

# MULTI-ARRRRCH

Building images for multiple architectures using buildah

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# Here's What We're Covering Today

- Building and pushing single-arch images to registries
- Pulling single-arch images from registries
- What's in a manifest
- Pulling multi-arch images from registries
- What's in a manifest list
- Building and pushing multi-arch images to registries
- **buildah manifest**
- Using **buildah manifest**
- Building those images for those arches

## Building and pushing single-arch images to registries

- Build an image.
- Push image to a repository in a registry, either using a tag, or noting its digest.
- Tell your friends about your image using the `registry/repository:tag` or `registry/repository@digest` name.
- Destroy the local evidence, never speak of this again.

## Pulling single-arch images from registries

- Client asks registry for the manifest for an image that matches a given digest or tag in a repository.
- Registry hands back manifest for the image.
- Client asks for the layers and other things that make up the image.
- Client builds root filesystem, sets up namespaces, etc., execs the entry point or command.

## What's in a manifest anyway?

```
{
  "schemaVersion": 2,
  "mediaType": "application/vnd.docker.distribution.manifest.v2+json",
  "config": {
    "mediaType": "application/vnd.docker.container.image.v1+json",
    "size": 2199,
    "digest": "sha256:f0858ad3febd45bb2e5501cb459affffacef081f79eaa436085c3b6d9bd46ca"
  },
  "layers": [
    {
      "mediaType": "application/vnd.docker.image.rootfs.diff.tar.gzip",
      "size": 66774261,
      "Digest": "sha256:d318c91bf2a81634e0283fb7e7362efdd7c21164b60b74498360756dc82a95d9"
    }
  ]
}
```

## Pulling multi-arch images from registries

- Client asks registry for the manifest for an image that matches a given digest or tag in a repository.
- Registry hands back a *list* of manifests.
- Client selects an image from the list.
- Client asks registry for the manifest for the chosen image.
- Registry hands back manifest for the image.
- Client asks for the layers and other things that make up the image.
- Client builds root filesystem, sets up namespaces, execs the entry point or command.

## What's in the manifest list anyway?

```
{
  "schemaVersion": 2,
  "manifests": [
    {
      "mediaType": "application/vnd.oci.image.manifest.v1+json",
      "digest": "sha256:2bdf5f7e128130d711351178b9daaeb5e7c1cc63b3738882fc2cad80245b21eb",
      "size": 500,
      "platform": {
        "architecture": "amd64",
        "os": "linux"
      }
    }
  ]
}
```

## Building and pushing multi-arch images to registries

- Build an image. Repeat, repeat, repeat.
- Push images to a repository in a registry, either using unique tags, or noting their digests.
- Build a list of those images, describing the types of systems they're each best for.
- Push the list to a registry, probably using a tag, or noting its digest.
- Tell your friends about your “image” using the `registry/repository:tag` or `registry/repository@digest` name.
- Destroy the local evidence, never speak of this again.



## buildah manifest

- `buildah manifest create list`
  - Creates a new “image” that’s actually an image index / manifest list.
- `buildah manifest add list image`
  - Adds an entry to the list.
  - Handles either local (names or IDs) or remote (`docker://...`) images.
- `buildah manifest push list registry/repository:tag`
  - Pushes just the list.
- `buildah manifest push --all list registry/repository:tag`
  - Pushes the list *and* everything it references.
- `buildah rmi list`
  - Removes the list from local storage.

## Using buildah manifest

- `buildah manifest add` takes arguments.
  - `--arch`: mostly Go arch names.
  - `--os`: *linux*
  - `--os-version`: mostly unused, except maybe when OS is *windows*.
  - `--variant`: mostly unused, except for ARM.
  - `--features`: unused, in Docker format but reserved in OCI format.
  - `--os-features`: unused, except maybe when OS is *windows*.
- Read from the image by default, which is usually enough.
  - It's not enough for ARM, and we need to do some work there.

## Building those images for those arches

- Build on actual hardware, push to registry, for each arch. Build list, push list.
  - Add images using their digests or arch-specific tags.
  - The fastest or second-fastest option.
- Build in a VM, push to registry, for each arch. Build list, push list.
  - Cross-arch VMs exist, are kind of slow.
  - The slowest option.
- Cross-compile on build host for runtime arch, install onto a suitable base image, push along with list.
  - Be sure to mark the image with the right architecture!
  - The second-fastest or fastest option.
- Build for runtime, emulate for RUN (qemu-user-static), push along with list.
  - Faster than a cross-arch VM, probably slower than actual hardware.

## fedora-with-iputils (1/2)

```
#!/bin/bash
```

```
cat > Dockerfile <<- EOF
    FROM fedora
    RUN dnf -y install iputils && dnf clean all
EOF
```

```
declare -A image
for arch in amd64 arm64 s390x ; do
    buildah build-using-dockerfile --override-arch $arch --iidfile iid .
    image[$arch]=$(cat iid)
done
```

## fedora-with-iputils (2/2)

```
buildah manifest create fedora-with-iputils
```

```
for arch in ${!image[@]} ; do
    flags=
    case $arch in
        arm64|aarch64)
            flags="--arch arm64 --variant v8"
        esac
    buildah manifest add fedora-with-iputils $flags ${image[$arch]}
done
```

```
buildah manifest push --all fedora-with-iputils docker://nalind/fedora-with-iputils
```

## cursed-image

```
buildah manifest create cursed-image
buildah manifest add --override-arch=arm64 --override-os=linux \
--os=linux --arch=arm64 --variant=v8 cursed-image docker://fedora
buildah manifest add --override-arch=amd64 --override-os=linux \
--os=linux --arch=amd64 cursed-image docker://centos
buildah manifest add --override-arch=ppc64le --override-os=linux \
--os=linux --arch=ppc64le cursed-image docker://debian
buildah manifest add --override-arch=s390x --override-os=linux \
--os=linux --arch=s390x cursed-image docker://alpine
buildah manifest push --all cursed-image docker://nalind/cursed-image
```

# Thank You!

[buildah.io](https://buildah.io)

<https://github.com/nalind/devconfcz2020>



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