Efficient Kernel Backporting

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http://www.linaro.org

Why is old stable kernel?

- Product considerations
  - Product Time line, life cycle
  - Kenrel/user API, in-kernel API
    - /sys, /proc,
    - Driver API
  - Stability

Extra Features Needed

- Desire for extra features?
  - Latest drivers, functions or security updates, like
    - PCI-E support
    - Cgroup writeback, hibernation on arm64, KASAN
    - Or out of tree features:
      HMP/EAS on ARM for big LITTLE arch.

Solutions and Disadvantage

- Solution: LTS + feature backporting
  - An example: Linaro Stable Kernel
    - https://wiki.linaro.org/LSK
- Disadvantages of backporting
  - Repeated work for enabled feature
  - Less review/testing from community
  - Trouble with newer API or other components

Ideal Solutions?

A ideal upstream kernel?

- A bug free kernel? no
- Consistent kernel API, like: driver API, /proc, /sys, ioctl ? no

Before Backporting

Backporting Preparation

- Get requested feature resources:
  - Get feature info from requester, what/why
  - Get feature profile from lwn.net or wiki
- Which version of feature is best:
  - First target is always the upstream patchset
  - An old version feature maybe acceptable, if it's using old kernel API.

Get all feature commits

- Know feature patches from lkml
- Get commits in git tree
  - Get commits list from feature related source files and headers
  - All commits mentioned feature name
  - get all writeback cgroup patches by author

git log -i -G'KASAN' v3.18..v4.4 (54 commits)
git log -i --grep=kasan v3.18..v4.4 (126 commits)

git log --author=tj@kernel.org --reverse v4.1.18.

Backporting

Backporting

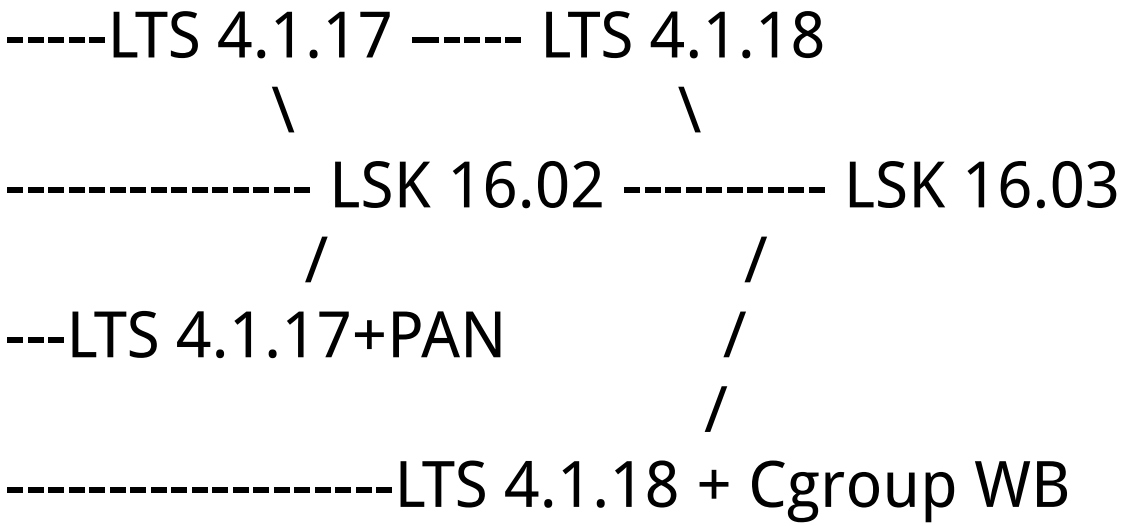
- Pick up wanted changes/commits

  $git cherry-pick -sx commit1..commit2

  - git cherry-pick a patchset range
    - Get all commit at once, easily disturbed by dependent missing.
  - git cherry-pick patches one by one.
    - Easy to control for every commits

Backporting Path

- An example of backporting organize:



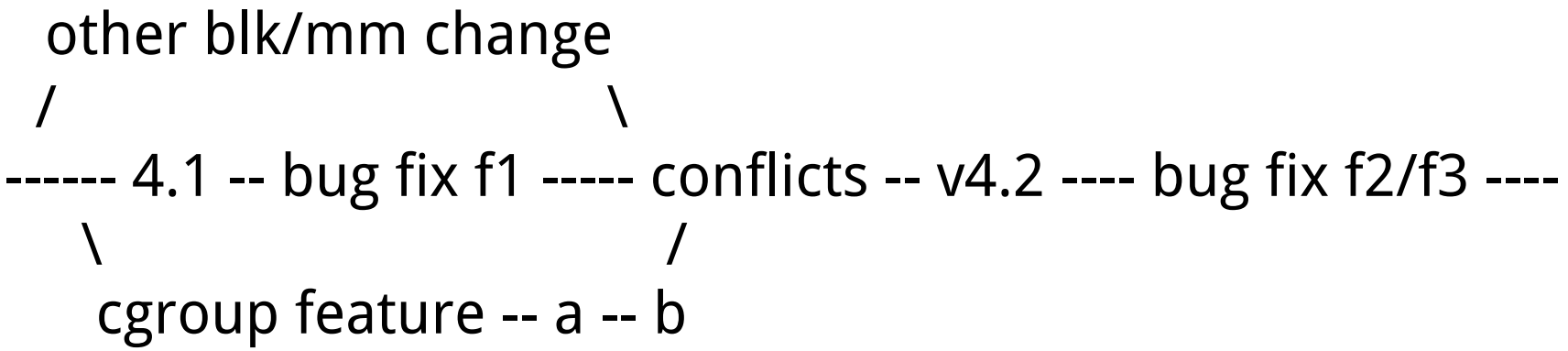
Conflicts & Solutions

Conflicts & Solutions

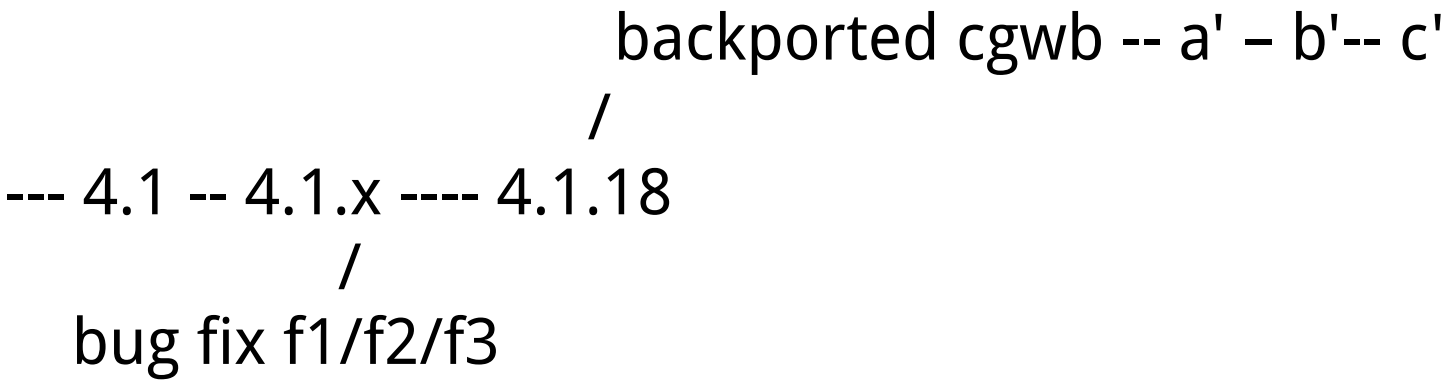
- Conflicts: middle changes missed
  - Direct code base changed
    - Know reasons of the changes, pick or skip
  - Miss some dependencies
    - Find and pick them
  - Feature coupled with other kernel components
    - Cut off the connection maybe better
    - Or bring trouble on the other kernel part

Feature/LTS Conflicts

- Possible upstream situation:



- Usual solution for cgroup writeback LTS branch:



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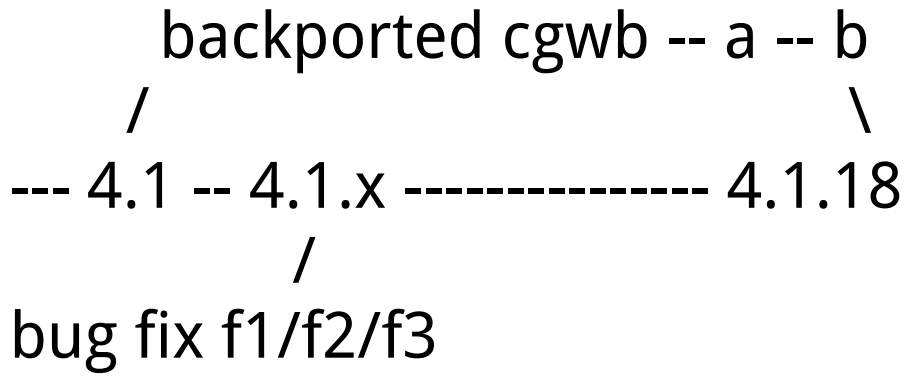
Feature/LTS Conflicts

- A better way:

Do the backporting on v4.1 kernel, and left the conflicts on merging to 4.1.18



Tips for Conflicts

- Reduce conflicts
  - Find out all related changes on feature code area
    - Pick up from base to upstream direction
  - Pick up the related set commits instead of only single related patch,
    - Use gitk not git log --graph to find out the commit set

Tips for Conflicts

- Conflicts solution reuse
  - Use git rerere to reuse conflicts solutions
- Find commits that trigger conflicts
  - Tools git log, git blame

    git log -G'extern void inet_twsk_put' – include/net/inet_timewait_sock.h

    git log v3.10..v3.18 -S'newsk->sk_v6_rcv_saddr = ireq6->loc_addr' -- net/dccp/ipv6.c

Don't Do ...

- Don't change kernel/Uese API /sys, /proc etc
  - System applications
- Don't pick up big coupled kernel parts
  - Cut off early
- Don't change driver API
  - Downstream drivers

Post Backporting

- Check if all necessary patches picked
  - Scan and compare all changed and related commits

    git log --cherry v4.4...v4.1/topic/KASAN -- ./mm/kasan ./include/config/have/arch/kasan.h ./include/linux/kasan.h ./arch/arm64/mm/kasan_init.c ./arch/arm64/include/asm/kasan.h

- Testing
  - Seek testing method from community

Post Backporting

- Scan bug fix for picked commits

  https://git.linaro.org/people/alex.shi/scripts.git/blob/HEAD:/chkfix.sh

  The latest features are often buggy, so scan the upstream kernel, to see if any commits which you picked was mentioned by others, that's probably a bug fix.

Post Backporting

- Notice your users of Any API changes if you have to do so.
  - Explain reasons
  - And give compatible solution for changes

Expectation for Upstream

- Stable, stable, stable
- The less API change, the better.
  - Stands of API
    - Libcgroup, DRM, memfd,
    - Driver API
- keep old function when new ones introduced
    - Good examples, cgroup v2 coexist with cgroup v1

Thanks!