



**Ganpat  
University**

॥ विद्यया समाजोत्कर्षः ॥

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## **-----PRACTICAL 07-----**

### **Securing a Docker Image Before Deployment to Production**

**John, a developer, is working on a web application called *SecureApp* that his team plans to deploy to a Kubernetes cluster in IBM Cloud. Before deployment, John wants to ensure the Docker image for *SecureApp* is secure and free from vulnerabilities. He decides to use IBM Cloud Container Registry and Vulnerability Advisor to scan the image for security issues and make the necessary corrections.**

#### **Steps:**

- **Building the Docker Image**
- **Tag the image for container registry**
- **Login to IBM Cloud Container Registry**
- **Push Image to Container Registry**
- **Check Vulnerability Scan Results**
- **Address Vulnerabilities**
- **Rebuild and Re-scan the Image**
- **Deploy the Secure Image**

First we login to IBM cloud

```
C:\Windows\System32\cmd.exe
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>ibmcloud login -a https://cloud.ibm.com -u passcode -p K8xwGe2oXo
API endpoint: https://cloud.ibm.com
Authenticating...
OK
Targeted account IBM India Pvt ltd, C/o Software (9553f5f7184ddb922a056f240cf78ef6) <-> 2716063

Select a region (or press enter to skip):
1. au-syd
2. in-che
3. jp-osa
4. jp-tok
5. eu-de
6. eu-es
7. eu-gb
8. ca-tor
9. us-south
10. us-east
11. br-sao
Enter a number> 1
Targeted region au-syd

API endpoint: https://cloud.ibm.com
Region: au-syd
User: tusharpanchal21@gnu.ac.in
Account: IBM India Pvt ltd, C/o Software (9553f5f7184ddb922a056f240cf78ef6) <-> 2716063
Resource group: No resource group targeted, use 'ibmcloud target -g RESOURCE_GROUP'

New version 2.28.1 is available.
Change logs: https://github.com/IBM-Cloud/ibm-cloud-cli-release/releases/tag/v2.28.1
TIP: use 'ibmcloud config --check-version=false' to disable update check.

Do you want to update? [y/N] > y

Installing version '2.28.1'...
Failed to upgrade CLI. No binary is available for your Windows ARM64 operating system.

C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>
```

And we'll login to container registry too

```
C:\Windows\System32\cmd.exe
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>ibmcloud cr login
Logging 'docker' in to 'au.icr.io'...
Logged in to 'au.icr.io'.
OK

C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>ibmcloud target -g default
Targeted resource group default

API endpoint: https://cloud.ibm.com
Region: au-syd
User: tusharpanchal21@gnu.ac.in
Account: IBM India Pvt ltd, C/o Software (9553f5f7184ddb922a056f240cf78ef6) <-> 2716063
Resource group: default

C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>
```

And than build the image

```

C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>docker build -t tushar-test .
[+] Building 1.8s (12/12) FINISHED
=> [internal] load build definition from Dockerfile
=> => transferring dockerfile: 956B
=> [internal] load metadata for docker.io/library/node:18-alpine
=> [auth] library/node:pull token for registry-1.docker.io
=> [internal] load .dockerignore
=> => transferring context: 7B
=> [1/6] FROM docker.io/library/node:18-alpine@sha256:82794a00b894c0f4bbd190040040b1c00005791713000637a0000000000000000
=> [internal] load build context
=> => transferring context: 88B
=> CACHED [2/6] WORKDIR /app
=> CACHED [3/6] COPY public/ ./public/
=> CACHED [4/6] RUN echo '{ "name": "html", "version": "1.0.0", "main": "app.js", "dependencies": { "express": "4.18.2" } }' > package.json
=> CACHED [5/6] RUN npm install
=> CACHED [6/6] RUN echo "const express = require('express'); const path = require('path'); const app = express(); app.use(express.static(path.join(
=> exporting to image
=> => exporting layers
=> => writing image sha256:3dc975fcc4593dcb0bd5189930a087e7b0f35ac401192b0ba0000000000000000
=> => naming to docker.io/library/tushar-test
=> => 0.0s

What's next:
View a summary of image vulnerabilities and recommendations + docker scout quickview

C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>

```

Here we can see our new image is created

```

C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>docker images
REPOSITORY          TAG                 IMAGE ID            SIZE
tushar-test         latest             3dc975fcc459       135MB
tusharproject        latest             3dc975fcc459       135MB
icr.io/tushar/newimagetushar latest             3dc975fcc459       135MB
au.icr.io/tushar/newimagetushar latest             3dc975fcc459       135MB
docker/desktop-kubernetes v1.30.2-cni-v1.4.0-critools-v1.29.0-cri-dockerd-v0.3.11-1-debian 8b7b9de36bd5
registry.k8s.io/kube-apiserver v1.30.2            56ce0fd9fb53
registry.k8s.io/kube-controller-manager v1.30.2            e874818b3caa
registry.k8s.io/kube-scheduler v1.30.2            7820c83aa139
registry.k8s.io/kube-proxy v1.30.2            53c535741fb4
registry.k8s.io/etcd 3.5.12-0           3861cfd7c04
registry.k8s.io/coredns/coredns v1.11.1            cbb01a7bd410
busybox             latest             6fd955f66c23
docker/desktop-vpnkit-controller dc331cb22850be0cdd97c84a9cfecaf44a1afb6e 556098075b3d
registry.k8s.io/pause 3.9                e6f181688397
docker/desktop-storage-provisioner v2.0                99f89471f470

```

We need to install container-service and container-registry plugins

```
C:\Windows\System32\cmd.exe
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>ibmcloud plugin install container-registry container-service
Looking up 'container-registry' from repository 'IBM Cloud'...
Plug-in 'container-registry[cr] 1.3.11' found in repository 'IBM Cloud'
Plug-in 'container-registry[cr] 1.3.11' was already installed. Do you want to re-install it or not? [y/N] > y
Attempting to download the binary file...
 12.25 MiB / 12.25 MiB [=====] 100.00% 1s
12842496 bytes downloaded
Installing binary...
OK
Plug-in 'container-registry 1.3.11' was successfully installed into C:\Users\tushar\bluemix\plugins\container-registry. Use 'ibmcloud
plugin show container-registry' to show its details.
Looking up 'container-service' from repository 'IBM Cloud'...
Plug-in 'container-service[kubernetes-service/ks] 1.0.665' found in repository 'IBM Cloud'
Plug-in 'container-service[kubernetes-service/ks] 1.0.665' was already installed. Do you want to re-install it or not? [y/N] > y
Attempting to download the binary file...
 30.75 MiB / 30.75 MiB [=====] 100.00% 3s
32241152 bytes downloaded
Installing binary...
OK
Plug-in 'container-service 1.0.665' was successfully installed into C:\Users\tushar\bluemix\plugins\container-service. Use 'ibmcloud
plugin show container-service' to show its details.
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>
```

Now login to your cluster

```
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>ibmcloud ks cluster config --cluster cr3cpfcs0m882o64nbq0
OK
The configuration for cr3cpfcs0m882o64nbq0 was downloaded successfully.

Added context for cr3cpfcs0m882o64nbq0 to the current kubeconfig file.
You can now execute 'kubectl' commands against your cluster. For example, run 'kubectl get nodes'.
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>
```

Now add namespace into your registry and make sure that your region is au-sydney and registry should be au.icr.io

```
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>ibmcloud cr region-set au-syd
The region is set to 'ap-south', the registry is 'au.icr.io'.
OK
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>ibmcloud cr namespace-add tk-namespace
Adding namespace 'tk-namespace' in resource group 'default' for account IBM India Pvt ltd, C/o Software in registry au.icr.io...
Successfully added namespace 'tk-namespace'
OK
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>
```

So i just exceed the quota for uploading image so i'm creating namespace in new region

```

C:\Windows\System32\cmd.exe x Windows PowerShell x + v
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>ibmcloud cr login
Logging 'docker' in to 'au.icr.io'...
Logged in to 'au.icr.io'.

OK
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>docker tag au.icr.io/ushar-test au.icr.io/tk-namespace/tushar-test
Error response from daemon: No such image: au.icr.io/ushar-test:latest
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>docker tag au.icr.io/tushar-test au.icr.io/tk-namespace/tushar-test
Error response from daemon: No such image: au.icr.io/tushar-test:latest
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>docker tag au.icr.io/tusharproject au.icr.io/tk-namespace/tusharproject
Error response from daemon: No such image: au.icr.io/tusharproject:latest
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>docker tag tushar-test au.icr.io/tk-namespace/tushar-test
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>ibmcloud cr namespace-add tk-namespace-au
Adding namespace 'tk-namespace-au' in resource group 'default' for account IBM India Pvt ltd, C/o Software in registry au.icr.io...
Successfully added namespace 'tk-namespace-au'

OK
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>

```

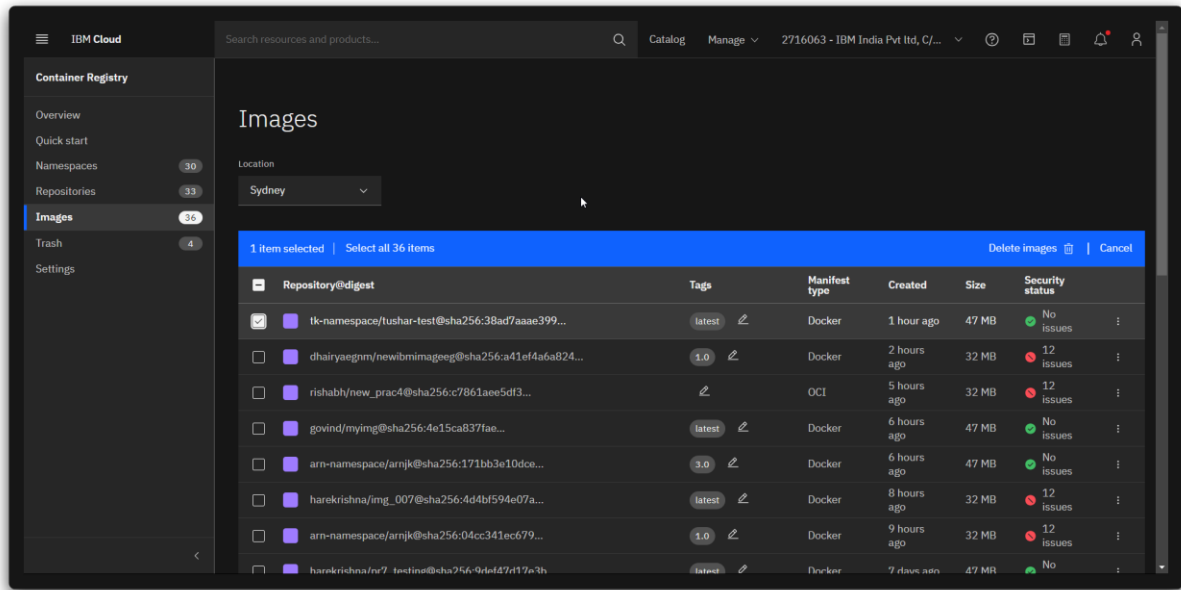
And then push image:

```

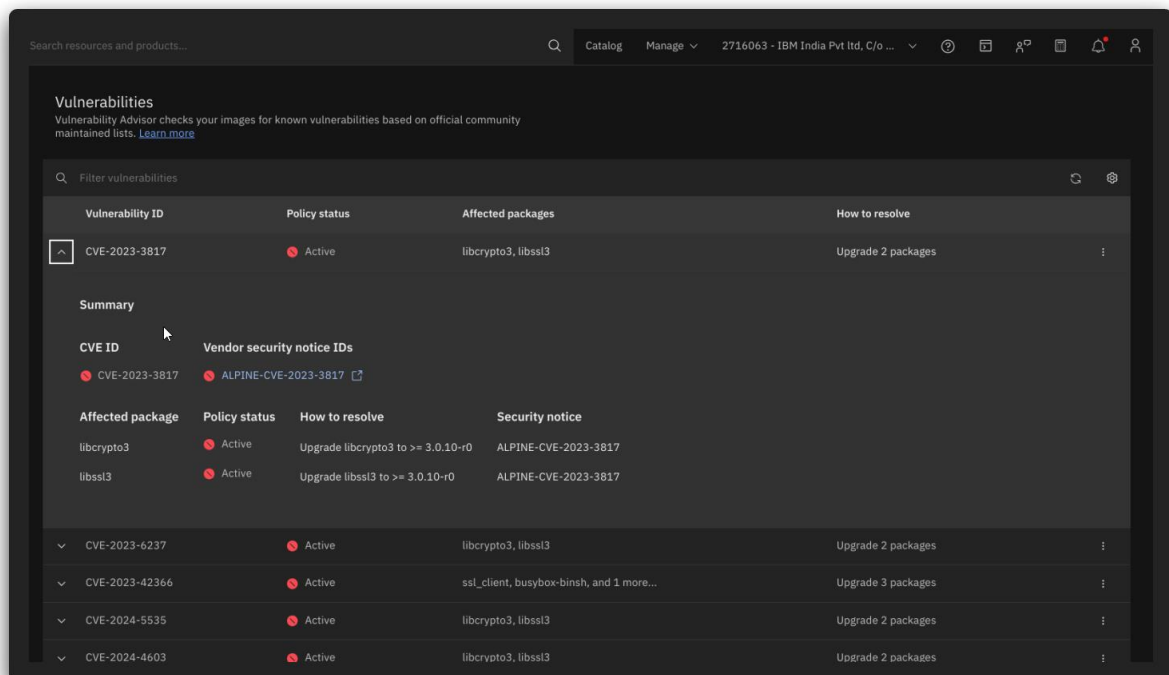
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>set DOCKER_CONTENT_TRUST=0
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>docker push au.icr.io/tk-namespace/tushar-test
Using default tag: latest
The push refers to repository [au.icr.io/tk-namespace/tushar-test]
ed3cb218d42f: Layer already exists
60f936a73ba8: Layer already exists
565e3ec7f734: Layer already exists
0d565e983994: Layer already exists
d3bd48d70171: Layer already exists
e2be10e97665: Layer already exists
06fd85419b65: Layer already exists
f58c462fa079: Layer already exists
63calfbb43ae: Layer already exists
latest: digest: sha256:38ad7aae3995083f125c8373a2d84fd7778a7da24e9aae8b8d7b6ddc2e4d265 size: 2197

```

Now we can see on container registry that our image is there



And also it has many issues So what we do to remove that issue is we check for the issue in detailed



Than check for it that what is error we'll search for it see what kind of issues we're getting



**Required CVE Record Information**

**CNA: OpenSSL Software Foundation**

Published: 2023-07-31 Updated: 2023-07-31  
Title: Excessive Time Spent Checking DH Q Parameter Value

**Description**

Issue summary: Checking excessively long DH keys or parameters may be very slow. Impact summary: Applications that use the functions DH\_check(), DH\_check\_ex() or EVP\_PKEY\_param\_check() to check a DH key or DH parameters may experience long delays. Where the key or parameters that are being checked have been obtained from an untrusted source this may lead to a Denial of Service. The function DH\_check() performs various checks on DH parameters. After fixing CVE-2023-3446 it was discovered that a large q parameter value can also trigger an overly long computation during some of these checks. A correct q value, if present, cannot be larger than the modulus p parameter, thus it is unnecessary to perform these checks if q is larger than p. An application that calls DH\_check() and supplies a key or parameters obtained from an untrusted source could be vulnerable to a Denial of Service attack. The function DH\_check() is itself called by a number of other OpenSSL functions. An application calling any of those other functions may similarly be affected. The other functions affected by this are DH\_check\_ex() and EVP\_PKEY\_param\_check(). Also vulnerable are the OpenSSL dhparam and pkeyparam command line applications when using the "-check" option. The OpenSSL SSL/TLS implementation is not affected by this issue. The OpenSSL 3.0 and 3.1 FIPS providers are not affected by this issue.

**Product Status**  
[Learn more](#)

Vendor	Product
OpenSSL	OpenSSL

Versions 4 Total

**On This Page**

Required CVE Record Information

- CNA: OpenSSL Software Foundation
- CVE Program

So we learn that our alpine version 12 is giving the issue so we'll update it to alpine18 . Now again we have to build the docker file

```
Dockertile > ...
1 FROM node:18-alpine
2
3 # Create the app directory and ensure permissions before switching to the non-root user
4 RUN mkdir -p /home/node/app && chown -R node:node /home/node/app
5
6 # Set working directory
7 WORKDIR /home/node/app
8
9 # Copy the package.json files
10 COPY package*.json ./
11
12 # Perform the npm install as root to avoid permission issues
13 RUN npm install
14
15 # Copy the rest of the application code with the right ownership
16 COPY --chown=node:node . .
17
18 # Switch to the non-root node user
19 USER node
20
21 # Expose the application's port
22 EXPOSE 3000
23
```

Now we again build image and tag image and pus that image  
And now if we see on registry we can see there is no issues now

Repository@digest	Tags	Manifest type	Created	Size	Security status
tk-namespace/tushar-test@sha256:38ad7aaae399...	latest	Docker	1 hour ago	47 MB	No issues
dhairyagnm/newbimimageeg@sha256:a41ef4a6a824...	1.0	Docker	2 hours ago	32 MB	12 issues

We can find issues through vulnerability adviser

We can scan image with

Ibmcloud cr va au.icr.io/tk-namespace/tushar-test

```
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>Ibmcloud cr va au.icr.io/tk-namespace/tushar-test
Checking security issues for 'au.icr.io/tk-namespace/tushar-test:latest'...

Image 'au.icr.io/tk-namespace/tushar-test:latest' was last scanned on Wed Oct 2 13:19:16 UTC 2024
The scan results show that NO ISSUES were found for the image.

OK
```

We know that there is not any issue for this image so we'll check for another image which is on sydney region

```
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>Ibmcloud cr va au.icr.io/dhairyaegnm/newibmimageeg@sha256:a41ef4a6a824a7188130d3a9dc70cb46fd5d9640887ecfla6dd85df3f8b65c78
Checking security issues for 'au.icr.io/dhairyaegnm/newibmimageeg@sha256:a41ef4a6a824a7188130d3a9dc70cb46fd5d9640887ecfla6dd85df3f8b65c78'...

Image 'au.icr.io/dhairyaegnm/newibmimageeg@sha256:a41ef4a6a824a7188130d3a9dc70cb46fd5d9640887ecfla6dd85df3f8b65c78' was last scanned on Wed Oct 2 13:19:16 UTC 2024
The scan results show that 12 ISSUES were found for the image.

Vulnerable Packages Found
=====
Vulnerability ID Policy Status Affected Packages How to Resolve
CVE-2022-37434 Active zlib Upgrade zlib to >= 1.2.12-r2
CVE-2023-0465 Active libcrypto1.1 and libssl1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2023-5678 Active libcrypto1.1 and libssl1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2023-3817 Active libcrypto1.1 and libssl1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2023-0464 Active libcrypto1.1 and libssl1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2022-4450 Active libssl1.1 and libcrypto1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2022-4304 Active libcrypto1.1 and libssl1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2023-0215 Active libcrypto1.1 and libssl1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2023-3446 Active libssl1.1 and libcrypto1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2023-0286 Active libcrypto1.1 and libssl1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2023-2650 Active libcrypto1.1 and libssl1.1 Upgrade 2 packages. Re-run command with --extended to view.
CVE-2022-2097 Active libcrypto1.1 and libssl1.1 Upgrade 2 packages. Re-run command with --extended to view.

To see the details about the fixes for these packages, run the command again with the '--extended' flag.

OK

C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODS\PRACTICAL-4\project>
```

We can see extended version with adding -extended in command



```

C:\Windows\System32\cmd.exe x Windows PowerShell x + v
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>Ibmcloud cr va au.icr.io/dhairyaegnm/newibmimageeg@sha256:a41ef4a6a824a718130d3a9dc70cb46fd5d9640887ecf1a6dd85df3f8b65c78 --extended
Checking security issues for 'au.icr.io/dhairyaegnm/newibmimageeg@sha256:a41ef4a6a824a718130d3a9dc70cb46fd5d9640887ecf1a6dd85df3f8b65c78'...
Image 'au.icr.io/dhairyaegnm/newibmimageeg@sha256:a41ef4a6a824a718130d3a9dc70cb46fd5d9640887ecf1a6dd85df3f8b65c78' was last scanned on Wed Oct 2 13:19:16 UTC 2024
The scan results show that 11 (50%) were found for the image.

Vulnerable Packages Found
=====
CVE-2022-37434

Policy Status
Active

Summary

Vendor Security Notice IDs   Official Notice
ALPINE-CVE-2022-37434        https://www.cve.org/CVERecord?id=CVE-2022-37434

Affected Packages   Policy Status   How to Resolve   Security Notice
zlib                Active          Upgrade zlib to >= 1.2.12-r2   ALPINE-CVE-2022-37434

CVE-2023-0465

Policy Status
Active

Summary

Vendor Security Notice IDs   Official Notice

```

Now we can scan our image locally through Scout

Through this command

Docker scout recommendation ImageName

```

C:\Windows\System32\cmd.exe x Windows PowerShell x + v
C:\Users\tushar\Documents\SEM 7\SEM 7\CS\CODES\PRACTICAL-4\project>docker scout recommendations au.icr.io/tk-namespace/tushar-test
! New version 1.14.0 available (installed version is 1.13.0) at https://github.com/docker/scout-cli
v Image stored for indexing
v Indexed 280 packages

! Base image was auto-detected. To get more accurate recommendations, build images with max-mode provenance attestations.
Review docs.docker.com / for more information.
Alternatively, use docker scout recommendations --tag <base image tag> to pass a specific base image tag.

Target | au.icr.io/tk-namespace/tushar-test:latest
digest | 3dc975fcc459

## Recommended fixes

Base image is node:18-alpine

Name      | 18-alpine
Digest    | sha256:ea8e360a721d870337fe899c70ea7def62f2a72cf1b6f7beb8a3ccaac8b6049c
Vulnerabilities | 0C 0H 0M 0L
Pushed    | 2 months ago
Size      | 45 MB
Packages  | 219
Flavor     | alpine
OS         | 3.20
Runtime    | 18

The base image is also available under the supported tag(s) 18-alpine3.20, 18.20-alpine, 18.20-alpine3.20, 18.20.4-alpine, 18.20.4-alpine3.20, hydrogen-alpine, hydrogen-alpine3.20. If you want to display recommendations specifically for a different tag, please re-run the command using the --tag flag.

Refresh base image

```