**What is the Balancer Protocol?**

Balancer is a protocol for multi-token [automated market-making](/balancer/core-concepts/protocol/background-1). It enables portfolio owners to create Balancer Pools, and traders to trade against them. Balancer Pools contain two or more tokens, each with an independent weight representing its proportion of the total pool value. The pools provide the Balancer Protocol with liquidity, and charge traders a fee for access to it. Pools can be considered automated market-makers, since anyone can swap any two tokens, in any pool.

### How is the Balancer Protocol useful?

There are two categories of users who can benefit from the Balancer Protocol: liquidity providers - who own Balancer Pools or participate in shared pools, and traders - who buy or sell the underlying pool assets on the open market. Anyone with two or more ERC20 tokens can be a liquidity provider. For example:

* Portfolio managers, who want to have controlled exposure to different assets without complicated and expensive rebalancing
* Investors who have ERC20 tokens sitting idly in a wallet, and would like to put them to work earning passive income from fees

Traders can choose from a diverse set of pools, each presenting a unique set of investment opportunities and challenges through its particular configuration of tokens, weights, and fees. The interplay between these settings, pool volume, and external prices generates market forces which incentivize traders to maintain stable token ratios, thereby preserving asset value for liquidity providers.

There are three main categories:

* "Retail" traders seeking to exchange tokens with low slippage at favorable rates
* Arbitrageurs seeking profit through leveling market inefficiencies between DEXs or CEXs
* Ethereum smart contracts seeking liquidity for a variety of reasons, such as liquidating positions on other protocols, trading on behalf of users, etc.

**Is Balancer Protocol fully permissionless?**

Yes. Balancer Pools cannot be censored or whitelisted. Traders cannot be censored or whitelisted. Balancer Labs does not have the power to halt or edit the smart contracts in any way after they’ve been deployed. The contracts are not upgradeable, and there is no admin functionality or "backdoor" present in the code.

Of course, Balancer has no control over the contracts of ERC20 tokens placed in Balancer pools. If a centralized token (e.g., USDC) were to blacklist an address or freeze all transfers, that would affect all USDC tokens everywhere, including those in Balancer Pools

### What is a Balancer Pool?

The fundamental building block of the Balancer Protocol is the Balancer Pool. Pools are smart contracts that implement the Balancer Protocol, and hold value in two or more ERC20 tokens.

You can think of a Balancer Pool as an automated, market-making portfolio. Each token asset has an independent weight, and can be traded against any other token in the pool. For example, you could have a pool with three tokens in the following proportions 50% WETH, 25% MKR and 25% DAI.

The value proposition of Balancer flows from two main features:

1. Even as the relative unit prices of the tokens vary, the pool as a whole is continuously rebalanced (in an efficient market) to maintain each token's proportion of the total value.
2. Each trade that takes place in a Balancer Pool generates a fee for the pool owner. The fee is a percentage of the trading volume, and is customizable by the pool owner when the pool is created.

Thus the incentives of both participants are aligned. Liquidity providers earn trading fees, while the overall value of their portfolio is preserved through continuous rebalancing. Traders pay these fees for the opportunity to either swap tokens with low slippage, or profit from arbitrage opportunities between pools and the open market.

### Are there constraints for setting up a Balancer Pool?

Only a few. Balancer Protocol limits pools in the following ways:

* Number of tokens: pools must contain at least two, and may contain up to eight tokens on V1 (16 on V2 Weighted pools).
* Swap fee: the fee must be between 0.0001% and 10%
  + ERC20 compliance: pool tokens must be ERC20 compliant. Bronze does not support ERC20 tokens that do not return bools for transfer and transferFrom. V2 is a bit more flexible, but will not support some token types, such as tokens that change balances (e.g., elastic supply tokens).
* There are a few additional ratio and balance constraints that can be found at [Limitations](/balancer/core-concepts/protocol/limitations).

Link - <https://balancer.fi/whitepaper.pdf>

(for understanding the maths behind calculations in balancer)

**Swaps –**

## **Batch Swaps**

You'll want to use **Batch Swaps** when you're making a trade that hops through multiple pools. These are useful for swapping between two tokens that aren't in the same pool, and for routes with better prices than naive single swaps.

### Flash Swaps

There is a specific case of Batch Swap called a Flash Swap that enables trades with no input tokens. These are useful for doing arbitrage among Balancer pools. To make a Flash Swap, create a Batch Swap with all your token limits set to zero.

## **Single Swaps**

You'll want to use **Single Swaps** when you're making a trade between two tokens in one pool. While it's possible to do this with a one-step Batch Swap, using a **Single Swap** will save ~6,000 gas.

**Why should I use a batchSwap?**

Tokens that aren't in the same pool

Let's say we want to trade TokenA for TokenC, but we only have pools with [TokenA, TokenB] and [TokenB, TokenC]. We can swap A -> B and B -> C.

**Routes with better prices than Single Swaps**

Let's say we still want to trade TokenA for TokenC, but now there's a [TokenA, TokenC] pool. We could use a Single Swap there, but there might be a better price routing by swapping A -> B and B -> C.

Link - <https://thegraph.com/docs/en>

(Link for the graph docs)

# **Why should I use the Balancer Subgraph?**

The Subgraph features easy-to-query data using GraphQL, and can log data in such a way that you can easily access data that's difficult to query on-chain. For example, there is no on-chain list of all Balancer pools (similar to how there's no on-chain list of all ERC20 tokens), but on the Subgraph, you can easily query all pools, even filtering by PoolType.