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Let's add Fedora multiarch containers to your CI

Flock Budapest
August 2019

Fedora and Upstream

Past and Present

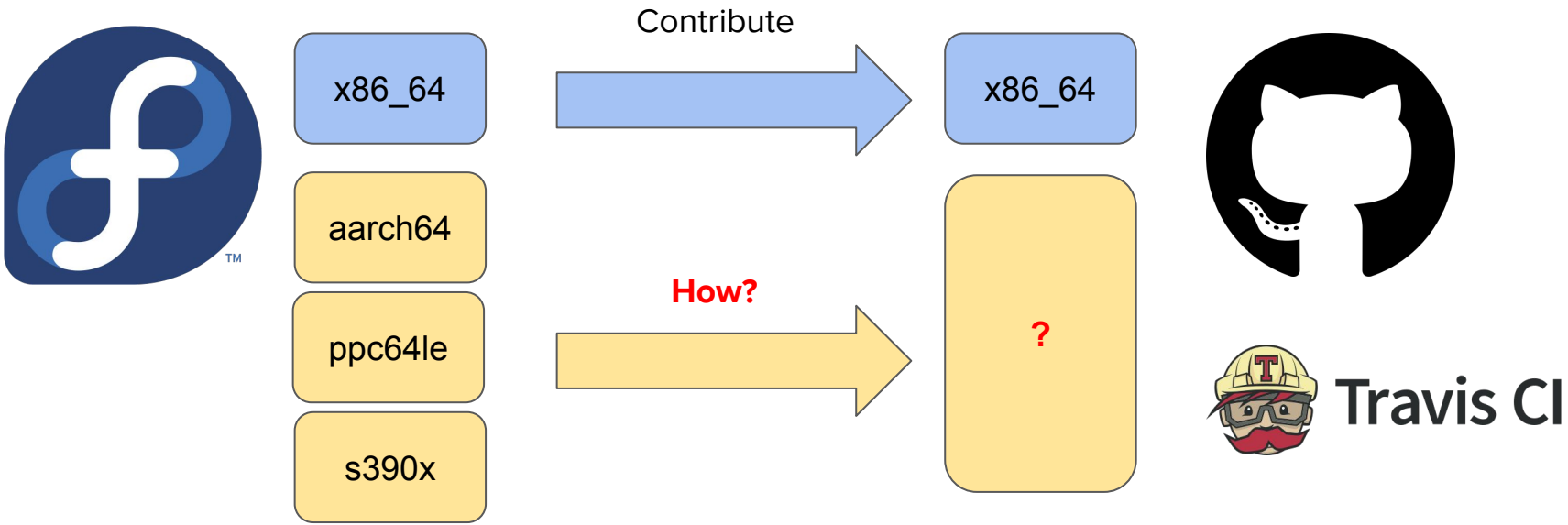

Image source: GitHub, Travis CI Wikipedia

Go https://github.com/junaruga/fedora-workshop-multiarch

CPU Architecture Kinds

Host architecture "uname -m"	**RPM Package architecture "rpm -q rpm --qf "%{arch}\n"**	**Description**
x86_64	x86_64	Intel, 64-bit, Little-endian
x86_64, i686	i686	Intel, 32-bit, Little-endian
aarch64	aarch64	ARM 64-bit, Little-endian
aarch64, armv7l, armv8l	armv7hl	ARM 32-bit, Little-endian
ppc64le	ppc64le	IBM PowerPC, 64-bit, Little-endian
s390x	s390x	IBM Z/Linux ONE 64-bit, Big-endian

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Tools for multiarch

Today's topics

- qemu-user-static [✔]
- mock
- Koji
- Packit
- multiarch/qemu-user-static image [✔]
- {podman,docker,docker buildx} build --platform (extra) [✔]

Go https://github.com/junaruga/fedora-workshop-multiarch

QEMU and binfmt_misc

on News

docker engineering Why Docker? Products Solutions Custo

Building Multi-Arch Images for Arm and x86 with Docker Desktop

April, 30, 2019 Docker engineering

kernel (LinuxKit), which is included as part of Docker Desktop. This fast and lightweight container OS comes packaged with the QEMU emulator, and comes pre-configured with binfmt_misc to run binaries of any supported architecture. Arm is committed to supporting

Image source: https://engineering.docker.com/2019/04/multi-arch-images/

Go https://github.com/junaruga/fedora-workshop-multiarch

5 steps

to add Fedora multiarch to upstream CI

1. qemu-$arch-static
2. binfmt_misc
3. qemu-user-static RPM
4. qemu-user-static RPM and container
5. multiarch/qemu-user-static container to add Fedora multiarch cases to CI

Go https://github.com/junaruga/fedora-workshop-multiarch

1. qemu-$arch-static

An interpreter

```
$ uname -m
x86_64

$ file /path/to/bin/hello-aarch64
bin/hello-aarch64: ELF 64-bit LSB executable, ARM aarch64, ...

$ /path/to/bin/hello-aarch64
bash: bin/hello-aarch64: cannot execute binary file: Exec format error

$ qemu-aarch64-static /path/to/bin/hello-aarch64
Hello World!
```


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2. binfmt_misc (1)

A kernel feature for binary format

How to add

```
$ ls /proc/sys/fs/binfmt_misc
register  status

# echo ":my-qemu-aarch64:M::\x7fELF\x02\ ...\xff:/path/to/qemu-aarch64-static:F" \
  > /proc/sys/fs/binfmt_misc/register

$ ls /proc/sys/fs/binfmt_misc
my-qemu-aarch64  register  status
```


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2. binfmt_misc (2)

The usefulness

```
$ cat /proc/sys/fs/binfmt_misc/my-qemu-aarch64
enabled
interpreter /path/to/qemu-aarch64-static
flags: F
offset 0
magic 7f454c4602010100000000000000000200b700
mask ffffffffffffff00fffffffffffffffeffffff

$ /path/to/bin/hello-aarch64
Hello World!
```


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2. binfmt_misc (3)

flags: F to work without the existance of interpreter

```
$ /path/to/bin/hello-aarch64
Hello World!

$ rm /path/to/qemu-aarch64-static

$ /path/to/bin/hello-aarch64
Hello World!
```


Go https://github.com/junaruga/fedora-workshop-multiarch

2. binfmt_misc (4)

How to remove

```
$ ls /proc/sys/fs/binfmt_misc
my-qemu-aarch64  register  status

# echo -1 > /proc/sys/fs/binfmt_misc/my-qemu-aarch64

$ ls /proc/sys/fs/binfmt_misc
register  status
```


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3. qemu-user-static RPM (1)

installs binfmt_misc/qemu-$arch files

```
$ ls /proc/sys/fs/binfmt_misc
register  status

# dnf install qemu-user-static

$ ls /proc/sys/fs/binfmt_misc
qemu-aarch64 qemu-aarch64_be ... qemu-xtensaeb register status
```


Go https://github.com/junaruga/fedora-workshop-multiarch

3. qemu-user-static RPM (2)

How to reset binfmt_misc/qemu-$arch files (1/2)

```
$ ls /proc/sys/fs/binfmt_misc
qemu-aarch64 qemu-aarch64_be ... qemu-xtensaeb register status

# echo -1 > /proc/sys/fs/binfmt_misc/qemu-aarch64
# echo ":qemu-aarch64:M:: ... :/usr/local/bin/my-qemu-aarch64-static:" >
/proc/sys/fs/binfmt_misc/register

# echo ":my-qemu:M:: ... :/path/to/qemu-aarch64-static:" >
/proc/sys/fs/binfmt_misc/register
```

Just edit and add the binfmt_misc files for an experiment of reset.

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3. qemu-user-static RPM (3)

How to reset binfmt_misc/qemu-$arch files (2/2)

```
$ ls /proc/sys/fs/binfmt_misc
my-qemu  qemu-aarch64  qemu-aarch64_be ... register  status

# systemctl restart systemd-binfmt

$ ls /proc/sys/fs/binfmt_misc
qemu-aarch64 qemu-aarch64_be ... qemu-xtensaeb register status
```


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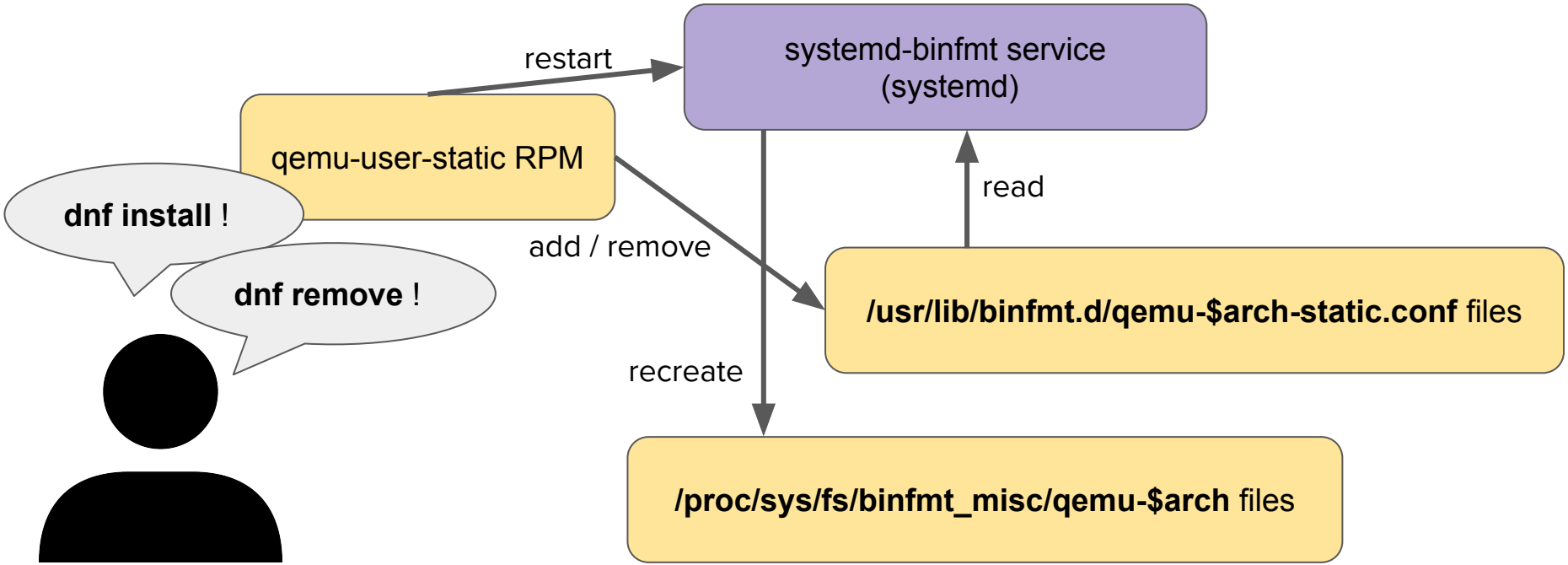
3. qemu-user-static RPM (4)



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4. qemu-user-static RPM and container (1)

```
$ podman run --rm -t arm64v8/fedora uname -m
standard_init_linux.go:211: exec user process caused "exec format error"

# dnf install qemu-user-static

$ cat /proc/sys/fs/binfmt_misc/qemu-aarch64
...
flags: F
...

$ podman run --rm -t arm64v8/fedora uname -m
aarch64
```


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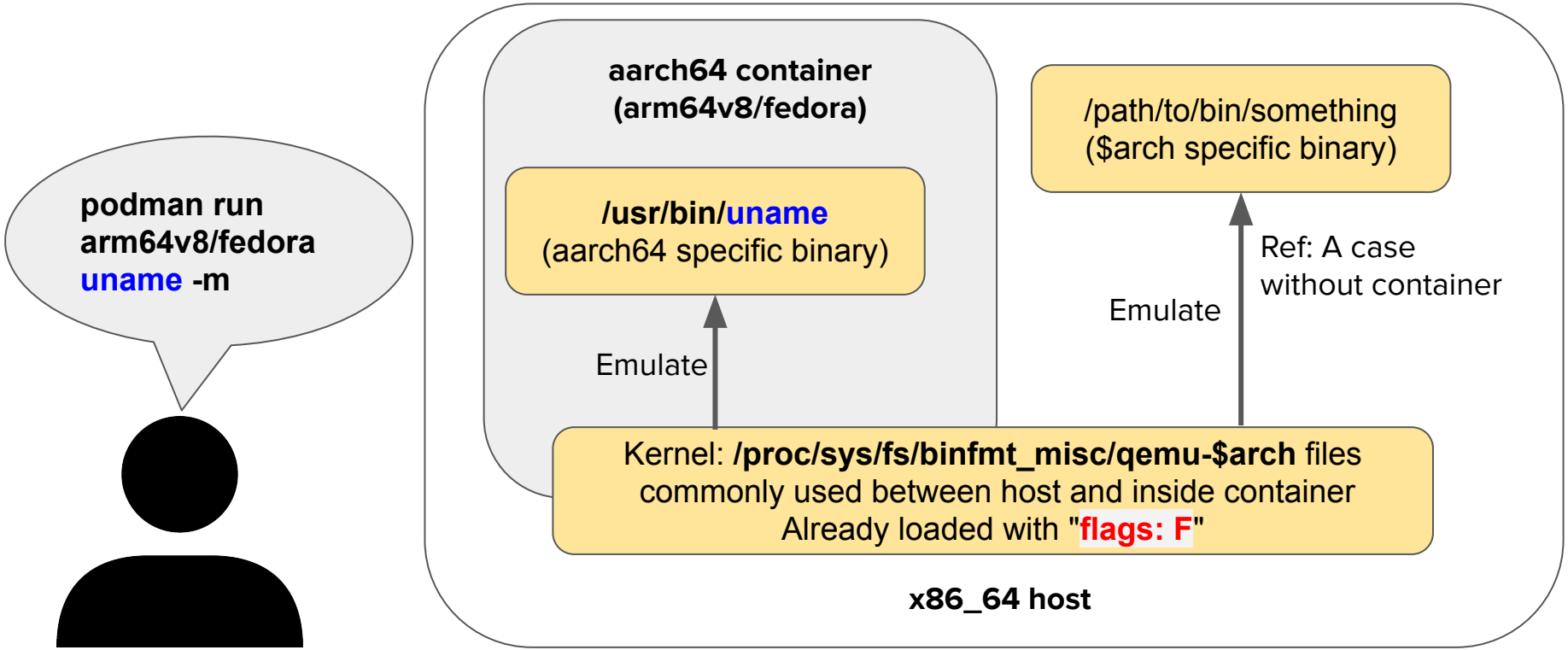
4. qemu-user-static RPM and container (2)



Go https://github.com/junaruga/fedora-workshop-multiarch

5. multiarch/qemu-user-static and CI (1)

```
$ sudo podman run --rm --privileged multiarch/qemu-user-static --reset -p yes

$ cat /proc/sys/fs/binfmt_misc/qemu-aarch64
...
flags: F
...

$ podman run --rm -t arm64v8/fedora uname -m
aarch64
```


Go https://github.com/junaruga/fedora-workshop-multiarch

5. multiarch/qemu-user-static and CI (2)


```
install:
  - ls /proc/sys/fs/binfmt_misc/
  - docker run --rm --privileged multiarch/qemu-user-static --reset -p yes
  - ls /proc/sys/fs/binfmt_misc/
  - docker build --rm --build-arg BASE_IMAGE="${BASE_IMAGE}" -t my-fedora .
script:
  - docker run --rm -t my-fedora bash -cx "uname -m && make clean test"
```

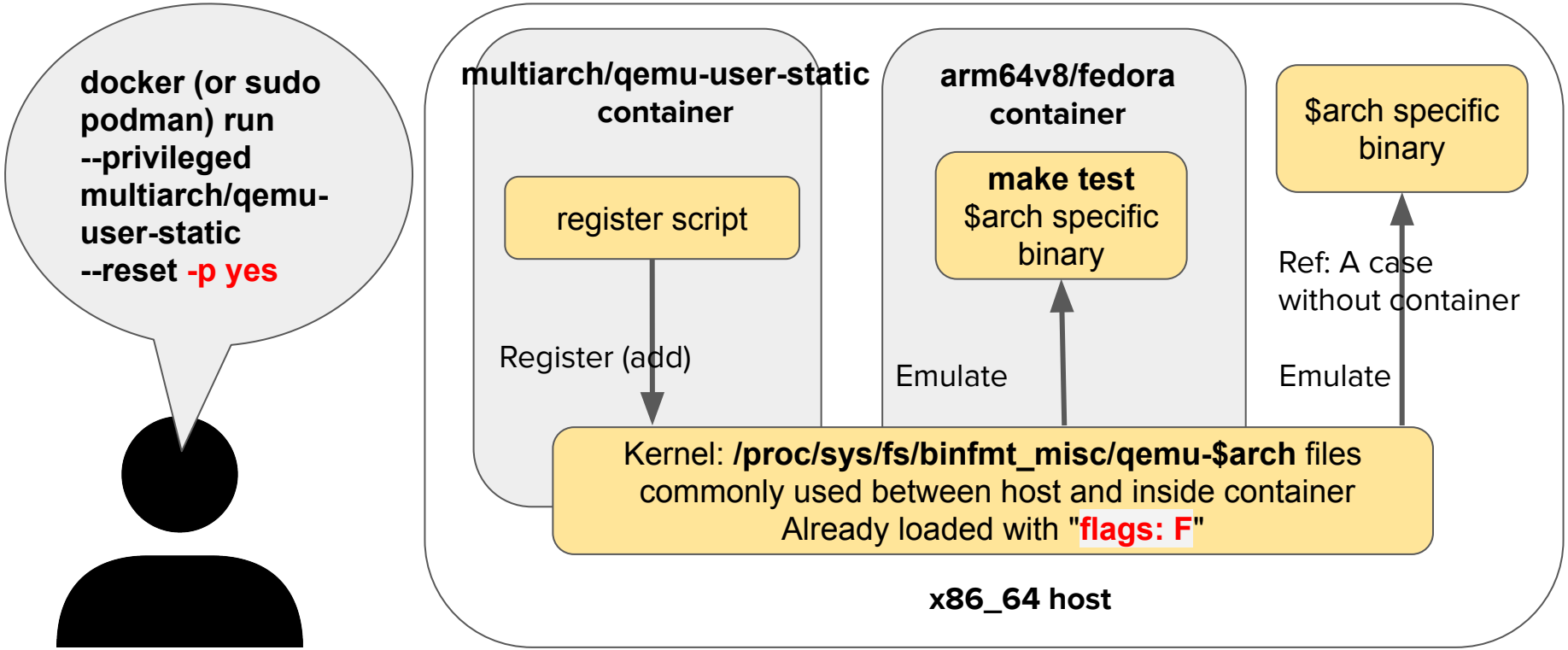
```
matrix:
  include:
    # Fedora cor
    # * Docker H
    #   https://
    # * Fedora c
    #   https://
    # Intel, 64-bit, Little-endian
    - name: x86_64
      env: BASE_IMAGE=fedora
    # ARM, 64-bit, Little-endian
    - name: aarch64
      env: BASE_IMAGE=arm64v8/fedora
    # ARM, 32-bit, Little-endian
    - name: armv7hl
      env: BASE_IMAGE=arm32v7/fedora
    # IBM PowerPC, 64-bit, Little-endian
    - name: ppc64le
      env: BASE_IMAGE=ppc64le/fedora
    # IBM Z and LinuxONE, 64-bit, Big-endian
    - name: s390x
      env: BASE_IMAGE=s390x/fedora
```

```
$ cat Dockerfile
ARG BASE_IMAGE=fedora
FROM ${BASE_IMAGE}
...
```

Go https://github.com/junaruga/fedora-workshop-multiarch/blob/master/.travis.yml **!**

Go https://github.com/junaruga/fedora-workshop-multiarch

5. multiarch/qemu-user-static and CI (3)



Go https://github.com/junaruga/fedora-workshop-multiarch

Note A: ARM supported CI services

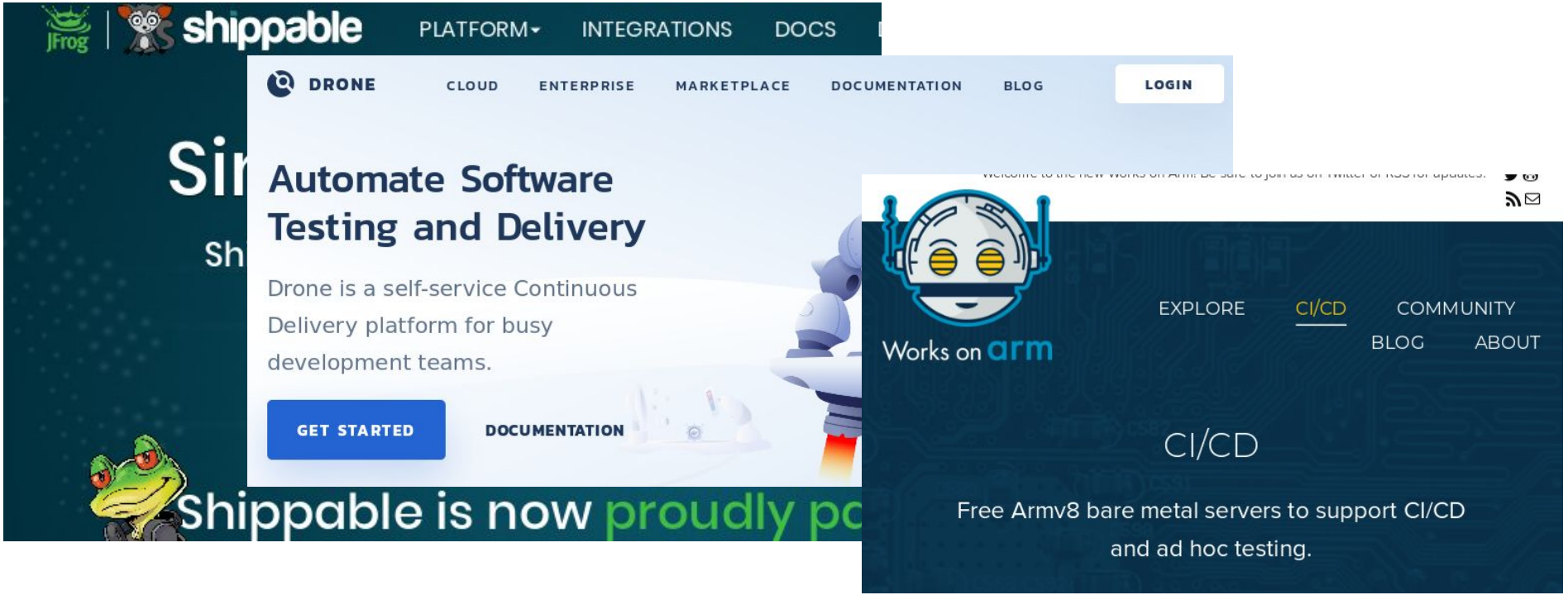


Image source: https://www.shippable.com/ , https://drone.io/ , https://www.worksonarm.com/cluster/

Go https://github.com/junaruga/fedora-workshop-multiarch

Note B: A Dockerfile to multi-arch images (1)

podman build --platform

```
$ cat Dockerfile
FROM fedora
RUN uname -m

$ podman build --rm -t my-fedora:aarch64 --platform linux/aarch64 .

$ podman run --rm -t my-fedora:aarch64 uname -m
aarch64
```

buildah, podman:
developing in progress.
https://github.com/containers/buildah/issues/1590

Go https://github.com/junaruga/fedora-workshop-multiarch

Note B: A Dockerfile to multi-arch images (2)

docker build --platform or docker buildx build --platform

```
$ DOCKER_BUILDKIT=1 \
  docker build --rm -t my-fedora:aarch64 --platform linux/aarch64 .
```

or

```
$ docker buildx build --rm -t my-fedora:aarch64 --platform linux/aarch64 .
```

then

```
$ docker run --rm -t my-fedora:aarch64 uname -m
aarch64
```

Run on installed qemu-user-static RPM.

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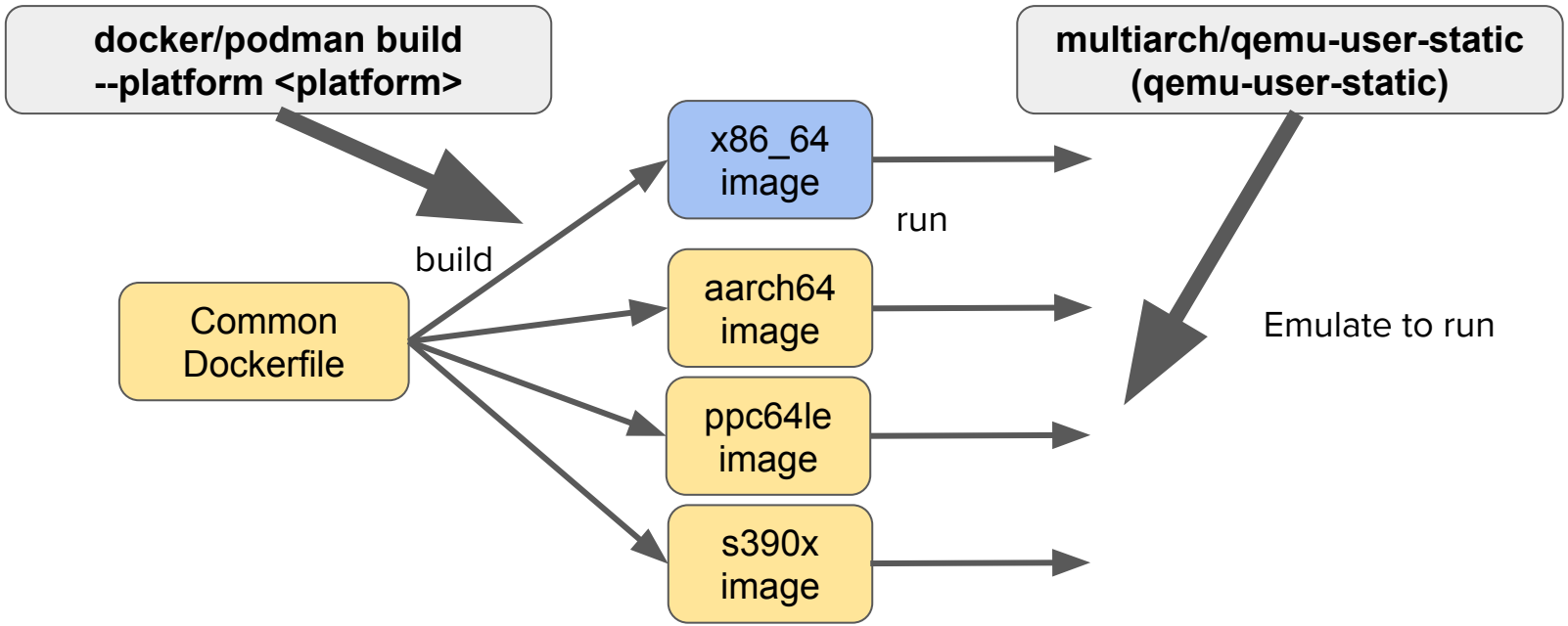
Note B: A Dockerfile to multi-arch images (3)



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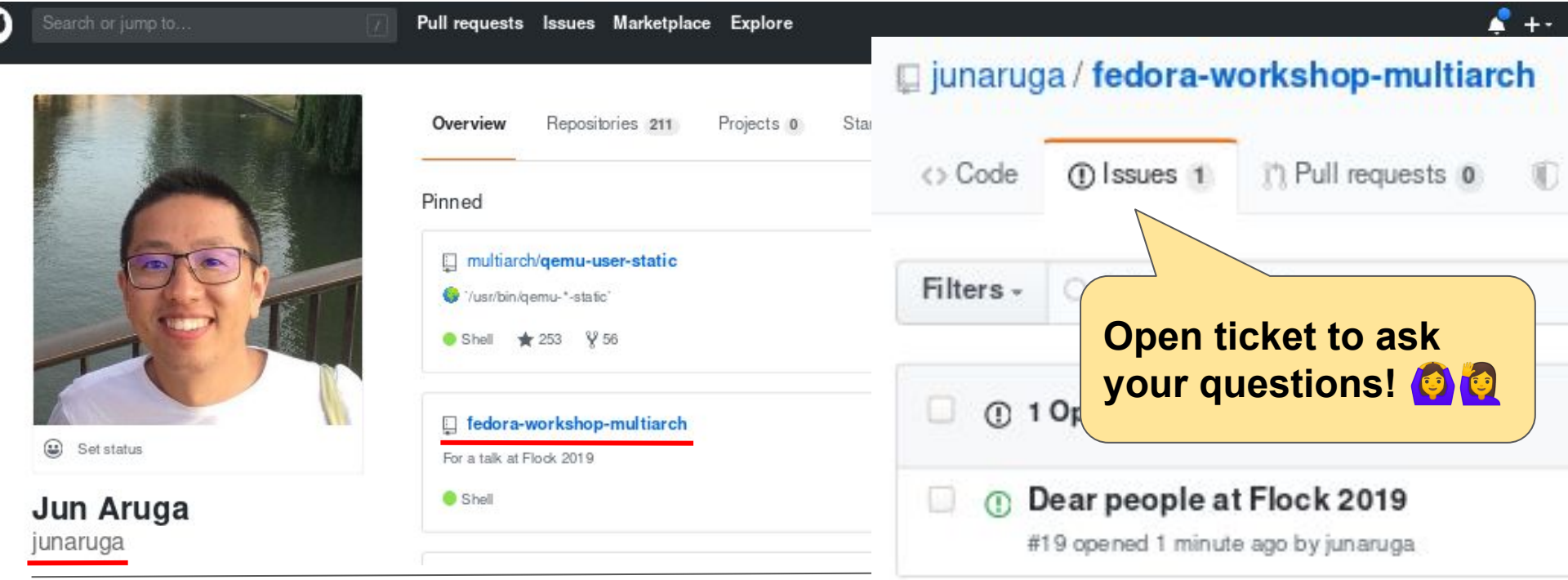
Special Thanks!

1. multiarch/qemu-user-static project
2. dbhi/qus project (sister project)
3. containers/libpod project
4. containers/buildah project
5. docker/buildx project

Go https://github.com/junaruga/fedora-workshop-multiarch

Questions & Answers

Slide URL: https://github.com/junaruga/fedora-workshop-multiarch/slides



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