Pi 加密货币白皮书 | Pi 网络 --- Pi Cryptocurrency White Paper | Pi Network

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Pi Network, The Future of Social Cryptocurrency in Web3

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TABLE OF CONTENTS

Pi 项目白皮书
Whitepaper

2021 年 12 月发布的白皮书章节“代币模型与挖矿”和“路线图”作为 2019 年原始白皮书的附录，提供了关于主网的新信息。

The December 2021 Whitepaper chapters “Token Model and Mining” and “Roadmap” were released as an addendum to the original 2019 Whitepaper, with new information on Mainnet.

2019 年 3 月的原始白皮书可能需要更新内容，请参考最新的 Pi Network 通讯以获取最新信息。这两个白皮书可能会根据在主网封闭网络期间收集的数据而有所更改。

The original March 2019 Whitepaper may need updates to its content, so please refer to the latest Pi Network communications for up-to-date information. Both Whitepapers are subject to change based on data collected during the Enclosed Network period of Mainnet.

Original March 2019

December 2021

白皮书：2019 年 3 月版
Whitepaper: March 2019 Original

Introduction

引言 Preface

随着世界日益数字化，数字货币是货币演变的下一个自然步骤。Pi 是首个面向普通人的数字货币，标志着全球对数字货币采用的重要进展。

As the world becomes increasingly digital, cryptocurrency is a next natural step in the evolution of money. Pi is the first digital currency for everyday people, representing a major step forward in the adoption of cryptocurrency worldwide.

我们的使命是构建一个由普通人安全运营的加密货币和智能合约平台。

Our Mission: Build a cryptocurrency and smart contracts platform secured and operated by everyday people.

我们的愿景是构建一个全球最具包容性的点对点生态系统和在线体验，以 Pi 作为支撑，Pi 是全球使用最广泛的加密货币。

Our Vision: Build the world's most inclusive peer-to-peer ecosystem and online experience, fueled by Pi, the world's most widely used cryptocurrency.

对于更高级读者的免责声明：由于 Pi 的使命是尽可能包容，我们将借此机会向区块链新手们介绍这个复杂的领域 🙂

DISCLAIMER for more advanced readers: Because Pi's mission is to be inclusive as possible, we're going to take this opportunity to introduce our blockchain newbies to the rabbit hole 🙂

介绍：加密货币为何重要

Introduction: Why cryptocurrencies matter

目前，我们的日常金融交易依赖于一个可信的第三方来维护交易记录。例如，当您进行银行交易时，银行系统会记录交易并确保其安全可靠。

Currently, our everyday financial transactions rely upon a trusted third party to maintain a record of transactions. For example, when you do a bank transaction, the banking system keeps a record & guarantees that the transaction is safe & reliable.

同样，当辛迪通过 PayPal 向史蒂夫转账 5 美元时，PayPal 会记录从辛迪账户中扣除的 5 美元和存入史蒂夫账户的 5 美元。

Likewise, when Cindy transfers $5 to Steve using PayPal, PayPal maintains a central record of $5 dollars debited from Cindy's account and $5 credited to Steve's.

银行、PayPal 及其他经济系统中的中介在调节全球金融交易方面扮演着重要角色。

Intermediaries like banks, PayPal, and other members of the current economic system play an important role in regulating the world's financial transactions.

然而，这些可信赖的中介角色也存在一些局限性：

However, the role of these trusted intermediaries also has limitations:

1. 不公平的价值获取。这些中介积累了数十亿美元的财富（PayPal 的市值约为 1300 亿美元），但几乎没有将任何利益回馈给他们的客户——那些在一线的普通人，他们的资金推动了全球经济的相当大一部分。

   Unfair value capture. These intermediaries amass billions of dollars in wealth creation (PayPal market cap is ~$130B), but pass virtually nothing onto their customers – the everyday people on the ground, whose money drives a meaningful proportion of the global economy.

   越来越多的人正在落后。
   More and more people are falling behind.

2. 费用。银行和公司在交易中收取高额费用，这些费用往往对低收入人群造成不成比例的影响，因为他们的选择最少。

   Fees. Banks and companies charge large fees for facilitating transactions. These fees often disproportionately impact lower-income populations who have the fewest alternatives.

3. 审查。如果一个特别可信的中介决定你无法动用资金，它可以对你的资金流动施加限制。

   Censorship. If a particularly trusted intermediary decides that you should not be able to move your money, it can place restrictions on the movement of your money.

4. 有权限的。可信的中介作为守门人，可以随意阻止任何人加入网络。

   Permissioned. The trusted intermediary serves as a gatekeeper who can arbitrarily prevent anybody from being part of the network.

5. 匿名。在隐私问题日益紧迫的时刻，这些强大的守门人可能会无意中泄露，或者迫使你透露比你所希望的更多的财务信息。

   Pseudonymous. At a time when the issue of privacy is gaining greater urgency, these powerful gatekeepers can accidentally disclose — or force you to disclose — more financial information about yourself than you may want.

比特币的“点对点电子现金系统”由一位匿名程序员（或团队）中本聪于 2009 年推出，标志着货币自由的一个重要里程碑。

Bitcoin’s “peer-to-peer electronic cash system,” launched in 2009 by an anonymous programmer (or group) Satoshi Nakamoto, was a watershed moment for the freedom of money.

这是历史上第一次，人们可以安全地交换价值，而无需第三方或可信的中介。使用比特币支付意味着像史蒂夫和辛迪这样的人可以直接相互支付，避免了机构费用、障碍和干扰。

For the first time in history, people could securely exchange value, without requiring a third party or trusted intermediary. Paying in Bitcoin meant that people like Steve and Cindy could pay each other directly, bypassing institutional fees, obstructions, and intrusions.

比特币确实是一种无国界的货币，推动并连接了全新的全球经济。

Bitcoin was truly a currency without boundaries, powering and connecting a new global economy.

分布式账本的介绍

Introduction To Distributed Ledgers

比特币通过使用分布式账本实现了这一历史性成就。与当前金融系统依赖的传统中央真相记录不同，比特币的账本由一个分布式的“验证者”社区维护，他们负责访问和更新这个公共账本。

Bitcoin achieved this historical feat by using a distributed record. While the current financial system relies on the traditional central record of truth, the Bitcoin record is maintained by a distributed community of “validators,” who access and update this public ledger.

想象一下，比特币协议就像一个全球共享的“谷歌表格”，记录着交易信息，并由这个分布式社区进行验证和维护。

Imagine the Bitcoin protocol as a globally shared “Google Sheet” that contains

a record of transactions, validated and maintained by this distributed community.

比特币（以及区块链技术）的突破在于，尽管记录由社区维护，但该技术使他们能够始终就真实交易达成共识，从而确保作弊者无法记录虚假交易或操控系统。

The breakthrough of Bitcoin (and general blockchain technology) is that, even though the record is maintained by a community, the technology enables them to always reach consensus on truthful transactions, insuring that cheaters cannot record false transactions or overtake the system.

这一技术进步使得可以去掉集中中介，同时确保交易的金融安全性。

This technological advancement allows for the removal of the centralized intermediary, without compromising transactional financial security.

分布式账本的优势

Benefits Of Distributed Ledgers

除了去中心化，比特币及其他加密货币还具备一些优良特性，使得货币更加智能和安全。尽管不同的加密货币在某些特性上可能表现更强，而在其他特性上则可能较弱，这取决于它们协议的不同实现。

In addition to decentralization, bitcoin, or cryptocurrencies in general, share a few nice properties that make money smarter and safer, although different cryptocurrencies may be stronger in some properties and weaker in others, based on different implementations of their protocols.

加密货币存储在通过公开地址识别的加密钱包中，并由一个非常强大的私人密码（称为私钥）进行保护。

Cryptocurrencies are held in cryptographic wallets identified by a publicly accessible address, and is secured by a very strong privately held password, called the private key.

这个私钥通过加密方式对交易进行签名，几乎不可能伪造签名，从而提供了安全性和不可被扣押的特性。

This private key cryptographically signs transactions and is virtually impossible to create fraudulent signatures. This provides security and unseizability.
与传统银行账户不同，您的钱包中的加密货币在没有您的私钥的情况下，永远不会被任何人夺走。

Unlike traditional bank accounts that can be seized by government authorities, the cryptocurrency in your wallet can never be taken away by anyone without your private key.
加密货币因其去中心化的特性而具备抗审查能力，因为任何人都可以向网络中的任意计算机提交交易进行记录和验证。

Cryptocurrencies are censorship-resistant due to the decentralized nature because anyone can submit transactions to any computer in the network to get recorded and validated.
加密货币交易是不可更改的，因为每个交易区块都代表了之前所有区块的加密证明（哈希）。

Cryptocurrency transactions are immutable because each block of transactions represents a cryptographic proof (a hash) of all the previous blocks that existed before that.
一旦有人向你发送了款项，他们就无法收回这笔支付（也就是说，区块链中不存在退票支票）。某些加密货币甚至可以支持原子交易。

Once someone sends you money, they cannot steal back their payment to you (i.e., no bouncing checks in blockchain). Some of the cryptocurrencies can even support atomic transactions.
“智能合约”基于这些加密货币，不仅依赖法律来执行，而是通过公开可审计的代码直接执行，这使得它们无需信任，并有可能在许多业务中消除中介，例如房地产的托管服务。

“Smart contracts” built atop these cryptocurrencies do not merely rely on law for enforcement, but directly enforced through publicly auditable code, which

make them trustless and can potentially get rid of middlemen in many businesses, e.g. Escrow for real estate.

确保分布式账本的安全性（挖矿）

Securing Distributed Ledgers (Mining)

维护分布式交易记录的一个挑战是安全性——具体来说，如何在防止欺诈活动的同时，保持账本的开放性和可编辑性。

One of the challenges of maintaining a distributed record of transactions is security — specifically, how to have an open and editable ledger while preventing fraudulent activity.

为了解决这一挑战，比特币引入了一种新颖的过程，称为挖矿（采用“工作量证明”共识算法），以确定谁有“信任”来更新共享的交易记录。

To address this challenge, Bitcoin introduced a novel process called Mining (using the consensus algorithm “Proof of Work”) to determine who is “trusted” to make updates to the shared record of transactions.

你可以把挖矿视为一种经济游戏，它要求“验证者”在尝试将交易记录添加到账本时证明自己的价值。为了获得资格，验证者必须解决一系列复杂的计算难题。

You can think of the mining as a type of economic game that forces “Validators” to prove their merit when trying to add transactions to the record. To qualify, Validators must solve a series of complex computational puzzles.

首先解决难题的验证者将获得奖励，允许他们发布最新的交易区块。发布最新的交易区块使验证者能够“挖掘”区块奖励——目前为 12.5 个比特币（在撰写时约为 40,000 美元）。

The Validator who solves the puzzle first is rewarded by being allowed to post the latest block of transactions. Posting the latest block of transactions allows Validators to “mine” a Block Reward – currently 12.5 bitcoin (or ~$40,000 at the time of writing).

这个过程非常安全，但它需要巨大的计算能力和能源消耗，因为用户实际上是在“烧钱”来解决计算难题，以赚取更多的比特币。

This process is very secure, but it demands enormous computing power and energy consumption as users essentially “burn money” to solve the computational puzzle that earns them more Bitcoin.

烧毁与奖励的比例极为苛刻，因此验证者总是有动机在比特币记录上发布诚实的交易。

The burn-to-reward ratio is so punitive that it is always in Validators’ self-interest to post honest transactions to the Bitcoin record.

向上滑动 Scroll Up

Problem

问题：权力和财富的集中使得第一代加密货币变得遥不可及

Problem: Centralization of power and money put 1st Generation Cryptocurrencies out of reach

在比特币的早期阶段，只有少数人参与验证交易和挖掘第一个区块，任何人只需在个人电脑上运行比特币挖矿软件，就能轻松赚取 50 个比特币。

In the early days of Bitcoin, when only a few people were working to validate transactions and mining the first blocks, anyone could earn 50 BTC by simply running Bitcoin mining software on their personal computer.

随着这种货币的流行，聪明的矿工们意识到，如果他们使用多台计算机进行挖矿，就能赚到更多的钱。

As the currency began to gain in popularity, clever miners realized that they could earn more if they had more than one computer working to mine.

随着比特币价值不断攀升，许多公司开始涌现出来进行挖矿。这些公司研发了专用芯片（“ASIC”），并利用这些芯片建立了庞大的服务器农场来挖掘比特币。

As Bitcoin continued to increase in value, entire companies began to spring up to mine. These companies developed specialized chips (“ASICs”) and constructed huge farms of servers using these ASIC chips to mine Bitcoin.

这些庞大的挖矿公司崛起，推动了比特币的淘金热，使得普通人很难参与网络并获得回报。

The emergence of these enormous mining corporations, known drove the Bitcoin Gold Rush, making it very difficult for everyday people to contribute to the network and get rewarded.

他们的努力开始消耗越来越多的计算资源，进而加剧了全球的环境问题。

Their efforts also began consuming increasingly large amounts of computing energy, contributing to mounting environmental issues around the world.

比特币挖矿的简单性和比特币矿场的快速发展，迅速造成了比特币网络中生产力和财富的高度集中。

The ease of mining Bitcoin and the subsequent rise of Bitcoin mining farms quickly produced a massive centralization of production power and wealth in Bitcoin’s network.

为了提供一些背景，目前 87%的比特币由 1%的用户拥有，而这些比特币在早期几乎是免费挖掘的。另一个例子是，比特大陆，作为比特币最大的挖矿公司之一，已经获得了数十亿的收入和利润。

To provide some context, 87% of all Bitcoins are now owned by 1% of their network, many of these coins were mined virtually free in their early days. As another example, Bitmain, one of Bitcoin’s biggest mining operations has earned billions in revenue and profits.

比特币网络的权力集中使得普通人获取比特币变得非常困难且成本高昂。如果你想获得比特币，最简单的方式是：

The centralization of power in Bitcoin's network makes it very difficult and expensive for the average person. If you want to acquire Bitcoin, your easiest options are to:

1. 自己挖矿。只需连接专用硬件（如果你感兴趣，这里有一个亚马逊上的矿机！）然后就可以开始了。

   Mine It Yourself. Just hook up the specialized hardware (here's a rig on Amazon, if you're interested!) and go to town.
   只需知道，由于您将与来自全球的庞大服务器农场竞争，它们的能耗相当于瑞士的总能耗，因此您将无法挖掘到多少

   Just know that since you'll be competing against massive server farms from across the world, consuming as much energy as the country of Switzerland, you won't be able to mine much

2. 在交易所购买比特币。如今，您可以以每个 3,500 美元的价格购买比特币（注意：您可以购买比特币的部分金额！）当然，这样做会面临相当大的风险，因为比特币的价格波动很大。

   Buy Bitcoin on an exchange. Today, you can buy Bitcoin at a unit price of $3,500 / coin at the time of writing (note: you can buy the fractional amount of Bitcoin!) Of course, you would also be taking on substantial risk in doing so as the price of Bitcoin is quite volatile.

比特币是首个展示加密货币如何颠覆现有金融模式的例子，让人们能够在没有第三方的情况下进行交易。

Bitcoin was the first to show how cryptocurrency could disrupt the current financial model, giving people the ability to make transactions without having a third party in the way.
自由、灵活性和隐私的提升不断推动数字货币成为新常态。尽管数字货币有其优势，但比特币（可能是无意中）导致的财富和权力集中，成为主流接受的一个重要障碍。

The increase in freedom, flexibility, and privacy continues to drive the inevitable march toward digital currencies as a new norm. Despite its benefits, Bitcoin's (likely unintended) concentration of money and power present a meaningful barrier to mainstream adoption.

Pi 的核心团队进行了研究，以了解人们为何不愿意进入加密货币领域。大家普遍认为，投资和挖矿的风险是进入这一领域的主要障碍。

As Pi's core team has conducted research to try to understand why people are reluctant to enter the cryptocurrency space. People consistently cited the risk of investing/mining as a key barrier to entry.

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Solution

解决方案：Pi - 在手机上进行挖矿

Solution: Pi - Enabling mining on mobile phones

在识别出这些主要的采纳障碍后，Pi 核心团队开始寻找一种方法，让普通人能够进行挖矿（或通过验证分布式交易记录上的交易来获得加密货币奖励）。

After identifying these key barriers to adoption, the Pi Core Team set out to find a way that would allow everyday people to mine (or earn cryptocurrency rewards for validating transactions on a distributed record of transactions).

作为提醒，维护分布式交易记录的主要挑战之一是确保对这一开放记录的更新不涉及欺诈行为。

As a refresher, one of the major challenges that arises with maintaining a distributed record of transactions is ensuring that updates to this open record are not fraudulent.

虽然比特币更新记录的方式是经过验证的（通过消耗能源/金钱来证明可信度），但对用户（或地球！）来说并不友好。

While Bitcoin's process for updating its record is proven (burning energy / money to prove trustworthiness), it is not very user (or planet!) friendly.
对于 Pi，我们增加了一个设计要求，即采用一种既用户友好又能在个人电脑和手机上进行挖矿的共识算法。

For Pi, we introduced the additional design requirement of employing a consensus algorithm that would also be extremely user friendly and ideally enable mining on personal computers and mobile phones.

在比较现有的共识算法（将交易记录到分布式账本的过程）时，Stellar 共识协议脱颖而出，成为实现用户友好、以移动为先的挖矿的最佳选择。Stellar 共识协议（SCP）由斯坦福大学计算机科学教授 David Mazières 设计，他同时担任 Stellar 开发基金会的首席科学家。SCP 采用了一种名为联邦拜占庭协议的新机制，以确保对分布式账本的更新既准确又可信。此外，SCP 还通过自 2015 年以来运行的 Stellar 区块链在实际中得到了应用。

In comparing existing consensus algorithms (the process that records transactions into a distributed ledger), the Stellar Consensus Protocol emerges as the leading candidate to enable user-friendly, mobile-first mining. Stellar Consensus Protocol(SCP) was architected by David Mazières a professor of Computer Science at Stanford who also serves as Chief Scientist at the Stellar Development Foundation. SCP uses a novel mechanism called Federated Byzantine Agreements to ensure that updates to a distributed ledger are accurate and trustworthy. SCP is also deployed in practice through the Stellar blockchain that has been operating since 2015.

简明的共识算法介绍
A Simplified Introduction To Consensus Algorithms

在介绍 Pi 共识算法之前，先简单了解一下共识算法在区块链中的作用，以及当前区块链协议（如比特币和 SCP）通常使用的共识算法类型，这将有助于我们的理解。

Before jumping to introducing the Pi consensus algorithm, it helps to have a simple explanation on what a consensus algorithm does for a blockchain and

the types of consensus algorithms that today's blockchain protocols generally use, e.g. Bitcoin and SCP.
本节为了清晰起见，故意以过于简化的方式撰写，并不完整。欲获取更高的准确性，请参阅下方的“对 SCP 的适应”部分，并阅读恒星共识协议论文。

This section is explicitly written in a oversimplified manner for the sake of clarity, and is not complete. For higher accuracy, see the section Adaptations to SCP below and read the stellar consensus protocol paper.

区块链是一种容错的分布式系统，旨在对交易区块的列表进行完全排序。容错分布式系统是计算机科学的一个研究领域，已有数十年的历史。

A blockchain is a fault-tolerant distributed system that aims to totally order a list of blocks of transactions. Fault-tolerant distributed systems is an area of computer science that has been studied for many decades.
它们被称为分布式系统，因为没有集中式服务器，而是由一组去中心化的计算机（称为节点或对等体）组成，这些计算机需要就区块的内容和总排序达成一致。

They are called distributed systems because they do not have a centralized server but instead they are composed of a decentralized list of computers (called nodes or peers) that need to come to a consensus as to what is the content and total ordering of blocks.
它们被称为容错系统，因为能够容忍一定比例的故障节点（例如，最多 33%的节点可以故障，而整个系统仍能正常运行）。

They are also called fault-tolerant because they can tolerate a certain degree of faulty nodes into the system (e.g. up to 33% of nodes can be faulty and the overall system continues to operate normally).

共识算法大致可以分为两类：一种是选举一个节点作为领导者，负责生成下一个区块；另一种则没有明确的领导者，所有节点通过相互发送消息进行投票，达成对下一个区块的共识。

There are two broad categories of consensus algorithms: The ones that elect a

node as the leader who produces the next block, and the ones where there is no explicit leader but all nodes come to a consensus of what the next block is after exchanging votes by sending computer messages to each other.
（严格来说，最后一句话有多个不准确的地方，但这有助于我们解释整体情况。）

(Strictly speaking the last sentence contains multiple inaccuracies, but it helps us explain the broad strokes.)

比特币采用了第一种共识算法：所有比特币节点相互竞争，解决一个加密难题。

Bitcoin uses the first type of consensus algorithm: All bitcoin nodes are competing against each other in solving a cryptographic puzzle.
由于解决方案是随机产生的，因此第一个偶然找到解决方案的节点被选为本轮的领导者，负责生成下一个区块。这个算法称为“工作量证明”，会消耗大量能源。

Because the solution is found randomly, essentially the node that finds the solution first, by chance, is elected the leader of the round who produces the next block. This algorithm is called “Proof of work” and results in a lot of energy consumption.

恒星共识协议的简明介绍
A Simplified Introduction To Stellar Consensus Protocol
Pi 采用了另一种共识算法，基于恒星共识协议（SCP）和一种称为联邦拜占庭协议（FBA）的算法。

Pi uses the other type of consensus algorithms and is based on the Stellar Consensus Protocol (SCP) and an algorithm called Federated Byzantine Agreement (FBA).
这种算法不会浪费能源，但需要交换大量网络消息，以便节点能够就下一个区块达成“共识”。

Such algorithms don’t have energy waste but they require exchanging many network messages in order for the nodes to come to “consensus” on what the next block should be.

每个节点可以独立判断交易的有效性，例如，基于加密签名和交易历史来判断是否有权进行转账以及是否存在双重支付。

Each node can independently determine if a transaction is valid or not, e.g. authority of making the transition and double spending, based on the cryptographic signature and the transaction history.

然而，为了让一组计算机就哪些交易应记录在区块中以及这些交易和区块的顺序达成一致，它们需要相互通信，并进行多轮投票以达成共识。

However, for a network of computers to agree on which transactions to record in a block and the order of these transactions and blocks, they need to message each other and have multiple rounds of voting to come to consensus.

直观地说，来自网络中不同计算机的消息关于哪个区块是下一个，通常会是这样的：“我提议大家投票支持区块 A 作为下一个”；“我投票支持区块 A 作为下一个区块”；“我确认我信任的大多数节点也投票支持区块 A”。通过这些信息，共识算法使得该节点得出“区块 A 是下一个区块；而且下一个区块不可能是其他区块”。尽管这些投票步骤看起来很多，但互联网速度足够快，这些消息也很轻量，因此这样的共识算法比比特币的工作量证明更为轻量。

Intuitively, such messages from different computers in the network about which block is the next would look like the following: “I propose we all vote for block A to be next”; “I vote for block A to be the next block”; “I confirm that the majority of the nodes I trust also voted for block A”, from which the consensus algorithm enables this node to conclude that “A is the next block; and there could be no block other than A as the next block”; Even though the above voting steps seem a lot, the internet is adequately fast and these messages are lightweight, thus such consensus algorithms are more lightweight than Bitcoin’s proof of work.

这种算法的一个主要代表是拜占庭容错（BFT）。如今，一些顶级区块链，如 NEO 和 Ripple，都是基于 BFT 的不同变体。

One major representative of such algorithms is called Byzantine Fault

Tolerance (BFT). Several of the top blockchains today are based on variants of BFT, such as NEO and Ripple.

BFT 的一个主要批评是它存在中心化问题：由于涉及投票，参与投票“法定人数”的节点集合是由系统创建者在最初阶段集中决定的。

One major criticism of BFT is that it has a centralization point: because voting is involved, the set of nodes participating in the voting “quorum” are centrally determined by the creator of the system in its beginning.

FBA 的贡献在于，节点不再依赖一个中心确定的法定人数，而是各自设定自己的“法定切片”，这些切片将形成不同的法定人数。新节点可以以去中心化的方式加入网络：它们声明自己信任的节点，并说服其他节点信任自己，而不需要说服任何中央权威。

The contribution of FBA is that, instead of having one centrally determined quorum, each node sets their own “quorum slices”, which will in turn form different quorums. New nodes can join the network in a decentralized way: they declare the nodes that they trust and convince other nodes to trust them, but they don’t have to convince any central authority.

SCP 是 FBA 的一种实现方式。与比特币的工作量证明共识算法通过消耗能量来保护网络不同，SCP 节点通过为网络中的其他节点提供可信担保来确保共享记录的安全。

SCP is one instantiation of FBA. Instead of burning energy like in Bitcoin’s proof of work consensus algorithm, SCP nodes secure the shared record by vouching for other nodes in the network as trustworthy.

网络中的每个节点都会构建一个法定切片，包含他们认为可信的其他节点。

Each node in the network builds a quorum slice, consisting of other nodes in the network that they deem to be trustworthy.

法定是根据其成员的法定切片形成的，验证者只有在其法定中的一部分节点也接受交易时，才会接受新交易。

Quorums are formed based on its members quorum slices, and a validator will only accept new transactions if and only if a proportion of nodes in their quorums will also accept the transaction.
随着网络中的验证者构建法定人数，这些法定人数帮助节点就交易达成共识，并确保安全性。您可以通过查看这份 SCP 的技术摘要来深入了解 Stellar 共识协议。

As validators across the network construct their quorums, these quorums help nodes to reach consensus about transactions with guarantee on security. You can learn more about the Stellar Consensus Protocol by checking out this technical summary of SCP.

Pi 对恒星共识协议（SCP）的适应性调整

Pi's Adaptations to Stellar Consensus Protocol (SCP)

Pi 的共识算法基于 SCP。SCP 已经经过正式证明[Mazieres 2015]，并且目前已在 Stellar 网络中实施。

Pi's consensus algorithm builds atop SCP. SCP has been formally proven [Mazieres 2015] and is currently implemented within the Stellar Network.
与主要由公司和机构（如 IBM）作为节点的 Stellar Network 不同，Pi 希望允许个人的设备在协议层面上进行贡献并获得奖励，包括手机、笔记本电脑和计算机。

Unlike Stellar Network consisting mostly of companies and institutions (e.g., IBM) as nodes, Pi intends to allow devices of individuals to contribute on the protocol level and get rewarded, including mobile phones, laptops and computers.
下面是关于 Pi 如何利用 SCP 来帮助个人进行挖矿的介绍。

Below is an introduction on how Pi applies SCP to enabling mining by individuals.

Pi 用户可以作为矿工扮演四种角色，具体如下：

There are four roles Pi users can play, as Pi miners. Namely:

- 先锋。使用 Pi 移动应用的用户，每天简单地确认自己不是“机器人”。每次登录应用时，他们都会验证自己的身份。他们还可以打开应用请求交易（例如，向另一位先锋支付 Pi）。

  Pioneer. A user of the Pi mobile app who is simply confirming that they are not a “robot” on a daily basis. This user validates their presence every time they sign in to the app. They can also open the app to request transactions (e.g. make a payment in Pi to another Pioneer)

- 贡献者。使用 Pi 移动应用的用户，通过提供他或她所知和信任的先驱名单来进行贡献。总体而言，Pi 的贡献者将共同构建一个全球信任图谱。

  Contributor. A user of the Pi mobile app who is contributing by providing a list of pioneers he or she knows and trusts. In aggregate, Pi contributors will build a global trust graph.

- 大使。使用 Pi 移动应用的用户，正在邀请其他用户加入 Pi 网络。

  Ambassador. A user of the Pi mobile app who is introducing other users into Pi network.

- 节点。一个用户，既是先锋，也是使用 Pi 移动应用程序的贡献者，同时在桌面或笔记本电脑上运行 Pi 节点软件。

  Node. A user who is a pioneer, a contributor using the Pi mobile app, and is also running the Pi node software on their desktop or laptop computer.
  Pi 节点软件是执行核心 SCP 算法的程序，它会考虑贡献者提供的信任图信息。

  The Pi node software is the software that runs the core SCP algorithm, taking into account the trust graph information provided by the Contributors.

用户可以同时扮演多个角色。所有角色都是必不可少的，只要他们在当天参与并做出贡献，就会每天获得新铸造的 Pi 作为奖励。

A user can play more than one of the above roles. All roles are necessary, thus all roles are rewarded with newly minted Pi on a daily basis as long as they

participated and contributed during that given day.
在“矿工”的宽泛定义中，矿工是指因贡献而获得新铸造货币作为奖励的用户，因此这四个角色都被视为 Pi 矿工。

In the loose definition of a “miner” being a user who receives newly minted currency as a reward for contributions, all four roles are considered to be Pi miners.
我们对“挖矿”的定义比传统意义更为广泛，传统意义上是指执行类似比特币或以太坊的工作量证明共识算法。

We define“mining” more broadly than its traditional meaning equated to executing proof of work consensus algorithm as in Bitcoin or Ethereum.

首先，我们需要强调，Pi Node 软件尚未发布。因此，本节主要作为架构设计，并请求技术社区提供反馈。

First of all, we need to emphasize that the Pi Node software has not been released yet. So this section is offered more as an architectural design and as a request to solicit comments from the technical community.
该软件将完全开源，并且将高度依赖于 stellar-core，这也是开源软件，您可以在这里找到。这意味着社区中的任何人都可以阅读、评论并提出改进建议。以下是为了使个人设备能够进行挖矿而对 SCP 提出的 Pi 修改建议。

This software will be fully open source and it will also heavily depend on stellar-core which is also open source software, available here. This means that anyone in the community will be able to read, comment and propose improvements on it. Below are the Pi proposed changes to SCP to enable mining by individual devices.

节点（指网络或系统中的连接点） Nodes

为了便于理解，我们将“正确连接的节点”定义为 SCP 论文中提到的“完整节点”。同时，我们将“主 Pi 网络”定义为 Pi 网络中所有完整节点的集合。

For readability, we define as a correctly connected node to be what the SCP paper refers to as an intact node. Also, for readability, we define as the main Pi network to be the set of all intact nodes in the Pi network.
每个节点的主要任务是配置为正确连接到主 Pi 网络。直观来说，节点如果未能正确连接到主网络，就像比特币节点未能连接到主比特币网络一样。

The main task of each Node is to be configured to be correctly connected to the main Pi network. Intuitively, a node being incorrectly connected to the main network is similar to a Bitcoin node not being connected to the main bitcoin network.

在 SCP 的术语中，一个节点要正确连接，意味着该节点必须选择一个“法定切片”，使得所有包含该节点的法定集合与现有网络的法定集合相交。更准确地说，如果一个节点 vn+1 正确连接到一个由 n 个已经正确连接的节点(v1, v2, ..., vn)组成的主网络 N，那么由 n+1 个节点(v1, v2, ..., vn+1)组成的系统 N'就会形成法定交集。

In SCP's terms, for a node to get correctly connected means that this node must chose a "quorum slice" such that all resulting quorums that include this node intersect with the existing network's quorums. More precisely, a node vn+1 is correctly connected to a main network N of n already correctly connected nodes (v1, v2, ..., vn) if the resulting system N' of n+1 nodes (v1, v2, ..., vn+1) enjoys quorum intersection.
换句话说，N' 只有在其任意两个法定人数共享一个节点时，才享有法定人数交集。——也就是说，对于所有法定人数 U1 和 U2，U1∩U2 不为空。

In other words, N' enjoys quorum intersection iff any two of its quorums share a node. — i.e., for all quorums U1 and U2, U1∩U2 ≠ ∅.

Pi 对现有 Stellar 共识部署的主要贡献在于引入了由 Pi 贡献者提供的信任图概念，这些信息可以帮助 Pi 节点在配置连接主 Pi 网络时使用。

The main contribution of Pi over the existing Stellar consensus deployment is

that it introduces the concept of a trust graph provided by the Pi Contributors as information that can be used by the Pi nodes when they are setting up their configurations to connect to the main Pi network.

在选择法定代表团时，这些节点必须考虑贡献者提供的信任图谱，以及他们自己的安全圈。

When picking their quorum slices, these Nodes must take into consideration the trust graph provided by the Contributors, including their own security circle.
为了帮助做出这个决定，我们计划提供辅助图形分析软件，帮助运行节点的用户尽可能做出明智的选择。该软件每天的输出将包括：

To assist in this decision, we intend to provide auxiliary graph analysis software to assist users running Nodes to make as informed decisions as possible. This software's daily output will include:

- 根据与当前节点在信任图中的距离排序的节点列表；基于信任图中节点的 PageRank 分析得出的节点列表

  a ranked list of nodes ordered by their distance from the current node in the trust graph; a ranked list of nodes based a pagerank analysis of nodes in the trust graph

- 社区报告的故障节点列表和寻求加入网络的新节点列表

  a list of nodes reported by the community as faulty in any way a list of new nodes seeking to join the network

- 一份关于“行为不当的 Pi 节点”和其他相关关键词的最新文章列表；一个类似于 StellarBeat Quorum 监视器中展示的 Pi 网络节点的可视化图示[源代码]

  a list of most recent articles from the web on the keyword “misbehaving Pi nodes” and other related keywords; a visual representation of Nodes comprising the Pi network similar to what is shown in StellarBeat Quorum monitor [source code]

- 一个类似于 QuorumExplorer.com 的法定人数探索工具 [源代码]

  a quorum explorer similar to QuorumExplorer.com [source code]

- 一个类似于 StellarBeat Quorum 监视器的模拟工具，可以显示当前节点配置更改时，该节点与 Pi 网络连接的预期影响。

  a simulation tool like the one in StellarBeat Quorum monitor that shows the expected resulting impacts to this nodes' connectivity to the Pi network when the current node's configuration changes.

一个有趣的研究课题是开发能够考虑信任图的算法，为每个节点推荐最佳配置，甚至自动设置该配置。

An interesting research problem for future work is to develop algorithms that can take into consideration the trust graph and suggest each node an optimal configuration, or even set that configuration automatically.

在 Pi Network 的首次部署中，虽然运行节点的用户可以随时更新他们的节点配置，但他们每天都会被提示确认配置，并在需要时被要求进行更新。

On the first deployment of the Pi Network, while users running Nodes can update their Node configuration at any time, they will be prompted to confirm their configurations daily and asked to update them if they see fit.

手机应用用户 Mobile app users

当先锋需要确认某笔交易是否已完成（例如，他们是否已收到 Pi）时，他们会打开移动应用。

When a Pioneer needs to confirm that a given transaction has been executed (e.g. that they have received Pi) they open the mobile app.

此时，移动应用程序会连接到一个或多个节点，以查询交易是否已记录在账本上，并获取该区块的最新区块号和哈希值。

At that point, the mobile app connects to one or more Nodes to inquire if the transaction has been recorded on the ledger and also to get the most recent

block number and hash value of that block.
如果该先锋正在运行一个节点，移动应用将连接到该先锋的节点。如果先锋没有运行节点，应用将连接多个节点以交叉验证这些信息。

If that Pioneer is also running a Node the mobile app connects to that Pioneer's own node. If the Pioneer is not running a node, then the app connects to multiple nodes and to cross check this information.
先锋们将能够选择他们希望应用程序连接的节点。

Pioneers will have the ability select which nodes they want their apps to connect to.
为了让大多数用户更容易使用，应用程序应该提供一组合理的默认节点，例如，根据信任图选择与用户最接近的多个节点，以及随机选择一些页面排名较高的节点。

But to make it simple for most users, the app should have a reasonable default set of nodes, e.g. a number of nodes closest to the user based on the trust graph, along with a random selection of nodes high in pagerank.
我们希望您能对移动先锋的默认节点集选择方式提供反馈。

We ask for your feedback on how the default set of nodes for mobile Pioneers should be selected.

挖矿奖励 Mining rewards

SCP 算法的一个优点是它比区块链更具通用性。它能够在一个分布式节点系统中协调共识。

A beautiful property of the SCP algorithm is that it is more generic than a blockchain. It coordinates consensus across a distributed system of Nodes.
这意味着相同的核心算法不仅每隔几秒就会用来记录新交易到新块中，还可以定期用于进行更复杂的计算。

This means that the same core algorithm is not only used every few seconds to record new transactions in new blocks, but also it can be used to periodically run more complex computations.

例如，每周一次，恒星网络会利用它来计算网络上的通货膨胀，并将新铸造的代币按比例分配给所有恒星币持有者（恒星币称为卢门）。

For example, once a week, the stellar network is using it to compute inflation on the stellar network and allocate the newly minted tokens proportionally to all stellar coin holders (Stellar's coin is called lumens).

Pi 网络以类似的方式每天使用 SCP，计算所有积极参与的 Pi 矿工（先锋、贡献者、大使、节点）之间的网络范围内的新 Pi 分配。

In a similar manner, the Pi network employs SCP once a day to compute the network-wide new Pi distribution across all Pi miners (pioneers, contributors, ambassadors, nodes) who actively participated in any given day.

换句话说，Pi 挖矿的奖励每天只计算一次，而不是在每个区块上都计算。

In other words, Pi mining rewards are computed only once daily and not on every block of the blockchain.

为了进行比较，比特币在每个区块上分配挖矿奖励，并将所有奖励给予那个足够幸运、能够解决计算密集型随机任务的矿工。

For comparison Bitcoin allocates mining rewards on every block and it give all of the reward to the miner who was lucky enough to be able to solve a computationally intensive randomized task.

目前这个比特币奖励为 12.5 个比特币（约合 4 万美元），每 10 分钟只会发放给一位矿工。这使得任何矿工获得奖励的机会非常渺小。

This reward in Bitcoin currently 12.5 Bitcoin (~$40K) is given to only one miner every 10 minutes. This makes it extremely unlikely for any given miner to ever get rewards.

作为解决方案，比特币矿工们正在组织成集中式矿池，这些矿池共同提供算力，从而提高获得奖励的机会，并最终按比例分享这些奖励。

As a solution to that, bitcoin miners are getting organized in centralized mining pools, which all contribute processing power, increasing the likelihood of getting rewards, and eventually sharing proportionally those rewards.

挖矿池不仅是集中化的地方，而且其运营者会抽取一部分，减少分配给个别矿工的收益。在 Pi 中，不需要挖矿池，因为每天都有贡献者可以获得新 Pi 的公平分配。

Mining pools are not only points of centralization, but also their operators get cuts reducing the amount going to individual miners. In Pi, there is no need for mining pools, since once a day everyone who contributed get a meritocratic distribution of new Pi.

交易手续费 Transaction fees

在 Pi 网络中，费用类似于比特币交易，是可选的。每个区块对可以包含的交易数量有一定限制。当没有交易积压时，交易通常是免费的。

Similar to Bitcoin transactions, fees are optional in the Pi network. Each block has a certain limit of how many transactions can be included in it. When there is no backlog of transactions, transactions tend to be free.
但如果有更多交易，节点会根据费用对它们进行排序，费用最高的交易排在最前面，并只选择这些交易纳入生成的区块中。这使得市场变得开放。实现方式：费用每天按比例在节点之间分配。

But if there are more transactions, nodes order them by fee, with highest-fee-transactions at the top and pick only the top transactions to be included in the produced blocks. This makes it an open market. Implementation: Fees are proportionally split among Nodes once a day.
在每个区块中，每笔交易的费用会被转入一个临时钱包，最终在一天结束时分配给当天的活跃矿工。这个钱包的私钥是未知的。

On every block, the fee of each transaction is transferred into a temporary wallet from where in the end of the day it is distributed to the active miners of the day. This wallet has an unknown private key.
该钱包的进出交易是由协议本身在所有节点的共识下强制进行的，方式与共识每天铸造新的 Pi 相同。

Transactions in and out of that wallet are forced by the protocol itself under the

consensus of all nodes in the same way the consensus also mints new Pi every day.

限制与未来的工作方向

Limitations and future work

SCP 作为恒星网络的一部分，经过多年的广泛测试，目前是全球第九大加密货币。这让我们对它充满了信心。

SCP has been extensively tested for several years as part of the Stellar Network, which at the time of this writing is the ninth largest cryptocurrency in the world. This gives us a quite large degree of confidence in it.

Pi 项目的一个目标是将 Pi 网络中的节点数量扩大到超过 Stellar 网络的节点数量，从而让更多的普通用户能够参与核心共识算法。

One ambition of the Pi project is to scale the number of nodes in the Pi network to be larger than the number of nodes in the Stellar network to allow more everyday users to participate in the core consensus algorithm.

节点数量的增加必然会导致它们之间需要交换的网络消息数量增加。

Increasing the number of nodes, will inevitably increase the number of network messages that must be exchanged between them.

尽管这些消息比图像或 YouTube 视频小得多，且如今互联网能够快速可靠地传输视频，但随着参与节点数量的增加，所需的消息数量也会增加，这可能会成为达成共识速度的瓶颈。

Even though these messages are much smaller than an image or a youtube video, and the Internet today can reliably transfer videos quickly, the number of messages necessary increases with the number of participating nodes, which can become bottleneck to the speed of reaching consensus.

这将最终减缓新块和新交易在网络中记录的速度。幸运的是，Stellar 目前的速度远快于比特币。

This will ultimately slow down the rate, at which new blocks and new

transactions are recorded in the network. Thankfully, Stellar is currently much faster than Bitcoin.

目前，Stellar 的区块生成速度为每 3 到 5 秒一个，能够支持每秒数千笔交易。而比特币则每 10 分钟生成一个新区块。

At the moment, Stellar is calibrated to produce a new block every 3 to 5 seconds, being able to support thousands of transactions per second. By comparison, Bitcoin produces a new block every 10 minutes.

此外，由于比特币缺乏安全保障，比特币的区块链在极少数情况下可能会在第一个小时内被覆盖。这意味着比特币用户必须等待大约 1 小时，才能确认交易是最终的。

Moreover, due to Bitcoin's lack in the safety guarantee, Bitcoin's blockchain in rare occasions can be overwritten within the first hour. This means that a user of Bitcoin must wait about 1 hour before they can be sure that a transaction is considered final.

SCP 确保安全，这意味着在 3 到 5 秒后，交易的结果是可以确定的。

SCP guarantees safety, which means after 3-5 seconds one is certain about a transaction.

尽管存在潜在的可扩展性瓶颈，Pi 预计将比比特币更快地实现交易最终性，可能会比 Stellar 慢，并且每秒处理的交易数量将超过比特币，但可能少于 Stellar。

So even with the potential scalability bottleneck, Pi expects to achieve transaction finality faster than Bitcoin and possibly slower than Stellar, and process more transactions per second than Bitcoin and possibly fewer than Stellar.

尽管 SCP 的可扩展性仍然是一个待解决的研究问题，但有多种有前景的方法可以加快进程。其中一种可扩展性解决方案是 bloXroute。BloXroute 提出了一种区块链分发网络（BDN），利用全球范围内优化网络性能的服务器网络。虽然每个 BDN 由一个组织集中控制，但它们提供了可证明的中立消息传递加速。

While scalability of SCP is still an open research problem. There are multiple

promising ways one could speed things up. One possible scalability solution is bloXroute. BloXroute proposes a blockchain distribution network (BDN) that utilizes a global network of servers optimized for network performance. While each BDN is centrally controlled by one organization, they offer a provably neutral message passing acceleration.

也就是说，BDN 只能公平地为所有节点提供服务，不会有任何歧视，因为消息是加密的。这意味着 BDN 无法知道消息的来源、去向或内容。

I.e. BDNs can only serve all nodes fairly without discrimination as messages are encrypted. This means the BDN does not know where messages come from, where they go, or what is inside.

这样，Pi 节点可以有两条消息传递路径：一条是通过 BDN 的快速路径，预计大部分时间都很可靠；另一条是其原始的点对点消息传递接口，虽然完全去中心化且可靠，但速度较慢。

This way Pi nodes can have two message passing routes: A fast one through BDN, which is expected to be reliable most of the time, and its original peer-to-peer message passing interface that is fully decentralized and reliable but is slower.

这个想法的直觉与缓存有些相似：缓存是计算机可以快速访问数据的地方，从而加快平均计算速度，但并不能保证总是拥有所有所需的信息。

The intuition of this idea is vaguely similar to caching: The cache is place where a computer can access data very quickly, speeding the average computation, but it is not guaranteed to always have every needed piece of information.

当缓存失效时，计算机会变慢，但不会造成严重后果。另一种解决方案是在开放的点对点网络中使用多播消息的安全确认 [Nicolosi 和 Mazieres 2004]，以加速节点之间的消息传播。

When the cache misses, the computer is slowed down but nothing catastrophic happens. Another solution can be using secure acknowledgment of multicast messages in open Peer-to-Peer networks [Nicolosi and Mazieres 2004] to speed up message propagation among peers.

Pi Economic Model

Pi 经济模型：在稀缺性与获取之间的平衡

Pi Economic Model: Balancing Scarcity and Access

比特币最令人瞩目的创新之一是将分布式系统与经济博弈论相结合。

One of Bitcoin's most impressive innovations is its marriage of distributed systems with economic game theory.

优势 Pros

固定供应量 Fixed Supply

比特币的经济模型非常简单。总共只会有 2100 万个比特币存在，这个数字是由代码设定的。在全球 75 亿人口中，2100 万个比特币显然是不够的。

Bitcoin's economic model is simple. There will only ever be 21 million Bitcoin in existence. This number is set in code. With only 21M to circulate among 7.5B people around the world, there is not enough Bitcoin to go around.

这种稀缺性是比特币价值的主要驱动因素之一。

This scarcity is one of most important drivers of Bitcoin's value.

递减的区块奖励 Decreasing Block Reward

比特币的分配机制，如下图所示，进一步增强了稀缺感。比特币的区块挖矿奖励每 210,000 个区块减半（大约每 4 年一次）。在早期，比特币的区块奖励为 50 个币。

Bitcoin' distribution scheme, pictured below, further enforces this sense of scarcity. The Bitcoin block mining reward halves every 210,000 blocks (approximately every ~4 years.) In its early days, the Bitcoin block reward was 50 coins.

现在的奖励是 12.5 个比特币，预计在 2020 年 5 月将进一步减少到 6.25 个。比特币的分发速度逐渐降低，这意味着即使人们对这种货币的认知度提高，实际可挖掘的数量也在减少。

Now, the reward is 12.5, and will further decrease to 6.25 coins in May 2020. Bitcoin's decreasing rate of distribution means that, even as awareness of the currency grows, there is less to actually mine.

不同意 Cons

倒置意味着不平衡 Inverted Means Uneven

比特币的反向分配模型（最初只有少数人进行挖矿，而如今更多的人挖得更少）是其分配不均的主要原因之一。

Bitcoin's inverted distribution model (less people mining more in the beginning, and more people mine less today) is one of the primary contributors to its uneven distribution.

由于少数早期采用者掌握了大量比特币，新矿工消耗的能源越来越多，但获得的比特币却越来越少。

With so much Bitcoin in the hands of a few early adopters, new miners are "burning" more energy for less bitcoin.

囤积行为抑制了其作为交换媒介的使用

Hoarding Inhibits Use As A Medium Of Exchange

虽然比特币被推出作为一种“点对点电子现金”系统，但其相对稀缺性却妨碍了比特币作为交换媒介的目标。比特币的稀缺性使其被视为一种“数字黄金”或数字价值储存手段。

Although Bitcoin was released as a "peer to peer electronic cash" system, the relative scarcity of Bitcoin has impeded Bitcoin's goal of serving as a medium exchange. Bitcoin's scarcity has led to its perception as a form of "digital gold" or a digital store of value.

这种认知导致许多比特币持有者不愿意将比特币用于日常开支。

The result of this perception is that many Bitcoin holders are unwilling to spend Bitcoin on day-to-day expenses.

Pi 的经济模型 The Pi Economic Model

另一方面，Pi 旨在在创造稀缺感的同时，确保大量的 Pi 不会集中在少数人手中。我们希望用户在为网络贡献时能够挖掘到更多的 Pi。

Pi, on the other hand, seeks to strike a balance between creating a sense of scarcity for Pi, while still ensuring that a large amount does not accumulate into a very small number of hands. We want to make sure our users mine more Pi as they make contributions to the network.

Pi 的目标是构建一个既复杂又能平衡这些优先事项的经济模型，同时又要足够直观，方便人们使用。

Pi's goal is to build an economic model that is sophisticated enough to achieve and balance these priorities while remaining intuitive enough for people to use.

Pi 的经济模型设计需求：

Pi's economic model design requirements:

- **简单：建立一个直观且透明的模型**

  Simple: Build an intuitive and transparent model

- **公平分配：让全球大部分人口都能获得 Pi 的使用权**

  Fair distribution: Give a critical mass of the world's population access to Pi

- **稀缺性：营造稀缺感以持续维持 Pi 的价格稳定**

  Scarcity: Create a sense of scarcity to sustain Pi's price over time

- **精英挖矿：通过奖励贡献来构建和维护网络**

  Meritocratic mining: Reward contributions to build and sustain the network

Pi – 代币供应量 Pi – Token Supply

代币发行政策指南 Token Emission Policy

1. 总最大供应量 = M + R + D

   Total Max Supply = M + R + D

   1. M = 挖矿总奖励

      M = total mining rewards

   2. R = 总的推荐奖励

      R = total referral rewards

   3. D = 开发者总奖励

      D = total developer rewards

1. M = ∫ f(P) dx，其中 f 是一个对数下降的函数

   M = ∫ f(P) dx where f is a logarithmically declining function

   1. P = 人口数量（例如，第一位加入的人、第二位加入的人等）

      P = Population number (e.g., 1st person to join, 2nd person to join, etc.)

1. R = r 乘以 M

   R = r * M

   1. r = 推荐率（总计 50%或推荐人和被推荐人各 25%）

      r = referral rate (50% total or 25% for both referrer and referee)

1. D = t * (M + R)
2. t = 开发者奖励比例 (25%)

   t = developer reward rate (25%)

M - 挖矿供应（根据每人固定铸造的挖矿供应）

M – Mining Supply (Based on xed mining supply minted per person)

与比特币为全球人口创造固定数量的硬币不同，Pi 为每位加入网络的用户提供固定数量的 Pi，直到达到一亿名参与者。

In contrast to Bitcoin which created a fixed supply of coins for the entire global population, Pi creates a fixed supply of Pi for each person that joins the network up to the first 100 Million participants.
换句话说，每当有人加入 Pi 网络，就会预先铸造一定数量的 Pi。这些 Pi 将在该成员的生命周期内，根据他们的参与程度和对网络安全的贡献逐步释放。

In other words, for each person that joins the Pi Network, a fixed amount of Pi is pre-minted. This supply is then released over the lifetime of that member based on their level of engagement and contribution to network security.
供应量在会员的生命周期内是通过一个类似于比特币的指数递减函数释放的。

The supply is released using an exponentially decreasing function similar to Bitcoin's over the member's lifetime.

R – 推荐供应（基于每人固定的推荐奖励，推荐人和被推荐人共享）

R – Referral Supply (Based on xed referral reward minted per person and shared b/w referrer and referee)

一种货币要有价值，就必须得到广泛流通。

In order for a currency to have value, it must be widely distributed.
为了激励这一目标，协议还会生成一定数量的 Pi，作为推荐人和被推荐人（或父母和子代 🙂）的推荐奖金。这个共享池可以在双方的生命周期内进行挖掘——只要双方都在积极挖掘。

To incentivize this goal, the protocol also generates a fixed amount of Pi that serves as a referral bonus for both the referrer and the referee (or both parent and offspring 🙂 This shared pool can be mined by both parties over their lifetime – when both parties are actively mining.
介绍人和被介绍人都可以利用这个资源，以避免出现介绍人“捕食”被介绍人的剥削性模式。

Both referrer and referee are able to draw upon this pool in order to avoid exploitative models where referrers are able to "prey" on their referees.
推荐奖金作为网络层面的激励措施，旨在促进 Pi 网络的增长，同时鼓励成员积极参与网络安全。

The referral bonus serves as a network-level incentive to grow the Pi Network while also incentivizing engagement among members in actively securing the network.

D – 开发者奖励供应（额外铸造的 Pi 用于支持持续开发）

D – Developer Reward Supply (Additional Pi minted to support ongoing development)

Pi 将通过与每个挖矿和推荐铸造的 Pi 币同时铸造的“开发者奖励”来资助其持续发展。传统上，加密货币协议会铸造固定数量的供应，并立即将其放入国库。

Pi will fund its ongoing development with a “Developer Reward” that is minted alongside each Pi coin that is minted for mining and referrals. Traditionally, cryptocurrency protocols have minted a fixed amount of supply that is immediately placed into treasury.

由于 Pi 的总供应量依赖于网络中的成员数量，随着网络的扩展，Pi 逐步铸造其开发者奖励。

Because Pi’s total supply is dependent on the number of members in the network, Pi progressively mints its developer reward as the network scales.

Pi 开发者奖励的逐步发放旨在使贡献者的激励与网络的整体健康相一致。

The progressive minting of Pi’s developer reward is meant to align the incentives of Pi’s contributors with the overall health of the network.

f 是一个对数递减函数——早期成员挖掘的更多

f is a logarithmically decreasing function – early members mine more

尽管 Pi 希望避免财富的极端集中，但该网络也致力于以相对更大的 Pi 份额来奖励早期成员及其贡献。在像 Pi 这样的网络刚起步时，通常会为参与者提供较低的效用。

While Pi seeks to avoid extreme concentrations of wealth, the network also seeks to reward earlier members and their contributions with a relatively larger share of Pi. When networks such as Pi are in their early days, they tend to provide a lower utility to participants.

例如，想象一下拥有世界上第一部电话。这将是一个伟大的技术创新，但并不是特别实用。然而，随着越来越多的人拥有电话，每个电话用户从网络中获得的价值也会增加。

For example, imagine having the very first telephone in the world. It would be a great technological innovation but not extremely useful. However, as more people acquire telephones, each telephone holder gets more utility out of the network.

为了奖励早期加入网络的人，Pi 的个人挖矿奖励和推荐奖励会随着网络中人数的增加而逐渐减少。换句话说，Pi 网络为每个“名额”预留了一定数量的 Pi。

In order to reward people that come to the network early, Pi's individual mining reward and referral rewards decrease as a function of the number of people in the network. In other words, there is a certain amount of Pi that is reserved for each “slot” in the Pi Network.

向上滑动 Scroll up

Utility

实用工具：如何有效利用和变现我们的在线时间

Utility: Pooling and monetizing our time online

今天，每个人都坐拥一个真正的未开发资源宝库。我们每天都在手机上花费数小时。在手机上，我们的每一次浏览、发布或点击都为大公司带来了巨额利润。

Today, everyone is sitting on a veritable treasure trove of untapped resources. Each of us spend hours day on our phones. While on our phones, each of our views, posts or clicks creates extraordinary profits for large corporations.

在 Pi，我们认为每个人都有权利从自己的资源中获取所创造的价值。

At Pi, we believe that people have the right to capture value created from their resources.

我们都知道，团结的力量远大于个人的力量。在当今网络时代，像谷歌、亚马逊和脸书这样的巨头对个人消费者拥有巨大的影响力。

We all know that we can do more together than we can alone. On today's web, massive corporations like Google, Amazon, Facebook have immense leverage against individual consumers.

因此，他们能够获取网络上个别消费者创造的主要价值。Pi 通过让成员们汇聚资源，平衡了竞争环境，使他们能够分享自己创造的价值。

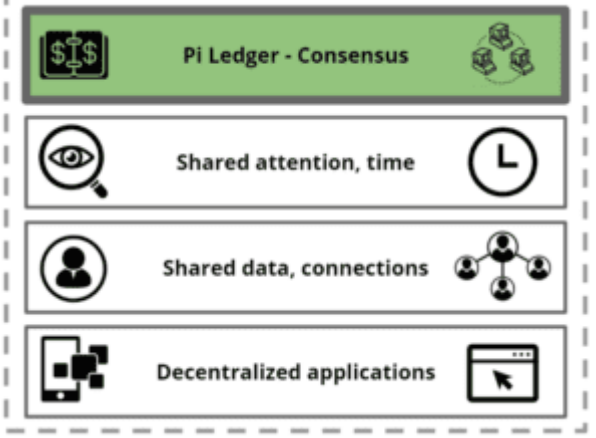
As a result, they are able to capture the lionshare of value created by individual consumers on the web. Pi levels the playing field by allowing its members to pool their collective resources so they can get a share of the value that they create.

下面的图是 Pi Stack，我们看到了一些特别有前景的机会，可以帮助我们的成员实现价值。接下来，我们将更详细地探讨这些领域。

The graphic below is the Pi Stack, where we see particularly promising opportunities for helping our members capture value. Below, we go into each of these areas in more detail.

介绍 Pi Stack - 发掘未被充分利用的资源

Introducing the Pi Stack – Unleashing underutilized resources



Pi 账本与共享信任图 - 在网络中扩展信任

Pi Ledger And Shared Trust Graph – Scaling Trust Across The Web

互联网面临的最大挑战之一就是如何判断可信赖的对象。如今，我们依靠亚马逊、eBay、Yelp 等平台的评分系统来识别可以在网上进行交易的商家。

One of the biggest challenges on the internet is knowing who to trust. Today, we rely on the rating systems of providers such as Amazon, eBay, Yelp, to know who we can transact with on the internet.

尽管我们客户付出了努力来评价和评论同行，但这些互联网中介却占据了我们所创造的价值的大部分。

Despite the fact that we, customers, do the hard work of rating and reviewing our peers, these internet intermediaries capture the lionshare of the value created this work.

Pi 的共识算法如上所述，构建了一个本地信任层，使得在没有中介的情况下能够在网络上扩展信任。

Pi's consensus algorithm, described above, creates a native trust layer that scales trust on the web without intermediaries.

尽管单个个体的安全圈价值不大，但我们每个人的安全圈汇聚起来形成了一个全球“信任图”，帮助人们理解在 Pi 网络中谁是值得信赖的。

While the value of just one individual's Security Circle is small, the aggregate of our individual security circles build a global "trust graph" that help people understand who on the Pi Network can be trusted.

Pi 网络的全球信任图将促进陌生人之间本来无法进行的交易。Pi 的本地货币使每位为网络安全贡献的人都能分享他们所帮助创造的价值。

The Pi Network's global trust graph will facilitate transactions between strangers that would not have otherwise been possible. Pi's native currency, in turn, allows everyone who contributes to the security of the network to capture a share of the value they have helped create.

Pi 的注意力市场 - 交换未被利用的注意力和时间

Pi's Attention Marketplace – Bartering Unutilized Attention And Time

Pi 允许其成员集中集体注意力，创造一个比任何个人注意力更有价值的注意力市场。基于这一层的第一个应用将是一个稀缺的社交媒体频道，目前位于应用程序的主屏幕上。

Pi allows its members to pool their collective attention to create an attention market much more valuable than any individual's attention alone. The first application built on this layer will be a scarce social media channel currently hosted on the home screen of the application.

你可以把这个稀缺的社交媒体频道看作是一个一次只能发布一个全球帖子的 Instagram。

You can think of the scarce social media channel as Instagram with one global post at a time.

先锋可以用 Pi 吸引网络中其他成员的注意，方法是分享内容（如文本、图片、视频）或提出问题，以挖掘社区的集体智慧。

Pioneers can wager Pi to engage the attention of other members of the network, by sharing content (e.g., text, images, videos) or asking questions that seek to tap into the collective wisdom of the community.

在 Pi 网络上，每个人都有机会成为影响者，或借助大众的智慧。

On the Pi Network, everyone has the opportunity to be an influencer or to tap into the wisdom of the crowd.

截至目前，Pi 的核心团队一直通过这个渠道征求社区对 Pi 设计选择的意见（例如，社区对 Pi 徽标的设计和颜色进行了投票）。我们收到了许多来自社区的宝贵反馈和建议。

To date, Pi's Core Team has been using this channel to poll the community's opinion on design choices for Pi (e.g. the community voted on the design and colors of the Pi logo.) We have received many valuable responses and feedback from the community on the project.

一个可能的未来方向是开放注意力市场，让任何先锋都能使用 Pi 发布他们的内容，同时增加在 Pi 网络上托管的频道数量。

One possible future direction is to open the attention market for any Pioneer to use Pi to post their content, while expanding the number of channels hosted on the Pi Network.

除了与同龄人进行注意力的交换，先锋们还可以选择与那些寻求他们关注的公司进行交易。普通美国人每天会看到 4,000 到 10,000 个广告。公司为了争夺我们的注意力而支付巨额费用。然而，我们作为客户，并没有从这些交易中获得任何价值。在 Pi 的注意力市场中，想要接触先锋的公司必须用 Pi 来补偿他们的受众。

In addition to bartering attention with their peers, Pioneers may also opt into bartering with companies that are seeking their attention. The average American sees between 4,000 and 10,000 ads a day. Companies fight for our attention and pay tremendous amounts of money for it. But we, the customers, receive no value from these transactions. In Pi's attention marketplace, companies seeking to reach Pioneers will have to compensate their audience in Pi.

Pi 的广告市场将严格采用自愿参与的方式，为开拓者提供一个将他们最宝贵的资源之一——注意力，变现的机会。

Pi's advertising marketplace will be strictly opt-in only and will provide an opportunity for Pioneers to monetize one of their greatest untapped resources: their attention.

Pi 的以物易物市场 - 创建您的个人虚拟商店

Pi's Barter Marketplace – Build Your Personal Virtual Storefront

除了为 Pi 网络提供信任和关注，我们希望先锋们未来能够贡献他们独特的技能和服务。

In addition to contributing trust and attention to the Pi Network, we expect Pioneers to be able to contribute their unique skills and services in the future.

Pi 的移动应用程序还将作为一个销售平台，Pi 的成员可以通过“虚拟商店”向其他 Pi 网络成员提供他们尚未开发的商品和服务。

Pi's mobile application will also serve as a Point of Sales where Pi's members can offer their untapped goods and services via a "virtual storefront" to other members of the Pi Network.

例如，成员可以将自己公寓中未充分利用的房间出租给其他 Pi 网络的成员。除了实物资产，Pi 网络的成员还可以通过他们的虚拟店面提供技能和服务。

For example, a member offer up an underutilized room in their apartment for rent to other members on the Pi Network. In addition to real assets, members of the Pi Network will also be able to offer skills and services via their virtual storefronts.

例如，Pi Network 的成员可以在 Pi 市场上提供编程或设计技能。随着时间的推移，Pi 的价值将由日益丰富的商品和服务所支撑。

For example, a member of the Pi Network could offer their programming or design skills on the Pi marketplace. Overtime, the value of Pi will be supported by a growing basket of goods and services.

Pi 去中心化应用商店 - 降低创作者的门槛

Pi's Decentralized App Store – Lowering The Barrier Of Entry For Creators

Pi Network 的共享货币、信任图谱和市场将为更广泛的去中心化应用生态系统提供基础。如今，任何想要启动应用程序的人都必须从零开始构建其技术基础设施和社区。

The Pi Network's shared currency, trust graph, and marketplace will be the soil

for a broader ecosystem of decentralized applications. Today, anyone that wants to start an application needs to bootstrap its technical infrastructure and community from scratch.

Pi 的去中心化应用商店将使 Dapp 开发者能够利用 Pi 现有的基础设施以及社区和用户共享的资源。

Pi's decentralized applications store will allow Dapp developers to leverage Pi's existing infrastructure as well as the shared resources of the community and users.

企业家和开发者可以向社区提出新的去中心化应用程序，并申请访问网络的共享资源。

Entrepreneurs and developers can propose new Dapps to the community with requests for access to the network's shared resources.

Pi 还将以一定的互操作性构建其 Dapps，使得这些 Dapps 能够引用其他去中心化应用中的数据、资产和流程。

Pi will also build its Dapps with some degree of interoperability so that Dapps are able to reference data, assets, and processes in other decentralized applications.

向上滑动 Scroll up

Governance

治理 - 由人民创造和使用的加密货币

Governance - Cryptocurrency for and by the people

第一代治理模型所面临的挑战

Challenges w/ 1st Generation Governance models

信任是任何成功货币系统的基础。产生信任的关键因素之一是治理，即随着时间推移对协议进行更改的过程。尽管治理至关重要，但它往往是加密经济系统中最被忽

视的方面之一。

Trust is the foundation of any successful monetary system. One of the most important factors engendering trust is governance or the process by which changes are implemented to the protocol over time. Despite its importance, governance is often one of the most overlooked aspects of cryptoeconomic systems.

第一代网络，例如比特币，主要避免了正式的（或“链上”）治理机制，而是采用了非正式的（或“链下”）机制，这些机制源于角色和激励设计的结合。

First generation networks such as Bitcoin largely avoided formal (or “on-chain”) governance mechanisms in favor of informal (or “off-chain”) mechanisms arising from a combination of role and incentive design.

从多个角度来看，比特币的治理机制非常成功，自诞生以来，协议的规模和价值都大幅提升。然而，也遇到了一些挑战。

By most measures, Bitcoin’s governance mechanisms has been quite successful, allowing the protocol to grow dramatically in scale and value since its inception. However, there have also been some challenges.

比特币的经济集中导致了政治权力的集中，普通人可能会被卷入比特币大户之间的激烈斗争。最近，比特币与比特币现金之间的持续冲突就是一个例子。这些内战可能会导致区块链的分叉。对于代币持有者来说，硬分叉会引发通货膨胀，可能会威胁到他们资产的价值。

The economic concentration of Bitcoin has led to a concentration of political power. The result is that everyday people can get caught in the middle of destructive battles between massive holders of Bitcoin. One of the most recent examples of this challenge has been the ongoing battle between Bitcoin and Bitcoin Cash. These civil wars can end in a fork where or where the blockchain. For token holders, hard forks are inflationary and can threaten the value of their holdings.

Pi 的治理模型 - 两个阶段的计划

Pi's Governance Model – a two-phase plan

在一篇质疑链上治理优点的文章中，以太坊核心开发者弗拉德·赞菲尔指出，区块链治理“并不是一个抽象的设计问题”。

In an article challenging the merits of on-chain governance, Vlad Zamfir, one of Ethereum's core developers, argues that blockchain governance "is not an abstract design problem.

“这是一个实际的社会问题。”弗拉德的一个关键观点是，在观察特定政治系统所面临的具体挑战之前，事先设计治理系统是非常困难的。

It's an applied social problem." One of Vlad's key points is that it is very difficult to design governance systems "a priori" or before observations of the particular challenges arising from a specific political system.

一个历史例子是美国的建立。美国的第一次民主实验，《联邦条款》，在八年的试验后失败了。

One historical example is in the founding of the United States. The first experiment with democracy in the United States, the Articles of Confederation, failed after an eight-year experiment.

美国的开国元勋们借鉴了《联邦条款》的经验，成功地制定了宪法——这是一个更为成功的尝试。

The Founding Fathers of the United States were then able to draw upon the lessons of the Article of Confederation to craft the the Constitution – a much more successful experiment.

为了构建一个持久的治理模型，Pi 将采取两阶段的计划。

To build an enduring governance model, Pi will pursue a two-phase plan.

临时治理模式（少于 500 万成员）
Provisional Governance Model (< 5M Members)

在网络成员达到 500 万的临界点之前，Pi 将采用临时治理模式。

Until the network hits a critical mass of 5M members, Pi will operate under a

provisional governance model.
该模型将与目前比特币和以太坊等协议所采用的“链外”治理模型最为相似，Pi 的核心团队在协议的发展中扮演着重要的指导角色。

This model will most closely resemble “off-chain” governance models currently employed by protocols like Bitcoin and Ethereum, with Pi’s Core Team playing an important role in guiding the development of the protocol.
然而，Pi 的核心团队仍然会非常依赖社区的反馈。Pi 移动应用程序正是他们征求社区意见和与先锋们互动的平台。

However,, Pi’s Core Team will still rely heavily on the input of the community. The Pi mobile application itself is where Pi’s core team has been soliciting community input and engaging with Pioneers.
Pi 欢迎社区的批评和建议，这通过 Pi 的登录页面、常见问题解答和白皮书中的开放评论功能得以体现。

Pi embraces community critiques and suggestions, which is implemented by the open-for-comments features of Pi’s landing page, FAQs and Whitepaper.
当人们在 Pi 的网站上浏览这些材料时，可以在特定部分提交评论，提出问题和建议。Pi 的核心团队组织的线下先锋聚会也将成为社区反馈的重要渠道。

Whenever people browse these materials on Pi’s websites, they can submit comment on a specific section right there to ask for questions and make suggestions. Offline Pioneer meetups that Pi’s core team have been organizing will also be an important channel for community input.

此外，Pi 的核心团队将建立更正式的治理机制。其中一个可能的治理系统是液态民主。

Additionally, Pi’s Core Team will develop more formal governance mechanics. One potential governance system is liquid democracy.
在液态民主中，每位先锋都可以直接对某个问题投票，或者将自己的投票委托给网络中的其他成员。液态民主将使 Pi 社区的成员参与更加广泛和高效。

In liquid democracy, every Pioneer will have the ability to either vote on an

issue directly or to delegate their vote to another member of the network. Liquid democracy would allow for both broad and efficient membership from Pi's community.

Pi 的“宪法大会”（超过 500 万成员）

Pi's "Constitutional Convention" (> 5M Members)

当成员达到 500 万时，将根据之前对 Pi Network 的贡献成立一个临时委员会。该委员会负责向更广泛的社区征求和提出建议。

Upon hitting 5M members, a provisional committee will be formed based on previous contributions to the Pi Network. This committee will be responsible for soliciting and proposing suggestions from and to the wider community.

它还将组织一系列线上和线下的讨论，Pi 的成员可以对 Pi 的长期章程发表看法。考虑到 Pi 的全球用户基础，Pi 网络将在世界各地的多个地点举行这些会议，以确保大家都能参与。

It will also organize a series of on- and offline conversations where Pi's members will be able to weigh on Pi's long-term constitution. Given Pi's global user base, the Pi Network will conduct these conventions at multiple locations across the world to ensure accessibility.

除了举办线下会议，Pi 还将利用其移动应用程序作为平台，让 Pi 的成员能够远程参与这一过程。

In addition to hosting in-person conventions, Pi will also use its mobile application as a platform for allowing Pi's member to participate in the process remotely.

无论是面对面还是在线，Pi 的社区成员都将有机会参与构建 Pi 的长期治理结构。

Whether in-person or online, Pi's community members will have the ability to participate in the crafting Pi's long-term governance structure.

向上滑动 Scroll up

路线图与部署计划 Roadmap/Deployment Plan

第一阶段 - 设计、分发和信任图的启动。

Phase 1 – Design, Distribution, Trust Graph Bootstrap.

Pi 服务器作为一个水龙头，模拟去中心化系统的运作方式，就像它上线后将会运行的样子。在这个阶段，用户体验和行为的改进是可能的，并且相比主网的稳定阶段，进行这些改进相对容易。

The Pi server is operating as a faucet emulating the behavior of the decentralized system as it will function once its live. During this phase improvements in the user experience and behavior are possible and relatively easy to make compared to the stable phase of the main net.

所有向用户铸造硬币的操作将在上线后迁移到实时网络。换句话说，实时网络将在其创世区块中预先铸造第一阶段生成的所有账户余额，并将继续像当前系统一样运作，但实现完全去中心化。

All minting of coins to users will be migrated to the live net once it launches. In other words, the livenet will pre-mint in its genesis block all account holder balances generated during Phase 1, and continue operating just like the current system but fully decentralized.

在这个阶段，Pi 尚未在交易所上市，因此无法用任何其他货币“购买”Pi。

Pi is not listed on exchanges during this phase and it is impossible to “buy” Pi with any other currency.

第二阶段 – 测试网络 Phase 2 – Testnet

在我们启动主网之前，节点软件将部署在测试网上。测试网将使用与主网完全相同的信任图，但将使用测试版的 Pi 币。

Before we launch the main net, the Node software will be deployed on a test net. The test net will use the same exact trust graph as the main net but on a testing Pi coin.

Pi 核心团队将在测试网托管多个节点，同时鼓励更多的先锋在测试网上启动自己的节点。实际上，为了让任何节点能够加入主网，他们建议先在测试网上进行尝试。

Pi core team will host several nodes on the test net, but will encourage more Pioneers to start their own nodes on the testnet. In fact, in order for any node to join the main net, they are advised to begin on the testnet.

测试网络将在第一阶段与 Pi 模拟器并行运行，并且会定期（例如每天）比较两个系统的结果，以发现测试网络的不足和遗漏，这将帮助 Pi 开发者提出并实施修复方案。

The test net will be run in parallel to the Pi emulator in phase one, and periodically, e.g. daily, the results from both systems will be compared to catch the gaps and misses of the test net, which will allow Pi developers to propose and implement fixes.

在对两个系统进行全面的并行测试后，测试网将达到一个状态，其结果将始终与模拟器的结果一致。当社区认为准备好时，Pi 将进入下一个阶段。

After a thorough concurrent run of both systems, testnet will reach a state where its results consistently match the emulator's. At that time when the community feels its ready, Pi will migrate to the next phase.

第三阶段 - 主网络 Phase 3 – Mainnet

当社区认为软件已经准备好投入生产，并在测试网上经过全面测试后，Pi 网络的正式主网将会启动。

When the community feels the software is ready for production, and it has been thoroughly tested on the testnet, the official mainnet of the Pi network will be launched.

一个重要的细节是，在过渡到主网时，只有经过验证的、属于不同真实个人的账户才会被认可。在此之后，第一阶段的水龙头和 Pi 网络模拟器将被关闭，系统将永远独立运行。

An important detail is that, in the transition into the mainnet, only accounts validated to belong to distinct real individuals will be honored. After this point,

the faucet and Pi network emulator of Phase 1 will be shut down and the system will continue on its own forever.

未来对协议的更新将由 Pi 开发者社区和 Pi 核心团队共同贡献，并由委员会提出。它们的实施和部署将依赖于节点像其他区块链一样更新挖矿软件。

Future updates to the protocol will be contributed by the Pi developer community and Pi's core team, and will be proposed by the committee. Their implementation and deployment will depend on nodes updating the mining software just like any other blockchains.

没有中央权威将控制货币，货币将完全去中心化。虚假用户或重复用户的余额将被剔除。这是 Pi 可以与交易所连接并兑换其他货币的阶段。

No central authority will be controlling the currency and it will be fully decentralized. Balances of fake users or duplicate users will be discarded. This is the phase when Pi can be connected to exchanges and be exchanged for other currencies.

回到顶部 Back to top

白皮书：2021 年 12 月的章节及 2022 年 3 月的奖励发行公式

Whitepaper: December 2021 Chapters with March 2022 Rewards Issuance Formula

Token Model and Mining

注意：这些 2021 年的白皮书章节是 2019 年原始白皮书的补充，提供了关于 Pi Network 主网启动的更多信息。

Note: These 2021 Whitepaper chapters are an addendum to the original

2019 Whitepaper, with additional information on Pi Network's Mainnet launch.

令牌模型与数据挖掘 Token Model and Mining

精心设计的代币对于加密货币网络的成功至关重要。

A well thought-out, sound token design is critical to the success of a cryptocurrency network.

它有潜力激励网络的形成与发展，构建一个以公用事业为驱动的生态系统，从而支持这种系统所依赖的加密货币。

It has the potential to create incentives to bootstrap network formation and growth, build a utilities-driven ecosystem, and thereby support the cryptocurrency underpinning such a system.

网络所激励的内容在很大程度上反映了其需求——例如，网络的增长或基于基本面的效用创造，单纯的价值存储，或是加密原生生态系统中的交换媒介。

What a network incentivizes says a lot about what a network needs—for example, network growth or fundamentals-driven utility creation, a mere store of value or a medium of exchange for the cryptonative ecosystem.

本章介绍了 Pi 的供应情况，以及先锋如何在网络的不同阶段进行 Pi 的挖掘，同时探讨了不同挖掘机制的设计理念，包括如何构建和发展网络，以及激励创建基于实用的生态系统。

This chapter covers the supply of Pi and how Pioneers can mine Pi in different phases of the network, and the underlying design rationale for different mining mechanisms including to build and grow the network and to incentivize the creation of a utilities-based ecosystem.

请注意，Pi 是一种在自己区块链上运行的第一层加密货币，这里的“代币”就是指它。

Note that Pi is a layer one cryptocurrency running on its own

blockchain, which “token” here refers to.

Pi Supply

Pi 供应量 Pi Supply

Pi Network 的愿景是构建一个全球最具包容性的点对点生态系统和在线体验，依托于 Pi 这一全球使用最广泛的加密货币。

Pi Network’s vision is to build the world’s most inclusive peer-to-peer ecosystem and online experience, fueled by Pi, the world’s most widely used cryptocurrency.

为了实现这一愿景，扩大网络并使 Pi 广泛可用是至关重要的，同时还要确保区块链的安全性和长期的网络激励。

To deliver on this vision, it is important to grow the network and make Pi widely accessible while maintaining the security of the blockchain and long-term network incentives.

尽管这些目标一直在指导代币供应模型和挖矿设计，但关键的区别在于：主网前的阶段主要关注推动网络增长和广泛分发 Pi，而主网阶段则将重点放在奖励更多样化的先锋贡献，这些贡献对于生态系统的建设和实用工具的创建至关重要。

While these goals have always guided the token supply model and mining design, the key distinction is: the pre-Mainnet phases focused on driving network growth and widely distributing Pi and the Mainnet phase will focus on rewarding more diverse forms of Pioneer contributions necessary for ecosystem building and utilities creation.

预主网的供应量 Pre-Mainnet Supply

在早期阶段，Pi Network 的重点是发展和保障网络。建立一个关键参与者的基础对于任何网络和生态系统来说都是至关重要的。

In the early stages, the focus of Pi Network was on growing and securing the network. Bootstrapping to build a critical mass of participants is paramount to any network and ecosystem.

在将 Pi 打造成全球最广泛使用的加密货币的愿景驱动下，分发 Pi 并使其在全球范围内可获得，进一步增强了对增长的关注。

Driven by the vision to make Pi the world's most widely used cryptocurrency, distributing Pi and making it accessible globally further added to the focus on growth.

Pi 的共识算法依赖于一个全球信任图，这个图是由各个先锋的安全圈汇总而成。因此，激励先锋们建立各自的安全圈显得尤为重要。

Pi's consensus algorithm relies on a global trust graph, which is aggregated from the Security Circles of individual Pioneers. It was, therefore, critical to incentivize Pioneers to form individual Security Circles.

这意味着在主网启动之前，作为挖矿奖励的代币供应并没有明确的上限。

This meant a supply of tokens available as mining rewards that was not explicitly capped before Mainnet.

同时，保持长期的网络激励非常重要。

At the same time, maintaining long-term network incentives is important.

正如在挖矿部分所述，网络采用了一种挖矿机制：每当网络规模增加 10 倍，挖矿率就会减半。这导致在达到不同的先锋参与里程碑时，出现一系列减半事件。

As explained under the Mining section, the network adopted a mining mechanism where the network mining rate halves every

time the network size increases by 10 times, resulting in a series of halving events when it reaches various milestones of engaged Pioneers.

根据这个模型，下一次减半事件将在网络达到 1 亿个活跃先锋时发生。目前，我们已经有超过 4500 万活跃先锋。

The next halving event based on this model would be when the network reaches 100 million engaged Pioneers. Currently, we have over 45 million Engaged Pioneers.

网络还保留了一个选项，可以在达到某个规模时完全停止所有挖矿，但这个规模尚未确定。在主网之前并没有行使限制 Pi 供应的选项，因此总供应量仍然未确定。

The network also retained an option to stop all mining altogether in the event that the network reached a certain size, which was, however, yet to be determined. The option to cap the supply of Pi was not exercised before Mainnet, therefore leaving the total supply undefined.

预主网的供应模型采用了一个专为可访问性、增长和安全性设计的挖矿机制，已经建立了一个超过 3000 万活跃先锋的社区，并形成了数百万个相互关联的安全圈。

The pre-Mainnet supply model with a mining mechanism tailored to accessibility, growth and security has bootstrapped a community of over 30 million engaged Pioneers with millions of intertwined Security Circles.

一种简单易用的手机挖掘 Pi 的方式，使得代币在全球范围内得以广泛分发，包括那些因缺乏资本、知识或技术而被排除在加密革命之外的人群。

A simple, accessible means to mine Pi on a mobile phone helped distribute the tokens widely throughout the world, including among

populations that have been left out of the crypto revolution because of a lack of capital, knowledge or technology.
通过这种方式，网络避免了比特币和其他加密货币中明显的极端代币集中，准备成为一个真正的点对点去中心化生态系统，拥有足够的参与者和交易量来创造实际的应用价值。

In doing so, the network avoided the extreme token concentration evident in Bitcoin and other cryptocurrencies, preparing itself to become a true peer-to-peer decentralized ecosystem with a large enough volume of participants and transactions for utility creation.

主网的供应量 Mainnet Supply

供应燃料促进增长，并激励对网络的必要贡献，以实现一个可持续发展的生态系统。

Supply fuels growth and incentivizes necessary contributions to the network to achieve an organically viable ecosystem.
为此，主网之后的挖矿奖励将继续发放，但会以多种形式出现，以激励不同类型的贡献，具体内容将在下面的挖矿部分中说明。

To that end, mining rewards will continue after Mainnet but will take diverse forms to incentivize different types of contributions, which will be explained in the Mining section below.
关于供应，由于预主网挖矿机制的不确定性，这种机制旨在优化网络的可达性和增长，给主网阶段带来了一些问题，包括规划中的不可预测性、对新阶段不同类型必要贡献的过度奖励和不足奖励，以及维持长期网络激励的挑战。

In regard to supply, the undetermined supply due to the pre-Mainnet mining mechanism that optimizes for accessibility and growth of the network presents a few problems for the Mainnet phase, including unpredictability in planning, over-rewarding and under-rewarding of different types of necessary contributions in the

new phase, and challenges to maintaining long-term network incentives.

为了解决这些问题，网络将从完全依赖网络行为的预主网供应模型转变为主网供应模型，在这个模型中有一个明确的最大供应量。

To address these issues, the network will shift from its pre-Mainnet supply model that is completely dependent on network behavior to the Mainnet supply model where there is a clear maximum supply.

在 2020 年 9 月至 10 月的 Pi Network 第一次 COiNVENTION 上，关于预主网供应模型中规划的不确定性问题引起了讨论，社区小组和社区提交的意见探讨了在网络规模达到 1000 万时，挖矿是否应该减半或停止。

The issue of unpredictability for planning in the pre-Mainnet supply model surfaced in Pi Network's first COiNVENTION in September-October 2020 where the community panel and community submissions discussed whether mining should be halved or stopped at the network size of 10 million at the time.

社区成员的多样声音提出了网络面临的一个困境。如果继续基于当前（主网前）挖矿机制进行挖矿，就会引发对 Pi 在提供长期网络激励能力方面的担忧。

The diverse voices of community members presented the following dilemma for the network. If mining continued based on the ongoing (pre-Mainnet) mining mechanism, then it raised concerns with respect to Pi's ability to provide long-term network incentives.

然而，如果挖矿停止，将会影响网络的增长，并阻碍新的先锋作为矿工加入，从而降低 Pi 的可访问性。

However, if mining stopped, it would hurt the growth of the network and prevent new Pioneers joining the network as miners, thereby undermining the accessibility of Pi.

尽管网络已经从那个决定中转变，并在达到 1000 万规模时将挖矿速率减半，但这个问题依然存在，亟需解决。

Even though the network moved on from that decision and halved the mining rate at its 10 Million size, this dilemma still remains and needs to be resolved.

社区如何在解决供应问题的同时，实现持续增长和可达性，是设计主网代币模型时的重要考虑因素之一。

How the community can achieve continued growth and accessibility while addressing concerns about supply is one of the main factors considered in the design of the Mainnet token model.

此外，未定义和不可预测的总供应量使得整体网络代币规划变得困难，因为社区和生态系统本身有需要使用一些 Pi 的目的，这些目的有利于整个社区和生态系统，而不仅仅是个人的挖矿奖励，这在几乎所有其他区块链网络中都有体现。

In addition, the undefined and unpredictable total supply makes it hard to have overall network token planning because the community as a collective and the ecosystem itself have needs to use some Pi for purposes that benefit the community and ecosystem as a whole, other than only mining rewards for individuals, as evidenced by almost every other blockchain network.

因此，需要明确用于集体社区目的的分配方案。考虑到目前超过 3000 万先锋的网络规模以及未来预期的交易和活动量，主网的供应模型是清晰的。

Clear allocations for such collective community purposes need to be defined. Hence, given the current network size of over 30 million Pioneers and the expected volume of transactions and activities in

the future, the Mainnet supply model has a clear
最大总供应量为 1000 亿 Pi，这样可以激励持续增长和新贡献，同时消除对供应不稳定性的担忧。

maximum total supply of 100 billion Pi allowing incentivizations of continued growth and new contributions while removing the concerns about the unpredictability of the supply.

供应分配将遵循 2019 年 3 月 14 日白皮书中的原始分配原则——Pi 社区占有 80%的 Pi 总流通供应，而 Pi 核心团队占有 20%的 Pi 总流通供应，无论在任何时刻 Pi 网络的流通供应量是多少。

The supply distribution will honor the original distribution principle in the March 14, 2019 Whitepaper—the Pi community has 80% and the Pi Core Team has 20% of the total circulating supply of Pi, regardless of how much circulating supply there is in the Pi Network at any given point in time.
因此，考虑到总供应量为 1000 亿 Pi，社区最终将获得 800 亿 Pi，核心团队将获得 200 亿 Pi。以下饼图展示了整体分配情况。

Thus, given a total max supply of 100 billion Pi, the community will eventually receive 80 billion Pi and the Core Team will eventually receive 20 billion Pi. The following pie chart depicts the overall distribution.
核心团队的分配将与社区逐步挖掘更多 Pi 的速度保持一致，并可能受到自我设定的额外锁定。

The Core Team's allocation gets unlocked at the same pace as the community progressively mines more and more Pi and may be subject to additional lockup through a self-imposed mandate.
这意味着如果社区有一部分分配在流通中（例如，25%），那么核心团队的分配中最多只能解锁相应的 25%。

This means that if the community has a portion of its allocation in

circulation (for example, 25%), only the proportional amount in Core Team's allocation (in this example, 25%) can get unlocked at most.

以上分布显示，Pi Network 并没有进行 ICO 分配，也不进行任何形式的 Pi 众筹销售。因此，任何冒充 Pi Network 或其创始人进行销售或上市的行为都是非法、未经授权且虚假的。

This distribution above shows that Pi Network does not have any allocation for ICO and is NOT running any type of crowdfunding sales of Pi. Thus, any impersonation of Pi Network or its founders to conduct a sale or listing is illegal, unauthorized and fake.

这些冒充者与 Pi 核心团队没有任何关联。开创者应当警惕各种骗局，并避免参与。通过为生态系统贡献力量，Pi 可以自由挖掘。

These impersonators have no affiliation with Pi Core Team. Pioneers should beware of any scams and not participate. Pi can be mined freely by contributing to the ecosystem.

此外，所有挖掘的 Pi 只能通过 Pi 应用程序中的主网仪表板进行索取，然后转入您的 Pi 钱包。任何要求先锋以其他方式索取 Pi 的网站都是虚假的。

Further, all mined Pi can only be claimed from inside the Pi App through the Mainnet dashboard and then transferred into your Pi wallet. Any website asking Pioneers to claim Pi in other means is fake.

社区供应的 80%进一步分为：65%用于所有过去和未来的先锋挖矿奖励，地址为

GBQQRIQKS7XLMWTTRM2EPMTRLPUGQJDLEKCGNDIFGTBZG4GL5CH

HJI25（主网）；10%用于支持社区组织和生态系统建设，未来将由非营利组织 Pi 基金会管理，地址为 GDPDSLFVGEPX6FJKGZXSTJCPTSKKAI4KBHBAQCCKQDXISW3S5SJ6MGMS；5%用于流动性池，为先锋和开发者在 Pi 生态系统中提供流动性，地址为 GB7HLN74IIY6PENSHHBBJJXWV6IZQDELTBZNXXORDGTL75O4KC5CUXEV。

The 80% of the community supply is further divided into: 65% allocated for all past and future Pioneer mining rewards, at address GBQQRIQKS7XLMWTTRM2EPMTRLPUGQJDLEKCGNDIFGTBZG4GL5CHHJI25 on the Mainnet, 10% reserved for supporting community organization and ecosystem building that will eventually be managed by a Pi Foundation, a non-profit organization in the future, at address GDPDSLFVGEPX6FJKGZXSTJCPTSKKAI4KBHBAQCCKQDXISW3S5SJ6MGMS, and 5% reserved for the liquidity pool to provide liquidity for Pioneers and developers in the Pi ecosystem at address GB7HLN74IIY6PENSHHBBJJXWV6IZQDELTBZNXXORDGTL75O4KC5CUXEV.

下表展示了社区供应的分配情况：

The following table depicts the community supply distribution:

Community Allocations	Pi Community Distribution (Out of Projected 80 Billion Pi Total)
Pre-mainnet Mining Rewards	20 billion Pi (approx.)
Mainnet Mining Rewards	45 billion Pi (approx.)
Liquidity Pool reserve	5 billion Pi
Foundation reserve (Grants, Community events, etc.)	10 billion Pi

650 亿 Pi 将用于所有挖矿奖励，包括过去和未来的挖矿。至于过去的挖矿奖励，到目前为止（在主网之前）所有先锋挖掘的 Pi 总和大约为 300 亿 Pi。

65 Billion Pi will be allocated for all mining rewards—both past and future mining. For past mining rewards, the rough sum of all Pi mined by all Pioneers so far (before Mainnet) is about 30 Billion Pi.

然而，在禁止在虚假账户中迁移 Pi 之后（如下面“KYC 对主网奖励的影响”和“KYC 验证与主网余额转移”小节中所讨论的），根据 KYC 的速度和参与情况，开放网络初期预挖的 Pi 估计在 100 亿到 200 亿之间。

However, after prohibiting the migration of the Pi in fake accounts (as discussed in the subsections “The Effect of KYC on Mainnet rewards” and “KYC Verification and Mainnet Balance Transfer” below) and depending on the speed and participation of KYC, the pre-Mainnet mined Pi at the beginning of the Open Network can be estimated to range from 10 to 20 Billion.

65 亿 Pi 供应中用于挖矿奖励的剩余部分将通过新的主网挖矿机制分配给先锋

The remaining amount in the 65 billion Pi supply for mining rewards will be distributed to Pioneers through the new Mainnet mining mechanism

设定了概念性的年度供应限制。

with conceptual yearly supply limits.

这样的年度供应限制将根据逐渐减少的公式来确定。

Such yearly supply limits will be determined based on a declining formula.

年度限制可以根据更细致的标准进行计算，比如按天或更短的时间段，这取决于锁定比例和当时网络的剩余供应等因素。

The yearly limit may be computed on a more granular basis such as by the day or by an even smaller time epoch dynamically, depending on factors such as the lockup ratio and the remaining supply of the network at the time.

这种基于细分时间周期的供应限制计算有助于实现更好且更平滑的时间分配曲线。为了简化起见，我们假设时间周期为一年。

Such calculation of supply limits based on granular time epochs helps achieve a better and more smooth allocation curve through time. For the sake of simplicity here, let’s suppose that the time epoch is yearly.

下降的公式意味着新主网挖矿第一年的年度供应限制将高于第二年，第二年的限制又高于第三年，依此类推。

The declining formula would mean that the yearly supply limit for the first year of new Mainnet mining will be higher than for the second year, the second year's higher than the third year's, and so on.

每年的下降公式及相关数字需要在主网开放网络期启动时最终确定，届时我们将了解有多少先锋完成了 KYC，以及他们转入主网的挖矿 Pi 的数量。

The yearly declining formula and these numbers will need to be finalized closer to the launch of the Open Network period of Mainnet once we will have seen how many Pioneers have KYC'ed and how much of their mined Pi they have transferred into Mainnet.

在主网中，先锋们将因持续为网络的成长和安全做出贡献而获得奖励。

At Mainnet, Pioneers will be rewarded for their continued contributions to the growth and security of the network.

正如在挖矿部分所述，先锋奖励将会更加多样化，因为网络需要与应用使用、节点运行和 Pi 锁定相关的更丰富和深入的贡献。

As explained in the Mining section, Pioneer rewards will be further diversified because the network needs more diverse and in-depth contributions related to app usage, node operation, and Pi lockup.

预主网先锋将继续为 Pi 贡献力量，并从主网的挖矿奖励中获取收益，同时欢迎新成员加入网络，以确保网络的持续增长和长久发展。

Pre-Mainnet Pioneers will continue to contribute to Pi and mine from the Mainnet mining rewards, along with any new members joining the network, to ensure growth and longevity of the network.

100 亿个 Pi 将用于社区组织和生态系统建设，未来将由一个非营利基金会进行管理。

10 Billion Pi will be reserved for community organization and ecosystem

building that will be, in the future, managed by a non-profit foundation.
大多数去中心化网络或加密货币虽然是去中心化的，但仍然需要一个组织来协调社区并规划生态系统的未来方向，例如以太坊和恒星币。

Most decentralized networks or cryptocurrencies, even though they are decentralized, still need an organization to organize the community and set the future direction of the ecosystem, e.g., Ethereum and Stellar.
未来的 Pi 基金会将（1）组织和赞助社区活动，如开发者大会、全球在线活动和地方社区会议；（2）组织志愿者和委员会成员，并为全职员工提供薪酬，他们致力于建设社区和生态系统；（3）收集社区的意见和反馈；（4）组织未来的社区投票；（5）建立品牌并维护网络的声誉；（6）代表网络与其他商业实体进行互动，包括政府、传统银行和企业；（7）履行各种责任，以促进 Pi 社区和生态系统的更好发展。

The future Pi foundation will (1) organize and sponsor community events, such as developer conventions, global online events and local community meetings, (2) organize volunteers and committee members, and pay full-time employees who are dedicated to building the community and ecosystem, (3) gather opinions and feedback from the community, (4) organize future community votings, (5) build branding and protect the reputation of the network, (6) represent the network to interact with other business entities including governments, traditional banks, and traditional enterprises, or (7) fulfill any number of responsibilities for the betterness of the Pi community and ecosystem.
此外，为了构建一个基于公用事业的 Pi 生态系统，基金会将设计、创建并实施多种社区开发者项目，以支持社区开发者，包括资助、孵化和合作伙伴关系等形式。

Further, in order to build a utilities-based Pi ecosystem, various community developer programs will be designed, created and carried out by the foundation to support community developers in the forms of grants, incubations, partnerships, etc.

50 亿 Pi 将用于流动性池，以为所有生态系统参与者提供流动性，包括先锋和 Pi 应用开发者。流动性是生态系统保持可行、活跃和健康的关键。

5 billion Pi will be reserved for liquidity pools to provide liquidity for any ecosystem participants, including Pioneers and Pi apps developers. Liquidity is key for an ecosystem to be viable, active, and healthy.

如果企业或个人希望参与生态系统活动（例如，在 Pi 中买卖商品和服务），他们必须及时获得 Pi。缺乏流动性将导致生态系统无法健康运作，从而影响公用事业的创造。

If businesses or individuals want to participate in ecosystem activities (e.g., by selling and buying goods and services in Pi), they must have timely access to Pi. Without liquidity, the ecosystem will not have a healthy flow of Pi, hence harming the creation of utilities.

正如在路线图章节中提到的，主网封闭网络阶段的一个好处是可以根据早期主网的结果对代币模型进行调整。因此，在开放网络阶段开始之前，代币模型是可以进行微调的。

As discussed in the Roadmap chapter, one benefit of the Enclosed Network period of the Mainnet is to allow calibrations on the token model, if any, based on the early Mainnet results. Therefore, the token model is subject to tweaking before the Open Network period starts.

此外，为了网络和生态系统的健康，未来网络可能会面临一些问题，比如在 1000 亿 Pi 分配完成后是否需要进行通货膨胀。

Also, in the future, for the health of the network and ecosystem, the network may face questions such as whether there needs to be any inflation after the completion of the distribution of the 100 Billion Pi.

通货膨胀可能是必要的，以进一步激励通过更多的挖矿奖励进行贡献，弥补因事故或死亡导致的 Pi 流通损失，提供更多流动性，减少抑制使用和创造效用的囤积等。在那时，基金会及其专门委员会将组织并引导社区以去中心化的方式达成共识。

The inflation may be necessary to further incentivize contributions through more mining rewards, make up for any loss of Pi from circulation due to accidents or death, provide for more liquidity, mitigate hoarding that inhibits usage and utility creation, etc. At that time, the foundation and its committees specialized in these matters will organize and guide the community to reach a conclusion on the matter in a decentralized way.

向上滑动 Scroll up

Mining Mechanism

挖矿机制 Mining Mechanism

Pi Network 的挖矿机制使先锋们能够为网络的增长、分配和安全做出贡献，并以绩效的方式获得奖励。预主网的挖矿机制帮助网络实现了超过 3500 万活跃成员的显著增长，广泛分布的货币和测试网，以及将为 Pi 区块链共识算法提供支持的安全圈信任图。

Pi Network's mining mechanism has been allowing Pioneers to contribute to the growth, distribution and security of the network and be rewarded in Pi meritocratically. The pre-Mainnet mining mechanism has helped the network achieve an impressive growth of over 35 million engaged members, a widely distributed currency and Testnet, and a trust graph of Security Circle aggregates that will feed the consensus algorithm of the Pi blockchain.

Looking ahead into the Mainnet phase, Pi Network needs further contributions, as well as more diverse types of contributions from all its members, to become a true ecosystem while continuing its growth and inclusion. In the Mainnet phase, we want to further

achieve **decentralization**, **utilities**, **stability** and **longevity,** in addition to **growth**, **inclusion**, and **security**

展望主网阶段，Pi Network 需要更多的贡献，以及来自所有成员的多样化贡献，以便成为一个真正的生态系统，并持续增长和包容。在主网阶段，我们希望进一步实现去中心化、实用性、稳定性和持久性，同时也关注增长、包容和安全。这些目标只有在网络中的所有先锋共同努力的情况下才能实现。因此，新的 Pi 挖矿机制旨在通过激励所有先锋根据相同的优才原则多样化地为网络贡献力量，从而实现这些目标。

. These goals can only be achieved if all Pioneers in the network work together. Hence, the new Pi mining mechanism is designed to achieve these goals by incentivizing all Pioneers to contribute diversely to the network based on the same meritocratic principle.

下面，我们首先介绍预主网挖矿公式，然后讲述主网公式的变化。主网挖矿公式于 2022 年 3 月生效，正值 2021 年 12 月 28 日开始的路线图中的封闭主网阶段。

Below, we first describe the pre-Mainnet mining formula, followed by the changes in the Mainnet formula. The Mainnet mining formula went into effect in March, 2022 – during the Enclosed Mainnet period of the Roadmap that started on December 28, 2021.

预主网公式说明 Pre-Mainnet Formula

预主网挖矿公式展示了先锋每小时挖矿率的优越性。积极参与挖矿的先锋至少能获得最低挖矿率，并因其对网络安全和发展的贡献而获得额外奖励。

The pre-Mainnet mining formula demonstrates a meritocratic determination of a Pioneer's hourly mining rate. Actively mining Pioneers received at least a minimum rate and were further rewarded for their contributions to security and growth of the network.

以下公式确定了先锋每小时挖掘 Pi 的速度：

The following formula determined the rate at which Pioneers mined Pi per hour:

M = I(B,S) + E(I)，其中

M = I(B,S) + E(I), where

- **M 是总的先锋挖矿比率，**

  M is the total Pioneer mining rate,

- **I 是个人先锋的基础采矿率**

  I is the Individual Pioneer base mining rate,

- **B 是全系统的基础采矿率**

  B is the systemwide base mining rate,

- **S 是安全圈奖励，它是来自有效安全圈连接的个人先锋基础挖矿率的一个组成部分**

  S is the Security Circle reward, which is a component of the individual Pioneer base mining rate from valid Security Circle connections, and

- **E 是活跃推荐团队成员的奖励。**

  E is the Referral Team reward from active Referral Team members.

系统的基础挖矿率 B 最初为 3.1415926 Pi/h，每当参与先锋的网络规模增加 10 倍时就会减半，起始于 1000 名先锋。截至目前，已经发生了五次减半事件：

The systemwide base mining rate B started as 3.1415926 Pi/h and halved every time the network of Engaged Pioneers increased in size by a factor of 10x, starting at 1000 Pioneers. As listed below, there have been five halving events thus far:

Engaged Pioneers Milestone	<1,000	1,000	10,000	100,000	1,000,000	10,000,000
Value of B (in Pi/hr, rounded to two decimals)	3.14	1.57	0.78	0.39	0.19	0.10
Value of I, with full Security Circle (in Pi/hr, rounded to two decimals*)	6.28	3.14	1.57	0.78	0.39	0.19

在这里， Here,

- I(B,S) = B + S(B)
- **S(B) = 0.2 • min(Sc,5) • B，表示**

  S(B) = 0.2 • min(Sc,5) • B, where
- **Sc 是有效安全圈连接的总数。**

  Sc is the count of valid Security Circle connections.
- **E(I) = Ec • I(B,S) • 0.25，其中**

  E(I) = Ec • I(B,S) • 0.25, where
- **Ec 是同时进行挖矿的活跃推荐团队成员的数量。**

  Ec is the count of active Referral Team members who mine concurrently.

挖矿公式也可以表示为 B 的倍数：

The mining formula can also be written as a multiple of B:

- M = I(B,S) + E(I)
- **M = [B + S(B)] + [Ec • I(B,S) • 0.25]，或者说**

  M = [B + S(B)] + [Ec • I(B,S) • 0.25], or
- **M = [B + {0.2 • min(Sc,5) • B}] + [Ec • 0.25 • {B + {0.2 • min(Sc,5) • B}}]，或者**

M = [B + {0.2 • min(Sc,5) • B}] + [Ec • 0.25 • {B + {0.2 • min(Sc,5) • B}}], or

- **M = B • [1 + {0.2 • min(Sc,5)} + {Ec • 0.25 • {1 + 0.2 • min(Sc,5)}}]，或者**

  M = B • [1 + {0.2 • min(Sc,5)} + {Ec • 0.25 • {1 + 0.2 • min(Sc,5)}}], or

- M = B • [(1 + Ec • 0.25) • {1 + 0.2 • min(Sc,5)}]

预主网系统的基础挖矿率

Pre-Mainnet Systemwide Base Mining Rate

每个活跃的先锋至少获得了系统范围内的基础采矿率（B）。也就是说，如果在上述采矿公式中 Sc 和 Ec 都为 0，那么 M 就等于 B。在任何情况下，总的先锋采矿率都是系统范围内基础采矿率的倍数。

Every active Pioneer received at least the systemwide base mining rate (B). That is, if Sc = 0 and Ec = 0 in the mining formula above, then M = B. In any case, the total Pioneer mining rate was a multiple of the systemwide base mining rate.

B 的值在主网之前就已预先确定，如上表所示，它只改变了五次。

The value of B was pre-determined before the Mainnet, and as shown in the table above, it changed only five times.

最大供应量尚未确定，这取决于预主网挖矿机制的动态进展，比如网络的规模和达到下一个减半事件的速度。只有当 B 降至 0 时，才能确定。

The max supply was undetermined due to the dynamic progress of the pre-Mainnet mining mechanism, e.g. how large the network is and how fast the network reaches the next halving event. It would only be determined when B dropped to 0.

然而，如下一节所述，Mainnet 上 B 的值是实时计算的，动态根据年度 Pi 总供应量和所有先锋的总挖矿系数进行调整。Mainnet 上的 Pi 供应是有限的。

However, as explained in the next section, the value of B at Mainnet is calculated in real time, dynamically adjusting based on the total annual Pi

supply and the total mining coefficient across all the Pioneers. The supply of Pi is finite at Mainnet.

安全圈奖励机制 Security Circle Reward

Pi 的共识算法依赖于一个全球信任图，这个图是由数百万个相互交织的先锋安全圈汇总而成。因此，每个先锋每小时因每个新的有效安全圈连接获得额外的 Pi 奖励，最多可获得 5 个这样的连接。安全圈对 Pi 区块链的安全性至关重要，因此安全圈奖励以两种方式提高了先锋的总挖矿速率：

Pi's consensus algorithm relies on a global trust graph, which is aggregated from the millions of intertwining Security Circles of individual Pioneers. Thus, a Pioneer was rewarded with additional Pi per hour for each new valid Security Circle connection, up to 5 such connections. The Security Circles are so central to the security of the Pi blockchain that the Security Circle reward raised the total Pioneer mining rate in two ways:

- **通过直接增加个别先锋的基础采矿率（I），以及**

  by directly adding to the individual Pioneer base mining rate (I), and
- **通过提升推荐团队的奖励（如果有的话）。**

  by boosting the Referral Team reward, if any.

实际上，一个完整的安全圈——即至少有五个有效连接——使个人先锋基础采矿速率和推荐团队奖励都翻了一番。

In fact, a full Security Circle—that is, having at least five valid connections—doubled both the individual Pioneer base mining rate and the Referral Team reward.

推荐团队奖励计划 Referral Team Reward

先锋还可以邀请其他人加入 Pi Network，组建他们的推荐团队。邀请者和被邀请者共享推荐团队奖金，双方在同时挖矿时，各自的基础挖矿速率将提高

25%。

Pioneers can also invite others to join Pi Network and form their Referral Team. The inviter and invitee share an equal split of the Referral Team bonus rewards, that is a 25% boost to their respective individual Pioneer base mining rates, whenever both are mining concurrently.

先锋们与每位同时挖矿的推荐团队成员一起，每小时挖掘更多的 Pi。这项推荐团队奖励表彰了先锋们对网络发展和 Pi 代币分发的贡献。

Pioneers mined more Pi per hour with each concurrently mining Referral Team member. This Referral Team reward recognized the Pioneers' contribution to the growth of the network and the distribution of the Pi token.

主网矿工公式 Mainnet Mining Formula

主网阶段的目标是进一步推动去中心化和实用性，确保稳定性和持久性，同时保持增长和安全性。下面的新公式激励更多样化的先锋贡献，以支持这些主网目标，同时保留保护和发展网络的激励机制。与之前一样，这一机制是基于优点的，并以先锋每小时挖掘 Pi 的速率来表示。

The goals of the Mainnet phase are to make further progress in *decentralization* and *utilities*, ensure *stability* and *longevity*, and retain *growth* and *security*. The new formula, as written below, incentivizes more diverse contributions of Pioneers to support these Mainnet goals while retaining the incentives to secure and grow the network. As before, it is meritocratic and expressed as the rate at which Pioneers mine Pi per hour.

M = I(B,L,S) + E(I) + N(I) + A(I) + X(B)，其中

M = I(B,L,S) + E(I) + N(I) + A(I) + X(B), where

- **M 是总的先锋挖矿比率，**

  M is the total Pioneer mining rate,

- I 是个人先锋的基础采矿率

  I is the individual Pioneer base mining rate,

- B 是系统的基础挖矿率（根据在特定时间段内可分配的 Pi 池进行调整）

  B is the systemwide base mining rate (adjusted based on the available pool of Pi to distribute for a given time period),

- L 是锁定奖励，它是个人先锋基础挖矿率的新组成部分

  L is the lockup reward, which is a new component of the individual Pioneer base mining rate,

- S 是安全圈奖励，它是来自有效安全圈连接的个人先锋基础挖矿率的一个组成部分，计算方式与预主网挖矿公式相同

  S is the the Security Circle reward, which is a component of the individual Pioneer base mining rate from valid Security Circle connections the same way as in the pre-Mainnet mining formula,

- E 是来自活跃推荐团队成员的奖励，方式与主网前的挖矿公式相同

  E is the Referral Team reward from active Referral Team members the same way as in the pre-Mainnet mining formula,

- N 是节点的奖励

  N is the Node reward,

- A 是 Pi 应用的使用奖励，和

  A is the Pi apps usage reward, and

- X 是未来网络生态系统中所需的新型贡献，这些贡献将在后续确定，并将设计为 B 的倍数。

  X are new types of contributions necessary for the network ecosystem in the future, which will be determined later, but will also be designed as a multiple of B.

简而言之，S 和 E 在预主网挖矿公式中保持不变，同时新的奖励如 L、N 和 A 被添加到当前公式中。L 作为 I 的一部分被引入；N 和 A 则是基于 I 计算的额外奖励。换句话说，网络依然通过 E 奖励增长，通过 S 保障安全，同时通过 N 激励先锋为去中心化运行节点的贡献，通过 A 利用应用程序创造实用工具的贡献，以及通过 L 在初期几年特别是为了稳定而进行锁定。此外，未来可能会通过 X 为先锋提供新的奖励，以建立一个完全运作的生态系统，例如为成功开发 Pi 应用程序的先锋开发者提供奖励。 B 在长时间内持续存在，并设定年度上限，以确保网络增长的可持续性，同时保持长期的网络激励。实际上，所有奖励都可以用 B 来表示，如下所示。

In short, S and E remain the same as in the pre-Mainnet mining formula, while new rewards such as L, N and A have been added to the current formula. L is added as part of I; N and A are added as additional rewards calculated based on I. In other words, the network still rewards *growth* through E and *security* through S, while incentivizing Pioneers' contributions to running nodes for *decentralization* through N, using apps for *utilities* creation through A, and locking up for *stability* especially during the initial years through L. Further, new types of rewards to Pioneers through X in the future may be added for building a fully functioning *ecosystem*, such as rewards for Pioneer developers creating successful Pi apps. B continues to exist over a long period of time while having a yearly cap to ensure *longevity* of network *growth* bywhile maintaining long-term network incentives. In fact, all the rewards can be expressed in B as follows.

在这里， Here,

$$I(B,L,S) = B + S(B) + L(B)$$

$S(B) = 0.2 \bullet \min(Sc,5) \bullet B$，表示

S(B) = 0.2 • min(Sc,5) • B, where

- **Sc 是有效安全圈连接的总数。**

  Sc is the count of valid Security Circle connections.

E(I) = Ec • 0.25 • I(B,L,S)，这表示

E(I) = Ec • 0.25 • I(B,L,S), where

- **Ec 是活跃推荐团队成员的总数。**

  Ec is the count of active Referral Team members.

L(B) = Lt • Lp • log(N) • B，表示

L(B) = Lt • Lp • log(N) • B, where

- **Lt 是与锁定期持续时间相关的乘数**

  Lt is a multiplier corresponding to the duration of a lockup,

- **Lp 是先锋在主网挖掘的 Pi 的比例，最多可锁定 200%**

  Lp is the proportion of Pioneer's mined Pi on the Mainnet that is locked up with the maximum being 200%, and

- **N 是当前挖矿会话之前 Pioneer 进行的挖矿会话总数。**

  N is the total number of Pioneer's mining sessions preceding the current mining session.

N(I) = 节点因子 • 调整因子 • I，表示

N(I) = node_factor • tuning_factor • I, where

- **节点因子 = 最近 1 天的正常运行时间百分比 • (正常运行因子 + 端口开放因子 + CPU 因子)，其中**

Node_factor = Percent_uptime_last_1_days • (Uptime_factor + Port_open_factor + CPU_factor), where

- **Uptime_factor = (过去 90 天的正常运行时间百分比 + 1.5 * 过去 360 天的正常运行时间百分比(360-90) + 2 * 过去 2 年的正常运行时间百分比 + 3 * 过去 10 年的正常运行时间百分比)**

  Uptime_factor = (Percent_uptime_last_90_days + 1.5*Percent_uptime_last_360_days(360-90) + 2* Percent_uptime_last_2_years + 3*Percent_uptime_last_10_years),

- **Port_open_factor = 1 + 最近 90 天开放端口的百分比 + 1.5 * 最近 360 天开放端口的百分比 + 2 * 最近 2 年开放端口的百分比 + 3 * 最近 10 年开放端口的百分比,**

  Port_open_factor = 1 + percent_ports_open_last_90_days + 1.5*percent_ports_open_last_360_days + 2* percent_ports_open_last_2_years + 3*percent_ports_open_last_10_years,

- **CPU 因子 = (1 + 最近 90 天的平均 CPU 数量 + 1.5 * 最近 360 天的平均 CPU 数量 + 2 * 最近 2 年的平均 CPU 数量 + 3 * 最近 10 年的平均 CPU 数量) / 4。**

  CPU_factor = (1 + avg_CPU_count_last_90_days + 1.5*avg_CPU_count_last_360_days + 2* avg_CPU_count_last_2_years + 3*avg_CPU_count_last_10_years)/4.

以及 and

- **最近*天/年的正常运行时间百分比表示在过去*时间段内，特定节点在线并可被网络访问的时间比例。**

  Percent_uptime_last_*_days/years is the percentage of the last * time period when the individual Node was live and accessible by the network.

- percent_ports_open_last_*_days/years 是指在过去 * 时间段内，单个节点的端口开放以便连接网络的百分比。

  percent_ports_open_last_*_days/years is the percentage of the last * time period when the ports of the individual Node were open for connectivity to the network.

- avg_CPU_count_last_*_days/years 是指个体节点在过去 * 时间段内为网络提供的平均 CPU 计算能力。

  avg_CPU_count_last_*_days/years is the average CPU that the individual Node provided to the network during the last * time period.

- 调整因子是一个统计指标，用于将节点因子标准化为 0 到 10 之间的数值。

  tuning_factor is a statistical factor that normalizes the node_factor to a number between 0 and 10.

```
A (I)* = log [ Σ_across_apps {log(time_spent_per_app_yesterday_in_seconds) } ] · log [ log(
    0.8 · avg_daily_time_spent_across_apps_last_30_days +
    0.6 · avg_daily_time_spent_across_apps_last_90_days +
    0.4 · avg_daily_time_spent_across_apps_last_180_days +
    0.2 · avg_daily_time_spent_across_apps_last_1_year +
    0.1 · avg_daily_time_spent_across_apps_last_2_year
    ) ] · I
```

- time_spent_per_app_yesterday_in_seconds 是每个 Pi 应用程序在前一天先驱使用该应用程序的总时间（以秒为单位）。

  time_spent_per_app_yesterday_in_seconds is, for each Pi app, the total amount of time in seconds that the Pioneer spends using the app on the prior day.

- Σ_across_apps 汇总了先锋在所有 Pi 应用中昨天每个应用的使用时间（以秒为单位）的对数值。

Σ_across_apps sums up the logarithmic value of the Pioneer's time_spent_per_app_yesterday_in_seconds across all the Pi apps.

- 在过去的*天/年中，先锋在所有 Pi 应用程序上平均每日花费的时间（以秒为单位）是该*时间段内的总时间。

  avg_daily_time_spent_across_apps_last_*_days/years is the average daily time in seconds the Pioneer spends across all the Pi apps in the aggregate during the last * time period.

请注意，当任何对数函数返回未定义值或小于 0 的值时（即，当对数函数的输入小于 1 时），公式会将对数函数的值重置为 0，以避免出现负的挖矿奖励或函数错误。

* Note that when any of the logarithmic functions returns an undefined value or a value below 0 (that is, when, the input to the logarithmic function is below 1), the formula resets the value of the logarithmic function to be 0 in order to avoid negative mining rewards or an error in the function.

X(B)将在未来根据新类型的贡献来确定，但将是 B 的倍数，并与其他奖励一起控制在年度供应限制内。

X(B) is to be determined in the future based on the new types of contributions, but will be a multiple of B and kept within the yearly supply limit along with other rewards.

如上所示，S 和 E 的表达式与预主网挖矿公式中的保持一致，这里不再详细解释。接下来，我们将重点讲解 B 的变化，I 到 L 的变化，以及 N 和 A 的新增内容。

As shown above, the expressions of S and E remain the same as in the pre-Mainnet mining formula, and will not be explained further here. Next, we

will focus on explaining the changes to B, changes to I through L, and the additions of N and A.

系统整体基础采矿率

Systemwide Base Mining Rate

就像在预主网挖矿中，上述主网挖矿公式中的所有术语都可以用每小时的 Pi 表示，并且设计为 B 的倍数。因此，这个方程也可以重新表述为如下。每位先锋每天至少可以按照系统基础挖矿率进行挖矿，如果他们还有其他类型的贡献，这些贡献也会被计算为 B 的倍数，他们将能够以更高的速度进行挖矿。

Like in Pre-Mainnet mining, all of the terms in the Mainnet mining formula above can be expressed in Pi per hour and are designed to be a multiple of B. Hence, the equation can also be re-written as below. Every Pioneer can mine at least the Systemwide Base Mining Rate everyday, and will be able to mine at a higher rate if they also have other types of contributions that are calculated as multiples of B.

$$M = B \bullet (1 + S + L) \bullet (1 + N + E + A + X)$$

与之前的预主网挖矿不同，主网挖矿中的 B 不再是一个在特定时间点上对所有先锋都恒定的值，而是根据年度供应上限实时计算并动态调整。

Unlike in the pre-Mainnet mining, B in Mainnet mining as in the formula above is no longer a constant across all Pioneers at a given point in time, but is calculated in real time and dynamically adjusted based on a yearly supply cap.

Given a yearly supply limit

由于每年的供应限制，无法像主网前那样保持恒定的 B，因为每个先锋的挖矿量以及在某段时间内积极挖矿的先锋数量都是不可预测的。

, it is impossible to keep a constant B like in the pre-Mainnet period

because it's unpredictable how much each Pioneer mines and how many Pioneers are actively mining during a period of time.
预主网模型旨在激励网络在初期几年的增长。随着网络规模的扩大，它还需要确保生态系统的整体健康。

The pre-Mainnet model was designed to incentivize growth during the beginning years to bootstrap the network. As the network achieves a certain scale, it also needs to ensure the overall health of the ecosystem.
因此，随着网络的指数增长和挖矿率的保持不变，代币的指数发行已不再合理。B 的变化从一个常数变为

Therefore, an exponential issuance of the tokens through exponential network growth and a constant mining rate does not make sense any longer. The shift of B from being a constant to
在一年中的某段时间内进行动态调整，是为了激励先锋的贡献，既要以功绩为基础，又要将总奖励控制在一定范围内。

being dynamically adjusted for a certain period of time throughout the year results from the need to incentivize Pioneers' contributions meritocratically but also to keep the total rewards within a limit.

调整 B 的时间周期可以是每年、每月、每天、每小时，甚至更细致。Pi Network 将根据仔细监测和评估，随着时间的推移不断优化这个时间周期。

The time period for adjusting B could be yearly, monthly, daily, hourly, or even more granular. Pi Network will iterate on this time period over time based on careful monitoring and review.

奖励发行公式的第一个版本于 2022 年 3 月 1 日公布——即下面描述的递减指数函数——在与挖矿活动结合的情况下，系统的基础挖矿率（B）会根据公式确定的每月供应限制进行调整。

The first version of the *Rewards Issuance Formula* was announced March 1st 2022—the *declining exponential function* described below—whereby in

combination with mining activities, **the systemwide base mining rate (B) is adjusted** based on a **monthly** supply limit determined by the formula.

请注意，以下递减指数公式是奖励发放公式的初版，因为无法准确预测主网和新挖矿的未来数据。

Please note that the declining exponential formula below is the first version of the Rewards Issuance Formula, as it is impossible to precisely predict the future data on Mainnet and from new mining.

这个初始版本是基于过去的数据、模拟和最佳假设而设计的，包括未来挖矿奖励的 350 亿剩余供应、先锋锁定以及整体生态系统的因素。

This first version was designed based on past data, simulations and best assumptions, such as the 35 billion remaining supply for future mining rewards, Pioneer lockups and overall ecosystem factors.

例如，剩余的 350 亿 Pi 是根据目前可用的真实先锋移动余额数据进行估算的。更准确的数字将取决于网络 KYC 的速度以及未来迁移到主网的 Pi 数量。

For example, the 35 billion remaining Pi is estimated based on the currently available data about real Pioneers' mobile balances. A more accurate figure will be determined by the speed of network KYC and how much Pi is migrated to the Mainnet in the future.

进一步的数据和持续的模拟将有助于评估奖励发放公式中的基本假设，从而可能使该公式根据网络目标进行调整。

Further data and continual simulations will help assess such underlying assumptions in the rewards issuance formula, and thus may lead to the formula's adjustment in line with the network's objectives.

供应限制（以 Pi/天计算）= exp (–last_day_total_mining_rewards / 1220) • 35,000,000,000，具体为

supply_limits (expressed in Pi/day) = exp (–last_day_total_mining_rewards / 1220) • 35,000,000,000, where

- **supply_limits 是这个公式的结果，该公式为每一天分配一定数量的 Pi，持续时间不定，同时确保未来的总发行量不会超过剩余的可用供应**

  supply_limits are the output of this formula that allocates a specific amount of Pi to each day for the indefinite time while making sure the total future issuance will not exceed the remaining available supply,

- **last_day_total_mining_rewards 等于前一天发放的所有 Pi 挖矿奖励**

  last_day_total_mining_rewards is equal to the total Pi mining rewards issued on the previous day,

- **1220 是一个调节因子，未来几个月将会进一步优化**

  1220 is a tuning factor to be further tuned over the coming months, and

- **预计未来可供开采的 Pi 数量为 350 亿。**

  35 billion is the estimated number of Pi available for Pioneers to mine going forward.

这个每月的 B 表示 B 将在一个月内保持不变，并将在每个月底根据奖励发行公式和网络的挖矿活动进行调整。

This monthly B means that that B will stay constant for a month and will be adjusted based on the rewards issuance formula and the network's mining activities at the end of each month.

以一个在一个月内保持不变的 B 开始，帮助先锋们理解以下几点：1) 新的供应限制，2) 新的挖矿机制及其新奖励，3) B 的更动态特性（未来可能会出现）。这些概念复杂，且都会影响先锋们的挖矿奖励。

Starting with a B that stays constant for a month helps Pioneers understand the implications of 1) new supply limits, 2) the new mining mechanism with new rewards, and 3) a more dynamic nature of B

(potentially in the future) one at a time, given that these concepts are complex and all have an effect on Pioneers' mining rewards.

同时，月度周期足够短，可以纠正任何可能的 Pi 超发或不足发放，这与奖励发放公式的偏差相对应，而 B 则保持足够的稳定性，使先锋们能够跟上并调整他们对网络的贡献，以获取奖励。

At the same time, a monthly period is short enough to correct any potential over- or under-issuance of Pi deviating from the rewards issuance formula while B is stable long enough for Pioneers to follow along and adjust their contributions to the network to mine for rewards.

每个月的 B 值是根据该月的供应限制以及上个月最后一天所有活跃先锋的奖励系数总和计算得出的。这个 B 值会在每个月的第一天进行更新。

Each month's B is calculated based on the supply limit for the month based on this formula and the sum of all reward coefficients of all active Pioneers from the last day of the previous month. This B updates again on the first day of every month.

更具体地说，某个月份的 B 值是通过以下方式计算的：

More specifically, the value of B for a given month is calculated by:

- 根据上述奖励发放公式，汇总本月每日的供应限制

  Summing up the daily *supply_limits* for the month from the above rewards issuance formula

- 按照一个月的天数进行划分，以实现月内的均匀分配

  Dividing it by the number of days in the month for even daily allocation within the month

- 再次将其除以上个月最后一天所有活跃先锋的挖矿奖励系数之和（sum_of_B_multiples），其中包括他们的推荐团队、安保圈、Pi 锁定、

应用使用和节点操作奖励的倍数

Dividing it again by the sum of coefficients (sum_of_B_multiples) of mining rewards of all active Pioneers of the last day of the previous month—including their multiples of Referral Team, Security Circle, Pi Lockup, App usage, and Node Operation rewards

每个月都会进行类似的迭代。

Similar iterations occur each month.

When B stays constant in a month, the *total*

当 B 在一个月内保持不变时，每个月实际挖掘的 Pi 总数会根据积极挖掘的先锋人数及其当月的贡献而有所不同。在月底，实际挖掘的 Pi 总数将与公式最初预测的总数进行比较。

number of Pi actually mined every month varies with the total number of actively mining Pioneers and the contributions they make in that month. At the end of the month, the total number of Pi actually mined will be compared with the number initially projected by the formula.

每个月这两个数字之间的任何偏差都将导致对剩余的 Pi 供应进行进一步调整，这将贯穿整个无限挖矿期，并包括上述提到的其他调整类型，例如假定的 350 亿剩余挖矿奖励供应。

Any deviation between the two numbers each month will lead to a further adjustment on the remaining Pi supply, across the remaining indefinite mining period, along with any other types of adjustments explained above, e.g. the assumed 35 billion remaining mining rewards supply.

因此，当先锋人数和他们的挖矿速度意外增加时，月度 B 可能会导致 Pi 的过度发行，从而偏离奖励发行的公式。

As such, the monthly B can potentially cause an overissuance of Pi when there is an unexpected increase in the number of Pioneers and their mining rates, leading to a deviation from the rewards issuance formula.

如果每月的偏差持续较大，网络可以转向 B 模型的更动态版本，在这种版本中，Pi 的每月发行保持不变，但 B 会根据更细致的时间周期进行调整。

If such deviation on a monthly basis is constantly large, the network can move to a more dynamic version of the B model where the monthly issuance of Pi remains constant but B gets adjusted on a more granular time epoch basis.

调整 B 以符合公式的时间越短，针对目标供应限制的过度或不足发行的可能性就越小，同时在此期间偏离公式的机会也会减少。

The shorter the time period for adjusting B to follow the formula, the less is the potential for over- or under-issuance against the targeted supply limits, and the less is the chance for deviation from the formula over that period.

关于主网和新挖矿机制的更多数据将有助于评估当前每月动态 B 的有效性，并判断是否需要推出更动态的版本 B。

More data on Mainnet and the new mining mechanism will help examine the efficacy of the current monthly dynamic B and determine if a more dynamic version B is necessary.

例如，如果 B 是按天计算的，而不是目前的每月版本，那么对于一年中的某一天，

For example, if the B is calculated *daily*, instead of the current *monthly* version, for a given *day* of the year,

B = 日供应量 / (B 的倍数总和 • 24 小时)

B = day_supply / (sum_of_B_multiples • 24h)

- 将剩余的年度 Pi 供应总量除以一年中剩余的天数，以计算每日供应量

  Divide the remaining total Pi supply of the year by the number of days left in the year to get day_supply based on the remaining yearly supply,

- 在过去 24 小时内，将所有活跃挖矿先锋的 B 的倍数相加，这代表了先锋贡献的多样性，然后将其放入上述主网挖矿公式中，以计算该 24 小时窗口内整个网络的 B 倍数总和

  Add the multiples of B from *all Pioneers* actively mining within the last 24 hours, which represents a diverse set of Pioneers' contributions, in the Mainnet mining formula above to get the sum_of_B_multiples of the whole network for that 24-hour window, and

- 进一步将 day_supply 除以 sum_of_B_multiples 和 24 小时，以计算该特定挖矿会话的 B 值。

  Further divide day_supply by sum_of_B_multiples and 24 hours to get B of that specific mining session.

Under this potential framework with a *day*
在这个潜在框架下，以天为调整时间单位，B 在一年中的不同日子会有所不同，这取决于过去 24 小时内有多少先锋进行了挖矿，以及他们通过运行节点、使用实用程序应用或锁定等方式做出了什么样的贡献，从而获得额外的 B 倍数。每个先锋在其挖矿会话中的 B 值在挖矿会话期间保持不变，也就是说，从他们开始挖矿的那一刻起，接下来的 24 小时内 B 值不会改变。

as the unit of time for adjustment, B on different days of the year will be different depending on how many Pioneers mined in the last 24 hours as well as what and how much contributions they made to receive the extra multiples of B by running nodes, using utilities apps or lockups, etc. Each Pioneer's B of their day stays constant through their mining session, that is, over the next 24 hours from the moment they start their mining session.

该模型无论是按月、按日还是更细粒度的时间段，都解决了在公式中包含 X(B)—未来对先锋的贡献奖励类型时的任何不确定性。

This model, whether it is monthly, daily or by more granular time periods,

also addresses any uncertainty with having X(B)—future types of contribution rewards for Pioneers—in the formula.
无论 X 的数量是多少，它都将保持在相同的年度供应限制内，不会增加总供应量，只会影响不同类型贡献的奖励分配。

Regardless of how much X is going to be, it will be kept within the same yearly supply limit without increasing the total supply and will only affect the division of rewards among different types of contributions.
这个动态机制使先锋们能够以去中心化的方式确保（1）奖励不超过年度供应上限，（2）年度供应的分配不会在年初就结束，以及（3）奖励是根据贡献进行分配的。

This dynamic mechanism allows Pioneers themselves, in a decentralized way, to make sure that (1) the rewards do not exceed the yearly supply limit, (2) the distribution of the yearly supply does not end early in the year, and (3) the rewards are divided meritocratically.

为了说明，假设在某一天只有两个先锋，B 是每日的挖矿速率（在这个例子中以 Pi/天表示）——在特定的先锋挖矿会话中是一个固定值，但在不同的日子里会动态调整：

For purposes of illustration, let's suppose there are only two Pioneers on a given day and B is the daily mining rate (expressed in Pi/day for this illustration)—a constant during a specific Pioneer mining session, but dynamically adjusted across different *days*:

- Pioneer 1 没有应用参与（A=0），没有运行节点（N=0），没有安全连接（S=0），也没有活跃的推荐团队成员（E=0）。他们正在进行第 11 次挖矿（N=10），并将 100%的挖矿 Pi 锁定（Lp=1）3 年（Lt=2）。

  Pioneer 1 has no app engagement (A=0), is not operating a Node (N=0), has no security connections (S=0), and has no active Referral Team members (E=0). They are in their 11th mining session (N=10) and are

locking up 100% of their mined Pi (Lp=1) for 3 years (Lt=2).

先锋 1 号当天的采矿速率为：

Pioneer 1's mining rate on this day is:

M1 = I(B,L,S) + 0 + 0 + 0，或者说

M1 = I(B,L,S) + 0 + 0 + 0, or

M1 = B + {2 • 1 • log(10)} • B + 0，或者

M1 = B + {2 • 1 • log(10)} • B + 0, or

M1 = 3B

- **先锋 2 没有应用参与（A=0），没有运行节点（N=0），没有锁定（L=0），也没有活跃的推荐团队成员（E=0）。他们拥有一个完整的安全圈。先锋 2 在这一天的挖矿速率为：**

  Pioneer 2 has no app engagement (A=0), is not operating a Node (N=0), has no lockup (L=0), and has no active Referral Team members (E=0). They have a full Security Circle. Pioneer 2's mining rate on this day is:

M2 = I(B,L,S) + 0 + 0 + 0，或者说

M2 = I(B,L,S) + 0 + 0 + 0, or

M2 = B + 0 + {0.2 • min(Sc,5) • B}，或者

M2 = B + 0 + {0.2 • min(Sc,5) • B}, or

M2 = B + {0.2 • 5 • B}，或者说

M2 = B + {0.2 • 5 • B}, or

M2 = 2B

- **在这一天，整个网络中要挖掘的总 Pi 为 M1 + M2 = 50 亿**

  Here, Total Pi to be mined in the whole network on this day = M1 + M2 = 5B

  假设一年还有 500 个 Pi 和 50 天剩下。

  Let's assume there are 500 Pi and 50 days left in the year.

  因此，今天可挖掘的总 Pi 为 500 Pi，分为 50 天，每天可挖掘 10 Pi

  Therefore, Total Pi available to be mined for this day = 500 Pi / 50 days = 10 Pi/day

- **根据上述两个方程求解 B，**

  Solving B based on the two equations above,

5B=10 Pi ⇒ B = 2 Pi/天（或每小时 0.083 Pi）

5B=10 Pi ⇒ B = 2 Pi/day (or 0.083 Pi/hour)

- **因此，先锋 1 号和 2 号的实际挖矿速率如下：**

  Accordingly, Pioneers 1 and 2 will have their actual mining rates as follows:

M1 = 3 • 2 Pi/天 = 6 Pi/天（即每小时 0.25 Pi）

M1 = 3 • 2 Pi/day = 6 Pi/day (or 0.25 Pi/hour)

M2 = 2 • 2 Pi/天 = 4 Pi/天（或每小时 0.17 Pi）

M2 = 2 • 2 Pi/day = 4 Pi/day (or 0.17 Pi/hour)

先锋基地的采矿速度 Pioneer Base Mining rate

相比之下，个人先锋基础挖矿率在主网挖矿公式中仅包含系统范围内的基础挖矿率和安全圈奖励。在主网中，新增了一个组件，即锁定奖励，加入到个人先锋基础挖矿率 I 中。

By comparison, the individual Pioneer base mining rate in the pre-Mainnet mining formula includes only system-wide base mining rate and Security Circle rewards. At Mainnet, a new component, lockup reward, is added to individual Pioneer base mining rate I.

锁定奖励 L、系统整体基础挖矿率 B 和安全圈奖励 S 共同构成了个人先锋的基础挖矿率 I。

Lockup rewards L, along with the system-wide base mining rate B and Security Circle reward S, constitute the individual Pioneer base mining rate I.

由于 I 被用作计算所有其他奖励的输入，因此，安全圈和锁定奖励通过以下两种方式提升了总的先锋挖矿率：（1）直接增加个人先锋基础挖矿率；（2）提升任何推荐团队奖励 E、节点奖励 N 和应用使用奖励 A。

Since I is used as an input to calculate all the other rewards, as a result, the Security Circle and lockup rewards enhance the total Pioneer mining rate by: (1) by directly adding to the individual Pioneer base mining rate and (2) by boosting the any Referral Team reward E, nodes reward N, and app usage reward A.

锁定奖励机制 Lockup Reward

在主网中，锁定奖励旨在支持健康、顺畅的生态系统，并激励用户长期参与网络，同时帮助网络启动和创造实用工具。

At Mainnet, the lockup reward is meant to support a healthy and smooth ecosystem and incentivize long-term engagement with the network, while the network is bootstrapping and creating utilities.

这是一种重要的去中心化宏观经济机制，旨在调节市场中的流通供应，尤其是在开放市场的初期阶段，当各种应用正在开发时。Pi Network 的一个重要目标

是建立一个以实用工具为基础的应用生态系统。

It is an important decentralized macroeconomic mechanism to moderate circulating supply in the market, especially in the early years of the open market when utilities are being created. One important goal of the Pi Network is to create a utility-based ecosystem of apps.

生态系统中进行的真实商品和服务交易，而不仅仅是投机交易，旨在评估 Pi 的实际价值。

Transactions for real goods and services in the ecosystem, rather than just speculative trading, are intended to determine the utility of Pi.

随着我们进入主网的封闭网络阶段，重点之一将是支持和发展 Pi 应用开发者社区，培育更多的 Pi 应用以促进其增长。

As we launch the Enclosed Network phase of the Mainnet, one of the main areas of focus will be to support and grow the Pi app developer community and nurture more Pi apps to grow.

与此同时，先锋们可以选择锁定他们的 Pi，以帮助为生态系统创造一个稳定的市场环境，使其得以成熟，并促使更多的 Pi 应用程序出现，提供吸引人的使用案例来消费 Pi——最终通过实用性来创造自然需求。

In the meantime, Pioneers can choose to lock up their Pi to help create a stable market environment for the ecosystem to mature and for more Pi apps to emerge and provide compelling use cases for spending Pi – to ultimately create organic demands through utilities.

锁定奖励公式在此重新列出：

The lockup reward formula is reprinted here:

- L(B) = Lt • Lp • log(N) • B，表示

  L(B) = Lt • Lp • log(N) • B, where

Lt 是 B 的锁定时间段的倍数。

Lt is the *Lockup Time period multiplier* of B.

Lt 等于 0

0 → Lt = 0

2 周 → Lt = 0.1

2 weeks → Lt = 0.1

6 个月 → Lt = 0.5

6 months → Lt = 0.5

1 年 → Lt = 1

1 year → Lt = 1

3 年 → Lt = 2

3 years → Lt = 2

- **Lp 是 B 的锁定百分比的乘数，**

  Lp is the *Lockup Percentage multiplier* of B, where

  - **锁定百分比是指锁定金额与从之前的挖矿奖励（Lb）转移到主网余额的比率，锁定百分比的乘数如下。**

    the Lockup Percentage is the lockup amount over the Mainnet Balance transferred from one's previous mining rewards (Lb), and the *Lockup Percentage multiplier* is as follows.

0% → Lp = 0

25% → Lp = 0.25

50% → Lp = 0.5

90% → Lp = 0.9

100% → Lp = 1.0

150% → Lp = 1.5

200% → Lp = 2

- log(N) 是之前所有挖矿会话总数 (N) 的对数。

  log(N) is the logarithmic value of the total number of previous mining sessions (N).

先锋们将有机会自愿锁定他们的 Pi，以获得更高速率挖矿的权利。首先，获得锁定奖励的前提是先锋必须积极参与挖矿。

Pioneers will have the opportunity to voluntarily lock up their Pi to earn the right to mine at a higher rate. First of all, the prerequisite of the lockup reward is that the Pioneer must be actively mining.
如果没有进行挖矿，任何不活跃的挖矿会话都不会获得锁定奖励，即使 Pi 已经被锁定。

Without mining in the first place, there will be no lockup rewards for any inactive mining sessions, even if Pi is locked up.
如上所述，锁定的唯一作用是为 B 提供倍增器，因此如果 B 为 0（即先锋没有进行挖矿），则不会有锁定奖励。

As expressed in the formula above, all that the lockup does is to provide multipliers to B, so there will be no lockup rewards if B is 0 (which means the Pioneers is not mining).

其次，锁定奖励与锁定的贡献呈正相关，即锁定时间段的持续时间（Lt）和锁定的金额。然而，锁定金额是根据先锋总挖掘的 Pi 的百分比（Lp）来计算的。

Secondly, the lockup reward is positively associated with the contribution to the lockup, i.e. the duration of the lockup time period (Lt) and the amount locked up. However the lockup amount is accounted for by the percentage of a Pioneer's total Pi mined (Lp).

先锋可以锁定的最大 Pi 是他们在移动应用中转移的主网余额（Lb）的两倍，也就是 200% Lb。

The maximum Pi that a Pioneer can lock up is twice as much as their Mainnet Balance that got transferred from their prior mining in the mobile app (Lb), i.e. 200% Lb.

对于将转移的主网余额（Lb）设定 2 倍最大锁定金额的原因有两个：1）防止锁定奖励被滥用；2）进一步鼓励对 Pi 生态系统的其他贡献，比如提升挖矿效率、运行节点和使用应用程序。

The reasons for having a 2X maximum lockup amount of one's transferred Mainnet Balance (Lb) are to 1) prevent exploitation of the lockup reward and 2) further encourage other contributions to the Pi ecosystem, such as further boosting their mining, running nodes and using apps.

从某种意义上说，这有利于那些为网络挖矿和做出其他贡献的先锋。

This, in a sense, favors Pioneers who mine and make other types of contributions to the network.

Thirdly, Log(N) offers a higher lockup incentive to Pioneers who have a long mining history and presumably a large transferable balance to lock up. While the lockup reward formula generally favors *equality*

第三，Log(N)为那些拥有较长挖矿历史且可能有大量可转移余额的先锋提供了更高的锁定激励。虽然锁定奖励公式通常通过考虑转移余额的百分比（Lp）而非绝对金额来实现平等——这使得短期挖矿历史的小账户可以锁定小额资金，并且仍然获得与大账户相同的锁定奖励倍数——我们需要引入一个 Log(N)因

子，以考虑那些拥有较长挖矿历史的矿工，从而抵消对小余额先锋的偏见，并为拥有更大余额的长期先锋提供足够的激励。

by accounting for not the absolute amount but the percentage of their transferred balance (Lp) — which allows smaller accounts with a short mining history to lock up small amounts and yet receive the same lockup reward multiplier as big accounts — we need to add a Log(N) factor that accounts for miners with a long mining history, to counterbalance the bias in favor of Pioneers with small balances and provide enough incentive for long-history Pioneers with bigger balances.

然而，挖矿历史对锁定奖励的影响也需要设定上限。因此，公式对之前的挖矿会话数量 N 进行了对数处理。

However, the effect of mining history on lockup rewards also needs to be capped. Thus, the formula applies a logarithm to the number of previous mining sessions N.

例如，如果一位先锋在过去三年几乎每天都在挖矿，他们的总挖矿次数（N）大约为 1,000。在这种情况下，Log(1,000)等于 3，这为他们的锁定奖励增加了一个额外的乘数 B。

For example, if a Pioneer mined almost everyday for the last 3 years, their total previous mining sessions (N) will be about 1,000. In this scenario, Log(1,000) equals 3, adding another multiplier to B in their lockup rewards.

请记住，为了给长期挖矿历史的先锋们提供有意义的锁仓奖励，他们需要锁定的 Pi 数量远远高于小账户。

Keep in mind that to achieve meaningful lockup rewards for long-mining-history Pioneers, the amount of Pi they have to lock up is much more than smaller accounts. Fourthly, one Pioneer can voluntarily have multiple lockups at different times with different amounts and durations. The calculation of the total lockup rewards for this Pioneer with *i*

第四，先锋可以自愿在不同时间进行多次锁定，且每次锁定的金额和持续时间各不相同。对于这个拥有 i 个不同锁定的先锋，计算总锁定奖励的方法是找出 B 的总锁定奖励倍数，具体公式如下。

number of different lockups is to find the total lockup reward multiplier of B, as expressed in the formula below.

下面的公式与上述锁定奖励公式是等效的，唯一的区别在于它考虑了同一先锋的多个锁定，以计算他们的总锁定奖励，例如不同的锁定时长 (

The formula below is the equivalent to the lockup reward formula above, with the only difference being that it accounts for multiple lockups of the same Pioneer to calculate their total lockup rewards, e.g. different durations (

Lti) 及在不同时间每种锁定的不同数量 (Lci):

Lti) and different amounts (Lci) of each lockup at different time:

$$L(B) = \frac{\left(\sum_i Lt_i \cdot Lc_i \cdot log(N_i)\right)}{Lb} \cdot B$$

这个公式的目的是根据每个锁定金额（Lc）在之前挖矿的总主网余额（Lb）中所占的比例，计算总的锁定奖励，作为权重，并乘以各自的锁定时间（Lt）和 Log(N)。

The purpose of this formula is to calculate the total lockup rewards based proportionally on each lockup's amount (Lc) over the total Mainnet Balance from previous mining (Lb) as a weight, multiplied by their respective lockup time period (Lt) and Log(N).

因此，即使同一个先锋有多个锁定，不同设置的更多锁定也会按比例增加它们的总锁定奖励。每个锁定的 Lt、Lc 和 log(N)值都会被计算并相乘。

So that, even though there are multiple lockups of the same Pioneer, more lockups with different settings will proportionally add to their total lockup rewards. The values of Lt, Lc, and log(N) are calculated and multiplied for

each lockup *i* and then summed across various *i*
我在不同的 i 上求和，然后将其除以在特定挖矿会话中 Lb 的值，从而得出该会话的 L(B) 值。

's, which is then divided by the value of Lb at a given mining session, to arrive at the value of L(B) for that mining session.
这个公式确保无论 Lb 的数值如何，只要先锋在 Lb 上保持相同的锁定金额百分比，总锁定奖励的倍增器就会保持不变。

This formula ensures that regardless of the Lb, as long as the Pioneer maintains the same percentage of their lockup amount over their Lb, the total lockup rewards multiplier will remain the same.

Lastly, when can a Pioneer lock up Pi? Pioneers can decide their lockup duration and lockup percentage of their transferable balance anytime they want as an overall account setting in the Pi app.
They can even preselect these settings before they're KYC'ed or ready to migrate to the Mainnet. As they and their Referral Team/Security Circle pass KYC, more of their Mobile Balance will become transferable.
At the moment of the migration of their Transferable Balance to Mainnet, their preselected setting of lockup duration and percentage will automatically apply to the amount of balance transferred, resulting in two types of balances on the Mainnet: lockup balance and free balance, both of which will be recorded on the Mainnet blockchain and reside in the Pioneer's non-custodial Pi wallet.
Thus, lockups cannot be reversed once confirmed and must remain locked up for the entirety of the chosen duration due to the nature of blockchain. Any changes to this Pioneer's lockup setting will take effect in their next balance transfer to the Mainnet.

此账户范围的锁定设置允许先锋将其可转移余额的最高 100%从移动端锁定到主网。

This account-wide lockup setting allows Pioneers to lock up a maximum of 100% of their transferable balance from mobile to Mainnet.
在主网启动后，先锋们转移余额后，还可以通过稍有不同的锁定界面在主网上直接锁定更多的 Pi。

After Mainnet launches and Pioneers transfer their balances, Pioneers can also lock up more Pi directly on the Mainnet through a slightly different lockup interface later on.
在那个时候，先锋可以锁定多达 200%的已转移主网余额，这些余额是他们之前挖矿获得的。

At that time, Pioneers can lock up as much as 200% of their already-transferred Mainnet balance acquired from their previous mining.
额外的锁定津贴可以通过公用事业性质的 Pi 应用交易获得，也就是说，超过先锋个人挖掘的 Pi 可以通过销售商品和服务来赚取。

The additional lockup allowance for more Pi than individually mined by the Pioneer can come from utility-based Pi apps transactions, i.e., making Pi from selling goods and services.

应用使用奖励计划 App Usage Reward

Pi Network 的主要目标是通过我们的应用生态系统，构建一个包容性的点对点生态系统和在线体验，依托于 Pi 加密货币。

An overarching goal of Pi Network is to build an inclusive peer-to-peer ecosystem and online experience fueled by the Pi cryptocurrency through our app ecosystem.
因此，先锋用户在通过 Pi 浏览器使用 Pi 应用时，将获得额外的挖矿奖励，这些应用包括生态系统内的应用和 Pi 目录中的第三方应用。先锋的应用使用奖励在两个方面促进了生态系统的发展。

Therefore, Pioneers will have additional mining rewards for using Pi apps on the Pi apps platform through the Pi Browser, including ecosystem apps

and third-party apps in the Pi Directory. The app usage reward for Pioneers helps the ecosystem in two ways.

首先，这将为 Pi 应用开发者提供市场准入，并提升他们应用的曝光率。

First, it will give Pi app developers market access and increased impressions of their apps.

Pi 应用程序开发者将从 Pioneers 获得使用和产品迭代的机会，这一直是区块链行业创建可行去中心化应用的主要障碍之一。

Pi app developers will gain usage and product iteration opportunities from Pioneers, which has been one of the biggest barriers to creating viable decentralized applications in the blockchain industry.

去中心化应用程序（dApp）开发者目前还没有一个充足、稳定且追求实用的消费者市场环境来测试和完善他们的消费产品，以创造消费者效用。

Decentralized application (dApp) developers do not yet have a plentiful, stable, and utility-seeking consumer market environment to test and hone their consumer products to create consumer utilities.

Pi Network 的应用平台及其使用奖励旨在为 dApp 开发者创造良好的环境。

Pi Network's apps platform and the app usage reward are meant to provide that environment for dApp developers.

其次，增加的展示量和使用频率可能会导致先锋在 Pi 应用中增加对 Pi 的支出。尽管展示是通过应用使用奖励来激励的，但 Pi 的支出并不受此影响。

Second, the increased impressions and usage will potentially lead to increased spending of Pi by Pioneers in the Pi apps. Even though the impressions are incentivized through the app usage reward, the spending of Pi is not.

这意味着，Pi 应用的使用奖励对先锋们有帮助，促进了 Pi 应用开发者的发展，先锋们就在他们的门口。决定先锋们是否会真正留在这些应用中并花费 Pi 的关键在于这些产品和应用的实用性和吸引力。

This means that the Pi app usage reward to Pioneers helps the Pi app developers to the extent that Pioneers are at their door. Now what determines whether Pioneers will actually stay and spend Pi in their apps is how useful and engaging their products and apps are.

这个框架确保这些应用能够在产品质量和实用性上进行竞争，从而使最优秀的应用能够脱颖而出并留在生态系统中。

This framework ensures that these apps are able to compete on the basis of product quality and utility, ultimately allowing the best apps to emerge and stay in the ecosystem.

通过这两种机制，应用使用奖励旨在帮助先锋用户在使用 Pi 应用时，从外在激励逐步转向内在动机，从而实现 Pi 应用的激励使用向自然使用的转变，最终建立一个基于效用的 Pi 应用生态系统。

Through the above two mechanisms, the app usage reward aims to achieve the gradual transition from extrinsic incentives to intrinsic motivations among Pioneers visiting Pi apps, and thus the transition from incentivized to organic usage of Pi apps in order to ultimately bootstrap a utility-based ecosystem of apps using Pi.

这里重新列出了应用程序使用奖励的公式：

The app usage reward formula is reprinted here:

```
A (I)* = log [ Σ_across_apps {log(time_spent_per_app_yesterday_in_seconds) } ] · log [ log(

    0.8 · avg_daily_time_spent_across_apps_last_30_days +

    0.6 · avg_daily_time_spent_across_apps_last_90_days +

    0.4 · avg_daily_time_spent_across_apps_last_180_days +

    0.2 · avg_daily_time_spent_across_apps_last_1_year +

    0.1 · avg_daily_time_spent_across_apps_last_2_year

    ) ] · I
```

- time_spent_per_app_yesterday_in_seconds 是每个 Pi 应用程序在前一天先驱使用该应用程序的总时间（以秒为单位）。

  time_spent_per_app_yesterday_in_seconds is, for each Pi app, the total amount of time in seconds that the Pioneer spends using the app on the prior day.

- Σ_across_apps 汇总了先锋在所有 Pi 应用中昨天每个应用的使用时间（以秒为单位）的对数值。

  Σ_across_apps sums up the logarithmic value of the Pioneer's time_spent_per_app_yesterday_in_seconds across all the Pi apps.

- 在过去的*天/年中，先锋在所有 Pi 应用程序上平均每日花费的时间（以秒为单位）是该*时间段内的总时间。

  avg_daily_time_spent_across_apps_last_*_days/years is the average daily time in seconds the Pioneer spends across all the Pi apps in the aggregate during the last * time period.

请注意，当任何对数函数返回未定义值或小于 0 的值时（即，当对数函数的输入小于 1 时），公式会将对数函数的值重置为 0，以避免出现负的挖矿奖励或函数错误。

* Note that when any of the logarithmic functions returns an undefined value or a value below 0 (that is, when, the input to the logarithmic function

is below 1), the formula resets the value of the logarithmic function to be 0 in order to avoid negative mining rewards or an error in the function.

通常，应用程序使用奖励的计算公式考虑两个因素：在应用程序中花费的时间和使用的应用程序数量，同时在长期内记录应用程序的使用历史，并对奖励进行限制以防止滥用。这个公式主要分为两个部分。

Generally, the app usage reward formula takes into account two factors: time spent in apps and the number of apps used while crediting the history of app usage in the long term and capping the rewards to avoid exploitation. There are two main parts to the formula.

第一部分汇总了先锋在上一个挖矿会话中（即前一天）在每个应用上所花费的时间。

The first part aggregates a Pioneer's time spent across each app in the last mining session (i.e., in the previous day).

对数函数提供了一种正向的递减回报，这意味着在某个应用上花费的时间越多，通常回报也会增加，但随着时间的增加，花费在回报上的正面效果会逐渐减弱。

The logarithmic function provides a positive function with diminishing rewards, meaning that an increase in time spent on any one app will generally increase the rewards, but the positive effect of time spent on rewards decreases as more time is spent.

这个设置鼓励先锋们在多个不同的应用上花费更多时间，从而帮助网络启动多样化工具的开发。

This setup encourages Pioneers to generally spend more time on multiple diverse apps, helping the network to bootstrap the creation of diverse utilities.

同时，它对奖励进行了限制，以防止用户通过全天候保持应用程序开启来不当利用这一奖励，这样做并不会对创造实际效用产生实质性贡献。

At the same time, it caps the rewards to prevent users from exploiting this reward by artificially keeping the apps open all day, which would not meaningfully contribute to utilities creation.

应用使用奖励公式的第二部分关注先锋在不同时间段内所有应用的每日使用时间的滚动平均值。时间段越久，权重就越小。

The second part of the app usage reward formula looks at a Pioneer's rolling average of daily time spent across all apps in various time periods. The further back the time period goes, the less it is weighted.
换句话说，先锋在使用 Pi 应用的时间越长，挖掘的 Pi 就越多，但最近在应用上花费的时间比之前的时间更重要。此外，实际上，只有当先锋在上一次挖掘时也使用了 Pi 应用，应用使用历史才会影响当前的挖掘奖励。

In other words, a Pioneer mines more Pi the longer they have been using the Pi apps, but their recent time spent on the apps counts more toward mining than their previous time spent further back in the past. In addition, as a matter of fact, the app usage history takes effect on the current mining reward only if the Pioneer also used Pi apps during their last mining session.
这意味着仅凭过去的使用并没有被动奖励。再次强调，使用对数函数有助于调节应用使用带来的挖矿增益，以避免对应用使用奖励的滥用。

This means that there is no passive reward for only the past usage. Once again, the use of logarithmic functions helps moderate the mining boost from app usage to avoid exploitation of the app usage reward.
一个值得注意的含义是，过去两年里帮助指导先锋并监控 Pi 聊天中不当行为的 Pi 聊天管理员，在主网启动时将以更高的速度获得应用使用奖励。

A noteworthy implication here is that Pi chat moderators who have been helping to guide Pioneers and monitor undesirable activities on Pi chats over the last two years will mine the app usage reward at a higher rate when the Mainnet launches.

节点奖励机制 Node Reward

Like on any blockchain, Nodes are at the heart of the decentralization of Pi. In Pi, instead of relying on centralized institutional nodes, we decided to open up the Nodes to any Pioneer with a computer connected to the internet.

像所有区块链一样，节点是 Pi 去中心化的核心。在 Pi 中，我们选择不依赖于集中式的机构节点，而是向任何有互联网连接的先锋开放节点。借助于从个人先锋的安全圈中聚合的全球信任图，这些节点将运行共识算法来验证交易和处理区块。

Aided by the global trust graph aggregated from individual Pioneer's Security Circles from the mobile app, these Nodes will run the consensus algorithm to validate transactions and process blocks.

由于节点对 Pi 区块链的去中心化、安全性和持久性至关重要，运营节点的先锋将获得额外的挖矿奖励。

Because the Nodes are critical to the decentralization, security, and longevity of the Pi blockchain, Node-operating Pioneers will receive additional mining rewards.

这里重新印刷了节点奖励公式：

The node reward formula is reprinted here:

N(I) = 节点因子 • 调整因子 • I，表示

N(I) = node_factor • tuning_factor • I, where

- **节点因子 = 最近 1 天的正常运行时间百分比 • (正常运行因子 + 端口开放因子 + CPU 因子)，其中**

  Node_factor = Percent_uptime_last_1_days • (Uptime_factor + Port_open_factor + CPU_factor), where

- Uptime_factor = (过去 90 天的正常运行时间百分比 + 1.5 * 过去 360 天的正常运行时间百分比(360-90) + 2 * 过去 2 年的正常运行时间百分比 + 3 * 过去 10 年的正常运行时间百分比)

  Uptime_factor = (Percent_uptime_last_90_days + 1.5*Percent_uptime_last_360_days(360-90) + 2* Percent_uptime_last_2_years + 3*Percent_uptime_last_10_years),

- Port_open_factor = 1 + 最近 90 天开放端口的百分比 + 1.5 * 最近 360 天开放端口的百分比 + 2 * 最近 2 年开放端口的百分比 + 3 * 最近 10 年开放端口的百分比,

  Port_open_factor = 1 + percent_ports_open_last_90_days + 1.5*percent_ports_open_last_360_days + 2* percent_ports_open_last_2_years + 3*percent_ports_open_last_10_years,

- CPU 因子 = (1 + 最近 90 天的平均 CPU 数量 + 1.5 * 最近 360 天的平均 CPU 数量 + 2 * 最近 2 年的平均 CPU 数量 + 3 * 最近 10 年的平均 CPU 数量) / 4。

  CPU_factor = (1 + avg_CPU_count_last_90_days + 1.5*avg_CPU_count_last_360_days + 2* avg_CPU_count_last_2_years + 3*avg_CPU_count_last_10_years)/4.

以及 and

- 最近*天/年的正常运行时间百分比表示在过去*时间段内，特定节点在线并可被网络访问的时间比例。

  Percent_uptime_last_*_days/years is the percentage of the last * time period when the individual Node was live and accessible by the network.

- percent_ports_open_last_*_days/years 是指在过去 * 时间段内，单个节点的端口开放以便连接网络的百分比。

percent_ports_open_last_*_days/years is the percentage of the last * time period when the ports of the individual Node were open for connectivity to the network.

- **avg_CPU_count_last_*_days/years 是指个体节点在过去 * 时间段内为网络提供的平均 CPU 计算能力。**

  avg_CPU_count_last_*_days/years is the average CPU that the individual Node provided to the network during the last * time period.

- **调整因子是一个统计指标，用于将节点因子标准化为 0 到 10 之间的数值。**

  tuning_factor is a statistical factor that normalizes the node_factor to a number between 0 and 10.

节点奖励取决于正常运行时间因子、端口开放因子、CPU 因子和调优因子。在特定时间段内，节点的正常运行时间因子是该节点在此期间处于活动状态的时间比例。

The node reward depends on the uptime factor, port open factor, CPU factor, and the tuning factor. The uptime factor of a Node for a given period of time is the proportion of time the Node is active during that period.
例如，昨天的正常运行时间为 25%，这意味着该节点在 24 小时内有 6 小时是在线和可访问的。Pi 节点软件会记录特定节点的活动时间。

For example, a 25% uptime factor yesterday means that the Node was live and accessible for a total of 6 out of 24 hours yesterday. The Pi Node software tracks the time a particular Node is active.
从开放网络阶段开始，只有在特定时间点上正常运行的节点才被视为活跃。这反映了节点的可靠性。

Starting in the Open Network phase, only a Node running functionally at a given point in time is considered active. This is a proxy for the reliability of the Node.

然而，对于与挖矿奖励相关的历史数据，只要节点应用程序处于打开状态并连接到互联网，即使没有正常运行，节点也被视为活跃。

However, for the historical data relevant to the mining reward, a Node is considered active if the Node app is open and connected to the internet even if it is not running functionally.

这个对过去表现的豁免承认，运行测试网的社区节点运营商为网络提供了重要的数据和基础设施，使得多个版本的节点软件和测试网得以实现，并且节点无法正常运行并不总是节点运营商的责任。

This exemption for the past performance recognizes that the Community Node operators running the Testnet provided the network with important data and infrastructure to enable multiple iterations of the Node software and Testnet, and that it was not always the fault of the Node operator that their Nodes were inoperative.

节点在特定时间段内的端口开放因子是指该时间段内，节点的特定端口被检测到可从互联网访问的时间比例。

The port open factor of a Node for a given period of time is the proportion of time the Node's specific ports are detected to be accessible from the Internet during that period.

Pi 节点使用 31400 至 31409 端口，允许其他节点通过这些端口和网络 IP 地址与它们进行连接。

Pi Nodes use ports 31400 through 31409, enabling other nodes to reach them through these ports and the network IP address.

开放端口的节点可以响应其他节点发起的通信，而关闭端口的节点无法接收来自其他节点的通信，只能主动发起通信。

An open-port Node is able to respond to communications initiated by other Nodes, while closed-port Nodes are not able to receive such communications from other Nodes and can only initiate communications.

Pi 的共识协议依赖于节点之间相互发送一系列消息。因此，开放端口的节点对 Pi 区块链的正常运行至关重要，因此值得获得挖矿奖励的提升。实际上，网络的目标是至少拥有 1/8 的节点。

Pi's consensus protocol relies on Nodes sending a series of messages among each other. Therefore, open-port Nodes are critical to the operation of the Pi blockchain, and thus, worthy of a mining reward boost. In fact, the network aims to have at least 1/8

节点必须有开放端口，而拥有开放端口是成为超级节点的必要条件之一。

th of the Nodes with open ports, and having an open port is one of the prerequisites for being a Super Node.

节点在特定时间段内的 CPU 因子是该段时间内计算机可用的 CPU 核心或线程的平均数量。

The CPU factor of a Node for a given period of time is the average number of CPU cores/threads available on the computer during that period.

更高的 CPU 因子为区块链的未来可扩展性奠定了基础，例如，能够处理每个区块更多的交易或每秒更多的交易。Pi 区块链并不是一个能源和资源消耗密集型的区块链。

A higher CPU factor prepares the blockchain for future scalability, for example, the ability to process more transactions per block or more transactions per second. The Pi blockchain is not an energy and resource-intensive blockchain.

网络最初设定为每 5 秒处理一个新区块，最多可容纳 1,000 笔交易（T）。因此，网络实际上能够每秒处理约 200 笔交易（TPS），相当于每天约 1700 万笔交易。

The network is initially set to operate at one new block of up to 1,000 transactions (T) about every 5 seconds. Thus the network is effectively capable of processing up to about 200 transactions per second (TPS) or ~17M T/day.

如果未来区块链出现拥堵，可以通过将区块大小从 1000 个交易增加到 10000 个交易，将这一限制提高到每秒 2000 笔交易（约每天 1.7 亿笔交易）。

Should the blockchain get congested in the future, this limit can be increased to 2,000 TPS (~170M T/day) by increasing the block size from 1000 to 10,000 transactions per block.

Pi 节点贡献的 CPU 越多，网络未来的扩展和发展空间就越大。

The higher the CPU contributed by Pi Nodes, the more room the network will have to grow and scale further in the future.

此外，来自 Pi 节点的更高集体 CPU 能够在 Pi 网络上构建新型的点对点节点应用，例如去中心化的 CPU 共享应用，这些应用可以支持计算密集型任务或提供分布式云服务。

Furthermore, higher collective CPU from Pi Nodes will allow novel peer-to-peer node-based applications to be built on Pi Network, such as decentralized CPU sharing applications that let computing power-intensive applications run or provide distributed cloud services.

这些服务将进一步奖励贡献节点，客户将为这些服务支付额外的 Pi。

Such services will be further rewarding contributing nodes with additional Pi paid by the clients of those services.

最后，一个调节因子将节点奖励标准化为 0 到 10 之间的数值。这是为了使节点奖励能够与其他类型的挖矿奖励相比较，这些奖励认可对 Pi 网络的其他贡献。

Finally, a tuning factor normalizes the Node reward to a number between 0 and 10. This is meant to make Node rewards comparable to other types of mining rewards that recognize other contributions to Pi Network.

在封闭主网阶段（如路线图部分所述），节点奖励公式预计将会进行迭代。例如，使用对数或根函数可能会消除对调节因子的需求。

During the Enclosed Mainnet phase (as explained in the Roadmap section), the Node reward formula is expected to iterate. For example, the use of

logarithmic or root functions may potentially obviate the need for a tuning factor.

在长时间内保持可靠的节点稳定运行对区块链的健康至关重要，这并不是一次性的贡献。

Having reliable Nodes running predictably over a long stretch of time is critical to the health of the blockchain. It is not a one and done contribution.
因此，正常运行时间因子、端口开放因子和 CPU 因子都是在不同时间段内计算的，最近时间段的值比更远过去相同长度时间段的值更具权重。然而，请注意，节点奖励是上一个挖矿会话正常运行时间因子的倍数。

Therefore, the uptime factor, port open factor, and the CPU factor are all calculated over varying time periods, where the value from more recent time periods are more heavily weighted than the time periods of equal lengths from a more distant past. Note, however, that the Node reward is a multiple of the uptime factor of the previous mining session.
因此，如果一个节点在前一天的整个时间内处于非活动状态，先锋在该挖矿会话中将无法获得任何节点奖励。与应用使用奖励类似，作为节点操作员的过去贡献并不会带来被动奖励。

Hence, a Pioneer will not receive any Node reward in a given mining session if their Node was inactive for the entirety of the immediately preceding calendar day. Similar to the app usage reward, there is no passive reward for only the past contribution as a Node operator.
这也意味着，如果前一天的正常运行时间较低（即使节点在一天中的某些时间是活跃的），也会显著减少该节点在某一天的奖励，尽管过去的节点贡献很高。

This also means that a low uptime factor in the previous calendar day (even if the Node is active for a part of the day) will substantially reduce the Node reward in a given day despite high past Node contributions.

KYC 对主网奖励的影响分析

将设定一个为期六个月的滚动宽限期，供先锋完成 KYC。此后，在六个月的滚动窗口之外挖掘的 Pi 将无法转移到主网，而是会重新分配给先锋挖矿奖励，具体如下。

There will be a rolling grace period of six calendar months for a Pioneer to complete KYC. Thereafter, the Pi mined outside of the rolling 6-month window will not be transferable to the Mainnet, and will instead be reallocated to Pioneer mining rewards, as discussed below.

在 6 个月的窗口期内，挖掘的 Pi 将无限期保留，直到他们通过 KYC 或 KYC 政策发生变化。

The retention of the mined Pi in the 6-month window continues indefinitely until they pass KYC or the KYC policy changes.

请注意，这个 KYC 窗口挖矿框架将在未来 KYC 解决方案普遍向所有合格的先锋开放时开始，并会提前通知社区。

Note that this KYC-window mining framework will only begin when the KYC solution is generally available to all eligible Pioneers in the future, and will be announced to the community beforehand.

在我们启动主网时，六个月的限制不会立即生效。

The six-month restriction will not be immediately in place yet when we launch the Mainnet.

鉴于真正人性在我们的社交网络挖掘中的重要性，只有通过 KYC 的先锋才能将他们的电话余额转移到区块链上。我们的目标是让尽可能多的真正先锋顺利通过 KYC。

Because of the importance of true humanness in our social network-based mining, only the Pioneers who pass KYC will be able to transfer their Phone balance to the blockchain. Our objective is to have as many true Pioneers as possible pass KYC.

如下所述，六个月的滚动时间窗口有以下几个重要目的：

As explained further below, the rolling six-month window serves the following important purposes:

- **在给予先锋足够时间完成 KYC 与营造通过 KYC 的紧迫感之间找到平衡，**

  strike a balance between giving Pioneers adequate time to pass KYC and creating enough urgency to pass KYC,

- **防止未经验证的 Pi 在六个月的 KYC 宽限期结束后迁移到主网，而是将其释放给其他经过 KYC 认证的先锋进行挖矿，同时保持先锋挖矿的 Pi 总供应限制**

  prevent unverified Pi beyond the rolling six-month KYC grace period from migrating to the Mainnet, instead freeing it up for mining by other KYC'ed Pioneers within the allocated Pi overall supply limit for Pioneer mining, and

- **限制 KYC 中的垃圾邮件和滥用（请参阅下方新成员 KYC 的 30 天延迟）**

  limit KYC spam and abuse (see 30-day delay in KYCing new members below)

如果先锋们未能及时通过 KYC，将会导致他们的余额无法在主网转移，同时也会影响其他在他们的安全圈和推荐团队中持有这些余额的先锋。没有主网余额，先锋们将无法在 Pi 应用中进行支付，这将阻碍我们基于实用性的生态系统的发展。

If Pioneers do not pass KYC in time, it delays the Mainnet transfer of their balances and the balances of other Pioneers who have them on their Security Circles and Referral Teams. Without balances on the Mainnet, Pioneers are not able to use payments in Pi apps, thereby undermining the growth of our utility-based ecosystem.

六个月的时间窗口让先锋们感到紧迫，同时也给他们足够的时间来提取挖掘的 Pi。

A six-month window creates a sense of urgency for Pioneers while giving

them adequate time to retrieve their mined Pi.

KYC 验证过程通常会考虑 Pioneers 是否为真实人类，这基于 Pi 在过去三年中运行的机器自动预测机制。

The KYC verification process will generally take into account Pioneers' likelihood of being real human beings based on Pi's machine-automated prediction mechanisms run over the last three years.

新创建的账户在 30 天内无法立即申请 KYC 验证。这有助于网络限制机器人和虚假账户对 KYC 流程的垃圾邮件和滥用，同时优先为真实用户提供 KYC 验证资源。

Newly created accounts will not be able to immediately apply for KYC verification, until after 30 days. This helps the network limit the ability of bots and fake accounts to spam and abuse our KYC process and prioritize KYC validation resources for real human Pioneers.

最终，延迟 KYC 验证超过六个月的先锋的 Pi 将不会转移到主网，并且在六个月的 KYC 宽限期结束后将不计入系统整体基础挖矿率 (B) 的计算。

Finally, the Pi of the Pioneers who delay KYC verification beyond six months will not be transferred to the Mainnet and will not be accounted for in the calculation of the systemwide base mining rate (B) beyond the rolling six-month KYC grace period.

因此，先锋们需要及时认领他们的 Pi，否则他们的 Pi 将在同一年被其他经过验证的先锋重新分配给 B 进行挖矿，而这些先锋能够为网络做出全面贡献。

Pioneers will, therefore, need to claim their Pi in time, or their Pi will be reallocated to B for mining in the same year by other verified Pioneers who can make full contributions to the network.

向上滑动 Scroll up

发展路线图 Roadmap

Pi Network 在技术和生态系统设计上独具特色，同时我们社区在开发过程中的贡献也至关重要。

Pi Network is unique in our technological and ecosystem design as well as the significance of our community input in development.
这种独特性最适合通过一种深思熟虑和迭代的方法来实现，这种方法允许社区反馈、产品和功能的测试，以及用户体验的改进，阶段则由里程碑来定义。我们的开发主要分为三个阶段：（1）Beta 阶段，（2）测试网阶段，以及（3）主网阶段。

This uniqueness is best served by a thoughtful and iterative approach that allows for community feedback, testing of products, features, and user experience, and phases defined by milestones. There are three main phases to our development: (1) Beta, (2) Testnet, and (3) Mainnet.

第一阶段：公测版 Phase 1: Beta

2018 年 12 月，我们在 iOS 应用商店公开发布了我们的移动应用，作为引导最初先锋的 alpha 原型。在 2019 年 3 月 14 日的 Pi Day，原始的 Pi 白皮书发布，标志着 Pi Network 的正式启动。

In December 2018, we publicly launched our mobile app on the iOS App store as an alpha prototype that onboarded the initial Pioneers. On Pi Day, March 14, 2019, the original Pi whitepaper was published, marking the official launch of the Pi Network.
在这个阶段，我们的应用程序允许先锋通过为未来的 Pi 区块链的成长和安全贡献力量来挖掘 Pi。

At this stage, our app allowed Pioneers to mine Pi by contributing

to the growth and security of the future Pi blockchain.
最终目标是启动主网并围绕 Pi 平台构建生态系统。运行在集中式 Pi 服务器上的 Pi 应用程序使手机用户（先锋）能够贡献他们的安全圈，这些安全圈汇聚在一起，构建了 Pi 区块链共识算法所需的信任图。作为回报，先锋们获得了挖矿奖励。

As the eventual goal was to launch the Mainnet and build an ecosystem around the Pi platform, the Pi app running on the centralized Pi server enabled mobile phone users (Pioneers) to contribute their Security Circles that, in aggregate, built the trust graph required by the consensus algorithm of the Pi Blockchain, and in return, the Pioneers received mining rewards.
此外，集中化阶段促进了网络的增长，社区的形成，以及 Pi 代币的获取和广泛分发。

Furthermore, the centralized phase allowed the network to grow, the community to form, and the Pi token to be accessible and widely distributed.
这个阶段还通过在开发过程中充分利用社区的反馈，迭代了许多技术特性和先锋经验。

This phase also allowed for the iteration of many technical features and Pioneer experience by leveraging community input throughout the development process.

在 Beta 阶段，我们取得了以下重要成就：

The following major accomplishments were made during the Beta phase:

- Pi Network 移动应用程序已在 iOS App Store 和 Google Play 商店上线并可供下载。

The Pi Network mobile app was listed and accessible through the iOS App Store and Google Playstore.

- **Pi Network 从零发展到超过 350 万名活跃先锋。**

  Pi Network grew from 0 to over 3.5 million engaged Pioneers.

- **Pi 网络社区通过应用程序的首页互动和聊天功能积极参与该项目。**

  The Pi Network community actively engaged with the project through the app home screen interactions and chat app.

- **Pi Network 已在全球 233 个国家和地区开展业务。**

  Pi Network reached 233 countries and regions around the world.

第二阶段：测试网络 Phase 2: Testnet

这个阶段始于 2020 年 3 月 14 日，标志着向去中心化区块链过渡的重要一步——一个来自全球的分布式节点的实时测试网。

This phase started on March 14, 2020, marking another critical preparation to the transition to a decentralized blockchain—a live Testnet with distributed Nodes from all over the world.

Pi Network 的节点软件使个人计算机能够支持通过 Test-Pi 运行 Pi Testnet。Test-Pi 仅用于测试目的，且与 Pioneers 在 Pi 应用上的账户余额无关。

Pi Network's Node software enabled individual computers to support running the Pi Testnet using Test-Pi. Test-Pi was available only for the purpose of testing and has no relation to Pioneers' account balances on the Pi app.

Pi 测试网目前已拥有超过 10,000 个完全功能的社区节点，以及超过 100,000 个每日活跃的等待节点。正如后文所述，它将在主网阶段继续存在，以便进行测试。

The Pi Testnet has reached over 10,000 fully functional community

Nodes and over 100,000 daily active Nodes on the waiting list, and as explained in a later section, will continue to exist for testing purposes in the Mainnet phase.

Pi Testnet 允许测试区块链的连接性、性能、安全性和可扩展性，同时也为 Pi 应用开发者提供了在将应用部署到主网之前进行开发的机会。

Pi Testnet allows for the testing of connectivity, performance, security, and scalability of the blockchain, and allows Pi apps developers to develop the Pi apps before they can deploy their app on the Mainnet.

在测试网阶段，采用了三项主要策略：（1）通过测试网节点实现去中心化，（2）通过主 Pi 应用程序促进移动挖矿的增长，以及（3）通过 Pi 浏览器上的 Pi 应用平台创造实用价值。

During the Testnet phase, 3 major strategies were adopted: (1) decentralization through Testnet Nodes, (2) growth through the main Pi app for mobile mining, and (3) utility creation through the Pi apps platform on the Pi Browser.

测试网与第一阶段的 Pi 移动挖矿应用程序同时运行，使去中心化的社区节点能够上线并为主网做好准备。具体而言，测试网节点帮助评估区块链的性能、安全性和可扩展性。

The Testnet ran in parallel with the Pi mobile mining app from Phase 1 and enabled decentralized community Nodes to get online and ready for the Mainnet. Specifically, the Testnet Nodes helped with the assessment of the blockchain's performance, security, and scalability.

这也帮助 Pi App 开发者测试他们的应用程序与 Pi 区块链的兼容性。同时，Pi 移动挖矿应用程序持续吸引数百万先锋，建立社区并增强区块链的安全性。

It also helped Pi App developers test their apps against the Pi

Blockchain. At the same time, the Pi mobile mining app continued to onboard millions of Pioneers, building the community and contributing to the security of the blockchain.

Pi 浏览器和 Pi SDK 使社区能够开发工具，推动 Pi 生态系统的发展。

The Pi Browser, along with the Pi SDK, enabled the community to create utilities and develop the Pi ecosystem.

在测试网阶段，我们取得了以下重要成就：

The following major accomplishments were made during the Testnet phase:

- **发布了多个版本的 Node 软件。**

  Many versions of the Node software were released.

- **Pi 平台与我们生态系统基础设施的关键组件一同发布：钱包、浏览器、头脑风暴和开发工具。**

  The Pi Platform was released along with key ingredients of our ecosystem infrastructure: Wallet, Browser, Brainstorm and developer tools.

- **KYC 应用的试点版本已在 Pi 浏览器上发布。**

  Pilot version of the KYC app was introduced on the Pi Browser.

- **该项目首次举办了全球在线黑客马拉松，吸引了来自先锋社区的成千上万名参与者。**

  The project ran its first ever worldwide online Hackathon with thousands of participants from within the Pioneer Community.

- **Pi Network 的用户已超过 3000 万活跃先锋，社区节点从零增长到超过 10000 个，等待名单上的每日活跃节点也超过 10 万个。**

  Pi Network grew to over 30 million engaged Pioneers, and from

0 to over 10,000 fully functional community Nodes and over 100,000 daily active Nodes on the waiting list.

- **Pi Network 几乎遍布全球所有国家和地区。**

  Pi Network reached almost all countries and regions in the world.

第三阶段：主网络 Phase 3: Mainnet

2021 年 12 月，Pi 区块链的主网将正式上线。在此期间，先锋账户的余额将从手机账户迁移到主网。同时，先锋的 KYC 认证将在余额迁移到主网之前完成。

In December 2021, the Mainnet of the Pi blockchain will go live. The migration of Pioneer balances from their phone account to the Mainnet starts during this period. KYC authentication of a Pioneer precedes their balance migration to the Mainnet.

为了让数百万先锋有足够的时间成功完成 KYC 验证、在 Pi 生态系统中创建工具，并持续优化我们的技术和生态设计，主网将分为两个阶段：

In order to allow for sufficient time for millions of Pioneers to successfully complete their KYC verification, create utilities in the Pi ecosystem, and continue to iterate on our technology and ecosystem design, the Mainnet will have two periods:

1. **起初，受到防火墙保护的主网（即封闭网络），**

   at first, firewalled Mainnet (i.e., the Enclosed Network),

2. **然后，启动主网（即开放网络）。**

   and then, open Mainnet (i.e., the Open Network).

封闭网络时代

The Enclosed Network Period

这个阶段将于 2021 年 12 月开始。封闭网络阶段意味着主网已经上线，但设有防火墙，以防止任何不必要的外部连接。先锋们将有时间进行 KYC，并将他们的 Pi 迁移到实时主网区块链上。

This period will begin in December 2021. The Enclosed Network period means that the Mainnet is live but with a firewall that prevents any unwanted external connectivity. Pioneers will be able to take time to KYC and migrate their Pi to the live Mainnet blockchain.

任何迁移到主网的余额都可以由先锋选择，用于在 Pi 应用中购买商品和服务、转账给其他先锋，或锁定一段时间以获得更高的挖矿收益。

Any balance migrated to the Mainnet can be used, by the choice of the Pioneer, to purchase goods and services in Pi apps, transfer to other Pioneers, or get locked up for a duration of time for a higher mining rate.

完成 KYC 的先锋将能够在 Pi Network 的封闭环境中自由使用他们的 Pi。然而，在此期间，Pi 区块链与其他区块链之间将无法连接。

KYC'ed Pioneers will be able to use their Pi on the Mainnet freely in an enclosed environment within Pi Network. However, this period will not allow connectivity between the Pi blockchain and other blockchains.

两期方法在主网中的优势

Advantages of the Two-Period Approach to Mainnet

在完全开放的主网之前设定一个中间的封闭期有多个优点。这种方法为以下内容提供了时间：

There are multiple advantages to having an **intermediate** enclosed period to ramp up to the fully open Mainnet. This approach allows time for:

- 全球数百万先锋完成 KYC 认证，

  millions of Pioneers worldwide to pass KYC,

- 构建和部署更多的 Pi 应用，允许创建和使用更多的实用工具

  building and deploying more Pi Apps and allowing more utilities to be created and used,

- 将在测试网部署的 Pi 应用程序转移到主网，

  transitioning Pi Apps deployed on the Testnet to the Mainnet, and

- 在开放网络之前，对主网及其生态系统进行任何修改和调整的迭代。

  iterating on any modifications and adjustments to the Mainnet and the ecosystem before the Open Network.

封闭网络阶段为数百万先锋提供了进行 KYC 和将他们的 Pi 迁移到主网的时间。然而，只有少数先锋能够在主网启动时完成 KYC。

The Enclosed Network period allows time for millions of Pioneers to KYC and migrate their Pi to the Mainnet. Only a small fraction of Pioneers have been able to complete their KYC around the launch of the Mainnet.

在接下来的几个月中，我们将继续向更多先锋推出 KYC 解决方案，并协助他们完成 KYC。

Over the coming months, we will continue to roll out the KYC solution to more Pioneers and help them complete their KYC.

如果我们直接从测试网转到开放网络，这意味着那些能够比其他人更早完成 KYC 的先锋，可以在 Pi 平台之外使用 Pi，而仍在等待完成 KYC 的先锋则尚未享有这一特权。

If we moved directly from Testnet to Open Network, this would mean that the Pioneers who were able to KYC before others would

have Pi available for use outside of the Pi platform while the Pioneers still waiting to complete their KYC would not yet have this privilege.

全球各地的先锋完成 KYC 的速度将取决于各地社区提供 KYC 验证者的效率，以及每位先锋参与 KYC 的积极性。

The speed at which Pioneers all over the world are able to complete their KYC will depend on the speed at which each local community provides the KYC validator crowd work force as well as the speed at which individual Pioneers participate in the KYC.

封闭网络的阶段为数百万先锋提供了时间，以完成他们的 KYC 并将 Pi 转移到主网。

Having the Enclosed Network period gives time for millions of Pioneers to complete their KYC and transfer their Pi to the Mainnet.

这样，所有愿意并能够在合理时间内完成 KYC 的先锋们都可以立即在 Pi 平台之外使用他们的 Pi。

This way, all the Pioneers who are willing and able to complete their KYC in a reasonable period of time get to use their Pi outside of the Pi platform at once.

由于在封闭网络期间，Pi 区块链与其他区块链或系统之间不允许外部连接，这使得先锋能够更加专注于向主网的过渡，避免受到 Pi 区块链外部的影响。

Given that external connectivity between the Pi Blockchain and other blockchains or systems is not allowed during the Enclosed Network period, this further helps Pioneers focus on transitioning into Mainnet without any influences external to the Pi Blockchain.

这个时期将帮助社区专注于创建公共设施和推动生态系统的发展，而不受外部干扰。

This period will also help the community focus on creating utilities and bootstrapping the ecosystem without any external distractions.
这与 Pi 网络的愿景相符，允许应用程序在主网部署并为先锋创造实用工具。Pi 应用程序将能够从测试网切换到主网，以进行真实的 Pi 交易。

Consistent with the vision of the Pi network to enable a utility-based ecosystem, this allows apps to deploy on Mainnet and create utilities for Pioneers. Pi apps will be able to switch from Testnet to Mainnet—to production mode for real Pi transactions.
此时，完成 KYC 的先锋们将能够在 Pi 应用上使用他们的 Pi，这将促进实用工具的开发，并在开放网络之前为 Pi 生态系统提供支持。

At this time, KYC'ed Pioneers will be able to spend their Pi on Pi apps, boosting utilities creation and bootstrapping the Pi ecosystem before the Open Network.
这种渐进而有计划的开放网络过渡将帮助应用程序和 Pi 网络识别并解决市场和技术中的任何问题。

This gradual and deliberate ramp to Open Network will help the apps, as well as the Pi Network, to uncover and resolve any glitches in the market and the technology.
因此，封闭网络时期与 Pi 所设想的基于实用的生态系统及其迭代哲学相符。

Thus, the Enclosed Network period is in line with Pi's vision of a utility-based ecosystem and its iterative philosophy.

此外，封闭网络将使主网能够使用生产数据和真实的 Pi，这与测试网有所不同。

Moreover, the Enclosed Network will allow the Mainnet to run with production data and real Pi, which differs from Testnet.

在封闭网络期间收集的数据将帮助我们校准和调整任何必要的配置和公式，以确保开放网络的稳定性和成功。

Data gathered during the Enclosed Network will help calibrate and tweak any configurations and formulae, if necessary, to ensure a stable and successful Open Network.

KYC 验证与主网余额转账

KYC Verification and Mainnet Balance Transfer

“了解您的客户”（KYC）是一个验证身份的过程，用于区分真实账户和虚假账户。Pi Network 的愿景是为所有先锋建立一个包容性且广泛分发的代币和生态系统。

“Know Your Customer/Client” (KYC) is a process that verifies identification to distinguish genuine accounts from fake ones. The vision of Pi Network is to build an inclusive and the most widely distributed token and ecosystem for all Pioneers.

Pi Network 的挖矿机制是基于社交网络的，随着社交网络规模增长到超过 1K、10K、100K、1M 和 10M 的活跃成员，挖矿率已经减半 5 次。因此，Pi 实施了严格的每人一个账户的政策。

The mining mechanism of Pi Network is social network-based, and the mining rate has halved 5 times so far as the social network size grew to over 1K, 10K, 100K, 1M, and 10M engaged members. Therefore, Pi has a strict policy of one account per person.

这需要高度的准确性，以确保网络中的成员是真正的人，防止个人通过创建虚假账户不公平地囤积 Pi。

This requires a high degree of accuracy to establish that members in the network are genuine human beings, preventing individuals from being able to unfairly hoard Pi by creating fake accounts.

先锋的 KYC 结果不仅依赖于身份验证，还需要与 Pi 账户的姓名匹配，并对照政府制裁名单进行筛查。因此，KYC 有助于确保网络的真实人

性，并遵守反洗钱（AML）和反恐法规。

Pioneers' KYC results will depend on not only identity verification, but also their name matching with the Pi account and screening against government sanction list. KYC, thus, helps ensure the true humanness of the network and compliance with the Anti-Money Laundering (AML) and anti-terrorism regulations.

正如在网络成立时所提到的，为了确保真正的人性，假冒的 Pi 账户和脚本挖矿是严格禁止的。这些账户将被禁用，无法迁移到主网。

As communicated at the founding of the network, to ensure true humanness, fake Pi accounts and scripted mining are strictly prohibited. These accounts will be disabled, and will not be able to migrate to Mainnet.

在过去三年里，已经实施了多种技术手段来识别机器人和虚假账户。对于那些被 Pi 算法判定为极有可能是虚假的账户，责任在于这些账户证明自己不是虚假的。

Over the past three years, multiple technical mechanisms have been implemented to identify bots and fake accounts. For the accounts identified as highly likely to be fake by Pi's algorithm, the weight is on these accounts to prove otherwise.

这些识别出的假账户将被禁用，或需经过更严格的审查和申诉程序。KYC 名额的分配将优先考虑那些很可能是真正人类用户的账户。

These identified fake accounts will either be disabled or go through a much more rigorous review and appeal process. The allocation of KYC slots will be prioritized for accounts with a high likelihood of being true human holders.

只有身份经过验证的账户才能迁移到主网，且只有与这些账户相关的 Pi 余额才能转入主网余额。

Only the accounts with verified identities will be allowed to transition to Mainnet, and only the Pi balances attributable to identity-verified accounts will be allowed to transfer to the Mainnet balance.

当先锋及其推荐团队和安全圈成员完成 KYC 后，将决定先锋何时以及在多大程度上可以转移他们的余额。

When a Pioneer and their Referral Team and Security Circle members pass the KYC determines if and when, and to what extent, a Pioneer can transfer their balances.

下面是一个假设的例子，说明 Pioneers 的 KYC 验证在迁移到主网时如何影响他们的余额。

Below is a hypothetical example to illustrate how the KYC verification of Pioneers affects their balances in migration to the Mainnet.

为了简化，我们将不同的 Pi 平衡概念定义如下：

For simplicity, we define different concepts of Pi balances as follows:

- **移动余额：在先锋账户中显示的当前 Pi 余额**

  Mobile Balance: The Pi balance currently shown in a Pioneer's account in the Pi mobile app

- **可转移余额：已获准转移至主网的余额，因为先锋及其在推荐团队和安全圈中的特定关联人员已通过 KYC 认证**

  Transferable Balance: The balance that has been allowed to be transferred to the Mainnet because the Pioneer and their specific associated individuals in the Referral Teams and Security Circles have passed KYC

- **主网余额：先锋迁移并转移到主网的资金余额**

Mainnet balance: The balance that has been migrated and transferred by the Pioneer to the Mainnet

假设个人 A 是一个 Pi 账户的拥有者，想要转移他们的移动余额。先锋 A 只有在身份验证通过后，即通过 KYC，才能将任何移动余额转移到主网。假设这个人有个人 B、C、D 和 E 在他们的推荐团队中，以及个人 D、E、F 和 G 在他们的安全圈中。目前，只有个人 A、B、D 和 F 完成了 KYC 验证。

Suppose individual **A** is the owner of a Pi account who wants to transfer their Mobile Balance. Pioneer A will only be allowed to transfer any of the Mobile Balance to the Mainnet when their identity is verified, i.e., when they pass the KYC. Let's say this individual has Individuals **B**, C, **D**, and E on their Referral Team and Individuals **D**, E, **F**, and G in their Security Circle. So far, only individuals **A**, **B**, **D**, and **F** have completed their KYC verification.

在这个示例配置中：

In this example setup:

- **A 是一位已通过 KYC 的挖矿先锋。**

  A is a mining Pioneer who has passed KYC.

- **B、C、D 和 E 是 A 的推荐团队成员。**

  B, C, **D,** E are in the Referral Team of A.

- **D、E、F、G 在 A 的安全圈中。**

  D, E, **F**, G are in the Security Circle of A.

- **A、B、D 和 F 已完成 KYC 认证。**

  A, **B**, **D**, and **F** have passed KYC.

在这里，A 的可转移余额由以下三个部分的总和构成：

Here, A's Transferable Balance is the sum of the following three components:

- 先锋奖励：根据 A 的先锋状态在所有挖矿会话中获得的 Pi

  Pioneer Rewards: Pi mined based on A's Pioneer status across all mining sessions

- 贡献者奖励：D 和 F 在所有挖矿会话中对 A 挖矿速率的贡献

  Contributor Rewards: D and F's contribution to A's mining rate as Contributors in all mining sessions

- 大使奖励：当 B 和 D 作为推荐团队成员与 A 在同一挖矿会话中进行挖矿时，来自所有挖矿会话的奖金

  Ambassador Rewards: Mining bonuses from all mining sessions when B and D as Referral Team members mined during the same session as A mined

随着先锋 A 的推荐团队和安全圈成员（如 C、E 和 G）通过 KYC，A 的移动余额将有更多部分转变为可转移余额——为 A 迁移到主网做好准备，最终成为 A 的主网余额。

As more of Pioneer A's Referral Team and Security Circle members (i.e., C, E, and G) pass KYC, more portions of A's Mobile Balance will become Transferable Balance—ready for A to migrate to the Mainnet, and ultimately become A's Mainnet Balance.

在封闭主网期间，任何尚未转为可转移余额的移动余额将保留在移动挖矿应用中，直到相关的推荐团队和安全圈中的先锋通过 KYC，且相应的金额可以转移到主网。

During the Enclosed Mainnet period, any Mobile Balance that has not become Transferable Balance will remain in the Mobile mining app until the associated Pioneers in the Referral Team and Security Circles pass KYC and the corresponding amount becomes transferable to Mainnet.

在先锋 A 的例子中，C、E 和 G 的余额贡献将作为 A 在挖矿应用中的移动余额，等待他们完成 KYC，以便该余额能够转移。

In the case of the above example of Pioneer A, the balance contribution by C, E, and G will remain as Mobile Balance for A in the mining app waiting for them to pass KYC in order for such balance to become transferable.

如果这些关联账户从未通过 KYC，那么这些未进行 KYC 的账户余额将在某个日期到期，这个日期将为整个网络提供足够的时间完成 KYC。

If such associated accounts never pass KYC, the balance attributed to these non-KYC'ed accounts will expire at a certain date which will have allowed enough time for the whole network to KYC.

由于缺乏 KYC，未认领的余额将被丢弃，不会转移到主网，而是将其释放给其他已完成 KYC 的先锋进行挖矿，符合先锋挖矿的 Pi 整体供应限制，如 Pi 供应部分所述。

The unclaimed balances due to lack of KYC will be discarded by not being transferred to the Mainnet at all, instead freeing it up for mining by other KYC'ed Pioneers within the allocated Pi overall supply limit for Pioneer mining as explained in the Pi Supply section.

封闭网络的限制

Restrictions in the Enclosed Network

尽管在 Pi 网络中允许 Pi 应用与先锋之间以及先锋之间的交易，但封闭网络将实施以下限制。这些限制在此阶段有助于维护网络的封闭性：

While transactions between Pi apps and Pioneers and Pioneer-to-

Pioneer transactions are allowed within Pi Network, the Enclosed Network will have in place the restrictions as listed below. These restrictions at this stage help enforce the enclosed nature of the network:

- **Pi 与其他区块链或加密交易所之间将无法连接。**

  There will be no connectivity between Pi and other blockchains or crypto exchanges.

- **主网只能通过 Pi 钱包和 Pi 浏览器中的 Pi 应用程序访问。**

  Mainnet can only be accessed through the Pi Wallet and Pi apps on the Pi Browser.

- **主网区块链将可以通过互联网的任何计算机访问，但只能通过防火墙来执行这些规则。**

  The Mainnet blockchain will be accessible to any computer on the internet but only through a firewall to enforce the above rules.

- **主网将仅设有核心团队节点，以确保防火墙始终有效。**

  There will only be Core Team Nodes on the Mainnet to ensure that the firewall is in place at all times.

封闭网络将支持 Pi 生态系统的经济活动和发展。因此，经过 KYC 认证的先锋可以通过 Pi 钱包进行先锋之间的交易。

The Enclosed Network will support the economic activities and growth of the Pi ecosystem. Thus, Pioneer-to-Pioneer transactions are possible through the Pi Wallet as KYC'ed Pioneers will be able to use the Pi Wallet to transact in Pi.

先锋用户还可以在 Pi 浏览器中的 Pi 应用上使用 Pi，这些应用可以通过 Pi 应用 SDK 和 Pi 区块链 API 访问主网。

Pioneers can also spend Pi in Pi apps on the Pi Browser, which can access the Mainnet through the Pi Apps SDK and the Pi Blockchain API.

在封闭网络期间，Pi 浏览器上的应用只能通过防火墙白名单中的 Pi 区块链 API 与主网进行交互。

During the Enclosed Network period, an app on the Pi Browser can only use the Pi blockchain APIs whitelisted by the firewall to interact with the Mainnet.

将允许以下 Pioneer 对 Pioneer、Pioneer 对应用程序和应用程序对 Pioneer 的交易：

The following uses of Pioneer-to-Pioneer, Pioneer-to-App, and App-to-Pioneer transactions will be allowed:

- **通过 Pi 应用程序用 Pi 兑换商品和服务**

  Exchange of Pi for goods and services through Pi Apps

- **先锋之间用于商品和服务的 Pi 转账**

  Transfer of Pi between Pioneers for goods and services

以下行为将被禁止：

The following uses will be prohibited:

- **将 Pi 兑换为法定货币**

  Exchange of Pi for fiat currency

- **用 Pi 兑换其他加密货币**

  Exchange of Pi for other cryptocurrencies

- **转让 Pi 以换取法定货币或其他加密货币的未来承诺**

Transfer for Pi for a future promise of fiat or other cryptocurrencies

We will enforce the above restrictions by adding a firewall to the Mainnet and by exclusively running the Mainnet Nodes for this **interim period**

我们将通过在主网添加防火墙，并在此过渡期间专门运行主网节点来实施上述限制。社区节点将在封闭网络期间继续在测试网上运行。我们将继续对节点进行界面和其他更改，以为开放网络时期的到来做好准备，届时社区节点将能够在主网上运行。

. Community Nodes will continue to run on the Testnet in the Enclosed Network period. We will continue to implement interface and other changes to the Nodes in preparation for the Open Network period where the Community Nodes will be able to run on the Mainnet.

随着进入下一个阶段——开放网络，网络的限制将会被放宽。

The restrictions of the Network to keep it enclosed will be relaxed as it reaches the next period—Open Network.

开放网络时代 The Open Network Period

根据封闭网络生态系统的成熟程度和 KYC 的进展，这一时期可能会在圆周率日（2022 年 3 月 14 日）、Pi2 日（2022 年 6 月 28 日）或更晚开始。

Depending on the maturity of the Enclosed Network ecosystem and the progress of the KYC, this period may begin on Pi Day (March 14, 2022), Pi2 Day (June 28, 2022), or later.

开放网络阶段意味着封闭网络阶段的防火墙将被移除，从而允许任何外部连接，例如连接到其他网络、钱包，以及任何希望连接到 Pi 主网的人。

The Open Network period means that the firewall in the Enclosed

Network period will be removed, allowing any external connectivity, e.g., to other networks, wallets, and anyone who wants to connect to Pi Mainnet.

API 调用不会被防火墙阻挡，先锋可以运行自己的 Pi 节点和 API 服务，并与其他区块链连接。社区节点也可以运行主网。

API calls will not be firewalled, and Pioneers will be able to run their own Pi Nodes and API services. Pioneers will have connectivity with other blockchains. Community Nodes can also run the Mainnet.

回到顶部 Back to top

Pi 项目白皮书 Pi Whitepaper

支持与常见问题解答 Support & FAQ

社区守则

Community Code of Conduct

使用条款 Terms of Service

隐私政策说明 Privacy Policy

开发者服务条款

Developer Terms of Use

Pi 标志 Pi Trademark

安全服务中心 Safety Center

Pi Network

Just One Page PDF

Pi Network, The Future of Social Cryptocurrency in Web3

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