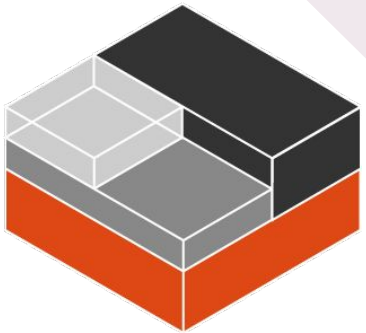
New Container Kernel Features



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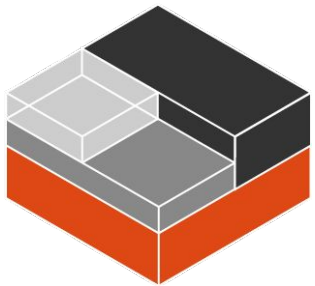
CANONICAL ubuntu

Seccomp: notify target

- **Allows running less privileged containers**
  Unprivileged containers can be granted very specific privileges.

- **Seccomp asks userspace for return value and errno**
  Execution does NOT continue in the kernel, userspace must do the work.

- **Initial support landed in 5.0**
  Userspace requires un-released libseccomp.

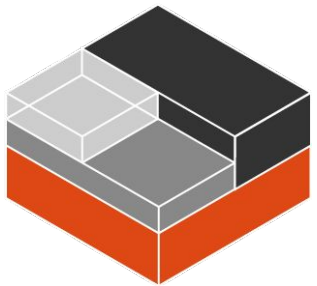


Seccomp: notify target -> resume syscalls

- **Builds on top of existing notify target**
  Effectively a new type of return value from userspace.

- **Allows for complex userspace filtering**
  For cases where the kernel cannot filter on some arguments.

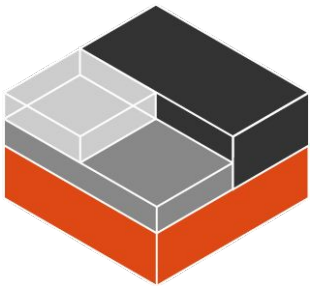
- **No raised privileges**
  Execution continues in the kernel with original privileges.



Seccomp: extended syscall filtering

- **In-kernel filtering of pointer arguments**
  Filter syscalls such as clone3(), bpf() etc.

- **Discussion scheduled for KSummit in Lisbon**
  https://lists.linuxfoundation.org/pipermail/ksummit-discuss/2019-July/006699.html

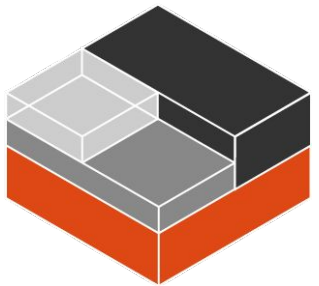


LSM: stacking

- **Run Ubuntu on Fedora (AppArmor) or Android on Ubuntu (SELinux)**
  Allows them to retain their individual LSM policies.

- **Goal is to stack major LSMs on top of each other**
  AppArmor on SELinux or SELinux on AppArmor.

- **Currently can stack minor LSMs with major LSMs**
  TOMOYO, loadpin, etc. with AppArmor or selinux.

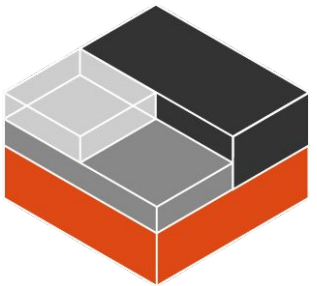


LSM: safeSetID

- **Restrict id transitions through setid-like syscalls**
  System policy determines what transitions are allowed.

- **Mostly useful for privileged containers**
  Can be used to allow a limited range of uid/gid for the container.

- **Will be in Linux 5.3**



New mount API

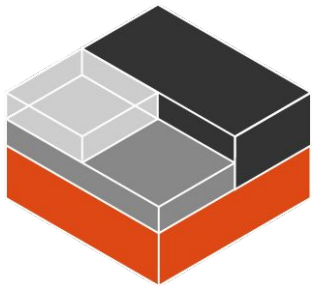
- **Use file descriptors for mounting**
  Mounts are created, configured, and setup via file descriptors.

- **Anonymous mounts**
  Mounts that are not attached to any path in the filesystem.

- **Avoids numerous race conditions**
  Container managers cannot trust the container's mount table.

- **Potential for clean uid/gid shifting**
  Shiftfs-in-vfs approach.

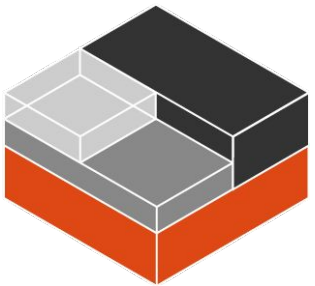
- **Potential for setting up namespace**
  Mounting into a set of namespaces.



Keyring namespacing

- **Namespace keyring facility**
  Allows to have per-container keyrings.

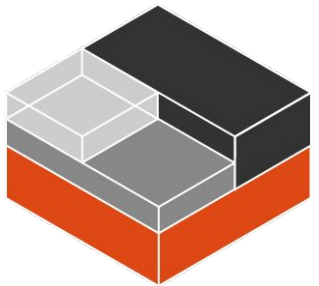
- **Use by network filesystems**
  Keyring namespaces will allow per-container authentication.



openat2() syscall

- **Restrict path resolution**
  LOOKUP_NO_XDEV, LOOKUP_NO_MAGICLINKS,
  LOOKUP_BENEATH, LOOKUP_NO_SYMLINKS, LOOKUP_IN_ROOT

- **Restrict O_PATH file descriptors**
  Prevent elevating permissions through magic symlinks.



pidfd API

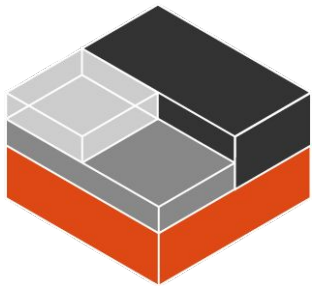
- **File descriptor referring to a process**
  Eliminates inherent races in process management.

- **Get with clone() and CLONE_PIDFD**
  Request pidfd be returned together with pid.

- **Send signals with pidfd_send_signal()**
  Race-free signal sending (no accidental wrong target).

- **Get pidfd for an existing process with pidfd_open()**
  Create pidfd for processes created without CLONE_PIDFD.

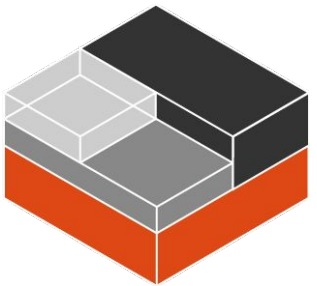
- **Poll on a pidfd**
  Get exit notifcation for non-child processes.



CLONE_SET_TID

- **Request a specific PID**
  Process will be created with a specific PID.

- **Interesting for CRIU**
  Significantly improves restoring of container workloads.



Questions ?

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