



ALICE



Calibration and Conditions Database (CCDB)

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CCDB at a glance

- Central store of calibration and condition data

Metadata stored separately from the serialized calibration data

Data distribution using a set of reliable Grid SEs

- Millisecond resolution for object IoV
- Expected $O(100\text{Hz})$ updates and $O(20\text{kHz})$ queries
- Authenticated writes, open reads (*)
- HTTP(s) for metadata queries
HTTP(s) and/or XrootD for data access

(*) For now, will soon require a valid identity

REST API for querying it

/

POST - upload new objects

GET - retrieve the content, ready to follow redirects to `alien://`, `root://` or `http://`

PUT - update existing objects (metadata or end of IoV)

HEAD - only the headers (metadata)

DELETE - obvious

/download

GET - retrieve the cached content of one object (only if redirected to it)

HEAD - the object metadata only

/browse, /latest

GET - listing of matching objects and subfolders (all and the most recent one only respectively)

/monitor - performance metrics and access counters

Query format

.../Task/Detector/[more/]/*tStart*[/tEnd][[/UUID][[/key=value]

Folder structure is between 1 and 10 levels deep

For most requests the **reference time** is mandatory

Additional HTTP headers:

If-None-Match : client cached object to validate

If-Not-After : snapshot timestamp to limit queries by

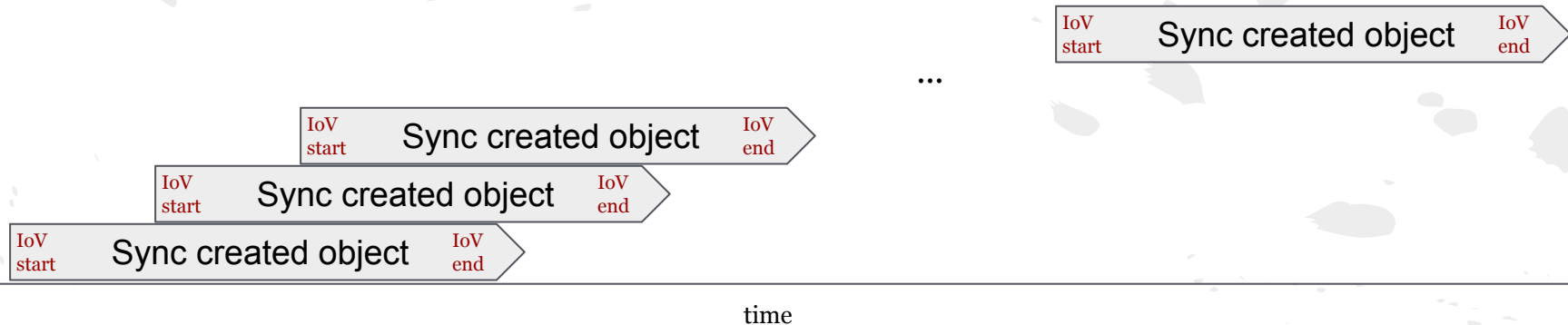
IoV queries

Interval of Validity

Calibration: status collected now, applying between [now, next sampling time)

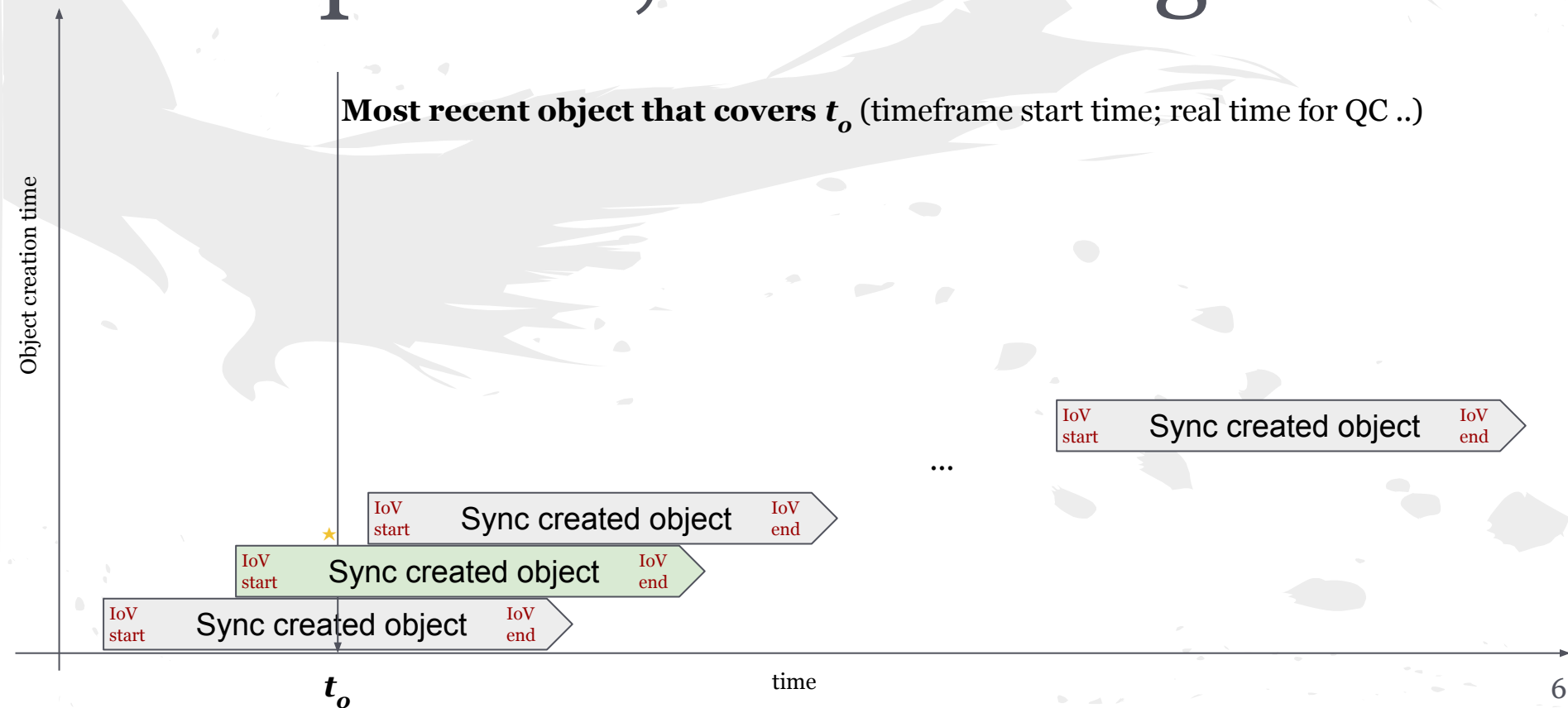
QC: accumulated information between reset times, i.e. [now - 5 minutes, now)

Object creation time

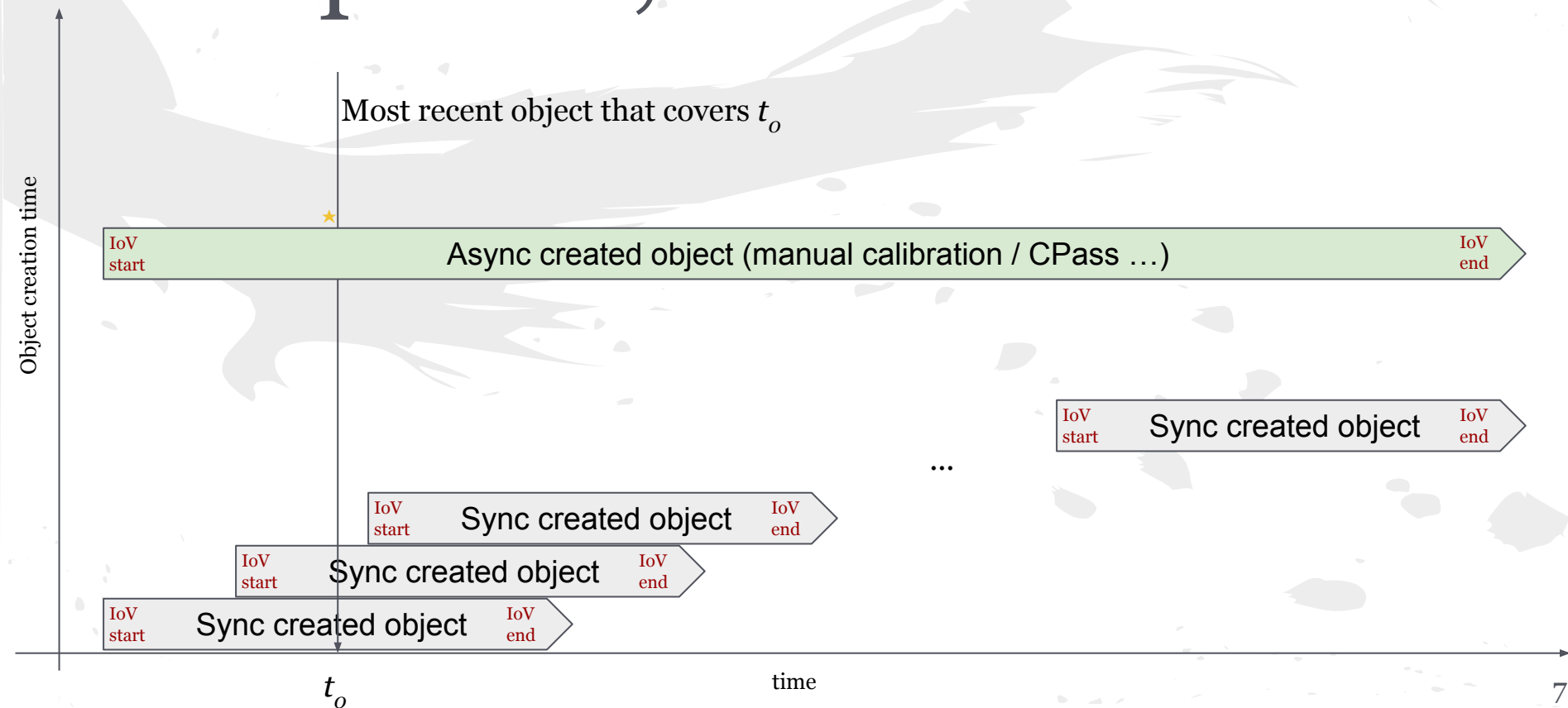


time

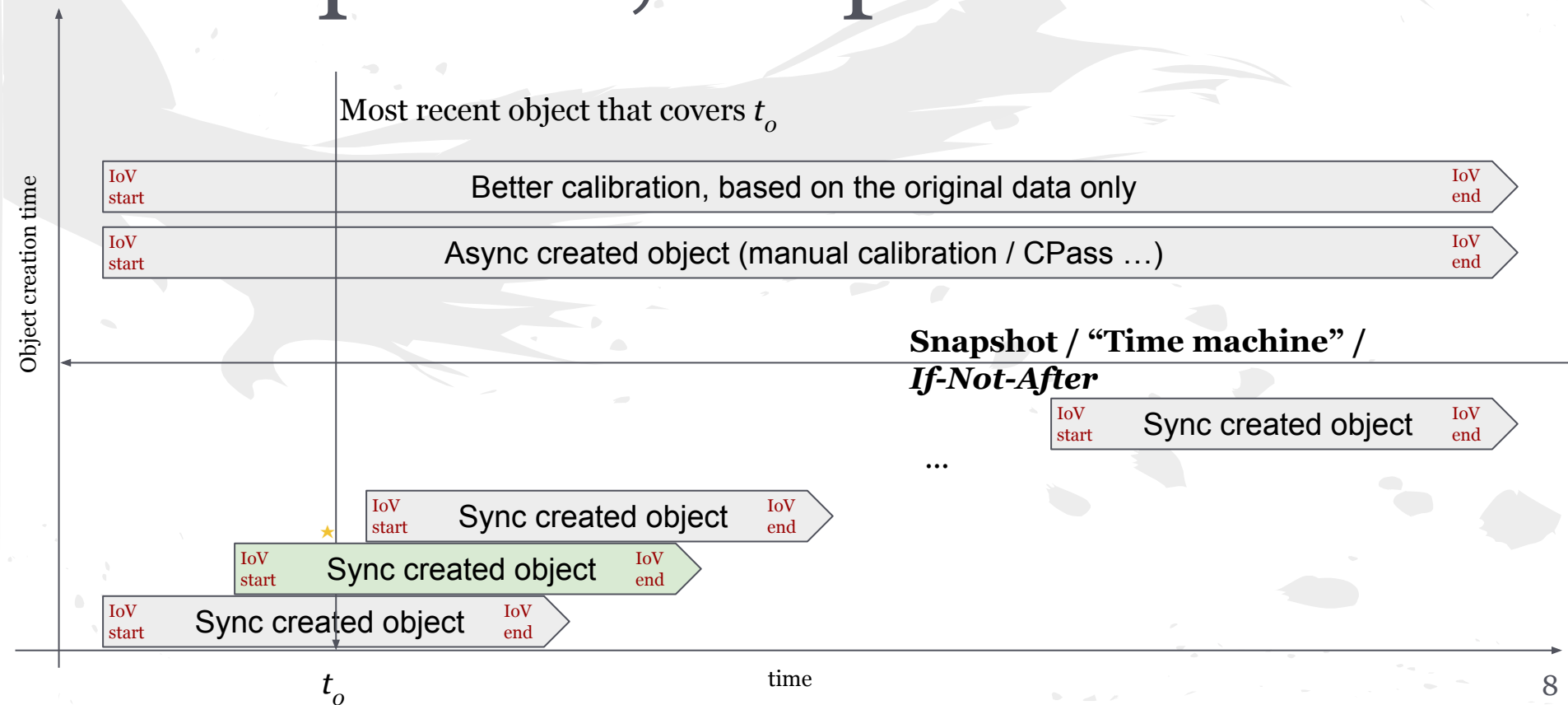
IoV queries, data taking time



IoV queries, manual calib.



IoV queries, snapshots



cURL-based REST examples

#upload an object to the repository

```
curl -F blob=@/tmp/file localhost:8080/Local/Task1/Detector1/1/100000/quality=2
```

```
Location: /Local/Task1/Detector1/1/a329fcc6-9818-4d2e-a5af-16ca73686cf2
```

#query to find the object valid at given moment in time

```
curl localhost:8080/Local/Task1/Detector1/50000
```

```
Date: Thu, 01 Jan 1970 00:00:00 GMT
```

```
Date-Epoch: 1
```

```
Last-Modified: Thu, 01 Jan 1970 00:01:40 GMT
```

```
Last-Modified-Epoch: 100000
```

```
Location: /Local/Task1/Detector1/1/a329fcc6-9818-4d2e-a5af-16ca73686cf2
```

#with non-matching metadata constraints

```
curl localhost:8080/Local/Task1/Detector1/50000/quality=1
```

```
HTTP/1.1 404
```

#download the content (just following the above redirect)

```
curl localhost:8080/Local/Task1/Detector1/1/a329fcc6-9818-4d2e-a5af-16ca73686cf2
```

```
ETag: a329fcc6-9818-4d2e-a5af-16ca73686cf2
```

```
Date: Thu, 01 Jan 1970 00:00:00 GMT
```

```
Date-Epoch: 1
```

```
Last-Modified: Thu, 01 Jan 1970 00:01:40 GMT
```

```
Last-Modified-Epoch: 100000
```

```
Content-Length: 2972
```

```
...
```

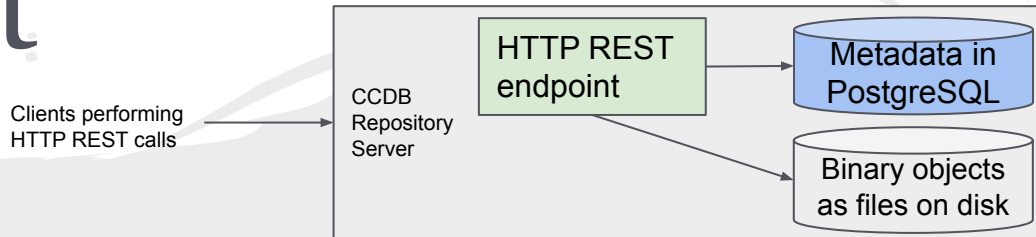
#check if the object is still valid at a later moment in time

```
curl -i -H 'If-None-Match: a329fcc6-9818-4d2e-a5af-16ca73686cf2' localhost:8080/Local/Task1/Detector1/76543
```

```
HTTP/1.1 304
```

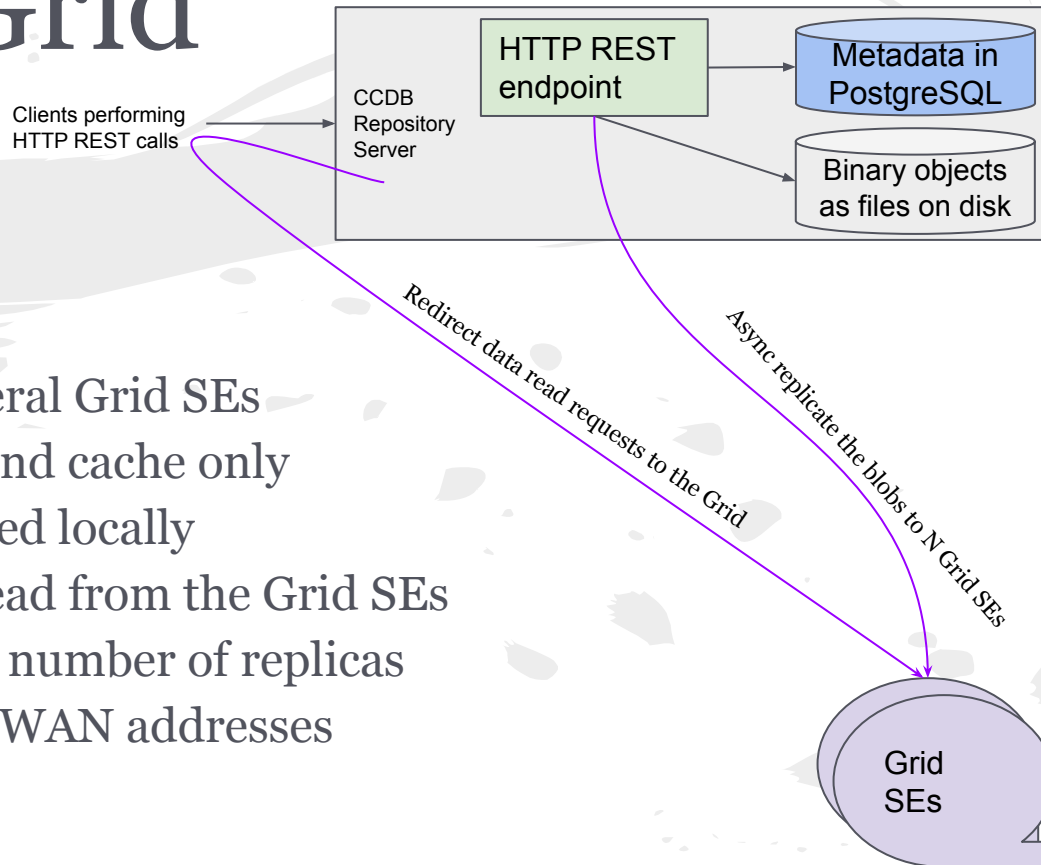
Not modified

Deployment



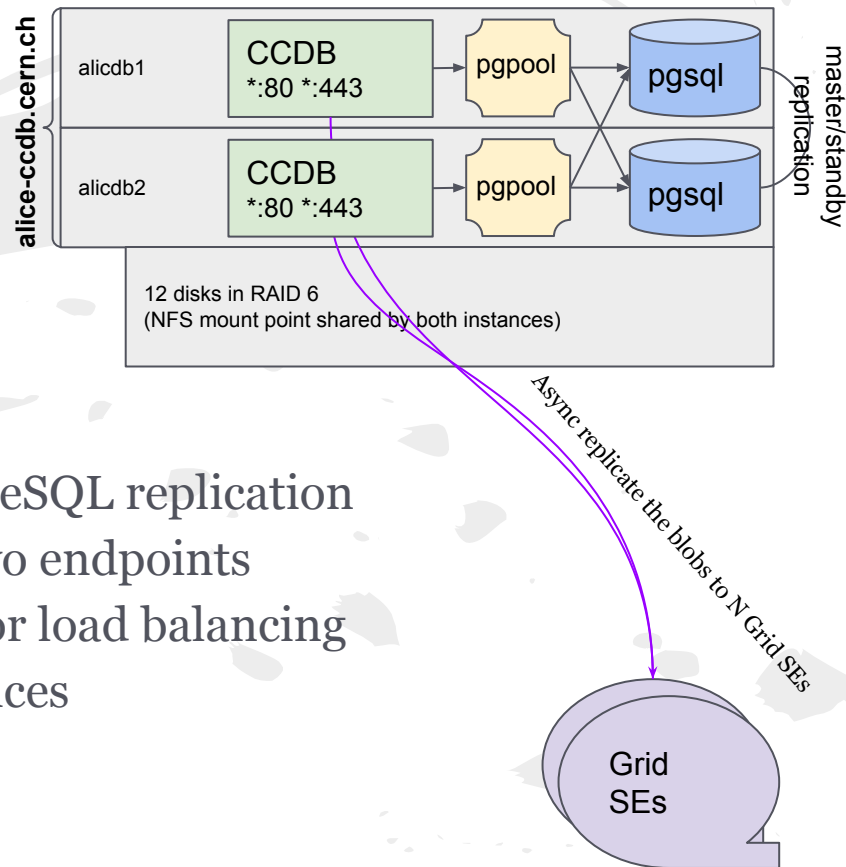
- Smallest setup that only requires one open port on the server
- All data is stored and served from the machine itself
- Limited by the amount of disk and bandwidth

Offload to Grid

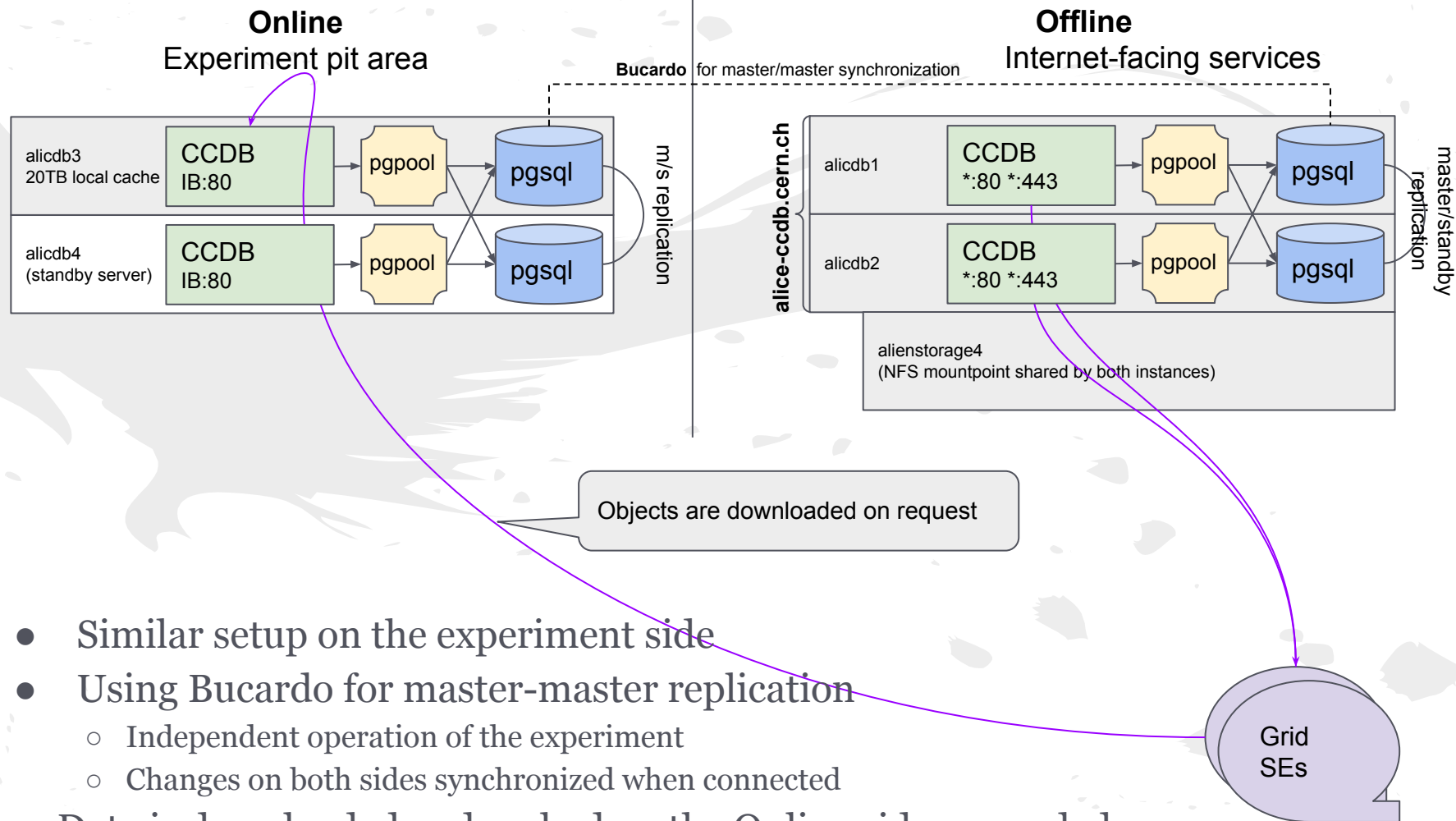


- Blobs are uploaded to several Grid SEs
- Local disk used as buffer and cache only
- Metadata queries performed locally
- Clients are redirected to read from the Grid SEs
- Bandwidth scales with the number of replicas
- Location-aware sorting of WAN addresses

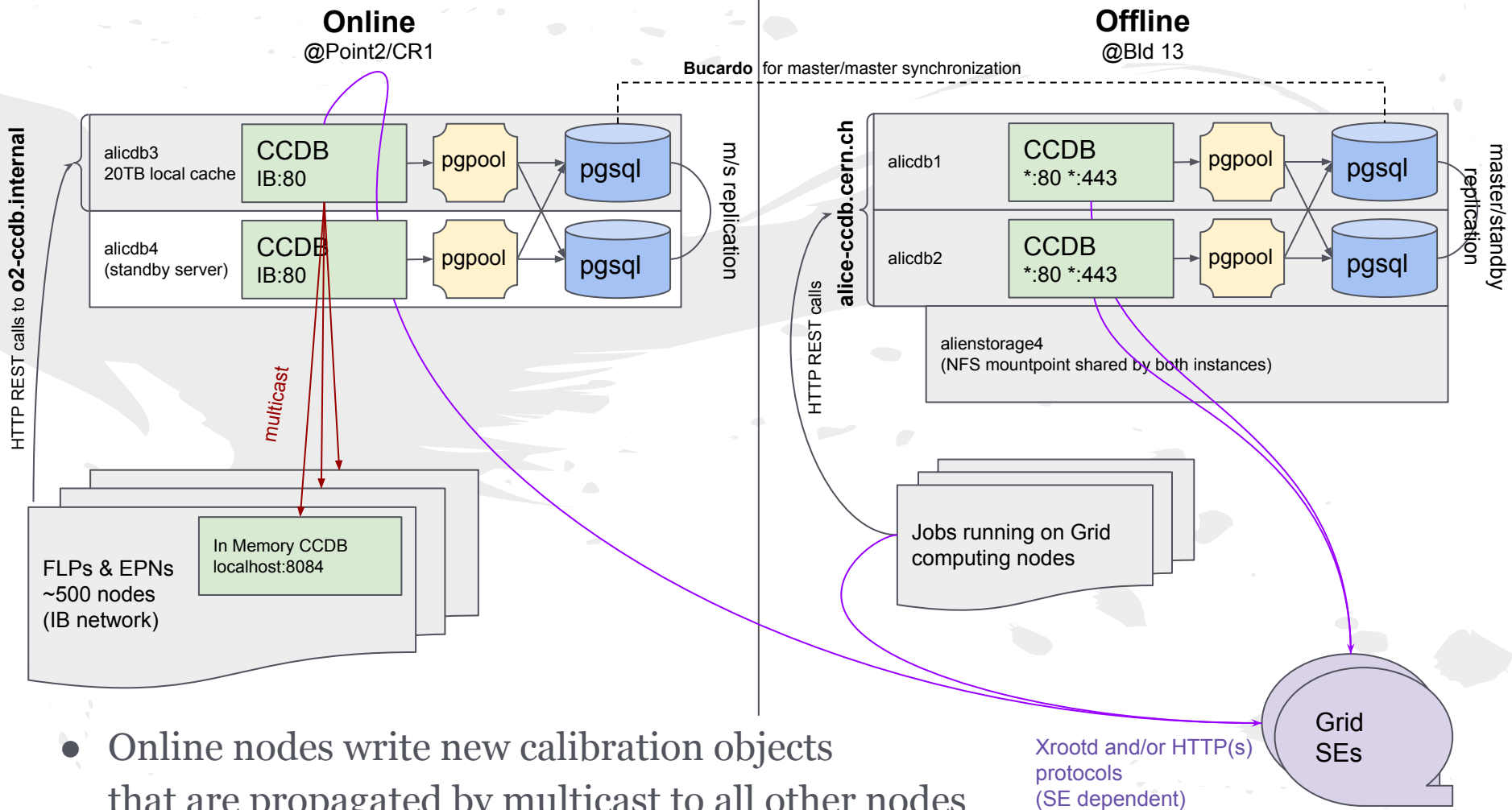
Redundancy



- Database replication with native PostgreSQL replication
- *pgpool* to balance reads between the two endpoints
- Two HTTP servers under a DNS alias for load balancing
- Blob storage area shared by both instances



- Similar setup on the experiment side
- Using Bucardo for master-master replication
 - Independent operation of the experiment
 - Changes on both sides synchronized when connected
- Data is downloaded and cached on the Online side as needed



Default read access

Redirect to *alien*::/

`$ curl -i http://alice-ccdb.cern.ch/Users/g/grigoras/My/Object/1345566677000`
HTTP/1.1 303
Content-Location: alien:///alice/data/CCDB/Users/g/grigoras/My/Object/06/26880/6a615450-1ae1-11ec-89
Content-Location: http://alice-ccdb.cern.ch/download/6a615450-1ae1-11ec-895d-200114580201
Location: alien:///alice/data/CCDB/Users/g/grigoras/My/Object/06/26880/6a615450-1ae1-11ec-895d-20011

alien::/ URL handling plugin in ROOT

Asking the central file catalogue for the physical locations

Binary content fetched over the Xrootd protocol

Deserialized as ROOT object

Cast to the type indicated in the CcdbApi call

Alternate read access

Optional HTTP redirection (client calling from the USA):

```
$ curl -i http://alice-ccdb.cern.ch/Users/g/grigoras/My/Object/1345566677000 ?HTTPOnly=true  
HTTP/1.1 303
```

Repl. 5x 2x Alt. locations {	Content-Location: https://alicemgm0.lbl.gov:8443//15/26953/6a7b6c00-1ae1-11ec-895d-08f1eaf0250c?authz=...
	Content-Location: https://eosalice.cern.ch:443//eos/alice/cond/15/26953/6a7b6c00-1ae1-11ec-895d-08f1eaf0250c?authz=...
	Content-Location: https://eosalice.cern.ch:443//15/26953/6a7b6c00-1ae1-11ec-895d-08f1eaf0250c?authz=...
	Content-Location: http://naneosmgr.in2p3.fr:8000//15/26953/6a7b6c00-1ae1-11ec-895d-08f1eaf0250c?authz=...
	Content-Location: http://mgm.spacescience.ro:8000//15/26953/6a7b6c00-1ae1-11ec-895d-08f1eaf0250c?authz=...
	Content-Location: http://rd.spacescience.ro:1094//home/aliprod/data/15/26953/6a7b6c00-1ae1-11ec-895d-08f1eaf0250c?...
	Content-Location: http://eos-mgm.grid.pub.ro:8000//15/26953/6a7b6c00-1ae1-11ec-895d-08f1eaf0250c?authz=...
	...
Location: https://alicemgm0.lbl.gov:8443//15/26953/6a7b6c00-1ae1-11ec-895d-08f1eaf0250c?authz=...	

JSROOT integration

- Shown only for locally cached files due to browser application security restrictions
- Example: http://ccdb-test.cern.ch:8080/latest/qc/TPC/MO/Calibration/c_ROCs_Noise_1D

Size	Path	Metadata	Replicas
22528	qc/TPC/MO/Calibration/c_ROCs_Noise_1D	ObjectType TCanvas qc_detector_name TPC qc_task_name Calibration qc_version 1.10.0 partName send custom 42	• local repo (http) ROOT browser

Read a ROOT file

JSROOT version 6.1.0 15/04/2021

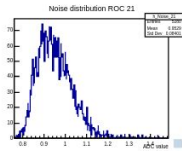
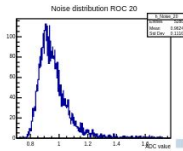
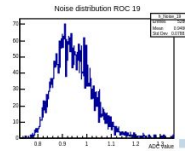
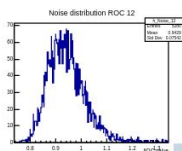
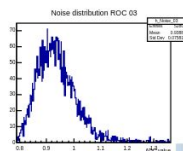
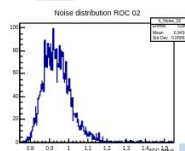
simple

[open all](#) | [close all](#) | [clear](#)

TObject_1612948255371.root

ccdb_object,1

StreamerInfo



Summary

Java open source code embedding a Tomcat server

Edge integration with AliEn for external data mgmt

REST service for storing calibration/condition/QC data

- ROOT serialization & streaming support
 - TGrid plugin and CCDB helper functions

Three builds for

- Local machine / development
- In memory cache with multicast receiver (DAQ nodes)
- PostgreSQL, Grid SE-backed & multicast sender