Code health in EOS

Improving test infrastructure and overall service quality

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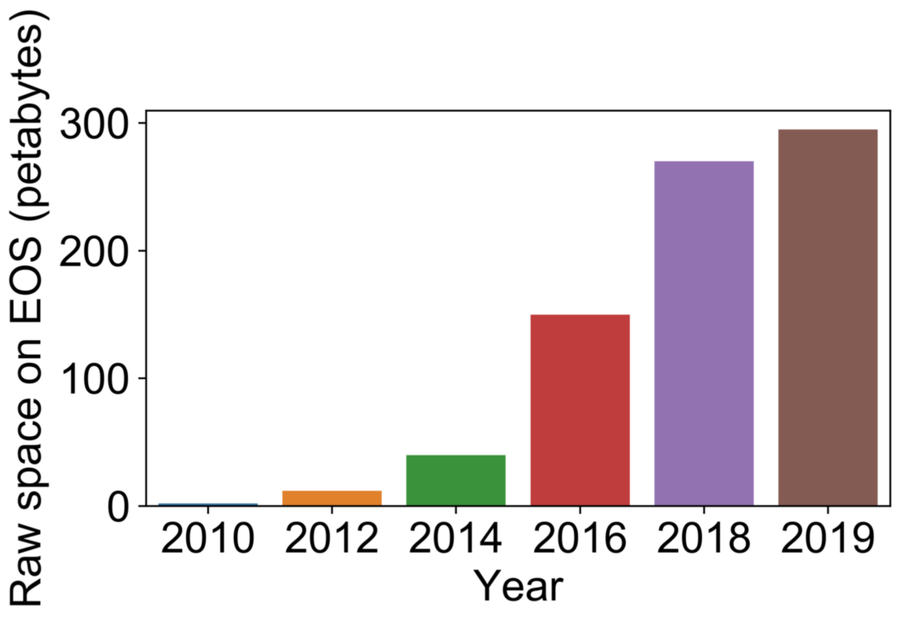
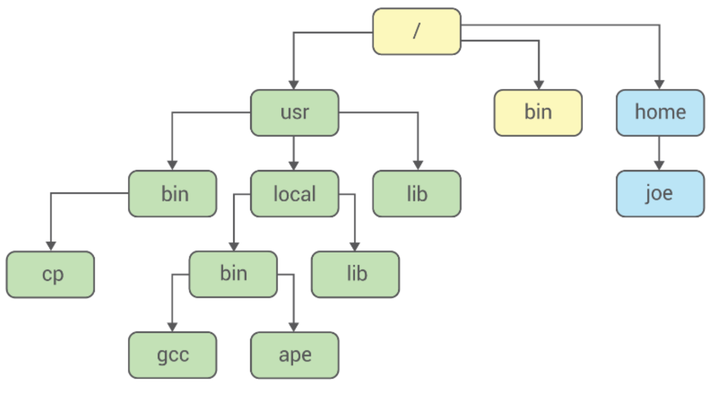
Introduction

EOS, the distributed storage system developed and deployed at CERN, recently reached the milestone of **300 PB** in total deployed raw disk space, storing approximately **5 billion files** across more than **50.000** physical hard drives.

This has brought the unwelcome side-effect of stretching the EOS software stack to its design constraints, resulting in frequent user-facing issues and occasional downtime of **critical** services.





Design limitations

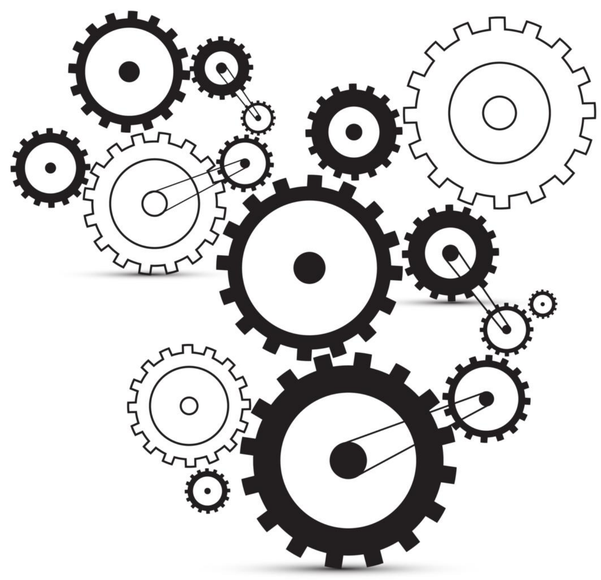
The most significant issue affecting EOS **uptime** has been its in-memory namespace implementation. The metadata server had to scan through the entire namespace contents during boot, taking up to **1 hour** for large instances.

This greatly amplified the disruption caused by occasional server crashes and upgrades, as a simple process restart would take very long. The **new namespace** based on QuarkDB has now been deployed across all EOS instances, making metadata server restart virtually **instant**.

Accumulated technical complexity

Over the past several years of its operation, EOS has received many feature requests both from end-users as well as operators, causing an accumulation of code complexity and some difficulty in ensuring a **reliable service** in face of heavier and heavier production traffic.

To counter these effects, a refactoring effort is being undertaken with the goal of significantly simplifying the C++ codebase and increasing test coverage.



On-going testing strategy

Comprehensive testing at the development stage will enable both a **lower incidence** of user-facing issues, as well as a more **robust development process**. The cornerstones of our testing strategy are **Gitlab CI** and **Kubernetes**, allowing to spawn virtual clusters and orchestrate demanding test scenarios on a nightly and weekly schedule.

- **Unit tests** to validate individual functions and classes.
- **Functional tests** to validate entire subsystems, such as namespace or inter-cluster messaging.
- **AddressSanitizer tests** for detecting hard-to-identify memory corruption bugs.
- **Stress tests** for validating cluster stability under heavy load.
- **Performance tests** to measure end-to-end performance and overall system scalability.
- **Coverity scanning** for static code analysis.

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