



# Managing your files at PDC

Researchers using PDC's facilities need different types of storage:

- mass storage for archiving large volumes of research data (see Mass data storage poster) and
- somewhere to store files relating to calculations being performed on PDC's systems (such as data files or program files).

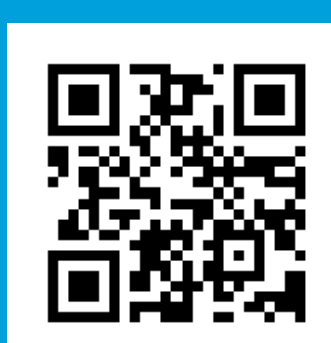
For storing the latter type of files, PDC has two file systems:

- AFS (Andrew File System), and
- Lustre.

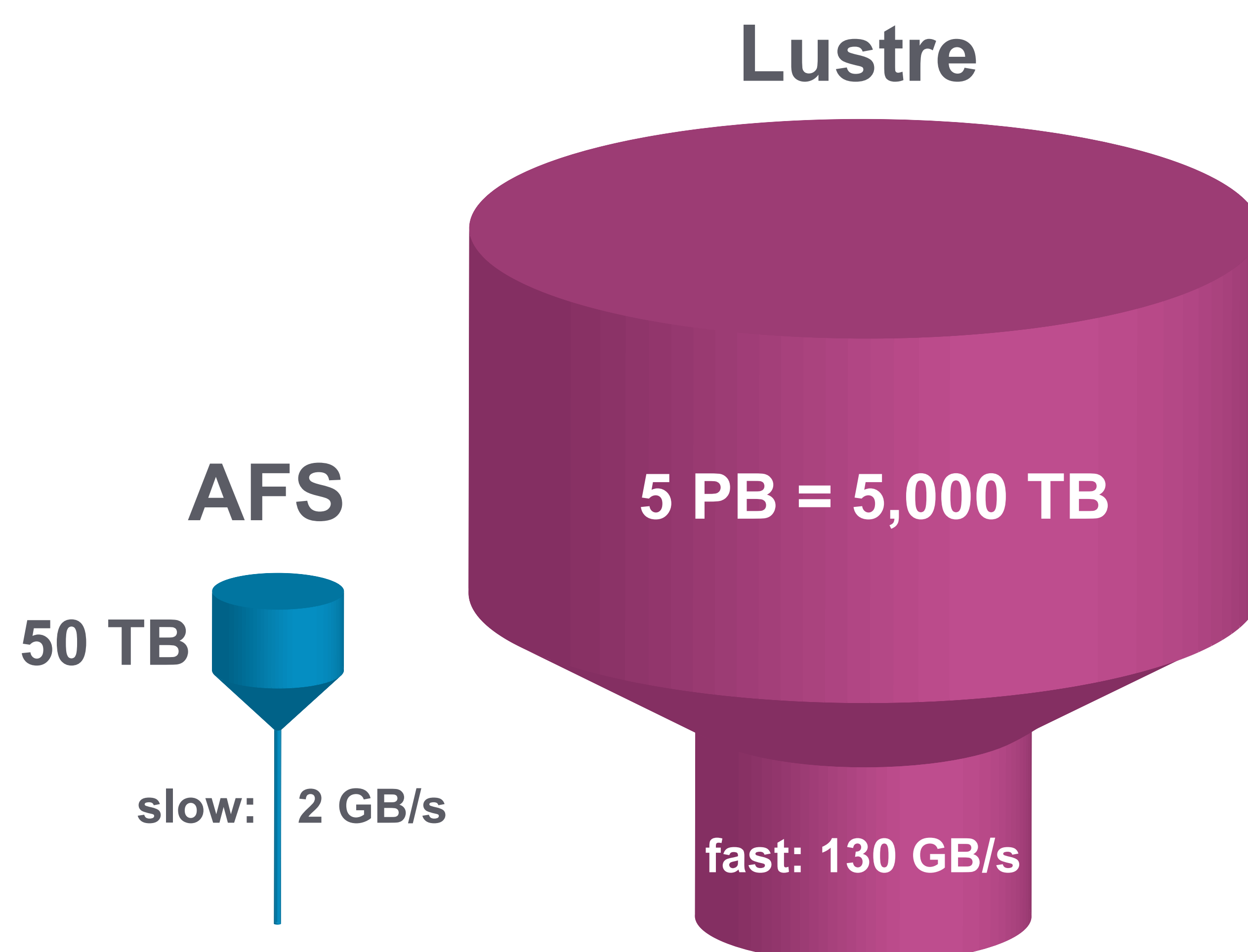
Which system you should use to store your files depends on:

- the amount of data you need to store, and
- how you will be using or accessing the data.

## AFS /afs/pdc.kth.se



- based on the Andrew File System
- small volume of storage (around 50 TB total)
- relatively slow access to files (not good for files being accessed by parallel computations)
- all files on AFS are backed up
- files stored on AFS can be directly accessed from any computer connected to the internet - it is not necessary to log in to a PDC computer over the internet first
- files on AFS are not accessible from Beskow's compute nodes (so any data or program files that you need for running programs on Beskow must be stored on Lustre)
- files on AFS can be accessed from Tegner's compute nodes - so small amounts of data for Tegner computations can be stored on AFS (any large amounts of data should be stored on Lustre for reasons of speed of access)
- good for storing small files that need to be backed up
- home directories are on AFS (so you will be in AFS when you first log in to PDC's systems)
- AFS has its own implementation of Access Control Lists (ACLs) where users can define new groups (Note: In AFS access is set per directory and not on individual files.)
- secure access – uses Kerberos for authentication and is designed for security and robustness
- mainly used for:
  - users' home directories (with backup) – 5 GB,
  - project volumes (backup optional) – typically 10-50 GB (time limited),
  - installation and configuration of the PDC environment, and
  - source code packages



## Lustre /cfs/klemming



- a parallel file system optimized for handling data from many clients at the same time
- large volume of storage (total over 5 PB – so 100 times more than AFS)
- fast access (good for files accessed for computations)
- files are not backed up
- files stored on Lustre can only be accessed when you are logged in to one of the PDC clusters
- any data or program files that you need for running programs on Beskow must be stored using Lustre
- any data or program files that you need for running programs on Tegner should be stored using Lustre
- good for storing any large files and program code
- Lustre supports standard (POSIX) Access Control Lists
- used for
  - cluster scratch (/cfs/klemming/scratch/<u>/<username>) – shared scratch area for temporary files – no backup – old files will be deleted periodically by the system, and
  - nobackup area (/cfs/klemming/nobackup/<u>/<username>) – shared area to be used for input/output for running jobs – no backup – users should move files elsewhere as soon as possible when they are not needed by jobs

## File systems and input/output (I/O)

As the speed of CPU computations keep increasing, the relatively slow rate of input/output (I/O) or data accessing operations can create bottlenecks and cause programs to slow down significantly. Therefore it is very important to pay attention to how your programs are doing I/O and accessing data as that can have a huge impact on the run time of your jobs. In general at PDC

- all files for Beskow computations must go on Lustre,
- small data files for Tegner computations can be put on AFS, and
- big data files for computation on Tegner should be put on Lustre.

At present, since space on Lustre is limited and files there are not backed up, researchers should move important data files to their own departmental storage systems after performing computations at PDC. Smaller data files can also be moved to AFS after performing computations.

## Things to remember when using all types of files

- Larger input/output (I/O) operations are more efficient than small ones – if possible aggregate reads/writes into larger blocks.
- Avoid creating too many files – post-processing a large number of files can be very hard on the file system.
- Avoid creating directories with very large numbers of files – instead create directory hierarchies, which also improves interactivensess.
- Use the dedicated file transfer nodes on Tegner for large file transfers to Tegner or Beskow and also use them for extensive file operations.

## Things to remember when using Lustre

- Avoid all unnecessary metadata operations - once a file is opened, do as much as possible before closing it again. Do not check the existence of files or `stat()` files too often.
- Open files as *read-only* if possible – *read-only* files require less locking and therefore put less load on the file system.

TIP: Avoid flags such as `-l`, `-F` or `--color` with `ls` by default as this requires `ls` to `stat()` every file to determine its type, which puts an unnecessary load on the file system. Use such flags only when the extra information is really needed.

Access QR codes or visit [www.pdc.kth.se](http://www.pdc.kth.se) for more information.