Federated data storage for Helmholtz Research & Friends

Uwe Jandt, Paul Millar, Tigran Mkrtchyan (DESY) on behalf of HIFIS and dCache teams

National and International Trends in Research Storage at Scale

Nov 12, 2020
The Six Research Fields of Helmholtz

ENERGY
EARTH AND ENVIRONMENT
HEALTH
AERONAUTICS, SPACE AND TRANSPORT
MATTER
KEY TECHNOLOGY (IN THE FUTURE)

RESEARCH FOR GRAND CHALLENGES
Why HIFIS?

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  - High performance + collaborative services
  - Shall **connect all centres**
    - ....and their world-wide collaboration partners!
  - **Secure, simple access** and easy-to-use
- Widely establish **best-practices** for development + use of research software:
  - high level of **quality**, visibility and sustainability

Photos by Markus Winkler, NOAA, National Cancer Institute on Unsplash
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This year’s pandemic still and again ヽ(ಠ_ಠ)ﾉ is a powerful reminder of how important collaborative and scalable IT services are.
Helmholtz Federated IT

Scientific Advisory Board (SAB) – Feedback

HIFIS SAB Meeting + Report (May’20)

- Open discussions and written feedback report
- High visibility → expert feedback

Major comments

- Integration with other platforms + internationally
- Integration into the proposal process
- Support scientists + tackle IT knowledge gap
- Appreciated HIFIS is a platform, not a project

18 members
from EU, USA, AUS:

Ari Asmi University of Helsinki
Rosa M Badia BSC
Magchiel Bijsterbosch SURF
Michael Brünig University of Queensland
Isabel Campos CSIC
Mirjam van Daalen PSI
Tiziana Ferrari EGI
Andy Götz ESRF
Christian Grimm DFN
Marc Heron DLS
Jörg Herrmann MPG
Neil Chue Hong SSI
Christine Kirkpatrick NDS, SDSC, OSN
Rupert Lück EMBL
Pierre Etienne Macchi IN2P3 CNRS
Wolfgang E. Nagel TU Dresden
Davide Salomoni INFN
Bruno Weikl FhG
Getting domain scientists involved

HIFIS conducted surveys throughout Helmholtz

- Covering all research fields, all centres, scientists/users and ICT provider!
- **Software Services survey:**
  
  Approximately **1000 replies** from nearly all centers

- **Cloud Service Survey:**
  
  **18+1 centres visited**; Feedback from more than **110 scientists** + ca. 100 IT experts
  
  ➢ Resulted in Initial Service Portfolio
Cloud Services

Done

- **Service Selection and Priorization** finished
  - Process reviewed by Fed Board
  - Strong focus on **benefit for researchers**, and research platforms + International compatibility
  - Full list: [hifis.net ➔ news](https://hifis.net)

- Top priority: **Urgent interest in collaboration services and common access** infrastructure

Next

- 1st “MVP” Version of **Helmholtz Cloud Portal**
- Start / continue **Integration of first services**
Backbone Services: Getting everybody connected

Common Helmholtz Authentication and Authorization Infrastructure (AAI)

- Enabling common access to collaborative and scientific services through credentials of the home institution
- Helmholtz AAI ready and in use, compatible to AARC
- Precondition to build Helmholtz Cloud
  - Various technologies: OIDC, SAML, SSH, LDAP
  - Group / VO Management
  - Secure SSH key management
  - 2FA
  - Deprovisioning (not yet in all modules)
- Documentation / Policies available:
  - https://hifis.net/doc/backbone-aai
  - https://hifis.net/mission/publications
dCache: Areas of Interests

- Workflow integration
- POSIX
- AuthN
- Sync&Share
- In-transit protection
- Interactive analysis
- HPC Friendly
- QoS
- In-transit protection
- Data exchange
dCache Motivation and Design

- Data never fits into a single disk/host
  - Multiple data servers
  - Tape off-load
- Number of clients only grows
- Control over HW/OS selection
  - Maximize local expertise
  - More flexibility on HW offers

- Single-rooted namespace, distributed data
- Clients talk to namespace only for metadata operations
- Bandwidth and capacity grows with the number of data servers
- Standard access protocols
- The same data available with any protocol, independent from Authentication schema
Distributed Data Management

- dCache is designed to federate storage
- Flexible data placement policies allows to get most out of local resources
- HA-capability reduces operational overhead to achieve desired SLO
- Cache-only sites can be integrated with HSM-enabled sites into single deployment
- In-transit data protection provide data privacy in distributed environment
dCache Identity Management

- gPlazma: a pluggable authentication and identity management system.
- Provides flexible framework for identity management, based on Pluggable Authentication Module (PAM).
- dCache comes with plugins to support common approaches: Kerberos, htpassword, OpenID-Connect, X.509, LDAP, ...

  - **OpenID-Connect** integration provides **Helmholtz users with seamless access**.

- OAuth2 supports delegation, allowing storage access to be delegated from user to an agent working on their behalf.
dCache Integration with Transfer Service

- CERN File Transfer Service (FTS):
  - Deployed throughout the world for managing transfers between different storage endpoints.
  - dCache includes integration with FTS where information provided by FTS is recorded

- Active party in third party copy (WIP!):
  - Third party can commission transfers between source and destination
  - Data is transferred directly between endpoints w/o third party
  - One endpoint needs to understand TPC-COPY extension (active party)
    - dCache
  - The other endpoint needs to enable PUT or GET requests for files (passive party)
    - Available extensions for Apache webserver (OIDC, write with specific user ACLs, ...)
dCache Event Generation

- dCache trigger actions on data state changes.
  - Clients may consume events to react to changes
- Automated work-flows integration
  - metadata extraction
  - catalogue update
  - replication
  - data processing

Two interfaces for different consumers:
- Kafka provides notification of uploads, deletions, media locality changes.
- Inotify-over-SSE provides notification on namespace changes.
Roadmap (Selection) / Next Steps

- **End Oct‘20**: Roadmap for Integration of Initial Cloud Services
- **Nov’20**: Integrate the Software Management Platform into the Helmholtz Cloud
- **Jan’21**: Set-up of Helmholtz Backbone Connections
- **March’21**: Reporting for the first two years of HIFIS: Including User-oriented KPIs
- **April’21**: Start evaluation of further Cloud Services
- **End’21**: Cloud Service Process Manual

[https://hifis.net/roadmap](https://hifis.net/roadmap)
Summary

- Very positive and intensive feedback from surveys conducted by HIFIS.
  - Next round of survey on usage by scientists

- **Highest interest** in and outside of Helmholtz for *commonly accessible* collaboration tools, high performance IT and sustainable software development.
  - Numerous pilot projects throughout 2020

- Currently: Integration of initial set of **Helmholtz Cloud IT services**.
  - **dCache**: a *science agnostic* system which natively integrates into Helmholtz federated cloud environment.
DANKE!
THANK YOU!
MERCI!
GRAZIE!
GRACIAS!
DANK JE WEL!

http://hifis.net

- Subscribe for HIFIS announcement letter!
- General queries to: support@hifis.net
- Coordinators: office@hifis.net

www.dcache.org