Booster rockets for Birds: New Backends for the Pelican Origin

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What is Pelican Here to Accomplish?

Pelican's goals are to:

- Enable access to data wherever it is needed, regardless of where it comes from — without having to learn multiple backend technologies. This access could take place in a Jupyter notebook, a campus cluster, or from national-scale computing infrastructure like the OSPool ↗.
- Support Open Science initiatives by supporting inter-disciplinary data sharing
- Encourage and support FAIR ↗ data practices
- Allow computing providers to stage data on-site as it's needed

Pelican enables researchers to:

- Integrate their data with national-scale computing infrastructure, with a focus on easy setup, distributed data caching and object delivery efficiency
- Make their data accessible to a broad range of users while maintaining control over how their data is accessed and by whom
- Coalesce disparate data repositories like S3, Globus and Posix under a common namespace

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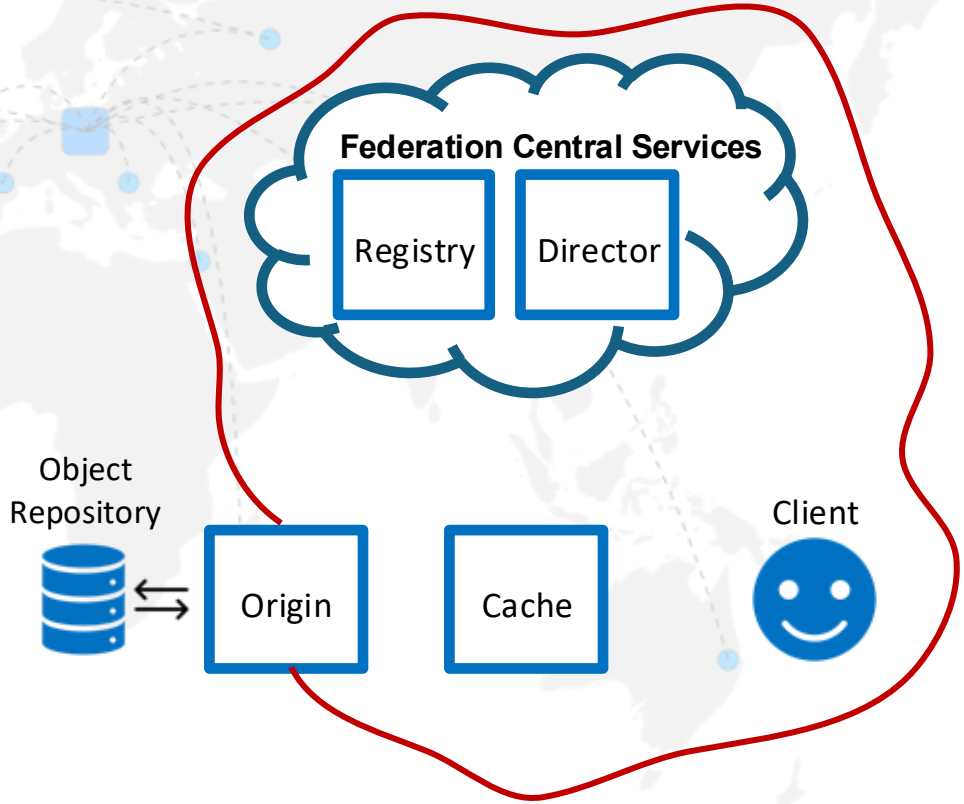

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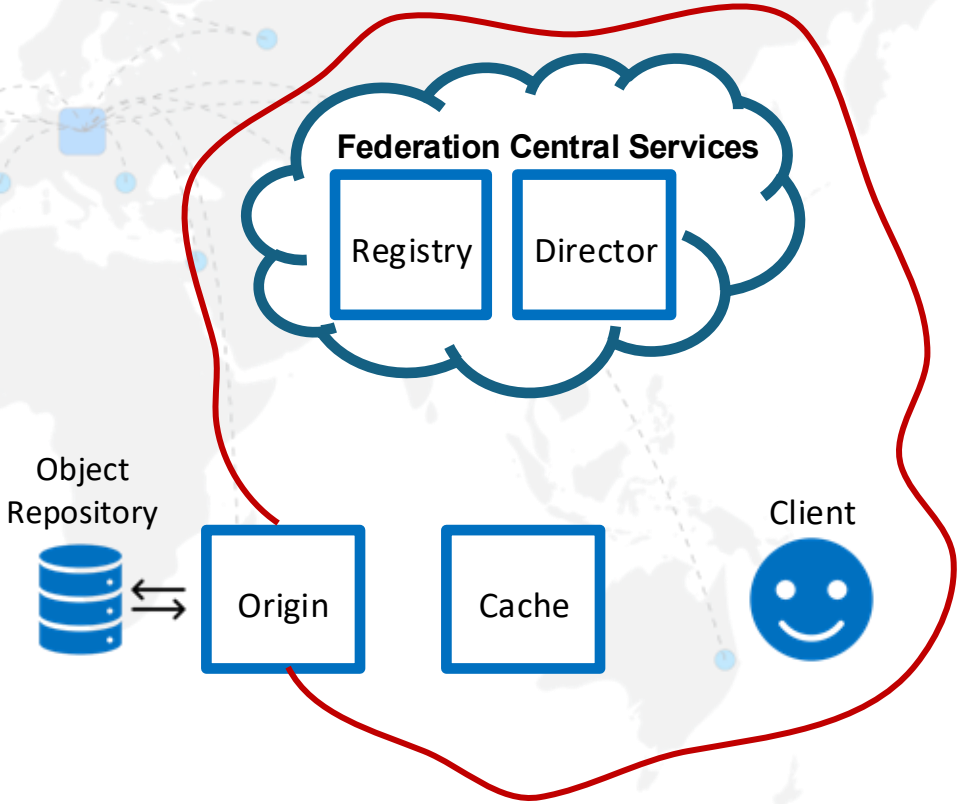

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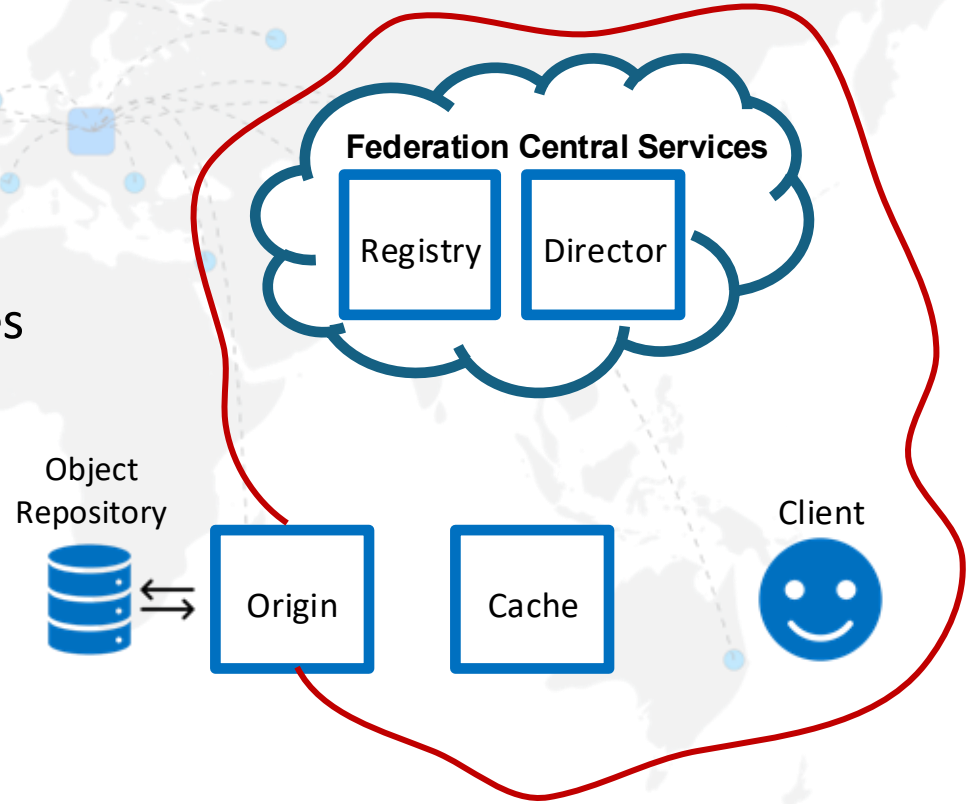

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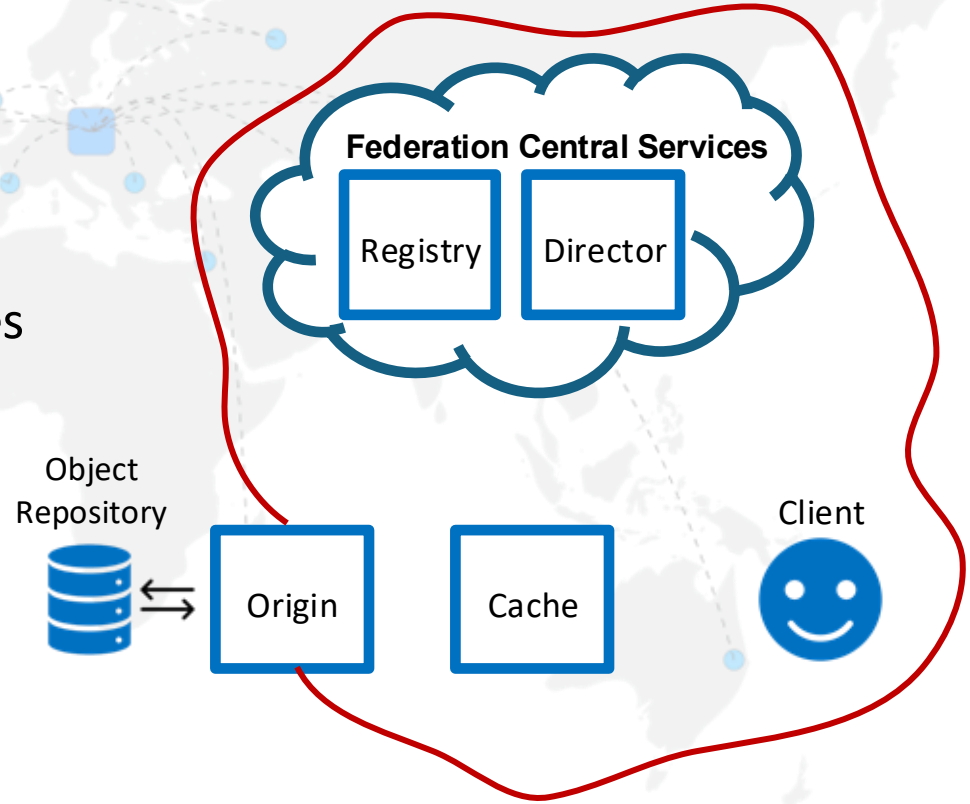

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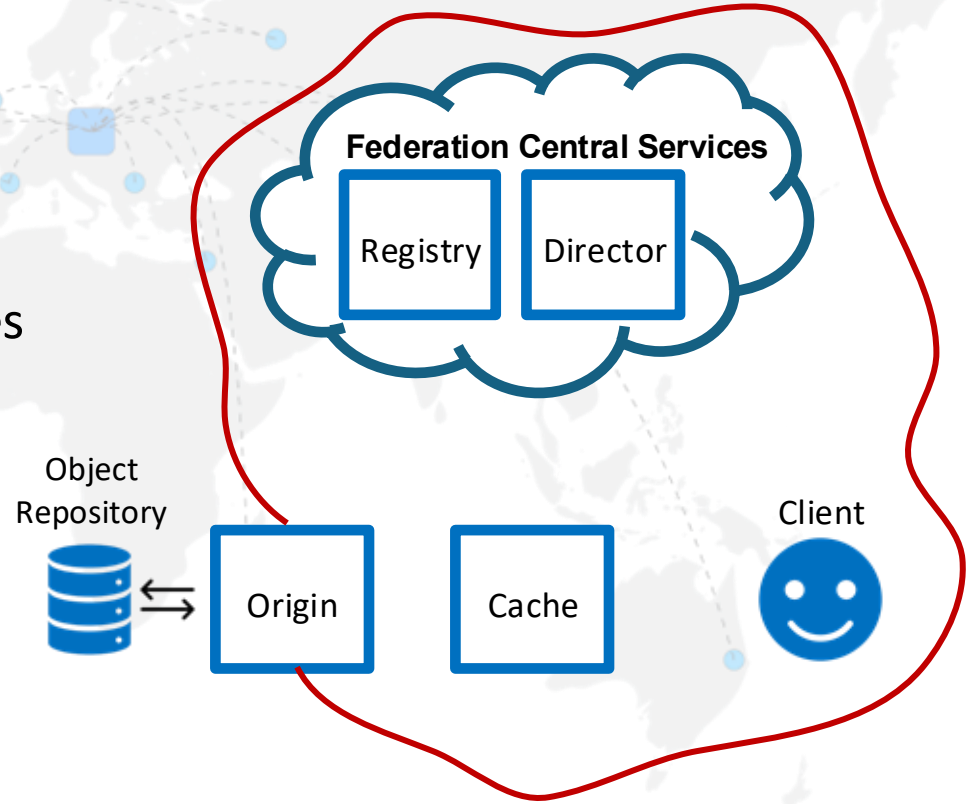

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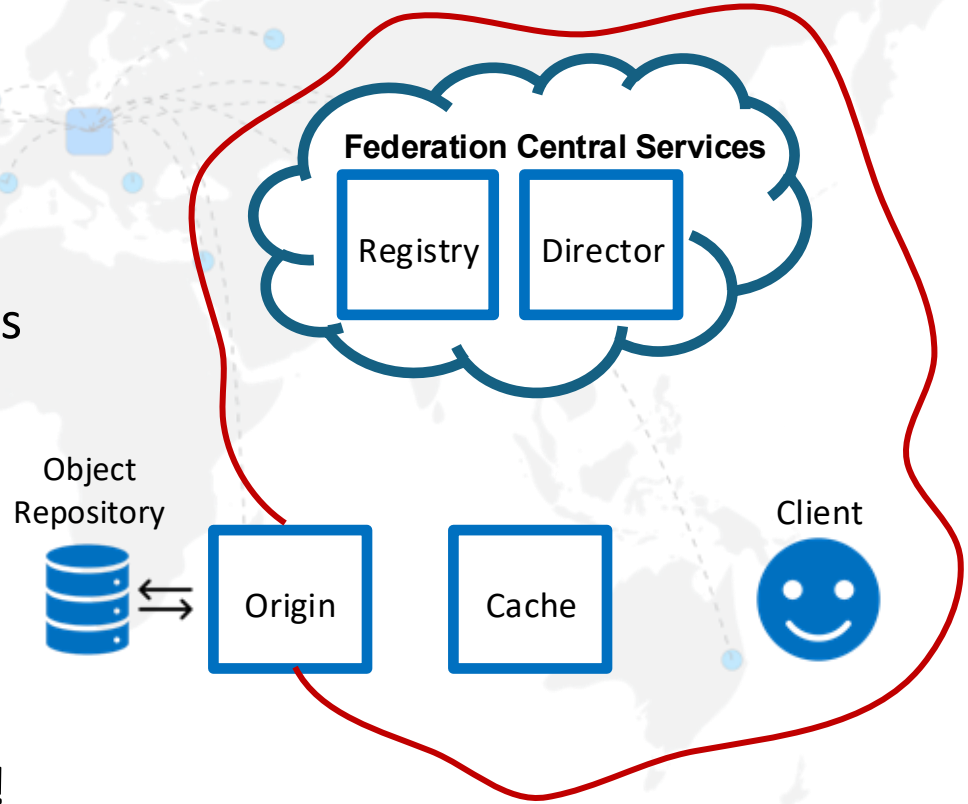

Every one of these may be unique to the particular object repository!

Origins as Translators


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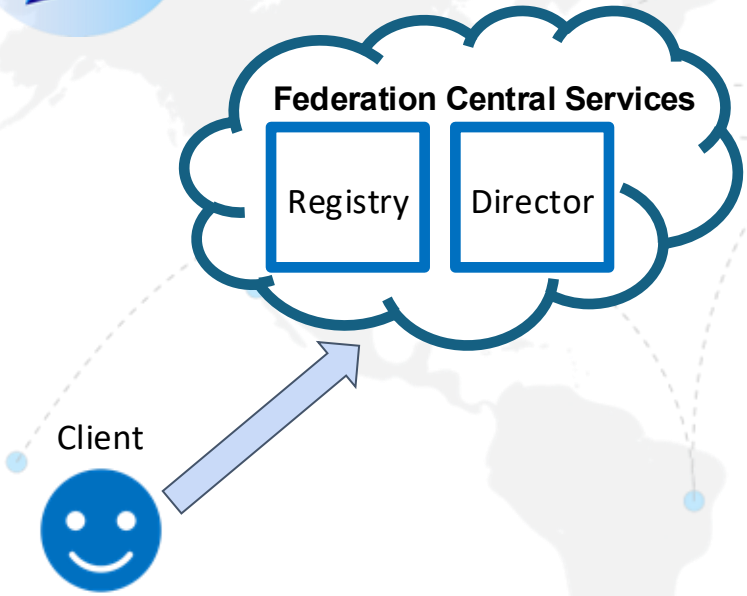


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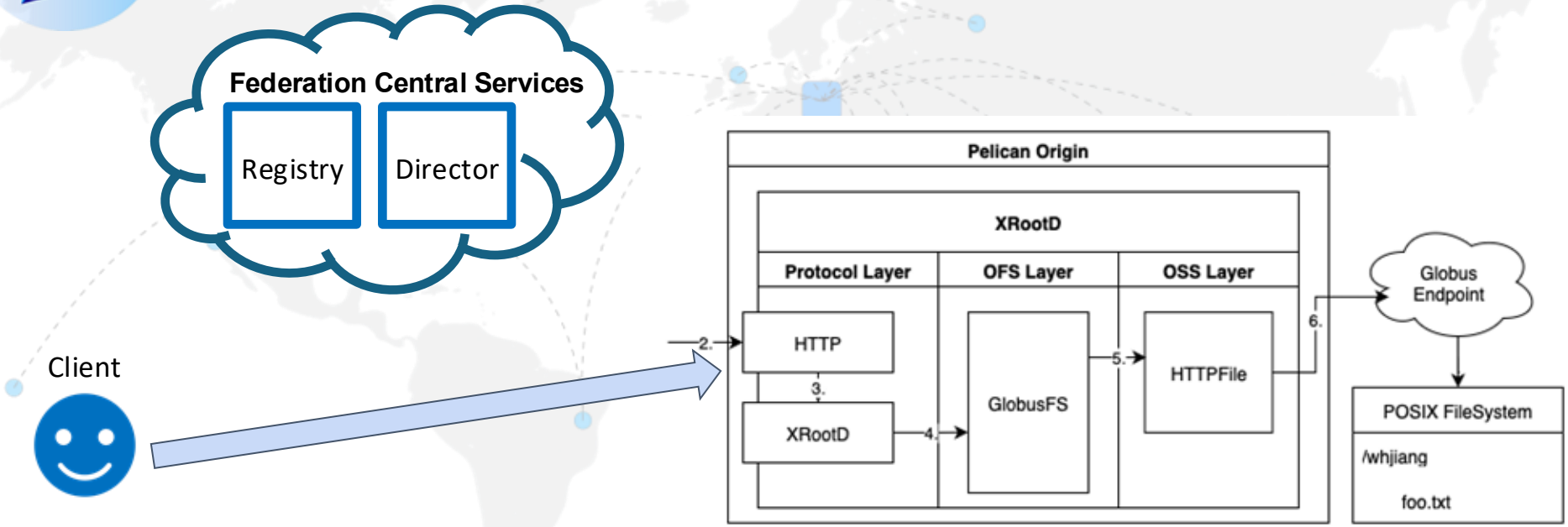

Diagram courtesy of CHTC Fellow alumnus William Jiang

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Protocol Translations

Pelican verb	HTTP (client→Origin)	XRootD Internal	posix backend	https backend	s3 backend	globus backend	xroot backend
get	HTTP GET (ranged)	open + read x N + close	open + pread	HEAD + GET (ranged)	HeadObject + GetObject (ranged)	HEAD + GET (ranged)	kXR_open + kXR_read
put	HTTP PUT	open + write x N + close	open + pwrite	PUT (chunked)	CreateMPU + UploadPart x N + CompleteMPU	PUT (chunked)	kXR_open + kXR_write
stat	WebDAV PROPFIND depth=0	stat	stat(2)	HEAD	HeadObject (+ListObjectsV2 for dirs)	Transfer API stat	kXR_stat
ls	WebDAV PROPFIND depth=1	opendir + readdir x N	opendir + readdir	GET	ListObjectsV2 (paginated)	Transfer API ls	kXR_dirlist

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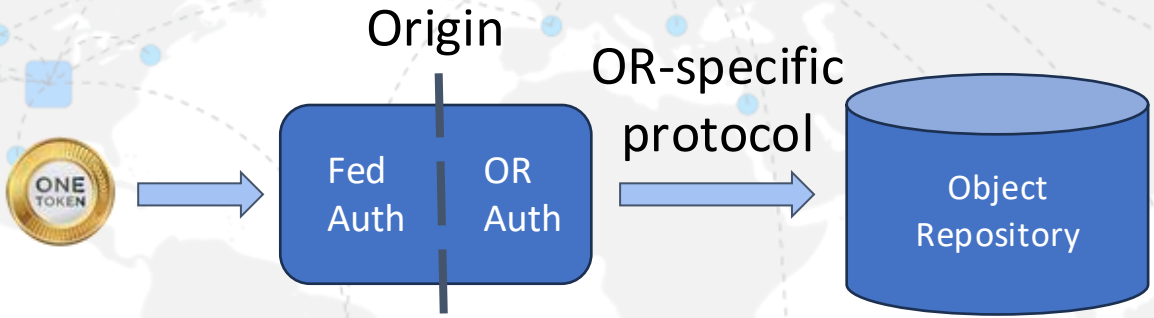
Differing object store and federation semantics lead to messy situations:

- Pelican's hierarchical namespaces vs S3's flat buckets
- POSIX partial writes vs Pelican's whole-object PUT model

Not everything can be mapped from one "philosophy" into another.

Origins must also translate authz



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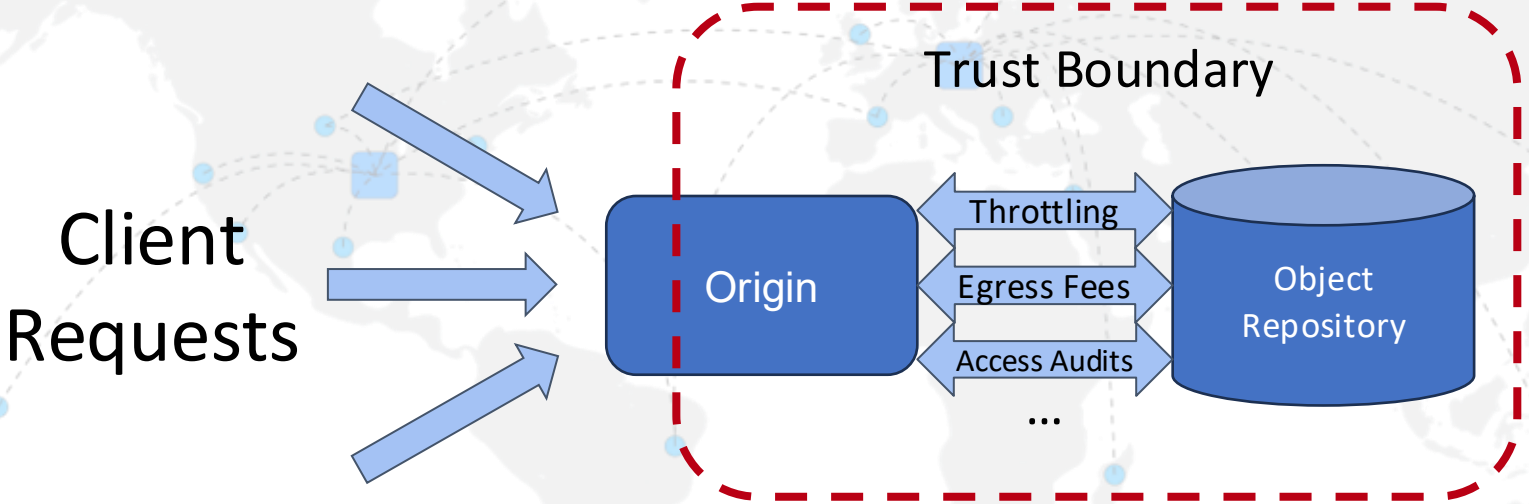

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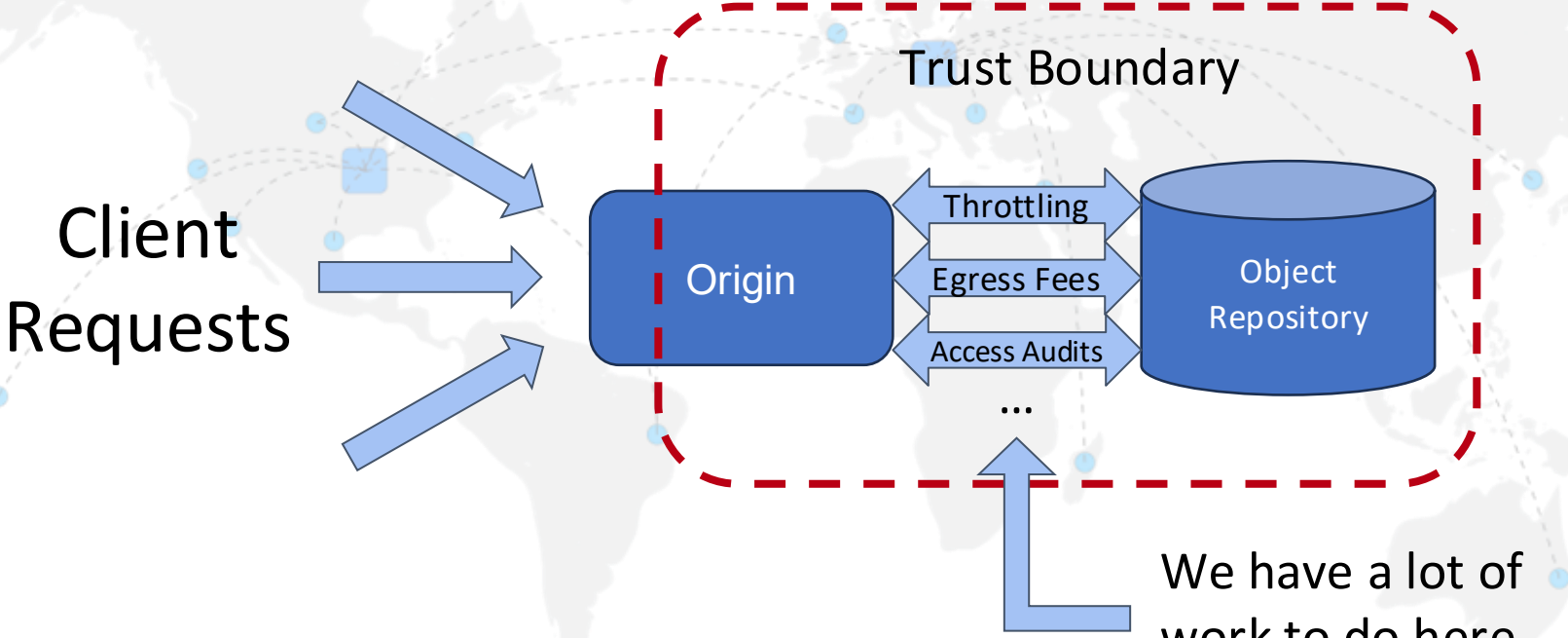
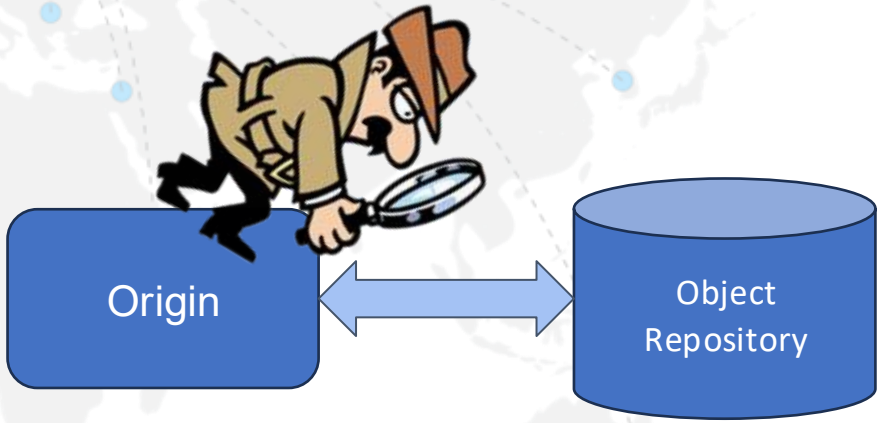


Does it even work?

Origins provide a service to clients on behalf of data providers.

How can we tell if that service is functioning as "expected"?



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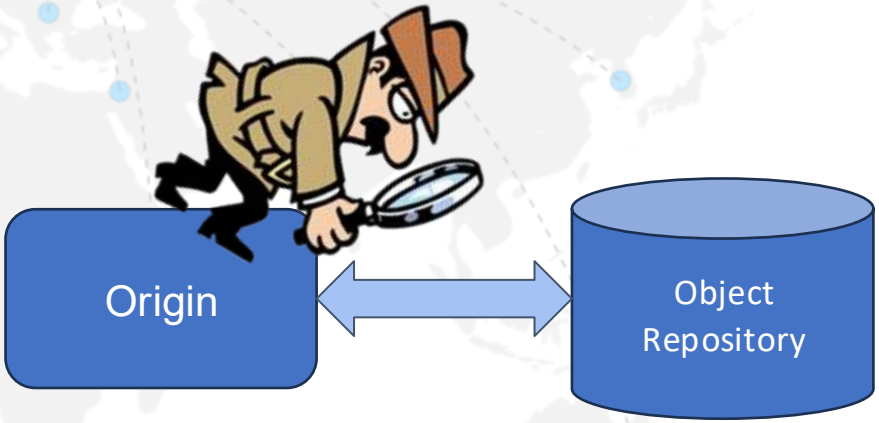

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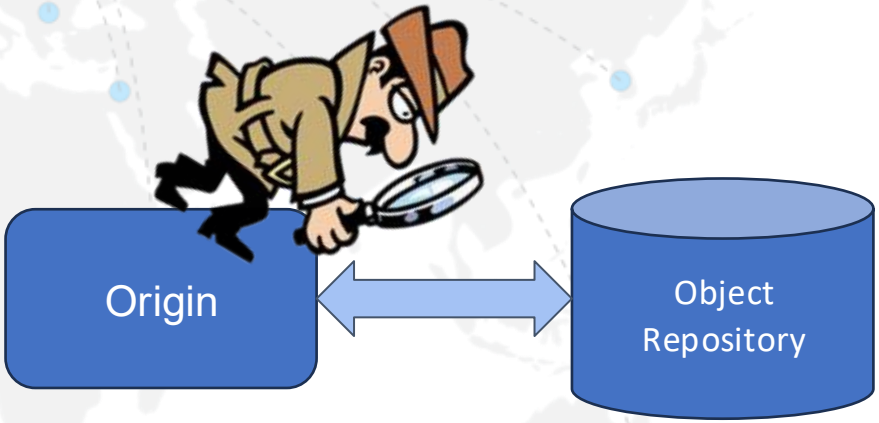
Testing/determining the "health" of this connection is backend dependent.



Polished & Upcoming Origin backends

Several backends are maturing from "reads work" to production-ready:

- **Globus, HTTPS**: writes, stats, listings were the hard part – now complete
- **xroot**: name remapping lets the federation namespace differ from the upstream XRootD layout

XRootD

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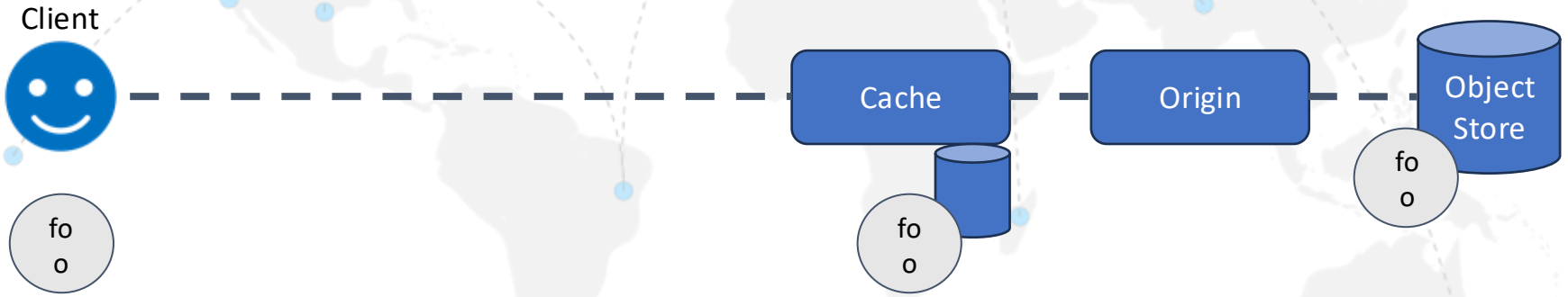
Rethinking the architecture with XRootD-less backends:

- **posixv2** is already running in production; lighter, simpler to deploy
- **globusv2**, **httpsv2** and **s3v2** coming soon!

XRootD

Caching everywhere!

The typical setup relies on federation-wide caches/staging devices



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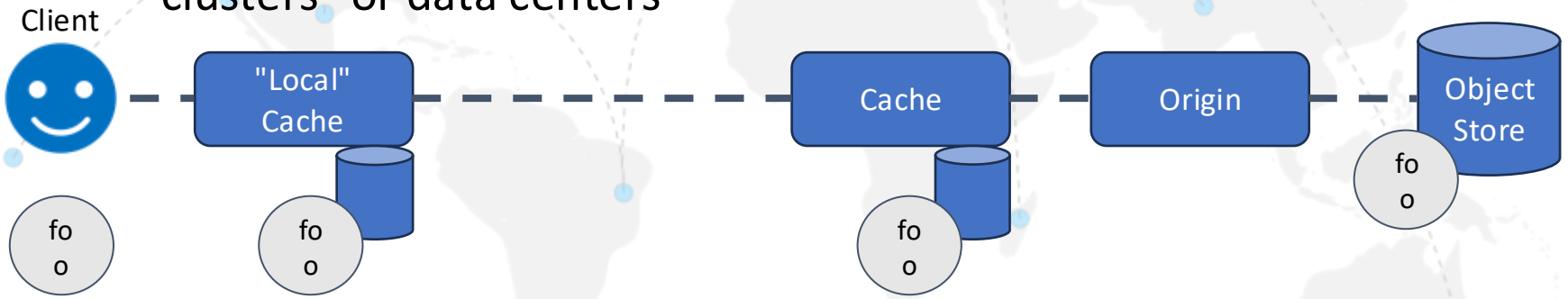
A few years ago, we started working on "local" cache Pelican component that's meant to serve individual "clusters" or data centers



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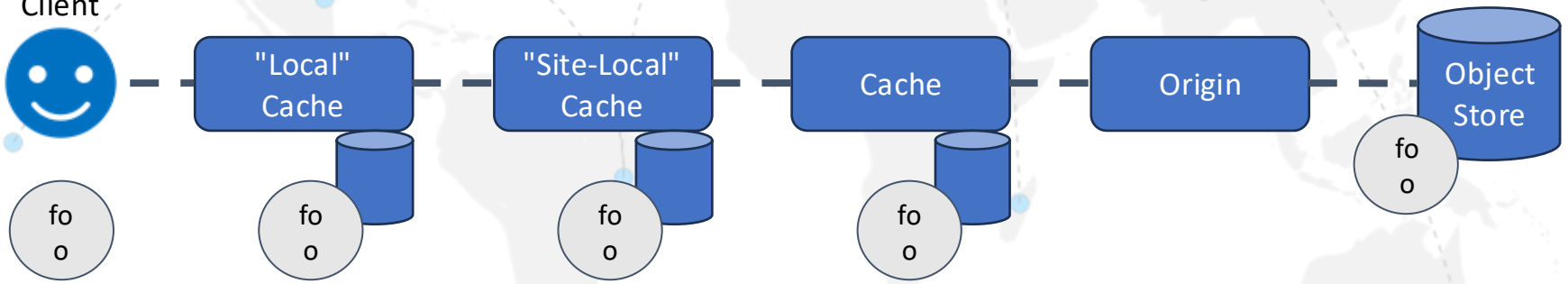
In the last year, we introduced first-class "institutional" or "site-local" caches that aren't open to all federation users.



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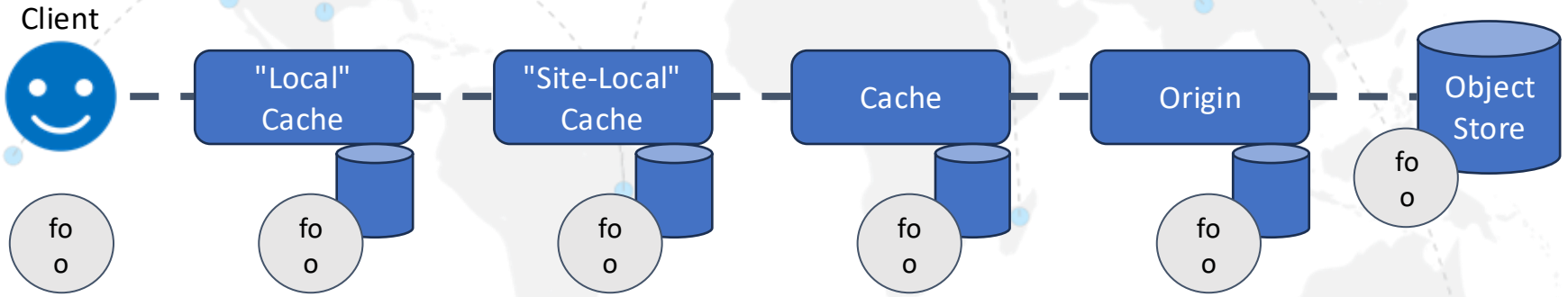
We're also now exploring Origins with their own caching capabilities.



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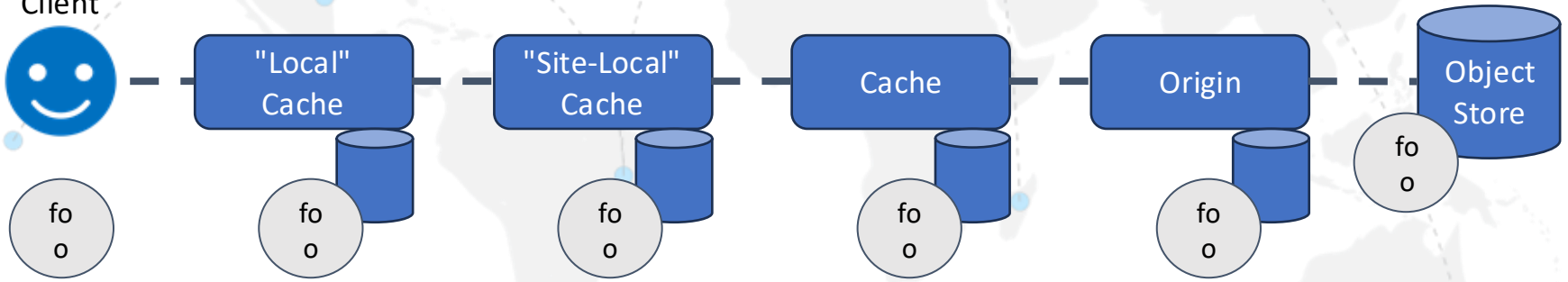
Why do this?

Whom are these caches meant to serve?



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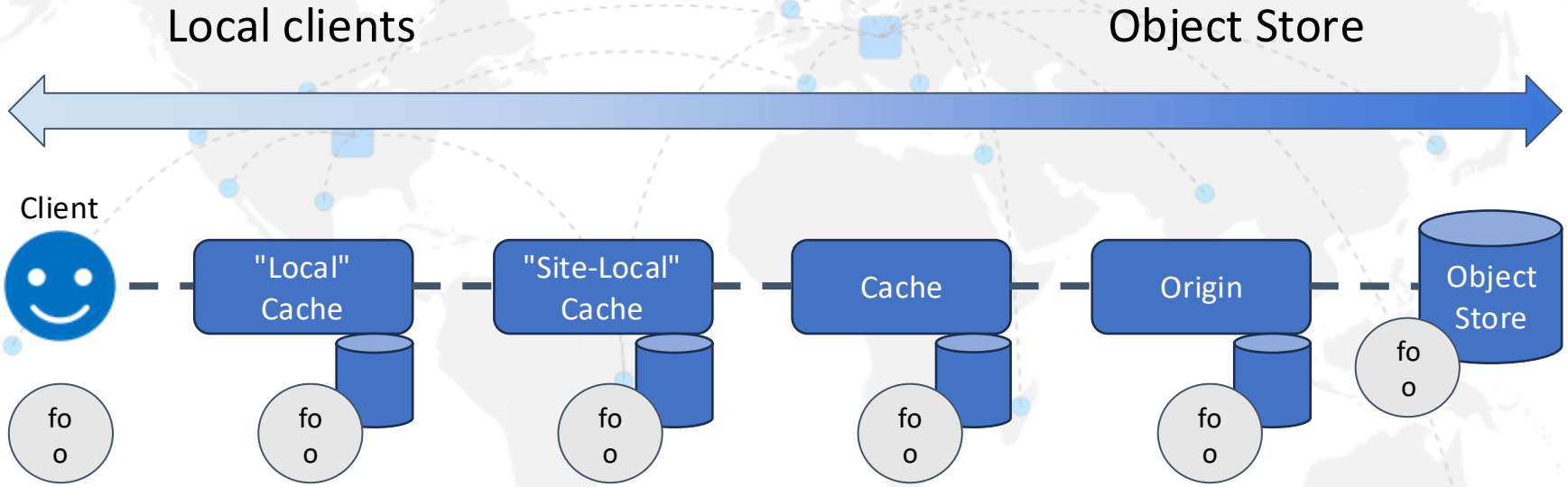


Questions?

Acknowledgements

This material is based upon work supported by the National Science Foundation under Cooperative Agreements OAC-2209645. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.