



Rare Art Registry and Exchange
["R.A.R.E."]

R.A.R.E. Protocol

Enabling Monetization for Digital Content Creators

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ABSTRACT

Art is humanity's seminal achievement, the pinnacle of what we're capable of as a species. Art adds beauty and joy to our lives and has been a powerful cultural force for millennia. Artists, however, suffer from a universal problem: they capture only a small fraction of the aggregate value they create. This is a global problem affecting creators of every art form – poetry, prose, images, music, video, etc. This has broad and underappreciated effects on all humankind. It detracts from the livelihood and profit incentive of every potential artist, which dampens aggregate artistic creation.

Art has value for two reasons: because it is beautiful or meaningful to its audience (strong demand) and because it is scarce (limited supply). Artists make the most money from their art when the creations cannot be replicated and when Artists distribute directly to their audience.

Physical art like sculptures and paintings are perfectly scarce, as they are painstakingly created individually by an Artist. However, physical art is also difficult and expensive to create and distribute. Physical artists sell a creation only once and Consumers capture the value appreciation as an Artist's popularity grows.

The rise of recorded media created radically new dynamics for artists. Pop culture was created and the world saw an explosion in the overall audience demand for recorded artistic content. However, recorded media could now be replicated and redistributed more easily than physical art, reducing scarcity value. The result was a massive net increase in the overall value of art, but with minimal participation by Artists in the value creation. Middlemen (e.g. music labels; record studios) and distribution channels (e.g. radio stations; movie theatres) took a much greater share of value out of the market.

The internet had the potential to shrink the role of middlemen with direct, inexpensive distribution to Consumers. Instead, the replication and redistribution problem of digital files eliminated scarcity and Artists had to turn to new middlemen (e.g. YouTube; Spotify; Facebook) to monetize.

Artists need the ability to create scarce works of art to be sold directly to fans and collectors with minimal distribution costs or middlemen. The R.A.R.E Art Registry and Exchange (“R.A.R.E”) Protocol makes this a reality and finally allows artistic creators to capture their fair share of the value they create. The R.A.R.E Protocol uses cryptographic access keys, a network-enabling token called the R.A.R.Etoken, and the public and decentralized Ethereum blockchain ledger to govern digital art’s ownership and access.

This work:

- a) Introduces the R.A.R.E Protocol, the network of actors, and the necessity of the R.A.R.Etoken
- b) Details the contact and market structure for Persistent Keys and Perishable Keys, which grant ownership rights and access rights, respectively
- c) Reviews expected use cases for the R.A.R.E Protocol and a rationale for increasing utility
- d) Describes the role of R.A.R.E Art Labs and its incentive to grow the network

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INTRODUCTION

Purpose of the R.A.R.E Protocol

The purpose of the R.A.R.E Protocol is to increase the amount of value artists capture from their digital art and to increase the aggregate artistic output of humankind.

Definition of Problem

Since the beginning of history, humans have used art to communicate and to reflect on existence. Life influences art and art influences life. Every day humans sing songs to themselves, watch films with friends, and recite poetry to loved ones. Art is our medium of emotional expression and preservation of ideas.

For most of history, art was naturally scarce. Performances of music and theater could be experienced once. Sculptures of antiquity and Old Master paintings exist in scarce quantities, and the tragedies of time further deplete the number of surviving works. Given the cultural importance and inherent scarcity of physical art, it's no wonder why the value of the corpus is priceless and why \$45 billion worth of art is purchased in a given year¹.

The scarcity of art began to change in the 19th century with advances in photography and phonography. Through mechanical recording processes, musical performances, images, and motion pictures could now be stored on physical media and distributed for future consumption. The 20th century brought advances in electrical and digital recording, each reducing the cost of duplication to the advantage of distribution.

Then the internet completely disrupted the distribution of digital data. The peer-to-peer nature of the internet should have enabled creators of artistic content (“Artists”) to

¹ The European Fine Art Foundation. TEFAF Art Market Report 2017. 2017.

remove middlemen such as record labels and music studios from their distribution channels, but it did not. In fact, peer-to-peer file sharing services and protocols, like Napster and BitTorrent, allowed content consumers (“Consumers”) to circumvent Artists all together. The duplicative nature of digital art made in incredibly susceptible to unlicensed peer-to-peer distribution, and even today 90% of musical content is consumed without a license in China².

To combat piracy, Artists turned to centralized digital distribution networks. These enterprising networks come in many forms such as: iTunes and Spotify for music, YouTube for video, and Instagram for images. They all have powerful network effects – adding a new network participant increases value to existing participants – which create a gravitational force for growth. As distributors gain market power, they capture more economic value and Artists less. Spotify exemplifies this behavior. The company cut its payout rate to Artists over the last year and will continue to cut the payout rate while the firm’s revenue continues to increase³. Perhaps more concerning is Artists’ dependence on these few, centralized channels. YouTube video creators, for example, are subject to “demonetization” of their work at any time. This means a creator’s livelihood can be turned off at any time for any reason by YouTube⁴.

The end result has been the total failure of the internet to empower a better revenue stream for Artists. Further, compensation has shifted from passive income to “live” experiences, and both phenomena economically injured Artists.

² IFPI. Global Music Report 2017: Annual State of the Industry.

³ “Exclusive Report: Spotify Artist Payments Are Declining In 2017, Data Shows”. Digital Music News. <https://www.digitalmusicnews.com/2017/05/16/spotify-audiam-low-rates/>. Retrieved 3 Aug 2017.

⁴ “YouTube Wants Content Creators To Appeal Demonetization, But It's Not Always That Easy.” Forbes. <https://www.forbes.com/sites/erikkain/2017/09/18/adpocalypse-2017-heres-what-you-need-to-know-about-youtubes-demonetization-troubles/#32af017e6c26>. 18 Sept 2017.

Artists' compensation mix consistently moves toward events, productions, and experiences. In the context of scarcity, this makes complete sense. The Artist can still sell a one-time experience. However, the economics are deceptively worse. Gone are the days of royalties and passive income, which allow Artists to live comfortably far beyond their creative years. The market has moved to earned income, which only lasts so long as the Artist can continue to perform her art.

Scarcity is the underlying problem, and a blockchain provides the native solution. The R.A.R.E Protocol will solve the scarcity problem, increase Artist profitability, and encourage global artistic creation.

Protocol Solution

Blockchains are the ultimate solution to enforce ownership and access to digital art. The R.A.R.E protocol is a blockchain-based protocol for digital art which solves the major pain points Artists experience with monetization today. The R.A.R.E protocol's use of the blockchain can enforce art's scarcity on a publicly-verifiable, immutable ledger. It also eliminates fraud and ensures incentives to all network participants for good behavior.

The R.A.R.E Protocol has three tokenized keys. "Persistent Keys" (K_p) are ownership rights for an artistic creation and "Perishable Keys" (K_x) are access rights for a creation. R.A.R.Etoken (ρ) is a protocol access key. Consumers own R.A.R.Etoken to purchase art from Artists, and Artists earn compensation in R.A.R.Etoken as they sell scarce Keys to their creations. Artists auction off their Keys, first with an Initial Public Auction and later with follow-on auctions, and earn R.A.R.Etokens over time.

Artists partner with an Auctioneer to sell Persistent or Perishable Keys to their creations. Auctioneers are responsible for "Tokenizing" an artistic creation: creating the Key on the

blockchain and burning the required ether (ETH) gas⁵ to create the Key. Auctioneers then help the Artist sell all of her Keys for as long as there are Keys to sell.

Consumers buy Keys for many reasons, just as they enjoy art in many forms. Keys allow Artists to sell collectibles, assets for video games, tickets to events, limited-run content, and much more. Consumers can trade Keys directly or into liquid secondary markets through Exchanges. The R.A.R.E Protocol provides significantly more liquidity than today's solutions, and thereby grows the market.

Persistent Keys can be traded forever, and represent ownership of an artistic asset. On the other hand, Perishable Keys are redeemed for access to an artistic creation. The Consumer must pay an "Access Commission" in R.A.R.E.token as well, and this fee is collected by the Auctioneer to be split with the Artist.

All three tokenized keys are ERC20 tokens recorded on the Ethereum blockchain. We envision a future network and economy built around the cryptographic tokens, and R.A.R.E Protocol Labs ("The Lab") will make this a reality. A small value is extracted from primary market sales of Keys and is used to maintain the protocol and grow the ecosystem.

The R.A.R.E Protocol creates more value for digital art, allows artists to capture greater margin on their value creation, and increases aggregate artistic output of mankind through profit incentive.

Network of Protocol Actors

⁵ <https://ethereum.org/ether>

There are 4 primary protocol actors in the R.A.R.E Protocol. Artists, Auctioneers, Consumers, and Exchanges all play separate roles, but all stand to gain from network growth.

Artists create the works of art that Consumers enjoy, and the innate value of the network. When they decide to sell ownership or access rights on the R.A.R.E Protocol, they enlist the help of an Auctioneer. Artists and Auctioneers have a close relationship that lasts until the Artist sells all of the Keys created. Sale proceeds are always collected by the Auctioneer, who has a contractual relationship with the Artist to define how the proceeds are split.

Auctioneers prepare artistic creations to be sold in public markets. They compete for the business of Artists, and earn seller's commissions for taking the financial risk of tokenization, promoting the auctions, and managing sale proceeds. Auctioneers are the gateways to the protocol and abstract technical implementation away from Artists. They are enterprising businesses that will compete on security, trustworthiness, and ability to maximize sale proceeds. An Auctioneer's relationship with an artist ends once an Artist sells all Persistent Keys or once Consumers redeem all Perishable Keys for access.

Consumers submit bids for Keys in the auctions hosted by Auctioneers. They are fans, collectors, speculators, and other members of the public. In an auction, they submit their bids to the Key contract by indicating how many Keys they are bidding on and at what effective price. At the auction end date, the Key contract automatically distributes Keys and R.A.R.Etoken reimbursements to the bidding Consumers.

Exchanges facilitate secondary market trading of Keys and R.A.R.Etoken. They create liquidity for Keys and charge Consumers to trade on their platforms. Many token exchanges today compete for the business of Consumers on the grounds of security,

liquidity, and best execution. Many Exchanges will immediately support the R.A.R.Etoken and Keys because they conform to ERC20 standards.

Keys

When an Artist decides to sell rights to her creation through the R.A.R.E Protocol, she must first select an Auctioneer to Tokenize the creation and prepare it for auction. With the Auctioneer's consult, the Artist must decide a number of required variables at Tokenization: Persistent (K_p) or Perishable (K_λ); the total quantity of Keys (Q_K); the quantity of Keys to sell in the Initial Public Auction (Q_A); and the Initial Public Auction ending datetime (τ_ω). The Artist must also assign the properties of the underlying artistic "Asset" that the keys represent: an IPFS hash representing the underlying art, a name, and an optional reference address to another smart contract on the Ethereum blockchain. The Auctioneer establishes a wallet, programs these variables into the smart contract while burning the necessary Ether (ETH), and then manages future R.A.R.Etoken inflows and outflows to the Artist.

Persistent Keys are permanent ownership rights to an artistic creation. Ownership dictated by the blockchain has many advantages to today's solutions for tracking art ownership. A decentralized, public ledger improves transparency and auditability. To prevent theft, the physical art market has even moved toward online ownership registries such as those maintained by Interpol, the FBI, and the Art Loss Register⁶. Additionally, the blockchain establishes scarcity of Persistent Keys and increases value by preventing duplication or Artist revisionism. The section of this white paper titled "Network Use Cases" discusses probable uses of Persistent Keys, such as for collectibles, assets in video games (e.g. *Magic: The Gathering; World of Warcraft*), tickets to performances, and conceptual art.

⁶ Center for Art Law. <https://itsartlaw.com/2015/04/23/competing-or-complementing-art-loss-databases-proliferate/>. 23 Sept 2017.

Perishable Keys are one-time access rights to an artistic creation. Their primary difference to Persistent Keys is that they are redeemed for a watermarked version of the creation file. When a Consumer holding a Perishable Key decides to “Turn” the Key and access the underlying content, she must also pay an access commission. The Consumer submits the Perishable Key and access commission (in R.A.R.Etoken) to the smart contract, and the smart contract then distributes the access commission to the Auctioneer with a memo indicating the Key-Turning wallet address. The Auctioneer may then display a watermarked version of the creation file to the Consumer that can prove access to the aforementioned wallet address. We believe Perishable Keys will have strong initial utility and grow into a global digital rights management (“DRM”) solution for mass market content.

Primary & Secondary Markets for Keys

Consumers purchase Keys from Artists in auctions – the primary market – and from other Consumers – the secondary market. All primary market purchases transact in R.A.R.Etoken, and this is enforced by the Keys’ smart contracts. Consumers must hold R.A.R.Etoken to buy and consume art, and Artists are compensated in R.A.R.Etoken over the long-tail of follow-on auctions and access commissions. Exchanges provide secondary market liquidity for owners of R.A.R.Etoken and Keys. Generally, all R.A.R.E Protocol actors benefit in environments of rising prices for the 3 tokenized keys.

The primary market for Keys consists of an Initial Public Auction (“IPA”) and follow-on auctions. The market begins when an Artist selects an Auctioneer to Tokenize her creation and lead all primary market logistics. The Artist and Auctioneer must define all variables relating to the Key and IPA structure at this time. For Perishable Keys, IPFS links for all watermarked versions of the creation file are established, hashed, and then encrypted with

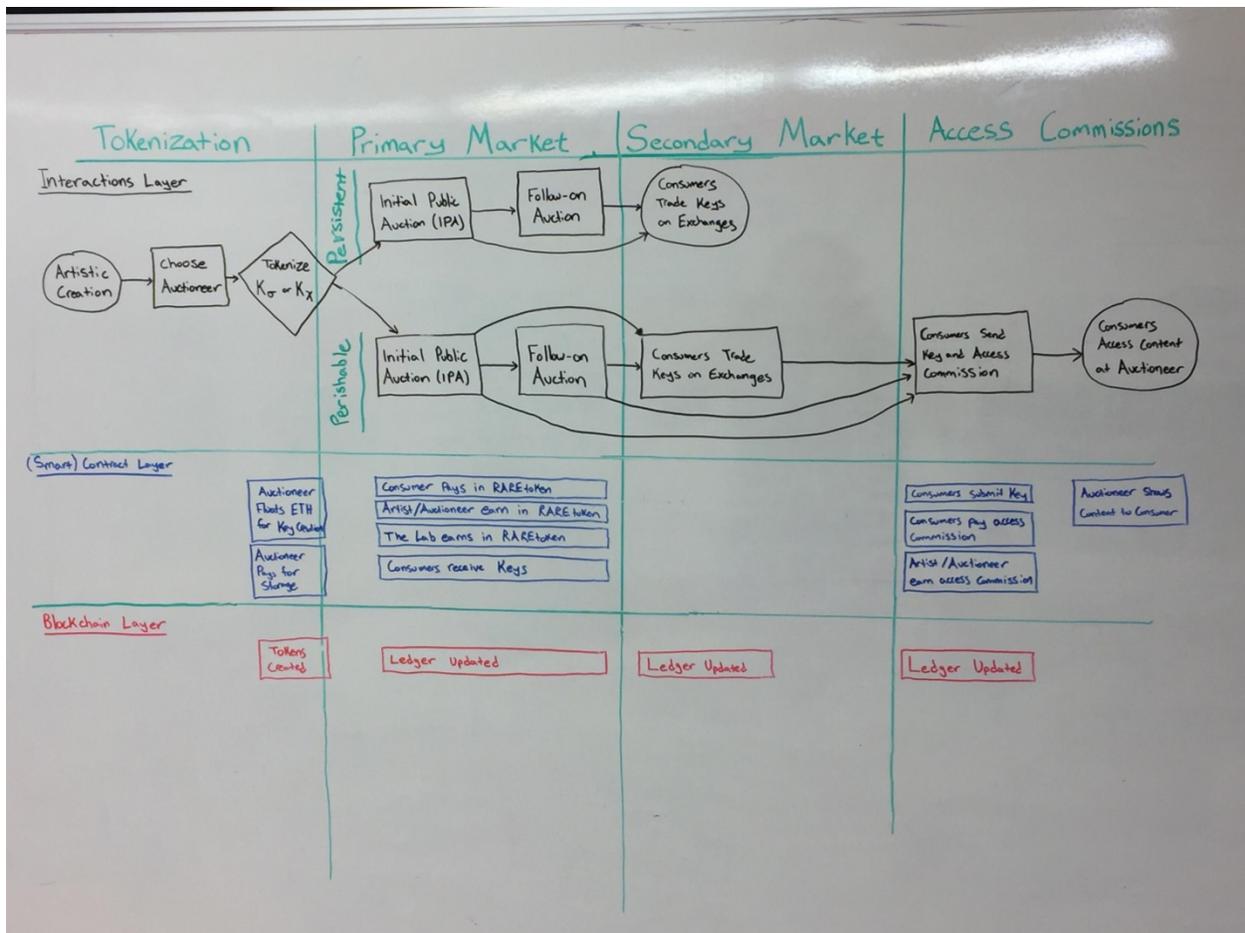
a private key unique to this Perishable Key. After the creation is Tokenized, the IPA may begin.

Throughout the IPA, Consumers send bids (β) denominated in R.A.R.Etoken to the Key's smart contract address and indicate the quantity of Keys bid (β_Q). The smart contract can then derive how many Keys the Consumer's wallet desires, and at what maximum per Key price (β_P). The Consumer's β_Q is locked, but she may send more R.A.R.Etoken to the contract address in order to increase β_P before the auction ends. At the auction's ending datetime (τ_ω), the smart contract automatically distributes Keys, R.A.R.Etoken reimbursements, and "Rake" proceeds (ρ_ψ) to The Lab.

The Artist does not have to sell all Keys in the IPA, and may choose to reserve some for follow-on auctions. Follow-on auctions operate similarly to IPAs and can only be initiated by the sending wallet that created the Key and hosted the IPA. Follow-on auctions allow Artists to benefit from rising Key prices, and offers an incentive for them to grow the ecosystem.

A number of Exchanges will allow Consumer-to-Consumer trading of Keys, just as they exist for many ERC20 tokens today. Importantly, Persistent Keys will be tradeable in the secondary market indefinitely, while Perishable Keys are sent back to the smart contract in exchange for access to the creation. Perishable Keys will be tradeable until they are Turned. The liquidity brought by the secondary market increases the value of all Keys and brings more players, such as speculators, to the market.

Protocol Diagram



SMART CONTRACTS: R.A.R.E.TOKEN AND TOKENIZATION

The R.A.R.E Protocol revolves around three types of ERC20 tokens on the Ethereum blockchain: R.A.R.E.token (ρ), Persistent Keys (K_p), and Perishable Keys (K_x). This section describes the purpose of the R.A.R.E.token and the contract structure for tokenized Keys.

The R.A.R.E.token serves as the primary medium of exchange in the R.A.R.E Protocol. The smart contracts that auction Keys only accept R.A.R.E.token. The contracts then distribute proceeds to the Artists and Auctioneers, both immediately in the IPA and then over the long-tail of follow-on auctions and access commissions. Artists, Auctioneers,

and Consumer token-holders all have long exposure to the R.A.R.Etoken and can increase its value by increasing utility.

The R.A.R.Etoken is a perpetual access license to use the protocol. Given the immutability of blockchain-based smart contracts, Consumers have a guarantee that the R.A.R.Etoken has fixed scarcity and that its purchase offers perpetual utility for buying Keys. The price of 1ρ , denominated in any fiat currency such as the US Dollar, will fluctuate. This characteristic is common for access to server-based cloud computing resources today. For example, Amazon Web Services allows users to bid on Spot Instances of unused Amazon EC2 capacity, the price of which fluctuates on the balance of supply and demand⁷. The Lab seeks to both sell and auction R.A.R.Etoken to Consumers at the onset of the R.A.R.E Protocol, a process colloquially referred to as an “ICO”.

After the Artist has created an artwork and chosen an Auctioneer, the Auctioneer controls the process of Tokenization. The Auctioneer must send a number of variables to one of the two smart contracts that creates either a set of Persistent Keys or Perishable Keys. The parameters are detailed below and referenced throughout this white paper:

⁷ “An Introduction to Spot Instances.” Amazon Web Services, Inc. White paper. 26 May 2011.

Symbol	Description	Shape	Necessity
Q_K	Total number of keys	Natural number	Required
	$0 < Q_K$		
Q_A	Number of keys to sell in IPA	Natural number	Required
	$0 < Q_A \leq Q_K$		
τ_a	Auction beginning datetime	UTC datetime	Optional
	$now() < \tau_a$		
τ_ω	Auction ending datetime	UTC datetime	Required
	$max(now(), \tau_a) + 24h \leq \tau_\omega$		
P_R	Seller's per-Key reserve price (ρ)	Real number	Optional
	$0 < P_R$		
C_χ	Access commission rate	Real number	Required (for K_χ only)
	$0 < C_\chi < 1$		

When the Auctioneer sends the above variables to the smart contract, a set of Keys are created within the contract. The IPA begins at the datetime τ_a , or if the variable is not passed, then immediately. Consumers can begin to send their bids (β) to the Key's contract address until the auction ending datetime (τ_ω). When the IPA concludes, the contract runs the auction logic described in the following section and then distributes Keys, reimburses β , distributes ρ to the Auctioneer, and sends Rake proceeds (ρ_ψ) to The Lab.

After a Consumer wins Keys in an auction, her paths differ depending on whether the Keys are Persistent or Perishable. Persistent Keys have no terminal state – they may be traded in secondary markets for as long Consumers desire. The value of Persistent Keys is generally created from an application layer built on top of the R.A.R.E Protocol. Private enterprises will build hybrid systems of proprietary application layers with partially decentralized data layers, using Persistent Keys for user-tradeable assets.

Perishable Keys are only tradeable until the time they are redeemed at the smart contract for access to the creation. In order to obtain access, the Consumer must send the Perishable Key and access commission to the smart contract. The access commission rate was set at Tokenization, and it is applied to the threshold price achieved in that Key’s auction. The commission is distributed to the Auctioneer with a memo indicating the Key-Turning wallet address. The Auctioneer can then grant one-time access to the creation file, watermarked, to the Consumer that proves ownership of the permissioned wallet. The access commission helps compensate the Auctioneer for the long-tail expenses of file retrieval (from a decentralized storage network perhaps), watermark processing, and maintenance of operational infrastructure.

PRIMARY MARKET AUCTIONS

The primary market consists of Initial Public Auctions (IPAs) and follow-on auctions, whereby Artists and Auctioneers pair to sell Keys directly to Consumers.

The previous section defined the process of Tokenization, at which point the IPA parameters are defined. Upon datetime τ_α , Consumers may begin to send bids (β) in R.A.R.Etoken to the smart contract. They also have the ability to bid for multiple Keys at the same time by including a memo in their ρ transfer indicating the quantity of Keys (β_Q) for which this bid applies. If β_Q is not passed, or if the memo is not decipherable into a natural number, then a default of $\beta_Q = 1$ is applied. See a definition of the bidding parameters below:

Symbol	Description	Shape	Necessity
β	Bid, denominated in RAREtoken	Real number	Required
β_Q	Quantity of Keys bid	Natural number	Optional
<i>$1 < \beta_Q \leq Q_A$; non-conforming or null values receive $\beta_Q = 1$</i>			

The bidding variables passed above allow the smart contract to derive an important variable for each bidding wallet, which is the effective per-Key bid price shown below:

Symbol	Description	Derivation
β_P	Effective per-Key bid price	$= \rho / \beta_Q$

The effective per-Key bid price (β_P) will determine which wallets become winning bidders and which losers. Consumers also have the ability to increase β_P during the auction by sending more ρ to the smart contract. The variable β_Q is set after a wallet's first bid, and so any incremental ρ sent to the smart contract lifts that wallet's β_P by the increment $= \rho / \beta_Q$.

Both IPAs and follow-on auctions share the same bidding scheme and auction logic for distributions at auction end. Follow-ons can only be initiated by the Auctioneer's sending wallet, which was used to Tokenize and create the set of Keys. The follow-on parameters are as follows:

Symbol	Description	Shape	Necessity
Q_A	Number of keys to sell in auction	Natural number	Required
$0 < Q_A \leq \text{Quantity of keys held in abeyance in the smart contract}$			
τ_α	Auction beginning datetime	UTC datetime	Optional
$\text{now}() < \tau_\alpha$			
τ_ω	Auction ending datetime	UTC datetime	Required
$\max(\text{now}(), \tau_\alpha) + 24h \leq \tau_\omega$			
P_R	Seller's per-Key reserve price (ρ)	Real number	Optional
$0 < P_R$			

For both IPAs and follow-on auctions, the smart contract automatically disburses tokens at the auction ending datetime. The contract logic is transparent and programmatic, enforcing meritorious behavior by all protocol actors. The auction logic is described below:

1	<i>If $(\text{sum}(\beta_Q) < Q_A)$, then:</i>
2	<i>All bids returned to their sending wallet addresses;</i>
3	<i>Else:</i>
4	<i>Group all ρ by sending wallet address, creating bids (β);</i>
5	<i>Create array $[\beta]$, sorted by descending β_P, then sorted by descending β_Q;</i>
6	<i>Set Fulcrum Bid (β_ϕ) as the first β where $\text{sum}(\beta_Q) \geq Q_A$;</i>
7	<i>Set Threshold Price (P_θ) as the β_P for β_ϕ;</i>
8	<i>If $P_\theta < P_R$, then:</i>
9	<i>All bids returned to their sending wallet addresses;</i>
10	<i>Else:</i>
11	<i>Save bids above β_ϕ to Winning Bids array $[\beta_W]$, those below to Losing Bids array $[\beta_L]$;</i>
12	<i>Set gross auction proceeds $(\rho_A) = P_\theta * Q_A$;</i>
13	<i>Begin calculation of Rake with : $a = 0$; $b = 0$; $c = 0$;</i>
14	<i>If $\rho_A > 1,000$, then:</i>
15	<i>$a = \rho_A - 1,000$; $b = 900$; $c = 100$;</i>
16	<i>Else if $\rho_A > 100$, then:</i>
17	<i>$b = \rho_A - 100$; $c = 100$;</i>
18	<i>Else:</i>
19	<i>$c = \rho_A$;</i>
20	<i>Set Rake proceeds $(\rho_\Psi) = a * 0.49\% + b * 0.69\% + c * 0.89\%$;</i>
21	<i>Set Rake rate $(\Psi) = \rho_\Psi / \rho_A$;</i>
22	<i>Send $[\beta_W]$ each a quantity of Keys $= \beta_Q$;</i>
23	<i>Send $[\beta_W]$ each ρ reimbursement $= \beta_Q * (\beta_P - P_\theta)$;</i>
24	<i>Send $[\beta_L]$ each ρ reimbursement $= \beta$;</i>
25	<i>Send β_ϕ a quantity of Keys $(Q_\phi) = Q_A - \text{sum}([\beta_W].\beta_Q)$;</i>
26	<i>Send β_ϕ a ρ reimbursement $= \beta_\phi - (Q_\phi * P_\theta)$;</i>
27	<i>Send The Lab ρ_Ψ</i>
28	<i>Send Auctioneer net auction proceeds $= \rho_A * (1 - \Psi)$;</i>
29	<i>Keys not sold in auction are held in abeyance in the contract (Q_U);</i>

The auction logic detailed above derives a number of variables referenced throughout this white paper. These derived variables are listed here:

Symbol	Description	Derivation
β_ϕ	Fulcrum bid	<i>Descending $[\beta]$, first β where $sum(\beta_Q) \geq Q_A$</i>
P_θ	Threshold price	$= \beta_\phi \cdot \beta_P$
ρ_A	Gross auction proceeds	$= P_\theta * Q_A$
ρ_ψ	Rake proceeds	<i>See auction logic</i>
Ψ	Rake rate	$= \rho_\psi / \rho_A$
Q_ϕ	Quantity of Keys to fulcrum bidder	$= Q_A - sum([\beta_w] \cdot \beta_Q)$
Q_U	Quantity of Keys left unsold in contract	$= Q_K - sum(Q_A)$

The smart contracts of the R.A.R.E Protocol control most interactions between protocol actors, but do not intermediate the relationship between Artists and Auctioneers. This is purposeful. Auctioneers are designed as protocol gatekeepers to abstract the technical and financial costs of Key creation from Artists. This allows Artists to focus on their craft, but does not preclude enterprising artists from establishing their own Auctioneers.

We view the end state of the Auctioneer market to be perfectly competitive, where Auctioneers compete for Artists' business on the grounds of trust, security, and auction proceeds maximization. The Auctioneers are entrusted with distributing auction proceeds from their wallets to those of Artists, and behavior can be audited on the public ledger. Only trustworthy Auctioneers will survive.

Agreements between Auctioneers and Artists will be beyond the protocol's control initially, but we envision a market similar to investment banks vying for equity underwriting business. Auctioneers must front the Ether (ETH) burn to create the set of Keys on the Ethereum ledger, must maintain an operational system for collection of

future access commissions, and will likely provide consult and promotion to the Artist. For compensation, Auctioneers will likely ask for a percentage of all primary market proceeds and access commissions. This compensation structure aligns incentives and encourages Auctioneers to screen low-value Artists.

Growth in the primary market is critical for the R.A.R.E Protocol's success. Artists and Auctioneers earn the bulk of their compensation in this market, and The Lab exacts its only value from this market. All parties are incented to grow the primary market, and the initial bulk sale of R.A.R.Etoken to Consumers should bootstrap Consumer demand for Keys.

ACCESS COMMISSIONS FOR PERISHABLE KEYS

Perishable Keys grant Consumers one-time access to the creation, and Consumers redeem this right through possession of a Perishable Key and payment of an access commission. A protocol solution for art consumption must improve upon the current state of duplication and redistribution of artistic creations. The R.A.R.E Protocol solution introduces wallet-based authentication and watermarking within an advantageous monetization framework for Artists and speculating Consumers.

At Tokenization, the Artist and Auctioneer must decide on the access commission rate (C_χ) for a set of Perishable Keys. This commission is expressed as a percentage (with the constraint $0 < C_\chi < 1$) and it is applied to the threshold price (P_θ) of any given auction. Though the rate stays constant for a set of Perishable Keys, the commission in absolute ρ will vary depending on P_θ of the auction in which a given Key was sold. An access commission is always required, because it transmits identifying information on the Key-Turning wallet.

When a Consumer Turns a Perishable Key, she sends the Key and the access commission to the smart contract. The smart contract immediately routes C_x to the Auctioneer with a memo containing the wallet address of the Key-Turning Consumer. The Auctioneer now knows to permission access to any Consumer who can prove ownership of the wallet. We envision an authentication system in the R.A.R.E ecosystem similar to how internet companies (e.g. Facebook, Google, Twitter, LinkedIn) today use OAuth to share user data to third-party apps with permission from Consumers. An Auctioneer who maintains an internal database of permissioned wallet addresses can then allow access to the user who logs in with her Ethereum wallet.

This system also allows Auctioneers to display the creation to the Consumer with a watermark that identifies the Consumer's wallet address. Watermark implementation will be at the discretion of the Auctioneer, but Artists will choose to do business only with Auctioneers who uphold robust implementations. We envision different implementations for different file types and expect an efficient, capitalistic market among Auctioneers to drive innovation.

Access commissions have a number of benefits to the protocol. Primarily, a wallet-based authentication and watermarking system can provide a global standard for DRM of digital artistic content. Piracy requires significantly more labor when Consumers do not possess the creation file and are only displayed self-identifying copies. Outside of court systems and at the behest of Artists, Auctioneers may enforce meritorious Consumer behavior by maintaining blacklists of cheating wallet addresses.

Access commissions also create a new monetization framework for Artists and Consumers. Because Consumers can trade Perishable Keys prior to the Turn, we expect speculators to grow the base of Consumers bidding in auctions. As Keys are turned, the total supply decreases. Not only is this attractive to speculating Consumers, but Artists

also benefit from rising price environments through follow-on auctions. The R.A.R.E Protocol is advantageous to today's solutions because it enforces scarcity of access, grows the access market through liquidity, and offers a global DRM standard to inhibit file duplication and redistribution.

NETWORK USE CASES

The R.A.R.E protocol is extraordinary in that it facilitates not only enhancements to existing artistic use cases but also the creation of entirely new forms of art. We believe the network will be bootstrapped by these “native” use cases that weren't possible or practical without the R.A.R.E protocol and then will continue to increase in value as more mainstream use cases take advantage of the network.

There is significant evidence to suggest three use cases will be among the earliest of the R.A.R.E Protocol: 1) digital collectibles; and 2) the game industry. Additionally, there other use cases that will follow where the R.A.R.E protocol will dominate certain sub-markets of the entertainment industry, representing truly “mainstream” adoption. Among those are: 1) limited edition content from prominent creators and 2) live event ticketing

Digital Collectibles

Digital Collectibles are an obvious use case for the R.A.R.E protocol. Collectibles, assets that are R.A.R.E, transferable, and interesting to a niche audience, have been collected for all of modern history. While this has also been slow to transfer to the digital realm, there are examples that show the promise of digital collectibles.

The breakout use case for digital collectibles is stickers. Stickers have become a massive money maker for messaging apps like Line, WeChat, and even Apple's iMessage.

Interestingly, individual creators have started using stickers as a way to issue digital collectibles as well. Kim Kardashian’s sticker app “Kimoji” is generating almost \$3m a year in revenue alone, showing there is a demand on both sides for collectibles from celebrities.

Digital collectibles have actually already been released as crypto assets, most prominently in the form of [“Pepecash” and the “Rare Pepe Wallet”](#). R.A.R.E Pepes in the “R.A.R.E Pepe Wallet” are digital images with associated assets on the Bitcoin Blockchain. The associated coin, Pepe Cash, has a market cap of around \$6,000,000, despite being a very niche, one-off implementation.

The R.A.R.E Protocol will make the creation of digital collectibles accessible to all creators while adding additional value through liquidity, transparency, and standardization. This content could be images, gifs, videos, memes, or any other type of content that fans may want to collect and trade.

Games with Tradeable Digital Assets

Perhaps the most important early use case of the R.A.R.E Protocol will be digital games that utilize scarce, tradeable assets. What makes this use case so exciting is that there are both physical world and digital world proxies that show the utility of R.A.R.E digital assets in games.

In the physical world, trading card games have hundreds of millions of fans and have created billions of dollars in value. Games like Pokémon and Magic the Gathering⁸ are so

⁸ Trading Magic the Gathering cards and cryptocurrencies are more than just theoretically aligned. The first mainstream Bitcoin exchange, [Mt Gox, was originally an exchange for Magic the Gathering cards and was only later transformed into a Bitcoin Exchange](#). The founder of Mt Gox, Jed McCaleb, now runs Stellar, another growing cryptocurrency.

fascinating because the cards that power the games are not only useful in playing the game but also R.A.R.E and collectible. As such, the ecosystems around Pokémon and Magic the Gathering are robust with not only players but also collectors, speculators, and traders. These games succeed despite their lack of transparency and reliance on central authorities, and games built on R.A.R.E will be even stronger.

The massively multiplayer online video game industry could also benefit tremendously from the R.A.R.E protocol for the issuing and trading of in-game assets. Massively multiplayer online games (“MMOG’s”), like *World of Warcraft*, already have secondary markets for their in-game assets. *World of Warcraft* superfans exchange in-game assets on third-party sites, such as IGE’s, for real currency⁹. This system is weak and awkward as it is not officially supported in the game and rather takes advantage of functionality originally designed to help teams of players cooperate more efficiently. Persistent Keys on the R.A.R.E Protocol are a better solution and they create public enforceability of scarcity and ownership transparency. *World of Warcraft’s* last reported subscriber base was 5.5 million people¹⁰, and many similar online multiplayer video games could benefit from the Protocol.

The R.A.R.E protocol will make creating digital trading card games with the characteristics of the best physical world trading card games possible for the first time. Additionally, all video games with scarce assets will be able to implement provable scarcity and liquid exchange without the clunky hacks and extreme player motivation that were required to create the World of Warcraft asset exchange. Games ranging from MMORPGs like WoW and League of Legends to sports games like the FIFA and Madden franchises will be able to easily create and implement R.A.R.E, exchangeable assets into their games with the R.A.R.E protocol.

⁹ <https://en.wikipedia.org/wiki/IGE>

¹⁰ Activision Blizzard, Inc. 10-Q filed with the SEC. 6 November 2015. pp31.

Limited Edition Content

The issuing of “Limited Edition” content has been an important tool in the artist’s toolbox for centuries that has disappeared with the rise of the internet and digital content. Digital content scales infinitely by and is “ownerless” by default, making things like collectible “First Edition” books, limited run music albums, and other forms of scarce art difficult common in the physical world difficult to transfer into the digital world.

Difficult, however, is not “impossible”. The Wu Tang Clan proved there is still a demand, on both sides of the market, for limited run content with the release of their album “Once Upon a Time in Shaolin” in 2015. They issued only a single copy via auction which [netted them over \\$2,000,000 from a single buyer](#). The Wu Tang Clan assumed the buyer would eventually release the album to the public, but that has only partially happened as of today.

While this experiment’s success shows the demand for Limited Edition Digital Content, it also shows its limitations today without the R.A.R.E ecosystem. The process had to be built from scratch with massive legal and logistical overhead, it had to be limited to exactly one buyer, and that buyer could not functionally or legally re-sell the ownership of the Limited Edition Content after buying it. This is not how Limited Edition Content works in the real world, where it is often sold to multiple buyers and is re-sellable to other collectors and buyers after the initial sale.

The R.A.R.E protocol will make issuing a variety of “Limited Edition” content easy and profitable for artists of all kinds. Artists will be able to create Limited Edition Content without the overhead the Wu Tang Clan had to build and without the constraints the Wu Tang Clan encountered. Not only will the next Wu Tang Clan issue their content as

R.A.R.E assets, but creators of all kinds will be able to confidently issue scarce, tradeable editions of their content.

Concert and Event Ticketing

Concert and Event ticketing is the largest scale implementation of “R.A.R.E digital assets” in the real world today. Tickets to events used to be pieces of paper, but increasingly today they are released in apps or in emails as digital barcodes one can scan to gain entrance to an event. This transition works fine for primary ticket sales, however, secondary ticket markets today are fraught with fraud, as buyers cannot determine whether their ticket is authentic or not.

R.A.R.E perishable keys will solve this problem. Ticket buyers will get access to a digital ticket asset that can easily be exchanged and traded peer to peer with proof of ownership and then can be used exactly one time, at the event. This will require hardware and software integrations which will take some time and investment, but Blockchain ticketing is an inevitability at this point and the R.A.R.E protocol is the perfect fit to make it a reality.

ROLE OF R.A.R.E ART LABS

R.A.R.E Art Labs (“The Lab”) is the author of this white paper and the creator of the R.A.R.E Protocol. The Lab’s mission is to increase the amount of value artists capture from their digital art and to increase the aggregate artistic output of humankind, and we created the R.A.R.E Protocol with this purpose.

The Lab will oversee the Initial Public Auction of R.A.R.Etoken to Consumers.

R.A.R.Etoken offers its owner a perpetual protocol access license and has one utility

function – the purchase of Persistent or Perishable Keys. We believe that the enforced fixed supply of R.A.R.Etoken invites Consumers and speculators alike to purchase the token ahead of any meaningful Key IPAs. Consumer ownership of R.A.R.Etoken should thereby encourage innovative Artists to enter the protocol network. We hope that the IPA of R.A.R.Etoken will bootstrap momentum of the virtuous cycle that incents all actors to grow the R.A.R.E Protocol.

The Lab's proceeds from the IPA of R.A.R.Etoken will allow The Lab to build the initial infrastructure of the protocol. Our first project is to build the protocol's first Auctioneer so that cutting-edge Artists can begin to auction Keys imminently. The faster we can prove that the R.A.R.E Protocol offers a better monetization structure to digital artists, the more likely it becomes that the R.A.R.E Protocol replaces all current solutions for digital art monetization and distribution. The protocol is best served by a perfectly competitive landscape of Auctioneers, and so The Lab plans to unwind its Auctioneer after sufficient competitors have entered the market.

The proceeds from auctioning R.A.R.Etoken will not last indefinitely, though the engineering and technical support costs required to maintain the Protocol will persist indefinitely. For this reason, The Lab created the Rake (Ψ) to fund ongoing maintenance of the Protocol. The Rake will initially be paid to The Lab, but we are committed to implementing a method for decentralizing the payment of the rake to whomever is contributing the most to Protocol upkeep, be that the lab or other parties. The Rake is assessed in all primary market actions, and aligns The Lab's monetization with that of Artists and Auctioneers. The Rake rate is always less than 0.9% of auction gross proceeds (ρ_A), and scales down with larger auction sizes, as shown below:

<i>Auction Gross Proceeds (ρ_A)</i>		
Floor (Excl.)	Ceiling (Incl.)	Rate
-	100	0.89%
100	1,000	0.69%
1,000	N/A	0.49%

There are several interesting experiments for decentralizing core protocol maintenance going on in the cryptocurrency community and The Lab will keep a close on each of them. The Lab will move forward with re-assigning the Rake if and when a clear path to implementing a sustainable system to incentivize protocol maintenance emerges.

CONCLUSION

The R.A.R.E Protocol has the ability to increase the amount of value artists capture from their digital art and to increase the aggregate artistic output of humankind. Artists today capture too little value from their creations, and the R.A.R.E Protocol provides a native solution of smart contracts for digital art. Artists and Auctioneers collaborate to increase the amount of transactional value in the primary market for Keys. They both earn long-tail monetization on Perishable Keys, and Artists can reserve Keys from the IPA for future sales at higher prices. Exchanges provide secondary market liquidity for owners of Keys, including the protocol access key R.A.R.Etoken. Consumers provide the inherent demand for artistic creations, R.A.R.Etoken, and Keys. It is The Lab's belief that the R.A.R.E Protocol provides the best solution to the monetization problem for digital art.

CONTINUING RESEARCH

The Lab continues its research, and this whitepaper will evolve. The whitepaper's version will always be printed on the front page, in the format: "v"YYYY.MM.DD. Questions and suggestions regarding the Protocol should be directed to: TheLab@rareart.io.

The Lab continues to research this non-exhaustive list of topics:

- The Lab is interested in models to incentivize decentralized protocol maintenance and upkeep.
- Should auction distributions to Auctioneers be automatically split between Artists and Auctioneer wallets? Initially we rely on off-protocol agreements between Auctioneers and Artists to split proceeds - this provides for flexibility in agreements. If The Lab notes a convergence around a limited number of compensation agreements, then it will consider adding contract parameters for contract-governed splits between Auctioneers and Artists.
- For Perishable Keys only, what method of file watermarking maximizes security while minimizing intrusiveness of the watermark
- Might there be a point where ETH burn required to create new Keys becomes prohibitively expensive for artistic creation on the Protocol