

## Programming with [OmpSs?-2](#)

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### Introduction

[OmpSs?-2](#) is a programming model composed of a set of directives and library routines that can be used in conjunction with a high-level programming language in order to develop concurrent applications.

### File Systems

On the DEEP-EST system, three different groups of filesystems are available:

- the [?JSC GPFS filesystems](#), provided via [?JUST](#) and mounted on all JSC systems;
- the DEEP-EST (and SDV) parallel BeeGFS filesystems, available on all the nodes of the DEEP-EST system;
- the filesystems local to each node.

The users home folders are placed on the shared GPFS filesystems. With the advent of the new user model at JSC ([?JUMO](#)), the shared filesystems are structured as follows:

- **\$HOME**: each JSC user has a folder under `/p/home/juser s/`, in which different home folders are available, one per system he/she has access to. These home folders have a low space quota and are reserved for configuration files, ssh keys, etc.
- **\$PROJECT**: In JUMO, data and computational resources are assigned to projects: users can request access to a project and use the resources associated to it. As a consequence, each user has a folder within each of the projects he/she is part of. For the DEEP project, such folder is located under `/p/project/cdeep/`. Here is where the user should place data, and where the old files generated in the home folder before the JUMO transition can be found.

The DEEP-EST system doesn't mount the **\$SCRATCH** and **\$ARCHIVE** filesystems, as it is expected to provide similar functionalities with its own parallel filesystems.

The following table summarizes the characteristics of the file systems available in the DEEP-EST and DEEP-ER (SDV) systems:

| Mount Point              | User can remount without                                                                                                    | Cluster   | Type                                 | Global / Local   | SW Version   | Stripe Pattern Details                                           | Maximum Measured Performance (see footnotes)                            | Description                                                                                                           | Other                                                                                                                                                                                                                                                                                |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------|------------------|--------------|------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>/p/home</code>     | <code>/p/home/juser s/</code><br><small>DEEP-EST</small>                                                                    |           | GPFS                                 | imported via NFS |              |                                                                  |                                                                         | Home directory; used only for configuration files.                                                                    |                                                                                                                                                                                                                                                                                      |
| <code>/p/project</code>  | <code>/p/project/cdeep/</code><br><small>DEEP-EST</small>                                                                   |           | GPFS                                 | imported via NFS |              |                                                                  |                                                                         | Project directory; GPFS main storage file system; not suitable for performance intensive applications or benchmarking |                                                                                                                                                                                                                                                                                      |
| <code>/work</code>       | <code>/work/cdeep</code>                                                                                                    | DEEP-EST* | BeeGFS                               | Global           | BeeGFS 7.1.2 |                                                                  |                                                                         | Work file system                                                                                                      | *Not available in the SDV but only through 1 Gb network connection                                                                                                                                                                                                                   |
| <code>/sdv-work</code>   | <code>/sdv-work/cdeep</code><br><small>SDV (deep-adv node via EXTOLL, DEEP-EST via GSE only), DEEP-EST (1 GSE only)</small> |           | BeeGFS                               | Global           | BeeGFS 7.1.2 | Type RAID0, Charact.: 512K, Number of storage targets: default 4 | 1024 MB/s write, 1200 MB/s read, 15000 ops/s create, 1111 ops/s remove* | Work file system                                                                                                      | *Test results and parameters used stored in JUMO<br>user@BeeGFS \$ cd /usr/local<br>user@BeeGFS \$ ./jube2 result benchmarks<br>user@BeeGFS \$ cd /usr/local<br>user@BeeGFS \$ ./jube2 result benchmarks<br>user@BeeGFS \$ cd /usr/local<br>user@BeeGFS \$ ./jube2 result benchmarks |
| <code>/home</code>       | <code>/home/cdeep</code>                                                                                                    | SDV       | NVMe device                          | Local            | BeeGFS 7.1.2 | Block size: 4K                                                   | 140 MB/s write, 1100 MB/s read, 12000 ops/s create, 6200 ops/s remove*  | 1 NVMe device available at each SDV compute node                                                                      | *Test results and parameters used stored in JUMO<br>user@BeeGFS \$ cd /usr/local<br>user@BeeGFS \$ ./jube2 result benchmarks<br>user@BeeGFS \$ cd /usr/local<br>user@BeeGFS \$ ./jube2 result benchmarks<br>user@BeeGFS \$ cd /usr/local<br>user@BeeGFS \$ ./jube2 result benchmarks |
| <code>/home/cdeep</code> | <code>/home/cdeep</code>                                                                                                    | SDV       | BeeGFS On Demand running on the NVMe | Local            | BeeGFS 7.1.2 | Block size: 512K                                                 | 110 MB/s write, 1047 MB/s read, 12011 ops/s create, 18024 ops/s remove* | 1 BeeGFS instance running on each NVMe device                                                                         | *Test results and parameters used stored in JUMO<br>user@BeeGFS \$ cd /usr/local<br>user@BeeGFS \$ ./jube2 result benchmarks<br>user@BeeGFS \$ cd /usr/local<br>user@BeeGFS \$ ./jube2 result benchmarks<br>user@BeeGFS \$ cd /usr/local<br>user@BeeGFS \$ ./jube2 result benchmarks |

## Stripe Pattern Details

It is possible to query this information from the deep login node, for instance:

```
manzano@deep $ fhgfs-ctl --getentryinfo /work/manzano
Path: /manzano
Mount: /work
EntryID: 1D-53BA4FF8-3BD3
Metadata node: deep-fs02 [ID: 15315]
Stripe pattern details:
+ Type: RAID0
+ Chunksize: 512K
+ Number of storage targets: desired: 4

manzano@deep $ beegfs-ctl --getentryinfo /sdv-work/manzano
Path: /manzano
Mount: /sdv-work
EntryID: 0-565C499C-1
Metadata node: deeper-fs01 [ID: 1]
Stripe pattern details:
+ Type: RAID0
+ Chunksize: 512K
+ Number of storage targets: desired: 4
```

Or like this:

```
manzano@deep $ stat -f /work/manzano
File: "/work/manzano"
ID: 0      Namelen: 255      Type: fhgfs
Block size: 524288      Fundamental block size: 524288
Blocks: Total: 120178676 Free: 65045470 Available: 65045470
Inodes: Total: 0        Free: 0

manzano@deep $ stat -f /sdv-work/manzano
File: "/sdv-work/manzano"
ID: 0      Namelen: 255      Type: fhgfs
Block size: 524288      Fundamental block size: 524288
Blocks: Total: 120154793 Free: 110378947 Available: 110378947
Inodes: Total: 0        Free: 0
```

See <http://www.beegfs.com/wiki/Striping> for more information.

## Additional infos

Detailed information on the **BeeGFS Configuration** can be found [?here](#).

Detailed information on the **BeeOND Configuration** can be found [?here](#).

Detailed information on the **Storage Configuration** can be found [?here](#).

Detailed information on the **Storage Performance** can be found [?here](#).

## Notes

- The /work file system which is available in the DEEP-EST prototype, is as well reachable from the nodes in the SDV (including KNLs and KNMs) but through a slower connection of 1 Gig. The file system is therefore not suitable for benchmarking or I/O task intensive jobs from those nodes
- Performance tests (IOR and mdtest) reports are available in the BSCW under DEEP-ER → Work Packages (WPs) → WP4 → T4.5 - Performance measurement and evaluation of I/O software → Jülich DEEP Cluster → Benchmarking reports: <https://bscw.zam.kfa-juelich.de/bscw/bscw.cgi/1382059>
- Test results and parameters used stored in JUBE:

```
user@deep $ cd /usr/local/deep-er/sdv-benchmarks/synthetic/ior
user@deep $ jube2 result benchmarks

user@deep $ cd /usr/local/deep-er/sdv-benchmarks/synthetic/mdtest
user@deep $ jube2 result benchmarks
```