

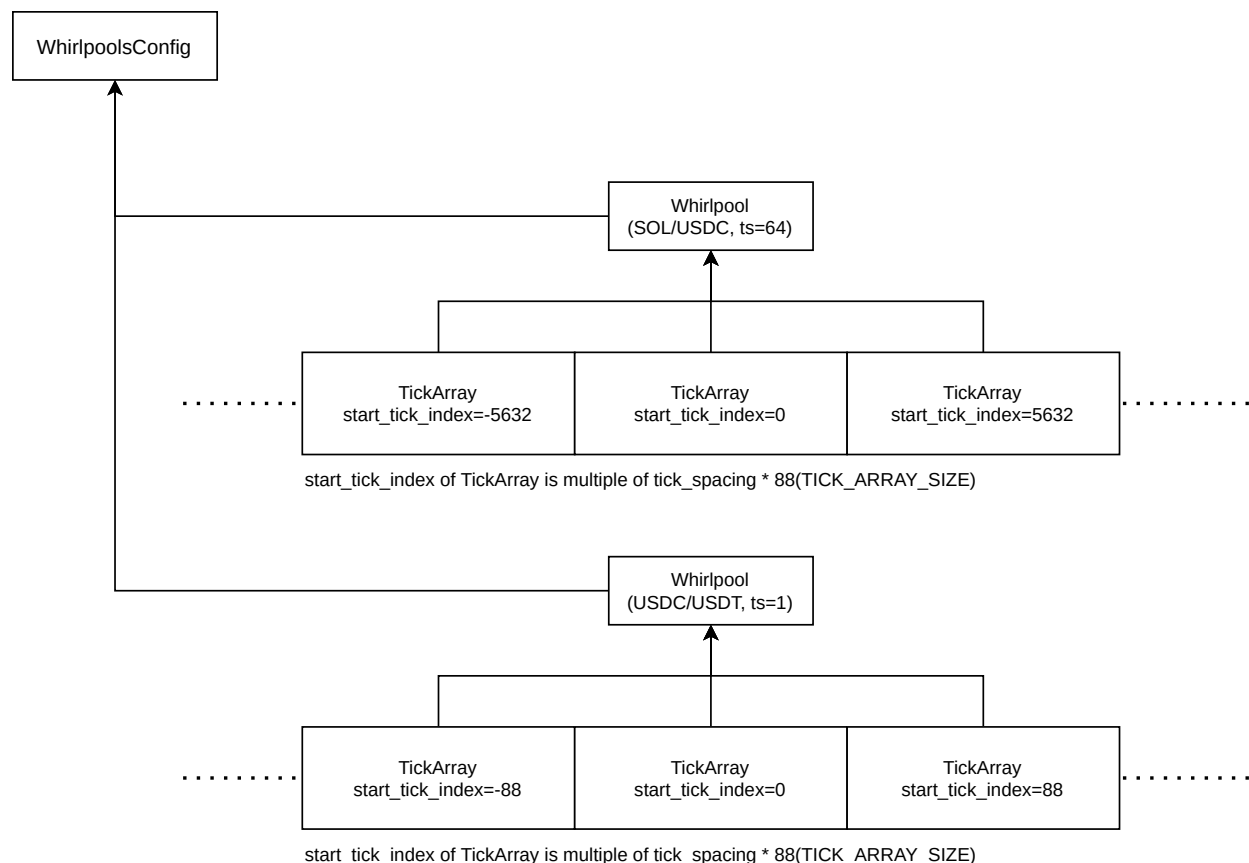
How TickArray works to maintain GlobalLiquidity


Account Structure

A sequence of Ticks are stored in individual TickArray accounts on chain.

Each whirlpool has a sequence of tick-array accounts to host the entire tick range.

In other words, SOL/USDC whirlpool have its TickArray accounts, and USDC/USDT whirlpool have its TickArray accounts respectively.



 <https://orca-so.gitbook.io/orca-developer-portal/whirlpools/architecture-overview/understanding-tick-arrays>

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TickArray definition

TickArray is an array(sequence) of Tick. Its size is always 88.

Tick

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 <https://github.com/orca-so/whirlpools/blob/main/programs/whirlpool/src/state/tick.rs#L19>

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Open source concentrated liquidity AMM contract on Solana



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```
pub struct Tick {
    // Total 137 bytes
    pub initialized: bool,    // 1
    pub liquidity_net: i128,  // 16
    pub liquidity_gross: u128, // 16


    // Q64.64
    pub fee_growth_outside_a: u128, // 16
    // Q64.64
    pub fee_growth_outside_b: u128, // 16

    // Array of Q64.64
    pub reward_growth_outside: [u128; NUM_REWARDS], // 48 = 16 * 3
}
```

TickArray


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 <https://github.com/orca-so/whirlpools/blob/main/programs/whirlpool/src/state/tick.rs#L143>


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```
pub const TICK_ARRAY_SIZE: i32 = 88;
pub const TICK_ARRAY_SIZE_USIZE: usize = 88;
...

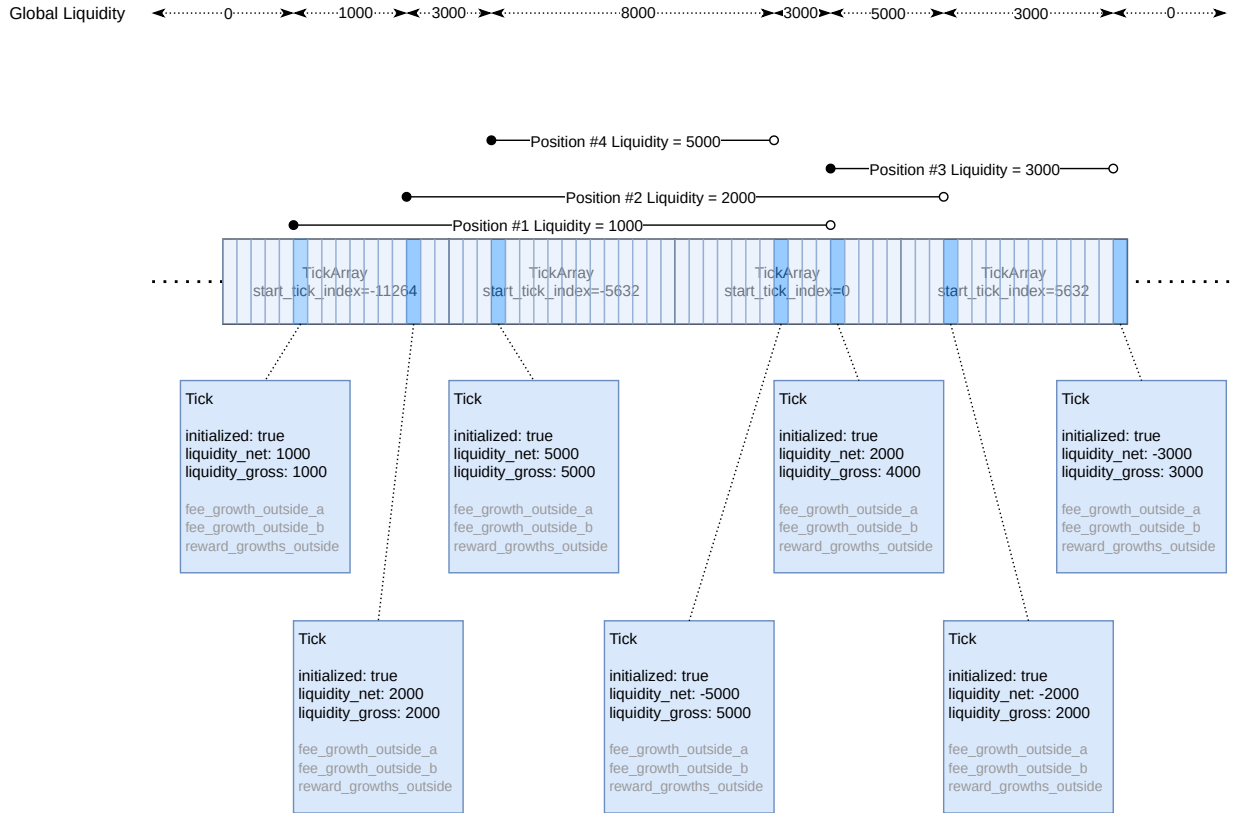
pub struct TickArray {
    pub start_tick_index: i32,
    pub ticks: [Tick; TICK_ARRAY_SIZE_USIZE],
    pub whirlpool: Pubkey,
}
```

The purpose of TickArray is as follows:

- To maintain global liquidity
- To calculate fees & rewards

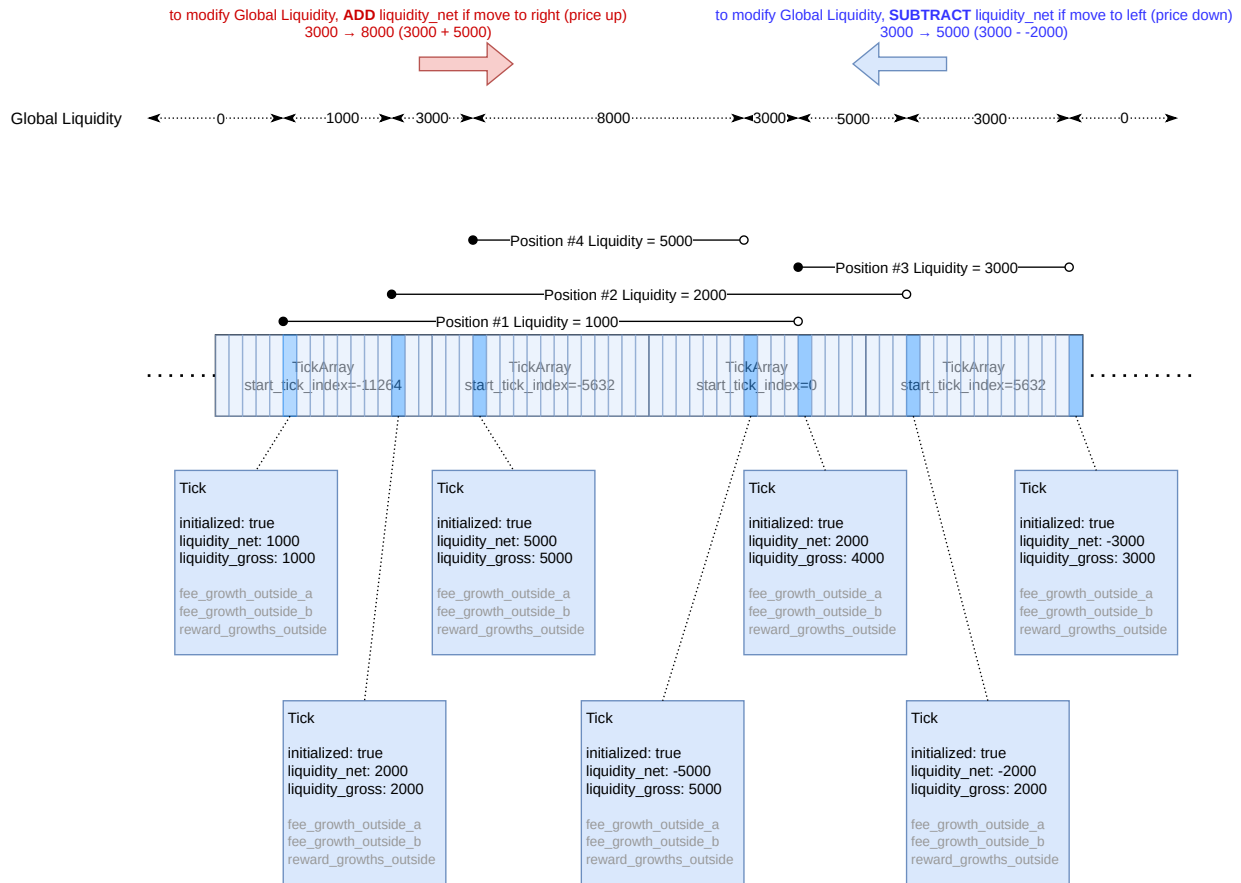
How TickArrays maintains global liquidity

Assuming only 4 open positions, TickArray and Tick are initialized as shown in the following figure.



Liquidity is added to the liquidity_net of the Tick corresponding to the lower_index of the position and subtracted from the liquidity_net of the Tick corresponding to the upper_index.

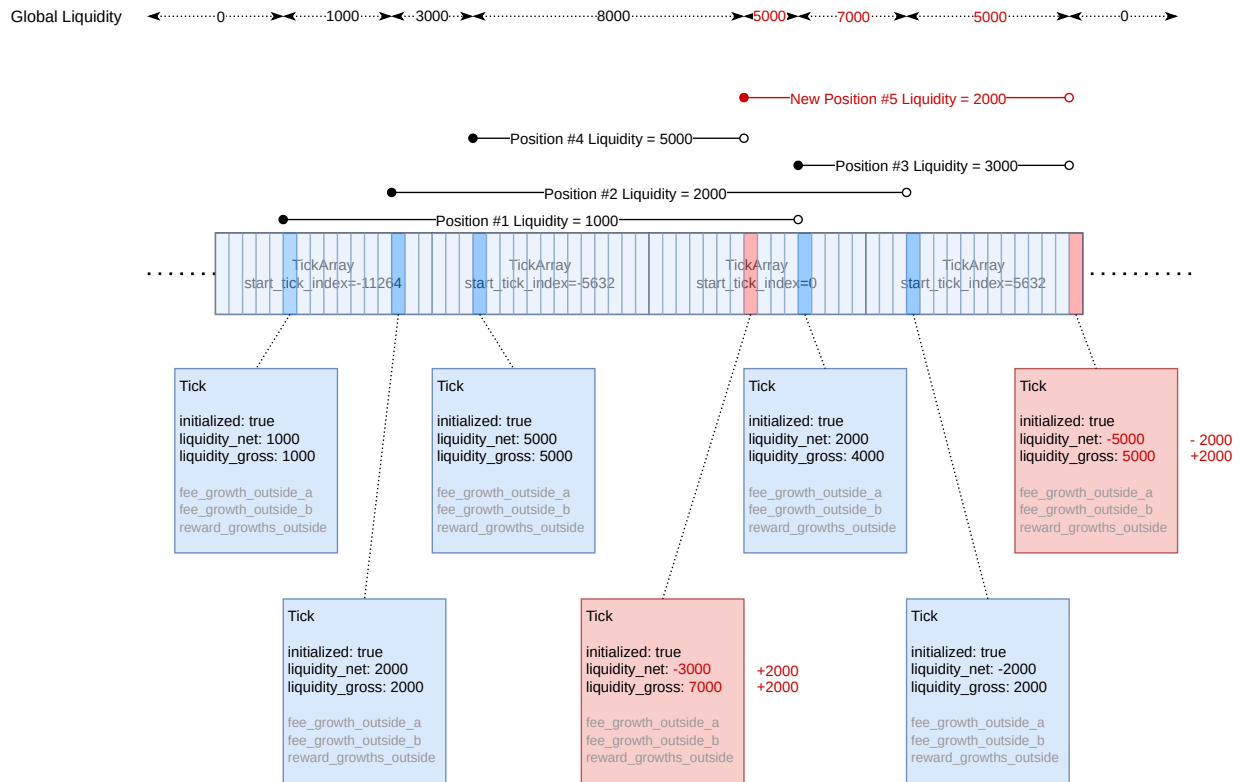
This initialization allows GlobalLiquidity to be calculated by adding liquidity_net if the price moves up due to the swap and crosses the tick.



Conversely, if the price moves downward due to a swap and crosses a tick, GlobalLiquidity can be calculated by subtracting liquidity_net.

The beauty of this management method is that it does not require consideration of a huge number of positions and only a limited number of accounts need to be read. This is especially important for Solana, where only a limited number of accounts can be read.

To be sure, the figure shows the update when a position is added.



To make such an update, the instruction to manipulate the position requires accounts of TickArray containing Tick corresponding to lower_index and upper_index.