CS 551: Assignment 2

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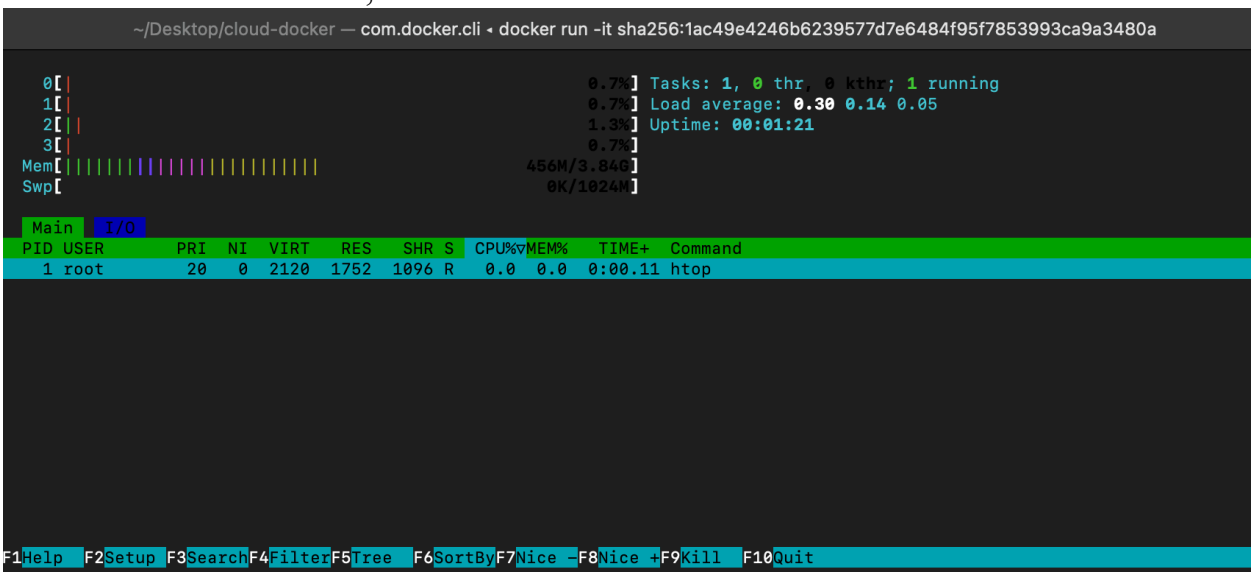
Part 2: Dockerfiles

My Dockerfile was structured like this:

```
FROM alpine

RUN adduser -D iroycho-clc

RUN apk update && apk add htop

USER iroycho-clc

ENTRYPOINT ["htop"]
```

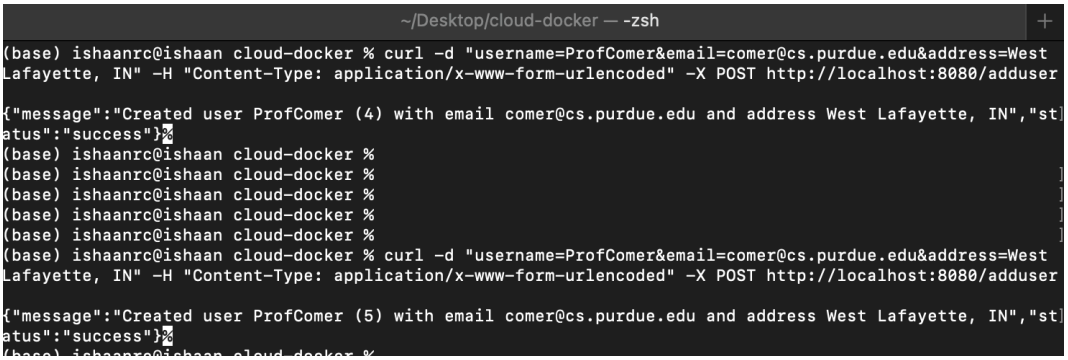
When I ran "`docker build .`", I got a hash when the build was complete. Then I ran the command "`docker run -it (hash)`". At this point, I could use the arrow keys to move the columns left and right and see the values in the TIME+ column increasing.

Attached is a screenshot, of the same:

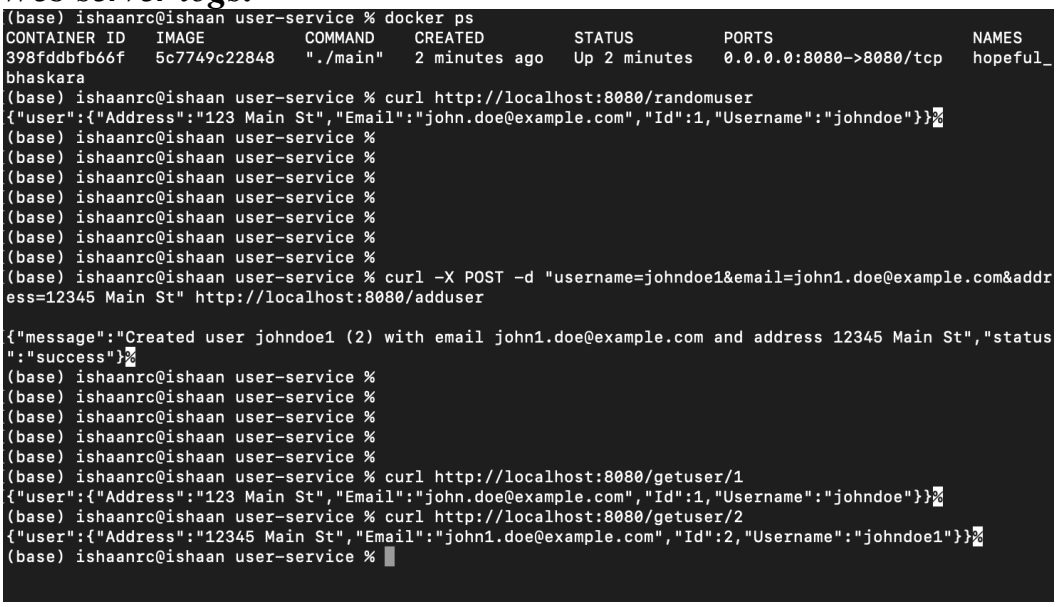


Part 3: Running a RESTful Go Microservice

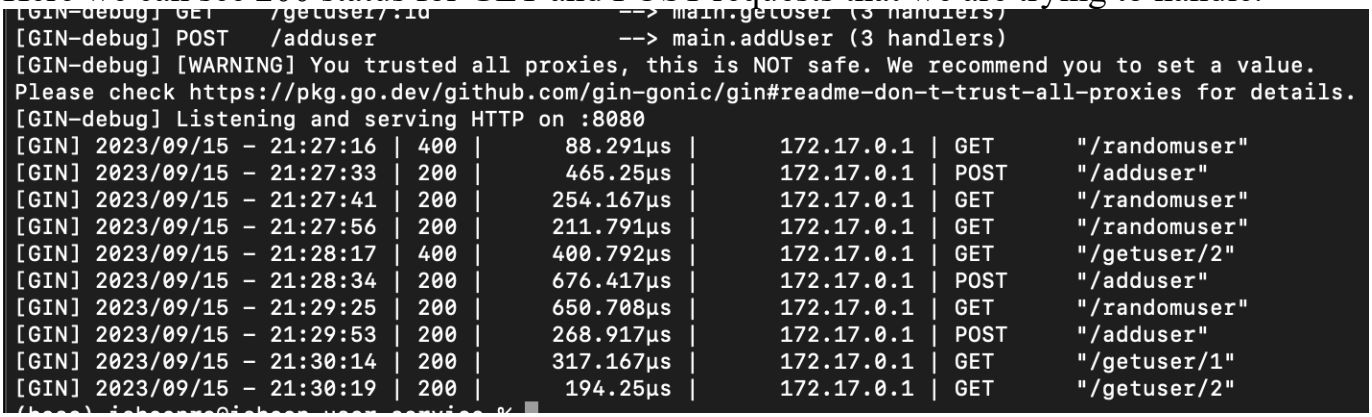
Curl commands:



Web server logs:



Here we can see 200 status for GET and POST requests that we are trying to handle.



Part 4: Security of Public Containers Analysis

Some of my public containers had the following vulnerabilities:

Container 1:

1. **CVE-2023-24540**
   Severity: 9.8 Critical
   - **Description:** Some JavaScript whitespaces aren't recognized as such, potentially allowing unsanitized template execution.
   - **Mitigation:** Update the affected software to the latest version where the issue is fixed or sanitize JavaScript inputs thoroughly to consider all whitespace characters.

2. **CVE-2022-23806**
   Severity: 9.1 Critical
   - **Description:** In certain Go crypto operations, an invalid big.Int value might be wrongly considered valid.
   - **Mitigation:** Upgrade Go to versions 1.16.14 or 1.17.7 and later to patch this vulnerability.

Container 2:

1. **CVE-2023-31047**
   Severity: 9.8 Critical
   - **Description:** Django versions mentioned could allow multiple file uploads without validating all files.
   - **Mitigation:** Upgrade Django to versions 3.2.19, 4.1.9, or 4.2.1 and later to ensure proper file upload validation.

2. **CVE-2023-36053**
   Severity: 7.5 High
   - **Description:** Django's email and URL validation can be exploited to cause denial of service using specially crafted domain names.
   - **Mitigation:** Update Django to versions 3.2.20, 4.1.10, or 4.2.3 and later to prevent this potential ReDoS attack.

3. **CVE-2023-39417**
   Severity: 8.8 High
   - **Description:** PostgreSQL has a SQL injection flaw when using certain extension script constructs.

- **Mitigation:** Avoid using vulnerable, trusted, non-bundled extensions or ensure PostgreSQL and its extensions are updated to patched versions.

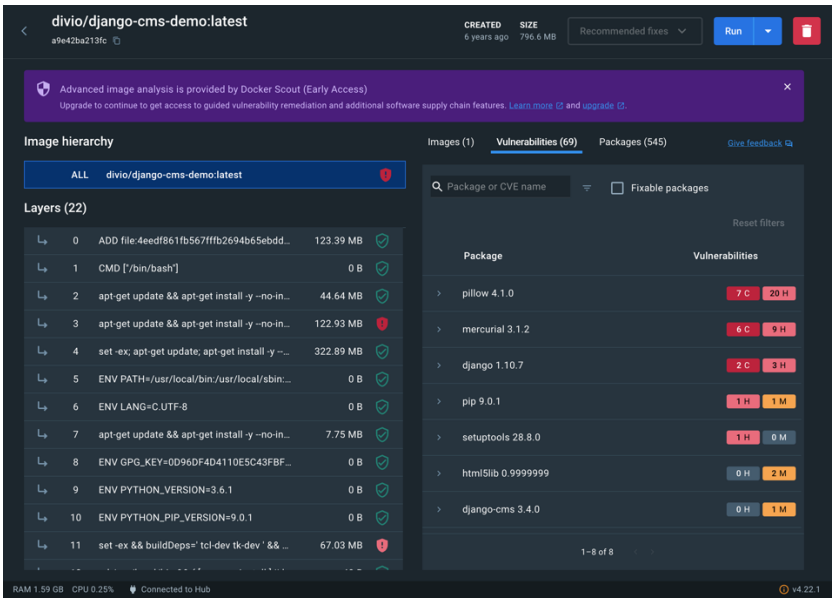
Container 3:

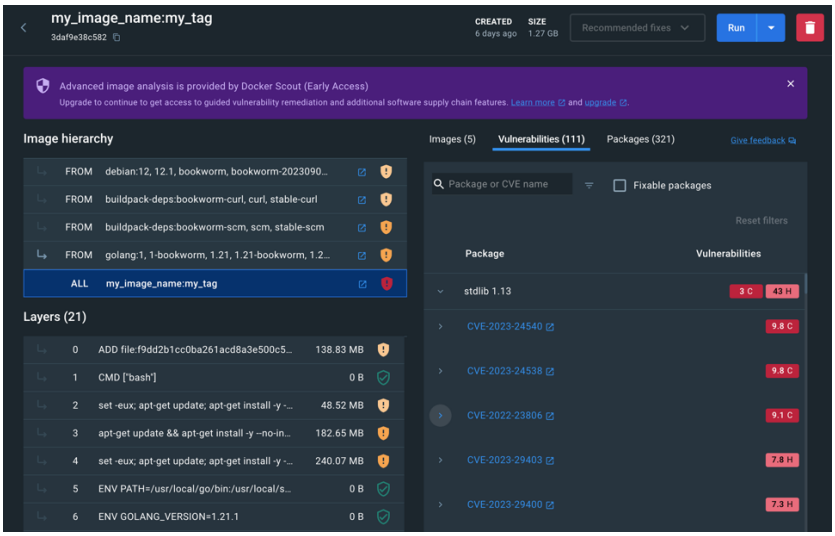
1. **CVE-2022-23219**
   Severity: 9.8 Critical
   - **Description:** The sunrpc module in the GNU C Library (glibc) can have a buffer overflow due to the unchecked copying of its hostname argument.
   - **Mitigation:** Upgrade the GNU C Library to a version beyond 2.34. Ensure applications using this library have stack protection enabled to prevent potential arbitrary code execution.

2. **CVE-2021-33574**
   Severity: 9.8 Critical
   - **Description:** The **mq_notify** function in glibc might access a thread attributes object after its memory has been freed, causing potential crashes or other unspecified issues.
   - **Mitigation:** Update the GNU C Library to a version later than 2.33 to ensure this use-after-free vulnerability is patched.

3. **CVE-2022-41903**
   Severity: 9.8 Critical
   - **Description:** Git has an integer overflow issue during commit formatting, potentially leading to arbitrary heap writes and code execution when using certain commands or attributes.
   - **Mitigation:** Update Git to versions released on or after 2023-01-17. If updating isn't immediately possible, disable **git archive** in untrusted repositories and ensure **daemon.uploadArch** is set to false if **git archive** is exposed via **git daemon**.

Screenshots of the vulnerabilities:





Part 5: Securing Your Container

So, I re-wrote my Dockerfile in part 2 making it more secure.

```
FROM alpine:3.14

RUN adduser -D -h /nonexistent -s /sbin/nologin iroycho-clc

RUN apk update && apk add --no-cache htop && rm -rf /var/cache/apk/*

USER iroycho-clc

ENTRYPOINT ["htop"]
```

I decided to add the following security additions:

1) **Base Image Version added**: To avoid potential bugs or vulnerabilities that exist in using “latest” or just “alpine”, we can use the exact version number to remove any possibility of buggy software.
2) **Clean up after installation:** To minimize the image size and reduce our attack surface, we clean up all temporary files, caches, etc. so attackers can’t manipulate it later.
3) **No home directory:** To minimize the attack surface, we don’t give the user a valid home directory. This removes the potential for attackers to gain access to temp files, configuration files, etc.
4) **Deny shell access:** This means even if a user uses “su” or similar command to switch users, he will not be given shell access. This prevents malicious actions that can be taken by an attacker.