



## HIFIS backbone transfer service: FTS for everyone

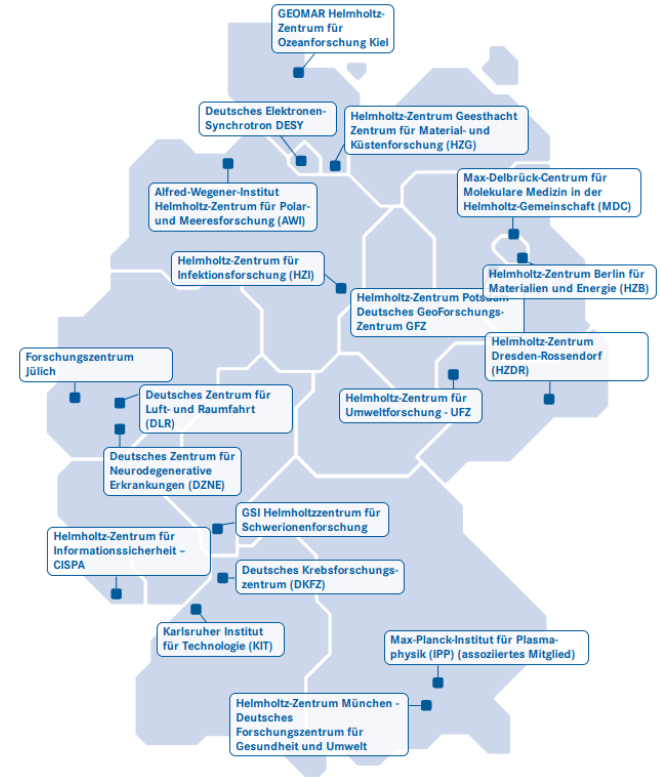
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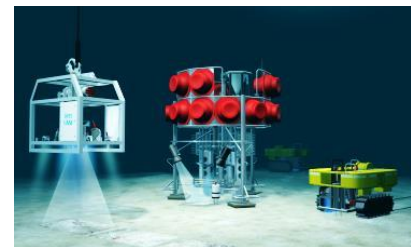
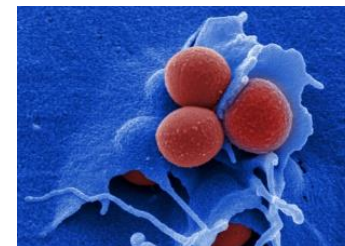
HEPiX 2020, Oct 14, 2020

- Founded in 1995 to formalise relationships between research centres
- Members: 19 autonomous research centres in Germany
- Mission: Contributions to grand challenges facing society, science and industry
- Fields: energy, earth & environment, health, aeronautics, space & transport, matter and key technologies

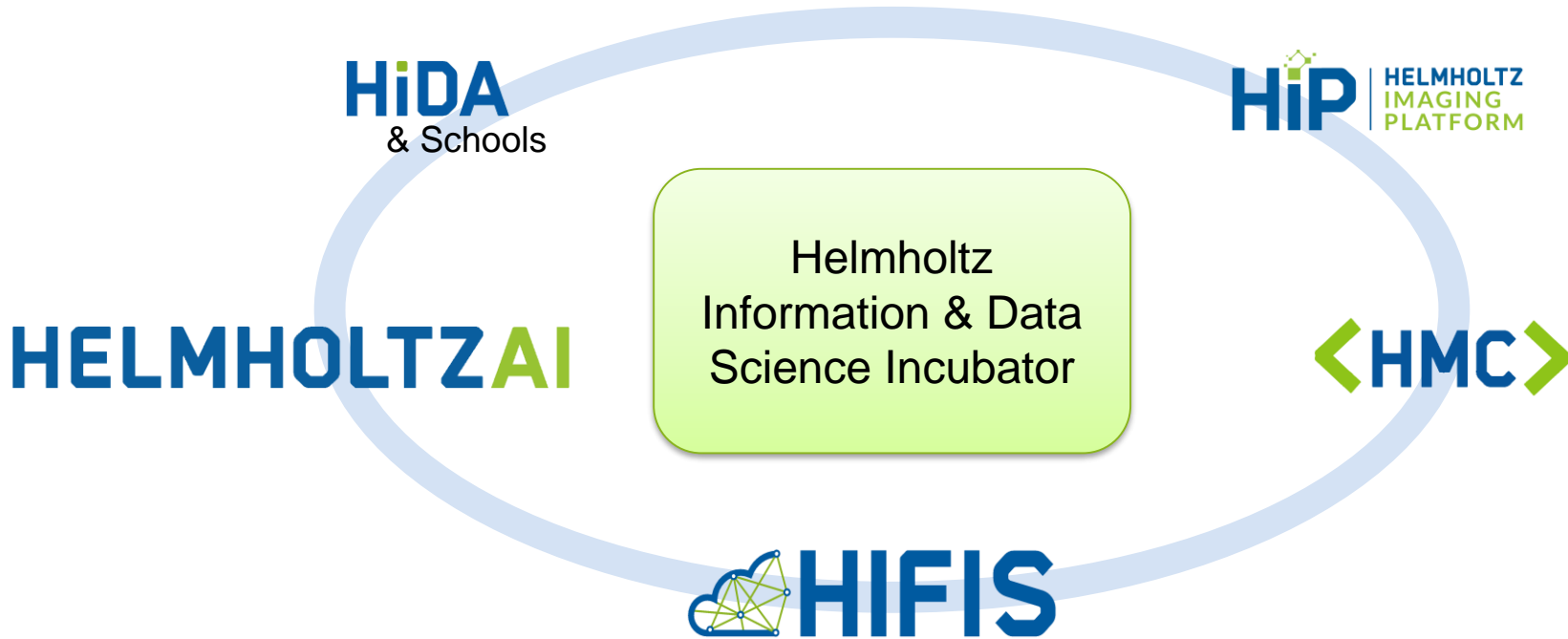


## New challenges

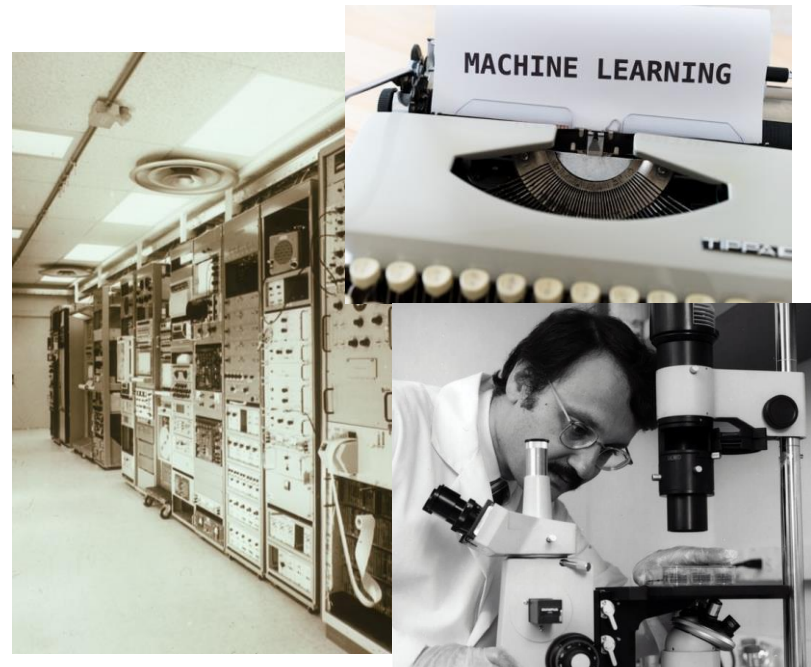
- Top position of Helmholtz research relies increasingly on **cross-centre** collaboration and international cooperation
- Growing importance of cloud access to **common data treasure** and -services
- Rapidly growing **data exchange** from research instruments requires excellent data networking
- Growing connections between HGF, **EOSC** and **FAIR**



- Helmholtz aims for joint research & information environment for all Research Fields



- Helmholtz aims for joint research & information environment for all Research Fields
  - Helmholtz Infrastructure for Federated IT Services **HIFIS**
  - **connects all HGF centres**
    - ....and their world-wide collaboration partners!
  - **Portfolio** of federated IT services
  - Common **marketplace**
  - Access via **HelmholtzAAI** with home credentials
- Easy and comfortable federation for collaborative web services



Photos by Markus Winkler, NOAA, National Cancer Institute on Unsplash

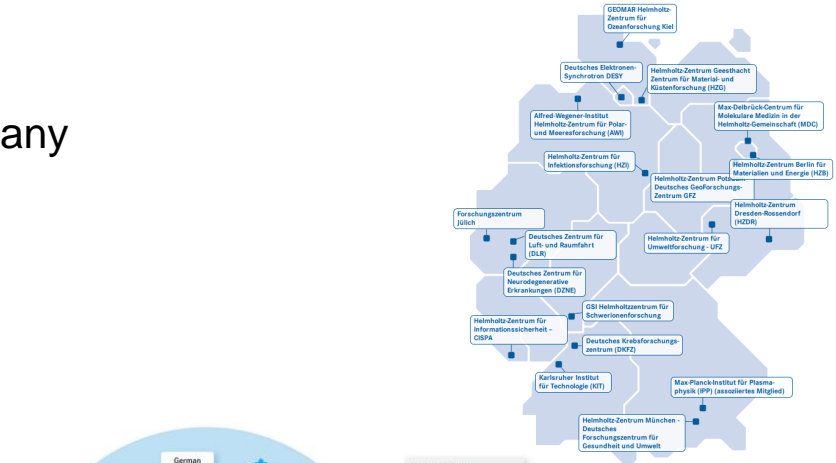
- Helmholtz aims for joint research & information environment for all Research Fields
  - High performance + collaborative services
  - Shall **connect all centres**
    - ....and their world-wide collaboration partners!
  - **Secure, simple and easy to use**
- Widely establish **best-practices** for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

**This year's pandemic was a powerful reminder of how important collaborative and scalable IT services are today!**



# Why data transfers?

- Helmholtz centres **distributed** all over Germany
- Large data sets in **collaborative** research projects
- **Policy-driven** data transfers required
- Data analysis often sensitive to **latency**
- **Data locality** is important!
- Part of **HIFIS** backbone contract
- ➔ Reliable, comfortable and robust transfer methods needed

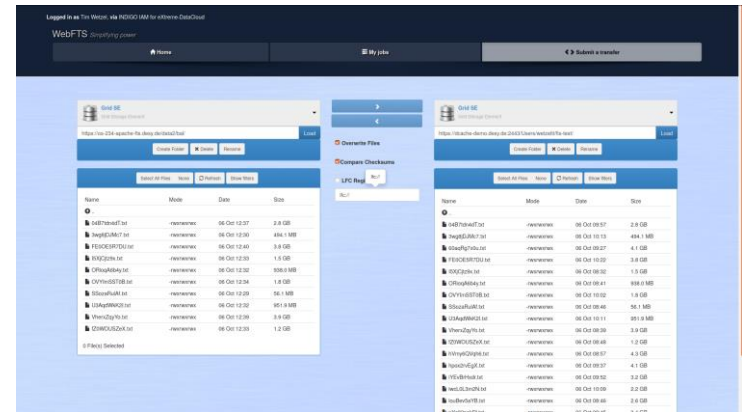


Helmholtz centres in Germany



helmholtz.ai structure

- As **HIFIS** backbone core service
  - CERN's **FTS3** as backend
  - **webFTS** as comfortable WebUI
  - **FTS3-REST-API** as CLI for automated transfers
  - Later: **Rucio** for policy driven transfers
- ➔ Client applications for all needs and purposes





- WLCG development for data transfers
  - ✓ Extension of the **HTTP** protocol
  - ✓ **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**, WLCG)
  - ✓ The other endpoint needs to enable PUT or GET requests for files (**passive party**)
- **Asynchronous** data transfers possible
  - ➔ Not implemented in standard Apache httpd
  - ➔ dCache needed as active party

- storage solutions in WLCG:
  - ✓ dCache
  - ✓ EOS
  - ✓ DPM
  - ✓ StoRM
- Developed for constant high load and huge data volumes
- Enclosed view on data
- ➔ More open endpoint solution needed for **HIFIS**



- Apache **httpd** webserver modules used:
  - ✓ mod\_ssl (SSL/TLS capabilities)
  - ✓ mod\_dav (webDAV capabilities)
  - ✓ mod\_auth\_openidc (OpenIDConnect/OAuth2)
  - ✓ modified mpm\_itk (Multiprocessing module, user mapping)
  - ✓ self-written lua script (local user mapping)
  - ✓ self-written mod\_want\_digest (instance digests following RFC 3230)
- ➔ Compatible with FTS3 and accessible via OAuth2 secured webDAV
- ➔ Transfers are possible between GRID storage and Apache
- ➔ Direct transfers between two Apaches are WIP

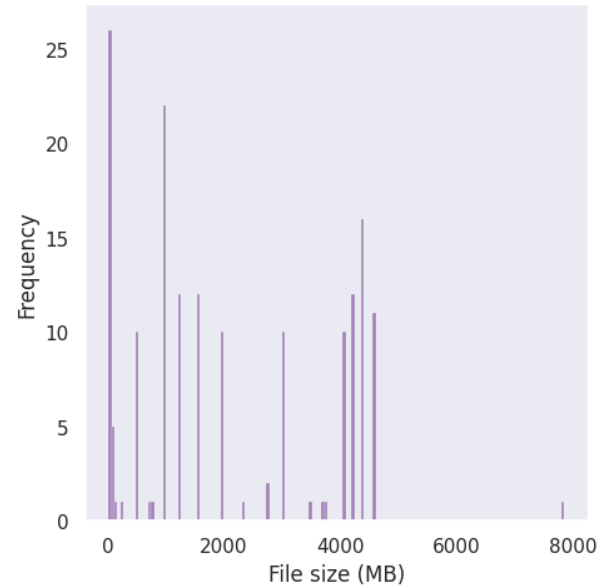
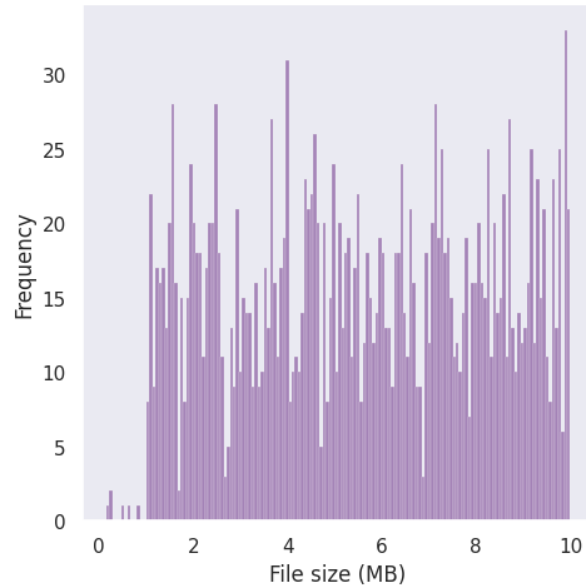


- `mod_want_digest` ([github.com/wetzel-desy/mod\\_want\\_digest](https://github.com/wetzel-desy/mod_want_digest)):
  - Developed by Tim Wetzel and Paul Millar, fragments taken from `httpd`'s `mod_negotiation`
  - Implements instance digests in accordance with RFC 3230 (HTTP headers „**Want-Digest**“ and „**Digest**“)
  - Supports ADLER32, MD5 and SHA digests
  - Alpha version until now
    - × No digest caching mechanism or on-the-fly calculation
      - Has to read file from disk for digest calculation
- ➔ Good first version but needs to be optimized (WIP)

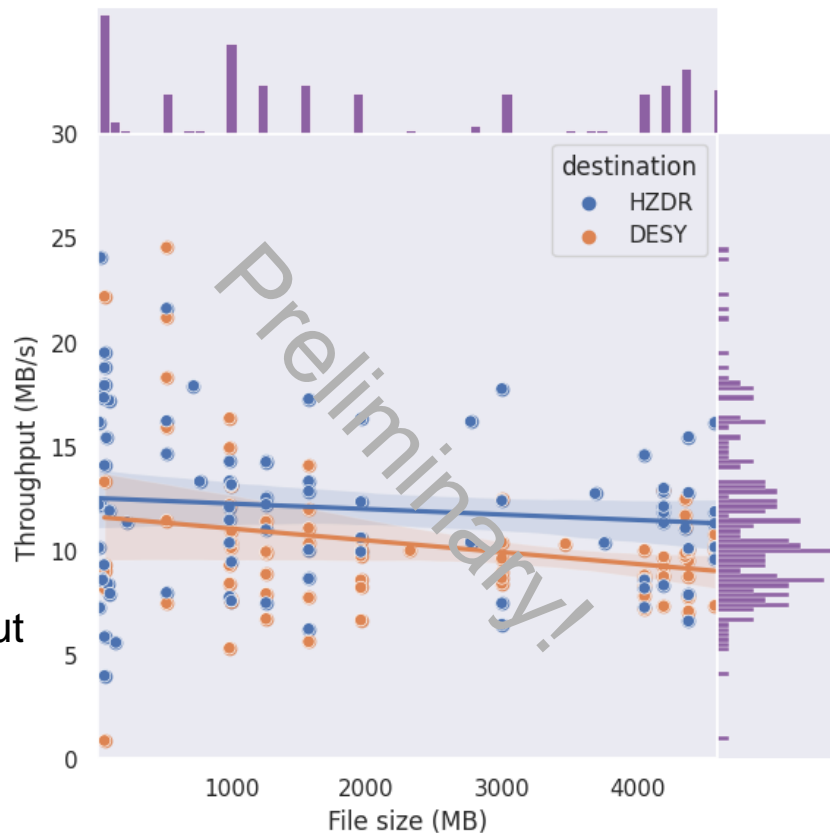
- Endpoints:
  - DCache @ DESY as active party
  - Apache @ **HZDR** Dresden (OAuth2-secured webDAV EP) & @ **DESY** (+ local user mapping and instance digests) as passive parties
- ➔ **2344** successful transfers over 3 days, manually initiated via WebFTS
- ➔ **363.9 GB** of data in total
- ➔ Failed transfers only due to either exceeding disk space or initial misconfigurations of httpd excluded from the results, which could be fixed easily



- Total transferred volume: ~363.9 GB in ~2300 files over 3 days
- 2166 < 10 MB, 167 > 10 MB

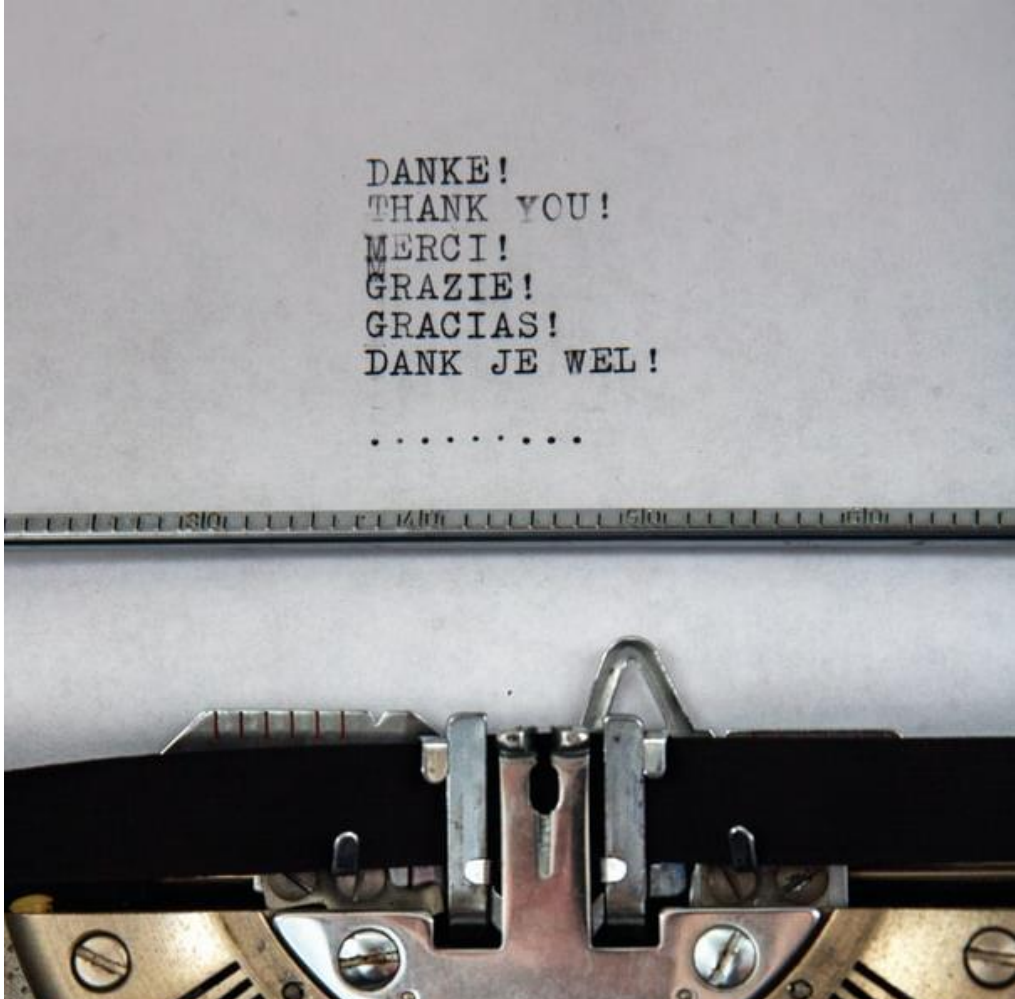


- Mean throughput
  - 3.64 MB/s (<10 MB)
  - 11.2 MB/s (>10 MB)
- Standard deviation
  - 2.66 MB/s (<10 MB)
  - 3.83 MB/s (>10 MB)
- DESY instance provides lower throughput because of instance digest calculations



- Enabling data transfers between HGF centres with existing open-source software
- New software configuration for HTTP-TPC that is easy to deploy
- Together with FTS3 and WebFTS provides base for a transfer service
- Transfer tests between Apache endpoints and dCache instance successful
- Instance digest calculation and throughput still present considerable possibilities for optimization
- Currently limited to transfers involving grid storage endpoint (e.g., dCache), but future work will make Apache httpd itself capable of HTTP-TPC
- ➔ Practical solution for data transfers between Helmholtz centres





DANKE!  
THANK YOU!  
MERCİ!  
GRAZIE!  
GRACIAS!  
DANK JE WEL!

.....

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