CERN

More Filesystems!

AFS, FILER, DFS, SAMBA

TechWeekStorage 2024

Enrico BOCCHI, Sebastian BUKOWIEC
CERN IT

Outline

- AFS, Filer
- Storage for Windows systems
  DFS, SMB

AFS: Use cases

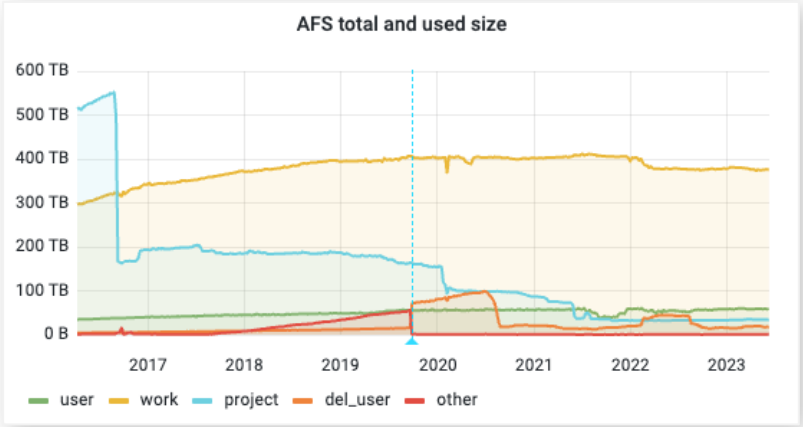
- **Current**
  - $HOME (interactive logon service) → user volumes (/afs/cern.ch/user)
  - Filesystem interface for local BATCH access
    → preferably workspace volumes (/afs/cern.ch/work)
  - Small Experiments data, projects → /afs/cern.ch/project, …
  - Software compilation, websites... → all (mainly workspaces)

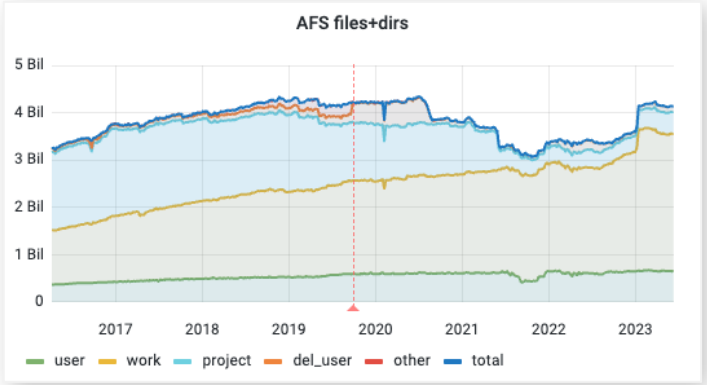
- **Migrated into other services**
  - Large Experiments data
  - Most of Project spaces
  - Archival of old data/projects **(first website in the world!)**
  - Software distribution → now on a dedicated, RO system (CVMFS)

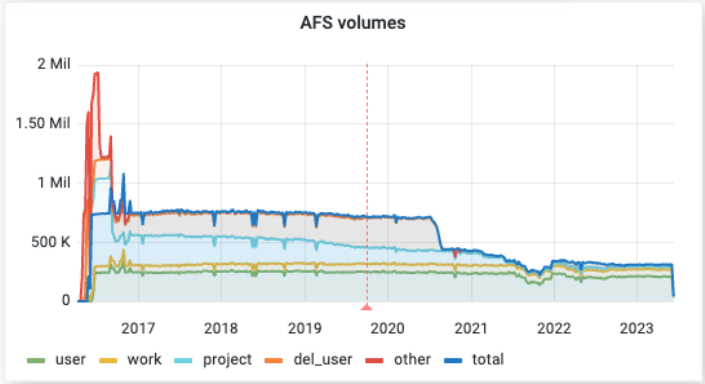
AFS: Infrastructure and Operations

- **Fully virtualized on OpenStack VMs + Ceph storage:**
  - 69 Fileservers (shared, 8cores/15G/4partitions)
  - CEPH block storage
  - 4 DBs
  - Some FS+DB under critical power ($HOME + Critical projects)
- **Software:**
  - OpenAFS 1.8.10
  - RHEL 9 (on-going migration)
- **Backup to Tape:**
  - Daily
  - Integrated with CERN Tape Archive

AFS In Numbers





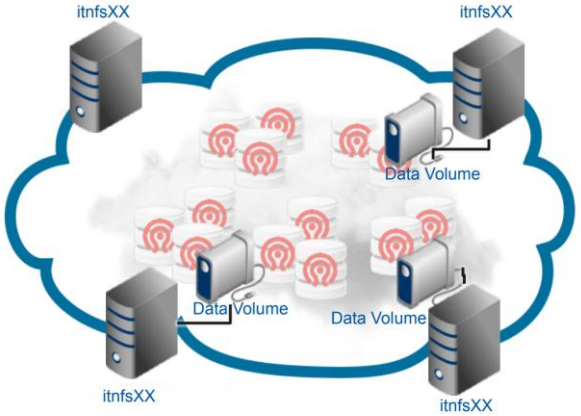


- 44487 volumes, 7k clients
- 487 TB (-4% than 2022)
- 4.4 billion files (+26% than 2022)

- Numbers stable, no big additions or removals
- AFS is global, but its usage at CERN is mostly local

Filer

- **Virtualized NFS (v3 or v4) server on VM**
  - Underlying storage is Ceph RBD
    - Plain and simple attached volume
    - QoS from volume type or aggregation of volumes
  - ZFS as filesystem on top
    - Comes as 3rd-party Kernel module
    - Provides snapshots and replication capabilities (`zfs send | receive`)
    - Quota management (.zfs.{user/group}quotas), compression, deduplicati
- **No HA, no Clustering, Failover is manual**
  - We could do better (e.g., DRBD, Pacemaker, ...)
  - Never manifested as lacking feature
- **Plans? Consolidate in favour of Ceph**



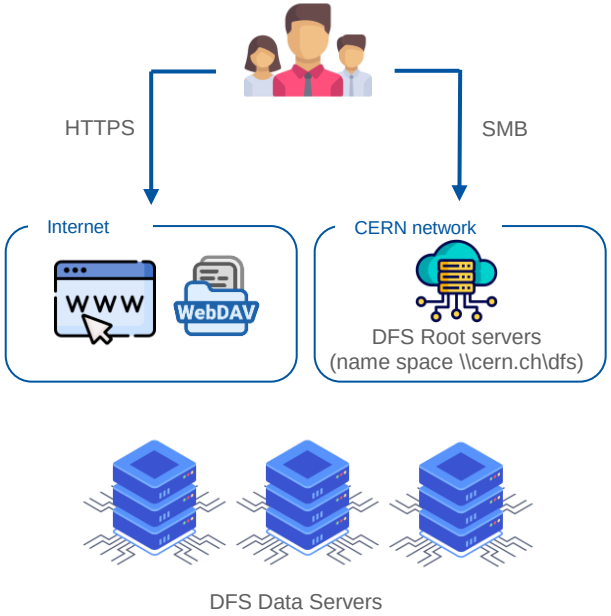
DFS Service

DFS (Distributed File System) is a role service in Windows Server that enables to group shared folders located on different servers into one or more logically structured namespaces. Provides a virtual view of shared folders, where a single path leads to files located on multiple servers.

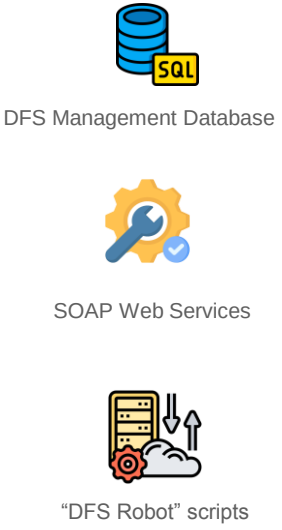
DFS provides to all CERN users a centrally hosted file space. Primarily dedicated to the **Windows** based ecosystem.

DFS overview

Core components



Auxiliary components



DFS features

- Windows Network Share access
- Windows-native permissions management
- Web GUI + WebDAV access
- Quota management
- Snapshots (Previous versions)
- Backup
- Managed by Puppet, Group policies and CMF
- Alarms: icinga2
- Metrics: telegraf > influxDB > Grafana

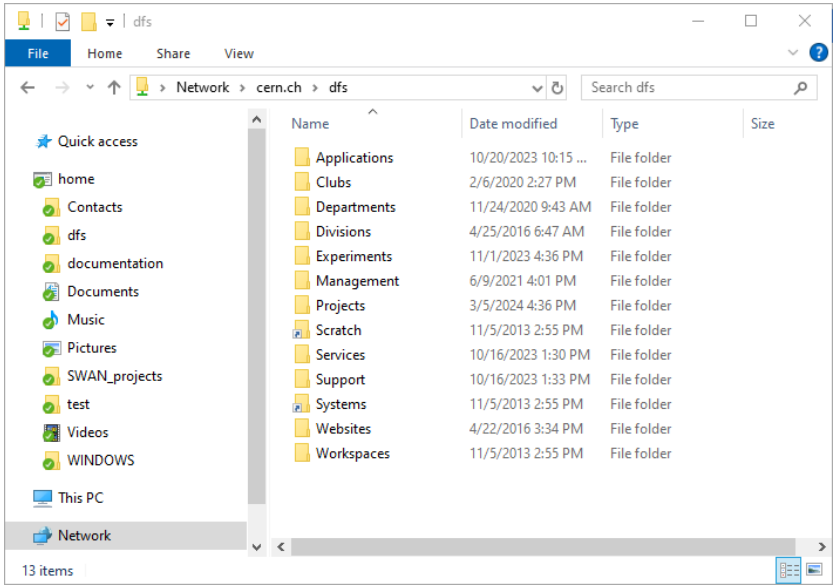
DFS Backup

	DFS
Technology	TSM – IBM Spectrum Protect
Schedule	Daily invoked at 18:00
Type	- Incremental - Image every 4 weeks
Retention	Extra Versions: 300 days Only Version: 370 days
Restore	2nd or 3rd line support

IBM
Spectrum
Protect Plus

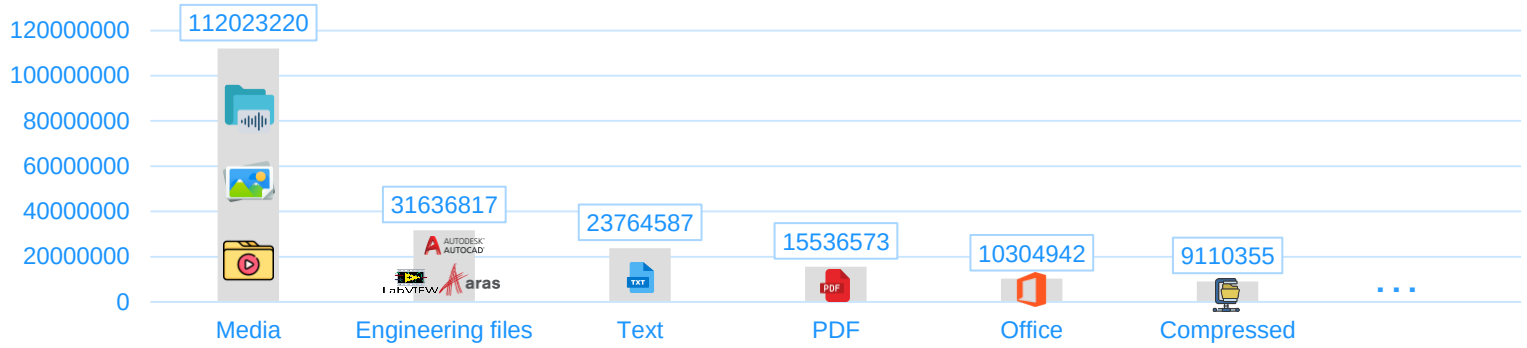
Usage overview

- **Standard DFS projects**
- **UNOSAT dedicated servers**
  (5 servers, 227 TB)
- **MEDIA (CDS content)**
  (12 servers, 257 TB)
- **Engineering data (PLM/ARAS)**
  (5 servers, Storage Spaces Direct)
- **DFS Web hosting storage**
  (2 servers, 4155 websites)



Examples of DFS usage

Total number of files stored on DFS: ~500 millions



- Media (CDS multimedia content, lecture recordings etc.)
- Engineering storage
- Documents
- Web for IIS websites

- Sources (images, drivers) for Windows installations (Diane) and CMF applications
- Antimatter experiments: ALPHA, BASE, …
- Cryogenics, cooling and ventilation, power supply infrastructure data

Size of the service

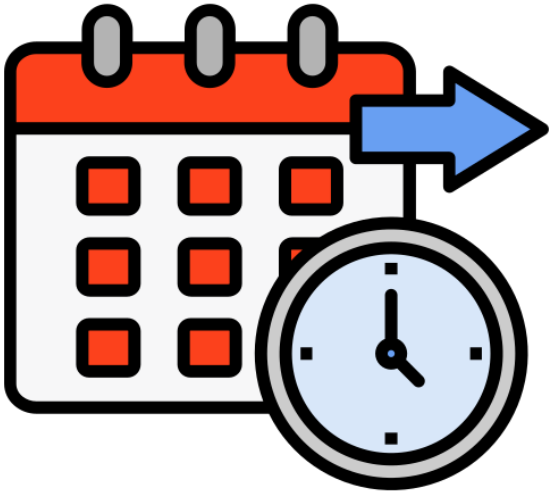
Number of “projects”	**2 870** (**)
Number of websites	4 102 (**)
Users (unique)	6 338 (*)
Accounts (unique, users + web + computers)	15 984 (*)
Data servers	75
Namespace servers	3
Total capacity	~3 PB
Used capacity	~1.5 PB

(*) data from 2024
(**) data from 07/03/2024

DFS plans

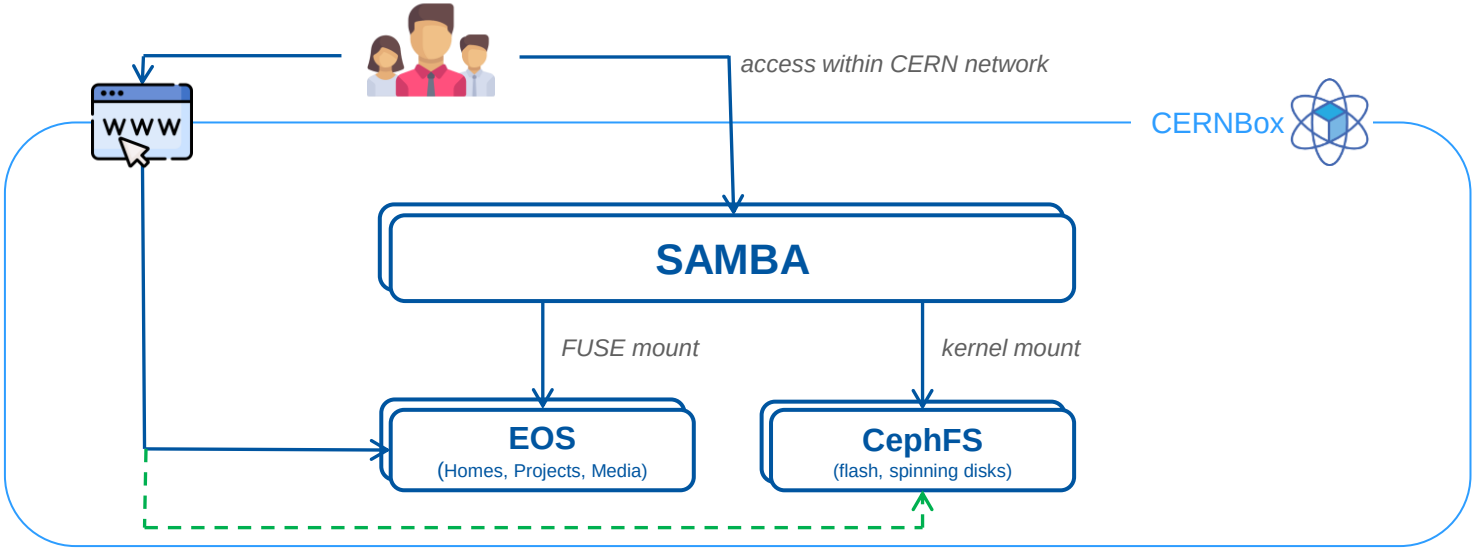
In the context of rationalisation of document management systems at CERN and consolidation of available storage systems the **DFS** is slowly **phased-out**.

CERNBox service replaces DFS delivering higher capacity, sync and share capabilities, modern web interface with applications and many more functionalities.

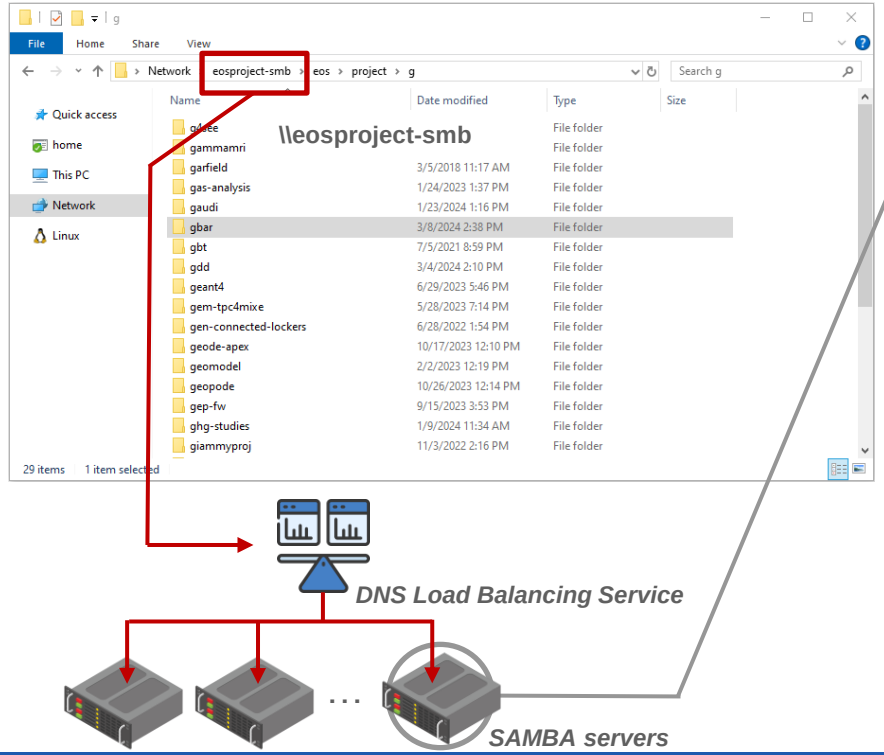


SAMBA gateway in CERNBox

- Provides SAMBA access for Windows clients to CERNBox
- High-available solution implemented based on the CTDB daemon



SAMBA architecture



SAMBA server internals

- CTDB - a high-availability load-sharing CIFS server cluster (floating IPs)
- Bare-metal deployment (due to network constraints at CERN)
- EOS (fuse mount)
  - Homes, media, projects instances
- CephFS (kernel mount)
  - Multiple volumes
- Different ACLs management between EOS and CephFS

Thank you!