

Whitepaper Etherpoly

Decentralized ERC721 DApp game

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ABSTRACT

The invention of Bitcoin and Ethereum has revolutionized the digital world as we know it, by introducing the concept of Blockchain.

A blockchain is a digitized, decentralized, public ledger of all cryptocurrency transactions. Constantly growing as 'completed' blocks, transactions are recorded and added to it in chronological order, allowing market participants to keep track of digital currency transactions without central recordkeeping. The active nodes - computers connected to the network – get a copy of the blockchain, which is downloaded automatically, and use their computer power to authenticate the transactions, incentivized by the reward of cryptocurrencies for authenticating new blocks. Users often use a “light wallet”, that allows them to interact with the blockchain without having to download its data.

Ethereum has improved the blockchain concept, by introducing Smart contracts, which allow specific computation to happen within the blockchain, leading the way to decentralized applications that we refer to as DApps. There are numerous DApps that provide a multitude of different applications. Generally, DApps tend to include tokens that can be cryptographically traded through the blockchain.

There have been highly successful DApp games released, including Cryptokitties and Etherbots.

Cryptokitties, a game in which users can trade virtual cats, has generated close to \$15 million in trade value.

Etherpoly provides a decentralized game service, in which virtual tokens are created based on real Cities' characteristics. City tokens are based on the ERC-720 standard. Moreover, the game also implements its own virtual currency, based on an independent ERC-20 Token, used as a currency for the game's economy.

The service is entirely decentralized, meaning that it uses no database other than the Ethereum blockchain, and holds no personal information on its users.

By using the Metamask wallet, users of the service may acquire city tokens, and start earning virtual revenues. They can then buy other cities or upgrade their own cities, by using the earned virtual revenues.

GAME CONCEPT

Etherpoly is a fully decentralized game, based on Ethereum smart contracts, that combines the use of two set of tokens.

POLY, the first set, are standard ERC721 tokens, virtual cities that users can freely acquire, upgrade and trade.

OLY, the second set, based on standard ERC20 tokens, is the currency system and represents the economy of the game.

By acquiring POLY virtual city tokens, users start earning recurrent OLY revenues - based on an algorithm that takes into account the city's properties - until the user sells or transfers the POLY token.

The user can then use the earned OLY tokens to upgrade their virtual cities, or acquire additional cities.

Once upgraded, cities start earning additional revenues.

There are four types of upgrades, each with their own advantages. Depending on cities characteristics, some upgrades will yield better improvement than others. Hence, the most profitable upgrade for each city will not be the same.

Both POLY and OLY tokens, once acquired, are solely owned by the user, and are freely tradable, and transferable.

Users define whether or not their cities are for sale. They can set them for sale in exchange for OLY, and/or ETH, and define the desired value for each cryptocurrency. Or they may define them as not currently for sale, and keep acquiring passive revenues.

While the list of available countries is hard-coded into the contract, meaning that they cannot be added anymore, Cities will be added progressively throughout the development of the game. This means that the set amount of cities that may be added is limited, unlike other DAP games in which tokens can be minted without limits.

The list of hard-coded countries is as follows:

Country	Population	GDP (in \$ billions)
USA	323100000	18570
China	1379000000	11200
France	66900000	2465
South Korea	51107797	1441
Japan	126194685	4884
Germany	81365343	3652
United Kingdom	65861628	2565
India	1355621800	2439
Brazil	213202329	1921
Canada	36991986	1640
Russia	146466710	1469
Australia	25039715	1390
Spain	45878041	1307

Mexico	131951936	1142
Indonesia	266895567	1011
Turkey	82491371	841
Netherlands	17090565	824
Switzerland	8573481	681
Saudi Arabia	33645897	679
Argentina	44684737	620
Taiwan	23591604	571
Sweden	10008633	542
Poland	38639940	510
Belgium	11510188	492
Thailand	68684785	438
Iran	81938060	428
Austria	25039734	409
Egypt	97187207	408
Nigeria	22176294	395
Norway	5397619	392
UAE	9542843	379
Israel	8446249	348
South Africa	56175824	344
Hong Kong	7455354	334
Ireland	4728945	326
Denmark	5736458	324
Malaysia	31637840	310
Colombia	49571747	307
Singapore	5921295	306
Pakistan	200195156	304
Chile	18487758	263
Finland	5581914	251
Vietnam	96392488	216
Venezuela	32347707	215
Portugal	10224152	212
Peru	32543775	210
Romania	19078379	205
Greece	10833357	204
New Zealand	4618946	201
Iraq	39880904	193
Qatar	2562082	166
Hungary	9768789	132
Kuwait	4457395	118
Morocco	35280000	111
Ukraine	42264829	104
Puerto Rico	3667634	103
Lebanon	6927630	53
Cote d'Ivoire	24244054	40
Uganda	42672478	26

Iceland	336002	25
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The entirety of the service is decentralized. The site of the service uses no database, and interacts directly with the Ethereum blockchain. This means that future applications, whether on Etherpoly website, or by third parties, may be built based on the POLY and OLY tokens.

OLY REVENUES

OLY is the cryptocurrency that is used by the POLY Smart contract. It is the official currency of Etherpoly.

OLY is based on the standard ERC20 specification, has 3 decimals and implements the payload security layer.

This cryptocurrency is rather unique, in a way that:

- The owner of the Smart contract doesn't start with an initial balance, other than a small amount that is used for initial deployment test packages.
- The balance of the cryptocurrency is exclusively generated through City revenues, starting from the moment of their addition into the game.
- It cannot be minted by the owner.
- Standard specifications functions are public, and openly accessible, including the functions for total supply, user balance, approval and transfer, meaning it could be listed on exchanges.
- However, functions that include generation of OLY based on City revenues, expenditure when upgrading cities, and transfer related to the acquisition of a city through OLY, can only be accessed through the POLY ERC721 Smart contract, which is the Smart contract holding the virtual City tokens of the game.

The frequency at which revenues are calculated is hourly. Meaning that every hour, a user earns the revenues for each cities that he owns.

However, the balance update occurs at specific events, in order to avoid needless gas expenditure:

- When using OLY to upgrade a City
- When selling a City, the user that is selling the City gets his earnings before transferring it
- When acquiring a City with OLY
- Or when the user manually updates the revenues balance for the City

The Ether balance of Users, that updates whenever they sell a city for ETH, must be manually retrieved so they can receive their Ethers. This is a standard security feature in modern Smart contracts.

Etherpoly holds a 5% commission on the value of the sale of Cities in ETH. Meaning, it takes 5% of the total value of the transaction in ETH. However, there are no commissions for City sales in OLY.

The formula for the algorithm that defines the value of the revenues for each City takes into account two key characteristics, the City's population, and the Country's GDP:

$$\text{Monthly revenues} = [\text{CITY POP} * x \text{ GDP IN BILLIONS} / 100000000 * 24 * 30]$$

Upgrading Cities increase their revenues output. There are four different types of upgrades, on top of the default state, each with their own specific boosts to revenues:

Upgrade type	Percentage boost	Fixed value boost (monthly)
None (Default)	-	-
Housing	+25%	-

Hotels	+50%	-
Offices	+15%	50 OLY
Factories	-	100 OLY

In most cases, while Cities with high revenues will yield better profits with Housing or Hotels upgrades, Offices and Factories will provide a better alternative for Cities with low revenues.

The formula that determines the cost for each upgrade must also take into account key characteristics of Cities, since the value generated by the revenue boost depends on the actual base revenues:

$$\text{Upgrade cost} = [(\text{MONTHLY BOOSTED REVENUES} - \text{MONTHLY BASE REVENUES}) + \text{ADDITIONAL COST}]$$

The additional cost factor depends on the type of upgrade:

Upgrade type	Additional cost formula
Housing	COUNTRY GDP (BILLIONS) / 10
Hotels	COUNTRY GDP (BILLIONS) / 5
Offices	COUNTRY GDP (BILLIONS) / 8
Factories	COUNTRY GDP (BILLIONS) / 15

Based on the above information, we can determine the key attributes of Cities. Below is an estimated hypothesis of some data for a few cities:

City	Population	Revenues	Rev + Hotel	Rev + Factory
New York	8,537,673	1,141,521	1,712,282	1,141,621
Jersey City	264,290	35,337	53,005	35,437
Shanghai	22,315,474	1,799,520	2,699,280	1,799,620
Paris	2,138,551	37,955	56,933	38,055
Versailles	85,416	1,516	2,274	1,616
Tokyo	8,336,599	296,516	444,774	296,616
Nagasaki	410,204	14,590	21,885	14,690
Seoul	10,349,312	105,141	157,711	105,241
Moscow	10,381,222	95,898	143,846	95,998
London	7,556,900	142,499	213,748	142,599
Oxford	171,380	3,232	4,848	3,332

Please keep in mind that there may be variations in numbers, as Solidity – the programming language for smart contracts – does not offer support for floating points.

When Cities are added into Etherpoly, they are setup with an initial acquisition cost, both in OLY and ETH. Initial acquisition cost for Cities are based on the following formulas:

OLY Initial value formula:

$$[\text{City monthly revenues} * 30 + 250]$$

Eth Initial value formula:

$[Population * GDP (BILLIONS) / 1000000000 * Bonus]$

Bonus can range between 200% and 300% for some of the top tier cities.

All future implemented cities will both be available for sale in ETH and OLY.

However, these formulas may change based on different parameters, including but not limited to, OLY abundance, City scarcity, Trade volume, etc.

CORE FUNCTIONS

The Etherpoly game mechanic interacts with various core functions, on both POLY and OLY Smart contracts:

Core function	Smart contracts	Type
Total supply	POLY, OLY	View only
Balance of	POLY, OLY	View only
Tokens of	POLY	View only
Owner of	POLY	View only
Approved for	POLY	View only
Transfer	POLY, OLY	Public (only owner) PayLoadSize protection
Transfer from	OLY	Public
Buy token wei	POLY	Public (payable)
Set eth value token	POLY	Public (only owner)
Set oly value token	POLY	Public (only owner)
Set city upgrade	POLY	Public (only owner)
Get user Balance	POLY	View only
Withdraw users	POLY	Public (Payable)
Approve	POLY, OLY	Public (only owner)
Allowance	OLY	View only
Increase approval	OLY	Public (only owner)
Decrease approval	OLY	Public (only owner)
Is approved for	POLY	Internal
Clear approval and transfer	POLY	Internal
Clear approval	POLY	Internal
Take ownership	POLY	Public (requires approval)
Mint city	POLY	Public (only owner)
Add token	POLY	Internal
Remove token	POLY	Internal
Burn owned cities (only Owner)	POLY	Public (only Owner, creator can't burn other users' tokens)
Set OLY address	POLY	Public (only creator)
Get OLY total supply	POLY	View only
Get city revenues value	POLY	View only
Get upgrade cost	POLY	View only
Oly update revenues	POLY	Public (only owner)
Oly buy token	POLY	Public
Oly upgrade city	POLY	Public (only owner)
Oly get balance	POLY	View Only
POLY update gen revenues	OLY	External (only POLY)
POLY transfer	OLY	External (only POLY)

In Etherpoly, users' Ether balance, that is updated when selling Cities with Ether, must be manually retrieved in order to be credited.

Etherpoly smart contracts have included security best practices in order to provide a secure environment. However, despite these measures, users must be aware, and accept that there may still be security risks related to the use of Blockchain, Decentralized applications, and the Etherpoly service, as there might be bugs or security vulnerabilities yet to be uncovered, that may cause service disruption or token and/or monetary loss, as specified in our Terms of Service.

TECHNICAL CONSIDERATIONS

In this section are detailed technical considerations regarding the implementation and interactions of the game on the Smart contracts, in the Ethereum blockchain.

Basic requirements

In order to play Etherpoly, users need Chrome or Firefox with the MetaMask wallet extension installed, as well as some available Ether in the primary wallet in order to acquire the first City.

MetaMask Digital Wallet

Etherpoly takes into account the primary active account on Metamask.

Ethereum

The Ethereum blockchain uses Ether as its official cryptocurrency, and requires gas for transactions. Ether can be acquired through Exchanges, by converting FIAT money (\$ / €) or other Cryptocurrencies. Gas is calculated in Wei, which is the smallest possible scale unit of Ether. When acquiring, or selling cities, Etherpoly makes use of Ether as well as its own cryptocurrency, OLY.

For more information regarding Ether scale units, please visit <https://etherconverter.online/>

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