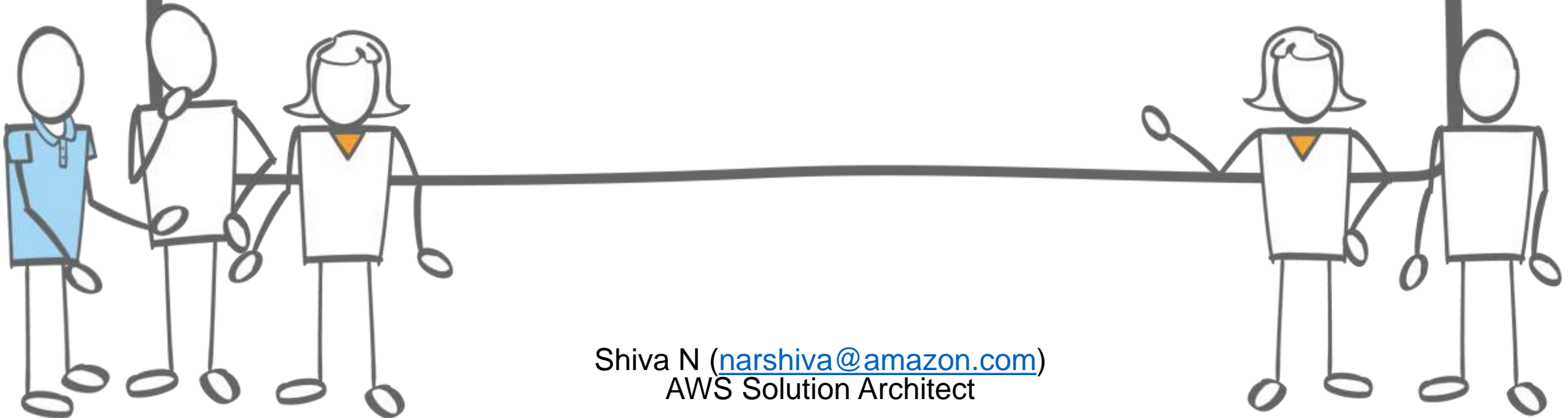


Continuous Delivery/Deployment on AWS



Shiva N (narshiva@amazon.com)
AWS Solution Architect

DEPLOYMENTS AT AMAZON.COM

~11.6s

Mean time between
deployments (weekday)

~1,079

Max number of deployments
in a single hour

~10,000

Mean number of hosts
simultaneously receiving a
deployment

~30,000

Max number of hosts
simultaneously receiving a
deployment



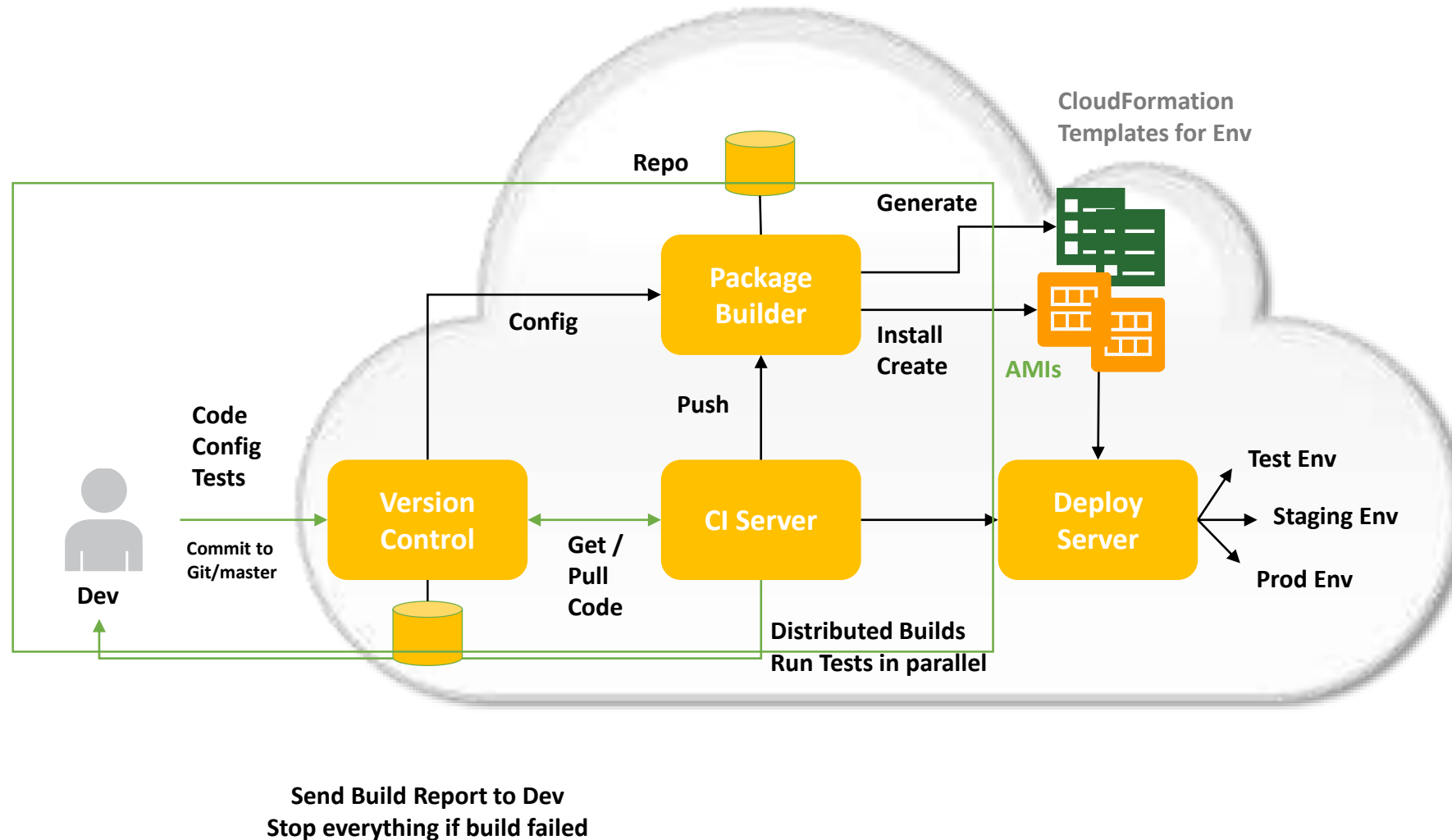
Agenda

- Intro to Continuous Integration and Continuous Deployment/Delivery (CI-CD)
- CD Strategies
- CI-CD on AWS
 - Application Management
 - Elastic BeanStalk
 - Opsworks
 - Cloudformation
 - *EC2 Container Service (ECS)*
 - Application Lifecycle Management
 - *Code Commit*
 - *Code Pipeline*
 - *Code Deploy*

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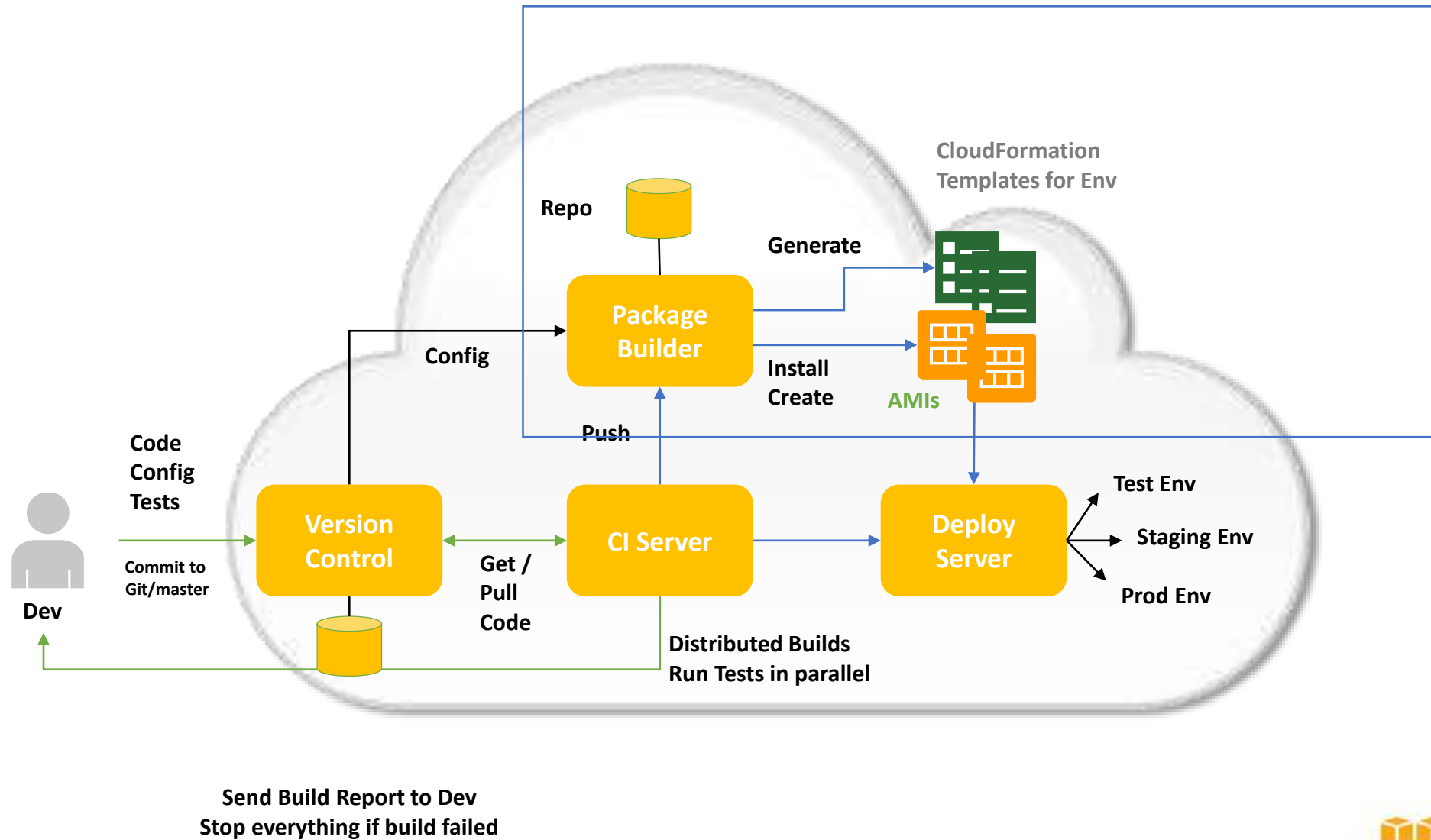
Continuous Integration



What does CI give us?

- Test driven promotion (of development change)
- Increasing velocity of feedback cycle through iterative change
- Contain change to reduce risk
- Bugs are detected quickly
- Automated testing reduces size of testing effort

Continuous Delivery/Deployment



What does CD give us?

- Automated, repeatable process to push changes to production
- Hardens, de-risks the deployment process
- Immediate feedback from users
- Supports A/B testing or “We test customer reactions to features in production”
- Gives us a breadth of data points across our applications

Continuous Delivery Vs Continuous Deployment

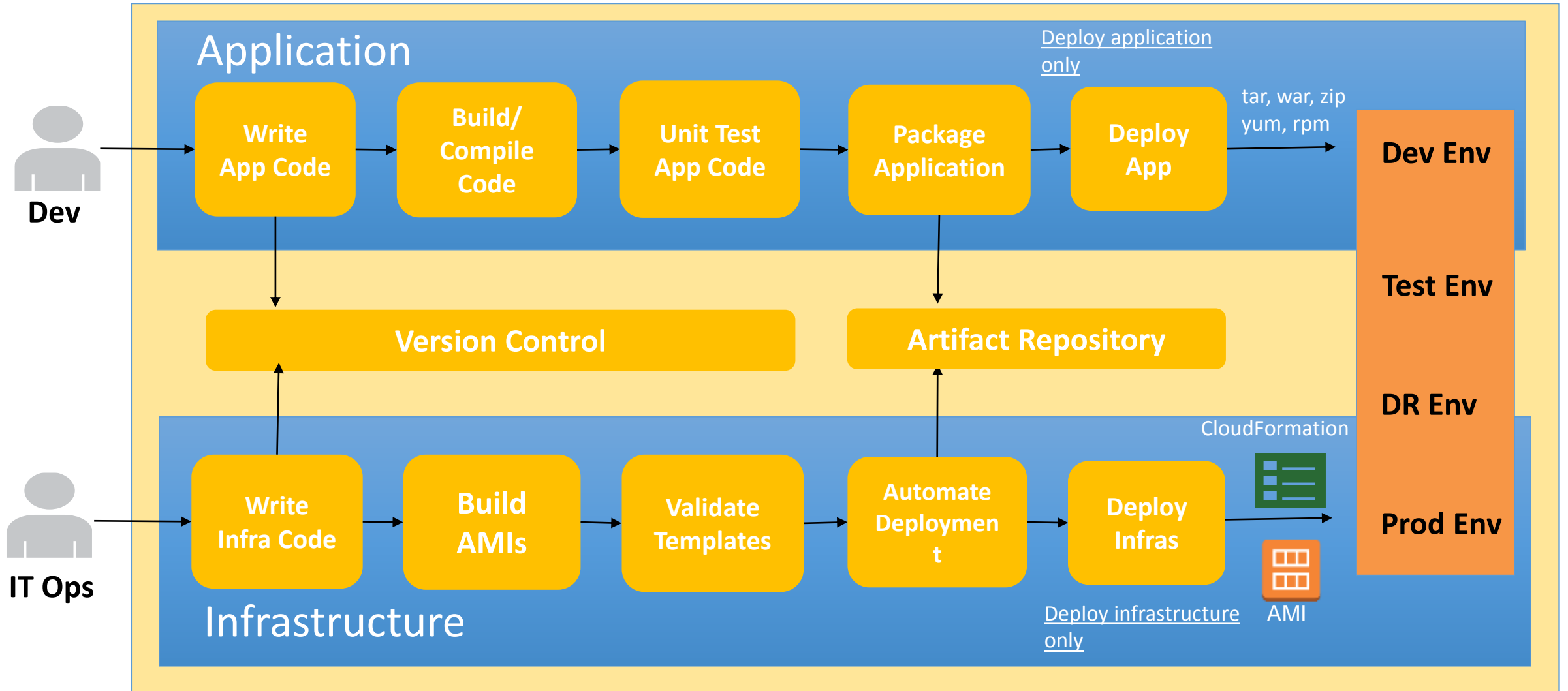
CONTINUOUS DELIVERY



CONTINUOUS DEPLOYMENT



Example CI-CD Pipeline



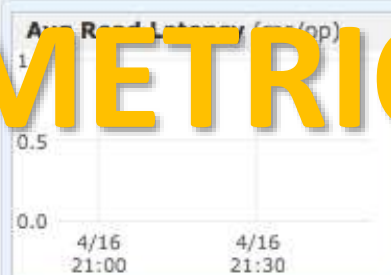
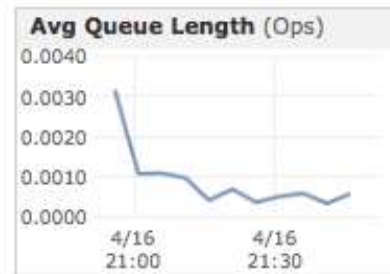


View all CloudWatch alarms

Create Alarm



ServerRequestTime



HOST METRICS

If it moves, plot it...



SERVICE METRICS

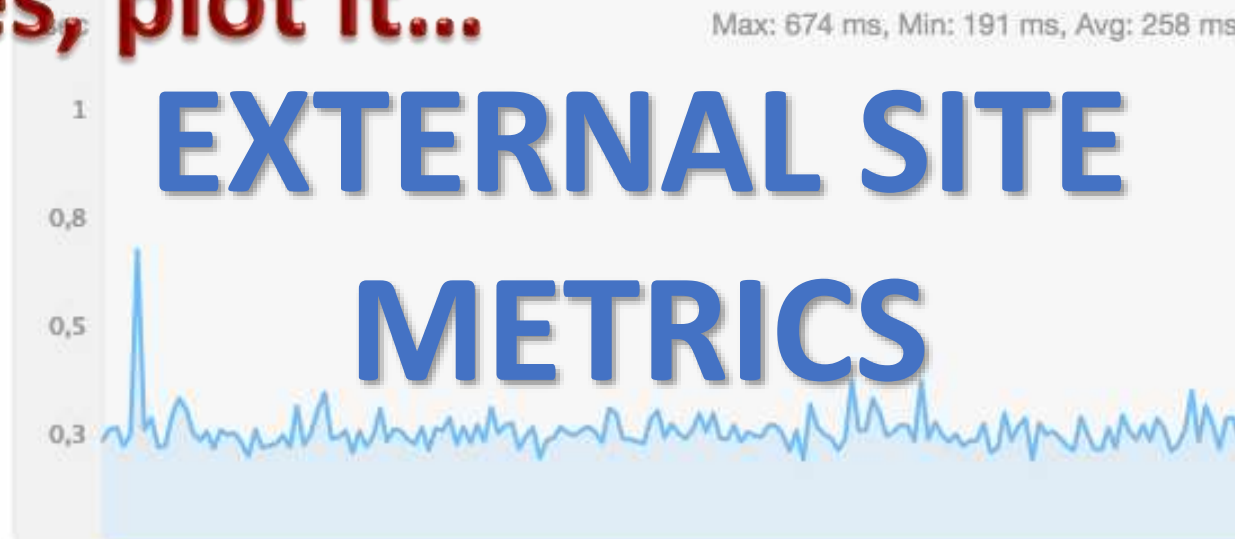
Apache logs

QUERY FILTERING

LOG ANALYSIS

HISTOGRAM

View | Zoom Out | * (954) count per 10s | (954 hits)



EXTERNAL SITE METRICS

Oct 30th

Oct 31st

Nov 1st

Nov 2nd

Nov 3rd

Nov 4th

Nov 5th

Response time

Uptime

Downtime

Unknown



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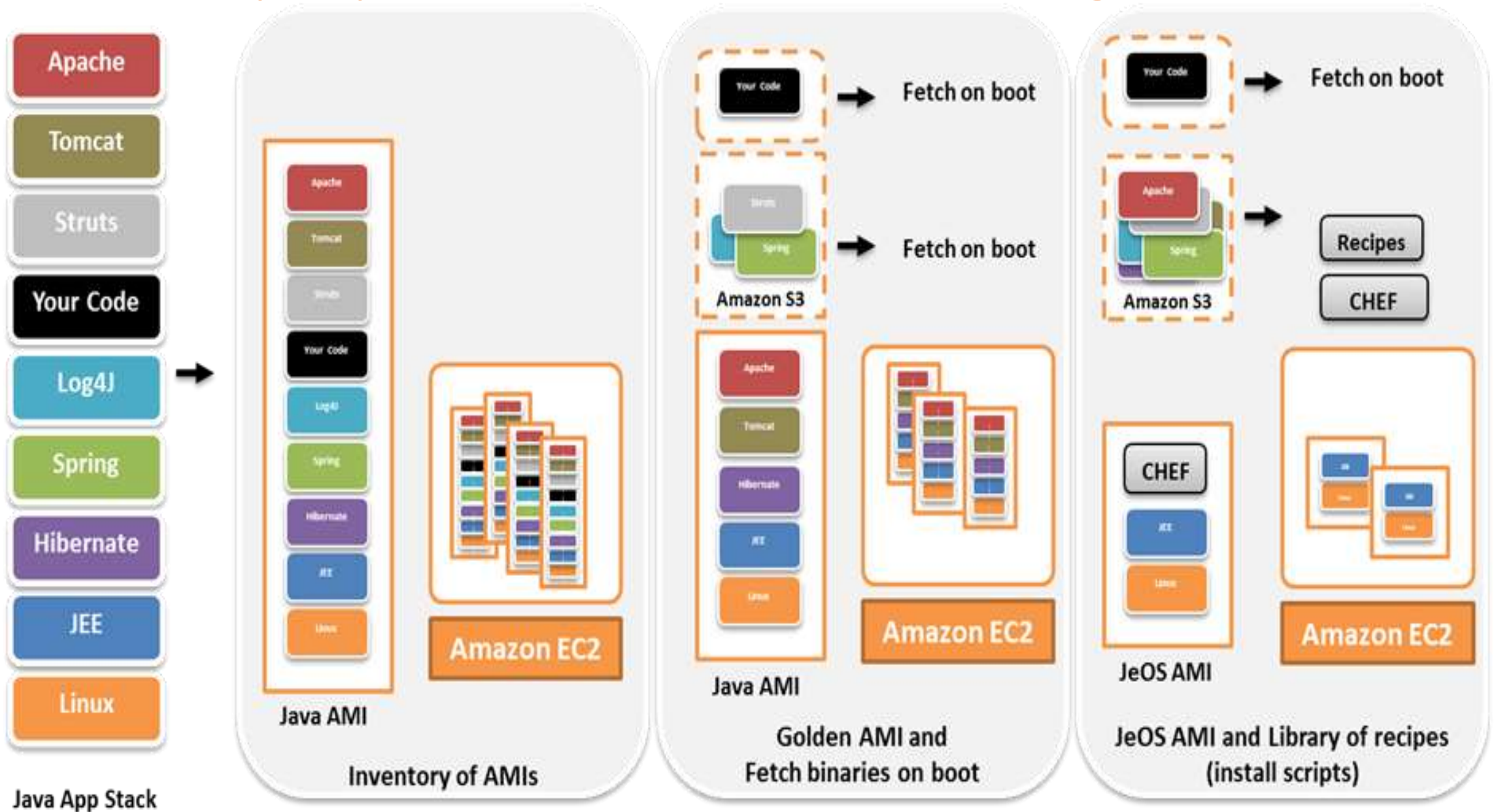


Delivery approaches

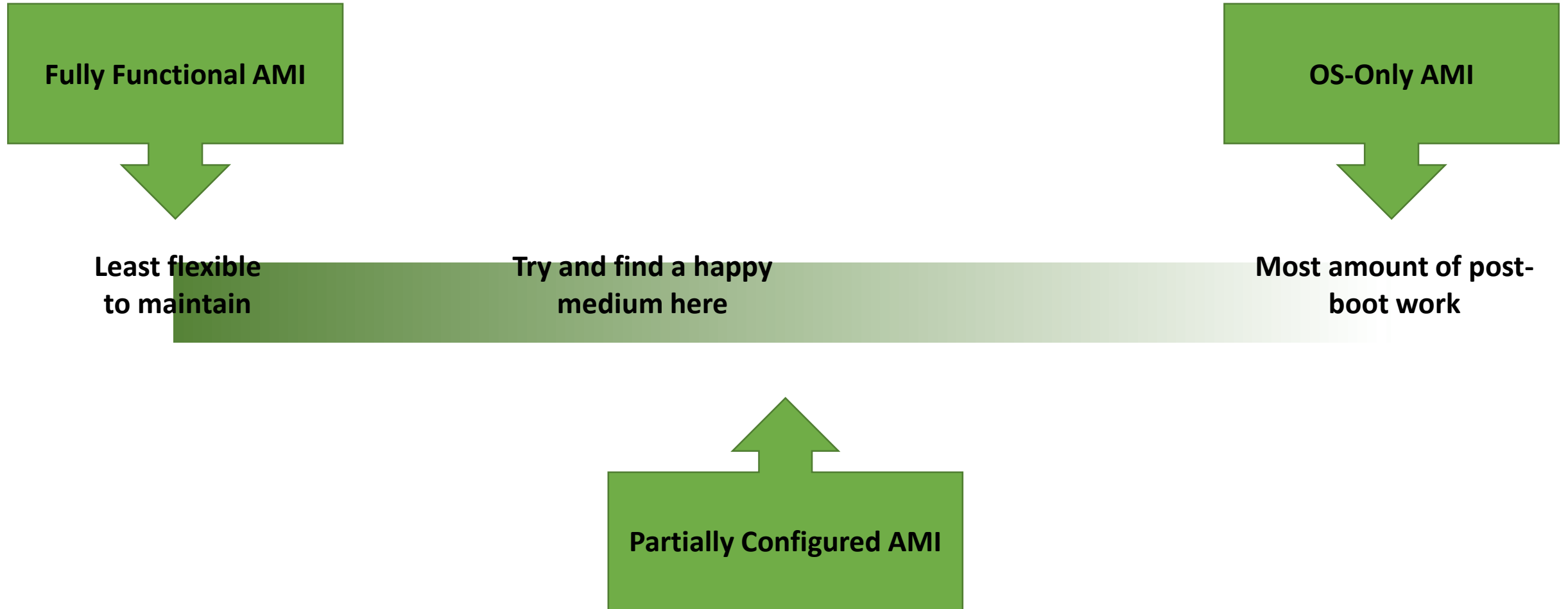
- How are we going to deliver our code?
 - File shipping:
 - Binaries (.rpm, .msi, .exe, .deb, .conf...)
 - As an AMI:
 - Bundle one or more of the above into an AMI
- Which method do you choose?
 - How fast do we need to do this?
 - Across how many instances?
 - How do we roll back (or forward)?



AMI Deployment Method - Building



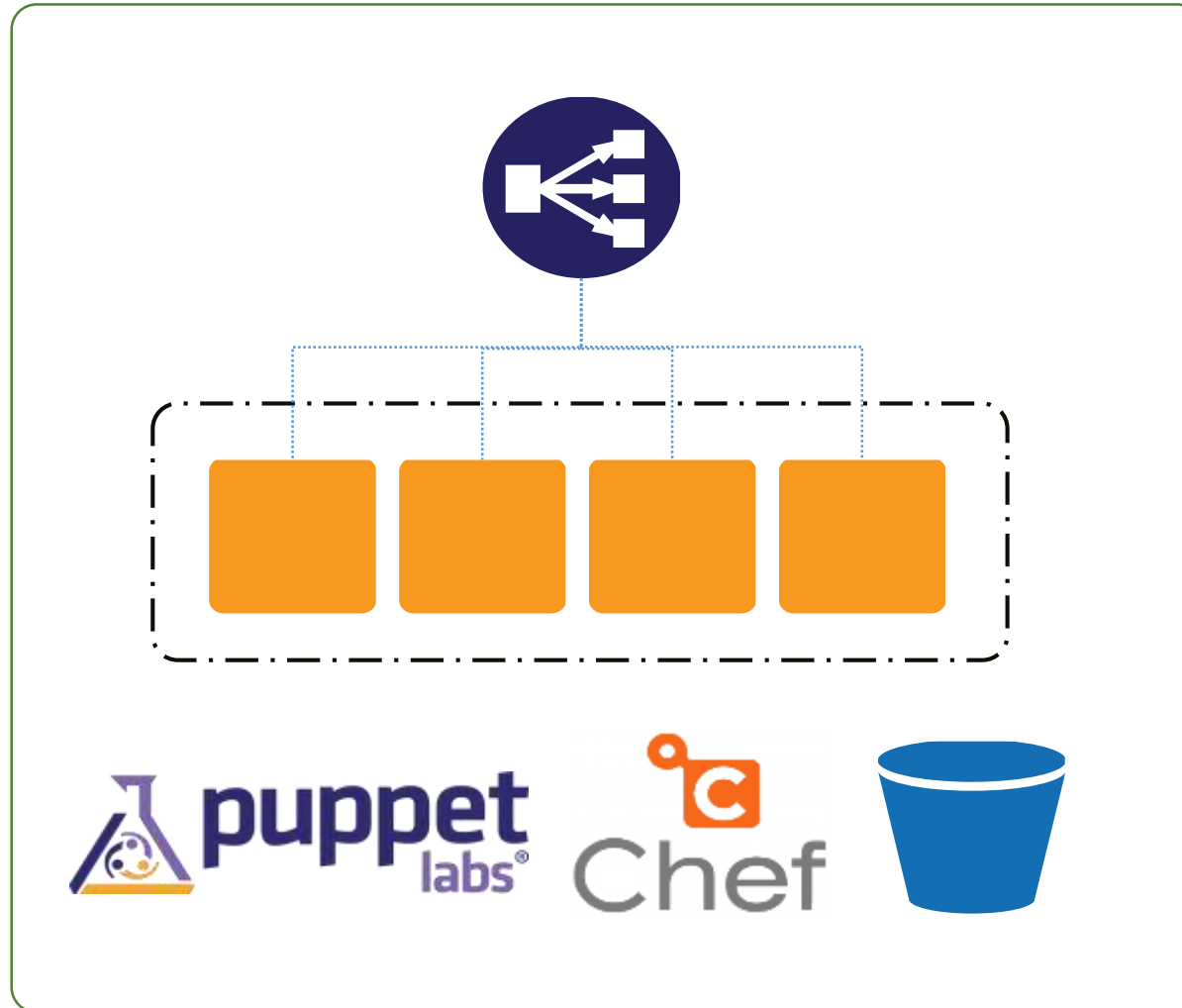
Delivery approaches...



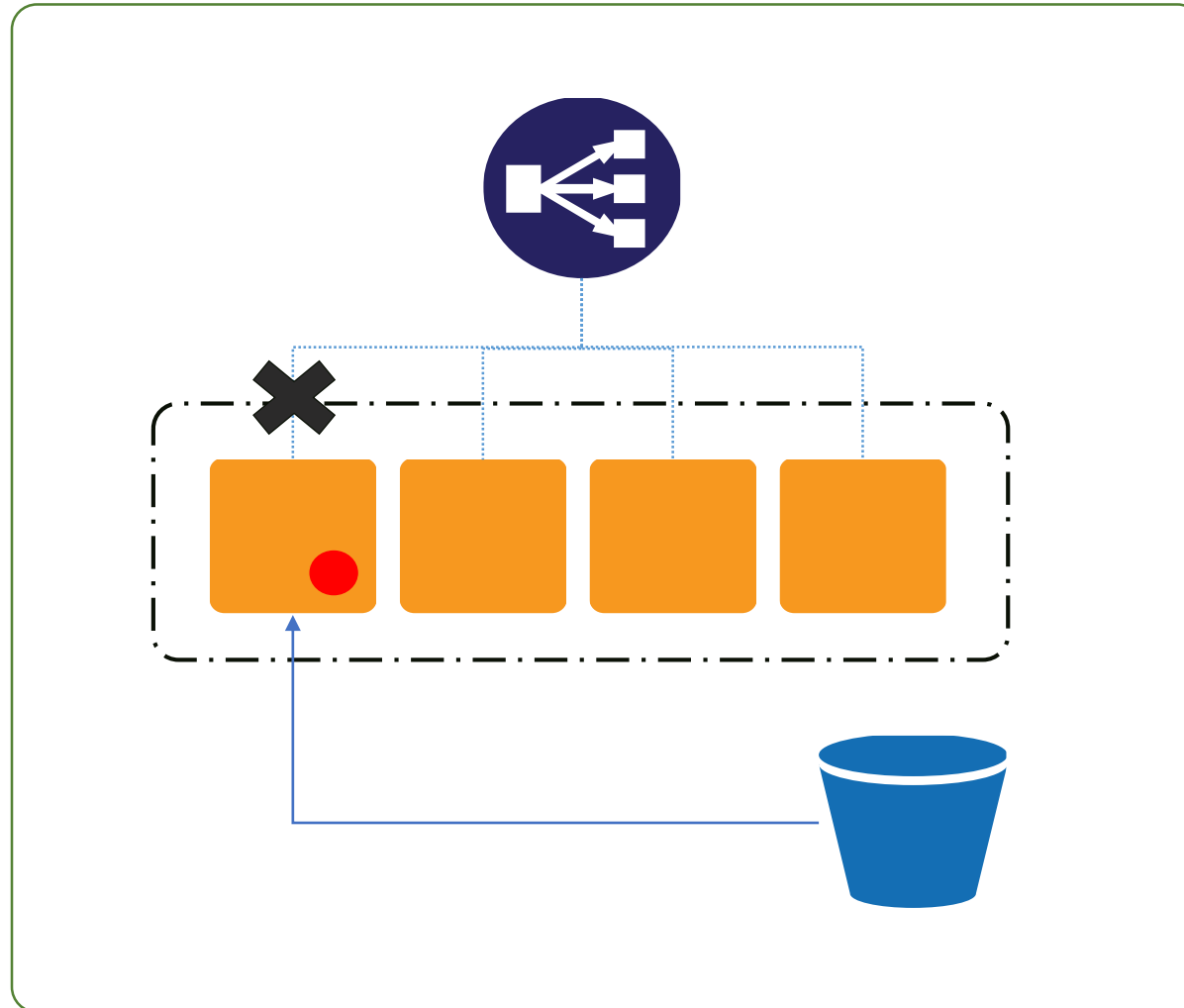
Deployment approaches

- Deploy in place
 - Deploy all at once (Service outage)
 - Rolling updates
- Blue-Green Deployment
 - Discrete environment
 - Multiple environments from branches
 - Support A/B testing
 - “Rolling DNS”
- Alternate Blue-Green (Red-Black?) deployment
 - Alternate auto scaling group
 - Avoid messing with DNS

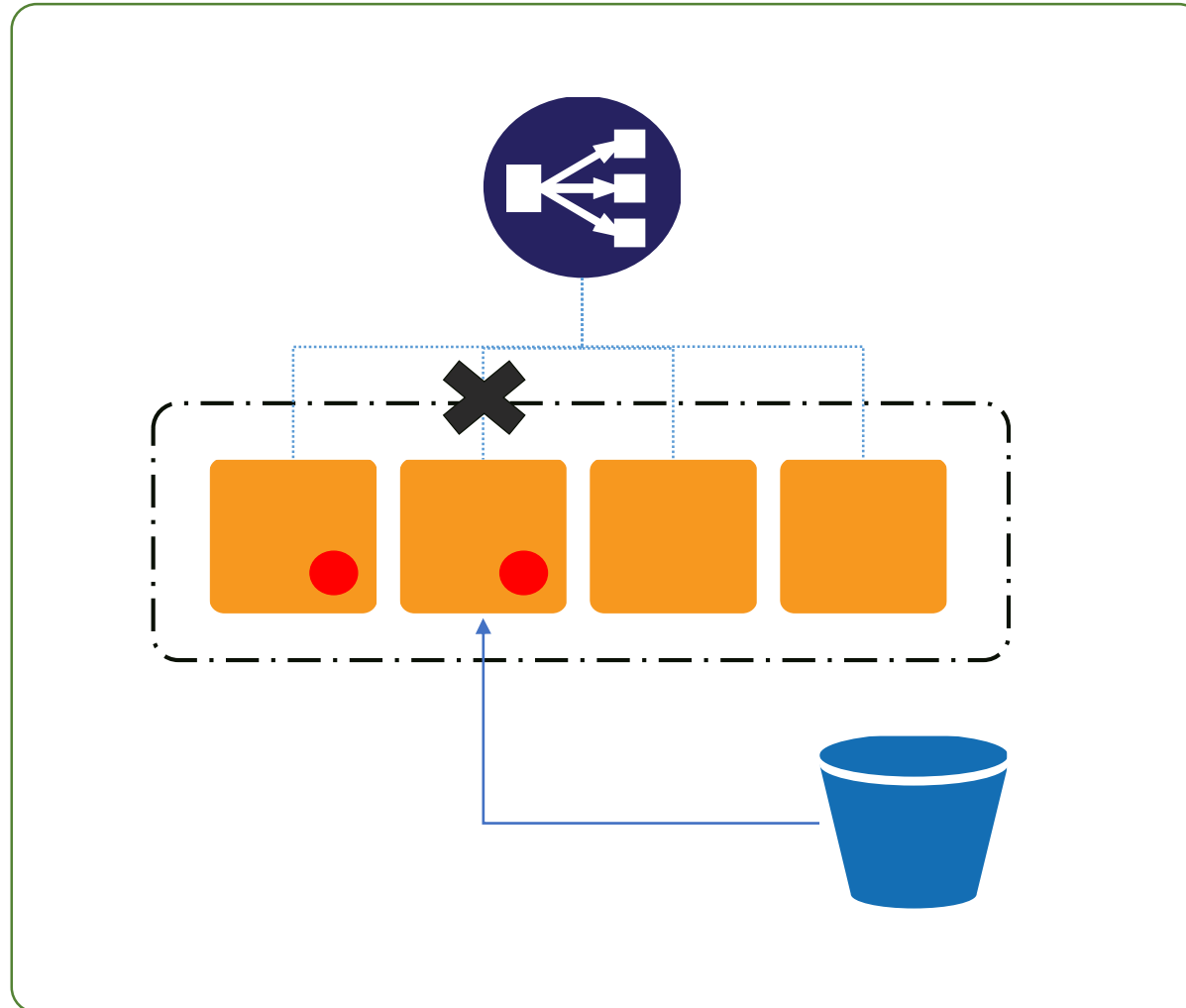
Deploy in place – Rolling update



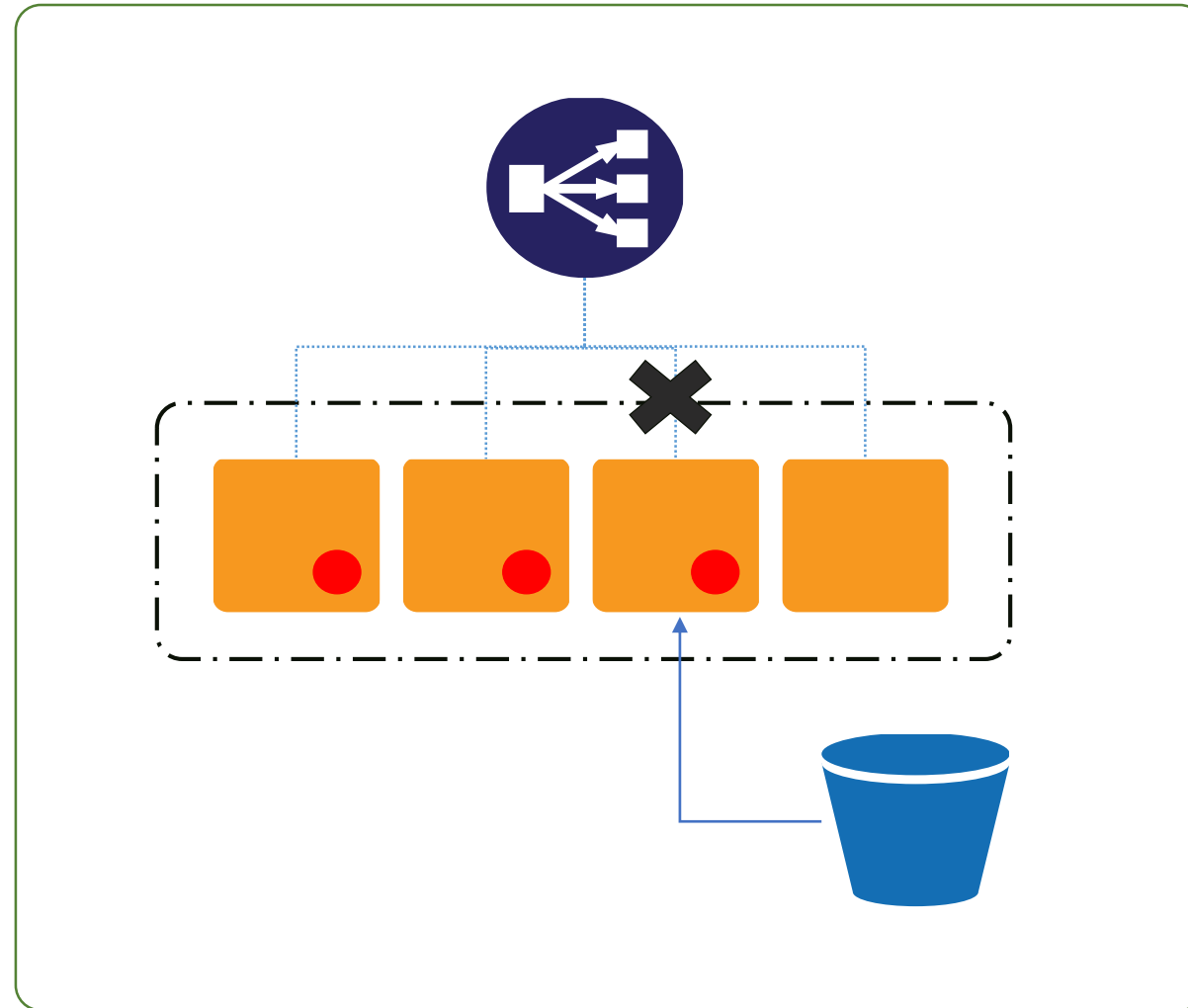
Deploy in place – Rolling update



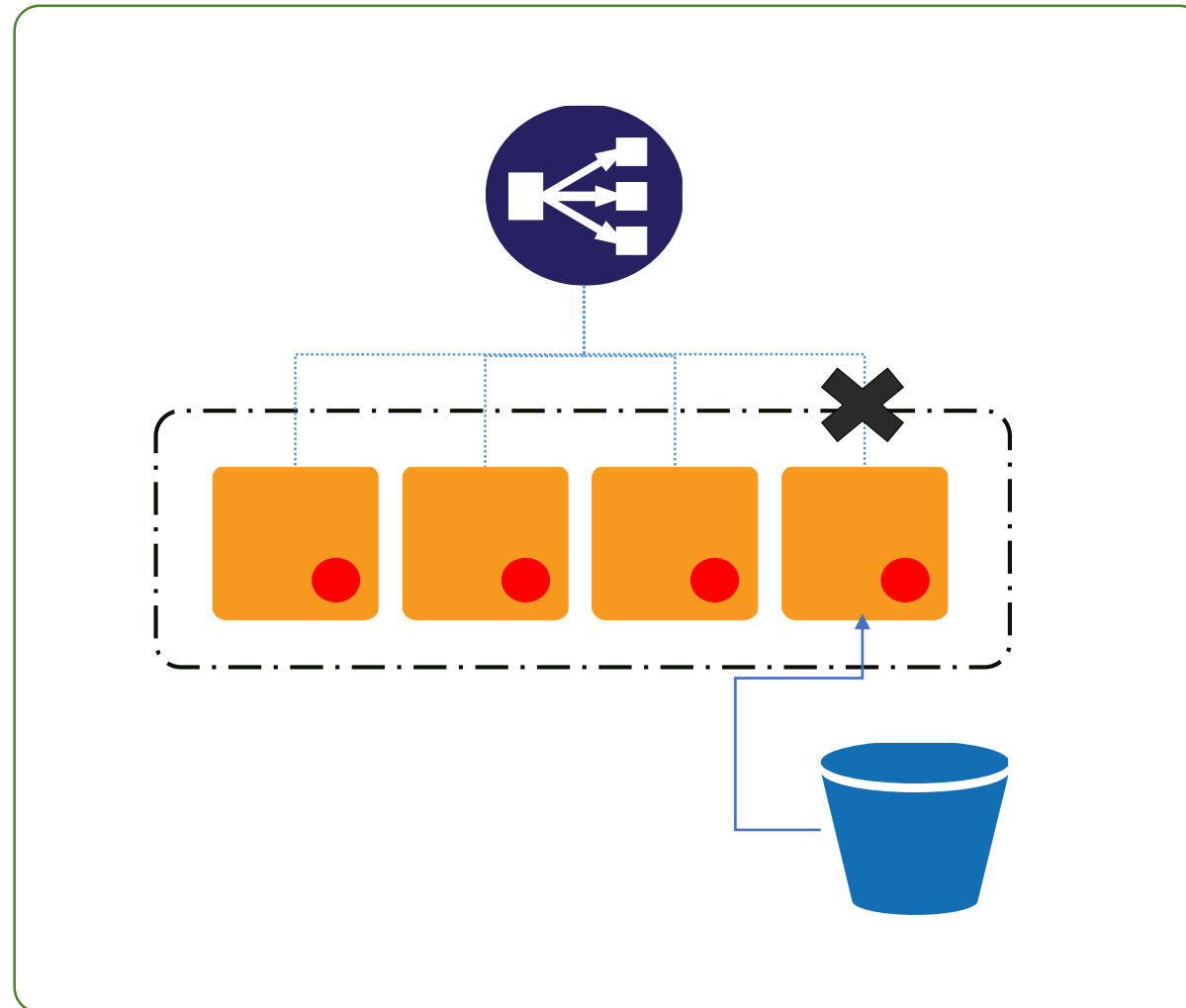
Deploy in place – Rolling update



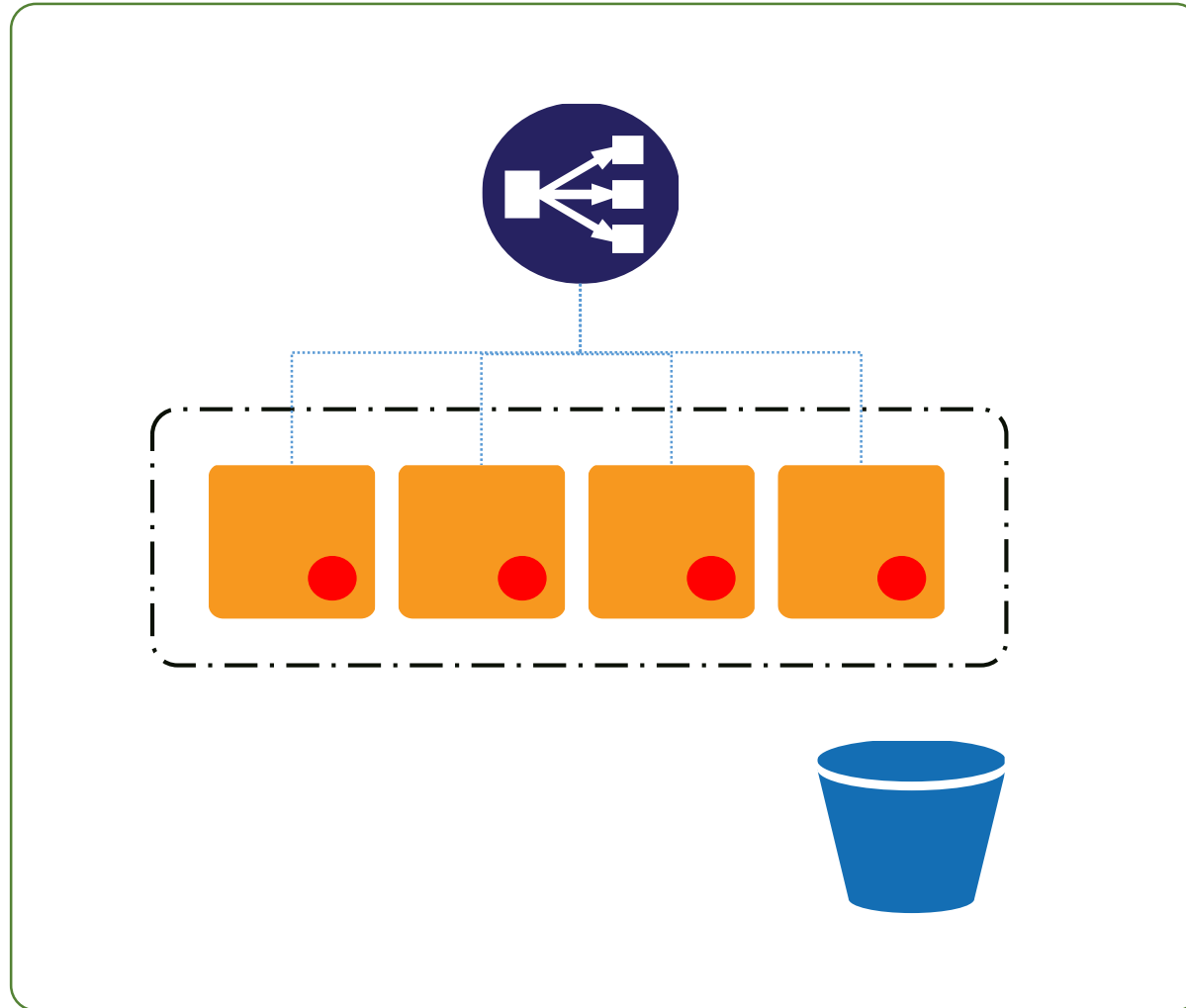
Deploy in place – Rolling update



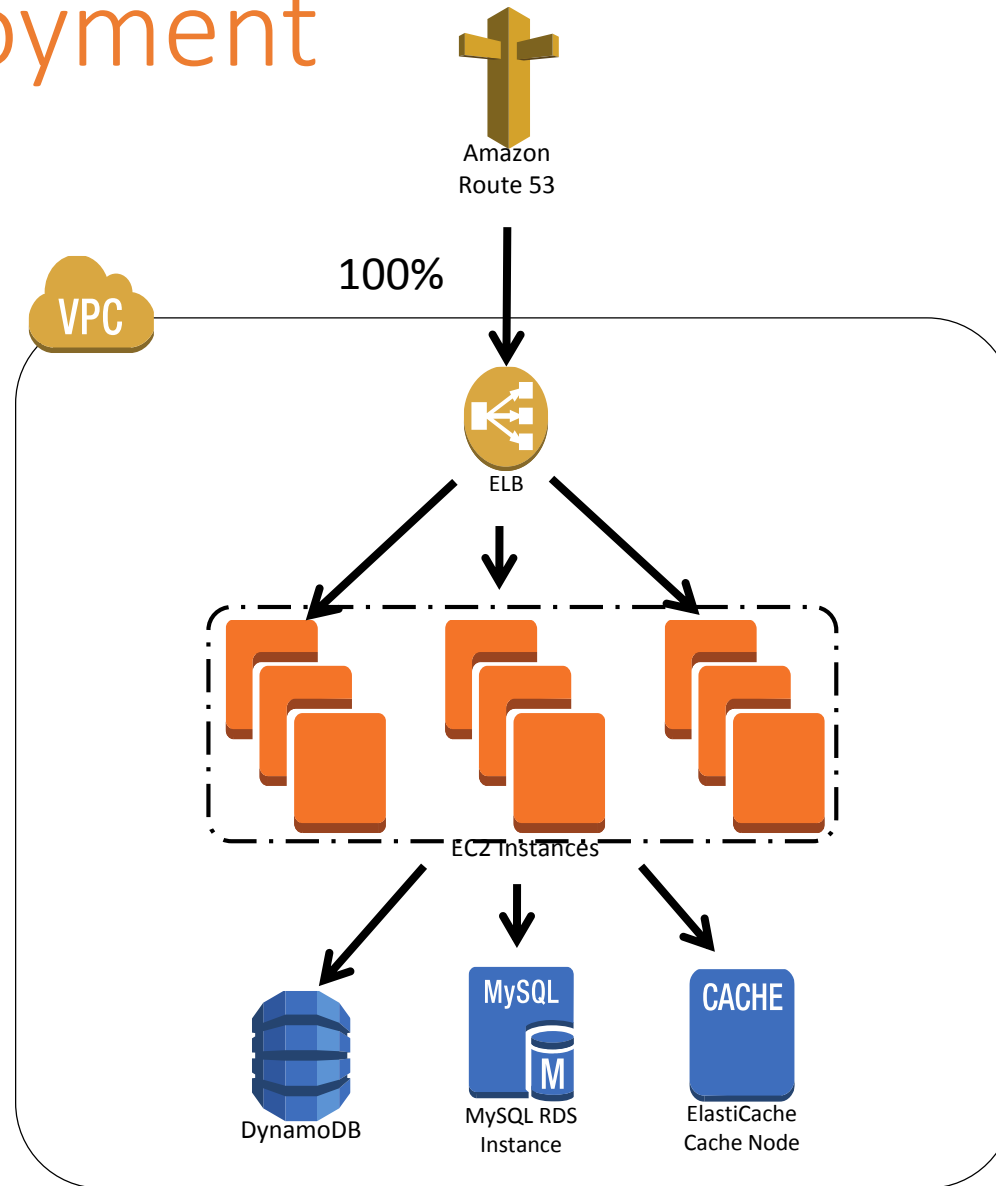
Deploy in place – Rolling update



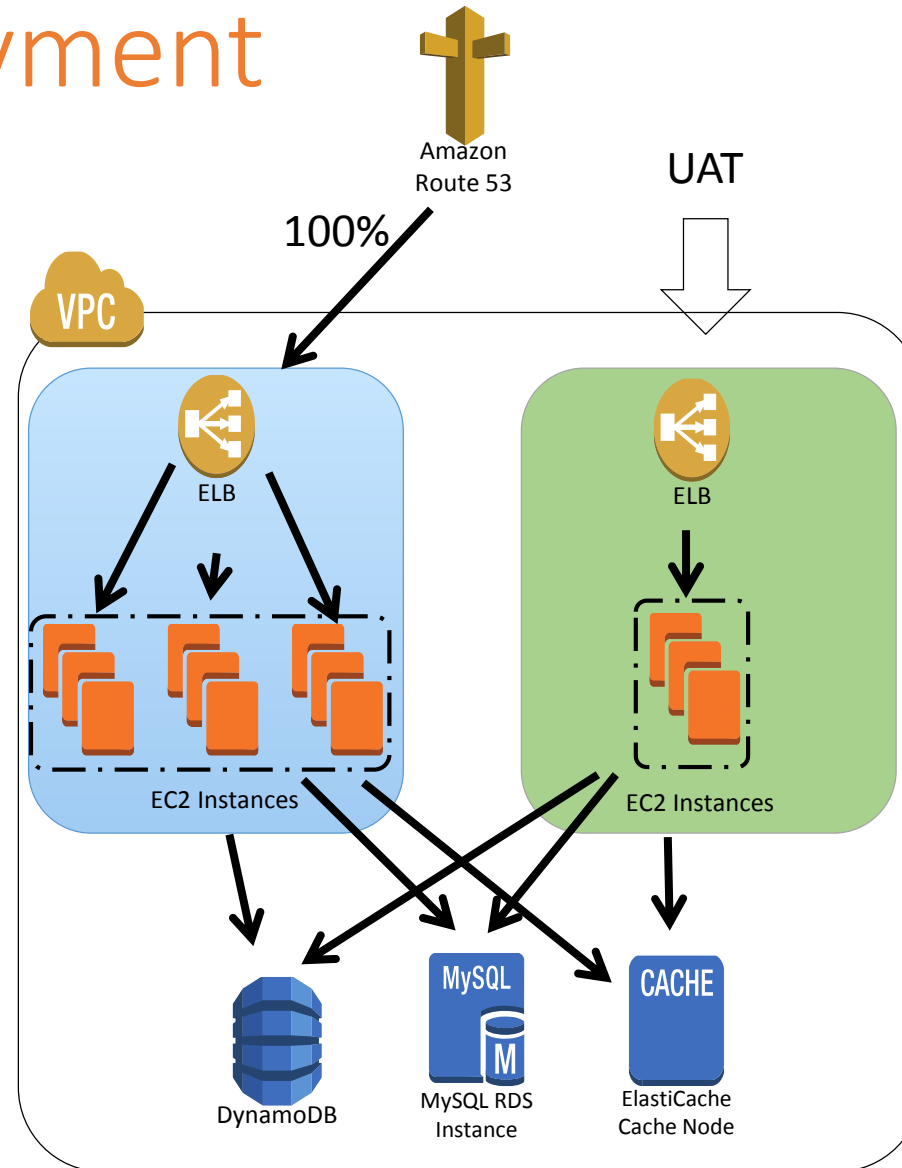
Deploy in place – Rolling update



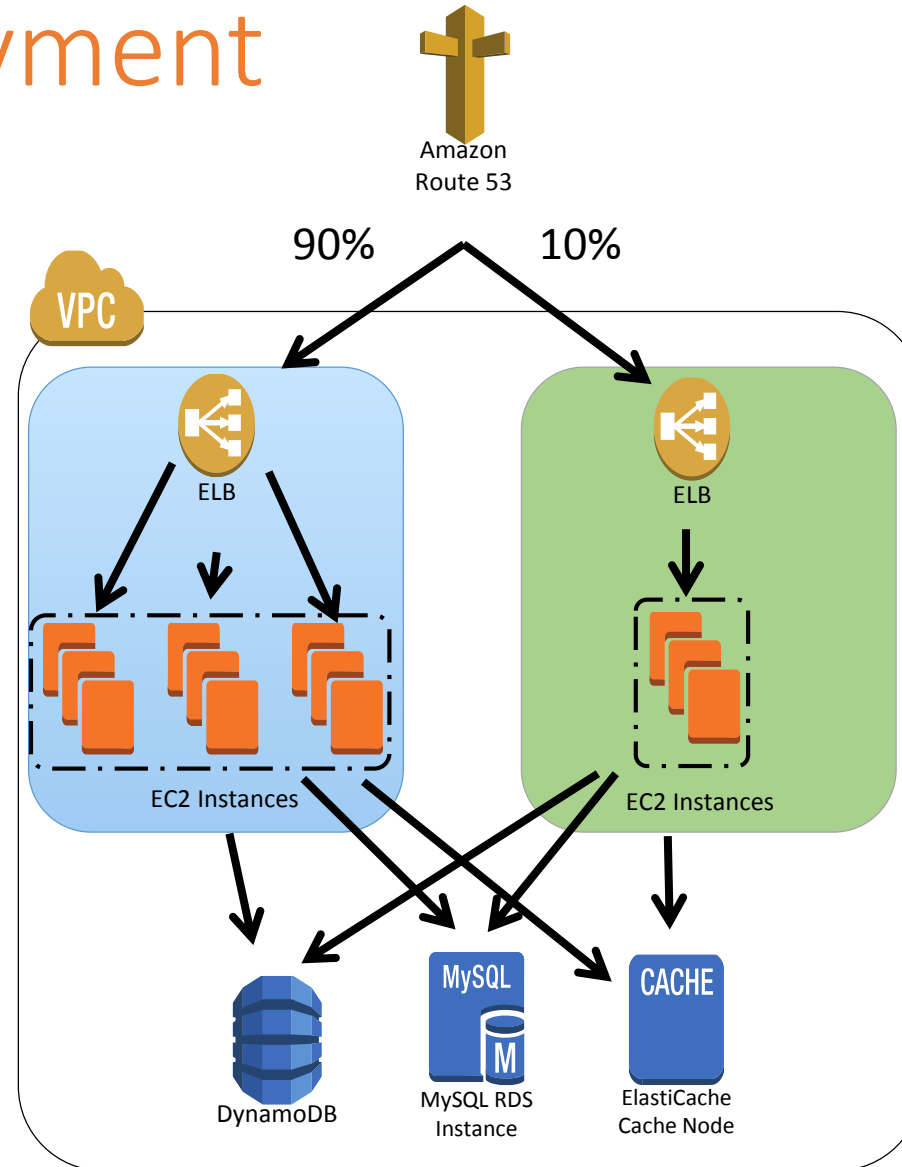
Blue-Green deployment



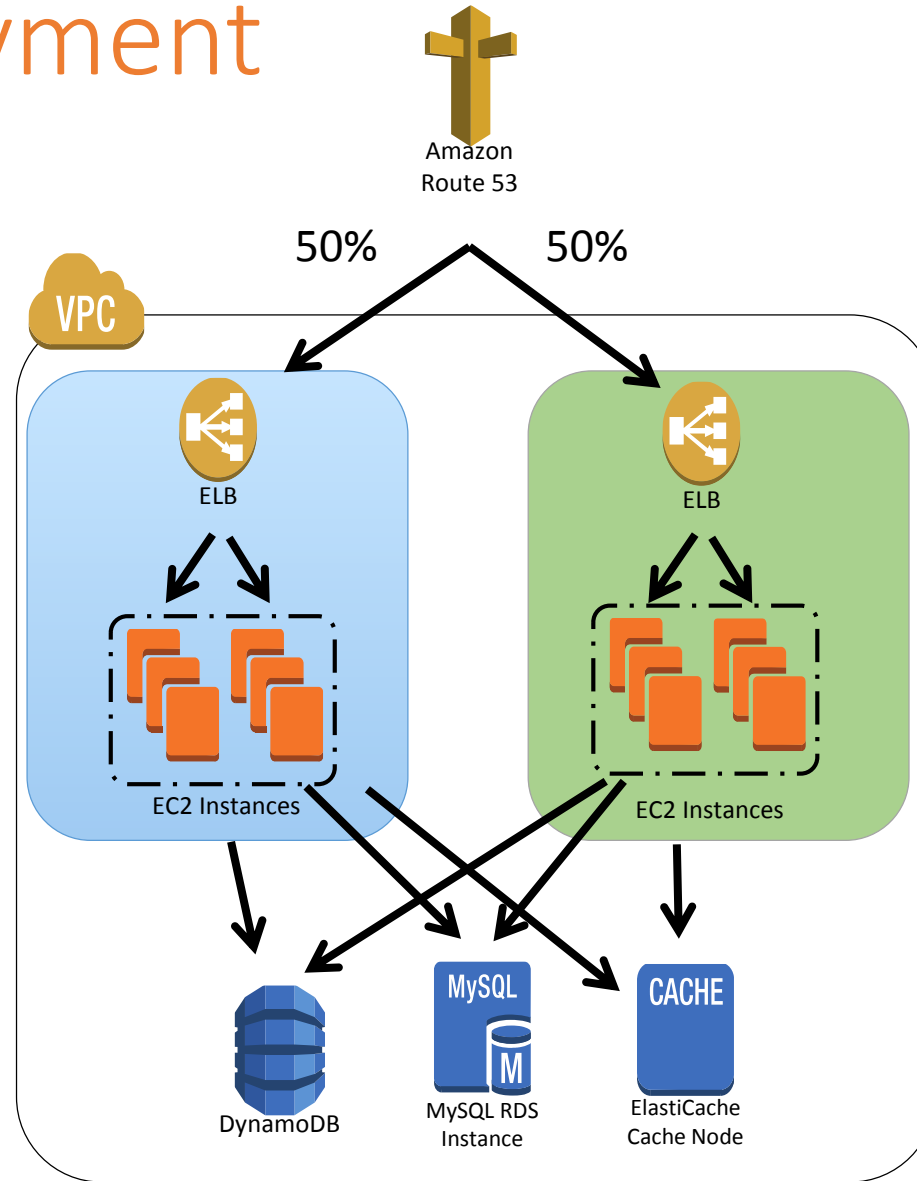
Blue-Green deployment



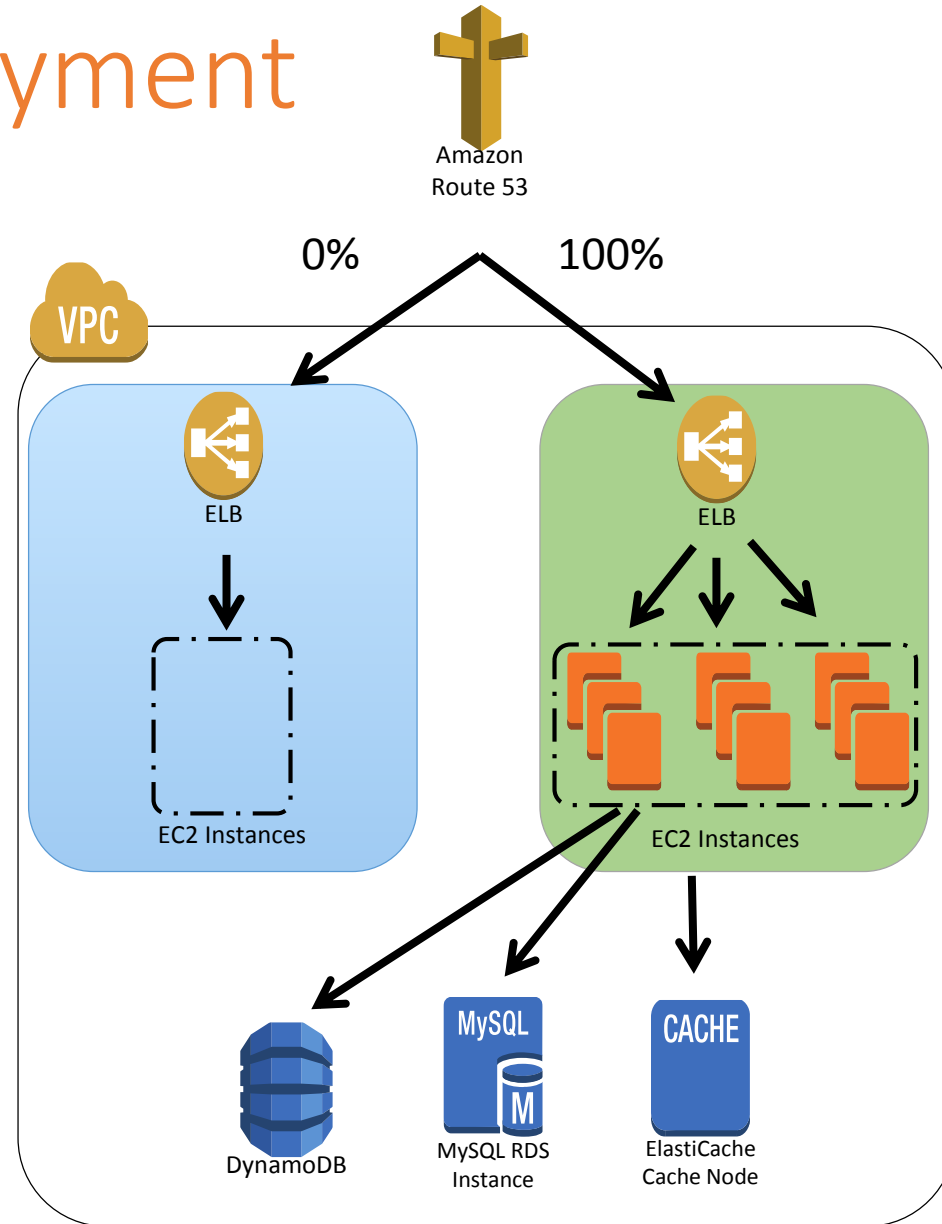
Blue-Green deployment



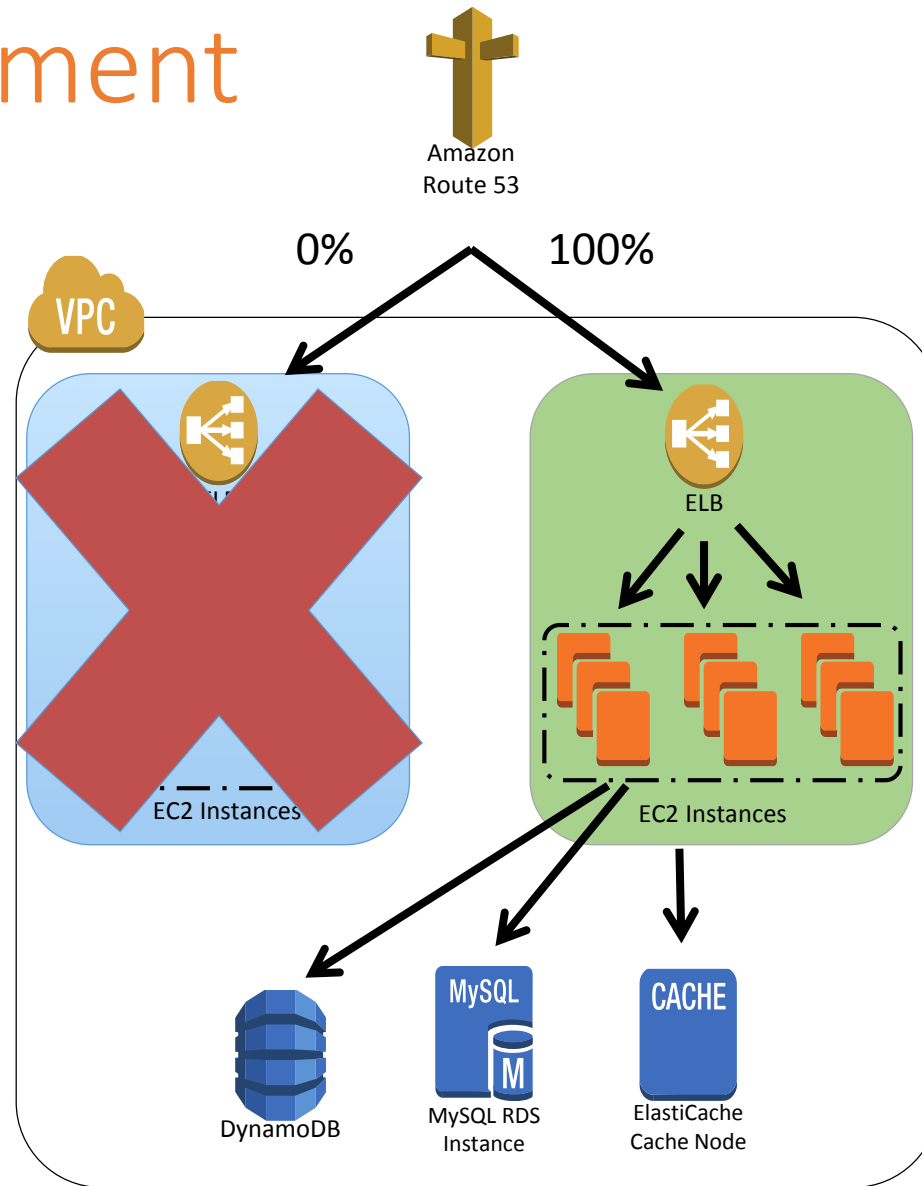
Blue-Green deployment



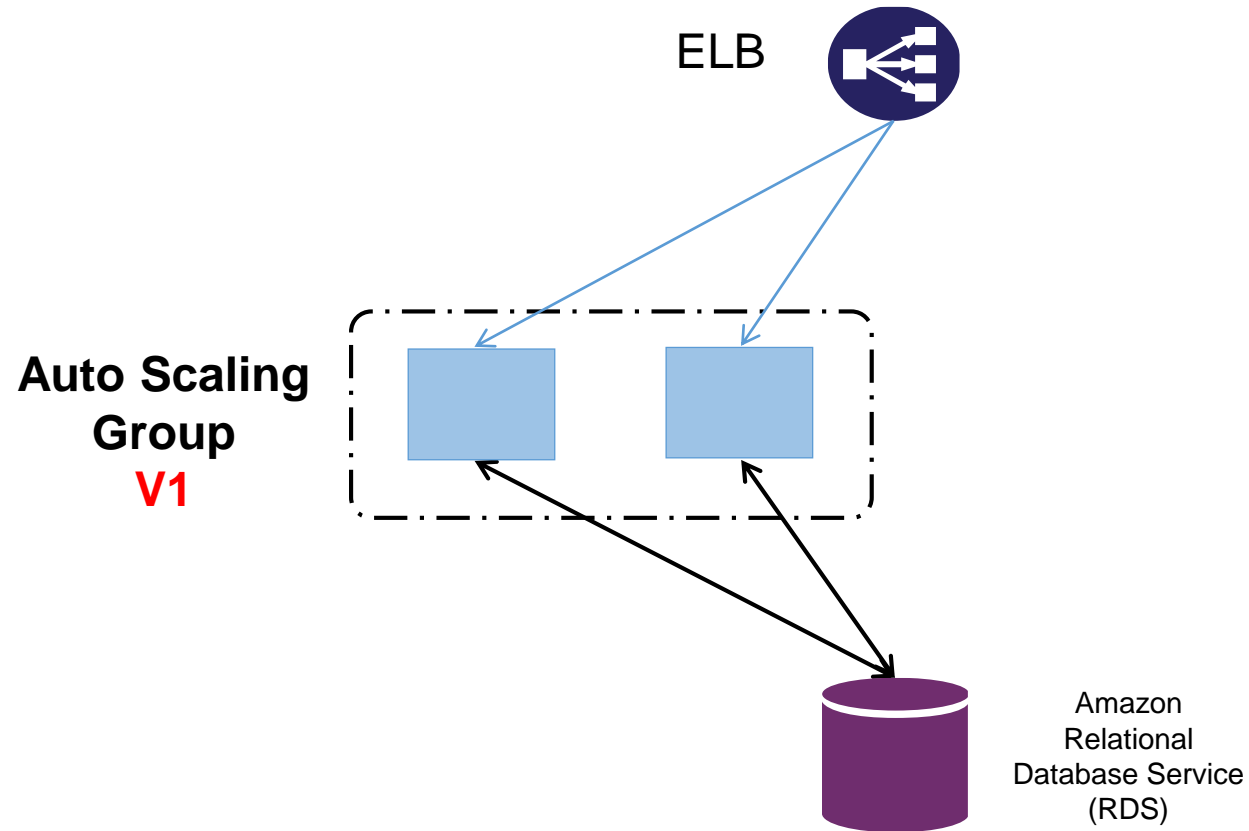
Blue-Green deployment



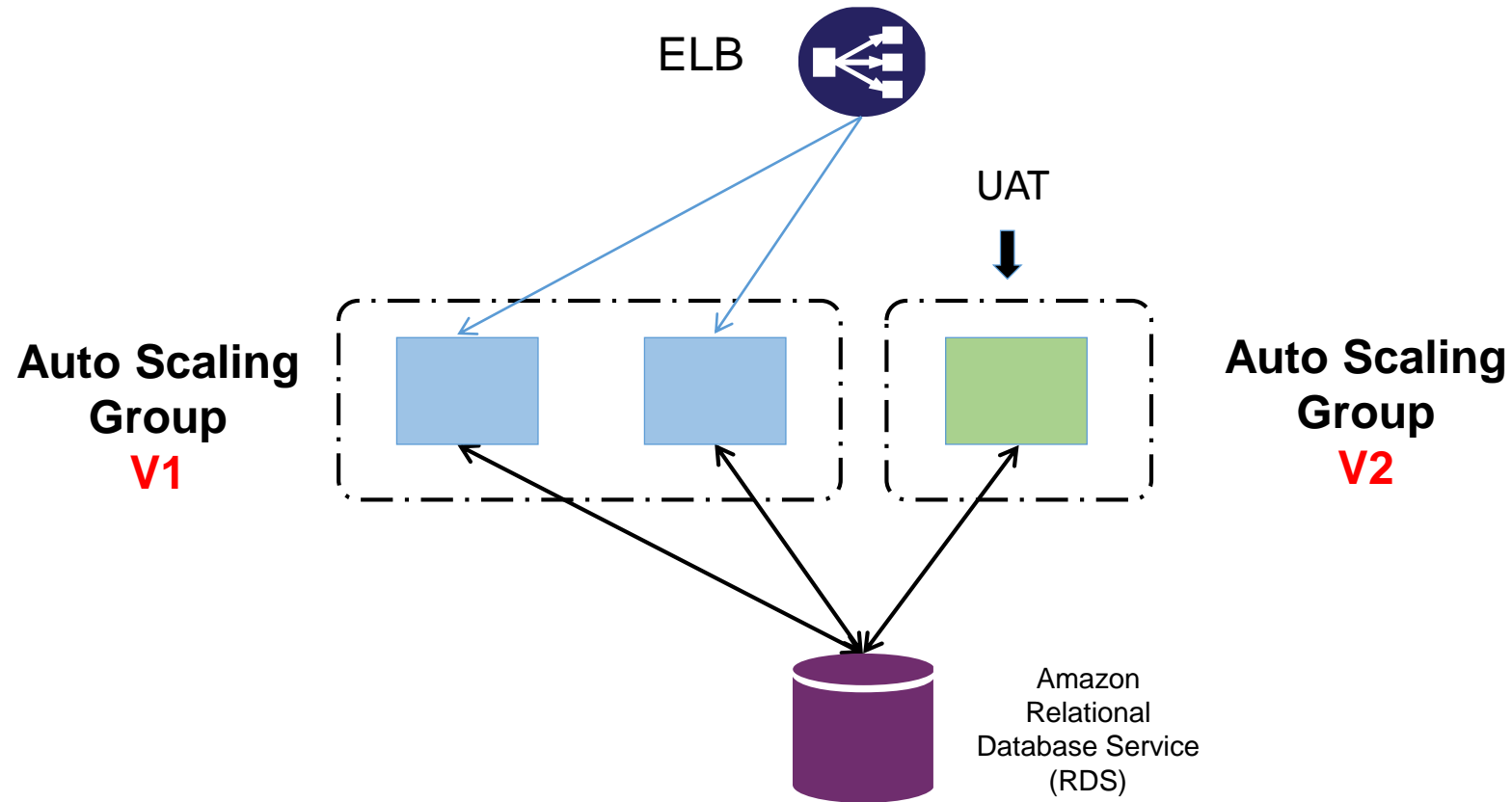
Blue-Green deployment



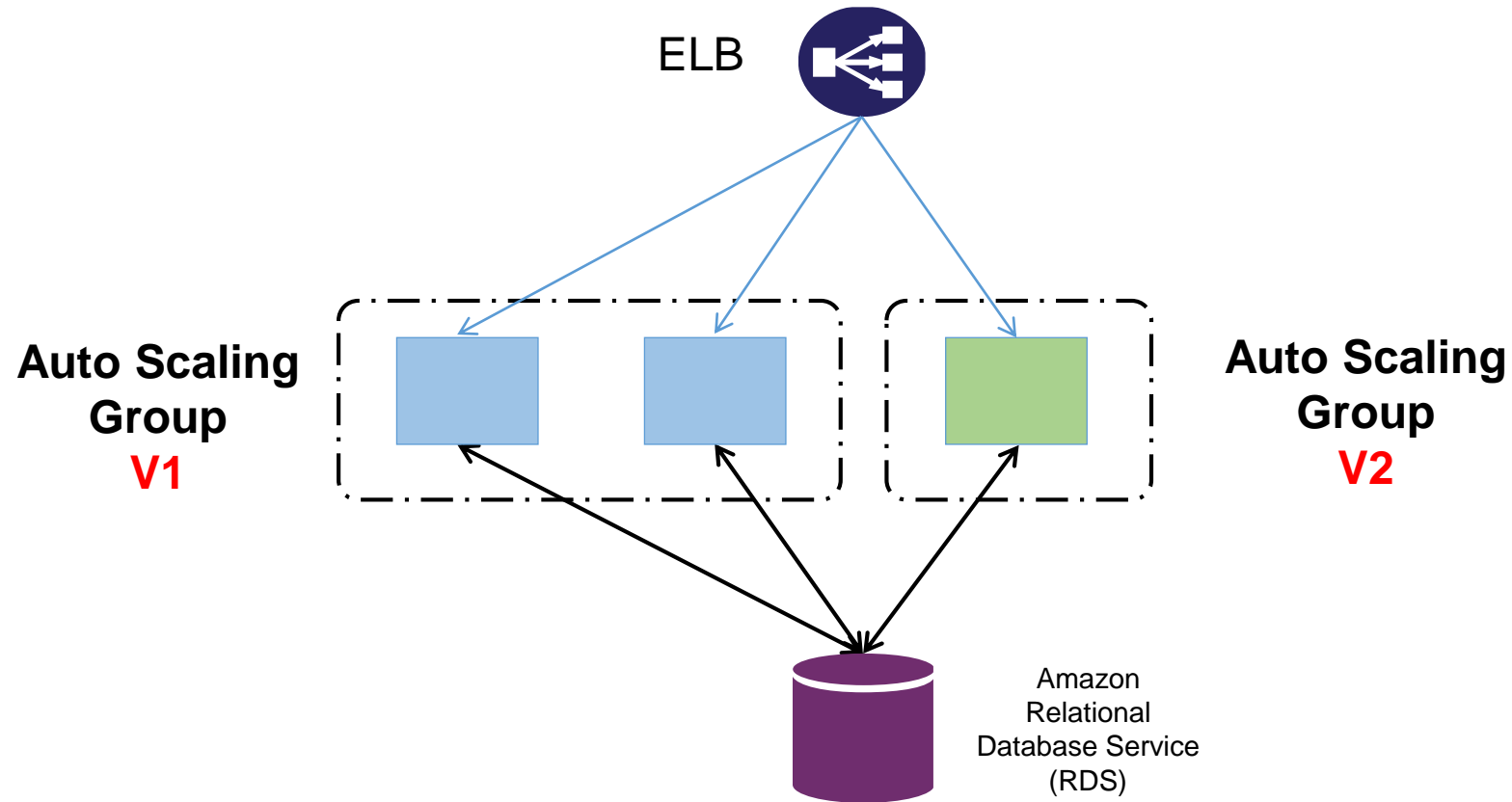
Red-Black Deployment



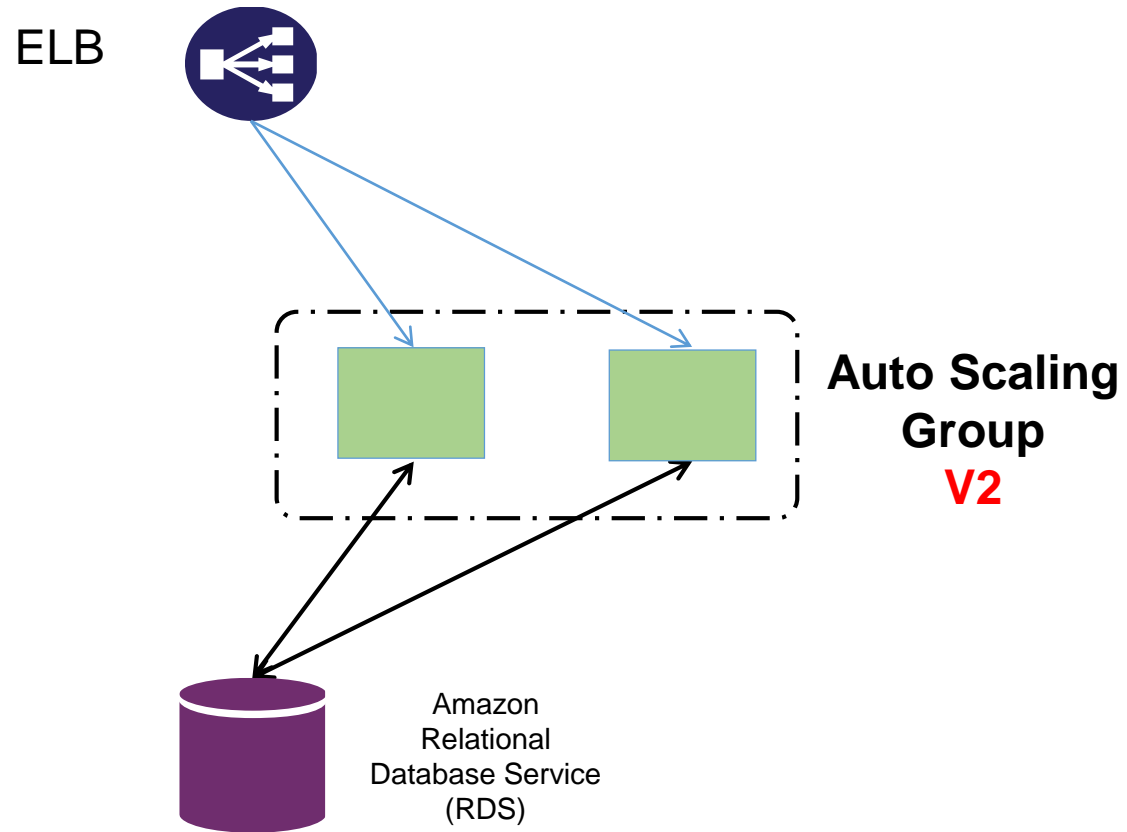
Red-Black Deployment



Red-Black Deployment



Red-Black Deployment

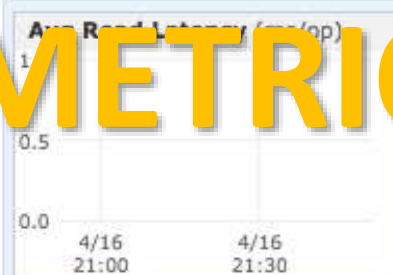


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Create Alarm



ServerRequestTime

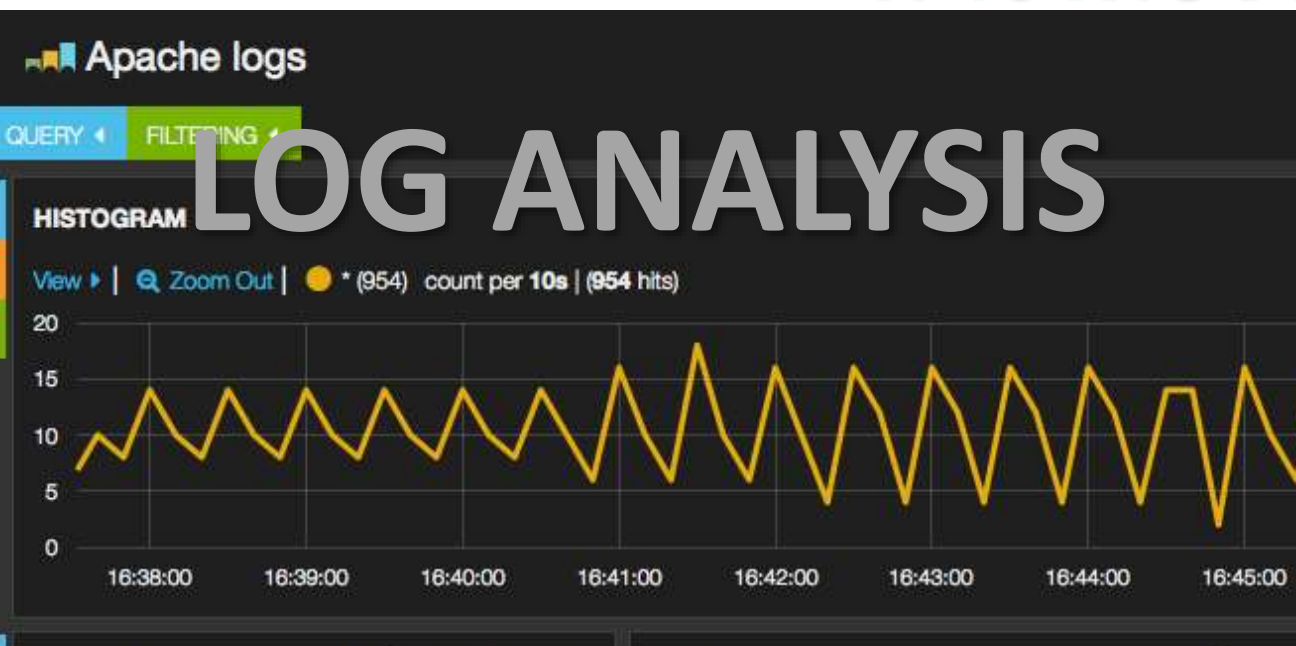


HOST METRICS

If it moves, plot it...



SERVICE METRICS



LOG ANALYSIS





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Deployment and Management

AWS Elastic Beanstalk

Automated resource management – web apps made easy



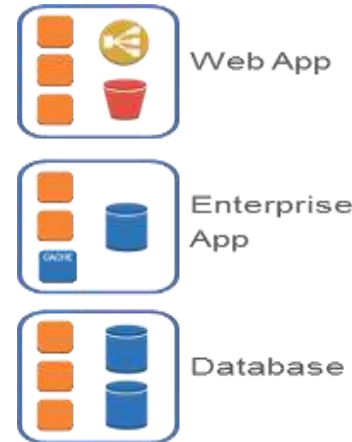
AWS OpsWorks

DevOps framework for application lifecycle management and automation



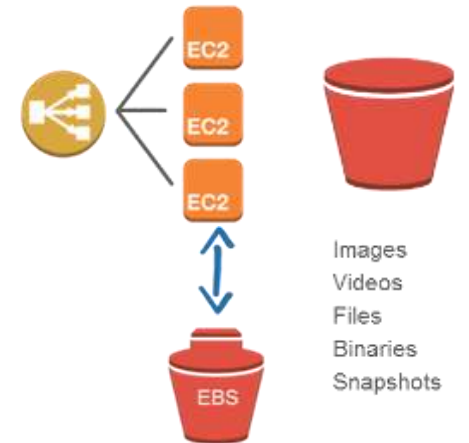
AWS CloudFormation

Templates to deploy & update infrastructure as code



DIY / On Demand

DIY, on demand resources: EC2, S3, custom AMI's, etc.



Convenience

Control



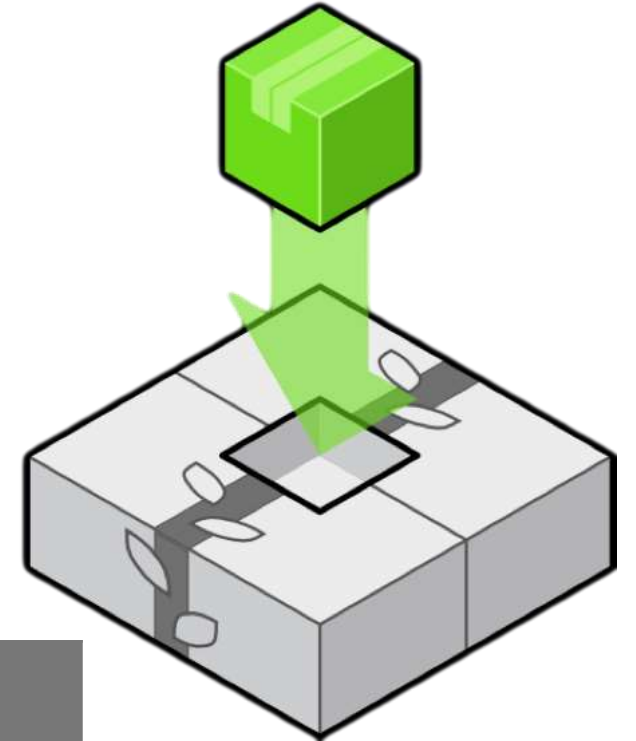
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AWS Elastic Beanstalk (EB)

- Easily deploy, monitor, and scale three-tier web applications and services.
- Infrastructure provisioned and managed by EB – but you maintain complete control.
- Preconfigured application containers that are easily customizable.
- Support for these platforms:



Elastic Beanstalk object model

Application

Environments

- Infrastructure resources (such as EC2 instances, ELB load balancers, and Auto Scaling groups)
- Runs a single application version at a time for better scalability
- An application can have many environments (such as staging and production)

Application versions

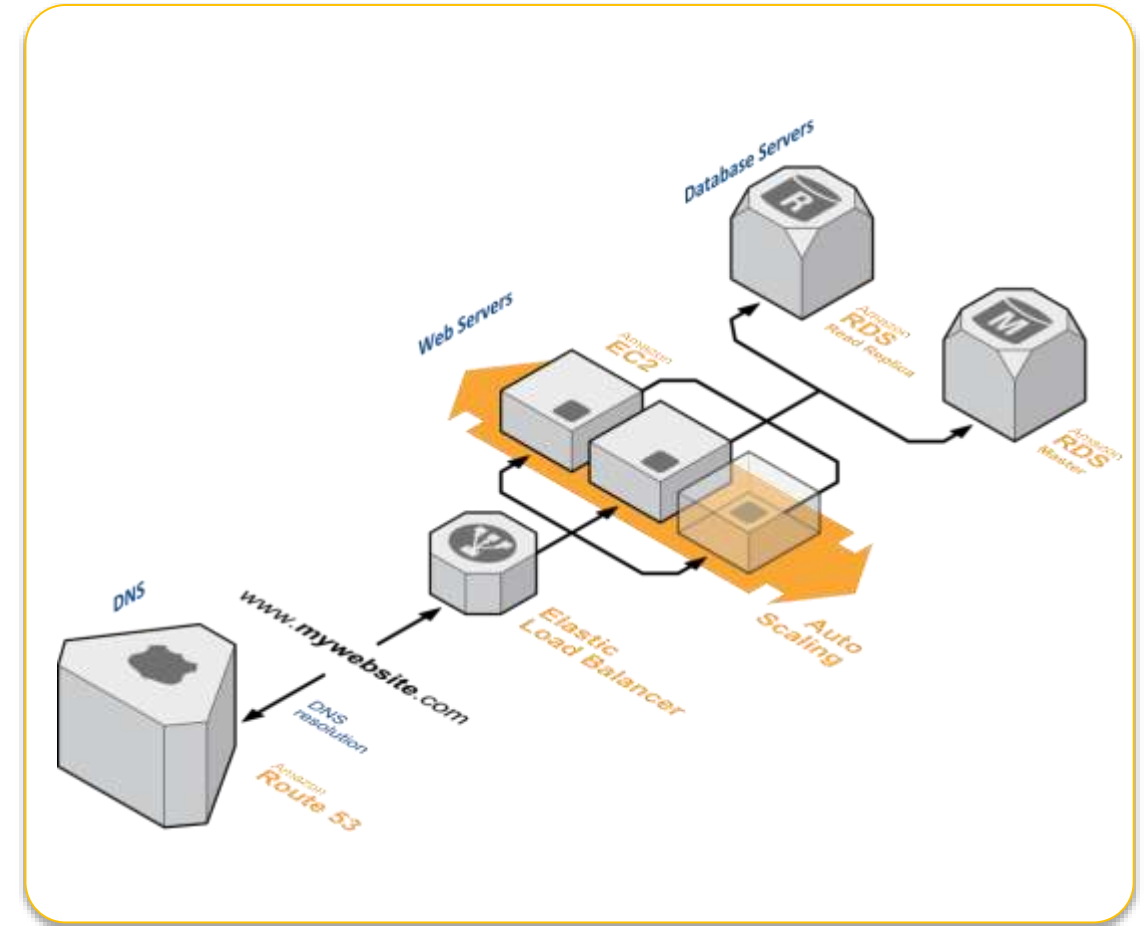
- Application code
- Stored in Amazon S3
- An application can have many application versions (easy to rollback to previous versions)

Saved configurations

- Configuration that defines how an environment and its resources behave
- Can be used to launch new environments quickly or roll-back configuration
- An application can have many saved configurations

Elastic Beanstalk environment

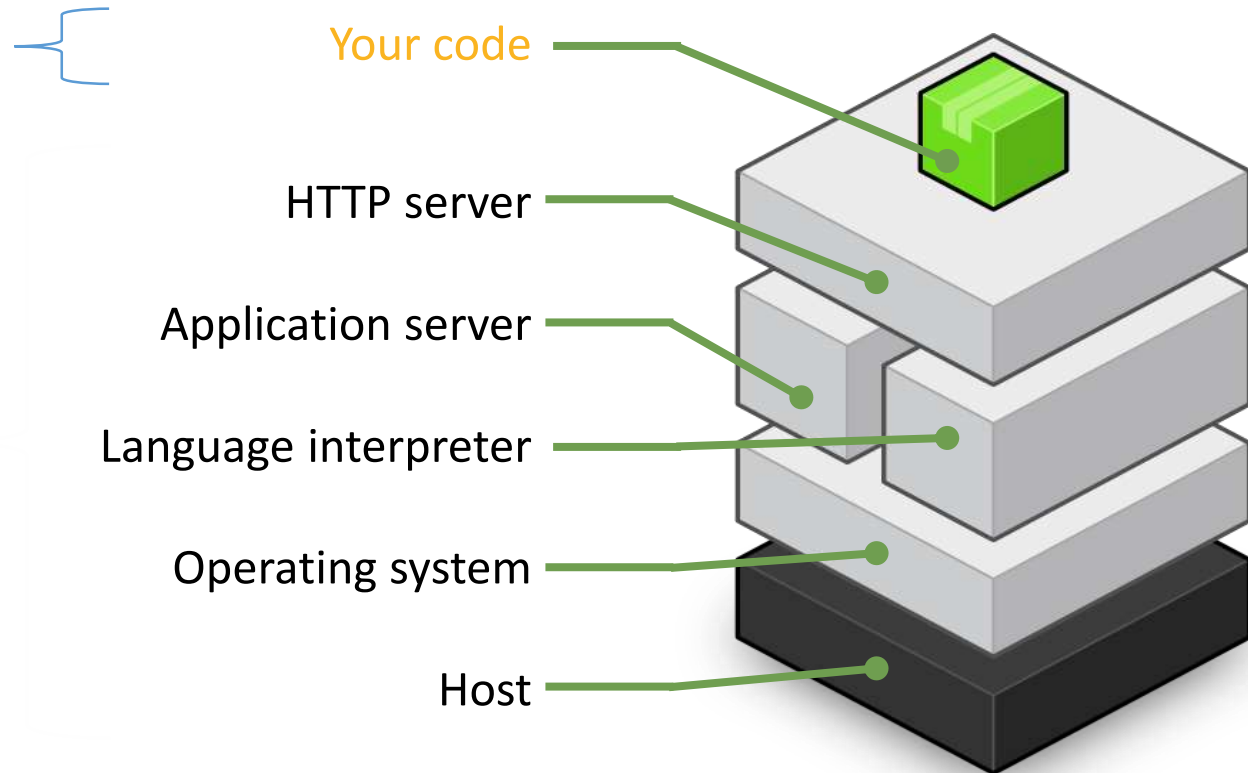
- Two types:
 - Single instance
 - Load balancing, auto scaling
- Two tiers (web server and worker)
- Elastic Beanstalk provisions necessary infrastructure resources such as load balancers, auto-scaling groups, security groups, and databases (optional)
- Configures Amazon Route 53 and gives you a unique domain name
(For example: yourapp.elasticbeanstalk.com)



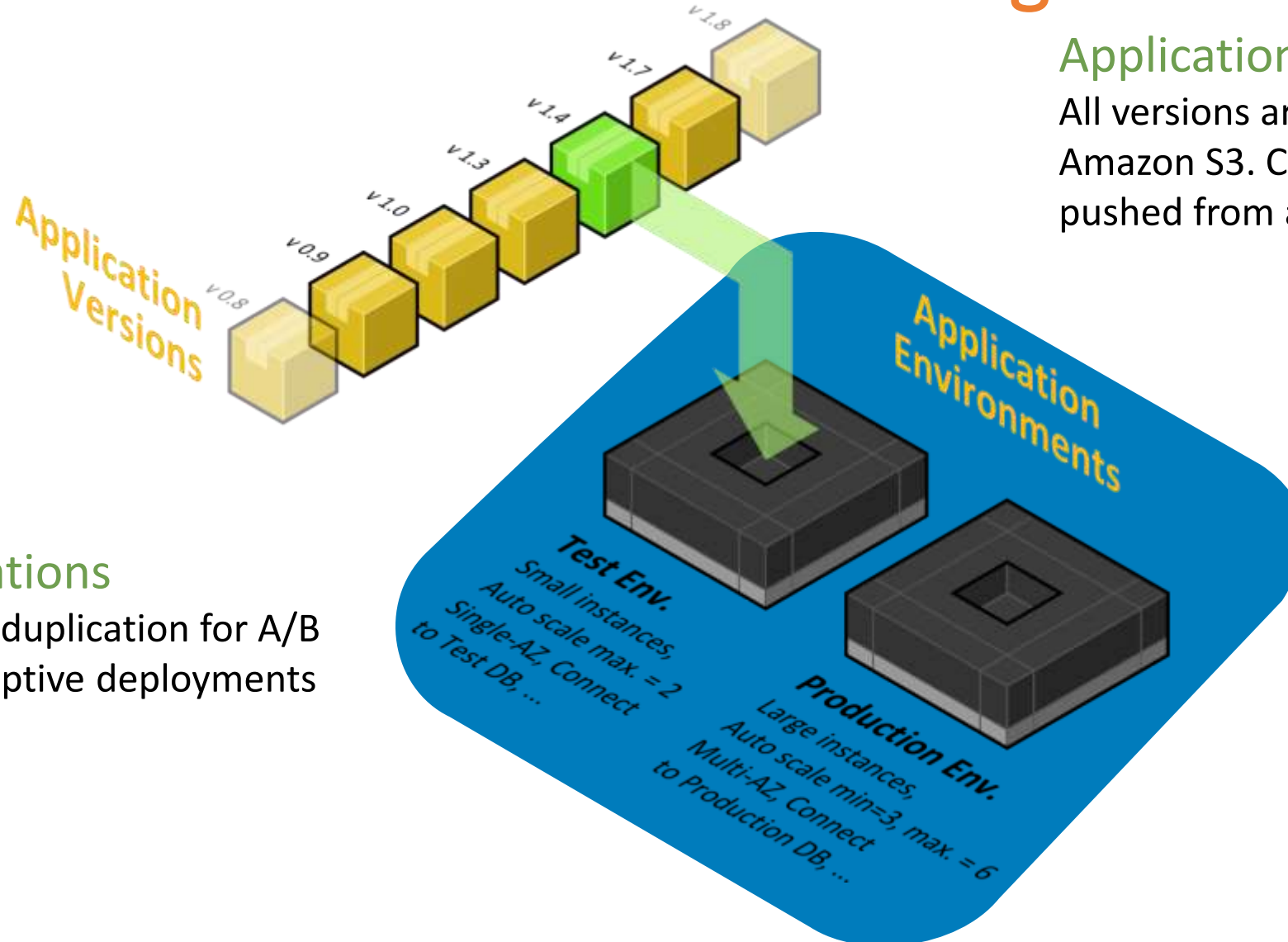
On-instance configuration

Focus on building your application

- Elastic Beanstalk configures each EC2 instance in your environment with the components necessary to run applications for the selected platform
- No more worrying about logging into instances to install and configure your application stack



Application versions and saved configurations



Application versions

All versions are stored durably in Amazon S3. Code can also be pushed from a Git repository!

Saved configurations

Save these for easy duplication for A/B testing or non-disruptive deployments

Deployment options

1. Via the AWS Management Console

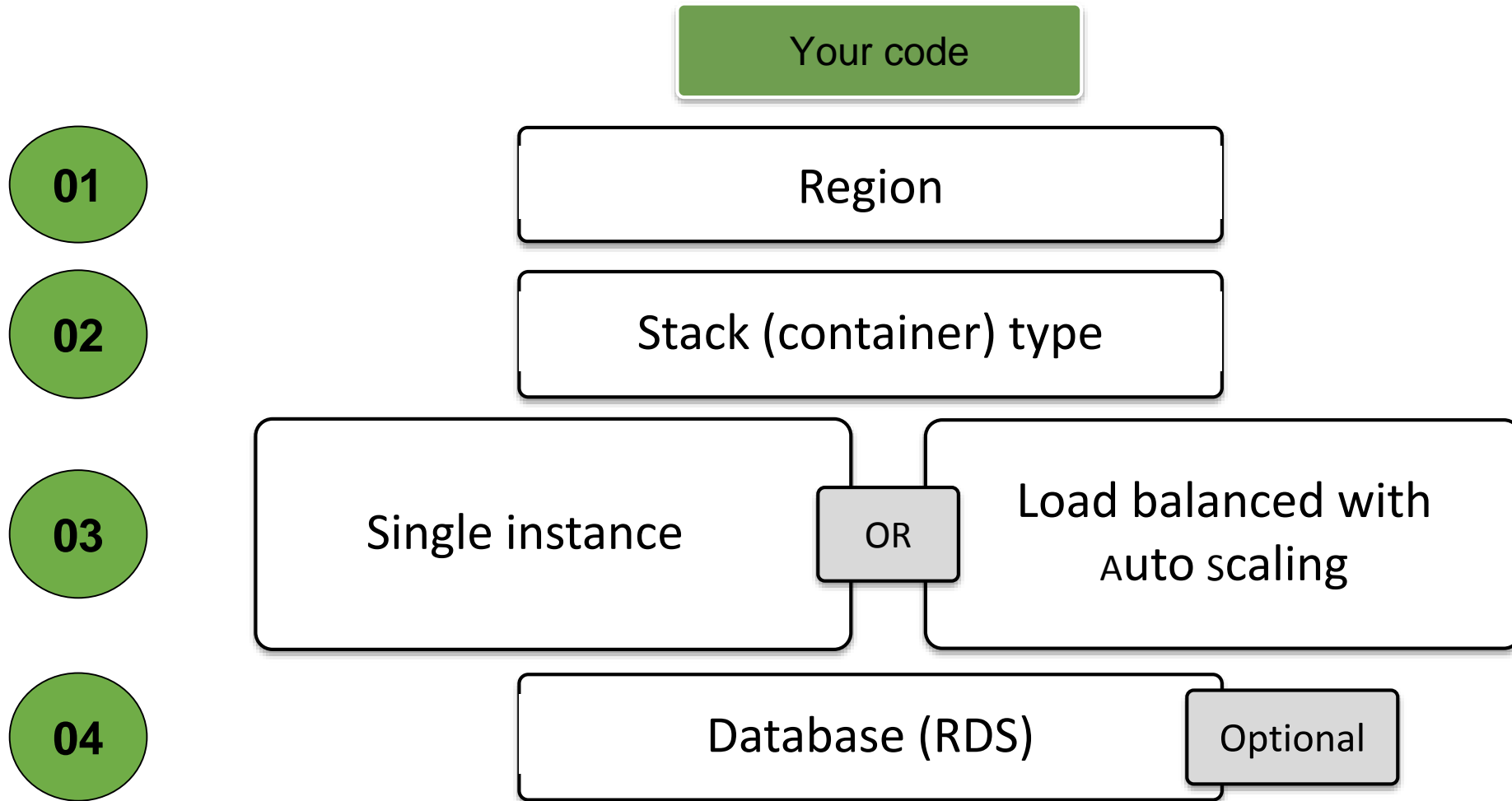
2. Via Git / EB CLI

```
$ git aws.push
```

3. Via the AWS Toolkit for Eclipse and the Visual Studio IDE



Deployment configuration



Example: CLI workflow

Initial app deployment:

01 Initialize your Git repository

```
$ git init .
```

02 Create your Elastic Beanstalk app

```
$ eb init
```

03

Follow the prompts to configure the environment

04 Add your code

```
$ git add .
```

05 Commit

```
$ git commit -m "v1.0"
```

06

Create the resources and launch the application

```
$ eb create
```



Example: CLI workflow

Update your app:

01 Update your code

02 Push the new code

```
$ git add .  
$ git commit -m "v2.0"  
$ eb deploy
```

03 Monitor the deployment progress

```
$ eb status
```

Customize application containers

Add custom software to your environment using ebextensions:

```
packages:
  yum:
    newrelic-sysmond: []
  rpm:
    newrelic: http://yum.newrelic.com/pub/newrelic/el5/i386/newrelic-repo-5-3.noarch.rpm

commands:
  0_newrelic_command:
    command: "touch /tmp/$(date '+%F.%T.%N').newrelic_command_0"
  1_configure_new_relic_key:
    command: nrsysmond-config --set license_key=<Your key here>
  1a_newrelic_command:
    command: "touch /tmp/$(date '+%F.%T.%N').newrelic_command_1a"
  2_start_new_relic:
    command: "/etc/init.d/newrelic-sysmond start"
  2a_newrelic_command:
    command: "touch /tmp/$(date '+%F.%T.%N').newrelic_command_2a"
```

Iterate on application architecture

Add additional resources to your environments using ebextensions:

Add other components such as:

- In-memory caching (Amazon ElastiCache Redis and Memcached)
- Amazon SQS
- Amazon CloudFront

```
Resources:
  MyElastiCache:
    Type: AWS::ElastiCache::CacheCluster
    Properties:
      CacheNodeType:
        Fn::GetOptionSetting:
          OptionName : CacheNodeType
          DefaultValue: cache.m1.small
      NumCacheNodes:
        Fn::GetOptionSetting:
          OptionName : NumCacheNodes
          DefaultValue: 1
      Engine:
        Fn::GetOptionSetting:
          OptionName : Engine
          DefaultValue: memcached
```

Zero-downtime deployments

Swap URLs

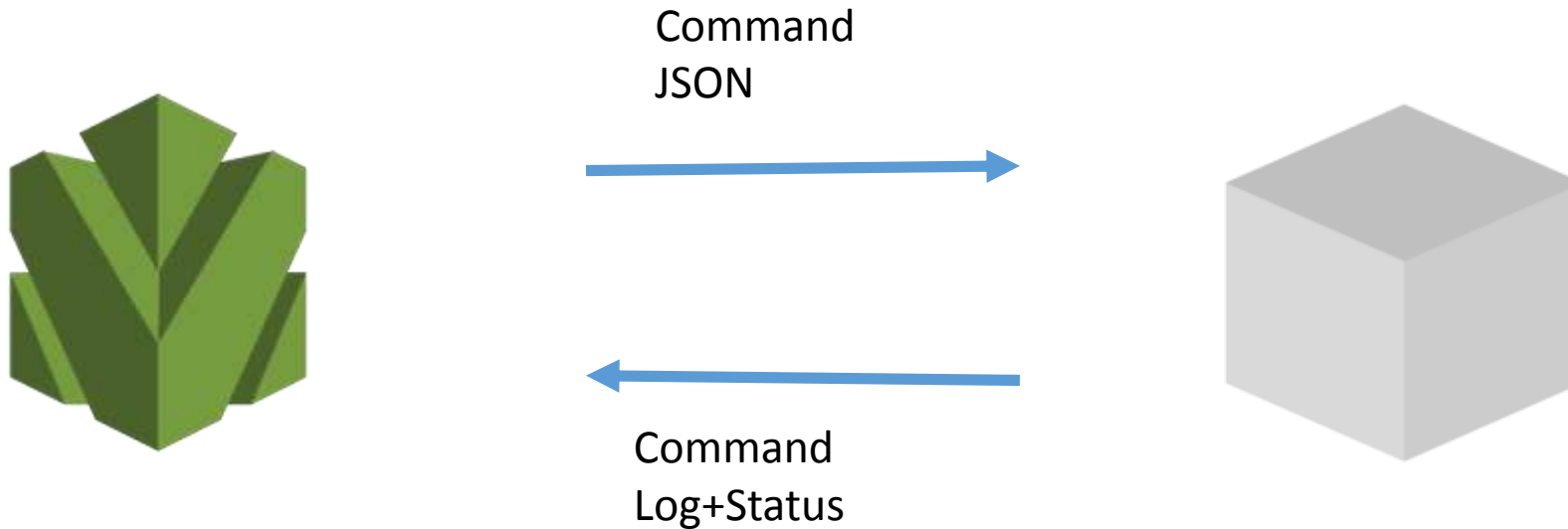
1. Create a new environment for an existing application
2. Deploy your updated application code to the new environment
3. Use the “Swap URLs” feature to transition users to the new production environment

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AWS OpsWorks architecture



Amazon EC2, Amazon EBS, EIP,
Amazon VPC, Elastic Load Balancing....
Auto-Scaling, Auto-Healing....

On-instance execution via
Chef client/zero

The heart of AWS OpsWorks

Agent on each
EC2 instance



understands a set of commands that are triggered by OpsWorks.
The agent then runs a Chef solo run.

Chef integration

- Supports Chef 11.10
- Built-in convenience cookbooks / bring your own
- Chef run is triggered by lifecycle event firing:
push vs. pull
- Event comes with stack state JSON

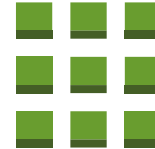
Opsworks components



Stack is basically a container for AWS resources—Amazon EC2 instances, Amazon EBS volumes, Elastic IP addresses, and so on—that have a common purpose and would be logically managed together.



A layer is basically a blueprint that specifies how to configure a set of Amazon EC2 instances for a particular purpose, such as serving applications or hosting a database server. Eg Java App server layer, PHP layer, RDS layer, MySQL Layer, HAProxy layer etc

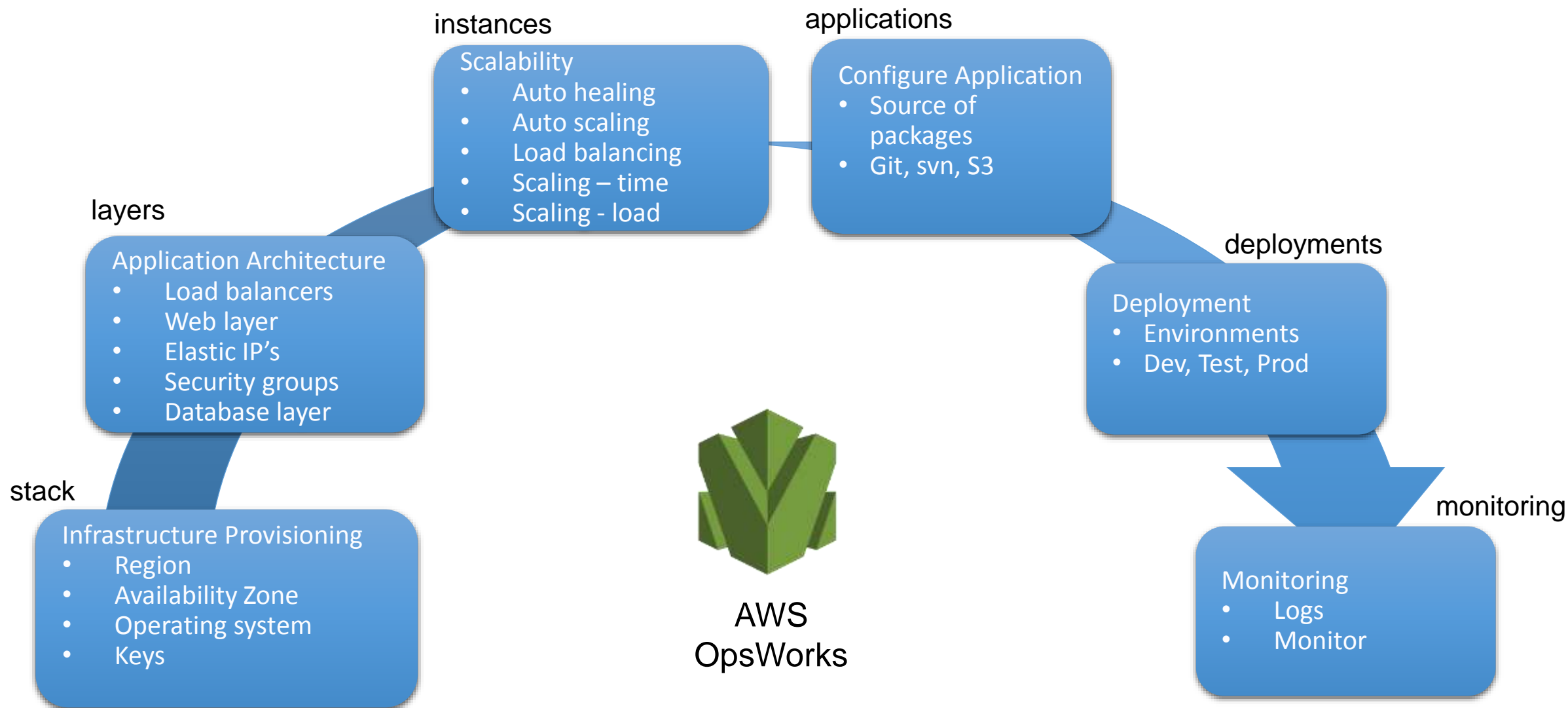


An instance represents an Amazon EC2 instance and defines its basic configuration, such as operating system and size. Each layer has an associated set of Chef recipes that AWS OpsWorks runs on the layer's instances at key points in an instance's life cycle.



Each application is represented by an app, which specifies the application type and contains the information that AWS OpsWorks needs to deploy the application from the repository to your instances.

Opsworks components



Instance lifecycle commands

setup



configure



deploy



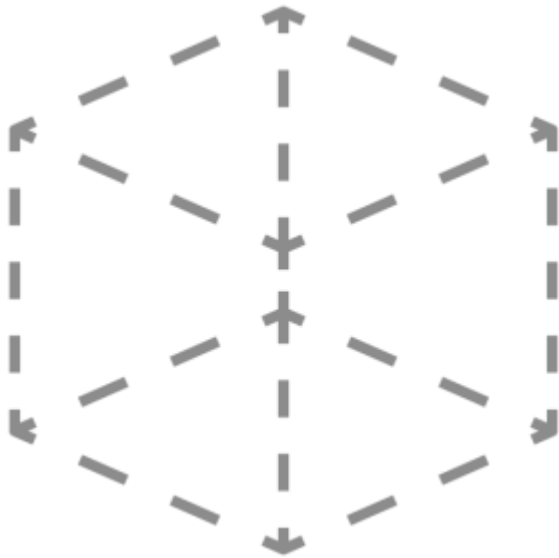
undeploy



shutdown

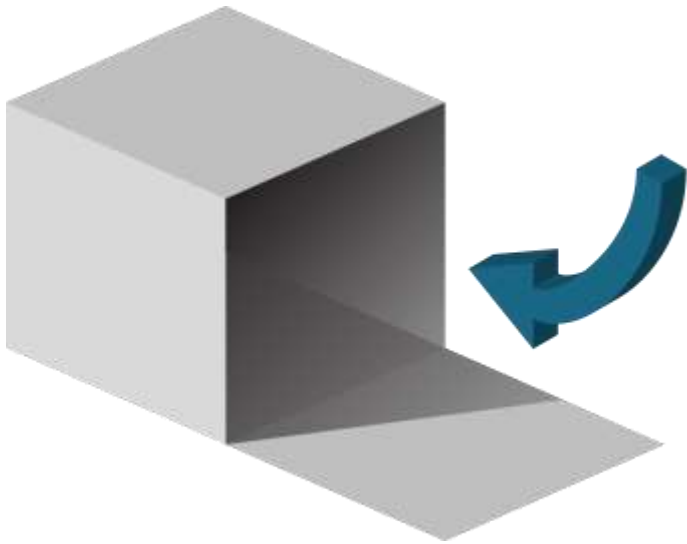


Setup event



- Sent when instance boots
- Includes **deploy** event
- Use for initial installation of software & services

Configure event



- Sent to all instances when any instance enters or leaves online state
- Use for making sure the configuration is up-to-date

Deploy event



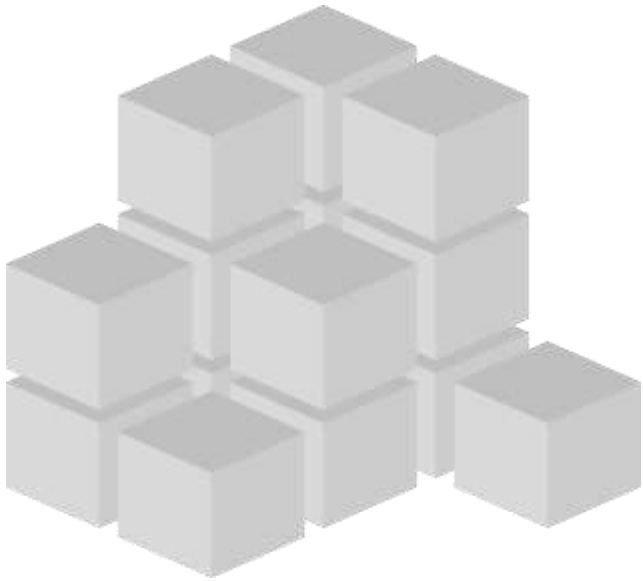
- Sent when you deploy via UI/API; part of each setup.
- Use for custom deployment

Undeploy event



- Sent via UI/API when apps are deleted
- Use to remove apps from running instances

Shutdown event



- Sent when an instance is shut down
- ~45s to execute
- Use for clean shutdown

Automation good!



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Amazon CloudFormation



AWS CloudFormation

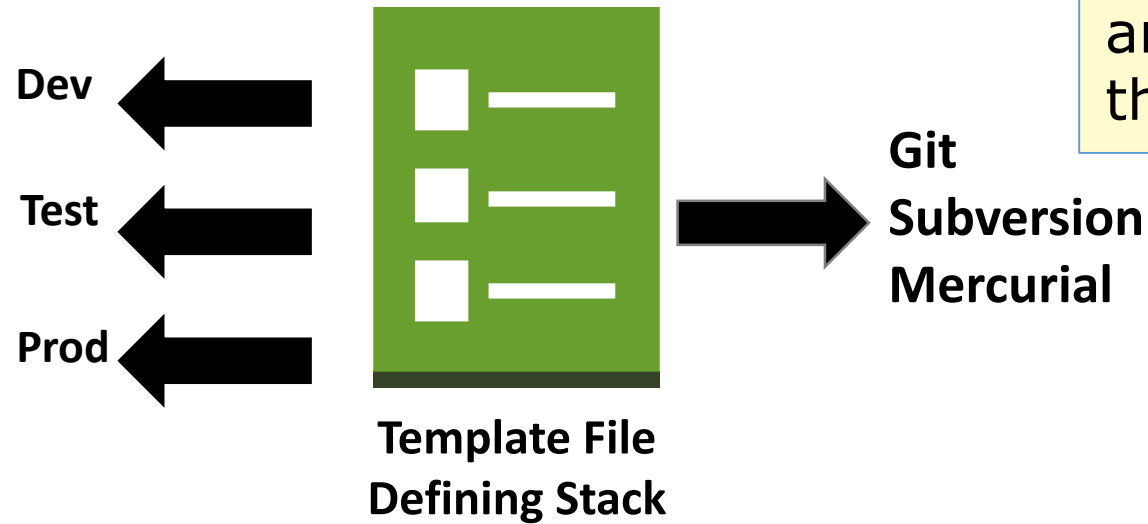
- Infrastructure as Code
- Integrates with version control
- JSON format
- Templates
- Stacks
- Supports all AWS resource types

AWS CloudFormation: Model Your App

- Document, version control, and share your applications and infrastructure as a JSON document
- Provision app and other AWS resources (VPC, DynamoDB, etc) from a template
- Repeatable, reliable deployments for test/dev/prod in any AWS Region

AWS CloudFormation: Application stack example (continue)

Build out multiple environments, such as for Development, Test, and Production using the template



Use the version control system of your choice to store and track changes to this template

The entire application can be represented in an AWS CloudFormation template.

Template Anatomy

```
{
  "Description" : "Create an EC2 instance.",
  "Resources" : {
    "Ec2Instance" : {
      "Type" : "AWS::EC2::Instance",
      "Properties" : {
        "KeyName" : "my-key-pair",
        "ImageId" : "ami-75g0061f",
        "InstanceType" : "m1.medium"
      }
    }
  }
}
```

Template Anatomy

```
{
  "Description" : "Create an EC2 instance.",
  "Parameters" : {
    "UserKeyName" : {
      "Description" : "The EC2 Key Pair to allow SSH access to the instance",
      "Type" : "String"
    }
  },
  "Resources" : {
    "Ec2Instance" : {
      "Type" : "AWS::EC2::Instance",
      "Properties" : {
        "KeyName" : { "Ref" : "UserKeyName" },
        "ImageId" : "ami-75g0061f",
        "InstanceType" : "m1.medium"
      }
    }
  }
}
```

Template Anatomy

```
{
  "Description" : "Create an EC2 instance.",
  "Parameters" : {
    "UserKeyName" : {
      "Description" : "The EC2 Key Pair to allow SSH access to the instance",
      "Type" : "String"
    },
    "InstanceType" : {
      "Description" : "The EC2 Instance Type to launch.",
      "Type" : "String",
      "AllowedValues" : ["t1.micro", "m1.small", "m1.medium"]
    }
  },
  "Resources" : {
    "Ec2Instance" : {
      "Type" : "AWS::EC2::Instance",
      "Properties" : {
        "KeyName" : { "Ref" : "UserKeyName" },
        "ImageId" : "ami-75g0061f",
        "InstanceType" : { "Ref" : "InstanceType" }
      }
    }
  },
  "Outputs" : {
    "InstancePublicDnsName" : {
      "Description" : "The public DNS name of the newly created EC2 instance",
      "Value" : { "Fn::GetAtt" : [ "Ec2Instance", "PublicDnsName" ] }
    }
  }
}
```

Application Deployment - User Data

```
"UserData": {  
  "Fn::Base64": {  
    "Fn::Join": [  
      "",  
      [  
        "#!/bin/bash -ex\n",  
        "yum -y install git-core\n",  
        "yum -y install php-pear\n",  
        "pear install Crypt_HMAC2-1.0.0\n",  
        "pear install HTTP_Request-1.4.4\n",  
        "pear install aws/sdk\n",
```

Application Deployment - cfn-init

```
"Ec2Instance": {  
  "Metadata": {  
    "AWS::CloudFormation::Init": {  
      "config": {  
        "sources" : {  
          "/usr/local/bin/s3cmd" : "https://github.com/s3tools/s3cmd"  
        },  
        "packages": {  
          "yum": { "git": [] }  
        }  
      }  
    }  
  }  
}
```

3rd Party Tools

- Easily integrate with existing configuration management tools
- Simply use User-Data or cfn-init to configure agents



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 - Code Pipeline
 - Code Deploy



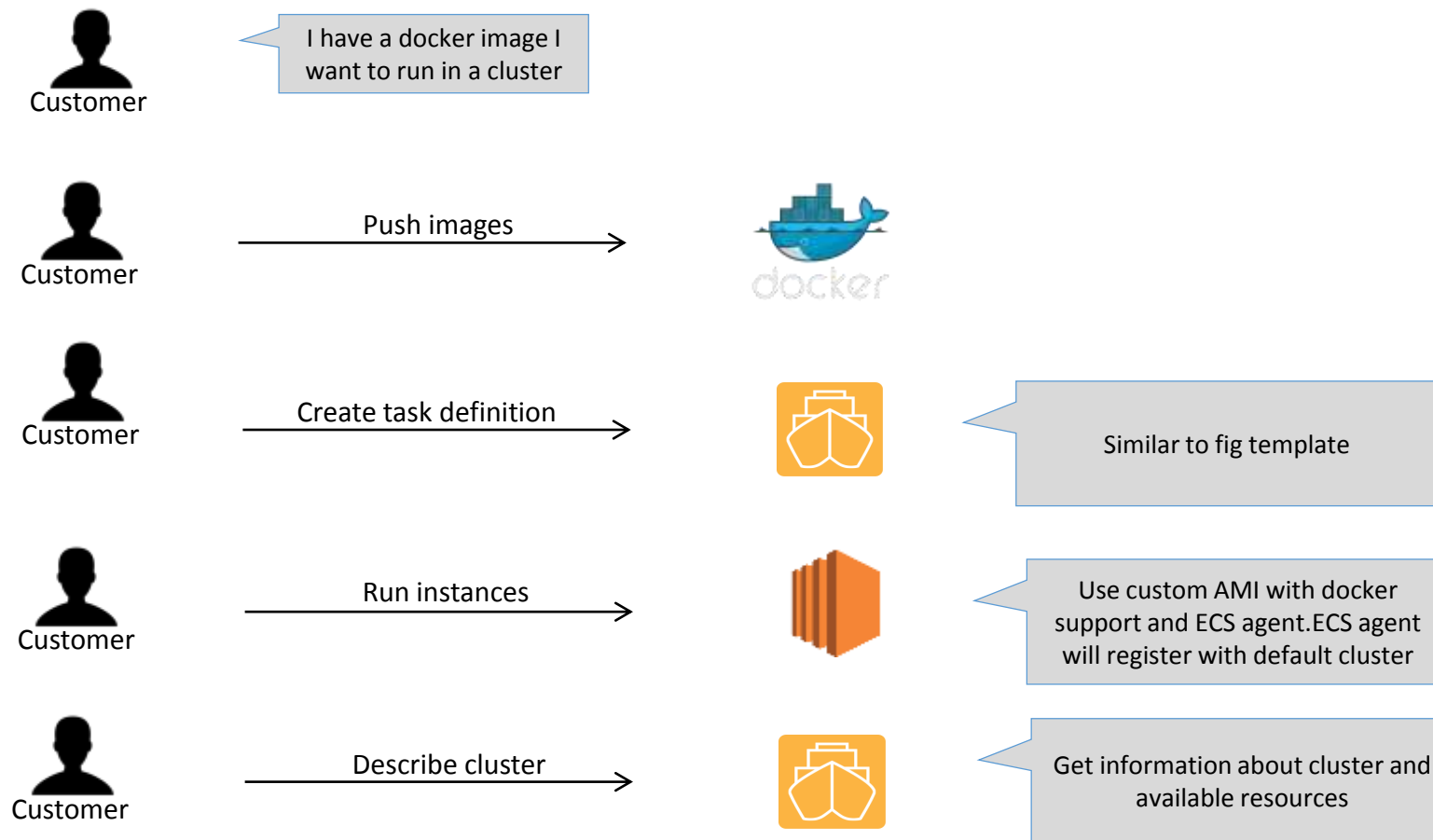
EC2 Container Service (ECS)

- Cluster Management Made Easy
- Flexible Scheduling
- High Performance
- Resource Efficiency
- Extensible
- Security
- Programmatic Control
- Docker Compatibility
- Monitoring
- AWS Integration

ECS Components

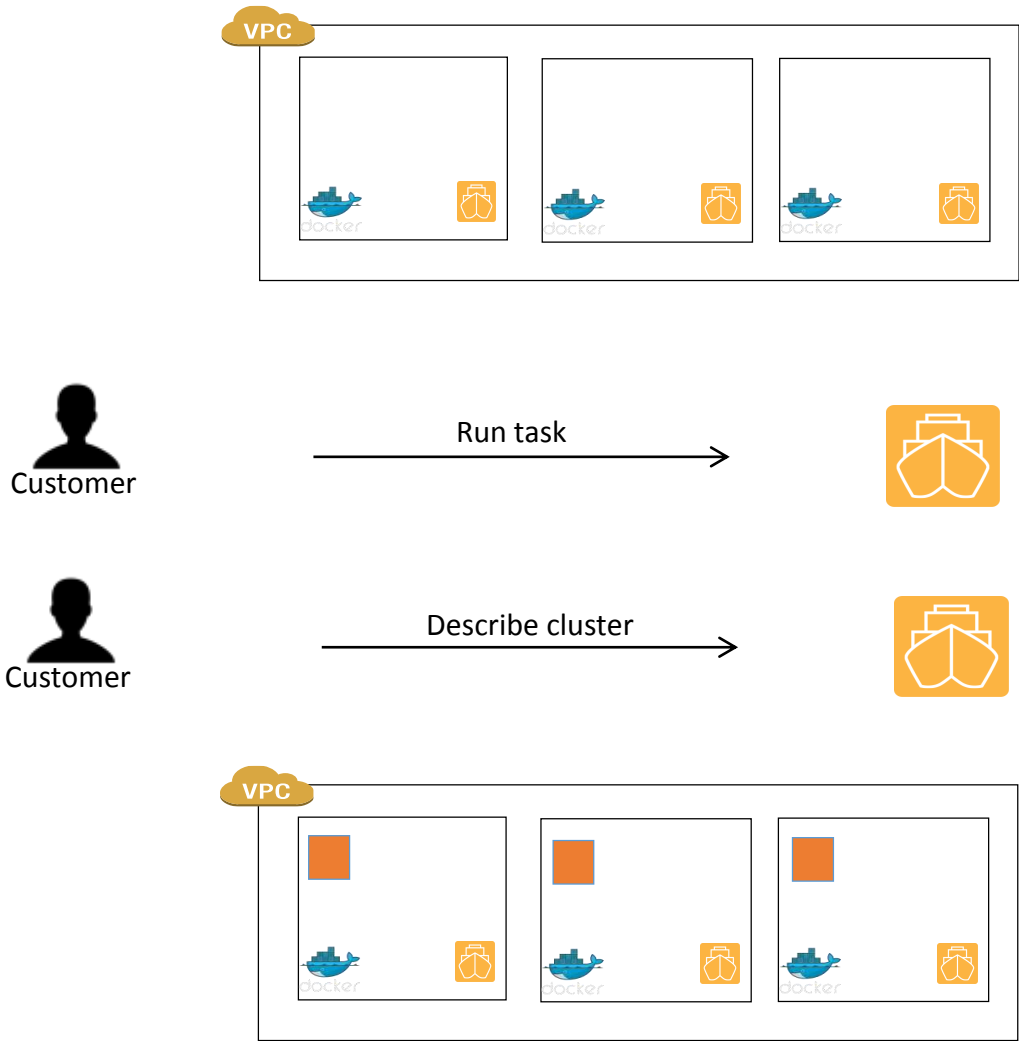
- Containers
 - Names and identifies your image
 - Includes default runtime attributes for your container (Environment Variables, Port Mappings, Container entry point and commands, Resource constraints...)
- Tasks
 - A group of related containers
- Container Instances
 - An instance on which Tasks are scheduled
 - Runs AMI with ECS Agent installed
 - Registers into cluster on launch
- Clusters
 - Provides a pool of resources for your Tasks
 - A grouping of Container Instances
 - Starts empty, dynamically scalable

User Workflow



Preview

User Workflow



Agenda

- Intro to Continuous Integration and Continuous Deployment/Delivery (CI-CD)
- CD Strategies
- CI-CD on AWS
 - Application Management
 - Cloudformation
 - Elastic BeanStalk
 - Opsworks
 - EC2 Container Service (ECS)
 - **Application Lifecycle Management**
 - **Code Commit**
 - Code Pipeline
 - Code Deploy

Announced

ALM | What is CodeCommit?

A secure, highly scalable, managed source control service that hosts private Git repositories.

Eliminates the need to operate your own source control system or worry about scaling its infrastructure.

Basically, managed Git



Announced

ALM | What is CodeCommit?

Fully managed service source control service for hosting private Git repositories

Automatically scales to meet the needs of your project
Stores any type of file (source, images, videos, libraries etc.) with no limit on repository size.

Fully integrated with AWS **CodePipeline** and AWS **CodeDeploy** to streamline development and release processes.

ALM | What is CodeCommit?

Only transfers incremental changes – not the entire application

CodeCommit supports all Git commands and works with your existing Git-based tools (e.g., continuous integration/continuous delivery systems, and graphical clients).

Built-in encryption support

Fully integrated with AWS Identity and Access Management (IAM)

Announced

ALM | Preliminary look at CodeCommit console

AWS

Services

CodeCommit

Edit

N. Virginia

Support

Dashboard

Teams

Settings

aws-sdk-js

Overview

Code

Branches

Commits

Tags

Settings

aws-sdk-js

https://user123@aws/user/repo.arc

The official AWS SDK for JavaScript, available for browsers and mobile devices, or Node.js backends. If you are upgrading from 1.x to 2.0 of the SDK, please see the (file:UPGRADING.md) notes for information on how to migrate existing code to work with the new major version.

Loren authored 22 minutes ago latest commit 9383f02

Branch: Master Actions Add File

aws-sdk-js

Edit

dist-tools	29 days ago	Add AWS.CognitoIdentity and AWS.CognitoSync to default browser build
dist	15 days ago	Tag release v2.0.15
doc-src	10 days ago	Update tracker JS URL
eslint-rules	5 months ago	Use context.getFilename() instead (eslint API change)
features	1 month ago	Add integration tests for AWS.Route53Domains
lib	5 days ago	Use createUnbufferedStream() in createReadStream() impl
scripts	2 months ago	Add support for AWS.CloudSearchDomain
tasks	20 days ago	Fix rake api:<service_name>. Pass correct argument to translator
tests	5 days ago	Add support for AWS.HttpResponse.createUnbufferedStream()
.eslintrc	6 days ago	Fix formatting
.gitignore	3 months ago	Add Istanbul for coverage and improve some test coverage
.npmignore	3 months ago	Add coverage to .npmignore
.travis.yml	3 months ago	Test APIs module off of master branch for now
.yardopts	3 months ago	Add upgrading notes (1.x-2.0) to repository

NewsFeed

Commit 9383f02
Fix some README formatting
Loren authored 22 minutes ago

test-branch
Deleted branch
Mike deleted 2 days ago

Commit b72ca16
Add Coveralls badge
Wade authored 3 days ago

test-branch
Created branch
Clare created 10 days ago

Show More ...



Agenda

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ALM | What is CodePipeline?

A continuous delivery and release automation service that aids smooth deployments.

You can design your development workflow for **checking in** code, **building** the code, **deploying** your application into staging, testing it, and releasing it to production



Similar to Bamboo or Jenkins

ALM | What is CodePipeline?

CodePipeline standardizes and automates the software release process, allowing you to rapidly release new features to users

Provides the capability to set up configurable gates between each stage such as time-based rules or manual approvals

Workflows can be created to run unit and integration tests before deploying to production

ALM | What is CodePipeline?

IMPORTANT:

Able to be used stand-alone as an end-to-end solution, or can be integrated with your existing source control system, test framework or build tools (like Bamboo, Jenkins, etc)

Announced ALM | Preliminary look at the console

AWS Services CodePipeline Edit

CodePipeline Company Web App

Company Web App

View progress, edit, and manage your pipeline.

Stop Pipeline **Edit** Last updated on November 11, 2014 8:15:47 AM UTC

Source Actions

CompanyWebApp/mainline
GitHub Repository
1 day ago

Build In Progress Disable Stage

1 Change

Release build
ANT Build
In Progress
Stop

Beta Failed Disable Stage

Beta-Fleet-1
CodeDeploy Deployment
Succeeded 2 days ago

Beta-Fleet-2
CodeDeploy Deployment
Succeeded 2 days ago

First Flight Tests
Automated Test
Failed 2 days ago
View 2 Errors

- Source
- Build
- Beta
- Waiting to Promote
- Gamma
- US-East-1 OneB
- Manual Approval
- US-East-1 Prod
- US-West-2 OneB
- Prod Regions

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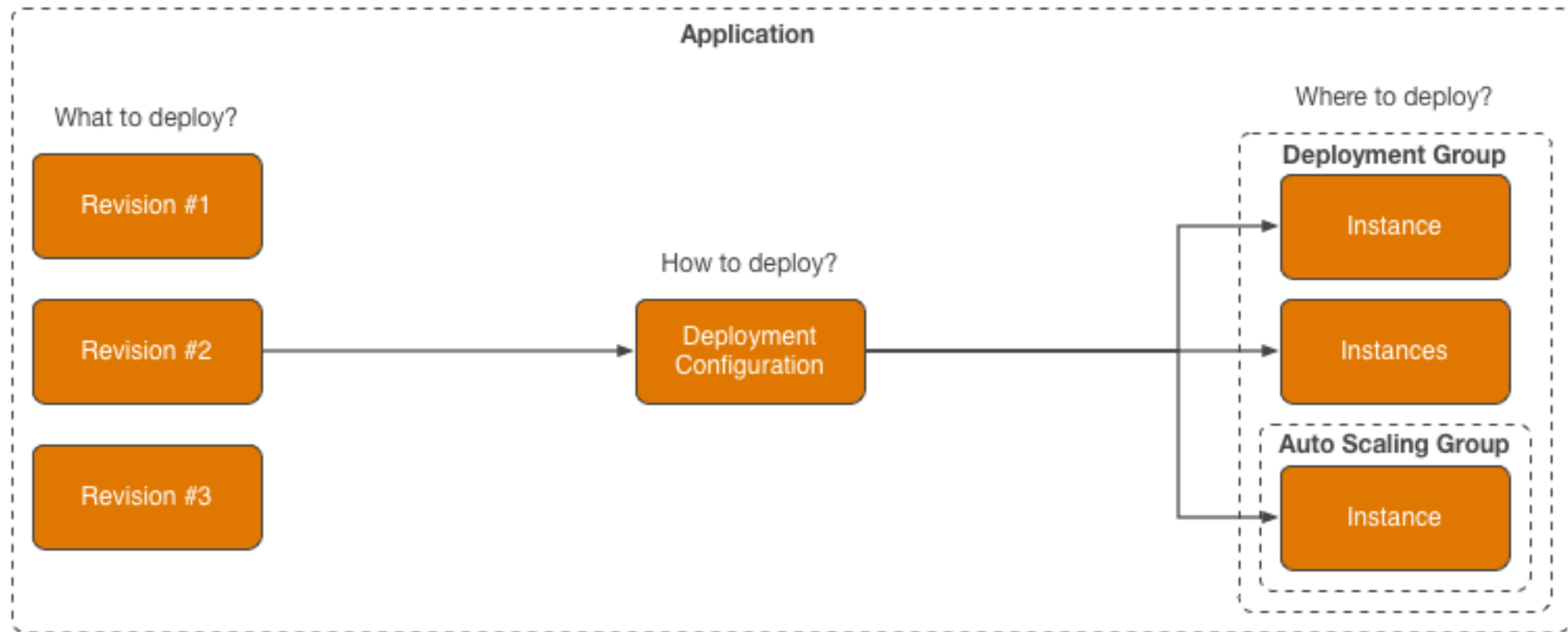
AWS CodeDeploy

Code Deploy

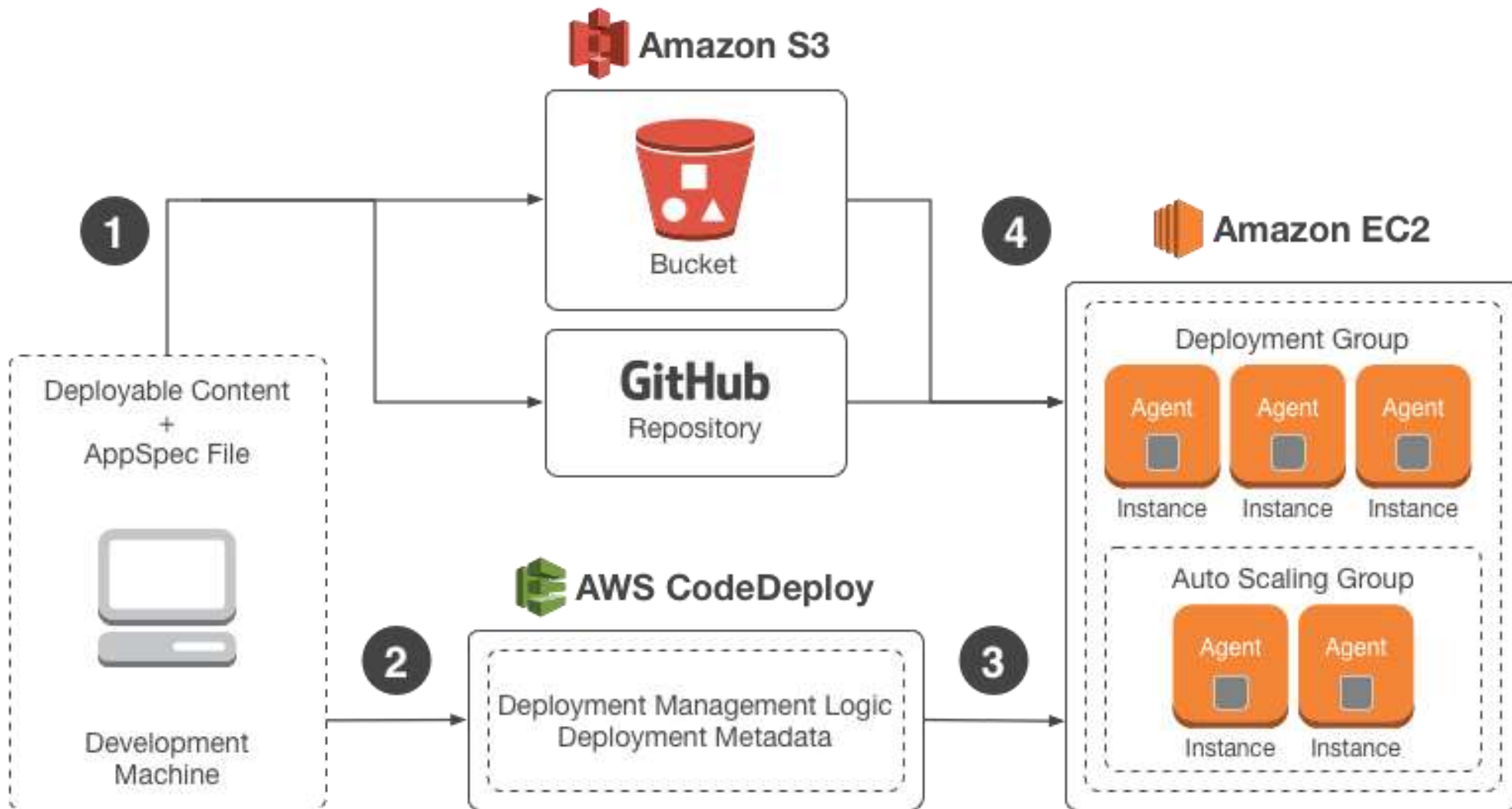


- ❏ Deploys your released code to a "fleet" of EC2 instances
- ❏ Accommodate fleets that range in size from one instance all the way up to tens of thousands of instances
- ❏ Automatically schedules updates across multiple Availability Zones in order to maintain high availability during the deployment
- ❏ Application and Deployment groups described in YAML-formatted files
- ❏ Deployment groups identify EC2 instances by tags & can also reference Auto Scaling Groups
- ❏ Managed via AWS Management Console, CLI or APIs
- ❏ Can be used in conjunction with Chef recipes or Puppet scripts

Code Deploy components



Code Deploy Workflow



Using AWS CodeDeploy

Application Name

Type a name that uniquely identifies the application that you want to deploy. AWS CodeDeploy will group the application revision, deployment group, service role, and deployment configuration under this application name.

Application Name*

***Required** [Cancel](#) [Previous](#) [Next Step](#)

- Begin by defining an Application

Using AWS CodeDeploy

Revision ?

A revision in AWS CodeDeploy is a version of an application that you want to deploy. Our sample application revisions are stored in Amazon S3.

Revision Type	Sample Amazon Linux Application
Revision Location	<code>https://s3.amazonaws.com/aws-codedeploy-us-east-1/samples/latest/SampleApp_Linux.zip</code> <small>The URL of the sample application in Amazon S3.</small>
Revision Description	Sample web page for Amazon Linux. To view the sample web page after deployment, from your web browser go to <code>http://<Public DNS></code> , for example <code>http://ec2-12-345-678-901.compute-1.amazonaws.com</code> .

***Required**CancelPreviousNext Step

- Create a versioned revision for deployment.

In this example the revision is stored in S3 but it could also come from CodeCommit or GitHub

Using AWS CodeDeploy

Service Role

Select an existing service role that allows AWS CodeDeploy to work with other dependent AWS services on your behalf during a deployment. If you're not sure if you already have a service role with the correct permissions, in the Service Role drop-down list select Create A New Service Role, and we will create one for you.

Service Role*

Use an existing service role ▼

Role Name*

CodeDeploySampleStack-9eatwh-Co ▼

*Required

Cancel

Previous

Next Step

- Define the IAM role to be used when interacting with other AWS services such as EC2 or Auto Scaling

Using AWS CodeDeploy

Deployment Configuration ?

Choose from a list of default deployment configurations, or create a custom configuration.

☒ Default Deployment Configurations

☐ Create Custom Deployment Configuration

One at a Time

The deployment will:
Deploy to one instance at a time. Succeed if all instances succeed. Fail after the very first failure. Allow the deployment to succeed for some instances, even if the overall deployment fails.

Example:
If you deploy your application to 3 instances, this configuration will deploy to one instance at a time.
✔ Succeeds if all 3 instances succeed.
⚠ Fails after any instance fails.

Select

Half at a Time

The deployment will:
Deploy to up to half of the instances at a time, with fractions rounded down. Succeed if at least half of the instances succeed, otherwise it will fail. The deployment may succeed for some instances, even if the overall deployment fails.

Example:
If you deploy your application to 3 instances, this configuration will deploy to one instance at a time.
✔ Succeeds if 2 or more instances succeed.
⚠ Fails if 2 or more instances fail.

Select

All at Once

The deployment will:
Deploy to all instances at once. Succeed if at least one instance succeeds. Fail after all instances fail.

Example:
If you deploy your application to 3 instances, this configuration will deploy to all 3 instances at once.
✔ Succeeds if any instance succeeds.
⚠ Fails if all instances fail.

Select

*Required

Cancel Previous **Next Step**

- Create a new Deployment Configuration or select from one of the defaults.

Using AWS CodeDeploy

Review

Review the details of your deployment. To make any changes, click **Edit**, **Previous**, or one of the steps in the navigation pane. When you're ready to deploy with these details, click **Deploy Now**.

You are about to create the following deployment

Application [Edit](#)
You will create the application **DemoApplication**.

Revision [Edit](#)
You will deploy the following revision of the application **DemoApplication**.
Revision: https://s3.amazonaws.com/aws-codedeploy-us-east-1/samples/latest/sampleApp_Linux.zip

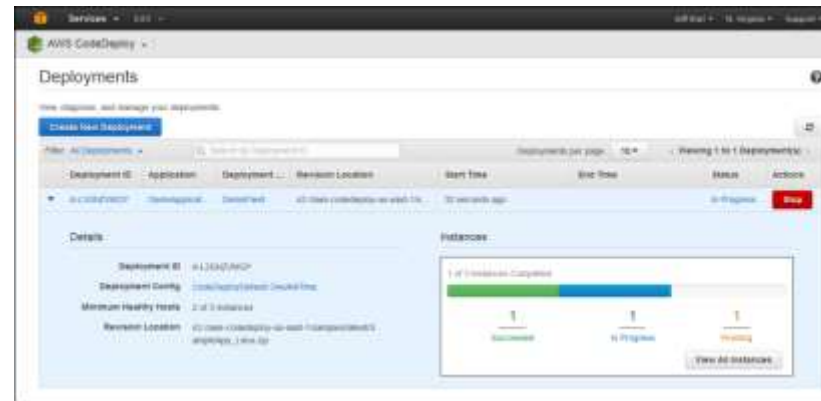
Deployment Group [Edit](#)
DemoApplication will be deployed to your instances using the deployment group **DemoFleet**.

Service Role [Edit](#)
DemoFleet will use the **CodeDeploySampleStack-Session-CodeDeployTrustRole-1H85QHQ63ME** IAM service role to access the instances.

Deployment Configuration [Edit](#)
You will deploy **DemoApplication** to your instances using the following deployment configuration:
Deployment Configuration: **CodeDeployDefault-AmazonLinux2**

Required [Cancel](#) [Previous](#) [Deploy Now](#)

- Review your settings and deploy.



- Deployment progress will be displayed in the AWS Management Console.

