THETA FAQ

Last Updated: May 1, 2018
Version 1.6

BASICS

What is Theta?

Theta is a blockchain and token that will be used to power a decentralized video streaming and delivery network. The Theta Token functions as an incentive mechanism that encourages users to share their unused memory and bandwidth, serving as video caching and relay nodes for the network. Theta will be an open-source project that will be shared with industry and community participants, and our long-term vision is to have all video platforms participate in the network by building decentralized apps (Dapps) on top of the Theta protocol. Applications such as TV, movies, esports, music, education, and enterprise conferencing can benefit from building on the Theta Network.

Theta ERC20-compliant tokens are live and fully integrated into the SLIVER.tv platform as of December 2017. The new native blockchain and protocol is planned to go live in Q4 2018, at which point each ERC20 token will be 1:1 exchanged for native Theta Tokens.

What is the Theta decentralized video mesh network and how does it work?

In Theta's decentralized video mesh network, viewers will be incentivized to share redundant bandwidth and computing resources to address today's video streaming challenges. Viewers around the globe can contribute their devices as caching / relay nodes whereby they form a video delivery infrastructure that is responsible for relaying any given video stream to other geographically near viewers.

What problems are the Theta network solving?

There are three major challenges in the video streaming industry today:

1. Poor video stream quality caused by the "last-mile" problem, particularly in developing countries;
2. High cost of video content delivery and content delivery networks (CDNs);
3. Inefficient video ecosystem and lack of transparency among advertisers, influencers and users.

What are Theta Tokens? How will Theta Tokens be used?

Theta Tokens work as a long-term sustainable incentive mechanism to motivate various stakeholders to participate in the network:

1. Users earn new tokens by caching and relaying video streams;
2. Viewers can gift Theta Tokens to support their favorite streamers, content creators, and to purchase premium products, services and virtual goods;
3. Advertisers can use tokens to fund advertising campaigns to support influencers, streaming sites and viewers;
4. Viewers can also optionally earn tokens from advertisers as an engagement reward for their attention.

How is Theta different from other video tokens?

Theta is aiming to develop a new blockchain and technology purpose-built for video delivery and streaming, while the tokens work as an incentive and reward mechanism to motivate all stakeholders, specifically the video caching/ relay miners to participate in the network. Most other existing video tokens are ERC20-only application level tokens, and do not have the technical ability to scale and handle infrastructure level video delivery needs with built-in incentives.

Theta is the only end-to-end solution for decentralized video streaming, providing incentives to all users within the network. In the long-run, as more caching and relay nodes join and the Theta network becomes denser the utility of tokens will also increase.

What benefits does the Theta Network provide over existing content delivery networks?

Theta's decentralized network provides various benefits to stakeholders in the streaming video ecosystem:

1. **Viewers**: Improved video Quality of Service (QoS) and the potential to be rewarded just for watching videos;
2. **Caching Nodes / Relayers**: The opportunity to earn Theta Tokens by sharing their bandwidth, relaying video streams, and supporting the Theta Network;
3. **Streaming Video Platforms**: Bandwidth costs can be reduced by up to 80% for video streams off-loaded to the Theta mesh network, which increases the profitability of video platforms and provides them greater ability to reward content creators and their viewers;
4. **Content Creators:** Increased transparency of video views and payments, allowing creators to earn more for the content they have created;
5. **Advertisers**: Increased transparency of which ads are being viewed via proof-of-engagement, leading to more effective, directed ads and better user experience

Why is Theta purpose-building its own blockchain?

The main reasons are to incorporate features specific to a streaming video use case such as handling off-chain micropayment transactions for video streaming, enabling content consumption proof of engagement, and to cultivate the largest decentralized video streaming ecosystem through enabling the development of Dapps on top of the Theta protocol.

Theta will enable ultra high transaction throughput on the blockchain for payments and relaying of video segments. Furthermore, micropayments which are recorded on the blockchain are associated with resourceIDs, which denote video segments delivered to end viewers. This can be used for the purposes of proof of engagement and also content rights management.

Developing a purpose-built blockchain is the only way to guarantee an appropriate protocol for all media and video streaming use cases.

See the "Theta Blockchain" section below for further details.

What type of consensus will Theta blockchain use?

Currently, Theta ERC20 tokens are based on proof-of-work (PoW) and with the native blockchain is being built with a proof of stake consensus mechanism based on the Tendermint protocol. This offers numerous advantages in our use case, including increased scalability, less wasted resources, and greater versatility to create economic incentives. More detail on the token economics of the Theta Network will be released ahead of our testnet launch in late Q2 2018.

Where is the Theta project's roadmap?

Our development roadmap for the rest of 2018 can be found on our Medium blog here.

Is Theta an open source project?

The Theta blockchain is currently being developed by our team in private GitHub repositories, but the code will be released to the public around the time our testnet is released.

Who is building Theta?

Theta Labs, Inc. is a wholly-owned subsidiary of SLIVER VR TECHNOLOGIES, Inc, both US Delaware C-Corp. Theta Labs is governed by the board of directors of SLIVER.tv and consists of founders Mitch Liu and Jieyi Long, and Dovey Wan, Managing Partner of Danhua Capital. SLIVER.tv, a leading esports entertainment platform has raised over $17MM in equity financing from Silicon Valley VCs, Hollywood media investors including Danhua Capital, DCM, Sierra, Advancit, Creative Artists Agency, BDMI, Greycroft and major corporations including Samsung and Sony.

What strategic partnerships has Theta formed?

Theta Labs has partnered with SamsungVR and Aelf. SamsungVR is spearheading the Theta Media Advisory Council, a select group of early partners to provide input and contribute strategic direction for the native Theta blockchain rollout. SamsungVR has the largest library of immersive 360 VR experiences, viewable across a number of devices and form factors. Aelf is a new decentralized cloud computing blockchain network with high-performance resource segregation and governance structure..

Additional partnerships in the media, streaming video, and blockchain verticals will be announced in the upcoming months.

Who sits on the Theta advisory board?

Justin Kan, Co-founder of Twitch

Steve Chen, Co-founder of YouTube

Fan Zhang, Founding member, Sequoia Capital China

Steve Dakh, CTO of SmartWallet and a founding member of the Ethereum project

Ma Haobo, CEO of aelf

Travis Skweres, Founder CoinMkt, one of the first US bitcoin exchanges

Rajeev Surati, MIT PhD, video compression and streaming expert

Professor Shoucheng Zhang, Founder of Danhua Capital

Sam Wick, Head of UTA Ventures, United Talent Agency Hollywood

Chandler Guo, Blockchain angel investor

Sebastian Serrano, Founder Ripio, first global lending network on blockchain

Cliff Morgan, CEO, GFUEL energy drink

Dennis Fong, CEO, Plays.tv aka "Thresh" the world champion of Quake and Doom

THETA TEAM

1. **Mitch Liu** - Mr. Liu is the co-founder and CEO of Theta Labs and SLIVER.tv, the leading esports entertainment platform with patented technology to live stream top esports events in fully immersive 360° VR in partnership with Intel Extreme Masters, Turner ELEAGUE, ESL One and Dreamhack among other global tournament operators. Along with his co-founder Mr. Long, they currently hold two patents and two additional pending patents for virtual reality 360° video streaming, and new algorithms for generating highly efficient live spherical video streams.

   In 2010, Mr. Liu co-founded Gameview Studios best known for its Tap Fish mobile game franchise with nearly 100 Million downloads. The company was acquired by DeNA, a leading Japanese mobile gaming company within 6 months of launch. Prior to that, he co-founded Tapjoy in 2007, a pioneer of rewarded social and mobile video advertising, and grew that company to $100MM in revenues. He received a BS in Computer Science & Engineering from MIT, completed his thesis research at MIT Media Lab "Interactive Cinema" video group and received a MBA from Stanford Graduate School of Business.

2. **Jieyi Long** - Mr. Long is the co-founder and Chief Technology Officer of Theta Labs and SLIVER.tv. He leads the technical team and developed multiple patented technologies including VR live streaming and instant replay for video games. He received a B.S. degree in Microelectronics from Peking University in Beijing, China. He also received a Ph.D. degree in Computer Engineering from Northwestern University in Evanston, IL where he conducted research in mathematical modeling

and algorithms to optimize large scale electronics systems, and a cryptography enthusiast.

3. **Ryan Nichols** - Mr. Nichols is the Head of Product and Platform for Theta Labs and SLIVER.tv. He leads the company's eSports entertainment platform built around one of the largest esports virtual economies with 1B+ virtual tokens circulated within two months of launch. Leading previous startups, he's designed and launched virtual currency systems for a variety of multiplayer games, including a cross-game virtual currency API used by hundreds of third-party game developers and tens of millions of players worldwide. Mr. Nichols was a director for Tencent on the globally popular WeChat app, and a co-founder of a live video streaming app for foodies.

4. **Rizwan Virk** - Mr. Virk is an advisor, investor and the Head of Corporate Development at Theta Labs and SLIVER.tv. Mr. Virk also serves as the current director of Play Labs @ MIT, and did his research at the MIT Media Lab. Mr. Virk is an early investor in cryptocurrency and blockchain companies, including BitPagos, CoinMkt, Bex.io, and has been active with BitAngels since 2013. Mr. Virk is the co-author of several cryptocurrency related papers including Online Automatic Auctions for Bitcoin Over-The-Counter Trading (2015) and Creating a Peer to Peer System for Buying and Selling Bitcoin Online (2013) and was the designer of Bitcoin Bazaar, one of the first peer-to-peer mobile applications for in-person trading of bitcoin. Mr. Virk received his BS in Computer Science & Engineering from MIT and his Master's in Management from Stanford Graduate School of Business.

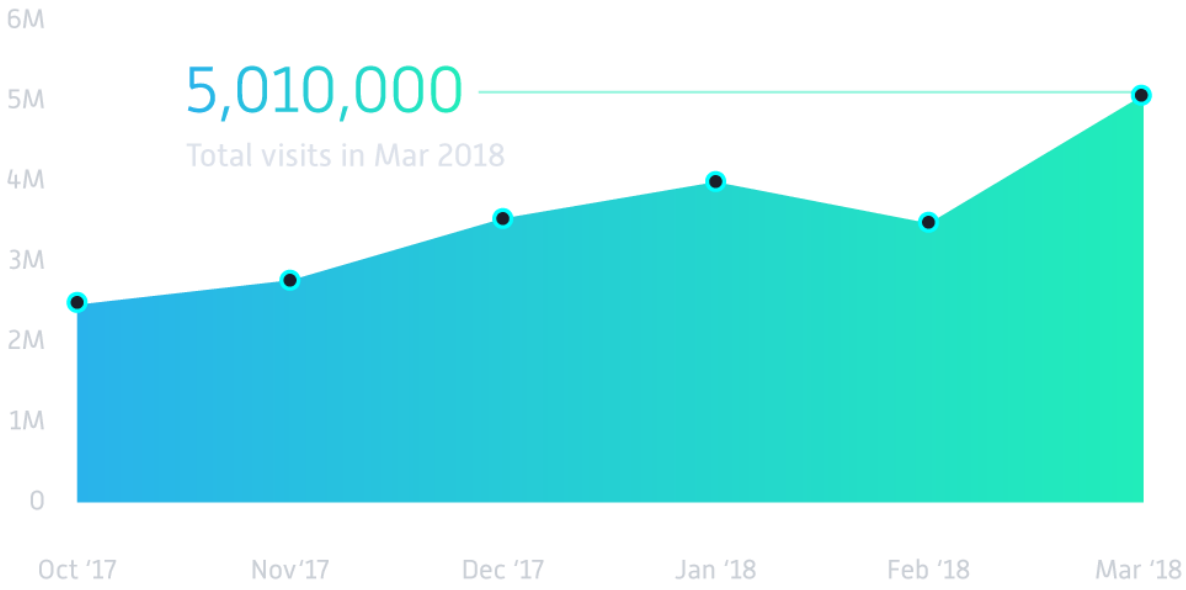
SLIVER.tv BACKGROUND

Who is SLIVER.tv?

SLIVER.tv is the parent company of Theta Labs, Inc. and the leading esports live-streaming platform built around a virtual economy with more than 5 million unique monthly visits. The company is based in Cupertino, CA and backed by top-tier Silicon Valley VCs including Danhua Capital, DCM, Sierra Ventures, Venture Reality Fund, leading Hollywood/media investors including Creative Artists Agency, BDMI, Greycroft GC Tracker, Advancit Capital and top Japanese mobile gaming firms including GREE and Colopl.

SLIVER.tv platform is growing quickly, with month-to-month growth rates driven by word-of-mouth, social and referral channels.

TRAFFIC OVERVIEW



How will Theta work with the SLIVER.tv network?

SLIVER.tv's live esports streaming content will be the first Dapp to be built on top of the Theta network by Q4 2018, leveraging SLIVER.tv's more than five million unique monthly visits and growing. In December 2017, SLIVER.tv launched the Theta ERC20-compliant token on the SLIVER.tv platform, as an application token for virtual gifting to support streamers and in Q1 2018, SLIVER.tv fully integrated Theta for purchasing premium services, goods and virtual items.

THETA BLOCKCHAIN

How will Theta address the scalability and throughput requirements for global video delivery?

Theta's technical solution is to build an off-chain micropayment pool to support ultra high transaction throughput required for a global video delivery and streaming network.

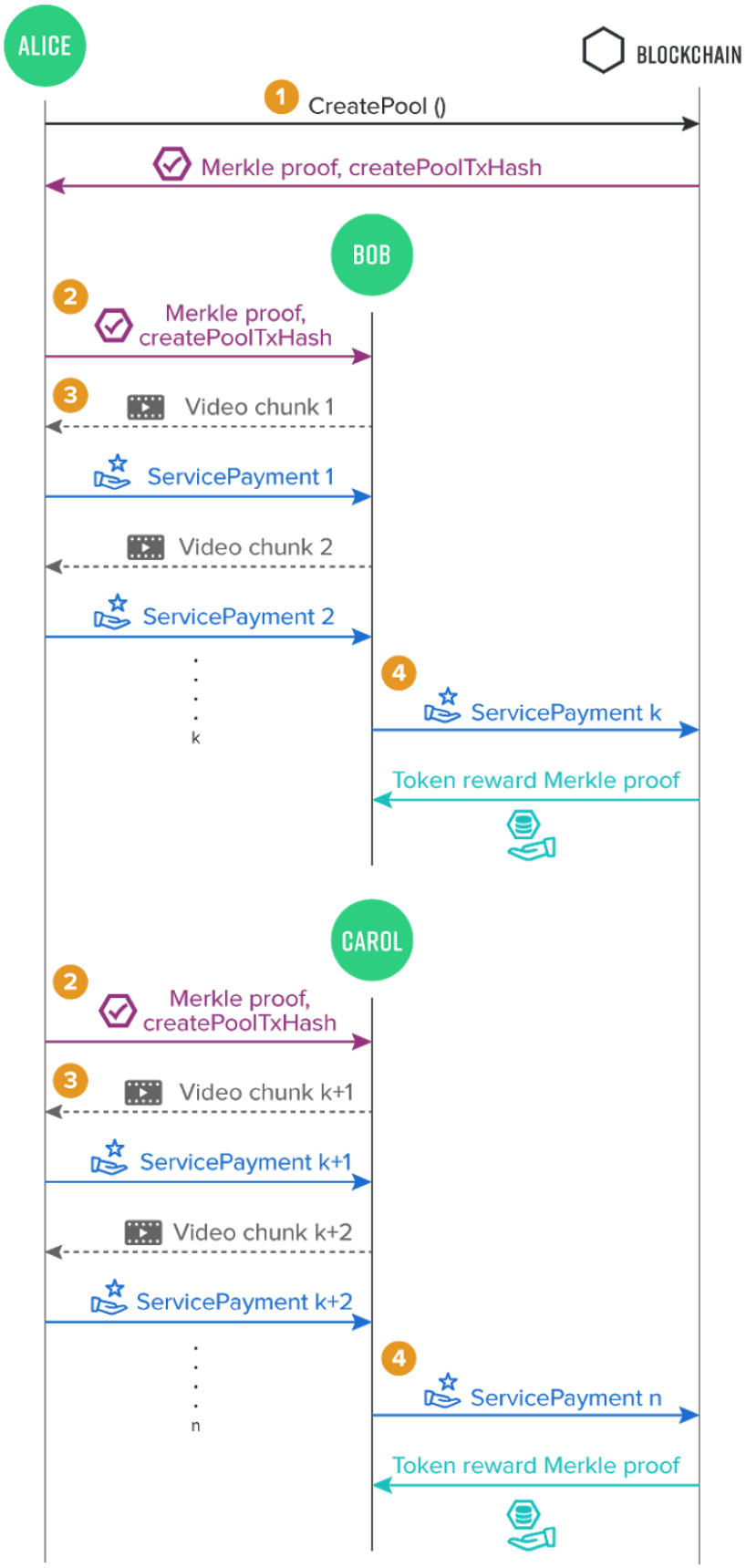
One of the biggest challenges we identified when designing the Theta protocol is how to scale our native chain for ultra high transaction throughput. Although many blockchain projects are facing scaling problems, scaling for live video streaming is different and possibly even more complex. Existing level two scaling solutions like payment channels have various disadvantages when applied to the video streaming. We have designed and implemented an off-chain **"Resource Oriented Micropayment Pool"** that is purpose-built for video streaming. It allows a user to create an off-chain micropayment pool that any other user can withdraw from using off-chain transactions, and is double-spend resistant. It is much more flexible compared to off-chain payment channels. In particular, for the video streaming use case, it allows a viewer to pay for video content pulled from multiple caching nodes without on-chain transactions. By

replacing on-chain transactions with off-chain payments, the built-in "Resource Oriented Micropayment Pool" significantly improves the scalability of the blockchain.

A micropayment pool is created where the deposit amount is at least the total value of the resource to be retrieved (entire video). For instance, if the resource is a video file which is worth 10 tokens, then the deposit has to be at least 10 tokens. A collateral amount (where collateral > deposit) is also set aside as a guarantee against malicious behavior. Upon creation of the micropayment pool, the blockchain returns the merkle proof and the transaction hash. These serve as verification to caching/relay nodes that the viewer node has sufficient funds (deposit and collateral) in exchange for video segments. Off-chain micropayments are made when the viewer node signs a ServicePayment transaction and sends them to the peers off-chain in exchange for the specified resource (e.g. segment of stream).

On-chain settlement is made by caching/relay nodes at the end of a session. Any caching/relay node that received the ServicePayment transactions from a viewing node can publish the signed transactions to the blockchain. We call the ServicePayment transactions that are published "on-chain settlement" transactions.

A diagram of the **"Resource Oriented Micropayment Pool"** is shown below:


ALICE
BLOCKCHAIN
1
CreatePool ()
Merkle proof, createPoolTxHash
BOB
2
Merkle proof, createPoolTxHash
3
Video chunk 1
ServicePayment 1
Video chunk 2
ServicePayment 2
k
4
ServicePayment k
Token reward Merkle proof
CAROL
2
Merkle proof, createPoolTxHash
3
Video chunk k+1
ServicePayment k+1
Video chunk k+2
ServicePayment k+2
n
4
ServicePayment n
Token reward Merkle proof

For more details:

https://medium.com/@ThetaLabs/building-the-theta-protocol-part-iii-7a0ba6d5a352

https://medium.com/@ThetaLabs/building-the-theta-protocol-part-iv-d7cce583aad1

How do you plan to implement Proof-of-Engagement?

The "Resource Oriented Micropayment Pool" described in the last question can actually be leveraged to track the delivery of the video segments to the end viewers, **since each payment for the video segment is associated with the ID of the video (i.e. the resource ID)**. This indicates that the micropayments recorded in the blockchain reflect the viewing activity of the end viewers. Thus the micropayment records can be used as the "Proof-of-Engagement (PoE)". With PoE, viewers can earn tokens as rewards from advertisers in exchange for their attention to video streams and by providing PoE. PoE not only brings benefits to viewers, but also to advertisers as it provides them with a reliable and verifiable engagement measurement of the delivered video streams. PoE can also be used as a basis to reward the content creators, which could be done automatically by the validators of the Theta blockchain since PoE can be inferred from the transaction records.

How does Theta's mesh streaming approach compare with existing solutions?

Hybrid mesh streaming utilizes both peer-to-peer and content delivery network (CDN) for video delivery, and thus combines the advantages of both worlds, namely high scalability of the peer-to-peer approach with the high availability of CDN delivery. Our in-progress development shows that the hybrid mesh streaming technology results in 40% to 80% CDN bandwidth usage reduction, which could translate to millions of dollars bandwidth cost savings for popular streaming sites.

To achieve the goal of significant bandwidth reduction while preserving quality of service, Theta has designed and is currently implementing a strategy which combines both a hyper-optimized tracker server and client-side player intelligence.

The first version of the client video player will be a web/HTML5 based player which employs the WebRTC protocol for stream delivery among peers. Deploying web-based players requires minimal effort. Streaming sites and platforms simply embed the player onto their webpages, and it instantly has access and "launches" millions of end user nodes in the mesh network. Thus the deployment of Theta's mesh streaming technology is very light-weight and frictionless.

To read more:

https://medium.com/@ThetaLabs/building-the-theta-protocol-part-ii-ea9d12e221bb