XRootD
Status & Plans

WLCG Open Technical Forum #13 — 17 September 2026

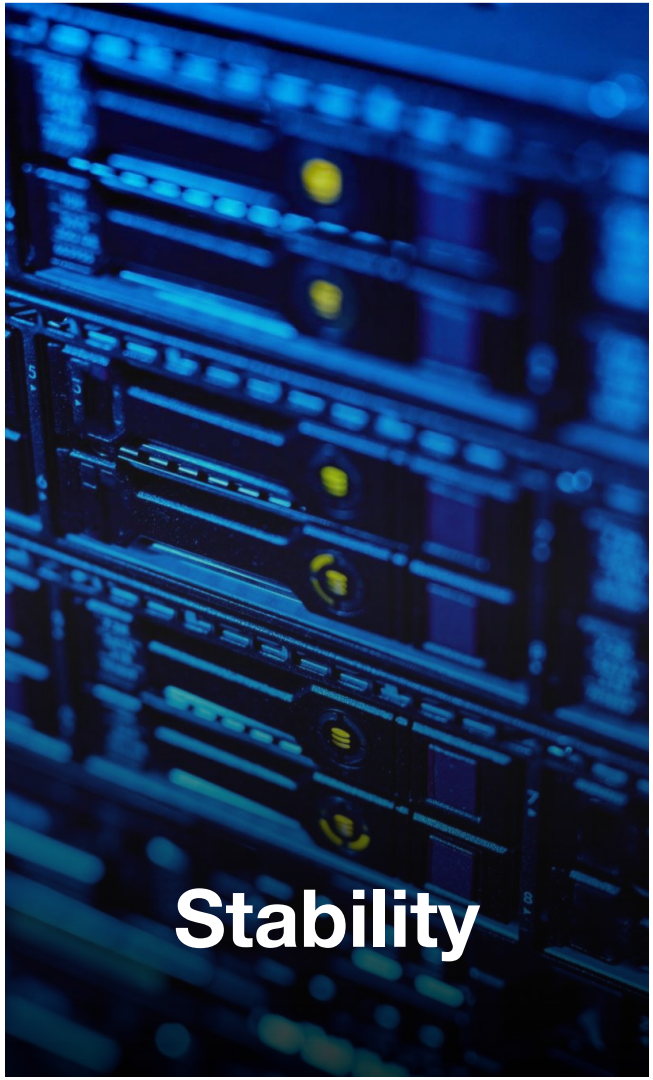
Introduction

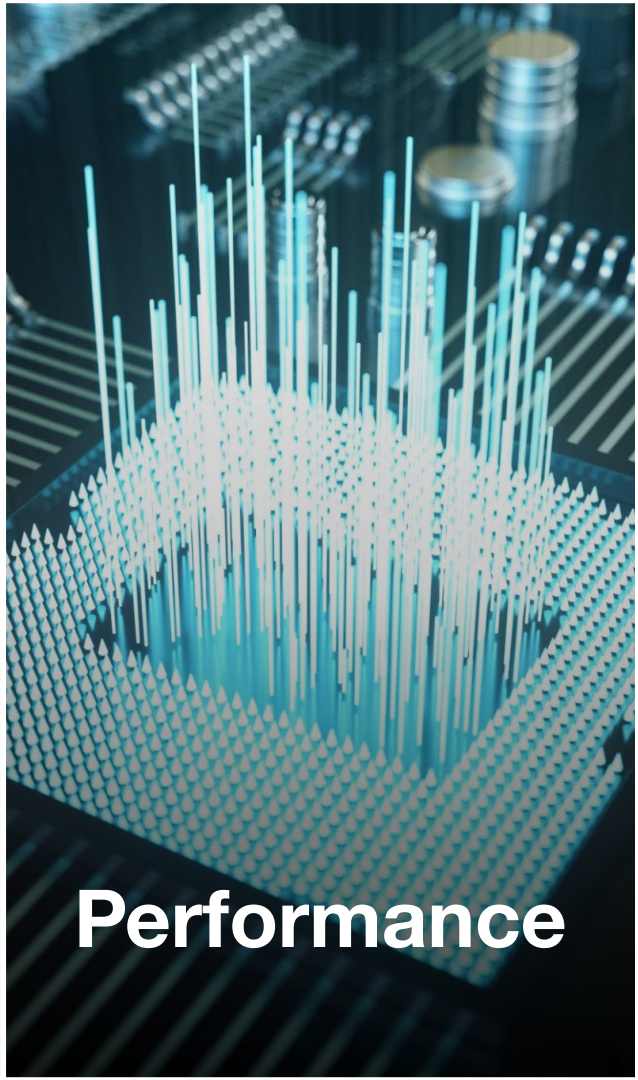
- XRootD is very important for HEP and the broader scientific community
  - Both client and server side components heavily used
- XRootD provides a unique set of features needed by the community
  - Data federation, server, proxy, and cache, third-party copy
  - Support for XRootD & HTTP protocols
  - Authentication methods needed in HEP (Kerberos, X509+VOMS, scitokens)
  - Client libraries (C++ & Python)
- The community's top priorities are our top priorities
  - Security, Stability, Performance as our main pillars
- Steady progress on code improvements and features needed by community
  - Listen to the community's needs and prioritize issues with highest impact
- Look ahead on how to evolve XRootD to continue to support your needs in the long term

What's happened in XRootD since last WLCG OTF?

- 24—25 Mar 2026 — WLCG Open Technical Forum #9
  - 27/03/26 — XRootD 5.9.2
  - 09/04/26 — XRootD 6.0.0
  - 05/05/26 — XRootD 5.9.3, XRootD 6.0.1
  - 18/05/26 — XRootD 5.9.4
  - 19/05/26 — XRootD 6.0.2
  - 29/05/26 — XRootD 5.9.5
  - 01/06/26 — XRootD 6.0.3
  - 20/06/26 — XRootD 5.9.6, XRootD 6.1.0
- 9 Jul 26 XRootD Collaboration Meeting @ CERN
  - 07/08/25 — XRootD 5.9.7
  - 01/06/26 — XRootD 6.1.1
  - Coming soon: XRootD 5.9.8, XRootD 6.2.0

Security


Stability


Performance

XRootD 6.x Highlights

- **XRootD 6.0**
  - Server-side support for file cloning (reflink, copy-on-write)
  - Replace Davix with curl (new implementation of XrdClHttp plugin)
  - Support for tape operations with tokens (**storage.stage**, **storage.poll**)
  - WLCG HTTP TPC data integrity check support (RFC9530)
- **XRootD 6.1**
  - Add support for OpenSSL 4.0
  - New XrdOssMirage plugin to simulate storage
  - Add initial support for streaming real-time checksums
- **XRootD 6.2**
  - Evolution of the XRootD client
    - Support for HTTP TPC in xrdcp
    - Support for HTTP tape REST API in xrdfs
    - Consolidate features into XRootD client so that it can act as the main client in the grid
  - Finalize support for streaming real-time checksums

XRootD 6.x Next Releases

- **XRootD 6.3 (Dec 2026)**
  - XRootD Monitoring: metrics, logs, and traces
    - Native support for Prometheus metrics (XrdMetrics + XrdHttpMetricsExporter)
    - New detailed monitoring collector with support for OpenTelemetry
  - Native support for standard OAuth2 tokens (Keycloak, etc), SSH keys
  - Continue evolution of XRootD command line client and Python bindings as gfal replacement
- **XRootD 6.4 (Mar 2027)**
  - Migrate xrootdfs to support FUSE 3.x
  - Refactor test suite end-to-end tests, significantly improve test coverage
  - Security audit and creation of formal security thread model for XRootD (draft)
- **XRootD 6.5 (Jun 2027)**
  - Server-side support for HTTP tape REST API and CTA integration
  - Client-side monitoring features in XrdCl (monitoring of batch jobs)
  - Improve support for metalink files, enable local metalink support by default
  - Enable true async support in Python bindings, evolve interfaces to be more Pythonic

Major Milestones for 2026

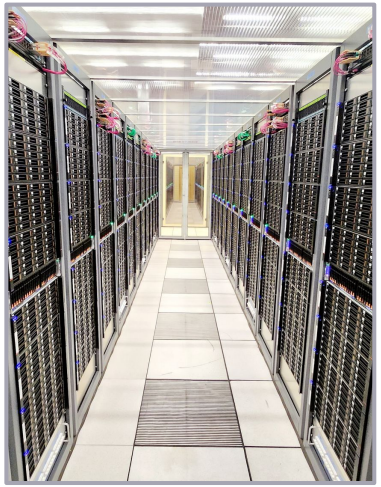
Feature	Description	Impact	Status	Release / Date
XRootD Client HTTP TPC and Tape REST API	Feature parity between xrdcp/xrdfs and gfal2 tools	Enables XRootD to replace Gfal2/Davix to become the main client in the grid	Done	XRootD 6.2 (Sep 2026)
Streaming real-time checksum support	Compute checksum while file is being written to disk	Avoids needing to re-read file later to compute checksum	Done	XRootD 6.2 (Sep 2026)
XRootD Monitoring (metrics & collector)	Cloud native monitoring features, integrated with Grafana	Complete monitoring solution maintained within XRootD project	In Progress	XRootD 6.3 (Dec 2026)
OAuth2 / OpenID Authentication	Bearer-token authentication based on RFC6750	Enables use of CERN SSO tokens with XRootD/EOS (e.g. in SWAN)	In Progress	XRootD 6.3 (Dec 2026)

Major Milestones for the Coming Years

Feature	Description	Impact	Decision Point	Release / Date
Server-side support for Tape REST API	Complete WLCG Tape REST API support in XRootD	Enables vanilla XRootD integrated with tape backends	2026 Q3	XRootD 6.5 (Jun 2027)
Support for async I/O with io_uring	Enables each server thread to hold many I/O operations in flight	Reduced CPU usage due to syscalls, important for HL–LHC era	2026 Q4	XRootD 7.0 (2028)
HTTP/2.0	New HTTP/2.0 protocol plugin to replace XrdHttp	HTTP performance improvements for multi-stream and async operations	2027 Q4	XRootD 7.x (2029)
pNFS	Server-side support for parallel Network Filesystem protocol	Replace FUSE mounts with NFS mounts, use native Linux kernel client	2028 Q4	?

Cloud Native XRootD

- Scattered efforts on GitHub to create container images and Kubernetes integration
  - Many people using Kubernetes to test and deploy XRootD already
- We should create an official XRootD image on DockerHub
  - Improve systemd, SELinux integration while at it
- Make it easy to integrate XRootD into Kubernetes deployments
  - Make image easy to customize XRootD containers/pods
  - Make it easy to cluster pods with xrootd+cmsd in Kubernetes
  - Use containers to extend testing infrastructure to test compatibility across XRootD versions
  - Create and maintain Helm charts to deploy XRootD clusters on Kubernetes
- Evolve XRootD to play well with Cloud Native technologies
  - XRootD Kubernetes integration as storage provider, service proxy
  - Better integration with Keycloak for authentication (OAuth2/OpenID) as alternative to IAM
  - XRootD monitoring with native integration with Prometheus and OpenTelemetry

XRootD in the Scientific Community & Beyond

- XRootD is a core component of the HEP ecosystem, but is also used in other communities
  - ESNet and Open Science Grid (OSG), e.g. LIGO, NRAO, NCAR, United States
  - Science and Technology Facilities Council (STFC), e.g. SKAO, United Kingdom
  - Vera Rubin Observatory (LSST), uses XrdSsi to build clustered MySQL (QServ)
  - InvenioRDM, CERN OpenData, Zenodo
- XRootD needs to be **secure**, **stable**, and **high-performance**
  - Ensuring data integrity, safety, and longevity is our top priority!
  - Ensure XRootD is secure and stable to hold LHC experiment data
  - Ensure XRootD maximizes storage and network performance
- XRootD needs to remain sustainable beyond HL–LHC (i.e. FCC)
  - Make it possible for XRootD to serve our community and its future needs