How Quasar Vaults Work

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In this piece, we take a closer look at our original vault and the details of what happens at every step of its functioning.

Vault Smart Contract

Quasar vaults function as a result of the interactions between two primary types of smart contracts. First, the vault smart contract:

- Tracks deposited assets and each user's share of value locked within the vault.
- Includes the entry points of bond ("deposit" on the UI), unbond, and claim ("withdraw" on the UI).
- Can call upon multiple other smart contracts referred to as strategy primitives (or simply, primitives) to execute DeFi strategies

Strategy Primitive Smart Contracts

Primitive smart contracts are essentially wrappers around atomic DeFi actions needed for vaults' strategies. They are:

- Highly customizable, with the transaction execution logic necessary for carrying out the strategy or sub-strategy
- IBC-enabled, utilizing interchain accounts (ICA), interchain queries (ICQ), and token transfer (ICS-20) channels to interact with counterparty chains

Multiple primitives are typically used to comprise a vault's active strategy. In the following example, we will use our first vault, OSMO PRO, to detail the flow of how a simple vault that requires only a single asset, OSMO, works.

OSMO PRO Vault Flow

Before being able to deposit any assets into a vault, a user must bring assets (in this case, from Osmosis) onto the Quasar chain via IBC transfer. This is done with the "IBC Transfer" button on the Quasar web app.

contract calls upon each of its attached primitives, sending a message to each primitive contract with a single transaction:

1. **Query** | An ICQ message is sent from Quasar to the counterparty chain (Osmosis, in this case).
   - The ICQ message queries the current balance of an interchain account on Osmosis associated with a Quasar primitive. This balance comprises Osmosis LP shares and OSMO.
   - Checks for accumulated liquidity pool rewards and includes them in Step 3 for autocompounding

2. **Transfer** | Once the ICQ acknowledgment is received, an ICS-20 transfer is initiated from Quasar to Osmosis
   - The sum of bonded (queed and pending) OSMO is deposited into the vault's interchain account on Osmosis.

3. **Join + Swap** | An ICA message is sent to Osmosis to execute a single-sided join into the appropriate liquidity pool.
   - The acknowledgment message in this case returns the amount of LP shares received by the interchain account on Osmosis as a result of joining the liquidity pool.

4. **Lock** | An ICA message is sent to Osmosis to lock the funds and receive Osmosis incentives.
   - The ICA acknowledgment received in the last step dictates how many LP shares are to be locked into the pool for at least 14 days. *Bond_response* is sent back to the original caller (the vault, from where the bond originated).

The vault receives a *bond_response* from each primitive it is associated with. Once all *bond_response* messages have been received by the vault smart contract, the appropriate number of vault shares are minted for the user. Vault shares track each user's pro-rata claim to the funds held by the vault.

Unbond

An "unbond" begins the process of withdrawing funds for the user by activating a 14-day exit timer after which the user's funds can be withdrawn to a Quasar address associated with their self-custody wallet. It is an entry point on the vault smart contract called *unbond* which then calls the entry point *start_unbond* for each primitive. When a *start_unbond* is initiated, the vault smart contract calls upon each of its attached primitives, repeating the following process for each primitive:

1. **Query** | An ICQ message is sent from Quasar to Osmosis.
   - The ICQ message queries the current balance of an interchain account on Osmosis associated with the relevant Quasar primitive, similar to the ICQ message involved in Bond.
   - This ICQ message also checks how many Osmosis liquidity pool shares need to be unlocked to match what the user wants to unbond at the Quasar vault level.

2. **Unlock** | Once the ICQ acknowledgment is received, an ICA message is sent to initiate the transfer from the relevant Osmosis liquidity pool back to the interchain account on Osmosis.
   - ICA is used to begin unlocking the relevant assets locked into the Osmosis LP.
   - The 14-day exit timer tracked by the vault begins when the acknowledgment for this ICA message is received.

A “withdrawal” finalizes the process of withdrawing funds for the user and is available to the user after 14 days have elapsed following a successful *start_unbond*. It is an entry point on the vault smart contract called *claim*. When a claim is initiated, the vault smart contract calls upon each of its attached primitives, repeating the following process for each primitive:

1. **Query** | An ICQ message is sent from Quasar to the counterparty chain (Osmosis, in this case).
   - The ICQ message calculates slippage by querying Osmosis and returns a value to the primitive smart contract.

2. **Swap + Exit Pool** | An ICA message initiates a swap at a small, configurable percentage under the slippage value. This ensures slippage-tolerant swaps that avoid MEV exploits such as sandwich attacks or any threat of arbitrary, sudden, and dramatic price shifts.
   - The ICA message tries to exit the liquidity pool with the unlocked LP shares, executing a one-sided withdrawal of OSMO. If the ICA account would not receive the expected amount of tokens, then the transaction should fail due to slippage.
   - Assets in the relevant liquidity pool are liquidated into OSMO and returned to ICA address on Osmosis associated with the strategy primitive

3. **Transfer** | The funds, in OSMO, are returned to Quasar via an ICS-20 channel using IBC hooks. IBC hooks are middleware that allows cross-chain execution by including information, in JSON format, in the memo field of an ICS-20 packet. This unique packet structure functions like a “bootleg” version of ICA that allows some cross-chain execution. Anything defined by a smart contract can be called by including the contract address and the message that includes execution logic.
   - Funds are held at the vault smart contract until all primitives complete their transactions of funds back to the vault. Once all funds have been returned, they are sent to the user’s address and become available in their wallet.

Note that “Unbond” on the UI begins the unbonding process and is connected to the *unbond* entry point in the vault smart contract which in turn calls *start_unbond* in the strategy primitive. “Withdraw” on the UI is connected to *claim* in the strategy’s code which in turn calls *unbond* in the strategy primitive, and completes the unbending + withdrawal process.

Coming Soon

That’s it! With new vaults like the concentrated liquidity vaults coming soon, we’ll release additional detail on more complex smart contracts. In due time, we will have more formalized documentation on the inner workings of Quasar tech that will be publicly available to incoming strategist and developer teams.

About Quasar

Quasar is building the primary asset management hub of the Cosmos ecosystem, representing the gateway to IBC-enabled yield opportunities. We’ve co-developed key IBC implementations such as interchain queries and pioneered IBC-enabled CosmWasm contracts for interchain vaults. We’ve recently launched our native token, QSR.
Quasar is striving to become the premier yield aggregator across all of IBC. We are a global team passionate about improving the Cosmos UX by pushing forward IBC technology while abstracting away its unwieldy technical details for users.

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