

One common misconception of rollups is that they all require an on-chain dispute resolution contract in the form of a light client implemented as a smart contract. This is only true if the rollup needs a two way bridge with some other chain (i.e. the Ethereum parent chain), which is not necessary for all use cases.

Consider a rollup for recording the ownership of NFTs. You can achieve all the same functionalities as a standard rollup (i.e. a trust-minimized bridge between the rollup and the main chain), without a dispute resolution on the Ethereum chain. Instead, you only need a one-way read-only bridge for the NFT rollup to read the Ethereum chain state.

Let's assume a rollup for recording the ownership of NFTs, that uses Ethereum for data availability, but does not have a bridge/dispute resolution contract on the Ethereum chain. Now, let's assume that an owner of an NFT on the rollup wants to use the NFT for some DeFi application on the Ethereum main chain or one of its rollups, e.g. use the NFT as collateral for a loan. How would they do this?

Owners of NFTs on the rollup can create a 'wrapper NFT' on the main Ethereum chain (or some rollup like Arbitrum connected to the Ethereum chain). The rollup's state transition function would be designed such that whoever owns the wrapper NFT on Ethereum, also owns it on the rollup, because the rollup clients would also run Ethereum nodes.

The fraud proofs and validity proofs would be shared on the peer-to-peer layer of the rollup's subnet, rather than posted on any chain, so the rollup's light clients can still reject invalid blocks. This is similar to Mina validity proofs, or if you were to add fraud proofs to Bitcoin light clients - they don't need to be posted to any on-chain dispute resolution layer.

To determine if a wrapper NFT is valid or not, you would need to follow the canonical rollup chain to check that the wrapper NFT was minted correctly. This means that a smart contract on Ethereum wouldn't be able to check if the wrapper NFT was valid or not without a dispute resolution contract, but this doesn't matter. The status quo is already that because anyone can obviously create a worthless NFT, you need to check the value of an NFT off-chain anyway before e.g. offering to lend someone funds collateralized by it. Checking whether the wrapper NFT is valid or not is a part of checking whether the NFT has value. Checking what the value of ETH itself within a DeFi protocol for example is a similar problem; protocols like Maker use external price oracles.

The key intuitive here is that: you need a two-way bridge and therefore on-chain dispute resolution, only if you want to move assets (e.g. ETH) 'hosted' on the Ethereum chain, but not necessarily vice versa (e.g. moving an NFT from the rollup to the Ethereum chain).