



The ATLAS Data Carousel Project

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Data Carousel

- Data Carousel : on demand reading from tape without pre-staging
- Uses a rolling disk buffer whose size can be tuned to suit available resources and production requirements
- Key to success : rate at which data can be staged to disk at the Tier-0 and Tier-1 sites
- Technique can eventually be used for any experiment

ATLAS Data Carousel Project Phases

- Phase I : Tape Sites Evaluation (Y2018)

- completed* ○ Conduct tape staging tests, understand tape system performance at sites and define primary metrics

- Phase II : ProdSys2/Rucio/Facilities integration (Y2019-2020)

CHEP2019 [talk](#)

- completed* ○ Address issues found in Phase I
- Deeper integration between workflow, workload and data management systems (ProdSys2/PanDA/Rucio), plus facilities
- Identify missing software components

- completed* ● Phase III : Run production, at scale, for selected workflows (Y2020)

This talk

- Phase IV : Use data carousel for many workflows in parallel, respect computing share per workflow. Run Data Carousel jointly for more than one experiment (Y2021)

*Now we are at the middle of Phase IV (we are increasing the number of workflows running in Data Carousel mode) **The initial goal is reached : to have data carousel in full production for LHC Run3***

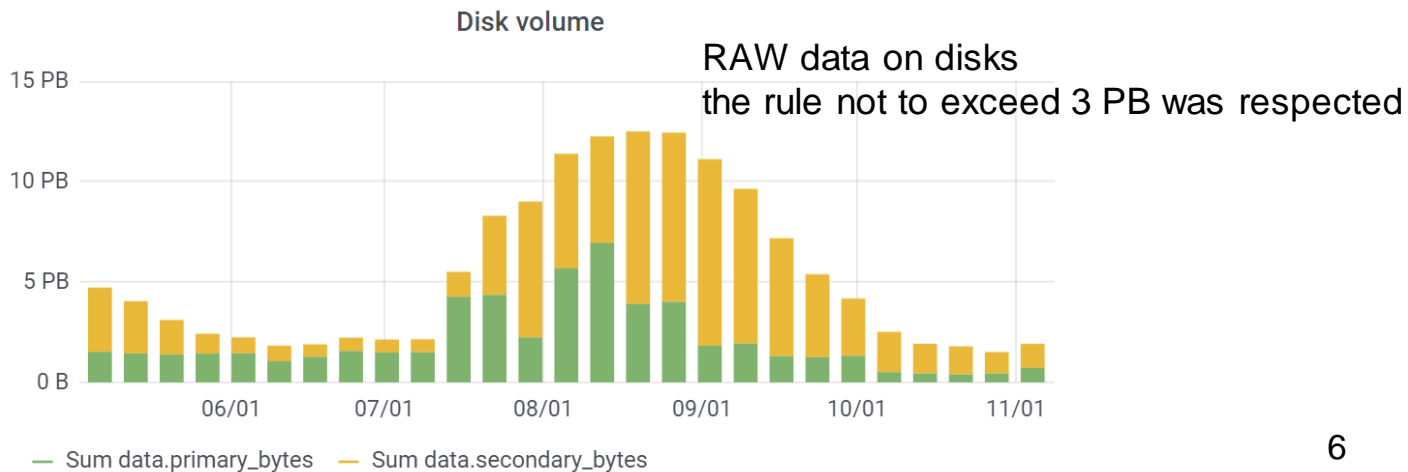
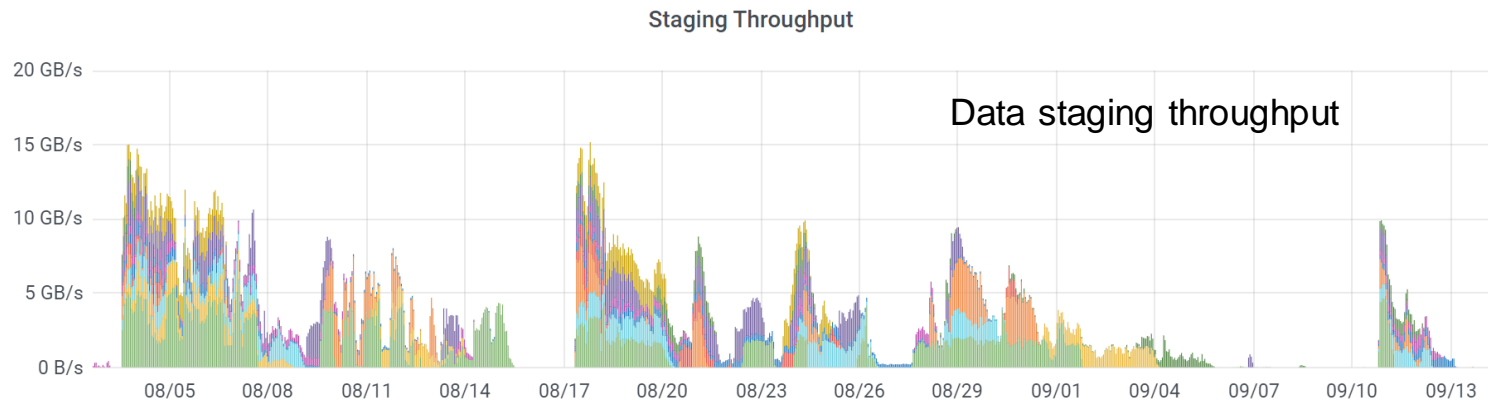
ATLAS Run2 Data Reprocessing in Data Carousel Mode

- Ultimate goal to demonstrate Data Carousel for bulk production and respect computing shares and disk buffer size
- Data have been processed in reverse order (year 2018 first). The total data volume was close to 18.5 PB

ATLAS Run2 Data Reprocessing in Data Carousel Mode

- Fine tuning before reprocessing was started
 - Tier-1, CERN, CTA, dCache teams participation in global monitoring
 - Tier-1s and CERN data staging profiles were developed and stored in the Information System (CRIC). Staging profiles were used by the ATLAS Production System
 - The Production System doesn't send new e.g. requests to Rucio to stage a new data chunk until the previous one has reached a predefined level, usually 50+%.
 - Reprocessing shares have been defined by Physics Coordination and respected

ATLAS Run2 Data Reprocessing in Data Carousel Mode

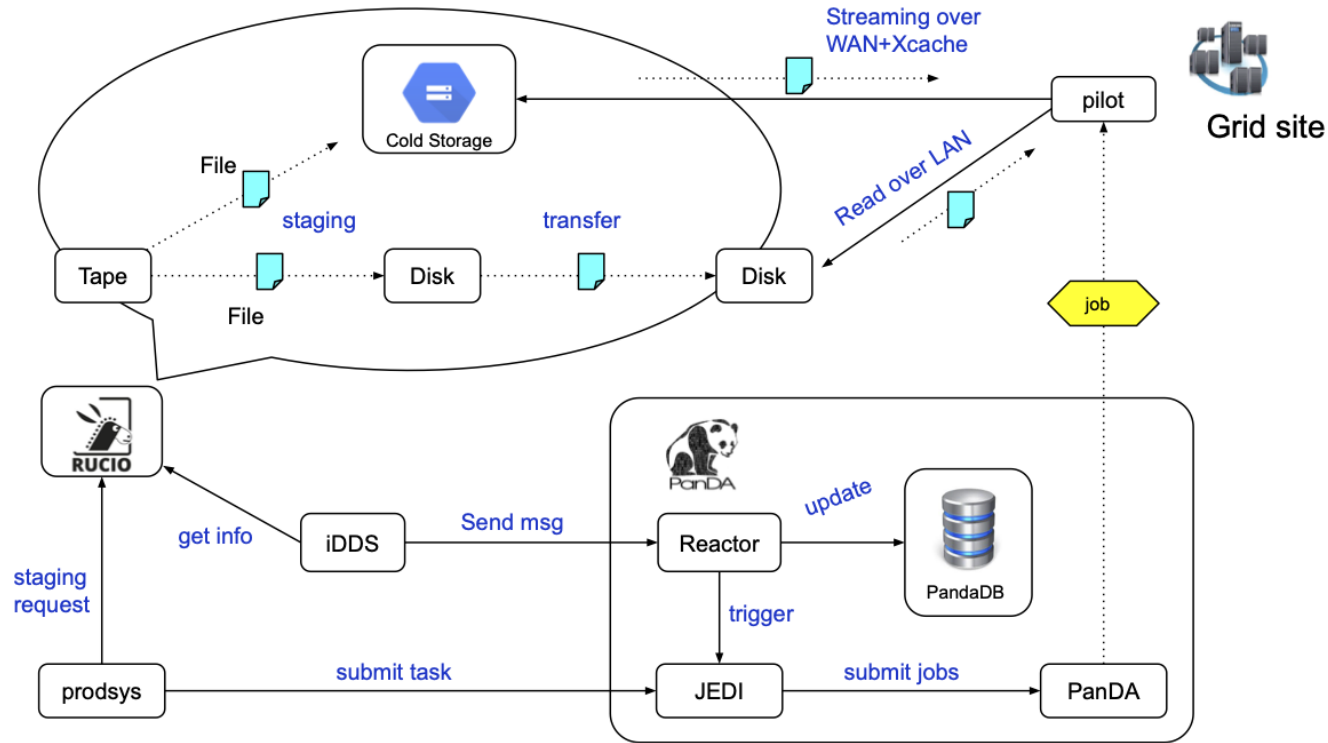


ATLAS Run2 Data Reprocessing in Data Carousel Mode

Sites	2018 Phase I Test (MB/s)	2020 Reprocessing (MB/s)
CERN (CTA Test)	2000	4300
BNL	866	3400
FZK	300	1600
INFN	300	1100
PIC	380	540
TRIUMF	1000	1600
CC-IN2P3	3000	3000
SARA-NIKHEF	640	1100
RAL	2000	2000
NDGF	500	600

Table 1: Stable Rucio tape throughput for the ATLAS Tier-1 sites and CERN, measured from the 2020 reprocessing campaign, with comparison to the Phase I results.

New distributed software component : intelligent Data Delivery Service (iDDS)



See T.Maeno's iDDS talk (###)

Summary and Data Carousel Today

- We successfully and quickly passed the R&D project phases among ATLAS, FTS, dCache, CTA and the WLCG centers.
- During full Run2 data reprocessing, i.e., 18.5 PB of RAW data, ATLAS demonstrated the real Data Carousel mode in action, in a production environment with many other concurrent activities such as data writing, data rebalancing, or data consolidation between ATLAS Grid sites.
- Deep integration and communication protocols between data and workflow management systems were defined and implemented. We have evaluated the optimal file size to have more efficient tape I/O and based on this evaluation file size will be increased for data produced by prompt reprocessing, i.e., Tier-0 data processing and by the Production System.
- The first joint ATLAS-CMS test was conducted in February-March 2021 for three Tier-1s
- End-user analysis in Data Carousel mode with data staging from tape to be evaluated
- The major campaigns requesting data from tape will run in Data Carousel mode in Run3
- We continue to improve tape recall efficiency and grow tape capacity towards the needs of the HL-LHC

Acknowledgments



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