LIVEPEER FAQ

16 Vestry St, Floor 4, New York, NY, 10013

Contents

Livepeer – FAQ 4
General Questions: 4
What is Livepeer? 4
Who can use Livepeer? 4
What is the Livepeer network? 4
Why decentralize live video broadcasting? 4
Is it worth it to decentralize live video broadcasting? 4
How do you decentralize live video broadcasting? 4
What do you mean economic incentives? 4
What are some of the use cases of Livepeer? 5
I am new to Livepeer. Which is the best place to start? 5
What are major components of Livepeer Project? 5
Is Livepeer built on a blockchain? 6
Is Livepeer protocol based on PoW(Proof of Work) or PoS (Proof of Stake)? 6
Does Livepeer have a roadmap? 6
What is the difference between Livepeer and other decentralized streaming projects like Stream, PROPS, DLive, and others? 7
Where does Livepeer stand in comparison to centralized services? 7
Where can I learn more about the team members of Livepeer? 8
Where can I get more technical information about the Livepeer protocol? 8
Where can I find all the documentation related to Livepeer protocol? 9
Token Distribution: 9
Is Livepeer up and running? 9
How is the Livepeer token distributed? Was there an ICO? 9
Livepeer Token 10
What is Livepeer token? 10
How can I get LPT? 10
How can Livepeer Token be used? 10
What is the contract address for adding LPT to Metamask or MyCrypto or MyEtherWallet? 10
Why should I stake my tokens? 11
How can I participate in Livepeer Network? 11
What is the current inflation of LPT? 11
What is Participation rate? 11

Where can I find all the metrics related to Livepeer Network? 11
Delegating 12
What is Delegating? 12
What is Stake? 12
What is a delegator? 12
Why You Should Delegate 12
How to Delegate 12
Applying these Methods: Examples 14
Getting your tokens and rewards 15
How much token will I earn from bonding? 16
Why would I delegate my bond towards another transcoder? 16
Is it ok not to bond? 17
Can I bond more stake later? 17
Why do I have some fees in ETH and some in LPT? 17
Where can I stake towards a Transcoder? 17
Where can I view transcoder campaigns? 17
Contributing to the community 17
How can I help? 17
Transcoding 18
What is Transcoding? 18
How to become a Transcoder? 18
Broadcasting 18
What is Broadcasting? 18
What is Live Broadcasting or Live Streaming? 18
Why would Broadcasters use Livepeer? What are the advantages? 18
How do I broadcast on Livepeer? Could you please provide me step-by-step instructions? 19
Developing on Livepeer 19
Building Video Dapps 19
Building Livepeer Protocol Dapps 19
Building Tools for Livepeer 19
Open Projects 19
Contributing to Livepeer 19
Streamflow Protocol Proposal 20
What is Streamflow and what are the major changes to be introduced? 20

How does it benefit Broadcasters?....20
How does it affect Transcoders? Why should a transcoder care?....21
What is the difference between a Transcoder and an Orchestrator?....21
How does it affect Delegators?....21
Who are Orchestrators and what is their role?....21
How much minimum stake is required to be an Orchestrator?....22
Will delegators also be slashed if their Orchestrator is behaving incorrectly? How to avoid it?....22
What are the implications of the introduction of the new Orchestrator role for a) centralization, b) censorship-resistance?....22
Who chooses who in the network?....22
Why probabilistic micropayments? What's the motivation?....22
How long would it take for Streamflow to go live?....23
Is there any risk of Centralization after Streamflow implementation?....23
How can you enable public transcoder pools?....23
Where can I find more information about Streamflow?....24

Livepeer – FAQ

General Questions:

What is Livepeer?

Livepeer is an open source project that is focused on decentralizing live video broadcasting (streaming) over the internet.

Who can use Livepeer?

- Developers who want to build applications that include live video can use the Livepeer to power their video functionality.
- Users who want to stream video, gaming, coding, entertainment, educational courses, and other types of content can use applications built on Livepeer to do so.
- Broadcasters who have large audiences and high streaming bills or infrastructure costs can use the Livepeer network to potentially reduce costs or infrastructure overhead.

What is the Livepeer network?

All the users who run the Livepeer software are connecting to one another in a peer-to-peer network. This is similar to how Limewire or BitTorrent worked, except with a focus on live video instead of media files.

Why decentralize live video broadcasting?

Right now, live video broadcast on the internet is very expensive and makes use of the same few centralized providers. Users can either pay these steep prices or use platforms that control their audience, advertising, and monetization options. A decentralized platform could create more scalable, pay-as-you-go, censorship resistant, and flexible solutions for broadcasters and streamers.

Is it worth it to decentralize live video broadcasting?

Yes, because the current live video broadcasting is expensive, centralized and not scalable.

How do you decentralize live video broadcasting?

The two roles that centralized providers usually play when it comes to video broadcasting are transcoding and content delivery. In order to decentralize these, you need to define the right incentives to get anyone running the Livepeer software on their computer to be able to play these roles in a performant and secure way. Fortunately, cryptocurrency and blockchain technology enable projects to now embed these economic incentives directly into systems for the first time.

What do you mean economic incentives?

Money. People who run the Livepeer software can earn Livepeer Token, which may have a value if the market deems it so. Cryptocurrency exchanges exist that let people easily move between tokens like Livepeer token, and their local currencies.

What are some of the use cases of Livepeer?

The Livepeer project is concerned with decentralizing one-to-many live video broadcast (multicast). This is the truest form of media distribution, as it allows a broadcaster to connect directly with their audience in a first-hand manner, free from alterations, after-the-fact interpretation, and spin. It gives everyone a platform to have a voice. Existing centralized solutions can suffer from censorship, third party control over user data/relationship/monetization, and inefficient cost structures around payment for the service. Here are some of the logical use cases for applications and services to be built on top of Livepeer.

Pay-As-You-Go Content Consumption

With a transfer of value transaction baked into the protocol, it is now possible for broadcasters to charge viewers directly for the consumption of their live broadcast, without requiring a credit card, account, or control over user identity via a centralized platform. This has applications in education (pay to attend an online course), events (pay to view a concert or live sporting event), entertainment (pay to watch a gamer or performer's live stream), and many other use cases - all while preserving the privacy of the viewer, and allowing them to pay for only what they consume directly to the broadcaster.

Auto-scaling Social Video Services

One of the challenges of building consumer video services today is scaling infrastructure to support the demand for the growing number of streams and growing number of consumers as new users are added. A service layer that easily lets developers begin building their video solution on top of the Livepeer Network, which will automatically scale to support any number of streams and viewers as they go, will be a welcome solution to infrastructure developers who would otherwise have to continue provisioning servers, licensing media servers, and efficiently manage resources to handle spikes.

Uncensorable Live Journalism

Current platforms such as Twitter and Facebook provide amazing live video solutions for reaching a large audience, but they're also the first to get blocked or censored in a variety of political conflict situations. Use of a decentralized network such as Livepeer would render it nearly impossible to prevent the word from getting out as to what is really going on the ground in real time.

Video Enabled DApps

Decentralized apps (DApps) are beginning to emerge, driven largely by the Ethereum ecosystem. However, to date there hasn't been a viable solution for embedding live video within a DApp without using a centralized solution or limiting the number of consuming clients based on the constraints of WebRTC. By introducing Livepeer to the stack, an application can be fully decentralized, yet still contain live video, at scale, to as many users as wish to consume it.

I am new to Livepeer. Which is the best place to start?

May be this blog post would serve as a great starting point: Livepeer for Beginners

What are major components of Livepeer Project?

Please find below the four major components of the Livepeer project and a brief description regarding each component. To learn more please click the Project Overview or Livepeer whitepaper:

- The Livepeer Media Server - The Livepeer Media Server is an open source media server that is capable of taking input streams of live video and audio and transcoding them into alternate encodings, transrating it into different bitrates, and transmuxing it into different delivery formats. This is necessary so that a video, recorded in one format and bitrate, can now reach every screen on every device on every platform, each of which may have their own requirements about format and bandwidth restrictions.
- The Livepeer Network - The Livepeer Network comprises a set of nodes that run the Livepeer Media Server and speak the Livepeer Protocol. The network operates primarily on two types of requests: publishing a stream, and requesting a stream. A publish request is a request to transcode a live video with certain parameters, and to serve the resulting video. A request is an attempt to access an existing live stream that is on the network.
- The Livepeer Token - The Livepeer Token will be a protocol token for staking, used by those who want to perform work on the network, that serves purposes such as a bonding mechanism in a delegated proof of stake system, as a potential slashing mechanism that occurs due to protocol violation, as a coordination mechanism routing work through the network in proportion to the amount of staked and delegated token and as a unit of account specific to the Livepeer ecosystem that can be applicable to additional functionality to be introduced in the future (such as ad insertion/monetization, analytics, closed captioning etc.)
- The Livepeer Protocol - The Livepeer Protocol specification will lay out the various roles in the Livepeer Network, the various transactions types supported, the cryptoeconomic security measures in place to prevent collusion, and the token distribution mechanics.

Is Livepeer built on a blockchain?

Yes, the Livepeer protocol that defines the security and incentives to get users to run the Livepeer software is built atop the Ethereum blockchain.

Is Livepeer protocol based on PoW(Proof of Work) or PoS (Proof of Stake)?

Livepeer protocol is based on Delegated Proof of Stake. Which means community members can stake their tokens by delegating them to nodes that perform actual work on Livepeer Network such as Transcoders (This role will be broken down in to Transcoders and Orchestrators after “Streamflow” implementation and community members will be able to delegate their tokens to Orchestrators only)

Does Livepeer have a roadmap?

Yes, the Livepeer project is very early, and as such, the full scope of what needs to be accomplished keeps evolving based on how the project unfolds. Below is a brief summary of roadmap that could help you understand where we are going:

Milestone	Description
Proof of concept	Create a P2P network in which video can be broadcast, consumed, and propagated along at scale. Launch a toynet.

Snowmelt (Alpha)	Protocol is designed, and incentives are implemented within the network. LPMS supports adaptive bitrate streaming with RTMP in and HLS out. Launch a testnet.
Tributary (Beta)	LPMS supports majority of functionality to support common live streaming use cases and prepare streams to reach every device. Initial token is distributed. Bounties on testnet are complete and protocol is vetted. Governance structures are in place. Go to main net.
Streamflow	Performance release focusing on peer-to-peer video distribution, WebRTC support to bridge Livepeer into the browser, seeding incentives, and more codecs.
Confluence	Production ready user facing release. Clients for major platforms, privacy and rights managements solutions. Move beyond just developers to traditional broadcasters.
Delta	Full decentralization. Move beyond somewhat trusted verification solutions to Truebit.
Ocean	Extensibility release. Livepeer as a platform. Architecture for protocol extensions in both the LPMS to add additional features and custom filters to video processing, as well as extensions at the ecosystem level, where other Ethereum based services can tap into the Livepeer network at the smart contract interaction level.

You can read more about the above philosophical phases of the Livepeer roadmap here.

For a more detailed technical breakup of roadmap click on this link

What is the difference between Livepeer and other decentralized streaming projects like Stream, PROPS, DLive, and others?

This question comes up quite a bit, and it's a good one. All the decentralized streaming projects are focused on different layers in the video ecosystem (with some overlap). Some focus on the user experience of content discovery, others focus on the economic layer for the broadcasters and curators, and Livepeer focuses on the infrastructure that allows these apps and more to exist sustainably in a decentralized way.

You can think of many of these projects as building a decentralized Youtube or Twitch, allowing people to broadcast, users to discover content, and value to flow towards the broadcasters who create the content. This is great.

You can think of Livepeer more like an Amazon Web Services for video - the infrastructure that a site like Twitch, and thousands of other apps, might run on top of. Value in the Livepeer protocol flows towards those who contribute computing resources like bandwidth and GPU/CPU to the network so that it is cheap, scalable, fast, available, and decentralized.

Where does Livepeer stand in comparison to centralized services?

	Proprietary Video Services Provider	Social Broadcasting Service	Livepeer's Decentralized Network
Cost	Expensive (cost of service + margin)	Free	Market price
Monetization	Monetize how you want	They monetize your users and potentially give you a cut	Monetize how you want. Native digital token built in.
User experience	Build whatever experience you'd like	They control the experience	Build whatever experience you'd like
Content restrictions	Potential content restrictions	Many types of content prohibited or demonetized	No content restrictions
Scale	Pre-pay to provision infrastructure	Scaling handled for you	Scaling handled for you
Open Source	No	No	Yes
Risk	Service shuts down or censors your content	Service demonetizes you, censors your content, or limits traffic it was previously directing towards you	Building on emerging technologies

If you read down the Livepeer column in the above comparison, you'll see that Livepeer is really about freedom and empowerment. The Livepeer project gives users the tools to build what they want, broadcast the content they want, monetize how they want, and pay-as-they-go at a competitive market price that scales automatically as their audience grows.

Where can I learn more about the team members of Livepeer?

Here are short biographies of some of our Livepeer team members on our blog:

- Doug Petkanics
- Raffi Sapire
- Chris Hobcroft
- Josh Allman
- Josiah Savary
- Yondon Fu

You can also check out all of our team members on our website by going to the Team section

Where can I get more technical information about the Livepeer protocol?

Please click on the following link: The Livepeer Whitepaper.

Where can I find all the documentation related to Livepeer protocol?

Please click on the following link: Livepeer Documentation

Token Distribution:

Is Livepeer up and running?

Yes after 18 months of research, design, development and testing Livepeer launched to Ethereum main net on April 30th 2018.

How is the Livepeer token distributed? Was there an ICO?

Livepeer never held an ICO. Livepeer distributed 63.437% of its initial token supply 10,000,000 LPT to community using a distribution mechanism called "Merklemine" allowing anyone around the world to participate and mine LPT (Livepeer Token). Merklemine ended on October 2nd 2018. You can learn more details regarding Merklemine distribution by clicking on the following link: The End of the Initial Livepeer Token Distribution

Below is the summary of distribution of entire Livepeer Token:

Token Recipient	Percentage	Vesting Period	Reason for distribution
Founders and early team	12.35%	Over 36 months from network launch (April 30, 2018)	Incentives for employees
Pre-sale purchasers	19%	Over 18 months from network launch (April 30, 2018)	Purchasers facilitated 3 years of runway for Livepeer's lean, engineering focused core team.
Community/Public	63.437%	Mined by public over 7 months using Merklemine algorithm	To enable wide distribution of LPT and to encourage community participation
Grant – Early advisors	0.213%	Immediately issued to a couple early advisors and contributors	Early advisors helped Livepeer get off the ground
Long term project endowment	5%	Immediately issued	To ensure the longevity of the Livepeer project

Livepeer Token

What is Livepeer token?

Broadcasters pay fees in Ethereum's ETH in order to broadcast video on the network. It is the medium of exchange token for using the network.

Livepeer token on the other hand, is the token that is staked by users looking to perform work in the network, and the amount staked routes work towards these users. Participants stake Livepeer token in order to have the right to do the transcoding jobs present on the network - or in order to delegate these jobs towards someone else. In return, those who do the work earn the ETH fees that broadcasters pay to use the network.

How can I get LPT?

You can get LPT in multiple ways:

- By buying them on exchanges such as Poloniex, Radar Relay or DDEX.
- By staking your LPT through delegating to a transcoder. When you stake your LPT you will earn inflationary rewards in the form of LPT for participating and securing the network.
- By performing actual work on Livepeer Network such as transcoding. You can run a transcoder node by staking your own LPT or attracting LPT from other delegators. The more LPT you stake, the more chances of attracting transcoding jobs. When you perform transcoding job you can gain LPT as reward cut (from inflationary LPT) and ETH as fees.
- By contributing to Livepeer protocol development such as performing some technical work through bug bounties, application development grants etc.
- By contributing to Livepeer Network development such as hosting meetups etc.

Join our community call (that happens every other Thursday at 12pm EST) to learn more and we will get you started.

How can Livepeer Token be used?

The main use of LPT is to stake it. Staking means depositing some token into a smart contract (also called “bonding”), which is locked up for a period of time before it can be withdrawn. This serves as a security deposit which can be penalized or taken away if the user does not act honestly. The work that users who stake have the right to do comes in two forms: 1) running transcoding nodes 2) delegate. Read more on How to Use LPT

What is the contract address for adding LPT to Metamask or MyCrypto or MyEtherWallet?

Following are the details you need to add LPT to any of the above wallets:

- Contract address: 0x58b6a8a3302369daec383334672404ee733ab239
- Decimals: 18
- Symbol: LPT

Why should I stake my tokens?

Users who do work on the network will earn fees that are charged to broadcaster in ETH. They will also generate more LPT which will route a higher proportion of work towards them in the future, should they choose to stake it. For more details on the relationship between fees, generated token, delegates, and transcoders, see the details in the Livepeer Whitepaper.

How can I participate in Livepeer Network?

You can participate in multiple ways. Following are based on the roles you play in the network:

- Broadcaster: You participate or use Livepeer Network to broadcast or stream videos that you would like to be distributed around the globe.
- Transcoder: You can participate by running a transcoding node in Livepeer Network and performing transcoding work assigned by the broadcaster. You have to stake your own LPT or LPT delegated by other community members in order to be eligible for receiving transcoding jobs (currently only top 15 transcoders with highest LPT staked are being considered (but this will change to include any transcoder with a minimum stake required with the implementation of Streamflow in the coming months).
- Delegator: You can participate by staking your LPT indirectly through a transcoder. This is called delegating your LPT. You can earn inflationary LPT by delegating and securing the network. The amount of LPT you earn will be based on the LPT you staked. The higher you stake, the more you will earn.
- Community Contributor: You can participate by contributing your technical or community skills for the development of Livepeer Network. Livepeer team has different ways of compensating people, through grants, bug bounties etc., who contribute to the network.

What is the current inflation of LPT?

Current inflation rate per round is 0.0857% (as on 20th Dec 2018). Inflation rate per round increases by 0.0003% until the participation rate reaches 50%. Once the participation rate reaches 50%, inflation rate will decrease by 0.0003% until the inflation rate per round reaches 0%.

Note: one round in Livepeer network is approximately equal to 1 day.

What is Participation rate?

Participation rate is the percentage of LPT tokens staked in the network. Current participation rate (as on 20th Dec 2018) is 22.32%.

Where can I find all the metrics related to Livepeer Network?

You can see all the important metrics related to Livepeer Network by vising this website created by one of the community members of Livepeer: Livepeer Network Metrics

Delegating

What is Delegating?

Think of delegating as committing to the network long term. Delegating and Bonding can be used interchangeably. When you bond, your tokens are locked in for at least as long as the UnbondingPeriod, which is one week. It's like putting down a security deposit.

Your responsibility as a token holder is to either do the work (transcoder), or stake towards someone to do the work for you (delegator).

In exchange, you earn newly minted token and fees from the network, growing your total ownership in the network. People who do not bond will have easy access to their tokens and liquidity, but their ownership in the network will decrease as new tokens are released that they won't receive. While people who bond will give up immediate liquidity in exchange for growing their ownership in the network, and helping to make the network high quality and secure.

What is Stake?

Bonded tokens are "at stake" or at risk. Often times bonded tokens are called stake. If you cheat as a transcoder, or you elect transcoders who try to cheat, then you can lose some or all of your stake. Cheating in this case consists of not behaving according to the rules of the protocol, and maliciously trying to steal token out of the system in ways that can be cryptographically proven. If you delegate your stake towards a transcoder who acts in the best interest of the network and plays by the rules, you should not lose any stake.

What is a delegator?

The term "Delegator" refers to token holders who participate in the network by staking their LPT towards a transcoder candidate. Your job as a delegator is to ensure quality, cost efficiency of network. You do this by staking LPT each round, you can earn further fees and LPT rewards as the network becomes more valuable. Everyone who holds LPT wants the network to be as useful as possible. and are incentivized to delegate towards registered transcoders by potential rewards

Why You Should Delegate

There are several reasons why it is beneficial for you to choose to delegate:

- Participation in delegating towards effective transcoders who will provide great service to the network, ensuring its value to broadcasters
- Earn token rewards in proportion to stake.
- Earn fees generated from transcoders.
- They may wish to be a Transcoder.

How to Delegate

These two videos below provide you an overview of how to use Livepeer explorer to delegate and how to assess transcoders. If you want to learn more, please read through the rest of the sections below:

- To learn how to use Livepeer explorer and how to bond/delegate LPT to a transcoder: Exploring the explorer
- To learn how to assess transcoders: How to assess Transcoders

Where to start

The easiest way to stake token is to visit Livepeer Explorer. This will display a list of active and candidate transcoders on the network, along with the prices they are charging, and some useful stats.

Assessing Transcoders

It is your job as a token holder to research transcoders based upon their past performance, statistics, rates they are charging, and any social campaigns that they've posted indicating why they believe they will do a good job for the network. Click on any transcoder to view their on-chain statistics. Visit this forum thread to view campaigns that certain transcoders may have posted.

There are three spectrums you should assess transcoders on: Performance, Fees, and Social Campaigns.

Social Campaigns

View each Transcoder's profile on the Transcoder Campaign forum. Here, you can learn about who the Transcoder is and why they think you should stake towards them.

Performance and Fee Statistics

Click on any transcoder to view their on-chain statistics.

- Price: This is the amount the Transcoder will charge broadcasters per segment. Wei is the base unit of Ethereum, which is 10^18 Wei = 1 ETH. The price illustrated is based on a segment of video, which is 4 seconds
- Reward Cut: Reward Cut is the percent of the newly minted token that the Transcoder keeps from the round's inflation distribution. The remainder gets distributed across all bonded nodes in proportion to how much you bond relative to others. For example, if this is 20%, that means that if a Transcoder were to receive 100 LPT in block reward and their "reward Cut" were 20%, they would keep 20 LPT and distribute remaining 80%, or 80 LPT
- Fee share: Fee share is how much the delegator receives of the Price/segment. For example, if Fee Share is 25%, If a transcoder were to charge 100WEI in fees per segment, they would pay 25WEI to the bonded nodes
- Total Stake: Total amount of LPT staked towards this node, including the transcoders own stake

Rewards vs Fees

Rewards are credited towards your bonded stake. If you have 100 bonded stake, when you credit yourself with rewards, that is automatically in bonded stake. So, if you get 10 reward token its 110. If you get fees, since fees in denominated in ETH, it is a separate "Collected Fees". Those are not restricted from unbonding / bonding period. You are allowed to cash out. Idea behind this is because right now this is a long unbonding period to ensure capital is locked up so that people can be incentivized and punished properly, to make people more entrenched. If you are a transcoder, you need to pay service bills. On the flip side if you have number of jobs and fees, you can sell this ETH to pay for service cost.

How to Bond

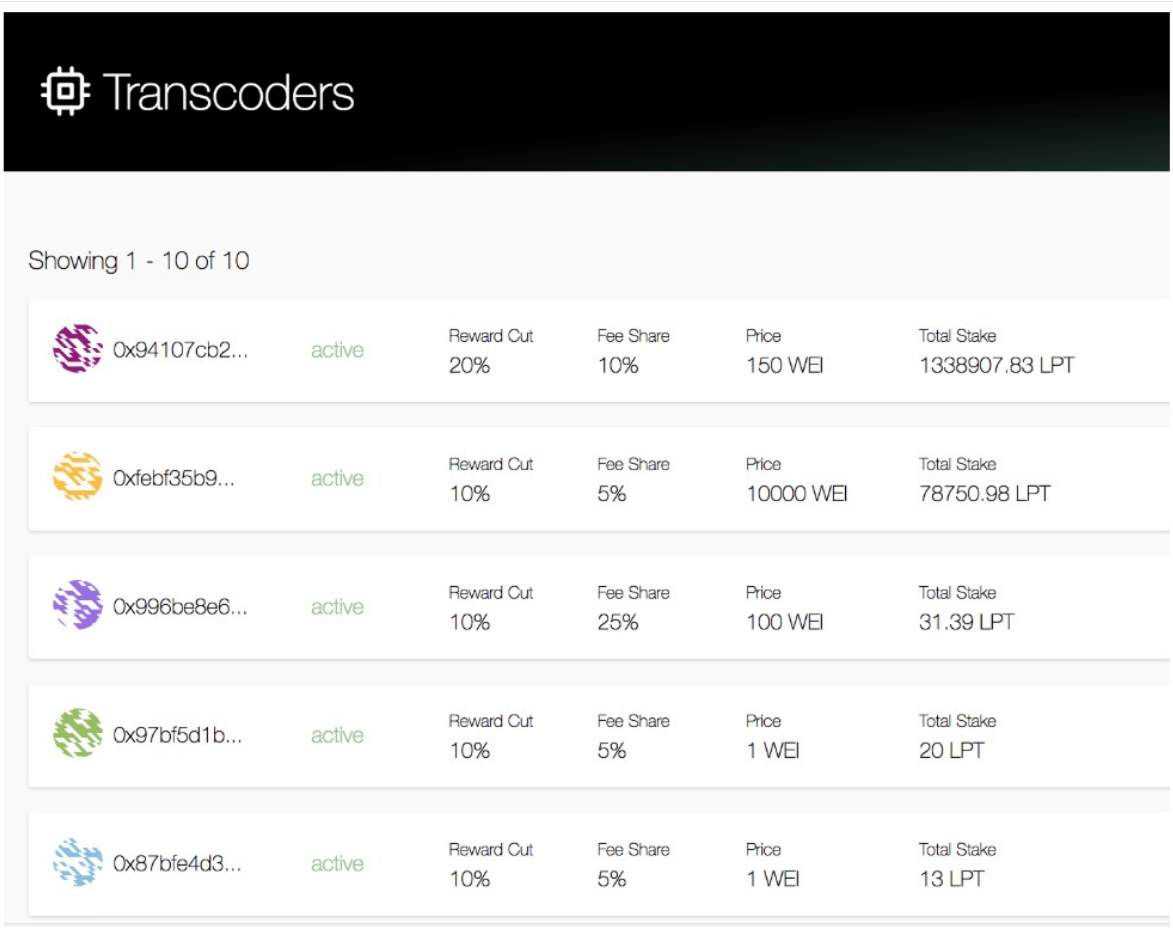
When you have selected the transcoder, you would like to delegate your stake towards, return to the explorer and click the "bond" button using your Ethereum enabled browser (Metamask, Parity, Mist, Toshi, Cipher, etc.). It will ask you how many tokens you would like to bond, and have you confirmed an Ethereum transaction.

- Each row is a different transcoder
- The transcoder page shows a select number of stats. Clicking on a transcoder dives deeper into their profile, where you can explore stats across four tabs

Remember that you can always change who you are bonded to or unbound if you don't believe the transcoder is doing a good job, but when you bond, you have to wait for the multi-week unbonding period before you can withdraw your token.

Applying these Methods: Examples

Let's use this example set of transcoders:



Let's say after this round, the reward is 100,000 LPT, so that is how many new tokens are minted.

Scenario One: Delegate towards the top transcoder

Price Per Segment - This transcoder is charging 150 WEI per 4 second segment of video

Fee Share - This transcoder is sharing 10% of their fees from transcoding with their delegators. So, of 150WEI, this Transcoder is sharing 10%, or 15 WEI across all delegators

Reward Share

- First, you want to calculate how much of that reward a specific Transcoder will get. The tokens get distributed by how much each transcoder has staked relative to transcoders. So, you can add up all stake in the network using the "Total Stake" numbers, and see that as a percentage, T1 (Transcoder at the top of the list) has contributed 94.4% of the total stake. So, the protocol will distribute 94.4% of the 100,000 reward, or 94,400 LPT to that transcoder.
- Now how much of that is the transcoder taking? If the reward cut is 20%, which means they are keeping 20% (18,880 LPT) of the 94,400 and sharing the remaining 80% with everyone staked towards them.
- How much will you get? You receive a portion of that LPT in proportion to how much you have staked relative to every other delegator staked toward that transcoder.
- Calculating your share. So, let's say you staked 1,000 LPT of the 1,338,907 that is staked towards T1 (as it says in Total Stake). You get (1000/1,338,907) * 75,553, or 56 LPT additional that day.

Scenario 2: You delegate towards the second Transcoder on the list instead

Price Per Segment - This transcoder is charging 10,000 WEI per 4 second segment of video

Fee Share - This transcoder is sharing 5% of their fees from transcoding with their delegators. Fee share is **how much the transcoder shares ** with Delegators of the Price/segment. So, a broadcaster is paying 10,000 WEI per segment for a service, and 95% goes to that transcoder, while 5%, or 500 WEI, gets shared back across all delegators staked towards them.

Reward Cut - Reward cut is the amount of LPT the Transcoder will keep from the round's inflation distribution. The transcoder will distribute the remainder in proportion to stake. So, in the case of staking towards Transcoder 2, if 100,000 tokens are minted and distributed, this transcoder gets 5.6%, since its total stake, 78750.98, is 5.6% of the total amount staked in the entire network (calculated by adding up all stakes). So, of the 5,554, this Transcoder's Reward cut is 10%. This means they are keeping 555 LPT and distributing the remaining 5,554 in proportion to the amount staked. So, if you have staked 1000 of the 78750.98, that is 1.3%, or 7 LPT.

Getting your tokens and rewards

Unbonding

Delegators who want to unbound can do so after the unbonding period which is initialized from the moment of calling bonding manager.unbond() from the transcoder

If you have bonded your token, and you would like to withdraw, then you can do so. From the time you Unbond(), you have to wait the UnbondingPeriod length of time before you can access your token, which may be set at weeks or months.

Claiming Fees

The transcoder pool is reset each round (approx every 24h) based on who's got the most stake, and that's when new token is generated for claiming. But you need to claim the token yourself. Because of Ethereum gas limits, you can claim token for up to 20 rounds at a time. Claim() is necessary once in

awhile, but only 1x/every 20 rounds (or just batch multiple txns later to claim for 40 rounds, 60 rounds, etc.). So, it's not something you have to show up to do every day or anything if you're just delegating. Our explorer UI attempts to mask this issue by submitting multiple transactions if you're more than 20 rounds behind, but it still requires a manual confirmation for each tx with Metamask. The CLI does this automatically.

Claim here: Livepeer Explorer

Note: please note that you need to be logged in to your wallet for the above link to work and for you to claim your fees

The challenge that is addressed through claiming fees is from a computation power perspective. Its hard to distribute all the proceeds accordingly after each time transcoder accumulates fees or rewards. For example, during a round, a transcoder accumulates 1,000 tokens fees and rewards, from a smart contract Point of View, if you have 10,000 delegators, it can't properly distribute all proportional rewards shares because there are so many delegators, as a smart contract only has a limited amount of computational capacity, so it's just not feasible. This claim fees workaround tries to get around that, but we know, it creates quirky UX features. Each time the transcoder accumulates rewards, instead of them actively distributing for a given round to all delegators, the transcoder will pool rewards into a pool. Now there is a pool of reward tokens from all rounds that have occurred. Any time a delegator is able to claim his or her reward share for a specific round that has occurred from that pool, so now instead of transcoder distributing shares, each delegator is responsible for claiming their own reward share after it has been distributed. That is a workaround to put the computation for your own reward and fees on yourself. Now each person triggers a function in the smart contract that triggers a reward share for a given round. We don't run into computational capacity issue where you have to distribute 1,000 reward shares to 10,000 different people in one single transaction. Instead you have each delegator after the rewards have been distributed run their individual transaction to calculate their own reward share in that given round.

Current set up is that whenever you bond to someone else, say you have been bonded to T2 for a couple of rounds and now you want to bond to someone else. You must claim your rewards and fees before bonding to another Transcoder. If you have not, when you try to bond to transcoder 3, when you submit the transaction, it will claim all rewards and fees since last time you claimed since delegating to transcoder. Only once you have claimed all rewards and fees associated with the current transcoder can you delegate towards another Transcoder. This is because we want to make sure the values are in sync, such that when you move tokens to a separate transcoder you want to credit yourself with all reward and fee shares that you have been owed for however much time you have been delegated toward transcoder. Now you are up to date information wise and it can be used to delegate towards someone else.

How much token will I earn from bonding?

That depends on how much total bonded stake there is, and what the inflation rate is set at. If the network is going to issue 10% more token this year, and 50% of all the token on the network is bonded, and you bond all year, then you will earn 20% more token. At the beginning of the year 50% of the network was bonded and 50% of the network was not bonded. The additional 10% of tokens all went to the portion that was bonded. So, at the end of the year the bonded holders now hold 54.5% of the network token. Their network ownership increased in exchange for making the network useful, secure, and high quality.

Why would I delegate my bond towards another transcoder?

You likely don't want to be a transcoder on the Livepeer network yourself unless you're running reliable always-on hardware, have a lot of bandwidth, and can do the DevOps work to keep the Livepeer processes running around the clock. Instead you should delegate towards other users who have proven that they can do this and create a high-quality network. In exchange for doing so, you'll receive newly minted tokens from the network's inflation, and you'll receive a share of the fees the transcoder earns.

Is it ok not to bond?

Yes. It is okay not to bond. However, if you're holding token for a long time without bonding it, then your relative power to do work on the network will decrease if you do not bond. The protocol assigns new token to those who bond, increasing their ability to do work in the future.

Can I bond more stake later?

Yes, you can always add more bond. In addition, the newly minted tokens from inflation will be added to your bonded balance so it will grow over time. The fees that transcoders who you delegate towards pay out to you will be added to your unbonded token balance in the current design?

Why do I have some fees in ETH and some in LPT?

Rewards are credited towards your bonded stake. If you have 100 bonded stake, when you credit yourself with rewards, that is automatically in bonded stake. So, if you get 10 reward token it's 110. If you get fees, since fees are denominated in ETH, it is a separate "Collected Fees". Those are not restricted from unbonding / bonding period. You are allowed to cash out. Idea behind this is because right now this is a long unbonding period to ensure capital is locked up so that people can be incentivized and punished properly, to make people more entrenched. If you are a transcoder, you need to pay service bills. On the flip side if you have number of jobs and fees, you can sell this ETH to pay for service cost.

Where can I stake towards a Transcoder?

Visit Livepeer Explorer.

Where can I view transcoder campaigns?

Visit Transcoder Campaigns.

Contributing to the community

How can I help?

We need lots of help!

- The best place to start is to introduce yourself in our community chat and state how you're interested in contributing. At the moment many of the most helpful ways to contribute are through development, but we also need community help with product definition, design, translation, and more.
- Here is a list of research tasks
- Contribute to livepeerjs

Transcoding

What is Transcoding?

Transcoding is the process of taking an input video in one format and bitrate, and converting it into many formats and bitrates to make it playable on the majority of devices on the planet at any connection speed.

In the Livepeer network, nodes who play the role of transcoder, perform this very important function, and as a result it's important that they have high bandwidth connections, sufficient hardware, and reliable devOps practices. These nodes are delegated towards and elected to perform this role, and they are rewarded with the ability to earn fees from the network.

How to become a Transcoder?

A transcoder needs to have reliable hardware and software to run a Transcoder node. A Transcoder also needs to have sufficient amount of DevOps experience to keep their Transcoding node performing at highest efficiency all the time. Learn more about becoming a transcoder by following this link: Transcoding

Broadcasting

What is Broadcasting?

Broadcasting is the distribution of audio or video content to a dispersed audience via any electronic mass communications medium, but typically one using the electromagnetic spectrum (radio waves), in a one-to-many model.

What is Live Broadcasting or Live Streaming?

A live broadcast or stream, also called a live transmission generally refers to various types of media that are broadcast without a significant delay. Other types of live broadcasts include: Live radio. Live television. Internet television.

Why would Broadcasters use Livepeer? What are the advantages?

Currently most of the broadcasters and streamers use centralized services and live video broadcast on the internet is very expensive. Users can either pay these steep prices or use platforms that control their audience, advertising, and monetization options.

A decentralized platform like Livepeer could create more scalable, pay-as-you-go, censorship resistant, and flexible solutions for broadcasters and streamers.

How do I broadcast on Livepeer? Could you please provide me step-by-step instructions?

Please click on the following link to learn more about broadcasting on Livepeer network.

Developing on Livepeer

Building Video Dapps

- Video-based Dapps (for example, Livepeer TV)
- Infrastructure tools and services for broadcasters or live streamers (for example, SAAS services on top of Livepeer)
- Livepeer Player - A react component for playing live video

Building Livepeer Protocol Dapps

- Dapps for the Livepeer ecosystem. (for example, Livepeer Protocol Explorer or Supermax)

Building Tools for Livepeer

- SDKs for Livepeer (for example, livepeerjs-sdk or livepeerjs-graphql)
- Client implementation for Livepeer (for example, go-livepeer)

Open Projects

Livepeer also posts open problems for discussion, ideas, and collaboration on Github. Check out:

- Open Project Proposals
- Open Research Areas

Contributing to Livepeer

For developers who are looking for interesting to problems to work on related to decentralized tech, blockchain, cryptocurrency, video engineering, and peer-to-peer networking, Livepeer may provide some interesting challenges. The three technical areas that Livepeer focuses on today are:

- Protocol implementation (Smart Contract)
- Livepeer Node (Distributed Systems / Networking)
- Livepeer Media Server (Video Engineering)

For the protocol, you can follow the protocol repo. It requires some background in Solidity and the Livepeer Whitepaper.

For the livepeer node, check out the go-livepeer repo. It requires some understanding of Golang and Geth. Setting up a development environment can be done by following these instructions

For the livepeer media server implementation, take a look at the LPMS repo. It requires some video engineering knowledge. The demuxed conf videos and the Apple Live streaming doc are good resources to start learning.

If you're interested in the any of the above challenges, or are building video features into an application, jump into our development chat room on Discord and join the conversation.

Streamflow Protocol Proposal

What is Streamflow and what are the major changes to be introduced?

Streamflow is a proposal that introduces a number of changes and new concepts into the Livepeer ecosystem. Each delivers impact across one or many of the areas of affordability, performance, reliability, or scalability. They include:

- Introduction of a new role of Orchestrator, to the existing roles of Broadcasters and Transcoders.
- Relaxation on the limitation on number of transcoders, allowing open access to compete for work amongst any aspiring token holding Orchestrator meeting the minimum stake and security requirements.
- Service registry in which Orchestrators advertise their available capabilities and services on chain.
- Offchain price negotiation and job assignment between Broadcasters and Orchestrators.
- Offchain payments using Probabilistic Micropayments, with on chain settlement and security deposits.
- Updated verification flow, in which on chain verification only needs to occur in the case of an observed fault.

How does it benefit Broadcasters?

Broadcasters will be benefited as price negotiation and job assignment between Broadcasters and Orchestrators can be done offchain which reduces cost. Broadcasters will be able to work with multiple nodes for redundancy or switch quickly in the case that the transcoder they are working with becomes unavailable.

Offchain payments using Probabilistic Micropayments reduces cost, improves speed and reliability while enabling onchain settlement and security deposits.

As the limit on number of Transcoders will be removed through Streamflow, Broadcasters will have a large pool of Orchestrators and Transcoders to choose from based on the price, availability, security deposit, past performance etc.

How does it affect Transcoders? Why should a transcoder care?

Three reasons Transcoders should care about Streamflow are:

- Their role will be split into Orchestrators and Transcoders
- No limit on number of Transcoders
- Amount of stake required to be a transcoder will change

You can read a brief summary of how Streamflow could affect Transcoders in this blog post

What is the difference between a Transcoder and an Orchestrator?

Currently a Transcoder on the Livepeer network is a protocol-aware node that both watches and interacts with the blockchain protocol and performs video transcoding work. In short, it both orchestrates work on the network, and transcodes video. This can create performance and reliability issues, and make it difficult for nodes to scale their operations.

Streamflow proposes a two-tiered architecture, which contains a split between:

- An Orchestrator which is protocol aware, negotiates work with Broadcasters, is responsible for delivering verified transcoded segments to the Broadcasters, and coordinates the execution of this work amongst a potentially large pool of transcoders.
- A Transcoder which is not necessarily aware of the Livepeer staking protocol or blockchain, and instead is just competitive, cost-effective hardware, which does the sole job of racing to transcode video as cheaply and quickly as possible, as coordinated by Orchestrators.

How does it affect Delegators?

Delegators will have to be much more active than what they currently are. They will have many more Orchestrators to choose from to bond their LPT. As inflation rate is likely to decrease in the future with increase in Participation rate, Delegators have to actively check which Orchestrators are winning the most work, who are sharing large percentage of fees with their delegators, and which Orchestrator could provide the best ROI for their bonded LPT. If Delegators are not active then they will be foregoing the opportunity to make the most out their bonded LPT.

Who are Orchestrators and what is their role?

Orchestrator is a new role that will be introduced with Streamflow implementation. Current Transcoder role will be broken down in to Orchestrator and Transcoder. Orchestrator will perform the below role:

- An Orchestrator which is protocol aware, negotiates work with Broadcasters, is responsible for delivering verified transcoded segments to the Broadcasters, and coordinates the execution of this work amongst a potentially large pool of transcoders.

How much minimum stake is required to be an Orchestrator?

There is no minimum. Anyone can be an Orchestrator. But the clients will likely enforce a minimum by default to give Broadcasters protection against their streams being tampered with.

Will delegators also be slashed if their Orchestrator is behaving incorrectly? How to avoid it?

Yes, Delegators will also be slashed proportionally along with the Orchestrator. Orchestrator's history should be visible on chain, but also through tools like the explorer, so that Delegators can evaluate their level of risk. Remember that no one should ever be slashed unless they do something proactively malicious.

What are the implications of the introduction of the new Orchestrator role for a) centralization, b) censorship-resistance?

This should be a powerful decentralizing force. It dramatically lowers the barrier to entry for anyone to be able to compete on pricing and quality of service, without needing to meet a "top 15 stake" requirement in order to be active on the network.

As for censorship resistance, any Orchestrator can of course refuse to do work on certain content (should they choose to monitor/moderate), however with an abundance of Orchestrators offering different services, there should generally be a fallback option for Broadcasters. In fact, I think Orchestrators could optionally advertise exactly this feature (and maybe charge a premium for it) if they philosophically stood for that.

Who chooses who in the network?

Broadcasters get price/service quotes from Orchestrators and select to work with one or many. Orchestrators can stop doing work at any time for Broadcaster, and Broadcaster should be resilient enough to just work with another Orchestrator instantly. Failure is expected and the network can still provide reliability in the case of any failing Orchestrator.

Orchestrators likely run their own Transcoding processes, though if they operate a public pool then the relationship between Orchestrator and Transcoder would be mutual.

Why probabilistic micropayments? What's the motivation?

This is a big topic. We suggest you start by reading this post from Orchid Protocol for background. In short:

- Dramatic cost reduction for everyone - You as an orchestrator can determine the cost overhead of cashing payments on Ethereum, rather than be subjected to various overheads depending upon the price of Ethereum gas.
- You don't need to pay the overhead to open a payment channel for each Broadcaster/Orchestrator relationship. This wouldn't be worth it if the relationship was short lived for only a few segments of video.
- You don't need to pay the overhead of releasing payments on chain for each stream (especially if it's short, and wouldn't be worth it). You only cash payments when you collect a certain amount that is definitely worth it.

How long would it take for Streamflow to go live?

The build has already been under way, so we'd like to have an internal testnet before the end of December as the next milestone. From there, of course external testing, reviews, audits, etc. - so I can't predict a date yet, but we're working hard!

Is there any risk of Centralization after Streamflow implementation?

Certainly, if the most efficient operators who can charge the lowest possible prices continue to provide great service, share the most fees, and attract the most stake, then they will likely win much of the work.

Two factors which work against this:

- The more stake they attract, the more ways the fee-share is being split - hence a lower ETH/staked LPT fee ratio for delegators. If any up-and-coming node can attract work due to being available with good performance, a lower price, or more attractive fee share - then stake would likely shift over towards this node in favor of a higher ETH/LPT fee ratio.
- Local nodes have an advantage - if an up-and-coming node happens to be located closer to a Broadcaster, then they'll potentially have a lower latency response time on the transcoding, and hence they'll win work, and attract an outsized ETH/LPT fee ration - attracting further delegation.

So yes if there are only 2 big Broadcasters on the network, and 2 big Orchestrators are serving them reliably as cheap as possible, there may be some centralization, but that's a pretty small network…let's onboard more diverse Broadcasters, with different use cases, in different locations, building awesome video products

How can you enable public transcoder pools?

This is an open research area. Public transcoder pools can definitely exist, but they incur cost overhead of the Orchestrator having to verify the work that Transcoders perform, either through redundancy or metrics based sampling.

Below are some of the list of initial ideas outlined by Livepeer team so far:

- Check the Work: Orchestrator can check all the work, and maybe the extra costs are recovered by the gains in efficiency by opening up your pool to the world.
- Use redundancies and randomization: Make multiple Transcoders compete to perform the work, compare their results to one another, and only check it if they disagree. Use some sort of randomness as to who is eligible to do the work to minimize the chance of collaborating Transcoder screwing you over.
- Secure the work via Transcoder Stake: Transcoders have to deposit some stake into a smart contract, that can be slashed if they provide an improperly encoded segment. This has the downside of Transcoders now needing to be crypto-aware rather than just dumb hardware.
- Use a quasi-trusted pool with governance: Run the pool as a DAO, where Transcoders have to buy in to do work. If the Orchestrators gets slashed, it hurts the funds that the DAO would otherwise control. Use governance to determine who can/can't do work based upon a number of factors.

Further ideas and research are necessary. An active discussion is going on in Livepeer community forums. To learn more or participate in the discussion click on this link.

Where can I find more information about Streamflow?

You can find detailed information about Streamflow in Streamflow Protocol Proposal