



PARATII

Blueprint for a
decentralized video
distribution ecosystem

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This is an alpha version of this document.

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Abstract

The world of online video is undergoing a radical transformation that blurs the distinction between service providers, value providers and end users. Blockchain technologies allow for novel ways of coordinating people, and represent an emerging force that can speed up this process of change. In the present paper, we outline a video distribution system that leverages recent developments in the fields of peer to peer networking and cryptocurrencies to move beyond the model of centralized video platforms and place full revenue control on the hands of content producers.

Keywords: *peer to peer, cryptocurrencies, blockchain, Ethereum*

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I. Introduction

Digital video advertising moves U\$18 billion in annual expenditure¹. This paper outlines a system called Paratii, designed to obtain a share of this market through three main principles:

- I. Distribution of value via a rich set of economic interactions among the individuals that sustain the ecosystem, including a flexible and creator-centric monetization scheme that allows the coexistence of AVOD, TVOD and SVOD business models².
- II. Use of peer-to-peer networks to minimize file distribution costs and create more value for content producers.
- III. Zero intrinsic value cuts for maintaining centralized for-profit entities.

Paratii is founded by a team that combines decades of advertising market practice, blockchain technical expertise, game theory background, and is developed under the sponsorship of BossaNova, one of Brazil's biggest film production companies.

I.a. The vision of Paratii

Paratii is a decentralized video distribution ecosystem that offers creators a disintermediated, fair and free alternative to centralized platforms. Through it, video-makers are rewarded for the videos they produce in proportion to the audience they generate.

Paratii defines a structure in which creators themselves choose a monetization model to follow, where users can influence how much a video is worth, and on which advertisers pick a way of exposing themselves to the world. Keeping as its compass the social mission to spread the bug of disintermediation, Paratii aims to facilitate the delivery of content that makes people excited about being human, above all. If the web was invented to make it easier and straightforward to find scientific information from peers, our goal is to make it easier and fairer for people to find inspiration from peers.

In the long term, the Paratii project aims to decentralize all of its main functions, effectively becoming a DAO - a Decentralized Autonomous Organization³ that lives on the internet and is not owned or controlled by any single entity.

The Paratii ecosystem embraces adaptation as a key success factor. In a rapidly moving world, the forces that drive change will account for most of the DAO's evolution. Uploading inspiring content, purchasing big bulks of media and spreading the word about a particular video are all contributions that have a certain social potential: these actions embody a certain power to transform individuals, which is a valuable asset inside an ecosystem that needs to constantly influence its members, in order to be reshaped by them, to adapt and to thrive.

Paratii's core proposition is to showcase videos that transform or influence people in a positive way - according to people's own judgement - and to reward the creators of that content accordingly. For that purpose, Paratii introduces a cryptographic token called PTI, that is used for paying contributors and which can be exchanged for hard currency. Tying the distribution of PTI to people's own perception of how affected they are by a particular piece of content embeds the stimulus for personal transformation in the cryptoeconomy and should push creators towards uploading impactful (thus profitable) videos. PTI represent to the creator a measure of how successful his content is, and grant to advertisers the access to a certain amount of media space before users' eyes - to all extents, the token's intrinsic concept can be stated as an acronym, where:

PTI = Power to Transform Individuals

The value of PTI is driven by the sales of advertising and premium content. Ultimately, this means that the contributions that earn rewards for Paratii users are those that are most successful in attracting the attention of the public. The value a video does not only depend on the video maker, but by its audience as well: having a viewer is as essential for selling an advertisement than having a video. It makes sense, therefore, to allow content producers to flexibly share what they earn with their public. This is permitted by a mechanism we will refer to as a market of attention, which allows creators to tweak the rules that affect their income.

In a nutshell, some key differences between Paratii and existing centralized alternatives are:

- Videomakers' income also depend on the quality of their content (it's transformative value) and not only on its commercial value.
- Mechanisms for creator-centric redistribution of value make nothing like an "end user" or "mass

1. Statista. Digital video advertising revenue worldwide from 2015 to 2021, by device (in million U.S. dollars). 2017. URL (visited on Jan. 15th 2017): <https://www.statista.com/statistics/456747/digital-video-advertising-revenue-device-digital-market-outlook-worldwide>

2. There are three main business models when it comes to video on demand services: advertising-supported video on demand (AVOD), where advertising is included as part of the content offered (i.e: YouTube); transactional video on demand (TVOD), on which content is payed for whenever it's to be watched or rented (think Apple's iTunes); and subscription video on demand (SVOD), on which a periodic fee is charged to allow retrieval from a catalog of content (for example, Netflix).

3. BUTERIN, Vitalik. DAOs, DACs, DAs and More: An Incomplete Terminology Guide. 2014. URL (visited on Jan. 15th 2017): <https://blog.ethereum.org/2014/05/06/daos-dacs-das-and-more-an-incomplete-terminology-guide>

market" exist in the Paratii ecosystem. Instead, fine-grained individual choices activate a feedback loop between viewers and creators that's more transformative than single direction feedbacks.

II.b. Background & History

Decentralization is at the root of the world wide web, which was designed as an open and non-proprietary network. Even if the decades that followed Tim Berners-Lee's creation saw the rise of tech companies, media conglomerates and regulatory institutions that arguably undermined the internet's original aim, the drive to decentralise remained a key propeller to major processes that shaped the web as it is today - e.g. the transition to web 2.0 and the emergence of the sharing economy.

The tension between centralized and decentralized is also visible in the area of video distribution: since the 2000s, the field is controlled by a small number of corporations (who've always pursued to restrain the adoption of peer to peer content distribution mechanisms).

Content producers have gotten used to creating value for these centralized institutions, exchanging their content for free hosting and, in some cases, a fraction of the revenue they generate. This habit led to rising dependence on private networks owned by institutions like these: as of 2015, more than half of all transatlantic data flows relied on networks of this kind⁴, while video's share of global internet traffic already surpassed 70%. Facebook and Google now account for practically half of all money spent on digital advertising worldwide⁵, a concentration hardly ever approached on other electronic and even print channels. As Mr. Berners-Lee puts it, "we don't have a technology problem, we have a social problem"⁶.

With the publication of Satoshi Nakamoto's white paper in 2008⁷ and the launch of Bitcoin in 2009, it has been proven that it is possible to create a decentralized and trustless system - a system that is not controlled by any single party - in which digital objects can hold value, and immediate and secure transfers of value are possible on large scale. Blockchain technology - the combination of insights and technologies that made Bitcoin possible - holds a potential that goes well beyond the creation

of electronic "bank-less" money. Blockchain technology allows for the creation of new forms of "programmable money", token-based accounting and "smart contracts". It offers new ways to involve people as economic participants in an organization: it becomes possible to create economic systems that provide monetary incentives to users and contributors that are usually left out of the economic system and to internalize effects that tend to remain external to the market⁸.

A key concept is that of Decentralized Autonomous Organizations, or DAOs, which leverage blockchain technology to replace traditional business structures by software and decentralized ways of coordinating. DAOs can be seen as entities that exist autonomously on the internet and manage their own capital. A DAO may rely on hiring people to perform certain tasks, but in contrast with the familiar organizations, in a DAO, automation is at the center, while humans are at the edges.

Of particular interest for the field of video distribution are peer-to-peer file sharing systems, of which BitTorrent, with over 170 million monthly active users⁹ (close to twice as many subscribers as Netflix had at the end of 2016¹⁰) is probably the most well-known example. What BitTorrent lacks, however, is a proper incentive structure: users are not rewarded in a systematic way for providing bandwidth and storage capacity, and the network must therefore depend on the goodwill of its participants to offer both of these. There are a number of projects that aim to use the blockchain for adding such incentives and creating a peer-to-peer exchange of storage and bandwidth. These developments will inevitably change the market for content distribution, leading to a much lower barrier of entry to the market of online video (the de facto monopolies of the likes of Google and Facebook are in part based on the fact that they can store and stream video at a cost that is unattainable for new entrants).

Throughout digital media history, there is no consensus as to whether advertising is an essential piece of the business model or not: some fiercely defend it, while others choose to avoid it at any cost. However, there are three ways of monetizing video content that cover basically everything tried so far (advertising supported video-on-demand, transaction supported video-on-demand and subscription based video-on-demand). The BitTorrent protocol has been used as the basis for a number of business models which illustrate this spectrum of

4. WONG, Joon Ian. Quartz. The internet has been quietly rewired, and video is the reason why. 2016. URL (visited on Jan. 15th 2017): www.qz.com/742474/how-streaming-video-changed-the-shape-of-the-internet

5. EDDY, Nathan. Google, Facebook Dominate Digital Ad Revenue. 2016. URL (visited on Jan. 13th 2017): www.eweek.com/small-business/google-facebook-dominate-digital-ad-revenue.html

6. HARDY, Quentin. New York Times. The Web's Creator Looks to Reinvent It. 2016. URL (visited on Jan. 15th 2017): www.nytimes.com/2016/06/08/technology/the-webs-creator-looks-to-reinvent-it.html

7. NAKAMOTO, Satoshi. Bitcoin: A Peer-to-Peer Electronic Cash System, <https://bitcoin.org/bitcoin.pdf>

8. DEMSETZ, Harold. Toward a theory of property rights. American Economic Review 57 (May, 1967): 347-359. URL (visited on February 15th): <https://www.jstor.org/stable/1821637>

9. BitTorrent. URL (visited on Dec. 5th, 2016): <http://www.bittorrent.com/>

10. Statista. Number of Netflix streaming subscribers worldwide from 3rd quarter 2011 to 3rd quarter 2016 (in millions). URL (visited on Dec. 5th, 2016): www.statista.com/statistics/250934

options: from the Dropbox-like file sharing application BitTorrent Sync¹¹ to the TVOD BitTorrent Bundles¹², the services had difficulty in scaling, until the addition of an ad supported free option made the Bundles program (rebranded as BitTorrent Now, now an AVOD platform) reach an audience of 200 million people. The Bundles service has benefited more than 30.000 publishers¹³, which is certainly an achievement, but still far from YouTube's estimated availability of over 100 million channels.

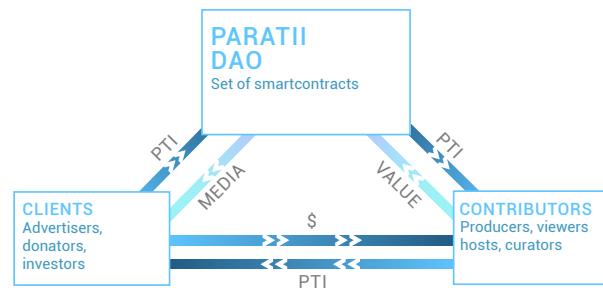
III. The Economics of Paratii

The ecosystem's economic token is called *paratii*, or PTI, a cryptographic token that is needed to access the services of the Paratii DAO and is used to reward contributors. The basic economic equation is simple: contributors to the network receive PTI, while expenditure for media inside Paratii is paid for by PTI. One of the goals of this paper is to formulate the economic rules of Paratii in a way that incentives of all participants are aligned towards contributing to the success of the ecosystem.

The main driver of PTI value, and the primary source of income for the Paratii DAO, will be advertising revenue: the ecosystem will allow individual views to be bundled and sold in exchange for PTI to the highest bidders. However, other revenue models, such as paying for access to content, are not in principle excluded.

PTI is a token of finite supply: a total amount of 21 million PTI will be created. Of these tokens, 30% will be "pre-mined" (issued at the outset) and used to finance the creation and development of the Paratii DAO and ecosystem up to the moment when it is fully autonomous. These funds will be managed by the Paratii Foundation, a nonprofit entity especially created for this purpose. The remaining 70% of *paratii* will be issued at a rate of 5 000 PTI per day (it will take a little more than 8 years¹⁴ to distribute all 21M Paratii).

The revenue of the platform, together with the newly issued *paratii*, will be distributed to contributors to the ecosystem. Content creators, curators, audience validators, and in some cases also viewers, earn in proportion to the value they add to the network. The fact that contributors also receive newly mined PTI in this start-up phase implies that video producers may receive an amount of PTI that is worth more than the market value of their content. It is a way to reward early adopters of the platform, and to jumpstart the growth of the ecosystem.



A diagram of basic value flows inside Paratii ecosystem.

III.a. Distributing *paratii* - Who Earns What

Parameters stated in this section will undergo adjustments during the Indigo phase of Paratii (see our roadmap), in order to reach an optimal equilibrium.

One of the insights of cryptoeconomics is that the distribution of "smart money" opens new ways of internalizing into an economy behaviors and costs that would otherwise remain externalities - new ways of incentivizing actions that add value to the network. In traditional business models for video distribution, if the revenue of a platform is shared with its users at all, it goes to those to whom that revenue can be directly traced: the owners of videos that are attractive to advertisers. This model is limited: the value of a video is never entirely generated by the content producer who "has earned it". The very possibility of a media sale, and therefore a part of its value, comes from the value of the network as a whole. And this value can be traced also to other users and contributors to the network: creators who chose not to monetize their work but help attract audience, viewers who watch content and share it with other viewers, and so on.

In Paratii's ecosystem, we can roughly distinguish two types of contributions that provide value to the network:

1. Contributions of content that is directly monetizable (e.g. uploading videos that attract advertisers).
2. Network contributions (contributions that maintain or increase the value of the network as a whole).

These two types of contributions correspond to two major revenue streams for contributors:

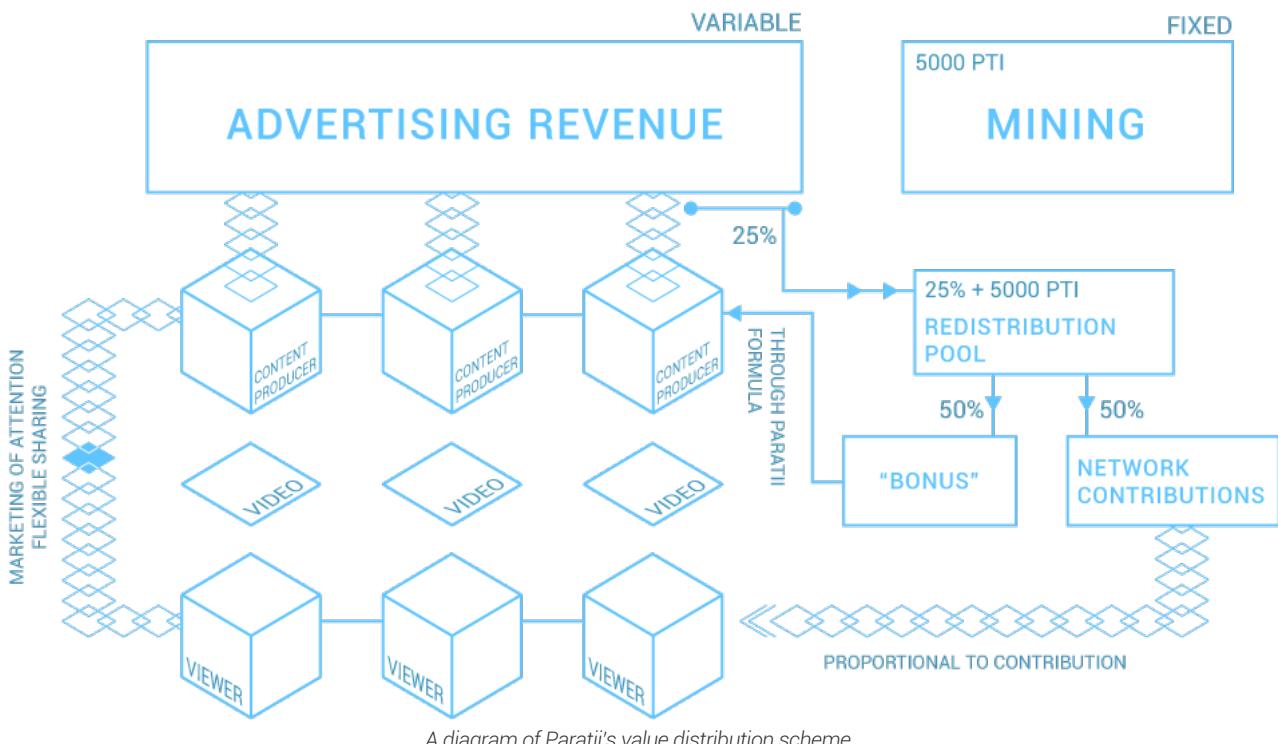
1. The revenue generated by ad sales on a video goes directly to the uploader of that video, discounted by a percentage, initially set at 25%¹⁵, that goes to the "redistribution pool".

11. Resilio. URL (visited on Mar. 1st, 2017): <https://www.resilio.com/>

12. BitTorrent Bundles. URL (visited on Mar. 1st, 2017): <https://now.bt.co/>

13. BitTorrent. BitTorrent 2015 Artist Survey. URL (visited on Mar. 1st, 2017): <http://artists.bundle.media>

14. 2940 days, to be precise, which equal 8 years and 20 days.



A diagram of Paratii's value distribution scheme.

2. The redistribution pool contains a percentage of the revenue together with newly mined tokens. The pool is used to reward contributions to the value of the network as a whole. These are actions that keep the network sane and actions that increase the network's value, such as flagging illegal or fraudulent content, rating, adding one or more tags to a video, sharing a video, commenting a video, and validating of users via the "bounty hunting" mechanism described later. Videomakers are awarded this bonus through the "*paratii formula*", (the bonus depends on the perceived quality of the video, as decided by the viewers' ratings, and its number of views), in addition to the revenue they earn directly from advertisements.

Because network contributions are partly financed by mining new coins (see scheme below), during the initial phase, part of the resources available in the redistribution pool are independent of advertising revenue, making it resilient against media sales highs and lows.

A key concern is to remain competitive with existing platforms in the eyes of content producers. In practical terms, if YouTube passes 55% of the direct sales of ads on a certain video directly to the creator of a video, this creator must be able to earn at least an equivalent amount if he publishes his videos on Paratii. In the distribution scheme described here, the earnings of a video maker consist partly of a percentage of the direct sales of advertisements, and partly of the bonus. In addition,

the Market for Attention, described below, offers a video maker the possibility to raise (or lower) the amount she makes on a video by sharing its revenue with the viewers of that video.

To be explicit, the chart on next page simulates what the creator of Video Z could earn from a little less than 30 000 views.

In this example, a popular video is seen by close to a fifth of the daily audience, and rated 30% better than the average ratings of the last 24 hours. It allows its creator to earn more than 100% of the revenue directly generated by it, while still sharing 20% of the income with his audience. A revenue of 6.835 PTI for 136.706 views means that impressions are being sold for a CPM of about 50 PTI. Assuming a value of CPM of U\$5, this implies that PTI is trading for about U\$0.10, and the creator cashes in the equivalent of U\$137 in PTI, versus an estimate of U\$82 - U\$136 potentially obtained on a classical centralized video platform for the same amount of audience (generated by a very optimistic RPM of U\$3 - U\$5).

15. This figure, and subsequent ones, serve mainly an illustrative purpose.

EXAMPLE CALCULATION OF REVENUE FOR A VIDEO MAKER			
	VALUE	UNIT	DESCRIPTION
Total revenue of Paratii in last 24h	6 835	PTI	
Mining Rate / 24h	5 000	PTI	
Total Views / Last 24h	136 706	Views	
Onus	25%	%	Percentage of revenue set aside for network contributions
Redistribution Pool	6 708,75	PTI	Mining + (onus * total revenue)
Total Ad Sales on Video Z	1 350	PTI	
Total Views on Video Z	27 341	PTI	
Direct Revenue for Video Producer	1 012,5	PTI	Ad Sales minus Onus
Video Z Rating (POQ Output)	1.3	Abs.	1 = average
Amount available as a Bonus to all video makers	3 354,37	PTI	50% of the redistribution pool
Bonus for video Z from the PTI Formula	872,13	PTI	Rating * (views for Z/total views) * Amount to be distributed as bonus
Total Revenue for Video Maker	1 884,63	PTI	Direct revenue + Bonus
Sharing Factor for Attention Market	20,00%	%	
Netto Revenue for Video Producer	1 507,70	PTI	

Simulation of a videomaker's earnings on a video with 27 341 views.

II.b. The Market for Attention

Viewers are as essential to the success of the platform just as much as content producers and curators are. They contribute their attention, which is, in a precise sense, the product that the advertisers are buying. In traditional platforms, such as Facebook or Youtube, users do not get rewarded in any economically meaningful way (users get "rewarded" by giving them access to the platform and to its content). We, instead, want our users to share in the revenue as well - not only because it seems the right thing to do, or because we think that including viewers as economic participants will be a great boost for user adoption and retention, but also because having our viewers participate in market mechanisms helps to make the ecosystem itself more efficient.

The replicability of digital content reduced the price of information on the internet to point that it is often free. But information, even if abundant and seemingly free, is always, in reality, paid in the precious currency of exclusive attention. The attention market captures this hidden value. The approach of the attention market can be summarized as a "pay per view by viewing" system, a concept that naturally arises from the monetization of the value brought by consumers to the ecosystem.

The amounts that a viewer receives are usually quite small, and we do not expect users to make their

decisions on basis of these minimal amounts. Instead, to the viewer and consumer of video content, the market is presented as a place to exchange attention for content. For example, to watch a video that charges a 50% percent premium (on top of what it makes from every view), a viewer can "pay" by watching two videos that are offering to share 25% of their proceedings. From the point of the viewer, the premium video is paid for with the PTI earned by watching other videos. To ensure the attention market works out, we may add the requirement that every payment comes from a special "attention account" from which one can withdraw, but not deposit PTI bought on the market. This would prevent an influx of fresh money that could cause inflation on premium content prices, and that could make people willing to work (watch enough videos that share earnings instead of charging an extra) for this premium content have to work more (watch more videos) to gain access to it.

In addition to offering videomakers control over their earnings, the attention market reveals users' opinions about the quality of content in the platform: they will be willing to pay more for videos they like, and less for videos they don't. It can be seen as way of rewarding the quality of videos that is complementary to the approach explained under this paper's section on "Proof of Quality". Thanks to the attention market, creators that decide not to show ads will gain proportionally to the willingness to pay attention for their works. This metric can well be a proxy for the value added to the network by such producers.

By paying in attention, every buyer will be empowered, because attention is scarce whereas video streaming is cheap. Redistribution is truly meritocratic and does not depend on budget constraints that can distort the real utility exchange in ordinary markets: there are no attention capitalists, at the same time there are no attention poor.

The user experience to convey all this flexibility must be minimal and seamless. By clicking play, any user accepts the split which can be expressed by a single number added to or subtracted from her balance. Content producers, on the other hand, simply have to decide how much revenue they want to share (up to 100%) or how they want to price a specific video at the moment of each upload. The middleground is neither sharing nor charging, like in most of the AVOD models. The design of an early interface for interacting with this mechanism can be seen on this paper's appendix.

The attention market can be made more sophisticated by offering creators additional options for pricing or selling their content, and by offering viewers other ways of paying. Such options range from personalized attention prices to combining videos in bundles that are sold as a package, and in general could involve different types of complex "attention contracts".

A possible additional feature that combines the merits of making the attention market richer and making the concept of selling attention more concrete is the following: each user owns a virtual "shelf" which has limited number of slots for videos available for a certain period of time. The shelf is accessible to the user's friends in an embedded social network, and it has the special feature that content on the users' shelf is free for all her friends to watch. Shelves will be socially shared, creating visibility for content and generating additional views. This is the "recommendation space" of the user: it internalizes an attention value that belongs to her in as far as she commands the attention of her friends. Creators can compete in the attention market for this space - instead of (or in addition to) asking for a monetary compensation, requiring viewers to promote a specific video by putting it on their shelf.

In the real world made of scarce objects, recommendation is in the hands of the user, but in the digital world, recommendation is more and more in the hands of algorithms. Serendipity has been substituted by echo chambers that lock users in their individuality. The shelves constitute a parallel recommendation system that enriches interactions. If in an ordinary social network we can only share content (and an algorithm decides which of our shares are seen by our friends) thanks to the scarcity of the recommendation space the users will be motivated to exchange content with their peers, who'll find premium videos for free on their friends' shelves.

III. Proof of Quality

One of the goals of Paratii is to reward videomakers not only on the basis their commercial success in selling advertisements, but also on basis of the quality of their content. Quality as a measure is the product of subjective judgement: it cannot be determined by algorithms alone, without human input. There are good reasons for crowdsourcing these judgements: having a large amount of people involved in deciding how good a video is makes it much more difficult for a single user to influence the final outcome of the vote; it also spreads out the work. This is exactly what most large content platforms already do through rating mechanisms.

Getting viewers to rate videos serves a dual purpose: it determines the "quality score" on which part of the revenue of a video maker depends, but it also serves its more traditional purpose as the basis of a recommendation algorithms that help users to discover content that suits their tastes.

Paratii's video player encourages users to rate the videos they watch. Because the rating of a video determines the earnings of the owner of that video, rating is vulnerable

to attack. In other words, Proof of Quality needs to be resilient - against manipulation by the content uploaders, for example. To mitigate this problem, the votes of users are weighed by their reputation. Each vote is weighted by the reputation of that user and the final rating of a video is determined by the median of all votes weighed by this reputation (the mechanics of reputation assignment are described in the next section).

Users will not only be encouraged to rate the quality of videos - in addition, they can also label the videos they watch through the insertion of tags. Categorization of content is important, not only as it helps making content discoverable, but also because it helps with selling advertisements: the more specific the information about an impression being sold, the more that product is worth. For this last reason, we will follow the IAB taxonomy¹⁶, a standard for categorization of content in digital advertising. As curation is an action that adds value to the platform, users that either rate or help categorize videos will be rewarded with a certain amount of *paratii* for their actions.

There is another aspect of curation that's less easy to crowdsource: the Paratii DAO needs some way of defending itself against abuse by people that upload content that's not their own, that's of bad quality, or that's in other ways objectionable. Bad content is damaging: it drives away audience, it diverts revenue away from content producers to malicious actors, and, in some cases, can lead to legal trouble. Spam, offensive material, videos claimed by users that have no rights to them, or simply stuff of inferior quality - it all needs to be flagged as such as quickly as possible and actions have to be taken accordingly.

Efficiently excluding malicious content is in a sense the "bottom line" of curation. It is a task that requires a certain swiftness of action: the sooner bad content is recognized as such, the better it is. It is also a difficult task that requires specialized skills: the use of software to detect duplicate or copyrighted contents, legal knowledge about copyright laws and fair use, etc. A functional flagging system should also allow for copyright holders to claim copyrighted content uploaded by other users, together with a way of evaluating the merits of such claims.

Paratii counts on a peer-to-peer file sharing network in which files are stored, and one of the features of such decentralized storage frameworks is that they are not "censorable": forcing the network to remove a certain video would imply somehow enforcing all peers in the system to erase that video. So Paratii cannot literally "remove content". What it can do, though, is to remove a video from its own registry of titles, or to change the recipient of a video's proceeds.

16. IAB. Tech Lab Content Taxonomy. URL (visited on Feb. 14th, 2017): www.iab.com/guidelines/iab-quality-assurance-guidelines-qag-taxonomy

Even though flagging is incentivized and constitutes a way of finding suspicious content, it is still unclear how an efficient mechanism to define content is indeed inappropriate could work (you can have a thousand Christians flagging a Muslim video because they find it offensive, and on the other side still have a thousand Muslims claiming it is the best rated video ever. How do you, as a decentralized network, choose who to believe in?).

For now, the "solution" we propose is very pragmatic: flagged content will be monitored by the Paratii Foundation (explained in detail below), which will make itself available to engage in discussion with offended users or alleged holders of property that's unauthorizedly being broadcast on Paratii's ecosystem. Technically, the Paratii DAO will depend on an "oracle"¹⁷ to check all video content determined to be suspicious, and, especially in the early phases, this third party can be the foundation itself. Causes settled off chain will be preceded by contacting all main parties involved, specially when it comes to property rights, and all efforts will be made never to "unlist" content. Besides, offended owners of video being shared in Paratii can always leave their content there after claiming it, simply registering in order to begin collecting its earnings.

III.a. The Backfeed Protocol

The "Backfeed Protocol" is a series of ideas on how to organize the governance of decentralized organizations. These ideas are disseminated in various channels - <http://backfeed.cc> is a good place to start¹⁸. For the purposes of the present project, we are cherry-picking a particular aspect of the protocol: the way that reputation is handled. For the scope of this paper, then, the Backfeed protocol is an algorithm that regulates how reputation is assigned and re-assigned between actors that vote on a number of issues.

The protocol determines the perceived skillfulness of every participant in a collective task and dynamically distributes authority accordingly. If you have a history of making decisions which are perceived by your peers as good, your impact on the decisions taken grows proportionally.

At the heart of the protocol is the concept of a reputation score: a unit of measure that determines the influence each user has in the evaluation process of the contributions. The agents can now vote on any kind of topic, and the final decision - the consensus - is a result of weighing each vote by its associated reputation score. Reputation is inherently linked to the specific agent who earned it, and it cannot be transferred to anyone else.

The Backfeed protocol presupposes that there is an

initial "seeding" of the reputation distribution - an assignment of reputation score among a limited group of trusted users. This initial seeding is important, because it sets the "value system" of the organization, and determines the measure against which future reputation holders are judged. Reputations can increase in two ways: either by making a contribution to the network that is perceived as valuable, or by making a useful evaluation of someone else's contribution.

In Paratii's initial phase, all reputation will be "seeded to" the Paratii Foundation, while reputation is further distributed by following the rules formulated for the distribution of new *paratii* to videomakers and viewers. Videomakers will earn reputation on the basis of the popularity and perceived quality of their videos, while viewers who rate, categorize and flag videos will earn it for their contributions. Over time, the reputation of the Foundation is diluted, and decision power is transferred to active users and popular creators.

The reputation is in constant flux as a function of the behavior of the users: if users vote "well", their reputation will grow, if they vote badly or not at all, their reputation will suffer. Specifically, the reputation dynamics consists of two complementary elements: the evaluation cost and a subsequent reputation reallocation.

Each time a user casts a vote, she puts some reputation at stake. She may lose her stake if her vote turns out to be not aligned with the "consensus" - i.e. with the final decision; if instead her vote is aligned with the consensus, she will get her stake back with interest. The rationale behind the evaluation cost is to encourage genuine participation and effort, as only those who are willing to put their reputation 'at stake' will be able to make an evaluation. In order that the evaluation cost of an evaluation be proportional to the potential reputation gain, we introduce a cost function which depends on the amount of reputation which has already voted on the contribution. Specifically, the cost decreases with the voted reputation so that last evaluators break even with non evaluators.

The second element is reputation reallocation, which consists of distributing the reputation at stake to all previous aligned evaluators. The distribution mechanism is a means to incentivize early evaluators — since the earlier the evaluation is made, the greater the potential gain from later evaluations is.

By way of illustration, the following figure depicts the reputation flow in a simple scenario in which 10 users evaluate a single contribution consecutively by the same value. The x-axis is the index of the evaluations and the y-axis is the normalized reputation of the users. The first user evaluates and therefore loses a fraction of his

17. https://en.wikipedia.org/wiki/Oracle_machine, <https://media.consensys.net/a-visit-to-the-oracle-de9097d38b2f#.s3imsmjb>

18. Backfeed. Technical overview: <http://backfeed.cc/assets/docs/TechnicalSummary.pdf>; Backfeed protocol reference implementation: <https://github.com/Backfeed/backfeed-protocol>.

reputation. When the other users vote just like him, he starts to gain reputation. The second user evaluates and again loses some reputation, though a smaller amount, according to the cost function, and gains when the rest evaluate and so on. Each evaluator is taking a risk that the next evaluators might not evaluate like him or might not evaluate at all - in that case he might lose a portion of his reputation.

This evaluation process has a certain responsibility mechanism designed into it: if your evaluations are very different to those of your peers, your reputation will suffer; if you're good in setting trends regarding the evaluations of others, you'll be rewarded. This reputation flow makes the consensus-seeking mechanism more robust - users that are not agreeing with the majority (and users that are not participating at all) will see their influence diminishing automatically. It is important to understand that a user's reputation arises out of the total sum of her value-producing interactions with other users in the system. It is not just a measure of their directly perceived prominence by their peers (as it would be in a voting or manual ranking mechanism), but it is also a result of the users evaluation of the actions of others. You're not just judged by your actions, but also by your judgment of the actions of others. Overall, the protocol encourages people to evaluate contributions at an early stage, since the earlier an evaluation is made, the greater are the potential rewards to be earned. Eventually, as others evaluate the same contribution with a similar evaluation, those who are the most in line with the overall community's evaluation will be able to retrieve the reputation they lost, and often gain more reputation than they initially had.

IV. Proof of View

Paratii sells advertising space, which makes it essential to ensure the veracity of the audience that's counted. But telling apart real people's views from fraudulent views is difficult. The North American marketing representative body (ANA) 2014 report findings that, on average, 23% of video ad views are fraudulent¹⁹, while other estimates range from 25% to as high as 75%²⁰ of fake views. Content that is affected by fraudulent activity appears to perform very well, so publishers have no intrinsic incentive to pursue and curb this kind of abuse.

Some suppliers have tried to resolve these issues, only to notice that solving the problem makes their clicks, conversions and impressions drop below those of others who choose to turn a blind eye on fraudulent activity. Often, these data are accepted with

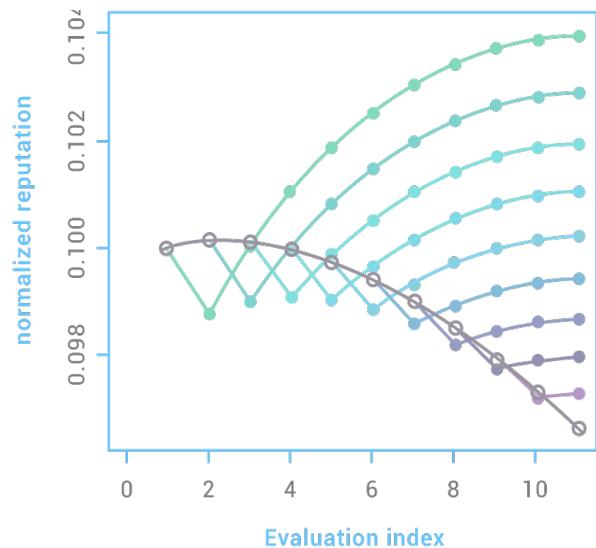


Illustration of the reputation flow for a simple scenario in which 10 users evaluate the same contribution consecutively by the same vote.

resignation by both supply and demand side agents involved: when inquired by the press on the claims that ad prices are inflated by fake views, sell side representatives have reportedly said "our buyers don't care, so we don't care"²¹. This may also be the reason behind the conclusion reached in a study conducted by researchers at the IMDEA Networks Institute, who found fake views are not only sold to advertisers but also that "YouTube applies different penalization schemes to the fake views in the monetized and public view counter, with the former being much more permissive than the latter"²². Combating fraud is rendered even more difficult because any approach that puts a burden on the valuable customers in terms of friction or performance is generally avoided.

Populating the adtech supply chain with intermediaries who are incentivized to distort their data has led fake traffic to represent close to one fourth of all video impressions counted online as of today, even when there are working methods to detect most of this activity. It seems imperative for the industry to improve its loose auditing systems, as the inflation of metrics, prices and related assets builds a house of cards that's vulnerable to transparency.

Even if industry standards are loose, the Paratii system needs a way to exclude - or at least not reward - fake traffic. Fraud prevention of this kind is an arms race with botnets and malwares of all sorts, and the battle is fought with a range of weapons, combining traffic analysis (distribution of impressions during the day, identifying

19. ANA and White Ops. The Bot Baseline: Fraud in Digital Advertising. 2014. URL (visited on Jan. 15th, 2017): <https://www.ana.net/getfile/21853>

20. VRANICA S. A 'Crisis' in Online Ads: One-Third of Traffic Is Bogus. 2014. URL (visited on Jan. 15th, 2017): www.online.wsj.com/news/articles/SB10001424052702304026304579453253860786362

21. Will Luttrell. Only The Buy-Side Can Solve Our Fraud Problem. 2013. URL (visited on Dec. 7h, 2016): www.adexchanger.com/data-driven-thinking/only-the-buy-side-can-solve-our-fraud-problem

22. MARCEL, Miriam; CUEVAS, Ruben; BANCHS, Albert; GONZALEZ, Roberto; TRAVERSO, Stefano; AHMED, Mohamed; AZCORRA, Arturo. Understanding the Detection of View Fraud in Video Content Portals. 2015. URL (visited on Dec. 12th, 2016): <https://arxiv.org/pdf/1507.08874v1.pdf>

anomalous changes in conversion rates, identifying sources of traffic by IP or other means) and analysis of individual user behavior²⁴.

Decentralizing and crowdsourcing this range of techniques that needs continuous adjustment to account for new kind of attacks presents a challenge. In the Paratii framework, the task of detecting fraudulent views will initially be handled by a centralized third party - an "oracle" with respect to the Paratii DAO that can eventually be the Paratii Foundation itself. WFA's Compendium of Ad Fraud Knowledge for Media Investors warns that there is no silver bullet to eliminate ad fraud and says that even with all the recommended counter measures in place, an advertiser could still suffer from single digit percentile exposure²³.

However, Paratii offers a new value proposition to advertisers with regard to counting of views, because of its radical level of transparency: all information about Paratii's traffic history gets registered on the blockchain and is thereby publicly available. This means that advertisers do not need to trust the Paratii DAO for its figures: it is simply impossible for the Paratii DAO to mislead advertisers by misrepresenting its data - what you see is what you get²⁵.

An alternative way to disincentivize fraudulent activity is to make it harder for fraudulent users to make money of their activity. Participants in the Paratii network are not completely anonymous, since they must have an account to receive (or pay) their PTI rewards and to participate in the peer-to-peer content distribution framework. The information regarding user interactions within the ecosystem is public, and provides an alternative approach to the problem of combating fake traffic: instead of validating views, another option is to validate users.

User accounts will only be able to move PTI out of their wallets after having been validated. When user wallet reaches reaches a certain threshold - initially set at U\$50 or equivalent - the user can request the validation of account. The process begins with a bounty that is set for a specific validation and that is proportional to that user's total PTI balance on hold. Invitations to validate the user are sent to random contributors that have demonstrated interest in bounty hunting inside the ecosystem and hold high reputation.

They can either ignore the invitation or perform a subjective judgement in relation to the data provided with the invitation. This data may or may not include sensitive information, that doesn't appear on the blockchain, according to the user's own choice (precise geolocation

and scanned documents are two examples). This hashes must be electronically signed by the user requesting validation, to be published on chain and linked to the user's register. Therefore, only the hash and signature of sensitive information will be publicly available, whereas validators, after accepting the invitation and getting into a contract with the user, will be granted access to a private key that decrypts all information to be analyzed. and will be able to check the signature, proving the data's origin.

Validators' judgements take the form of a positive / negative vote. The account is validated when at least 70% of the votes are positive. This bounty hunting scheme has the effect of making accounts with higher earnings prescribe higher bounties, therefore tending to be validated faster. Hence, users that want to ensure quick validation are led to keep hold of their PTI until their balance is capable of generating a bounty attractive enough to speed up the process. Furthermore, creators have control over how much sensitive data they want to risk versus how fast and easily they want their accounts to be verified.

V. Selling Advertisements

The Paratii DAO sells ad spaces in real-time, in exchange for PTI. The real time bidding (RTB) works as follows:

I. When a user requests a video, the video player publishes a bid request in an order book on the blockchain that specifies information about the video, the user and the impression that is for sale. For example, the bid request regards a 5 minute video about scuba diving in Patagonia; the viewer is known to be female, from Tokyo, and in her thirties. The offer also indicates conditions of the ad slot being sold. For example, that the winner should be a 5 seconds pre-roll ad, for a minimum price of 10 PTI.

II. Advertisers place bids in an order book. They specify price and conditions (for example, information about the video itself, and user demographics) together with a link to the creative (the actual advertisement to be shown). Bids can also be made as a response to a particular bid request. A bid also includes a certain amount of *paratii* that is held in escrow and will be used to settle the bid if it is accepted. This money is returned to the bidder once the bid is expired.

III. The system waits for a short amount of time (in the order of 200 milliseconds) for any new bids to

23. World Federation of Advertisers. *Compendium of Ad Fraud Knowledge for Media Investors*. 2016. URL (visited on Jan. 15th, 2017): http://www.wfanet.org/pdf/WFA_Compendium_Of_Ad_Fraud_Knowledge.pdf

24. Understanding the Detection of View Fraud in Video Content Portals (2016) by Miriam Marciel et al., <http://www2016.net/proceedings/proceedings/p357.pdf> gives a good overview of techniques used for fraud detection.

25. The fact that much of our user behavior is registered on the blockchain, and thereby rendered public, presents some obvious privacy issues - this paper's section on Risks has a few words on that.

arrive for the newly published offer. The impression is then awarded to the highest bid in the book that fits the conditions specified in the bid request. The payment is settled immediately: if the bid is fulfilled, the established price will be paid immediately to the Paratii DAO from the money held in escrow together.

IV. The video player shows the creative associated with the winning bid to the user.

It is unlikely for advertisers to bid directly on individual media slots. In fact, it is unlikely for them to bid directly at all, since a vast array of intermediaries have populated the space between advertisers and publishers, by acting as brokers of different kinds. Key intermediaries are DSPs, SSPs, ad networks and ad exchanges.

DSPs, or Demand Side Platforms, aggregate inventory offered by publishers and ad networks (who, in turn, aggregate inventory from multiple websites in categories) in order to offer access to varied options and facilitate media buying for advertisers or their agencies. SSPs - Supply Side Platforms - are the counterpart of DSPs: by bundling media slots and offering an accessible interface to publishers and DSPs, they optimize publishers' revenues and automatize the process of selling ads. Ad exchanges are platforms that execute RTB auctioning and determine winning bids.

Paratii's ad selling scheme is designed to fit in the existing logic that the industry is already used to. Our roadmap includes the creation of a supply-side platform that intermediates between DAO and the existing market. This Paratii SSP will follow industry standards as much as possible - and in particular it will implement the OpenRTB standard²⁶. The SSP service allows DSPs to publish orders in the order book, and facilitates the bundling of offers in the order book into thousands, so third-party brokers can resell Paratii impressions for themselves. The service also offers an integrated exchange of PTI for fiat currency, so that third party brokers can easily integrate the Paratii platform in their existing offers without being obliged to acquire and transfer PTI tokens. The SSP service will also actively seek bids for the inventory by posting new bid requests to compatible DSPs.

Allowing brokers access through a programming interface enables them to create their own packages and even charge for a service provided to advertisers or agencies: by selling 1000 impressions in two weeks to an advertiser, and then bidding on different individual offers, a broker can ease the process for advertisers and profit from media price fluctuations during this period. It also allows the commercial model of the Paratii ecosystem to be flexible and susceptible to its agents' creativity.

Paratii's video player will implement the industry standards to be compatible with major DSP services - and in particular the specifications of IAB's (Interactive Advertising Bureau) Video Ad Serving Template (VAST)²⁷ and the Video Player-Ad Interface Definition (VPAID). The player supports two main kinds of ads: linear ads (pre-roll, mid-roll, post-roll) and non-linear ads (overlay text or image ads).

VI. Content Storage and Distribution

One of the main costs of centralized video platforms lies in storage and distribution of content, which means the ability to host and stream files at a lower cost than that of rivals represents a strong competitive advantage.

Current initiatives in the blockchain space that offer decentralized, trustless solutions for storage and distribution (Swarm, IPFS, Storj and many others) may drastically change the standards for data retrieval infrastructures between participants of a given network. Instead of hosting and distributing files on a central server, any node in the network can contribute with disk space and bandwidth at his own will. Instead of the current situation, where traffic (and the corresponding payments and profits) passes through a small number of large service providing companies, these technologies distribute the resources (and corresponding costs) for storage and distribution over nodes that aren't charged by a central entity, but rather "pay" each other by exchanging network and storage resources. For a video platform, decentralization of this kind implies a radical reduction in costs: Paratii is not designed to pay for hosting and distribution itself, because its users "pay" for accessing content by making content accessible themselves.

Decentralized distribution can help avoid bottlenecks that are common among video platforms. In a centralized system, scaling presents a problem: the more popular a video becomes, the more bandwidth it requires - in other words, because popularity is a multiplying factor on the streaming cost equation, audience becomes expensive, in a certain sense. In contrast, a decentralized approach reverses the role of the audience in this equation. As more people are demanding a file, it becomes faster and cheaper to get it: retrieval takes less time because more nodes in the network will have associated files available, and since more popularity means that there is more competition among nodes to receive fees from streaming a specific file, popularity lowers the retrieval cost of a video.

Registered users of Paratii will automatically become nodes in the chosen P2P file exchange network once they

26. IAB. OpenRTB Native Ads API Specification Version 1.0.0.2. URL (visited on Mar. 3rd, 2017): www.iab.net/media/file/OpenRTB-Native-Ads-Specification-1_0-Final.pdf

27.IAB. Digital Video Ad Serving Template (VAST) 4.0. URL (visited on Nov. 14th, 2016): www.iab.com/wp-content/uploads/2016/04/VAST4.0_Updated_April_2016.pdf

have our in browser client. Content producers that publish videos on the platform are responsible for the availability of their own files: they can either host the content themselves (literally by leaving their computer on and connected), or they can pay other nodes in the file sharing network for storing pieces of his content (these costs are relatively low - the storj.io site cites \$0,015 per Gb per month²⁸). If their content turns out to be popular, it will be replicated in the network automatically, and availability of the files will be handled by the network itself.

User experience for content uploaders will be seamless, in which the details and accounting of the file sharing network remain hidden under standardized parameters.

VII. Towards a Paratii DAO

This is an ambitious project that takes an optimistic view on the near future of decentralized economies and the development of the underlying technologies. Even if we are optimistic, though, there's a need to be realistic: in this section, we formulate a number of first steps on the road to make this vision a reality.

VII.a. Paratii Foundation and Seeds

This project was conceived under the patronage of Bossa Nova Group, a Brazilian film and entertainment production company, and most of its design decisions were made by a small team of individuals. To realize our vision, we intend to establish the Paratii Foundation, a nonprofit entity that is responsible for the development of the Paratii ecosystem and software, up to the moment when both are fully autonomous. Its functions include the management of daily financial operations and digital asset management; recruitment and hiring of personnel or external contractors; auditing; legal and taxation research and operation; fostering the growth of a development community; running bug bounty programs; promoting and marketing Paratii. More generally, the foundation advocates for transparency, disintermediation and the power to transform individuals through visual storytelling.

In the spirit of all we've conceived so far, this entity will be managed as transparently and openly as possible. The foundation resorts to voting as a decision making mechanism to resolve disputes and determine the use of funding resources, code-related decisions and other issues. Voting on any of these resembles the application of the Backfeed Protocol proposed in this paper to handle video ratings: early voting is encouraged, and reputation is at stake whenever a vote is cast.

The foundation's "Initiators" (together with Bossa Nova) are the four authors of this paper and Amyr Klink,

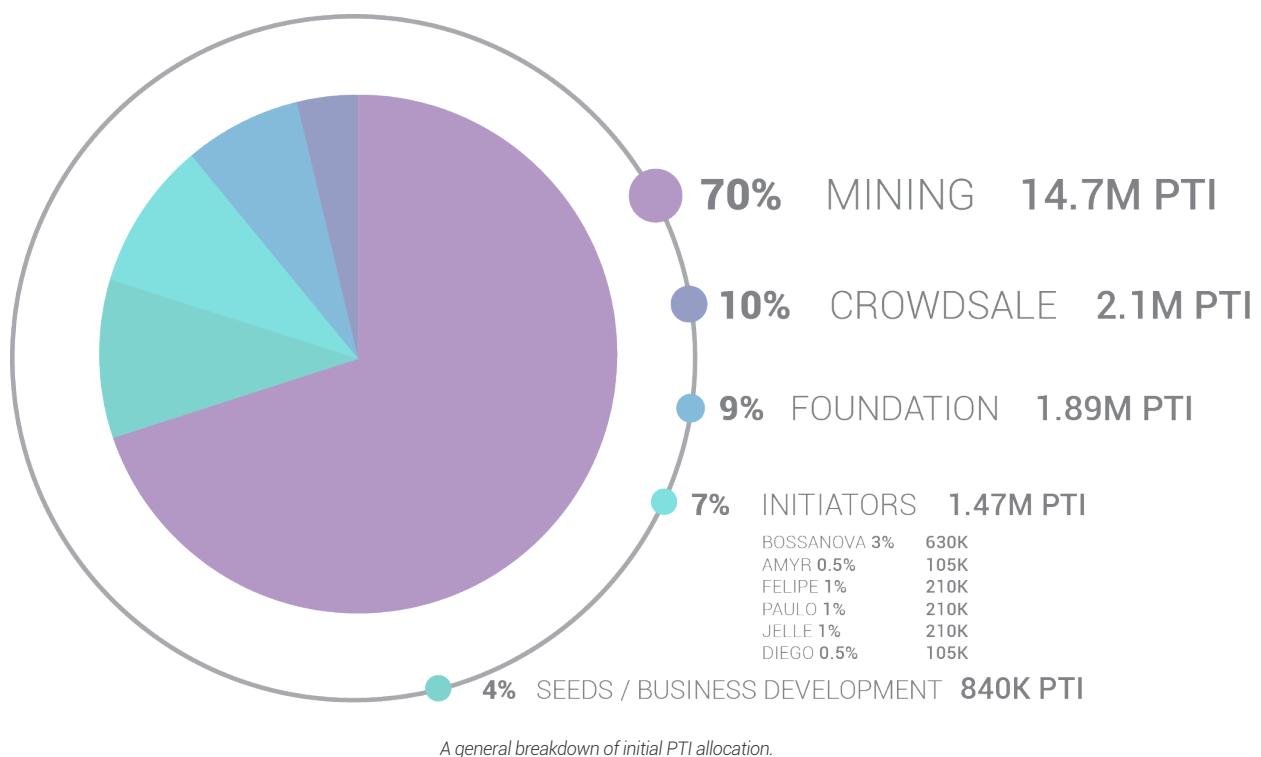
an intrepid human without whom this project would not have been possible, and whose spark of life set us in motion. These five individuals act also as the ecosystem's original "Seeds", and are assigned all the virtual reputation available on Paratii's decision process, in an egalitarian manner (20% each). The group of "Seeds" is expected to grow from five to fifteen by including inspiring producers, ambassadors and advisors, to whom a share of the reputation and of the coins will be assigned.

The foundation considers three major funding sources for the Paratii endeavor:

- **Angel Investment** - An initial quota provided by Bossa Nova Group due to the company's belief on Paratii's potential to reconfigure the digital video distribution landscape.
- **First Impressions Package (Seed Investment)** - Compliance issues are still a barrier for many companies interested in participating on blockchain related endeavors. Paratii's approach to facilitate the influx of investments is to presell media beaconed by KPIs the advertising industry is used to. Investors of this kind will literally buy the first ad impressions of the Paratii ecosystem, to be served after the third release in our roadmap, and the price tag for their investment quota will be calculated on basis of a low-cost CPM and projected audience. The uncertainty inherent to these type of projection means the delivery of the impressions pre-sold might be completed before or after expected. In practice, brands who buy a "First Impressions Package" will exchange fiat currency for pre-mined PTI, that on its turn will be handled by the foundation itself and applied to buy media at the appropriate moment, according to the preset specifications.
- **Crowdsale** - The foundation will raise money by selling PTI to the general public. Details of the PTI crowdsale are out of the scope of this paper.

Roughly, breakdown of initial token allocation is as illustrated by the chart below.

28. Storj. <https://storj.io/>



VII.b. Implementation

Paratii's general architecture follows a "hub and spoke" model. The hub at the center is the Paratii DAO, defining the basic economic rules and storing all the encrypted data. The DAO is surrounded by a number of specialised applications and services that function as access points to the DAO and as interfaces for the different types of users.

As the term "DAO" implies, the central component is decentralized and autonomous - it will be implemented as a series of smart contracts on the blockchain. As of writing, the most viable blockchain architecture to develop such a system upon is that of Ethereum. Ethereum provides an infrastructure through which connected nodes can not only transfer a cryptographic token (called Ether), but deploy smart contracts as well: pieces of unstoppable code that are run by the virtual machine formed by the collection of computers operating under the network's built-in incentives. The Ethereum³¹ development roadmap also includes an integrated incentivized P2P file sharing system called Swarm, which is currently in development and is a particularly suitable candidate for serving as the basic distribution framework of the Paratii DAO. The DAO consists of a number of sub-components:

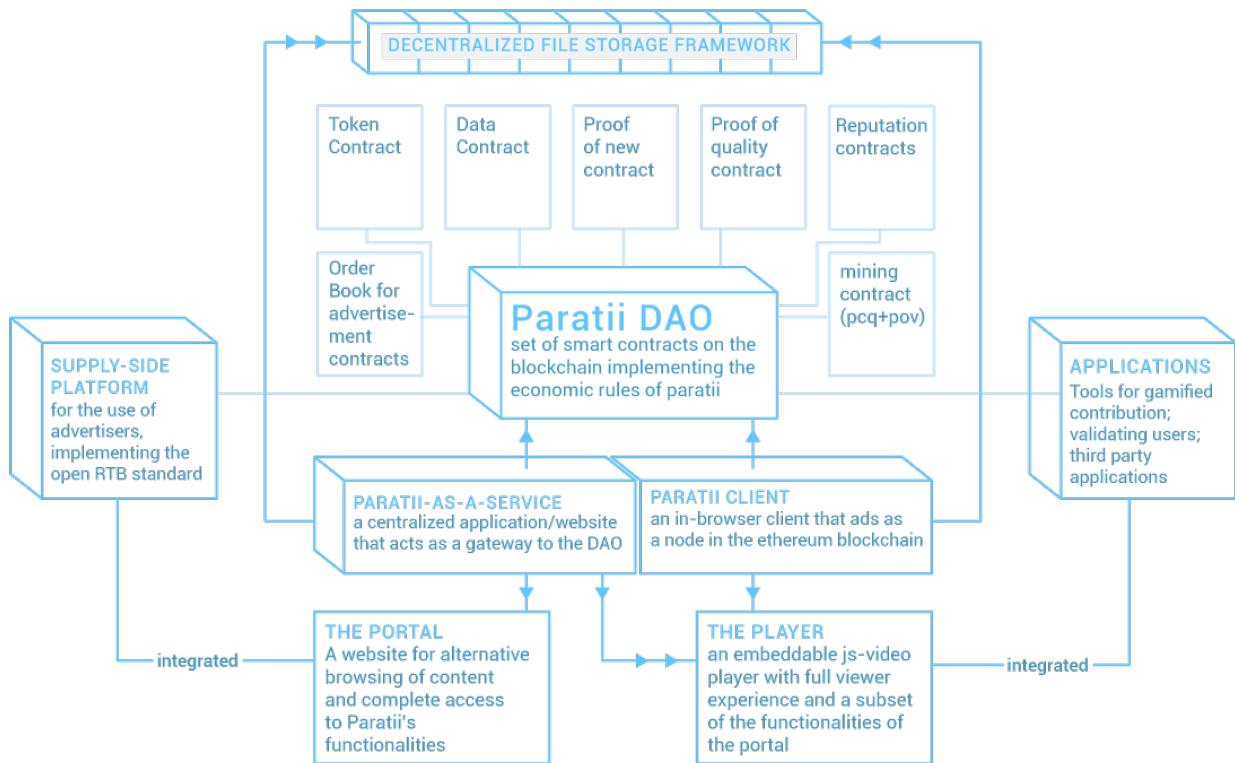
1. A Token contract that administers PTI, the user accounts, their respective balances, and that allows the mining contract to distribute a fixed number of PTI per day.
2. A data contract that stores information and

metadata about videos.

3. A mining contract that, based on information of the POQ Contract and POV Contract, distributes PTI to content producers and other contributors.
4. A reputation contract that manages the reputation of contributors and implements a version of the Backfeed protocol.
5. A Proof of Quality contract that records and manages votes from users with respect to the quality of the videos they rate or flag.
6. A Proof of View contract that records views of ads and videos, besides incentivizing crowdsourced ad hoc traffic data analysis in order to seek bot traffic and spot fake audience.
7. An order book for advertisements.

It is important to note here that the Ethereum blockchain is by no means mature enough to satisfy the kind of requirements on data storage and speed that are needed for Paratii's seamless functioning. Instead, we intend to start with an implementation of the DAO components that is mostly centralized. Subsequently, as the ecosystem as well our specifications become more mature, these components will be "ported" to the blockchain in the form of proper smart contracts.

Even if the Paratii DAO implements core functionalities, the ecosystem is not complete without a number of services that intermediate between the contracts on the blockchain and the users of Paratii. These services offer particular ways of interacting with the DAO - a casual viewer of videos will have a kind of activity that's hardly comparable to that of a broker for advertisements -, thus presenting very different requirements.



A high level overview of Paratii's main software components and contracts.

For consumers of content, the main entry points to the DAO are either the Embeddable Video Player or the Web Portal. The Web Portal is a web site that serves as an interface to play and discover content, shows information to (logged-in) users about their reputation and PTI, allows video makers to upload and register content, includes wallet functionality for users to manage their tokens, and allow users to vote on the quality of videos. The Video Player is an application written in JavaScript that is embeddable in third-party web sites, and offers a subset of the functionality of the portal. Both of these components connect via a local Ethereum node or in-browser light client with the DAO and the P2P file sharing network. Despite the apparent complexity, the mechanisms proposed require almost no extra UI in comparison to video players offered by centralized alternatives (rating, flagging and other subjective contributions already exist as social features on most platforms).

Content browsing will undergo a series of tests to determine exact architecture of a search system. It's important to note that even if bandwidth-intensive, search is a read-only operation that can be performed by client-side computation on the Ethereum blockchain alone. Since only transactions that write on the blockchain have a gas limit and cost Ether, some complex queries and caching logic can be handled by the machine where the Ethereum node is running, significantly improving user experience. The Embeddable Video Player is being designed to offer a browsing experience for average users and producers that's more pleasant, fluid and streamlined than navigating on a centralised platform - with the

advantage that you can go through it wherever that player is embedded on.

The Paratii-as-a-service is a centralized platform that serves as a gateway between the Paratii DAO and the user-facing client applications. It will implement a REST API that offers easy access to information about users and videos. To interact with the Paratii DAO, users must have an account, which leads to friction towards adoption of the platform. To help reduce this friction and to diffuse adoption of the platform, the gateway also offers access to the platform for unregistered users: it will handle all interactions with Swarm (or any other compatible P2P file sharing framework) and the Ethereum blockchain, pays the fees and collects rewards in place of the user, being actively sponsored by the Paratii foundation.

In addition to the Embeddable Video Player and Web Portal, which are the main ways for a video producer or consumer of content to interact with the DAO, other services will be implemented as well. In particular, the Paratii ecosystem includes a Supply Side Platform for advertisers: a gateway providing an API that implements the OpenRTB specifications and provides real-time information about the bid requests and the possibility to place bids.

VII.c. Road Map

We plan four main phases of development:

1. **Indigo Release (Minimal Viable Product)** - The MVP consists of rudimentary versions of various essential components of the core system, and offers first versions of the user-facing applications. Most of these functions will at this stage be implemented in a centralized way, although the Paratii token will be on the blockchain. This first release will serve mostly as proof of concept, and its scope is both to demonstrate the technical viability of the project as well as to serve as a first model for the user-facing application.
2. **Atlantic Release (Alpha Version)** - Informed by the experiences of the MVP, this is a first version that is made available to the general public. The focus in this release is to create a system that is economically viable - in other words, a system that serves content as well as advertisements to users, that offers value to advertisers and distributes that value to video makers. Bootstrapping is key - we want to reach out and that's why Paratii counts on the participation of early content providers with an already established audience on other platforms.

Technically, the Paratii framework at this stage is still only partially decentralized: many functions, such as the validation of views, or advertisement auctions,

will be implemented in a classical, centralized manner. However, since a functional P2P file sharing system is essential for the economic viability of the ecosystem, the client application will implement basic wallet functionality and act as a node in the chosen file sharing network. Reputation will be functional, and video uploading will be gradually made available, first to the most regarded registered producers. This release marks the launch of the Embeddable Video Player and of the Paratii-as-a-service gateway for anyone to experiment participating in the ecosystem.

3. **Antarctic Release (Beta Version)** - In this phase, most components of the Paratii DAO that need to function in a trustless and decentralized way will be migrated to a family of smart contracts on the Ethereum blockchain. A milestone here is the decentralization of governance regarding core improvements: with a well established system for reputation flow, major changes to the distribution scheme and other issues can be proposed and evaluated in a decentralized manner.
4. **Atlantis Release (Fully-fledged version)** - At the end, all core economic functions are managed by a true DAO - no single person or entity will be in control, or own, the Paratii DAO. Whenever advertisers are buying impressions seamlessly, video sharing is stable and there's a clear position towards security issues and fake traffic, Paratii is mature to move into this stage.

ROADMAP



VIII. Risks and Challenges

Perhaps the main risk to the success of the Paratii project is that, simply put, the technology it is based on may fail to deliver its promise. The Ethereum blockchain is already a sophisticated tool that handles hundreds of millions of dollars in assets, but as a world computer it is still expensive, slow, and not ready to handle large amounts of data or perform complex computations. These issues are being worked on by the Ethereum community - keywords are "proof of stake", "sharding" and "swarm" - but it is difficult to say with confidence when they will be market ready. Our implementation approach will be pragmatic: all technology that is not yet ready to be implemented on the blockchain will be developed using a classical centralized model, and then be ported to the Ethereum blockchain once the technology is mature enough.

The success of the project depends on the availability of an incentivized P2P file sharing system. As of writing, the Swarm component of Ethereum, which is the technology we are hoping to use, is in its early testing stage, and does not have a working incentives layer yet. We may, as an alternative, decide to use one another incentivized file sharing framework, such as IPFS and Filecoin²⁹, storj, siacoin³⁰ or maidsafe³¹.

Another risk concerns the Backfeed protocol, which has not been tested on large scale yet, and will need further research. This technology is not as essential as the distributed technologies mentioned above - if, for some reason, the Backfeed protocol is not suitable or workable, we can explore different reputation systems instead.

Privacy is another concern. It is inherent to the model we described in this paper that users are identified (in the sense that all users have an account associated with their Paratii), and that all views of videos are registered on the blockchain. This means that, even if users are pseudonymous, their viewing history is public. In centralized proprietary platforms, this kind of information is collected and either kept secret, or, if made available to third parties, presumably "anonymized" as much as possible. This practice offers if not a guarantee, at least some degree of assurance to the user that the data about his behavior remains private.

Keeping secrets on the blockchain is difficult, but not

impossible. ZCash³² is a Bitcoin-like payment system in which only "zero-knowledge-proofs"³³ of valid transactions are registered - the data about who owns how much are not available on the blockchain itself. Another interesting application in this sense comes from the hedge fund Numerai³⁴, which uses *homomorphic encryption*³⁵ to make proprietary financial data available to data scientists. The encryption preserves certain structural characteristics of the datasets, allowing algorithms to work on them even though not all of the raw data are available. If privacy turns out to be a serious issue, one could imagine a setup in which, for example, views and users will be registered, and users will get paid (or pay), but the connection between users and views is not registered as such.

Apart from the technological risks, there are also organizational risks. Creating and managing a complex and sophisticated organization as a DAO is something that simply has never been successfully done yet. The experience of the few precedents is mixed: while what's happened to "The DAO" (a decentralized investment fund on the Ethereum blockchain) was disappointing, to say the least³⁶, projects such as Bitcoin and Ethereum (which are, arguably, DAOs themselves) are examples where the model does work reasonably well. To mitigate this risk, we will develop Paratii incrementally way, starting with an implementation that is mostly centralized and decentralizing its components in a piecemeal way. The roadmap provides more details.

Finally, it is never enough to remember that just like everything else in the field of cryptocurrencies, Paratii is first and foremost an experiment. However, it also makes no harm to remind readers that, throughout human history, progress has always come from experiments.

29. IPFS. <https://ipfs.io>; Filecoin. <http://filecoin.io>

30. Sia. <https://sia.tech/>

31. Maidsafe. <https://maidsafe.net/>

32. ZCash. <http://zerocash-project.org/paper>

33. https://en.wikipedia.org/wiki/Non-interactive_zero-knowledge_proof

34. Numerai. <http://numer.ai/about>

35. CRAIB, Richard. Encrypted Data For Efficient Markets
<https://medium.com/numerai/encrypted-data-for-efficient-markets-fffbe9743ba8#.cdj18pmng>

36. JENTZSCH, Christoph. The History of The Dao and Lessons Learned. URL (visited on Nov 7th, 2016): www.blog.slock.it/the-history-of-the-dao-and-lessons-learned-d06740f8cfa5#ynh77sole

IX. Appendix

IX.a. Setting a Human Mining Rate

Each day, in addition to the revenue of the platform, a fixed amount of PTI gets distributed from the network to its participants. We will refer to the amount of PTI mined per day as the mining rate, and refer to n , the amount of PTI assigned to a view, as the difficulty: the lower the number n is, the more difficult it is to obtain PTI.

Our task is to assign to each view an amount n of PTI in such a way that the total amount that is distributed equals a given target N - say 5.000 PTI. Or, in other words, we need to set the difficulty in such a way that the mining rate is N .

This task is complicated because the market mechanisms we describe above depend on the fact that views are rewarded in real time. The view rate - that is, the amount of views in a given period - is inherently variable: for example, we expect less views at 5:00 AM than at 5:00 PM. Since we do not know in advance how many views there will be today, or how these views will be distributed in time, we need a way to reward a view that is occurring now without knowing now without knowing how many views there will be today. So, in contrast to the proof-of-work algorithms of "machine mining" used in Bitcoin and other systems, "human mining" is affected by exogenous factors, such as daytime cycles: people don't work 24/hours a day at the same pace as machines do.

The following formula gives a reasonable result if the view rates each day are similar, even if they may change within a single day:

5.000 divided by the number of views in the preceding 24 hours

This means that if the view rate (i.e. the amount of views in a 24 hour period) remains constant, the reward per view will be constant as well, and will be set in such a way that exactly 5.000 pti are mined in each 24-hour period. If the number of views goes up or down, the mining rate will adjust correspondingly - although with a delay of at most 24 hours. So, we constantly adjust the mining difficulty (i.e. the amount of pti reward for each view) on the basis of the mining rate of the past period. This approach is similar to the way that the Bitcoin difficulty is periodically adjusted towards the target of mining one block every 10 minutes. This approach is also fine when the number of views changes slowly - the mining rate will temporarily go over or below the target, but will re-adjust in a 24-hour period when the view rate stabilizes again.

However, for large and fast changes or spikes in the view rate, we need to safeguard formula (1). One risk is when the view rate goes up quickly (for example because of an attack, or because a video becomes suddenly very popular). It takes

some time for the difficulty to adjust, and this may lead to an amount of PTI to be distributed that is way higher than the target value. To protect against distributing too many coins when the view rate suddenly goes up, we need to add an extra mechanism to make sure that the difficulty is adjusted more quickly than as prescribed by (1).

To do this correctly, we need to be able to recognize when the view rate changes too fast - we need to distinguish between the normal case in which we the platform may be distributing 500 tokens in one hour because it is 3 PM when it is always busy, and the case where the platform distributes 500 tokens per hour at 3 AM, when usually only 10 tokens are distributed. The first case is just business as usual, and no reason to change the difficulty, the second case is a potential problem, because if the view rate indeed has gone up 50-fold, we will overshoot the target mining rate.

To distinguish natural changes in the view rate that are the result of human rhythms from changes that are anomalous, we can use the historical data of the platform itself. Given data about view rates and changes in view rate of the previous period, we can make a prediction about what the expected view rate is for the current time and day of the week. If the observed view rate is off by a statistically significant amount from these expectations, we aggressively adjust the mining rate to take this change into account. Such a rule could have the following form: if the 500 coins (i.e. 10% of the daily target) that are mined previously are mined at a rate of more than one standard deviation higher than the predicted mining rate, then the difficulty is adjusted with a factor up to 4; while if in the last period of 2 hours and 24 minutes (i.e. 10% of a day) the mining rate is significantly slower than the predicted mining rate, the difficulty is lowered with a factor up to $\frac{1}{4}$.

IX.b. Content Uploader Interface to Access Market for Attention

On next page, we propose an interface for content uploader to choose if they want to share revenue with their viewers (reward their attention), charge an additional price for that video, or simply follow a standard AVOD model.



Upload

Choose your Video

Your video format needs to be H264 MOV or MP4. Be aware of content property restrictions regarding your video. We also urge you read [Swarm - Terms and Conditions for Decentralized File Storage](#).

Video Information

Rendering Status 21% 



Upload :: Choose your Business Model

Standard Model Free Content with 30 Seg Pre-Roll Advertising ? RPM PTI\$185.75 ?

What words represent your video: ? Companies you don't want as advertisers: ?

Manual Adjustment Model Do you want to charge for your video or share what it earns? ?

24.80PTI 10.80PTI 6.80PTI 1.78PTI 5% 25% 50% 100%

10.80PTI is the price your audience will pay to watch your video.

Rendering Status 21%  ?



Upload :: Choose your Business Model

Standard Model Free Content with 30 Seg Pre-Roll Advertising ? RPM PTI\$185.75

What words represent your video: ? Companies you don't want as advertisers: ?

Manual Adjustment Model Do you want to charge for your video or share what it earns? ?

24.80PTI 10.80PTI 6.80PTI 1.78PTI STANDARD 5% 25% 50% 100%

10.80PTI is the price your audience will pay to watch your video.

Rendering Status 21%  ?

