Walrus & Sui vs IPFS & Filecoin

Find out which of these decentralized protocols are best for storing data.

25 Mar 2025 8 min

← Blog

When considering Walrus alongside other decentralized storage protocols, Filecoin stands out as the most directly comparable. However, both are closely linked to other protocols – Filecoin to IPFS and Walrus to Sui – so I also include these protocols in the analysis.

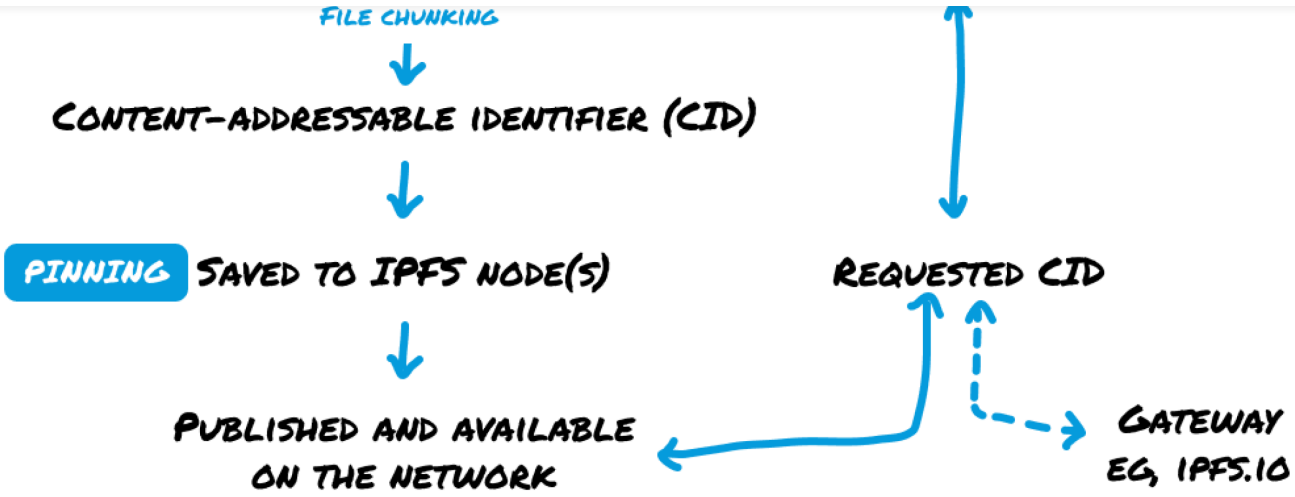
This is not an attempt to be an exhaustive technical review of these protocols. The purpose of this article is to focus on the most interesting and relevant points of comparison when considering using these protocols as a storage solution.

Introducing IPFS & Filecoin

IPFS & Filecoin **both come from Protocol Labs**, serving different but complementary roles in decentralized data storage.

IPFS (InterPlanetary File System), launched in 2015, is a protocol for **accessing and transferring data based on its contents**, not its location. It was designed to address issues inherent in HTTPS, which relies on URLs for data retrieval. IPFS employs content addressing **using a content-addressable identifier (CID)**, unlike location-based IP addresses. IPFS CIDs enable access from any host globally without relying on a centralized entity.

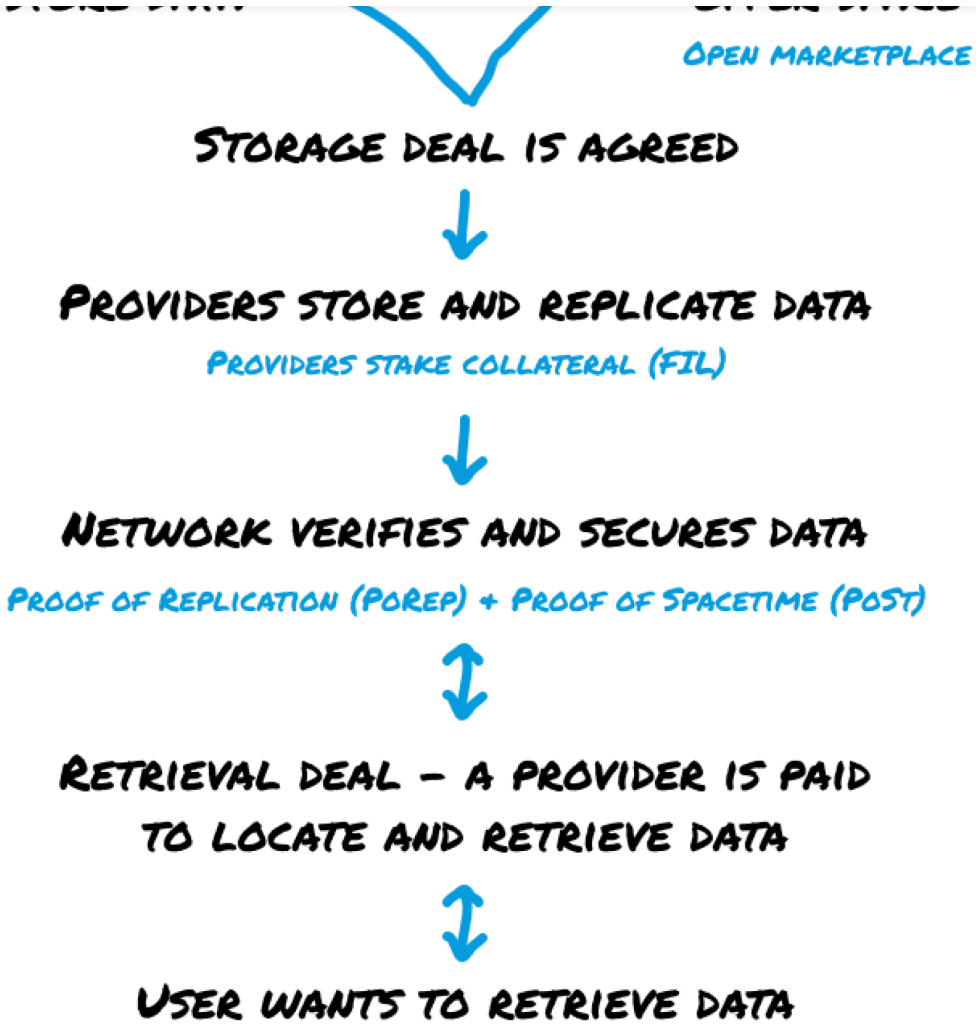
However, **IPFS is not a dedicated data storage solution** – it doesn't inherently guarantee persistent or reliable storage. When you add a file, it **remains online only while at least one node in the network is hosting i**t. This is where pinning comes into play: it's how data stays on IPFS, and without it, routine garbage collection would remove inactive data. **Pinning services – centralized, third-party providers – ensure your data remains accessible** by keeping copies on their nodes.



How pinning files and retrieving works on IPFS

One limitation of IPFS is the **lack of an incentive model** for users to store and maintain others' data over the long term. To address this gap and other limitations, Protocol Labs developed Filecoin, a complementary blockchain protocol. While IPFS focuses on addressing and retrieval, **Filecoin incentivizes and guarantees long-term availability**. Think of it like "**Airbnb meets Amazon Web Services**," where participants earn FIL tokens for renting out storage space.

Filecoin can be used independently of IPFS and, in theory, anyone can provide or consume data storage on the network. But it **most often supports use cases for long-term, archival storage**, because Filecoin's incentive model is **optimized for large-scale storage**. Filecoin miners are rewarded based on the amount of storage they commit, with 32 GiB and 64 GiB sectors serving as the standard unit of storage. As a result, files under 4 GiB are considered "small-scale storage" and are much harder to store directly, as providers prefer large, high-efficiency storage deals. **Small files often require third-party aggregation** services to bundle multiple datasets into larger, more attractive storage contracts – **often adding complexity and cost.**



How uploading and retrieving files works on Filecoin

Introducing Walrus & Sui

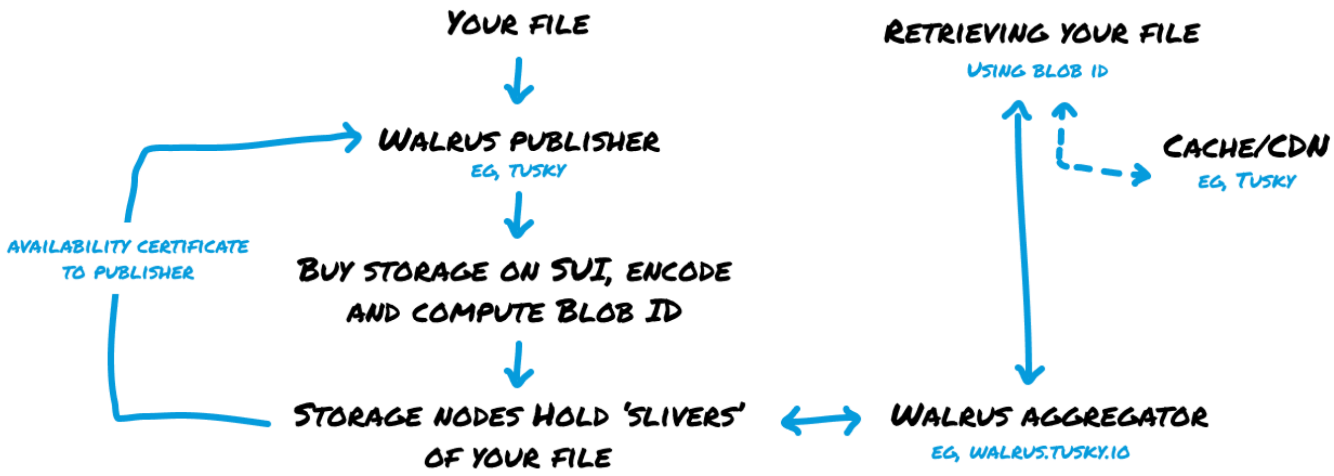
Walrus is a decentralized storage and data availability protocol **built by Mysten Labs**.

Walrus does not replicate the full file across nodes. Instead, it **uses the Red Stuff protocol for fast encoding of blobs** (large binary objects), and each node stores a 'sliver' of the encoded file. This **keeps the storage overhead to a 4-5x replication factor** and enables Red Stuff to scale to hundreds of nodes efficiently. This is in contrast to Reed Solomon (RS) encoding, which has been used by storage protocols like Sia and Storj, and cannot efficiently scale. Importantly, **Red Stuff can function under Byzantine Faults**, meaning one third of the nodes could be malicious.

Blobs are stored on Walrus for a defined period of epochs (2 week periods) up to 2 years. This can be extended with a transaction. **Blobs can be set as deletable (or non-deleteable**, making it censorship resistant) and the resource reused for its remaining lifetime. **Walrus doesn't incentivise large- or small-scale storage,** but the **current max file size on Walrus is ~14 GB** with the potential in the future to separate larger files into 14 GB chunks for much larger file storage.

Walrus is a **delegated proof of stake protocol**, where staking, rewards and penalties are used to align incentives and enforce long-term commitments. **Storage is paid in the WAL token**.

also used for programming storage resources and governance.



How uploading and retrieving files works on Walrus

Programmable storage

Programmable storage **refers to automating how data is stored, retrieved, and managed via code**. In a web3 context, this means using onchain conditions – like token ownership, identity, DAO governance approval, etc – and **smart contracts to govern storage access and lifecycle**. It's a key differentiator from web2 services, where storage is passive and the cost of moving and managing data is considerable.

Filecoin originally had no built-in smart contract layer, but **in 2023 the Filecoin Virtual Machine (FVM) launched** to enable a form of programmable storage. FVM lets developers create onchain logic to manage storage deals – such as automating replication, access control, or data tokenization – though **it interacts with metadata rather than the underlying data itself**. FVM supports multiple programming languages and is **EVM compatible**, making it familiar for many blockchain developers.

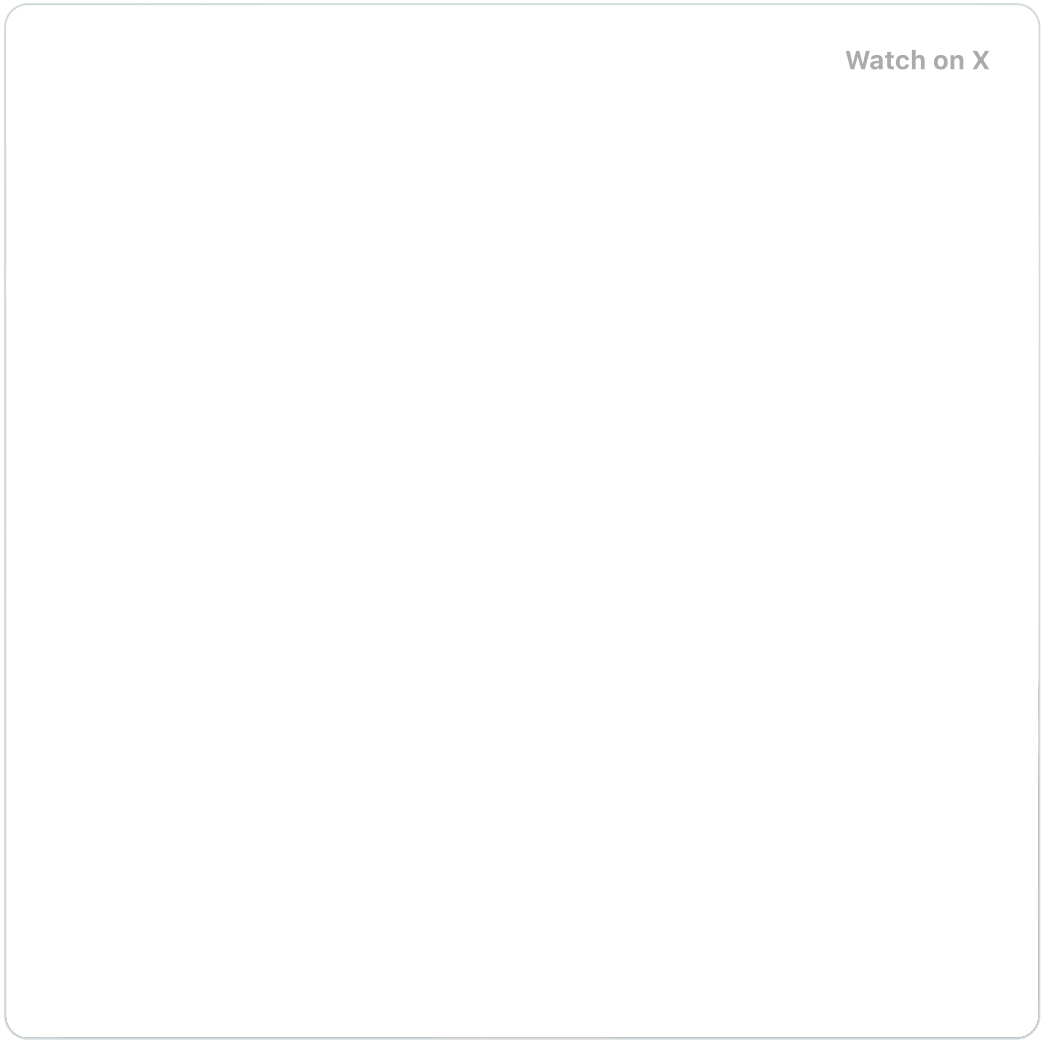
Walrus, on the other hand, was built from the ground up to be programmable, leveraging Sui and its Move smart contracts. In Walrus, **storage is a first-class object, meaning contracts directly manipulate the storage resource**. As the Walrus whitepaper puts it, "Storage resources can be split across time or space," enabling developers to partition, merge, or reassign storage resources at the object level. This differs from FVM, where the contract logic is primarily concerned with managing deals, and the underlying data still lives in a distinct layer.

The practical upshot is that **Walrus can handle complex ownership structures** – imagine multi-party workflows, tiered permissions, or ephemeral data lifecycles – without relying on external APIs. This deeper integration can enable **more flexibility and creativity for applications where storage is integral**, such as dynamic NFTs, onchain game assets, or collaborative and token-gated docs. In contrast, **FVM is more limited to orchestrating the economic aspects of Filecoin's network**, like awarding FIL tokens or verifying deals, while requiring some extra steps to interact with the actual data.

Finally, **Walrus benefits from Move's stronger safety guarantees**, since Move's resource-oriented model – which enforces **strict rules around the creation, management, and transfer of assets** – enforces consistent handling of assets (including storage). After the recent Bybit hack, Adeniyi Abiodun, Mysten Labs CPO, said:

EVM is an inherently unsafe system, and it's time for this industry to move beyond that. Move is the only programming paradigm built from the ground up to securely handle digital assets at scale.

Make the switch before it's too late.



4:21 PM · Feb 28, 2025

483 Reply Copy link

Read 46 replies

Storage verification

There is **no built-in functionality in IPFS to prove your data is stored on the network**, only content verification via the CID. **On Filecoin, consensus revolves around two cryptographic proofs: Proof-of-Replication (PoRep) and Proof-of-Spacetime (PoSt).** These proofs ensure storage miners have physically independent copies of the data and continuously store them over specified durations. **Storage miners are**

Filecoin's solution to achieving storage verification **comes at the cost of linear scaling inefficiencies and complexity**. In contrast, for storage verification **Walrus uses an asynchronous challenge protocol**, which does't require constant storage challenges for each file. It relies instead on:

> ... a novel storage attestation mechanism that challenges the storage node as a whole, rather than each file individually. Consequently, the cost of proving file storage scales logarithmically with the number of stored files.
>
> Walrus Whitepaper

Walrus is able to challenge a node for storage verification, because all storage nodes to hold slivers of all stored files, thanks to its 2d encoding protocol, Red Stuff.

Replication and retrieval

Filecoin and IPFS make no guarantees as to the level of data replication in storing users' data. Rather, **it is up to users to decide** how many times they want their data to be replicated across the network. If a user chooses an **IPFS pinning service**, they should **establish how many nodes the pinning service operates**. However, the risk here is that **pinning services could cease to operate at any time**, as Estuary and AlwaysNFT have shown.

When making a storage deal **on Filecoin, a replication factor is agreed with the storage provider**. The Filecoin whitepaper simply advises, "Higher redundancy results in a higher tolerance of storage faults." In a scenario where 1/3 of nodes were adversarial – a test of Byzantine fault tolerance – **Filecoin would need a 25x replication factor to achieve a level of 'twelve nines' security**. Filecoin users are then left to choose between paying for a 25x replication deal or accepting a lower replication (and some degree of lower security).

Walrus takes a very different approach, taking the lead on the level of replication for all data on the network. The **Red Stuff protocol bakes in a 4–5x level of replication across the network while maintaining Byzantine fault tolerance.**

When it comes to data retrieval, Filecoin and Walrus again make very different design decisions. **Filecoin relies on separate retrieval miners and does not ensure rapid or free access to stored data**, requiring separate incentives for fast retrieval. Users must negotiate terms before a user can retrieve their data.

Unlike Filecoin, **IPFS doesn't include economic incentives for retrieval** – it operates on a voluntary participation model. This makes it great for popular content that many peers want to share, but **unreliable for long-term storage of less-accessed data**.

"This should work [free and rapid access] since storage nodes are broadly aligned in making Walrus a successful system. In addition, we foresee other providers, such as caches or content distribution networks (CDNs), offering high-quality read access to data potentially for a fee paid by the reader or even the writer."

Indeed, **if we look at Tusky, users** pay a subscription for their storage plan, but **are not charged egress fees**. **Tusky provides its own Walrus aggregator** that resolves file types in the browser, **as well as its own CDN and caching layer on Walrus.** This makes reading data from Walrus fast and radically simplifies the process for users compared to Filecoin.

Tokenomics and economic incentives

Filecoin tokenomics

2 billion FIL supply (fixed).

Market cap. Fully diluted value $5.81B (as of March 2025)

Token distribution:
70% allocated to storage providers (miners) as block rewards and storage fees

30% allocated to the team (15%), investors (10%), and Filecoin Foundation (5%)

Miners earn FIL by proving storage over time. Incentives based on PoRep & PoSt.

Staking and slashing. Storage providers must stake FIL, with penalties for data loss or failure to prove storage.

Governance. Holders of FIL can participate in governance.

Walrus tokenomics

5 billion WAL supply (fixed).

WAL is not yet listed but the foundation **raised $140m from investors**.

Delegated Proof-of-Stake. Storage providers stake WAL to secure storage shards.

Token distribution:
10% user airdrop (4% pre-mainnet, 6% reserved for mainnet).

43% community reserve.

30% core contributors (20% early contributors, 10% Mysten Labs)

7% investors

10% subsidies

Staking and slashing. Nodes face slashing of staked collateral for failed commitments, poor performance and short-term staking.

Governance. WAL holders vote on storage costs and governance.

Comparing FIL & WAL

Filecoin's model has achieved adoption but depends on artificial subsidies.

Filecoin introduced the Filecoin Plus (Fil+) incentive program to verify clients and subsidize their storage fees, enabling them to charge drastically reduced fees (typically zero). **Fil+ subsidizes storage fees by paying miners 10x the block reward for storing verified client data**.

Of the 1.195 EiB of data stored in active storage deals **on Filecoin, over 99% is subsidized by Fil+**.

Equally worrying is that the **Filecoin network has decreased from 1.835 EiB this time last year, a 34.88% drop**. This suggests Filecoin is not attracting new clients and existing clients are not renewing storage deals when they expire.

Over time, **Fil+ incentives will stop** and storage providers accustomed to 10x rewards will start **passing the cost on to users** of the network.

Walrus, by contrast, allocates only 10% of its WAL token to subsidies and ties incentives mainly to governance and staking participation. While Filecoin has the advantage of longer market presence, Walrus's adaptive economic model should, with effective governance, make it far more sustainable in the long run.

Use cases

IPFS has been synonymous with decentralized storage thanks to its success as a storage solution for NFT assets, as well as a popular storage solution for web3 developers. NFT.storage claims to have stored 136 million uploads on IPFS. Pinata, another IPFS pinning service, advertises on its homepage that 600,000 developers have used its services, including companies such as OpenSea, Sorare and Ledger.

Due to its complexity around making storage deals, data retrieval and upload limitations, **Filecoin has predominately found success as a long-term archival solution**, particularly with public institutions. DeStor, the primary Filecoin storage solution linked to from the Filecoin.io website, boasts customers such as University of Berkeley, University of Utah, Cern, Starling Lab and the USC Shoah Foundation.

Walrus is just emerging from testnet, and so we cannot say with certainty where its main use cases will lie after a comparable amount of time in the market. **But early announcements from companies using Walrus** perhaps give an indication for where adoption may primarily come:

Decrypt. News and media.

ONE Championship. Entertainment and media.

Tusky. Decentralized Dropbox/AWS.

Tradeport. NFT marketplace.

Atoma Network. Decentralized, private AI.

Talus Network. AI agents.

Linera. L1 blockchain.

Plume Network. L1 for RWA.

Snow Reads. Digital archive.

Conclusion

Although IPFS & Filecoin have been pivotal in establishing decentralized storage, they come with trade-offs. **IPFS lacks data persistence, replication and storage verification guarantees**. Despite its incentives, **Filecoin's model faces challenges with scalability (especially for small-scale storage) and sustainability** due to its reliance on Fil+ subsidies.

IPFS & Filecoin were pioneers, but like most pioneers doing something for the first time they were learning on the job, figuring out what was needed as they went. **IPFS was not designed to store data, and Filecoin was not designed as programmable storage**. As a consequence, centralization, complexity and weaker guarantees around security and data availability have become the legacy of that journey.

Walrus & Sui, by introducing innovative encoding (Red Stuff), a delegated proof-of-stake framework, and deeply integrated programmable storage, **offer 'gen 2' decentralized storage**. They promise not only to reduce storage overhead and improve scalability, but also to provide a more robust, economically sustainable, and developer-friendly environment. Storage isn't just a passive service – it's an object that can be directly manipulated by onchain logic.

In short, **the Walrus & Sui approach represents a very promising evolution of decentralized storage** that addresses some of the most critical shortcomings of the established IPFS & Filecoin model, making it well-suited to go far beyond the fairly limited use cases of web3 storage we've seen so far.

Tusky

Pricing

Docs

Blog

Launch app

Community

Discord

X

Learn

Sui Ecosystem Map

What is Walrus

What is Sui

What wallets support SUI?

Walrus timeline