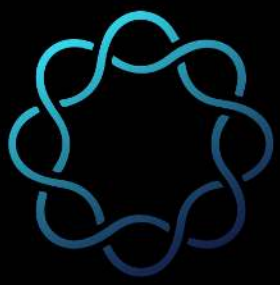

DELPHI LABS

Presents.

Lockdrop + Liquidity Bootstrap Auction: A Novel Token Launch Mechanism

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Introduction

At Delphi, we've spent a long time analysing and designing token launch mechanisms. Overall, while the space has come a long way since the ICO fixed price sales, we still believe there is significant room for improvement.

As we helped two of our most recently incubated projects--Mars and Astroport--think through their token-launch mechanisms, we couldn't find any existing structures that adequately satisfied all our design objectives. As a result, we decided to revisit token launches from first principles with the goal of coming up with something tailored to our goals. The result is what we're calling the "Lockdrop + Liquidity Bootstrap Auction" which will be trialed by Astroport in December and Mars soon after.

In this article, we explain the design goals we were trying to optimise for and why we believe this structure is the best token launch mechanism to achieve them.

Design Considerations

Current token launch mechanisms

Broadly speaking, the goal of a token launch mechanism is to distribute the token to the protocol's users and community. There are currently two main ways projects choose to do this:

(1) Distributing tokens to users - Users receive tokens for either past actions or ongoing actions. This includes airdrops as well as all forms of ongoing incentives (staking rewards, liquidity mining rewards, trading competitions, etc)

(2) Selling tokens to the public - Users receive tokens in exchange for an investment of money. This includes fixed price sales, auctions, LBPs, Pylon-style yield delegation, etc

Both these approaches have flaws.

Distributing tokens to users

There are two main ways protocols choose to distribute tokens to users: airdrops and ongoing liquidity incentives.

Airdrops aim to distribute tokens to users based on their past actions, either because they used the protocol previously or were high-value users of other protocols. While this seems like a good idea, airdrops reward past behaviour rather than future commitments and thus aren't guaranteed to benefit the protocol going forward. In fact, our research shows the majority of airdrops simply get dumped.

Ongoing liquidity incentives instead aim to reward ongoing participation in the protocol and have become the preferred method of distribution for most projects. However, relying solely on this also comes with a few drawbacks. Firstly, ongoing incentives can only be used to reward use that can be represented by an on-chain action such as providing liquidity, collateral, or completing trades. This benefits whales who have more capital and thus earn a higher share of rewards, but also excludes a variety of other stakeholders who add value to protocols such as community members, third-party integrators or even projects building on top of protocols. For these stakeholders, acquiring the token on the open market may be the only way to achieve incentive alignment.

Secondly, simply handing out the token to supply-siders results in additional problems like low initial float, lack of a mechanism for price discovery, and low liquidity (especially initially). This harms non-supply siders who want to buy tokens on the open market and either can't do it in size or get rekt by low liquidity price moves (e.g. ANC launch) and/or continuous selling pressure from token emissions on low float (e.g. MIR)

Public Sales

In order to prevent these issues, some projects choose to conduct public sales to facilitate price discovery. However, these come with their own set of drawbacks. Firstly and primarily, all public-sale-type mechanisms expose the projects to heightened regulatory risk. Sales involve an obvious "investment of money" and early-stage protocols are also those most likely to depend on the "essential entrepreneurial efforts" of a small group under the "Howey test". For these and other reasons a public token sale is more likely to be seen as an unregistered securities sale than other distribution methods.

Secondly, while public sales solve the price-discovery problem, they don't necessarily solve the low-initial-liquidity problem. While projects can add initial liquidity themselves, this requires significant capital and also exposes them to regulatory risk since they're basically establishing the market and setting a price for the token. As a result, many tokens exhibit high volatility in the days and weeks after launch--above all, this tends to hurt early users who are most enthusiastic about the project but may not be sophisticated traders.

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1 Gary Plastic Packaging Corp. v. Merrill Lynch, Pierce, Fenner & Smith, Inc., 756 F.2d 230 (2d Cir. 1985).

Thirdly, most sale and auction structures are vulnerable to bot frontrunning attacks (e.g. ANC, VKR) which result in supply being concentrated among a few whales with the technical skills and capital to take the entire sale.

Summary: Design goals and constraints

To summarise, we wanted to come up with a token distribution mechanism that achieved the following goals:

- **Distribution:** We wanted to ensure the token was distributed fairly to a wide range of stakeholders. Crucially, this meant the launch mechanism should not be exploitable by bots or whales. Ideally, we wanted to give smaller holders a chance to earn more tokens by signalling their commitment to the protocol.
- **Price discovery:** We wanted to make sure there was a fair, decentralised, bottom-up mechanism to establish a price for the token before it's trading.

- **Sufficient float:** Relatedly, we wanted to make sure there was enough initial supply to satisfy demand and allow for legitimate price discovery. Recently, a lot of projects have launched with extremely low floats (<5% of total supply), leading to highly inflated fully-diluted valuations (as demand is inelastic below a certain point and there simply isn't enough supply out there to satisfy this demand). From here, the token price slowly bleeds out over time due to continuous token emissions and unlocks, leading to disgruntled and demotivated community members. We firmly believe the only way to create a successful protocol is to involve the community from the get-go and let them grow and succeed alongside the project. For this reason, a key consideration was ensuring an initial float large enough to enable fair and legitimate price discovery.
- **Liquidity:** Once a price is established, we also wanted to make sure there was instant, deep liquidity at that price.
- **Decentralization:** The joint ventures involved in creating Mars and Astroport didn't want to set a price, conduct a public sale, initialise an AMM/LBP, accept an investment of "risk capital" or otherwise place themselves in the position of being sellers, authorities, market-makers, brokers, underwriters or "issuers"--thus, it was crucial that all liquidity and price-discovery be provided by Astroport's own users, acting on a decentralized basis.

The Lockdrop + Liquidity Bootstrap Auction (LBA)

We believe the Lockdrop + LBA achieves all these objectives. At the highest level, it is a two-phase process which works as follows:

- **Phase 1 (Lockdrop):** The distribution phase. A time-window during which anyone can pre-commit to being users of the protocol for a given amount of time (specific details included in "Phase 1: Lockdrop" section below). At the end of the time-window, they receive a pro-rata share of the total tokens being distributed based on the size and length of their commitment. These tokens are locked until the end of Phase 2.

- **Phase 2 (Liquidity Bootstrap Auction):** The price-discovery phase. A time-window during which lockdrop participants who wish to be liquidity providers can choose to commit to depositing part or all their ASTRO into one side of a stablecoin pair (i.e. ASTRO-UST) liquidity pool. Other users can then come in and commit UST into this liquidity pool, effectively buying ASTRO from Phase 1 (lockdrop) participants. At the end of the time period, the following happens:

1. Native tokens + stablecoins are deposited into a liquidity pool. The ratio of native tokens to stablecoins determines the final price of the native token
2. Auction participants receive LP shares pro rata to their deposits with the LP shares being locked and vesting linearly over 3 months. Assuming sufficient participation in Phase 2, this ensures immediate, deep liquidity at the market price
3. All tokens handed out in Phase 1 and not committed to the Liquidity Auction in Phase 2 unlock and become freely traded

Note: Either as an alternative or in addition to the lockdrop, an airdrop can also be used in Phase 1 to distribute tokens to users.

To see how this works in practice, we'll now examine this in the context of the Astrodrop: Astroport's token launch event.

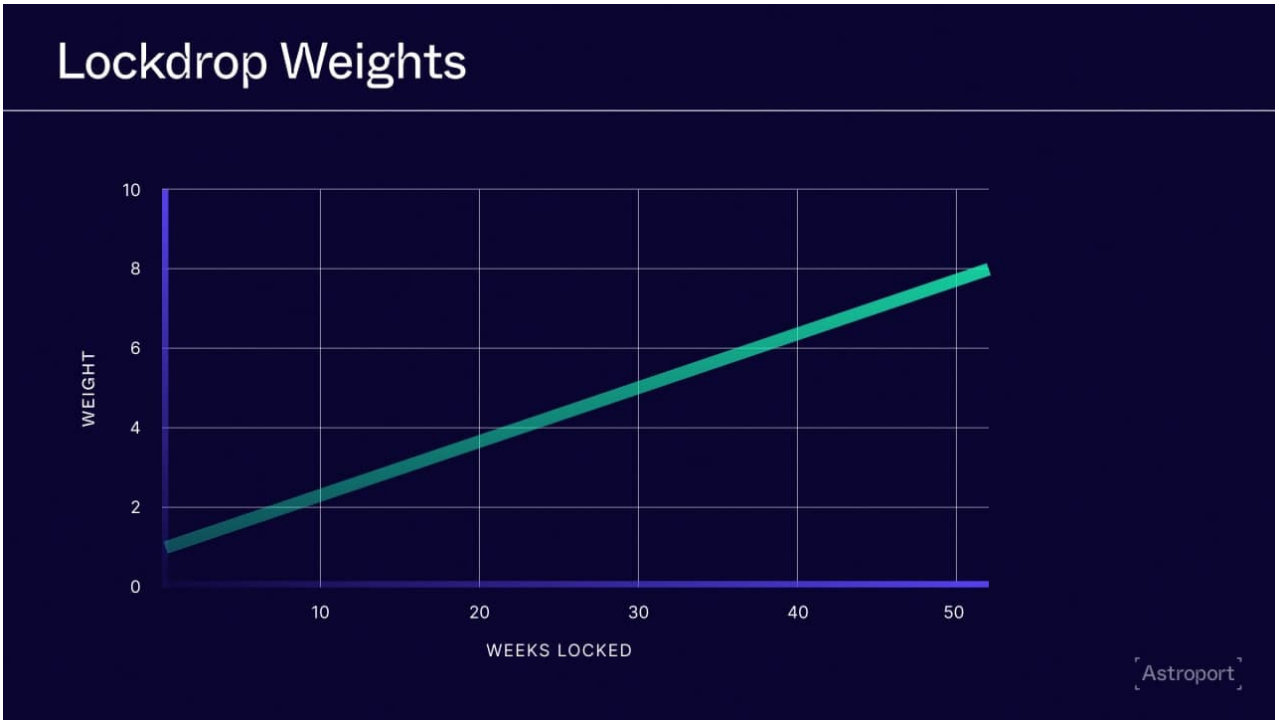
Phase 1: Lockdrop

Phase 1 is the distribution phase, where the goal is to put tokens in the hands of Astroport users. Ideally, the amount of tokens users earn should be proportional to the "value" they bring to the protocol. Value is measured in different ways, and different distribution mechanics target different forms of value. For example, an airdrop may recognize the value brought by historical users of the target protocol or of synergistic protocols who are very likely to use the target protocol. The lockdrop can be seen as similar to an airdrop, but rather than rewarding users for previous actions taken, it instead rewards users for a forward-facing commitment to use the protocol in the future--similar to getting a premium deal if you enter into a year-long contract with your mobile phone carrier, ISP or other service providers.

In the case of Astroport, these long-term protocol customers are the liquidity providers who bootstrap liquidity in key trading pairs. During the lockdrop time period, users can commit to depositing liquidity into Astroport in the form of Terraswap LP shares for pre-selected trading pairs. Crucially, users will be able to further signal their commitment to Astroport by locking this liquidity for up to 1 year, with length of lock acting as a boost to their rewards. 7.5% of the total ASTRO supply will be distributed to users who lock liquidity in Phase 1, hence the name "lockdrop".

Overall, an individual user's share of the lockdrop will be calculated based on two factors:

1. the total number of ASTRO allocated to the trading pair(s) the user contributed liquidity to (to be announced prior to the start of Phase 1)
2. A user's share of weight adjusted liquidity in a pool. Rather than just measuring it as user liquidity/total liquidity, there's a weight adjustor that's based on how long you lock up your LP tokens. This means the numerator is your weight adjusted liquidity and the denominator is the total weight adjusted liquidity provided by all users in that pair.



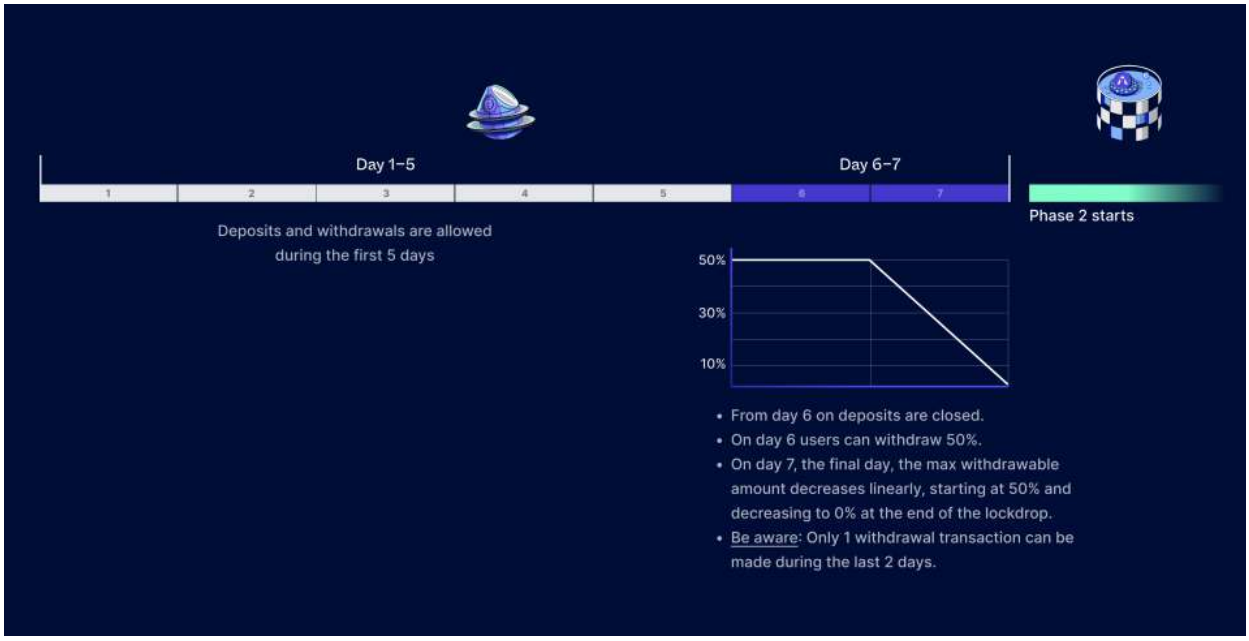
The amount of ASTRO a user receives for his on LP contribution to a given trading pair is given by:

A = Ap * (wLu/wLp)

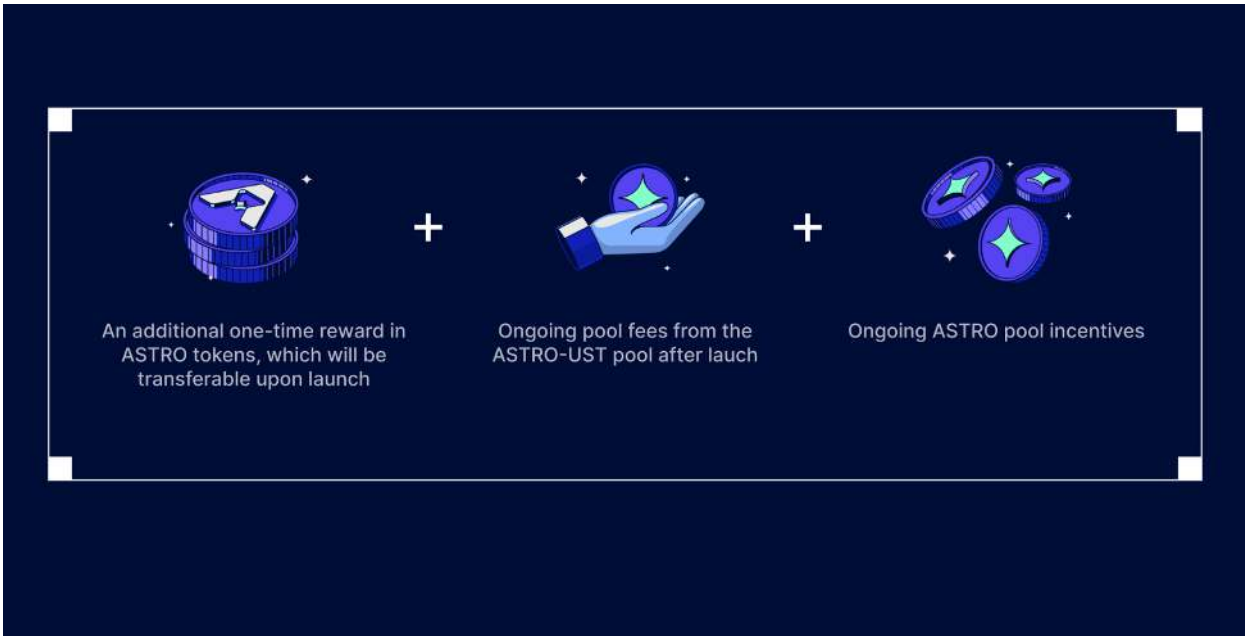
A = ASTRO received by user
Ap = Total ASTRO assigned to the user's chosen trading pair
wLu = Weight adjusted liquidity provided by user
wLp = Total weight adjusted liquidity in pool
B = Boost based on length of lock chosen

In terms of timeline, during the first 5 days users will be able to deposit and withdraw freely, encouraging anyone to come in and commit the maximum liquidity they're willing to put in. Over the last 2 days, users will only be able to withdraw, allowing them to pull out some of their liquidity if they feel the amount of ASTRO they're receiving in the lockdrop is less than the opportunity cost of that liquidity.

At the end of Phase 1, liquidity will be migrated from Terraswap to Astroport--with users' Terraswap LP shares being burned in exchange for locked Astroport LP shares.



Crucially, in addition to the one-time lockdrop reward, LPs will also receive trading fees + issuance on their pools (just like any other liquidity provider).



In addition to the 7.5% ASTRO distributed in the lockdrop, there will also be 2.5% distributed in an airdrop to LUNA stakers and Terraswap users. This results in a 10% float available for Phase 2.

Phase 2: Liquidity Bootstrap Auction

Phase 2 is the price discovery phase and the goal is to establish a price for the token as well as deep liquidity at that price. For those familiar, the Liquidity Bootstrap Auction can be seen as similar to the recent Mango Markets auction, with a few key differences:

1. Users are the ones selling the tokens rather than the protocol
2. Auction participants receive locked LP shares rather than unlocked tokens
3. Withdrawals are progressively limited over the last two days to prevent manipulation by whales (more on this later)

In Phase 2, users who either participated in the lockdrop or received tokens in the airdrop can choose to deposit part or all of their locked ASTRO tokens into an ASTRO-UST Liquidity Pool. Any user will then be able to come in and deposit UST on the other side, effectively buying the ASTRO from the lockdrop participants.

The price of ASTRO will be determined by how much UST and ASTRO users add to the pool, and in particular, the final ratio of UST to ASTRO. If 100 ASTRO is deposited and 100 UST is deposited, the implied ASTRO price is $1. If an additional 100 UST is deposited, the implied price jumps to $2. Crucially, this price is meaningful because participants are committing to initialize and lock their tokens in a liquidity pool at this price for 3 months (i.e. they're effectively buying ASTRO below the price and selling above it for 3 months)--which entails the typical risks of providing liquidity in an AMM, without the ability to withdraw spontaneously based on market conditions.

In terms of timeline, for the first 5 days of Phase 2 users will be able to deposit as much ASTRO and UST as they want, with only UST being withdrawable. This encourages users to come in and bid the maximum amount they're willing to commit. Over the last 2 days, users will only be able to withdraw UST. As UST is removed, the implied ASTRO price comes down. This enables price discovery as users pull UST until the ratio of ASTRO:UST reflects an ASTRO market price they're comfortable with.

It's important to dive into what happens during the last 2 days because that's where similar designs have been exposed to manipulation. Once day 6 begins, withdrawals will be limited to 50% of your deposit. Once day 7 begins, withdrawal limits will linearly decline from 50% to 0 throughout the day. The need for this component stems from the fact that without it, whales can deposit considerably more than they plan on leaving in the pool in an effort to inflate the price well beyond what they'd actually want to pay to discourage other participants. Then right as the window closes, they withdraw all the excess and lock in a much lower price. This situation happened with Mango Markets and it's poor for token distribution and price discovery. The withdrawal cap limits the efficacy of manipulation while the gradual decline creates increasing stability around price discovery leading into the close.

Now that the mechanics of the final days of phase 2 are clear, we need to address why users would participate in phase 2 in general. Regardless of whether their preference was to sell their rewards or use them to LP, they can accomplish both of these without participating in phase 2, all while preserving optionality. We say preserving optionality because your LP shares are locked for 3 months when you participate in phase 2. In response, we're offering incentives to Phase 2 participants in the form of an additional 1% of ASTRO supply (10m ASTRO). This 1% is split between ASTRO depositors and UST depositors, effectively acting as a premium for sellers and discount for buyers. The fixed 1% reward means that if phase 2 participation is low, the bonus increases on a relative basis. This helps ensure a level of participation that we deem is necessary to create sufficient secondary market liquidity. We present a table below that shows the bonus allocation given to Phase 2 depositors based on overall participation rates.

Participation Rate	Bonus Allocation
100%	5.00%
90%	5.56%
80%	6.25%
70%	7.14%
60%	8.33%
50%	10.00%
40%	12.50%
30%	16.67%
20%	25.00%
10%	50.00%

Although we included the full spectrum of participation scenarios in the table, we certainly don't expect participation to be anywhere near 100%. We provide an example with round numbers below to show how the table applies.

Example: 25% of Phase 1 token holders decide to participate in Phase 2 (25,000,000 ASTRO tokens) and 25,000,000 UST also gets deposited. This would result in a price per ASTRO of $1. These participants will receive an additional 10,000,000 ASTRO (5m to each side) in proportion to their deposits.

If you hypothetically represented 1% of the deposited ASTRO, you're also entitled to 1% of the 5m ASTRO reward. This means your 250,000 ASTRO deposit is now in LP tokens representing 125,000 ASTRO and 125,000 UST, and you receive an additional 50,000 ASTRO which is a bonus of 20%.

Once Phase 2 ends, auction participants receive LP shares pro rata to their share of liquidity contributed, with the LP shares being locked and vesting linearly over 3 months.

At this point, the ASTRO circulating supply will be 11%.

Benefits

Now that we understand the mechanism in more detail, we'll explore how it achieves the goals outlined in the "Design Considerations" section:

- **Distribution:** ASTRO is distributed to users who pre-commit to using the protocol. Smaller wallets can boost their share of ASTRO by committing to longer usage periods via voluntary locks. Non-users can also acquire the token in a way that isn't exploitable by whales or bots and allows users some control over the price they pay
- **Price discovery:** Phase 2 enables bottom-up price discovery via the LP share auction mechanism which allows buyers (users who commit UST to the LP) and sellers (Astroport users who commit ASTRO to the LP) to come together and determine a fair price for ASTRO.
- **Sufficient float:** By the end of Phase 2, there will be 110,000,000 ASTRO in circulation corresponding to 11% of total supply.
- **Liquidity:** Phase 2 ensures liquidity by auctioning off locked ASTRO-UST LP shares rather than ASTRO tokens themselves. The pool is automatically capitalized at the end of Phase 2, ensuring instant, deep liquidity.
- **Decentralization:** Neither the project team or DAO are selling tokens to the public. Instead, protocol users are granted tokens (essentially to enable user-based governance rather than as part of an 'investment') and then given the option to sell some of these via an auction mechanism. Furthermore, because of the large float, the potential influence of pre-launch builders on post-launch token-based governance is diluted, making governance decentralized much earlier than usual.

Conclusion

We believe both the Lockdrop and the LBA represent new primitives for token launches and are excited to see the ways in which the broader crypto community chooses to adapt and build on them. While we've chosen to combine the Lockdrop + LBA here, these are independent mechanisms which can also be used in isolation.

The lockdrop can be seen as a new method of distributing tokens to users, rewarding future commitments instead of past or ongoing actions. It can be used in any protocol where "use" involves a commitment of capital that can be tokenised and locked. The LBA as presented here doesn't fall cleanly into either the token distribution or public sale categories and arguably represents an entirely new type of token distribution: a peer-to-peer auction. That said, for those with higher tolerance for regulatory risk, the LBA can also be used purely as a superior price discovery and liquidity mechanism, with the tokens coming from the project's treasury rather than users.

We have open-sourced the code for the lockdrop here and for the LBA here. We've already spoken to a few projects who will be looking to leverage these mechanisms and will be working closely with them to help tailor the design to their goals. If you're a project interested in leveraging these mechanisms, feel free to reach out to our team and we'll be happy to help you think through how to do so.

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