

# reboot

THE UNSTOPPABLE ARCADE



ABSTRACT

## The gaming ecosystem is broken.

The current way that video games are produced, and played, is broken. Developers who bear the burden of risk for upfront development have little choice but to be funneled into centralized distribution channels designed to trap them into closed-loop ecosystems made exclusively to benefit the platform holder. Developers use these platforms to drive attention to their titles from an engaged user base in exchange for a share of gaming revenue generated by the platform. However, centralized platforms come at a high cost for developers with an industry average platform fee of 30%. If a developer seeks better promotion on the platform, they may be required to pay additional platform fees for that visibility. Additionally, centralized gaming platforms have content policies that restrict developer innovation.

**...casual gamers are recognizing fewer benefits over time when playing games on centralized platforms.**

As a result of increasingly high platform fees, and the desire to profit, developers are required to design games in a way that extracts value from players through perpetual-monetization tactics such as pay-to-download, free-to-play with in-game advertising, and microtransactions, such as loot boxes or additional downloadable content. Many of these monetization mechanics are viewed as predatory 'dark patterns' caused by the perverse misalignment of incentives between developers and gamers created by current platform models.

On the other hand, and as a direct result of the current distribution model for games, casual gamers are recognizing fewer benefits over time when playing games on centralized platforms. The combined eSports and Gaming Video Content (GVC) segments represent over \$10B in annual game-related revenue. While these segments have provided platforms that offer skilled professional gamers an opportunity to earn income from video games, only a fraction of the 2.7 billion gamers worldwide are able to take advantage of those benefits. Some of the top players in the world have earnings in excess of \$1 million, excluding endorsements and other opportunities, but the ability for up-and-coming pros and casual players is limited.

**30%**

A Guide to Platform Fees,  
The Verge (August 24, 2021)

THEVERGE.COM/21445923/PLATFORM-  
FEES-APPS-GAMES-BUSINESS-  
MARKETPLACE-APPLE-GOOGLE



REBOOT

## An Open Protocol That Levels the Playing Field

### AUTONOMOUS MARKETMAKING FOR COMPETITIVE GAMING REWARDS

The Reboot Protocol facilitates the creation of decentralized, automatic reward liquidity and matchmaking marketplaces for competitive skill-based games of any kind. With Reboot Protocol, developers and token communities are empowered to add a developed tokenomic fly-wheel to their gaming ecosystems.

### AUDITABLE FAIR PLAY

The Reboot Protocol allows for automatic validation of game sessions designed to ensure accuracy and fairness. It will also provide a common standard to track player performance across all games built on the protocol, which can be used to create fair matches based on historical gameplay.

### GOVERNANCE FOR GAMERS BY GAMERS

The Reboot Protocol's participatory governance structure means the more you play, build, provide rewards and validate gameplay within Reboot's ecosystem, the more say you have in how the protocol evolves, the games that get onboarded and potentially the future of gaming itself.

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**The following information highlights how Reboot Protocol changes the way blockchain technology rewards gamers for their skill-based play.**

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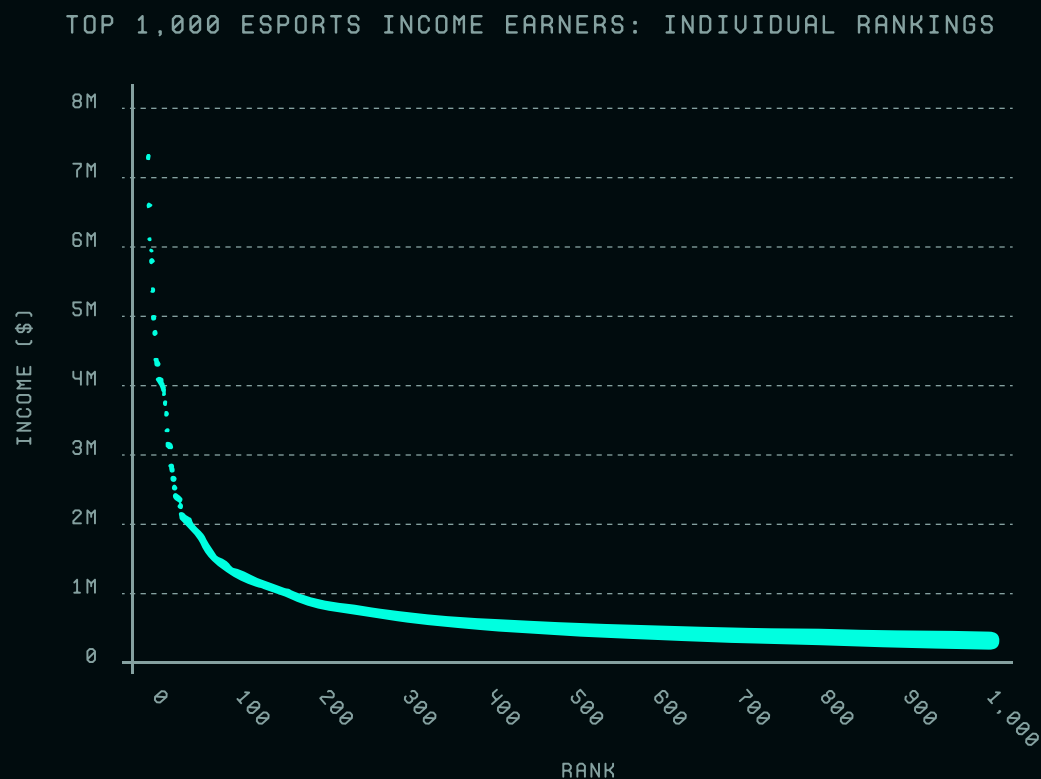


## INTRODUCTION

The concept of playing games as a profession has become a reality. The popularity of eSports and the associated Gaming Video Content (GVC) platforms that have developed to support the industry, has rapidly grown over the last five years. The eSports and GVC segments combine for \$10.6B of the gaming industry's \$300B+ revenue pool. For top players, the prizes for competing can be in the millions, not accounting for endorsements and other opportunities.

However, the ability for casual players and up-and-coming pros to financially benefit from their skill in these games are few and far between. Large winning pools are used as marketing tools for games and developers, and less money is being distributed to players that are outside of the top 1,000 worldwide. With over 8 million active Twitch streamers and 2.7 billion game players worldwide, a niche exists to pair casual and up-and-coming players with liquidity for prize pools.

This disparity begins to become more prevalent when comparing the income of the top 1,000 global eSports players. The top player has grossed \$7.2M, which is nearly 30x higher than the 1,000th ranked player whose income was \$240k.



When grouping competitive players into smaller sets, the top 100 eSports players have earned \$245.6M, compared to the \$263.1M earned collectively by the next 400 players.

## REALITY

Statista estimates that gaming video content alone produced \$9.3 billion in revenue worldwide in 2021.

STATISTA.COM/TOPICS/3147/GAMING-VIDEO-CONTENT-MARKET/#TOPICOVERVIEW

## STREAMERS

As of December 29, 2022, there are an estimated 8.04 million active streamers on Twitch.

DEMANDSAGE.COM/ESPORTS-STATISTICS/

## WORLDWIDE

2.7 billion: the estimated number of gamers worldwide in 2021

ACCENTURE.COM/US-EN/INSIGHTS/SOFTWARE-PLATFORMS/GAMING-THE-NEXT-SUPER-PLATFORM

## \$7.2M

E-Sports Earnings, accessed January 24, 2023

ESPORTSEARNINGS.COM

## \$245.6M

E-Sports Earnings, accessed January 24, 2023

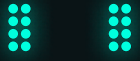
ESPORTSEARNINGS.COM

TOP 1,000 ESPORTS INCOME EARNERS: GROUPED BY RANKS OF 100



**There is an increasing concentration of game distribution occurring through specific platforms that charge steep fees, and developers are bearing the cost.**

The issues relating to income disparity and distribution of funds within the traditional gaming ecosystem do not just start and stop with gamers. There is an increasing concentration of game distribution occurring through specific platforms that charge steep fees, and developers are bearing the cost. Certain larger game platforms take 30% of all game sales, with occasional exceptions for games distributed by smaller developers. The percentage of game sales taken by the platform decreases as games earn more – benefitting large ecosystem players, and not smaller developers. For example, on one platform all sales between \$10 million and \$50 million are subject to a 25% platform fee and for every sale after the initial \$50 million, the platform fee is reduced to 20%.



## The Reboot Protocol

**There is a marketplace need to create innovative, frictionless game development and distribution services that return value created by gaming ecosystems to the hands of gamers, developers and token communities. The Reboot Protocol presents a unified solution for the critical barriers that block key participants from this vision. The problems and their solutions are highlighted in this whitepaper.**

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The Reboot Protocol is an open protocol that allows independent developers to build decentralized, skill-based peer-to-peer games paired with an automated market maker, creating autonomous player matchmaking and game session validation for gamers. The Reboot Protocol achieves this by:

- › Adding the infrastructure to allow developers to implement matchmaking features (mechanics that are cost-prohibitive for upstart games with budding audiences).
- › Creating a platform that allows third parties to fund counter-party liquidity that supports prize pools for games built on the protocol.
- › Offering automatic validation of game sessions designed to ensure accuracy and fairness.
- › Providing a common standard to track player performance across all games built on the protocol, which is used to create fair matches based on historical gameplay.
- › Establishing fair pricing and distribution of tokenized game items through a market-aware, autonomous prize shop mechanism.

The Reboot Protocol provides a scalable framework for developers of all sizes to focus on building entertaining games while players can be rewarded for their skilled gameplay. By using a decentralized, blockchain-based ecosystem, developers are no longer reliant upon centralized platforms to find audiences and monetize their content. Further, building within a blockchain-based

ecosystem will allow issuers of digital assets to quickly develop fun, engaging games that also drive utility to native tokens. In 2022, blockchain gaming accounted for 49% of dapp activity with 1.15M daily unique active wallets (“UAW”) participating. This is an 85% increase in UAWs for 2022, highlighting the growth in blockchain gaming. The Reboot Protocol is the solution to this problem.



THE REBOOT PROTOCOL

## The Arcade Economy

Players walking into an arcade with a pocket full of tokens have an enormous number of games to choose from and the rules for how value is exchanged are very clear.

**The amount you pay is directly proportional to how much fun you're having and the amount a developer makes is similarly proportional to how fun their games are.**

Choose a game that looks fun, put a token in and see how it goes. If you like it, keep putting tokens in. If not, there are many other options to choose from. As a result, the deal between the developer and the gamer is very clear. The amount you pay is directly proportional to how much fun you're having and the amount a developer makes is similarly proportional to how fun their games are. There's no room for exploitative 'gotcha' monetization tricks and the unit-economics create easy performance indicators to help developers clearly adapt and innovate.

The system of rewards in an arcade is similarly clear. All games payout tickets based on how skilled a player is. Players can play all the games they want, collect tickets and when they are done they can see what kinds of prizes can be claimed. More skill equals better prizes and players may choose the prizes they prefer.

Through these mechanics, arcades are a marketplace for games driven by clear unit economics consisting of tokens, tickets and prizes that creates a clearly traceable chain of value that starts with the tokens in your pocket, moves into the games you choose to play, and results in the prizes you choose to leave with.

The Reboot Protocol is modeled after an arcade for this reason and leverages this simple economic structure to create a clear per-play chain-of-value that incentivizes decentralized stakeholders to bootstrap, enable and scale marketplace operation around their favorite games.

## On Being Decentralized

The Reboot Protocol provides decentralized protocols and systems that enable communities of developers, players, benefactors, and fans to support the games they love in a way that benefits all participants. Additionally, the protocol's structure provides distributed scale to games

based on their popularity and economic viability by creating a marketplace of attention, rewards and infrastructure around each game. In short, if the market wants a game to exist, the Reboot Protocol will allow it with no central authority to stop its success.



THE REBOOT PROTOCOL

## Demolishing Barriers to Entry

Games are a natural environment for fungible and non-fungible tokens. However, critical game design issues emerge when developers consider how to build games around a tokenized economy. Introducing tangible, market-traded rewards as part of games causes design challenges, as developers need to be careful not to undercut the game's inherent level of fun. Market-traded assets must be balanced to avoid hyperinflation of assets or market-value mismatches that can create impenetrable barriers to entry. This challenge translates to less competition, less innovation, lower-quality games, and limited interest from the broader multibillion dollar gaming community in the burgeoning web3 gaming market.

As a result, millions of potential players and developers miss out on the clear and numerous benefits that could be had through web3 gaming including:

### Player Benefits

#### OWNERSHIP OF GAME ITEMS

With blockchain technology, a new genre of games exists that allows players to gain true ownership over their digital assets. Players now have the opportunity to earn value for their time spent in games through the trade of these digital assets on marketplaces.

#### GAME MOBILITY

Providing players with a vehicle to use items and share statistics across games and platforms through a public ledger creates new dynamics. Digital assets earned in one game could be interoperable with other games built on the Reboot Protocol.

#### DEMOCRATIZATION OF ESPORTS

Due to the ease of distributing assets across the blockchain, anyone can now create gaming competitions with highly fluid rewards, making the eSports arena more accessible.

#### TRUE RISK/REWARD GAMES

The Reboot Protocol ushers in a new era of game designs that allow players to experience true risk-reward trade-offs through gameplay decisions involving digital asset ownership.

### Developer Benefits

#### CREATE PREMIUM DIGITAL ASSETS

Developers can create highly-useful, low-quantity game assets which can be used as highly-desired prizes that generate engagement and excitement for players.

#### SECONDARY REVENUE STREAMS

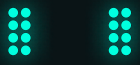
Blockchain-based gaming items can be traded on secondary markets, allowing developers to monetize players entering and exiting the ecosystem through secondary transaction fees.

#### PLAYER ADVOCACY AND COMMUNITY

Players that hold premium digital assets become aligned with the success of the games those items come from. These players form a highly-engaged fan base that can promote games, create content that targets player growth, provide community support, and act as early adopters of future titles.

The open Reboot Protocol provides a one-stop, minimal-cost solution for game developers to incorporate a stable web3 growth economy in their games through accessible APIs, including skilled gaming, auto-balancing marketplaces for game items, and clear entry points for players, patrons, fandoms, and content creators to take part in the success of their games. Furthermore, the Reboot Protocol's decentralized validation infrastructure means that a game will automatically scale proportional to its success at no cost to the developer.





## The Unstoppable Arcade

**Most compelling modern games can be considered games of skill and are structured with natural zero-sum, win/lose mechanics. The Reboot Protocol is designed to allow developers to leverage these mechanics as hooks for skill-based play and tangible rewards issuance through competitive play. Skill-based games are also a natural fit as they lend themselves to statistically sound player ranking systems that can accurately calculate fair rewards distribution for player-vs-player, player-vs-environment, and team-based games.**

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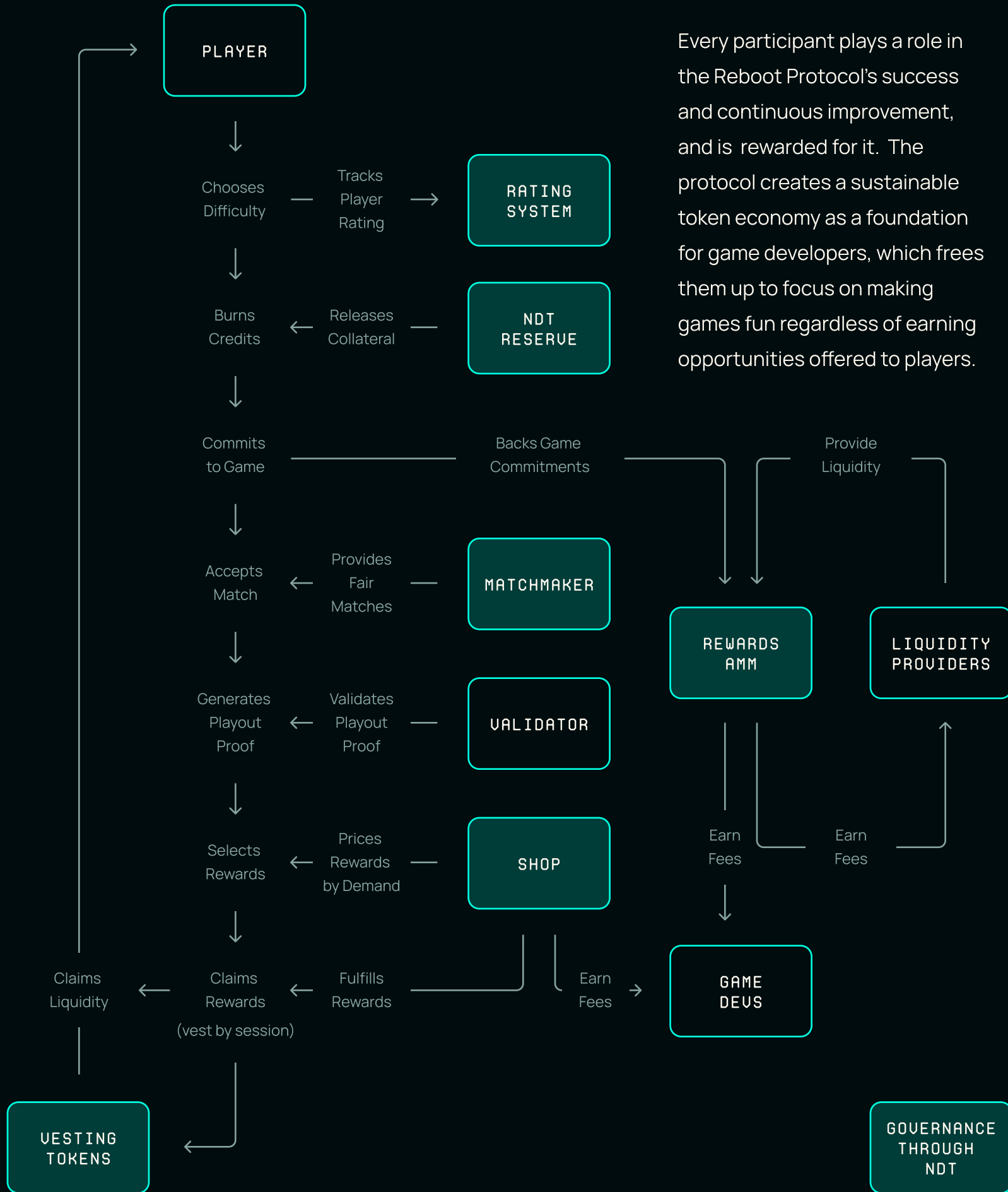
The Reboot Protocol uses its native ERC-20 standard digital token (“Native Digital Token” or “NDT”) across all its components, creating a unified accounting system. The Reboot Protocol tracks inflows and outflows from all components under one token, allowing value to remain fluid across games built on the system. This is achieved by collateralizing all digital assets used within the protocol with NDT, anchoring them to the game economy in a quantifiable way. Collateralizing the digital assets allows the Reboot Protocol to provide rewards liquidity through an Automated Market Maker. Through this structure, anyone holding the Native Digital Token can earn fees for providing rewards liquidity to gamers. This incentivizes participants to play games on the Reboot Protocol and supports the ongoing operation of its gaming economy.

Applying this technique at the protocol level provides for a balanced game economy by limiting the inflation of game rewards. Additionally, collateralized digital asset rewards provide players with a universal system for trading game items for fair market value or burning them for liquidity. The Reboot Protocol’s session-based gameplay, coupled with a novel application of dynamic minting mechanics through Variable Rate Gradual Dutch Auctions (“VRGDAs”), creates a system that provides automatic balancing of game-item distribution based on gameplay, dynamic pricing curves, and market demand. Through this system, developers design rewards to ensure fair-market pricing of their game items while leaning on market forces to identify and heal game balance irregularities.

To further support rewards liquidity, the Reboot Protocol is designed to ensure the constant availability of fairly-matched game sessions. A dynamic player ranking system aims to autonomously find appropriately matched game sessions. The Reboot Protocol’s player ranking system automatically and transparently updates player ranking for each game. It provides players incentives to keep their rank in good standing while disincentivizing bad-faith ranking actions such as smurfing and sandbagging. Coupled with an on-chain system for provably fair game matches, the Reboot Protocol continuously provides on-demand opponents backed by tangible rewards in appropriately matched game sessions. Games may be built on the Reboot Protocol that requires players to hold certain premium NFTs as a form of token-gating. The protocol includes a built-in, on-chain NFT rental system that incentivizes holders of premium NFTs to grant non-holders the ability to utilize them for gameplay while keeping the barrier for entry low.



# Components of the Reboot Protocol



Every participant plays a role in the Reboot Protocol's success and continuous improvement, and is rewarded for it. The protocol creates a sustainable token economy as a foundation for game developers, which frees them up to focus on making games fun regardless of earning opportunities offered to players.



## Components of the Reboot Protocol

The Reboot Protocol is composed of a set of decentralized services and functions that operate in conjunction with each other to create a highly liquid skill-based gaming ecosystem. The core components consist of:

### GAME CREDITS

A wrapper around the underlying NDT token that ensures stable pricing for game sessions regardless of the market pricing of NDT.

### PLAYER RATINGS

An on-chain, per-session rating system that also accounts for uncertainty around player ratings.

### MATCHMAKING

Utilizes player ratings to compute odds and create fair matches between players for skill-based games.

### REWARDS AMM

An on-chain market maker for rewards and prize issuance based on skilled gameplay that allows anyone holding NDT the opportunity to earn fees for contributing to a rewards marketplace for their favorite games.

### PROOF-OF-PLAY

A protocol that allows players and validators to generate an undeniable, community-supported proof of a player's results in a skill-based game through coordination with the Reboot Protocol's on-chain components.

### VESTING REWARDS

Vesting, collateralized-NFT and token rewards are underwritten by Native Digital Tokens, providing ecosystem insurance against bad actors while providing meaningful incentives to good actors in the form of rewards liquidity.

### REBOOT SHOP

A dynamic, market-aware prize shop that allows developers and players to discover the fair market value for in-game items and rewards through game-play-driven arbitrage.

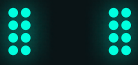
### RESERVE POOL

A pool of Native Digital Tokens or other ERC-20 tokens held in reserve to collateralize Game Credits, Vesting Rewards, and game items used within the Reboot Protocol.

### PROTOCOL GOVERNANCE

Decentralized governance of the Reboot Protocol is handled through its NDT and its respective holders. This creates a system where stakeholders can shape the direction of the protocol.





## Game Cards & Game Credits

**Similar to traditional physical gaming arcades, players may access games built on the Reboot Protocol with a Game Card that holds Game Credits, which are redeemable for gameplay on the Reboot Protocol, or players may play directly with NDT or vNDT.**

**Game Cards** are soulbound ERC-721 tokens which serve the sole purpose of holding a player's Game Credits. Game Cards are granted to a player when they register with the Reboot Protocol, and are pre-loaded with Game Credits in an amount determined by Protocol Governance. Game Cards are allowed to have one associated delegation wallet to allow players to access the protocol without requiring players to hold Game Credits in a hot wallet.

**Game Credits** are soulbound, uncapped ERC-1155 standard tokens that are burned to redeem a gaming session. Game Credits are designed as an ERC-1155 token because it allows for both (i) universal access to all games built on the Reboot Protocol and (ii) targeted access to specific games under one contract. Each Game Credit is fully collateralized against the Reserve Pool; however, the underlying NDT cannot be burned by the player for liquidity.

Token ID-0 is provisioned for Game Credits that work with all games built on the Reboot Protocol; however, developers may create new token IDs specific to games they develop. When developers are approved by Protocol Governance to join the Reboot Protocol, they are provided a unique Token ID to issue Game Credits that are specific to their game. All Game Credits are backed by a specific amount of underlying NDT from the Reserve Pool as determined by the Protocol Governance.

Universal Game Credits can be obtained through the Reboot Protocol in NDT or other supported ERC-20 tokens, and are minted directly to a designated player's Game Card. Game Credits must be stored on a Game Card, and are non-transferrable once loaded to the card. Game Credits may be minted to a player's own Game Card, or gifted to another player's Game Card at the direction of the person purchasing the Game Credits. The Reboot Protocol will also include functionality to allow sliding discounts to developers for bulk Game Credit purchases. Developers can purchase from the protocol and then re-sell for other ERC-20 tokens. For example, a developer allows for purchases of Game Credits from their native website. Game Credits can also be distributed as rewards for gameplay.

Developers can choose how many Game Credits are required to play their game. Developers can also issue game-specific promotional Game Credits that will be minted by the Reboot Protocol directly to a specific set of wallet addresses designated by the developer. When developers join the Reboot Protocol, they are provided with the right to distribute a limited number of these Game Credits to players either for free or for a charge. Any payment proceeds go directly to the Reboot Protocol, and developers will earn a percentage of all sales made through their direct channels. Developers may also be eligible for ecosystem funds that provide a financial benefit for developers to build on the Reboot Protocol.



COMPONENTS OF THE REBOOT PROTOCOL

## Player Ratings

**The Reboot Protocol transparently tracks player ratings using a modified form of the Glicko rating system adapted for efficient on-chain calculation.**

**The Glicko rating system is designed to measure player ratings for regular players in skill-based games.**

### GLICKO

The Glicko and Glicko-2 Rating Systems were designed by Mark Glickman and intended to more accurately predict any given users' strength in games of skill than the more traditional Elo rating.

[GLICKO.NET/GLICKO.HTML](http://GLICKO.NET/GLICKO.HTML)

Player Ratings are used to calculate:

### RISK

The amount of risk a player commits to a game which is used to infer the odds and fair rewards

### FEEES

Appropriate fees to charge players for providing access to the Player and Rewards AMMs based on the risk tolerance of their specific profile

### VESTING

The base vesting rate of the player for rewards to incentivize active participation in the protocol

In addition to a hard-rating number, which the Reboot Protocol uses to compute win probability for player matchups, Glicko also computes uncertainty bounds around player ratings based on their play frequency and volatility. The Reboot Protocol uses both of these features of the Glicko rating system to compute odds for player matchups and to provide rating provenance for provably fair matchmaking.

Players are incentivized to keep their rating in good standing within the protocol through regular ranked play, with lower counterparty fees and higher vesting rates. This feature additionally protects the ecosystem by disincentivizing high-rated players from smurfing their rank to rack up easy profits against easier opponents by charging higher fees for overly divergent or highly volatile play behavior.

The player's rating is automatically updated on-chain as part of each completed game session. The Glicko rating becomes more uncertain about a player's rating based on their inactivity, so it acts as an automatic incentive for regular game sessions and protocol completions.

The Reboot Protocol uses the Glicko rating system as a measure of relative player skill. Glicko assigns each player both a rating, representing their skill, and a rating deviation ("RD"), which represents how uncertain the protocol is about their skill.

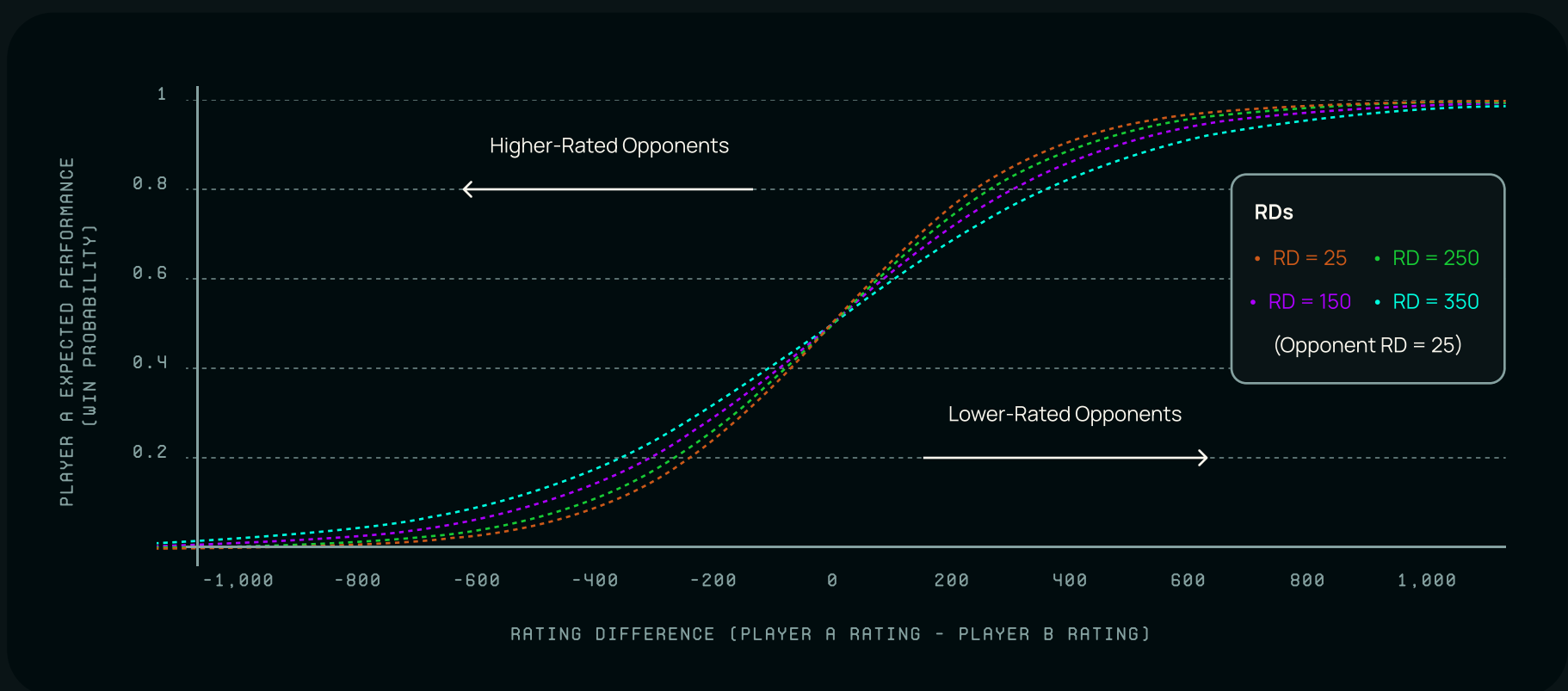
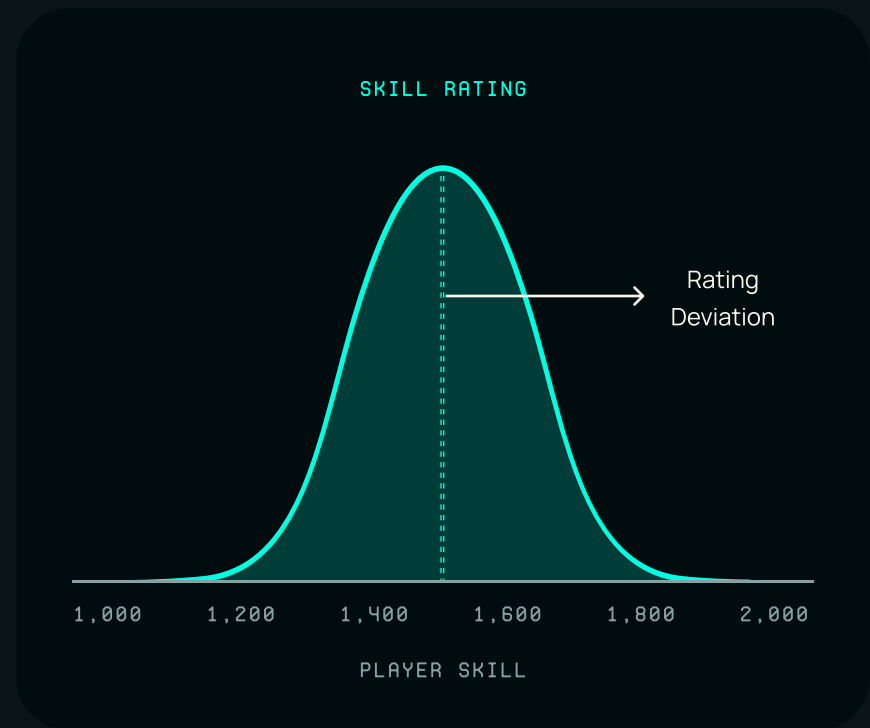


## COMPONENTS OF THE REBOOT PROTOCOL

## Player Ratings

A player's Glicko rating can be considered a normal distribution that predicts their actual performance in each game. The mean is their **rating** and the standard deviation is their **rating deviation**.

The Reboot Protocol will use any two players' Glicko ratings to accurately calculate the chance either of them wins a match. The calculation is primarily based on the difference in rating but also involves both players' rating deviations. This rating system is extensible to single-player games as well as massively multiplayer and team-based games.



Since the rating of a player with high uncertainty is a less reliable indicator of their actual skill, calculated win probabilities for those players will sit closer to 50/50 than those for players with a tighter rating estimate. This increases the level of challenge players with a high RD have to take on to earn the same amount of rewards, assuming their rating is accurate. A lower RD is better for the player since the protocol can confidently calculate more aggressive odds, which leads to potentially better rewards when winning a game session. The Reboot Protocol also disincentivizes high RD through reduced rewards.



## Player Ratings

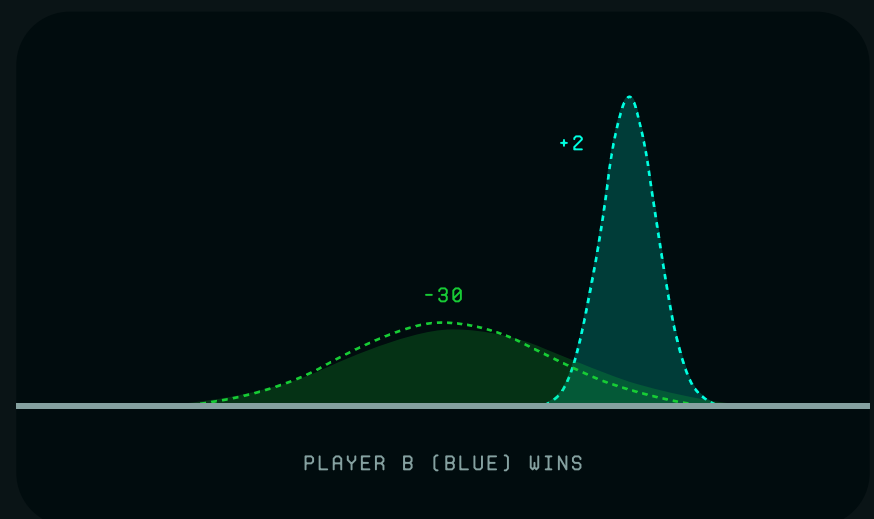
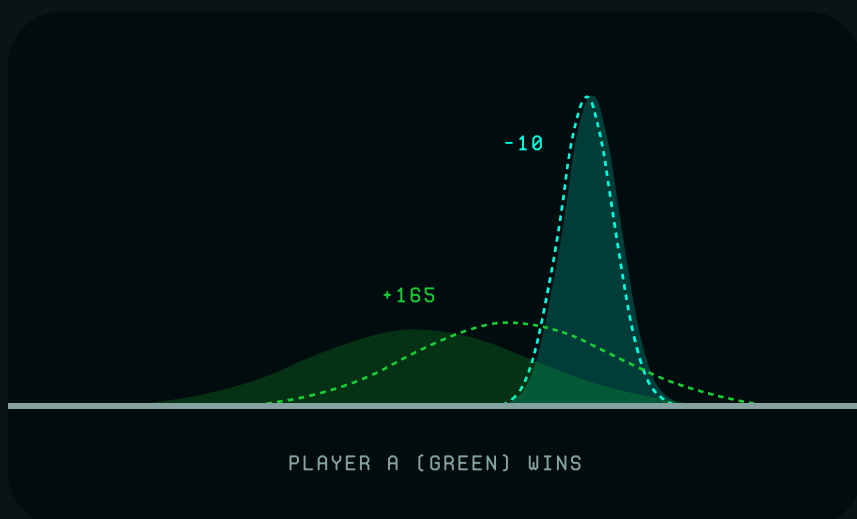
EXAMPLE

A 1,500-rated player with 350 RD would have to play against a 1900-rated player with 25 RD to have a 20% win probability. However, a player with 25 RD would only have to match with a 1,750-rated player with 25 RD to have that same 20% win probability.

After each game session, the ratings of each player are updated on-chain based on how their actual performance compares to the protocol's expectations and how uncertain the protocol is of their rating. Players who perform far outside the protocol's expectations – such as a player winning a game with a 1% win probability – will have their rating adjusted by more than players performing in line with expectations. This is because an unexpected outcome indicates the protocol's current rating is inaccurate. Players with high rating uncertainty experience a similar effect since their rating gives less concrete information about their skill than game outcomes and vice versa for players playing against high-uncertainty opponents.

EXAMPLE

Player A, with a 1,500 rating and 200 RD is matched against Player B, with an 1,800 rating and 50 RD. If Player A wins, their rating will be heavily adjusted (+165) to compensate for the initial high uncertainty. Player B's rating will be less impacted (-10) since the 1,500 rating of their opponent was highly uncertain. The below chart demonstrates how the player ratings would potentially shift based on whether Player A or Player B wins the match.



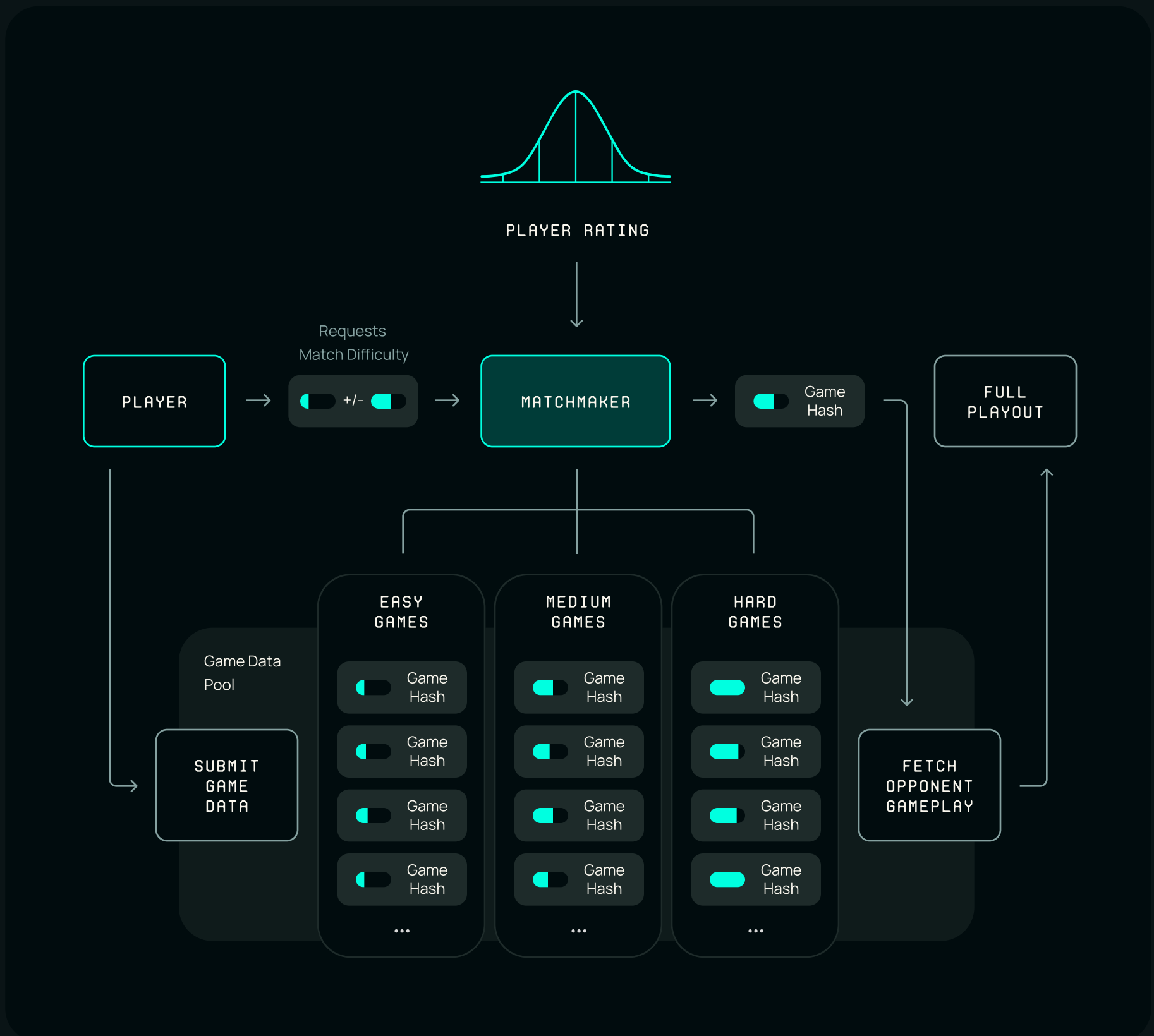
The Reboot Protocol features a player-centric automated market maker (“AMM”) that pairs similarly-ranked players against one another in games of skill deployed on the protocol. Players will have the choice to match with higher-skilled players for a chance at a greater reward; however, the Reboot Protocol will disincentivize players from matching down or smurfing. To enter a game on the Reboot Protocol, the player's wallet is charged with Game Credits backed by the Reboot Protocol's Reserve Pool.



COMPONENTS OF THE REBOOT PROTOCOL

## Matchmaking

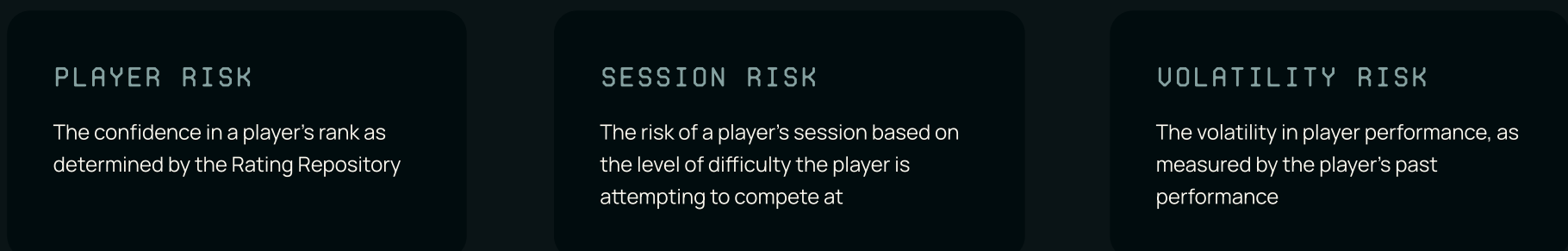
The Reboot Protocol uses the public ranking data and on-chain verifiable random number generation to provide autonomous, fair, and auditable matches for players. The protocol features a variety of default matchmaking archetypes for popular game types and provides abstract APIs for developers to adapt the system for the unique needs of their game.



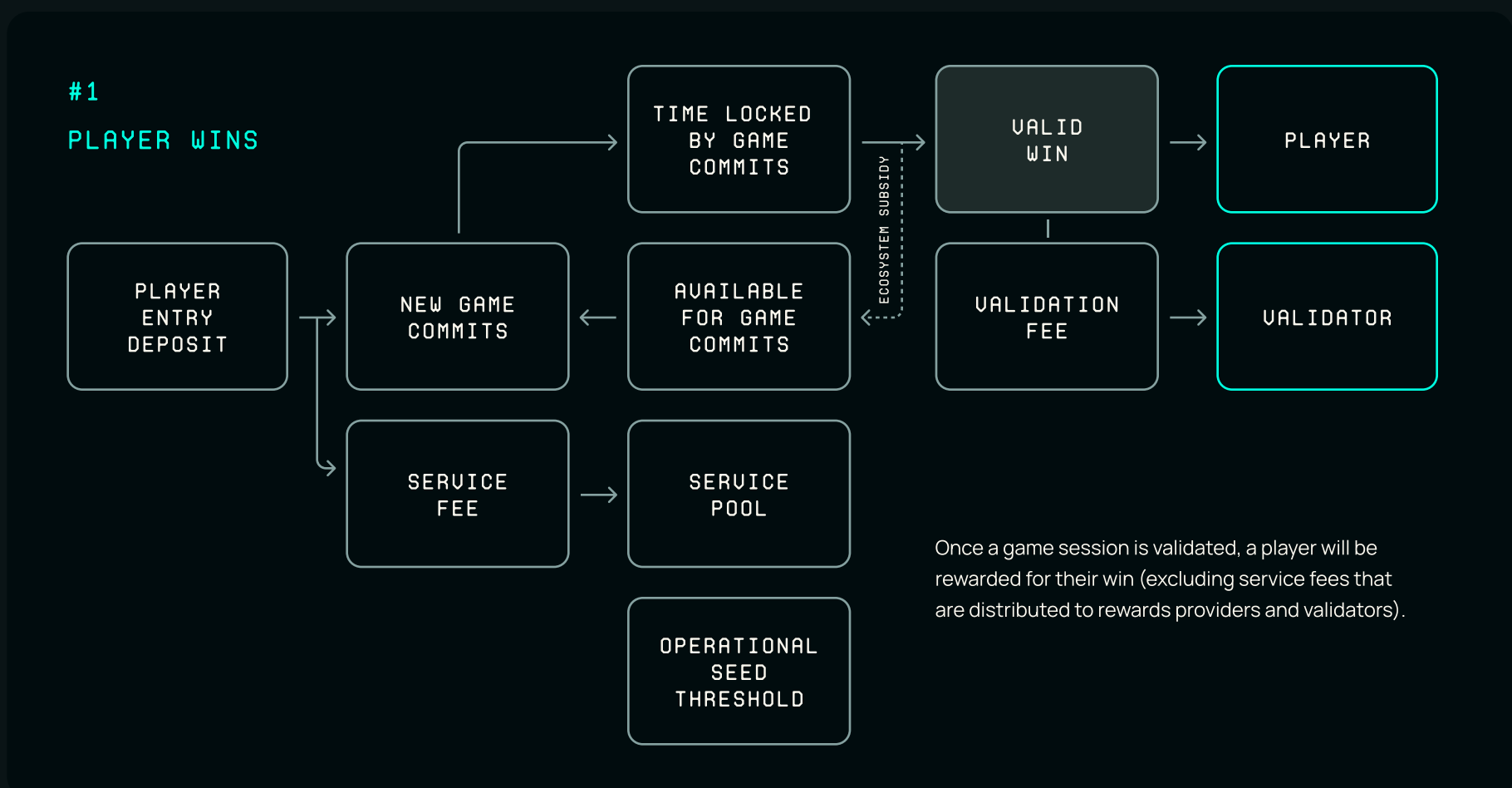


## Rewards AMM

The Rewards AMM is an Automated Market Maker that distributes rewards to gamers in skill-based competitions. The Rewards AMM automatically manages the pool of available tokens provided by its internal rewards pool. Rewards LP providers supply NDT to the Rewards AMM's rewards pool to earn fees for market making rewards economies for their favorite games. The Rewards AMM autonomously validates and accepts commitments from players requesting reward allocations that satisfy the AMM's security constraints. Rewards, fees and proceeds from game outcomes are automatically distributed to players, validators and rewards providers. The Rewards AMM takes into account the following factors when it accepts game commitments from players:



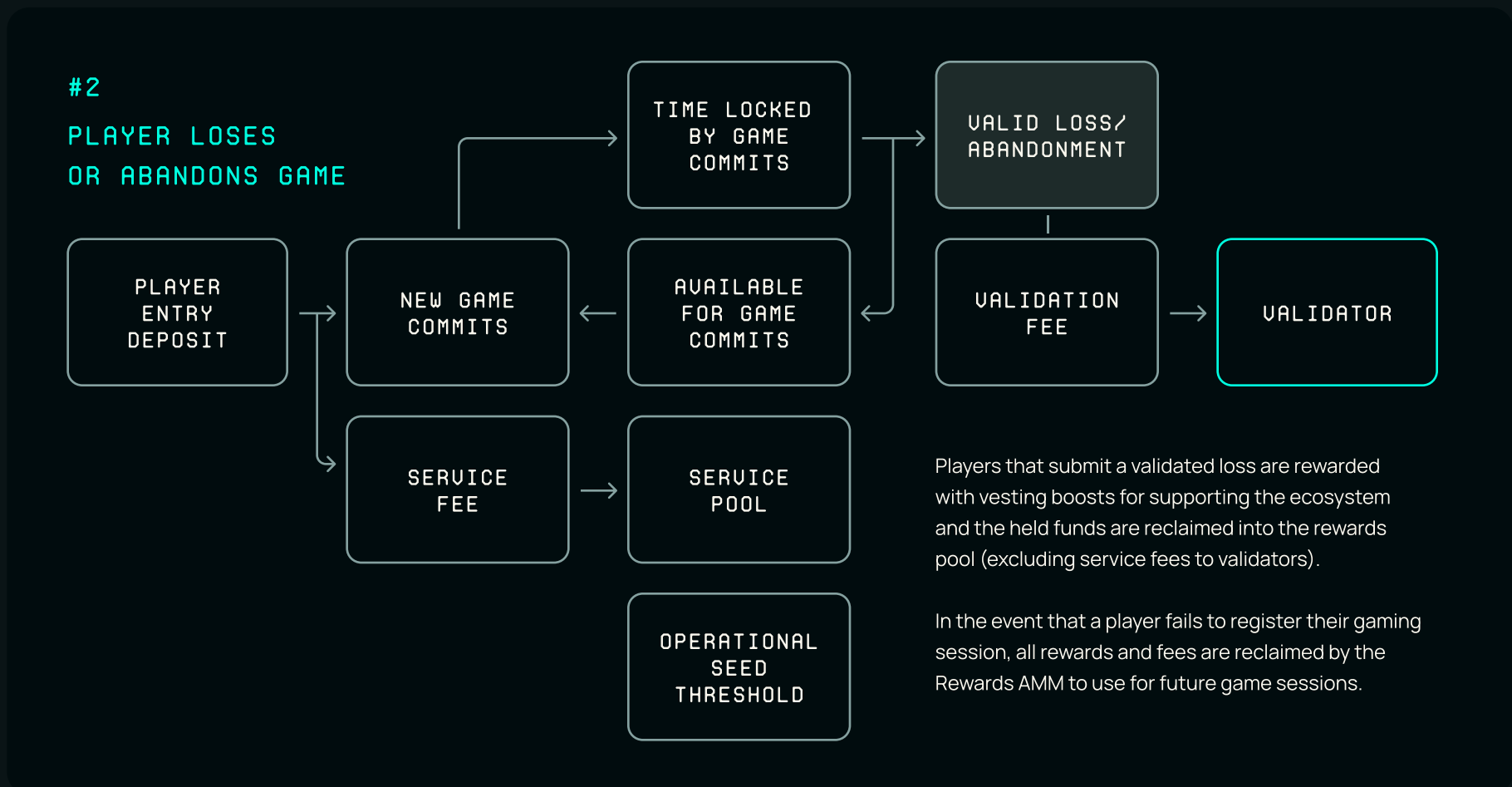
Session rewards are held in escrow by the Rewards AMM with a time-locked on-chain commitment while the player uses the matchmaking system to find a match, play the game and coordinate with the validator network to construct a provable, skill-based claim to the rewards held by the AMM based on the outcome of play. Once a session has been approved, the Rewards AMM only releases the held rewards under the following circumstances:







## Rewards AMM



Players earn rewards in the form of vesting NDT (vNDT) and vesting NFTs (vNFTs) which become liquid based on factors relating to the player's level of participation in the protocol. These factors include:

- > **Completed Game Sessions:** Rewards are primarily vested based on a player's completion of sessions, win or lose. Players who abandon gameplay or do not report a loss, will not vest rewards or vesting boosts earned during that game session.
- > **Gameplay Streaks:** Players that complete sequential game sessions on the Reboot Protocol within a preset period of time will earn a quicker vesting rate.
- > **Stable Rating:** Uncertainty of a player's rank converges as they complete game sessions, which de-risks that player's rewards claims and certifies honest play. By rewarding highly converged player ratings with boosts and reduced fees, the Reboot Protocol incentivizes fair play and disincentivizes detrimental behavior like smurfing or sandbagging.
- > **Participation Bonuses:** Reboot Protocol provides expedited vesting bonuses for highly engaged players that remain in continuous good standing within the platform.
- > **Developer Settings:** Developers have the ability to offer discretionary vesting bonuses that incentivizes specific actions by players within their games.

Rewards providers earn fees and a share of Rewards AMM proceeds for providing funds. Rewards providers use their NDT to choose the game portfolio they want to create markets for, incentivizing them to support the Reboot Protocol's economy.

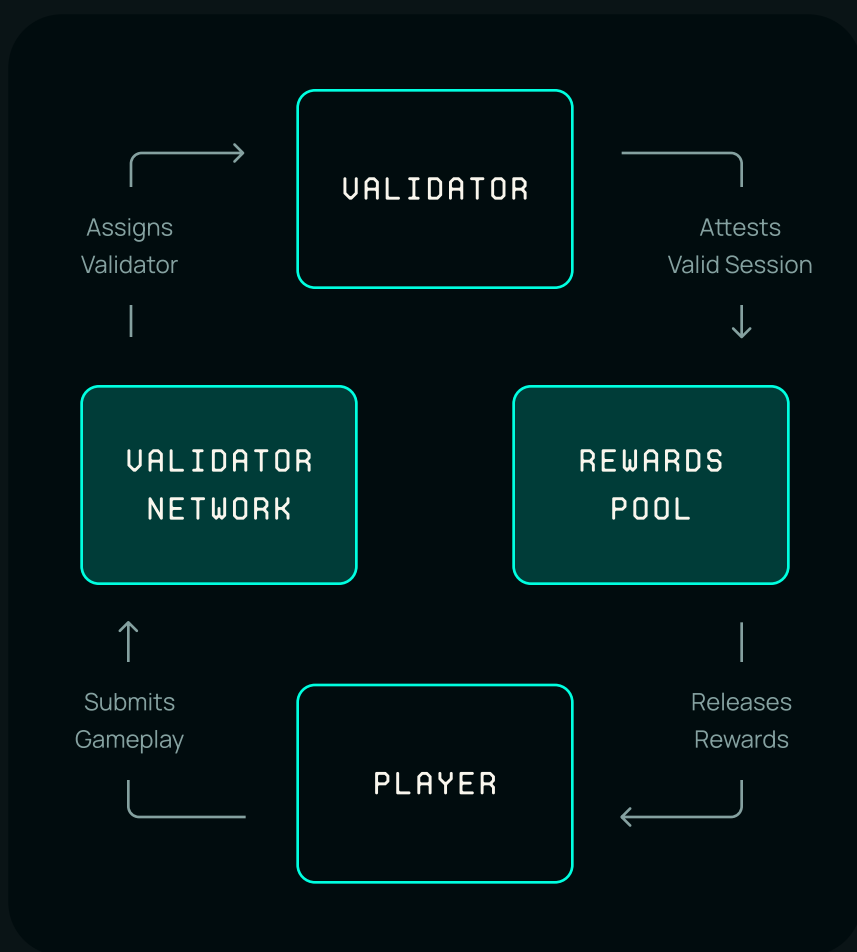


## COMPONENTS OF THE REBOOT PROTOCOL

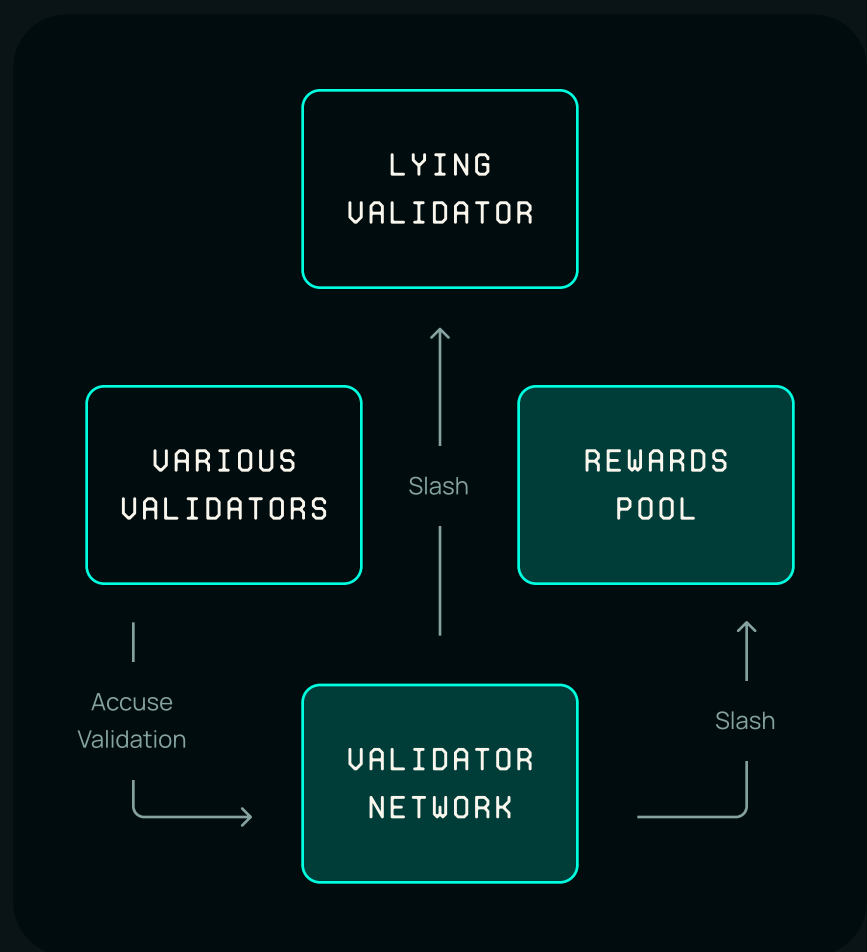
## Proof-of-Play

At the heart of the Reboot Protocol is a cryptographic commit-reveal structure called Proof-of-Play, which allows for automated validation of game outcomes played on the Reboot Protocol. This structure is used to demonstrate, in a publicly verifiable and provable chain, that all parties participating in the generation of the game's outcome did so fairly and by the rules of the game. Once generated, this Proof-of-Play is a fully auditable receipt that may be submitted to the Rewards AMM to calculate and claim a rewards payout.

## VALIDATION FLOW



## SLASHING FLOW



 PARTICIPANT  SYSTEM

Validation of game outcomes are automated by the Reboot Protocol. Validators provide a slashable stake of NDT to hold as collateral against validation defects. Approved validators earn fees for replaying and attesting to the outcomes of player gameplay sessions. The validation process is fully autonomous once a node is staked and running. Players submit validated game sessions as proof to claim rewards from the Reboot Rewards pool. A validator's staked tokens are locked and held as insurance against sessions from the Rewards AMM for a period of time known as the resolution time. Validator fees are awarded after the resolution time has ended for all attestations.





## Proof-of-Play

Game session validation is managed by the Rewards AMM, including the distribution of all validator stakes, dispersing fees to validators for good-faith attestations, liquidating validator positions, and paying out slashing requests. Validators that make incorrect, false, or incomplete attestations to the Reboot Protocol will be penalized or 'slashed'. Valid slashing claims made within the resolution time result in their staked tokens being drawn down by the Rewards AMM to cover lost sessions and compensate the slashing validators. Any validator can act as a slasher to earn additional fees for protecting the network from rogue validators.

The Reboot Protocol's tokenized incentive structure ensures that good-faith participation is the optimal strategy for all parties participating in the construction of a Proof-of-Play outcome. By this, the Rewards AMM can, by default, automatically and in good faith, accept and issue rewards to Proof-of-Play claims. The Reboot Protocol adds a second layer of security to protect the Rewards AMM pool by issuing rewards as provisional Vesting Rewards that are only usable within the system after the Proof-of-Play outcome passes validator review.



## Vesting Rewards

Tokens distributed by the Rewards AMM will include a vesting function. These tokens will vest over time as players are active on the Reboot Protocol. Vesting boosts can also be unlocked through gameplay to expedite the unlock process.

### vNDT

Represents wrapped NDT that must vest to become liquid. vNDT vests by redeeming boosts earned through gameplay, jubilee rewards (limited-time promotions of accelerated vesting for good-faith players), developer promotions and other methods TBD. vNDT acts as the Reboot Protocol's 'prize currency' and gives holders exclusive access to the Reboot Shop.

### vNFTS

A flexible standard for all NFTs issued by the Reboot Protocol. Developers can customize the vNFTs to create a wide array of rewards including soulbound achievement badges, tradable in-game assets, Game Credits and more. For avoidance of doubt, vNFT covers both ERC-721 and ERC-1155 standard digital tokens.

vNDT and vNFT represent a specific amount of NDT held in the Reserve Pool. vNDT and vNFT may be used to implement gamified mechanisms that allow players to make the underlying NDT liquid and market tradable. The default implementation provides for vesting, burning and crafting of Vesting Rewards to unlock liquidity.

Vesting Rewards that have not met the requirements for liquidity unlocks can also be used within the Reboot Protocol. Players can use vNDT to purchase Game Credits and vNFTs as in-game items for Reboot Protocol games.

Players accumulate Vesting Rewards for gameplay on a rolling-basis. Positive behavior on the Reboot Protocol is rewarded through vesting boosts, which are required to progressively unlock liquidity from the Vesting Rewards. When fully vested, vNDT will unlock for distribution to the holder and vNFTs can be burned to redeem the collateralized NDT.

Vesting boosts are earned when players win games and register their play with the Reboot Protocol. Players with a low RD accumulate vesting boosts at a higher rate as an incentive to maintain high certainty around their ratings. Players can increase their vesting rate by accumulating multiple vesting boosts. When a player has accumulated enough vesting boosts to unlock Vesting Rewards, their claim goes into a queue which is satisfied by the Reboot Protocol in claim-order.

Note: Players that have not been active and/or do not register their gameplay with the Reboot Protocol are subject to having their Vesting Rewards reclaimed by the protocol. The longer these rewards are dormant, the higher the probability that they will be reclaimed and recycled within the ecosystem.



COMPONENTS OF THE REBOOT PROTOCOL

## Vesting Rewards

Each vNFT has a configurable threshold that must be reached in order to fully vest and collateralize the underlying NFT. Once fully vested, the vNFT is considered collateralized and becomes transferable outside of the Reboot Protocol ecosystem. The vNFT can also be burned to collect the NDT that collateralize the token. Further, vNFTs will have the option to include a renting contract. This will allow other players to use these tokens and accumulate vesting boosts from gameplay that benefit the owner.

By allowing rewards to vest through this dynamic workflow, the Reboot Protocol creates a self-sustaining system that promotes active participation with accelerated rewards liquidity while also protecting the reward pools by:

### INCENTIVIZING GAMEPLAY

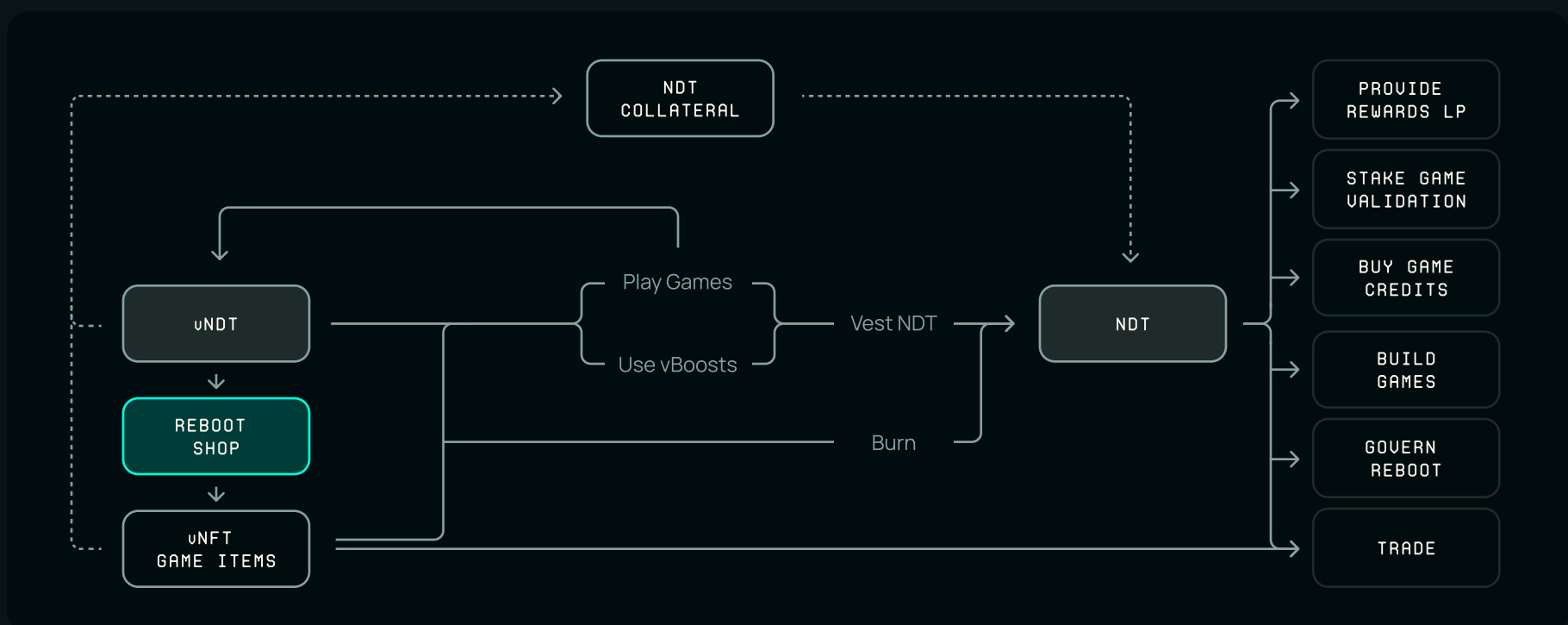
Players who complete gaming sessions receive expedited vesting of previously earned rewards at a higher rate as a benefit for protocol completion.

### REWARDING CONTINUOUS ENGAGEMENT

Players who regularly engage with the Reboot Protocol receive promotions that speed-up vesting rewards.

### DETERRING BAD ACTORS

Player accounts are disincentivized from smurfing by anchoring vesting rates to glicko-score convergence, providing better long-term rewards to those playing at their true skill level.



## Disincentivizing Inactivity

The Reboot Protocol performs regular clawbacks of unvested rewards that have lapsed as a measure to encourage players to regularly engage with the Reboot Protocol and remain in good standing.



## COMPONENTS OF THE REBOOT PROTOCOL

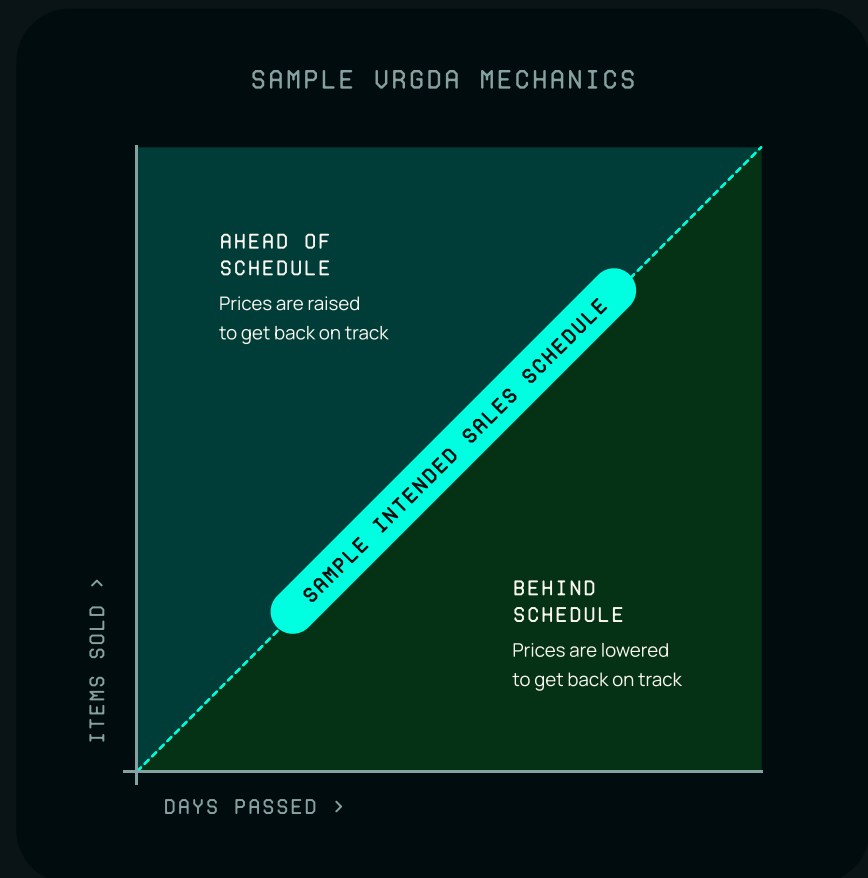
## Reboot Shop

The Reboot Shop is an AMM for in-game digital tokens that use VRGDAs to manage the distribution rate and price. Developers register digital tokens and their respective distribution curves with the Reboot Shop. These digital tokens are then sold by the Reboot Shop either directly to the players or exclusively to the protocol as vNFT rewards for posting a winning game to the Rewards AMM. Developers can select which digital tokens can be sold directly to players from the Reboot Shop and which can only be purchased by the Reboot Protocol to distribute as a reward to winning players.

### VRGDAs: Variable Rate Gradual Dutch Auctions

Game developers on the Reboot Protocol can leverage native contracts designed to satisfy a variety of use cases, including cosmetic items, in-game power-ups and consumables, context expansion packs, and more. Developers deploying a game can configure a shop powered by VRGDAs, with the various items represented as vNFTs. The vNFTs in the shop can be purchased using the Reboot Protocol's vNDT currency, ensuring prioritization of gamers over speculators.

For each item in the shop, the configuration process involves choosing a target number of sales across a given time period. When the number of sales stays on track with the expected sales rate, the price of the vNFTs remains static. If the item begins to exceed its sales target, the price proceeds to increase exponentially. Items that may be slower to sell will decrease in price until the market finds a level at which supply and demand are aligned based on the desired sales schedule.



Additionally, developers can select one of two curves, linear or logistic. When selecting a linear curve, the developer creates a vNFT with a high-cap supply limited only by the number of outstanding vNDT that is circulating. When selecting a logistic curve, the developer is explicitly choosing a maximum supply for the item, creating an initial burst in sales, followed by a slow rate of sale as the supply approaches the limit.

Further, games can allow the purchaser to set a max price on the item, or the developer can hard code in a tolerable slippage to mitigate the risks associated with front running purchases. If a player goes to purchase an item, the contract validates whether or not the max price is greater than the price at execution, ensuring that a transaction is reverted if a front-run is attempted. Developers can leverage algorithms used in surge pricing within their games and frontends to adjust slippage on behalf of users during times with high transaction volume to minimize the number of failed transactions.



## Reserve Pool

The Reserve Pool contains the protocol's native ERC-20 standard digital token ("Native Digital Token" or "NDT") as well as additional ERC-20 standard tokens that may be paired with the Native Digital Token by the Reboot Protocol in on-chain liquidity pools. Each of the tokens below, which are distributed by the Reboot Protocol, is automatically collateralized by the Reserve Pool:

### GAME CREDITS

Sold to players by the protocol, game credits release their backed Native Digital Token as a gameplay session against the Rewards AMM.

### vNDTS

Players who participate in the protocol receive Native Digital Tokens that vest (vNDT) based on the player's time spent playing games.

### vNFTS

Digital tokens distributed by the Rewards AMM are collateralized by Native Digital Tokens (vNFTs), and can be burned, crafted, and other gamified interactions to release the underlying NDT.

The Reserve Pool handles releasing NDTs on behalf of the Reboot Protocol under the following conditions:

### REWARDS AMM COMMITMENT

Native Digital Tokens are released to the Matchmaking Protocol when a player is charged Game Credits for a game session that it enters.

### VESTING vNFTS AND vNDTS

Native Digital Tokens are released to players when they complete enough protocol interactions to vest rewards fully.

The Reserve Pool also manages the conversion of other ERC-20 tokens that were originally used to purchase Game Credits from the protocol back to its NDT. For example, if a protocol instance allows players to use ETH or USDC to purchase Game Credits, the Reserve Pool would automatically purchase the NDT with ETH or USDC through an external AMM.

Further, Rewards AMM contracts may be configured to provide liquidity to the Reserve Pool and can do so through LP positions. Providers of rewards liquidity will mint an LP token representing their share of the Reserve Pool. While staked, the LP position will earn fee distributions for providing liquidity as set by the Protocol Governance. Providers may redeem their LP at any time. Reboot Protocol itself may automatically add and unwind LP positions to ensure proper risk-adjusted liquidity is maintained in the Reserve Pool.



COMPONENTS OF THE REBOOT PROTOCOL

## Protocol Governance

The Reboot Protocol features a decentralized governance body, which is an integral mechanic to ensure the protocol meets its mission of being a scalable, decentralized framework for developers to build entertaining, skill-based games that reward players.

Holders of the Reboot Protocol's NDT will have decision-making authority over the following protocol parameters:

APPROVAL OF NEW GAME SESSION VALIDATORS

APPROVAL OF DEVELOPERS BUILDING ON THE REBOOT PROTOCOL

APPROVAL OF GAMES BUILT ON THE REBOOT PROTOCOL

PLAYER SUSPENSION AND REINSTATEMENT

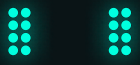
RESERVE POOL POLICIES

REVENUE DISTRIBUTION POLICIES

REWARDS AMM POLICIES

The list above is representative and is not meant to be exhaustive – all parameters within the Reboot Protocol are governed by holders of the Native Digital Token. Further, all NDT, vNDT, staked NDT, and items collateralized with NDT staked within the various Reboot Protocol components will automatically maintain their governance vote on a 1-to-1 basis.





## Other Participants

### Validators

The Reboot Protocol will feature automatic game validation, which must be completed for players to claim their rewards. **Validators on the Reboot Protocol will be required to hold its Native Digital Token in order to participate.** At launch, Reboot Protocol will use a provisional validator network that will scale and decentralize progressively over time. Validators must be approved by Protocol Governance in order to participate.

Those participating in validation will be required to stake their Native Digital Tokens which become locked for a to-be-determined timeframe (“Resolution Period”). This allows time for Proof-of-Play claims to be audited against bad-faith validation. Validators caught participating in bad-faith validations will have their locked tokens slashed or drawn-down by the Reboot Protocol to cover losses from distributing incorrectly validated prizes. Any approved validator may participate in this process and earn a share of any draw-downs for bad-faith actions.

Players use validated game sessions to claim prizes from the Rewards AMM rewards pool. Approved validators will gain access to a Reboot Protocol automated tool that replays and attests to gameplay session outcomes. Validators earn fees, proportional to the number of game sessions that they validate. Validator fees are awarded after the elapse of the Resolution Period for all attestations that have not been slashed. Validators with a streak of uncontested game attestations will have the option to be rewarded by Protocol Governance with vesting boosts credited against their earned fees.

### Auto-Affiliate Program

The Auto-Affiliate Program is an autonomous affiliate referral program that exists on-chain. There are two affiliate levels available on the Reboot Protocol:

#### Level 1

- › Affiliates must activate their referral codes on-chain, and new players may redeem these codes in various protocol transactions. Registering as an affiliate involves a transaction to connect a public account address to a referrer and create a fee-sharing account for the affiliate to make claims to the Reboot Protocol. Anyone can register as an affiliate through a contract frontend.
- › Affiliates activate their referral links on-chain which can then direct users to specific games or the Reboot Protocol through whichever method the affiliate wishes to use (i.e. social media, emails, etc). Every referral link redeemed by a new player is associated with the affiliate’s account.
- › Once a player redeems an affiliate code, it is perpetually bound to the player. The affiliate will then earn a share of all fees generated by the new player within the Reboot Protocol, which are claimable at any time. Parameters of the program are subject to Protocol Governance updates.

#### Level 2

- › Affiliates are allocated a budget of free Game Credits or promotional bundles to distribute to users. In this phase affiliates earn a larger share of fees from players they refer.
- › Affiliates can be promoted to Phase 2 either through a decision by Protocol Governance or via auto-promotion based on a threshold of accrued fees.
- › Phase 2 Affiliates unlock the ability to distribute prize bundles of Game Credits or vNFTs to players.



## Putting It All Together





PUTTING IT ALL TOGETHER

## The Game Session Cycle

The following example illustrates how the Reboot Protocol can be used to create a fully distributed gaming marketplace of rewards for any skill-based game. Extensions for the protocol include real-time multiplayer games, team-based games, asynchronous single-player and multiplayer games, and more. Through the protocol, players are able to earn rewards commensurate with their willingness to take on skill-based risk in a decentralized and anonymous manner. The protocol allows games to operate autonomously and leverage distributed scaling based on the demand for gameplay of any title.

EXAMPLE

To best explain the end-to-end process of the Reboot Protocol matching, validating, and rewarding a gaming session, we will use an example featuring **Alice (A)** and **Bob (B)** who are two players that wish to compete in a skill-based game of Tic-Tac-Toe for the exchange of tokens without needing to reveal their identities. They both want to be assured that the game will resolve fairly and according to the rules of the game without requiring either party to trust the other. However, Bob is a much worse Tic-Tac-Toe player than Alice. Based on his rating, Bob only has a 40% chance of defeating Alice.

$$P(\text{B BEATING A IN TICTACTOE}) = 0.4$$

$$P(\text{A BEATING B IN TICTACTOE}) = 0.6$$

If Bob chose to commit to this game, despite his reduced chance of winning, a fair compensation for his effort, in the event of a win after committing a deposit of 1 token is calculated as:

$$O(\text{B BEATS A IN TICTACTOE}) = \frac{1}{0.4} \approx 2.5 \text{ TOKENS}$$

Consequently Alice's potential winnings for the same 1 token commitment is calculated as:

$$O(\text{A BEATS B IN TICTACTOE}) = \frac{1}{0.6} \approx 1.7 \text{ TOKENS}$$

Assuming Bob and Alice are each willing to commit only 1 token for the opportunity to play this game, the disparity between their respective potential outcomes makes the game insolvent as the total of 2 tokens available to cover the outcome if Bob wins is insufficient to compensate him for the risk of competing against a challenging opponent. Additionally, Alice and Bob have no way to be assured of their true relative win probabilities, nor can they conduct this game fairly, anonymously, and according to the rules without entrusting the other party to play fairly.

The Reboot Protocol solves this problem by allowing Alice and Bob to conduct a fair game of Tic-Tac-Toe or any other deterministic skill-based game. They can both be assured that the outcome will be determined according to the rules of the game and that the winner will be fairly compensated relative to the risk they undertake by committing to the game. Further, the protocol provides a system to publicly rank players in such a way that fair and accurate winning may be calculated for such contests.



PUTTING IT ALL TOGETHER

## The Game Session Cycle

### Game Commitment

When applied to the Tic-Tac-Toe example in the previous page, below is how the Reboot Protocol allows a game between Alice and Bob to be conducted successfully and fairly, such that all parties are compensated for their risk without requiring them to rely on a centralized service, reveal their identities or trust each other to complete the protocol.

**EXAMPLE** Bob wishes to commit 1 token to a game of Tic-Tac-Toe and is willing to accept a 10% difficulty threshold, or variance, around a 50/50 Tic-Tac-Toe matchup. Bob sends a transaction to the Reboot Protocol's Tic-Tac-Toe Rewards AMM smart contract along with his 1 token payment for the service.

Bob's commitment is of the following form:

```
{  
  EUM_ADDRESS # USED TO LOOK UP BOB'S RATING & BALANCES  
  DIFFICULTY_THRESHOLD # 10% AROUND A 50/50 MATCH  
  COMMITMENT_EXPIRY_TIME # PROTOCOL ENFORCED GAME RESOLVE TIME  
}
```

Upon receiving Bob's request, the Reboot Protocol will first calculate the maximum number of tokens Bob can receive as rewards to ensure the rewards pool can collateralize the game session. The Rewards AMM looks up Bob's address in the Rating Repository to find his public rating for Tic-Tac-Toe, which can be used to calculate the probability of him winning a round and, by extension, his maximum reward.

The maximum reward calculation will vary by game depending on how many potential outcomes are involved. For this example of Alice and Bob's game of Tic-Tac-Toe, we can assume there is just one outcome - winning the game - with an occurrence probability of 40% calculated through a comparison of Bob's rating and his opponent's rating, as well as the protocol's certainty around each.

Based on this, the Rewards AMM can compute Bob's maximum potential reward as:

$$\text{MAX\_REWARD} = \text{ENTRY\_DEPOSIT} \times \sum_{I=1}^{N \text{ OUTCOMES}} \frac{W_I}{P_I} = \frac{1}{0.4} = 2.5 \text{ TOKENS}$$



PUTTING IT ALL TOGETHER

## The Game Session Cycle

This reward is then reduced by a fixed service fee established in conjunction with the Rewards AMM's launch, as well as a risk fee based on Bob's rating uncertainty and payout multiplier that compensates the pool for added risk. For this example, we assume there is a 5% service fee and 2.5% risk fee, such that:

$$\text{ADJUSTED\_MAX\_REWARD} = (1 - \text{SERVICE\_FEE}) \times (1 - \text{RISK\_FEE}) \times \text{MAX\_REWARD} = 2.316 \text{ TOKENS}$$

The risk fee is calculated as the sum of three smaller discounts: a fixed edge to ensure the pool grows over time, a payout reduction factor that tracks player RD, and a factor that tracks the payout multiplier.

$$\text{RISK\_FEE} = \text{RD\_RISK\_FEE} + \text{PAYOUT\_RISK\_FEE} + \text{FIXED\_RISK\_FEE}$$

The fixed factor remains constant, and the other two vary along a set range determined by Protocol Governance:

$$\text{PAYOUT\_RISK\_FEE} = \text{PRF\_MAX} - \frac{\text{PRF\_MAX}}{\text{PRF\_K} \times \text{MAX}(\text{PAYOUT\_MULTIPLIER} - 2, 0) + 1}$$

Where:

- > **PRF\_MAX** is the maximum that **PAYOUT\_RISK\_FEE** can take on
- > **PRF\_K** controls how fast **PAYOUT\_SIZE\_FACTOR** changes with respect to **PAYOUT\_MULTIPLIER**
- > **PAYOUT\_MULTIPLIER** is the **MAX\_REWARD** divided by the **ENTRY\_DEPOSIT**

$$\text{RD\_RISK\_FEE} = \text{RD\_RF\_MAX} \times (350 - \text{RD})$$

Where:

- > **RD\_RF\_MAX** is the maximum that **RD\_RISK\_FEE** can take on
- > **RD** is the player's rating deviation, sourced from the Ranking Repository upon initialization of the claim

Once the **ADJUSTED\_MAX\_REWARD** is calculated, the Rewards AMM checks against the current available balance from the pool. The Rewards AMM will accept Bob's commitment if the following holds:

$$\text{ADJUSTED\_MAX\_REWARD} \leq \text{AVAILABLE\_POOL\_BALANCE}$$



PUTTING IT ALL TOGETHER

## The Game Session Cycle

`AVAILABLE_POOL_BALANCE` is calculated as follows:

$$\text{AVAILABLE\_POOL\_BALANCE} = \text{MAX} [ (\text{POOL\_BALANCE} - \text{SEED\_BALANCE}) \times \text{PCT\_POOL\_AVAILABLE}, \text{FIXED\_MAX\_PAYOUT} ]$$

the available pool balance when  
the pool taps into the seed balance

If `POOL_BALANCE`  $\leq$  `FIXED_MAX_PAYOUT`, the pool cannot collateralize any more games and must wait for either

- > Existing claims to resolve if there are any, OR
- > For liquidity providers to inject more liquidity if there are no outstanding claims or reclaimable rewards.

Where `SEED_BALANCE` is a portion of the pool balance set aside upon initialization to insulate the pool against short-term volatility, and `PCT_POOL_AVAILABLE` tracks the percentage of the pool available for rewards. This percentage varies along a set range and is calculated as follows:

$$\text{PCT\_POOL\_AVAILABLE} = P_{\text{MIN}} - \frac{P_{\text{MIN}} - P_{\text{MAX}}}{K \times \text{MAX} (\text{POOL\_BALANCE} - \text{SEED\_BALANCE}, 0) + 1}$$

Where:

- >  $P_{\text{MIN}}$  is the minimum `PCT` of the pool available (this is reached at high pool balances)
- >  $P_{\text{MAX}}$  is the maximum `PCT` of the pool available (reached at low pool balances)
- >  $K$  is how quickly `PCT_POOL_AVAILABLE` changes with respect to `POOL_BALANCE`

Assuming the Rewards AMM can cover Bob's commitment, it adds Bob's deposit to the pool of funds, then allocates and holds in escrow a number of pool funds equal to `ADJUSTED_MAX_REWARD` to ensure there are funds available for Bob's reward if he wins. This balance will be unavailable until Bob submits a verified claim against it or the `COMMITMENT_EXPIRY_TIME` elapses at which point it may be reclaimed back into the pool.

Finally, the Rewards AMM writes a commitment record to the blockchain publicly recording the mutual commitment of Bob to complete the game and the Reward's AMM to fulfill the rewards claim upon receipt of a verifiable claim from an approved validator. The commitment record has the following form.

```
{  
  COMMITMENT_ID # COMMITMENT REFERENCE NUMBER  
  EVM_ADDRESS # BOB'S ADDRESS  
  ADJUSTED_MAX_REWARD # CALCULATED MAX REWARD TO BOB  
  DIFFICULTY_THRESHOLD # 10% AROUND A 50/50 MATCH  
  COMMITMENT_EXPIRY_TIME # EXPIRATION TIME OF COMMITMENT  
}
```

NOTE: As part of the full implementation of the protocol the Rewards AMM has the opportunity to clean up and claim previously expired or unclaimed commitments. The step is omitted in this discussion only for simplicity.



PUTTING IT ALL TOGETHER

## The Game Session Cycle

### Matchmaking

At this point, Bob is ready to proceed to the Matchmaking step of the protocol. Now that Bob has committed to the game, he must find a willing opponent. The Reboot Protocol's Matchmaking service allows for this by automatically accepting requests from players with active game commitments and generating fair matches based on the rank difficulty they committed to as part of their commitment phase.

In this scenario, Alice has previously made a compatible commitment to Bob via the Rewards AMM. Through the public nature of Alice and Bob's commitment, they are able to discover each other through the Reboot Protocol and submit a match-up request to the on-chain matchmaking interface. In this scenario, the Matchmaker confirms that Alice and Bob have made commitments to the Tic-Tac-Toe Rewards AMM and that their accepted difficulty commitments overlap enough to be acceptable to both parties.

The matchmaker then generates a publicly visible on-chain record of this matchup of the form:

```
{  
  MATCHMAKING_ID # UNIQUE ID ASSOCIATED WITH THIS MATCHUP  
  COMMITMENT_ID_ALICE # ALICE'S COMMITMENT ID  
  COMMITMENT_ID_BOB # BOB'S COMMITMENT ID  
}
```

Once a match is made, Bob and Alice can start playing by participating in a series of commit-reveal transactions, authorized by a validator or network of validators that can attest that both participants are operating within the rules of the game.



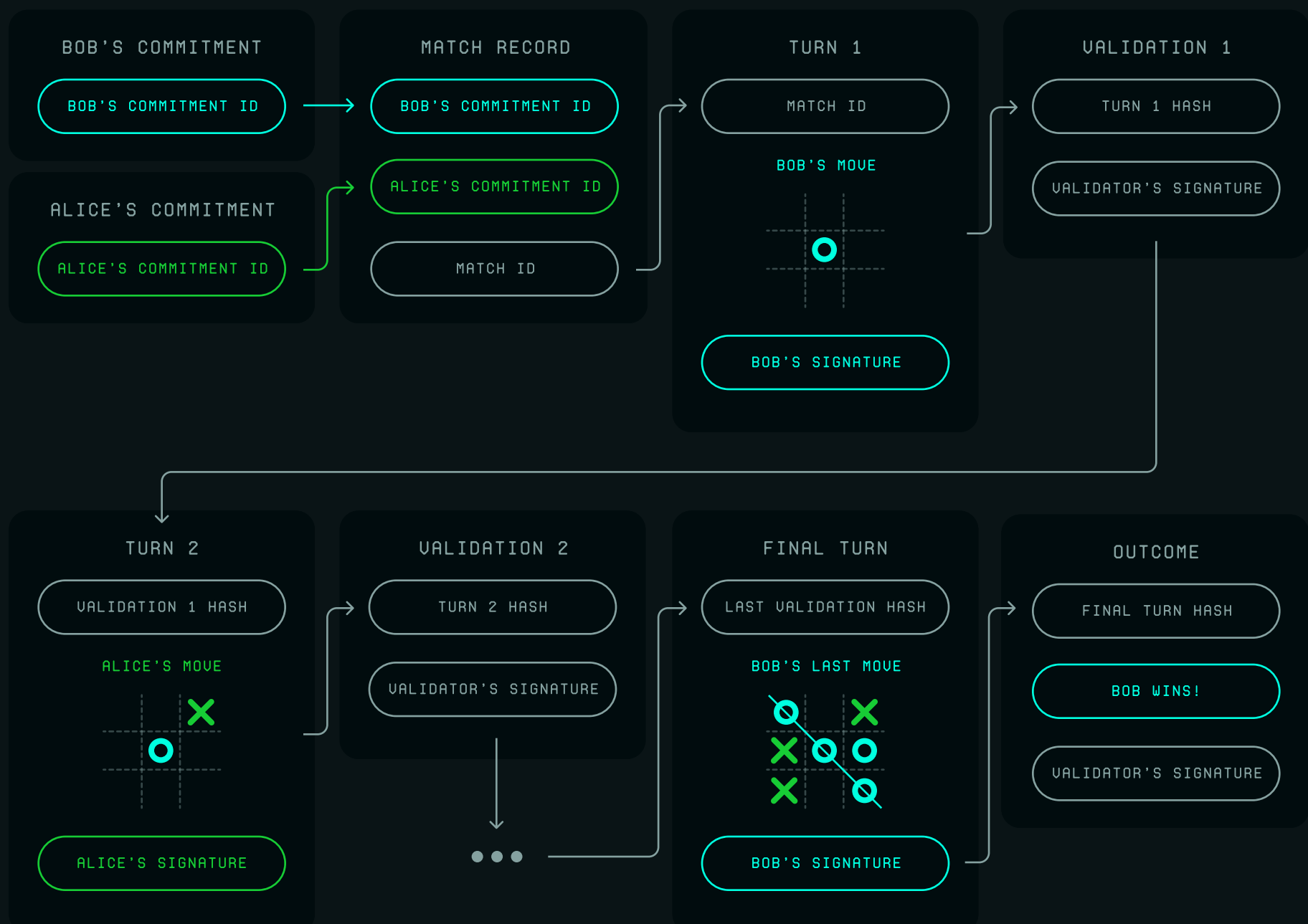
PUTTING IT ALL TOGETHER

## The Game Session Cycle

### Proof-of-Play

During this phase of the Reboot Protocol, Bob and Alice commit their moves via a cryptographic signature and relay them through a validator who replays each of their moves and validates them according to the rules of Tic-Tac-Toe via a verifiable signature. The validator stakes a number of tokens that exceeds the max outcome of the game with the Reboot Protocol's validator contract and accepts responsibility to compensate the Rewards AMM in the event of a fraudulent game submission. The outcome of this step is a fully verifiable, public transcript of every game move and the calculated final outcome of the game, signed by all participating parties and co-signed by a validator.

### Constructing Bob's Playout Proof





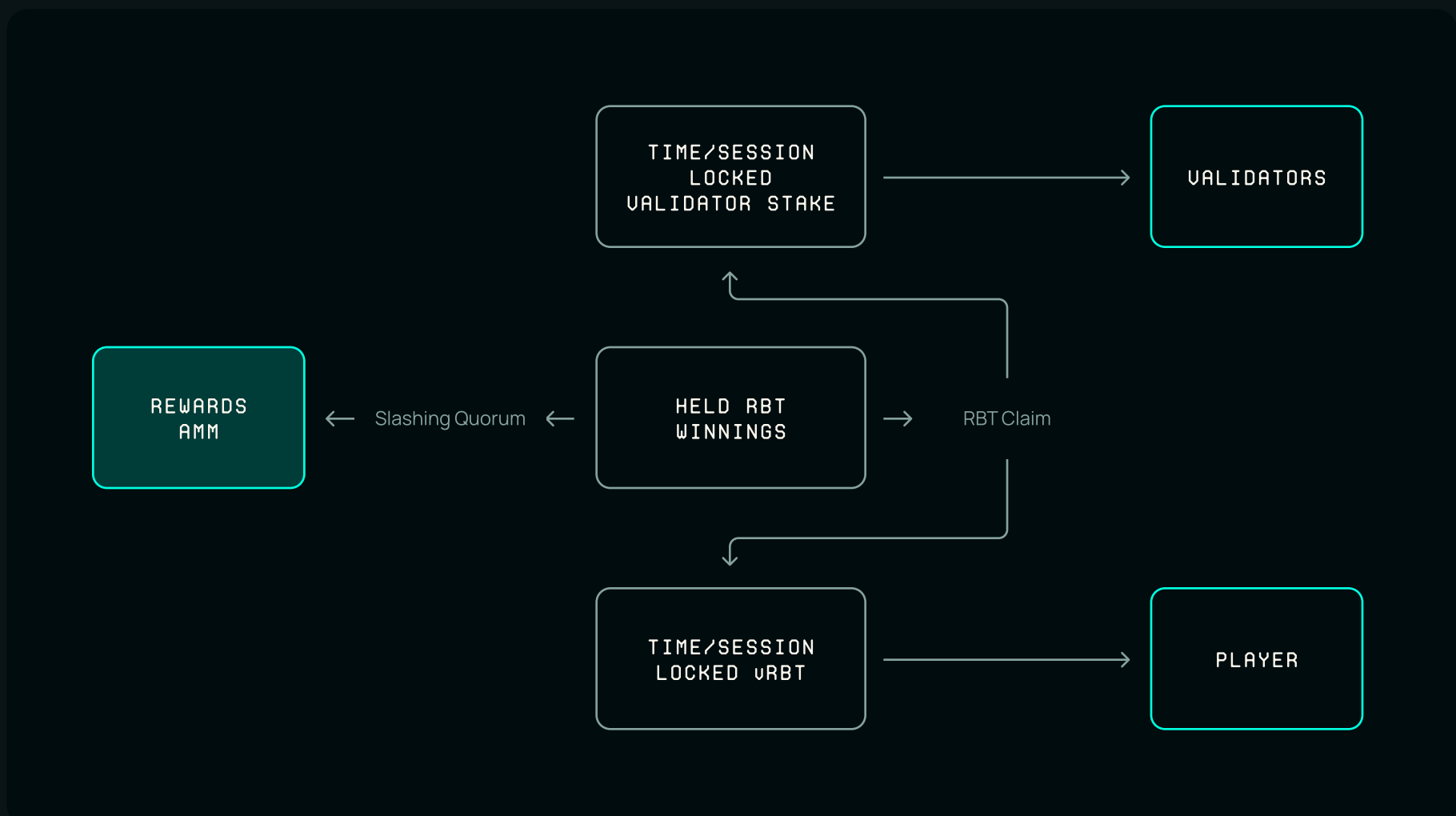
PUTTING IT ALL TOGETHER

## The Game Session Cycle

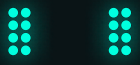
### Claims

Once constructed, the Proof-of-Play may be submitted by Alice or Bob to resolve the claim. In the event that Alice, Bob or the validator fail to complete the Proof-of-Play before the end of the expiry period, the other participants may submit a partially completed proof as evidence to claim remunerations against the opposing party. The Reboot Protocol holds all tokens in escrow until a valid claim is submitted and the Rewards AMM distributes rewards and ecosystem fees. Player fees are distributed in the form of vNDT which becomes convertible to NDT after the protocol's review phase completes and based on the player's level of interaction with the protocol. If a game is abandoned or lost, the Rewards AMM reclaims the entry tokens.

After a claim is submitted, it enters a review phase where the verifiable Proof-of-Play is subject to public cross-validation. In this phase approved validators have a limited time to vote down the validation as fraudulent and slash the validator of origin. In the event of a slashed validation, both the validator's funds and player's funds are subject to penalties. As player's rewards are denominated with vNDT the underlying collateral for those rewards may be re-allocated by the protocol to compensate the Rewards AMM for a fraudulent claim.







PUTTING IT ALL TOGETHER

## Providing Rewards AMM Liquidity

Those who choose to provide liquidity to the Rewards AMM pool can do so through liquidity provider (LP) positions. LP positions are tracked through separate tokens that represent a provider's proportional share of the rewards locked inside the rewards pool. These tokens are minted when liquidity is added and burned when liquidity is removed from the pool.

LP funds locked in the rewards pool are subject to short-term risk due to the inherent volatility of the pool balance. As compensation for this risk, LPs can collect a portion of fees collected off each transaction (fee percentages are set by protocol governance). The percentage of total fees paid to each provider is equivalent to their share of total LP tokens.

While the rewards pool balance may be volatile in the short term, it will accumulate a surplus over longer periods of time.

### Seed Threshold

Rewards AMM pools are configured with a seed operational threshold required for Rewards AMM operation. The seed threshold is necessary to ensure Rewards AMM solvency and to protect the LP Positions with a high degree of certainty from operational volatility. The seed threshold is analytically determined based on other Rewards AMM parameters as discussed below. If the Rewards AMM pool falls below the seed balance due to an LP withdrawing their funds, the Rewards AMM ceases to accept game sessions. When a Rewards AMM suspends operations, LP providers may still withdraw or add positions. If the pool increases back to an operational threshold, the rewards service automatically resumes.

Note: The Reboot Protocol governance body may elect to provide the seed threshold for the Rewards AMM or it may allow developers to petition the governing body for seed grants. Additionally, developers, communities, or fans may independently raise or contribute seed LP positions to bootstrap Rewards AMM pools independent of the governance body.

### Rewards AMM Seed Balance

To maintain solvency, the Rewards AMM liquidity pools are structured such that the max payout is correlated with the pool balance, meaning the protocol will only take on gaming sessions that it can collateralize. This works for the cases when the pool balance grows, but if the pool balance decreases too much due to short-term volatility, the max payout will become prohibitively small, and the protocol cannot accept new game commitments without an external injection of liquidity.

This risk is mitigated by allocating a fixed amount of rewards liquidity to a seed balance, creating a buffer that allows the protocol to always offer liquidity for gaming sessions while remaining highly insulated against a liquidity drain. The seed balance is separate from the remainder of the rewards pool, the surplus, which is used to calculate the available pool balance for maximum payouts.





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## Providing Rewards AMM Liquidity



To maximize the utility of all liquidity inside the pool, the seed balance should be kept at a minimum. Since the pool will always offer games, there is a chance that players will win too many times and drain out the seed balance. As the seed balance increases, the necessary number of wins increases and this chance is reduced. Understanding how the two quantities are related allows the Reboot Protocol to solve for the minimum seed balance required to keep the probability of a liquidity drain to a minimum. In addition to the probabilistic protection offered by the seed balance, hard protections are coded into the protocol so that it never allows a game session to pass if it cannot be collateralized with rewards.

### Seed Balance Derivation

#### Variables:

- > **SEED\_BALANCE**: The Seed Balance
- > **FIXED\_MAX\_PAYOUT**: The minimum max payout. Rewards at this level will always be accessible, even when the pool balance dips into the seed, assuming there is liquidity to collateralize them. **FIXED\_MAX\_PAYOUT** is set to  $2 \times (1 - \text{SERVICE\_FEE})$
- > **SERVICE\_FEE**: A percentage of entry fees paid to validators, developers, and LPs per transaction. This is removed prior to rewards calculation, so rewards are calculated as if the player is only wagering  $\text{ENTRY\_DEPOSIT} \times (1 - \text{SERVICE\_FEE})$  as opposed to the entire **ENTRY\_DEPOSIT**.
- > **RISK\_FEE**: A percentage removed from total player payout to ensure the pool both grows over time and is compensated more for serving as a counter-party to higher-risk games.
- > **FIXED\_RISK\_FEE**: The default/theoretical riskless value of **RISK\_FEE** that occurs when all risk factors are zeroed out. Ensures the pool grows over time. This value is added to a variable component to arrive at the total **RISK\_FEE**.
- > **ENTRY\_DEPOSIT**: The cost of a game in NDT



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## Providing Rewards AMM Liquidity

Known results:

- 1 The volatility of a game increases along with its payout multiplier, such that a game's volatility is maximized when its payout multiplier is maximized within given constraints.
- 2 Any biased random walk with step size  $s$ , probability of increasing  $p > 0.5$  and starting value  $k > 0$  will hit zero with probability  $\left(\frac{1-p}{p}\right)^{\frac{k}{s}}$ .

The general idea of this estimation is to approximate the pool balance with a random walk and use existing probability forecasting techniques relevant for random walks to estimate the probability the pool will drain out given the fee structure and seed balance. The estimation is then reverse-engineered to solve for seed balance as a function of the goal drain probability, which can be arbitrarily low, and fee structure.

This begins by characterizing the protocol's profit and loss for each game over  $n$  games as a set of random variables  $G_0, G_1, G_2, \dots, G_i, \dots, G_n$  where  $G_i$  represents the pool's P&L from the  $i$ 'th game. Assuming the seed balance is the only liquidity, the pool balance can be expressed as  $B_n$  after  $n$  games as the sum of all  $G_i$  added to **SEED\_BALANCE**:

$$B_n = \text{SEED\_BALANCE} + \sum_{i=1}^n G_i$$

Each  $G_i$  can be expressed as follows:

$$G_i = \text{ENTRY\_DEPOSIT} \times (1 - \text{SERVICE\_FEE}) - \text{PAYOUT}_i \text{ W/ PROB } P_i, \\ \text{ENTRY\_DEPOSIT} \times (1 - \text{SERVICE\_FEE}) \text{ W/ PROB } 1 - P_i$$

- > This assumes all games are one-outcome, but the concept can easily apply to multi-outcome cases by considering a multi-outcome game as several single-outcome games played at once.
- > Where  $P_i$  is the probability of the  $i$ 'th player winning the  $i$ 'th game, and  $\text{PAYOUT}_i$  is the potential rewards payout for the  $i$ 'th game.



PUTTING IT ALL TOGETHER

## Providing Rewards AMM Liquidity

We know that in the fixed range,  $PAYOUT_i \leq FIXED\_MAX\_PAYOUT$ . By setting  $PAYOUT_i = FIXED\_MAX\_PAYOUT$ , we simultaneously make the model simpler to forecast and maximize its volatility (and by extension the probability of it draining) vis. **1**. Substituting in  $FIXED\_MAX\_PAYOUT = 2 \times (1 - SERVICE\_FEE) \times ENTRY\_DEPOSIT$ , all  $G_i$  simplify to the following:

$$G_i = \{-ENTRY\_DEPOSIT \times (1 - SERVICE\_FEE) \text{ w/ PROB } P_i, ENTRY\_DEPOSIT \times (1 - SERVICE\_FEE) \text{ w/ PROB } 1 - P_i\}$$

If  $PAYOUT_i$  is constant, all  $P_i$  must also be constant. To be conservative, it is assumed that  $RISK\_FEE$  evaluates to its absolute minimum,  $FIXED\_RISK\_FEE$ , for all games, meaning the protocol has as little of an edge over players as possible and is by extension more likely to drain.

$$PAYOUT_i = \frac{(1 - SERVICE\_FEE) (1 - FIXED\_RISK\_FEE)}{P_i} \times ENTRY\_DEPOSIT$$

$$FIXED\_MAX\_PAYOUT = 2 \times (1 - SERVICE\_FEE) \times ENTRY\_DEPOSIT = ENTRY\_DEPOSIT \times \frac{(1 - SERVICE\_FEE) (1 - FIXED\_RISK\_FEE)}{P_i}$$

Simplifying:

$$P_i = \frac{(1 - FIXED\_RISK\_FEE)}{2}$$

$$G_i = -ENTRY\_DEPOSIT \times (1 - SERVICE\_FEE) \text{ w/ PROB } \frac{(1 - FIXED\_RISK\_FEE)}{2},$$

$$ENTRY\_DEPOSIT \times (1 - SERVICE\_FEE) \text{ w/ PROB } \frac{(1 + FIXED\_RISK\_FEE)}{2}$$

Since the pool balance  $B_n$  can now be modeled as the sum of independent and identically distributed random variables that increase and decrease by the same magnitude, it satisfies the definition of a biased random walk, and can now be described as a biased random walk with step size  $ENTRY\_DEPOSIT \times (1 - SERVICE\_FEE)$ , that increases each step with probability  $\frac{(1 + FIXED\_RISK\_FEE)}{2}$  and decreases with probability  $\frac{(1 - FIXED\_RISK\_FEE)}{2}$ , and starting value  $SEED\_BALANCE$ .



PUTTING IT ALL TOGETHER

## Providing Rewards AMM Liquidity

By **2**, the random walk approximating the pool balance hits zero (over an infinite timeframe) with the following probability:

$$\text{DRAIN\_PROBABILITY} = \left( \frac{\frac{(1 - \text{FIXED\_RISK\_FEE})}{2}}{\frac{(1 + \text{FIXED\_RISK\_FEE})}{2}} \right)^{\frac{\text{SEED\_BALANCE}}{\text{ENTRY\_DEPOSIT} \times (1 - \text{SERVICE\_FEE})}} = \left( \frac{(1 - \text{FIXED\_RISK\_FEE})}{(1 + \text{FIXED\_RISK\_FEE})} \right)^{\frac{\text{SEED\_BALANCE}}{\text{ENTRY\_DEPOSIT} \times (1 - \text{SERVICE\_FEE})}}$$

Finally, this equation is solved for **SEED\_BALANCE**, giving an estimate of the seed balance required to maintain any arbitrarily low drain probability while still taking on games of reasonable difficulty.

$$\text{SEED\_BALANCE} = \text{ENTRY\_DEPOSIT} \times (1 - \text{SERVICE\_FEE}) \times \frac{\ln(\text{DRAIN\_PROBABILITY})}{\ln\left(\frac{(1 - \text{FIXED\_RISK\_FEE})}{(1 + \text{FIXED\_RISK\_FEE})}\right)}$$

Since the logs are in a ratio, they can be computed in any base depending on what is most efficient in a given implementation.

In practice, the **SEED\_BALANCE** is computed upon initializing a Reboot Protocol rewards pool based on a goal **DRAIN\_PROBABILITY**, the **ENTRY\_DEPOSIT**, and the chosen **FIXED\_RISK\_FEE**. The LP initializing the pool must deposit an initial stake greater than or equal to the **SEED\_BALANCE** into the pool in order for it to be functional and accept game commitments.

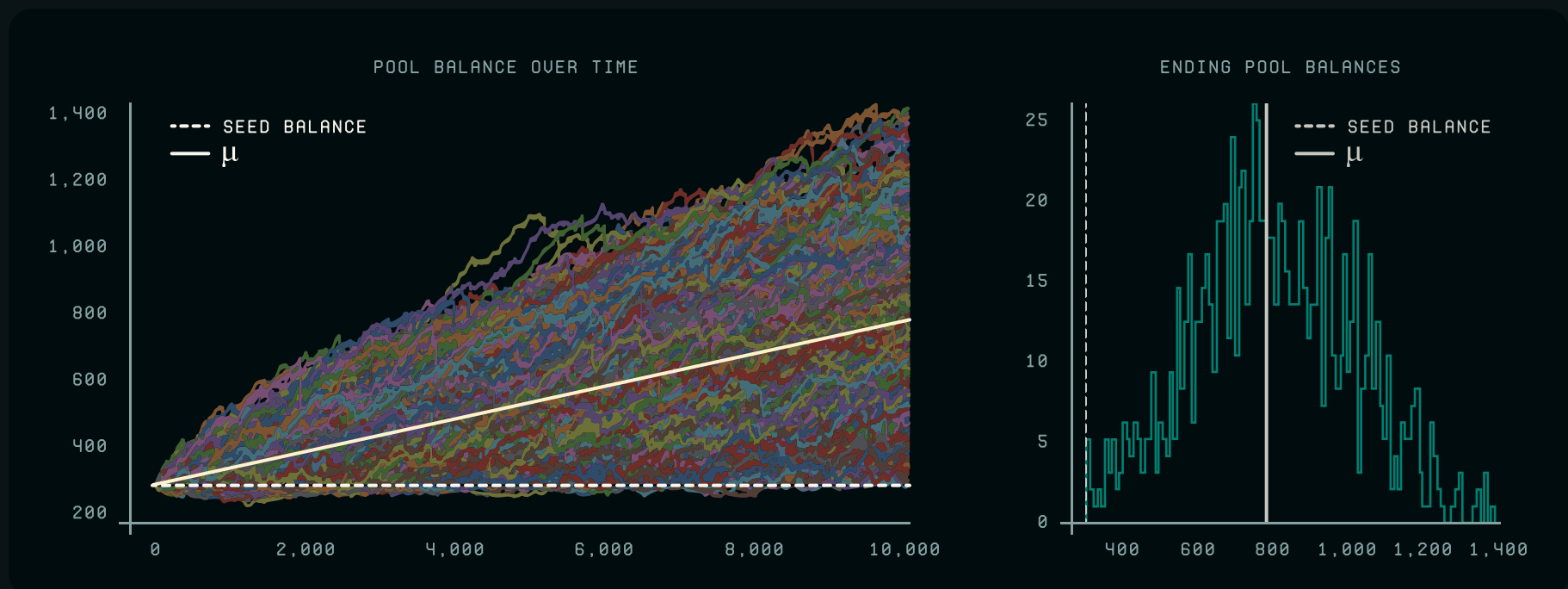


PUTTING IT ALL TOGETHER

## Providing Rewards AMM Liquidity

### Simulation Testing

The long-term behavior of a Rewards AMM pool has been simulated to test the underlying stability. These simulations assume uniformly random opponent difficulty each game, where the difficulty range is restricted based on the available pool balance. In practice, the Rewards AMM can also restrict the range of challenges players can accept based on their rank and players will self-regulate their difficulty settings around what is feasible and fun for them as a player.



This simulation demonstrates a Rewards AMM with a seed balance of 276 tokens serving 10,000 games over 1,000 trials. The dashed line represents the seed balance. Notice that even when the pool balance dips below the seed, it is able to recover and stay solvent. The solid line represents the expected growth rate of the pool.

The chart to the right is a cross-section of the simulated pool balances at the final iteration, which fits the analytically calculated expectation and indicates that seed liquidity will be preserved and the pool will grow within an arbitrarily high degree of certainty based on the initial seed balance.

### Model Limitations

While this model does operate at the maximum possible volatility within the fixed max payout range, it does not include the dynamic payout range where payouts become higher, and therefore volatility increases past what is accounted for. Decreasing the goal drain probability further than needed can help account for this.

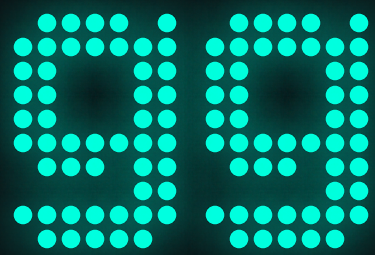


## Conclusion

In summary, the Reboot Protocol provides game developers with a decentralized, scalable framework for building games of skill that players can be rewarded for playing. The Reboot Protocol recognizes players, developers and other ecosystem participants as valued contributors to the gaming ecosystem and provides compensation in several ways to each for contributing to the growth of the ecosystem. Players have the opportunity to be rewarded through regular skilled gameplay and affiliate rewards, developers earn a share of all session revenue, in addition to the sale of in-game items, and other participants are able to earn fees from providing liquidity and validation. All fees and revenue generated from the operation of the Reboot Protocol are fully traceable from point-of-purchase and distributed seamlessly to participants. In this way the Reboot Protocol is constantly and visibly re-deploying any funds generated from the ecosystem back into the growth and health of the ecosystem through its most active participants.

**Let's Reboot  
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