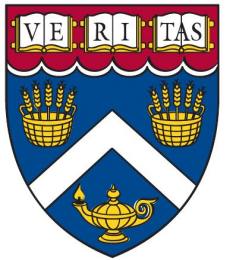


HARVARD
Extension School

Week 11
Logging, Serverless, Microservices and Docker

- **Week 11:** Logging,Serverless, Microservices and Docker
  - Logging and Log Analysis
    - CloudTrail
    - CloudWatch
  - Lambda (Serverless)
  - ElasticSearch and Visualization
  - API Gateway
  - Microservices
  - Docker

Logging and Log Analysis

Two major services for logging in AWS:

- CloudTrail: logs all activity on your account and it's enabled by default.
- CloudWatch: logs calls to specific API endpoints for AWS services.

CloudTrail can integrate with CloudWatch: Associate a CloudTrail event with a CloudWatch alarm.

CloudTrail

- Audit your AWS account
- COMPLIANCE : compliance audits by automatically recording and storing event logs for actions made within your AWS account
- SECURITY ANALYSIS AND TROUBLESHOOTING : capturing a comprehensive history of changes that occurred in your AWS account within a specified period of time
- VISIBILITY INTO USER AND RESOURCE ACTIVITY : user activity in AWS console and API calls, which users and accounts called AWS, the source IP address from which the calls were made, and when the calls occurred
- SECURITY AUTOMATION : respond to account activity threatening the security of your AWS resources like changing policy of a bucket to be public.

CloudWatch

- ACCESS ALL YOUR DATA LOGS FROM A SINGLE PLATFORM: AWS resources and on-premise
- VISIBILITY ACROSS YOUR APPLICATIONS, INFRASTRUCTURE, AND SERVICES : visualize key metrics like CPU utilization and memory. You can also correlate a log pattern
- INSIGHTS FOR AWS RESOURCES : integrated with many aws services

CloudWatch agent

AWS Instance

1) Create instance
2) Create an EC2 role with permission to write on AWS cloudwatch
   If on-premise server, get access key and secret key from IAM user that have permission to write on cloudwatch
3) Attach the role to the instance
4) Install aws log agent on the instance

On-premise

1) Create IAM user with permission to write on cloudwatch
2) Write down user credentials - access key and secret key
3) Install aws log agent and provide the credentials during the installation

CloudWatch agent

Installing cloudwatch agent
https://docs.aws.amazon.com/AmazonCloudWatch/latest/logs/QuickStartEC2Instance.html

```
curl https://s3.amazonaws.com/aws-cloudwatch/downloads/latest/awslogs-agent-setup.py -O
sudo python ./awslogs-agent-setup.py --region us-east-1
```

Check /var/awslogs/etc/awslogs.conf
And on AWS console check AWS CloudWatch logs.

Add apache logs to aws cloudWatch logs

1) Edit /var/awslogs/etc/awslogs.conf
2) At the end of the file, add apache log files (apache default log path on centos is /var/log/httpd/)
3) Restart awslogs (centos: systemctl restart awslogs)

AWS Lambda

- Compute without running or managing a server
- Zero administration
- Support many languages : Java , Python , C#, go , Node.js, Powershell
- Run your code in response to an event
- Serverless application

Create Lambda Function

1) Create Lambda execution role
2) AWS console -> Lambda -> create function -> python (or whatever language you use)

```
import json
def lambda_handler(event, context):
    # TODO implement
    return {
        'statusCode': 200,
        'body': json.dumps('Hello from Lambda!')
    }
```

Visualization

Splunk : Great but very expensive https://www.splunk.com/

Loggly : https://www.loggly.com/

ELK : Elasticsearch Logstash Kibana : Free but you need to manage the servers

- Elasticsearch: scalable, distributed, open source RESTful search and analytics engine.
- Logstash: Open source, data processing and transformation
- Kibana: Visualization part

AWS Elasticsearch: Manage nothing

Create Elasticsearch cluster

https://console.aws.amazon.com/es/home?region=us-east-1#

Create new domain

Fill up domain name and version

The rest is as you creating an EC2 machine(s)

Go to the cloudwatch -> select the log group(s) -> Action -> Stream to elasticsearch

API Gateway

From AWS Site

Amazon API Gateway helps developers to create and manage APIs to back-end systems running on Amazon EC2, AWS Lambda, or any publicly addressable web service. With Amazon API Gateway, you can generate custom client SDKs for your APIs, to connect your back-end systems to mobile, web, and server applications or services.

Create API Gateway with Lambda

https://console.aws.amazon.com/apigateway/home?region=us-east-1#/welcome

Create Lambda function , name it “e91lambda”

New API -> API Name

Action -> create Method -> Lambda function -> Lambda Function “e91lambda”

Action -> Deploy API -> New Stage -> Stage Name “say Prod” -> enable CORS

Microservices

Microservice is build and manage a well defined single service module. It is become very popular in DevOps in recent years.

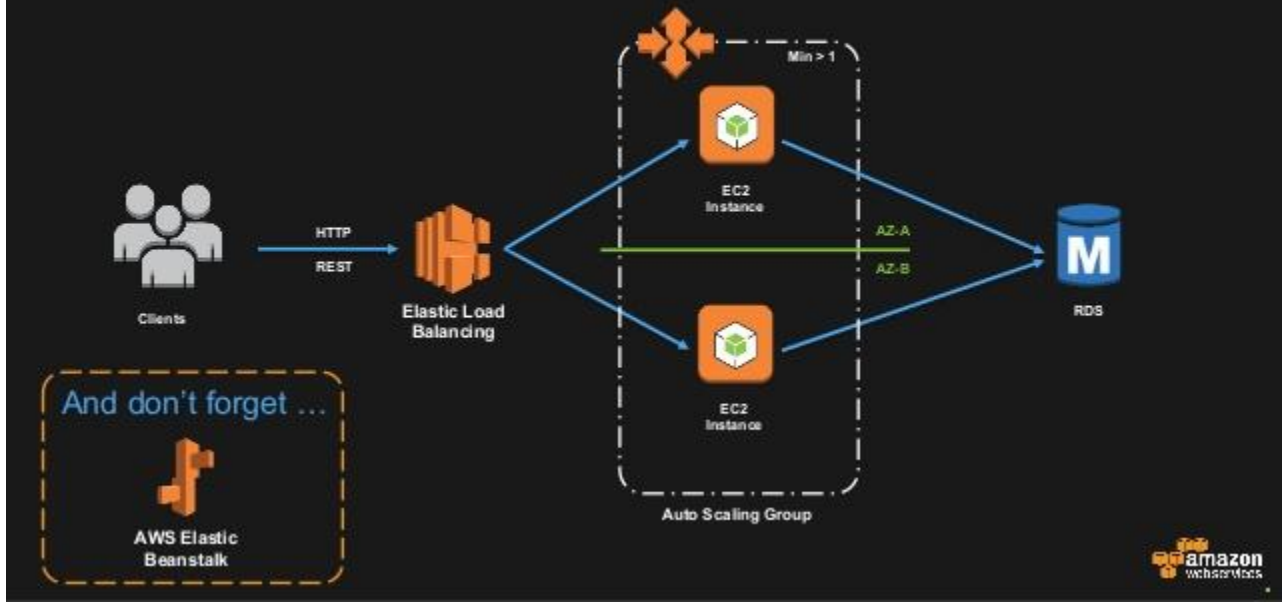
Microservice aligned with the Agile methodology and CI/CD.

https://trends.google.com/trends/explore?q=microservices

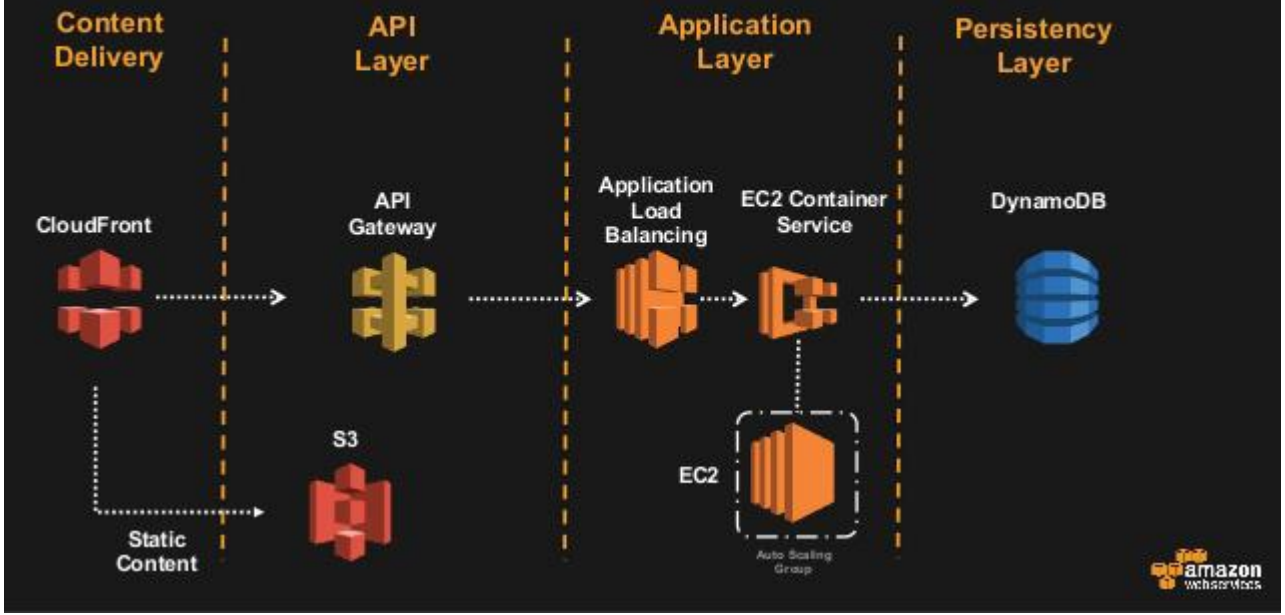
Why Microservices:

Modularity, Independence , different component , black box , faster, ownership, reusability, scalability, failure isolation, maintainability

The Traditional Microservice



A Typical Microservice Architecture on AWS



Docker

Scale and manage applications : https://www.docker.com

Docker Image : application code and dependencies in a single package

https://hub.docker.com/

Docker container : docker image at run time ,

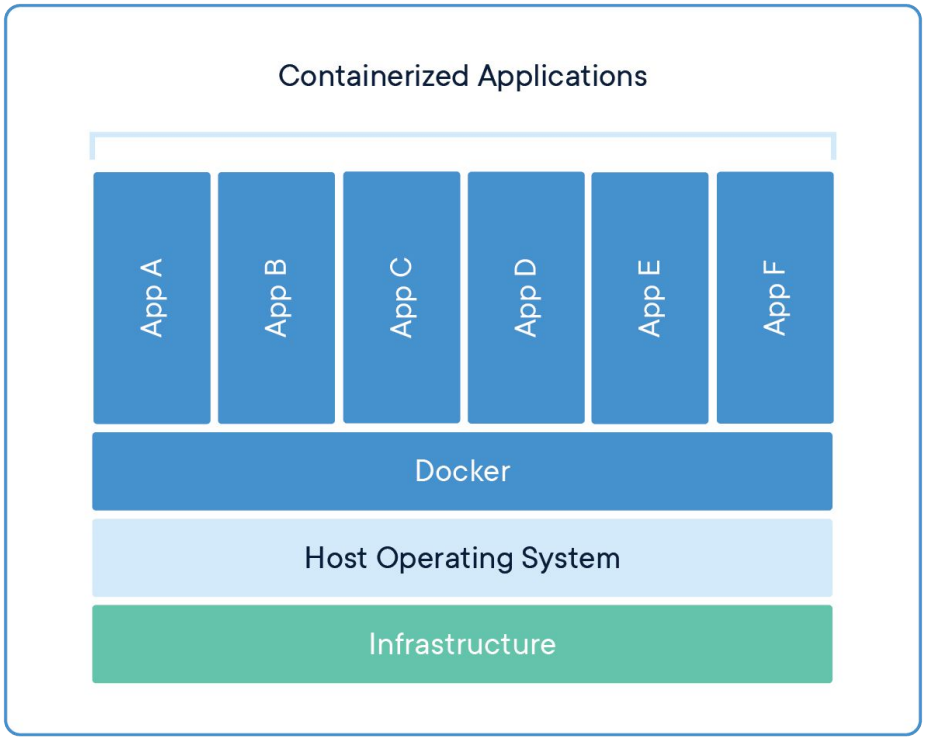
Docker containers share the machine OS.

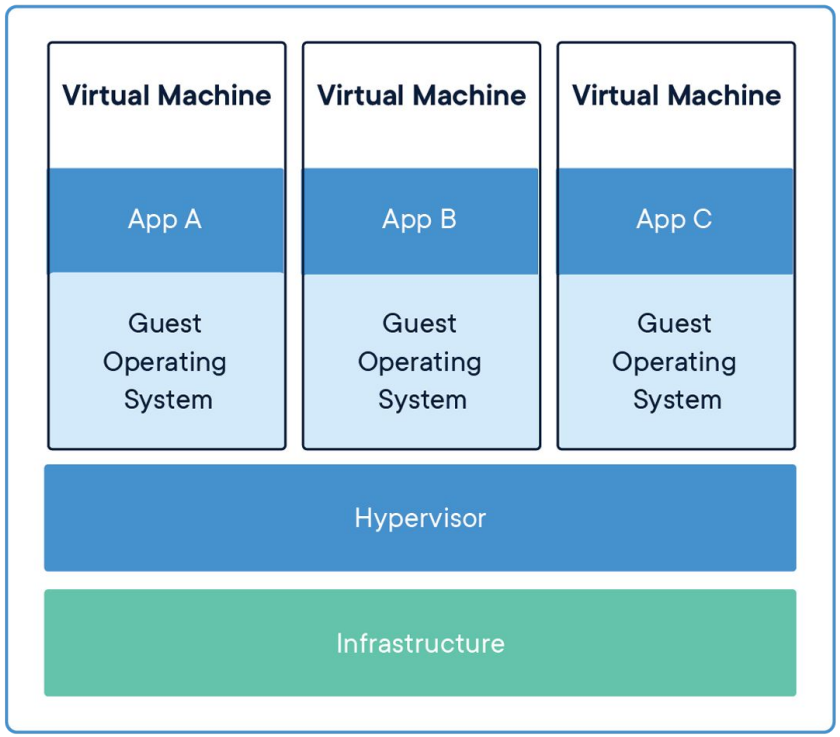
Docker vs Virtual Machine

Docker: abstraction at application layer

Virtual machine : abstraction of physical hardware

Containers vs Virtual Machine





```
yum install -y docker
systemctl start docker

docker images
REPOSITORY                    TAG                 IMAGE ID            CREATED             SIZE

docker pull centos
   Using default tag: latest
   Trying to pull repository docker.io/library/centos ...
   latest: Pulling from docker.io/library/centos
   aeb7866da422: Pull complete
   Digest: sha256:67dad89757a55bfdfabec8abd0e22f8c7c12a1856514726470228063ed86593b
   Status: Downloaded newer image for docker.io/centos:latest

docker images
   REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
   docker.io/centos    latest              75835a67d134        4 weeks ago         200 MB

docker pull seasadmin/centos
   Using default tag: latest
   Trying to pull repository docker.io/seasadmin/centos ...
   latest: Pulling from docker.io/seasadmin/centos
   Digest: sha256:dc29e2bcceac52af0f01300402f5e756cc8c44a310867f6b94f5f7271d4f3fec
   Status: Downloaded newer image for docker.io/seasadmin/centos:latest
```

```
mkdir test
cd test
cat > Dockerfile << EOF
FROM    seasadmin/centos:latest
RUN     yum update -y && yum install httpd -y
EXPOSE  80
CMD     ["/usr/sbin/httpd","-D","FOREGROUND"]
#COPY ./index.html /var/www/html/ <- example from https://hub.docker.com/_/httpd/

EOF

docker build -t "seasadmin/centos:0.2" .
   Sending build context to Docker daemon 2.048 kB
   Step 1/4 : FROM seasadmin/centos:latest
    ---> 75835a67d134
   Step 2/4 : RUN yum update -y && yum install httpd -y
    ---> Running in c098....
   .
   .
docker images
   REPOSITORY                  TAG             IMAGE ID            CREATED             SIZE
   seasadmin/centos            0.2             86318731b725        2 minutes ago       334 MB
   docker.io/centos            latest          75835a67d134        4 weeks ago         200 MB
   docker.io/seasadmin/centos  latest          75835a67d134        4 weeks ago         200 MB
```

```
echo "This is my site" >> /root/test/index.html

docker run -d -p 8080:80 -v /root/test:/var/www/html seasadmin/centos:0.2

docker ps
   CONTAINER ID        IMAGE                  COMMAND                  CREATED             STATUS
PORTS                  NAMES
   8d425a9cc654        seasadmin/centos:0.2   "/usr/sbin/httpd -..."   26 seconds ago      Up 25 seconds
0.0.0.0:8080->80/tcp   competent_engelbart


docker run -d -p 80:80 -v /root/test:/var/www/html seasadmin/centos:0.2

docker ps
CONTAINER ID        IMAGE                  COMMAND                  CREATED             STATUS              PORTS
NAMES
   bb8dca215064        seasadmin/centos:0.2   "/usr/sbin/httpd -..."   About a minute ago   Up About a minute
0.0.0.0:80->80/tcp     priceless_clarke
   8d425a9cc654        seasadmin/centos:0.2   "/usr/sbin/httpd -..."   3 minutes ago        Up 3 minutes
0.0.0.0:8080->80/tcp   competent_engelbart
```