Studies of Big Data metadata segmentation between relational and non-relational databases

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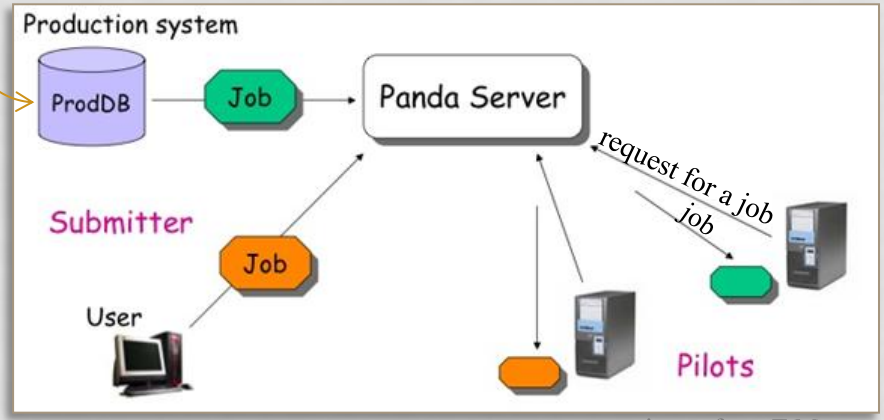
Outline

- **PanDA WMS**
  - Metadata
  - Monitoring
  - Data specification
- **NoSQL as archive**
  - Precalculation for speedup
- **Study**
  - Test set-up
  - Scaling
  - Precalculation effect
  - NoSQL archive performance

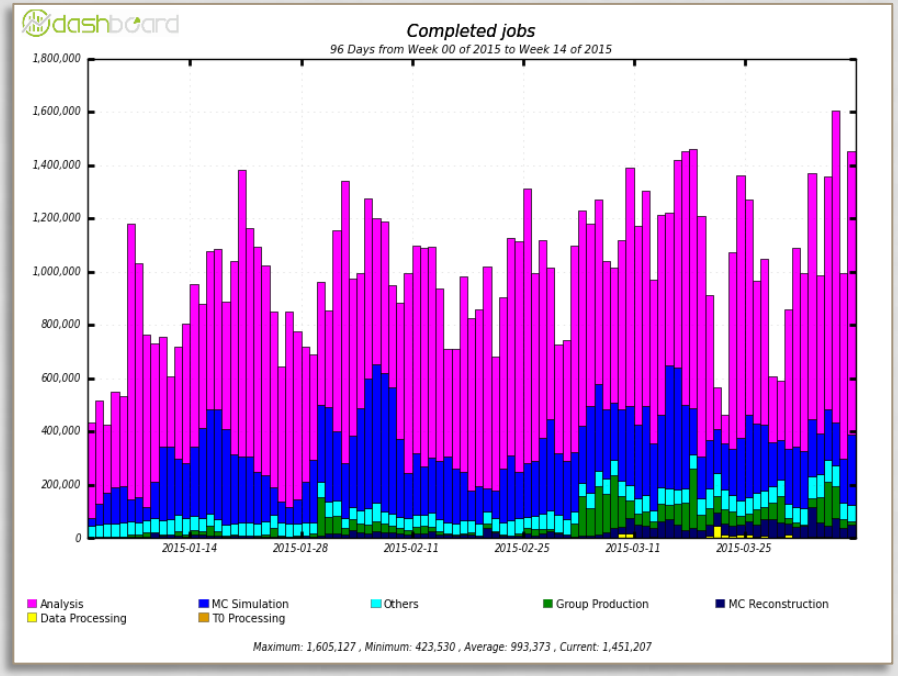
PanDA WMS

Metadata storage

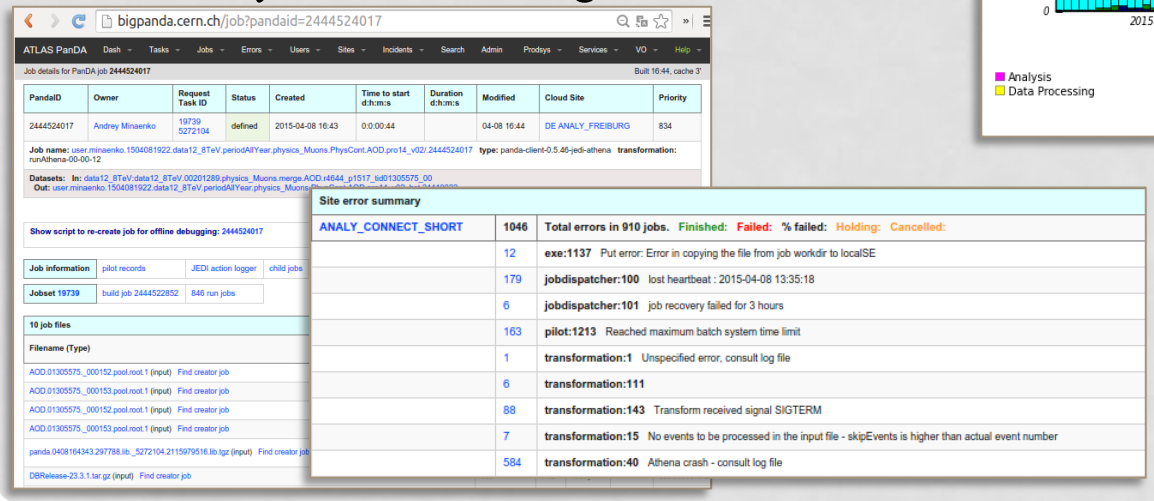


courtesy picture from T.Maeno

Scale of the challenge: up to 1.7M completed jobs per day



Metadata analysis and monitoring: PanDA Monitor

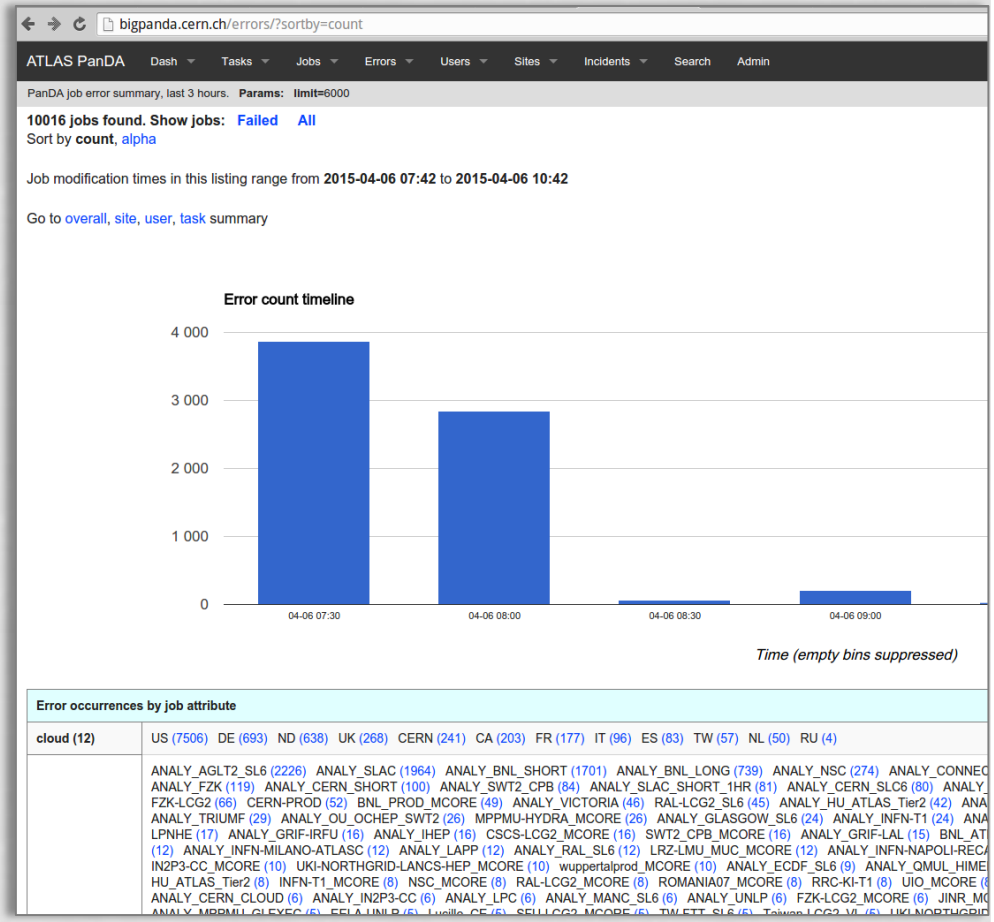


Related CHEP talks: T.Maeno, [The Future of PanDA in ATLAS Distributed Computing](#) (CHEP ID 144)

PanDA monitoring

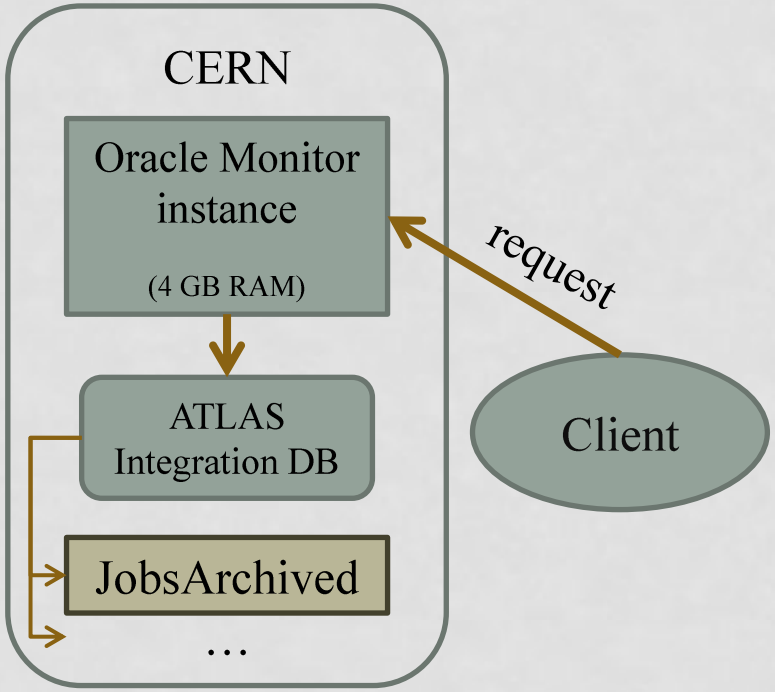
- **PanDA Monitor**
  Web-based analytical interface providing information about jobs and tasks within the system

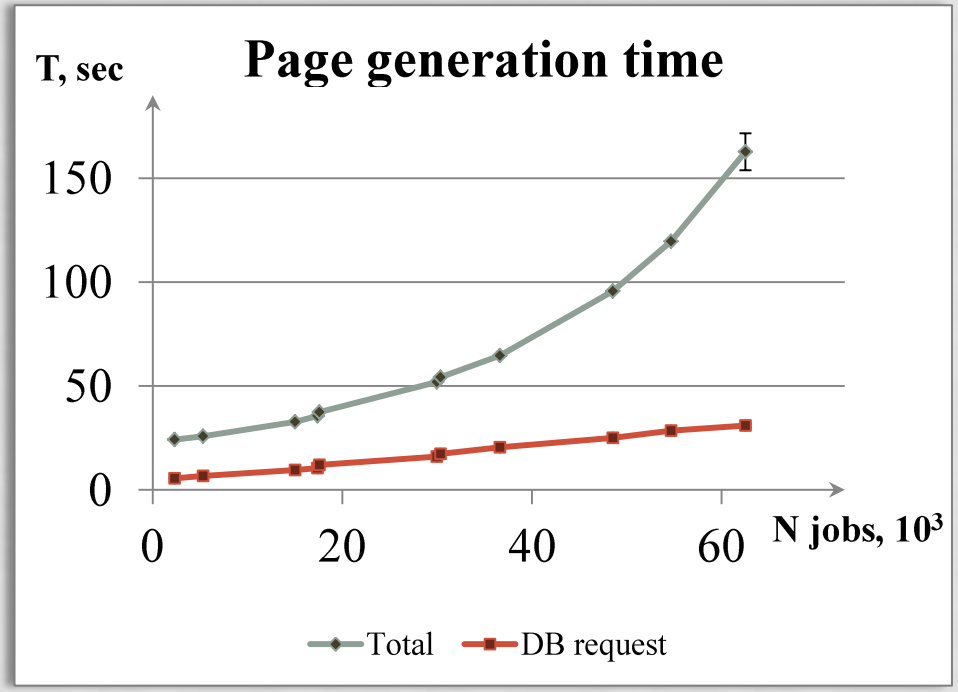
- **Page «Errors»**
  Page of PanDA Monitor providing information about job errors that have occurred in the system



http://bigpanda.cern.ch/errors/

Job errors monitoring

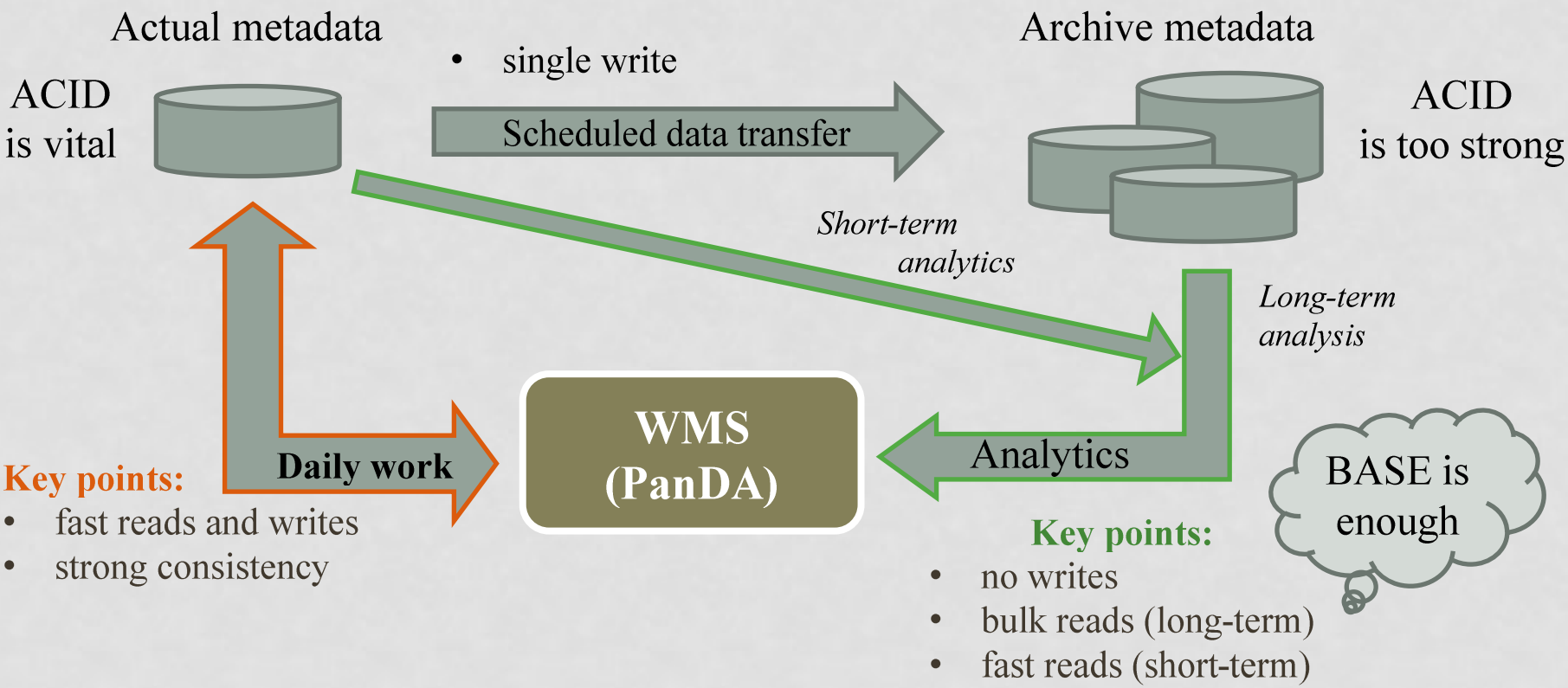




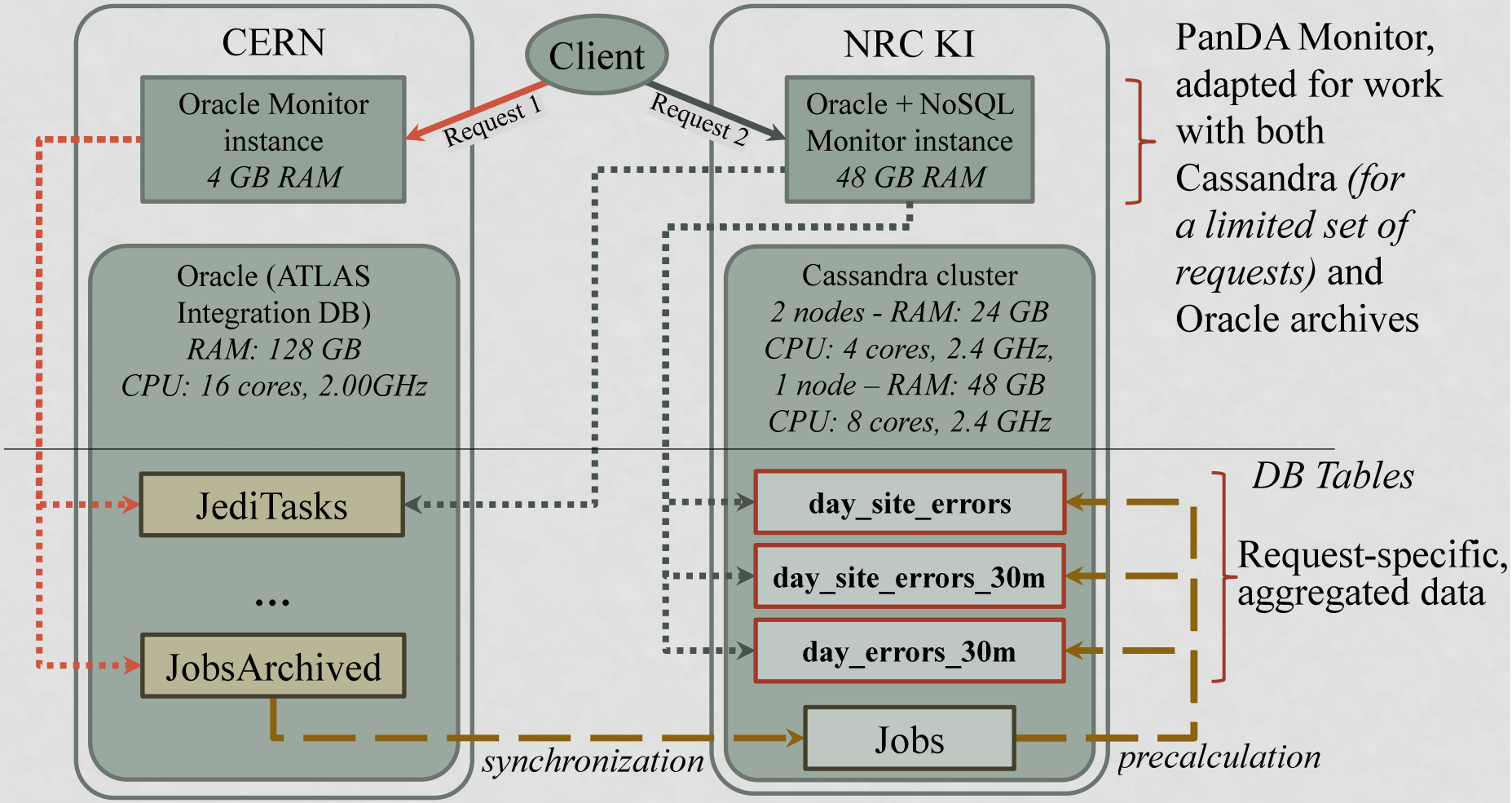
1) Get list of jobs from DB (according to request parameters) ⇨ **2) Summaries by parameters (overall, computing site, user, task)** ⇨ **3) Get additional information from DB** ⇨ **4) Generate output**

Specificity of the metadata storage

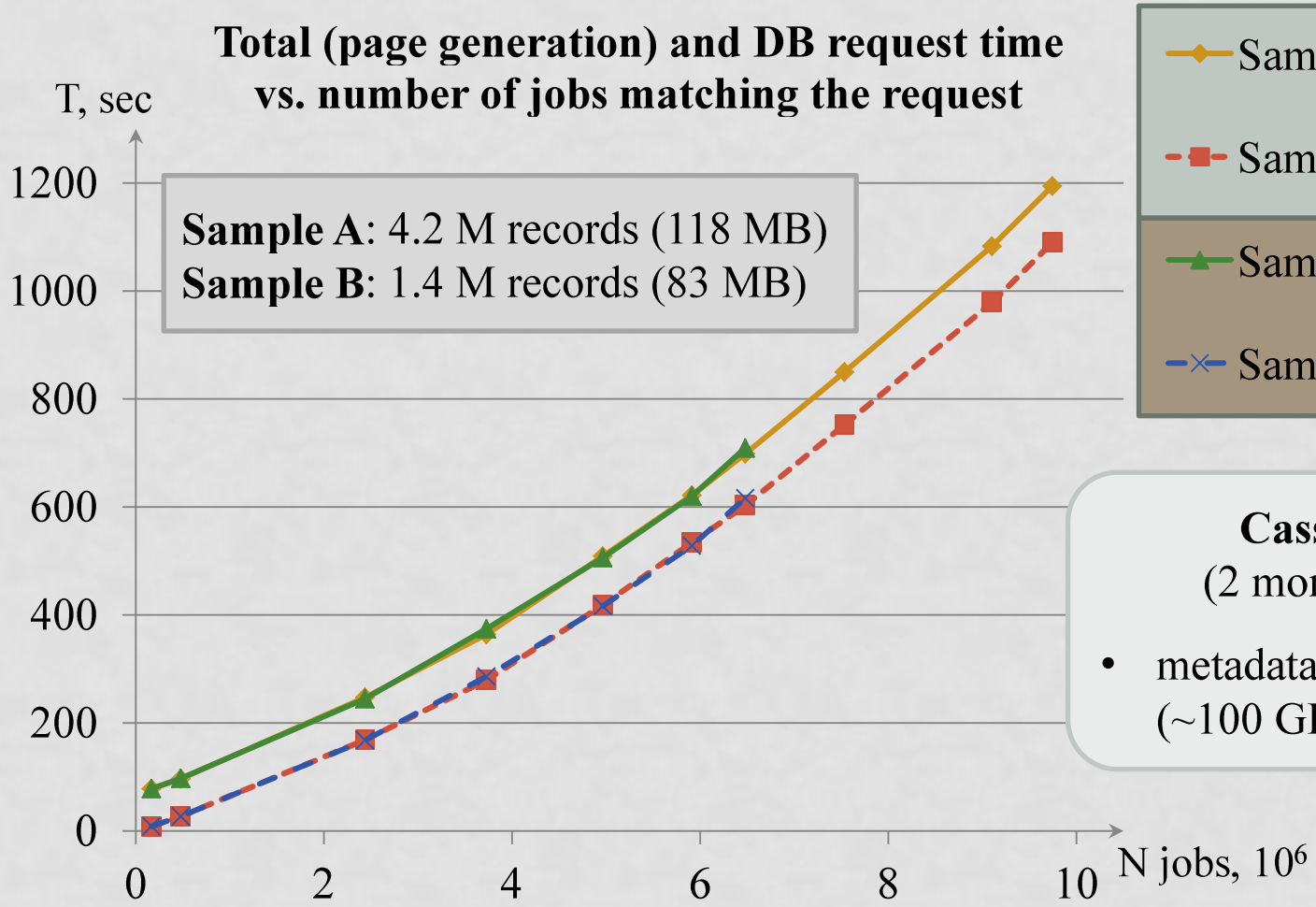
- Number of requested records (ATLAS PanDA Archive: ~900M of jobs)
- RDBMS as archive backend (ACID standard)



Test set-up


CERN
Client
NRC KI
Oracle Monitor instance
4 GB RAM
Request 1
Request 2
Oracle + NoSQL Monitor instance
48 GB RAM
PanDA Monitor, adapted for work with both Cassandra (for a limited set of requests) and Oracle archives
Oracle (ATLAS Integration DB)
RAM: 128 GB
CPU: 16 cores, 2.00GHz
Cassandra cluster
2 nodes - RAM: 24 GB
CPU: 4 cores, 2.4 GHz,
1 node – RAM: 48 GB
CPU: 8 cores, 2.4 GHz
DB Tables
JediTasks
...
JobsArchived
day_site_errors
day_site_errors_30m
day_errors_30m
Request-specific, aggregated data
Jobs
synchronization
precalculation

Cassandra scaling test



Sample A – total

Sample A – DB request

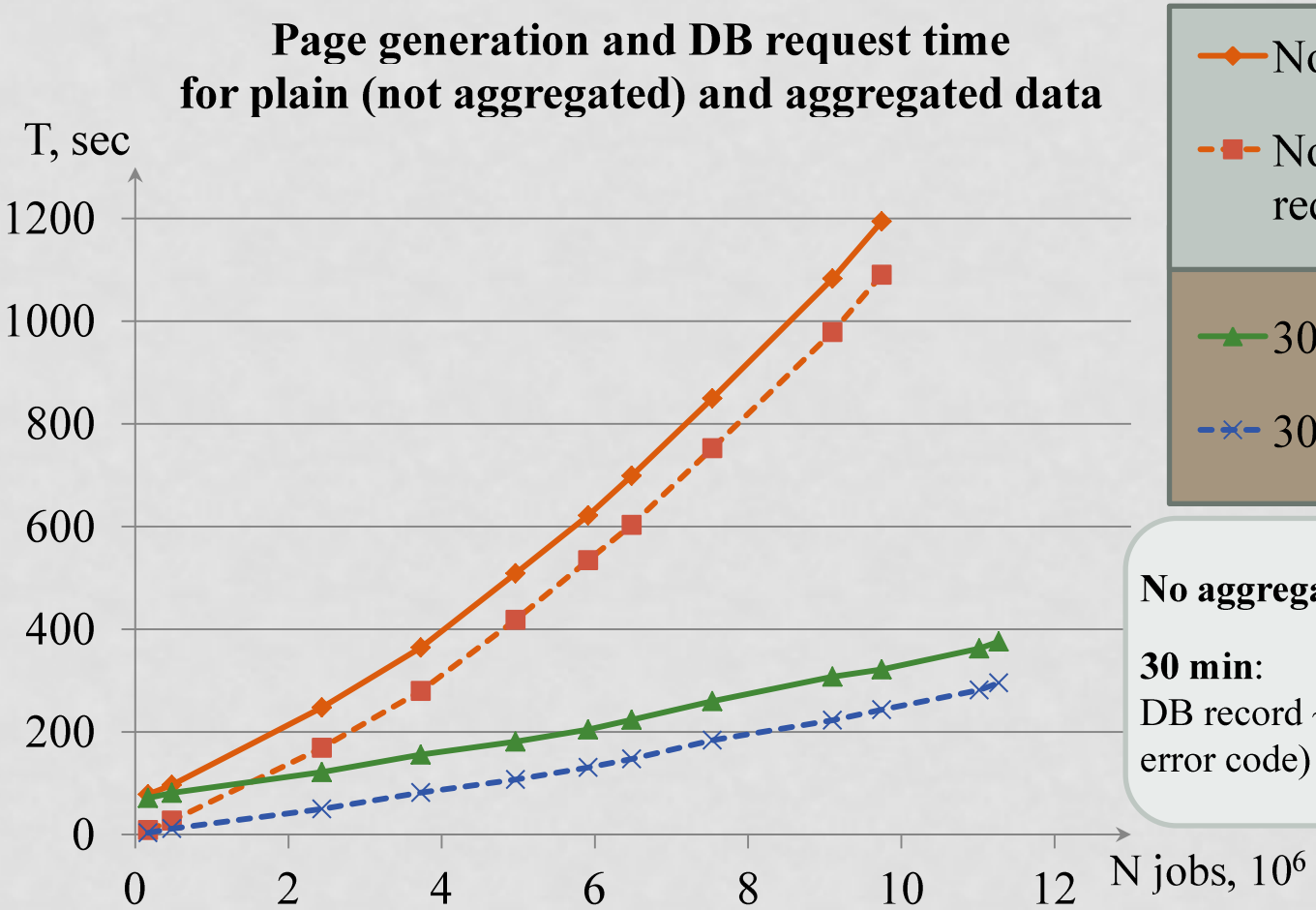
Sample B – total

Sample B – DB request

Cassandra DB
(2 months archive):

- metadata for ~60 M jobs (~100 GB per replica)

Aggregation effect test



No aggregation — total

No aggregation — DB request

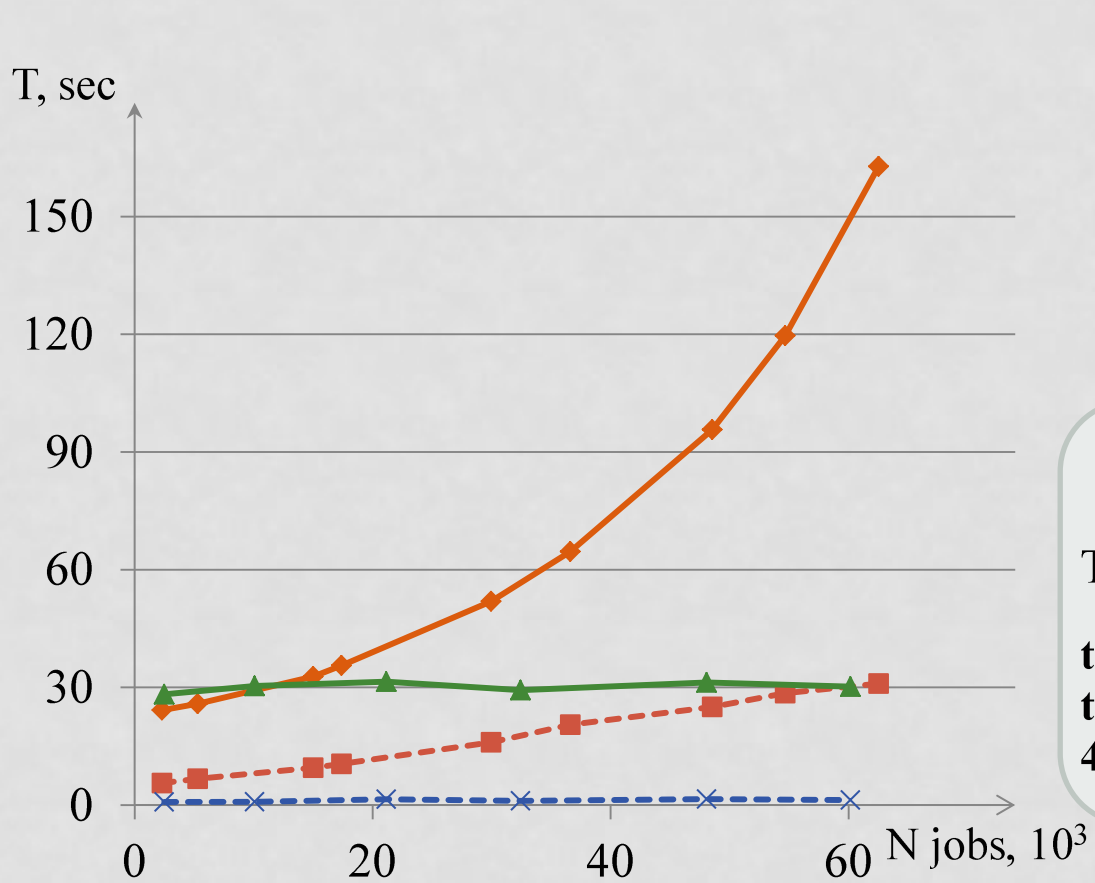
30 min — total

30 min — DB request

No aggregation: DB record ~ 1 error

30 min:
DB record ~ all errors (with the same error code) within given 30 minutes

NoSQL Archive performance



Oracle — total

Oracle — DB request

Cassandra — total

Cassandra — DB request

Values for Cassandra

$T = 4*(t - t_{add}) + t_{add}$, where:

t – total page generation time

$\mathbf{t_{add}}$ – not a summary-specific DB requests

4 – number of specific summaries

Summary

- It is hardly possible to perform long-term metadata analysis without any precalculation.
- Replacing RDBMS with NoSQL in archive part of metadata storage can be used to improve availability of historical data.
- Prototype of NoSQL (Cassandra) archive was created and tested on a 2-month slice of metadata from ATLAS PanDA Archive.
- First results look promising. NoSQL archive will be extended to confirm this belief in new tests.
- Adaptation of PanDA Monitor for work with NoSQL archive will be continued.

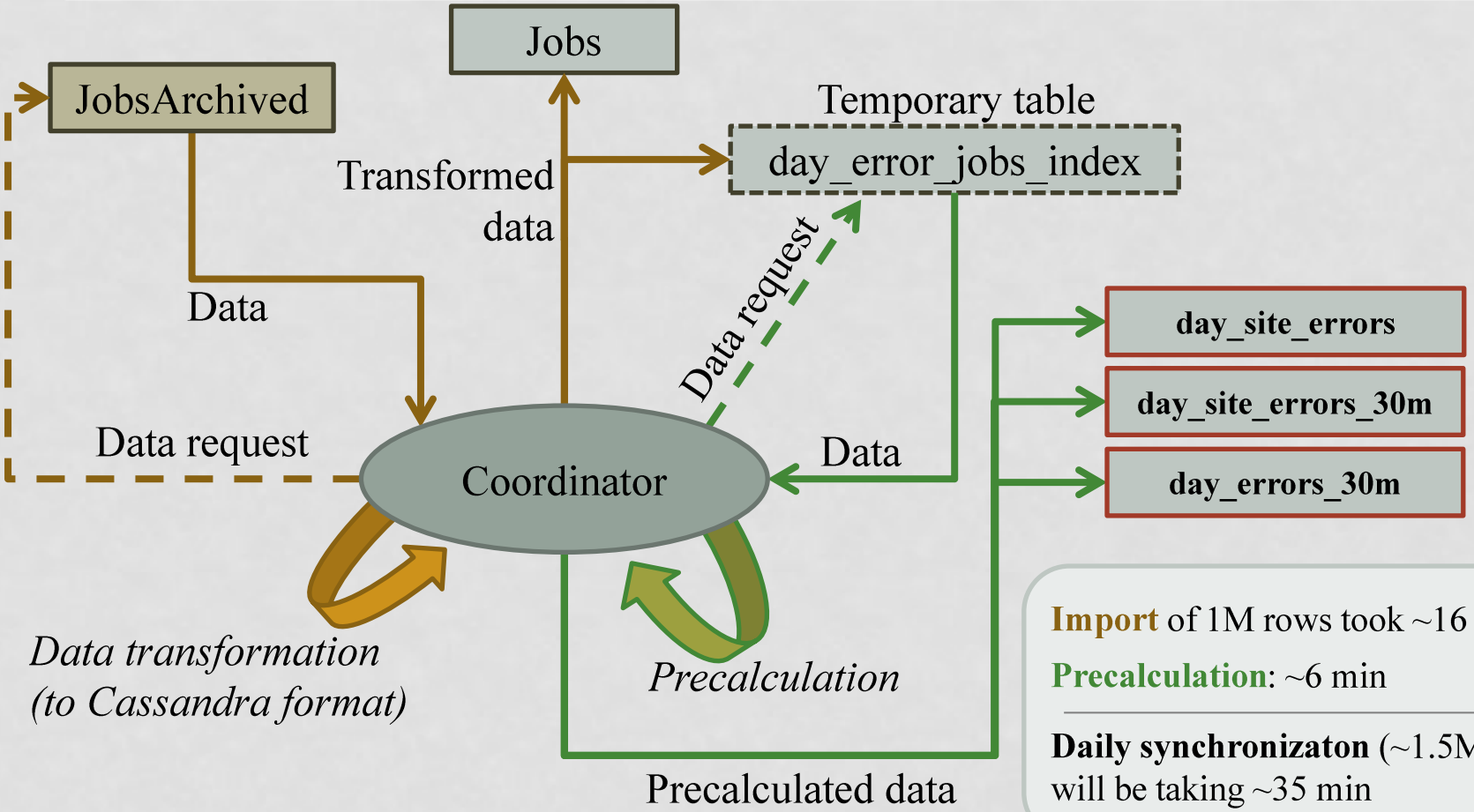
Acknowledgment

- This talk drew on presentations, discussions, comments, input from many our CERN, ATLAS, NRC-KI Colleagues, thanks to all people working in PanDA project

- This work was funded in part by the Russian Ministry of Science and Education under Contract N14.Z50.31.0024

Back up slides

Synchronization & Precalculation



Import of 1M rows took ~16 min

Precalculation: ~6 min

Daily synchronizaton (~1.5M jobs) will be taking ~35 min

Cassandra Column Families

Primary Key
- Partition Key
- Clustering Key

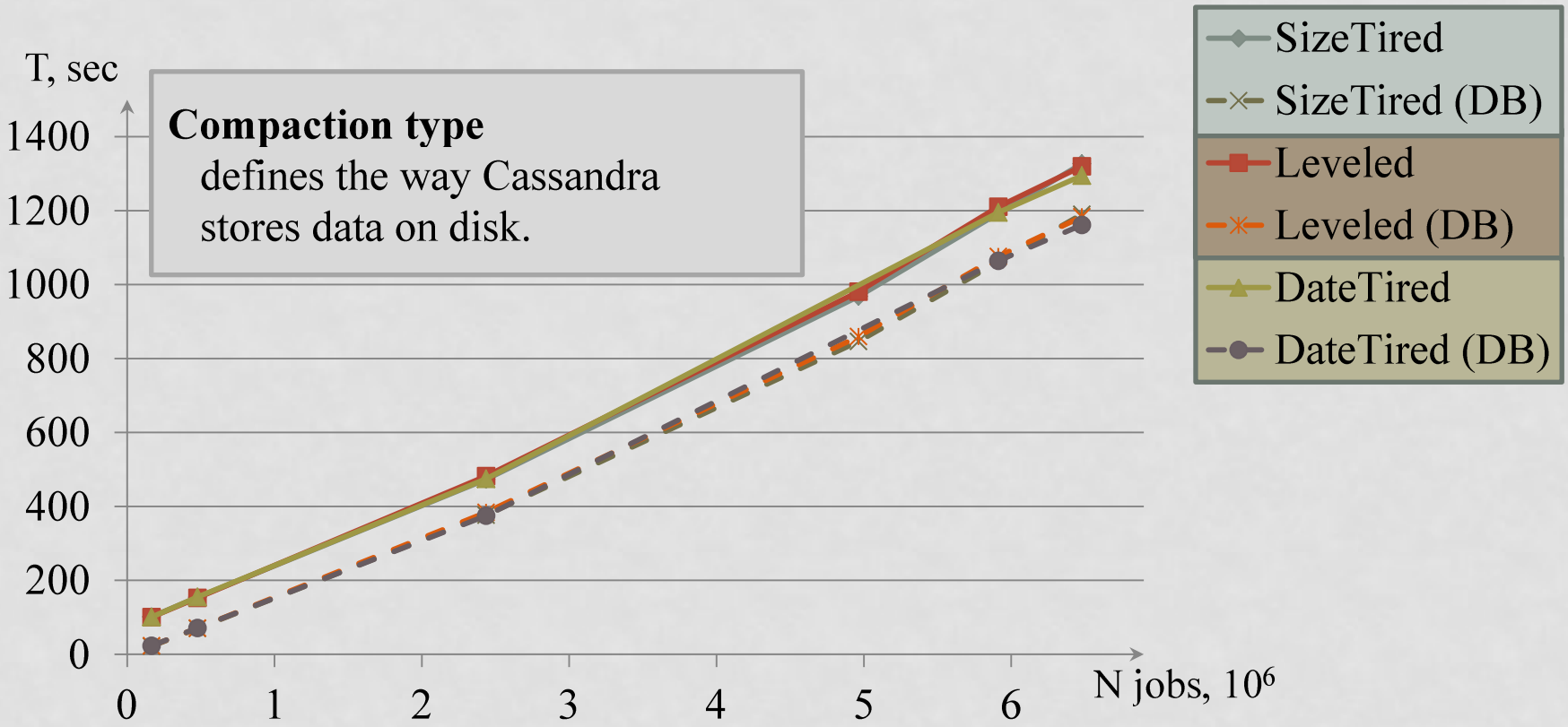
Columns
- Common
- Counter

day_site_errors_cnt_30m						
date	computingSite	base_mtime	errcode	errdiag	err_count	job_count

day_site_errors				
date	computingSite	errcode	pandaid	errdiag

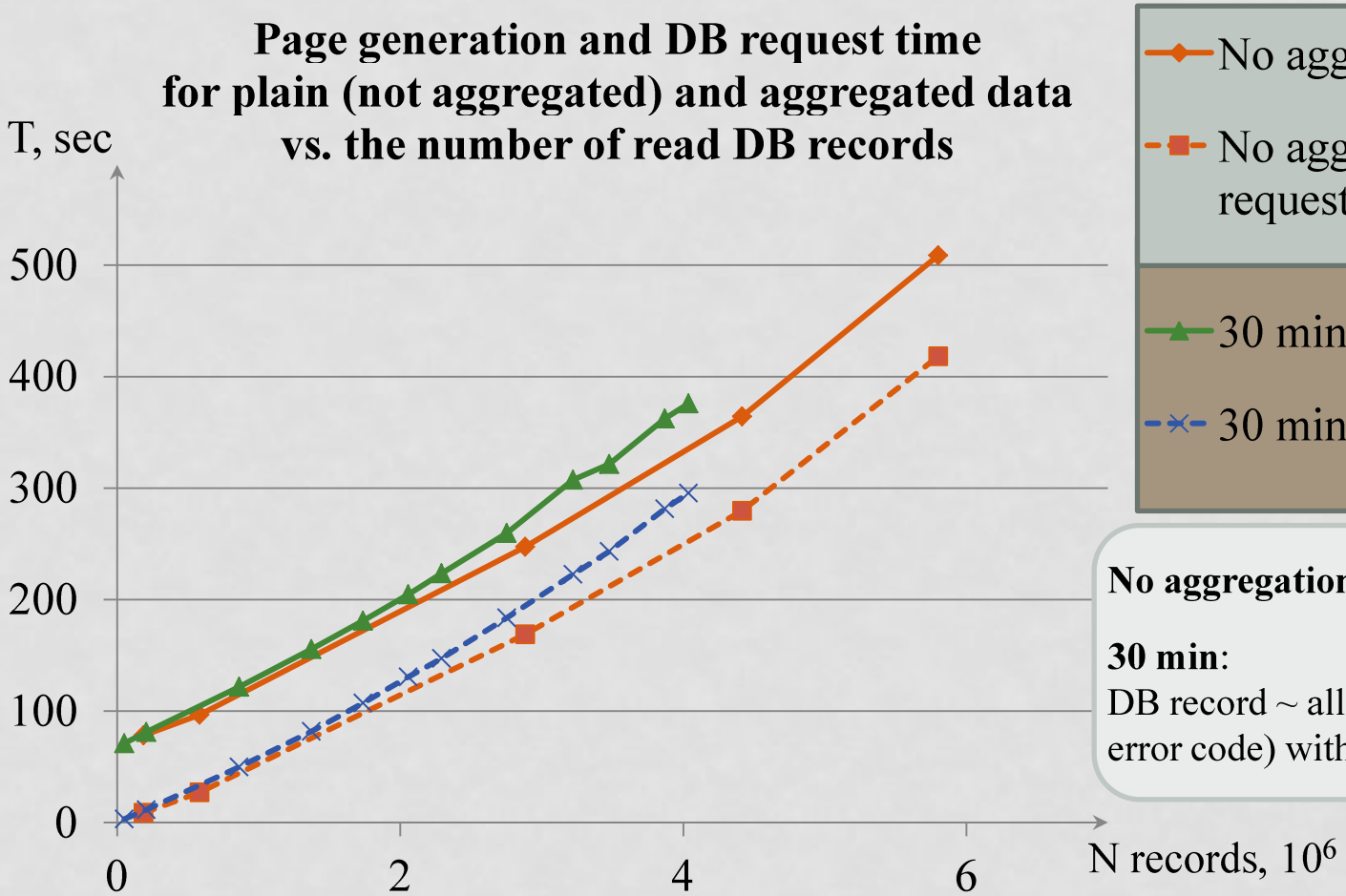
day_errors_30m		
date	base_mtime	count

Compaction types



Compaction type
defines the way Cassandra stores data on disk.

Aggregation effect test (DB records)



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