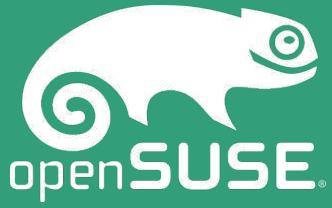

Reproducible builds

of openSUSE Factory and SLE

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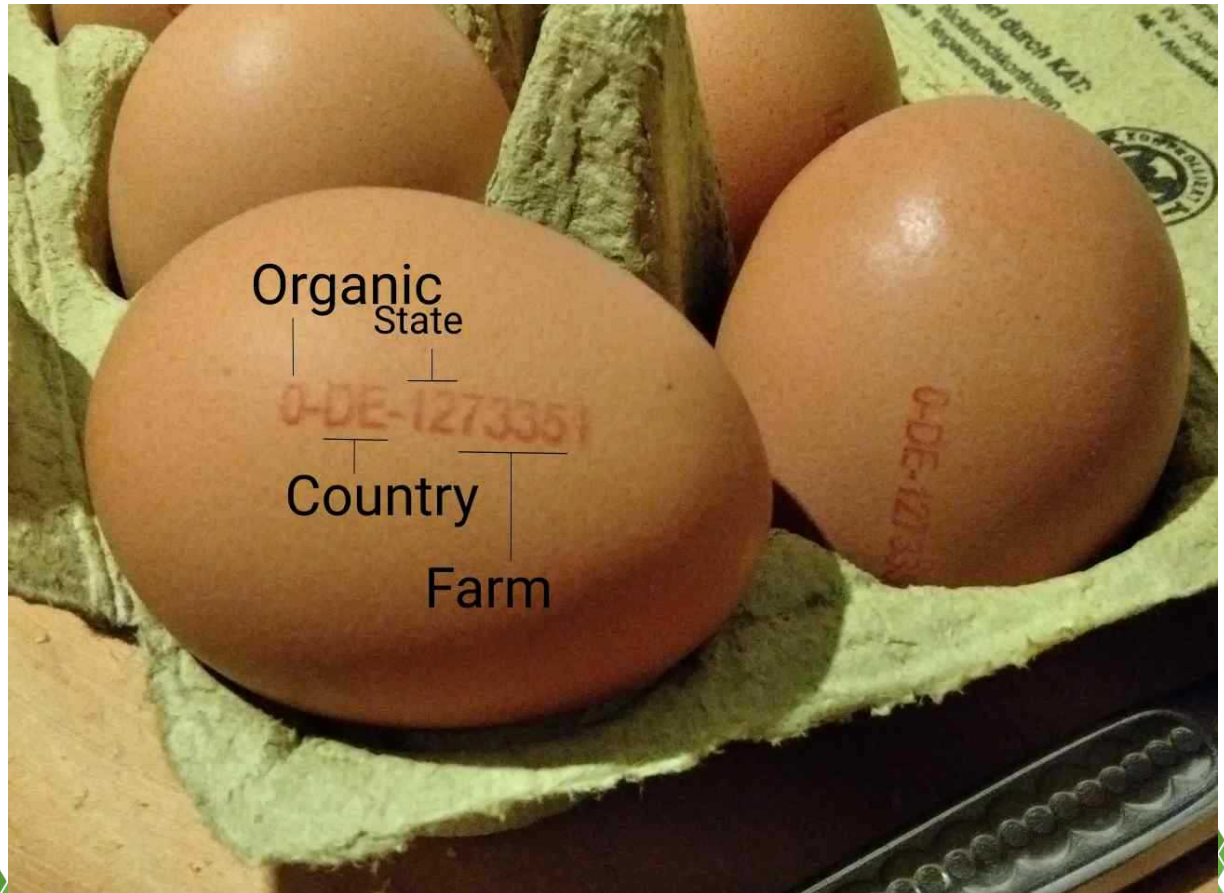
Introduction

About me

- working since 2010 for SUSE
- active since 2016 in reproducible builds
- interested in IT security for decades

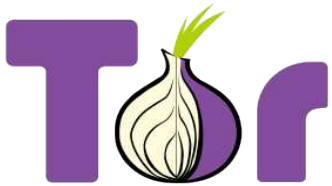
The Problem

Why do we stamp out eggs?

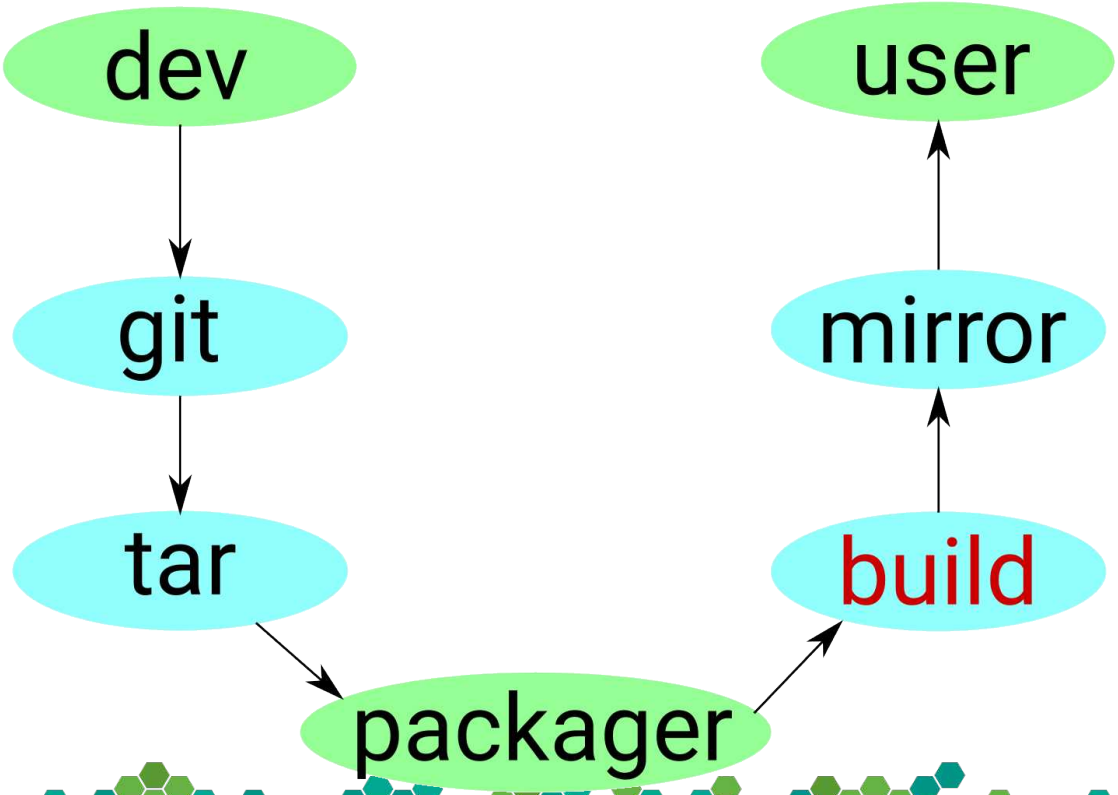


Where our eggs come from

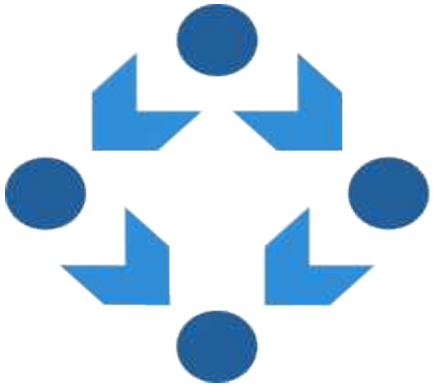
Similar problem with software



Where does our code come from



The solution

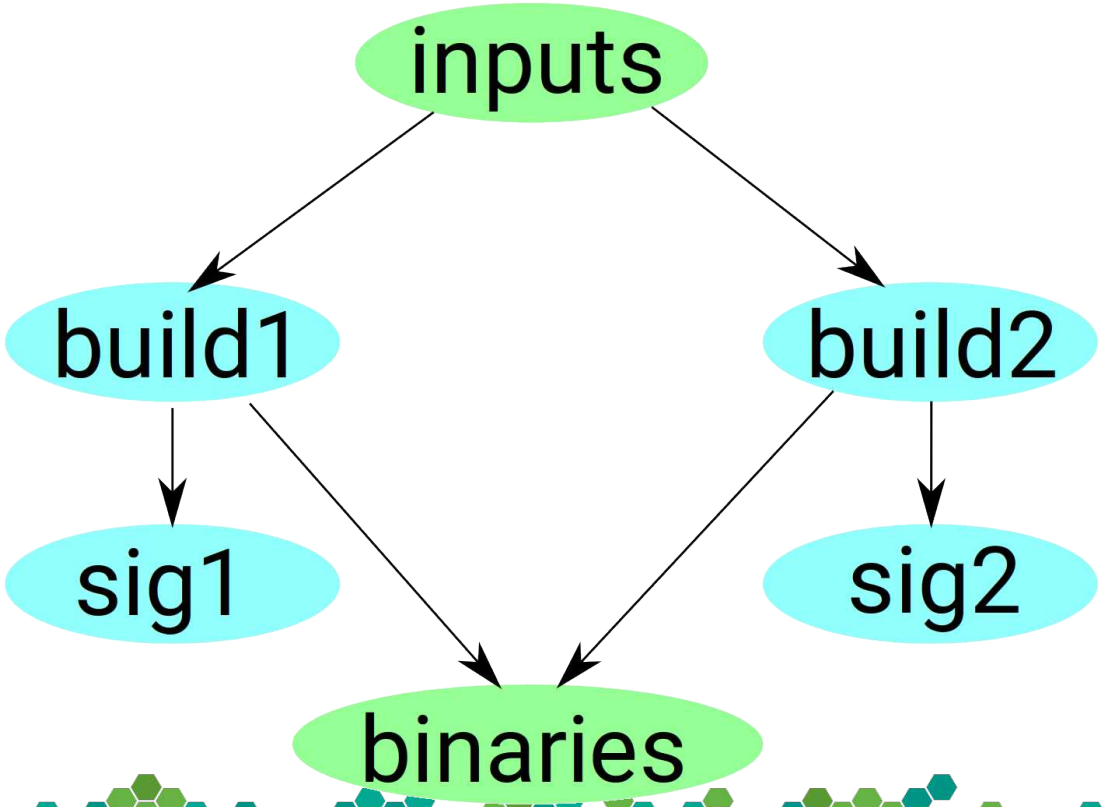


Reproducible Builds

What are reproducible builds?

- Get the same results from building sources twice
- Two use-cases
  - ideally bit-by-bit identical (thus same hashes)
  - weaker: same content after applying some filters (via build-compare)

RB diagram



Why reproducible builds?

- Need less trust in the build hosts
- Reduced load on build-service from rebuilds
- Smaller delta-rpms in update repos
- Save bandwidth (by building locally)
- Find other bugs that corrupt data during build time (e.g. boo#1021353, boo#1021335, bash, libcbor)

Typical problems

- embedded timestamps, hostname
- embedded rebuild counters
- random .o file link order changes optimization
- compile-time CPU detection

new sources of randomness discovered

- gcc profile-guided optimizations
  - can be fixed by always doing the same in the profiling run
  - or by removing differing .gcda files losing some of the optimizations, but not all
- `%ghost` files have (semi-random) sizes visible in `rpm -qp --dump`
- ASLR

new sources of randomness discovered #2

- unsorted globs in python, bam, boost/jam
  - `glob.glob("*.c")` => `sorted(...)`
  - jam see https://github.com/boostorg/container/pull/50

Current state

Work done

- 2016: 71 submit-requests ; 6 bugs filed
- 2017: +92 submit-requests ; 4 bugs filed
- 2018: +71 submit-requests ; 13 bugs filed
- 2019: +133 submit-requests ; 28 bugs filed
- 2020: +42 submit-requests ; 24 bugs filed
- 2021: +31 submit-requests ; 23 bugs filed

Work done #2

- 2016: 4 upstream fixes merged
- 2017: +51 upstream fixes submitted - ~34 merged
- 2018: +270 upstream submissions - 162 merged
- 2019: +170 upstream submissions - 120 merged
- 2020: +130 upstream submissions - 80 merged
- 2021: +49 upstream submissions - 34 merged

rebuild-test-scripts

- available from
  https://github.com/bmwiedemann/reproducibleopensuse
- including this presentation's source
  https://github.com/bmwiedemann/reproducibleopensuse/blob/presentation/presentation/reproducible.md

How reproducible can we get?

- bit-identical with factory rpm and `osc build --define='%_buildhost reproducible' --define='%clamp_mtime_to_source_date_epoch Y' --define='%use_source_date_epoch_as_buildtime Y'`

Why does not everyone do reproducible builds yet

- Performance is more important
- Details about build are more important
- Generating UUIDs via random is easier
- Digital signatures contain time and randomness

No panacea

- backdoors in source
- buffer overflows and other bugs
- bad crypto
- volkswagen testing-mode

Package managers

- can fetch and verify third party rebuild certifications

Where do we want to go?

- fix all build-compare issues
- produce bit-identical rpms
- continuously verify published binaries
- report reproducibility regressions in submit-requests

Bash

```
From:   Bernhard M. Wiedemann
Subject:    [PATCH] Use memmove instead of strcpy
Date:   Sat, 7 Jul 2018 07:25:52 +0200

In https://bugzilla.opensuse.org/show_bug.cgi?id=1100488
we found that depending on the build machine, bash-4.4's bash.html would
contain the string Bahh instead of Bash

strcpy can cause corruption when working on overlapping strings
so we use memmove instead that handles this case correctly
---
 support/man2html.c | 2 +-
 1 file changed, 1 insertion(+), 1 deletion(-)

diff --git a/support/man2html.c b/support/man2html.c
index 6ba50616..f56a8945 100644
--- a/support/man2html.c
+++ b/support/man2html.c
@@ -1992,7 +1992,7 @@ unescape (char *c)
     while (i < l && c[i]) {
         if (c[i] == '\a') {
             if (c[i+1])
-                strcpy(c + i, c + i + 1);       /* should be memmove */
+                memmove(c + i, c + i + 1, strlen(c + i));
 }
```

foma

https://github.com/mhulden/foma/pull/78

```
    Fix crash on 32-bit systems

    https://bugzilla.opensuse.org/show_bug.cgi?id=1109949

    On 32-bit systems like i586, the sizeof a pointer is 4
    so too little memory was allocated for the following loop

diff --git a/foma/rewrite.c b/foma/rewrite.c
index 8ac140a..f1b2073 100644
--- a/foma/rewrite.c
+++ b/foma/rewrite.c
@@ -103,7 +103,7 @@ struct fsm *fsm_rewrite(struct rewrite_set *all_rules) {
     rb = xxcalloc(1, sizeof(struct rewrite_batch));
     rb->rewrite_set = all_rules;
     rb->num_rules = num_rules;
-    rb->namestrings = xxmalloc(sizeof rb->namestrings * num_rules);
+    rb->namestrings = xxmalloc(sizeof *rb->namestrings * num_rules);
 for (i = 0; i < rb->num_rules; i++) { sprintf(rb->namestrings[i], "@#%04i@", i+1); }
```

dpdk

http://patches.dpdk.org/patch/29949/

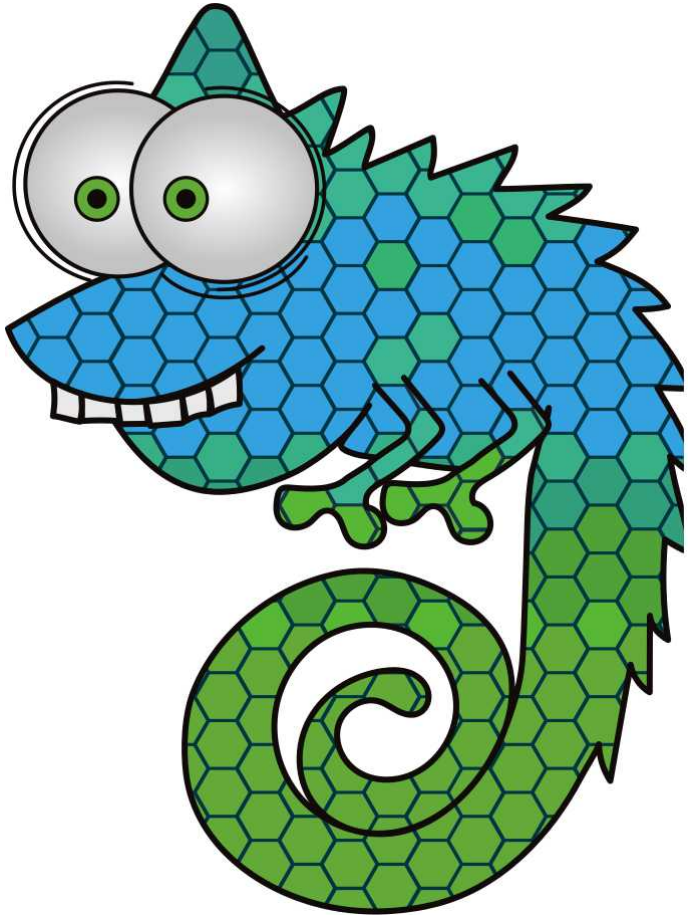
```
--- a/mk/rte.sdkdoc.mk
+++ b/mk/rte.sdkdoc.mk
@@ -93,7 +93,7 @@  $(API_EXAMPLES): api-html-clean
     $(Q)mkdir -p $(@D)
     @printf '/**\n' > $(API_EXAMPLES)
     @printf '@page examples DPDK Example Programs\n\n' >> $
(API_EXAMPLES)
-    @find examples -type f -name '*.c' -printf '@example %p\n' >> $
(API_EXAMPLES)
+    @find examples -type f -name '*.c' | LC_ALL=C sort | xargs -l
echo "@example" >> $(API_EXAMPLES)
  @printf '*/\n' >> $(API_EXAMPLES)
```

python sort

https://github.com/skyjake/Doomsday-Engine/pull/18

```
Sort input file list
so that doomsday.pk3 builds in a reproducible way
in spite of indeterministic filesystem readdir order.

--- a/doomsday/build/scripts/packres.py
+++ b/doomsday/build/scripts/packres.py
def process_dir(path, dest_path):
 self.msg("processing %s" % os.path.normpath(path))
-    for file in os.listdir(path):
+    for file in sorted(os.listdir(path)):
 real_file = os.path.join(path, file)
```



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