

Tampere University

COMP.SE.140 Continuous Development and Deployment - DevOps

Autumn 2025

Exercise 2: CD Pipeline hands-on

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The URL of the git repository:

- Course GitLab: <https://course-gitlab.tuni.fi/comp-cs-140-fall2025/nctesa.git>
- Personal public GitHub repo (just in case):
<https://github.com/SalonenTeemu/continuous-development-and-deployment.git>

Harbor links:

- Command + image link: docker pull
harbor.treok.eu/devops_exercise2_ts/exercise2@sha256:c52dddb569e04d064de4c
7b218b67564eb22ca625adf8b250da9c1fbac4172dc
- Harbor project repository link:
<https://harbor.treok.eu/harbor/projects/42/repositories/exercise2/>

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1 GitLab CI figures and logs

The following screenshots and logs show the requested situations and pipeline stages that occurred while completing this exercise.

1.1 Gitlab CI log of a build error

Change the images and gzip the image

Failed Teemu Salonen created pipeline for commit c4c38609 1 day ago, finished 5 minutes ago

For exercise2

branch → 6 jobs ⏱ 36 seconds, queued for 0 seconds

Pipeline Jobs 6 Failed Jobs 1 Tests 0

The screenshot shows a pipeline interface with five stages: build, test, package, smoketest, and scan. The build stage is highlighted with a red border and has a failed status. It contains a 'build' job with a failed status and a 'refresh' button. The other stages (test, package, smoketest, scan) have green borders and are marked as successful. Each stage has a corresponding 'test', 'package', and 'smoketest' job listed below it.

```
Running with gitlab-runner 18.2.1 (cc489270)
```

```
on gitlab-runner 5g9N4DjuD, system ID: s_a1de4ff0187a
```

```
Preparing the "docker" executor
```

```
00:19
```

```
Using Docker executor with image alpine/java:21-jre ...
Starting service docker:dind...
Using effective pull policy of [always] for container docker:dind
Pulling docker image docker:dind ...
Using docker image
sha256:0c6e741a59d2b5a4679660c106679ebc7d4db788ddc56ff5e6741120cb5615ee for docker:dind
with digest
docker@sha256:24173119fa6d1b5b4a27ab164fa7863deb66574ee5b90fef3b85dc888ef1a7e6 ...
Waiting for services to be up and running (timeout 30 seconds)...
Using effective pull policy of [always] for container alpine/java:21-jre
Pulling docker image alpine/java:21-jre ...
Using docker image
sha256:99544b4c5dba9decd3309582300a6a6348ff614e959f31290b3e31338b54310a for
alpine/java:21-jre with digest
alpine/java@sha256:a0433ecc16a0a9e389e216753019cc97f69f0973aecfadaf357d31838078bab5 ...
Preparing environment
00:01
Using effective pull policy of [always] for container
sha256:3a9fa0a34880c96b3a93a18645602cc1a1aa218de3cd76ba7c3856eb2f7d16bc
Running on runner-5g9n4djud-project-35173-concurrent-0 via gitlab-runner...
Getting source from Git repository
00:08
Gitaly correlation ID: 01K7771ER7JSVGPB4NDYT28C
Fetching changes with git depth set to 20...
Reinitialized existing Git repository in /builds/comp-cs-140-fall2025/nctesa/.git/
Created fresh repository.
Checking out c4c38609 as detached HEAD (ref is exercise2)...
Removing exercise2.tar.gz
Removing trivy-report.json
Skipping Git submodules setup
Executing "step_script" stage of the job script
```

```
00:03
```

```
Using effective pull policy of [always] for container alpine/java:21-jre
```

```
Using docker image
```

```
sha256:99544b4c5dba9decd3309582300a6a6348ff614e959f31290b3e31338b54310a for  
alpine/java:21-jre with digest
```

```
alpine/java@sha256:a0433ecc16a0a9e389e216753019cc97f69f0973aecfadaf357d31838078bab5 ...
```

```
$ echo "Compiling Java app..."
```

```
Compiling Java app...
```

```
$ javac src/*.java -d build/
```

```
/bin/sh: eval: line 165: javac: not found
```

```
Cleaning up project directory and file based variables
```

```
00:01
```

```
ERROR: Job failed: exit code 127
```

1.2 Gitlab CI log of a test error

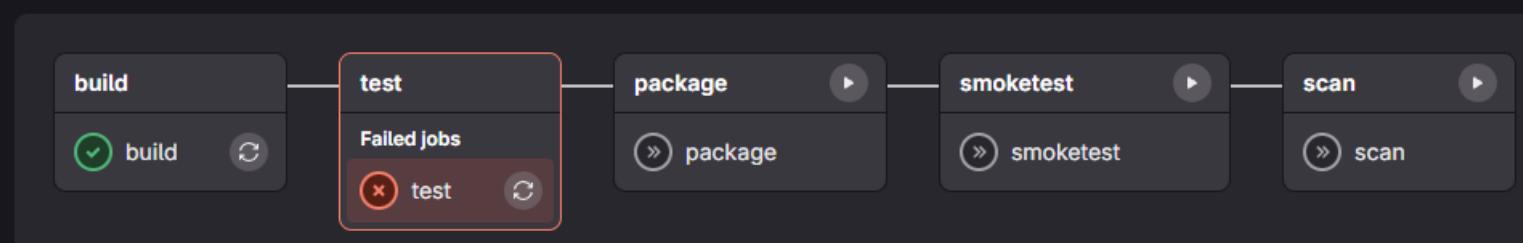
Update before_script part on test stage

✖ Failed Teemu Salonen created pipeline for commit 78a02acd 1 week ago, finished just now

For exercise2

branch → 6 jobs ⏱ 35 seconds, queued for 3 seconds

Pipeline Jobs 5 Failed Jobs 1 Tests 0



```
Running with gitlab-runner 18.2.1 (cc489270)
```

```
on gitlab-runner 5g9N4DjuD, system ID: s_a1de4ff0187a
```

```
Preparing the "docker" executor
```

```
00:17
```

```
Using Docker executor with image amazoncorretto:21 ...
```

```
Starting service docker:dind...
Using effective pull policy of [always] for container docker:dind
Pulling docker image docker:dind ...
Using docker image
sha256:0c6e741a59d2b5a4679660c106679ebc7d4db788ddc56ff5e6741120cb5615ee for docker:dind
with digest
docker@sha256:24173119fa6d1b5b4a27ab164fa7863deb66574ee5b90fef3b85dc888ef1a7e6 ...
Waiting for services to be up and running (timeout 30 seconds)...
Using effective pull policy of [always] for container amazoncorretto:21
Pulling docker image amazoncorretto:21 ...
Using docker image
sha256:5eb778d158131e70723d545dc9ea4e7e9e2b04bf7ee4a16e358feb4c727e6d7c for
amazoncorretto:21 with digest
amazoncorretto@sha256:4599af808338fc153b3d921e5e85797a477320cb677d5c672390b790159eebd1
...
Preparing environment
00:02
Using effective pull policy of [always] for container
sha256:3a9fa0a34880c96b3a93a18645602cc1a1aa218de3cd76ba7c3856eb2f7d16bc
Running on runner-5g9n4djud-project-35173-concurrent-0 via gitlab-runner...
Getting source from Git repository
00:02
Gitaly correlation ID: 01K777JDSD4X66KF00RG8BPR7Q
Fetching changes with git depth set to 20...
Reinitialized existing Git repository in /builds/comp-cs-140-fall2025/nctesa/.git/
Created fresh repository.
Checking out 78a02acd as detached HEAD (ref is exercise2)...
Removing build/
Skipping Git submodules setup
Downloading artifacts
00:01
Downloading artifacts for build (224808)...
```

```

Downloading artifacts from coordinator... ok
correlation_id=01K777K2DK01S6M6WH45S30CCR host=course-gitlab.tuni.fi id=224808
responseStatus=200 OK token=eyJraWQi0

Executing "step_script" stage of the job script

00:01

Using effective pull policy of [always] for container amazoncorretto:21

Using docker image
sha256:5eb778d158131e70723d545dc9ea4e7e9e2b04bf7ee4a16e358feb4c727e6d7c for
amazoncorretto:21 with digest
amazoncorretto@sha256:4599af808338fc153b3d921e5e85797a477320cb677d5c672390b790159eebd1
...
$ apk add --no-cache nodejs npm curl
/usr/bin/bash: line 162: apk: command not found

Cleaning up project directory and file based variables

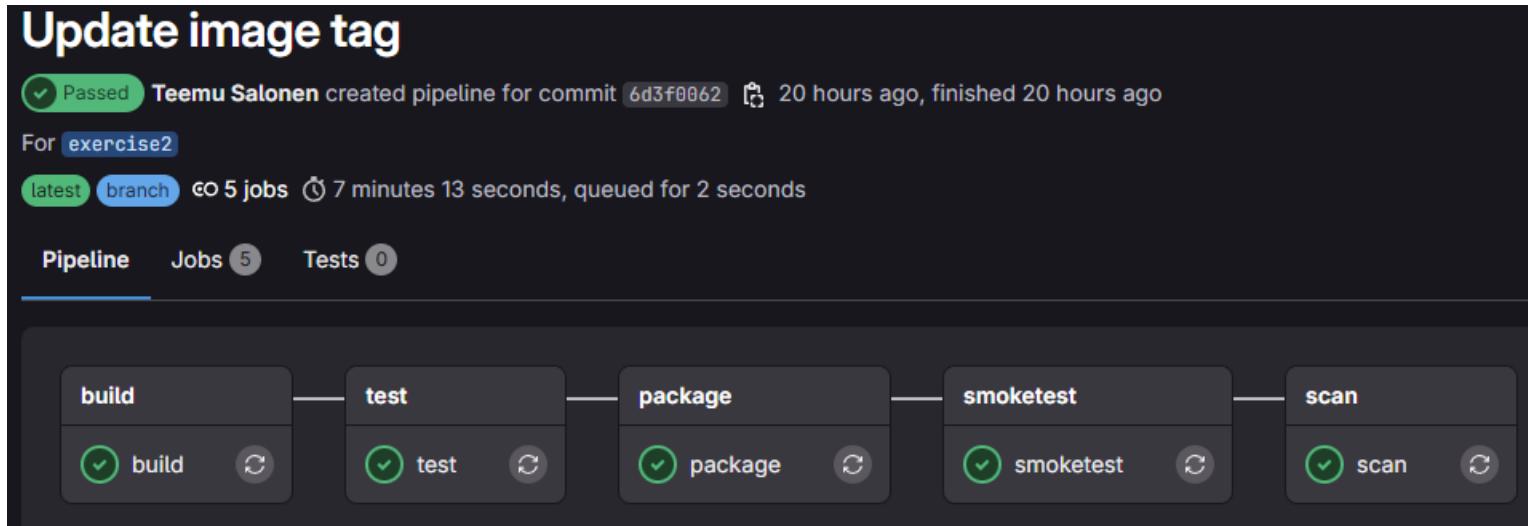
00:01

ERROR: Job failed: exit code 1

```

1.3 Gitlab CI log of successful test running the container

Log is from the smoketest stage.



```
Running with gitlab-runner 18.2.1 (cc489270)
```

```
on gitlab-runner 5g9N4DjuD, system ID: s_a1de4ff0187a
```

```
Preparing the "docker" executor
```

```
00:29
```

```
Using Docker executor with image docker:24 ...
Starting service docker:dind...
Using effective pull policy of [always] for container docker:dind
Pulling docker image docker:dind ...
Using docker image
sha256:0c6e741a59d2b5a4679660c106679ebc7d4db788ddc56ff5e6741120cb5615ee for docker:dind
with digest
docker@sha256:24173119fa6d1b5b4a27ab164fa7863deb66574ee5b90fef3b85dc888ef1a7e6 ...
Waiting for services to be up and running (timeout 30 seconds)...
Using effective pull policy of [always] for container docker:24
Pulling docker image docker:24 ...
Using docker image
sha256:e31dbb0fb5be21256b536b8650b8a7dc3dcf2f72167c8d486685e272df439e7a for docker:24
with digest
docker@sha256:9b17a9f25adf17b88d0a013b4f00160754adf4b07ccbe9986664a49886c2c98e ...
Preparing environment
00:03
Using effective pull policy of [always] for container
sha256:3a9fa0a34880c96b3a93a18645602cc1a1aa218de3cd76ba7c3856eb2f7d16bc
Running on runner-5g9n4djud-project-35173-concurrent-0 via gitlab-runner...
Getting source from Git repository
00:03
Gitaly correlation ID: 01K751GTQFD8RQQY1MR37037JF
Fetching changes with git depth set to 20...
Reinitialized existing Git repository in /builds/comp-cs-140-fall2025/nctesa/.git/
Created fresh repository.
Checking out 6d3f0062 as detached HEAD (ref is exercise2)...
Removing build/
Skipping Git submodules setup
Downloading artifacts
00:06
```

```
Downloading artifacts for package (224697)...

Downloading artifacts from coordinator... ok
correlation_id=01K751HY1J56TWHGBAS8E0TKPD host=course-gitlab.tuni.fi id=224697
responseStatus=200 OK token=eyJraWQiO

Executing "step_script" stage of the job script

00:26

Using effective pull policy of [always] for container docker:24

Using docker image
sha256:e31dbb0fb5be21256b536b8650b8a7dc3dcf2f72167c8d486685e272df439e7a for docker:24
with digest
docker@sha256:9b17a9f25adf17b88d0a013b4f00160754adf4b07ccbe9986664a49886c2c98e ...

$ echo "Unpacking and loading Docker image..." # collapsed multi-line command

Unpacking and loading Docker image...

Loaded image: exercise2:1.0

Starting the app container...

edfd77f1b8af7495fb5ecdf099ae489be5e07c0401b9a04c7b27725c8b6b1ef7

Waiting for container to be running...

Container started.

Waiting for service to respond...

Retrying in 2s...

Server running on port 8199

App is healthy!

Stopping and removing app container...

exercise2

exercise2

Uploading artifacts for successful job

00:03

Uploading artifacts...

smoketest-report.txt: found 1 matching artifact files and directories
```

```
Uploading artifacts as "archive" to coordinator... 201 Created  
correlation_id=01K751JY5TXY5MS8Z9R4S27ATM id=224698 responseStatus=201 Created  
token=eyJraWQi0

Cleaning up project directory and file based variables

00:02

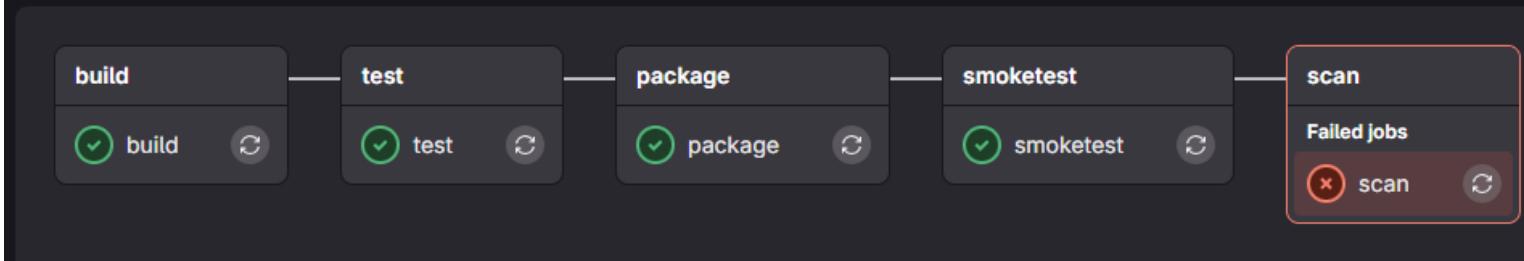
Job succeeded
```

1.4 Gitlab CI log of scan

The scan stage failed here because vulnerabilities were found and the `--exit-code 1` flag was set causing the job to stop. Some Trivy download logs were skipped here to keep the output shorter.

Fail scan stage if vulnerabilities are found

Failed Teemu Salonen created pipeline for commit fb4a60db 5 minutes ago, finished 15 seconds ago
For exercise2
latest branch 5 jobs 5 minutes 24 seconds, queued for 2 seconds
Pipeline Jobs 5 Failed Jobs 1 Tests 0



```
Running with gitlab-runner 18.2.1 (cc489270)  
on gitlab-runner 5g9N4DjuD, system ID: s_a1de4ff0187a  
Preparing the "docker" executor  
00:10  
Using Docker executor with image docker:24 ...  
Starting service docker:dind...  
Using effective pull policy of [always] for container docker:dind  
Pulling docker image docker:dind ...  
Using docker image sha256:0c6e741a59d2b5a4679660c106679ebc7d4db788ddc56ff5e6741120cb5615ee for docker:dind
```

```
with digest
docker@sha256:24173119fa6d1b5b4a27ab164fa7863deb66574ee5b90fef3b85dc888ef1a7e6 ...

Waiting for services to be up and running (timeout 30 seconds)...

Using effective pull policy of [always] for container docker:24

Pulling docker image docker:24 ...

Using docker image
sha256:e31dbb0fb5be21256b536b8650b8a7dc3dcf2f72167c8d486685e272df439e7a for docker:24
with digest
docker@sha256:9b17a9f25adf17b88d0a013b4f00160754adf4b07ccbe9986664a49886c2c98e ...

Preparing environment

00:01

Using effective pull policy of [always] for container
sha256:3a9fa0a34880c96b3a93a18645602cc1a1aa218de3cd76ba7c3856eb2f7d16bc

Running on runner-5g9n4djud-project-35173-concurrent-0 via gitlab-runner...

Getting source from Git repository

00:03

Gitaly correlation ID: 01K778706G14SE5Z2QVSE77NBM

Fetching changes with git depth set to 20...

Reinitialized existing Git repository in /builds/comp-cs-140-fall2025/nctesa/.git/
Created fresh repository.

Checking out fb4a60db as detached HEAD (ref is exercise2)...

Removing exercise2.tar.gz

Removing smoketest-report.txt

Skipping Git submodules setup

Downloading artifacts

00:06

Downloading artifacts for package (224817)...

Downloading artifacts from coordinator... ok
correlation_id=01K7787FGR157HQ12FJS1W10Z1 host=course-gitlab.tuni.fi id=224817
responseStatus=200 OK token=eyJraWQiO

Executing "step_script" stage of the job script
```

01:40

```
Using effective pull policy of [always] for container docker:24

Using docker image
sha256:e31dbb0fb5be21256b536b8650b8a7dc3dcf2f72167c8d486685e272df439e7a for docker:24
with digest
docker@sha256:9b17a9f25adf17b88d0a013b4f00160754adf4b07ccbe9986664a49886c2c98e ...

$ echo "Installing Trivy..."

Installing Trivy...

$ apk add --no-cache curl

fetch https://dl-cdn.alpinelinux.org/alpine/v3.20/main/x86_64/APKINDEX.tar.gz
fetch https://dl-cdn.alpinelinux.org/alpine/v3.20/community/x86_64/APKINDEX.tar.gz
(1/2) Upgrading libcurl (8.9.0-r0 -> 8.14.1-r2)
(2/2) Installing curl (8.14.1-r2)

Executing busybox-1.36.1-r29.trigger

OK: 43 MiB in 74 packages

$ curl -sfL
https://raw.githubusercontent.com/aquasecurity/trivy/main/contrib/install.sh | sh -s --
-b /usr/local/bin v0.67.0

aquasecurity/trivy info checking GitHub for tag 'v0.67.0'
aquasecurity/trivy info found version: 0.67.0 for v0.67.0/Linux/64bit
aquasecurity/trivy info installed /usr/local/bin/trivy

$ echo "Unpacking Docker image for scanning..."

Unpacking Docker image for scanning...

$ gunzip -c $APP_NAME.tar.gz | docker load

Loaded image: exercise2:1.0

$ echo "Scanning Docker image for vulnerabilities..."

Scanning Docker image for vulnerabilities...

$ trivy image --exit-code 1 --severity HIGH,CRITICAL --format json -o trivy-report.json
$DOCKER_IMAGE

2025-10-10T14:26:28Z      INFO      [vulndb] Need to update DB
2025-10-10T14:26:28Z      INFO      [vulndb] Downloading vulnerability DB...
```

```
2025-10-10T14:26:28Z      INFO      [vulndb] Downloading artifact...
    repo="mirror.gcr.io/aquasec/trivy-db:2"

1.47 MiB / 72.52 MiB [->-----]
2.02% ? p/s ?16.81 MiB / 72.52 MiB [-----]
>-----] 23.18% ?... 100.00% 11.14 MiB p/s
6.7s2025-10-10T14:26:36Z INFO      [vulndb] Artifact successfully downloaded
    repo="mirror.gcr.io/aquasec/trivy-db:2"

2025-10-10T14:26:36Z      INFO      [vuln] Vulnerability scanning is enabled

2025-10-10T14:26:36Z      INFO      [secret] Secret scanning is enabled

2025-10-10T14:26:36Z      INFO      [secret] If your scanning is slow, please try '--scanners vuln' to disable secret scanning

2025-10-10T14:26:36Z      INFO      [secret] Please see
https://trivy.dev/v0.67/docs/scanner/secret#recommendation for faster secret detection

2025-10-10T14:26:41Z      INFO      [javadb] Downloading Java DB...

2025-10-10T14:26:41Z      INFO      [javadb] Downloading artifact...
    repo="mirror.gcr.io/aquasec/trivy-java-db:1"

3.05 MiB / 784.28 MiB... [----->] 100.00% 207.67
KiB p/s ETA 0s784.28 MiB / 784.28 MiB [-----]
100.00% 12.57 MiB p/s 1m3s2025-10-10T14:27:44Z      INFO      [javadb] Artifact
successfully downloaded  repo="mirror.gcr.io/aquasec/trivy-java-db:1"

2025-10-10T14:27:44Z      INFO      [javadb] Java DB is cached for 3 days. If you want to
update the database more frequently, "trivy clean --java-db" command clears the DB
cache.

2025-10-10T14:27:45Z      INFO      Detected OS      family="alpine" version="3.20.2"

2025-10-10T14:27:45Z      INFO      [alpine] Detecting vulnerabilities...
    os_version="3.20" repository="3.20" pkg_num=50

2025-10-10T14:27:46Z      INFO      Number of language-specific files num=0

2025-10-10T14:27:46Z      WARN      Using severities from other vendors for some
vulnerabilities. Read https://trivy.dev/v0.67/docs/scanner/vulnerability#severity-selection for details.
```

⚠️ Notices:

- Version 0.67.2 of Trivy is now available, current version is 0.67.0

To suppress version checks, run Trivy scans with the --skip-version-check flag

Uploading artifacts for failed job

00:09

Uploading artifacts...

```

trivy-report.json: found 1 matching artifact files and directories

Uploading artifacts as "archive" to coordinator... 201 Created
correlation_id=01K778AYJZ7CPN074C0GR51S1A id=224819 responseStatus=201 Created
token=eyJraWQiO

Cleaning up project directory and file based variables

00:02

ERROR: Job failed: exit code 1

```

1.5 Gitlab CI log of delivery

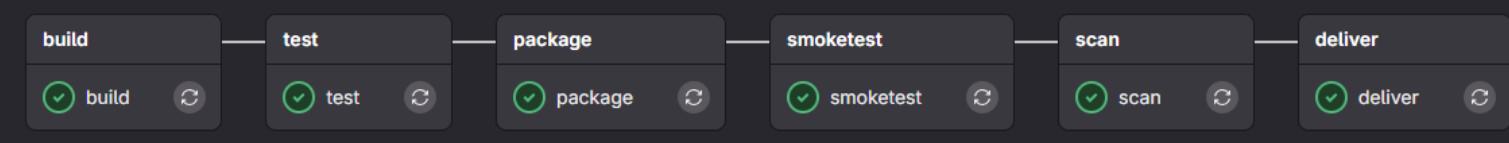
Update Harbor project

Passed Teemu Salonen created pipeline for commit `f6de3a70` 8 minutes ago, finished 37 seconds ago

For `deliver`

latest branch ← 6 jobs ⏱ 5 minutes 25 seconds, queued for 134 seconds

Pipeline Jobs 6 Tests 0



```

Running with gitlab-runner 18.2.1 (cc489270)

on gitlab-runner 5g9N4DjuD, system ID: s_a1de4ff0187a

Preparing the "docker" executor

00:12

Using Docker executor with image docker:24 ...

Starting service docker:dind...

Using effective pull policy of [always] for container docker:dind

Pulling docker image docker:dind ...

Using docker image
sha256:0c6e741a59d2b5a4679660c106679ebc7d4db788ddc56ff5e6741120cb5615ee for docker:dind
with digest
docker@sha256:24173119fa6d1b5b4a27ab164fa7863deb66574ee5b90fef3b85dc888ef1a7e6 ...

Waiting for services to be up and running (timeout 30 seconds)...

Using effective pull policy of [always] for container docker:24

```

```
Pulling docker image docker:24 ...

Using docker image
sha256:e31dbb0fb5be21256b536b8650b8a7dc3dcf2f72167c8d486685e272df439e7a for docker:24
with digest
docker@sha256:9b17a9f25adf17b88d0a013b4f00160754adf4b07ccbe9986664a49886c2c98e ...

Preparing environment

00:01

Using effective pull policy of [always] for container
sha256:3a9fa0a34880c96b3a93a18645602cc1a1aa218de3cd76ba7c3856eb2f7d16bc

Running on runner-5g9n4djud-project-35173-concurrent-0 via gitlab-runner...

Getting source from Git repository

00:04

Gitaly correlation ID: 01K77D0JSR078S3EEH4TB9B7ZC

Fetching changes with git depth set to 20...

Reinitialized existing Git repository in /builds/comp-cs-140-fall2025/nctesa/.git/
Created fresh repository.

Checking out f6de3a70 as detached HEAD (ref is deliver)...

Removing exercise2.tar.gz

Removing trivy-report.json

Skipping Git submodules setup

Downloading artifacts

00:05

Downloading artifacts for package (224829)...

Downloading artifacts from coordinator... ok
correlation_id=01K77D13G0F5482Y5SYNAPE9S1 host=course-gitlab.tuni.fi id=224829
responseStatus=200 OK token=eyJraWQiO

Executing "step_script" stage of the job script

00:18

Using effective pull policy of [always] for container docker:24

Using docker image
sha256:e31dbb0fb5be21256b536b8650b8a7dc3dcf2f72167c8d486685e272df439e7a for docker:24
```

```
with digest
docker@sha256:9b17a9f25adf17b88d0a013b4f00160754adf4b07ccbe9986664a49886c2c98e ...

$ echo "Logging in to Harbor..."
Logging in to Harbor...

$ docker login harbor.treok.eu -u Teemu -p $HARBOR_PASSWORD
WARNING! Using --password via the CLI is insecure. Use --password-stdin.
WARNING! Your password will be stored unencrypted in /root/.docker/config.json.

Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded

$ echo "Unpacking Docker image..."
Unpacking Docker image...

$ gunzip -c $APP_NAME.tar.gz | docker load
Loaded image: exercise2:1.0

$ echo "Tagging and pushing to Harbor..."
Tagging and pushing to Harbor...

$ docker tag $DOCKER_IMAGE $HARBOR_IMAGE
$ docker push $HARBOR_IMAGE

The push refers to repository [harbor.treok.eu/devops_exercise2_ts/exercise2]
19aaa39bc07a: Preparing
df48aaf6114d: Preparing
8be42626b269: Preparing
61e67853312d: Preparing
1206e1649bba: Preparing
befb1bf2e12b: Preparing
5fd6a51801a4: Preparing
78561cef0761: Preparing
befb1bf2e12b: Waiting
```

```
5fd6a51801a4: Waiting
78561cef0761: Waiting
61e67853312d: Pushed
1206e1649bba: Pushed
df48aaf6114d: Pushed
8be42626b269: Pushed
19aaa39bc07a: Pushed
5fd6a51801a4: Pushed
78561cef0761: Pushed
befb1bf2e12b: Pushed
1.0: digest: sha256:c52dddb569e04d064de4c7b218b67564eb22ca625adf8b250da9c1fbac4172dc
size: 1991

Running after_script
00:00

Running after script...
$ docker logout harbor.treok.eu

Removing login credentials for harbor.treok.eu

Cleaning up project directory and file based variables
00:01

Job succeeded
```

2 Summary of difficulties and main problems

- Encountered several syntax issues during the exercise, especially with multiline scripts and shell quoting. The GitLab pipeline editor helped with this.
- Problems in the before_script section of the test stage. I initially stupidly used Debian apt commands even though the image was alpine based, so they had to be replaced with apk.
- The artifact path in the test stage was initially incorrect. I saved the results to a subfolder (test/), but the GitLab runner expected them in the root directory.

- As discussed in the lectures, I initially faced issues saving and reloading the built Docker image because of the 100 MB artifact size limit in GitLab CI. This was resolved by switching to the recommended lightweight base image and compressing the Docker image with gzip before saving it.
- I encountered issues connecting to the application inside the running container. Initially, it was unclear to me whether the application had successfully started or had crashed. The problem again a bit stupidly turned out to be that I had forgotten to use `docker exec $APP_NAME` before the curl command.