Linux Plumbers Conference 2019

Distros and Syzkaller - Why bother?

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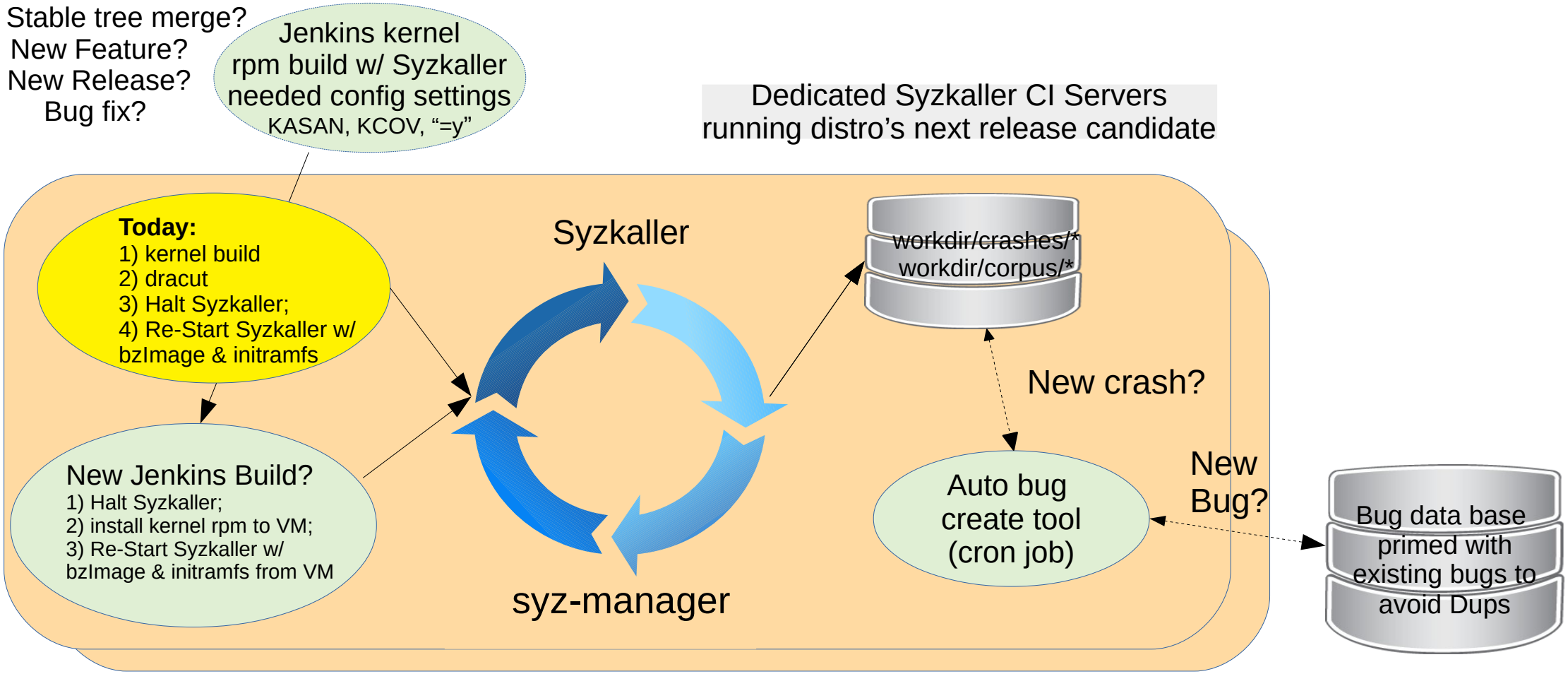
Distros and Syzkaller - Why bother?

1. What? Find out how distros and others are using Syzkaller and other fuzzers
2. Why? To collaborate to enhance distros development and release process (build a better kernel)
3. How? Continuous Integration (CI)

How to make Syzkaller part of distro release process?



Example of Syzkaller benefit (rds_sendmsg bug regression)

- Syzkaller found this rds_sendmsg bug:
  - KASAN: stack-out-of-bounds Read in rds_sendmsg
- Bug fixed by this Upstream commit:
  - 14e138a Thu Dec 21 20:17:04 2017 -0800 RDS: Check cmsg_len before dereferencing CMSG_DATA
- Commit is also in our distro release.
- Weekly Syzkaller runs showed that the rds_sendmsg bug was back in our distro release. How could that be?
- Yes, commit 14e138a is in our distro release, but we had overlaid it with new code.
- Syzkaller found the regression!

What are others doing?

- How do others track Syzkaller repo?
  - we pull Stable tree merges to build our distro release
  - Syzkaller tracks latest Upstream

What are others doing? (continued)

- We run into these types of Syzkaller build errors as a result of our distro release missing latest kernel defines:
  - Syzkaller build of reproducer C program fails (e.g. IFLA_HSR_SLAVE1 missing from if_link.h). Problem can show up after hours of testing.
  - Syzkaller build fails (e.g. tools/syz-env/env.go:34:12: undefined: osutil.SystemMemorySize)
- To come up with a Syzkaller build that works with our distro release requires some intervention.

What are others doing? (continued)

- What is the strategy that others are using to upgrade Syzkaller? Monthly Syzkaller update? Quarterly?

Wish List

- Syzkaller repo tag corresponding to Stable tree tag.
- tarball of Syzbot reproducer C programs.
  - Perfect for regression smoke test.
  - Could cut test time!

What other types of fuzzing do distros and others use?

- we fuzz MSRs, Control Regs, Debug Regs, etc with nano-VM (minimal KVM ioctls).
- what about qemu fuzzing?
- what about PCI fuzzing?
- how to add code coverage for other types of fuzzing?
- what about Intel vs AMD and other Architectures?
- e.g. Syzkaller AMD-only bug:
  - kernel BUG at arch/x86/kvm/x86.c:LINE!
  - vmload ←svm_vcpu_run+0xa83
  - https://groups.google.com/forum/#!searchin/syzkaller/kvm$20amd$20cpu/syzkaller/bIntrLGt2JA/SbRvpM6oCAAJ

Conclusion – How can we collaborate?

- Continue discussions through Syzkaller google groups?
- emails?
- What else?

References

- https://github.com/google/syzkaller
- https://github.com/google/syzkaller/blob/master/docs/linux/setup.md
- kernel: add kcov code coverage: https://lwn.net/Articles/671640/
- kcov patch: https://lkml.org/lkml/2016/1/25/475
- https://www.kernel.org/doc/html/v4.14/dev-tools/kasan.html
- https://www.kernel.org/doc/html/v4.14/dev-tools/kcov.html
- https://github.com/google/syzkaller/blob/master/executor/test_linux.h

Backup Slides

MSR fuzzing pseudo-code

Goal: allow any MSR to be written with any bit pattern to ensure that the host does not crash

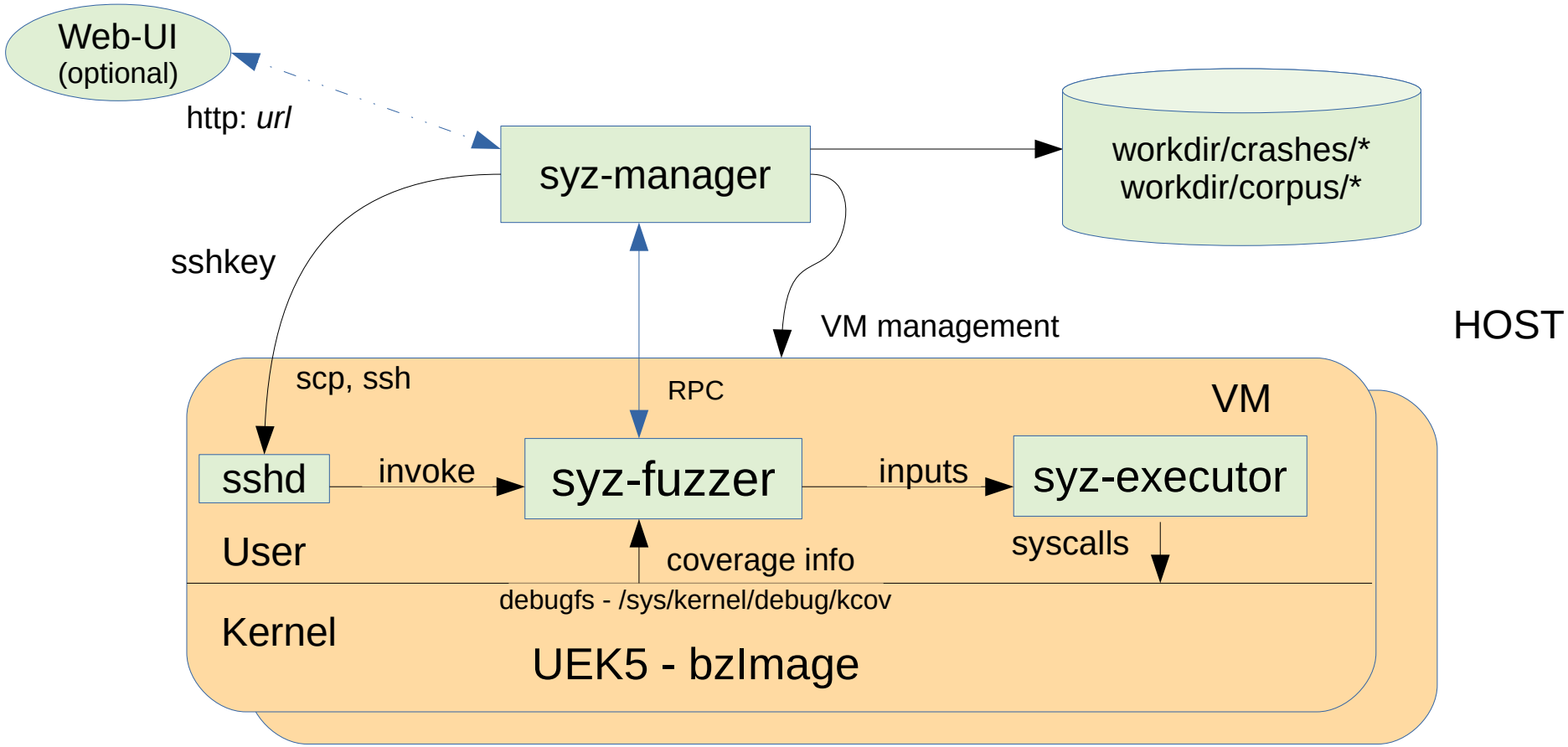
WRMSR — Write to Model Specific Register
Writes the contents of registers EDX:EAX into the 64-bit model specific register (MSR) specified in the ECX register.

```
./msrtest -m 0xc0000080 -w -a 0x1 -d 0x0        // msrtest calls test_one() to run nano-VM to write MSR 0xc0000080 (ecx) with eax=1 and edx=0
                                                // KVM_SET_REGS ioctl will set RCX, RAX, & RDX

00000000 <.data>:                               // nano-VM: 3 byte "kernel" to be launched by KVM_RUN ioctl in test_one()
  0:    0f 30                   wrmsr
  2:    f4                      hlt

      // test_one() called by msrtest
      // codep: pointer to above 3 byte "kernel"
      // codesz: 3
      if ((res = test_one(32, codep, codesz-1, 0, KVM_EXIT_HLT, false)))     //  from syzkaller/executor/test_linux.h
          return res;
...

exit_reason: 5
```

MSR fuzzing pseudo-code (continued)

```
static int test_one(int text_type, const char* text, int text_size, int flags, unsigned reason, bool check_rax)      //  from syzkaller/executor/test_linux.h
{
      int vmfd = ioctl(kvmfd, KVM_CREATE_VM, 0);
      int cpufd = ioctl(vmfd, KVM_CREATE_VCPU, 0);
      int cpu_mem_size = ioctl(kvmfd, KVM_GET_VCPU_MMAP_SIZE, 0);

      // do mmap()

      struct kvm_text kvm_text;
      kvm_text.typ = text_type;
      kvm_text.text = text;
      kvm_text.size = text_size;

      // ioctls used: KVM_SET_USER_MEMORY_REGION, KVM_GET_SREGS, KVM_SET_CPUID2, KVM_SET_SREGS
      // KVM_SET_REGS ioctl will set regs RCX, RAX & RDX for wrmsr
      if (syz_kvm_setup_cpu(vmfd, cpufd, (uintptr_t)vm_mem, (uintptr_t)&kvm_text, 1, flags, 0, 0))
            error …
      ioctl(cpufd, KVM_RUN, 0);

      ioctl(cpufd, KVM_GET_REGS, &regs);

      if (cpu_mem->exit_reason != reason)
            error  ...
}
```

What is Syzkaller? (based on Dmitry's slide)



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