AUX

THE INTERNET OF AUCTIONS

WHITE PAPER V0.9.1

BY ERIC WEINSTEIN AND KEVIN BEAUREGARD

THE WORD “AUCTION” IS DERIVED FROM THE LATIN AUGEŌ, MEANING “I AUGMENT”.[1]

ABSTRACT

Auctions are a mechanism for trade in which microeconomics and game theory co-evolve. Since as early as 500 BCE [1], auctions have provided a means of price discovery, access to rare assets, and have functioned as an alternative market structure to more traditional methods of exchange, such as barter or sale by predetermined price. The rise of major auction houses, such as Christie's, Sotheby's, and e-commerce platforms like eBay have resulted in a multi-trillion-dollar global auction marketplace. This marketplace, however, is fragmented among multiple houses and platforms: pricing and valuation histories are difficult or impossible to aggregate, and the auctions themselves are centralized and largely private, rendering large-scale efficient pricing of the assets involved a thorny problem at best.

AUX (Augmented Exchange) is a network for digital auctions and an associated utility token built atop the Ethereum blockchain. AUX aims to provide an ecosystem for fair, transparent, and programmatically enforceable auctions: one that encourages price and valuation discovery via those auctions, promotes innovation through the creation of new auction formats, and opens up a new marketplace for digital goods, known as the AUX Platform.

[1] Vijay Krishna, *Auction Theory* (2002).

KEY DEFINITIONS

AUX: a network of **Auction Houses** built with smart contracts, providing the the ability to create, participate in, and broker transparent auctions for digital assets.

AUCTION HOUSES: the most valuable asset within the AUX ecosystem. Auction Houses are decentralized applications (dApps) with reserves of AUX tokens that have the ability to deploy new **Auction Template Contracts**, as well as interface with the smart contracts provided by AUX. Anyone with a sufficient quantity of **AUX Tokens** can create an Auction House.

AUX PLATFORM: the Auction House dApp built and maintained by the AUX team, which also publishes **Auction Template Contracts (ATCs)** that can be used by Auction Houses. Some, but not all, of the ATCs will be available to Houses with no fee for their use.

AUX TOKEN: an ERC20/ERC223-compatible utility token that will be used to interface with AUX contracts. It will serve as the mechanism for fee-based auctions as well as payment to generate **Auction Template Contracts.**

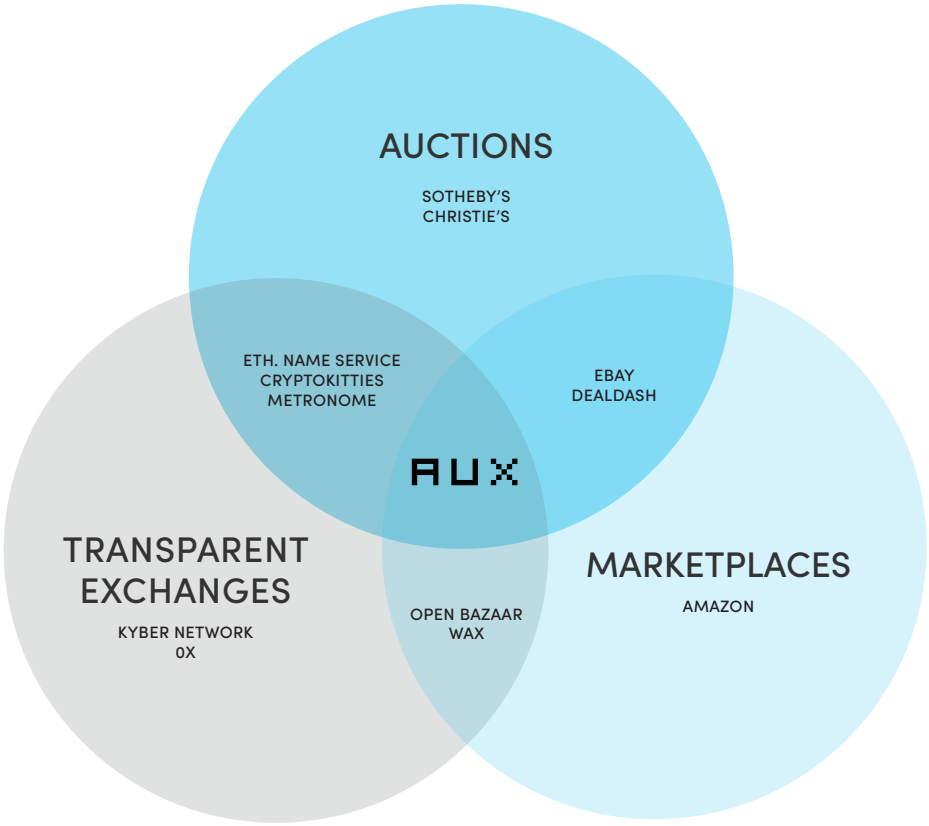
AUCTION TEMPLATE CONTRACTS: smart contracts that comply with a standard interface set by the AUX team. These can be public or private. New variations on ATCs can be added by **Auction Houses** directly. ATCs create **Auction Contracts.**

AUCTION CONTRACTS: contracts to operate a single auction or set of auctions, generated by an Auction Template Contract.

THE OPPORTUNITY

In 2017, e-commerce and online auctions generated over 450 billion dollars in revenue. Blockchain adoption is still in its infancy; existing assets are still being digitized while new, scarce digital resources are being created. The markets for these resources are notoriously erratic, with rapid, momentous swings. AUX seeks to disrupt the online auction space by offering a platform for buyers and sellers of digital assets to transact efficiently.

Major online auction platforms require trusting in a centralized authority, which has a number of downsides. First, there is no transparency to ensure bids are handled fairly. Second, fee-based incremental auctions (penny auctions) typically require the purchase of a centralized token (such as Quibids or Beezid). Third, these online auctions are only available to banked communities, limiting the potential market size for smaller purchases. And finally, existing auctions have failed to make significant headway into e-commerce platforms and fulfillment services, which manage inventory at fixed prices, because auction logic is too complex or slow to be feasible.



The AUX platform will initially focus on developing auctions for assets that are already on-chain. However, it will also look to partner with existing auction houses for physical assets and work with them to digitize their platforms. The current economies for scarce digital assets are immature: extreme price fluctuations are common and the assets must have a significant market cap to be listed on exchanges. AUX's decentralized auctions will allow for market-making within these ecosystems. Several companies in the blockchain space are working on the tokenization of assets, and AUX will exist at their nexus, working or partnering with these businesses to bring those assets onto the AUX platform.

AUCTIONS
IN ECONOMICS

Auctions serve several purposes: they can be an alternative to more traditional exchanges, such as set-price or haggling; they can be used for price discovery in both increasing- and decreasing-price auctions; or they can serve as a means to expedite transactions (such as quickly selling an asset via a first-price sealed-bid auction).

In their various formats, auctions define relationships between buyers and sellers. These buyers and sellers will behave differently depending on their economic situation and the rules of the auction. Unlike purely free markets where the total supply and demand dictate price, auctions provide a mechanism for price discovery in a fixed period of time. When an asset's value is unknown, the dominant strategy as a bidder (buyer) in a particular auction may be vastly different than when the asset has a common value to all parties. Additionally, the seller in an auction must be willing to commit to the outcome of the auction in advance.

AUCTIONS
IN GAME THEORY

Auctions are multiplayer, non-zero sum games of hidden information, and as such may have multiple Nash equilibria (circumstances under which players have no incentive to change their strategies, assuming all other players' strategies are unchanged). Conducting auctions programmatically on the Ethereum blockchain allows both bidders and sellers to capitalize on dominant Nash strategies, thereby maximizing their expected returns over time. In particular, we can ascertain:

- Distribution of private values (e.g. whether they are normally distributed);
- Risk tolerances of different cohorts of bidders;
- Common Nash strategies for auction formats with no strictly dominant Nash strategies;
- Trends in auction formats, the types of items being auctioned, and pricing history.

All of these promote efficiencies in standard auctions and allow bidders and sellers to optimize their strategies. Additionally, because it is built atop a public and immutable ledger, AUX provides a rich dataset of historical activity that incentivizes research and the creation of new, nonstandard auction formats, thereby promoting innovation.

THE STATE OF BLOCKCHAIN & ICOS

The blockchain ecosystem is growing at an unprecedented rate, with new assets and asset classes being introduced regularly. Despite the massive growth, this is an immature ecosystem and the prices for these assets are highly variable.

Many blockchain businesses are already using auctions to conduct their ICOs. This allows for more efficient price discovery and a more stable asset price as they enter or make new markets. This can be seen in Metronome's descending price auction token sale and EOS's custom auction format. Ethereum Name Service (ENS) uses a variation on second-price (Vickrey) auctions to sell ".eth" domains.

All of these implementations of auction formats are entirely within primary markets: they are specific to a given token and the issuance or utility of that token. AUX offers the opportunity to scale this market to any digital asset through participation in the platform. The AUX token, like other utility tokens, enables "small-scale economies that facilitate the application's purpose. These tokens serve as scarce resources that can be regulated and governed to more closely align with the functionality of a dapp."[2]

Furthermore, the blockchain ecosystem is evolving around a new(er) class of digital assets: digital goods. BLOCKv and WAX are two such platforms designed to move the needle forward when it comes to digital ownership of a good. WAX in particular is decentralizing the remarkably large industry that is in-game skin sales. By issuing and transacting on a blockchain, these assets are now connected and enforceably scarce.

PLATFORM MECHANICS

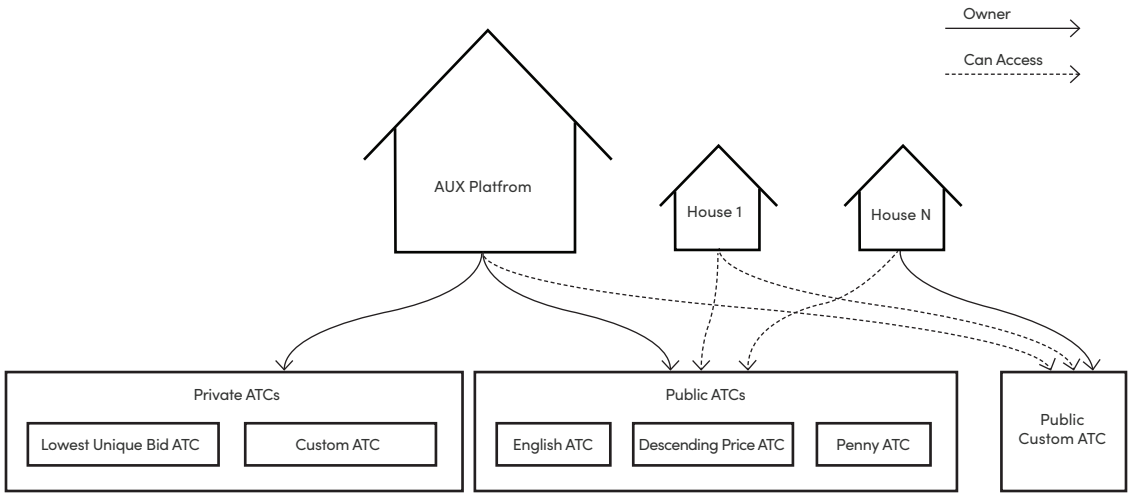


Figure 1: The AUX Network

Auction Houses have the unique ability to create new auction formats and charge whatever fees they wish for their use. AUX Platform will manage one Auction House, where users can come and buy and sell goods. However, the contracts released by AUX will enable any user holding a significant reserve of AUX tokens to create an Auction House.

[2] https://blog.ycombinator.com/building-for-the-blockchain/

When the Auction House is won at auction, no fee is paid to the contract or to AUX. Instead, 100% of the price (in AUX) will be sent to and locked within the House contract. Up to 50% of that balance can be withdrawn by the owner at any time, or used by the House to pay any fees needed to create Auction Contracts.

AUX will initiate a descending price auction approximately once per calendar month (or at the conclusion of the previous sale) for the ownership of a new Auction House. The initial price and floor for the auction will be set based on the previous sale price. The first Auction House will belong to AUX and will establish the AUX Platform.

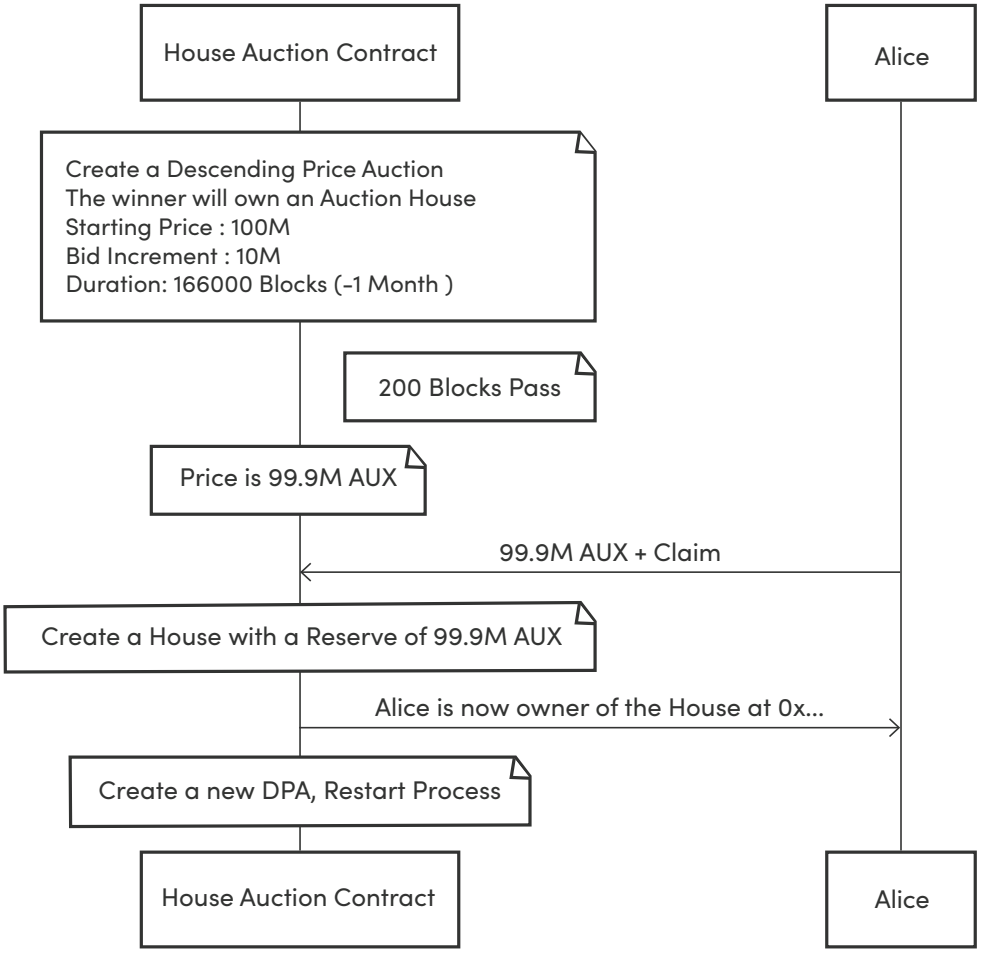


Figure 3: A lowest-unique-bid auction for a digital asset, Gamma.

AUCTION TEMPLATE CONTRACTS

Owners of Auction Houses will be able to link their Houses with AUX-compatible Auction Template Contracts (ATCs). Once linked, the ATC will know what House it belongs to (who gets the fees), and the House will know where each ATC is located so that it can delegate calls to it.

Only Houses can deploy ATCs. During the deployment, the House must burn a fractional amount of AUX tokens, irreversibly removing those tokens from the supply. This fee will discourage House owners from spamming the network with contracts unnecessarily. Houses can mark ATCs as public or private. A Public ATC can be accessed by other Houses for a static fee, set by the ATC. Once paid, the publishing House will allow the other House to use the ATC as if it were its own for a predetermined period of time. The same Public ATC could also employ a single-use fee.

ATCs will have to comply with a strict interface. The fees collected via public ATCs can be kept exclusively by the publishing House, or can automatically be split with a developer, incentivizing developers to create innovative formats and work with the Houses that have the most traffic.

The House has the ability to unlink itself from the ATC, but the ATC cannot unlink itself from the House once attached. However, if the contract is interfaced with directly it will still pay fees to its House. Auction Template Contracts can be created on-chain at any time, and linked to a House when said House is ready to allow its users to interact with the ATC.

AUCTION TYPES & EXAMPLES

There are a number of uses cases for AUX as a platform and currency for exchange via auction; we illustrate several such cases in the following infographics. Note that these are not the only formats being developed by AUX but are intended to illustrate the basic functionality and rules of these auctions.

EXAMPLE 1: ENGLISH (ASCENDING PRICE) AUCTIONS

ExOne is an AUX house specializing in English Auctions. An English Auction is the most commonly used auction format. It is what is most commonly thought of as “an auction,” and is the only format supported by major online auctions such as eBay.

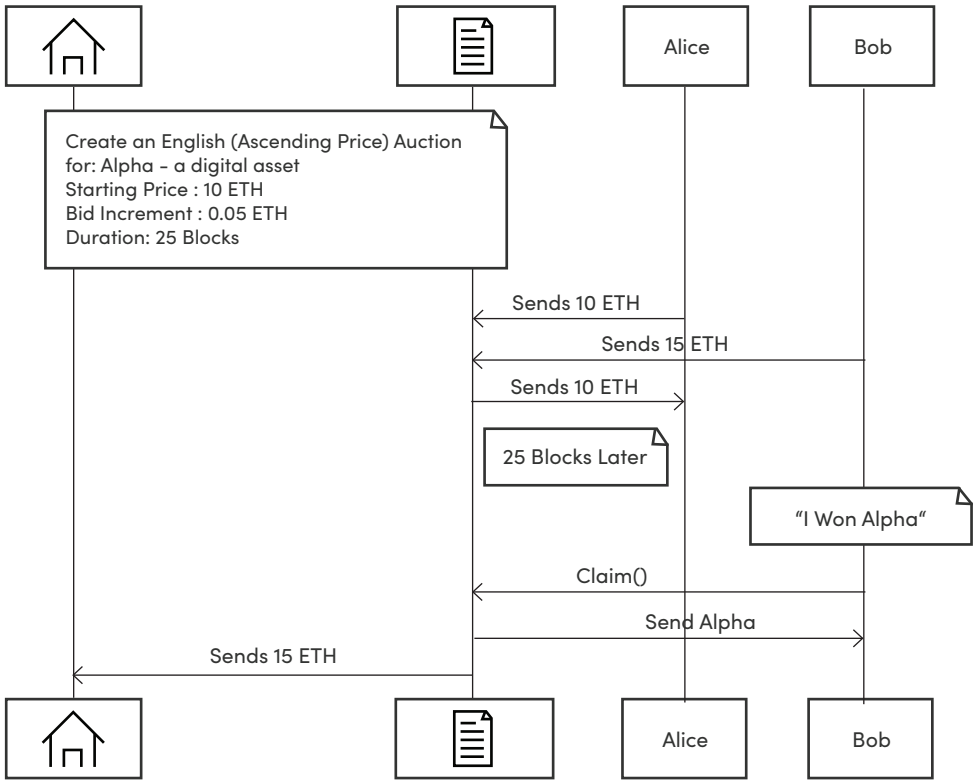


Figure 1: An English auction for a digital asset, Alpha.

Digital asset Alpha is for sale in a traditional (ascending price) auction. Alpha’s auction has a starting price of 10 ETH. The auction will exist for a fixed number of blocks and has a minimum bid increment of 0.05 ETH. Alice and Bob would each like to bid on it. This type of auction permits price discovery by iteratively winnowing the pool of participants as the price ascends.

Merchants and consumers are incentivized to participate due to the same market forces that draw them together in existing auctions; moreover, AUX provides an immutable public record of all auctions, as well as a platform for automatically executing the resulting transactions (via Ethereum smart contracts). Partners are incentivized to participate via their on-blockchain protocols, as integration with AUX offers an expanded global marketplace for digital goods.

EXAMPLE 2: INCREMENTAL FEE-BASED (PENNY) AUCTION

ExTwo is an AUX House specializing in penny auctions. A penny auction is a type of auction in which a small fee (a "penny") is used to augment a bid by a fixed increment. This fee is commonly paid using a token; in this case, AUX Tokens are used. The winning bidder must pay the final bid amount at the close of the auction.

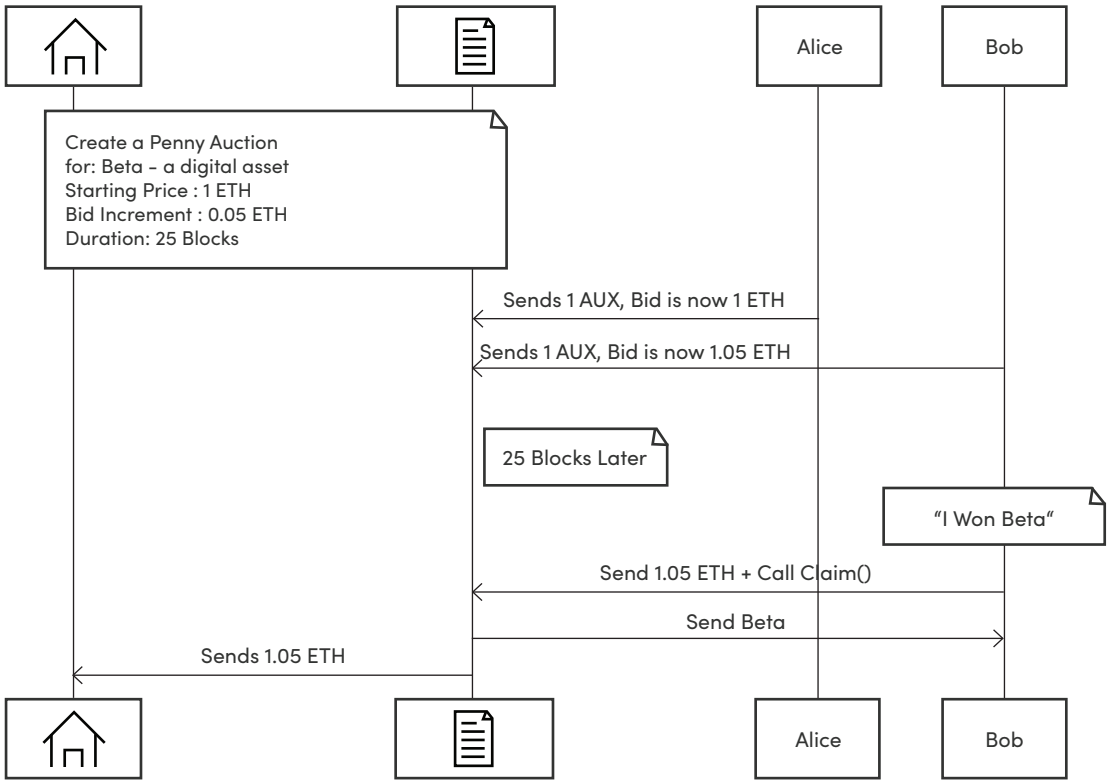


Figure 2: A penny auction for a digital asset, Beta.

Digital asset Beta is for sale in a penny auction. This type of auction traditionally requires a centralized token in order to participate, which serves as a barrier to entry; AUX's decentralized nature eliminates this downside by allowing any party to run their own auction or Auction House. The auction will exist for six blocks and has a start price of 1 ETH and a bid increment of 0.05 ETH. Alice and Bob each hold AUX tokens and would like to bid on Beta.

Merchants, consumers, and partners are motivated to participate in these types of auctions for the same reasons outlined in the prior use case: AUX provides an immutable public record of the bids, prices, and valuations that comprise auctions, as well as a platform for automatically executing the resulting transactions.

EXAMPLE 3: LOWEST UNIQUE BID AUCTION

ExThree is an AUX House specializing in lowest-unique-bid auctions. Lowest-unique-bid auctions are a format similar to a lottery or raffle, in which the winner of the auction is the bidder who bids the lowest value that was not duplicated by any other bidder.

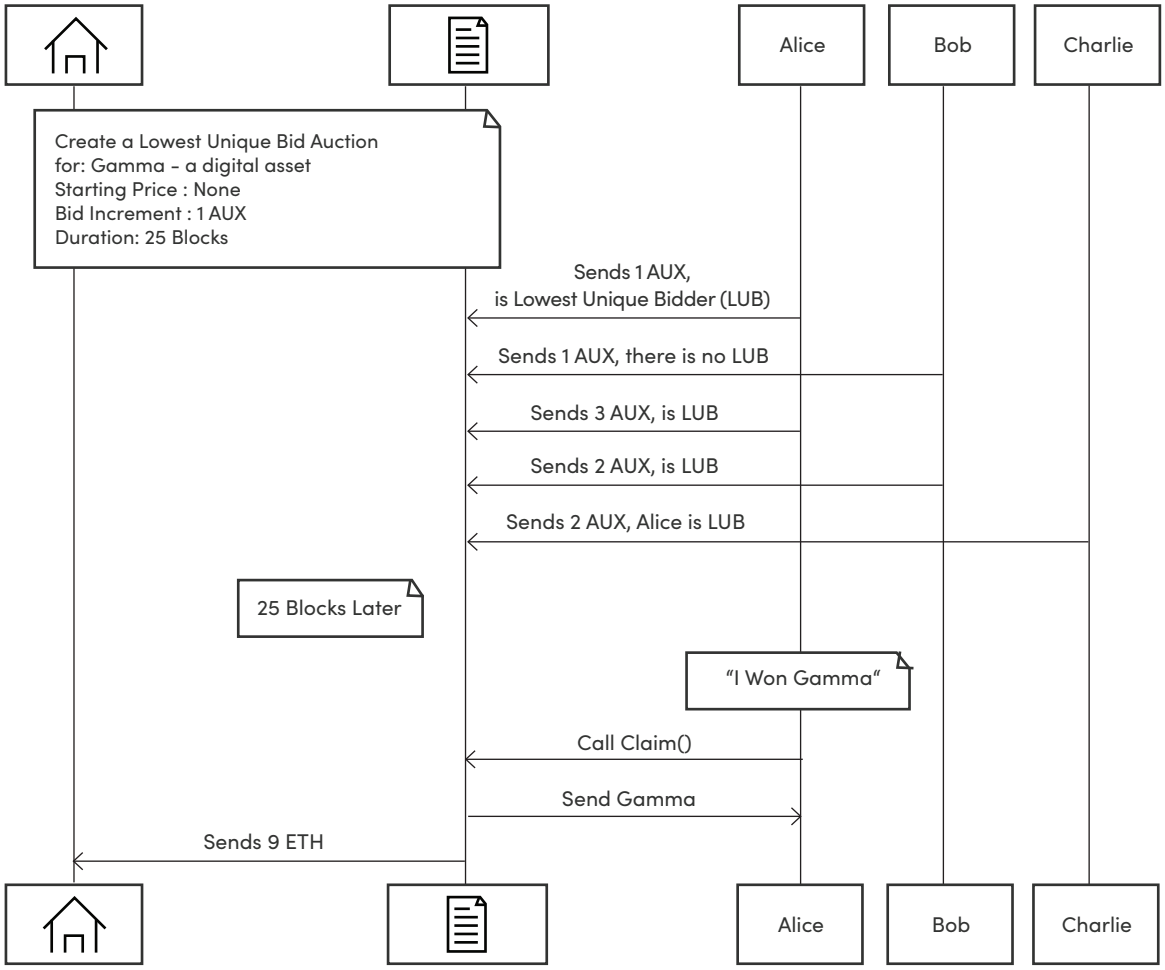


Figure 3: A lowest-unique-bid auction for a digital asset, Gamma.

Digital asset Gamma is for sale in a lowest unique bid auction (as might be the case for a raffle or lottery). The auction will exist for a fixed number of blocks. Alice, Bob, and Carol each hold AUX tokens and would like to bid on Gamma. Traditional lowest unique bid auctions are often criticized as being unfair, as the auction house is in a position of complete authority and could easily manipulate competition. Additionally, these events often require participants be physically present at the drawing or risk losing their winnings; AUX's use of Ethereum smart contracts ensures winners automatically receive their assets.

Merchants, consumers, and partners are motivated to participate in these types of auctions for the same reasons outlined in the prior use cases: an immutable public record of the bids, prices, and valuations that comprise auctions, as well as a platform for automatically executing the resulting transactions. Further, this opens the AUX platform to myriad lotteries, giveaways, and raffles (such as those offered by Omaze).

EXAMPLE 4: DESCENDING PRICE AUCTION

ExFour is an AUX House specializing in Dutch Auctions. A Dutch or descending price auction is an auction where the auctioneer begins at a high price, and then descends over a period of time to a reserve price. At any time, a bidder may claim the item or items by bidding the current price. Descending price auctions have been seen in blockchain implementations in the Metronome token sale and on the CryptoKitties platform.

Digital asset Delta is for sale using a Descending Price Auction (of CryptoKitties fame). The auction will exist for a fixed number of blocks. Alice wants to buy Delta.

Merchants, consumers, and partners are motivated to participate in these types of auctions for the same reasons outlined in the prior use cases: an immutable public record of the bids, prices, and valuations that comprise auctions, as well as a platform for automatically executing the resulting transactions.

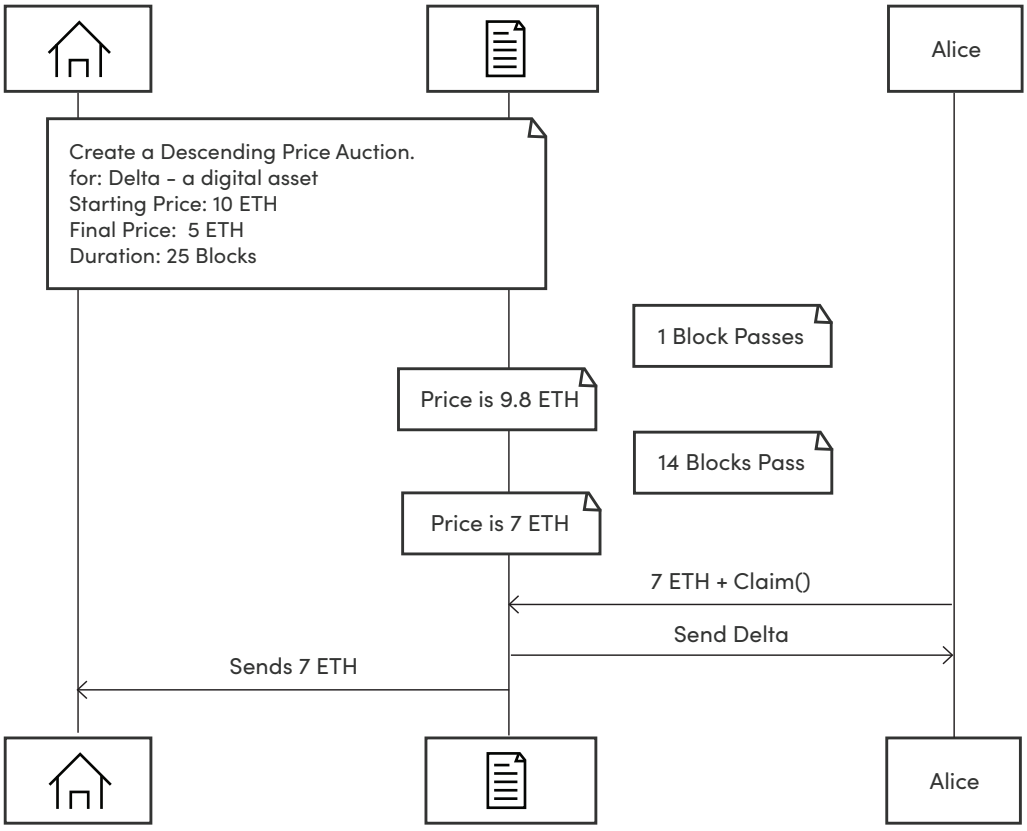


Figure 4: A descending price auction for a digital asset, Delta.

EXAMPLE 5: ICO OR TOKEN SALE USING AUX

The issuers of token Epsilon (EPS) would like to conduct their ICO by auction using the AUX platform. This ability to safely and easily conduct an ICO via an AUX Auction House is a significant value proposition.

- After minting their token, they conduct their auction via a smart contract derived from AUX's token auction contract (available prior to AUX's release). This contract determines the type of auction (e.g. ascending price, descending price), number of tokens available in the overall auction, duration of the auction (e.g. timestamp, number of blocks), and so on.
- Let's assume the issuers of EPS select a variation on an English (ascending price) auction contract. At each interval (in this case, one day), an auction for a predetermined number of tokens becomes live at a specified price (e.g. 0.001 ETH). Participants may pay a small entry fee (either ETH or AUX) to participate, or equivalently, the issuers of EPS set a reserve price. This ensures the seriousness of participants.

- Participants place bids to raise the price. When the auction expires (after a certain amount of time or number of blocks), the participant with the highest bid receives the pool of tokens at the bid price. Variations on a traditional auction are possible (for example, perhaps the highest bidder receives 70% of the tokens, the second-highest bidder receives 20% of the tokens, and the third-highest bidder receives 10% of the tokens, each at his or her bid price).
- In the case of an entry fee, all entry fees—less gas and any applicable auction fees—are refunded (unless the issuers stipulate that the entry fee and auction fees are one and the same). In the absence of an entry fee, the AUX House takes a small percentage of the pool as payment for running the auction.
- A new auction begins at the next specified interval until no more tokens remain.

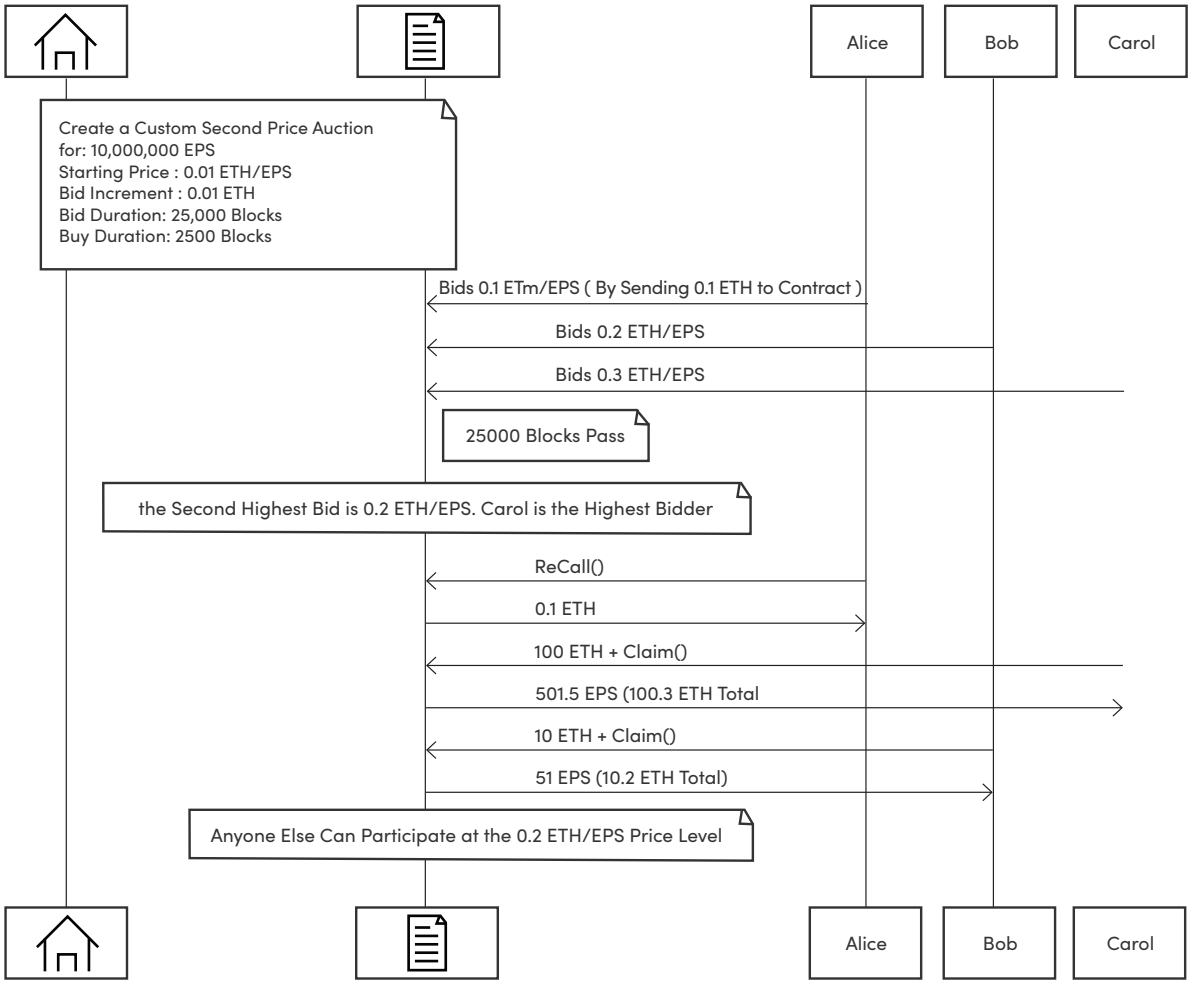


Figure 5: An ICO conducted using a variation on a Vickrey, or second price auction

Nonstandard variations on common auction formats are a central feature of AUX. For example, we might change the prior example such that the highest bid sets the price for all participants; this means that any participant may pay the high bid for a share of the token pool, balancing the incentive amongst bidders to collude to keep prices low against the incentive for individuals to bid prices upward to reduce competition and secure more of the pool for themselves. The Nash strategies that emerge from these games can be factored into future auctions, incentivizing users to invent new formats as they auction off goods, bid on assets, and set up their own Auction Houses.

AUDITING & SECURITY

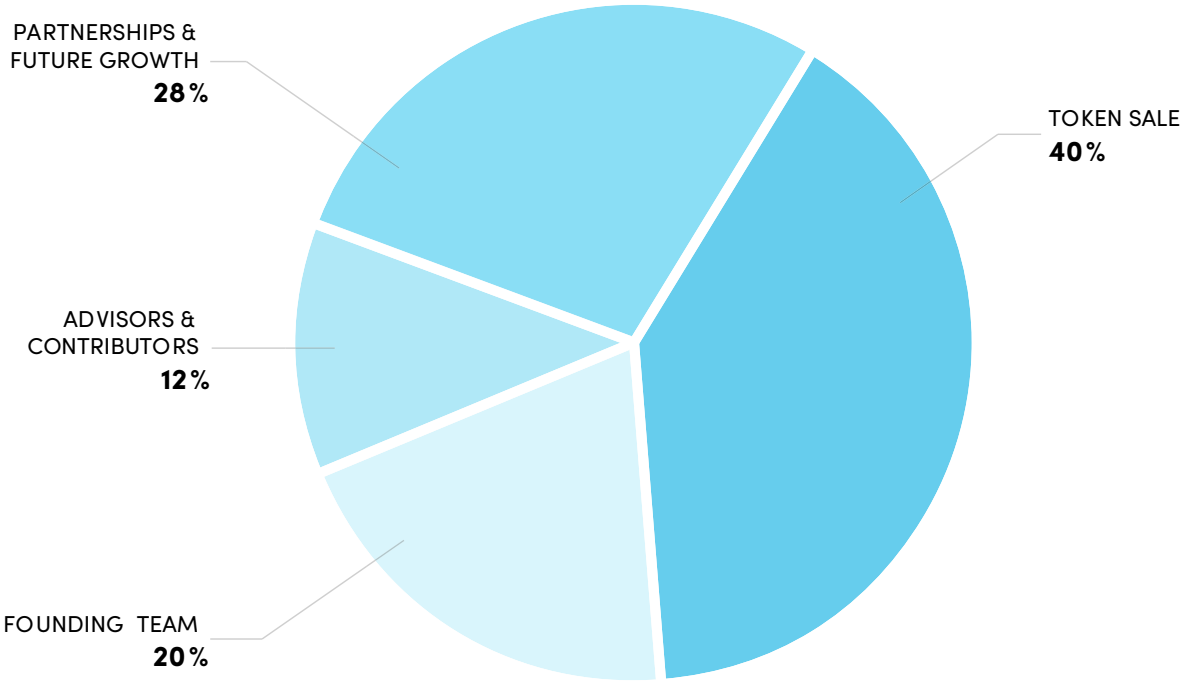
All smart contracts maintained by AUX will be fully audited for correctness, security, and economic viability. This process broadly comprises two phases.

Internal: our engineering team will follow all best practices and perform all due diligence necessary to ensure contracts execute as expected and as safely as possible. This includes, but is not limited to: assurance of data integrity (e.g. internal contract fields cannot be modified by unauthorized parties); use of open-source, audited code where possible (e.g. from OpenZeppelin or similar); and thorough unit testing of individual contracts and integrated testing on an industry standard testnet (such as Rinkeby).

External: all contracts maintained by AUX will be audited by an industry-recognized third party (e.g. Zeppelin). All code affecting AUX's capabilities as a network and token will be made available and open-sourced. Additionally, bug bounty programs will exist to reward the community at large for protecting and improving AUX.

TOKENS AND TOKEN SALE

The token will trade under the symbol AUX. AUX tokens will be used to create auction contracts as well as pay fees in penny and unique bid auction types. Prior to the initial coin offering (ICO), there will be a private presale with a 50,000 USD minimum purchase.



5,000,000,000 AUX tokens will be minted, of which 40% (2,000,000,000) will be available in the token sale. Any unsold or unallocated tokens will be sold using the AUX platform after the token sale using various auction formats. Additional information on the tokensale, including potentially revised total supply or allocations, will be available in our Tokensale Document, which will be published at least three calendar weeks before the crowdsale begins.

Ultimately, the AUX token and platform provide an ecosystem for fair, transparent, and programmatically enforceable auctions, encourage price and Nash strategy discovery via those auctions, and promote innovation—along with the associated potential for financial gain—in a new digital marketplace through the creation of new auction formats. We hope you join us as we explore this exciting new terrain.

ROADMAP/TIMELINE

Q4 2017

- AUX IS CONCEPTUALIZED
- WORK ON WHITE PAPER BEGINS
- BEGIN SMART CONTRACT DEVELOPMENT

Q1 2018

- RELEASE OF THE WHITE PAPER
- PRIVATE TOKEN PRE-SALE
- AUXTOKEN.COM IS LIVE

Q2 2018

- PUBLIC TOKEN PRE-SALE
- MVP LIVE ON TESTNET
- PARTNERSHIP DEVELOPMENT

Q3 2018

- MVP LIVE ON MAINNET
- CROWDSALE USING THE AUX PLATFORM MVP
- RELEASE OF OPEN-SOURCE DAPP FOR HOUSE MANAGEMENT

Q4 2018

- BEGIN PLATFORM TOOLING AND INFRASTRUCTURE DEVELOPMENT
- RELEASE OF TWELVE-MONTH ROADMAP

TEAM

CEO, FOUNDER KEVIN BEAUREGARD

Kevin was the technical co-founder at GoCoin and was responsible for architecting and building the GoCoin platform. As VP of Engineering at GoCoin, he oversaw the integrations with Bitcoin, Litecoin, Dogecoin, and Tether (Omni), making GoCoin the first Payment Processor in the space to handle altcoin-to-fiat conversions. Having been in Blockchain since 2013, Kevin was an early investor in Ethereum and a number of ICO projects. Kevin is a veteran of startups, having managed software teams at Connectivity, Hulu, and Vertebrae prior to founding AUX.

CTO, FOUNDER ERIC WEINSTEIN

Eric has led engineering teams at several organizations, most recently serving as Director of Engineering at Fox Networks Group, and frequently gives technical talks at conferences across the globe. This spring he will complete his master's degree in computer science from Georgia Tech with a specialization in machine learning, including work in computational finance, cryptography, distributed systems, and game theory.

VP OF PRODUCT DEVELOPMENT TODD MOFFETT

Todd is a veteran product strategist and serial entrepreneur in e-commerce and digital media. He co-founded Hollow Trees, a successful product development agency, in 2007. While there, he worked on products for JVC, Savings.com, Leadpoint, and dozens of others. Todd's business acumen, creative mind, and expertise as a user experience designer have been instrumental in the success of multiple early-stage startup ventures.

ADVISORS

STEVE BEAUREGARD

Steve was the founder of GoCoin and is the current CRO of Bloq. He is a serial entrepreneur and frequent speaker in the blockchain space. Steve brings his deep knowledge of business and the crypto-asset space to the team at AUX.

CRAIG SELLARS

Craig is an elite Blockchain architect, most recently he co-founded BlockV and architected that project. He is also the founder of the Omni Foundation and Tether.to.

DARREN RUSH

Darren is a seasoned entrepreneur with multiple exits and a proven track record as a technology and business development executive for high-tech startups. Darren specializes in search, open source, distributed system design, and high-scale network architecture.

THANK YOU