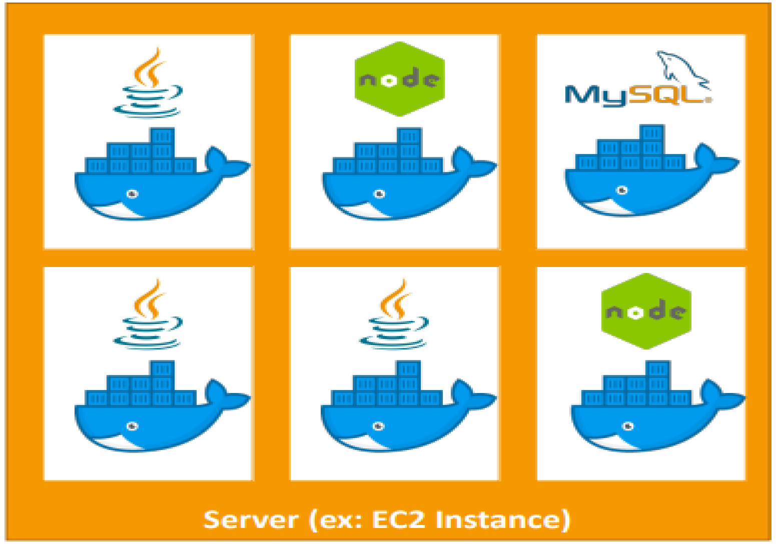
Other Compute Section

What is Docker?

- Docker is a software development platform to deploy apps
- Apps are packaged in **containers** that can be run on any OS
- **Apps run the same, regardless of where they're run**
  - Any machine
  - No compatibility issues
  - Predictable behavior
  - Less work
  - Easier to maintain and deploy
  - Works with any language, any OS, any technology
- Scale containers up and down very quickly (seconds)

Docker on an OS



Where Docker images are stored?

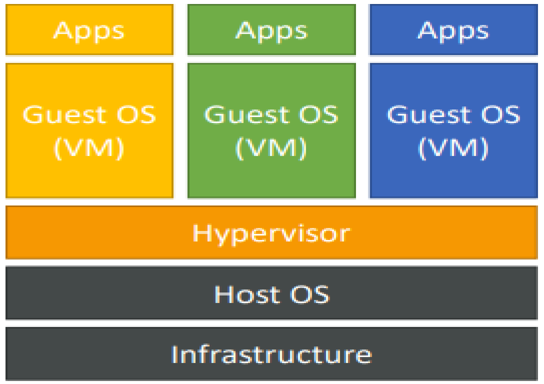
- Docker images are stored in Docker Repositories

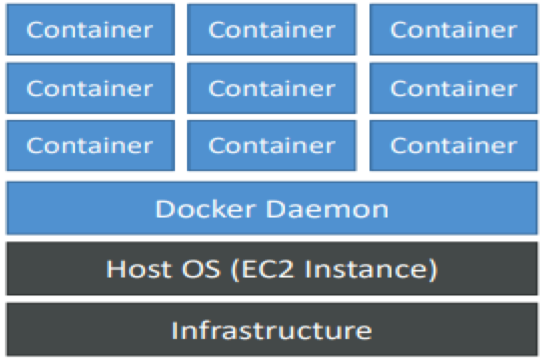
- Public: Docker Hub https://hub.docker.com/
    - Find base images for many technologies or OS:
    - Ubuntu
    - MySQL
    - NodeJS, Java…

- Private: Amazon ECR (Elastic Container Registry)

Docker versus Virtual Machines

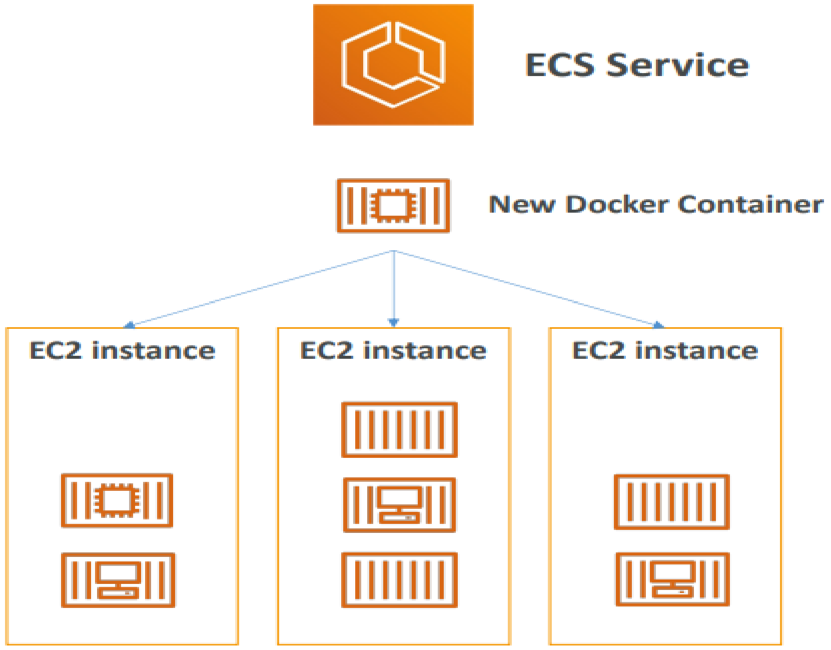
- Docker is "sort of" a virtualization technology, but not exactly
- Resources are shared with the host => many containers on one server





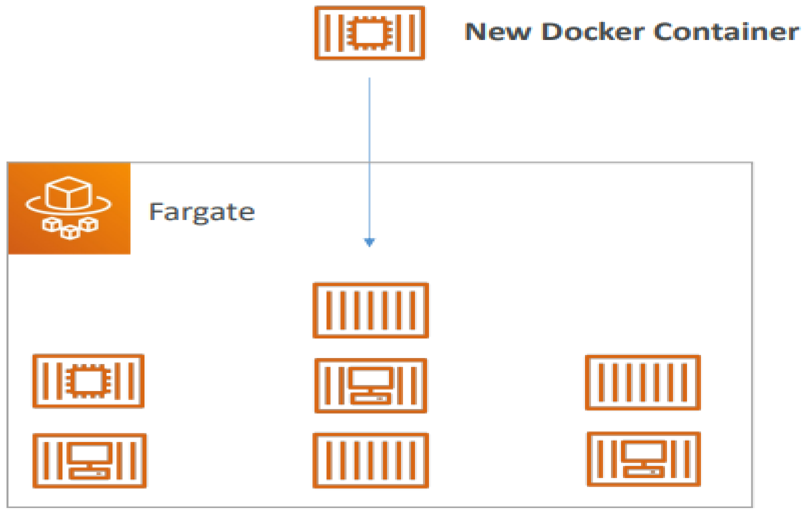
ECS

- ECS = Elastic Container Service
- Launch Docker containers on AWS
- **You must provision & maintain the infrastructure (the EC2 instances)**
- AWS takes care of starting / stopping containers
- Has integrations with the Application Load Balancer



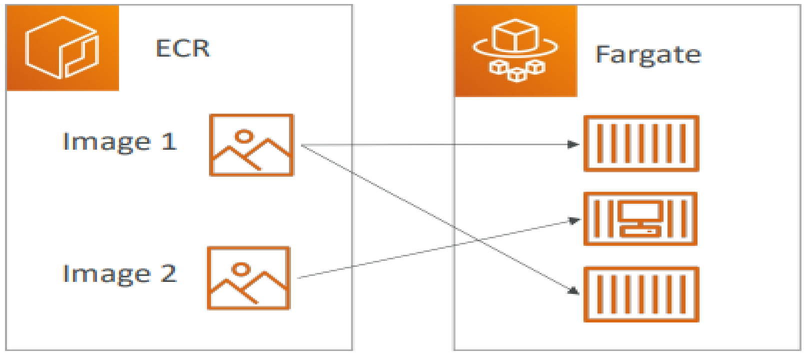
Fargate

- Launch Docker containers on AWS
- You do not provision the infrastructure (no EC2 instances to manage) – simpler!
- Serverless offering
- AWS just runs containers for you based on the CPU / RAM you need



ECR

- Elastic Container Registry
- Private Docker Registry on AWS
- This is where you **store your Docker images** so they can be run by ECS or Fargate



What's serverless?

- Serverless is a new paradigm in which the developers don't have to manage servers anymore…
- They just deploy code
- They just deploy… functions !
- Initially... Serverless == FaaS (Function as a Service)
- Serverless was pioneered by AWS Lambda but now also includes anything that's managed: "databases, messaging, storage, etc."
- **Serverless does not mean there are no servers…**
  it means you just don't manage / provision / see them

So far in this course…

Amazon S3

DynamoDB

Fargate

Lambda

Why AWS Lambda

Amazon EC2

- Virtual Servers in the Cloud
- Limited by RAM and CPU
- Continuously running
- Scaling means intervention to add / remove servers

Amazon Lambda

- Virtual **functions** – no servers to manage!
- Limited by time - **short executions**
- Run **on-demand**
- **Scaling is automated!**

Benefits of AWS Lambda

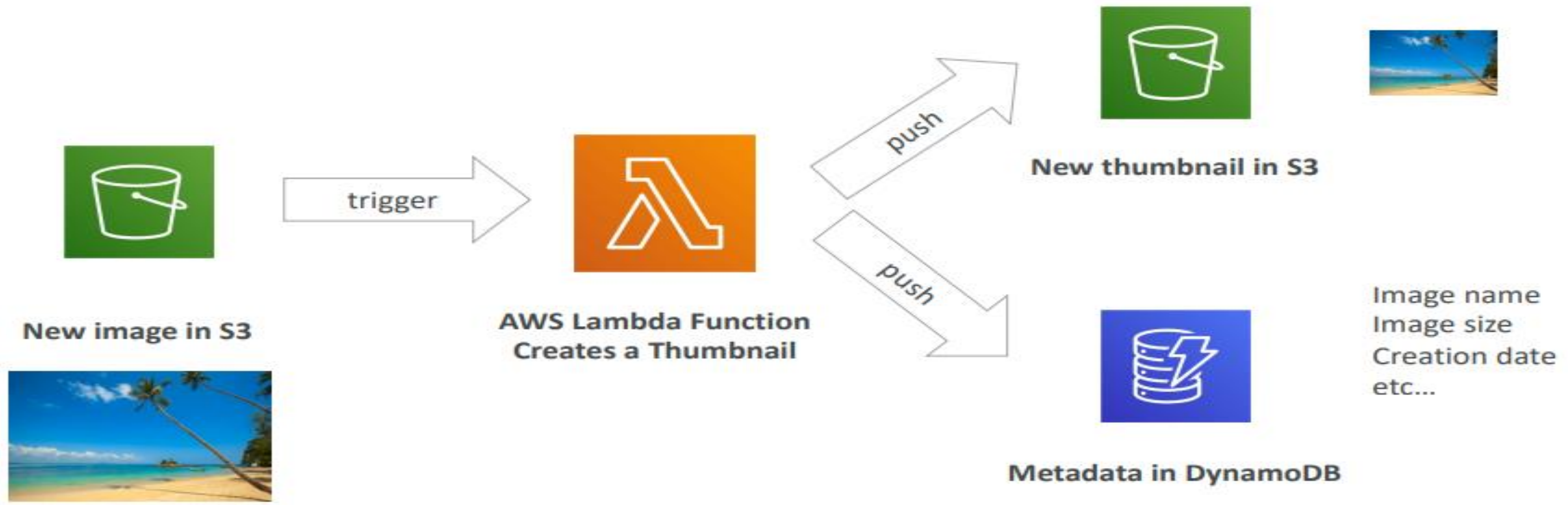
- Easy Pricing:
  - Pay per request and compute time
  - Free tier of 1,000,000 AWS Lambda requests and 400,000 GBs of compute time
- Integrated with the whole AWS suite of services
- **Event-Driven:** functions get invoked by AWS when needed
- Integrated with many programming languages
- Easy monitoring through AWS CloudWatch
- Easy to get more resources per functions (up to 10GB of RAM!)
- Increasing RAM will also improve CPU and network!

AWS Lambda language support

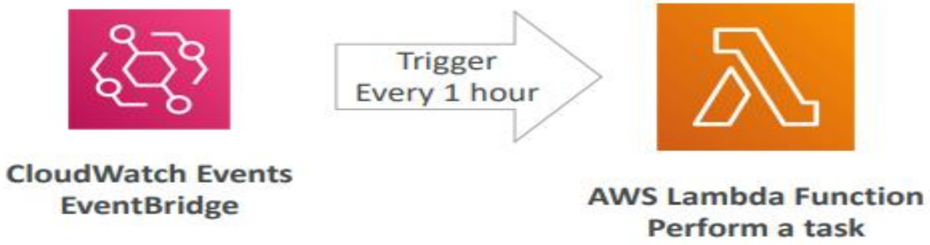
- Node.js (JavaScript)
- Python
- Java (Java 8 compatible)
- C# (.NET Core)
- Golang
- C# / Powershell
- Ruby
- Custom Runtime API (community supported, example Rust)

- Lambda Container Image
  - The container image must implement the Lambda Runtime API
  - ECS / Fargate is preferred for running arbitrary Docker images

Example: Serverless Thumbnail creation



Example: Serverless CRON Job

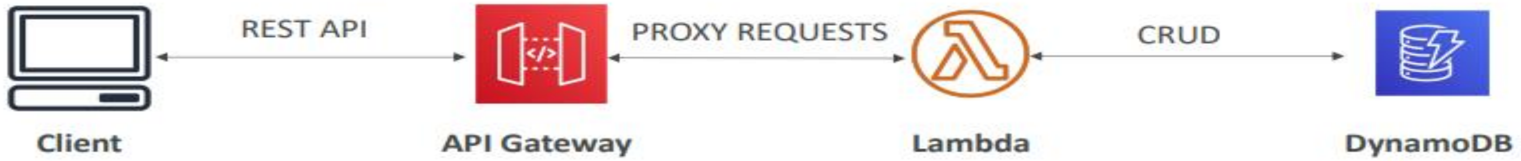


AWS Lambda Pricing: example

- You can find overall pricing information here: https://aws.amazon.com/lambda/pricing/
- Pay per **calls**:
  - First 1,000,000 requests are free
  - $0.20 per 1 million requests thereafter ($0.0000002 per request)
- Pay per **duration**: (in increment of 1 ms)
  - 400,000 GB-seconds of compute time per month for FREE
  - == 400,000 seconds if function is 1GB RAM
  - == 3,200,000 seconds if function is 128 MB RAM
  - After that $1.00 for 600,000 GB-seconds
- It is usually very cheap to run AWS Lambda so it's very popular

Amazon API Gateway

- Example: building a serverless API

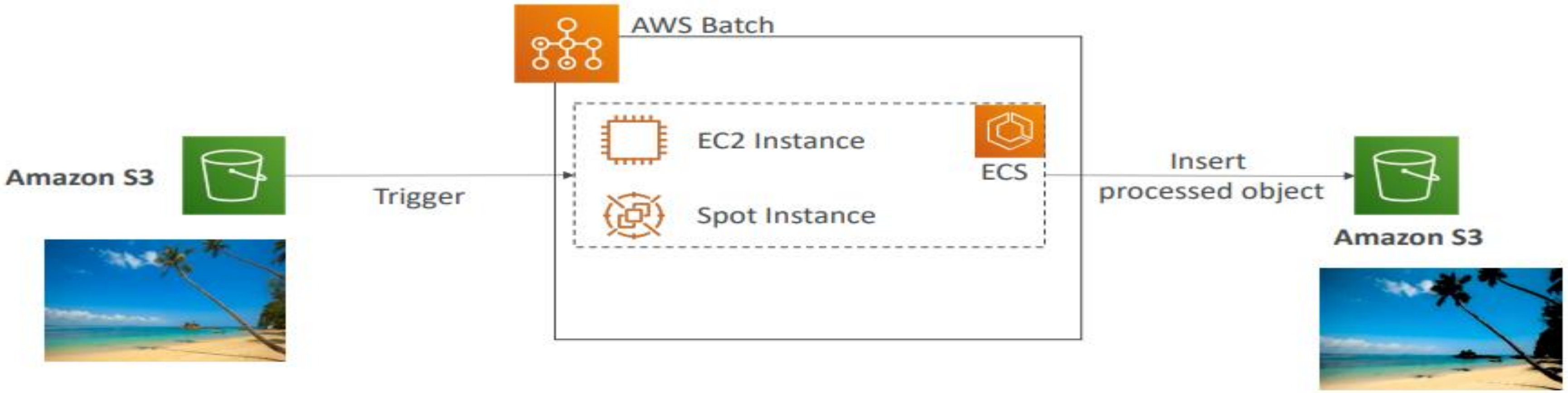


- Fully managed service for developers to easily create, publish, maintain, monitor, and secure APIs
- **Serverless** and scalable
- Supports RESTful APIs and WebSocket APIs
- Support for security, user authentication, API throttling, API keys, monitoring...

AWS Batch

- **Fully managed** batch processing at **any scale**
- Efficiently run 100,000s of computing batch jobs on AWS
- A "batch" job is a job with a start and an end (opposed to continuous)
- Batch will dynamically launch **EC2 instances** or **Spot Instances**
- AWS Batch provisions the right amount of compute / memory
- You submit or schedule batch jobs and AWS Batch does the rest!
- Batch jobs are defined as **Docker images** and **run on ECS**
- Helpful for cost optimizations and focusing less on the infrastructure

AWS Batch – Simplified Example



Batch vs Lambda

- Lambda:
  - Time limit
  - Limited runtimes
  - Limited temporary disk space
  - Serverless

- Batch:
  - No time limit
  - Any runtime as long as it's packaged as a Docker image
  - Rely on EBS / instance store for disk space
  - Relies on EC2 (can be managed by AWS)

Amazon Lightsail

- Virtual servers, storage, databases, and networking
- Low & predictable pricing
- Simpler alternative to using EC2, RDS, ELB, EBS, Route 53…
- Great for people **with little cloud experience**!
- Can setup notifications and monitoring of your Lightsail resources
- Use cases:
  - Simple web applications (has templates for LAMP, Nginx, MEAN, Node.js…)
  - Websites (templates for WordPress, Magento, Plesk, Joomla)
  - Dev / Test environment
- Has high availability but no auto-scaling, limited AWS integrations

Other Compute - Summary

- **Docker:** container technology to run applications
- **ECS:** run Docker containers on EC2 instances
- **Fargate:**
  - Run Docker containers without provisioning the infrastructure
  - Serverless offering (no EC2 instances)
- **ECR:** Private Docker Images Repository
- **Batch:** run batch jobs on AWS across managed EC2 instances
- **Lightsail:** predictable & low pricing for simple application & DB stacks

Lambda Summary

- Lambda is Serverless, Function as a Service, seamless scaling, reactive
- **Lambda Billing:**
  - By the time run x by the RAM provisioned
  - By the number of invocations
- **Language Support:** many programming languages except (arbitrary) Docker
- **Invocation time:** up to 15 minutes
- **Use cases:**
  - Create Thumbnails for images uploaded onto S3
  - Run a Serverless cron job
- **API Gateway**: expose Lambda functions as HTTP API