Userfeeds - an open protocol for establishing information relevance in crypto-economic networks.

[DRAFT]

Abstract

In this document, we describe Userfeeds, a protocol for establishing information relevance in crypto-economic networks.
The standard Internet protocols such as HTTP or SMTP only addressed the problem of transport of messages between a sender and a recipient. The problem of evaluation of their relevance to recipients was outside of the scope of those protocols and got solved by the application layer.
The application layer companies that most effectively solved the relevance problem generated enormous economic returns (with Google, Facebook and Amazon being the most prominent ones). The resulting network effects effectively put them in a position of central super-arbiters of information relevance on the Web. To maintain economic advantage as dominant middlemen, these companies have to maintain proprietary and closed siloes of user data to prevent new entrants from entering the relevance marketplace.
In this document, we show how problems that currently plague the Internet such as "fake news", the collapse of media business models and increasing polarization of the online discourse are the unintended consequences of super-arbiters pursuing more relevance using personalization algorithms.

In our view, the solution is to understand relevance at the information theoretic level, recognize its economic incentives and embed them at the open protocol layer. The protocol we present enables open relevance algorithms that combine elements of personalization (the existing domain of super-arbiter companies) and consensus (the existing domain of cryptocurrencies and blockchains).

The Userfeeds protocol uses one message type - a ’proof-of-evaluation’ - that can be processed by both consensus and personalization algorithms. The transaction already recorded on blockchains can be retroactively interpreted as 'proofs-of-evaluation'. The protocol is architected as a set of layers for evaluation, publication, aggregation, ranking and display of relevance signals stored in 'proofs-of-evaluation'. The incentive structure of the marketplace is based on competition for relevance between evaluation providers. Crypto-tokens are the currency of the marketplace.

The Userfeeds protocol can be used to build native Web 3.0 search engines, advertising networks or governance applications. It enables a new class of relevance algorithms that combine consensus with personalization.

Introduction

The first wave of Internet protocols (HTTP, SMTP, TCP/IP) solved the problem of information transmission but didn’t address the problem of its relevance to the recipients. From the economic perspective, the near-zero marginal costs of digital information distribution shifted the burden of evaluation from senders to the recipients.

The zero-marginal-cost of communication means that it costs senders almost nothing to distribute information to additional recipients. For a recipient, however, it creates a stream of incoming information with significant opportunity costs associated with filtering. Having a fixed amount of attention, the recipient can only evaluate and act on a very limited part of that inbound stream. In addition, evaluating one piece of information means ignoring other, potentially more valuable signals.

The opportunity cost of evaluating information forced information recipients to rely on external evaluators or ”arbiters of relevance” to maximize value-per-observation in their incoming stream. Companies such as Google, Facebook or Amazon (to name the largest ones) became such arbiters in their respective contexts (keywords, social relationships, consumption patterns). They could aggregate vast amounts of information and algorithmically determine the most valuable inputs for a particular recipient in a given context.

The data network effects that these companies enjoy, allow them to attract additional users, who provide them with even more data which results in better evaluations and even more users - in a self-reinforcing feedback loop. These centralizing network effects generated immense wealth for those few companies and their shareholders but also created unintended consequences - data centralization, the opacity of relevance algorithms, “fake news” and polarization etc.

In this document, we propose the Userfeeds protocol as the possible design for the open relevance layer for the Web 3.0 stack. By the Web 3.0, we mean the ecosystem of open networks and economic incentives powered by blockchains and crypto-tokens.

In the context of the Userfeeds protocol, the existing consensus algorithms and blockchains already provide one piece of the puzzle - the layer of "shared truth" which we call the "horizontal relevance". While extremely useful for context-independent applications such as money and assets, consensus layers are not suitable for applications where relevance is contextual, personalized and "vertical" - such as personalized rankings, feeds and content discovery applications. In those cases, achieving consensus is not necessary as relevance will depend on the context of the observer.

Historically, the "horizontal relevance" of money and assets has been provided and secured by the financial networks of payment processors and banks (commonly described as "Wall Street"). The "vertical relevance" of personalized information ranking has been the domain of Internet aggregators such as Google or Facebook (commonly described as "Silicon Valley").

The Userfeeds protocol creates an open layer for integrated relevance algorithms that combine signals from consensus layers but add a component of personalization.

The protocol is particularly well-suited for information relevance evaluation in adversarial contexts of the Web 3.0. By the Web 3.0, we mean the ecosystem of networks and economic incentives driven by blockchains and crypto-tokens such as Bitcoin[1] or Ethereum[2].

These networks create a new context for relevance which is defined by crypto-token ownership.

In those token-based contexts, the suppliers of relevance signals are often heavily biased by being financially invested in particular financial outcomes. Today, the signals they provide in the form of links, likes, votes are tainted by these biases, but the existing aggregators

(Google, FB, Twitter) are not able to adequately recognize them. Hence, rankings based on these signals will, by definition, be flawed.
Also, information about users' preferences stored in likes, links or votes reveals only one dimension of their preferences. More precisely, it only contains information about their preferences, in their particular context in a given moment.
Information stored in token buy and sell transactions belongs to a different dimension as it reveals information about users' expectations about the future.
The open nature of the financial graph created by tokens on the blockchain based infrastructure allows us to create new types of relevance algorithms that include expectations about the future into relevance algorithms.
The Userfeeds protocol is also natively designed to recognize subjectivity & economic agendas by combining 'proofs-of-evaluation' issued by a provider with information about their blockchain-based economic interests (like token balances etc.).
In the following sections, we define the concept of relevance in its vertical and horizontal manifestations, explore the problems with the existing relevance providers and explain the Userfeeds protocol solution and its implications.

The Definition and Economics of ”Relevance”

The Information Bottleneck Principle

To define the concept of ”information relevance” we will use the definition proposed by Tishby, Pereira and Bialek in their paper “The Information Bottleneck Method” [3]. The idea of an ‘information bottleneck’ is primarily used as a theoretical foundation for explaining mechanisms behind deep learning but is also applicable to other domains. The definition goes as follows:

“We define the relevant information in a signal $x \in X$ as being the information that this signal provides about another signal $y \in Y$. Examples include the information that face images provide about the names of the people portrayed, or the information that speech sounds provide about the words spoken. Understanding the signal x requires more than just predicting y, it also requires specifying which features of X play a role in the prediction. We formalize this problem as that of finding a short code for X that preserves the maximum information about Y .“

The authors further explain that it's possible to define 'meaningful' and 'relevant' in strictly quantitative terms:

"A fundamental problem in formalizing our intuitive ideas about information is to provide a quantitative notion of “meaningful” or “relevant” information. These issues were intentionally left out of information theory in its original formulation by Shannon, who focused attention on the problem of transmitting information rather than judging its value to the recipient. Correspondingly, information theory has often been viewed as being strictly a theory of communication, and this view has become so accepted that many people consider statistical and information theoretic principles as almost irrelevant for the question of meaning. In contrast, we argue here that information theory, in particular lossy source compression, provides a natural quantitative approach to the question of “relevant information.” Specifically, we formulate a variational principle for the extraction or efficient representation of relevant information. In related work [1] we argue that this single information theoretic principle contains as special cases a wide variety of problems, including prediction, filtering, and learning in its various forms."

In simple terms, ”relevance” according to this definition can be explained as “predictability”. The more relevant a signal is, the more predictive power it has about another signal. The process of identifying relevant information in X about Y is done by “compressing” information in X without losing the ability to predict Y. The end result of such “compression” is the ability to predict Y with minimum information about X.

In this document, we apply this understanding of information relevance to the mechanisms that govern the economics of the Web:

Relevant information in behaviours (x) of people on the Web (X) is the information that it provides about other behaviours (y) of other people on the Web. (Y)

Why "Fake News" Are Relevant

We believe this information theoretical concept can be applied not only to deep learning but also help us understand the economics of social and advertising networks and explain phenomena like “fake news” or digital addiction. The fascinating aspect of the ‘information bottleneck principle’ is that it can be equally applied at different levels of scale. It can explain incentives of corporations like Google, national news organizations and individual online influencers.

In popular understanding, the idea of “relevance” is described in terms of subjective feelings of the information receiver about the semantic content of received information. The ”quality content” or “meaningful information” are expressions commonly used to describe “relevance”. Therefore, most solutions to problems like “fake news” are tackling the issue as if it is semantic or even ontological.

The mathematically precise definition of ‘relevance-as-predictability’ introduced by the ‘information bottleneck method’ allows us to look at the problem from a different and unexpected angle.

According to the ‘information bottleneck’ definition of relevance, “fake news” is actually relevant. In fact, not only ”fake news” but many other online phenomena that are perceived as negative, are relevant too.

How is that possible?

The explanation is simple but has profound implications. In our view, the economics of the Internet operates similarly to the inner workings of deep neural networks. Agents in the Internet economy optimize for relevancy by being as predictive of behaviours of others as possible. If an agent X can predictably influence behaviours of agent Y in a context Z they’ll be considered relevant in that context.

To illustrate this abstract idea let’s use the following examples:

- an Instagram celebrity is relevant because if they post a photo X, they can predictably increase sales of a product Y
- an online news portal is relevant because if they publish an article X that will predictably cause comments on a Facebook page Y
- Google search results for a keyword X are relevant because they predictably increase traffic to the website Y

The Economics of Relevance in the Context of Advertising

Claude Shannon’s classic work “A Mathematical Theory of Communication” [4] relates the amount of information in the signal to the unexpectedness of that signal. On the other hand, if a signal is expected it carries no information. However, as Tishby, Pereira and Bialek note , Shannon's theory intentionally left out the problem of value judgement or relevance of that signal.

The authors point out that:

"In contrast, we argue here that information theory, in particular lossy source compression, provides a natural quantitative approach to the question of “relevant information.” Specifically, we formulate a variational principle for the extraction or efficient representation of relevant information."

Extrapolating that insight to the Web at large, we might formulate a rule that agents that are predictive of behaviours of other agents carry more information in the system.
Therefore, the economics of money flows and advertising on the Internet might have a deep information theoretical underpinning. From that perspective, “money follows eyeballs” is basically a reallocation of money in the system to agents that produce more unexpectedness and surprise away from agents that produce less surprise. It's important to note, however, that it's not purely surprise and unexpectedness that matter. What's important for "relevance" is that this surprise and unexpectedness is followed by predictable behaviours of other agents.
If a “celebrity” agent can predictably elicit behaviours of thousands of their "fan-agents", they accumulate relevance at the expense of their “followers”. As a source of signal in the system, the “celebrity” agent will then have more information, and their “followers” have less (as they are more predictable).
The resulting transfer of money to agents that have relevance, the native scarcity of the Internet, is a natural conclusion of the economics of networks. In the case of advertising today, relevance is bundled with its physical manifestation of a product or service and exchanged for money (although digital products start blurring this line). In the developed information economy which we’re heading towards, relevance will be unbundled from any of its manifestations and exchanged as a pure abstraction.

Relevance in Vertical and Horizontal Contexts

To expand on the topic of relevance, we'll define “context” as a frame of reference for computation of relevance.
We propose a classification of relevance based on context:

- a context-dependent, vertical relevance - examples: reputation, ranking, authority
- a context-independent, horizontal relevance - examples: money, assets

For context-dependent relevance, when context changes, the relevance changes as well. When information is relevant in a context X, its relevance doesn’t carry over to a context Y.

Things like 'reputation' and 'authority' belong this class of relevance. Agents that are relevant in one context can elicit predictable behaviours from other agents in the same context. This observation should be intuitive to most people. For context-dependent relevance, the frame of reference is either individual or shared by small groups of agents. For example, the relevance of family members, religious or industry leaders is highly contextual.

There's a second type of relevance that is fundamental to human affairs which is context independent. Money and assets belong to this class. For this document, we define money and assets as a class of relevance that is context-independent and "horizontal". For context-independent relevance, the same frame of reference is shared by the large groups of agents.

Money is a great example of a context-independent asset. It's relevant purely because it allows eliciting predictable behaviours from other agents regardless of a context.

To reiterate, if an agent has context-dependent relevance, they can influence actions of other agents in that context ("reputation", "authority"). If an agent has context-independent relevance, they can influence actions of other agents regardless of a context ("money", "assets").

Ensuring that the shared frame of reference is established and the shared view on the state of affairs is maintained has been the domain of the financial system. The role of the financial system has been to provide information about the relevance of agents in the context-independent sense (money, wealth) and mechanisms to exchange that relevance. The invention of the blockchains allows us now to establish horizontal relevance outside of the financial system.

For context-dependent relevance on the Internet, its provision has been dominated by the major Internet aggregators - the companies such as Google, Facebook, Amazon. Their role is to provide relevant data that is highly contextual. As we mentioned before, keywords, social relationships, purchasing patterns were the respective contexts dominated by these companies. Location is another recent context that was enabled by the mobile revolution.

Relevance in Space and in Time

The relevance of information in vertical contexts can be only evaluated in ”space” by an aggregator. It means that the importance of information will be determined by the spatial relationships between nodes and edges in its native graph. These edges can be links, likes,

purchases and nodes can be documents, people, products. All of them have spatial nature that reveals the evaluations of agents in their personalized contexts. The information stored in the graph answers the question - “is this information relevant in my personal context now”.
On the other hand, the relevance of information in horizontal contexts can be evaluated in “time” by the price discovery mechanisms of the open market. The market dynamics incentivizes agents to reveal their preferences about the future relevance of information in shared contexts. Buying and holding a stock reveals an agent’s evaluation that it will become more relevant (”price will go up”) in the future. The aggregation of buy/sell decisions ”compresses” evaluations about the future and provides us with a market price today. Evaluations in horizontal contexts answer the question - “will this information be relevant in shared contexts in the future”.

The Problems With Existing Monopolies of Vertical and Horizontal Relevance

Having established the conceptual framework of vertical and horizontal relevance and their spatial and temporal natures, we can now use it to analyze the problems with the existing providers of relevance.
The business model of the existing "vertical relevance" providers of online aggregators can be described as follows:

- develop algorithms that extract relevance information from a network graph built from evaluations submitted by users (e.g. the graph of documents and links - Google, the social graph and likes or friends - Facebook, purchase graph and purchases - Amazon)
- use that mechanism to aggregate as many relevance contexts as possible (in categories such as keywords, people, products, locations)
- leverage additional evaluations from users (clicks, likes, purchases) to extract even more relevance and secure dominant position via data network effects.
- use advertising to convert vertical relevance (attention, traffic) into horizontal relevance (cash flow and stock price)

- build the data silo and exclusive access to the graphs of interactions and hold the monopoly for relevance extraction from them.

The business model of a "horizontal relevance" providers of the financial system like banks or other financial institutions:

- secure a position of a trusted provider for any exchange of horizontal relevance signals (like - money transfers, loans, stocks)
- participate as a middleman in all of those exchanges and extract value from them
- build the data silo and exclusive access to the graphs of interactions and have the monopoly for relevance extraction from them.

So in the current model, these two domains of relevance - the vertical and horizontal one - operate on two separate networks and are controlled by separate sets of monopolies.

The nature of both sets of monopolies is purely informational. They collect signals from their users, evaluate them to establish relevance in a vertical or horizontal sense and provide that relevance data to the outside world. They also participate in all of the exchanges between the vertical and horizontal domains. For example, the business model of advertising, which is the dominant business model on the Internet, is merely an exchange of horizontal relevance (money) into a vertical one (reputation, ranking) or the reverse.

In our view, many of the problems that we currently face as an early information society are caused by the separation of semantic, social and financial graphs into proprietary silos. The information is lost during exchanges between these silos, and it unexpectedly causes systemic issues such as "fake news", the collapse of media business model and centralization of power in the hands of the few.

We introduce, the Userfeeds protocol as a potential solution to this problem. The Userfeeds protocol enables the creation of an open, transparent and logically decentralized graph that contains both vertical and horizontal relevance signals.

The Userfeeds Protocol Design

Overview

The protocol introduces one message type - a ’proof-of-evaluation’ - which represents a primary signal for information evaluation used for calculation of relevance (both vertical and horizontal).

'Proofs-of-evaluation' are cryptographically signed messages which prove that an owner of a private key evaluated information represented by an arbitrary string. Every existing blockchain transaction already processed by consensus algorithms can be retroactively interpreted as a ‘proof-of-evaluation’. It's just that their horizontal relevance has been already established by miners through the process of mining.

Additional ‘proof-of-evaluation’ message types can be specified by the protocol roles.

'Proofs-of-evaluation' are filtered through a set of interdependent layers for publication, aggregation, ranking and display. Each layer can modify the relevance of information stored in the 'proof-of-evaluation'. Providers of relevance at each layer are modularized and compete on the open marketplace.

The Userfeeds protocol is logically decentralized and can be understood as the meta layer on top of the existing Web 3.0 stack.

Protocol Roles

The protocol is structured in a set of evaluation layers. Providers at each layer provide an evaluation of messages from the layer below and supply the result of their evaluation to the layer above. Every provider at each layer influences relevance computation on the other layers.

- *Evaluation Layer* - **Evaluation Providers** - evaluate information and publish results of their evaluation as digitally-signed ‘proofs-of-evaluation’. Only Evaluation Providers can sign proofs-of-evaluation.
- *Publication Layer* - **Storage Providers** - store ’proofs-of-evaluation’ from Evaluation Layer and make them available to APIs from the Aggregation Layer.
- A*ggregation Layer* - **Aggregation APIs** - aggregate & combine ’proofs-of-evaluation’ from the Publication Layers and Consensus Layers and make the combined datasets available to Algorithm Providers at the Ranking Layer

- R*anking Layer* - **Algorithm Providers -** apply relevance scores to information stored in 'proofs-of-evaluation' at the Aggregation Layer and make these scores available to Application Interfaces at the Display Layer
- D*isplay Layer* - **Application Interface Providers** - display messages from the Ranking Layer and make them available for observation and evaluation by Evaluation Providers. By choosing how to display rankings they effectively influence their relevance score.

The Display Layer is the last layer of the cycle evaluated by Evaluation Providers which begins the new evaluation cycle. The protocol is self-reflexive as cycles of evaluation continue indefinitely.

Storage and Aggregation Providers have a binary influence on the information relevance scores - they either store or aggregate proofs-of-evaluation or not.

Ranking and Interface layers modify relevance on a spectrum.

Proof-Of-Evaluation Message Type

'Proofs-of-Evaluation' are messages that prove an author of a message (Evaluation Provider) evaluated some information represented by an arbitrary string.

To perform an evaluation, an Evaluation Provider has to make an observation of that information and then make a statement about it. In that sense, 'proof–of-evaluation' confirms that a single cycle of 'observation-evaluation' has been completed.

All messages in the Userfeeds protocol are digitally signed and contain the following elements:

- **Author** - defined by the cryptographic key that signed the message
- **Target** - an arbitrary string that represents information that was evaluated

Optionally, messages might contain:

- **Metadata** (e.g. types, labels or others).

So the basic structure of the message is:

"Author A evaluated Target B with metadata C"

or

A → B, C

Metadata allows Authors to attach additional information to their ‘proofs-of-evaluation’.

Here is the non-exclusive list of example Targets:

- URLs/URIs
- IPFS hashes
- blockchain addresses
- blockchain transaction IDs
- other ’proofs-of-evaluation’

The protocol doesn't define the exact syntax of the message. Protocol roles can define and evolve syntax of messages over time. Many syntaxes can be used in parallel as long as they follow the same basic structure - “A → B, C”.

It is important to note, that blockchain transactions are also ‘proofs-of-evaluation’ from the perspective of the Userfeeds protocol.

For example: from the perspective of the Userfeeds protocol, the regular Bitcoin transaction where A sends 1 bitcoin to B, is an evaluation of an address B by an address A with metadata “send 10”. In the context of a Bitcoin network, this ’proof-of-evaluation’ will be processed by a consensus algorithm and the network will agree on the shared meaning of that message which is ‘money transfer’. However, in the context of the Userfeeds protocol, the ’proof-of-evaluation’ itself has no shared meaning. It’s a basic information evaluation signal without any meaning besides “A made a statement about B with metadata C”.

This approach allows us to create a common structure for all types of evaluations that most users make on the Web every day.

Examples:

- A → exampleurl.com, “the best website” - HTTP hyperlink with an anchor text
- A → IPFS_hash_of_text_post , ‘like’ - Facebook ‘like’ of a text post
- A → IPFS_hash_of_a_photo, ‘favorite’ - Instagram ‘favorite’ of an image
- A → Bitcoin address, ‘send 10’ - Bitcoin ‘money transfer’

Even a regular ‘click’ could be represented as a proof-of-evaluation as:

- A → exampleurl.com, ’click’

In fact, the user clickstream data was used as evaluation signal by early Google search to improve their search results. It was not cryptographically signed but followed the same basic structure. Click is still the most widely used evaluation signal on the Web today and is stored in cookies.

Once we acknowledge that ‘crypto-token transfers’ and ‘Facebook likes’ can be structurally represented as the same message type, a ‘proof-of-evaluation’, then the main difference will lie in the type of algorithms that process them.

Protocol Game Theory and Economics

Incentives for Evaluation Providers

The goal of each Evaluation Provider is to become as relevant as possible (whether in a vertical or a horizontal sense).

Every Evaluation Provider aims to generate signals that will be predictive of other signals generated by other Evaluation providers. In the traditional sense, that means pursuing 'popularity', 'likes' or 'money'.

Because Evaluation Providers have finite attention they can only observe & evaluate finite amount of information.

As the attention of Evaluation Providers is finite, the absolute amount of relevance in the system is scarce as well. If a class of signals becomes more relevant, it means that some other class of signals has to become less relevant.

The criticial decision for each Evaluation Provider is to determine what information they should evaluate next and what algorithms they should use to achieve that.

There are multiple strategies Evaluation Providers can adopt in their competition for relevance. ’Proofs-of-evaluation’ that have most long term predictive value will usually be more scientific and fundamental in their nature but harder to achieve relevance in the short term. ’Proofs-of-evaluation’ based on current trends and fashions are more likely to have relevance short term but more likely to lose relevance over time.

Each Evaluation Provider influences other Evaluation Providers and is being influenced by them.

Incentives for Storage, Aggregation, Ranking and Interface Providers

These roles don't produce 'proofs-of-evaluation' but only extract relevance from the existing 'proofs-of-evaluation' created by Evaluation Providers.

As information signals are filtered through Storage, Aggregation, Ranking and Interface layers, their relevance will be influenced at each layer.

Providers at each layer are customers of the layer below and suppliers to the layer above.

The protocol doesn't specify the reward structure for providers at each layer. Many incentivization models can be used to reward providers for their services.

Userfeeds Protocol Tokens

The Userfeeds protocol doesn't specify a native 'protocol-token'. Any existing token can be used within the Userfeeds protocol. However, tokens that extend the protocol's functionalities and allow for better coordination of the protocol roles might be added in the future.

Privacy Considerations

In the context of the Userfeeds protocol, signing 'proofs-of-evaluation' that are intended to become relevant in the vertical sense will naturally affect agent's privacy in the horizontal sense. In other words, an agent's "money" will lose some of its fungibility as there will be "reputation" attached to them. While this problem can be mitigated using privacy-enabling blockchain solutions, it's inherently present in the nature of the exchange be. There's a natural tradeoff between privacy and reputation (or relevance in a vertical and horizontal sense). In order to get more privacy, the agent has to sacrifice reputation. To get the reputation, the agent has to sacrifice privacy.

Implications and Use Cases

The Userfeeds protocol enables a new class of relevance algorithms that integrate historically separate domains of vertical and horizontal relevance.
One of the fundamental rules of the Internet was that "organic" and "paid" rankings should be separated and not influence each other. We believe that this distinction can't be sustained going forward as economic incentives increasingly influence the "organic" rankings, but they do so in opaque ways, often hard to detect by the existing relevance platform operators. This is especially visible in the cryptocurrency space where most agents have vested financial interests in tokens they own and their "organic" actions on social media platforms are financially motivated.

By using 'proof-of-evaluation' as one message type for influencing both horizontal and vertical relevance contexts, the Userfeeds protocol allows new types of integrated relevance algorithms to emerge on top of the unified, open dataset.
Example use cases for the Userfeeds protocol might include:

Information feeds with "fake news" filters

We frame the problem of "fake news" as a consequence of the pursuit of too much 'contextualization' by the existing relevance providers. The only way the existing platforms can increase their profits in the current paradigm is to pursue increasing relevance in their vertical contexts. That naturally means more personalization and customization - the holy grail of personalization is ‘one context for one person’. However, pursuing vertical relevance only results in pushing users further into their individual realities. The result is a breakdown of shared narratives caused by too much optimization for narrow, individual and vertical relevance.
The problem is that, viewed only from the vertical relevance perspective, "fake news" are very relevant. They predict users' engagement better than other types of news.
The Userfeeds protocol allows to counterbalance the "fake news" problem by combining vertical and horizontal relevance signals in various proportions. Rather than solving the ranking problem on the "real"-"fake" spectrum, the Userfeeds protocol frames the problem on the "consensual" - "personalized" spectrum.
Because of the transparency of algorithms and data, users will always know how much of the incoming information belongs to the "consensual" vs "personalized" reality.

Information feeds with time-based information relevance

The current ranking algorithms used by search & social media platforms rely on evaluations such as links, likes or clicks that only reveal context-dependent preferences of users. Users that link, like or click reveal their preference in their specific context at the moment they're in. Their preferences stored in the information graphs are then used to predict evaluations (links, likes, clicks) of other users.
The horizontal domains such as stock exchanges or cryptocurrency markets force agents to reveal a different kind of expectations. The information stored in their buy/sell transactions reveals their expectations about the future. The expectation of profit and avoidance of loss ensures their evaluations are truthful in the game-theoretic sense.

The current ranking algorithms don't have access to such information. Only large companies on stock markets can be ranked using time-based signals.
The low cost of tokenization allows any idea to become an asset that can not only be linked, liked or clicked, but also bought/sold in the marketplace.
The Userfeeds protocol allows establishing the relevance of any idea with a corresponding token both in time (based on buys/sells) and in space (based on links, likes, clicks). Both time-based and space-based evaluations can be represented by a 'proof-of-evaluation'.

Governance Models

The Userfeeds protocol enables off-chain governance applications for token based communities and DAOs where stakeholders can evaluate developments proposals and roadmaps using 'proofs-of-evaluation'. Due to logical decentralization of the protocol and its off-chain nature, the existing communities and tokens can evolve their governance mechanisms without modifying their on-chain components.

Transparent Ad Networks Built Into Any Crypto-Token

The Userfeeds protocol allows building open and transparent advertising networks based on any blockchain token. As we discussed earlier, advertising is an exchange from horizontal relevance context (money) into a vertical relevance (ranking/reputation) based on an exchange function.
In these new types of advertising networks the interests of publishers, advertisers and users are aligned with the shared ownership of the token. The relevance of the advertising messages can be established based on token holdings or token-based actions performed by advertisers.

Conclusions

In this document, we have presented Userfeeds - an open protocol for establishing information relevance in crypto-economic networks.
The protocol economics is based on the concept of 'relevance' that unifies the existing notions of 'money' and 'reputation'. Agents in the system compete for relevance as the fundamental scarcity.

Architecturally, the protocol leverages the existing information signals that are currently stored on-chain and allows combining them with off-chain data to determine relevance. Establishing relevance is achieved by retroactively interpreting the existing on-chain messages as "proofs-of-evaluation" and combining them with "proofs-of-evaluation" from other sources. Information signals that were previously stored in separate data silos can be combined into a one, unified information graph that contains context-dependent and context-independent preferences of agents.

Footnotes

[1] - Bitcoin: A Peer-to-Peer Electronic Cash System, Satoshi Nakamoto https://bitcoin.org/bitcoin.pdf
[2] - Ethereum: A Next-Generation Smart Contract and Decentralized Application Platform, Vitalik Buterin https://github.com/ethereum/wiki/wiki/White-Paper
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Further Reading

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