An introduction to AWS CloudFormation

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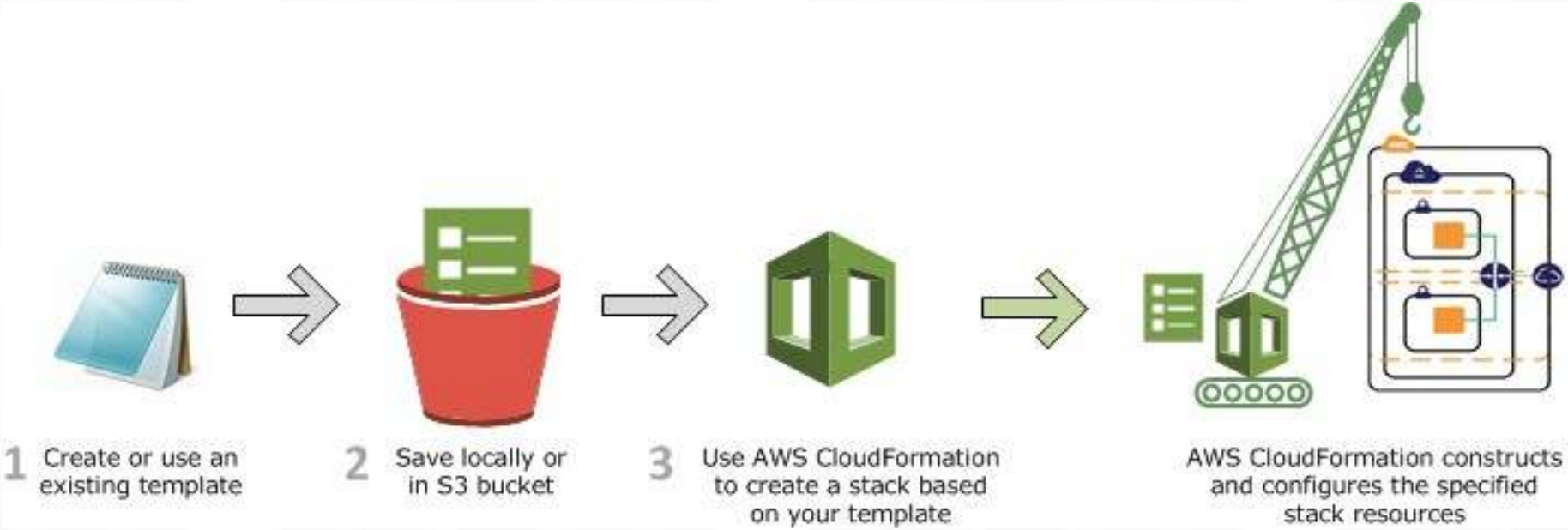
AWS CloudFormation

- Fundamental service in AWS used for automating deployment and configuration of resources

- CloudFormation Template 
  - JSON-formatted document which describes a configuration to be deployed in an AWS account
  - When deployed, refers to a “stack” of resources
  - Not a “script”, a *document*

AWS CloudFormation



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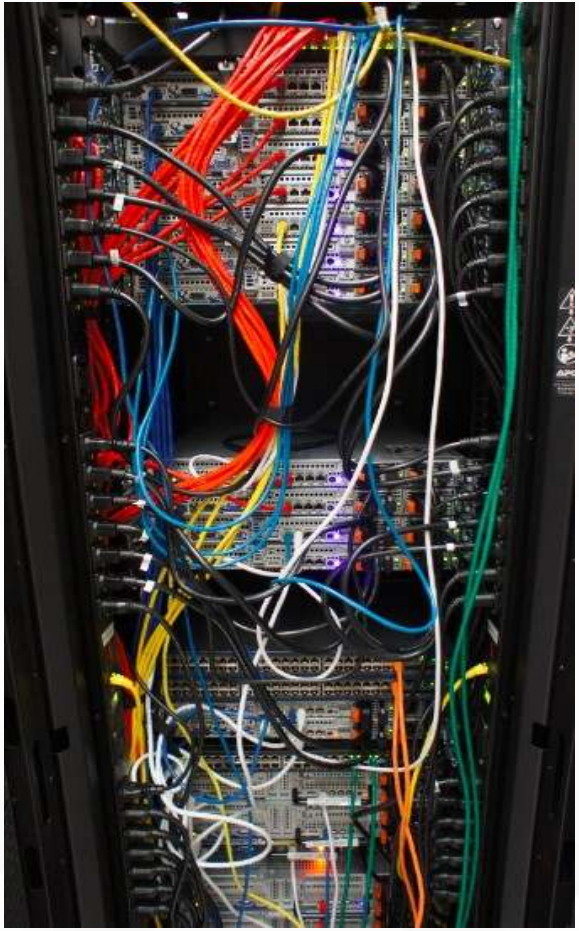

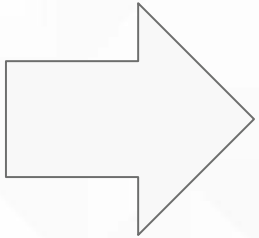

```
"Conditions" : {
  "HaveNoOtherRoles"  : { "Fn::Equals" : [{"Ref" : "OtherRoles"}, ""]},
  "HaveEbs"           : { "Fn::Not" : [{ "Fn::Equals" : [{"Ref" : "EbsVolumeSize"}, "0"]}] },
  "HaveEbsSnapshotId" : { "Fn::Not" : [{ "Fn::Equals" : [{"Ref" : "EbsSnapshotId"}, ""]}] },
  "HaveAdditionalTagKey": { "Fn::Not" : [{ "Fn::Equals" : [{"Ref" : "AdditionalTagKey"}, ""]}] },
  "HaveAdditionalTagValue": { "Fn::Not" : [{ "Fn::Equals" : [{"Ref" : "AdditionalTagValue"}, ""]}] },
  "HaveSSL": { "Fn::Not" : [{ "Fn::Equals" : [{"Ref" : "SSLPort"}, "0"]}] },
  "IsHTTP" : { "Fn::Equals" : [{"Ref" : "ElbProtocol"}, "HTTP"]},
  "HaveSpotPrice" : { "Fn::Not" : [{ "Fn::Equals" : [{"Ref" : "SpotPrice"}, ""]}]}
},
"Resources": {
  "AutoScalingGroup": {
    "Type": "AWS::AutoScaling::AutoScalingGroup",
    "UpdatePolicy" : {
      "AutoScalingRollingUpdate" : {
      "MaxBatchSize" : "1",
      "MinInstancesInService" : "0",
      "PauseTime" : "PT15M",
      "WaitOnResourceSignals": "true"
      }
    },
    "Properties": {
      "LaunchConfigurationName": { "Ref": "LaunchConfig" },
      "LoadBalancerNames": [ { "Ref": "ElasticLoadBalancer" } ],
      "MinSize": { "Ref": "MinPoolSize" },
      "MaxSize": { "Ref": "MaxPoolSize" },
      "AvailabilityZones": { "Fn::FindInMap": ["AZConfig", "AvailabilityZones", "all"] },
      "VPCZoneIdentifier": { "Ref": "EC2SubnetsIds" },
      "Tags" : [
        { "Fn::If": [
            "HaveAdditionalTagKey",
            {
              "Key" : { "Ref": "AdditionalTagKey" },
              "Value": {
                "Fn::If": [
                  "HaveAdditionalTagValue",
                  {"Ref": "AdditionalTagValue"},
                  ""
                ]
              },
              "PropagateAtLaunch": "true"
            },
            {"Ref" : "AWS::NoValue"}
          ]
        },
        { "Key" : "Name", "Value" : { "Fn::Join" : [ ".", [ { "Ref" : "ServiceName"}, {"Ref" : "EnvironmentName"
        { "Key" : "cost", "Value" : { "Ref" : "Cost" }, "PropagateAtLaunch": "true" },
        { "Key" : "environment", "Value": { "Ref" : "EnvironmentName"}, "PropagateAtLaunch": "true" }
      ]
    }
  }
```

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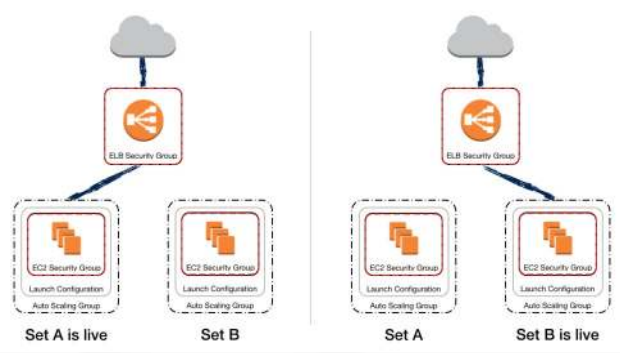
Infrastructure as code

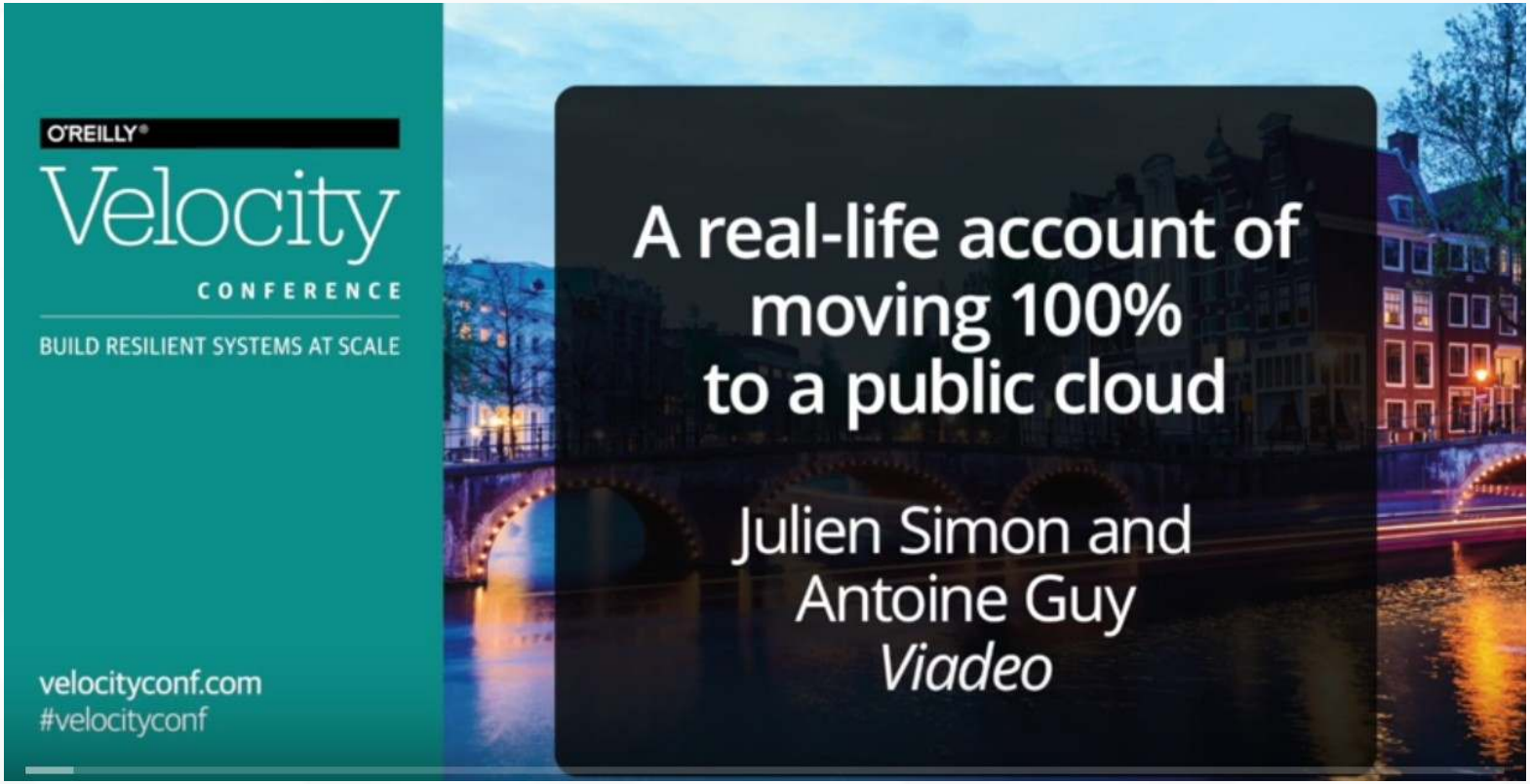
- Versioned, auditable blueprints (developers can contribute)
- Quick to deploy, repeatable, tested infrastructure
- Enables CI/CD for infrastructure (just like everything else)
- Deploy many times, anywhere

Typical use cases for AWS CloudFormation

- Used internally by many AWS products (Elastic Beanstalk, ECS)
- Replicating environments
  - Dev, staging, pre-production, production
  - Same architecture, different sizing → template + parameters
- Deploying in a different region
- Green / blue deployments
- Disaster Recovery



Case study: Viadeo



https://www.youtube.com/watch?v=JJm4V5fd0Z8

CloudFormation Template Structure

```
{
  "AWSTemplateFormatVersion" : "version date",

  "Description" : "JSON string",

  "Metadata" : {
    template metadata
  },

  "Parameters" : {
    set of parameters
  },

  "Mappings" : {
    set of mappings
  },

  "Conditions" : {
    set of conditions
  },

  "Resources" : {
    set of resources
  },

  "Outputs" : {
    set of outputs
  }
}
```

Resources

Describe detailed configuration of a resource in AWS

Include, but not limited to:

- IAM Policies, Users, Groups, Roles
- VPCs, Subnets, NACLs, Security Groups
- EC2 instances, AutoScaling Groups
- RDS Databases, S3 Buckets
- Elastic Load Balancers
- CloudWatch Alarms
- Lambda Functions
- Logging (CloudTrail, CW Logs)

```
"sysadminPolicy" : {
 "Type" : "AWS::IAM::ManagedPolicy",
 "Properties" : {
  "PolicyDocument" :
        {
                    "Version": "2012-10-17",
                    "Statement": [
                       {
                          "Effect": "Allow",
                          "NotAction": "iam:*",
                          "Resource": "*"
                       },
                        {
                              "Effect": "Deny",
                              "Action": "aws-portal:*Billing",
                              "Resource": "*"
                       },
                       {
                              "Effect" : "Deny",
                              "Action" : [ "cloudtrail:DeleteTrail",
                                           "cloudtrail:StopLogging",
                                           "cloudtrail:UpdateTrail" ],
                              "Resource" : "*"
                       }
                    ]
                },
                "Roles" : [
                { "Ref" : "sysadminRole" }
               ],
     "Groups" : [
      { "Ref" : "sysadminGroup" }
    ]
          }
 },
```

Nested Templates

- CloudFormation stacks themselves can be resources

```
"AWS::CloudFormation::Stack"
```

- Useful for making reusable templates, segmenting resources, and avoiding template size limitations
- Launching a template with nested stacks will launch multiple sub-stacks
- Deleting the launching stack will, by default, delete all substacks

Logical ID	Physical ID	Type	Status
stack1	arn:aws:cloudformation:us-east-1:979676883363:stack/GoldBase1-stack1-1IQK6Q0K6AZD5/8cc9fb90-78d6-11e5-ab62-5001ba48c2d2	AWS::CloudFormation::Stack	CREATE_COMPLETE
stack2	arn:aws:cloudformation:us-east-1:979676883363:stack/GoldBase1-stack2-32N9A77OO46U/8d192d00-78d6-11e5-a764-50e2416294a8	AWS::CloudFormation::Stack	CREATE_COMPLETE
stack3	arn:aws:cloudformation:us-east-1:979676883363:stack/GoldBase1-stack3-10QEXK61Z61LP/f46c9780-78d6-11e5-86e1-50e24162947c	AWS::CloudFormation::Stack	CREATE_COMPLETE
stack4	arn:aws:cloudformation:us-east-1:979676883363:stack/GoldBase1-stack4-1CIRM21C3IQ5G/2570cf40-78d7-11e5-abcb-507bb903ae0a	AWS::CloudFormation::Stack	CREATE_COMPLETE

Parameters

- Used to pass in variables when launching a stack

```
"Parameters" : {
  "InstanceTypeParameter" : {
    "Type" : "String",
    "Default" : "t1.micro",
    "AllowedValues" : ["t1.micro", "m1.small", "m1.large"],
    "Description" : "Enter t1.micro, m1.small, or m1.large. Default is t1.micro."
  }
}
```

- Use the “Ref” function to reference these variables in the Resources section of the template

```
"Ec2Instance" : {
  "Type" : "AWS::EC2::Instance",
  "Properties" : {
    "InstanceType" : { "Ref" : "InstanceTypeParameter" },
    "ImageId" : "ami-2f726546"
  }
}
```

Mappings

- Provides a set of custom named-value pairs
- Use for setting values based on different possible conditions (most notably, regions)
- Commonly used for mapping different AMI IDs to make template reusable across multiple AWS regions
- Use the FindInMap function when referencing in resources

```
"Mappings" : {
  "RegionMap" : {
    "us-east-1" : {
        "AMI" : "ami-76f0061f"
    },
    "us-west-1" : {
        "AMI" : "ami-655a0a20"
    },
    "eu-west-1" : {
        "AMI" : "ami-7fd4e10b"
    },
    "ap-southeast-1" : {
        "AMI" : "ami-72621c20"
    },
    "ap-northeast-1" : {
        "AMI" : "ami-8e08a38f"
    }
  }
},
```

```
"ImageId" : { "Fn::FindInMap" : [ "RegionMap", { "Ref" : "AWS::Region" }, "AMI" ]}
```

Conditions

- Allow you to determine if a resource gets created or a property is defined
- The “Condition” attribute applied to any resource to specify a condition defined in the “Conditions” section of the template
- Condition must evaluate to true, otherwise the resource will not get created

```
"Parameters" : {
  "EnvType" : {
    "Description" : "Environment type.",
    "Default" : "test",
    "Type" : "String",
    "AllowedValues" : ["prod", "test"],
    "ConstraintDescription" : "must specify prod or test."
  }
},

"Conditions" : {
  "CreateProdResources" : {"Fn::Equals" : [{"Ref" : "EnvType"}, "prod"]}
},
```

```
"MountPoint" :
 {
      "Type" : "AWS::EC2::VolumeAttachment",
      "Condition" : "CreateProdResources",
      "Properties" : {
              "InstanceId" : { "Ref" : "EC2Instance" },
              "VolumeId" : { "Ref" : "NewVolume" },
              "Device" : "/dev/sdh"
        }
 }
```

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AWS CloudFormation best practices

- Don’t start from scratch
- Read sample templates
- Use CloudFormer as a starting point (more info on the next slide)
- Reuse as much as possible
- Don’t go crazy on nested stacks… 1 level should be enough
- Use parameters: environment, region, instance names, instance sizes, etc..
- Tag everything with the stack name and version number

CloudFormer

 CloudFormer template creation tool

https://aws.amazon.com/developertools/6460180344805680

A new EC2 instance running CloudFormer will be started.

Connect to it, let it describe all your resources

Select the ones that you want to see listed in the template

Let’s summon the clouds!

Create a CodeCommit repository to version our stacks

Create, update, delete a basic stack

Create a VPC with 4 subnets. Add a public instance.

Create A LAMP stack

Using CloudFormer

Demo gods, I’m your humble servant, please be good to me

Create a Git repository with AWS CodeCommit

```
$ aws codecommit create-repository
--repository-name cfdemo --region us-east-1
--repository-description ”CloudFormation
demo"

$ git clone ssh://git-codecommit.us-
east-1.amazonaws.com/v1/repos/cfdemo
```

Managing AWS CloudFormation with the CLI

```
$ aws cloudformation validate-template --template-body
file://template.json

$ aws cloudformation create-stack --template-body
file://template.json --stack-name MyTemplate --region eu-
west-1

$ aws cloudformation get-template --stack-name MyTemplate

$ aws cloudformation update-stack --stack-name MyTemplate
--template-body file://template.json

$ aws cloudformation delete-stack --stack-name MyTemplate
```

AWS CloudFormation resources

Documentation

https://aws.amazon.com/fr/documentation/cloudformation/

https://docs.aws.amazon.com/fr_fr/AWSCloudFormation/latest/UserGuide/cfn-sample-templates.html

Blogs

https://aws.amazon.com/fr/blogs/aws/category/aws-cloud-formation/

https://blogs.aws.amazon.com/application-management/blog/tag/CloudFormation

Sessions @ AWS re:Invent 2015

ARC307 - Infrastructure as Code: slides and video

ARC401 - Cloud First: New Architecture for New Infrastructure: slides and video

DVO303 - Scaling Infrastructure Operations with AWS: slides and video

DVO304 - AWS CloudFormation Best Practices: slides and video

DVO310 - Benefit from DevOps When Moving to AWS for Windows: slides and video

DVO401 - Deep Dive into Blue/Green Deployments on AWS: slides and video

SEC312 - Reliable Design and Deployment of Security and Compliance: slides and video

Thank You

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