

# Transnational Access to Mass Storage Capacity for Computational QCD

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## I3HP

- I3HP: *HadronPhysics Integrated Infrastructure Initiative* [1]
- Funding: Sixth Framework Programme of the European Commission, Contract No. RI3-CT-2004-506078
- Goal: Study of Strongly Interacting Matter
- Consortium: experimental, theoretical, and computational physicists from about 150 institutions
- Structure:
  - 9 Transnational Access Activities
  - 7 Networking Activities
  - 12 Joint Research Activities
- Lattice QCD activities:
  - Networking activity *Computational Hadron Physics*
  - Transnational Access to supercomputer resources [2]
  - Transnational Access to mass storage capacity [3]

## Access to the mass storage system at ZIB

- ZIB: Konrad-Zuse-Zentrum für Informationstechnik Berlin / Zuse-Institut Berlin
- ZIB conducts:
  - Berlin supercomputer centre
  - research in applied mathematics and computer science
- Transnational Access:
  - In the framework of I3HP European lattice physics collaborations can apply for mass storage capacity (see [3])
- Motivation:
  - storage and sharing of gauge field configurations
  - more efficient use of expensive data

## Lattice Datagrid components

- The storage system at ZIB is part of the LATFOR [4] Datagrid which is set up in a joint effort together with the German sites DESY (Hamburg and Zeuthen) and NIC/FZJ (Jülich).
- Sites from France (CNRS) and Italy (INFN) plan to participate.
- Figure 1 shows the components of the LATFOR Datagrid. Meaning of the colours:
  - pink: components at the user's sites
  - blue: components at sites offering storage capacity
  - green: central components (operated by DESY)

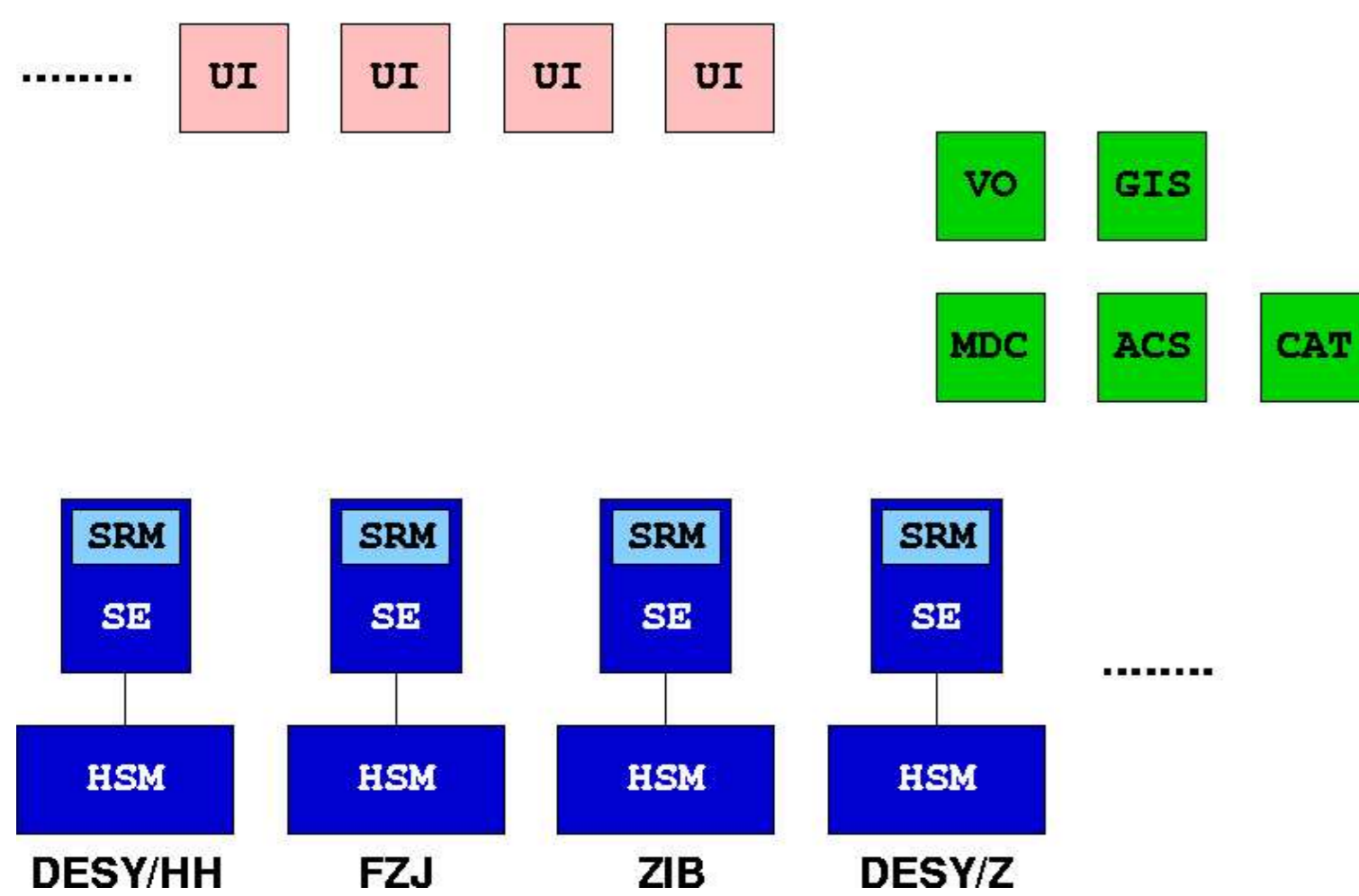


Figure 1. Grid components (picture from [5])

- Explanations:
  - UI User Interface
    - e.g. at the user's desktop
  - SE Storage Element
    - provides uniform access to a large data space
  - SRM Storage Resource Manager
    - software layer for storage access
  - HSM Hierarchical Storage Manager
    - a mass storage system employing tapes and disk caches
  - VO Virtual Organisation
    - organisational unit in a Grid infrastructure
    - the virtual organisation in *this* Grid context is *ildg*
  - GIS Grid Information Services
    - handles e.g. authentication

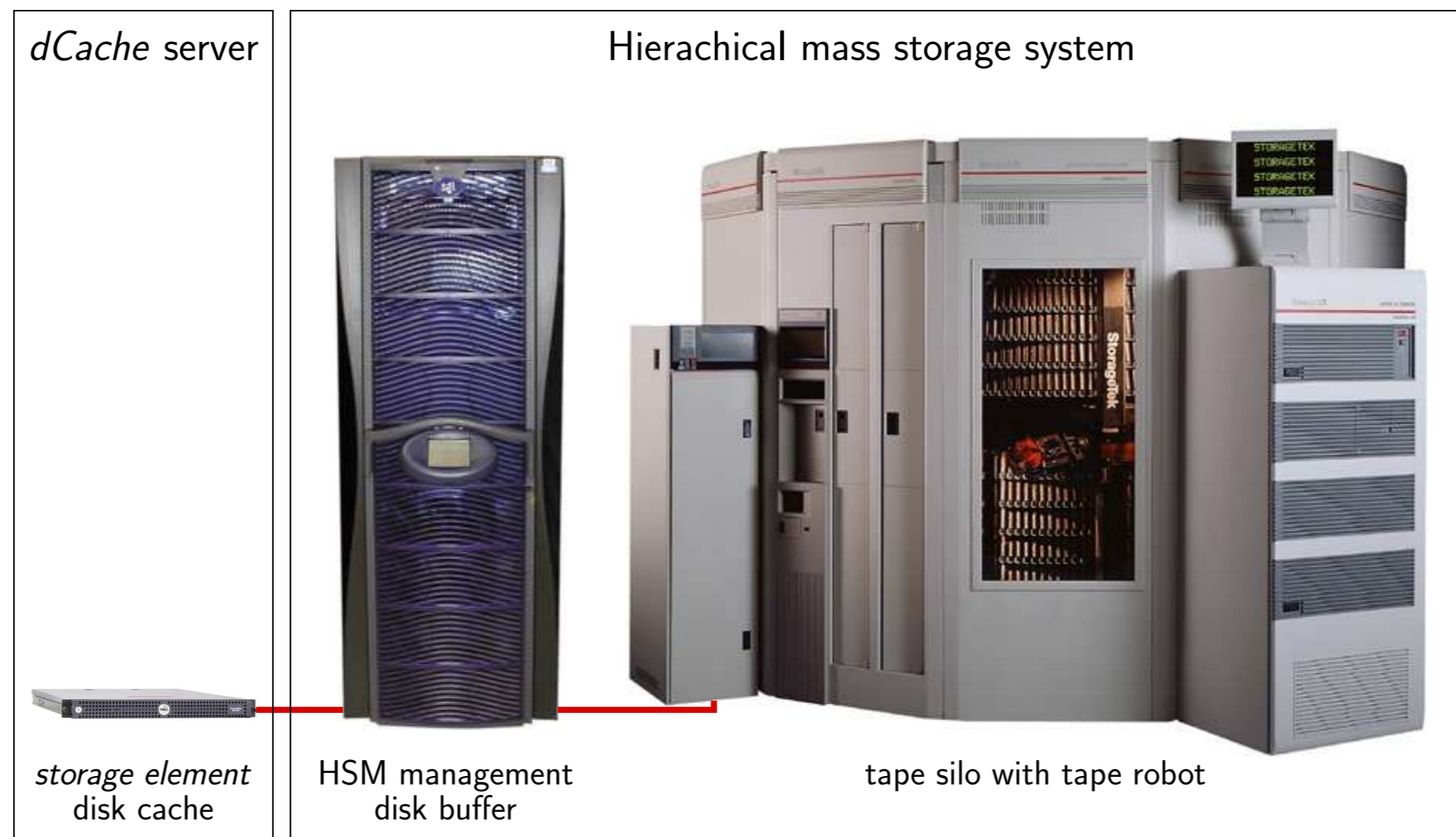


Figure 2. ZIB storage element and HSM system

- MDC Metadata Catalogue
  - storage and query of data descriptions
  - metadata conform to QCDm1.1 [8]
- ACS Access Control Service
  - handles access permissions
- CAT File Catalogue
  - mapping of local filenames to physical locations
  - manages copies of data files
- Storage element software: *dCache* [6]

## Storage facility

- Figure 2 shows the hardware components of the ZIB storage element
- HSM system (with capacities for QCD data):
  - tape storage: two StorageTek PowderHorn 9310 tape silos (20 TByte capacity for QCD configurations)
  - HSM server: SGI O300 (30 GByte disk buffer)
  - HSM management software: SGI Data Migration Facility (DMF)
  - safety: two copies of a file exist on different tapes
- *dCache* (Grid) server:
  - Dell PowerEdge SC 1425 (120 GByte disk cache)

## Important concepts

### Authentication via certificates

- Users are authenticated via *certificates*
- A certificate is a public key that is signed by a *certificate authority* (the user also has a corresponding private key)
- Certificate authorities for this Grid are LCG Regional Centres (LCG: Large Hadron Collider Computing Grid)

### Logical filenames and physical locations of files

- In a Datagrid files can be accessed by specifying a *Logical FileName* (LFN). The Grid middleware translates the LFN into a physical location. The LFN has to be unique inside a virtual organisation. By convention, this is ensured by beginning the LFN with the name of the collaboration.
- Examples for specifications of an LFN and a physical location:

```
lfn:qcdfs/b5p40kp13610-24x48/bqcd.561.1.1.00125.tar
srm://dcache.zib.de/pnfs/zib.de/data/ildg/qcdfs/\
b5p40kp13610-24x48/bqcd.561.1.1.00125.tar
```
- In general the user does not have to take care where the file can be found, although the physical filename can be used as well.
- Replicas of files can exist in the disk caches of several storage elements. The middleware is supposed to find the best accessible copy.

### Data formats

- The *International Lattice DataGrid* (ILDG) [7] has defined formats for metadata [8] and binary data [9]
- On uploading binary files correct metadata have to be supplied
- In future all configurations should be stored in the ILDG format. Old configuration files should be converted to the standard format.

## User tools

- The authors work on an easy to use command line tools, e.g.

```
lget      get a local copy of a configuration (or its metadata)
lput      put a configuration on the Grid
lls       list all configurations of an ensemble
lvalidate checks conformance of metadata to QCDm1
```
- Motivation:
  - simplifying LCG-commands by using natural defaults and combining sequences of commands
  - preventing erroneous use of LCG-commands (which could lead to inconsistencies)
- Example:

```
% lget qcdfs/b5p40kp13610-24x48/bqcd.561.1.1.00125.tar

Welcome to the Ltool-command lget -
Testing grid-proxy-init
grid-proxy...ok

Trying to get binary ...
Virtual Organisation is ildg
Executing lcg-cp ...

Checking nonzero size of downloaded File ...ok.
```
- Prototype implementations are available

## Usage

- At present mainly used by QCDSF for storing configurations from full simulations of clover improved QCD
- Present data set (every 5<sup>th</sup> trajectory stored):

$\beta$	$\kappa$	$c_{sw}$	Volume	$a$ [fm]	$m_{PS}/m_V$	$N_{traj}$
5.20	0.1342	2.0171	$16^3 \times 32$	0.115(2)	0.789(2)	O(5000)
5.25	0.1346	1.9603	$16^3 \times 32$	0.099(1)	0.784(2)	O(5800)
5.25	0.13575	1.9603	$24^3 \times 48$	0.084(1)	0.605(4)	O(5900)
5.29	0.1350	1.9192	$16^3 \times 32$	0.089(1)	0.759(2)	O(5600)
5.29	0.1355	1.9192	$24^3 \times 48$	0.084(1)	0.702(4)	O(2000)
5.29	0.1359	1.9192	$16^3 \times 32$		0.607(7)	O(1000)
5.40	0.1350	1.8228	$24^3 \times 48$	0.077(1)	0.803(2)	O(3700)
5.40	0.1356	1.8228	$24^3 \times 48$	0.073(1)	0.731(3)	O(3500)
5.40	0.1361	1.8228	$24^3 \times 48$	0.070(1)	0.631(6)	O(3500)

- Storage plans:

collaboration	fermionic action
SESAM / T $\chi$ L / GRAL	$N_f = 2$ Wilson fermions
$\chi$ LF	$N_f = 2$ Wilson twisted mass fermions
DFG-Forschergruppe, Jülich, Wuppertal	$N_f = 2$ overlap fermions

- Access policies are defined by the groups

## Contact

- Contact Hinnerk Stüben here at the conference
- E-mail to <stueben@zib.de>
- Visit <http://www.zib.de/i3hp/>

## References

- [1] <http://www.infn.it/eu/i3hp/>
- [2] <http://www.fz-juelich.de/nic/i3hp-nic-ta/>
- [3] <http://www.zib.de/i3hp/>
- [4] <http://www-zeuthen.desy.de/latfor/>
- [5] [http://www-zeuthen.desy.de/acat05/talks/Pleiter.Dirk.1/dirk\\_pleiter.pdf](http://www-zeuthen.desy.de/acat05/talks/Pleiter.Dirk.1/dirk_pleiter.pdf)
- [6] <http://www.dcache.org/>
- [7] <http://www.lqcd.org/ildg/>
- [8] [http://www.ph.ed.ac.uk/ukqcd/community/the\\_grid/QCDm1.1.1/](http://www.ph.ed.ac.uk/ukqcd/community/the_grid/QCDm1.1.1/)
- [9] <http://www-zeuthen.desy.de/~pleiter/ildg/#filefmt>