FSx for Lustre

FSx for Lustre and Open Source

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Topics

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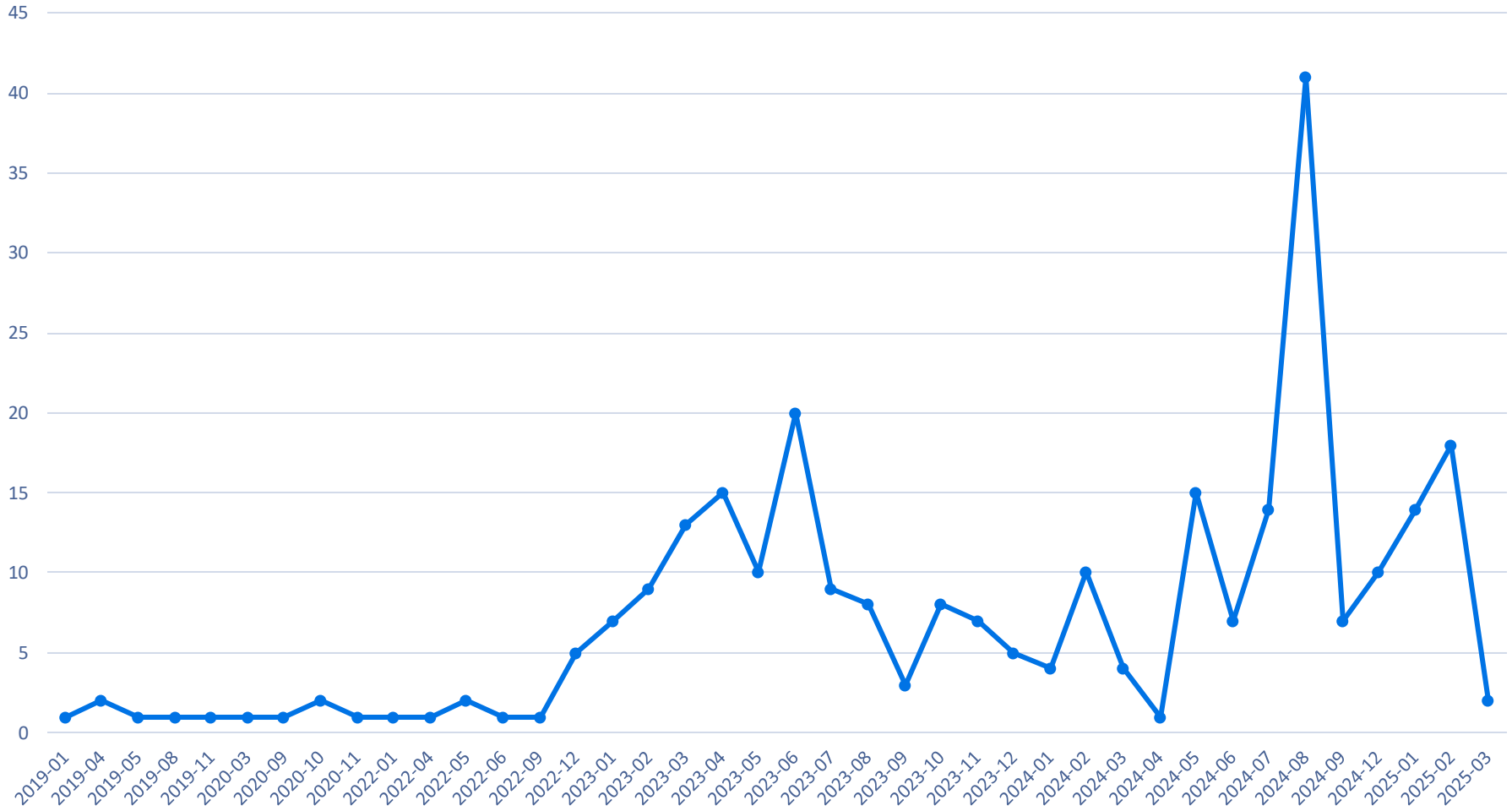
Overview

Contributions from AWS

NUMBER OF COMMITS CONTRIBUTED IN EACH MONTH



High Activity

AWS is increasingly active in Lustre.

Generated with:

```
git log --pretty=format:"%ae %ad" --
date=format:"%Y-%m" | grep "@amazon.com" |
awk '{print $NF}' | sort | uniq -c
```

Elastic Fabric Adapter (EFA) for Lustre

Why EFA?

- Unlock higher network throughput for customers
  - 8x – 12x throughput improvement on p5 H100 GPU instances
  - GPUDirect Storage (GDS)
  - RDMA
- Lustre is designed around RDMA

Protocol and LNET Changes

- LU-18808 - Unique addressing format for 2.15+ (to avoid IPoIB)
  - 171.12.97.0@efa = 10.200.171.12@tcp + 61:00.0
- Heterogeneous network
  - Protocol negotiation
  - MDS on ksocklnd and OSS on kefalnd
- Leverage UDSP and LNET Multirail

Future Work (EFA)

- Upstreaming!
- Investigate new p2pdma APIs (565.57.01) for GDS on for upstream Linux client

LLVM and Static Analysis

The Strengths of LLVM

- LU-16518 - Implement LLVM/Clang build support
- Different set of default warnings
- Powerful plugin ecosystem
  - LU-8191 – Marking static functions with FindStatic
  - LU-18753 - Purging orphaned code with xunused
  - Enforcing code organization
- Many opportunities for introspection

How to Use It

- Build the kernel using LLVM: https://docs.kernel.org/kbuild/llvm.html
- Build Lustre using LLVM:

./autogen.sh

./configure LLVM=1 – OR –

./configure LLVM=1 --disable-strict-errors

make

Everything should just work!

LLVM vs. Alternative Static Analysis

- LU-17000 – Fix Coverity Scan issues
- Coverity captures many issues
- Coverity has a higher false positive rate
- LLVM and plugin ecosystem is FOSS and easier to run locally
- LLVM is extensible

Future Work (LLVM)

- LLVM19+
- Leverage plugins to enforce code organization efforts required by upstreaming
- Improve native plugin integration

In-memory OSD and more!

In-memory OSD

- LU-17995 – Implemented a purely in-memory OSD (Object Storage Device). This enables Lustre servers to be run solely from memory (without ZFS or ldiskfs)
  - Prototype (3-5 kLoC)
  - Primarily targeting testing use-cases (at first)
- LU-17848 – Share more code between existing OSDs
- LU-17079 – Improve userspace handling of new OSDs
- LU-18813 (DDN) – OSD wbcfs derived (partially) from the in-memory OSD prototype and the memfs from MetaWBC

Future Work (OSD)

- Land the initial implementation of the OSD
- Enhance debugging/monitoring infrastructure
- De-duplicate more code!
- Update the documentation in “Documentation/osd-api.txt”
- Investigate mirroring or writeback

General Improvements

- LU-8802 – Remove MAX_OBD_DEVICES to allow many mounts
- LU-18162 – Improve lu/obd device handling
- LU-17216 - Tunable enable_health_write disk health checker
- LU-17242 - General debugging improvements
- LU-17862 - Unify more kernel modules

Upstreaming to Linux and LSF/MM/BPF

Upstreaming Lustre into the Linux kernel

- Good for Lustre
- Benefits AWS customers
- Lustre and Linux are stronger together!
- Much of our work is aimed towards upstreaming

LSF/MM/BPF

- Attended LSF/MM/BPF to advocate for upstreaming Lustre into the Linux kernel
- Warm reception!
- Plenty of work remaining:
  - Focusing primarily on the client
  - We must convert Lustre to use folios!
  - Client/Server code split
- Follow the project on the newly created wiki page: https://wiki.lustre.org/Lustre_Upstreaming_to_Linux_Kernel

Thank you!

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