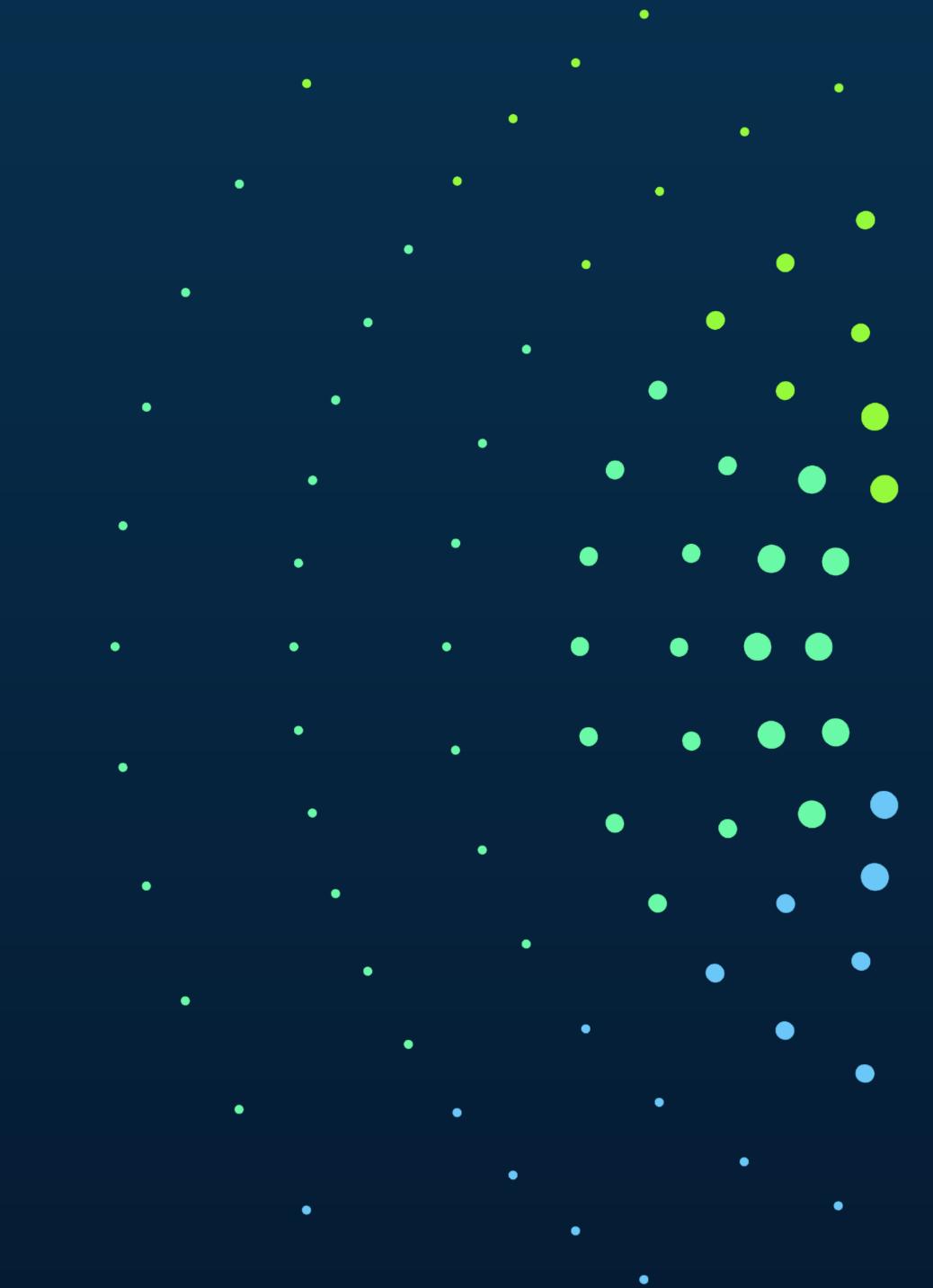


### **IDFS DING** Brussels, Belgium 2023

### HTTP Gateways

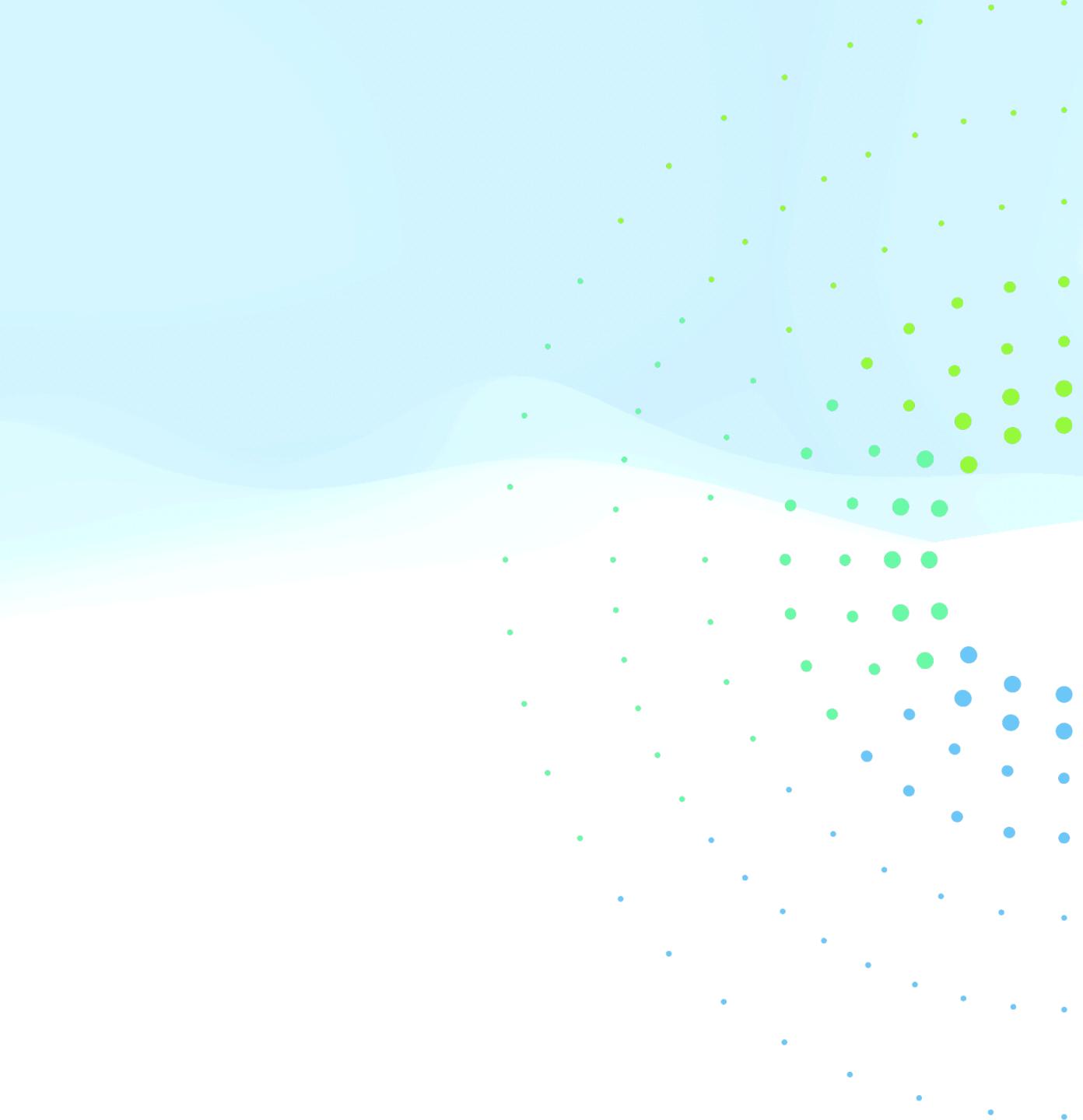




•

# What is Rhea?

Will Scott - April 17th - IPFS þing

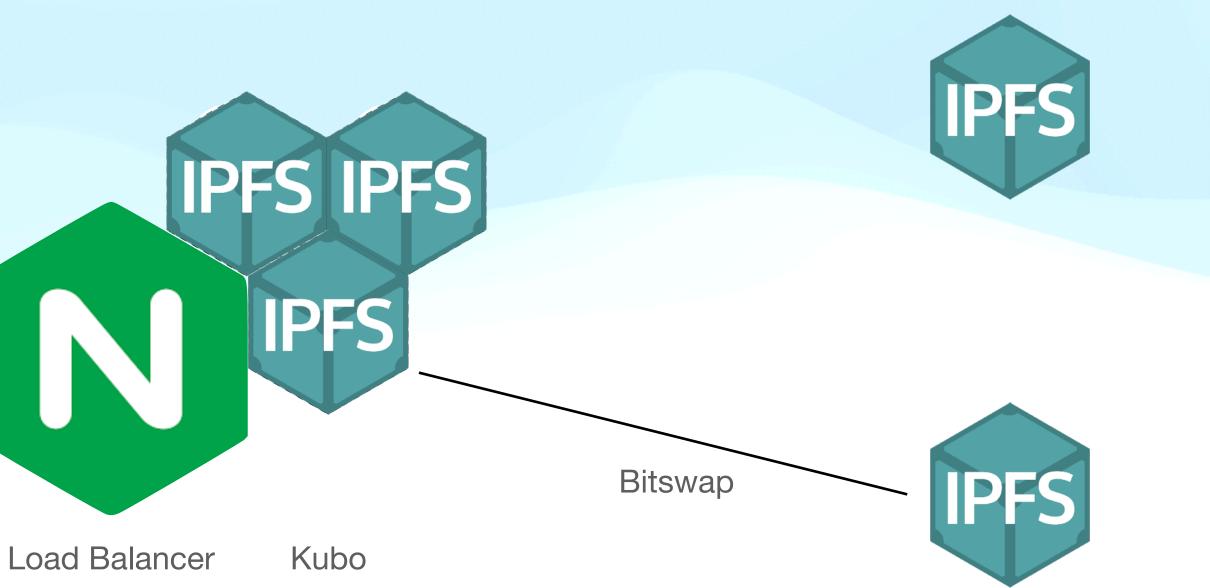


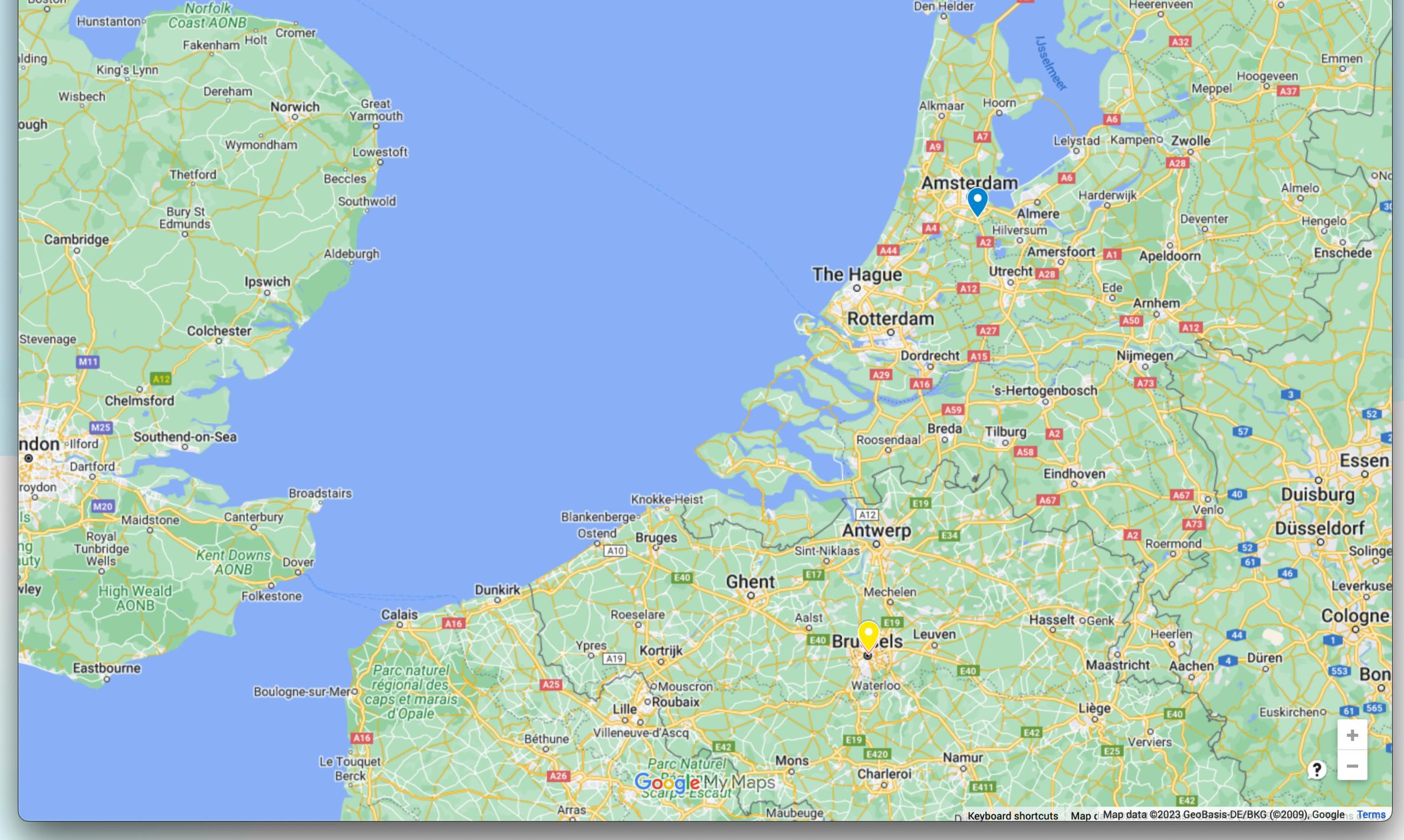
# Requests to ipfs.io today

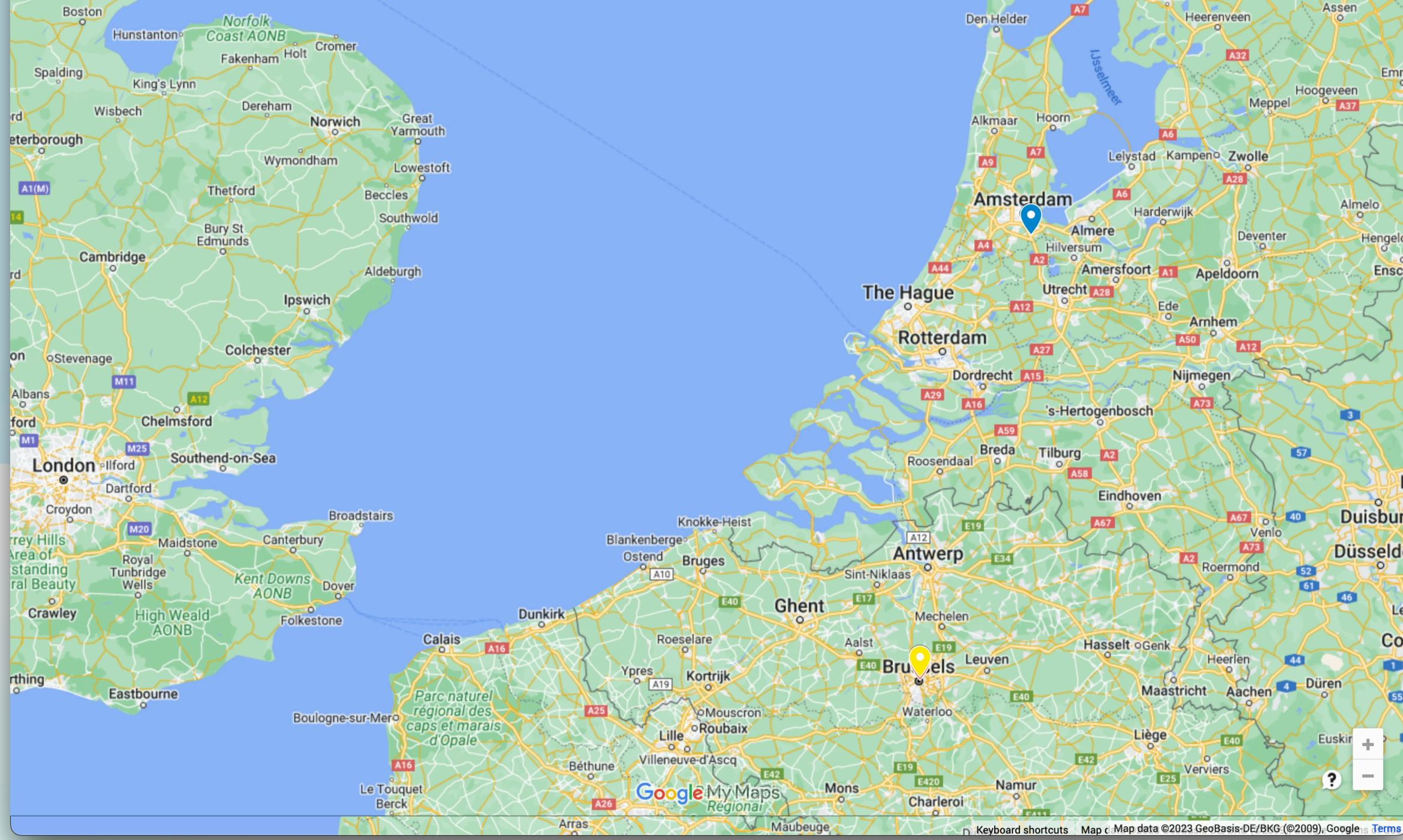
## **Requests today**

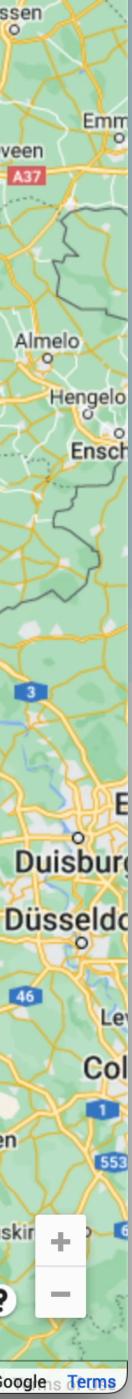
GET /ipfs/{cid}

HTTP









# Imagining Decentralization

## Decentralization

GET /ipfs/{cid}





### SATURN





## Decentralization







GET /ipfs/{cid}





# Project Rhea



## **Project Rhea**

- Enable Filecoin Retrievals
- Validate Saturn as a CDN
- Reduce Centralized Infrastructure Cost

. . . . . . . . . .

. . . . . . . . . . . .

# Agenda



## Agenda

- What is Rhea
- Trust Model
- Fetching Content
- Performance
- Component Systems



# Talking about Trust





## Trust

 Rendered pages from the gateway are generally not verifiable by the client

••	•	త	/ipfs/bafybeiakou6e7h	hnx4ms2ya×	+	-															
$\leftarrow$	$\rightarrow$ C	۵											$\checkmark$	lii\	۵	::					
	PFS																Ab	out II	PFS	Inst	tall IP
	-	-	<b>beiakou6e7hnx4ms2y</b> inx4ms2yangplzl6vi			-					-		n3q								
111	1007 - S	Sustain	able - alt.txt											QmW	leY	JRN				63 E	3
Image: 1007 - Sustainable - transcript.txtQmZPKB26												787	В								
	1007 - S	Sustain	able.png											Qme	eSw	jub				41 k	B



## Trust

- What's missing
  - Metadata blocks
- Won't, or Can't
  - There isn't a way for a client to signal that it promises to verify
  - Range requests are hard



#### 📄 gc — -zsh — 90×22

[willscott@d-1107 gc % car ls -v file.car

raw: bafkreifjjcie6lypi6ny7amxnfftagclbuxndqonfipmb64f2km2devei4

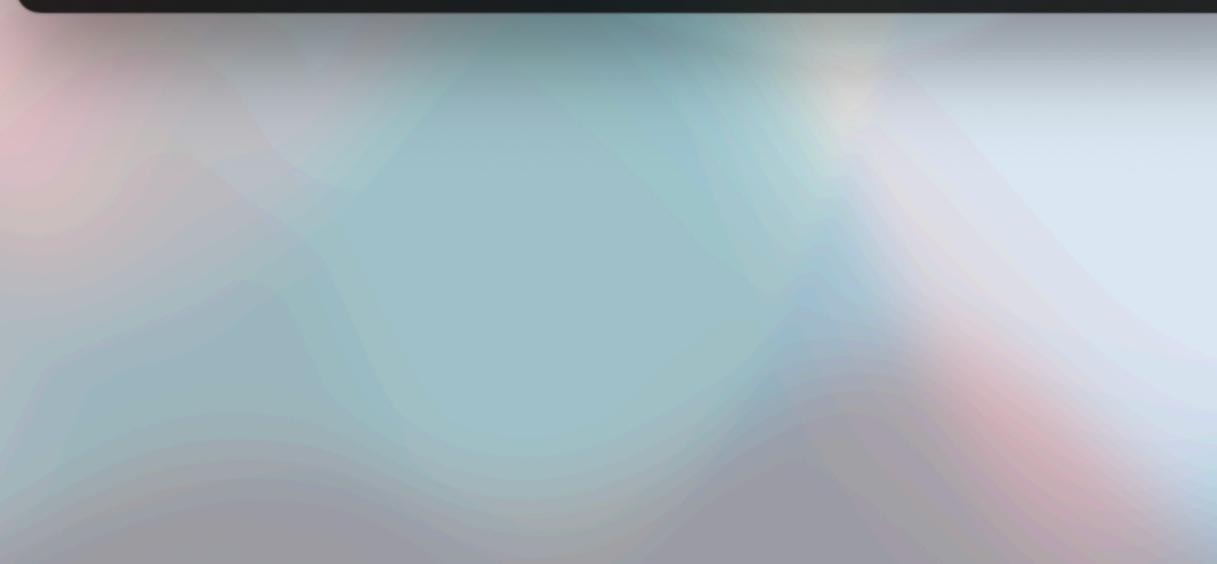
dag-pb: bafybeidx5vxxny6ca3mgs5d6wy5ubwcibpirctmktpkvfk4io34i2ww2hy

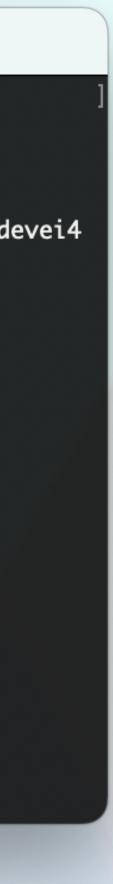
1 links. 2 bytes

foo.txt[12 B] bafkreifjjcie6lypi6ny7amxnfftagclbuxndqonfipmb64f2km2devei4

Unixfs Directory

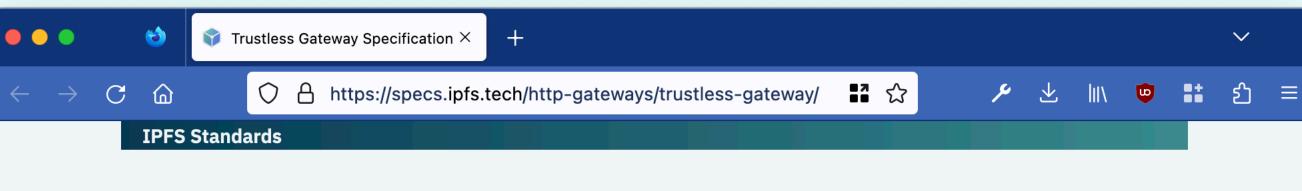
willscott@d-1107 gc %





# **Trustless gateway**

- Accept:
  - application/vnd.ipld.raw
  - application/vnd.ipld.car
- GET /ipfs/cid[/path][?depth=] [&bytes=a:b]



### **Trustless Gateway Specification**



9 November 2022

#### status reliable

#### **Editor**

Marcin Rataj 💭

Trustless Gateway is a minimal *subset* of [path-gateway] that allows light IPFS clients to retrieve data behind a CID and verify its integrity without delegating any trust to the gateway itself.

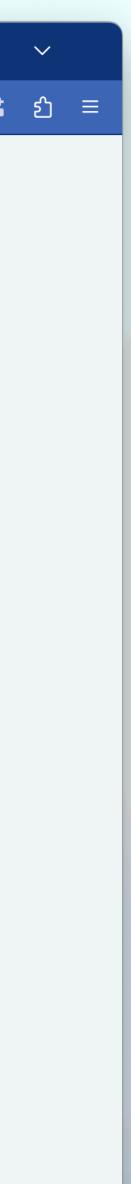
The minimal implementation means:

- data is requested by CID, only supported path is /ipfs/{cid}
- no path traversal or recursive resolution, no UnixFS/IPLD decoding server-side
- response type is always fully verifiable: client can decide between a raw block or a CAR stream

#### **Table of Contents**

#### 1. HTTP API

- 1.1 GET /ipfs/{cid}[?{params}]
- 1.2 HEAD /ipfs/{cid}[?{params}]
- 2. HTTP Request
- 2.1 HTTP Request Headers



# Show me the Bytes

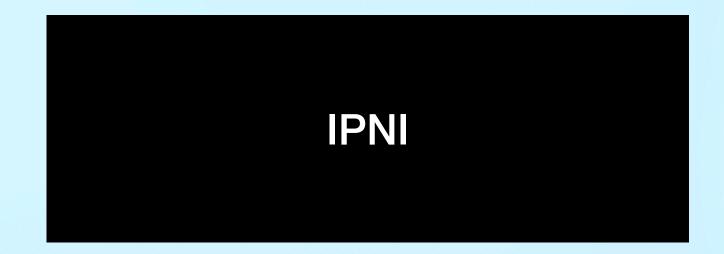


## Show me the Bytes

- Enable Filecoin Retrievals
  - Support bitswap on filecoin Storage Providers
  - Extend bitswap sessions to support other transports
  - Write another scheduling layer above bitswap

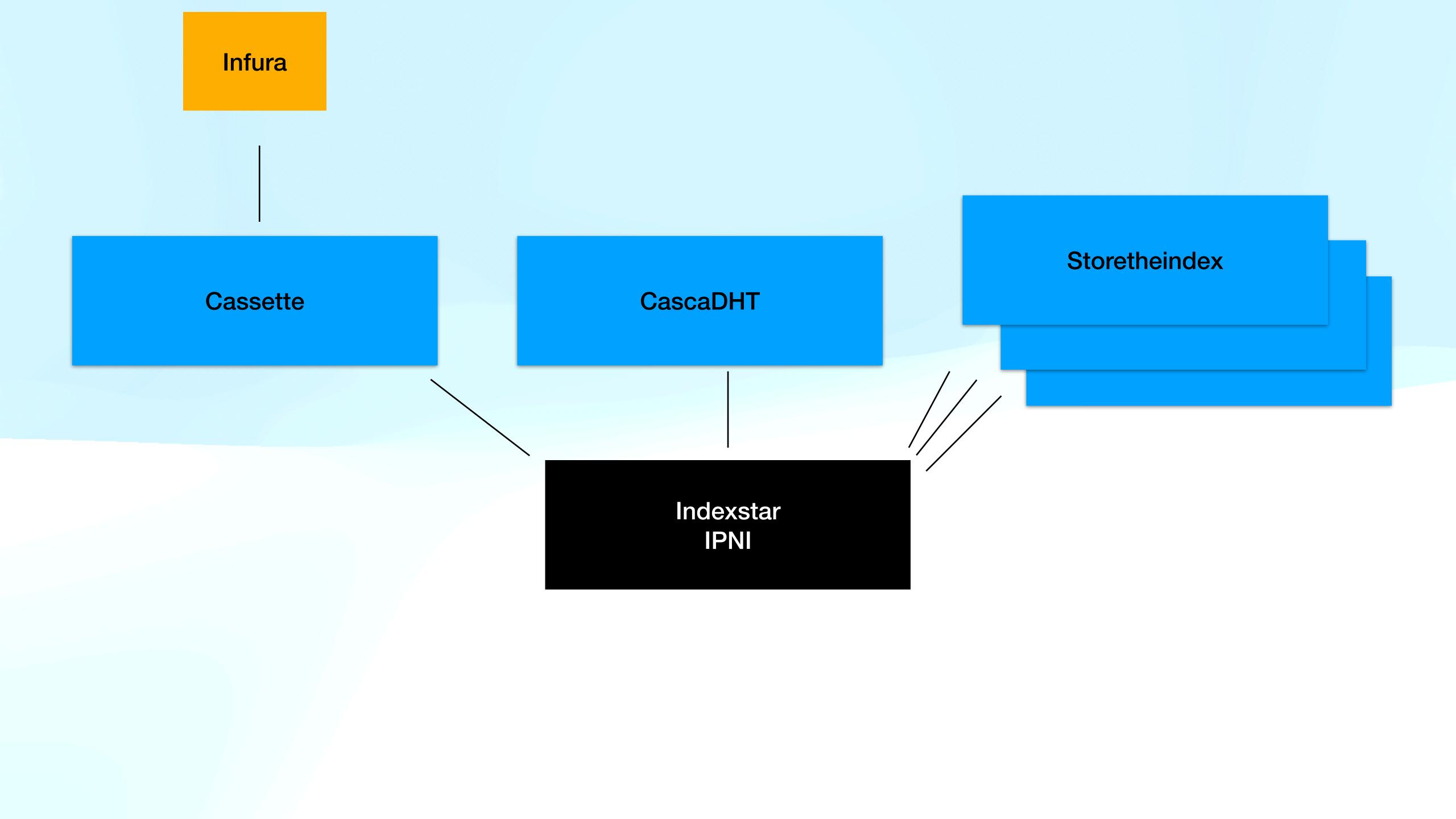


### Lassie



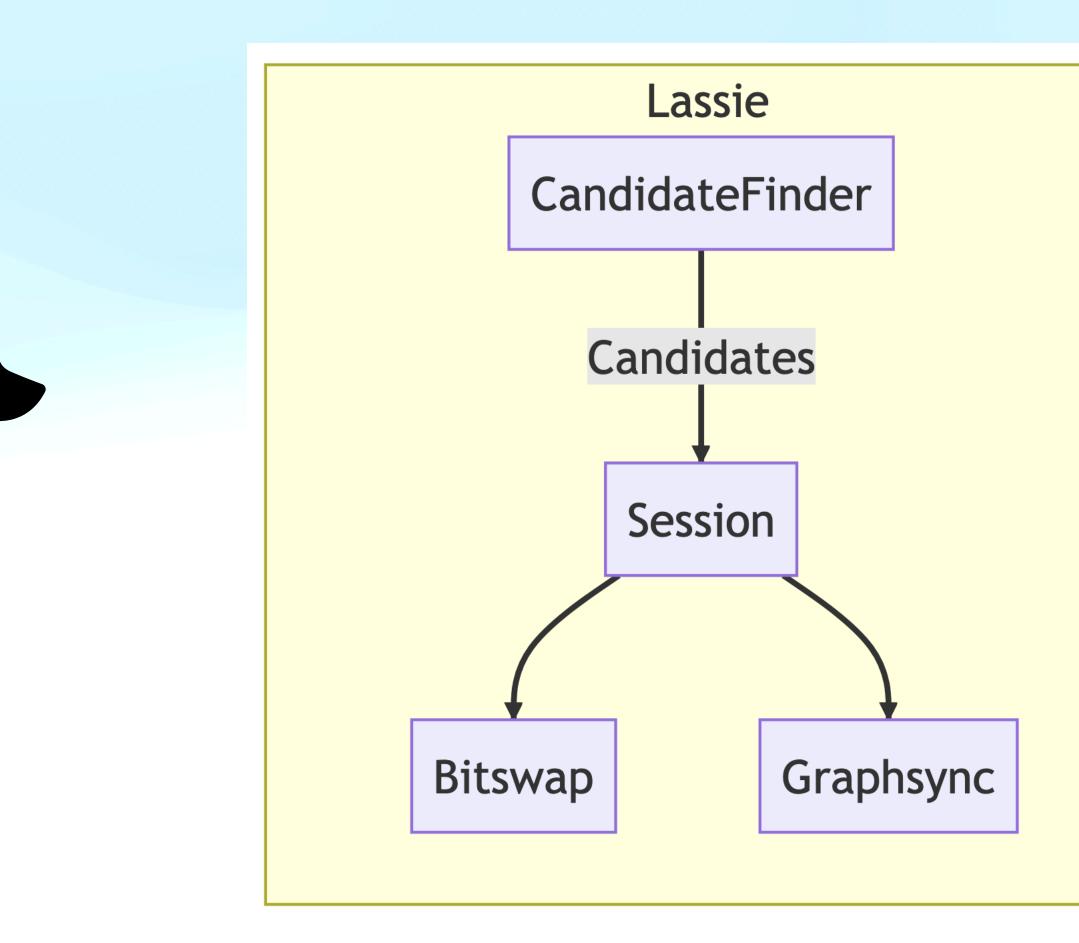
#### Bitswap

#### Graphsync





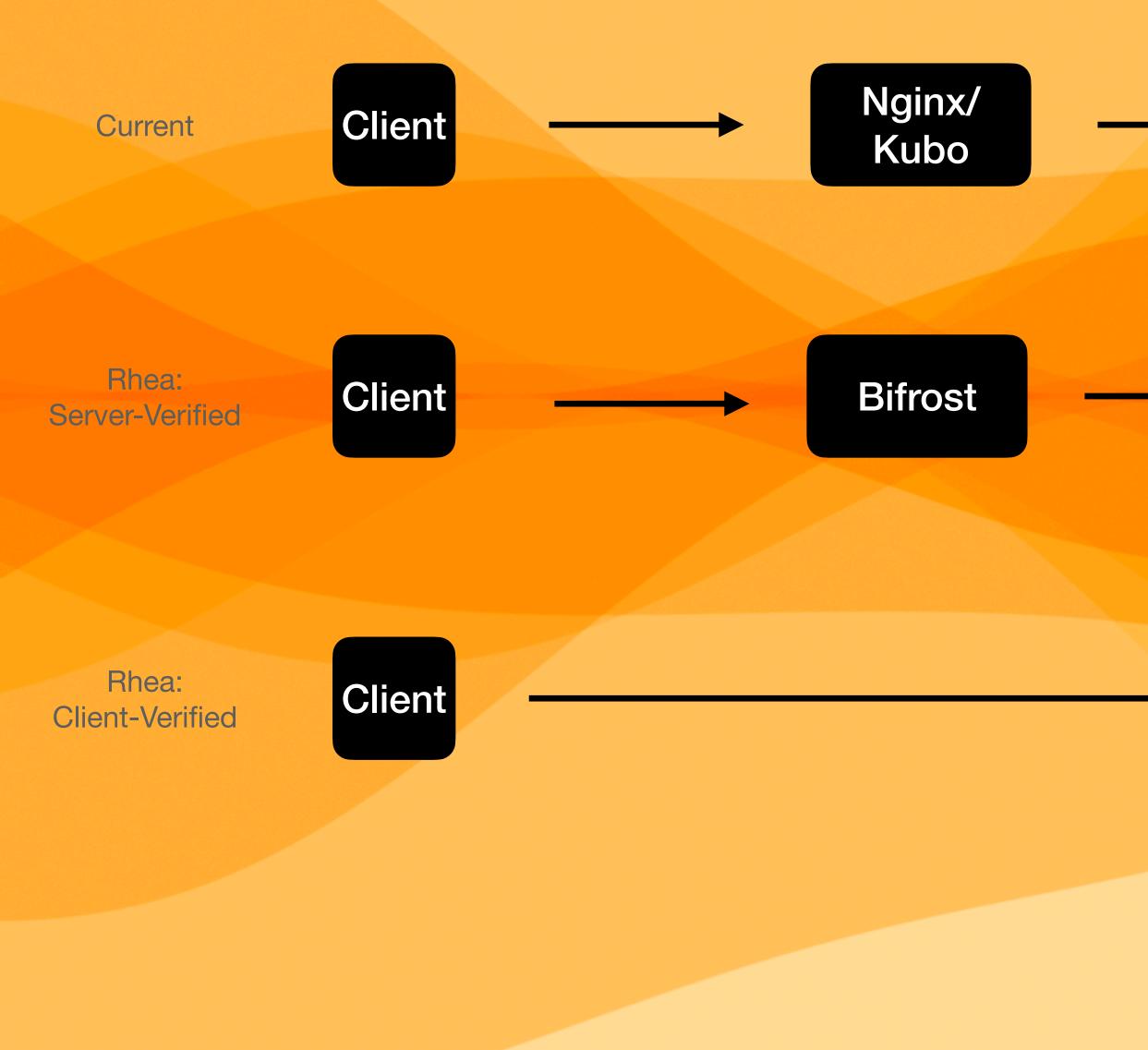
### Lassie





# **Caching and Performance**

### Performance





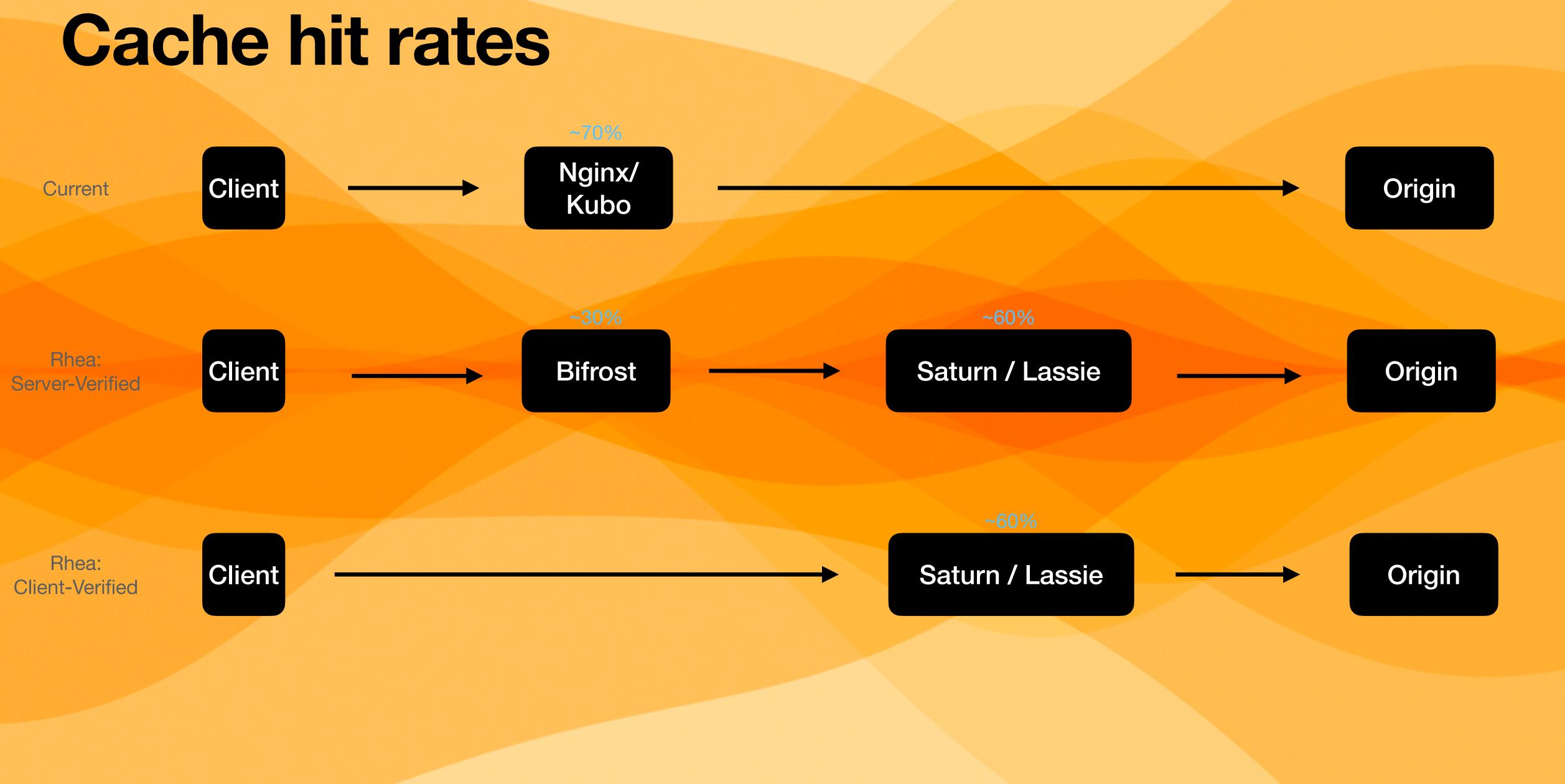


Origin

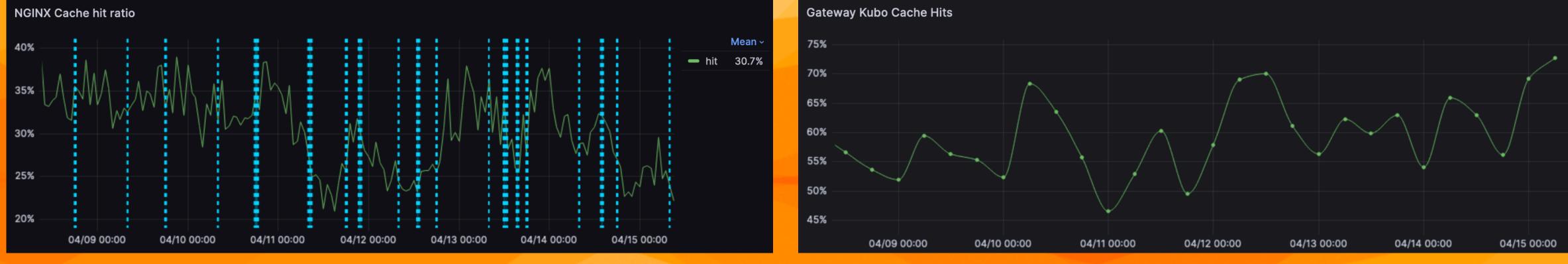
#### Saturn / Lassie







### Cache hit rates Current Gateway



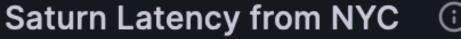


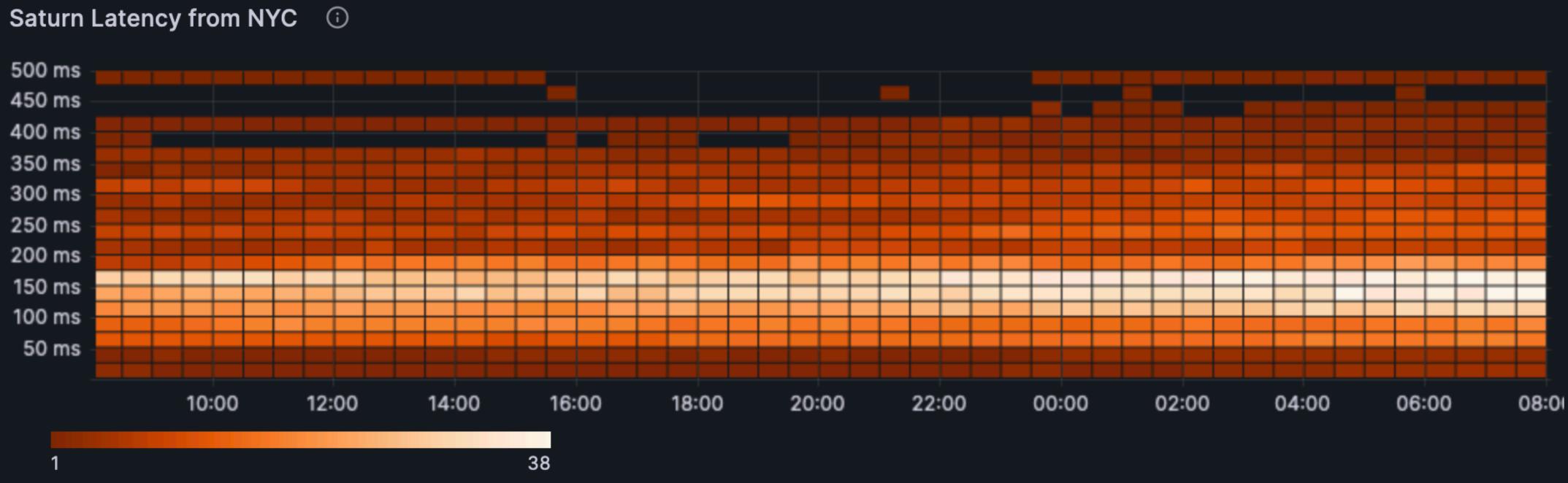




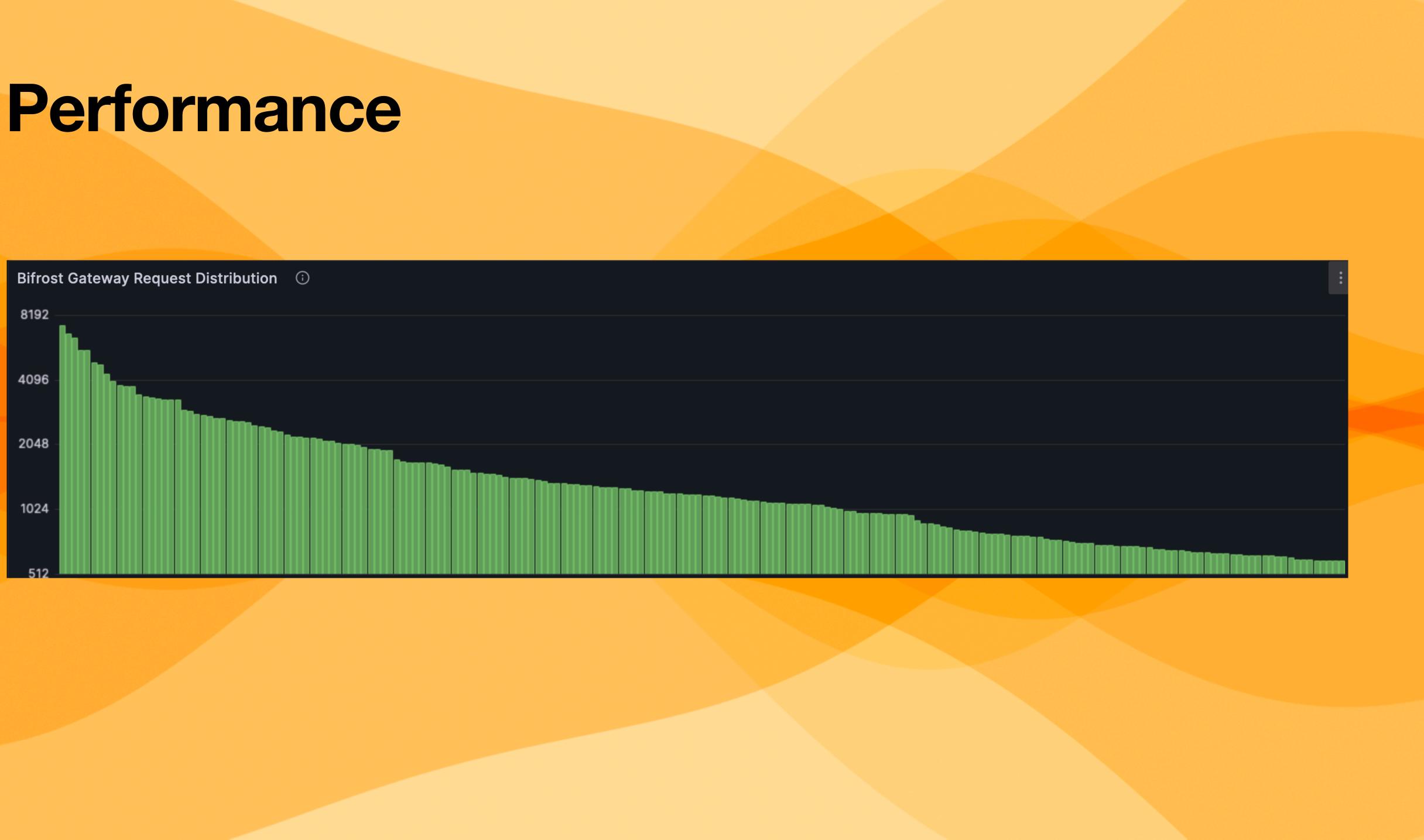


### Performance









# What are we building?





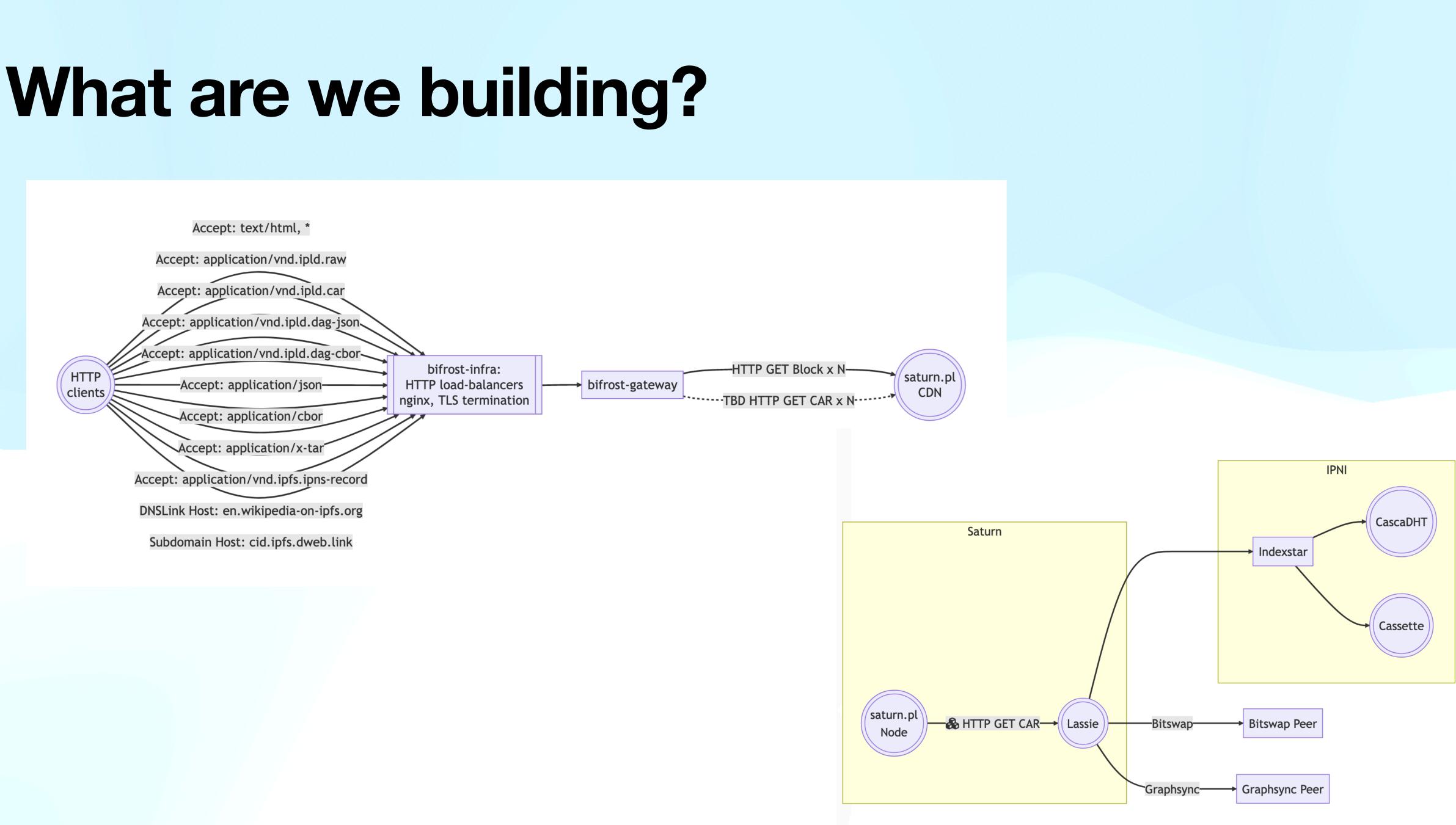
## What are we building?

- Bifrost-Gateway
  - Boxo / Gateway
  - Caboose
- L1-Node



- IPNI
  - Cascadht, Cassette

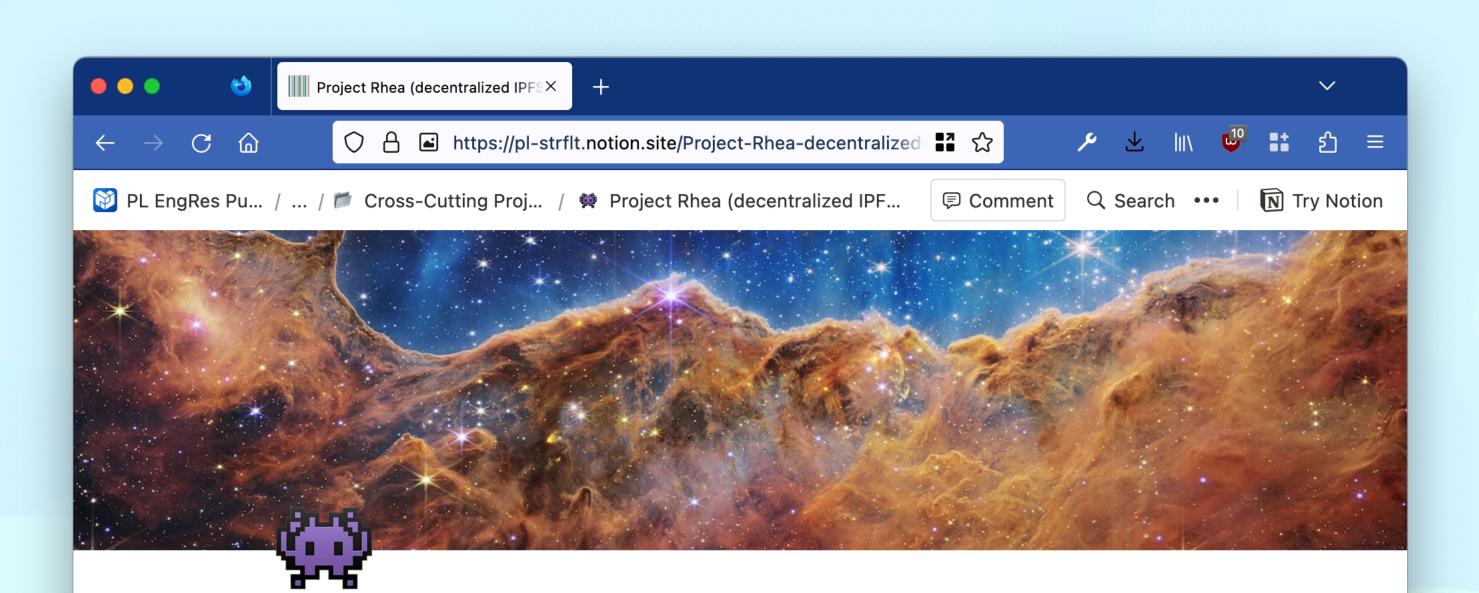






- 30% production traffic mirrored to bifrost-gateway / saturn
- Partial rollout of verifiable-car requests
  - Currently: "Fetch CAR into shared memory blockstore and serve response along with a blockservice that does block requests for missing data"
  - Next: "do the walk locally. if a path segment is incomplete, make follow-up requests"

- Caboose
  - Current: uses a dynamic 'stable hash' assignment of known nodes
  - Next: fixed-size pool of "best" nodes.
- Lassie
  - Current: Identifying upstream over-fetching / amplification
  - Next: HTTP transport

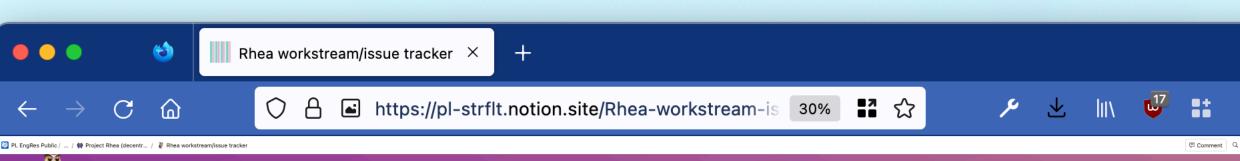


## **Project Rhea (decentralized IPFS gateway)**

HYPOTHESES AND EXPERIMENTS ← Go here for experiments we're running/have run







#### Rhea workstream/issue tracker

en							
ssues							
JA DRI	Issue Type	⊙ Target Milest	🔆 Status	⑦ priority	🖂 Due Date	i≡ tags	© Last edited time
\delta Adin Schmahmann	Workstream or Task	M1.0	At Risk	P2 (current milestone)	March 10, 2023		April 5, 2023 9:00 PM
Will Scott	Workstream or Task	M1.0	In progress		April 14, 2023	Metrics Tracing	April 6, 2023 3:10 PM
<ul> <li>Cameron Wood</li> <li>George Masgras</li> </ul>	Workstream or Task	M1.0	Not started	P2 (current milestone)		Ops	April 4, 2023 2:33 PM
🛞 Ansgar		M1 - Week 7	In progress	P1 (interrupts other work)			April 7, 2023 9:21 AM
lidel	Bug or Issue	M1.0	Not started			Correctness	April 12, 2023 3:37 AM
	SSLIES 21 DRI C Adin Schmahmann Will Scott Cameron Wood Cameron Wood Cameron Wood Cameron Masgras Ansgar	Adin Schmahmann Workstream or Task Adin Schmahmann Workstream or Task Will Scott Workstream or Task Cameron Wood George Masgras Ansgar	SSUES L DRI O Issue Type O Target Milest Adin Schmahmann Workstream or Task M1.0 Will Scott Workstream or Task M1.0 G Cameron Wood G George Masgras M1.0	SSUES         11 DRI       O Issue Type       Target Milest       Status         Adin Schmahmann       Workstream or Task       M1.0       At Risk         Will Scott       Workstream or Task       M1.0       In progress         Cameron Wood       Workstream or Task       M1.0       Not started         George Masgras       Morkstream or Task       M1.0       In progress         Ansgar       M1 - Week 7       In progress	SSUES         11 DRI       O Issue Type       Target Milest       Status       priority         Adin Schmahmann       Workstream or Task       M1.0       Atrisk       P2 (current milestone)         Will Scott       Workstream or Task       M1.0       In progress         Cameron Wood       Workstream or Task       M1.0       Not started       P2 (current milestone)         G George Masgras       Morkstream or Task       M1.0       Not started       P2 (current milestone)         Ansgar       M1 - Week 7       In progress       P1 (interrupts other work)	SSUES         1 DRI       O Issue Type       Target Milest Status       priority       Due Date         Adin Schmahmann       Workstream or Task       M1.0       At Risk       P2 (current milestone)       March 10, 2023         Will Scott       Workstream or Task       M1.0       In progress       April 14, 2023         Cameron Wood       Workstream or Task       M1.0       Not started       P2 (current milestone)         G George Masgras       Workstream or Task       M1.0       In progress       P1 (interrupts other work)	SSUES       Image: Status

#### 🐂 Current Milestone (M1.0) - Open

#### Table Active Workstree

Active Workstreams and	lissues							
a Workstream	JA DRI	⊙ Target Milest	🔆 Status		💷 Due Date	≡ Next Steps (w/ Dates)	Short Description	i≡ tags
Graph Request APIs [PARENT]	😣 Adin Schmahmann	M1.0	• At Risk	P2 (current milestone)	March 10, 2023	Top-level-tracking: Open this item to view sub- tasks.		
Outreach to explicit between peering partners <sup>5</sup>	Torfinn Olsen		In progress	P2 (current milestone)		Have confirmed that all of the long peering connections are in fact 100% on EIPFS and are reporting to the indexer. Infura is still outstanding but are planning presently when to make the switch.		Correctness
Streaming cars design	🐻 Adin Schmahmann	Backlog	Not started	P3 (backlog)				
Refactor bifrost-gateway code to handle car-based store and ensure this is tested   1	🚯 Adin Schmahmann		In progress	P3 (backlog)		This is likely to be Week 4 or Week 5. Reid and Adin to talk more about this.		
Parallel Bitswap	🕕 Hannah Howard		<sup>®</sup> Not started			3/20 - important in the long term, but we're going to move this out to a later week		Correctness
"Fairness" (evenness) of L1 use by Caboose - (some L1s are getting much more traffic)	🗷 Aarsh Shah		<sup>®</sup> Not started	P3 (backlog)		3/23 - we think it's better		Caboose
E2E Request Tracing 🖵 1	Will Scott	M1.0	In progress		April 14, 2023			Metrics Tracing
Investigate why Rhea request rate in dashboard is not 30% of prod traffic 🖓 s	Gameron Wood	M1 - Week 8		P1 (interrupts other work)			Right now Rhea should be getting 30% mirrored of the traffic going to prod. But the dashboard shows less than 25%, so we should investigate if this is a metric error or some other system problem. note: when I'm opening this ticket, the dashboard actually currently shows Rhea getting more traffic, which is also wrog.	
	<ul> <li>Gameron Wood</li> <li>George Masgras</li> </ul>	M1.0	<sup>®</sup> Not started	P2 (current milestone)				Ops
Create a new Saturn metrics dashboard with only data from Caboose as the client. Three charts: 1) HTTP Status Codes, 2) TTFB, 3) TTLB. Intent: allow debugging of Caboose correctness and latency as currently Saturn dashboards are Arc + Caboose data. $\square$ 2	🐨 Diego	M1 - Week 8	In progress	P1 (interrupts other work)			https://protocollabs.grafana.net /d/md/kp5YY2/caboose-aggregated_ metrics?orgld=larefresh=5m&from=now- 12h&to=now	Saturn Metrics
			Not started					
FR host has much lower success rate $ \bigtriangledown ^2$	🔥 Aarsh Shah	M1 - Week 8	Not started	P1 (interrupts other work)				
More traffic problems with EIPFS 🖓 1	🌍 Ansgar	M1 - Week 7	In progress	P1 (interrupts other work)				
			Not started					
			Not started					
Too many requests fetch requests fail because of Bifrost fetch context cancellation 🖓 1	\delta Aarsh Shah	M1 - Week 8	In progress	P1 (interrupts other work)				Caboose Correctness
Bifrost makes significant percentage of CAR & block fetch requests to Caboose with an already cancelled context 💭 1	Didel 🗭	м1.0	Not started					Correctness
			Not started					
	😣 Aarsh Shah 🎯 Eric Guan	M1 - Week 8	In progress	P1 (interrupts other work)				Correctness Saturn
	Will Scott Aarsh Shah	M1 - Week 8	In progress	P2 (current milestone)				Correctness Latency Caboose
50% of Caboose requests to Saturn fail with a 502 status code G	🔥 Aarsh Shah 🎯 Eric Guan	M1 - Week 8	In progress	P1 (interrupts other work)				
After dashboard switchover, Rhea correctness looks better than Old system $\Box$ 6	Cameron Wood	M1 - Week 8	In progress	P1 (interrupts other work)				Metrics
Should IPFS.io be billed for cancelled contexts?		Backlog	Not started	P3 (backlog)				



# HTTP Gateways

#### Will Scott - April 17th



• • • • • •