CS 240
Computer Systems

#14: Containers and Cloud Data Stores

Oct. 14, 2021 · Wade Fagen-Ulmschneider

Containers:

Containers provide an **isolated snapshot** of a system that can be deployed in an isolated environment on heterogeneous systems.

Key Modern Container Technology: _____

- **As a container developer,** you build a Dockerfile that specifies the **snapshot** of the system you want to provide and then **build** that snapshot into a _____.

- Example (creating a docker image):

mp3/Dockerfile

```
1 FROM gcc:latest
2 COPY ./docker/entrypoint.sh /
3 RUN chmod +x entrypoint.sh
4 ENTRYPOINT ["/entrypoint.sh"]
```

Line 1 (FROM):

Lines 2 (COPY):

Line 3 (RUN):

Line 4 (ENTRYPOINT):

To build it:

```
$ docker build --tag mp3-docker .
```

- As **a user of a container**, you specify the name of the docker image that you want to use to launch that image:

```
$ docker run -it --rm -v "pwd":/mp3  mp3-docker "make"
$ docker run --rm -it -p 27017:27017 mongo
```

Purchasing IaaS:

AWS provides IaaS as their EC2 product. Current generation general purpose computing:

- t4g: Uses AWS Graviton2 CPUs (ARM, ex: M1-like)
- t3a: Uses AMD CPUs (x86-64)
- t3: Uses Intel CPUs

	vCPU	RAM	t4g	t3	t3a
nano	2	0.5 GiB	$0.0042	$0.0052	$0.0047
micro	2	1 GiB	$0.0084	$0.0104	$0.0094
small	2	2 GiB	$0.0168	$0.0208	$0.0188
medium	2	4 GiB	$0.0336	$0.0416	$0.0376

On-demand general purpose hourly rate, as of October 13, 2021
https://aws.amazon.com/ec2/pricing/on-demand/

Azure provides Linux VMs as "Azure Virtual Machines":

- B1: Uses Intel CPUs (equivalent to AWS t3)

	vCPU	RAM	B1
B1ls	1	0.5 GiB	$0.0052
B1s	2	1 GiB	$0.0104
B1ms	2	2 GiB	$0.0207
B1s	2	4 GiB	$0.0416

On-demand general purpose hourly rate, as of October 13, 2021
https://azure.microsoft.com/en-us/pricing/details/virtual-machines/linux/

Google provides Linux VMs as "Google Compute Engine" and allows you to customize your VM to your exact requirements:

- $0.022890 / vCPU hour
- $0.003067 / GB hour
- ...or choose from their pre-built selection (starts large-ish)

	vCPU	RAM	Price
(Custom)	0.25	0.5 GiB	$0.00725
(Custom)	1	4 GiB	$0.035158
e2-standard-2	2	8 GiB	$0.067006
(Custom)	2	8 GiB	$0.070316

https://cloud.google.com/compute/vm-instance-pricing

Data Storage
Central to almost all cloud applications is data and there are many solutions to data storage available.

[Option 1]: In-Memory Storage
Idea:

Examples of Use:

[Option 2]: File-Backed Disk Storage
Idea:

Examples of Use:

[Option 3]: Key-Value Stores
Idea:

Technologies:

[Option 4]: Document Store (A "NoSQL" Database)
Idea:

Technologies:

[Option 5]: Relational Database
Idea:

Technologies:

[Other Options]: Specialized Data Stores
Idea:

Examples of Use:

Using MongoDB -- A Document Store

```
$ docker run --rm -it -p 27017:27017 mongo
```

We know that mongodb provides a dictionary store -- what can that provide for us?

- Many document stores:

```
collection =  db['cs240']
```

- Ability to insert a document:

```
collection.insert_one({"Hello": "World", "Name": "Wade"})
```

- Ability to search for a document:

```
collection.find_one({"Name": "Wade"})
```

- The interface is exactly what you'd expect to store dictionary-based data in the cloud!
    - MongoDB is a popular open-source technology.
    - Many other options, you'll explore the MongoDB API!