Proposal for US-Based xrootd Core Development, Testing and Expert-Level Support

Draft 2

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1. Introduction

Xrootd is a robust, highly scalable software system supporting local and distributed access to data. The US HEP program is making increasing use of xrootd, pushing forward the boundaries of its applicability in the areas of worldwide distributed data access, very high transaction rates, and deep storage hierarchies.

There is now an opportunity to deliver very high value to US HEP by applying core development effort across these areas of applicability, and at the same time ensuring adequate support for the more mundane issues of monitoring, security and expert-level support.

Much of the current growth in US xrootd usage takes place in the context of the Open Science Grid (OSG) and LHC distributed computing. This proposal is being developed in collaboration with OSG management as an OSG "satellite" proposal.

2. The xrootd "frontiers"

Worldwide Distributed Data Access: Xrootd is a major component in CMS-initiated developments aimed at any user's being able to get "any data, anytime, anywhere". In this approach, sites are free to choose any file system such as Hadoop's HDFS, Lustre, dCache, xrootd, etc. Xrootd provides the distributed data discovery system that makes all data transparently accessible to all authorized users.

Very High Transaction Rates: Xrootd technology is fundamental to the current LSST design for a responsive system supporting queries over a petabyte-scale database. LSST's "qserv" inserts xrootd between a MYSQL front end, and hundreds to thousands of shared-nothing MYSQL back-end servers. The qserv software decomposes a user query into thousands of sub-queries. Xrootd routes the sub-queries to the appropriate MYSQL server and qserv collects the results.

Multi-tier Storage: Storage must provide cheap, reliable petabytes, while supporting localized high access rates. Each activity needs the optimal mix of solid-state storage, high-performance disks, cheap slow disks, and sometimes tape. The goal is to give the science application the needed petabytes and access rate for the fewest dollars. A prototype of xrootd multi-tier storage is in production at the SLAC ATLAS Tier 2.

Each of these frontiers drives core xrootd developments and frontier-specific additions. The core development philosophy is to maintain a clean, "shared nothing" architecture that allows a vast range of use cases with practically zero case-specific code.

3. Proposed Work

We propose to improve massively the efficiency of data-intensive US HEP activities though coordinated developments at the three frontiers of xrootd applicability. A complementary effort in monitoring, security, testing and expert-level support will also be required. All work will take place within the context of the international Xrootd Collaboration. A two-year project is proposed. This field is evolving rapidly, and the need for longer-term effort should be reevaluated during the second year.

The frontiers justify and drive the development program, but the technical work is partitioned into functional activities. This will help to ensure the maximum coherence within the xrootd system.

Activity	**FTE year 1**	**FTE year 2**
* Project Coordination	0.2	0.2
* Overall Architecture[1]	0.2	0.2
* Server Code[1]	0.4	0.4
Client Code[1]		
Monitoring – instrumentation, management of monitoring data, administration tools, standardized APIs for "Dashboard" systems[1]	0.45	0.45
Security[1]	0.1	0.1
* Testing, functional and at-scale	0.2	0.3
Packaging and distribution (software, examples, configuration files)[1]	0.05	0.05
* Support provided at the developer level	0.2	0.3
TOTAL	1.8	2.0

[*] US has prime responsibility for this area
[1] Includes appropriate documentation

The table shows the US effort proposed in addition to the current core effort of approximately 1 FTE funded largely by US ATLAS. A matching increase in non-US effort, focused in the areas of client code, monitoring, security and packaging, is under active discussion.

The center of the new effort would be SLAC. We will seek to build on existing relationships to involve university-based partners, particularly in the monitoring development and testing.