

Economic Model

Authors: Albert Castellana, Daniel Hughes, Piers Ridyard

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Registered office: Argyle Works, 29-31 Euston Rd, London, England, NW1 2SD

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Executive Summary

The RADIX PROTOCOL (the 'Protocol') is public open source code that may be downloaded and run without any permission by any person or company. When configured correctly this Protocol will autonomously connect to other computers running the same Protocol and create a shared public ledger. A version of this shared public ledger will be published for adoption and will become identified as the RADIX LEDGER/NETWORK.

The RADIX TOKEN (XRD) is to be a non-redeemable Token. The RADIX or RAD is intended to have two principal functions on the RADIX LEDGER: first, it may be used to pay for services for use of the Network (NETWORK FEES); second it may be used as part of the mechanism to secure the RADIX LEDGER/NETWORK against attack.

Most on-Network operations will incur a fee that is payable in RADIX TOKENS. The RADIX TOKEN is intended to facilitate the mechanism defined by the RADIX PROTOCOL whereby users pay for use of the RADIX LEDGER/RADIX NETWORK.

The RADIX LEDGER is to be secured against attack by a Proof of Stake sybil prevention mechanism. Token holders can choose to Stake a portion of the RADIX TOKEN they control (the STAKE) to engage in the Proof of Stake network. Alternatively, token holders may delegate a portion of the RADIX TOKENS they control to a Node run by someone else. Staking is designed to cause the cost of attacking the RADIX LEDGER to rise in proportion to the total value of RADIX TOKENS Staked.

The RADIX PROTOCOL¹ will allocate RADS to those who choose to delegate their STAKE to NODE RUNNERS that choose to participate in the Proof of Stake mechanism to secure RADIX LEDGER. It is intended that the RADIX PROTOCOL should exhibit a constant rate of new token emission. These new tokens are programmatically generated by the RADIX PROTOCOL and delivered automatically to all delegators of STAKE, in proportion to the STAKE they delegate.

As the RADIX LEDGER will be based on a Proof of Stake protocol it is desirable that there is a broad decentralised ownership of RADIX TOKENS before the mainnet is instantiated.

Prior to release of the first RADIX LEDGER, an ERC20 token called the E-RADIX will be generated which can be exchanged for a RADIX TOKEN when the RADIX LEDGER (mainnet) is instantiated.

It is envisaged that a maximum of 24Bn RADIX TOKENS will be generated by the RADIX PROTOCOL over the life of the Public Network. 18.3% are to be issued as E-RADIX TOKENS on the Ethereum network, 31.6% are to be pre-allocated as RADIX TOKENS at genesis of the RADIX LEDGER, and the remaining 50% released as new NETWORK EMISSION paid to STAKING delegators over a 40-year period. Token STAKING may commence once the RADIX LEDGER is instantiated.

In order to improve a balance between market supply and demand of RADIX TOKENS, the market price of the RADIX TOKEN will determine how many RADIX TOKENS will be unlocked, making them available to be Staked or otherwise used. The design of the UNLOCK MECHANISM is intended to promote supply and demand that tends towards equilibrium.

The UNLOCK MECHANISM will initiate shortly after the release of the E-RADIX TOKEN and will continue on the RADIX LEDGER once instantiated.

¹ A automatic, autonomous process that is a function of the correct running of the Radix Public Network by a decentralised network of Nodes. Once set in motion neither the Foundation or the TGE has any control over this process.

Token Overview

This section covers key details around the likely use of the RADIX TOKEN, some security considerations for Proof of Stake, and how public control is achieved and maintained.

System Stages

Cerberus represents a novel consensus mechanism to underpin a decentralised, public network that can support and connect billions of users.

Not all features of Cerberus will be enabled in the first version of the Radix Public Network. The TOKEN GENERATING ENTITY (TGE) will publish THE RADIX LEDGER in stages, starting with one called RPN-1 (Radix Public Network 1).

This will start with a basic, “**unsharded**” version that will establish the foundations of the subsequent networks. It is anticipated that sharding will be implemented in later phases after the basic security model in RPN-1 has been tested.

This conservative approach to launching a public network is intended to ensure a short timeline to the first release and a greater degree of staged security testing.

Transaction Fees

The RADIX PROTOCOL will require that a TRANSACTION FEE in RADS be submitted with all requests for any NETWORK OPERATION requiring a change of ledger state (e.g. transaction, token creation, messaging, conditional state creation).

Once the requested NETWORK OPERATION has been validated, the Transaction Fee is burnt. The frequency and volume of token burn is therefore directly related to frequency and volume of Network use.

Proof of Stake Considerations

Staking is the process by which a user can lock their RADIX TOKENS so that they can participate in the Proof of Stake consensus mechanism and earn **NETWORK EMISSION**. A user must lock their “Stake” either to a **Node Runner** client that they run, or delegate their stake to another Node Runner. Any Node Runner that has RADIX locked to it is called a **Staking Node**. The locked Stake is then used by the Staking Node to participate in validating transactions and other on-ledger operations. This work forms the core of running the RADIX LEDGER.

As Cerberus is a BFT-style consensus algorithm, it has strict bounds on liveness and safety. Controlling greater than one third of currently Staked tokens gives the controller the ability to both halt liveness (stop the RADIX LEDGER from being able to reach consensus) and break safety (cause a double-spend).

For the unsharded RPN-1, the number of Staking Nodes is targeted to be approximately 100. Later versions of RADIX LEDGER are planned to substantially increase the number of nodes that can act as full consensus nodes and move the RADIX LEDGER to a fully sharded configuration. Any balance holder that is not running a **Staking Node** may delegate their stake to a Staking Node to share in RADIX LEDGER **NETWORK EMISSION**.

Staking Nodes protect the RADIX LEDGER from attack and are the backbone of its security. To ensure a truly decentralised network, RADIX LEDGER EMISSION earned by the Staking Nodes should represent enough value to cover the expenditure of running a Staking Node, with enough left over to encourage participation.

The higher or lower the market price of a RADIX TOKEN, the higher or lower the value of NETWORK EMISSION. Over time, the value of RADIX LEDGER EMISSION is likely to affect the number and professionalism of users who are willing to lock their holding of RADS and participate in running Staking Nodes. It is likely that a decrease in the value of the tokens could make the RADIX LEDGER less secure.²

The E-RADIX TOKEN

Achieving an early and a broad spread of Token distribution is essential to ensure sufficient decentralisation of the public network and that participants are incentivised as swiftly as possible from the moment of instantiation.

A RADIX ERC20 (E-RADIX) token will be released prior to the commencement of the RADIX LEDGER. The sale of the E-RADIX token is intended to promote distribution of Stake and achieve a high degree of decentralisation prior to the release of the RADIX LEDGER (mainnet).

In addition, as ERC20 tokens are one of the most commonly issued token types, generating an ERC RADIX token will also facilitate faster integration into the existing DeFi ecosystem on Ethereum, infrastructure such as exchanges, and user services such as wallets, further assisting distributed stake building.

On instantiation of the RADIX LEDGER, the E-RADIX will be exchangeable 1:1 for RADIX TOKENS.

E-RADIX TOKEN Sale

In Q4 of 2020, 642m RADIX TOKENS are made available for purchase. It is expected that the receipts will form the permanent endowment for the RADIX FOUNDATION to perform its objectives.

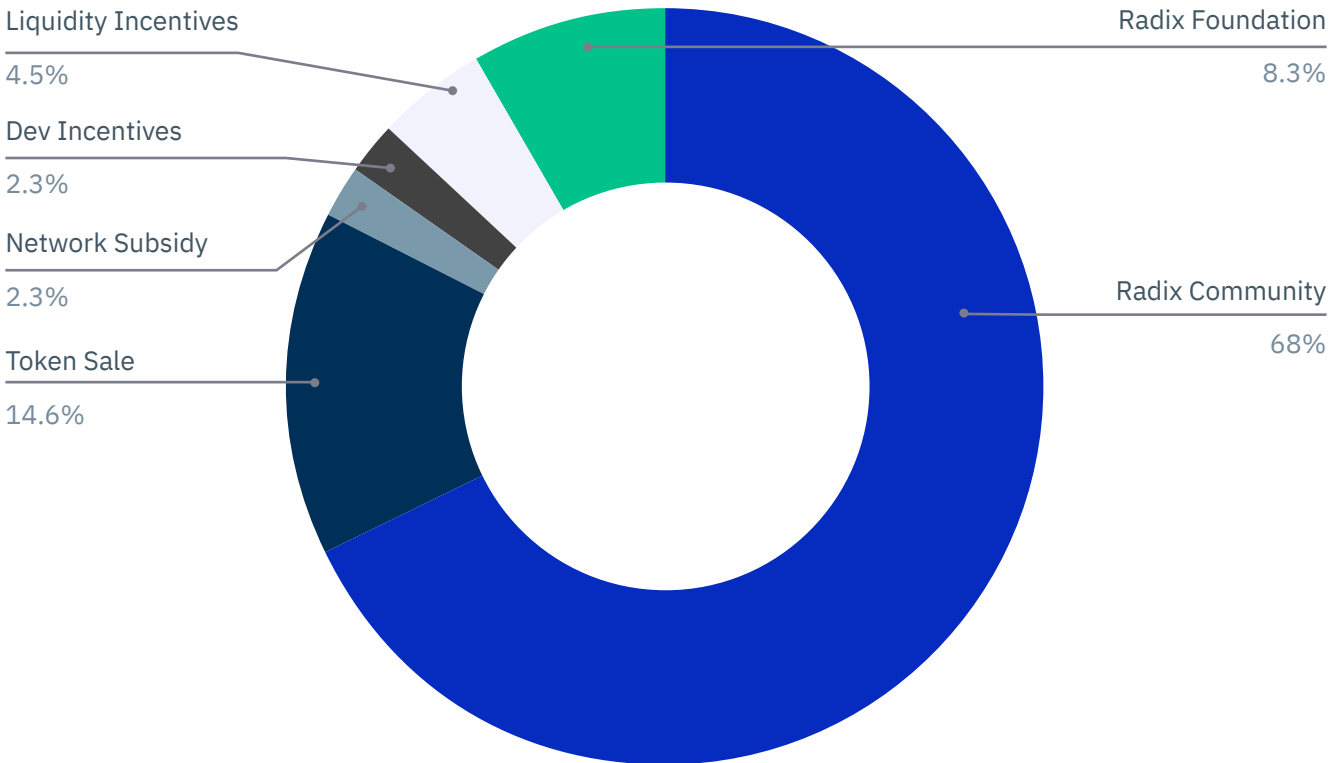
Purchase of these tokens is prohibited by citizens and entities from various jurisdictions, including the USA.

To make further enquiries please visit www.radixdlt.com for more information.

² This is based on the assumption of rational market behaviour under normal market conditions

E-RADIX TOKEN Distribution

A total of 4.41Bn E-RADIX will be distributed (INITIAL SUPPLY) as both locked and unlocked tokens on the Ethereum Public Ledger. This chart shows the proposed distribution (ceteris paribus) as a % of INITIAL SUPPLY:



See the [Table of E-RADIX and RADIX Distributions](#) for further details.

E-RADIX TOKEN Unlocking Schedule

Of the 4.41Bn INITIAL SUPPLY of E-RADIX TOKENS, 4.2Bn will be distributed as 99% locked and 1% unlocked E-RADIX TOKENS. A further 200m E-RADIX TOKENS are unlocked for the Liquidity Incentives, and 10m as a marketing float. **These 210m E-RADIX TOKENS are not included in the Circulating Supply tables below³.**

E-RADIX TOKENS will be unlocked as the market price for E-RADIX TOKENS increases. Many blockchain projects use time-based unlocking which is potentially less secure as they may cause a less than optimal alignment between the incentives to acquire tokens/price with the need for security.

As each price milestone is passed, more tokens will be unlocked.

Assuming a linear relationship between supply and demand, an increase in price can be reasonably assumed to reflect a proportionate increase in demand. By releasing tokens to feed that demand, it is assumed that the price of the tokens will stabilise. It is therefore assumed that as adoption of the RADIX LEDGER increases so will demand. The algorithm deployed to release tokens is designed to allow the market price to increase whilst keeping supply and demand in equilibrium, with upward pressure on price being exerted by functional demands for the RADIX LEDGER.

³ The 200m E-RADIX tokens are expected to be released via a long term liquidity incentivisation mechanism. The 10m marketing token float is subject to a variety of different lockups.

The 99% locked will remain locked until the 1 week Simple Moving Average (SMA) of the E-RADIX TOKEN crosses the following token price milestones:

SMA Milestones	% Total Unlocked	Circulating Supply of E-RADIX TOKENS	Total Market Value of Circulating E-RADIX TOKENS
NA	1%	42,000,000	\$1,638,00
\$0.05	5%	210,000,000	\$10,500,000
\$0.07	10%	420,000,000	\$29,400,000
\$0.09	15%	630,000,000	\$56,700,000
\$0.11	20%	840,000,000	\$92,400,000
\$0.13	25%	1,050,000,000	\$136,500,000
\$0.15	30%	1,260,000,000	\$189,000,000
\$0.17	35%	1,470,000,000	\$249,900,000
\$0.19	40%	1,680,000,000	\$319,200,000
\$0.21	45%	1,890,000,000	\$396,900,000
\$0.23	50%	2,100,000,000	\$483,000,000
\$0.25	55%	2,310,000,000	\$577,500,000
\$0.27	60%	2,520,000,000	\$680,400,000
\$0.29	65%	2,730,000,000	\$791,700,000
\$0.31	70%	2,940,000,000	\$911,400,000
\$0.33	75%	3,150,000,000	\$1,039,500,000
\$0.35	80%	3,360,000,000	\$1,176,000,000
\$0.37	85%	3,570,000,000	\$1,320,900,000
\$0.39	90%	3,780,000,000	\$1,474,200,000
\$0.41	95%	3,990,000,000	\$1,635,900,000
\$0.43	100%	4,200,000,000	\$1,806,000,000

The tracking and triggering of these milestones will commence after the initial distribution of the E-RADIX TOKENS to the [E-RADIX TOKEN Sale](#) purchasers, and a reliable price feed can be established by the TGE for the E-RADIX TOKEN price (as reported by Coin Gecko or similar).

Market experience suggests that during periods of low market liquidity there is likely to be an increase of price sensitivity (whereby small buy/sell volumes are predicted to have a disproportionate effect on price), thereby potentially triggering the release of large numbers of token tranches in a short time frame.

To mitigate this risk of rapid tranche unlocking, each time a new tranche is unlocked the SMA measure is reset to let the newly unlocked supply settle in the market. For example, if the price moved up to \$0.43 in the first two weeks, it would only unlock a further 4% of supply, taking total unlocked supply to 5%. If it still stayed above \$0.43 for the next two weeks, it would simply unlock the next tranche of 5%, taking the total unlocked supply to 10%, and so on.

After each unlocked the SMA measurement restarts from the first hour after the new tranche has entered circulation. This mechanism is designed to limit the frequency at which price-based unlocking can occur, making sure a minimum of 7 days must elapse before a new tranche can be unlocked.

To avoid supply shocks caused by sudden or violent volatility, only one new tranche can be unlocked at any given time.

Any E-RADIX still locked when the RADIX LEDGER (mainnet) is instantiated will remain locked on the Ethereum Public Ledger until such time as all milestones have been achieved.

E-RADIX TO RADIX TOKEN BRIDGE

Following RPN-1 launch, a 1-way “token bridge” service will be provided from Ethereum to the RADIX LEDGER. This service will allow holders to exchange unlocked E-RADIX for unlocked RADIX TOKENS.

Once mainnet is launched, all E-RADIX will be 1:1 exchangeable for RADIX TOKENS held securely in a 3rd party custodian.

E-RADIX holders who wish to use the bridge will send E-RADIX TOKENS from their ERC20 wallet to an Ethereum address provided by the service, and will then receive an equal number of RADIX TOKENS to a Radix wallet address that they provide.

Because each circulating E-RADIX TOKEN will be backed by a custodied RADIX TOKEN, these tokens share a single circulating supply equal to the total supply of RADIX.

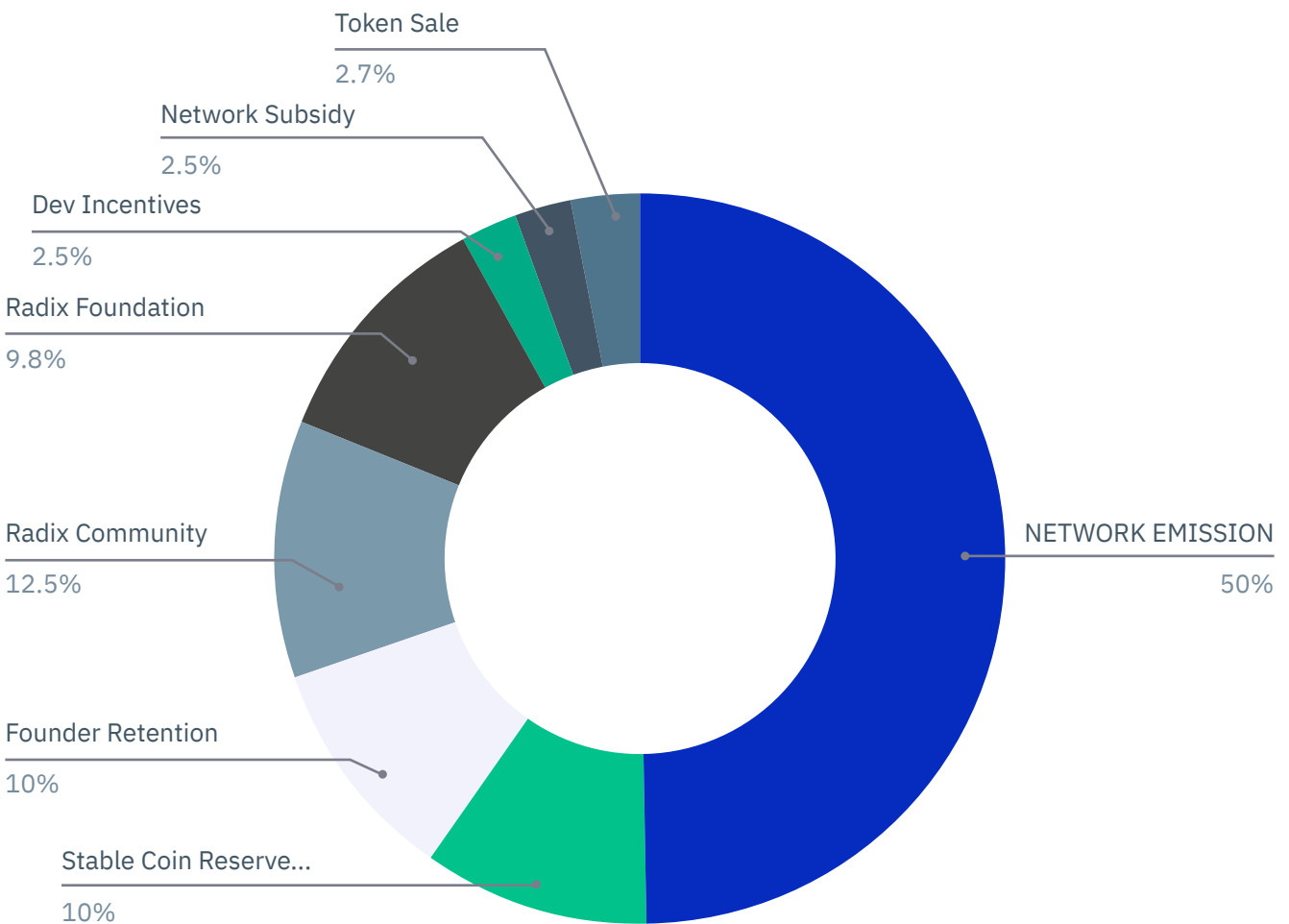
Initially, when there are only E-RADIX TOKENS, the unlocking milestones will follow the E-RADIX TOKEN market price. Following publication and adoption of the RADIX LEDGER, once the market trading volume of RADIX TOKEN exceeds that of E-RADIX TOKEN, the price data source will be switched permanently to follow the RADIX TOKEN price.

RADIX TOKEN DISTRIBUTION

The instantiation of the RADIX LEDGER will commence the generation of NETWORK EMISSION by the RADIX LEDGER. This NETWORK emission is capped at 12Bn RADIX TOKENS over a minimum 40-year period. For more details please see the [NETWORK EMISSION](#) section.

In addition to the 4.41Bn E-RADIX TOKENS, a further 7.59Bn RADIX TOKENS will be created at initiation of the RADIX LEDGER, these RADIX TOKENS will be instantiated as locked tokens for: the [FOUNDERS](#) (Radix DLT); the remainder of the RADIX LEDGER [Subsidy](#); the remainder of the [Dev Incentives](#); the remainder reserved for endowment of the [Radix Foundation](#); and an indefinitely locked allocation for the [Stable Coin Reserve](#).

This chart shows the distribution (ceteris paribus) as a % of maximum supply (24Bn RADIX TOKENS).



See the [Table of E-RADIX and RADIX Distributions](#) for further details.

RADIX TOKEN UNLOCKING SCHEDULE

The price based unlocking mechanism starting with the E-RADIX TOKEN is intended to continue for the RADIX TOKENS on the RADIX LEDGER.

Of 12Bn tokens issued or exchangeable for RADIX TOKENS on the Radix Public Network, 2.4Bn are locked in the Stable Coin Reserve, and 4.41Bn will have already been issued as E-RADIX TOKENS, leaving 5.19Bn to be unlocked via the price based unlocking mechanism on the RADIX LEDGER (mainnet).

The 5.19Bn RADIX TOKENS must also, separately, achieve the same SMA price targets as the E-RADIX TOKENS, with the same 1 week SMA period for each tranche to unlock. This means that even if the E-RADIX TOKEN has achieved 100% unlocking by the time the Radix Public Network is instantiated, the starting supply of unlocked RADIX TOKENS will still be 1% of the 5.19Bn locked RADIX TOKENS on RADIX LEDGER (mainnet).

System Components

This section introduces the key system components of the Radix Public Network and some notes about how they interact with each other.

Node Runners & Staking Nodes

The Radix Public Network will be effectuated by the engagement of a network of Nodes (computers running RADIX LEDGER client software). Those that choose to run Nodes are called Node Runners. Anyone may become a Node Runner by downloading and running the Node Runner client. Any Node Runner that has **RADIX locked** to it is called a **Staking Node**.

Although anyone may run the client, only Staking Nodes are able to directly participate in consensus. For the first version of the Radix Public Network (RPN-1), an initial maximum of 100 Staking Nodes will be permitted. Subsequent sharded versions of RADIX LEDGER are predicted to substantially extend this number.

Any RADIX balance holder that wishes to Stake but does not wish to run a Staking Node, or has insufficient balance to do so themselves, will be able to delegate their stake to any of these 100 Staking Nodes. Our target is to make the required balance less than 20 RADIX so that virtually anyone may participate in RADIX LEDGER's security and earn from RADIX LEDGER EMISSION should they wish to do so.

NETWORK EMISSION

The RADIX PROTOCOL will periodically create new RADIX TOKENS which will be paid to all delegators that have STAKED tokens to Staking Nodes that have been participating in consensus. These new tokens, called RADIX LEDGER **EMISSION**, are earned by delegators in proportion to the total amount of stake delegated.

NETWORK EMISSION is generated by the Radix Protocol at a rate of 300m RADIX TOKENS per annum. The total cap of 24Bn tokens would be reached 40 years from the release of the Radix mainnet. As Staking Nodes are the main beneficiaries of the transaction fee burn created by utility of RADIX LEDGER, RADIX LEDGER has 40 years to reach the stage that burn from utility sufficiently covers the cost of running a Staking Node.

This NETWORK EMISSION will be distributed (at least daily) in equal parts to all valid delegators. Each staking period a fixed amount of new RADIX TOKENS are available to be earned by the Staking Nodes.

From the perspective of a delegator, assuming the amount they stake is constant, the lower the Sum of all delegated Stakes, the larger the total earnings per period that delegator will earn.

This creates higher potential earnings for delegators at the start of RADIX LEDGER's life, when total staked supply is low.

Prior Funding and Distribution Details

MAXIMUM SUPPLY = 24Bn = 4.41Bn E-RADIX TOKENS + 19.59Bn RADIX TOKENS.

Radix NETWORK EMISSION. (0% E-RADIX Supply. 50% of Maximum Supply).

12Bn Total = 0 E-RADIX TOKENS + 12Bn RADIX TOKENS.

Generated by the RADIX LEDGER Protocol directly, these are capped at a maximum of 12Bn tokens programmatically generated and allocated over a 40-year period.

Radix Community. (68% E-RADIX Supply. 12.5% of Maximum Supply).

3Bn Total = up to 3Bn E-RADIX TOKENS

Between the years 2013 and 2017 members of the early Radix community contributed approximately 3,000 BTC to Dan Hughes who initiated the theoretical development of the RADIX PROJECT.

In 2017 Dan Hughes assigned all the code and technology he had developed, which was then incomplete, to RADIX DLT LIMITED.

In recognition of the contributions made by the early contributors RADIX DLT and DAN HUGHES have agreed with these community members to procure the delivery to them of 3Bn RADIX TOKENS, creating an approximate token price of 1 BTC per 1m RADIX when the RADIX LEDGER is instantiated.

Founder Retention. (0% E-RADIX Supply. 10% of Maximum Supply).

2.4Bn Total = 0 E-RADIX TOKENS + 2.4Bn RADIX TOKENS.

FOUNDER TOKENS are retained by Radix DLT Ltd, which has funded and developed the RADIX technology since 2017 until the present day.

Radix DLT Ltd will hold the tokens it retains from the instantiation of the RADIX LEDGER as a treasury asset of the company.

RADIX DLT LIMITED will not receive E-RADIX TOKENS.

SALE OF EQUITY (RADIX DLT LIMITED). Between the years 2018 and 2019 a total of circa 10% of the equity in Radix DLT Ltd was sold for \$6m in two rounds to investors including VC LocalGlobe and the co-founder of TransferWise, Taavet Hinrikus, giving them exposure to the 2.4Bn RADIX TOKENS that Radix DLT Ltd holds in treasury.

E-RADIX Token Sale. (14.6% E-RADIX Supply. 2.7% of Maximum Supply).

642m Total = 642m E-RADIX TOKENS.

642m RADIX tokens are to be reserved for the current token sale.

Radix Foundation. (8.3% E-RADIX Supply. 9.8% of Maximum Supply).

2.358Bn Total = 368m E-RADIX TOKENS + 1.99Bn RADIX TOKENS.

The Radix Foundation is a not-for-profit company limited by guarantee, registered in the United Kingdom.

The objects of the Foundation are to promote the use and development of the RADIX LEDGER as well as provide education and support for the Radix community and ecosystem, and operate incentive programs, events and more.

The token sale will be conducted by RADIX TOKENS (JERSEY) LIMITED a wholly owned subsidiary of the RADIX FOUNDATION that will instigate the TOKEN GENERATING EVENT.

Any unsold tokens from the sale will be donated to the Radix Foundation.

Dev Incentives. (2.3% E-RADIX Supply. 2.5% of Maximum Supply).

600m Total = 100m E-RADIX TOKENS + 500m RADIX TOKENS.

A healthy DeFi ecosystem is not just made up of large projects, but must also involve, and create value for, the individual developer. Indeed, it is the individual that often lays the coding groundwork that makes the larger projects possible. These individuals are so important that we expect to add to the RADIX LEDGER and the RADIX PROTOCOL a built-in incentivisation mechanism of developer royalties. Crucially, these developer royalties would be designed to be long term and self-incentivising.

This Dev Incentive grant aims to bootstrap the self incentivising developer ecosystem on the RADIX LEDGER. To learn more, please see our [DeFi White Paper](#).

Network Subsidy. (2.3% E-RADIX Supply. 2.5% of Maximum Supply).

600m Total = 100m E-RADIX TOKENS + 500m RADIX TOKENS.

The Network Subsidy is intended to help improve the performance of the RADIX LEDGER and the RADIX NETWORK. This is a discretionary pool to fund grants that are expected to be administered by the Foundation. These grants are expected to be used to incentivise both DeFi-related and performance-related activities on the RADIX NETWORK/RADIX LEDGER, depending on what is most needed by the ecosystem.

Simple examples of this would be test net incentives prior to the launch of the RADIX LEDGER (mainnet), or an early performance subsidy for any mainnet Staking Nodes that consistently meets or exceeds a set of minimum specifications for computing power, bandwidth, and responsiveness.

Stable Coin Reserve. (0% E-RADIX Supply. 10% of Maximum Supply - locked).

2.4Bn Total = Indefinitely locked to the mainnet.

Some components of an ecosystem are intrinsically important to its success. Decentralised stable coins provide a mechanism for converting native tokens into stable exchange tokens and back again, function as a helpful leverage mechanism, create large amounts of lockup, and provide a useful decentralised stable store of value for other applications to use. Intrinsically, decentralised stores of value also introduce a degree of systemic risk when pegged to an external store of value (such as the USD).

To help bootstrap important projects of this type, the Stable Coin Reserve will be formed. This Reserve holds 2.4Bn RADIX TOKENS that are indefinitely locked and entirely removed from circulating supply. The Foundation has a 10-year period in which to review, disburse this reserve to support a systemic stabilization protocol, which may or may not require the use of the Stable Coin Reserve. Should the Stable Coin Reserve not be needed, it will remain locked and be destroyed after the 10-year period.

The Stable Coin Reserve will not be issued as E-RADIX TOKENS.

Table of E-RADIX and RADIX Distributions

E-RADIX Tokens (ERC20)

Allocation	eXRD (bn)	(%)	Unlocking Schedule?	Description
Radix Community	3.000	68.03%	Yes	Genesis Allocation for 3000 BTC
Radix Foundation	0.358	8.12%	Yes	Awareness programs and OpEx
Token Sale	0.642	14.56%	Yes	New Token Buyers
Liquidity Incentives	0.200	4.54%	Yes*	Liquidity Mining Programs
Dev Incentives	0.100	2.27%	Yes	New Developer Incentives
Network Subsidy	0.100	2.27%	Yes	Security & Performance Incentives
Marketing	0.010	0.23%	No	Marketing Related Expenses
Total E-RADIX	4.410	100%		

**the liquidity incentives program is intended to be distributed over a 6 month period. Other unlocking schedules are price unlocking.*

RADIX Tokens (Mainnet)

Allocation	eXRD (bn)	(%)	Unlocking Schedule?	Description
Radix Foundation	1.790	34.49%	Yes	Awareness programs and OpEx
Founder Retention	2.400	46.24%	Yes	Team Allocation
Network Subsidy	0.500	9.63%	Yes	Security & Performance Incentives
Dev Incentives	0.500	9.63%	Yes	New Developer Incentives
Total E-RADIX	5.190	100%		

NETWORK EMISSION (Mainnet)

Allocation	XRD (bn)	(%)	Unlocking Schedule?	Description
NETWORK EMISSION	12.000	NA	NA	40 year programmed release for network security

Stable Coin Reserve (Mainnet) Non-Circulating

Allocation	XRD (bn)	(%)	Unlocking Schedule?	Description
Stable Coin Reserve	2.400	NA	NA	Future stable coin project supply



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