Using Apptainer with GHCR at NJIT Academics

A streamlined guide for authenticating with and using GitHub Container Registry (ghcr.io) for Apptainer images with the njit-academics organization.

Prerequisites

- Apptainer installed on your machine/cluster
- GitHub account with njit-academics organization membership

Part 1: Authentication (Critical Step)

1.1 Generate GitHub Personal Access Token (PAT)

1. Go to GitHub Settings → Developer settings → Personal access tokens → Tokens (classic)
2. Click "Generate new token (classic)"
3. Name: `apptainer-ghcr-njit`
4. **Scope: Select `write:packages`** (includes read:packages)
5. Generate and **copy the token immediately**

1.2 Authorize PAT for SSO (Most Missed Step)

1. On the Personal access tokens page, find your new token
2. Click **"Configure SSO"** → **"Authorize"** for njit-academics
3. This step is mandatory for organization access

1.3 Login with Apptainer

```
apptainer remote login --username YOUR_GITHUB_USERNAME ghcr.io
# When prompted for password, paste your PAT (not GitHub password)
```

Part 2: Pull from Docker Hub, Modify, and Push to GitHub

Our workflow eliminates Docker Hub for storage - pull any image from Docker Hub, modify it, then push to GitHub Container Registry.

2.1 Create Definition File Based on Docker Hub Image

Create a definition file that directly references any Docker Hub image:

```
# my-modified-app.def
Bootstrap: docker
From: ubuntu:22.04

%post
    # Add your modifications here
    apt-get update
    apt-get install -y your-software

%runscript
    # Your custom startup command
    echo "Running modified container"
```

Other examples:

```
Bootstrap: docker
From: python:3.9
# or From: nginx:latest
# or From: postgres:14
```

2.2 Build Your Modified Version

```
# Apptainer automatically pulls from Docker Hub and converts
sudo apptainer build my-modified-app.sif my-modified-app.def
```

Optional: Pre-convert to SIF (if you want to work with the base image locally first):

```
apptainer build ubuntu-base.sif docker://ubuntu:22.04
# Then use Bootstrap: localimage / From: ./ubuntu-base.sif in your
definition
```

2.3 Push to GitHub Container Registry

```
# Always push to GitHub (never back to Docker Hub)
# Push to njit-academics organization repository
apptainer push my-modified-app.sif oras://ghcr.io/njit-
academics/container-images/my-simple-app:1.0
```

Note: I am using a repository named `container-images` which is in the njit-academics GitHub organization. You can replace this name with your own repository, but it should be in this GitHub organization.

Running the image:

```
apptainer exec my-modified-app.sif <command>    # Run specific command
apptainer shell my-modified-app.sif             # Interactive shell
```

Troubleshooting

"forbidden: denied" errors = Authentication issue:

- Verify PAT has `write:packages` scope
- **Confirm SSO authorization for njit-academics** (most common cause)
- Check you used PAT (not password) in login

URI Prefixes:

- `docker://` - Pull existing Docker/OCI images
- `oras://` - Push native Apptainer .sif files

Organization Push: Direct push to `ghcr.io/njit-academics/container-images/...` requires specific write permissions from org owners. The example uses the `container-images` repository within the njit-academics organization.