ATOR

TOKENOMICS

Abstract

The purpose of this document is to provide insight into the monetary and fiscal policies of the ATOR token, which is the principal utility token of the ATOR Protocol. The project's goal is to drive adoption of decentralized relay-operated networks, such as Tor, by creating cryptocurrency incentives for relay participation, fostering a technically educated community of relay operators, and building a broader ecosystem for anonymous services powered by ATOR. Further to the protocol itself, ATOR produces signature hardware enabling ordinary people to contribute their bandwidth and offer services.

The ATOR token is an ERC20 token developed on the Ethereum network. It is a fixed supply token that will serve as a core payment method and incentivization driver on the ATOR Protocol. The token will be given as a recognition reward to relay operators while also generating governance rights. The ultimate goal of the ATOR token is to be the primary currency for anonymous web2 and web3 services running on decentralized nodes worldwide.

This paper is intended to be a living document, much like the Technical Whitepaper, and is subject to clarifications and improvements as the ATOR Team continues to innovate.

About FinDas

We are a team of crypto professionals with over 150+ crypto projects behind our backs and overwhelmingly positive feedback from our clients. Our team has a wide array of token economy specialists in various aspects - DeFi, CeFi, NFTs, and DAOs. We help design projects in a financially feasible and fiscally responsible way.

Hristo Piyankov has over ten years of experience in analytics, data science, machine learning, big data, and AI with a financial background. He was an Analytics Director for one of the largest consumer finance companies in the world's largest consumer market (China). During this time, he led several complex international projects to fruition. He is an expert in data modelling of all kinds (financial, forecasts, estimations, budgeting, machine learning, statistical).

Now he is working with various blockchain start-ups, helping them figure out their token economies and data problems. He is passionate about making sure that data works for the business and not the other way around. Hristo is an expert in Blockchain, Solidity, Python, and algorithmic trading, not to mention spreadsheeting and analysis.

Core

Website:
https://ator.io

Docs:
https://docs.ator.io

Announcements:
https://t.me/atorprotocol

Education:
https://educ.ator.io

Technical

GitHub:
https://github.com/ator-development

Technical Whitepaper:
https://github.com/ATOR-Development/resources/blob/main/ATOR_Technical.pdf

Issues/Development Channel:
https://t.me/atordevelopment

Socials

Twitter:
https://twitter.com/atorprotocol

Medium:
https://medium.com/@atorprotocol

YouTube:
https://www.youtube.com/@atorprotocol

Discussion

Official Discussion:
https://t.me/atorofficialportal

Price Discussion:
https://t.me/atorcommunityportal

Discord:
https://discord.gg/ator

Contract eth: 0xOF7B3F5a8FeD821c5eb60049538a548dB2D479ce

Executive Summary ATOR

User privacy and sovereignty has virtually disappeared from modern technology and constant monitoring and censorship has been normalized. ATOR aims to address this and give control of internet networks and personal data back to users. Through a combination of the ATOR Protocol and its signature hardware, the project provides people the tools they need to support and use alternative, more decentralized internet technologies that protect users' freedoms.

The ATOR Protocol is a scalable web infrastructure and decentralized token distribution layer, that together allows internet relays to earn ATOR tokens for contributing their bandwidth, starting with the Tor network and then broadening to a range of use-cases. ATOR aims to have 250,000 active relays on the protocol within 5 years.

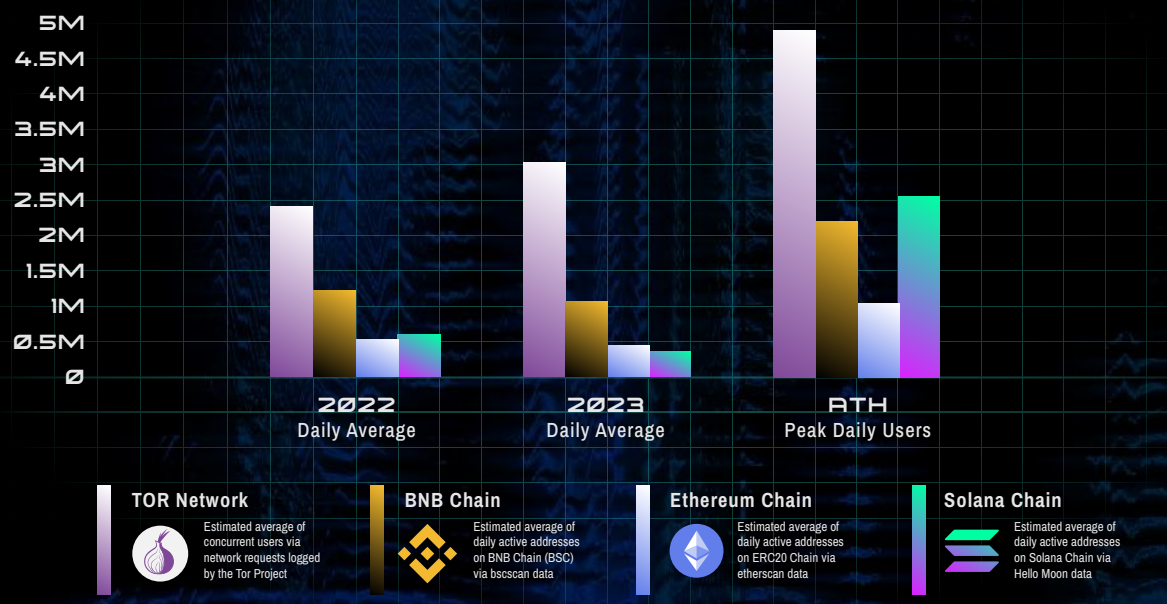
ATOR Protocol: The TOR Network

The Tor network enables individuals to browse the internet anonymously by routing users' encrypted traffic through distinct nodes, whilst ensuring that no intermediary can infer the traffic source. It relies on a distributed network of relays, run by a large enough number of operators, to continuously encrypt and reroute user traffic.

The ATOR Protocol is built to recognize the useful bandwidth contributed by registered relays to the Tor network. Based on Proof-of-Uptime - an aggregated consensus weight for each node - relay operators are rewarded the ATOR token. Thus, the ATOR token can represent a store of value that can be earned by contributing truly useful computation to a global network, in a cost and energy-efficient way, by a diverse number of participants.

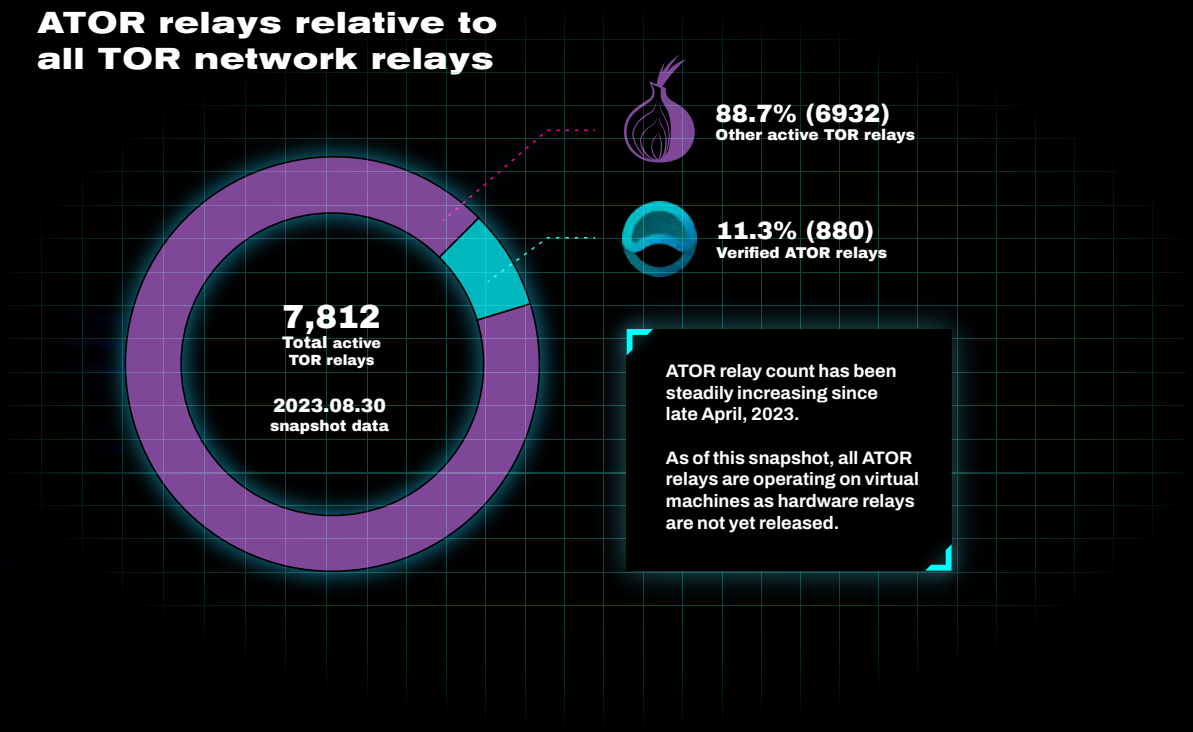
Comparison of users numbers by service

How privacy network user numbers compare to those of popular blockchains



Tor is the largest and one of the most established protocols for internet anonymity, with more daily active users than large swathes of DeFi. While Tor was instrumental in the adoption of Bitcoin, it has been subject to considerably less investment and external development than cryptocurrency. ATOR is the movement that brings focus back onto true internet anonymity and builds the foundation to onboard millions of users into a more decentralized and sovereign internet ecosystem. One of the measures of success of the ATOR Protocol will be the number of registered relays contributing to Tor; while still in testnet, ATOR has surpassed over 1000 registered Tor relays. ATOR-registered relays contribute 6-8 GB of bandwidth to the network every second.

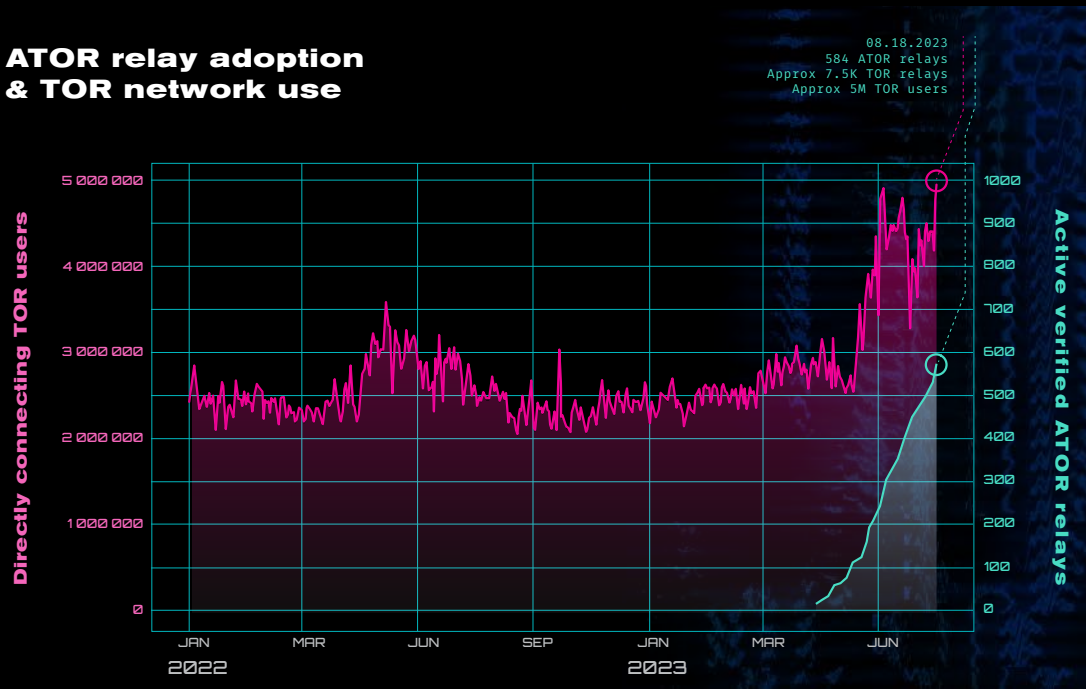
ATOR relays relative to all TOR network relays



Active registered Tor relays registered to ATOR, against other active Tor relays. Note that ATOR is developed independently from the Tor anonymity software and carries no guarantee from the Tor Project.

Furthermore, the Tor network itself is experiencing a 10-year high in daily active users. Through our continual education and outreach, ATOR hopes to accelerate the mindset change that internet privacy is a right to be actively pursued, regardless of whether you have anything to hide. The potential for growth in the number of users and internet services on censorship-resistant networks is immense.

ATOR relay adoption & TOR network use



ATOR Hardware

ATOR has developed its signature hardware – the ATOR Relay – a small, low powered device that can be used as a relay by connecting either to Wi-Fi or Ethernet. It is a sleek device built for easy setup, configuration and maintenance for the non-technical user.

ATOR PROTOCOL
HARDWARE RELAY v1.0

dual-cortex 1.5GHz CPU

4GB LPDDR4 RAM

16-64Gb of eMMC storage

encryption chip with CryptoAuth key generation

802.11 n/ac WiFi

inbuilt fan and ventilation

1000Mbps ethernet

USB 3.0 and USB C 5V power

In addition to running as a node in networks, the ATOR Relay hardware can create an outbound connection and act as an access point for users to connect their own devices (i.e., it can act as a 'router'). While previously planned as a separate device for 2024, the ATOR Router functionality will instead be delivered inbuilt in future iterations of the ATOR relay and be delivered as a firmware update to the first batches of relays. The router update creates a dual device that can route a user's network activity through Tor while earning ATOR recognition at the same time.

The size of the global Virtual Private Network (VPN) market was valued at 49 billion in 2022 and is expected to grow 7-fold over the following decade, while the home router market cap at 12 billion. ATOR aims to aggressively eat into both networks and enable the mainstream internet user to use fast, reliable and truly private internet through Tor.

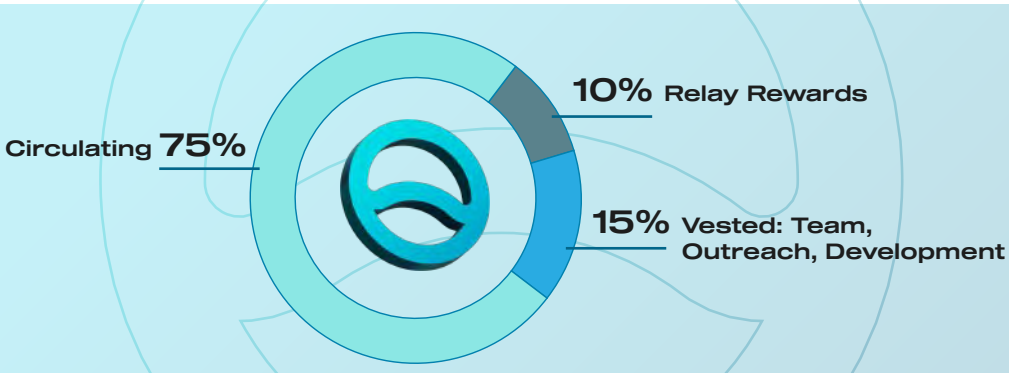
ATOR Phase I
Distribution & Relay Rewards

ATOR Token Distribution

The ATOR token is an ERC20 token with a fixed total supply of 100,000,000.

As of September 2023, 75% of ATOR token supply is circulating, with the remaining allocated as follows:

- 10% of supply will form the pool of tokens that fund the perpetual tokens rewards for Tor relays.
- 15% of supply is linearly vested over 18 months, supporting outreach, partnerships, development, listings and team funds.
- 75% is currently circulating, including tokens within LP pairs and exchanges.



ATOR is a fair-launched token, with no presale or VC holding. Our unique raise contract used in the launch stage, and the 4/4 tax for trading ATOR on the Uniswap WETH/ATOR pair, have together enabled us to self-fund our mission without large institutional or VC holding. The application of linear vesting prevents sudden, large token unlocks that have caused issues for other newer cryptocurrencies.

Note: Change in Source of Funds for Relay Rewards

Following the 24th of August token unlock, the source of funds for the 10% recognition rewards changed from the 18-month vesting contract (address: 0x234...81b) to the token unlock. This is a move towards greater predictability and availability of funds, allowing the entire 10% to be moved to the facilitator vault shortly after mainnet launch.

The 10% of supply that makes up the base relay rewards is currently in 4 secured multi-signatory wallets and 1 locked wallet, for the duration of the current testnet period.

Funding

The ATOR token contract has a 4% tax on both buys and sells when trading ATOR on the Uniswap WETH/ATOR pair. There is no fee on transferring tokens. The fees have been essential in enabling our astounding rate of development across enterprise level infrastructure, software, hardware, education and outreach. In addition, part of our fees is used for automatic liquidity, with over 700k USD of LP created, all of it burnt.

As ATOR solidifies its foundation, they will begin lowering fees from Q1 2024 with the eventual plan of being a 0-tax token.

Relay Reward Economics

It is almost impossible to get a project's token economy right from the start. On the one hand, there are unknowns that must be assumed (such as the number of users and their activity), and on the other hand, there are macro conditions that are unpredictable, such as the sentiment of the crypto community and markets. As a result, when designing a token economy, we prefer to adhere to fundamental principles that reduce the likelihood of significant economic instability in the future.

CRUCIAL BREAKING POINTS. There are certain events from which it would be very difficult for a token economy to recover. Several examples include the exhaustion of incentive tokens, the takeover of the project's governance by whales, and hyperinflation of the token. Given that prevention is significantly more effective than corrective action in these situations, our tokenomic design aims to reduce the likelihood that these events will occur in the first place.

VARIABLES. Every token economy has variables that must be adjusted in response to internal and external factors affecting the token economy's performance once the project is live. As previously mentioned, it is impossible to account for every contingency. However, we can (and should) design the token economy with multiple levers that allow the project team (and eventually the community) to make course corrections when necessary.

TOKEN PRICE. Throughout this document, we have sought to develop and demonstrate token economy principles that support price stability and long-term demand for tokens.

Phase I of the tokenomics report has been thoroughly simulated and tested by FinDas.

Reward Prerequisites

To be eligible to receive ATOR recognition rewards, users must lock 100 ATOR for 180 days in a lock contract. Once the 180 days have elapsed, the ATOR does not need to be re-locked, but must be kept within the lock contract for the user to continue to receive rewards. Users can operate multiple relays on the same wallet, so long as they declare the relays as a family and lock 100 ATOR for each.

Importantly, the lock contract will include the feature to delegate a 100-ATOR lock onto another ETH wallet public key, paving the way for mechanisms to keep the registration process gas-less for incumbent relay operators. In addition, purchasing a physical device removes the need to lock 100 ATOR tokens in order to earn ATOR.

Reward Structure

A common issue in the blockchain space is that projects tend to give huge incentives (in order to prop-up their token price) up-front and then eventually run out of tokens by doing so. A more elegant approach, inspired by Bitcoin, is a perpetual pool, where the rewards gradually go down over time, in order to ensure that the pool cannot run out of tokens to give in the foreseeable future. The pool is perpetual because only a fixed percentage of the **remaining** funds will be distributed each period.

The pool operates on an epoch basis, where each epoch has a fixed number of per-block rewards (for simplicity, we will refer to the daily reward rate, from which the per-block reward can be obtained simply by dividing by the number of blocks within the day). In turn, the epoch reward is always determined by the outstanding number of tokens in the reward pool.

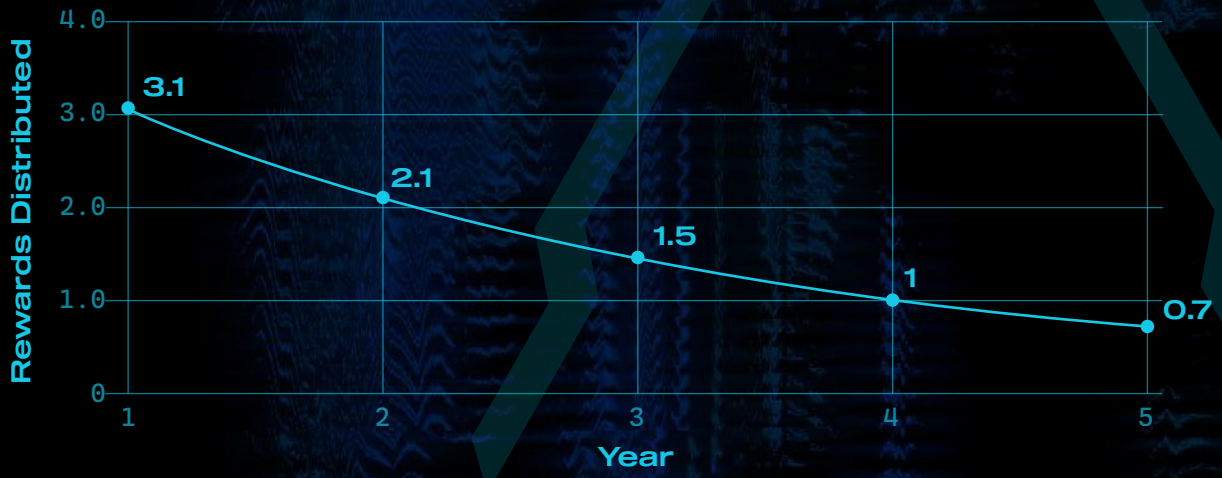
1. The pool starts with 10,000,000 tokens.
2. The epoch daily reward is set at 0.100% of the pool's tokens. This means that each day, for the first epoch, the pool will distribute 10,000 tokens.
3. The epoch duration is 15 days, so on day 15, 150,000 tokens have been distributed.
4. Epoch Two starts. The tokens in the pool are now 9,850,000. The Epoch reward is still 0.100%. This works out to 9,850 tokens per day for the next 15 days.

In summary, the variables determining the reward distribution are:

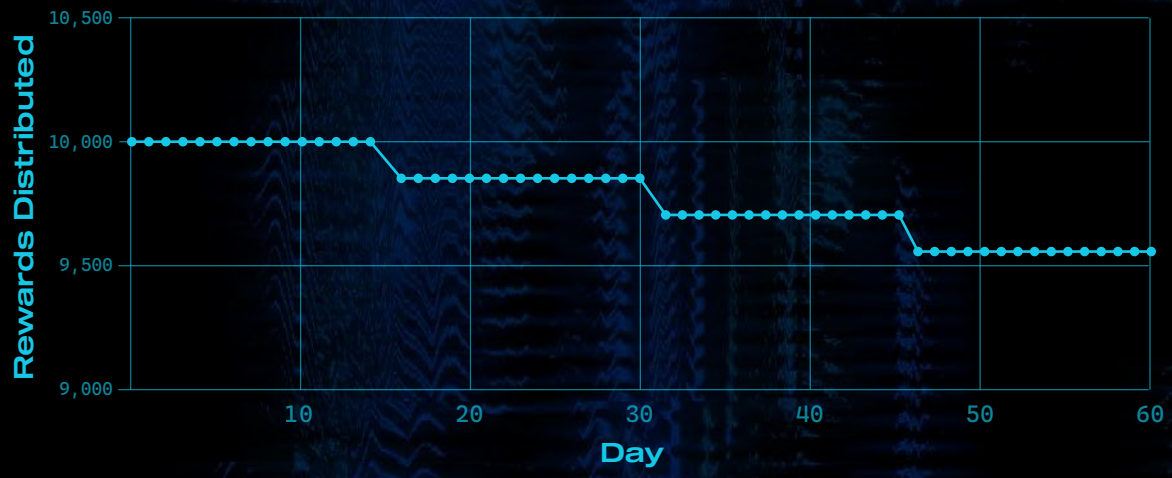
- 0.100% of the outstanding tokens in the pool will be used as a basis for the daily epoch rewards.
- Epoch duration of 15 days

The 0.100% number is picked as targeting an annual inflation rate of circulating supply of around 3.5% in the first year and gradually reducing it from there on. This gives the pool a half-life (the time it takes for 50% of the remaining tokens in the pool to be depleted) of 693 days or 46 epochs.

The above translates to the following yearly and daily distributions (for the first 60 days):



Net distribution from the pooled allocations



First 60 day reward distribution and depreciation from the pool(s)

ATOR Hardware Economics

Physical Devics Sale

ATOR's physical device sale will commence from Q4 2023. The first product released will be the ATOR Relay, which allows users to support traffic over the TOR network by contributing bandwidth.

FIRST SALE – 1000 UNITS

The first sale of the ATOR Relay hardware will commence from the end of Q4 2023. It will be a commemorative sale of 1,000 relays. For each relay, there will be an NFT that becomes redeemable for the physical hardware, and, when held, provide a bonus on top of the base relay rewards.

The NFT sale will be conducted with a partial whitelist; over the first 24 hours of the sale, only 500 whitelisted wallets will be eligible to mint the relay NFT. After the 12-hour period, all unsold relay NFTs will be available through a public mint for any wallet holding 100 ATOR, with a cap of one per wallet.

Holders can be awarded a whitelist through passing community-driven 'missions' organized by the team, awarded for activities including running a relay or committing to outreach and education, with spot whitelist giveaways throughout Q4 2024.

The initial 1,000 devices can be purchased for 0.1 ETH plus 250 ATOR (plus shipping and tax) but subsequent sales will happen in one of a range of currencies (and over time the price in ATOR might be adjusted in order to be close to the 250 USD reference amount). The user will have to stake their NFT to activate the bonus rewards.

Physical Devics Rewards

As mentioned in the previous section, all physical device purchasers will receive an NFT together with their physical device purchase. 30%* of each Physical device sold will be stored into a Physical Device Reward Pool (PDRP) and used to reward users who purchase a Physical Device. Upon the purchase of the device the 30% will be used to purchase ATOR tokens (in case the purchase was in a different currency) and stored into the pool until needed. The remaining revenue from hardware sales will go towards the team and further development.

This reward takes the form of 100%* bonus on their relay rewards when the NFT is staked. We demonstrate the economics around this in the Relay Unit Economics section. The rewards are valid until the funds in the PRDP pool run out.

*Both the 100% bonus and the 30% going to the pool are subject to change depending on current economic conditions such as the price of the ATOR token and demand for Physical Devices.

During year 1, ATOR will distribute around ~3 MM in ATOR tokens as recognition rewards for relays. Assuming an extreme scenario where 100% of those are Physical Devices, then the protocol needs an additional 3 MM in ATOR tokens as extra rewards. At around 500 ATOR per Physical Device and 30% going to the pool, the protocol needs to sell 20,000 Physical Devices in order to guarantee the bonus rewards from the PDRP for year 1.

Relay Unit Economics

Having defined all the components of the ecosystem, we can then ask the question: What are the potential earning and ROI on relays within the defined token monetary and fiscal policies?

Each ATOR physical device consumes between 50-100 KWh per year and generates income from two primary sources:

- Extra Rewards through NFT Multipliers
- The relay rewards pool

The average price of electricity is around 23 cents in the United States and an average of around 28 cents in Europe per KWh. Using the average of the two numbers, this gives us an operating cost of 26 USD to run a relay + the original 250 USD investment (for the physical device buyers). As detailed in the hardware rewards section, for the majority of the early device purchasers, this cost will be recouped several times.

The alternative approach for users would be to purchase and operate a relay via a virtual VM. The cost of this is on average 6 USD a month. While this can be reduced for a larger number of VMs, the ATOR team will discourage the running of VM farms through identification and throttling. Under default assumptions and given the cost of running a VM at 72 USD per year, running ATOR hardware is more efficient than running a VM, on top of the significant added benefits (Tor-ifying your entire home network).

As discussed in the previous section, the relay reward pool distributes higher rewards in the first year and then it gradually goes down. Since the rewards are denominated in ATOR tokens, we can explore the potential rewards amount in USD by using an assumption of the ATOR token price.

Tokens Distributed per Year

Year	1	2	3	4	5
Total Tokens Distributed	3,077,027	2,130,095	1,474,781	1,020,987	706,786

It is worth pointing out that while the net rewards are decreasing YoY in token terms, it is likely that the USD price of the token might increase, thus leading to higher YoY rewards in absolute terms. The expected increase is a direct consequence of Metcalfe's law stating that "the financial value or influence of a telecommunications network is proportional to the square of the number of connected users of the system". Thus, doubling the number of users in the ATOR network should be sufficient coding to 4x the token price. The 100x token price number would be achieved by simply growing the number of users 10x, which is a quite conservative number. In order to arrive at a more realistic business scenario, for each relay we will assume token price gradually increasing to 10x (~5 USD) within 5 years through the sequence (0.5, 1.00, 2.00, 3.50, 5.00)

Note that in the following analysis, and in the VM to hardware comparison, we do not dive into the potential effect of differences in consensus weight between relays. This is because, for a correctly functioning, highly available relay with reasonable bandwidth, we do not expect major differences in consensus weight.

This paper is intended to be a living document, much like the Technical Whitepaper, and is subject to clarifications and improvements as the ATOR Team continues to innovate.

Progression of Annual Rewards per Relay

Year	1	2	3	4	5
Assumed ATOR price	$0.50	$1.00	$2.00	$3.50	$5.00
Rewards USD eqv	1,538,514	2,130,095	2,949,562	3,573,455	3,533,930
Rewards per relay (relay reward pool only), based on the number of relays					
1,000	$1,539	$2,130	$2,950	$3,573	$3,534
5,000	$308	$426	$590	$715	$707
25,000	$62	$85	$118	$143	$141
125,000	$12	$17	$24	$29	$28
250,000	$6	$9	$12	$14	$14

Under the following assumption, we can then begin to explore a cost-benefit analysis for running a VM relay. We first explore the costs of operating a VM, including the initial outlay of 100 ATOR that must be continually locked to receive rewards.

Cumulative Costs for Running a VM Relay

Costs	122	72	72	72	72
Cumulative Costs	122	194	266	338	410

Assuming that all ATOR received is immediately liquidated, we can determine cumulative rewards in USD, under different options for the total number of relays.

Progression of Cumulative USD Rewards for a VM Relay

Relays \ Year	1	2	3	4	5
1,000	$1,539	$3,669	$6,618	$10,192	$13,726
5,000	$308	$734	$1,324	$2,038	$2,745
25,000	$62	$147	$265	$408	$549
125,000	$12	$29	$53	$82	$110
250,000	$6	$15	$26	$41	$55

From the following, we can determine the net profit-and-loss for running a VM relay.

Progression of Cumulative PNL for a VM Relay

Relays \ Year	1	2	3	4	5
1,000	$1,417	$3,475	$6,352	$9,854	$13,316
5,000	$186	$540	$1,058	$1,700	$2,335
25,000	-$60	-$47	-$1	$70	$139
125,000	-$110	-$165	-$213	-$256	-$300
250,000	-$116	-$179	-$240	-$297	-$355

However, under the above price assumptions, we should also consider the total rewards if users were to hold and accumulate their ATOR (in effect, compounding the USD value of ATOR by riding the potential price appreciation).

Cumulative Value of Rewards with ATOR Token Appreciation, VM Relay

Relays \ Year	1	2	3	4	5
1,000	$1,539	$5,207	$13,364	$26,960	$42,048
5,000	$308	$1,041	$2,673	$5,392	$8,410
25,000	$62	$208	$535	$1,078	$1,682
125,000	$12	$42	$107	$216	$336
250,000	$6	$21	$53	$108	$168

Overlaying with projected costs yields the following projections:

Cumulative PNL with ATOR Token Appreciation VM Relay

Relays \ Year	1	2	3	4	5
1,000	$1,417	$5,013	$13,098	$26,622	$41,638
5,000	$186	$847	$2,407	$5,054	$8,000
25,000	-$60	$14	$269	$740	$1,272
125,000	-$110	-$152	-$159	-$122	-$74
250,000	-$116	-$173	-$213	-$230	-$242

The above yields an interesting range of potential rewards for relays, with a huge range depending on the total number of relays on the network. A more realistic projection may see the total number of relays increase in an exponential fashion through the years.

Progression of Cumulative PNL with an Assumed Number of Relays, VM Relay

Year	1	2	3	4
Assumed Price	$0.50	$1.00	$2.00	$3.50
Assumed Relays	5000	25000	125000	250000
Rewards	$308	$85	$24	$14
Cumulative Rewards if sold	$308	$393	$417	$431
Net if sold	$186	$199	$151	$93
Cumulative Rewards if hold	$308	$700.61	$1,424.81	$2,507.72
Net if hold	$186	$507	$1,159	$2,170

Even if the ATOR price doesn't trend exactly as outlined in the report, as the number of relays reaches equilibrium with the recognition rewards, the total relays will trend up and down in accordance with price, keeping per-relay rewards at a level more consistent with predictions.

The analysis reveals that, in the absence of additional sources of the ATOR token into the relay reward pool, and under a conservative price appreciation, the protocol is capable of supporting the outlay of over 25,000 active VM relays. The Tor network currently has 8000 active relays supporting its 5M+ daily active users.

ATOR Relay Hardware Unit Economics

The calculation for physical devices is similar, but with a 100% higher reward earnt from the Physical Device Reward Pool in year 1, and similar bonuses in subsequent years. With its access point (router) functionality, the protocol makes the ATOR Relay the only private home router to route internet traffic across devices through Tor whilst paying operators a passive income for doing so.

We begin outlining a theoretical figure for the total number of ATOR tokens distributed each year, including a reward multiplier between 50-100% of rewards for all relays.

Assumptions Used for Hardware Reward Calculation

Year	1	2	3	4	5
Multiplier	100.00%	50.00%	50.00%	50.00%	50.00%
Total Tokens Distributed	6,154,054	3,195,143	2,212,172	1,531,481	1,060,179

USD Rewards per Hardware Relay with Reward Multiplier

Year	1	2	3	4	5
Reward Multiplier (%)	100.00%	50.00%	50.00%	50.00%	50.00%
	$0.50	$1.00	$2.00	$3.50	$5.00
Rewards USD eqv	3,077,027	3,195,143	4,424,343	5,360,182	5,300,895
Rewards per relay (relay reward pool only), based on the number of relays					
1,000	$3,077	$3,195	$4,424	$5,360	$5,301
5,000	$615	$639	$885	$1,072	$1,060
25,000	$123	$128	$177	$214	$212
125,000	$25	$26	$35	$43	$42
250,000	$12	$13	$18	$21	$21

The only initial cost for an ATOR relay is the hardware – there is no locking requirement for ATOR hardware. Subsequently, the only running cost is the price of electricity, estimated at 26 USD per year.

Cumulative Costs for Operating an ATOR Relay

Costs	276	26	26	26	26
Cumulative Costs	276	302	328	354	380

From this, we can get a measure for the cumulative USD value of recognition rewards paid to relays, for different numbers of relays, over time.

Cumulative Rewards for ATOR Relay Hardware

Relays \ Year	1	2	3	4	5
1,000	$3,077	$6,272	$10,697	$16,057	$21,358
5,000	$615	$1,254	$2,139	$3,211	$4,272
25,000	$123	$251	$428	$642	$854
125,000	$25	$50	$86	$128	$171
250,000	$12	$25	$43	$64	$85

Comparing to costs yields the following yearly PNL under different relay scenarios.

Progression of Cumulative PNL for ATOR Relay Hardware

Relays \ Year	1	2	3	4	5
1,000	$2,801	$5,970	$10,369	$15,703	$20,978
5,000	$339	$952	$1,811	$2,857	$3,892
25,000	-$153	-$51	$100	$288	$474
125,000	-$251	-$252	-$242	-$226	-$209
250,000	-$264	-$277	-$285	-$290	-$295

And under the same price assumptions as the VM analysis, the total USD value of rewards assuming that all ATOR is held.

Cumulative Rewards Including ATOR Token Appreciation, ATOR Relay Hardware

Relays \ Year	1	2	3	4	5
1,000	$3,077	$9,349	$23,123	$45,825	$70,765
5,000	$615	$1,870	$4,625	$9,165	$14,153
25,000	$123	$374	$925	$1,833	$2,831
125,000	$25	$75	$185	$367	$566
250,000	$12	$37	$92	$183	$283

And these totals against upfront and operating costs create a net PNL across the different scenarios:

Cumulative PNL Including ATOR Token Appreciation, ATOR Relay Hardware

Relays \ Year	1	2	3	4	5
1,000	$2,801	$9,047	$22,795	$45,471	$70,385
5,000	$339	$1,568	$4,297	$8,811	$13,773
25,000	-$153	$72	$597	$1,479	$2,451
125,000	-$251	-$227	-$143	$13	$186
250,000	-$264	-$265	-$236	-$171	-$97

Applying the same assumptions in relay growth to create a singular forecast:

Cumulative PNL with an Assumed Number of Relays, ATOR Relay Hardware

Year	1	2	3	4
Assumed Price	$0.50	$1.00	$2.00	$3.50
Assumed Relays	5000	25000	125000	250000
Rewards	$615	$128	$35	$21
Cumulative Rewards if sold	$615	$743	$779	$800
Net if sold	$339	$441	$451	$446
Cumulative Rewards if hold	$615	$1,358.62	$2,752.63	$4,838.54
Net if hold	$339	$1,057	$2,425	$4,485

It is apparent that, relative to running a VM with an ongoing monthly operating cost, the ATOR Relay offers the following benefits from the relay multiplier and its lower monthly operating cost. In addition, with no need to lock ATOR upfront to run a relay, and even assuming zero price appreciation in year 1, we can expect hardware to return double the initial outlay.

From an ROI perspective, while there is an approximately 500 ATOR upfront expense for the device (at current price of 0.5-0.6 USD per token ~250-300 USD), we subtract the 100 ATOR tokens requirement for locking a relay. We then add the higher rewards from the Physical Device Reward Pool and an electricity cost calculated at 26 USD per annum.

Even if the network achieves 100,000 relays within year 1, and with reduced PRDP rewards over time, the breakeven point occurs just after 3 years. With a more realistic, gradual growth in relays over time and the same conservative price appreciation, the breakeven point occurs within 6 months. If the growth in the overall ATOR ecosystem continues, and it hits the later-stage relay target, it is more than likely that the token price increase will be a lot higher than the conservative number that we used above and that the breakeven point will occur even sooner.

Finally, this analysis does not consider the crucial benefit of the hardware functioning as a router in your home network using which users can route their internet activity through Tor, encrypting their traffic and providing greater anonymity when online.

PHASE II

ATOR

Ecosystem and
Decentralization

This paper – defined by Tokenomics I – has primarily focused on the mechanics behind the incentives for Tor relays and its interaction with the ATOR Relay hardware. But the Tor incentive protocol, while immense in its scope and potential users, is just the beginning.

ATOR Tokenomics II outlines our goals and longer-term plans as a team to take our growing movement and build the foundation for an internet revolution. The subsequent part of this paper is provisional, a preview of ATOR Tokenomics II, to be released in Q2 of 2024.

Scaling to an Ecosystem

The ATOR Protocol has been built to recognize Tor relays. However, at its core, ATOR can reward relay operators autonomously for virtually any measurable computation. The protocol uses Arweave as an immutable source-of-truth, real-time registration and distribution on Smartweave, and a unique oracle approach, meaning that the protocol is both network and chain agnostic.

As such, the pool of ATOR tokens to pay out relays is not limited to the 10% provided by the team. Third parties who wish to either enhance a new network by onboarding relays or employ relays for a service will be able to buy ATOR and create a service pool to do so. As the protocol expands, so will the number of pools that all compete for relays bandwidth, computing power and storage, which will keep rewards per relay more sustainable. Furthermore, the competition between for relays will mean that pools will need to buy larger amounts of ATOR tokens to reward relay operators with more ATOR to host their services. It would therefore be feasible to see 20-30% of the circulating supply held in these pools. The integration and administration of service pools will be subject to a fee on each distribution, paid to the protocol and relay operators.

ATOR will form a unique medium of exchange to interact with individual relay services, from utilities developed and provided by the team directly, utilities paid for anonymously via a third-party pool, and ATOR paid directly to onion services on multiple marketplaces. With the potential of hundreds of thousands of registered relays, tens of millions of users on Tor and a growing desire to use services built for privacy, ATOR aims to be at the centre of a transition that sees all existing web2 and web3 services rebuilt for anonymity and hosted on globally distributed relays.

The ATOR Multi-Web

Onion services are a natural next-step for growing the user base on Tor – onion services are those hosted directly on a Tor relay, allowing both the service provider and the user to remain anonymous. They don't rely on the public DNS system, and are only accessible on the Tor network, making them more resilient to blocking and interception attacks. While many relays will continue contributing to the diversity and resilience of the network as a Tor relay, many more can run the onion services that Tor enable. Service providers who wish to employ relays to host an endpoint, or use cases around computation, are compatible with the creation of a service pool that pays out ATOR tokens to relays automatically, while other services would be paid directly in ATOR to the provider.

Potential for web2 services on Tor

ATOR is built to expand the footprint of cryptocurrency itself, onboarding traditional internet services into its network. ATOR service pools and marketplaces will allow nodes to offer anonymized, duplicated storage; file sharing; streaming and compute jobs; news and publishing; and peer-to-peer marketplaces. ATOR will host an 'app store' of anonymous services that developers can build on flexibly in accordance with market demands, with the ability to leverage a growing pool of relays with little lift by simply creating a service pool and defining pay-out requirements.

Potential for web3 services on Tor

The crypto and DeFi community have shown repeatedly to value privacy as they interact with the blockchain, with private swaps and on-chain anonymity a popular utility. However, a cryptocurrency utility cannot truly be anonymized unless both the endpoint and its interaction frontend don't expose the user's identity.

Take Metamask as a case-study. The default RPC (the endpoint where transactions are sent to push onto the relevant blockchain) on Metamask is provided by a sister company Infura. Infura's terms of service, like most mainstream RPC providers, mandate the collection of user's IP addresses on every transaction. Thus, regardless of the specific provider, a centralized RPC provider can link an IP address to a full history of transactions, even across different wallets and browsers.

The ATOR Team will focus on building out these endpoints as an onion service, across relays, allowing wallets, dApps, swaps and more to truly offer anonymity for their users.

Hardware for Service Provision

The current iteration of the ATOR Relay is built for low-power consumption and superior ROI. It has sufficient computing power and uplink/downlink to maximize PoU rewards. However, as phase II begins to roll out, ATOR will offer modular upgrades and variants of the ATOR Relay specialized for different types of services. For example, an upgraded relay with bigger SSD can act as a storage module for specific storage-related service pools.

Relay operators who are participating solely as volunteers for the Tor networks can also choose to donate their tokens towards charitable service pools, contribute tokens to the DAO fund or keep their tokens unclaimed on Arweave as a mark of recognition.

Revenue and Market Forces

The distribution of tokens from each service pool will engender a fee. Therefore, all use-cases, from web2 to web3, built on the protocol generate revenue that is dedicated entirely to holders, via the DAO fund. The DAO fund can implement revenue share allocated between holders, stakers and relay operators.

The ecosystem built by the protocol is designed to be autonomous. As more and more components of the ATOR Protocol begin to decentralize, any use-case where computation can be verified can be built as a service pool on the protocol. As such, both pools and services offered on ATOR will scale up and down in response to user demand, in an entirely decentralized, market-driven way, all whilst generating revenue for the protocol. The increased numbers of tokens in service pools and greater utility and demand for the ATOR token will serve to strengthen the number of token rewards and the price of the token as lesser amounts of tokens are emitted in later epochs.

As use cases begin to proliferate, ATOR will begin to experience the potential for the vast numbers of Tor users having their needs met anonymously through the purchase and use of ATOR. It is therefore plausible that ATOR could become a primary transaction mechanism for services built on the network anonymity.

100% of the revenue from this vast potential ecosystem will be shared amongst ATOR token holders and relay operators.

However, ATOR will continue to place focus on building out its backbone of relays. The relay reward pool is built to be perpetual indefinitely. In subsequent iterations, bridges and exit-nodes will be granted greater rewards to improve accessibility and bottlenecks respectively.

Relay Economics: Services

As an addendum to the relay economics of section I, we factor in relays hosting one service instead of subscribing to the main reward pool, with a proportion of relays serving third-party services growing from 25% to 80% as the number of relays and services scale over 4 years. Different relays hosting services or providing computing power will be able to earn differing amounts of ATOR. However, this analysis will focus on the competitive benefits of multiple pools on the original Tor recognition pay-out rate.

VM Relays

We consider a conservative growth in the percentage of relays operating in third party service pools. In the latter-year examples, such as 125,000 and 250,000 relays, we consider a scenario of over 60,000 relays operating from the main recognition pool, enough to utterly transform a range of networks and a likely overestimate. Nevertheless, we keep our highly conservative 10x price appreciation with 250,000 relays.

The network will be able to sustainably support a network of over 50,000 Tor relays once a base infrastructure has been setup, with the potential for hundreds of thousands of more relays forming the backbone of the sovereign service-driven internet paradigm.

Year	1	2	3	4
% of relays as service	25.00%	50.00%	70.00%	80.00%
Assumed Relays	5000	25000	125000	250000
Rewards	$410.27	$170.41	$78.65	$71.47
Cumulative Rewards if sold	$410	$581	$659	$731
Net if sold	$288	$387	$393	$393
Cumulative Rewards if hold	$410	$820.54	$1,641.08	$2,871.89
Net if hold	$288	$627	$1,375	$2,534

ATOR Relay Hardware

We consider the same logic for relay hardware, applying the same PRDP multipliers from phase I.

Year	1	2	3	4
Adoption (%)	25.00%	50.00%	70.00%	80.00%
Assumed Relays	5000	25000	125000	250000
Rewards	$820.54	$255.61	$117.98	$107.20
Cumulative Rewards if sold	$821	$1,076	$1,194	$1,301
Net if sold	$545	$774	$866	$947
Cumulative Rewards if hold	$821	$1,641.08	$3,282.16	$5,743.78
Net if hold	$545	$1,339	$2,954	$5,390

If holding ATOR, relay hardware operators could expect to make a significant return over the course of many years, while consistently earning a 50% ROI after the initial outlay of extremely high (2-4x annual) return of the first few years.

ATOR Token and Staking

ATOR Token Function and Value Proposition

The ATOR token is the native token of the project. It serves as an essential part of the ATOR ecosystem in the form of incentives for Tor relays – it is a token of on-chain recognition and a rallying point for ATOR's community of relay operators. Crucially, the ATOR token represents ownership over the protocol through its governance value; the token can be double-staked to generate voting rights. Governance will be used to allocate the relay rewards between networks and determine incentives. Ultimately, the ATOR token is the guiding force for ATOR's global network of internet relays.

In addition to the governance value, the ATOR token serves as a payment method or gateway for products and services and, when staked, grants access to ATOR utilities and a DAO fund of protocol revenue from service pool fees. Via its native pool-based payment infrastructure, ATOR will allow service providers to sell storage, computational power, dApps and other services without compromising end-user identity in the process. The payment pool is either derived from the protocol itself (i.e., the 10% reward pool for Tor relays) or created by service providers as the service is instantiated on the Tor network. The size of the pool depends entirely on the service provider - make it too small, and relays will not be interested to run your service, make it large and many relays will join, improving the service redundancy. Service pools can be replenished by the provider as necessary.

In addition to service pools, payment for pay-to-use onion services can, of course, be carried out in multiple accepted cryptocurrencies. While not the primary function of the native token, it can still be used for payment for onion services thanks to the gasless nature of transacting ATOR on Arweave L2. ATOR, when held, entitles users to future onion service endpoints built by the ATOR team. It can also be used on the network for pay-to-use third party utilities on hidden-services.

Staking & Revenue Share

Staking the ATOR token will enable users to receive revenue share* from the project. The company will commit percentage monthly contributions of its hosting revenue up to 50%, to a community-run DAO, from which the DAO can commit to revenue share for both stakers and relay operators.

***NB! The revenue share part of the staking benefits will ultimately be up to voting governance, who can determine how revenue is best utilized considering regulatory and strategic context.**

The rewards will be distributed based on the following formula:

$$P_{D\%} = \frac{U_x}{\Sigma_1^n U_1 \dots U_n}$$

Where:

- $P_{D\%}$ is the percent of the revenue share that a particular user (X) gets.
- U_x is the staking Power of user X.
- $\Sigma_1^n U_1 \dots U_n$ is the sum total of the Staking Power for all users.

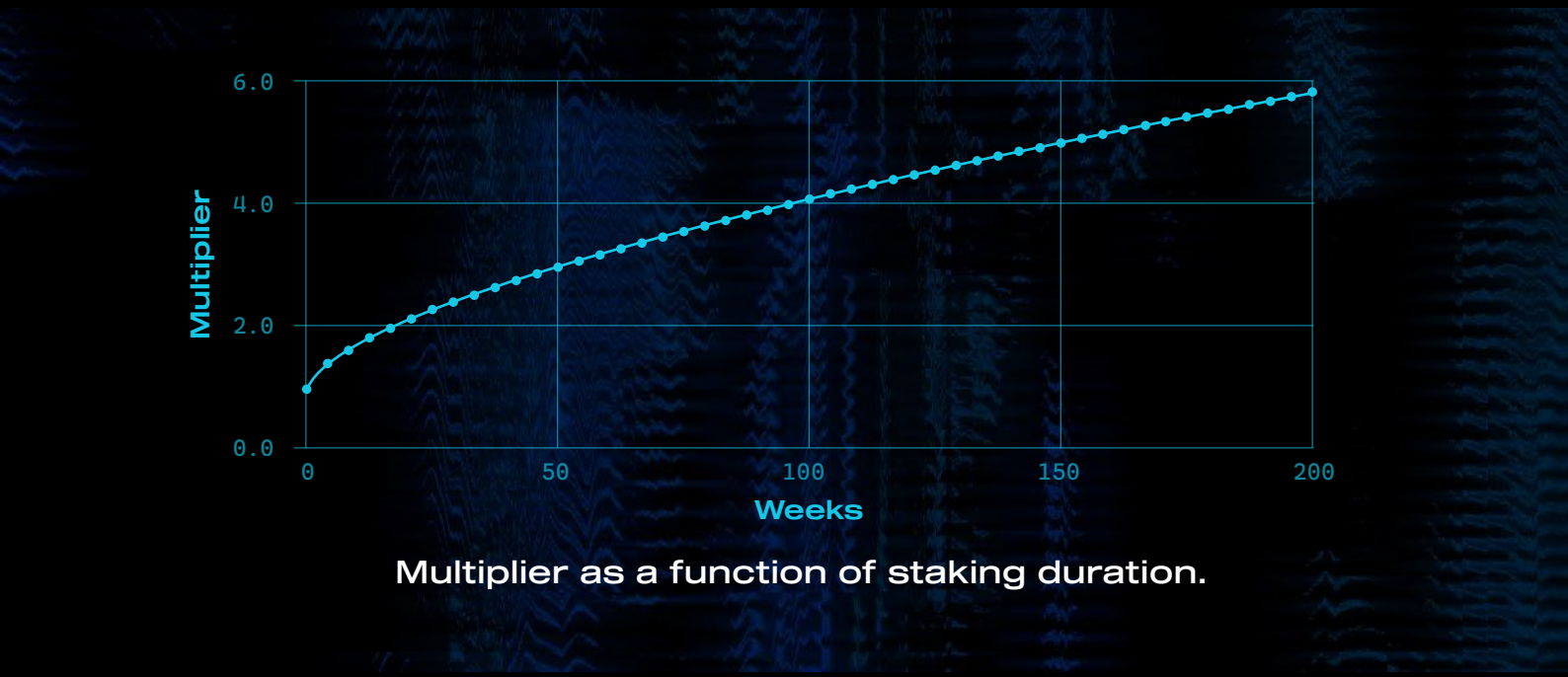
We can define the Staking Power as the ATOR tokens committed to the contract by users increased by "M" (staking multiplier).

$$U_x = T \times M$$

Then finally, we can define, as a function of the duration for which the tokens were staked, (in weeks):

$$M = 1 + 0.15 \times D^{0.65}$$

Where D is the duration of the stake in weeks, this gives us the following multiplier curve based on duration.



Multiplier as a function of staking duration.

The maximum multiplier is capped at 5.8.

Let's illustrate the above with an example:

- User A stakes 1000 tokens without a duration, so his Staking Power is 1000.
- User B stakes 1000 tokens with a duration of 50 weeks, which translates into a 3 multiplier, so that his Staking Power is 3000.
- If at the end of the day, those two users are the only two who have an active stake, then:
  - User A gets 1000 / (1000 + 3000) = 25% of the revenue shared.
  - User B gets 3000 / (1000+3000) = 75% of the revenue shared,even though he staked the exact same amount as user A.

After the duration M is over, the tokens remain staked. The user can withdraw them at any time. They still reap the benefits based on the original multiplier chosen.

DAO Governance

The ATOR Protocol project will begin as a centralized entity and gradually develop into a decentralized platform governed by its DAO members via a dedicated governance token derived from the staked ATOR Token. Creating a functioning governance framework is a massive undertaking. Lest the whole is less than the sum of its parts, it needs to be created carefully with checks and balances.

The decentralization of the project will be structured in 3 stages as follows:

1. **EARLY DAYS** - during this period, the team is in full control of the project, and no voting is done. This is because there will be core protocol development, as well as bugs and events which require immediate hotfixes, and neither cannot really be done democratically.

2. **SEMI-DECENTRALIZATION** - during this period, the team is still in complete control of the project and can deploy hotfixes as above, but for longer-term, strategic and community decisions, it can delegate to community input via a token-based voting. In addition, the DAO will have access to a fund of both ETH and ATOR tokens to drive innovation.

3. **FULL DECENTRALIZATION** - where the project will implement a process following industry best practices, as defined further below.

ATOR enter the beginning of phase-2 decentralization from 2024, with a delegated portion of DEX fees and supply dedicated to a DAO wallet for the community to take the lead on hackathons, grants for development and long-term innovation. Holders will be able to use circulating tokens to indicate support for various directions.

As phase 2 matures and ATOR transitions to greater decentralization, voting will be done via **LOCK-STAKED TOKENS (LS)**. LS tokens will be assigned a voting power by double-staking (locking staked tokens for various durations).

Additionally, to avoid system centralization and collusion, the voting will be done via quadratic voting. This means that the final voting power that a user has grows slower and slower the more tokens they have. More formally:

$$VP = \sqrt{(C_x \times M)}$$

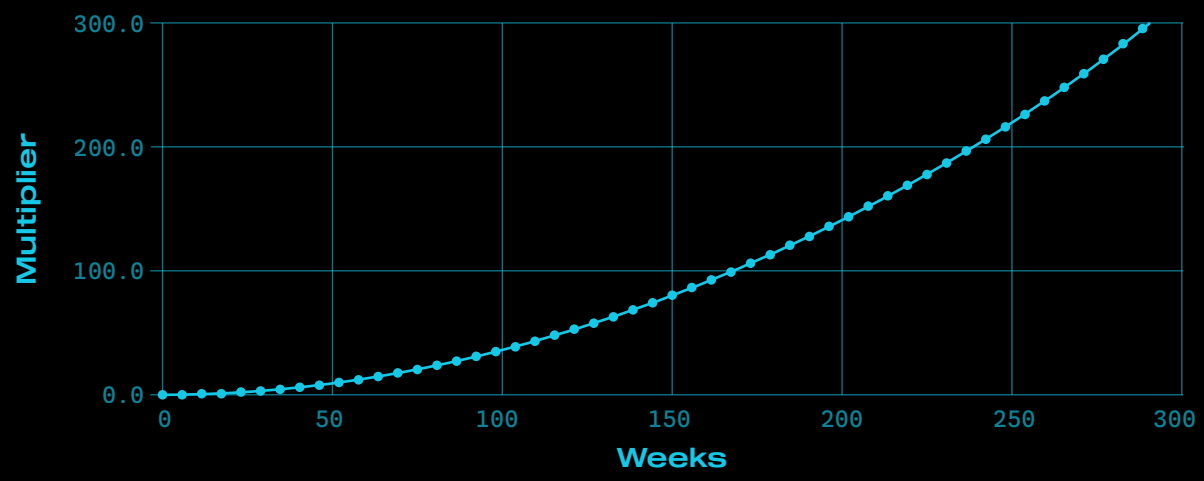
Where:

- VP is voting power
- C_x is the user contribution, outlined as the double-staked tokens
- M is a duration-based multiplier

We can then define M as follows:

$$M = 1 + 0.0035 \times D^2$$

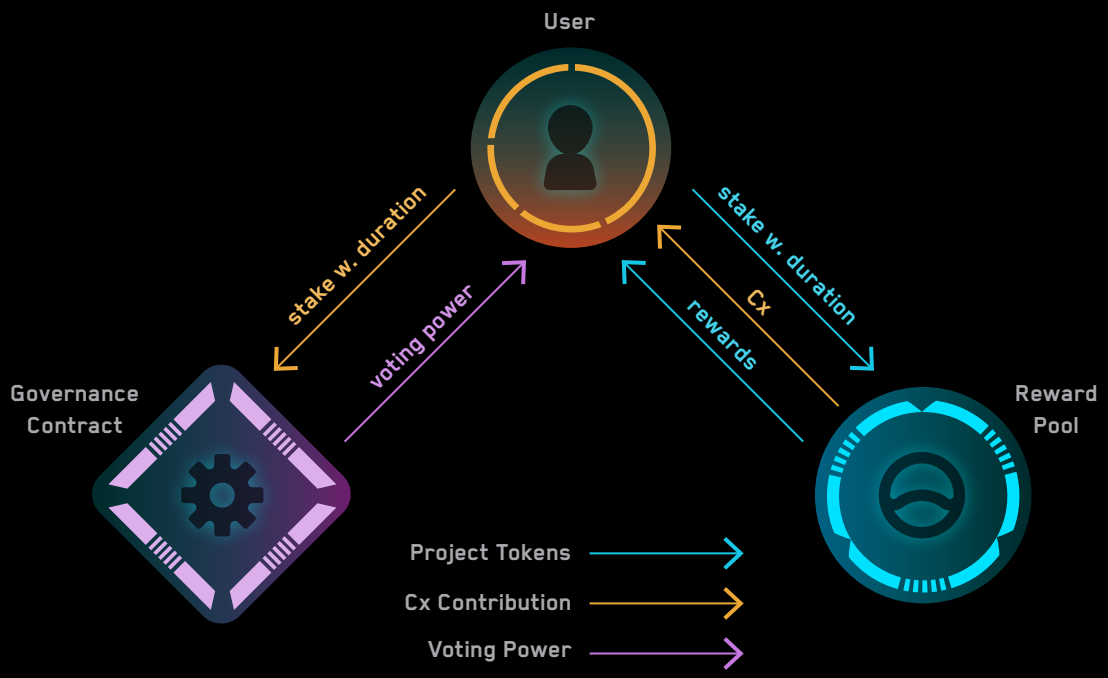
Where D is the duration of the stake in weeks, this gives us the following multiplier curve based on duration.



Multiplier as a function of the staking duration.

The maximum multiplier is capped at 290.

Here is a depiction of the whole process:



The above setup has several very desirable properties:

- Voting becomes an extension of regular staking, meaning that stakers and voters are awarded from the same pool.
- Voting does not provide any additional rewards compared to just staking, thus ensuring that only people interested in governing the system would participate since it requires a much longer token lockup.
- Voting tokens become "double locked," once via staking and then a second time for voting, ensuring they are taken out of circulation for the long term.
- It allows us to have significantly more aggressive multipliers for voting since they do not impact the rewards received.
- Loyal users (those who lock their staking and vote in the long term) benefit significantly from both multipliers.

Governance Next Steps:

Tax

We are steaming through our roadmap, approaching mainnet launch and hardware distribution across Q4 2023 / Q1 2024. As we pass these milestones, in keeping with the semi-decentralization outlined in the governance section, we want to allocate greater funds to community control. After mainnet, we will reallocate 1% of tax and 0.5% of supply to a DAO fund.

Next Steps: Decision Scope

With a revenue-driven DAO wallet, the phase-3 DAO system will have scope over the future tax percentages, how the protocol revenue is distributed (between burns, direct revenue for holders, incentives for hardware and so on), as well as development. The community can vote on developments going forward, from hackathons and onboarding to self-contained projects to build on our ecosystem.

Developers will be able to access funds to build services integrated into ATOR, build services that can run on relays to expand our ecosystem. Technological innovation is inevitable, but the need for privacy will only grow stronger. Nobody knows what the protocol looks like in two years' time, but if we remain nimble and responsive, we can grow an ecosystem that can truly offer sovereignty and anonymity to the mainstream internet user.

PHASE III

NOSTR