Making Reva talk to EOS
Ultimate scalability and performance for CERNBox

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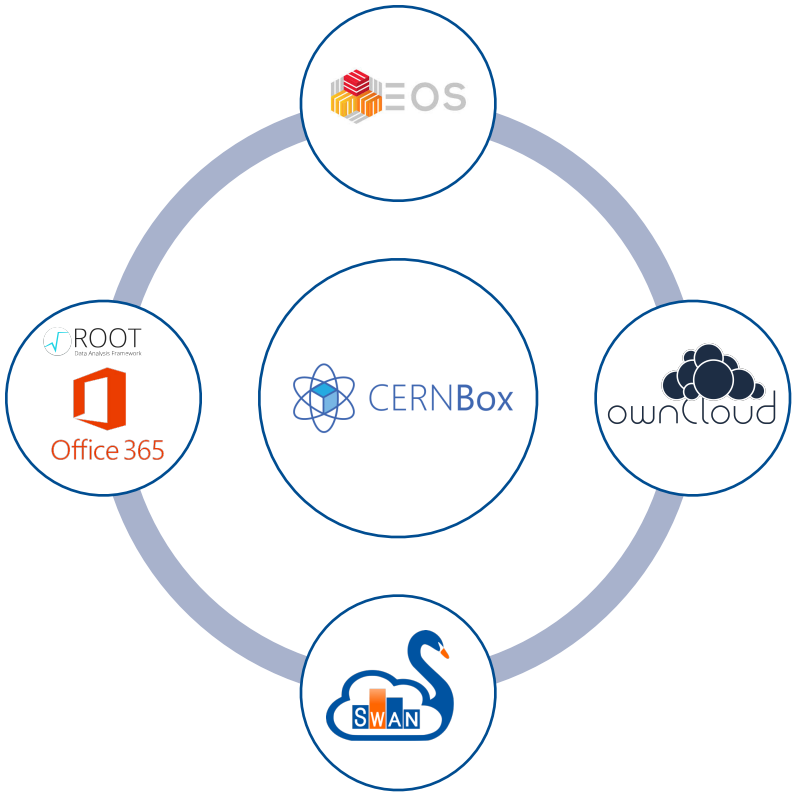
What is CERNBox

- CERNBox provides a cloud synchronization and sharing service
  - Available for all CERN Users (1TiB/ user)
  - Synchronize files (data at CERN) and offline data access
  - Easy and convenient way to share data across users and groups
  - All major platforms supported
  - Based on ownCloud, powered by EOS
  - Integrated with various productivity apps
  - Going through important core evolution steps



EOS

- EOS is a disk-based, low-latency highly scalable storage service, managing many hundreds of Petabytes at CERN
- Having a highly-scalable hierarchical namespace, and with data access possible by the XROOT protocol, it was initially used for physics data storage and massive data access
- It also supports a subset of HTTP/WebDAV data access, optimized for performance
- It also has a gRPC interface, for metadata access and commands
- Today, EOS provides storage for both physics and user use cases, instances of EOS include EOSHOME, EOSATLAS, EOSCMS, EOSATLAS, EOSLHCB and of course CERNBox

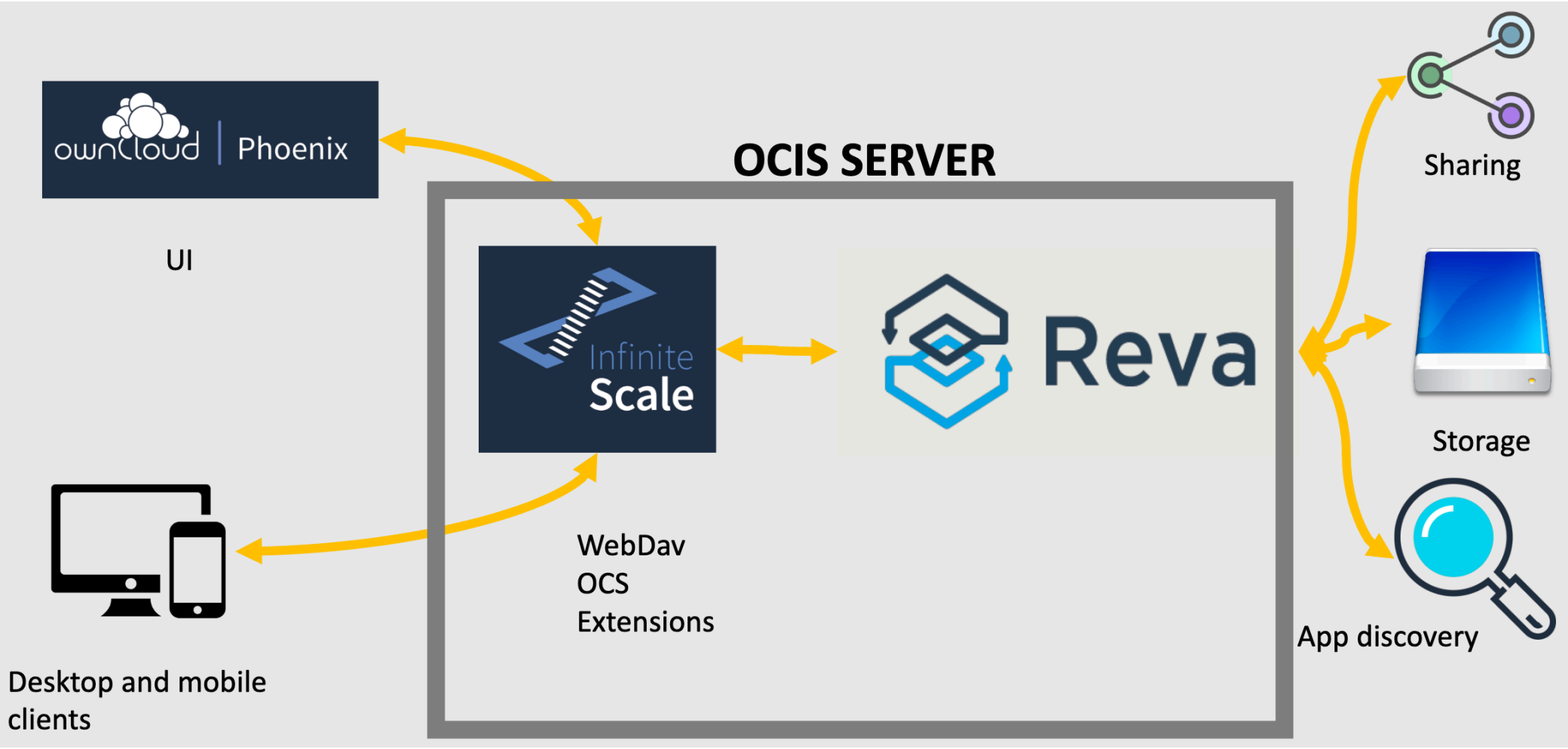
REVA

- The Reva project aims to make cloud storage and application providers inter-operable through a common platform
- The goal of the project is to offer a straightforward way to connect existing sync and share based services in a simple, portable and scalable way. In order to do that, it leverages the CS3 APIS

Scalable gateway mode

- In practice REVA is the component that adapts the APIs of the sync&share clients to the APIs of the background storage and metadata services
- We can also see this as a sort of highly configurable gateway
- It becomes more akin to a gateway especially when it starts managing the data (on top of metadata or redirections), on top of metadata
- This is the direction chosen for the evolution of REVA, in particular when EOS is the chosen backend like at CERN

The evolution



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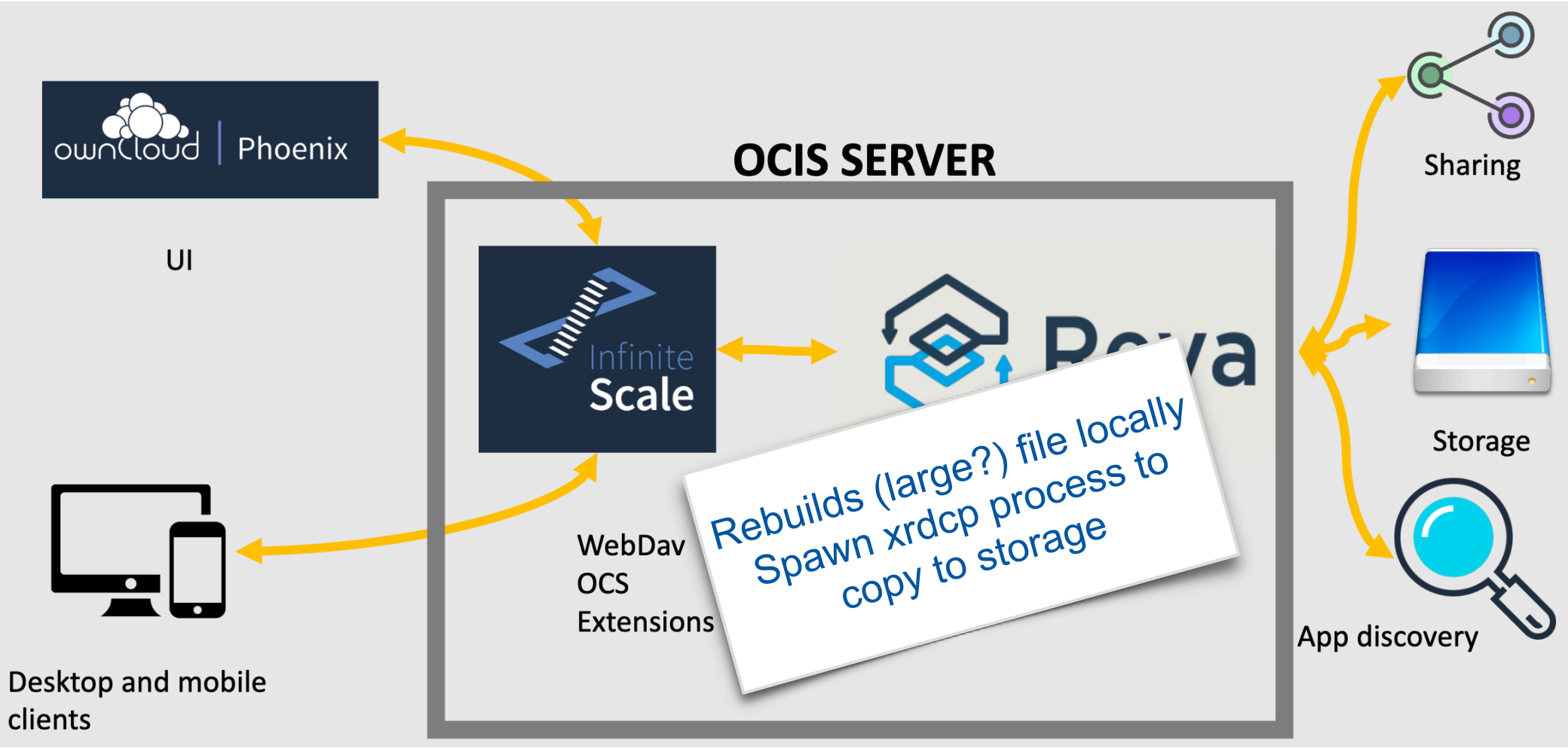

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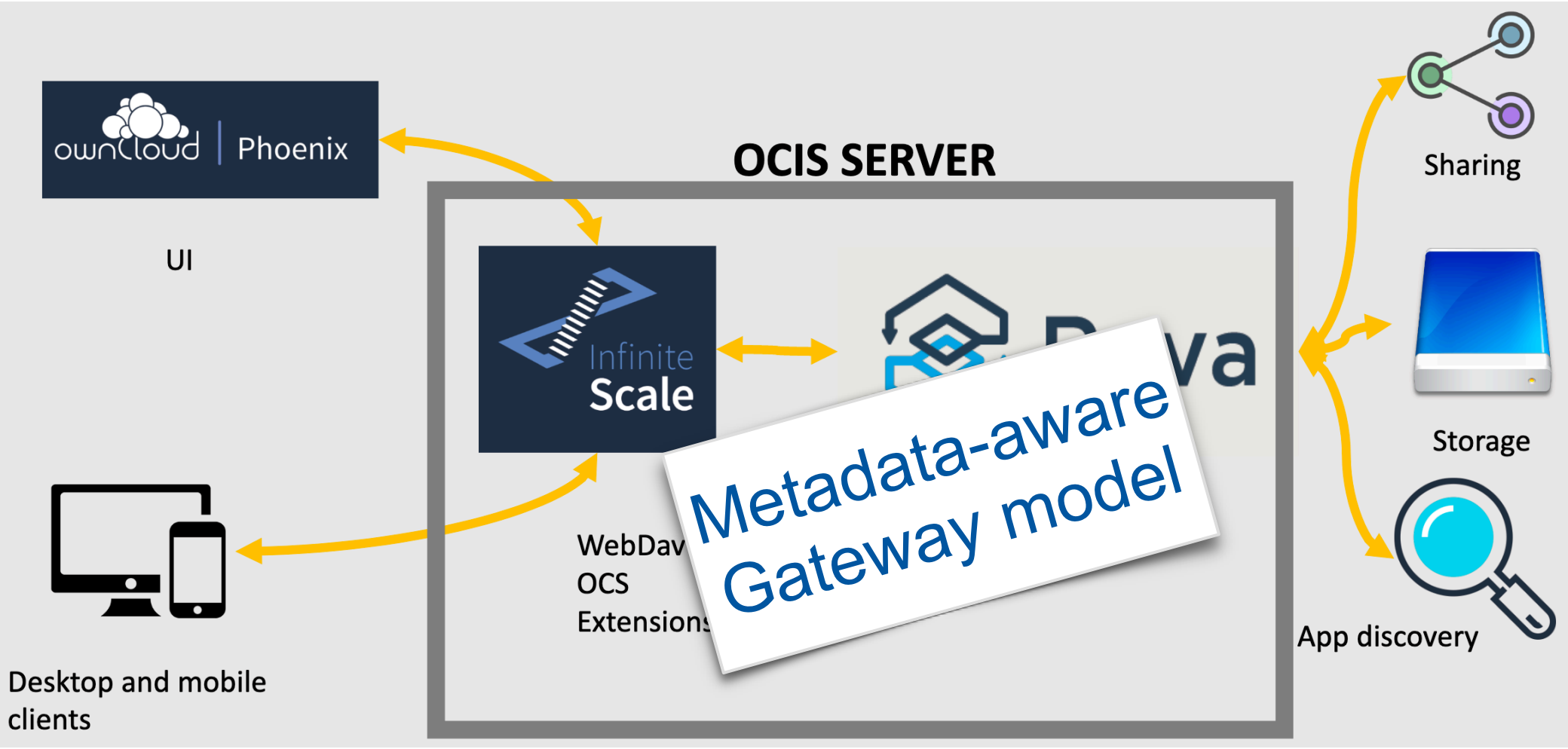

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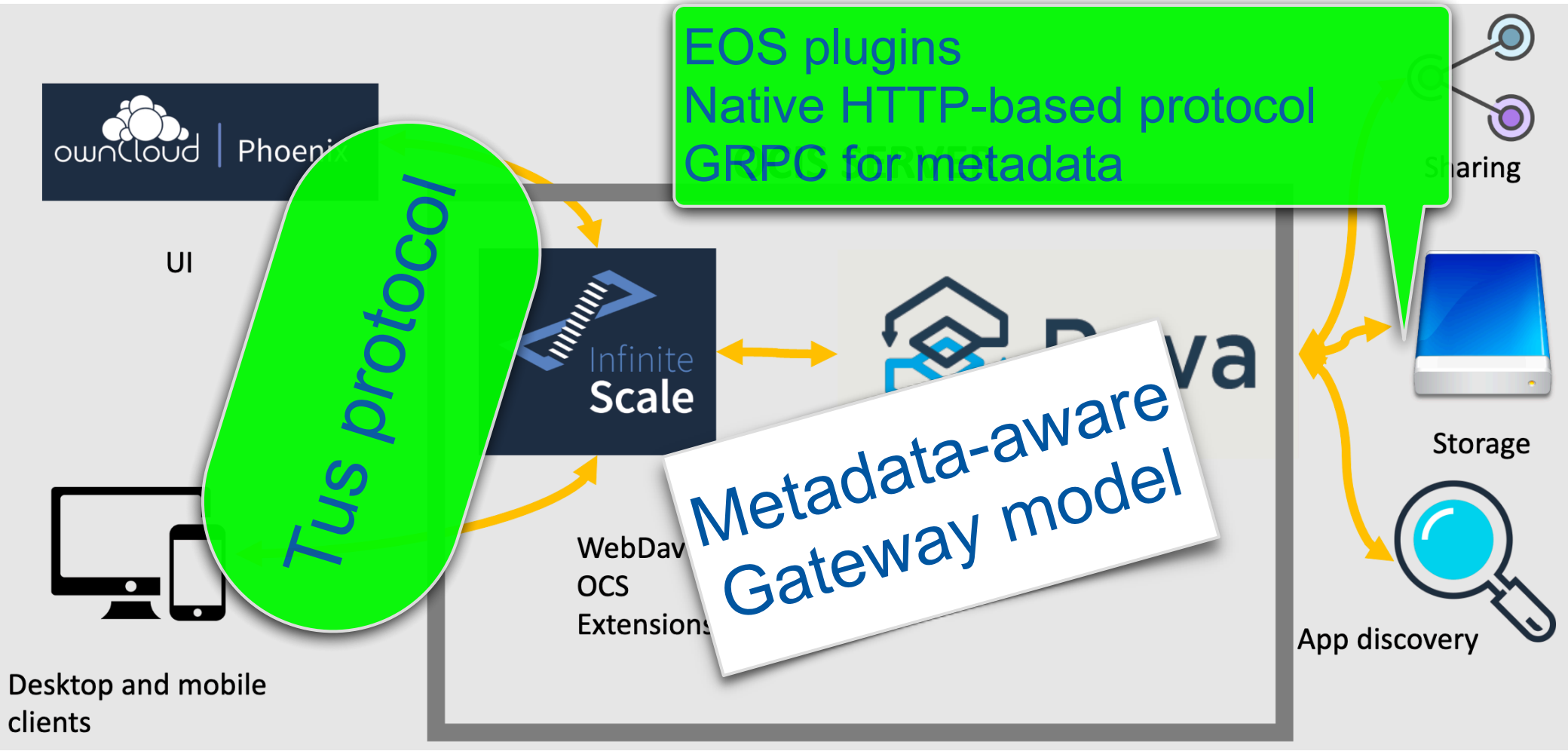
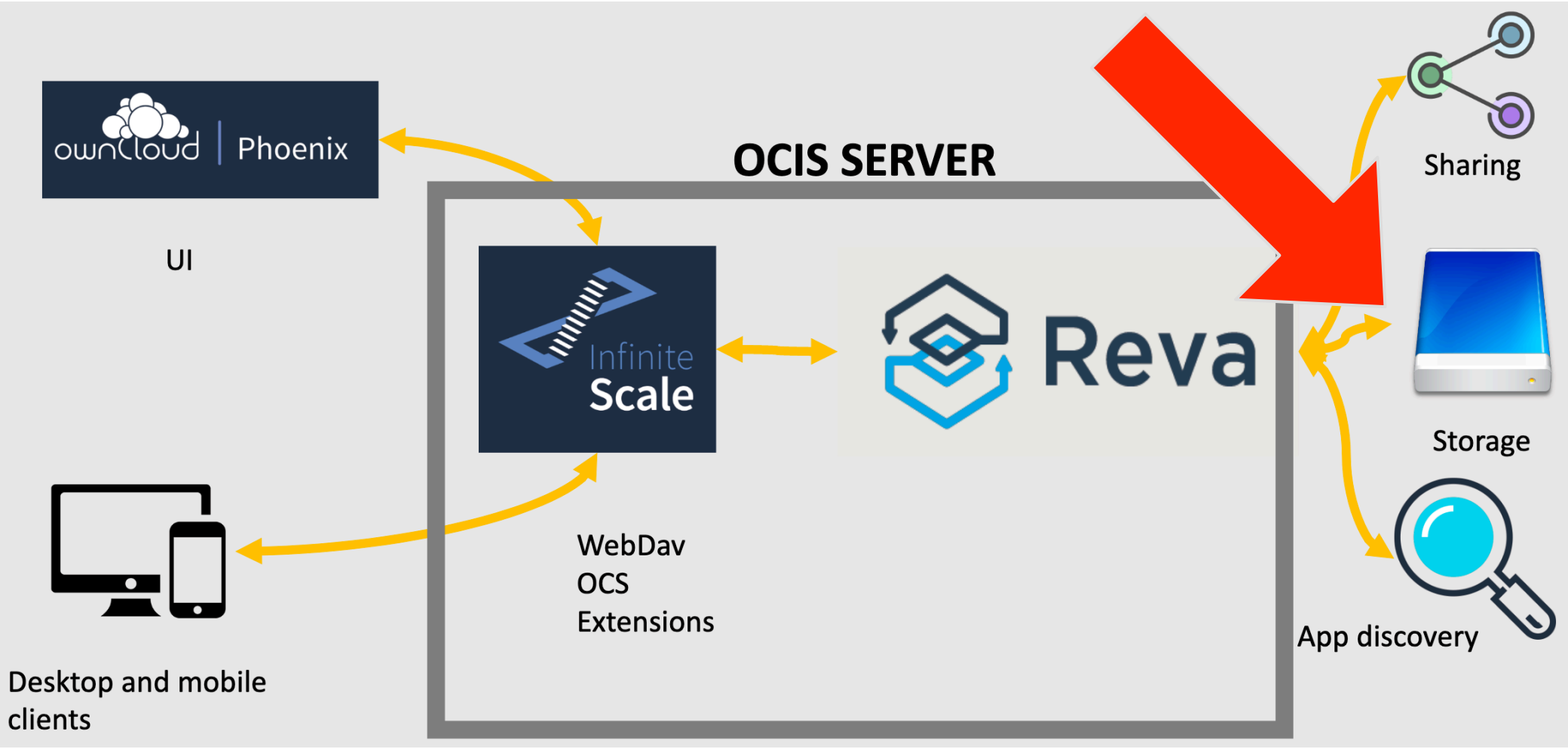


The evolution



Important place

- The connection between REVA and the EOS storage is being reworked

- Use the GRPC interface of EOS for fast metadata access (done, in testing phase)
- Use the HTTP support of EOS for data r/w
  - And make sure it can support this use case

- The step is more evident if we have a deeper look at how it works now…

Current HTTP gateway behaviour

- Get chunk (partial file) from client
- accumulate in local disk
- Do this for all the chunks, then build the whole file locally

- File complete? Upload it to the EOS servers by spawning xrdcp (xrootd protocol)

- Issues: many large files can fill the tmp space of REVA
- The spawned upload technique is suboptimal
  - consumes many resources, e.g. file descriptors
  - can be slow for small files

GRPC interface to EOS

- Reva can now use the GRPC interface to EOS
- previous model was spawning the EOS command line interface for each metadata request

- We expect more than one order of performance improvements in **metadata** internal transactions (we will evaluate this with the first prototypes)

- Together with the other advantages of GRPC… e.g. load balancing, interoperability, compatibility, etc.

- Status: the interface is almost finished and working. Will require contributing a couple of primitives to the EOS gRPC interface

Two phases

- We decided to proceed in two phases

1. Implement the gRPC+HTTP communication (on the REVA-EOS side)
2. Implement the TUS protocol in REVA and review what's missing for that in point 1

- Point 1 will already be production-ready, as it will use the current client protocol

Phase 1: REVA as native HTTP gateway to EOS

- Get chunk from client as “little” independent file
  - Forward it to EOS using the current OwnCloud upload protocol
  - **On the fly, no local temp copy**
- Repeat until all the chunks have been forwarded

- After the last chunk, EOS rebuilds the full file directly in the EOS backend

Phase 2: REVA as native HTTP gateway to EOS

- At some point Reva will use the TUS protocol towards the clients
  https://tus.io/

- Chunks will come as real chunks, through PATCH requests
  - Forward them to EOS, passing the appropriate offsets in the final destination file
    - Either “PUT with offset” or “bytestream PATCH”
  - **On the fly, no local temp copy**

- Repeat until all the chunks have been forwarded then rename the final file from temp to final

- This will have the goodies of the TUS protocol, keeping its details in REVA

REVA as native HTTP gateway to EOS

- Challenge: requires Reva to have a rock-solid HTTP client
  - The golang HTTP client is a good start

- Challenge: iron out the details in the EOS-side HTTP implementation

- benefits: no more spawning per each remote client
- all thread based, native support, lower replication latency and improved performance for smallish files

- We would like at least Phase 1 to be “production quality” during 2021

Status

- gRPC communication: working! Misses 2-3 quota-related calls (also EOS will be enhanced for that)

- Native HTTP(S) communication… works, and seems pretty snappy
  - Timeout managing… it's there, to be cleaned up
  - HTTP Retry logic across redirections to FST, it's there, to be cleaned up
  - Maybe some more parameters need to be exposed to the config file

- The EOS "vid" configuration works now, still with some question marks. Will it be the final one? Is it missing anything? We'll see…
- As soon as it's a bit consolidated it will be documented, especially for the configuration part

Useful references

Documentation: https://reva.link/
Tus protocol: https://tus.io/
Reva Github: https://github.com/cs3org/reva
GRPC: https://en.wikipedia.org/wiki/GRPC
Q&A: https://gitter.im/cs3org/REVA
Xrootd: https://xrootd.slac.stanford.edu/