Telegram

STAGE A PRIMER

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Introduction

Cryptocurrencies and other blockchain-based technologies have the potential to make the world more secure and self-governed. However, to this day, no consensus-backed currency has been able to appeal to the mass market and reach mainstream adoption.

This paper outlines a vision for a new cryptocurrency and an ecosystem capable of meeting the needs of hundreds of millions of consumers, including 200 million Telegram users.

Scheduled to launch in 2018, this cryptocurrency will be based on a multi-blockchain Proof-of-Stake system — TON (*Telegram Open Network, or ultimately The Open Network*) — designed to host a new generation of cryptocurrencies and decentralized applications.

The protocol and other components of TON are described in detail in the Technical White Paper (attached hereto as Appendix A), while this document focuses on a general overview of the proposed technology and its uses.

Problem Statement

Bitcoin has established itself as the "digital gold", and Ethereum has proved to be an efficient platform for token crowd sales. However, there is no current standard cryptocurrency used for the regular exchange of value in the daily lives of ordinary people. The blockchain ecosystem needs a decentralized counterpart to everyday money — a truly mass-market cryptocurrency.

Despite their revolutionary potential, existing cryptocurrencies lack the qualities required to attract the mass consumer. There are three main hurdles in today's crypto-environments:

The established blockchain networks — Bitcoin and Ethereum — play important roles in the ecosystem, but don't have the capacity to replace VISA or Mastercard. In their current architecture they are limited to a maximum of **only 7 transactions per second for Bitcoin and 15 transactions per second for Ethereum**, resulting in insufficient speeds and higher transaction costs.

Regular users starting to engage with Bitcoin and similar technologies **often get confused** when trying to buy, store, and send their coins.

The market of goods and services that can be bought with cryptocurrencies is limited, and the **demand** for most crypto-assets **comes mainly from investors, not consumers**.

The current state of blockchain technology resembles automobile design in 1870: it is promising and praised by enthusiasts, but inefficient and too complicated to appeal to the mass consumer. As a result, no cryptocurrency or decentralized platform has gone truly mainstream, and centralized solutions continue to dominate the market.

Outline of the Vision

Exchanging value should be as easy as exchanging information, and blockchain technology offers the ideal foundation to make this a reality. To reach mainstream adoption, a cryptocurrency — and its underlying blockchain design and ecosystem — requires:

**Speed and scalability** that allows for processing millions of transactions per second and potentially accommodating billions of active users.

Intuitive user interfaces that enable an average user to easily buy, store, and transfer value, as well as use decentralized apps in a natural way.

An engaged user base that drives demand for services in the ecosystem and provides pre-existing critical mass for future growth.
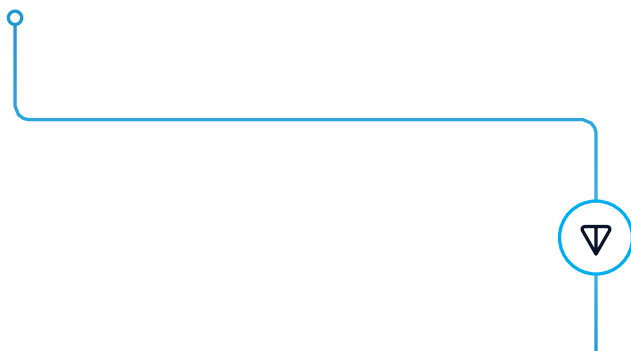
Telegram is uniquely positioned to establish the first mass-market cryptocurrency by providing a platform that combines these properties.

Telegram will use its expertise in encrypted distributed data storage to create TON, **a fast and inherently scalable** multi-blockchain architecture. TON can be regarded as a decentralized supercomputer and value transfer system. By combining minimum transaction time with strong security, TON can become a VISA/Mastercard alternative for the new decentralized economy.

The Telegram Team will rely on its 10-year experience in building **user-friendly interfaces** for tens of millions to create light wallets, and identification services that will allow users to get on board with cryptocurrencies in an intuitive way.

> Integrated into Telegram applications, the TON wallet should become the world's most adopted cryptocurrency wallet.

Telegram will leverage its **existing ecosystem** of communities, developers, publishers, payment providers, and merchants to drive demand for the TON cryptocurrency. We believe that a whole new economy saturated with goods and services sold for cryptocurrency will be born — similar to WeChat's fiat-based marketplace, but not confined to a centralized service.

A Brief History of Telegram

Telegram was founded in 2013 by libertarians to preserve freedom through encryption. The project has declared not-for-profit goals and remains independent and self-funded. Like Wikipedia, which for years has been a role model for the Telegram founders, Telegram has chosen a .org domain to emphasize its non-commercial status.

The physical infrastructure of Telegram reflects its founders' belief in larger decentralization. Telegram deploys a distributed server infrastructure to synchronize encrypted data across multiple independent server clusters spread across different continents and jurisdictions.

The resulting combination of speed, encryption, and independence attracted millions of users within a few months after the project's launch in 2013. Telegram kept evolving with an average of 12 major updates a year. By February 2016, it had 100 million users and was delivering 15 billion messages daily.

In October 2017, Telegram reached 170 million users, delivering 70 billion messages every day[1]. Over the past twelve months, an average of more than 500,000 new users have joined Telegram daily. At this rate, the service is expected to hit **200 million users in Q1 2018**. These users can provide the required critical mass to push cryptocurrencies towards widespread adoption. ▽

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1. Push notifications delivered on iOS and Android devices daily.

Telegram Open Network (TON)

Because taking cryptocurrencies mainstream in 2018 would not be possible using the existing blockchain platforms,[2] Telegram co-founder Dr. Nikolai Durov set out to find a novel solution to meet the speed and scalability required for mass adoption. His research resulted in the design for the Telegram Open Network — a fast and secure blockchain and network project.

BLOCKCHAIN — TON — PLATFORM
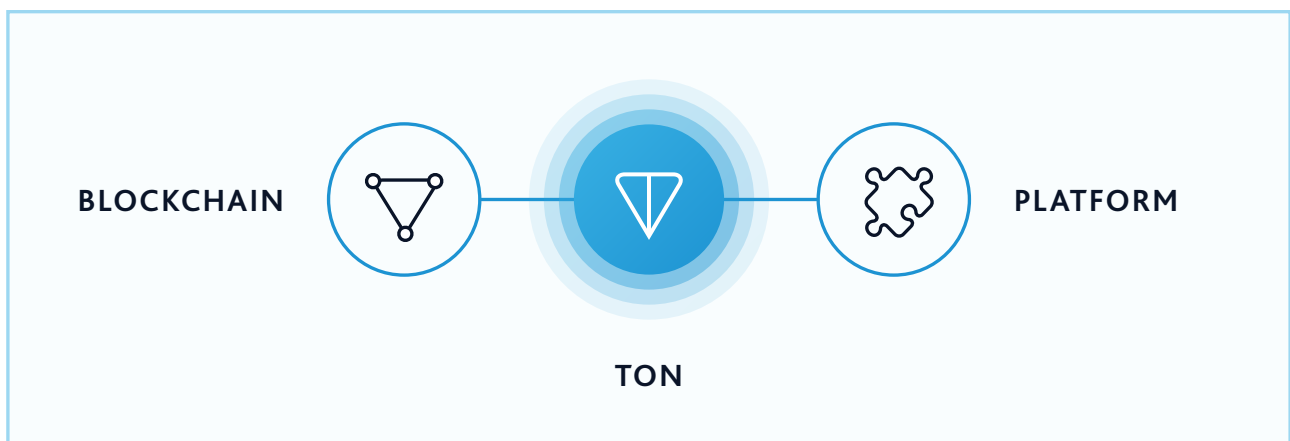
TON Blockchain

At the core of the platform will be the TON Blockchain — a scalable and flexible blockchain architecture that consists of a master chain and a number of optional accompanying blockchains. Below are some notable design choices that will allow the TON Blockchain to process millions of transactions per second.

Infinite Sharding Paradigm

To achieve scalability, TON will have built-in support for sharding: TON blockchains can automatically split and merge to accommodate changes in load. This means that new blocks are generated quickly and the absence of long queues helps keep transaction costs low, even if some of the services using the platform become massively popular.

See "Infinite Sharding Paradigm", 2.1.2.

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2. See sections 2.8 and 2.9 in the Technical White Paper for a comparison of blockchain projects.
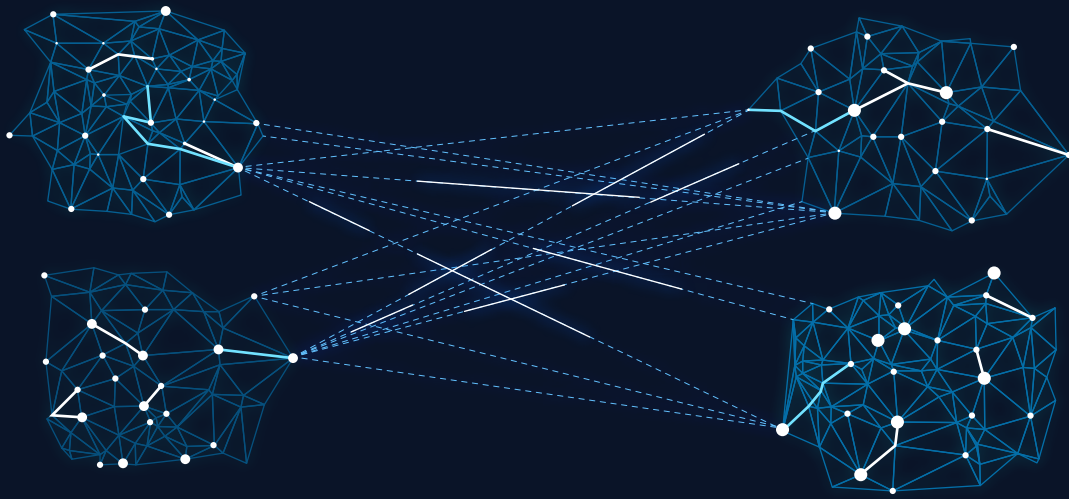
Instant Hypercube Routing

TON blockchains will use smart routing mechanisms to ensure that transactions between any two blockchains will be processed swiftly, regardless of the size of the system. The time needed to pass information between TON blockchains grows logarithmically with their number, so scaling to even millions of chains should allow them all to communicate at top speed.

See "Hypercube Routing" and "Instant Hypercube Routing", ***2.1.3, 2.4.19, 2.4.20***.

Proof-of-Stake Approach

TON will use a Proof-of-Stake approach in which processing nodes ("validators") deposit stakes to guarantee their dependability and reach consensus through a variant of the Byzantine Fault Tolerant protocol. This allows TON to focus the computing power of its nodes on handling transactions and smart contracts, further increasing speed and efficiency.

See "Proof-Of-Stake Approach", ***2.1.15, 2.6***.

2-D Distributed Ledgers

TON will be able to "grow" new valid blocks on top of any blocks that were proven to be incorrect to avoid unnecessary forks. This self-healing mechanism saves resources and helps ensure that valid transactions will not be discarded due to unrelated errors.

See "Account chains", ***2.1.1, 2.1.17***.

TON Platform

As a multi-blockchain project, TON requires sophisticated network protocols — such as the TON P2P Network used to access the TON blockchains[3] — that can be reused to give a boost in flexibility to the platform. The following components are scheduled to be released after the TON Blockchain core and will further increase the potential uses of the TON infrastructure.

TON Storage

TON Storage is a distributed file-storage technology, accessible through the TON P2P Network and available for storing arbitrary files, with torrent-like access technology and smart contracts used to enforce availability. This component not only enables storage services akin to a distributed Dropbox, but also paves the way for more complex decentralized apps that require storing large amounts of data, such as YouTube — or Telegram.

*See "TON Storage", **4.1.8** and "Is it possible to upload Facebook into blockchain?" **2.9.13***.

TON Proxy

TON Proxy is a network proxy/anonymizer layer used to hide the identity and IP addresses of TON nodes. Similar to I^{2}P (Invisible Internet Project), this layer can be used to create decentralized VPN services and blockchain-based TOR alternatives to achieve anonymity and protect online privacy. In conjunction with the TON P2P Network and TON DNS, we expect that TON Proxy can make any service, including Telegram, effectively immune to censorship.

*See "TON Proxy", **3.1.6, 4.1.6, 4.1.11***.

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3. See "TON Networking", Section 3 of the Technical White Paper.

TON Services

TON Services provides a platform for third-party services of any kind that enables smartphone-like friendly interfaces for decentralized apps and smart contracts, as well as a World Wide Web-like decentralized browsing experience.

See "TON Services and Applications", **4**.

TON DNS

TON DNS is a service for assigning human-readable names to accounts, smart contracts, services, and network nodes. With TON DNS, accessing decentralized services can be similar to viewing a website on the World Wide Web.

See "TON DNS", **4.3.1, 4.3.2, 4.3.3**.

TON Payments

TON Payments is a platform for micropayments and a micropayment channel network. It can be used for instant off-chain value transfers between users, bots, and other services. Safeguards built into the system are meant to ensure that these transfers are as secure as on-chain transactions.

See "TON Payments", Lightning-style off-chain transactions, **5**.

All these services can be integrated with third-party messaging and social networking applications, uniting the centralized and the decentralized worlds. ▽

Telegram Messenger-TON Integration

Telegram-TON integration will provide a clear path to cryptocurrencies for millions of people. Telegram Messenger will not only serve as an example of the possibilities offered by integrating with TON, but will also add features to the TON platform, leveraging Telegram's massive user base and developed ecosystem.

Light Wallet

The TON architecture supports light clients that can run on mobile devices without consuming significant resources. TON light wallets will be available as a standalone app, and will also be built into Telegram clients, allowing millions of users to store their funds securely within the TON blockchain. Telegram will evaluate compatibility with existing major cryptocurrency wallet custodians, but expects most Gram owners to use TON wallets as their primary means of transacting in Grams. Shortly after the time of launch of the TON blockchain network, subscribers in the offering will be contacted and asked to designate a TON blockchain address where they want their tokens distributed. From a security standpoint, it is expected that the designated wallet owner will be the sole holder of the corresponding encryption key. We also expect that the TON Wallet will offer additional protocols (such as multi-sig) for those seeking enhanced security.

*See "Merkle proofs", **2.3.10**; "Light wallet and TON entity explorer.", **4.3.19**.*

Telegram mobile and desktop applications with integrated wallets will also double as TON clients, enabling secure transfers of value within the TON blockchain and interaction with TON smart contracts and applications. Telegram will offer streamlined interfaces for sending value to contacts and paying for purchases in TON.

*See "TON DNS use cases", **4.3.2**; "Light wallet and TON entity explorer..", **4.3.19**; TON Payments, **5**.*

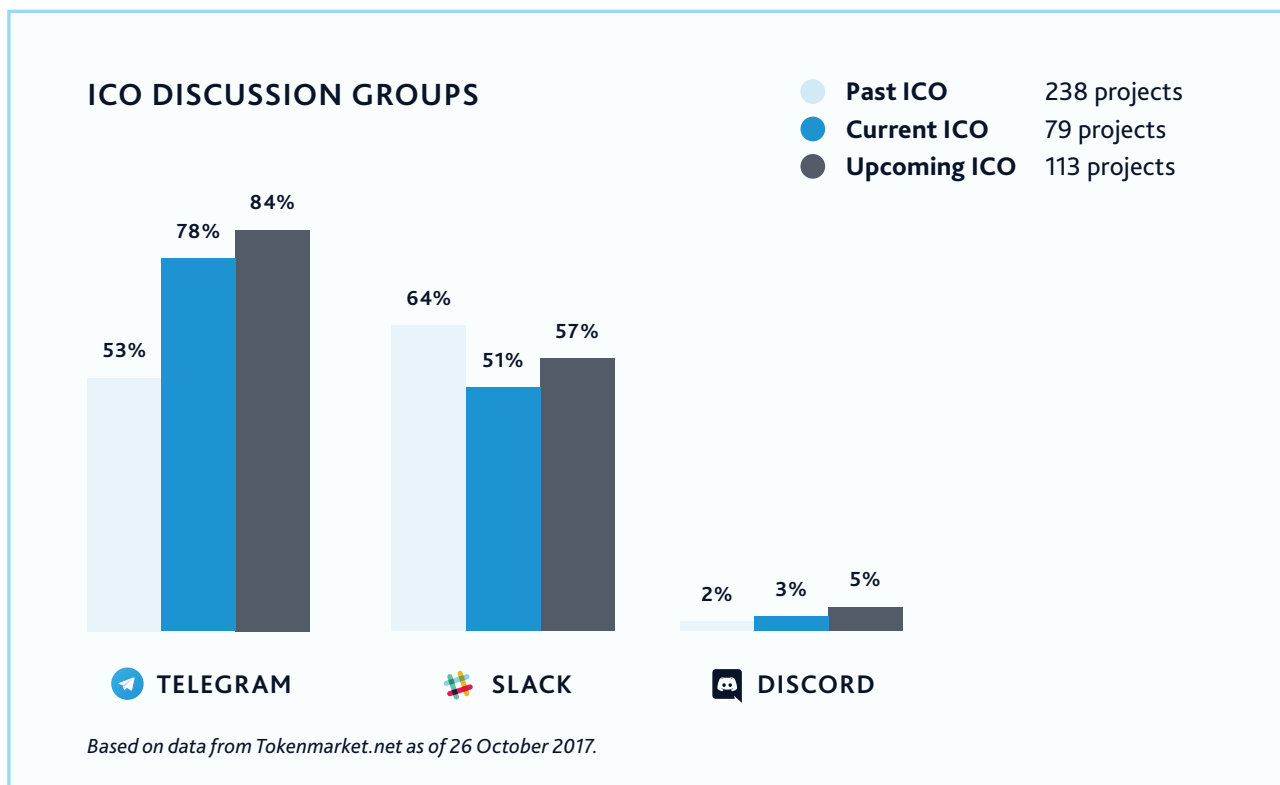Integrated into Telegram applications, the TON wallet is expected to become the world's most adopted cryptocurrency wallet.

The TON coins exchanged by Telegram users will be called "Grams" and denoted by the TON triangular symbol or the 💎 gem emoji. The Gram will serve as the principal currency for the in-app economy on Telegram and, like any other decentralized cryptocurrency, will be available for external use.

External Secure IDs

According to Tokenmarket, as of late 2017, 84 percent of upcoming blockchain-based projects had an active Telegram community, more than all other major chat applications combined.[4] Forbes and other media outlets have called Telegram the "cryptocurrency world's preferred messaging app" and "as ubiquitous to the cryptocurrency world as Snapchat is to a teenager".[5]

ICO DISCUSSION GROUPS

Past ICO — 238 projects
Current ICO — 79 projects
Upcoming ICO — 113 projects

TELEGRAM: 53%, 78%, 84%
SLACK: 64%, 51%, 57%
DISCORD: 2%, 3%, 5%

Based on data from Tokenmarket.net as of 26 October 2017.

Because the majority of actors in the new digital economy already have active Telegram accounts, it is natural for Telegram to offer a secure universal ID. After passing KYC-AML on Telegram once, users will get a virtual passport to log into services that require user verification, thereby eliminating a major point of friction for anyone engaging with crypto-assets.

All private data (such as passport scans) will eventually be stored end-to-end encrypted with a key known only to the owners. Telegram's distributed servers (and later the TON Blockchain) will have no access to this information, but will instead store a hash of the value to be able to confirm that the data was verified when the user obtained their secure ID. Third parties will be able to add further verifications to these virtual passports.

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4. Data from Tokenmarket, as of 26 October 2017.
5. Russia Fines Cryptocurrency World's Preferred Messaging App, Telegram.

Ecosystem

Telegram's existing ecosystem will offer simple ways of buying the TON coins (Grams) and a range of services to spend them on, driving demand for the cryptocurrency.

</> Bot Platform

As of October 2017, more than 800,000 unique third-party bots are used by 52 million Telegram users. These bots can already accept credit card payments from users in 200 countries via eight providers connected to the Telegram Payments Platform.[6] In the future, by using their verified IDs in conjunction with bots that accept credit cards, users are likely to be able to buy and **exchange cryptocurrencies** in a frictionless and legally compliant way.

Telegram will provide a unified entry point for users willing to connect with bots that offer exchange services, effectively creating a competitive market.

Groups and Channels

The Telegram ecosystem includes millions of public group chats reaching up to 50,000 members and broadcast channels, the largest of which have several million subscribers. Telegram's public broadcast channels generate over 30 billion views by 80 million users each month. Creators of large channels currently try to monetize them by posting advertisements or promoting other channels and groups. However, they presently lack the necessary tools to formalize their transactions with advertisers.

To fix this, Telegram will launch a TON-based **ad exchange** where parties interested in promoting their projects can connect with the relevant channel owners and negotiate a price in a transparent and fully automated way. All accompanying transactions will be made in Grams on a per-view or per-click basis, with the necessary statistics and guarantees provided to all parties.

Digital Content and Physical Goods

Bots, channels, and groups provide a ready market for paid content and subscription services. Users will be able to support publishers and content creators by making donations or paying for exclusive access. Bots can act as virtual storefronts and accept orders for the delivery of physical goods. Telegram's in-app economy will supply the TON market with a wide range of goods and services that can be obtained with TON coins.

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6. Bot API Payments: https://core.telegram.org/bots/payments.

⊞ A Gateway to Decentralized Services

Telegram will offer a searchable registry of decentralized services from its applications, providing a list of the most popular apps, as well as recommendations based on the user's history of choices. These steps can make Telegram a gateway to blockchain-based projects for the masses — similar to how Google Play and the App Store currently work for centralized applications. ▽

Uses of TON as a Cryptocurrency

In addition to payments for all digital and physical assets sold by individual merchants within the Telegram ecosystem and on other projects integrated with TON, the TON coins (Grams) will be used as:
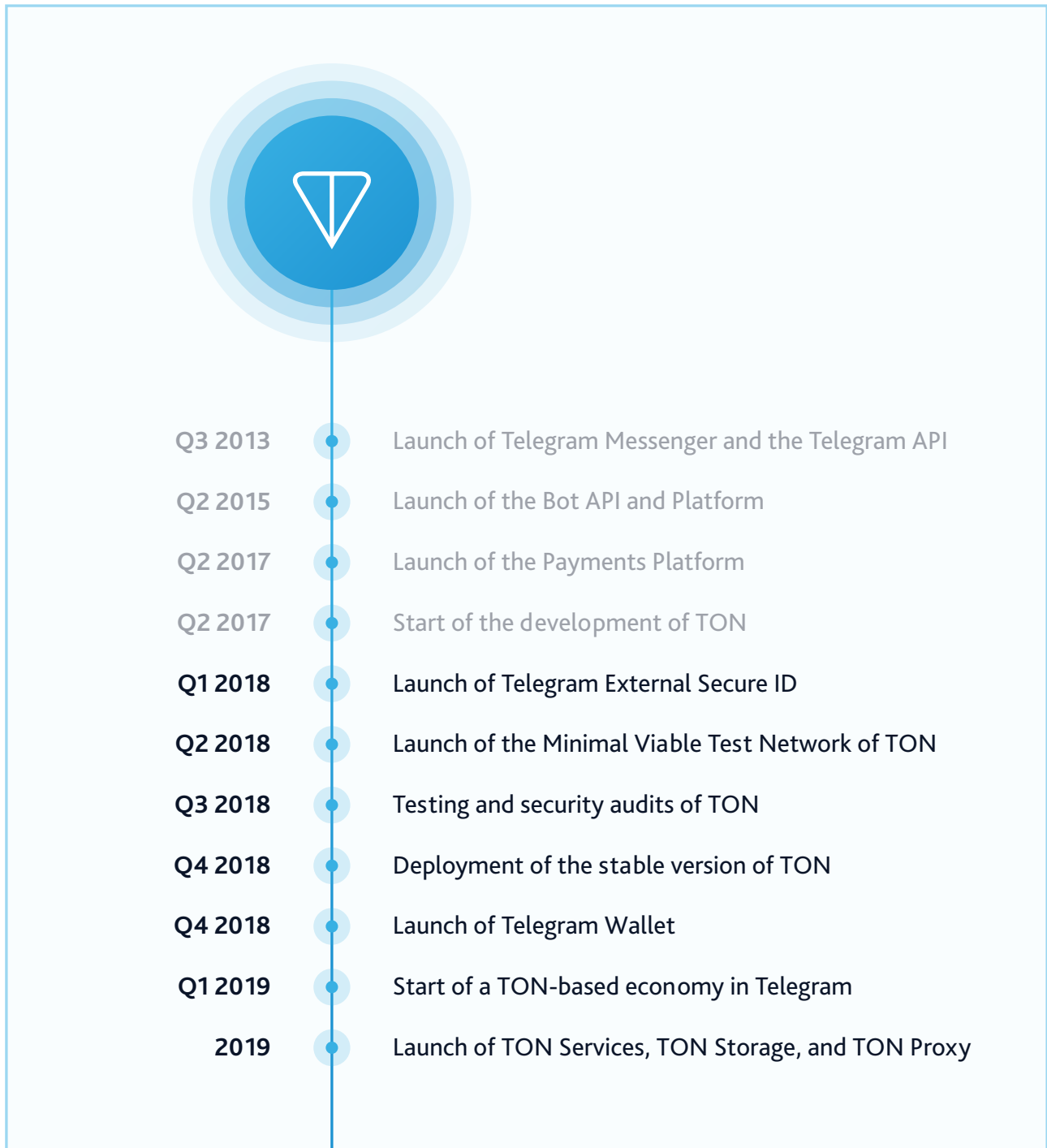
› Commission ("gas") paid to TON nodes ("validators") for processing transactions and smart contracts

› Stakes deposited by validators to be eligible to validate transactions and generate new blocks and coins

› Capital lent out to validators in exchange for a share of their reward

› Voting power required to support or oppose changes in the parameters of the protocol

› Payment for services provided by apps built on the platform (TON Services)

› Payment for storing data securely in a decentralized way (TON Storage)

› Payment for registering blockchain-based domain names (TON DNS) and hosting TON-sites (TON WWW)

› Payment for hiding identity and IP addresses (TON Proxy)

› Payment for bypassing censorship imposed by local ISPs (TON Proxy)

All of these services can be free for the users since the application owners may choose to cover the corresponding fees and adopt a freemium or an advertisement-based business model. ▽

Roadmap

The TON and Telegram technical roadmaps include the following expected milestones:

Q3 2013	Launch of Telegram Messenger and the Telegram API
Q2 2015	Launch of the Bot API and Platform
Q2 2017	Launch of the Payments Platform
Q2 2017	Start of the development of TON
Q1 2018	Launch of Telegram External Secure ID
Q2 2018	Launch of the Minimal Viable Test Network of TON
Q3 2018	Testing and security audits of TON
Q4 2018	Deployment of the stable version of TON
Q4 2018	Launch of Telegram Wallet
Q1 2019	Start of a TON-based economy in Telegram
2019	Launch of TON Services, TON Storage, and TON Proxy

Telegram will also continue shipping monthly product updates that are not related to TON.

Token Distribution

Telegram is conducting a token sale in two stages: an initial sale, which was completed in February 2018, and this subsequent sale. The TON tokens (Grams) are being subscribed for pursuant to purchase agreements. The purchase agreements provide for payment of fiat currency by the purchasers to Telegram in exchange for the delivery of Grams by Telegram to a TON light wallet at a TON blockchain account address designated by the applicable purchaser upon the launch of the TON Blockchain, which is expected to take place in Q4 2018.

The total supply of native TON tokens (Grams) will initially equal 5 billion.

After the TON Blockchain is fully deployed, the annual inflation rate in the supply of Grams derived from the fundamental parameters of TON is projected at two percent and, as a result, we expect that the supply of Grams will double to 10 billion in 35 years. This inflation represents a payment made by all members of the community to the validators for keeping the system functional.

*See "Validators", **2.6.1**, "Original supply, mining rewards and inflation", **A.3**.*

Ten percent of the initial supply of Grams (500 million Grams) will be reserved to be used as incentives for the ecosystem — to encourage installation of third-party validators, TON Storage, and TON Proxy nodes and to reward users for activating wallets and completing the know your customer (KYC) and anti-money laundering (AML) screening procedures. Four percent of the initial supply of Grams (200 million Grams) will be reserved for the development team, subject to a 4-year vesting period.

The price of Grams subscribed for in each stage of its token sale is being calculated as

$$P_{stage} = \frac{T_{stage}}{n_{stage}}$$

where T_{stage} is the total amount of funds (in USD) raised in that stage and n_{stage} is the total number of Grams sold in that stage, calculated as
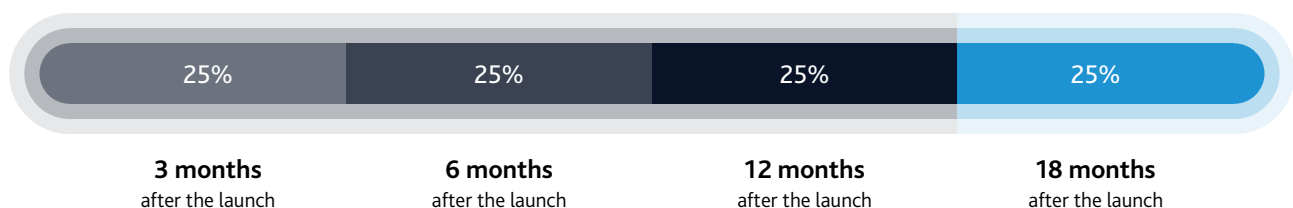
$$n_{stage} = 10^9 \times \ln\left(1 + \frac{T_{stage}}{10^9 \times p_n}\right)$$

Here n denotes the total amount of Grams sold prior to that stage, and p_n is the reference price of the Gram at the beginning of that stage, computed as

$$p_n = 0.1 \times e^{n \times 10^{-9}} \approx 0.1 \times (1 + 10^{-9})^n \text{ USD}$$

The initial sale began in January 2018 and closed in February 2018. Approximately 45 percent of the initial supply of Grams (approximately 2.25 billion Grams, or 850.0 million USD worth of Grams calculated in accordance with the formula above) were subscribed for in the initial sale.

Grams subscribed for during the initial sale are subject to lock-up restrictions, meaning those Grams will be "frozen" (and, therefore, non-transferable) until they are released from the lock-up. Those Grams will be released from the lock-up in four equal-sized tranches over an 18-month period, as illustrated below:

25%	25%	25%	25%
3 months after the launch	**6 months** after the launch	**12 months** after the launch	**18 months** after the launch

Telegram is now entertaining offers for subscriptions for Grams in the subsequent sale. No more than 21 percent of the initial supply of Grams (approximately 1.05 billion Grams) can be sold in the subsequent sale. Grams sold in the subsequent sale will not be subject to a lock-up following the launch of the TON Blockchain. This subsequent sale will be split into two stages: "stage A" and "stage B". The price of the Grams offered for subscription in each stage will be calculated separately in accordance with the formula above.

Telegram currently expects to offer up to 850.0 million USD worth of Grams for subscription in stage A. The number of Grams that will be offered for sale in stage B has not been determined at this time.
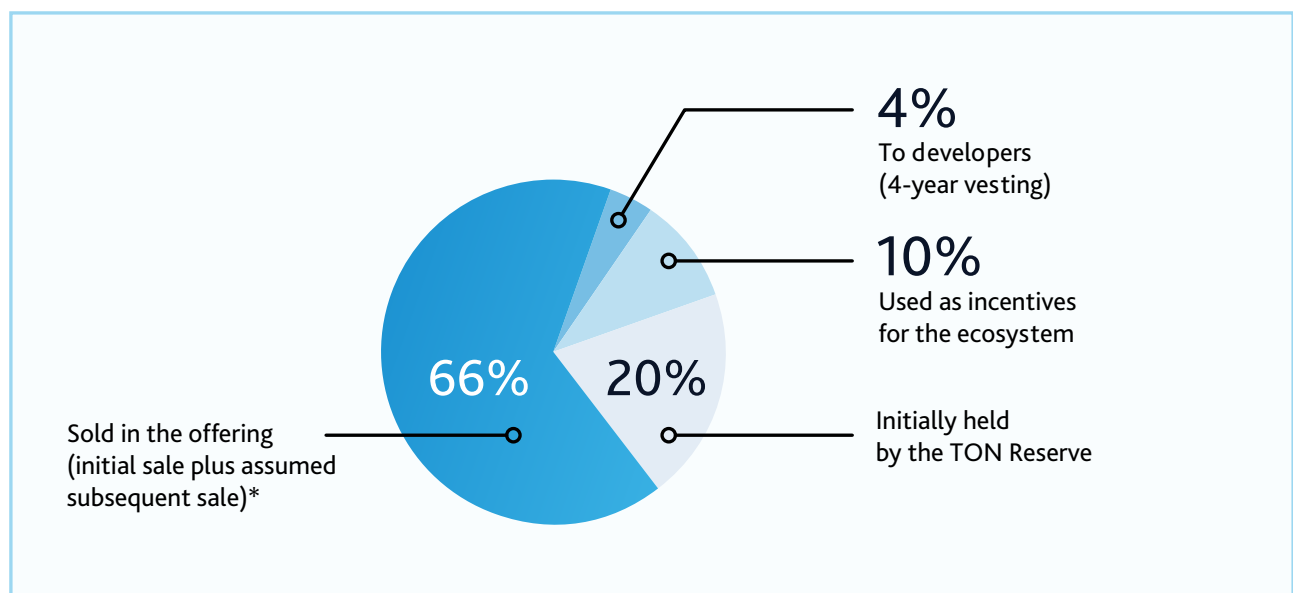
Grams that are not subscribed for in either stage of the subsequent sale will remain in the TON Reserve.

At the time the TON Blockchain is launched, the TON Reserve will hold a minimum of 1 billion Grams. These Grams may be sold by the TON Reserve after the launch of the TON Blockchain at a price no less than the reference price calculated in accordance with the following formula:

$$p_n = 0.1 \times e^{n \times 10^{-9}} \approx 0.1 \times (1 + 10^{-9})^n \text{ USD}$$

where n is the total amount of Grams already in circulation.

Possible initial distribution of Grams (assuming maximum of 1.05 billion Grams sold in the subsequent sale):

4%
To developers
(4-year vesting)

10%
Used as incentives
for the ecosystem

66%
Sold in the offering
(initial sale plus assumed
subsequent sale)*

20%
Initially held
by the TON Reserve

* 45% of the Grams were sold in the initial sale.

Use of Funds

We intend to use the proceeds raised from the offering (both the initial sale and the subsequent sale) for the development of the TON Blockchain, for the continued development and maintenance of Telegram Messenger, and for general corporate purposes at Telegram Messenger. Such expenses are expected to include, among others, equipment, bandwidth, colocation, and user verification costs, as well as wages, offices, and legal and consulting services.

We expect that proceeds from any Grams sold by the TON Reserve following the launch of the TON Blockchain will be used to stabilize the price of Grams and to fund the continued development of the TON Blockchain and its ecosystem.

While we currently anticipate that the funds will be used as outlined above, their actual use may vary depending upon numerous factors, including operating costs and capital expenditure requirements and other conditions in effect from time to time, as well as the other factors described in Appendix B to this Primer.

Pending their use, we intend to hold the proceeds of the offering as cash or in the form of cryptocurrencies. ▽

Governance

Over time, all responsibilities related to TON and the TON Reserve are expected to be transferred to the TON Foundation, a not-for-profit organization.

Ultimately, TON intends to let go of the "Telegram" element in its name and become "The Open Network".

Telegram Open Network ⟶ The Open Network

Telegram will serve as a launch pad for TON, ensuring its technological superiority and widespread adoption at launch. But the future of TON is in the hands of the global open-source community. ▽

Team

Telegram has a world-class team of 15 developers that were selected from thousands of contenders over the last ten years. To become part of the team, each of its current members had to either win one of the world's top programming contests or take first place in one of the nationwide multi-level coding competitions held by the founder of Telegram.

Core team members have ten years of experience in building scalable projects for tens of millions of users. Before building Telegram, they created VK, the largest Europe-based social network with more than **100 million active users**, which still enjoys a dominating share in its local markets.

The Telegram backend team, which has an unparalleled ratio of **winners of worldwide coding competitions**, specializes in creating secure data storage engines for distributed server infrastructures. All networking, cryptographic, and database engine software running on thousands of Telegram servers is custom-built by these developers.

Founders

Dr. Nikolai Durov

PhD (Bonn University), PhD (Saint-Petersburg State University)

› 2013-present: Co-founder, CTO, Architect, Lead C/C++ Engineer at Telegram. Built MTProto and Telegram's distributed data storage engines.
› 2006-2013: Co-founder, CTO, Architect, Lead C/C++ Engineer at VK. Built data storage and networking software.

Awards

› Absolute World Champion in Programming (2000, 2001) — one of ten people in history to win the ACM International Collegiate Programming Contest twice
› Gold Medals in International Mathematical Olympiads (1996, 1997, 1998)
› Gold and Silver Medals in International Olympiads in Informatics (1995, 1996, 1997, 1998)

Nikolai is a renowned mathematician and a world-class programmer, uniquely combined in one person. At the age of 8, Nikolai already solved cubic equations.[7] He started coding

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7. Nikolai was invited to demonstrate this skill on the main TV channel of Italy, where the Durovs lived at the time.

at 9, and by 13 he built a full-fledged operating system for Intel 80386 microprocessors in x86 assembly language. While spending summers in Siberia without access to a computer, 11-year old Nikolay filled hundreds of pages with x86 assembly code, creating programs such as a Forth interpreter entirely on paper. As a CTO and guru in distributed systems, he scaled VK and then Telegram to tens of millions of daily users. In 2014 Nikolai became interested in Bitcoin and related technologies. His research on these topics culminated in TON's Technical White Paper, in which he summarized the advancements of blockchain technology and proposed a novel architecture for scalable decentralized ledgers.

Pavel Durov

› 2013-present: Co-founder, CEO, Product Manager at Telegram
› 2006-2013: Co-founder, CEO, Product Manager, Lead Developer at VK

Awards

› The most promising Northern European leader under 30 (2014)[8]
› Young Global Leader by the World Economic Forum (2017)[9]

Pavel first gained international recognition for founding VK, which under his leadership commanded a 70 percent market share in Russia, Ukraine and Belorussia, eclipsing Facebook and other competing social networks. An outspoken libertarian, he published free market manifestos urging the Russian government to deregulate and decentralize the country's economy. Pavel was forced to sell VK and leave Russia in 2014 after a clash with the government over his users' privacy and freedom of speech.

Pavel started coding at 10, and at 11 he already created his first multiplayer strategy game. As a teenager, he built popular online communication tools for fellow students. At 21 he single-handedly coded the first version of VK. Pavel founded Telegram and became interested in cryptocurrencies in 2013, when he spent $1.5 million of his savings on Bitcoin that he holds to this day.

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8. VKontakte's Founder Pavel Durov the Most Promising Northern European Leader Under the Age of 30.
9. Young Global Leader, Class of 2017.

Other Notable Team Members

Aliaksei Levin

› 2013-present: C/C++ Engineer at Telegram. Developed distributed data storage engines, client cross-platform libraries, and the bot API.
› 2010-2013: C/C++ Engineer at VK. Built data storage engines and created the custom programming language KPHP for high-level backend developers.

Awards

› Gold Medal, ACM International Programming Contest World Finals (2011)
› Silver Medal, ACM International Programming Contest World Finals (2010)
› First Prize, International Mathematics Competition for University Students (2009)
› Gold Medal, First Place, International Mathematical Olympiad (2005)
› Silver Medal, International Mathematical Olympiad (2004)

Vitalik Valtman

› 2013-present: C/C++ Engineer at Telegram. Developed networking and data storage engines.
› 2010-2013: C/C++ Engineer at VK. Developed networking and data storage engines.

Awards

› Silver Medal, ACM International Programming Contest World Finals (2006)
› 4th place, Top Coder Open
› 4th place, Top Coder Collegiate Contest

Arseny Smirnov

› 2013-present: C/C++ Engineer at Telegram. Developed server data storage engines, client cross-platform libraries, and bot API.
› 2010-2013: C/C++ Engineer at VK. Developed data storage engines and created the custom programming language KPHP for high-level backend developers.

Awards

› Gold Medal, ACM International Programming Contest World Finals (2011)
› Silver Medal, ACM International Programming Contest World Finals (2010)

John

› 2014-present: Client C++ Engineer at Telegram. Single-handedly built Telegram Desktop.
› 2007-2013: Lead backend/frontend Engineer at VK after winning a nationwide contest in JS.

Igor

› 2014-present: Lead Backend Engineer at Telegram. Built the entire Telegram API for client apps.
› 2007-2013: Lead backend/frontend Engineer at VK after winning a nationwide contest in JS.

DrKlo

› 2014-present: Android Engineer at Telegram after winning a nationwide contest in Android Java. Built Telegram for Android.
› 2012-2013: iOS Engineer at VK after winning a nationwide contest in Objective C.

Peter

› 2014-present: iOS/Swift Engineer at Telegram. Built Telegram for iOS (Objective C). Built Telegram Beta for iOS (Swift).
› 2012-2013: iOS Engineer at VK after winning a nationwide contest in Objective C.

Grisha

› 2016-present: Cross Platform Developer at Telegram. Builds voice calls.
› 2010-2016: Android Engineer at VK after winning a nationwide contest in Java for Android. Single-handedly built the VK app for Android.

Kolar

› 2014-present: Backend/Frontend Engineer at Telegram. Built the Instant View Platform, the Translations Platform, telegra.ph, telesco.pe, etc.
› 2010-2013: Lead backend/frontend Engineer at VK after winning a nationwide contest in JS.

Ilya

› 2013-present: iOS/Swift Engineer at Telegram after winning several nationwide contests in Objective C. Built multiple features for Telegram iOS.

Igor

› 2013-present: Infrastructure Architect at Telegram. Scaled Telegram to tens of thousands of servers.
› 2008-2013: Senior System Engineer. Scaled VK to tens of thousands of servers.

Appendix A

Technical White Paper

See attached.

Risk Factors

See attached.