round varies, the amount of released ONG during each consensus round will also vary.

1.2.3 Ontology Foundation Bonus

The Ontology Foundation bonus remains unchanged.

The Ontology Foundation provides 10 million ONG every year for the first three years since staking was launched as incentives for **the top 49 nodes** with the highest total staked amounts. This incentive will be distributed manually by the Foundation on a monthly basis.

The Ontology Foundation bonus is calculated in two rounds:

- Round 1: The top 49 nodes linearly distribute the Ontology Foundation bonus received according to the total staked amount per node. The higher the total staked amount a node has, the more of the Foundation bonus it will receive.
- Round 2: Currently, the Foundation has put an initial stake (Init PoS) in seven consensus nodes, and the core team is also staking on these consensus nodes as stakers. These seven nodes have promised to distribute the Foundation bonus to stakers at a promised ratio. The stakers will receive a linear allocation, that is, the more stake a staker puts in, the higher Foundation bonus they will receive.

The Round 2 incentive pool: First, the allocated Foundation bonus corresponding to the initial stake provided by the Foundation is forwarded into the Round 2 incentive pool. Second, the core team

also has promised to forward the allocated Foundation bonus from their stake into the Round 2 incentive pool.

In Round 2, the initial stake provided by the Foundation and the core team's stake on the seven consensus nodes are not counted in the total staked amount of the consensus nodes, that is, they will not receive the Round 2 incentive. The Round 2 incentive will be distributed linearly to the top 49 nodes according to the node staked amount.

The above seven consensus nodes shall linearly distribute the Round 2 incentive to stakers according to their staked amounts.

2 Notations

The following notations are used in detailed calculations.

- $\bar{\sigma}_s$: the average staked amount of consensus nodes
- σ_d : the total staked amount across all the candidate nodes
- σ_{t49} : the total staked amount across the top 49 nodes
- S_i : the total staked amount in node i
- $U_{a,i}$: user a 's staked amount in node i
- p_i : the sharing ratio of node i 's promised network fees incentive and released ONG incentive to stakers
- G_T : the total amount of ONG released in a consensus round, which equals the release (1 ONG/s) times the number of seconds in the round
- F_T : the total amount of network fees accumulated in a consensus round
- B_T : the 10 million ONG incentive from the Ontology Foundation each year
- R_i : the released ONG received by node i in a consensus round
- G_i : the network gas fee received by node i in a consensus round
- B_i : the Ontology Foundation bonus received by node i each year

Assuming that the consensus nodes with an initial stake from the Foundation are $\{i\}_{i \in [7]}$:

- FP_i : the initial staked amount on node i by the Foundation
- FU_i : the total staked amount on node i by the core team
- pb_i : the sharing ratio of the Foundation bonus promised by node i to its stakers, currently $pb_i = p_i$

3 Calculation Formula

3.1 Node Incentive Calculation

The consensus nodes collectively receive 50% of the network fees and released ONG in a consensus round, and the candidate nodes collectively receive the other 50%. The Ontology Foundation bonus remains unchanged. Thus, the top 49 nodes receive a total of 10 million ONG from the Foundation each year for the first three years since staking was launched. The network fees and released ONG are distributed every round, while the Foundation bonus is given out on a monthly basis.

3.1.1 Network Fees Incentive and Released ONG Incentive

- If i is a **consensus node**, then it will receive the following network fees and released ONG:
 - According to the Ontology Incentive Curve (see Appendix), the incentive coefficient α_i of consensus node i can be computed as follows, where $\bar{\sigma}_s$ is the average staked amount of consensus nodes and S_i is the total staked amount of node i :

$$x_i = \frac{\eta}{\bar{\sigma}_s} \cdot S_i, \quad \eta = 0.5$$

$$\alpha_i = x_i \cdot e^{-x_i}$$

Assume $A = \sum_{j \in [\text{consensus nodes}]} \alpha_j$, namely A is the sum of the incentive coefficients of each consensus node.

- According to the incentive coefficient of each consensus node, linearly allocate from the total network fees F_T and from the total released ONG G_T for node i :

$$G_i = \frac{50\% \cdot F_T}{A} \cdot \alpha_i$$

$$R_i = \frac{50\% \cdot G_T}{A} \cdot \alpha_i$$

- If i is a **candidate node**, then linearly allocate from the total network fees and the total released ONG for node i according to the total staked amount S_i of that node divided by the total staked amount across all candidate nodes σ_d :

$$G_i = \frac{50\% \cdot F_T}{\sigma_d} \cdot S_i$$

$$R_i = \frac{50\% \cdot G_T}{\sigma_d} \cdot S_i$$

3.1.2 Ontology Foundation Bonus

- If i is a **top 49 node**, then it will receive the **Ontology Foundation bonus**. This incentive is given out in two rounds. Assume:

$$\gamma = \frac{B_T}{\sigma_{t49}},$$

B_T is the 10 million ONG bonus provided by the Ontology Foundation each year. σ_{t49} is the total staked amount across the top 49 nodes. Thus, γ is the amount of ONG received for each stake (1 ONT), that is, the Foundation bonus received for each stake.

- Round 1 : each node receives a linear allocation of the Foundation bonus according to the staked amount S_i of that node.

At present, **the seven consensus nodes with an initial stake from the Foundation FP_i and a stake from the core team FU_i** will distribute the bonus received from that stake to their stakers and the other nodes from the top 49. pb_i is the sharing ratio of the Foundation bonus promised by node i to its stakers, currently $pb_i = p_i$. The total stake amount to be calculated for incentive redistribution is:

$$S_r = \sum_{i \in [7]} [FU_i \cdot pb_i \cdot \frac{S_i}{S_i - FP_i} + FP_i \cdot (1 - pb_i)]$$

- Round 2: the redistributed incentive γS_r will be linearly distributed to the top 49 nodes based on the total staked amount after deducting the total staked amount from the Foundation and the core team. Assume:

$$\delta = \frac{S_r}{\sigma_{t49} - \sum_{i \in [7]} (FP_i + FU_i)},$$

where δ is the actual stake corresponding to each stake (1 ONT) from stakers excluding the Foundation and core team during Round 2.

- The **seven consensus nodes will send all of the Round 2 incentive to their stakers.** Therefore, in addition to the seven consensus nodes, the total Foundation bonus for the **other top 49 nodes** is:

$$B_i = \gamma \cdot S_i \cdot (1 + \delta)$$

The total amount of the Foundation bonus retained by the **seven consensus nodes** is:

$$B_i = \gamma \cdot (S_i - FP_i) \cdot (1 - pb_i)$$

3.1.3 Expected Total Node Incentive

In summary, the total expected annual incentive for node i is:

$$B_i + (R_i + G_i) \cdot \text{Annual Expected Rounds}$$

It is worth noting that, except for the Ontology Foundation bonus of the seven consensus nodes, this calculation does not deduct the incentives promised to the stakers. For example, say node i promises to distribute a portion of received fees and released ONG to stakers according to a sharing ratio p_i , while retaining all the Foundation bonus, then its final expected annual incentive is:

$$B_i + (R_i + G_i) \cdot (1 - p_i) \cdot \text{Annual Expected Rounds}$$

3.2 Stakers' Incentive Calculation

3.2.1 Network Fees and Released ONG

Node i may promise a sharing ratio p_i to stakers. Thus, if stakers stake on that node, the total fees and released ONG incentive received by the stakers are:

$$U' = (G_i + R_i) \cdot p_i$$

The network fees and released ONG incentive received by an individual staker will have a linear relationship with their staked amount. That is, if the ratio of staker a 's stake to all the stakers' stake on node i (excluding the initial staking amount of the node) is $\beta_{a,i}$, then the network fees and released ONG incentive received by the individual staker are:

$$U'_{a,i} = (G_i + R_i) \cdot p_i \cdot \beta_{a,i}$$

3.2.2 The Foundation Bonus

- When staker a stakes on a node i that is amongst **the seven consensus nodes that the Foundation has staked initially**, then a will receive an additional Foundation bonus promised by node i :

$$US'_{a,i} = \gamma \cdot U_{a,i} \cdot \left(\frac{pb_i \cdot S_i}{S_i - FP_i} + \delta \right)$$

- When staker a stakes on **the top 49 consensus nodes except the aforementioned seven nodes**, how the additional Foundation bonus is dealt with will depend on the rules set by the nodes themselves.

3.2.3 Other Incentives Promised by the Nodes

Some nodes may promise additional incentives, such as distributing their own tokens to stakers according to their own set of rules.

Appendix

A. The Ontology Incentive Curve

The Ontology Incentive Curve shows the relation between the node stake ratio and the incentive coefficient in the consensus node network fees incentive and released ONG incentive. The formula for the Ontology Incentive Curve is:

$$x_i = \frac{\eta}{\bar{\sigma}_s} \cdot S_i,$$

$$\alpha_i = x_i \cdot e^{-x_i}.$$

Currently, $\eta = 0.5$. If the number of consensus nodes is n , and the ratio of the staked amount S_i in node i to the average staked amount $\bar{\sigma}_s$ across all consensus nodes is P_i , that is, $P_i = \frac{S_i}{\bar{\sigma}_s}$, then we have $P_i \in (0, n)$. The figure below shows the relation between P_i and the incentive coefficient α_i . It can be seen that when $P_i = 2$, that is, when the total staked amount of node i is twice the average staked amount across the consensus nodes, its incentive coefficient reaches a maximum of e^{-1} , at which time it receives the highest possible allocation of network fees and released ONG relative to the other consensus nodes.

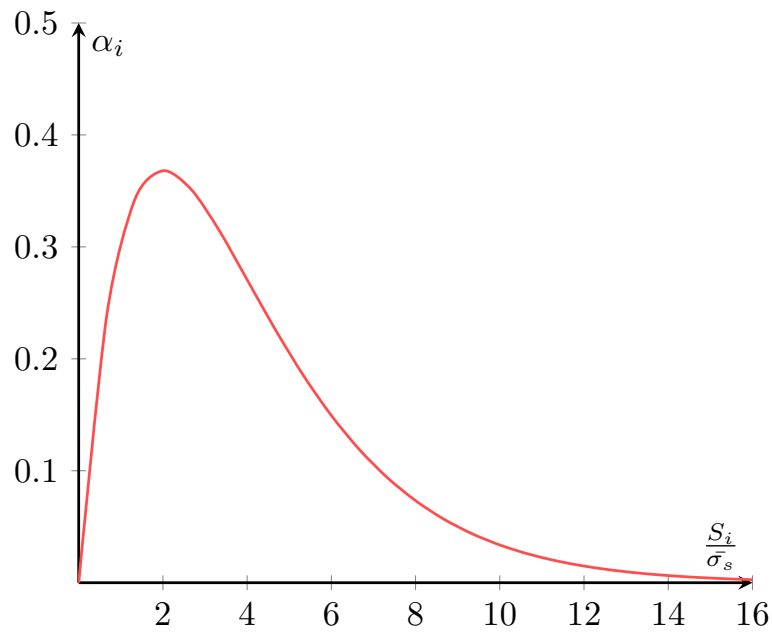


Figure 1: Ontology Consensus Nodes Incentive Curve