

Training Machines to be Open Source Contributors

Stef Walter

OS Architecture Lead, Red Hat



Cyborg Teams

**[We] ate all the low-hanging fruit
of modern history ...**

— Tyler Cowen

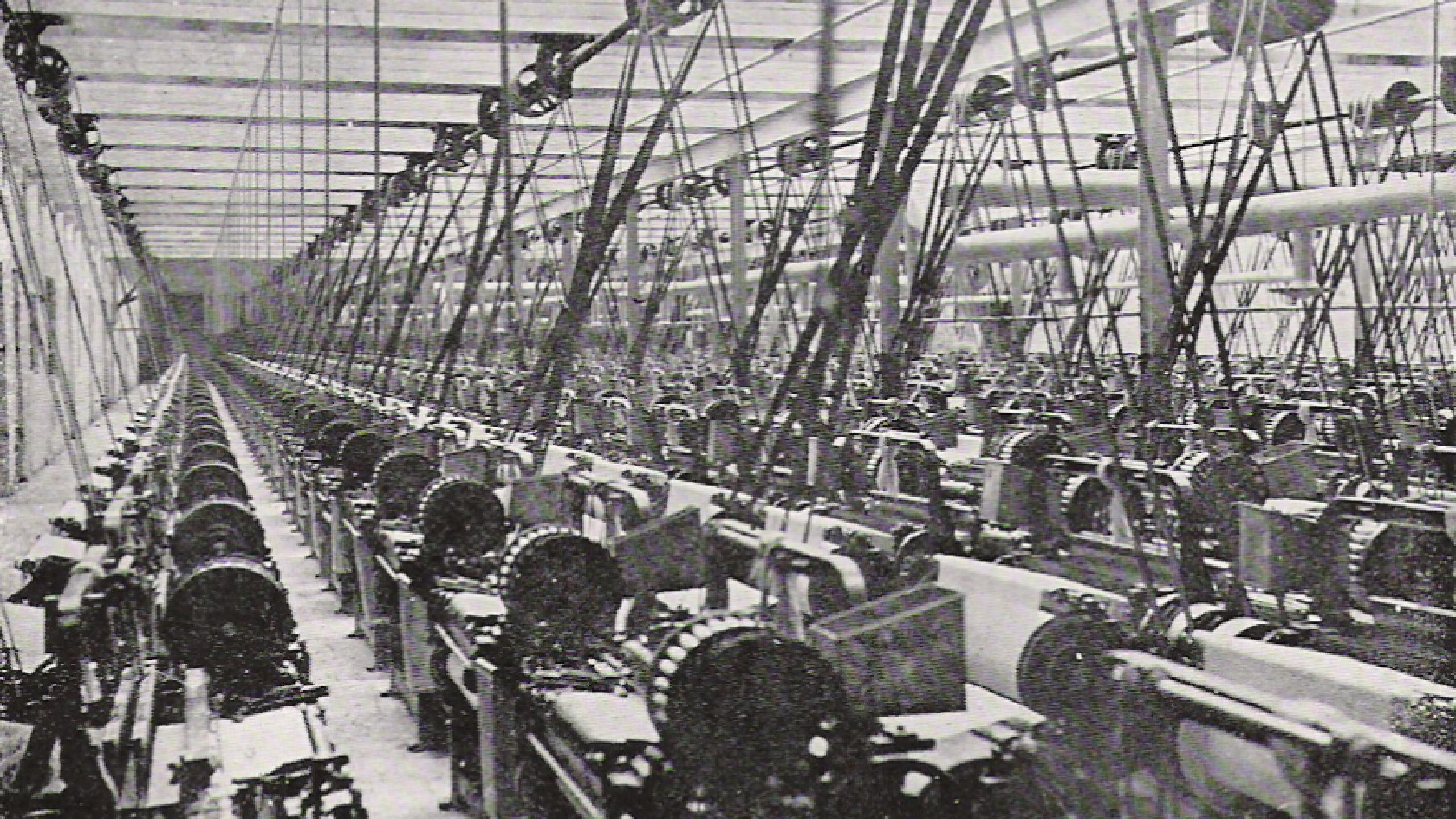
Y O U R W A L L P A P E R V . C O M

MACHINES!

**You see the computer age everywhere
but in the productivity statistics.**

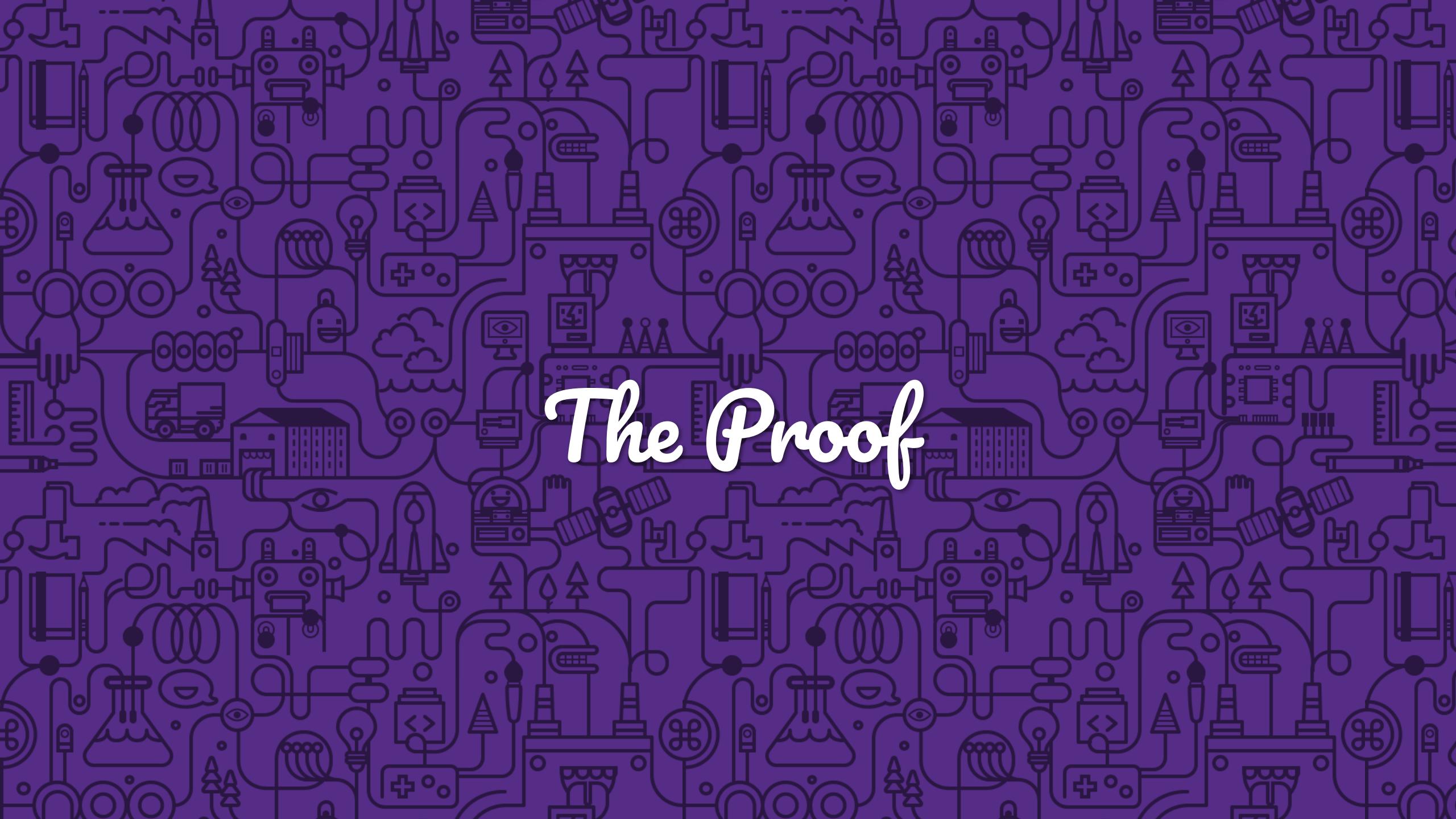
— Robert Solow

"But we use machines!"



Cyborg Teams

A team that is part human, part machine

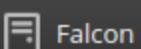


The Proof

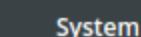


RED HAT ENTERPRISE LINUX SERVER

Unlocked Stef



Falcon



System

Logs

Storage

Networking

Containers

oVirt Machines

Accounts

Services

Applications

Diagnostic Reports

Kernel Dump

SELinux

Software Updates

Subscriptions

Terminal

Dashboard

Cluster

Image Registry

Hardware TAROX Basic 7000BD

Asset Tag 1437471

Machine ID a20c82e128524937ad8...

Operating System Employee SKU

Secure Shell Keys [Show fingerprints](#)

Host Name Falcon (falcon.thewalter...

Domain [Join Domain](#)System Time 2017-10-17 13:47 [i](#)Power Options [Restart](#) ▾Performance Profile none [i](#)Store Performance Data [OFF](#)

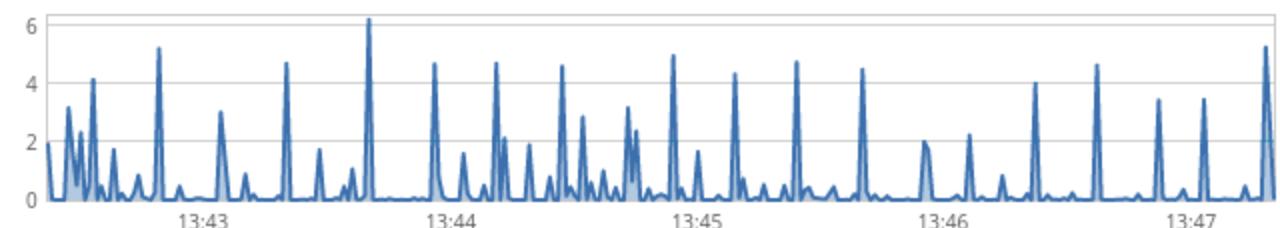
% CPU



GiB Memory



MiB/s Disk I/O



Mbps Network Traffic



RED HAT ENTERPRISE LINUX SERVER

Unlocked

Stef

Falcon

Dashboard

Cluster

Image Registry

Overview

Nodes

Containers

Topology

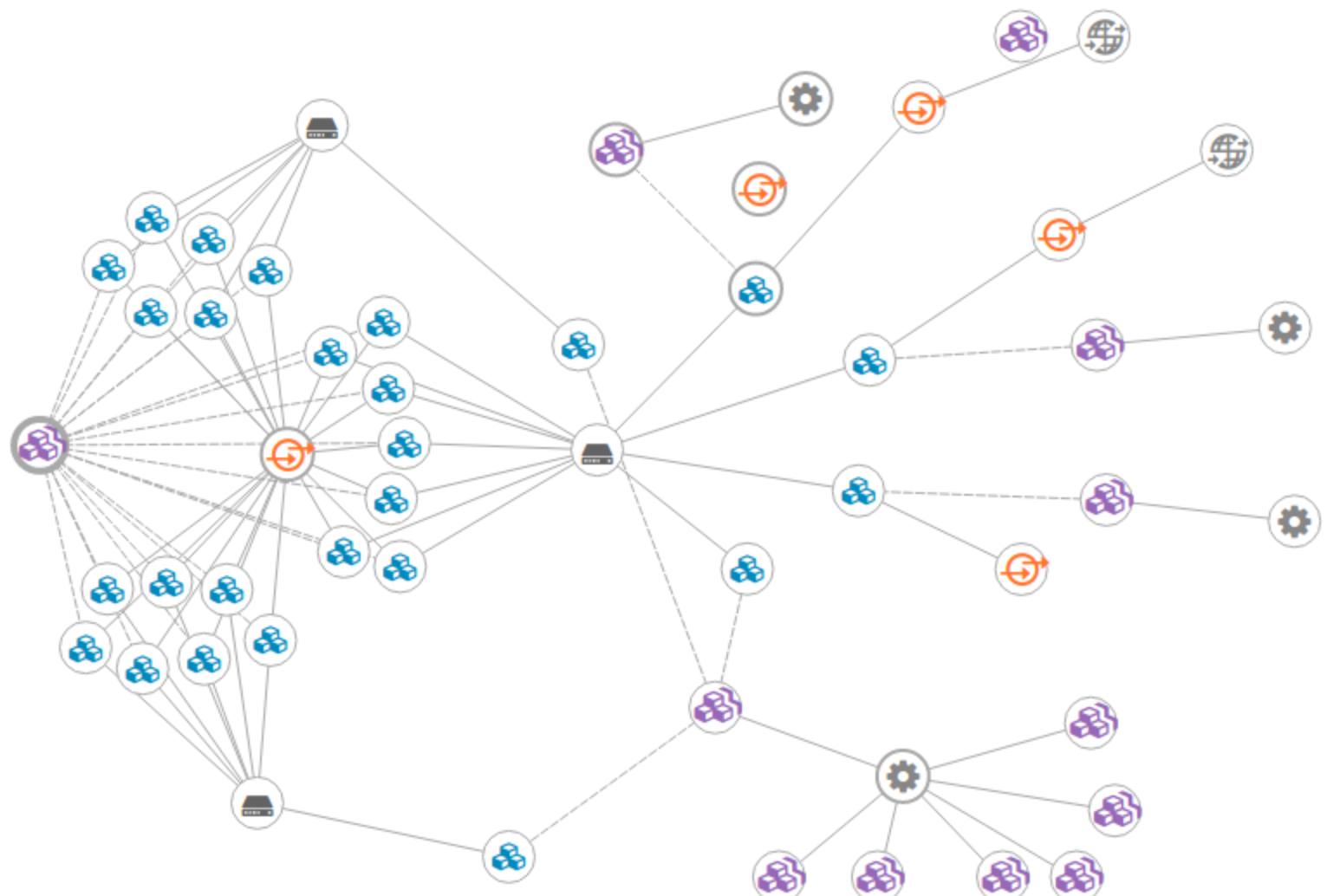
Details

Volumes

Images

Projects

All Projects



ReplicationController

Name	cockpit-tasks
Namespace	verify
Created	Sep 20, 2017 10:42:49 AM
Replicas	20

Selector

infra	cockpit-tasks
-------	---------------

Pod Template

Restart policy	Always
DNS policy	ClusterFirst
Service account	cockpituous

Containers

Name	cockpit-tasks
Image	docker.io/cockpit/tests
Ports	none
Env vars	TEST_JOBS=8 TEST_PUBLISH=sink

Name	cockpit-images
Image	docker.io/cockpit/images
Ports	80/TCP

FEDORA SERVER



System

Services

Containers

Logs

Storage

Networking

Hardware TAROX Basic 7000BD

Asset Tag 1437471

BIOS American Megatrends Inc. 2001 (06/16/2014)

Operating System Fedora 23 (Workstation Edition)

Host Name Falcon (falcon.thewalter.lan)

Domain [Join Domain](#)



Elements

Console

Sources

Network

Timeline

Profiles

Resources



<top frame>

▼ Preserve log



FEDORA SERVER



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<top frame>



Preserve log





90+ APIs: File, Command, REST, DBus, Socket

abrt	AppStream	apt-get	atomic	Candlepin /candlepin/
chpasswd	CloudForms	cryptsetup	curl	dbus-daemon
device-mapper	docker-storage-setup	docker	e2fsprogs	etcd
/etc/kdump.conf	/etc/passwd	firewalld	FreeIPA	GnuTLS
GSSAPI	hostnamed	ipa-client	ipa-client	iproute
iptables	iscsi-tools	journalctl	kdump	klist
krb5	Kubernetes /api/	lastlog	libvirt	loginctl
lvm	mdadm	NetworkManager	NetworkManager-te...	oddjob
Openshift /oapi/	Openshift OAuth2	openssl	ostree	oVirt /api/
PackageKit	passwd	PCP	PolicyKit	/proc/meminfo...
/proc/mounts	/proc/net/dev...	procps-ng	/proc/stat	pwquality
qemu	realmd	rm ...	rpmostreed	rpm
selinux-policy-target...	selinux-utils	setenforce	Setroubleshoott	shadow-utils
shutdown	sosreport	ssh-agent	sshd	ssh-keygen
ssh	sssd	storaged	subscription-manager	sudo
/sys/fs/cgroup	/sys/kernel	/sys/power	systemd	timedated
Tuned	udev	UDisks2	/usr/bin/kubectl	/usr/bin/timedatectl
/usr/bin/virt-install	/var/log/wtmp	/var/run/utmp	virsh	who/w
xfsprogs	yum			

15+ Linuxes and Products

CentOS (7.x, Atomic)

Fedora (25, 26, 27, Atomic)

Ubuntu (stable, 16.04)

RHEL (7.x, 7.4, Extras, Atomic)

Debian (stable, testing)

Openshift

RHEV Hypervisor

5+ maintained branches

master

rhel-7.4

rhel-7.3.x

i386

s390x

3+ browsers

Google Chrome

Internet Explorer

Firefox

A large, central, glowing explosion with radiating orange, yellow, and white light rays against a dark background.

92 × 15 × 5 × 3 × 50

The effort of a solely human team **does not scale**
past a certain complexity point

Cyborg Teams

Machines as team members





Bots own **mundane work**



Pair programming with bots



Humans train the bots



Bots learn from humans



Bots ship Cockpit



Bots own **mundane work**

Code Issues Pull requests Projects Wiki Insights Settings

Update translations from Fedora Zanata #7906

Open cockpituous opened this issue just now · 0 comments

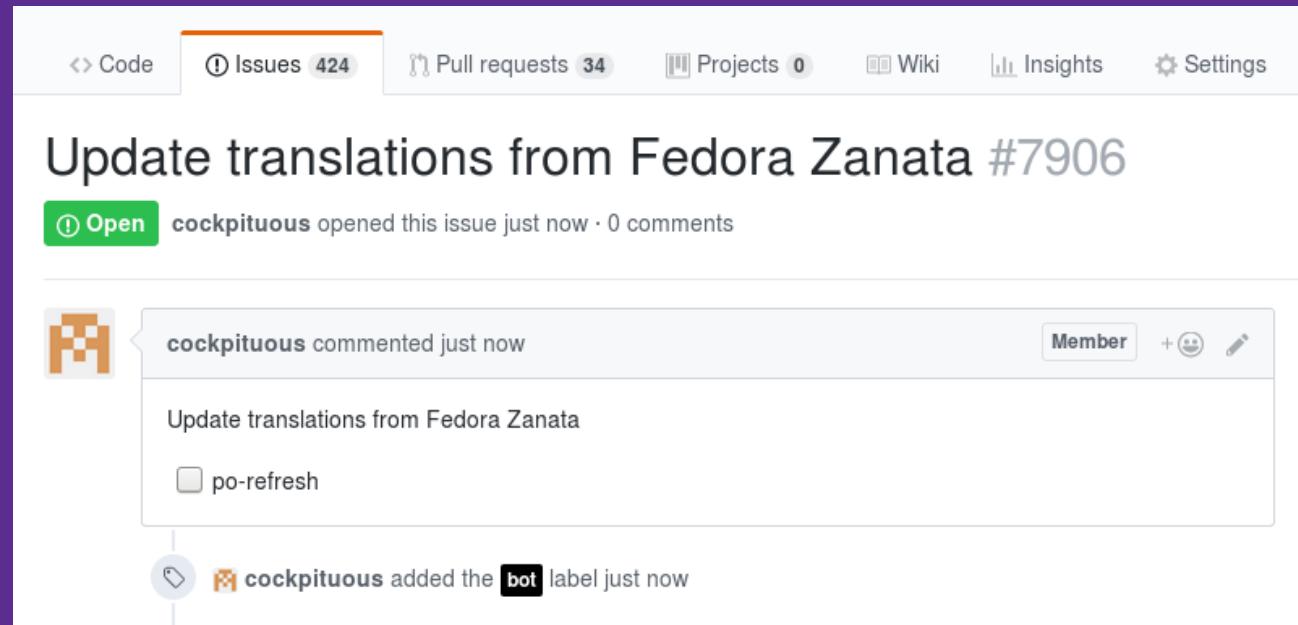
 cockpituous commented just now

Member + 😊 🖊

Update translations from Fedora Zanata

po-refresh

 cockpituous added the **bot** label just now



WIP: cockpit-tasks-jrsf1: Update translations from Fedora Zanata #7906

 Open **cockpituous** opened this issue 44 seconds ago · 1 comment



cockpituous commented just now

Member



Update translations from Fedora Zanata

po-refresh

  **cockpituous** added the **bot** label just now

```
$ make po/cockpit.pot  
$ make upload-pot  
$ make download-po  
$ git add po/  
$ git checkout -b po-refresh-xxx  
$ git commit -m "po: Update from Fedora Zanata"  
$ git push cockpitous po-refresh-xxx
```

[Code](#) [Issues 423](#) [Pull requests 35](#) [Projects 0](#) [Wiki](#) [Insights](#) [Settings](#)

Update translations from Fedora Zanata #7906

[Open](#) **cockpituous** wants to merge 1 commit into `cockpit-project:master` from `cockpituous:po-refresh-20171018`

[Conversation 2](#) [Commits 1](#) [Files changed 19](#)

 **cockpituous** commented 31 seconds ago • edited Member + 

Update translations from Fedora Zanata

po-refresh

  **cockpituous** added the **bot** label 4 minutes ago

 **cockpituous** commented 3 minutes ago Member +  

po-refresh in progress on cockpit-tasks-jrsf1.
Log: <http://fedorapeople.org/groups/cockpit/logs/po-refresh-7906-20171018-192929/>

  **cockpituous** changed the title from **Update translations from Fedora Zanata** to **WIP: cockpit-tasks-jrsf1: Update translations from Fedora Zanata** 3 minutes ago

 **cockpituous** commented 31 seconds ago Member +  

po-refresh done: <https://github.com/cockpituous/cockpit/commits/po-refresh-20171018-193232>



Some checks haven't completed yet

17 pending checks

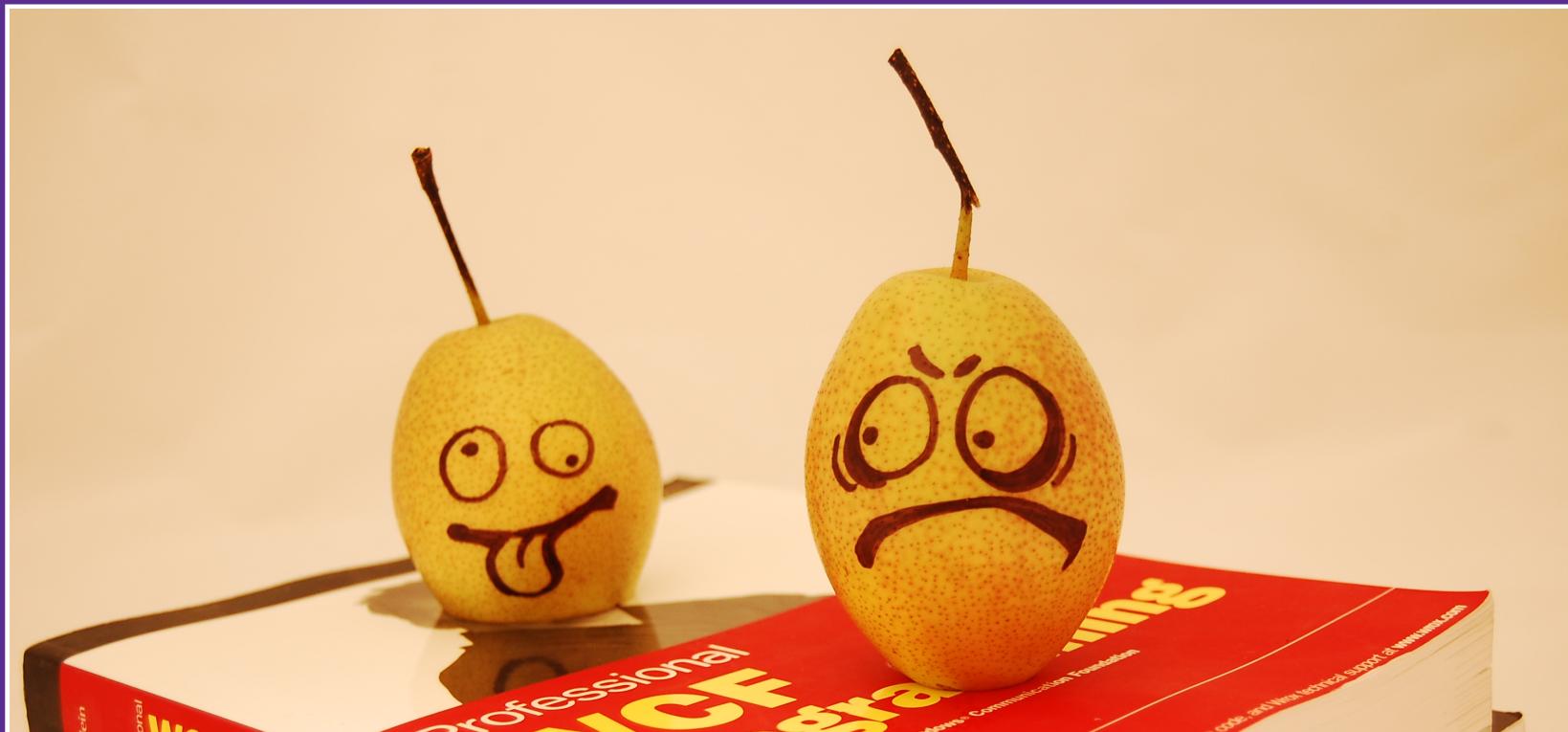
[Hide all checks](#)

- **avocado/fedora-25** — Testing in progress [verifymachine5] [Details](#)
- **container/kubernetes** — Not yet tested
- **selenium/chrome** — Testing in progress [cockpit-tasks-bcf7n] [Details](#)
- **selenium/explorer** — Testing in progress [cockpit-tasks-x2zt2] [Details](#)
- **selenium/firefox** — Testing in progress [cockpit-tasks-jrsf1] [Details](#)
- **semaphoreci** — The build is pending on Semaphore. [Details](#)
- **verify/centos-7** — Testing in progress [cockpit-tasks-c861x] [Details](#)
- **verify/debian-stable** — Not yet tested
- **verify/debian-testing** — Testing in progress [cockpit-tasks-3991c] [Details](#)
- **verify/fedora-27** — Testing in progress [cockpit-tasks-bq6gb] [Details](#)
- **verify/fedora-atomic** — Testing in progress [cockpit-tasks-flr95] [Details](#)
- **verify/fedora-i386** — Testing in progress [cockpit-tasks-4sfnk] [Details](#)
- **verify/rhel-7** — Testing in progress [cockpit-tasks-qzh35] [Details](#)
- **verify/rhel-7-4** — Testing in progress [cockpit-tasks-jsngc] [Details](#)
- **verify/rhel-atomic** — Testing in progress [cockpit-tasks-wx97l] [Details](#)
- **verify/ubuntu-1604** — Testing in progress [cockpit-tasks-xh4pv] [Details](#)
- **verify/ubuntu-stable** — Testing in progress [cockpit-tasks-lm1b] [Details](#)



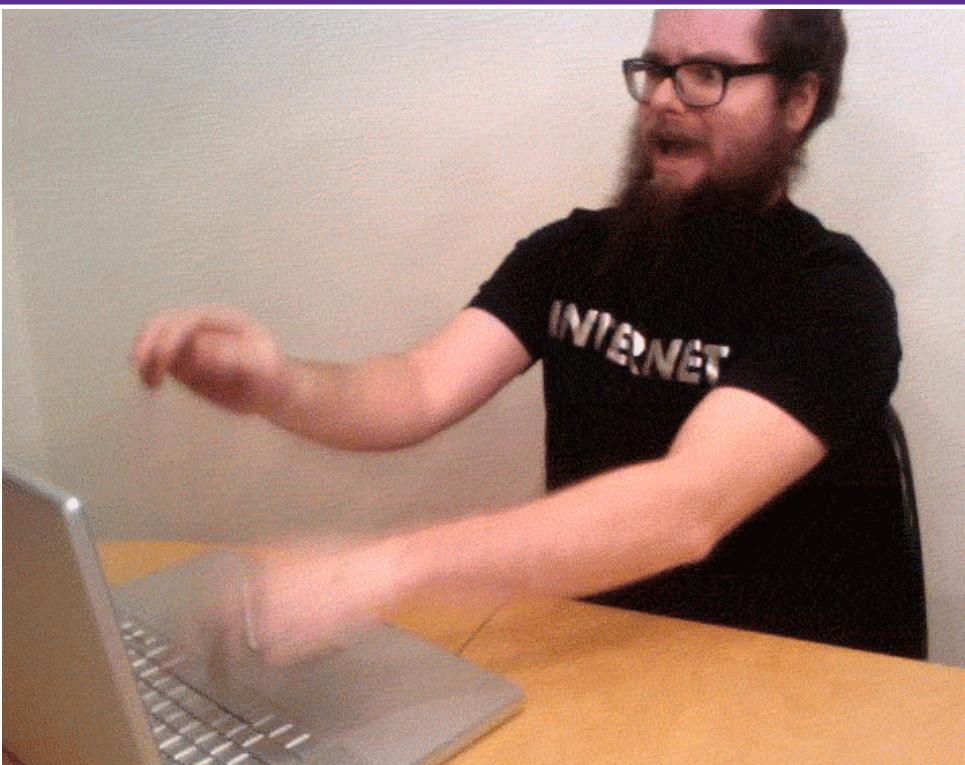


Pair programming with bots





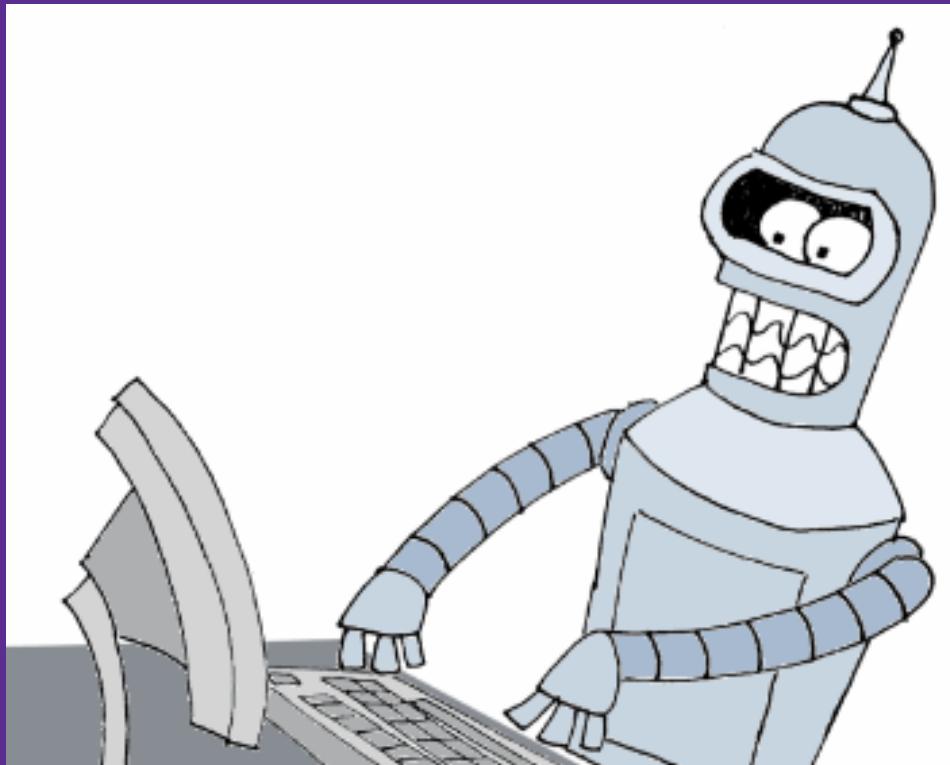
Humans train the bots

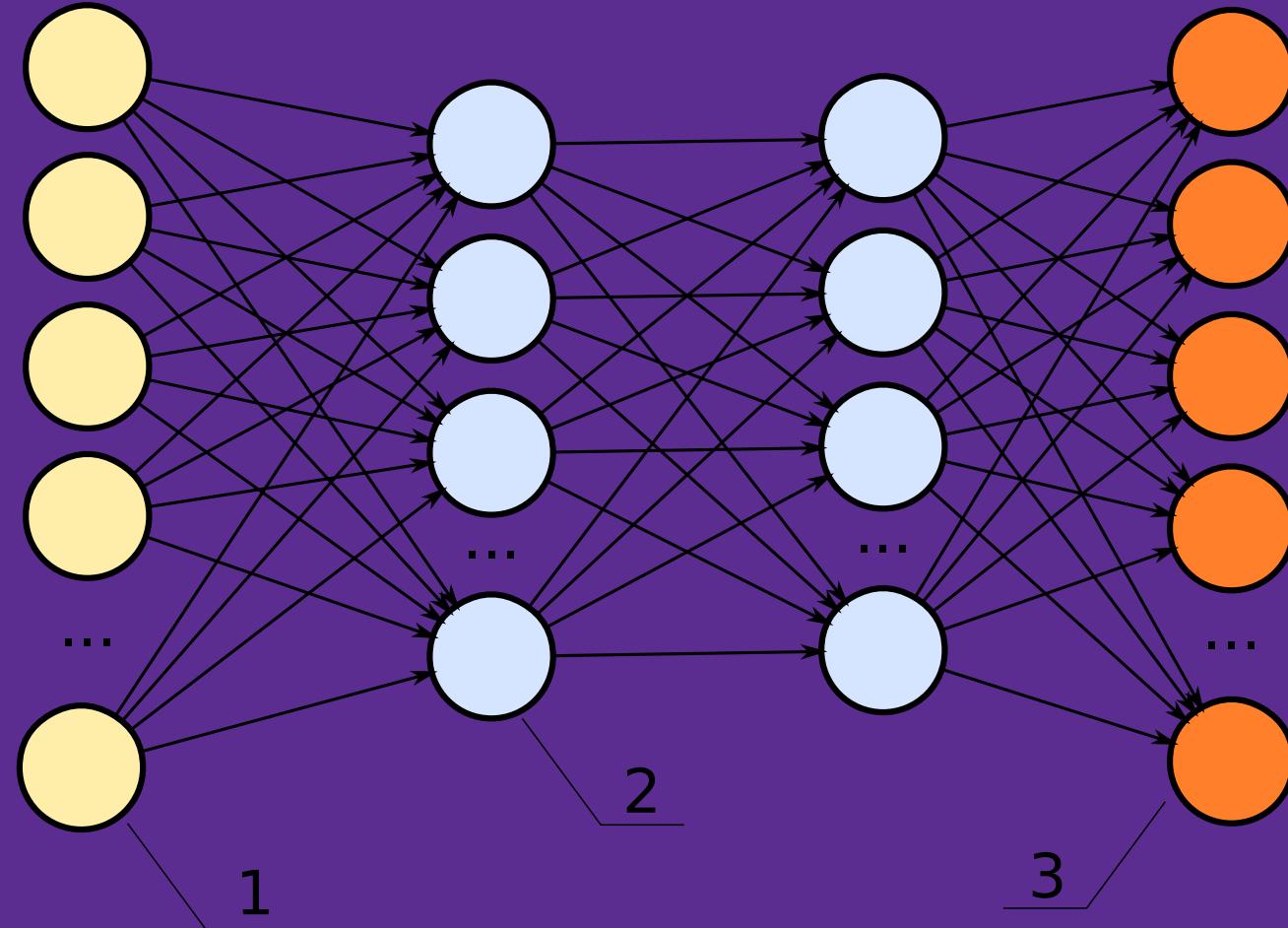


```
$ git shortlog --summary -- bots/ test/ | sort -nr
1140 Stef Walter
 707 Marius Vollmer
 278 Dominik Perpeet
 239 Peter Volpe
 214 Martin Pitt
   32 Jan Scotka
    13 Lars Karlitski
     12 Subin M
      10 Marek Libra
       6 Andreas Nilsson
        5 Matej Marusak
         4 Stephen Gallagher
....
```



Bots learn from humans







Bots ship Cockpit

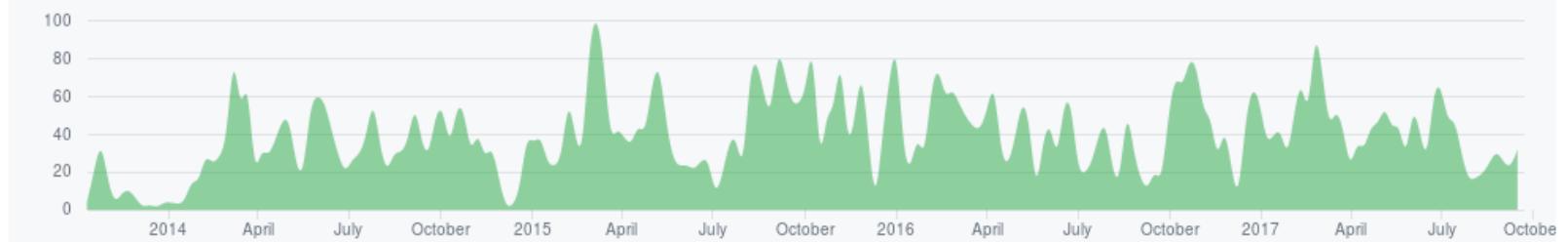
Human signs a tag in git

Bots scurry about

- Make **tarballs and patches**
- Update RPM spec files and Debian control files
- **Release** preview builds
- Update and push **Fedora** packages
- Upload packages into **Ubuntu**
- Upload packages into **Debian**
- Upload **tarballs**
- Container rebuilds on **Docker Hub**
- Online documentation update



Bots as committers

**stefwalter**

3,965 commits / 1,294,287 ++ / 1,173,543 --

#1

**mvollmer**

1,483 commits / 117,023 ++ / 92,855 --

#2

**petervo**

686 commits / 142,876 ++ / 105,312 --

#3

**cockpituous**

510 commits / 251,871 ++ / 123,461 --

#4

**dperpeet**

478 commits / 24,263 ++ / 17,764 --

#5

**martinpitt**

361 commits / 9,040 ++ / 3,589 --

#6

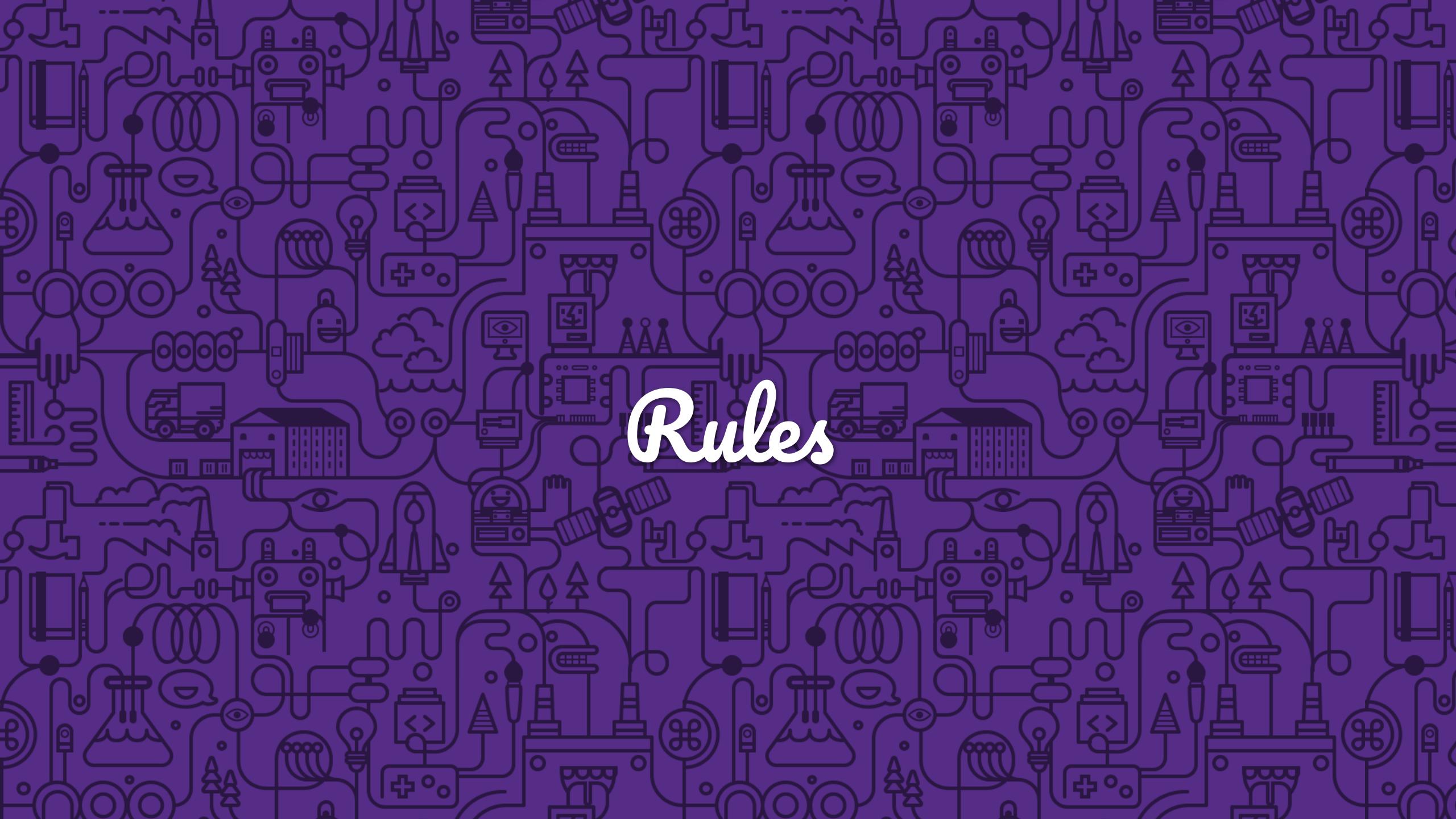


```
$ $ git shortlog -ns | head -n10 | cut -c8-30 | nl
1 Stef Walter
2 Marius Vollmer

3 Peter Volpe
4 Cockpituous
5 Dominik Perpeet
6 Martin Pitt
7 Andreas Nilsson
8 Lars Karlitski
9 Philip Donlon
10 Jan Scotka
```



Team stops without bots



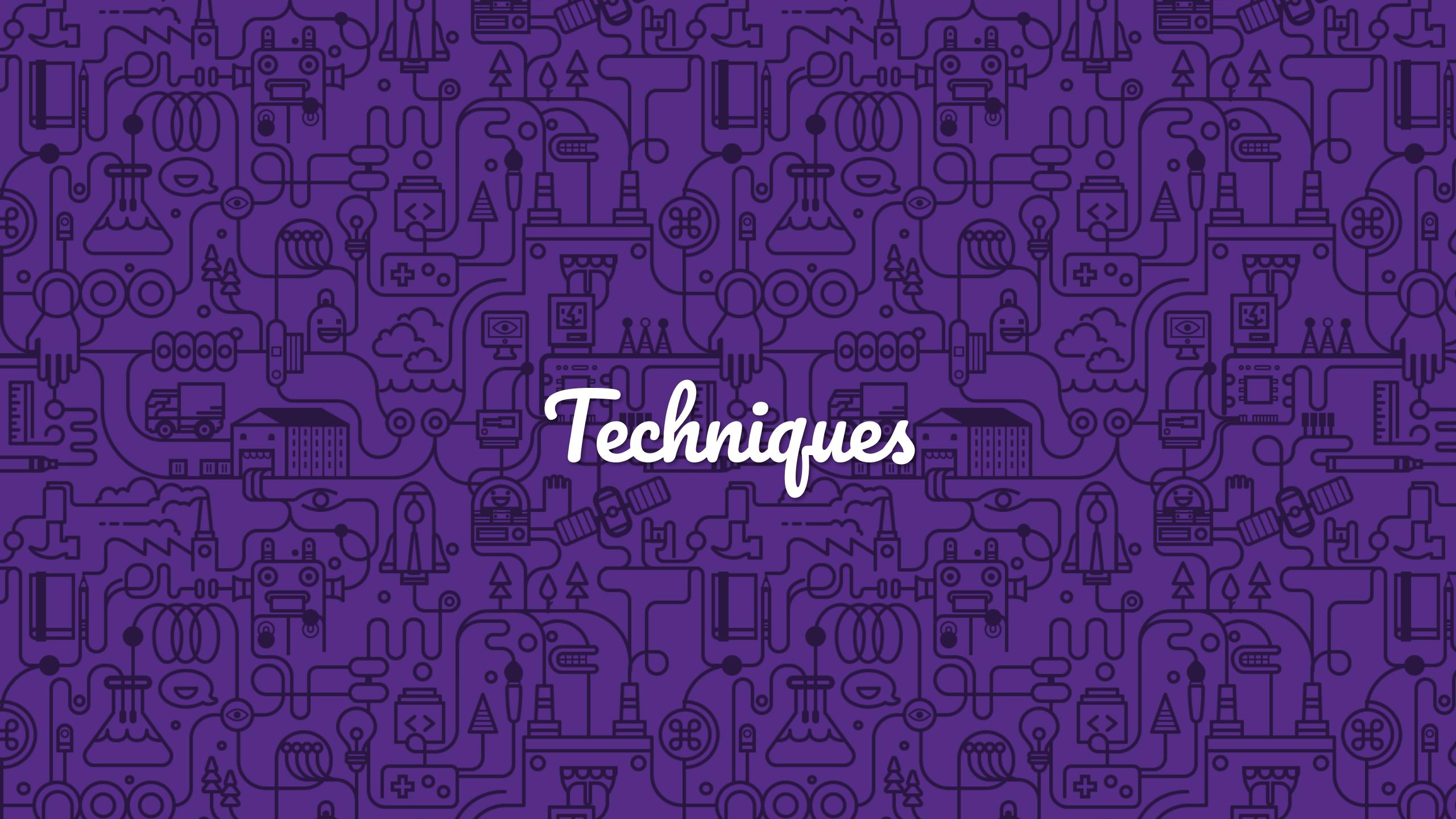
Rules

Laws of Cyborg Teams

- 1 Teaching a machine must be as easy as teaching a human
- 2 Machines must produce feedback into the team's workflow
- 3 A human should be able to impersonate a machine, and

Tests: The Soul of a Robot

Teaching machines right and wrong, good and evil



Techniques



Don't assume bots can't



Don't rework process (yet)



Containerize your bots, yo!



Organic and distributed bots



Self-validating and self-aware bots



Don't assume bots can't



Don't rework process (yet)



Containerize your bots, yo!

Testing **containers**
in **Virtual Machines**
in **container** bots
running on **virtual machines**
on turtles

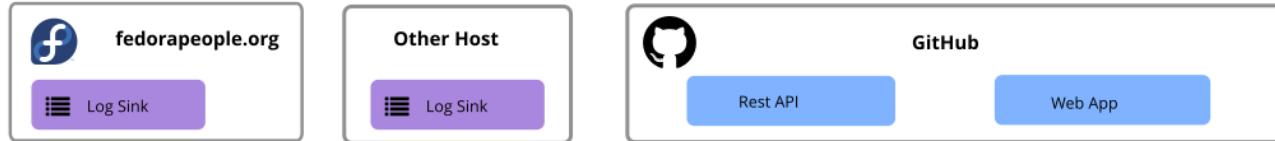
Yo Dawg...
~



Organic and distributed bots

Cockpit Task Bots

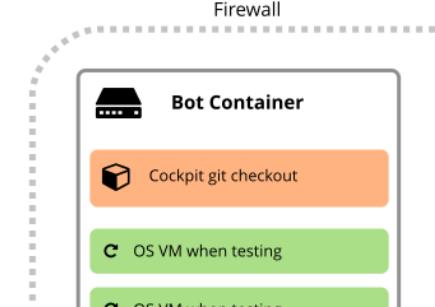
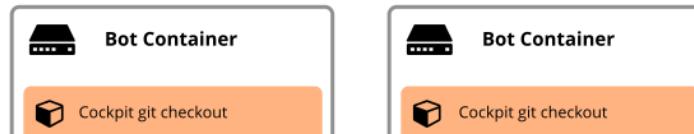
Task system is distributed with GitHub as the single point of failure



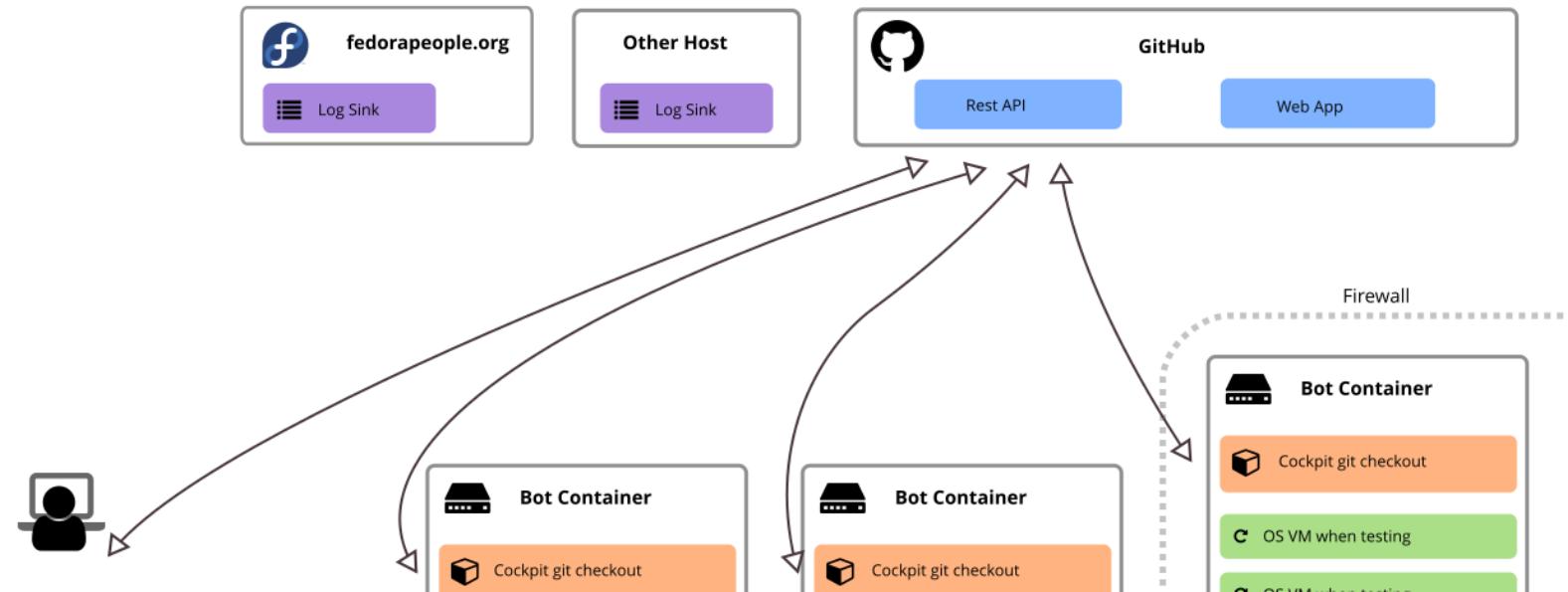
Every pull request is booted 100's of times
in Atomic, Debian, Fedora, RHEL, before it hits master.

Containers that start
1,000 - 10,000 test VMs a day

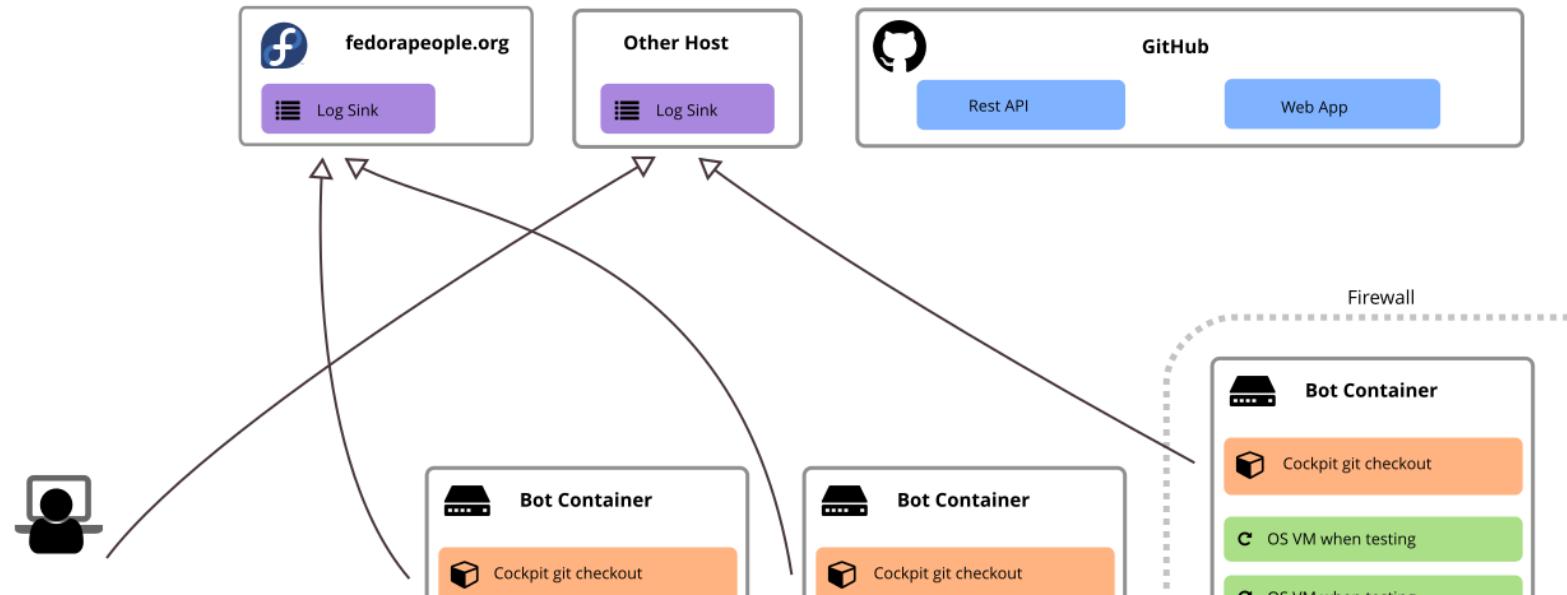
These containers can run anywhere



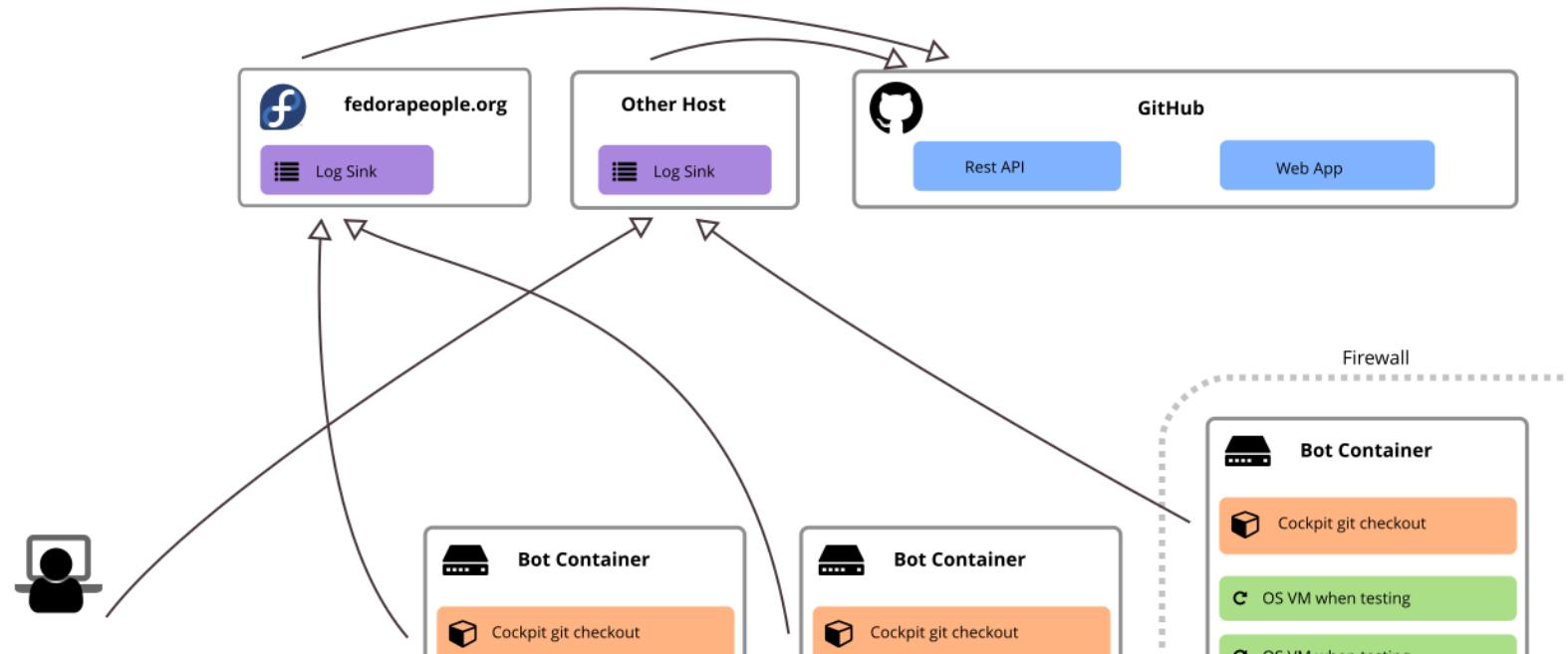
Looking for Tasks



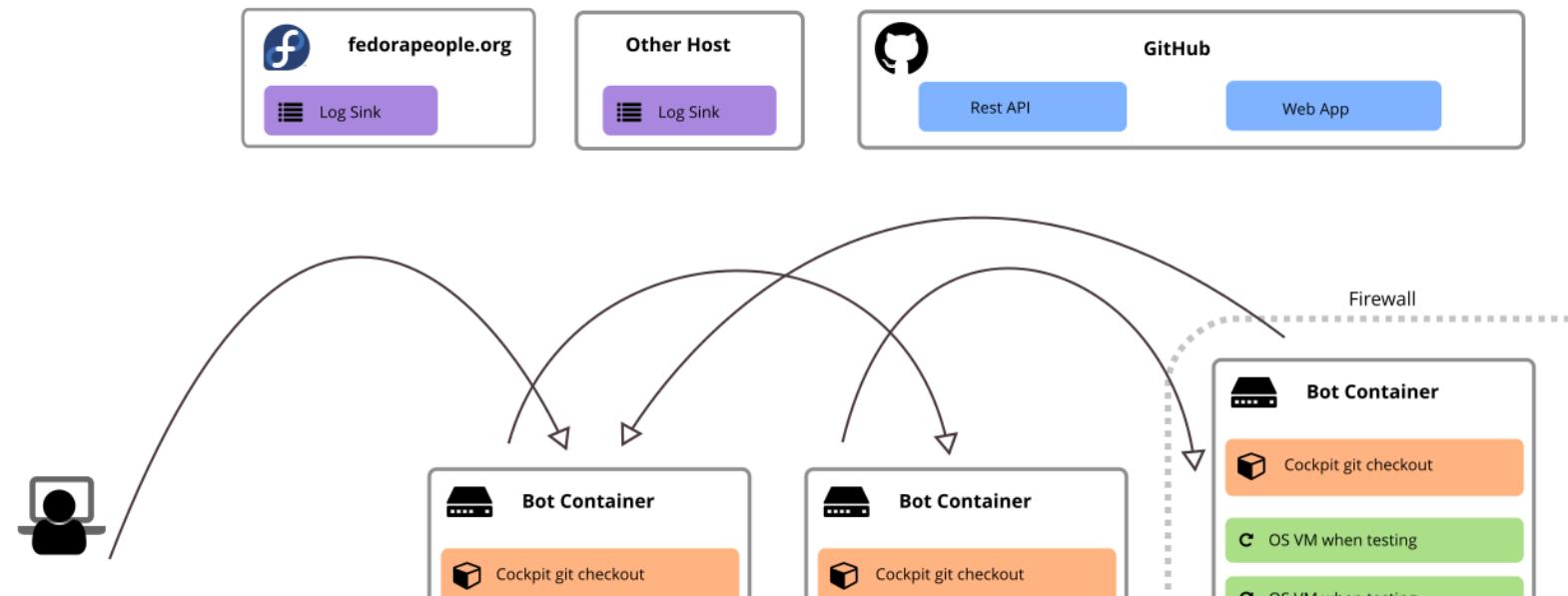
Post logs, attachments and publicly



Status updates to Pull Requests



Bots share state





Collision avoidance and detection

```
# Scan for all tests
bots/tests-scan

# File issues for these tasks
bots/po-trigger
bots/image-trigger
bots/npm-trigger
bots/naughty-trigger

# Any tasks related to issues
bots/issue-scan
```

```
PRIORITY=0009 bots/image-refresh --issue='7950' debian-testing
PRIORITY=0009 bots/image-refresh --issue='7949' rhel-7-4
PRIORITY=0009 bots/image-refresh --issue='7948' ubuntu-1604
PRIORITY=0006 TEST_NAME='rhel-7.4-20171024-112020' TEST_REVISION='c9a5bed
PRIORITY=0006 TEST_NAME='rhel-7.4-20171024-112020' TEST_REVISION='c9a5bed
PRIORITY=0006 TEST_NAME='rhel-7.4-20171024-112020' TEST_REVISION='c9a5bed
PRIORITY=0006 TEST_NAME='rhel-7.4-20171024-112020' TEST_REVISION='c9a5bed
PRIORITY=0005 TEST_NAME='rhel-7.4-20171024-112020' TEST_REVISION='c9a5bed
PRIORITY=0000 touch /tmp/cockpit-image-prune.stamp && bots/image-prune
...
...
```

```
GEN    dist/ostree/Makefile.deps
GEN    dist/networkmanager/Makefile.deps

GEN    dist/machines/Makefile.deps
GEN    dist/kubernetes/Makefile.deps
GEN    dist/kdump/Makefile.deps
GEN    dist/docker/Makefile.deps
GEN    dist/dashboard/Makefile.deps
GEN    dist/apps/Makefile.deps
```

**Expecting "WIP: cockpit-tasks-3991c: Update translations from Fedora Zana
State not as expected. Possible collision. Aborting.**



Self-validating self-aware bots

Make your bots try out changes to the bots

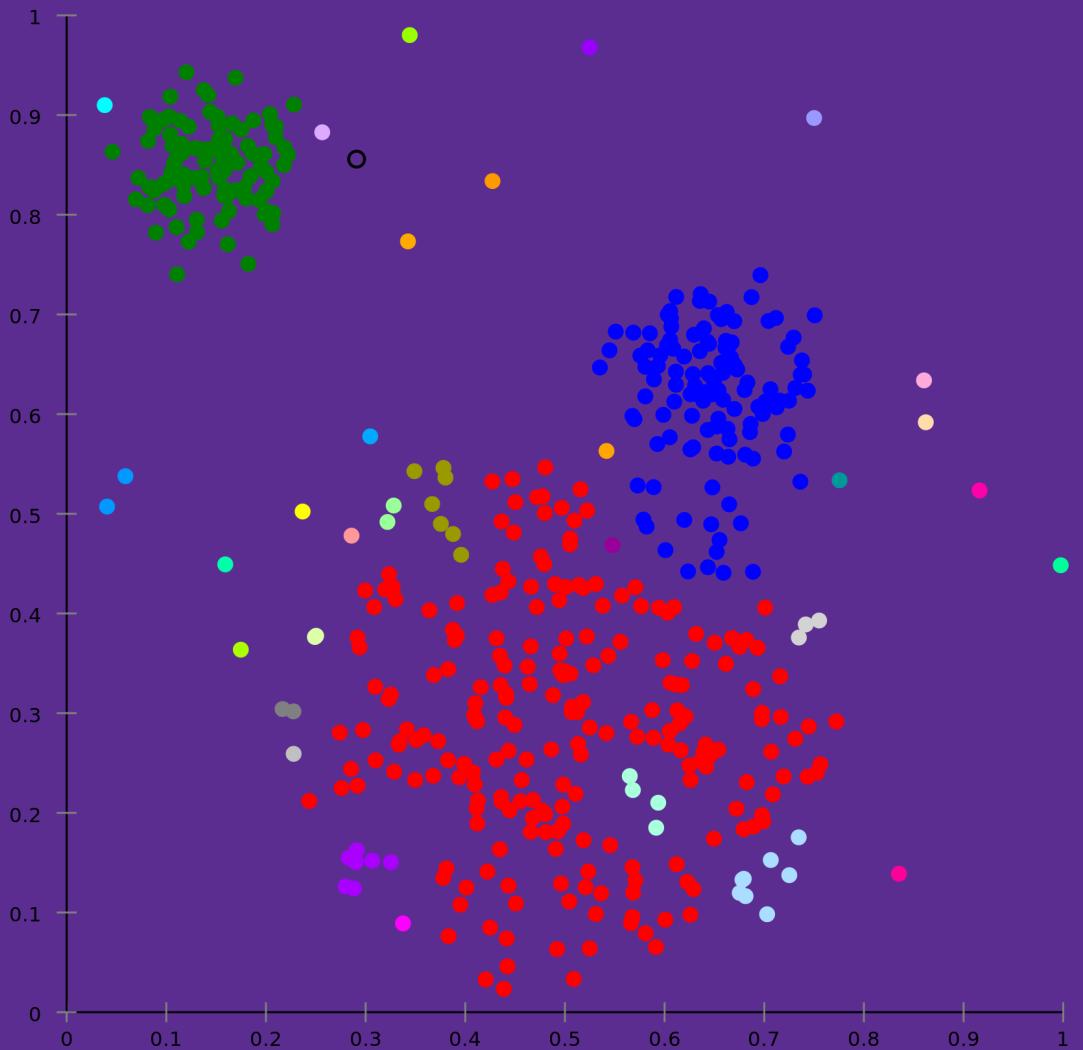
```
kvm = os.access("/dev/kvm", os.R_OK | os.W_OK)

try:
    urllib.urlopen(REDHAT_PING).read()
    redhat = os.path.exists(os.path.expanduser(REDHAT_CREDS))
except IOError:
    redhat = False
```



Test flakes are food not poison

Flakes are just mutations



! 35: testTeam (check_networking_team.TestNetworking), duration: 145s [Screenshot](#) [Journal](#) [Journal](#)

```
# testTeam (check_networking_team.TestNetworking)
#
#          NAME      UUID           TYPE      DEVICE
System eth0  5fb06bd0-0bb0-7ffb-45f1-d6edd65f3e03 802-3-ethernet  eth0
virbr0     24919ce5-8197-48f5-a08a-581f8274f04c bridge        virbr0
System eth1  9c92fad9-6ecb-3e6c-eb4d-8a47c6f50c04 802-3-ethernet  --
52:54:01:00:00:03 -> eth2
52:54:01:00:00:03 -> eth2
52:54:01:00:00:04 -> eth3
52:54:01:00:00:04 -> eth3
Unexpected journal message '/usr/libexec/cockpit-pcp: bridge was killed: 11'
Core dumps downloaded to /build/cockpit/TestNetworking-testTeam-rhel-7-4-127.0.0.2-2601-FAIL.core
Traceback (most recent call last):
  File "/build/cockpit/test/common/testlib.py", line 602, in tearDown
    self.check_journal_messages()
  File "/build/cockpit/test/common/testlib.py", line 773, in check_journal_messages
    i = 5 - (5 * i)
```

Cyborg Teams

Happy humans, tired machines

Questions?

cockpit-project.org
#cockpit on FreeNode

Credits:

Machines: tt2times on Flickr

Pear Programming: mendhak on Flickr

Clusters: Chire on Wikipedia

