OpenZFS on Linux Development

OpenZFS Developer Summit
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OpenZFS on Linux

- Current version 0.6.3 (released June 12th 2014)
- Easy to install packages for many distributions.

- Large enthusiastic user community.
  - zfs-discuss@zfsonlinux.org
  - #zfsonlinux on freenode.net
  - http://zfsonlinux.org
OpenZFS on Linux – Version 0.6.3

- Near feature parity with other OpenZFS implementations.
- Systematically addressing gaps in functionality
- Wide spectrum of users
- Used on diverse hardware
- Contributions (0.6.2-0.6.3)
  - 58 different developers
  - 301 commits

<table>
<thead>
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<th>Highlights</th>
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<td>Updated Write Throttle</td>
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<td>ARC Performance Improvements</td>
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<td>POSIX ACLs</td>
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<td>File Attributes (immutable, append-only)</td>
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<td>Relatime style updates</td>
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<td>SELinux Integration</td>
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<td>Systemd Integration</td>
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<td>ZFS Event Daemon (ZED)</td>
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<tr>
<td>Aarch64 and Sparc64 Support</td>
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<td>Over 200 Bug fixes</td>
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OpenZFS on Linux – Version 0.6.4

- Continue to integrate OpenZFS features
- Continue to address known gaps
- Continue to improve Linux integration
- Contributions (0.6.3-HEAD)
  - 37 different developers
  - 141 commits

**Planned Highlights**

<table>
<thead>
<tr>
<th>Feature Flag: Spacemap Histograms</th>
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<tr>
<td>Feature Flag: ZFS Bookmarks</td>
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<tr>
<td>Feature Flag: Hole Birth</td>
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<td>Feature Flag: Embedded Data</td>
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<td>Metaslab Improvements</td>
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<td>Xattr Improvements</td>
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<td>AIO and DirectIO Support</td>
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<td>Fallocate Hole Punching</td>
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<td>Linux Tracepoints</td>
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<tr>
<td>NFS access to .zfs/snapshot</td>
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<td>100 bug fixes and counting</td>
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The Road to Version 1.0.0

- Minor releases have a development focus
  - 0.6.x – Functionality / Integration
  - 0.7.x – Memory Management
  - 0.8.x – ZFS+SPL Consolidation
  - 0.9.x – Stable ABI / Hardening
  - 1.0.x – Feature Development / Performance

- Longer term roadmap to guide development
- Current development activities continue in parallel
- Features and bug fixes are merged when ready
OpenZFS on Linux - Version 0.7.x

- **Focus:** Memory Management
- **Goal:** ARC / page cache integration
  - Data buffers will be backed by page vectors
  - Data pages will be mapped in to the page cache
- **Benefits:**
  - Uses standard Linux memory accounting mechanisms
  - Uses standard Linux memory reclaim mechanisms
  - Eliminates fragmentation overhead
  - Eliminates `mmap` double caching
  - 32-Bit platform support (x86, ARM)
OpenZFS on Linux - Version 0.8.x

- **Focus:** ZFS+SPL Consolidation
- **Goal:** Merging ZFS+SPL git repositories
  - Existing layering is preserved
  - An opportunity to define the ZFS kernel ABI
- **Benefits:**
  - Simpler packaging for users and maintainers
  -Eliminates the kmod dependency problem
  - Eliminates the risk of mismatched versions
  - One source tree for developers
  - Improves portability for non-Linux platforms
OpenZFS on Linux - Version 0.9.x

- Focus: Stable ABI / Hardening
- Goal: Finalize a stable user/kernel ABI
- Benefits:
  - Smoother upgrades / downgrades
  - Establishes a clear user/kernel ABI for Linux

- Goal: Hardening
  - Gracefully handle a wider range of potential failure modes
  - Fault management via the ZFS Event Daemon (ZED)

- Benefits:
  - Enables deployment of lower end commodity hardware
  - Even more robust operation
OpenZFS on Linux - Version 1.0.x

- Focus: Feature development / performance
- Goal: Mature high quality code base
- Benefits:
  - Semantic Versioning
  - New feature development
  - Performance analysis
Development Model

- Project hosted at Github
  - [https://github.com/zfsonlinux/](https://github.com/zfsonlinux/)
  - 1201 Watchers, 300 Forks

- illumos is tracked as upstream

- Independent of the Linux Kernel
  - Decouples ZFS from kernel updates
  - Linux 2.6.32 – 3.17 kernels supported
  - Enables use on non-Linux platforms
  - ZFS utilities / kmod can share code
  - Easier to integrate OpenZFS changes from Illumos/FreeBSD/OSX/OSV
Development Model – Issue Tracker

- Github issue tracker
  - Feature requests, bug reports, and milestones
    - Developers actively participate on the tracker
    - 539 open issues including 115 feature requests
  - Everything is as open and public as possible
  - Discussion by users and developers is encouraged
  - Issues are cross-linked to relevant git commits
# Development Model - Milestones

<table>
<thead>
<tr>
<th>Version</th>
<th>Status</th>
<th>Description</th>
<th>Progress</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6.4</td>
<td>Open</td>
<td>ZFS on Linux v0.6.4 - Functionality / Integration</td>
<td>74% complete</td>
<td>101 open, 284 closed</td>
</tr>
<tr>
<td>0.7.0</td>
<td>Open</td>
<td>ZFS on Linux v0.7.0 - Memory management</td>
<td>51% complete</td>
<td>90 open, 95 closed</td>
</tr>
<tr>
<td>0.8.0</td>
<td>Open</td>
<td>ZFS on Linux v0.8.0 - ZFS+SPL Consolidation</td>
<td>32% complete</td>
<td>17 open, 8 closed</td>
</tr>
<tr>
<td>0.9.0</td>
<td>Open</td>
<td>ZFS on Linux v0.9.0 - Stable ABI / Hardening</td>
<td>17% complete</td>
<td>5 open, 1 closed</td>
</tr>
<tr>
<td>1.0.0</td>
<td>Open</td>
<td>ZFS on Linux v1.0.0 - Feature Development / Performance</td>
<td>0% complete</td>
<td>0 open, 0 closed</td>
</tr>
</tbody>
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Development Model – Pull Requests

- Github pull requests
  - Used to submit proposed code changes
  - All proposed changes must be reviewed
  - Continuous integration development model
    - Proposed changes are automatically tested using buildbot
    - Developers get quick feedback on any proposed change
    - Good test coverage (kernel, architecture, distribution, etc)
    - Changes are tested a second time after being merged
    - The master branch is *always* kept stable
  - Designed to make it easy for anyone to contribute
  - LLNL currently acts as the gatekeeper
Development Model – Pull Requests

Linux tracepoint integration #2874

nedbass wants to merge 4 commits into `rsonlinux:master` from `nedbass:b_tracepoints`

Conversation 0  Commits 4  Files changed 18

nedbass commented a day ago

See #2406

Changes from the PR by @prakashsurya:

- Implement `dprintf()` as a tracepoint.
- Implement two new `DTRACE_PROBE`'s
- Refactor patch stack and make it compile-compliant
- Address feedback from @behlendorf on #2406

One thing I'm concerned about is the 256 byte stack buffer used by `dprintf()`. While short-lived this could potentially push stack usage over the limit. I've seen messages as long as 202 bytes to this isn't an unreasonable size, but we may want to consider dynamic allocation if this turns out to be problematic.

nedbass and others added some commits 17 days ago

Move a few internal ARC structures to arc_impl.h

Fix `dprintf` format specifiers

cstyle: allow right paren on its own line

Swap `DTRACE_PROBE` with Linux tracepoints
Development Model - Buildbot
Join Us, Contributors Welcome

- If you are a developer…
  - Port a change from Illumos/FreeBSD/OSX/OSV
  - Review or comment on a proposed pull requests
  - Implement a requested feature or fix a known issue
  - Help us improve the automated testing

- If you are a user…
  - Open a new issue if you encounter a problem
  - Open pull requests even for trivial fixes
  - Help us rigorously test new features and bug fixes
Questions