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Cloud Computing Special Topics

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NLX Inc, Co-Founder & CEO

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HW2 Questions?

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1. Platform independent Microservices
2. DevOps
3. Infrastructure as Code
4. Data Science as Code

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Microservices using Docker

- What is Docker?
  - Software platform that allows you to build, test, and deploy applications quickly
  - The code, OS, libraries, etc. are bundled together as a unit called container, which is independently deployed at scale
  - Think of it as Open Source Lambda functions

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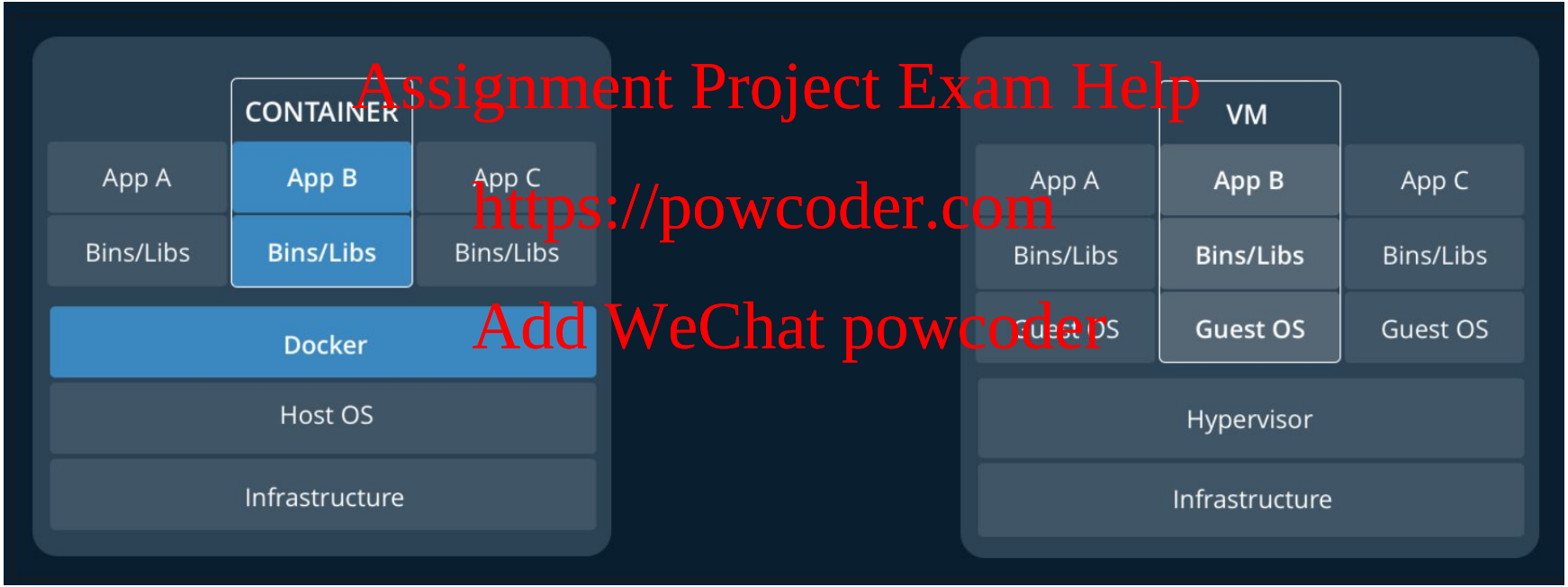
Docker Containers



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Why Docker?

- All the benefits of microservices PLUS
- Platform-independent
  - You can port your code between Cloud providers or accounts with less effort than porting provider-specific services
- Widespread developer support

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Docker on AWS

- The painful way
  - Run and manage your own Docker "swarm" on EC2
    - A cluster of Docker images orchestrated to run across one or more machines
- The easy way
  - Use Elastic Container Service (ECS), a highly-scalable, managed Docker container service from AWS

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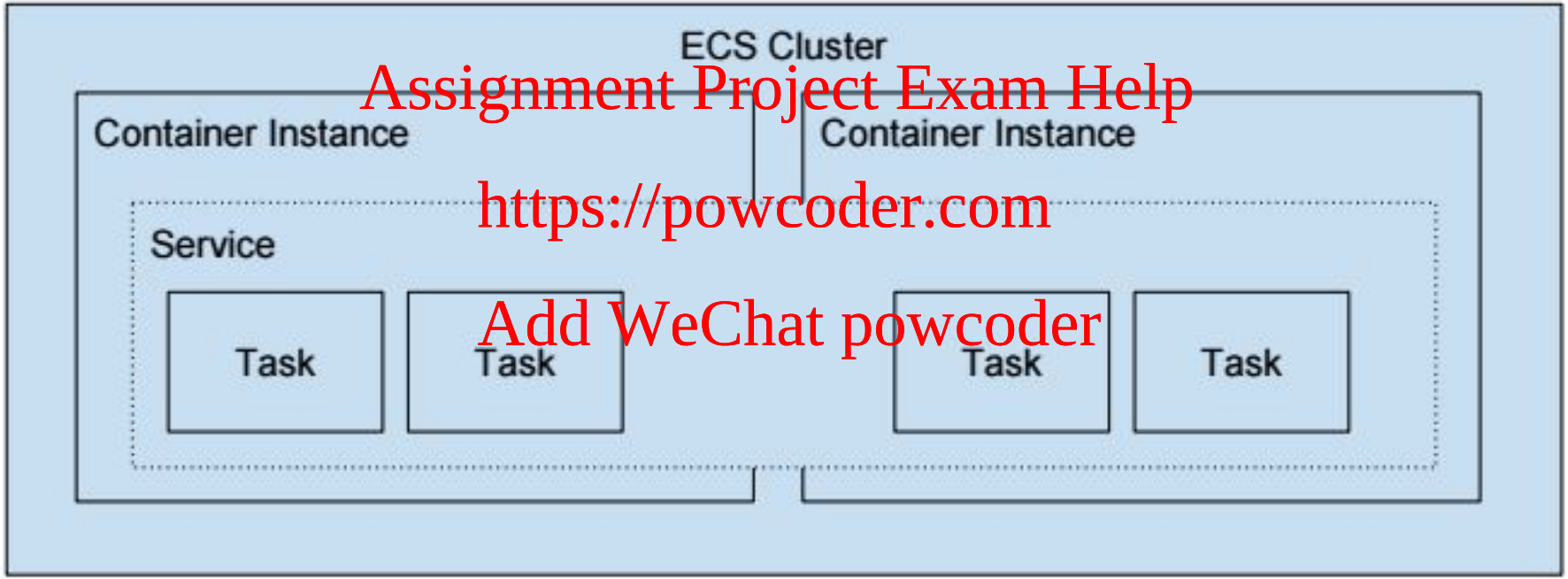
ECS Architecture



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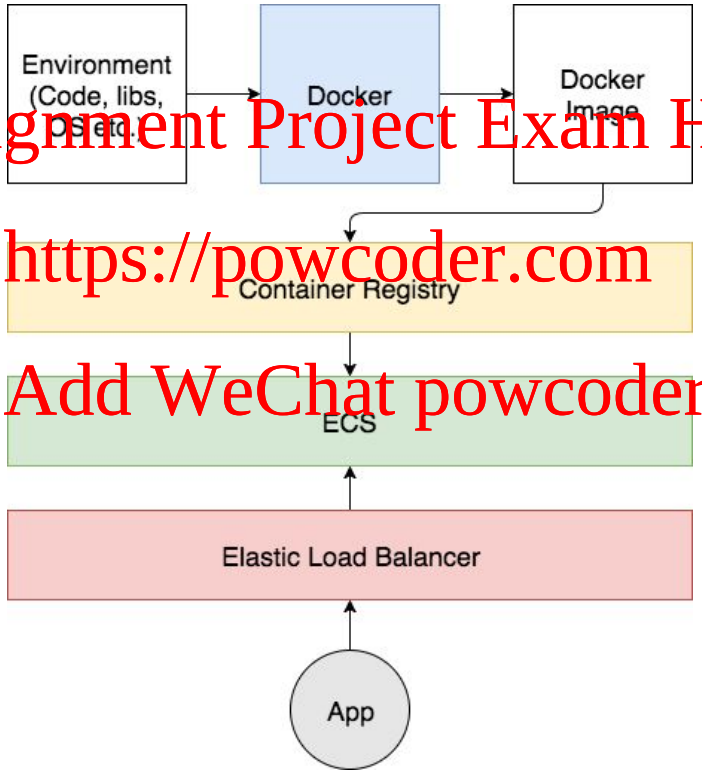
ECS Example



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Recap:

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1. You can use Docker to build your own microservices, which you can port across platforms.
2. You can use ECS to run your Docker containers at scale.

1. Platform independent Microservices
2. DevOps
3. Infrastructure as Code
4. Data Science as Code

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What is DevOps?

“DevOps is a set of practices that automates the processes between software development and IT teams, in order that they can **build**, **test**, and **release** software **faster** and more **reliably**.” -- Atlassian

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Release process stages

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- Check-in source code such as .java files
- Peer review new code

- Compile code
- Unit tests
- Style checkers
- Create container images and function deployment packages

- Integration tests with other systems
- Load testing
- UI tests
- Security testing

- Deployment to production environments
- Monitor code in production to quickly detect errors

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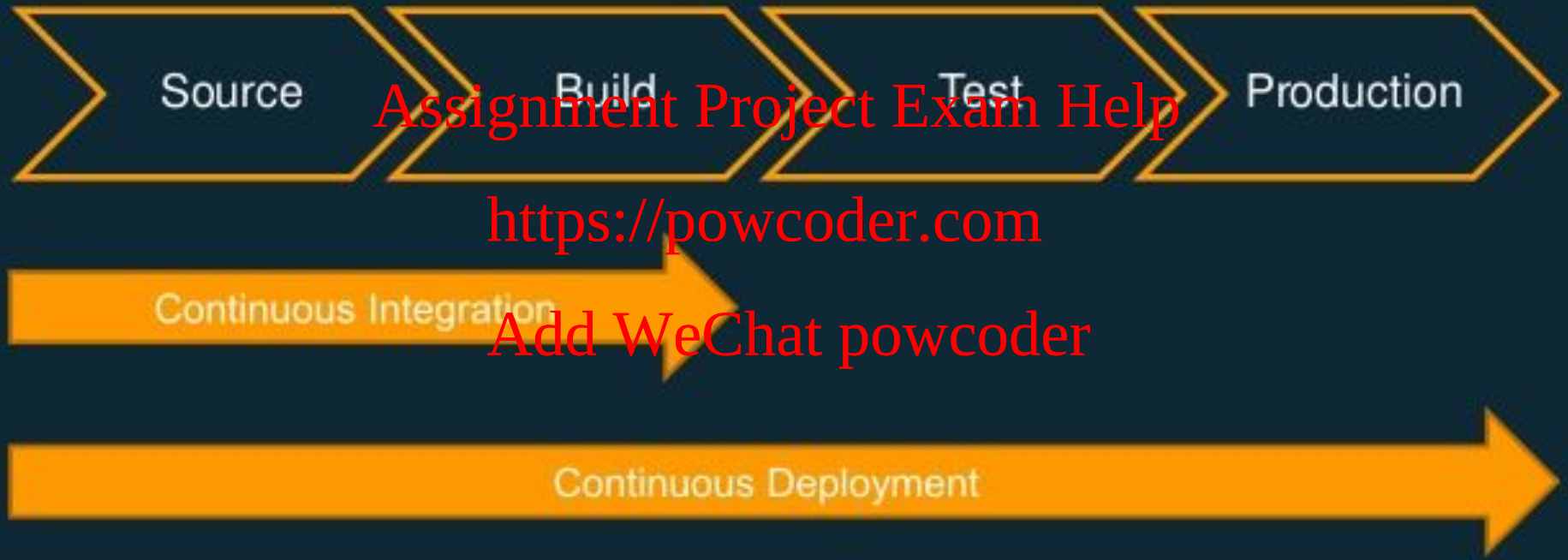
Release process stages



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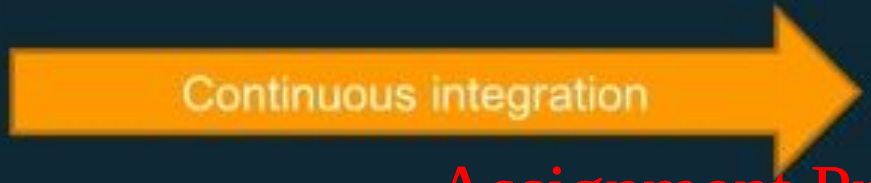
Continuous integration goals



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1. Automatically kick off a new release when new code is checked in
2. Build and test code in a consistent, repeatable environment
3. Continually have an artifact ready for deployment
4. Continually close feedback loop when build fails

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AWS CodePipeline

- Continuous delivery service for fast and reliable application updates
- Model and visualize your software release process
- Builds, tests, and deploys your code every time there is a code change
- Integrates with third-party tools and AWS

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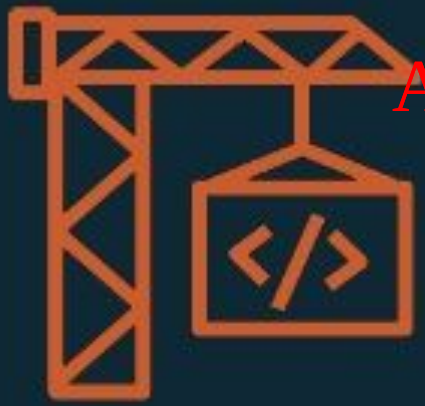
AWS CodeBuild



- Fully managed build service that compiles source code, runs tests, and produces software packages
- Scales continuously and processes multiple builds concurrently
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- Pay by the minute, only for the compute resources you use
- Monitor builds through CloudWatch Events

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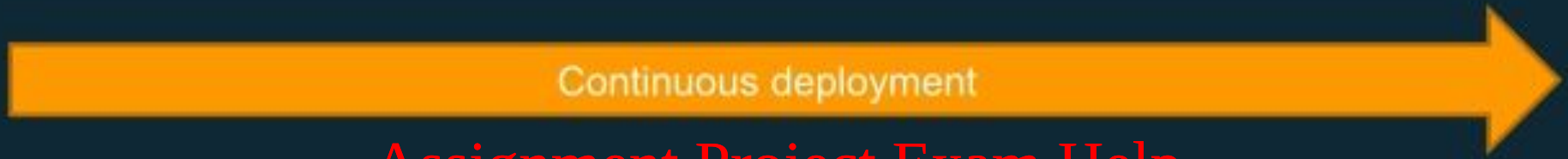
Continuous deployment goals



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1. Automatically deploy new changes to staging environments for testing
2. Deploy to production safely without impacting customers
3. Deliver to customers faster: Increase deployment frequency, and reduce change lead time and change failure rate

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AWS CodeDeploy

- Automates code deployments to any instance and Lambda
- Handles the complexity of updating your applications
- Avoid downtime during application deployment
- Roll back automatically if failure detected
- Deploy to Amazon EC2, Lambda, or on-premises servers

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Recap:

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1. DevOps is a set of practices to automate how you build, test, and release software.
2. On AWS you can use CodeBuild and CodePipeline to automate your code builds and deployments.

1. Platform independent Microservices
2. DevOps
3. Infrastructure as Code
4. Data Science as Code

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- ✓ DevOps helps with automating code deployments

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What about infrastructure?

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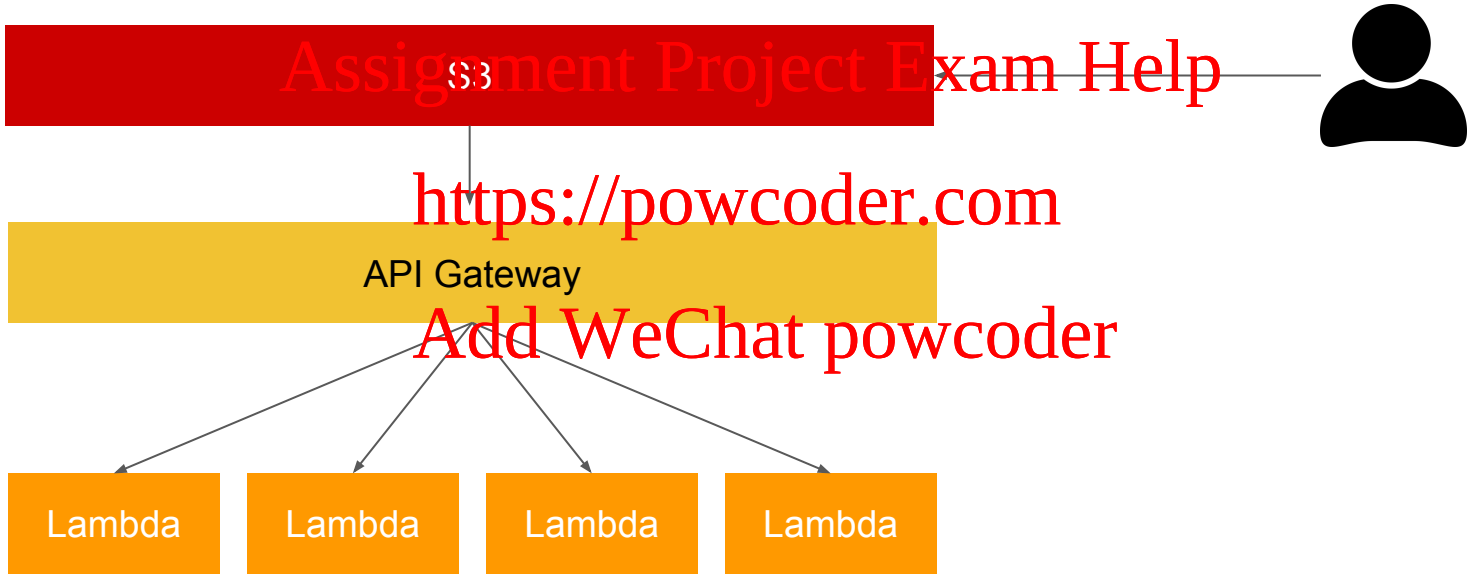
Serverless Website Infrastructure



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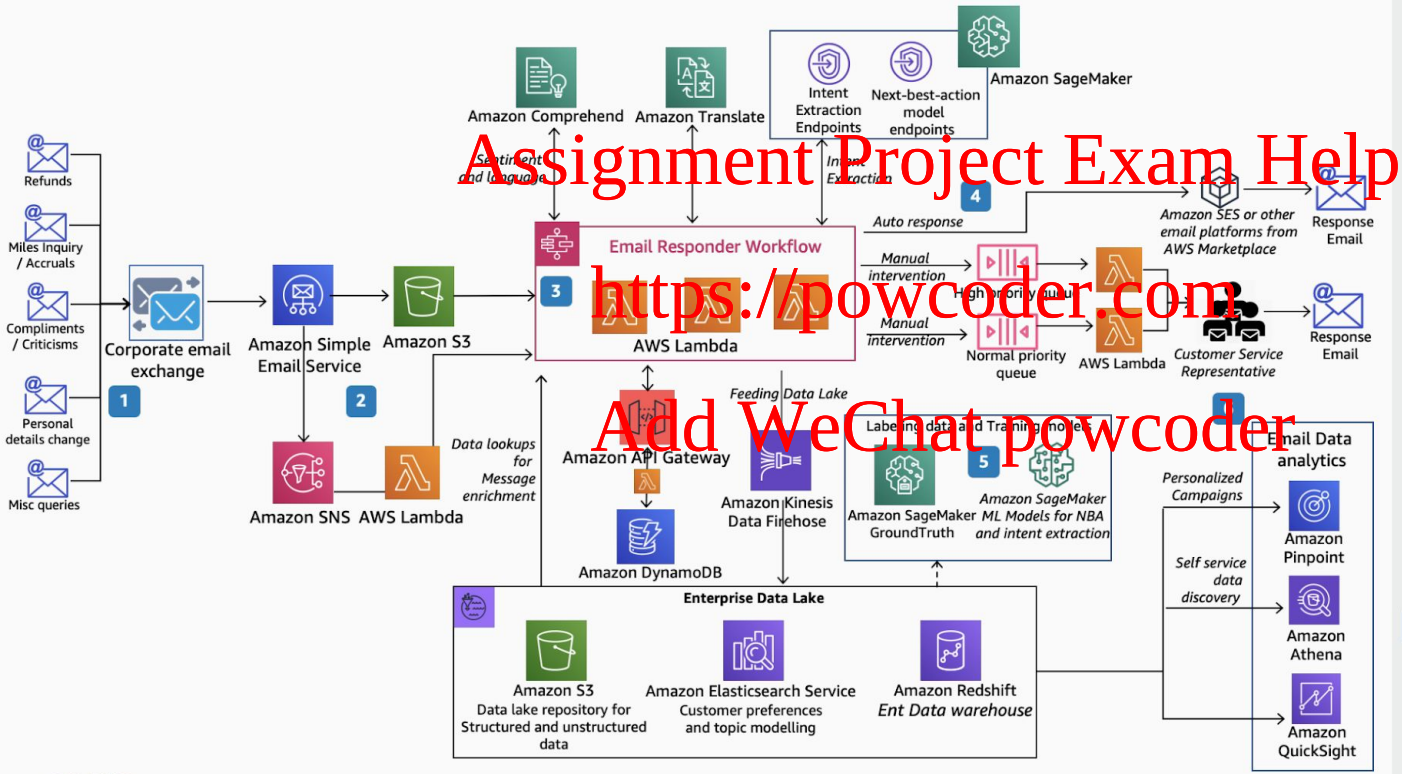
AI/ML Based Intelligent Email Responder

Improve customer experience and agent productivity by using Amazon Simple Email Service and Amazon Machine Learning services. This workflow comprehends the intent, identifies the next-best-action, and compiles all the data required for responding to a customer email.



1. **Amazon Simple Email Service (Amazon SES)** captures emails received at corporate email exchange.
2. **Amazon SES** writes the raw payload to **Amazon Simple Storage Service (Amazon S3)** and triggers a notification through **Amazon Simple Notification Service (Amazon SNS)**. This notification is captured by an AWS Lambda function that triggers the email responder workflow.
3. The email responder workflow performs the following tasks: a.) uses **Amazon Comprehend** for language, sentiment, and keyword extraction, b.) uses **Amazon Translate** for any preferred language translation for the agent, c.) calls intent extraction and next-best-action model endpoints deployed on **Amazon SageMaker** for better routing and responding of the email message, d.) performs data looks from the enterprise data lake and ODS stores, e.) updates the transactional data stores with relevant updates and feeds enterprise data lake using **Amazon Kinesis Data Firehose**.
4. Based on confidence and completeness of the response email, the email responder workflow either sends a response email via email platform services such as **Amazon SES** or routes the email to the right queue for the customer service agent to pick up.
5. From the data collected, the intent extraction and next-best-action models are continuously improved using **Amazon SageMaker GroundTruth** and **Amazon SageMaker**.
6. Personalized email campaigns, additional email analytics, and reporting can be performed using **Amazon Pinpoint**, **Amazon Athena**, and **Amazon QuickSight**.

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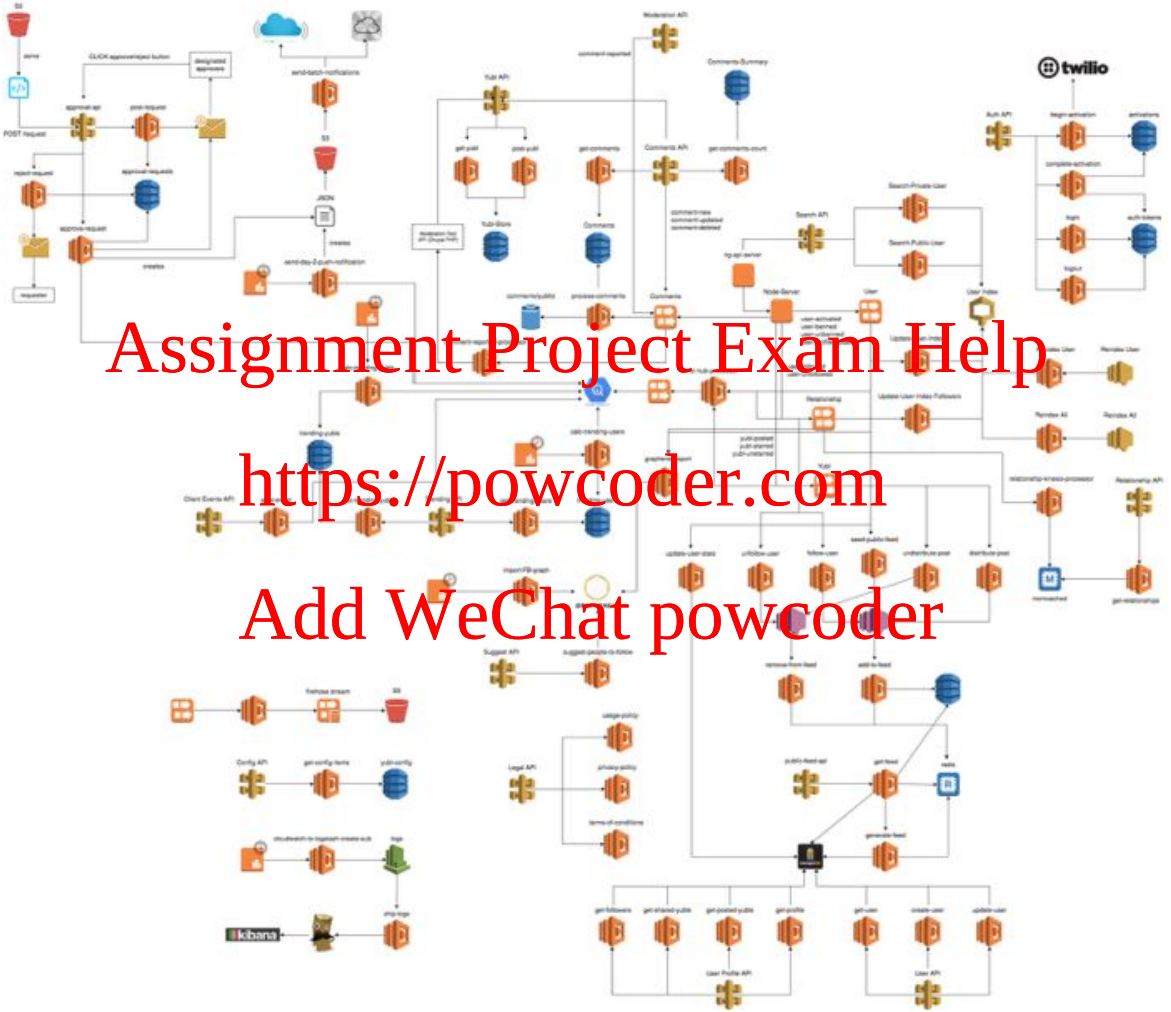
AWS Reference Architecture



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As your infrastructure gets more complex, the need for automating its deployment increases.

AWS CloudFormation

- “Infrastructure as Code”
- Infrastructure, configuration, and security all encoded in config files called “templates”
- Reproducible infrastructure safely and reliably

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AWS CloudFormation

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CloudFormation Template

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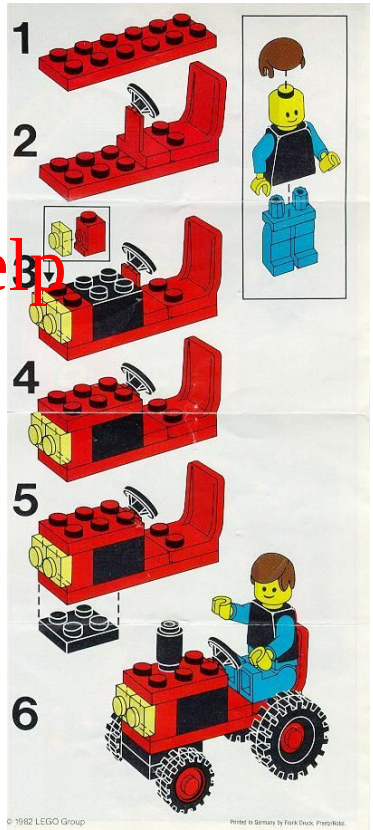
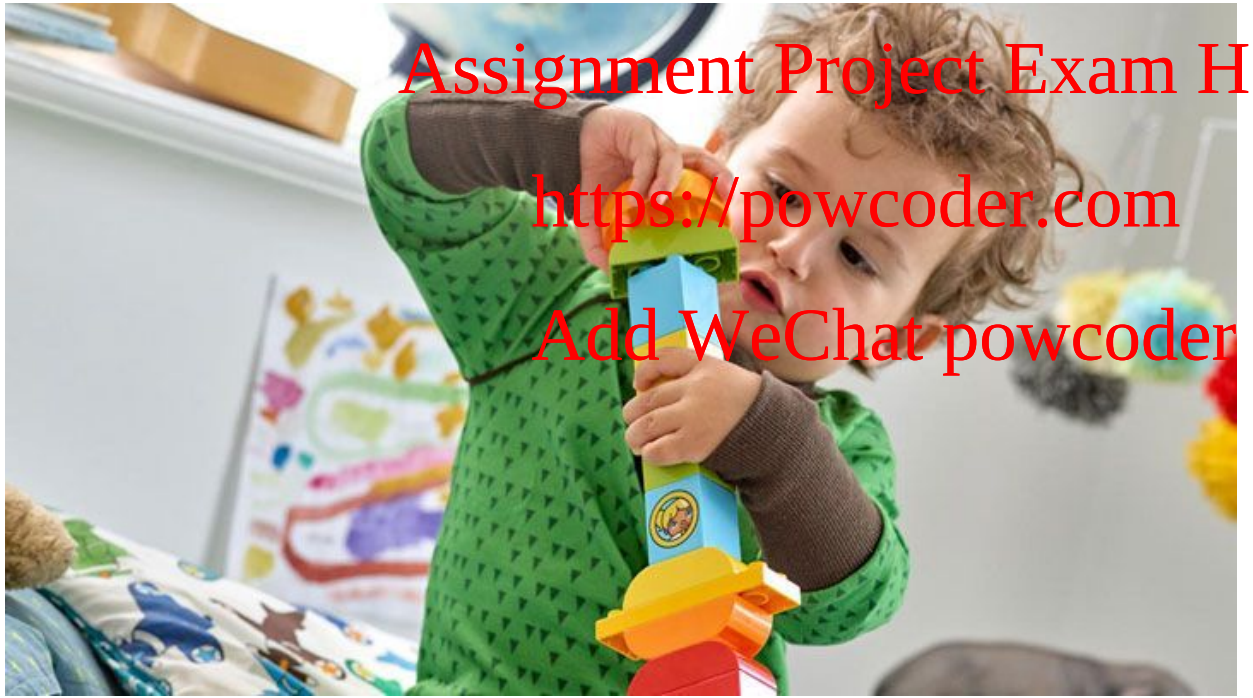


AWS CloudFormation



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Recap:

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1. Automating infrastructure is a great way to reproduce infrastructure safely and reliably
2. You can use CloudFormation on AWS to automate your entire infrastructure.

1. Platform independent Microservices
2. DevOps
3. Infrastructure as Code
4. Data Science as Code

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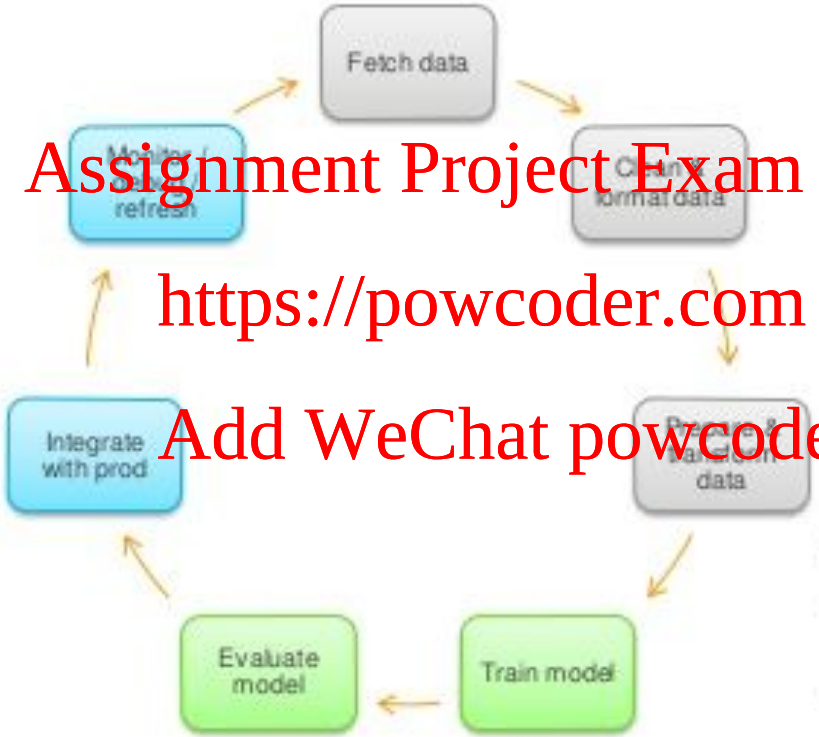
Machine Learning Process is Hard...



Data wrangling

- Set up and manage Notebook environments
- Get data to notebooks securely

Experimentation

- Set up and manage clusters
- Scale/distribute ML algorithms

Deployment

- Set up and manage inference clusters
- Manage and auto scale inference APIs
- Testing, versioning, and monitoring

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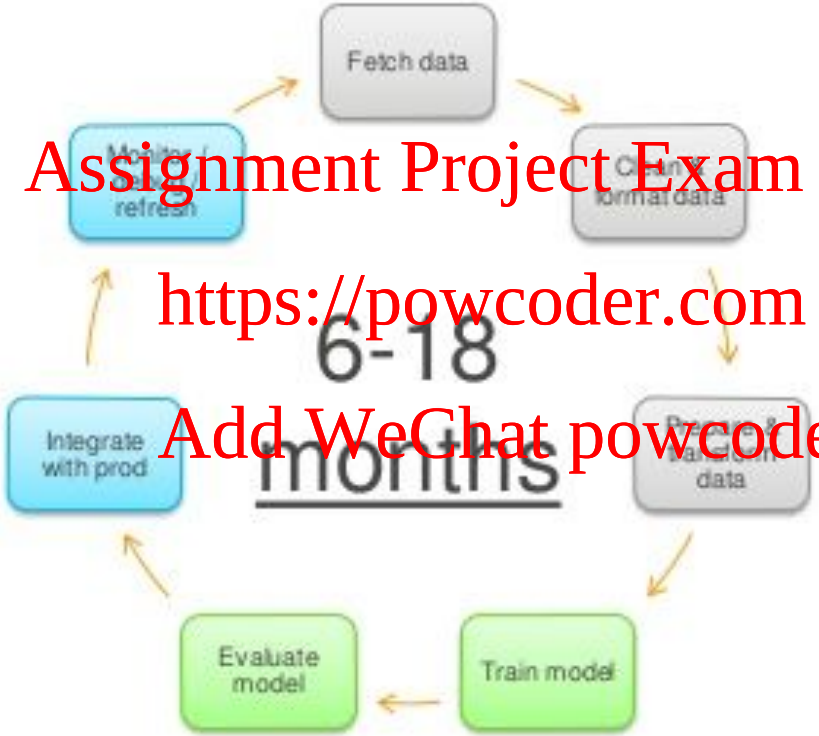
... and time consuming ...



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Introducing Amazon SageMaker

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End-to-end Machine Learning Platform

Zero setup

Flexible model training

Pay by the second

Amazon SageMaker's Four Components:

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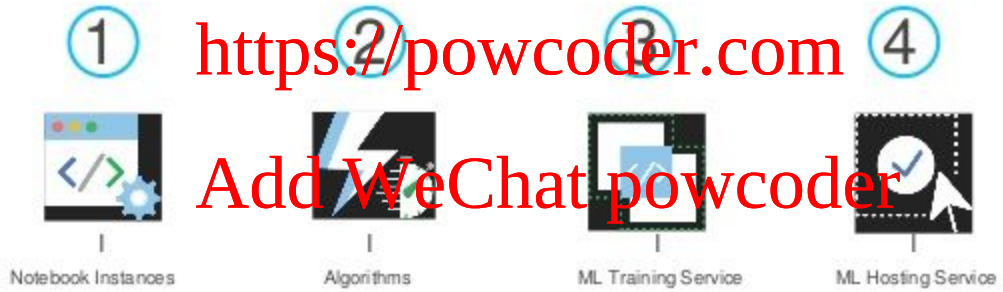

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1) Zero setup for data exploration

"Just add data"

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Resizable as you need

Common tools pre-installed

Easy access to your data sources

No servers to manage

2) Algorithms designed for huge datasets

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Streaming datasets, for cheaper training

Train faster, in a single pass

Greater reliability on extremely large datasets

Choice of several ML algorithms

More than just general purpose algorithms

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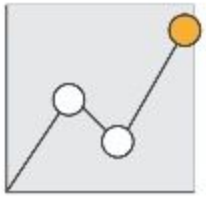
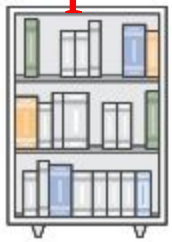


XGBoost, FM, and Linear for classification and regression

Kmeans and PCA for clustering and dimensionality reduction

Image classification with convolutional neural networks



LDA and NTM for topic modeling, seq2seq for translation

3) Distributed training that works with you

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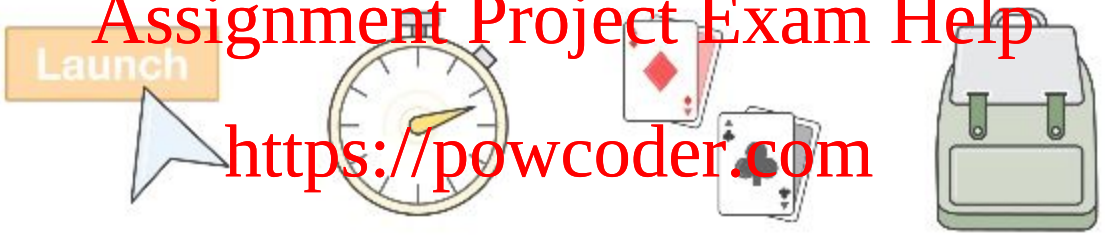
Amazon-optimized algorithms using the AWS SDK...

Or Apache Spark SageMaker Estimators

Bring your own deep learning script...

Or your custom algorithm Docker image

4) Quickly deploy in production



One step deployment

Low latency, high throughput, and high reliability

A/B testing

Use your own model

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Thank you!

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QUESTIONS?

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7. https://github.com/ndrppnc/serverless-cicd
8. https://github.com/alik0211/pokedex

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