Karlsruhe Institute of Technology

Institute of Experimental Particle Physics

Data-Aware Scheduling with Hash-Based Data Distribution

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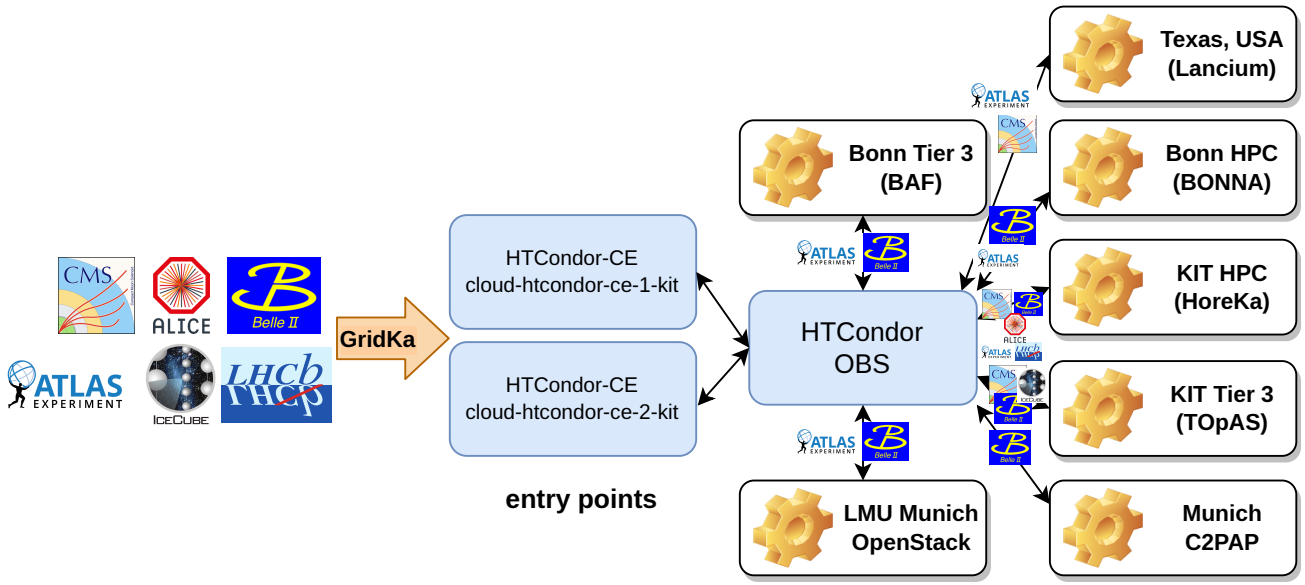
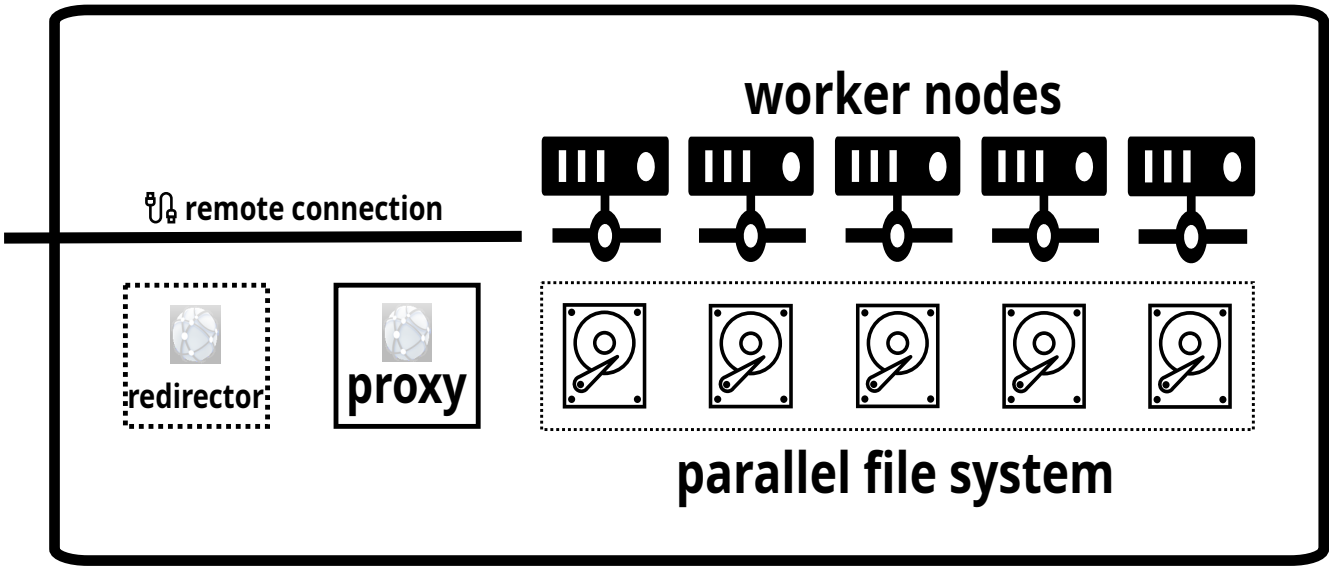
FTS and XRootD Workshop @ JSI (27-31 March 2023)

Integration of Opportunistic Resources



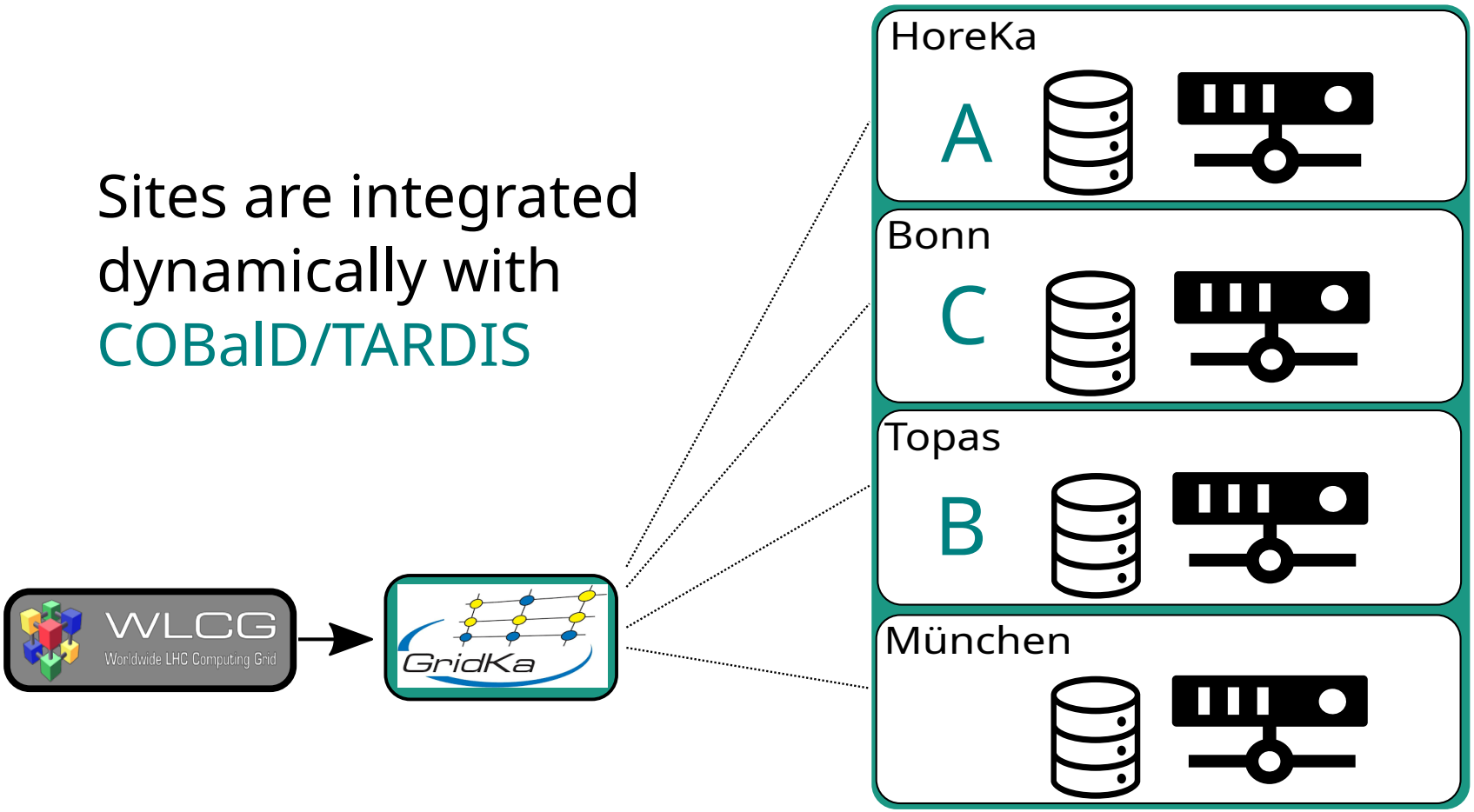
- Opportunistic resources are integrated dynamically with COBaID/TARDIS
- Very heterogeneous infrastructure
- No permanent, managed storage at integrated sites – only caches

Opportunistic Resource

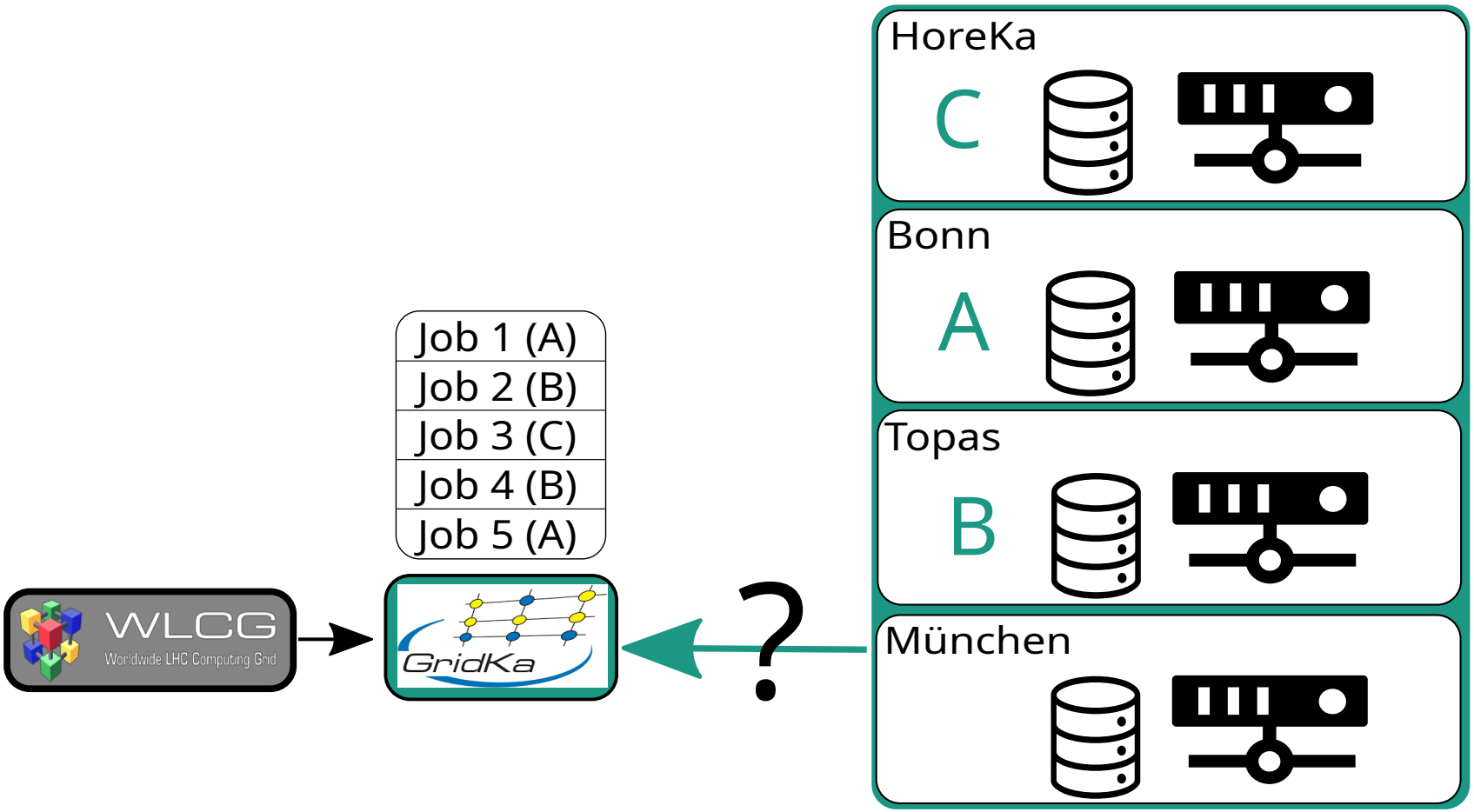


Data-Aware Scheduling for ORs

Sites are integrated dynamically with COBalD/TARDIS



Data-Aware Scheduling for ORs



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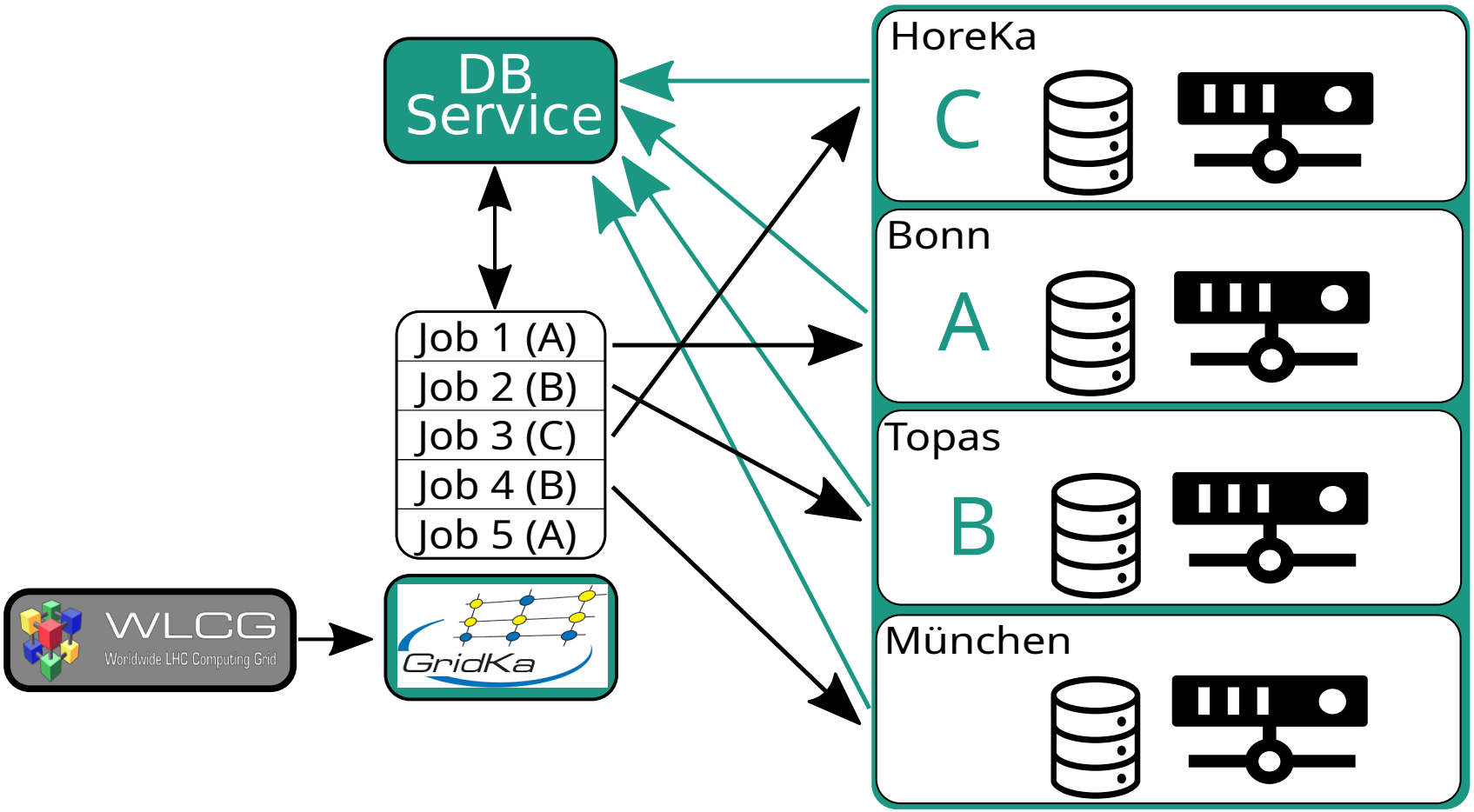

Hash-Based Approach

- Hash-based distribution of files inspired by Ceph/CRUSH

→ based on the file name, a hashing function calculates the data placement

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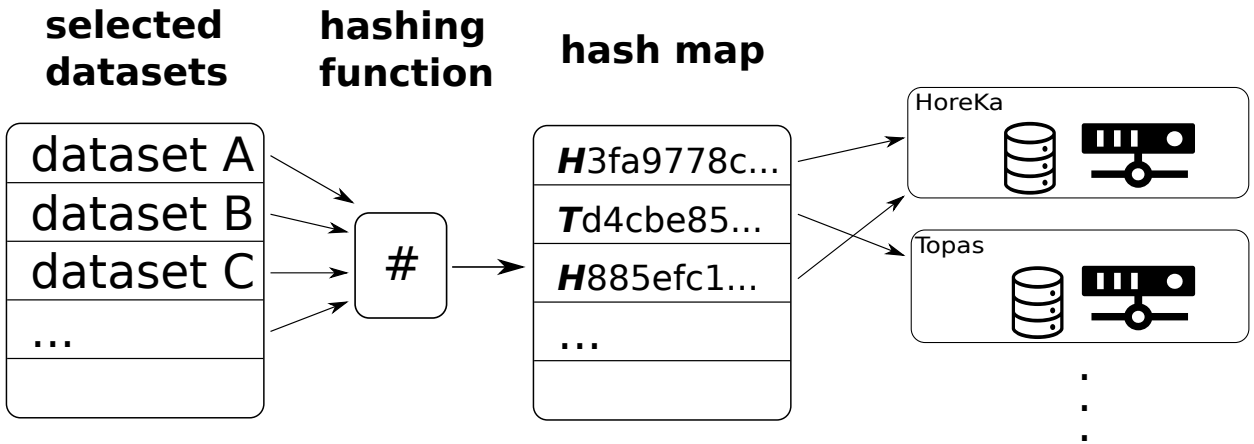
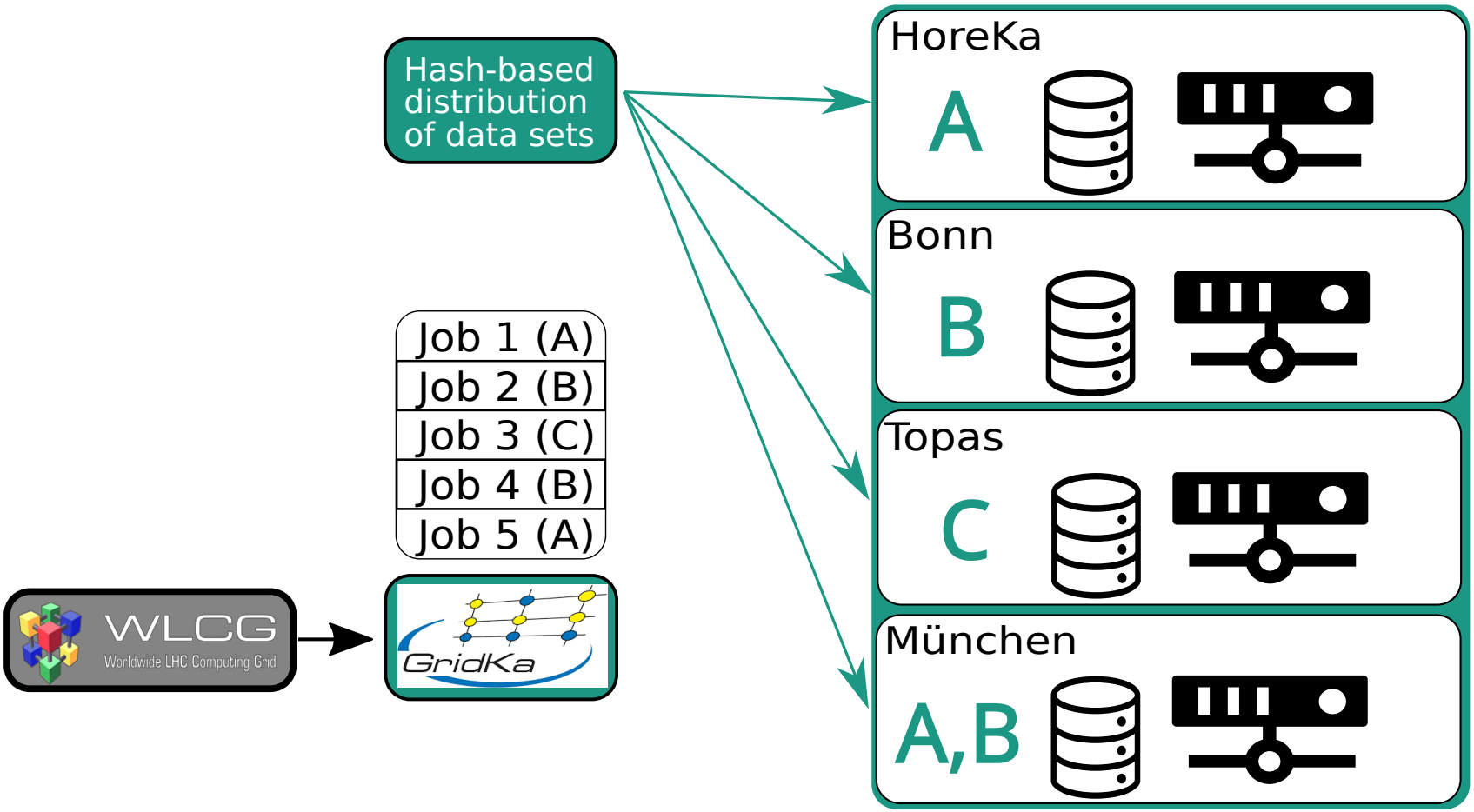


e.g.:
/SingleMuon/Run2022C-PromptNanoAODv10-v1/NANOAOD

Hash-Based Distribution of Datasets



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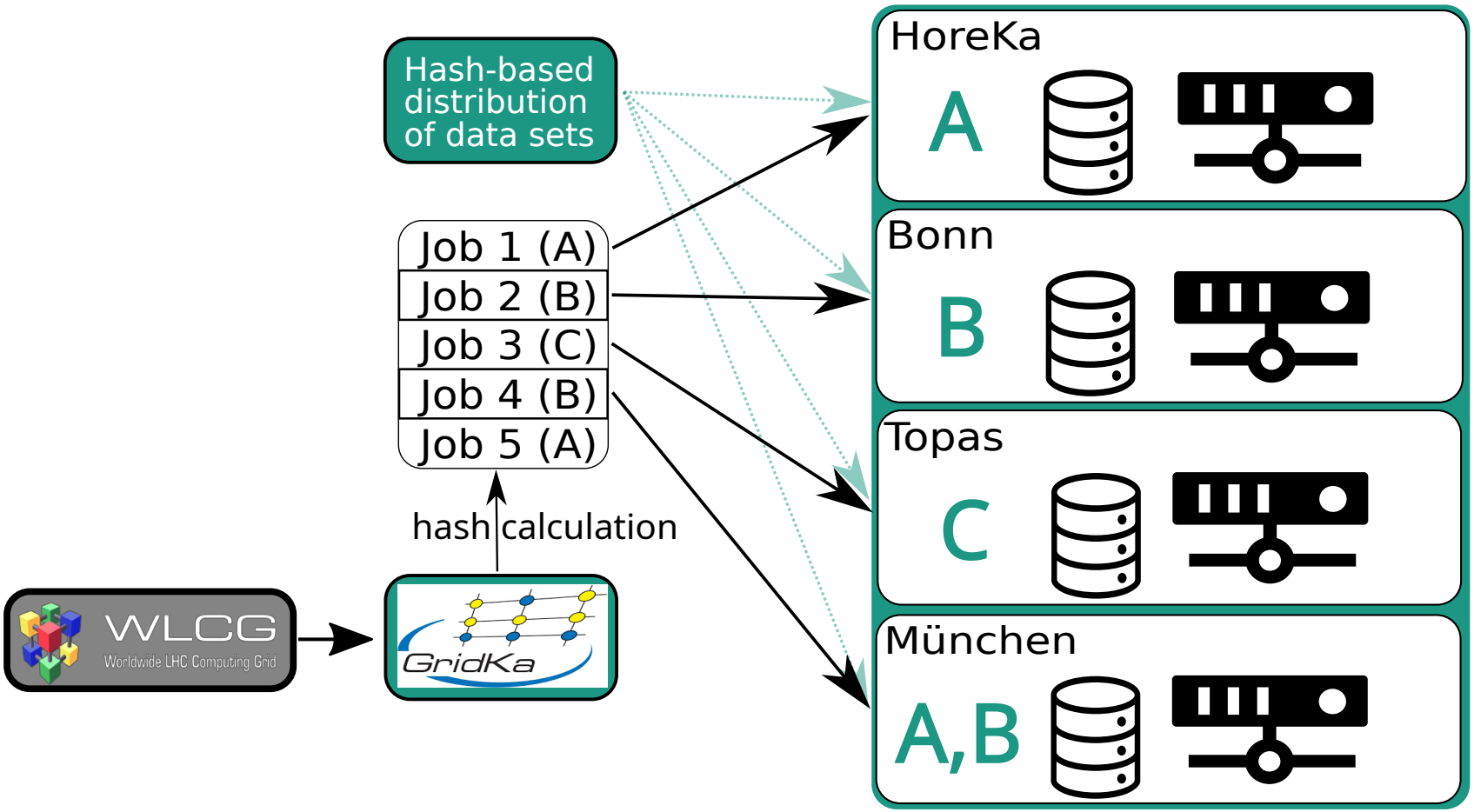
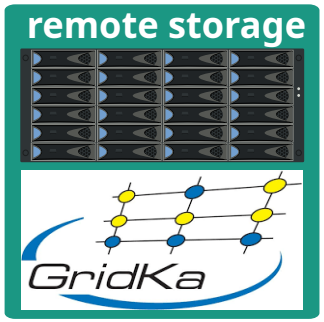
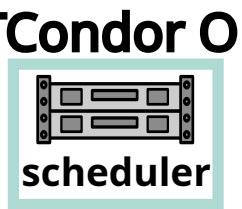
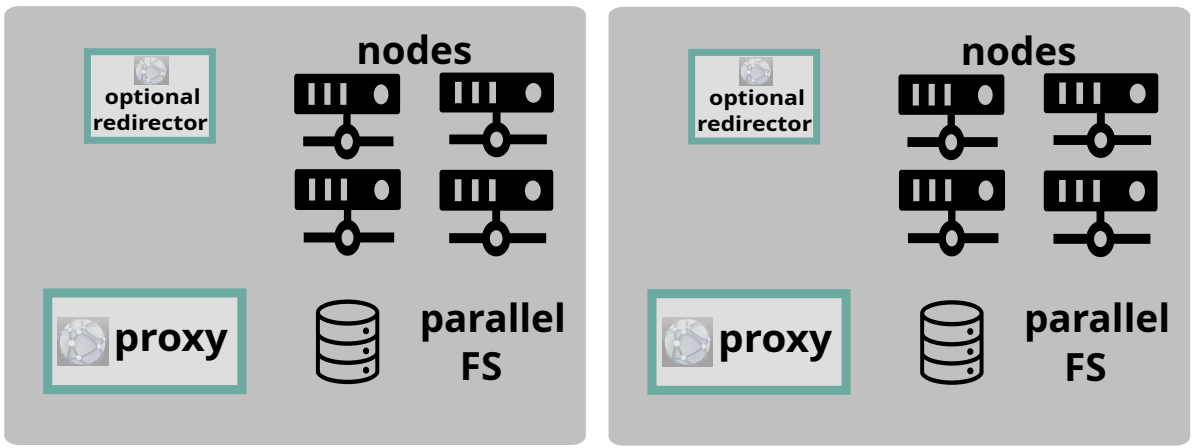


Concept and Implementation (I)



Remote storage at GridKa initially provides the data





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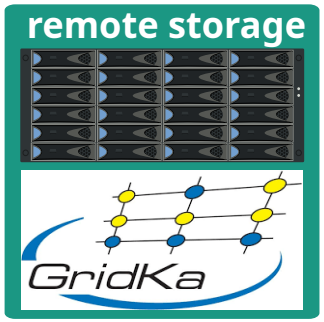

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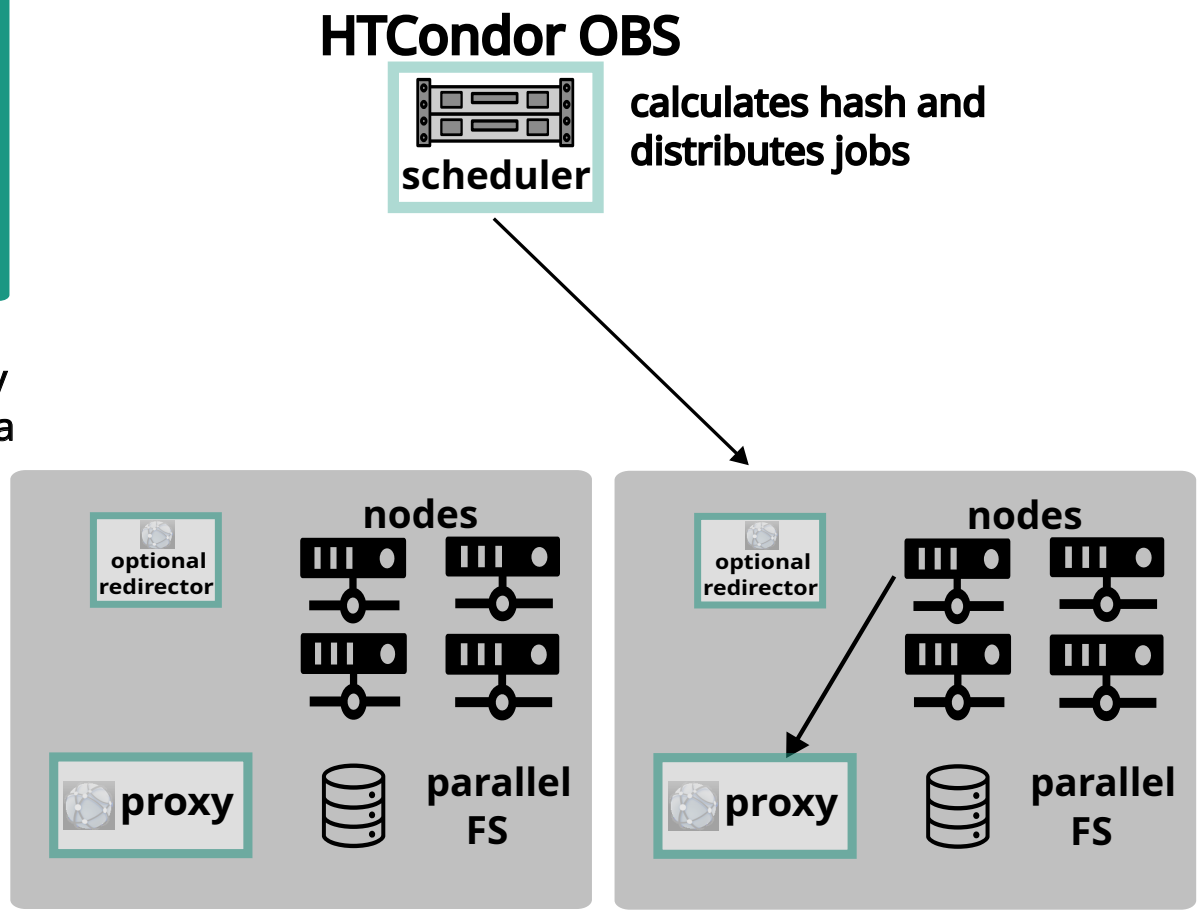

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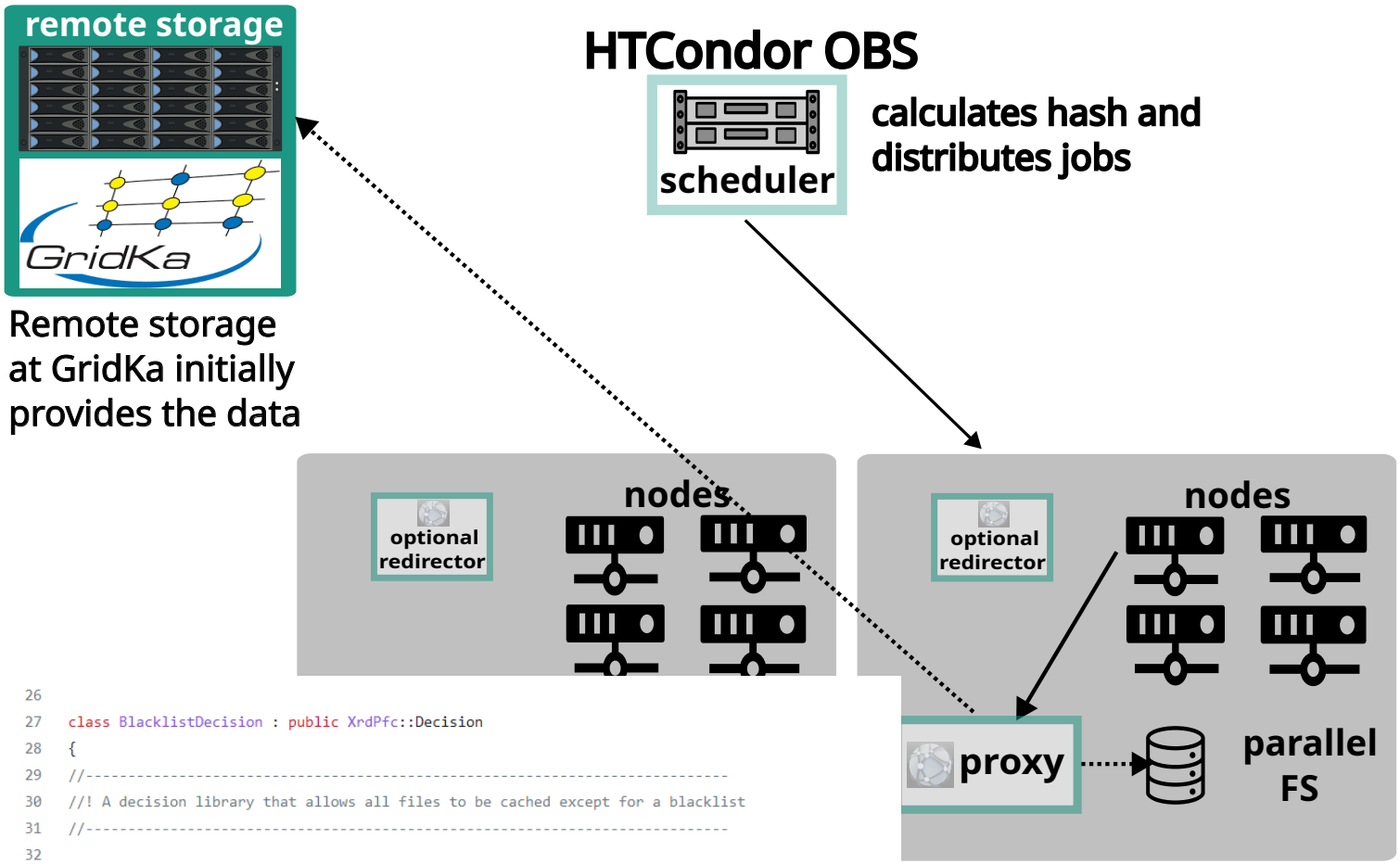
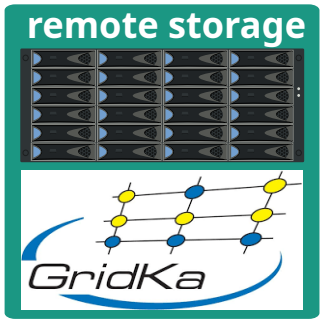



```
26
27  class BlacklistDecision : public XrdPfc::Decision
28  {
29  //------------------------------------------------------------------------
30  //! A decision library that allows all files to be cached except for a blacklist
31  //------------------------------------------------------------------------
32
```

Concept and Implementation (II)



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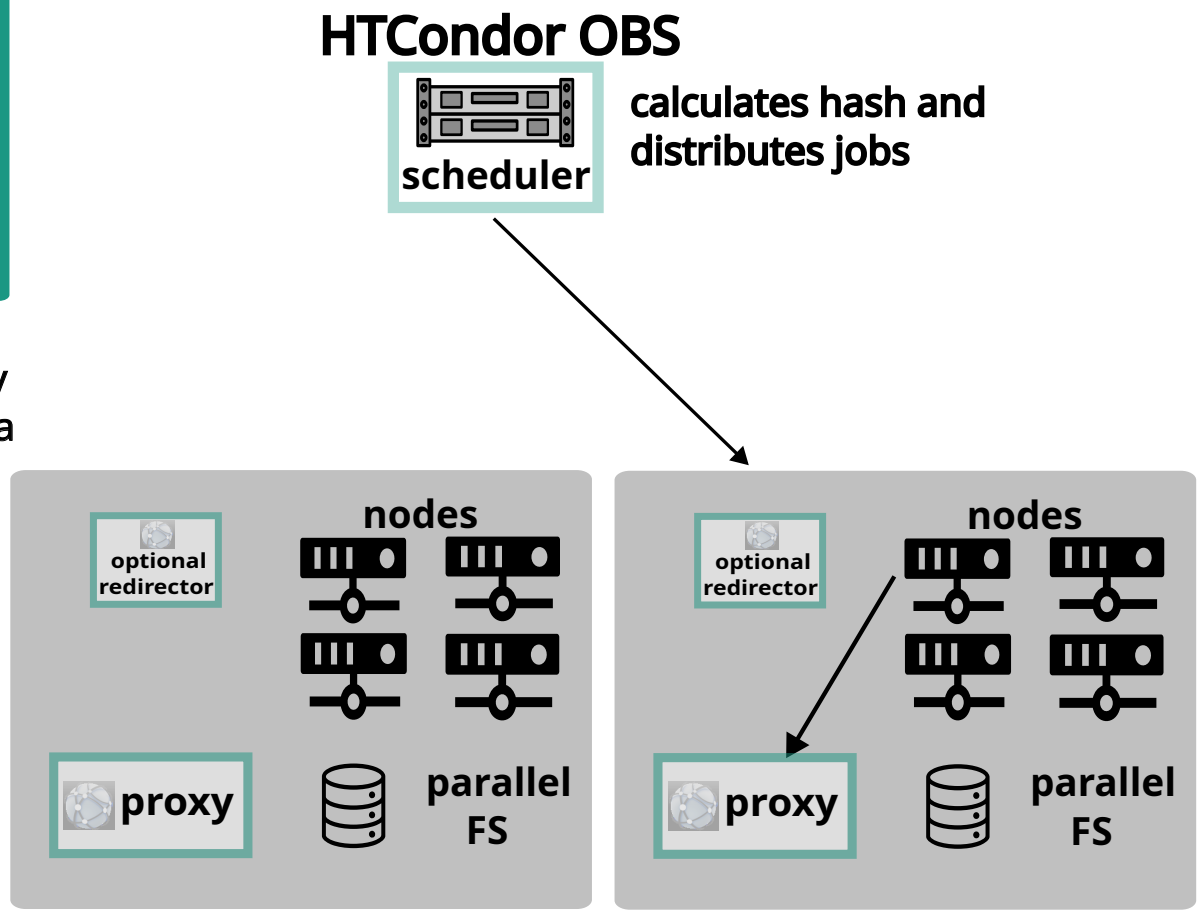

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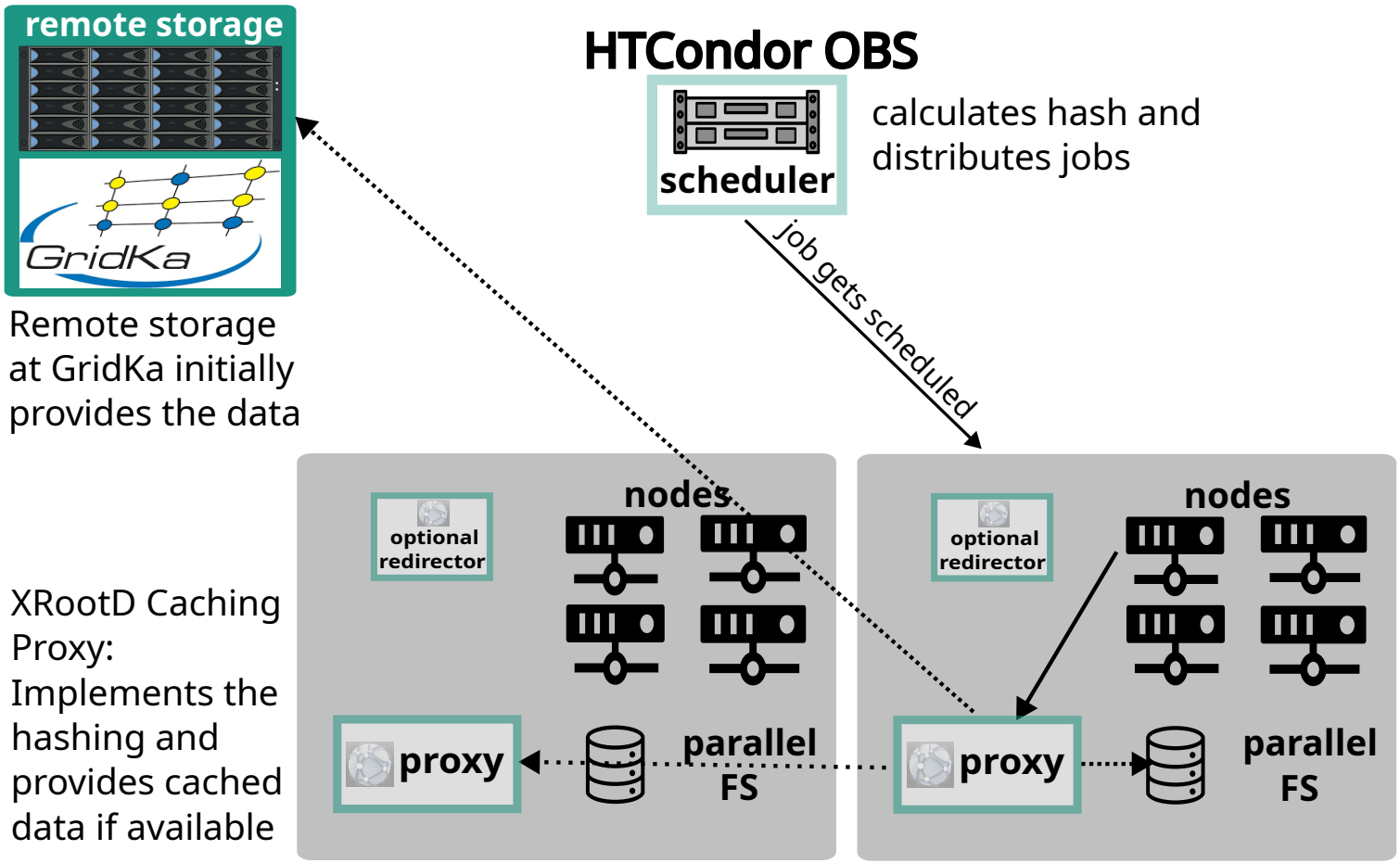

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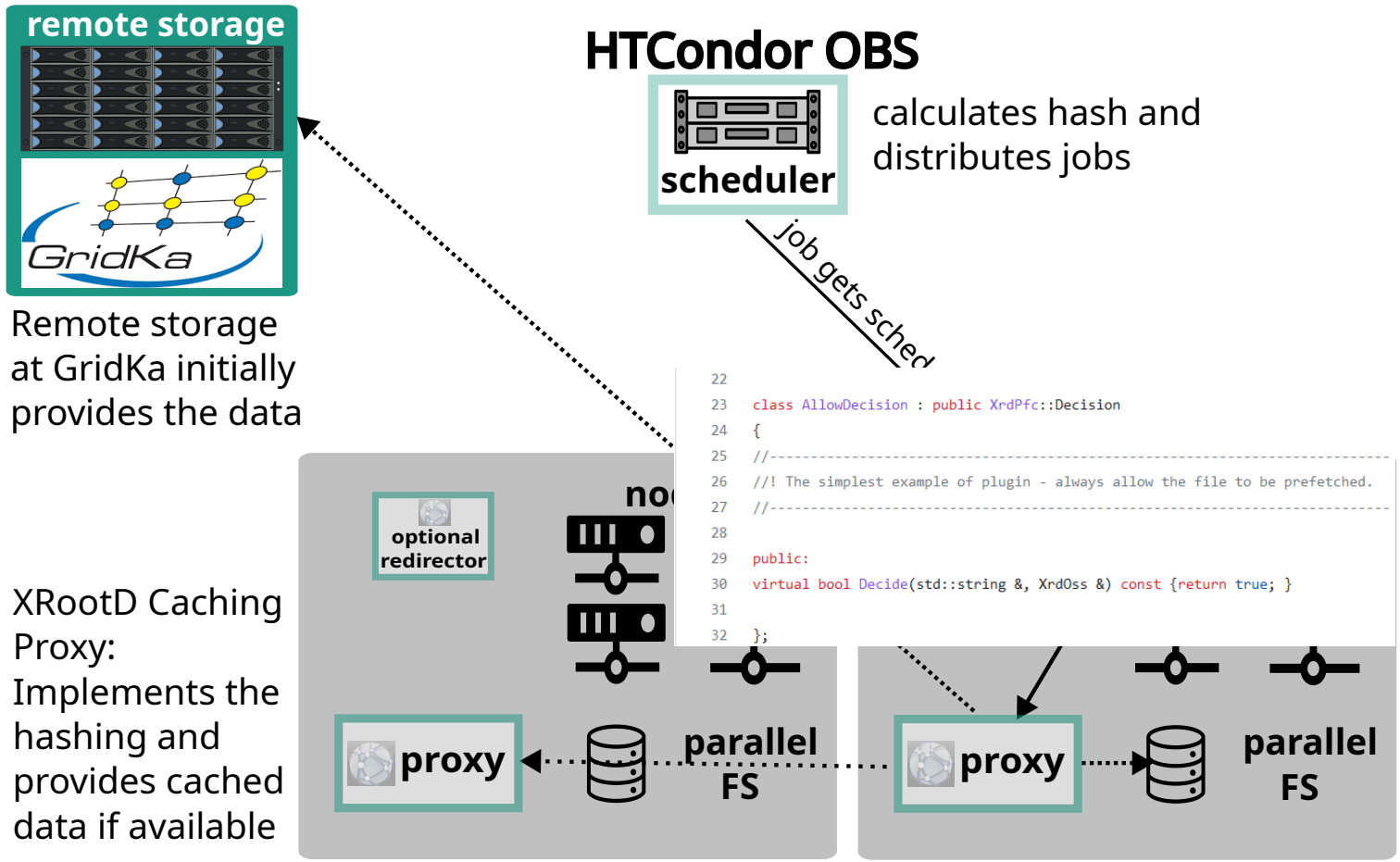


Next Steps

- Proof of Concept:
  - Setup a test system at our institute
  - There, we also integrate some external resources (NEMO@Freiburg and our own T3) into our HTCondor batch system
  - First: fixed file lists.
  - Later: hash-based data distribution
- Finally: adapt system to the opportunistic resources

Summary

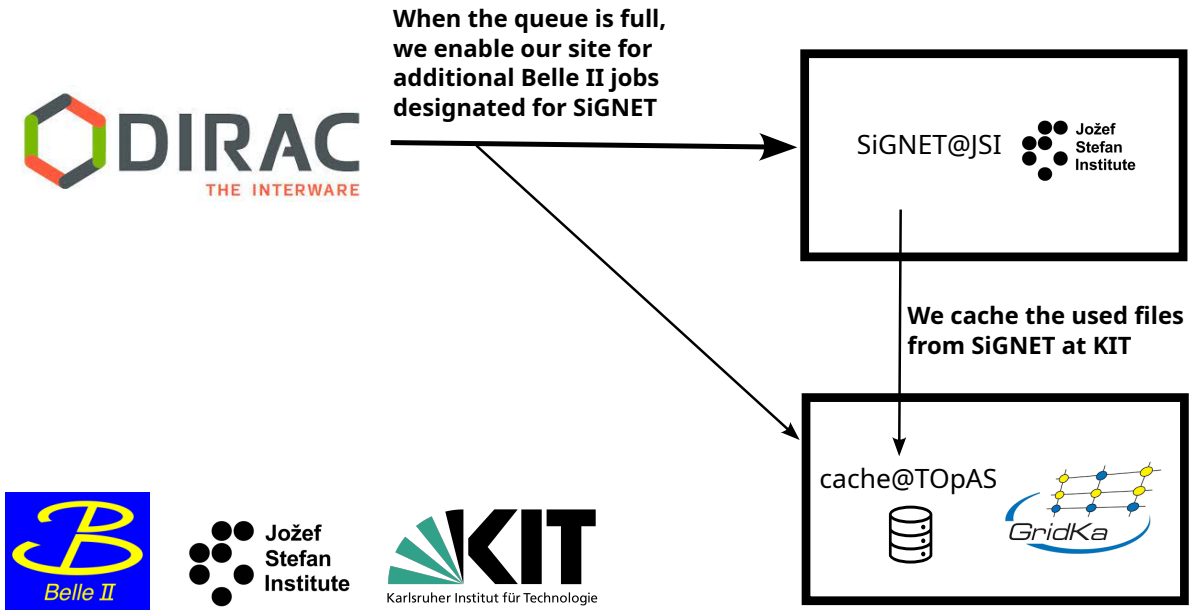
With our hash-based approach:

- We avoid actually keeping track of thousands of files on volatile caches
- The caching decision is determined locally (or centrally)
  $\rightarrow$ **horizontally scalable**
- With local on-the-fly caching, no prefetching is necessary (but possible)
- No database service needed (or at least more lightweight, tbd)
- Highly automatizable $\rightarrow$ **no active data management necessary**
- Allows inclusion of HPC sites without remote connection of WNs

$\rightarrow$ reduction of data transfers and more efficient utilization of resources achievable

Belle II Caching@GridKa

Currently, we have a XRootD caching project with SiGNET/JSI ongoing!
(I am not directly involved, credits go to: Moritz Bauer and Matthias Schnepf)



Belle II Caching@GridKa

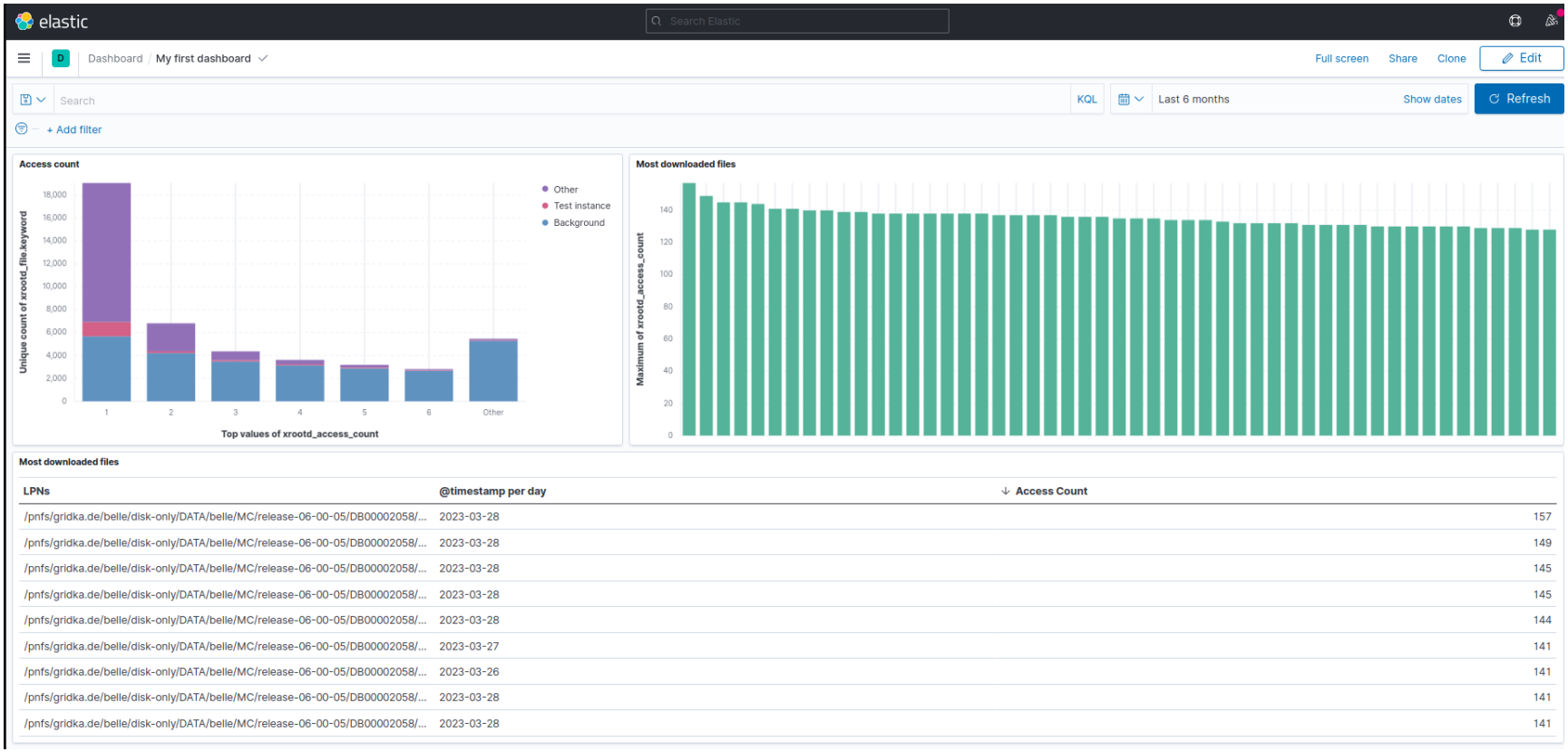
```
xrd.port 1094
all.export /xroot:/ nostage
all.export /root:/ nostage
all.export /https:/ nostage
all.export /davs:/ nostage
all.export /http:/ nostage

xrootd.chksum max 4 adler32
ofs.osslib  libXrdPss.so
pss.cachelib default
ofs.ckslib * libXrdPss.so
pss.origin =
oss.localroot /ceph/belle2-xrootd-cache/
pfc.ram 32g
pfc.diskusage 0.9 0.95
pss.debug

xrootd.monitor all flush 10s window 5s fstat 5 lfn gbuff 8k dest fstat info user pfc 129.13.101.187:9921
xrootd.mongstream pfc use flush 10s

continue /etc/opt/belle2-xrootd/config.d/
~
~
~
~
~
~
~
~
"b2-xrootd-cache-server.cfg" 21L, 537C                                  1,1           All
```

Belle II Caching@GridKa



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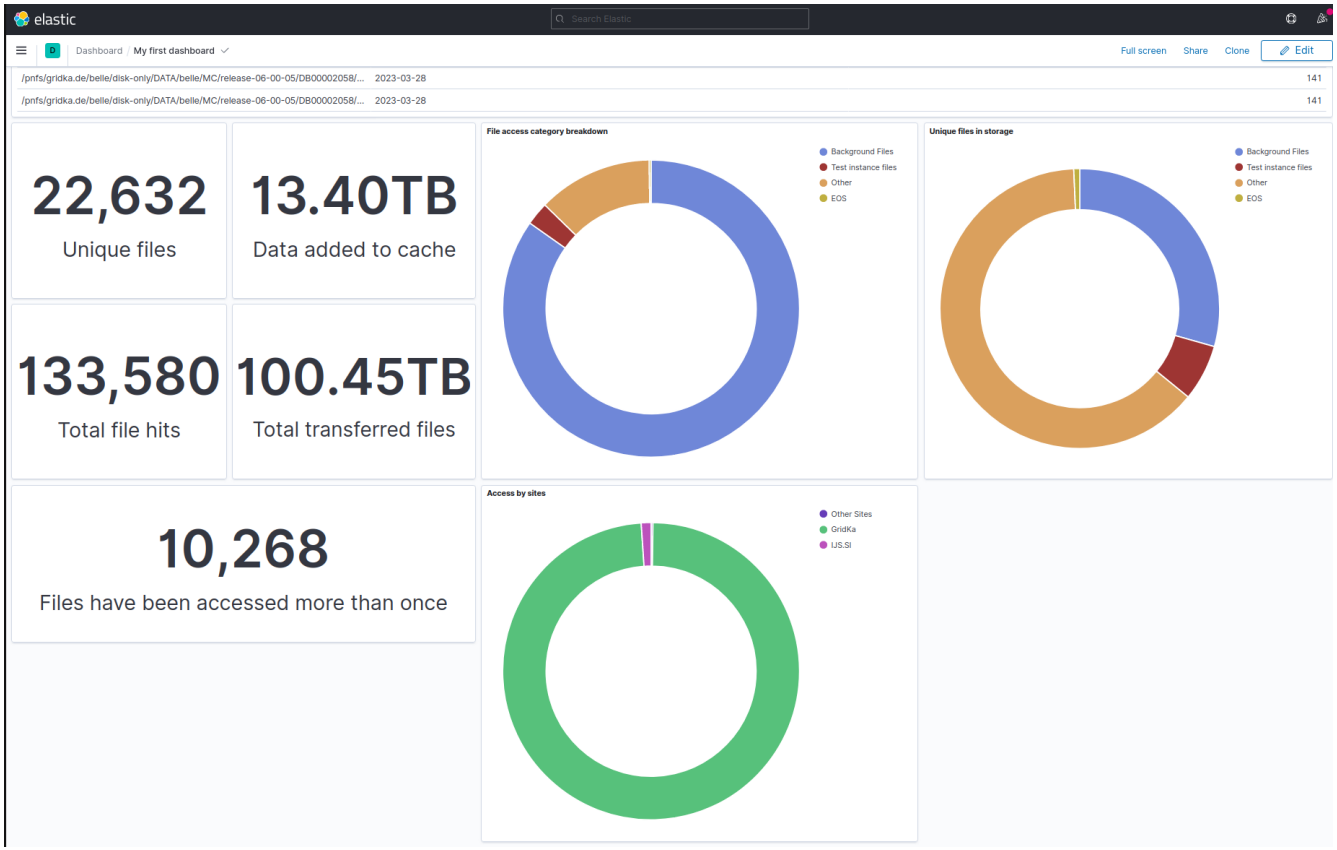

XRootD Interactive

Karlsruhe Institute of Technology

Available at GitHub: xrd-interactive

- set of convenience functions to use xrootd interactively (as python questionary)
- Intended to make the usage more easy for non-powerusers (bachelor/master students etc)
- It is not really matured, nor generalized... (mainly adapted to GridKa)
- No plans on further development, just a small gimmick

XRootD Interactive