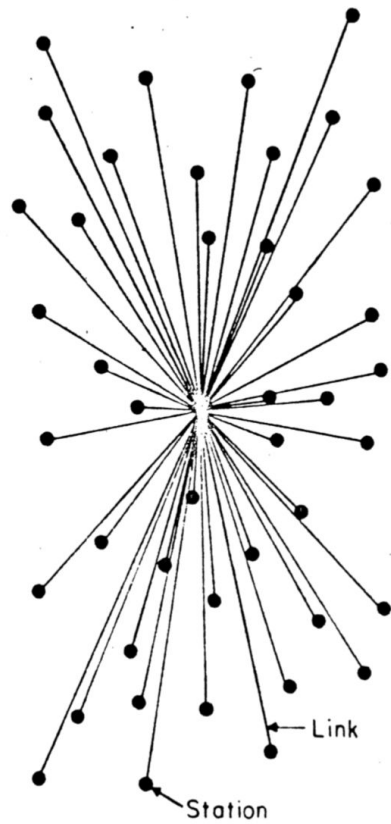STATUS USB LAN
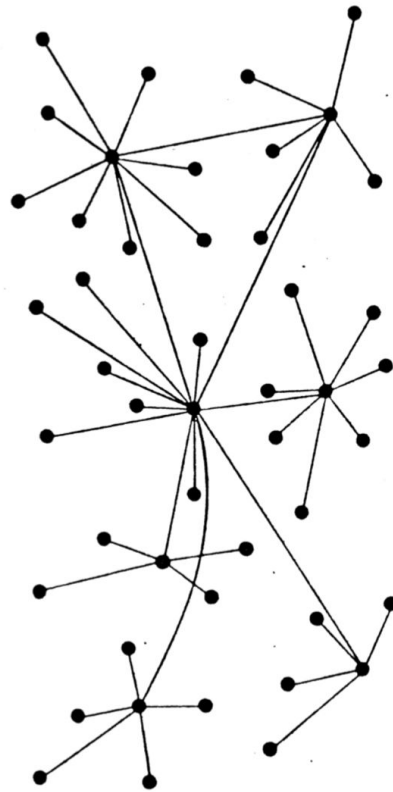
POWER

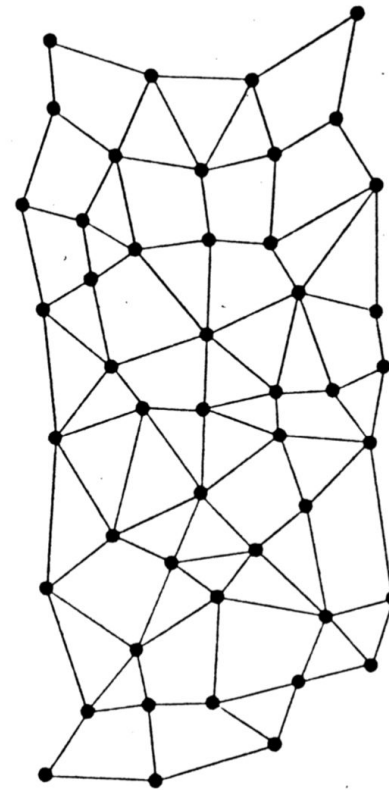COPY

CENTRALIZED
(A)

DECENTRALIZED
(B)

DISTRIBUTED
(C)

FIG. I — Centralized, Decentralized and Distributed Networks

Starling

Simplified & coordinated decentralized storage on the Filecoin network

Filecoin

Filecoin Node

- Buy or sell on storage market
- Prove storage
- Retrieve data
- Gossip orders and transactions
- Find and connect to other nodes
- Maintain consensus
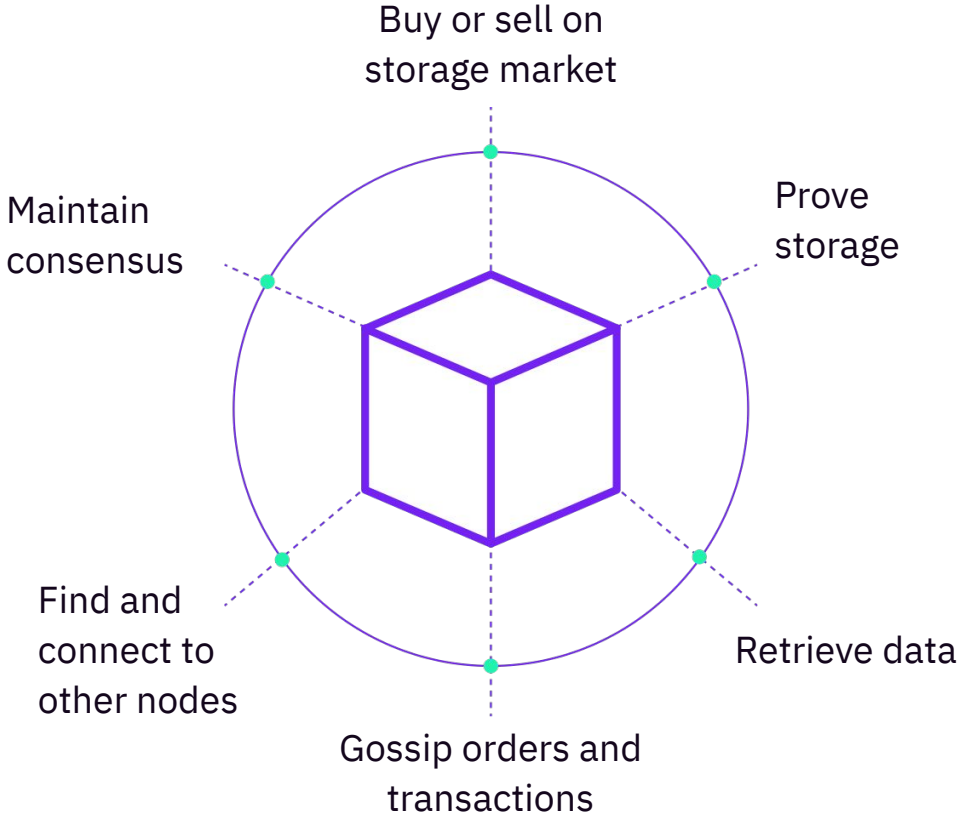
Storage Network

Public chain records messages and commitments

Decentralized storage nodes maintain copies of the chain via consensus + provide storage
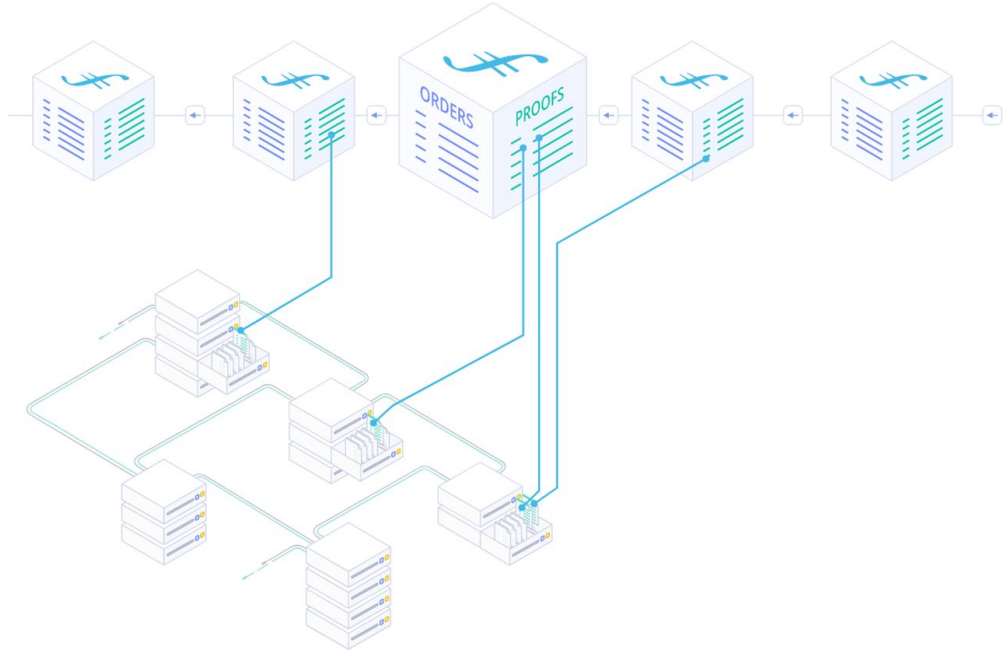
Storage Mining Details

Offer storage → **Make deals** → **Store data, get paid** → **Redeem payment**

Tell the network you're ready to store

Though the lifetime of the deal, as miners submit correct PoSts, funds are released in the payment channel.

Transfer funds from payment channel to wallet.

| Set your price |
| Price |
| How long it's valid for |
| Amount of storage |

| Wait for deals |

| Accept deal |

Uses bitswap by default

| Transfer data |

| Seal data |

| Submit PoSt |

Chain checks if on time and correct before releasing payment

Storage client can arbitrate deal if long failures. Miner penalty is storage collateral.

| Submit PoSt |

| Submit PoSt |

| Redeem payment |
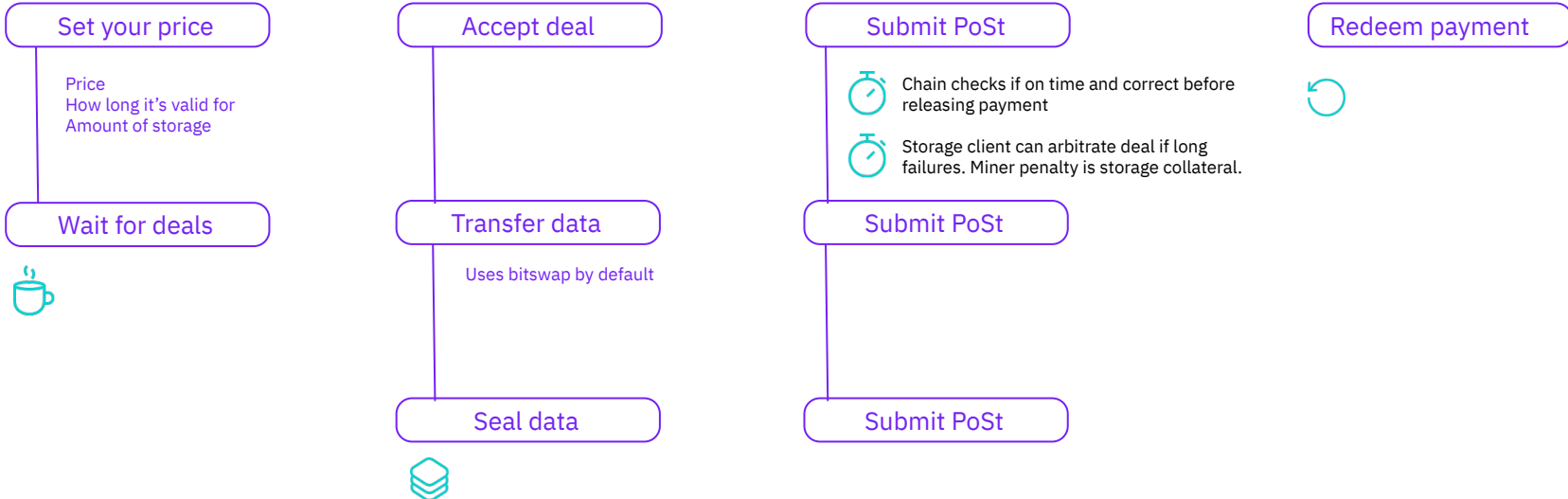
Storage Client Details

Prepare data → **Make deals** → **Data stored** → **Retrieve**

Miners submit proofs of
continuous storage. Clients
can verify or arbitrate.

| Prep and split | Browse miners | Check for proofs | Retrieve |

Price
How long it's valid for
Amount of storage
Reputation
Geography

Throughout the lifetime of the deal, miners
submit continuous proofs of storage.

Encrypt

Propose deals

Verify

Include funds from wallet

Transfer data

Arbitrate

Storage client can arbitrate deal if long
failures. Miner penalty is storage collateral.
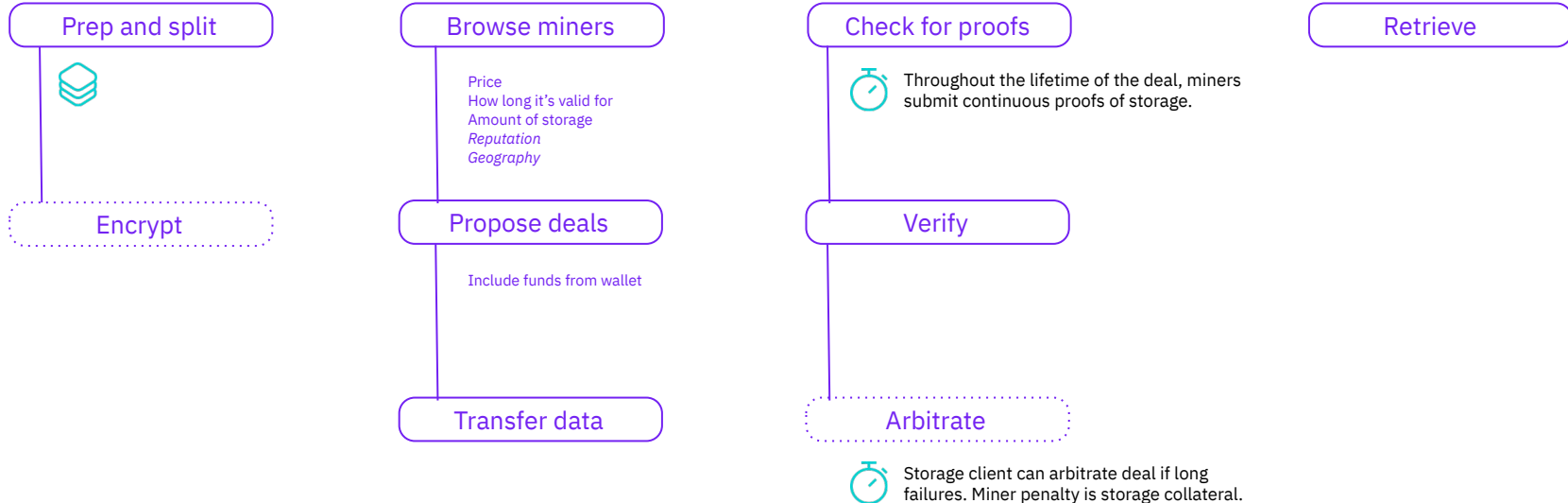
Filecoin Storage Proving

Seal

Not a proof, but an operation that combines data + pseudorandom seed to guarantee a unique replica.

Proof of Replication (PoRep)

Creates a replica via Seal operation, and proof that it was correctly generated

Inputs:
- prover key
- SEAL key
- data

Proof of Spacetime (PoSt)

A series of proofs that, together, give confidence in continuous storage over time.

Inputs:
- prover key
- replica R (from PoRep)
- random challenge
- time
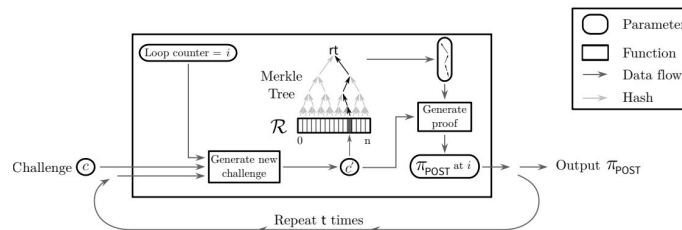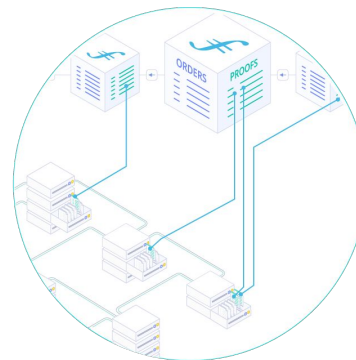
Iterative proofs for storage over time
Source: Filecoin Whitepaper, July 2017

Starling

```
My-computer: ~ user$ npm install -g starling
```

1. How many copies?
2. How much $

```
My-computer: ~ user$ starling store /Users/TSF/videos
```

```
My-computer: ~ user$ starling store /Users/TSF/videos

🔍  Indexing folder…
==> 189 files
==> 238 GB


📡  making Filecoin storage deals for 3 redundant copies
00:00:04 [===>------------------------] 13%
```

```
My-computer: ~ user$ starling store /Users/TSF/videos

🔍  Indexing folder…
==> 189 files
==> 238 GB


📡  making Filecoin storage deals for 3 redundant copies
00:00:10 [=========================>---] 90%
```

```
My-computer: ~ user$ starling store /Users/TSF/videos

🔍  Indexing folder…
==> 189 files
==> 238 GB

📡  making Filecoin storage deals for 3 redundant copies
00:00:11 [=============================] 100%

✅  all storage deals successfully made!
==> monitor progress with the "starling monitor" command
```

```
Files stored in the network: 1,503,159      Active jobs: 1,243
# of miners: 150                             Queued jobs: 5,243
Storage space used: 32 TB
Wallet batlance: $fil 1,000,000              ||||||||||||||||||||||||||||||||||  25%
```

jobId	type	status	content	size	elapsed time
123416	upload	sync	foo/bar/videos/	10GB	00:12:01:55
324509	upload	sync	video-test.mov	14GB	01:02:41:02
456736	upload	seal	video-with-a-long-name.mov	10GB	03:12:01:44
365824	upload	seal	foo/bar/another-video.mov	10GB	02:12:01:13
258365	download	sync	foo/bar/still-another-video.mov	700GB	22:12:01:22
346736	download	sync	a/with/really/...long/file/path.mov	10GB	00:00:00:01
346828	download	verify	foo/bar/video.mov	10GB	00:00:00:00
228286	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
098345	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
235752	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
525472	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
724572	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
865368	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
863436	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
863356	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
977754	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
675457	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
547454	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
467389	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
705747	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
569470	upload	queued	foo/bar/video.mov	10GB	00:00:00:00
658367	upload	queued	foo/bar/video.mov	10GB	00:00:00:00

`^S Sort  ^F Find  ^H hide queued`

```
My-computer: ~ user$ starling list
```

Starling list output ☆ 📁

File Edit View Insert Format Data Tools Add-ons Help   All changes saved in Drive

📈 💬 👤 Share 👤

↶ ↷ 🖶 ⊟ | 100% ▾ | $ % .0 .00 123▾ | Roboto Mo... ▾ | 10 ▾ | B I S A | 🖉 ⊞ ⊟▾ | ≡▾ ⊥▾ |‡|▾ ⬚▾ ⋯ ⌃

	A	B	C	D	E	F	G	H
1	Content	Size	CID	Miner ID	Deal commencement			
2	video-test.mov	10 GB	183081350891151	12834718025	2019-04-01			
3	another video.mov	160 GB	187145080145014	12834718025	2019-04-01			
4	still another video.mpeg	12 GB	145087198604923	12834718025	2019-04-01			
5	not a video.jpg	65 MB	432687082374895	12834718025	2019-04-01			
6	also not a video.pdf	10 MB	123435786935876	12834718025	2019-04-01			
7	definitely not a video.gif	560 KB	239459365275234	12834718025	2019-04-01			
8	example of a very long file name that d	40 GB	623565756345462	12834718025	2019-04-01			
9	video-test.mov	10 GB	183081350891151	91824759813	2019-04-01			
10	another video.mov	160 GB	187145080145014	91824759813	2019-04-01			
11	still another video.mpeg	12 GB	145087198604923	91824759813	2019-04-01			
12	not a video.jpg	65 MB	432687082374895	91824759813	2019-04-01			
13	also not a video.pdf	10 MB	123435786935876	91824759813	2019-04-01			
14	definitely not a video.gif	560 KB	239459365275234	91824759813	2019-04-01			
15	example of a very long file name that d	40 GB	623565756345462	91824759813	2019-04-01			
16	video-test.mov	10 GB	183081350891151	34682658734	2019-04-01			
17	another video.mov	160 GB	187145080145014	34682658734	2019-04-01			
18	still another video.mpeg	12 GB	145087198604923	34682658734	2019-04-01			
19	not a video.jpg	65 MB	432687082374895	34682658734	2019-04-01			
20	also not a video.pdf	10 MB	123435786935876	34682658734	2019-04-01			
21	definitely not a video.gif	560 KB	239459365275234	34682658734	2019-04-01			
22	example of a very long file name that d	40 GB	623565756345462	34682658734	2019-04-01			
23								
24								
25								

+ ☰ | Sheet1 ▾

Starling verification output

File   Edit   View   Insert   Format   Data   Tools   Add-ons   Help   All changes saved in Drive

100% $ %   .0   .00   123▾   Roboto Mo...   10   B   I   S   A   ▦   ⊞   ▾   ≡▾   ⊥▾   ↔▾   ▾   ⊙   ▦   ⊞▾   ▼▾   Σ▾

fx | pass

	A	B	C	D	E	F	G	H
1	Content	CID	Miner ID	Deal commencement	Original commP value	date of last check	Recalculated commP	Verification result
2	video-test.mov	183081350891151	12834718025	2019-04-01	1kjh12r97y12ou3h	2019-08-04	1kjh12r97y12ou3h	pass
3	another video.mov	187145080145014	12834718025	2019-04-01	vljshd085234jhwg	2019-08-04	vljshd085234jhwg	pass
4	still another video.mpeg	145087198604923	12834718025	2019-04-01	3129487192385123	2019-08-05	3129487192385123	pass
5	not a video.jpg	432687082374895	12834718025	2019-04-01	hf029823lkj2j30f	2019-08-05	hf029823lkj2j30f	pass
6	also not a video.pdf	123435786935876	12834718025	2019-04-01	2fj203f8uwtw0e8t	2019-08-05	2fj203f8uwtw0e8t	pass
7	definitely not a video.gif	239459365275234	12834718025	2019-04-01	jf208hwt082h3rkw	2019-08-05	jf208hwt082h3rkw	pass
8	example of a very long file r	623565756345462	12834718025	2019-04-01	jf0397iksndfio2e	2019-08-05	jf0397iksndfio2e	pass
9	video-test.mov	183081350891151	91824759813	2019-04-01	wflkjwer00ywe0ij	2019-08-06	wflkjwer00ywe0ij	pass
10	another video.mov	187145080145014	91824759813	2019-04-01	kj20ijejlkwenrwh	2019-08-06	kj20ijejlkwenrwh	pass
11	still another video.mpeg	145087198604923	91824759813	2019-04-01	982fsjf838ti23tg	2019-08-04	982fsjf838ti23tg	pass
12	not a video.jpg	432687082374895	91824759813	2019-04-01	rg3r6t2ryeths537	2019-08-05	rg3r6t2ryeths537	pass
13	also not a video.pdf	123435786935876	91824759813	2019-04-01	ry357355427ry877	2019-08-05	ry357355427ry877	pass
14	definitely not a video.gif	239459365275234	91824759813	2019-04-01	fw9872hg08wfrgwr	2019-08-05	8237489873256234	FAIL
15	example of a very long file r	623565756345462	91824759813	2019-04-01	wrg08742g0wg972t	2019-08-05	wrg08742g0wg972t	pass
16	video-test.mov	183081350891151	34682658734	2019-04-01	t246427yrdhetut7	2019-08-06	t246427yrdhetut7	pass
17	another video.mov	187145080145014	34682658734	2019-04-01	gef307824jkf2o35	2019-08-06	gef307824jkf2o35	pass
18	still another video.mpeg	145087198604923	34682658734	2019-04-01	g2346437e5tuju77	2019-08-06	g2346437e5tuju77	pass
19	not a video.jpg	432687082374895	34682658734	2019-04-01	g35735rhj46j4648	2019-08-06	g35735rhj46j4648	pass
20	also not a video.pdf	123435786935876	34682658734	2019-04-01	fw987wy982325678	2019-08-04	fw987wy982325678	pass
21	definitely not a video.gif	239459365275234	34682658734	2019-04-01	0980yh0n08y98hjj	2019-08-04	0980yh0n08y98hjj	pass
22	example of a very long file r	623565756345462	34682658734	2019-04-01	t2498879jokh2246	2019-08-05	t2498879jokh2246	pass
23								
24								
25								

+ ☰   Sheet1 ▾

Explore

B	Miner ID	Deal commencement	Original commP value	date of last check	Recalculated commP	Verification result
3081350891151	12834718025	2019-04-01	1kjh12r97y12ou3h	2019-08-04	1kjh12r97y12ou3h	pass
7145080145014	12834718025	2019-04-01	vljshd085234jhwg	2019-08-04	vljshd085234jhwg	pass
5087198604923	12834718025	2019-04-01	31294871923085123	2019-08-05	31294871923085123	pass
2687082374895	12834718025	2019-04-01	hf029823lkj2j30f	2019-08-05	hf029823lkj2j30f	pass
3435786935876	12834718025	2019-04-01	2fj203f8uwtw0e8t	2019-08-05	2fj203f8uwtw0e8t	pass
9459365275234	12834718025	2019-04-01	jf208hwt082h3rkw	2019-08-05	jf208hwt082h3rkw	pass
3565756345462	12834718025	2019-04-01	jf0397iksndfio2e	2019-08-06	jf0397iksndfio2e	pass
3081350891151	91824759813	2019-04-01	wflkjwer00ywe0ij	2019-08-06	wflkjwer00ywe0ij	pass
7145080145014	91824759813	2019-04-01	kj20ijejlkwenrwh	2019-08-06	kj20ijejlkwenrwh	pass
5087198604923	91824759813	2019-04-01	982fsjf838ti23tg	2019-08-04	982fsjf838ti23tg	pass
2687082374895	91824759813	2019-04-01	rg3r6t2ryeths537	2019-08-04	rg3r6t2ryeths537	pass
3435786935876	91824759813	2019-04-01	ry357355427ry877	2019-08-05	ry357355427ry877	pass
9459365275234	91824759813	2019-04-01	fw9872hg08wfrgwr	2019-08-05	8237489873256234	FAIL
3565756345462	91824759813	2019-04-01	wrg08742g0wg972t	2019-08-05	wrg08742g0wg972t	pass
3081350891151	34682658734	2019-04-01	t246427yrdhetut7	2019-08-05	t246427yrdhetut7	pass
7145080145014	34682658734	2019-04-01	gef307824jkf2o35	2019-08-06	gef307824jkf2o35	pass
5087198604923	34682658734	2019-04-01	g2346437e5tuju77	2019-08-06	g2346437e5tuju77	pass
2687082374895	34682658734	2019-04-01	g35735rhj46j4648	2019-08-06	g35735rhj46j4648	pass
3435786935876	34682658734	2019-04-01	fw987wy982325678	2019-08-04	fw987wy982325678	pass
9459365275234	34682658734	2019-04-01	0980yh0n08y98hjj	2019-08-04	0980yh0n08y98hjj	pass
3565756345462	34682658734	2019-04-01	t2498879jokh2246	2019-08-05	t2498879jokh2246	pass

Explore

```
My-computer: ~ user$ get 12834718025 123435786935876

==> queued job to download also not a video.pdf (10MB)

This may take a while - check progress with the "starling monitor" command

My-computer: ~ user$
```

Starling

What's next

https://filecoin-project.github.io/starling/