Thetan Arena Tokenomics report

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Introduction to the game

Thetan Arena is a successful example of the Free to Earn games and it was launched in Nov, 2021. It is a Multiplayer Online Battle Arena (MOBA) game with unique gameplay and interesting tokenomics design. The main features of the game are:

- Unlike Axie Infinity, players do not need to pay some initial amount to play the game. They can start playing and earn rewards. Although, the highest payoff would be possible only when users buy new heroes and upgrade the current ones. This is an amazing strategy since it attracts more users and increases the demand for the native tokens of the game.
- The tokenomics of the game consists of two tokens THC and THG (utility tokens) and the NFT heroes.

We start with the gameplay overview and the technical characteristics of the game itself. We then illustrate the tokenomics of the game, the utility of the tokens and their macro structures. We finally present a simulation of the Economy behind the game, and discuss the structure of the game and the incentives of the different entities.

1- Gameplay overview

Each user is given three free heroes in the beginning. He can start to play and earn with them and he can also upgrade them in different stages of the game, but it is not possible to sell them at any point. To maximize their rewards, users can buy new NFT heroes from the marketplace, who have a higher set of skills and consequently a higher probability of winning. In the following, we discuss different types of heroes and their features:

Heroes:

Like any other MOBA game, Heroes are the user's main tool to participate in the game and earn rewards. Heroes can have three different types: Assassin with low health and high attack who are useful for swift kills, Tanks with high health and low mobility who are useful for protecting their teammates, and finally marksmen with high attack and normal mobility who provide high damage per second (DPS).

Heroes also have two sources of rarity: basic rarity with different levels of common, epic and legendary, and skin rarity which is the frequency of the skin in the selling pool. Skin rarity is also in three different forms: Default, Rare and Mythical. Rarity of a hero is an important factor that determines the limit for the number of times the hero can be used to play overall or in one day.

These limits are as follows:

Hero Rarity	Skin Rarity	Min gTHC Battles	Max gTHC Battles	Daily gTHC Battles
Common	Normal	215	227	8
Common	Rare	228	240	8
Common	Mythic	241	253	8
Epic	Normal	348	373	10
Epic	Rare	376	402	10
Epic	Mythic	405	433	10
Legendary	Normal	753	829	12
Legendary	Rare	839	923	12
Legendary	Mythic	933	1,026	12

Min/Max gTHC Battles determine the total battles eligible for earning gTHC, and it is not possible to earn any rewards after reaching this limit. Note that different heroes might have slightly different limit values.

Daily gTHC Battles determine the total battles eligible for earning gTHC in one specific day.

Upgrade:

In the most general case, users have two different strategies to increase their winning chances. One is to buy new heroes from the marketplace and the other is to upgrade the existing ones. Upgrading increases hero stats by 1.5% at each level and it also increases the gTHC battles and winning bonuses.

There is an important difference between buying and upgrading heroes (From the tokenomics point of view). Users have to spend THC to buy new heroes, so it will increase the THC demand, but they should upgrade their heroes by paying THG tokens.

It is also necessary to talk about the cost of upgrading that depends on the level and rarity of the hero and it is as follows:

Level	POWER POINT			gTHG (*)		
	Common	Epic	Legendary	Common	Epic	Legendary
2	50	100	150	1.00	1.50	6.00
3	100	150	250	1.00	1.50	6.00
4	150	200	350	1.36	2.55	9.50
5	200	250	450	1.36	2.55	9.50
6	250	300	550	1.72	3.60	13.01
7	300	350	650	1.72	3.60	13.01
8	350	400	750	2.07	4.66	16.51
9	400	450	850	2.07	4.66	16.51
10		500	950		5.71	20.01
11			1,050			20.01

Game modes:

There are four different game modes: Battle Royale(Solo/Duo), Tower siege, Super star and Deathmatch. You can find a detailed description of each one of them in the game's whitepaper. The important points about the game modes are:

- They are different in structure, number of players and time limit.
- Battle Royale is the most played one, and I think this is the reason the development team implement a deflationary mechanism in it.
- It is also possible to create a custom game mode.

Rewards:

After each match, NFT heroes will be rewarded according to their performances and ranks (battle reward) and their rarities (bonus). Note that the rewards are paid with THC tokens and they are as follows:

Battle rewards:

Team Modes

Battle Result	gTHC
Win	6.00
Draw	2.00
Lose	1.00

Battle Royale - Solo mode

Battle Royale - Solo

Battle Result (Rank)	gTHC
1	6.013
2	4.738
3	3.463
4	2.188
5	0.913
6	0.000
7	0.000
8	0.000
9	0.000
10	0.000
11	0.000
12	0.000

Battle Royale - Duo mode

Battle Royale - Duo

Battle Result (Rank)	gTHC
1	5.375
2	2.825
3	0.275
4	0.000
5	0.000
6	0.000

Bonuses:

Hero Rarity	Skin Rarity	Win bonus (gTHC)
Common	Normal	3.25
Common	Rare	3.25
Common	Mythic	3.25
Epic	Normal	6.50
Epic	Rare	6.50
Epic	Mythic	6.50
Legendary	Normal	23.55
Legendary	Rare	23.55
Legendary	Mythic	23.55

2- Tokenomics

Thetan Arena has three virtual assets: Hero NFT, THC and THG. THC and THG are two BRC20 tokens implemented on Binance smart chain, and they are the utility tokens of the game.

THC:

THC is the main utility token of the game that can only be earned by playing the game or completing the quests that are proposed throughout the game.

. The main utilities of THC are:

- Pay for the Hero boxes, which are the only source of Heroes of all rarities in the game.
- Rewarding other players that stream the game.

Macrostructure of the THC token:

There are several points that we need to take into account when we analyze the THC supply:

- THC token has an unlimited supply. They are being published in accordance with the number of battles and the number of active users. In other words, as the game's community becomes bigger and stronger, more tokens will be published.
- This source of overinflation is the main reason for the token's poor performance in the market.
- The development team implemented a mechanism for deflation. It is a series of THC token burns that took place in January 2022, April 2022 and June 2022.

THG:

 THG is the second utility token of the game that is mostly used for currency or the medium of exchange in the ecosystem. The main utilities of THG are:

- Upgrading heroes to increase the chance of winning in battles.
- Governance
- Staking
- For every transaction, the fee of 4% will be charged in THG. We will see later in the simulation section that it is a strong source of demand.

There are plenty of ways to earn THG such as:

- participating in the events organized by the community and tournaments
- participating in governance
- staking NFT heroes or THG

Macrostructure of the THG:

- The total supply of the THG token is 420 million.

- Token distribution is as follows:

TOKEN METRICS

It seems to be a fair distribution of tokens among the participants.

- The token issuance takes around 4 years starting from September 2021. Although around 55% of the token's liquidity was issued in the first year. This is a huge inflation rate even for an online game with high demand in the beginning.
- One very interesting point about the tokenomics of the THG token is that its supply is growing almost linearly, but the demand is growing at a higher rate since it is a function of the number of users. The more people participate in the game, the more will sell their tokens and pay fees in THG tokens.

3-Simulation

I used cadCAD to model the ecosystem of the Thetan Arena. cadCAD is a powerful Python module that helps us to model complex systems. Although it can be used for a variety of problems such as the stock market and climate change, its most common application (at least for now) is to provide models for complicated systems such as the crypto startups and DEFI protocols.

We start with the differential specification of the model. We then discuss the assumptions we had to make and finally present the obtained results. Finally, we will talk about plenty of the questions that we can answer using the cadCAD framework.

Differential Specification:

The most important advantage of cadCAD is to provide a comprehensive structure for the analysis. This helps a lot specifically in the case where we are trying to model a complicated protocols such as Thetan Arena, which is a complex system with a number of participants and different interactions among them. The differential specification is the first step to providing a model so that we can easily determine the state variables, their respective state update functions and finally the policies that affect them. A simple structure of the thetan arena is as follows:

Differential Specification of Thetan Arena
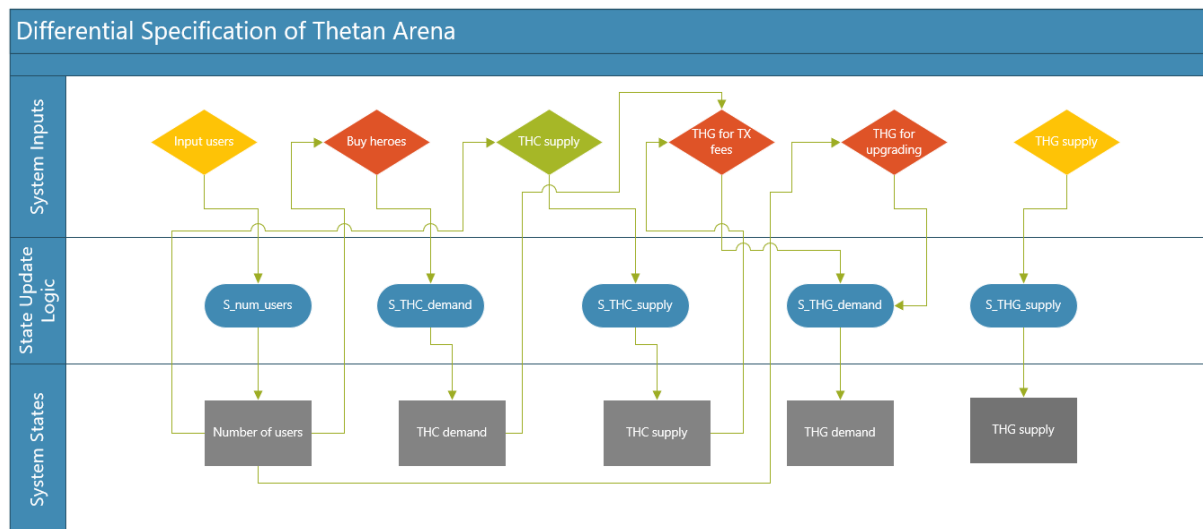
The main idea behind the partial specification is to identify the state variables of the system and the inputs that affect them. As we observe in the figure, the state variables (grey rectangles) are the number of users, THC demand and supply and THG demand and supply. Note that there is no unique way to define state variables.

Each state variable is updated using its respective state update function (Blue ellipses). In other words, state update functions are functions that take inputs (diamonds) from the system and output the state variables.

This system has 6 inputs. The yellow ones come from the environment. *Input users* determines the number of users who sign up in the game (new users) at each timestep (one day), and it has a Poisson distribution. Another environment input is the *THG supply* , which is the supply function of the THG token, and it is exogenous to the system, meaning that it does not depend on any state variables.

Red diamonds are the inputs resulting from the users' interactions. We assume that the only variable that affects the THC demand is the number of heroes bought by the users. The situation is different for the THG tokens. There are two variables that determine the THG demand function: transaction fees and upgrading fees.

Finally, Green diamonds are the inputs from the system itself. We have only one system input which is the *THC supply*. *THC supply* receives the number of users and the combination of different players and calculates the supplied amount at each timestep.

Assumptions:

Before we move on to the assumptions of the model, it is crucial to mention that the common way to analyze the economy of an ecosystem is to first categorize the participants of the game and determine a structure for their behaviors. We then use the data or agent-based simulation to estimate the parameters of this structure. Only then we can derive the aggregate behavior of the agents or equivalently, the demand side of the market. Finally, we consider different behaviors on the supply side to analyze the results of different strategies.

I did not implement the demand-side analysis here for two reasons: First I had only one week to provide a model and second, I did not have enough data to estimate the aggregate behaviors of the

agents. Instead, I considered a set of assumptions to present a simpler model for the market. The most important assumptions are as follows:

- We define three types for the users. They can be *Investors (buy heroes and keep them), Earners (play and sell their tokens) or Players (upgrade most often).*
- 20% of the agents are investors, 30% are players and the rest are earners.
- Although we include the effect of THC deflation in the THC supply input variable, we neglect its effect for now (THC_def_rate = 0).
- We assume that at each timestep, the number of people who enter the game comes from a Poisson distribution with mean 1000.
- When a user wants to buy a hero, he picks randomly from all the heroes that are available in the marketplace.
- Investors buy hero once every 10 days and the players buy once every 20 days. Earners do not buy any heroes, since they are only looking for short-term returns.
- Average fee for upgrading a hero is 4 gTHGs.
- At each timestep, the set of active users consists of 70% of players, 60% of earners and 50% of investors.
- the Average number of daily battles for each user is 14 battles. In other words, we have made an implicit assumption that one user only uses one hero each day.
- Average bonus token issued in each game is 5 gTHC.
- We only considered the Battle Royale game mode.

Results:

From the beginning of the simulation, my main purpose was to analyze the supply and demand of the utility tokens of the game. The results are as follows:

THC token:
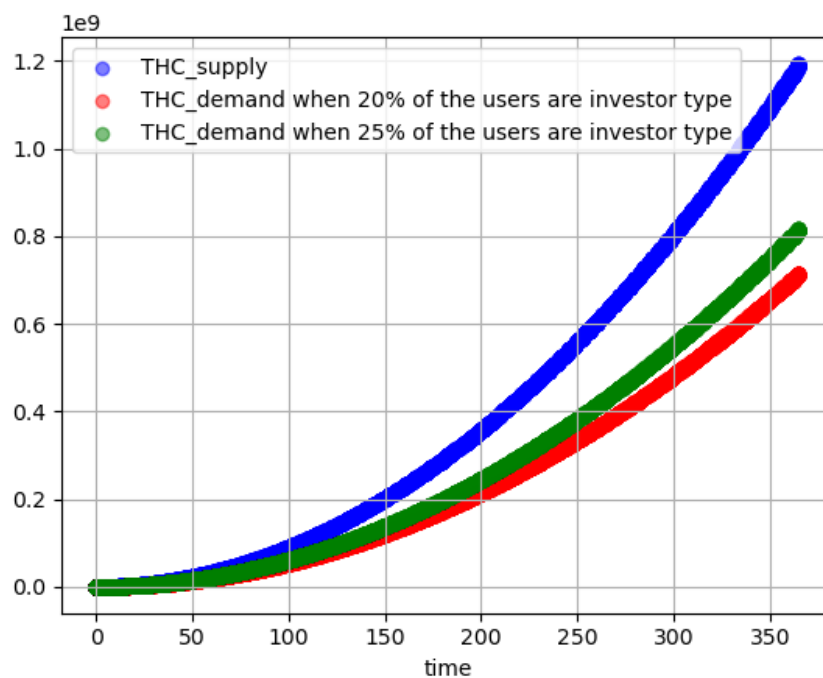
The important points are:

- Supply and demand are both increasing nonlinearly in time. As the result, the selling pressure (difference between supply and demand) is also increasing. This is one important reason for the decreasing price of THC token in the market.
- As we expected, by increasing the share of investors in the market (Green curve), the demand will be increased. The reason is that the investors are the ones who buy heroes more often and have the highest impact on the THC demand.

THG token:
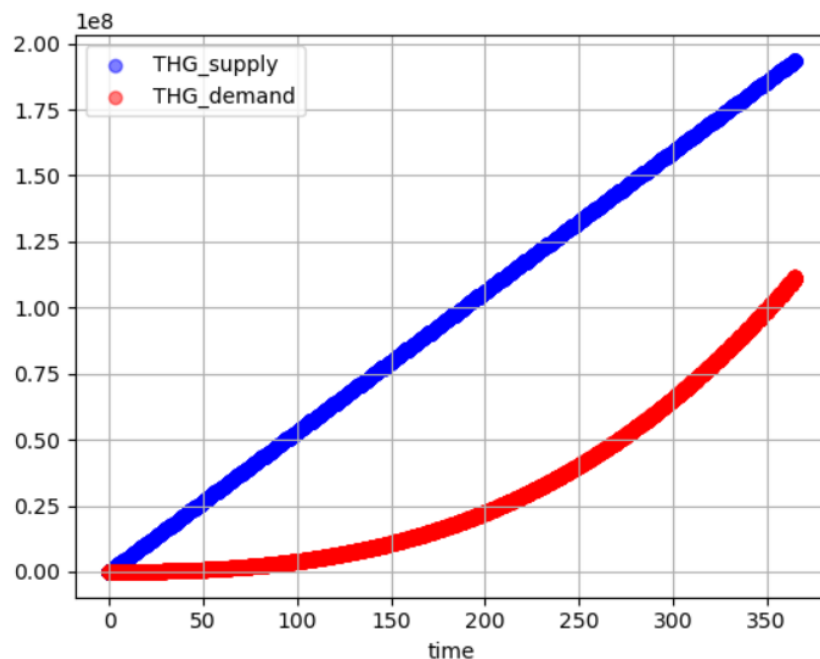
- As opposed to the previous case, the supply function is increasing linearly, but the demand function is nonlinear since it depends on the number of people in the market. I believe that this is the main reason behind the relatively better performance of the THG token in the market.

Other questions that we can answer using our simulation:

Unfortunately, I did not have enough time to perform a comprehensive analysis but the most interesting questions are:
- What is the effect of the deflation mechanism (implemented in the protocol) on the THC token supply?
- What is the best mechanism of deflation?
- There are two input variables that affect the THG demand. Which one has the highest impact?
- What is the best supply mechanism for the THG token?
- What is the best set of parameters for the model?