DPHEP @ DESY
Current efforts in data preservation

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Content

HERA

- HERA was the largest particle accelerator at DESY
- Active from 1991 to 2007
- Served experiments H1, ZEUS, HERMES, HERA-B
- The world's only high-energy electron-proton collider
- Investigation of the Proton
  - ⇒ Unique Dataset

HERA
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Summary

Areas of Data Preservation
DPHEP Activities
Strategy
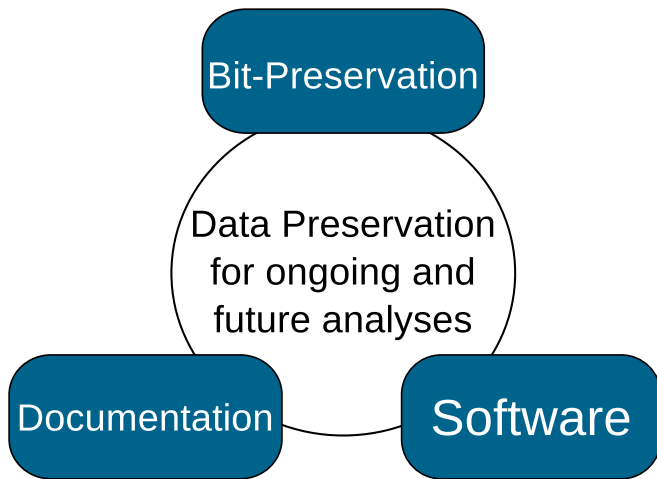Small Files Service

Data Preservation

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Aspects of Data Preservation

Bit-Preservation

Data Preservation
for ongoing and
future analyses

Documentation

Software

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Activities

DPHEP Activities at DESY

- Many activities over the past years
    - Documentation, accumulated by the experiments over the years, has been collected, stored and catalogued; non-digital documentation has been partly digitized.
    - Selected software is ensured to run on SL6, partly preserved in VMs
    - An ICFA study group has analyzed the various aspects of data preservation and explored various solutions.
        - Detailed status report in 2012 (see http://arxiv.org/abs/1205.4667)
    - DPHEP agreement signed in 2014 by many institutes including DESY
- Importance of data preservation is clearly acknowledged

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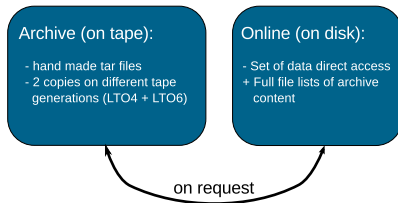Small Files Service

Strategy

What steps are taken to address preservation of HERA data?

- To ensure data is preserved beyond the end of the experiements, solutions have to be provided by DESY as institute.
    - Smooth transition from experiment specific solutions to institutional solution
    - IT department and Library

- Short- and long-term availability - **2-fold strategy**
    - Assure the long-term availability of the data → **tape archive**
    - Support on-going analyses work and keep still used data easily accessible → **disk pools**

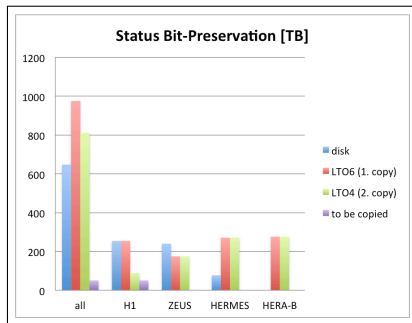- Our main effort during the last months was related to bit-preservation

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Storage Structure DPHEP on DESY dCache

- `Archive` part ($\approx 1.2\,PB$):
    - All data identified for preservation will be available in 2 redundant tape copies
    - The archive is not generally accessible, i.e. requires manual intervention
- `Online` part ($\approx 650\,TB$):
    - *dCache* disk pools where experiment data is available
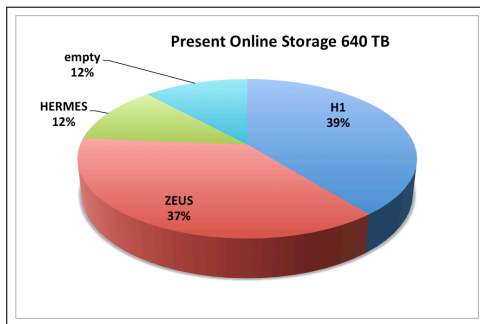   - Can be mounted r/o where needed (e.g., batch systems, Workgroup Server)

Archive (on tape):

- hand made tar files
- 2 copies on different tape
  generations (LTO4 + LTO6)

Online (on disk):

- Set of data direct access
+ Full file lists of archive
  content

on request

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Areas of Data Preservation
DPHEP Activities
Strategy
Small Files Service

Status of HERA Data on DESY dCache in 2015

- About 75% of all data already on tape
- 50TB still on H1 *dCache*

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Small Files Service

Status of Online part

Present Online Storage 640 TB

empty 12%
HERMES 12%
ZEUS 37%
H1 39%

- Already almost filled $\rightarrow$ experiments have to restrict themselves

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Summary

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Motivation for Extended Online Storage

Data Management View:

- Wasted (expensive) disk space for seldomly used data
- Additional work load related to handling of millions of small files

User View:

- As much data online as possible
- Avoid (slow) interaction with storage admin

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Summary

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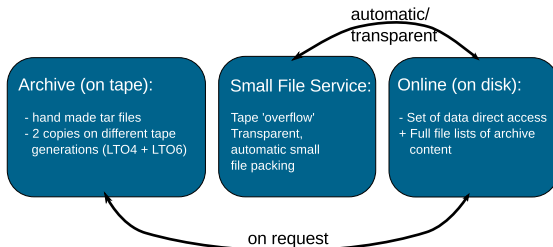
Extended Online Storage

Increase online space by automatic data swaps to and from tape with external *dCache* service:

- "Swapping" is automatically handled by *dCache*
- Files are transparently packed and unpacked from container files using *dCache*'s tape interface
- Can be attached to any recent *dCache* version
- Allows easy direct access to potentially all data w/o manual intervention
- All file metadata is stored in *dCache* → service failure does not prevent data from being accessed

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Summary

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Performance - Tape

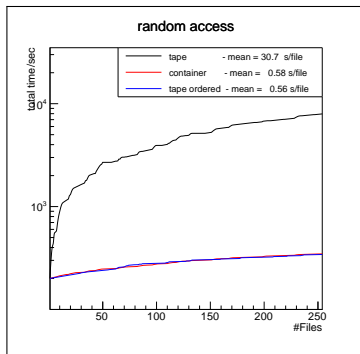Large container files allow optimized restoring of files from tape

Figure : The service improves random access to files on tape by a factor of ≈ 50 and provides data rates close to reading files from tape sequentially

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Performance - Unpacking

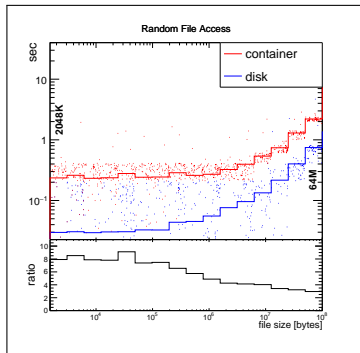Overhead introduced by unpacking files from containers

Figure : The overhead per file introduced by unpacking is $\approx .2s$

$\Rightarrow$ Details on poster "Transparent handling of small files with dCache" (Poster Session B #284)

Summary

- HERA dataset is unique → preservation for ongoing and future analyses is important
- Preservation is done by *DESY* on an institutional level
- Majority of files has already been archived
- We take care of the data in a 2-fold strategy (Online and Archive)
- Currently evaluating *Small File Service* to be used for Extended Online Storage