Deep Dive: Infrastructure as Code

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You are on-board …

Business	needs to experiment, innovate, reduce risk
Continuous Delivery	of services and applications
DevOps	culture, automation, measurement, sharing
Cloud	infrastructure-as-code

AWS CloudFormation

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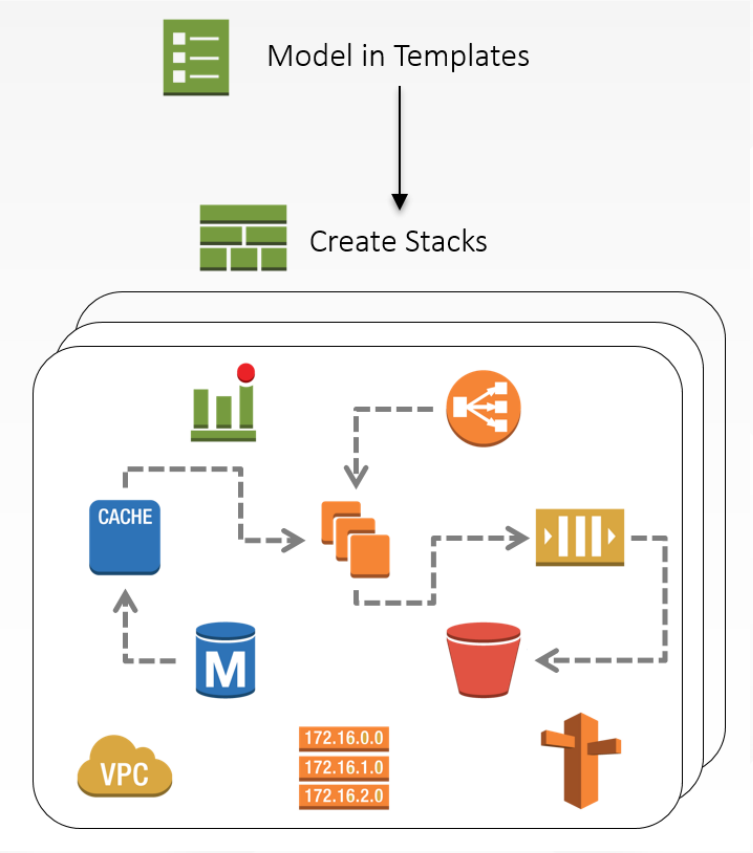
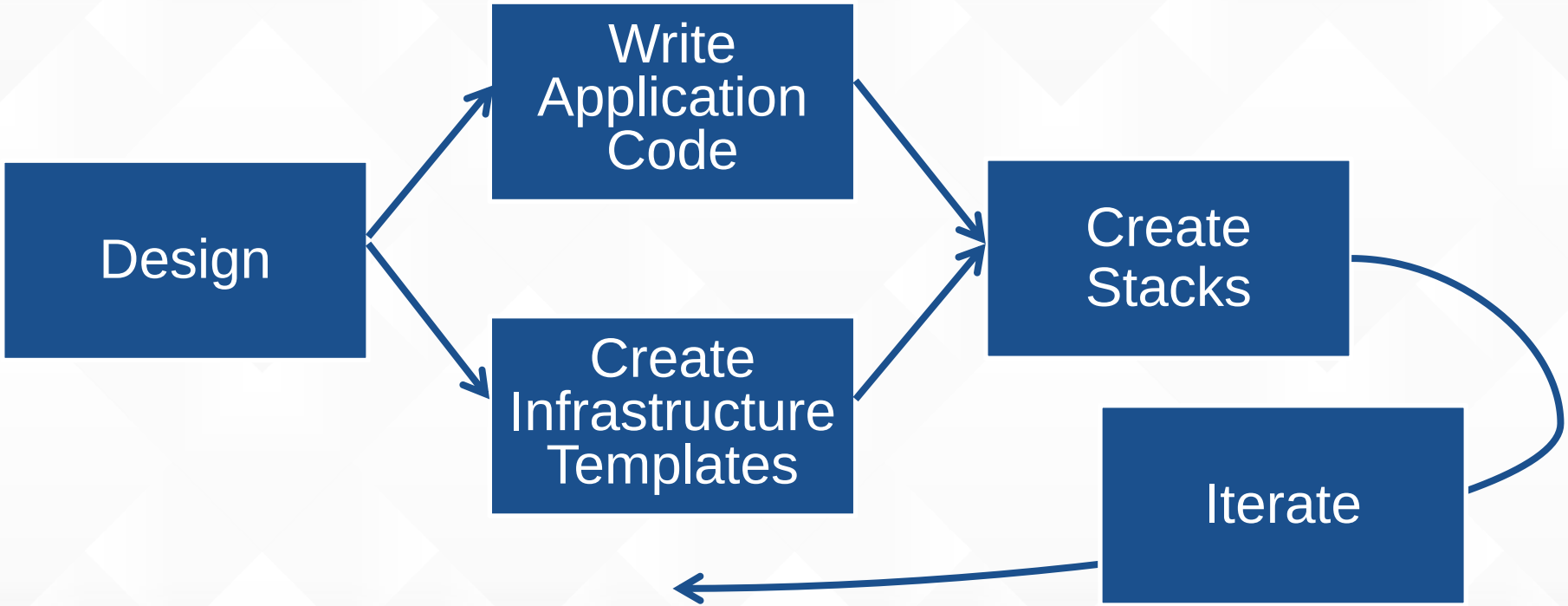
AWS CloudFormation

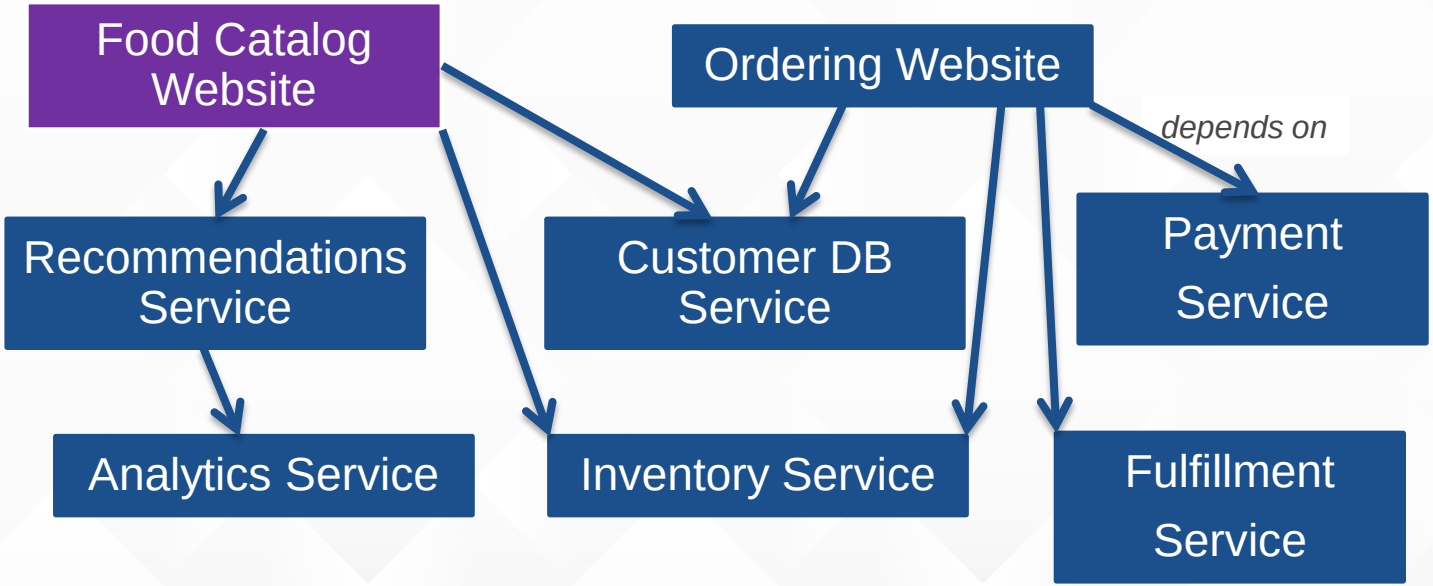
- Create templates of the infrastructure and applications you want to run on AWS
- Have the CloudFormation service automatically provision the required AWS resources and their relationships from the templates
- Easily version control, replicate or update the infrastructure and applications using the templates
- Integrates with other development, CI/CD, and management tools.



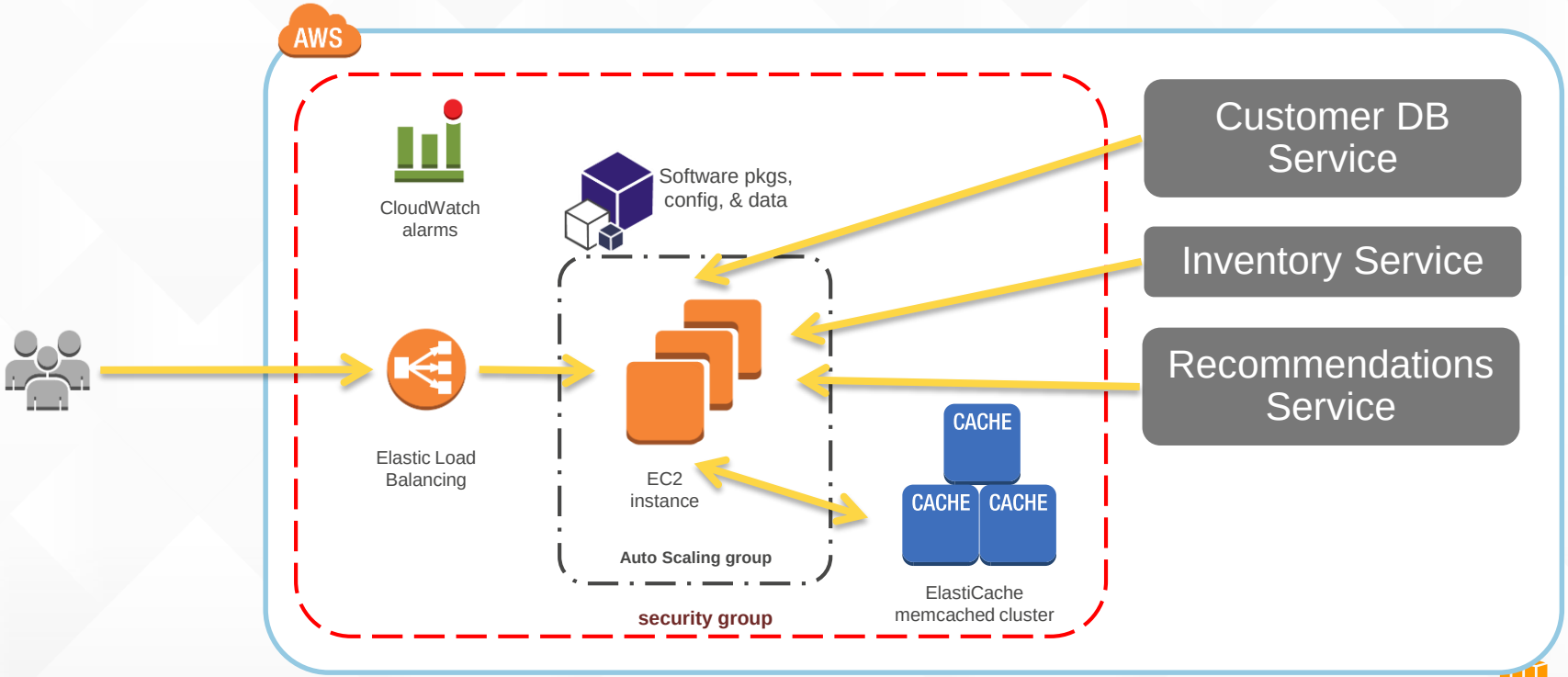
Basic workflow



Design -
Imagine building a food ordering service



Create template –
For example, for the food catalog website



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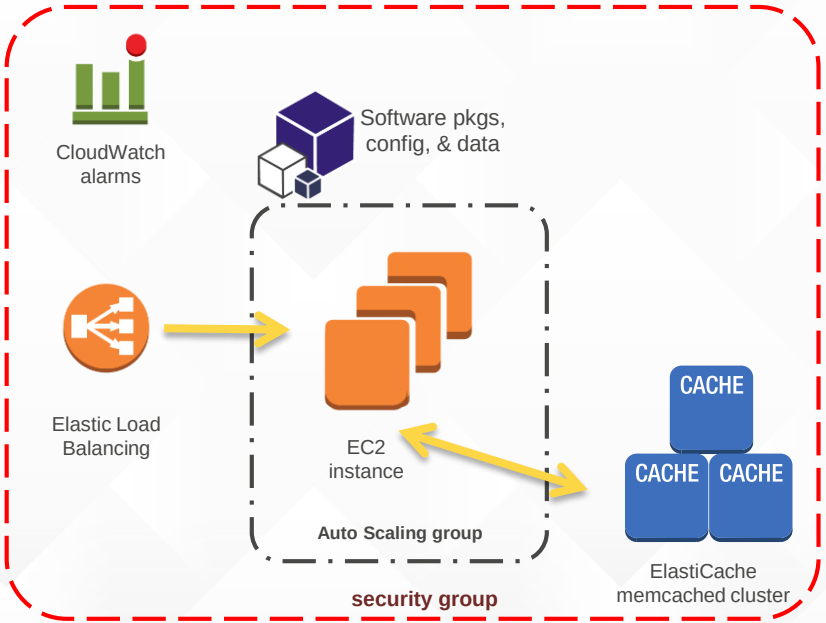
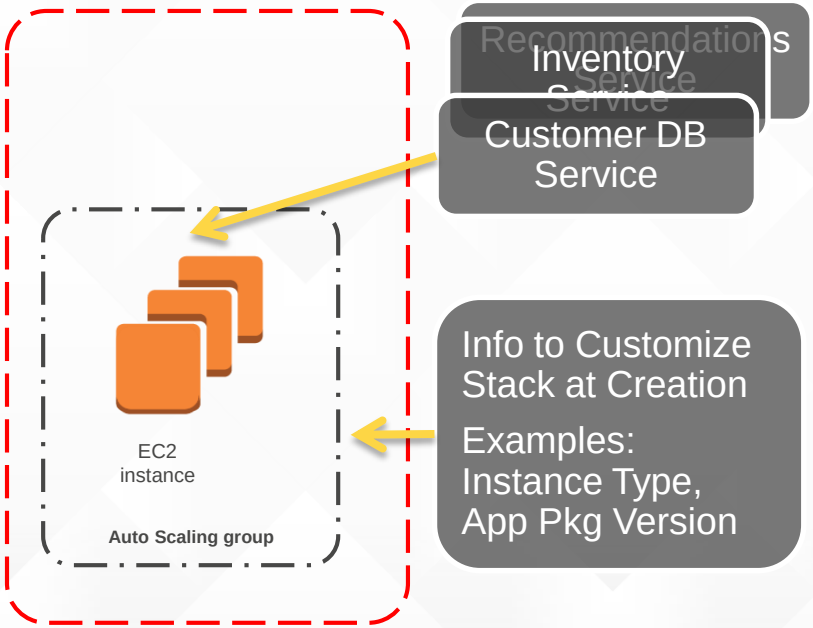
Create template – Resources



CloudFormation Template

```
"Resources" : {
    "SecurityGroup" : {},
    "WebServerGroup" : {
        "Type" : "AWS::AutoScaling::AutoScalingGroup",
        "Properties" : {
            "MinSize" : "1",
            "MaxSize" : "3",
            "LoadBalancerNames" : [ { "Ref" :
"LoadBalancer" } ],
            ...
        }
    },
    "LoadBalancer" : {},
    "CacheCluster" : {},
    "Alarm" : {}
},
```

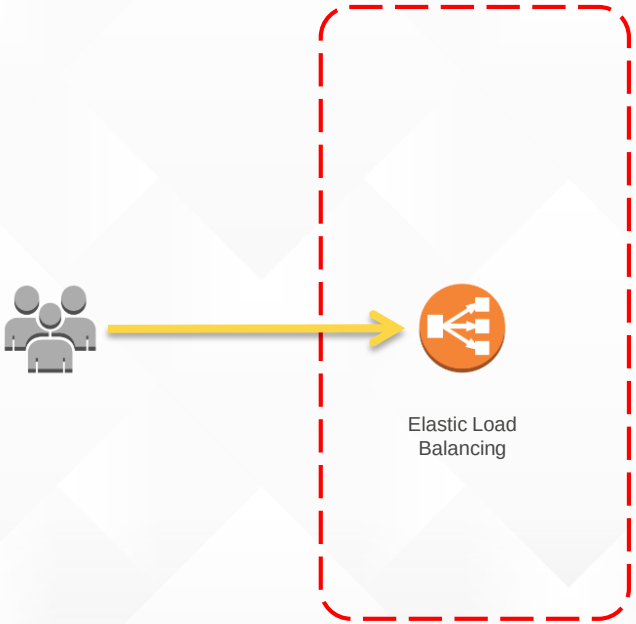
Create template – Parameters



CloudFormation Template

```
"Parameters" : {
    "CustomerDBServiceEndPoint" : {
        "Description" : "URL of the Customer DB Service",
        "Type" : "String"
    },
    "CustomerDBServiceKey" : {
        "Description" : "API key for the Customer DB
Service",
        "Type" : "String",
        "NoEcho" : "true"
    },
    "InstanceType" : {
        "Description" : "WebServer EC2 instance type",
        "Type" : "String",
        "Default" : "m3.medium",
        "AllowedValues" :
["m3.medium","m3.large","m3.xlarge"],
        "ConstraintDescription" : "Must be a valid
instance type"
```

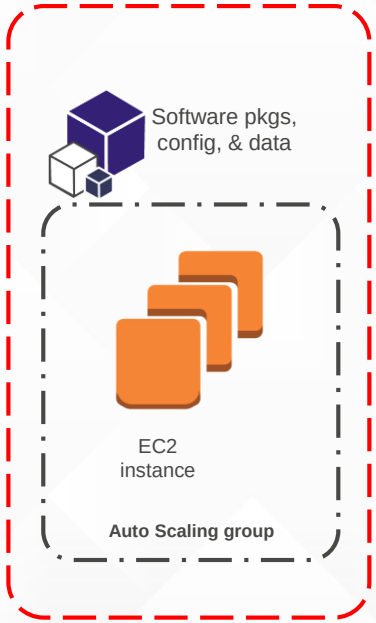
Create template – Outputs



CloudFormation Template

```
"Resources" : {
    "LoadBalancer" : {},
    ...
},
"Outputs" : {
    "WebsiteDNSName" : {
        "Description" : "The DNS name of the website",
        "Value" :  {
            "Fn::GetAtt" : [ "LoadBalancer", "DNSName" ]
        }
    }
}
```

Create template – Deploy and configure software



CloudFormation Template

```
"AWS::CloudFormation::Init": {
    "webapp-config": {
        "packages" : {}, "sources" : {}, "files" : {},
        "groups" : {}, "users" : {},
        "commands" : {}, "services" : {}
      },

    "chef-config" : {}
}
```

- ✓ Declarative
- ✓ Debug-able
- ✓ Updatable
- ✓ Highly Secure
- ✓ BIOT™ Bring In Other Tools

Create template – Language features

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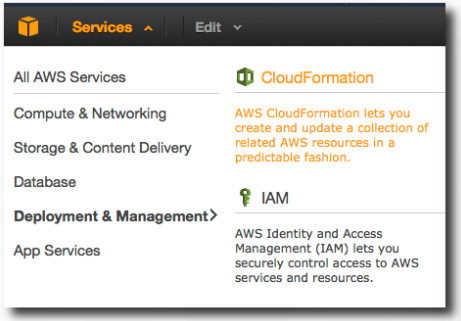
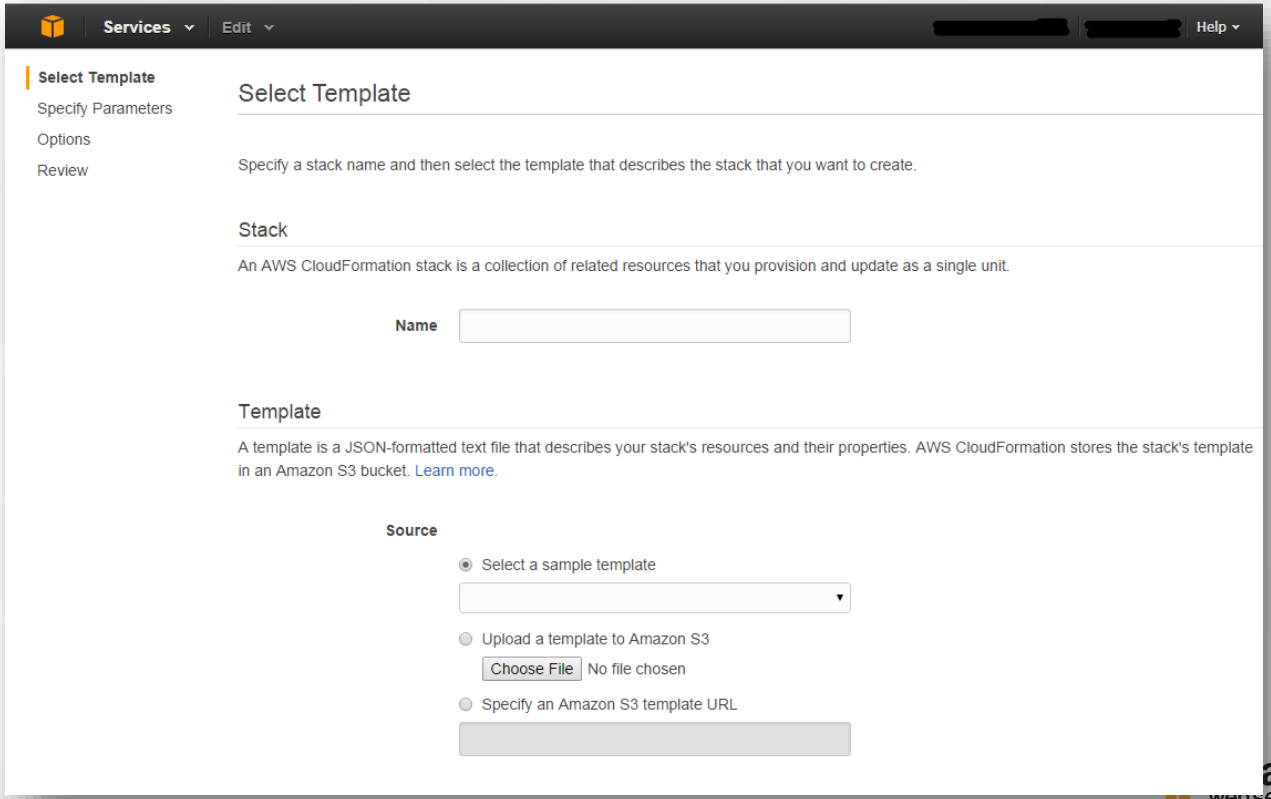
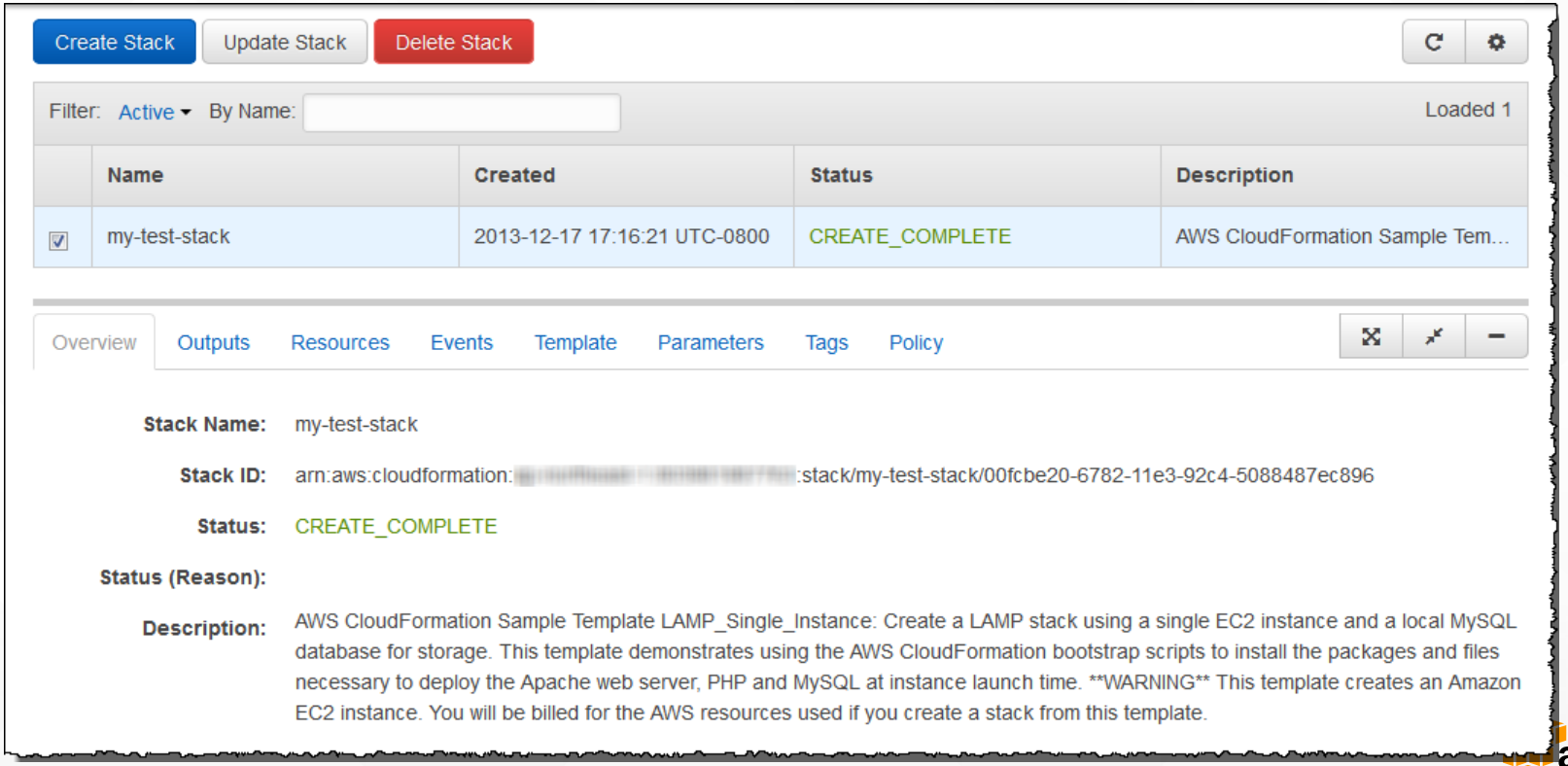
Create stack





Operate stack



Use a wide range of AWS services

- ✓ Auto Scaling
- ✓ Amazon CloudFront
- ✓ AWS CloudTrail
- ✓ Amazon CloudWatch
- ✓ Amazon DynamoDB
- ✓ Amazon EC2
- ✓ AWS Elastic Beanstalk
- ✓ Amazon ElastiCache
- ✓ Elastic Load Balancing
- ✓ Amazon Kinesis
- ✓ IAM
- ✓ AWS OpsWorks
- ✓ Amazon RDS
- ✓ Amazon Redshift
- ✓ Amazon Route 53
- ✓ Amazon S3
- ✓ Amazon SimpleDB
- ✓ Amazon SNS
- ✓ Amazon SQS
- ✓ Amazon VPC

and more …

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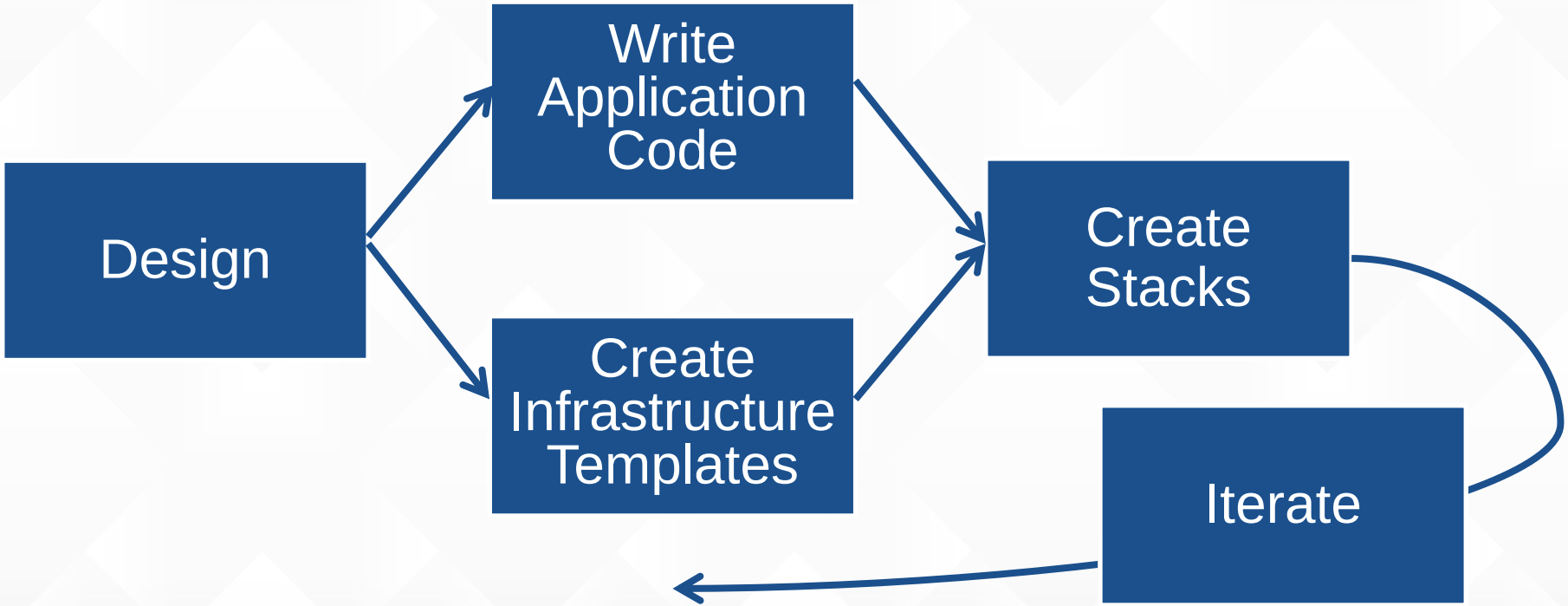
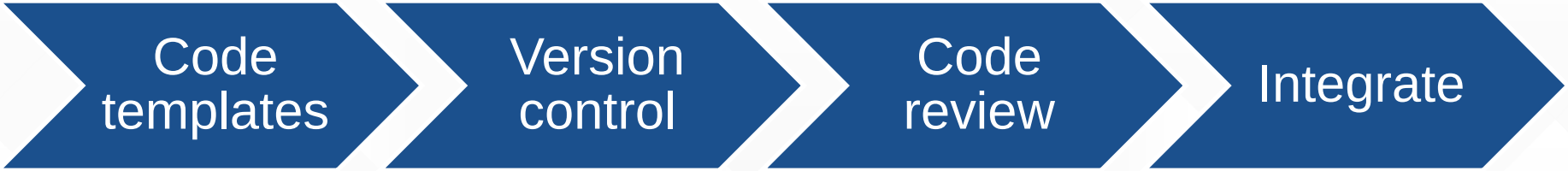
Basic workflow

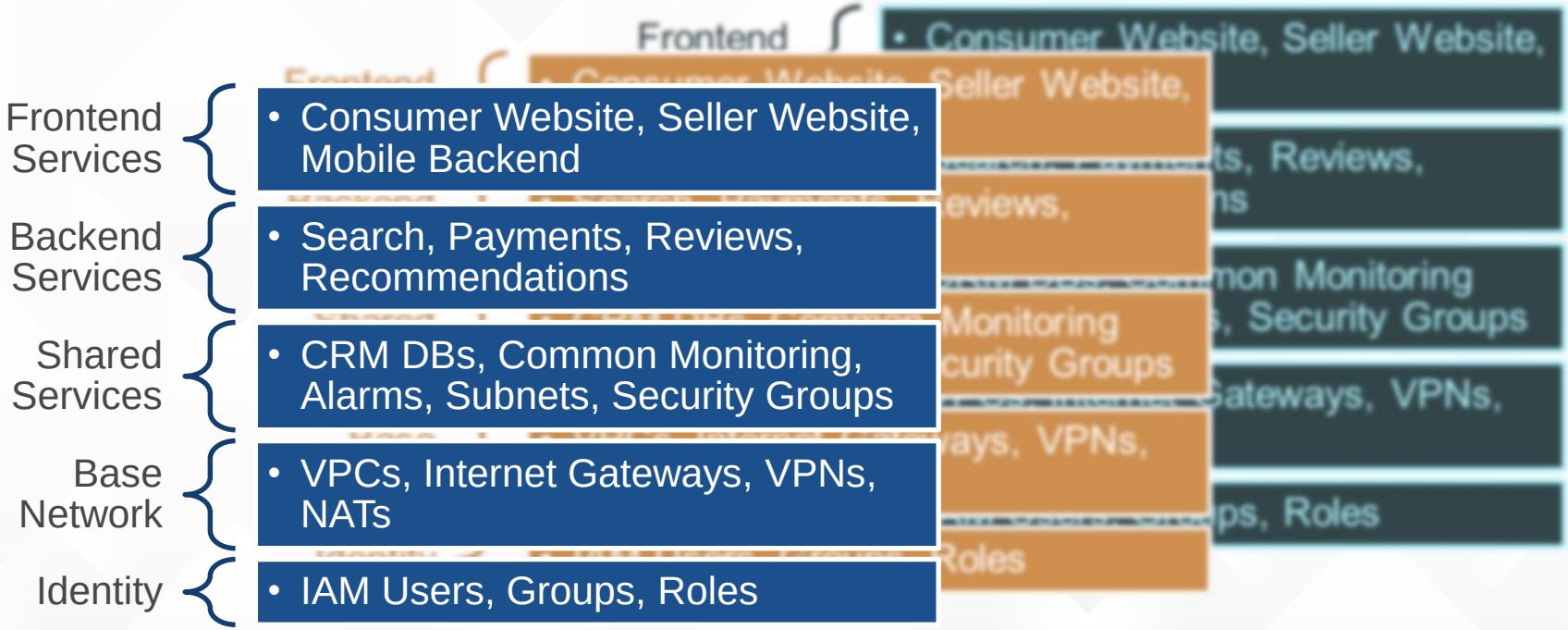


Infrastructure-as-code workflow

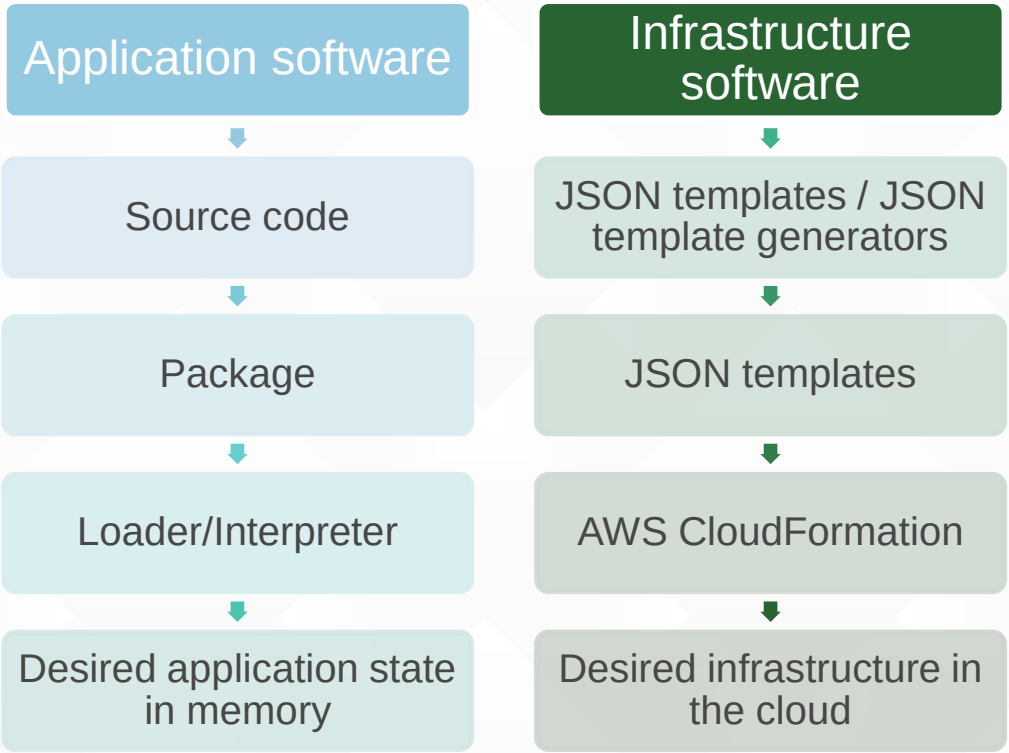


“It’s all software”

“It’s all software” – organize like it’s software



“It’s all software” – build and operate like it’s software



Iterate on infrastructure

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Update stack

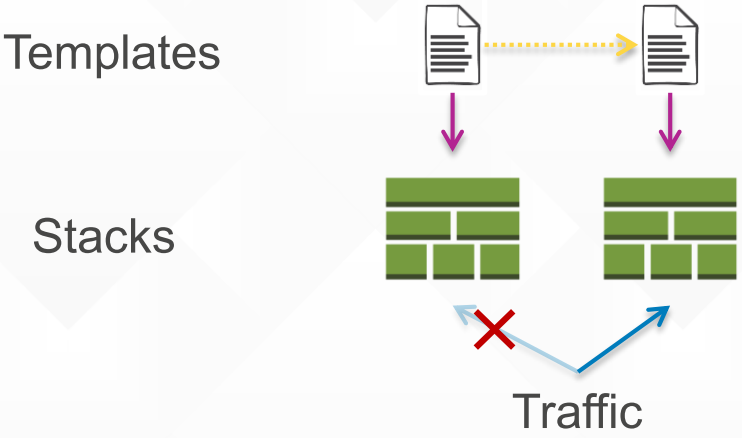
In-place

Faster

Cost-efficient

Simpler state and data migration

Blue-Green



Working stack not touched

Extending AWS CloudFormation

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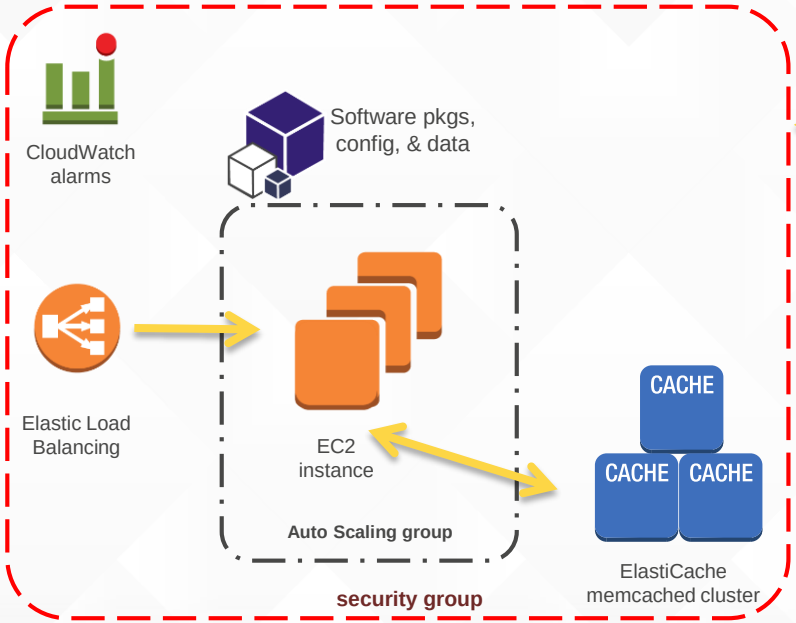
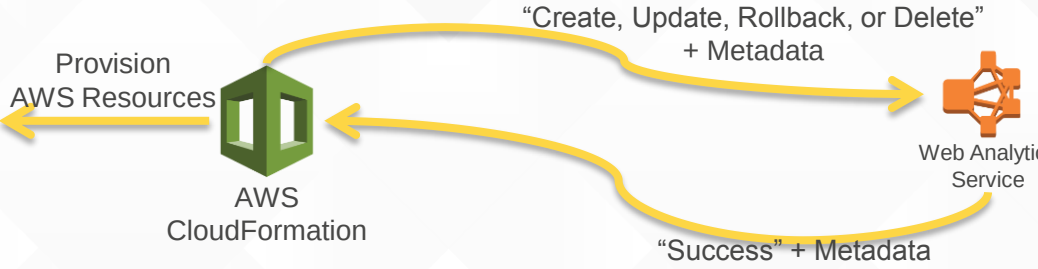
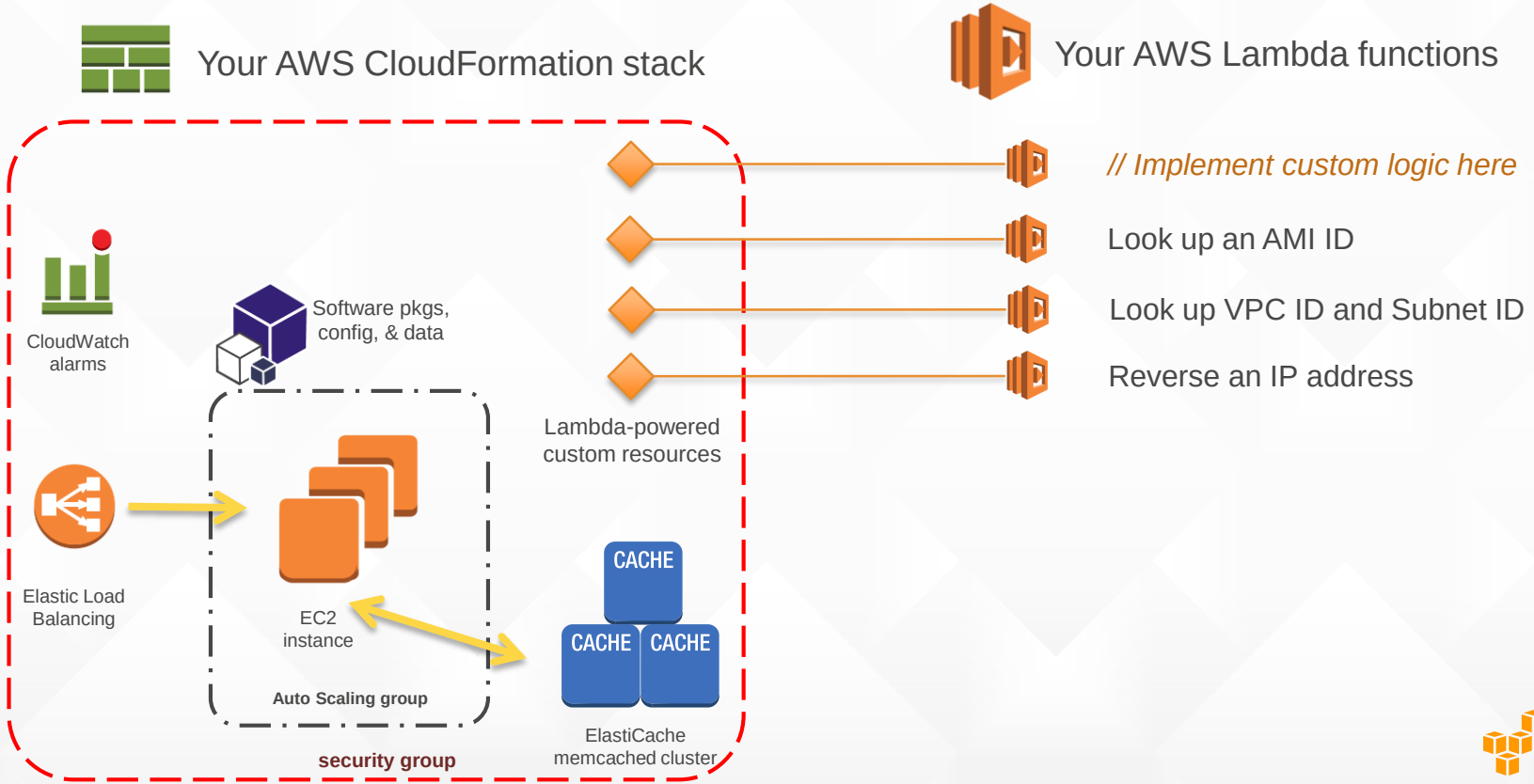
Extend with Custom Resources






```
"Resources" : {
    "WebAnalyticsTrackingID" : {
        "Type" : "Custom::WebAnalyticsService::TrackingID",
        "Properties" : {
            "ServiceToken" : "arn:aws:sns:...",
            "Target" : {"Fn::GetAtt" : ["LoadBalancer", "DNSName"]},
            "Plan" : "Gold"
        }
    },
...
```

Lambda-backed custom resources



Application-deployment-as-code

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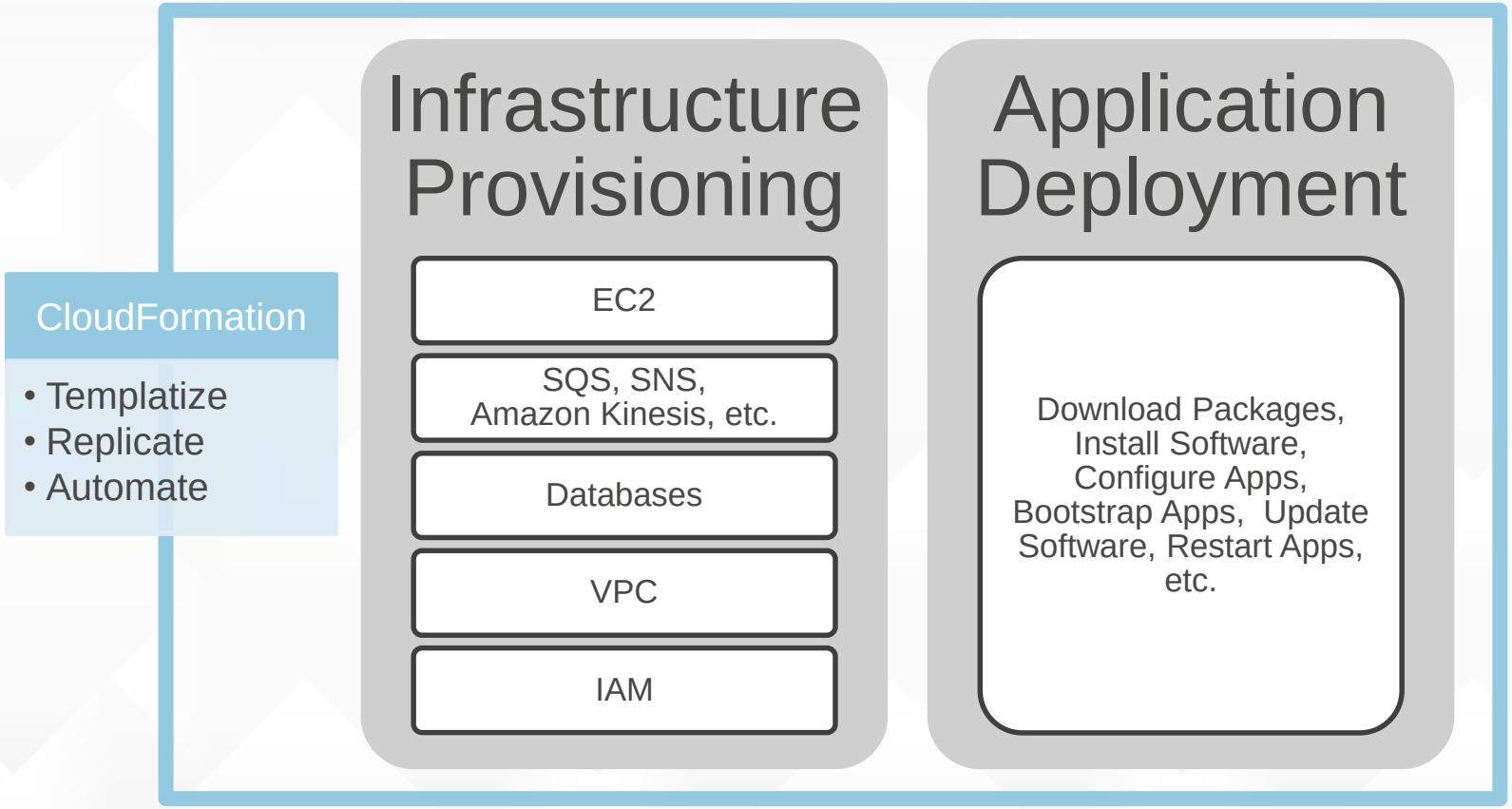

Application-deployment-as-code inside a CloudFormation template

Chef, Puppet, CodeDeploy, …

Chef

CloudFormation::Init

OpsWorks

Amazon Machine Images

AWS::CloudFormation::Init

- ✓ Declarative
- ✓ Reusable
- ✓ Grouping & Ordering
- ✓ Debug-able
- ✓ Updatable
- ✓ Highly Secure
- ✓ BIOT™ (Bring In Other Tools)

```
"MyInstance": {
    "Type": "AWS::EC2::Instance",
    "Metadata" : {
        "AWS::CloudFormation::Init" : {
            "webapp-config": {
                "packages" : {}, "sources" : {}, "files" : {},
                "groups" : {}, "users" : {},
                "commands" : {}, "services" : {}
```

ow.ly/DiNCm

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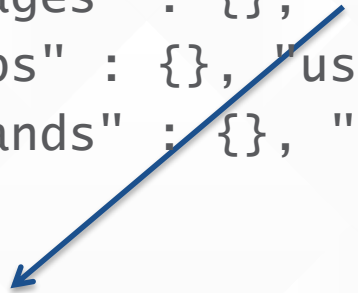
AWS::CloudFormation::Init

Declarative

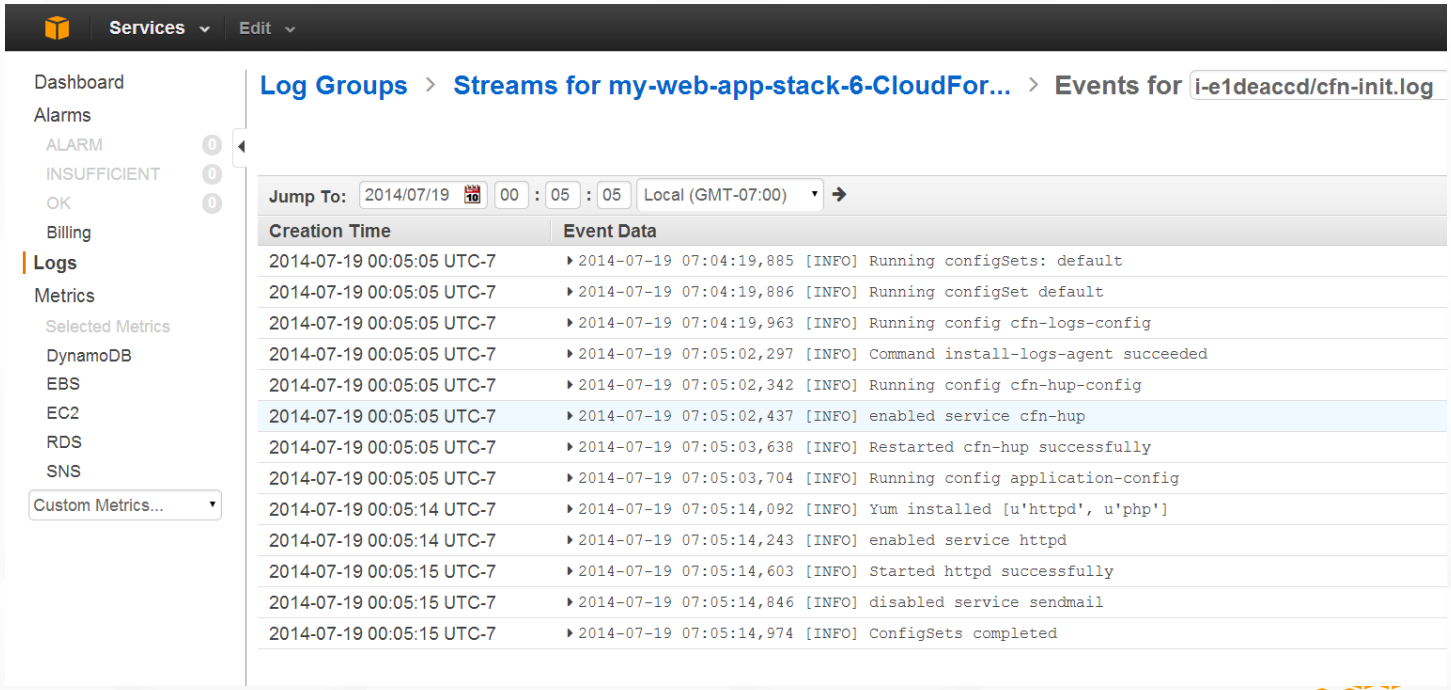
```
"AWS::CloudFormation::Init": {
    "webapp-config": {
        "packages" : {}, "sources" : {}, "files" : {},
        "groups" : {}, "users" : {},
        "commands" : {}, "services" : {}


"sources" : {
    "/etc/myapp" :
    "https://s3.amazonaws.com/mybucket/myapp.tar.gz"
```



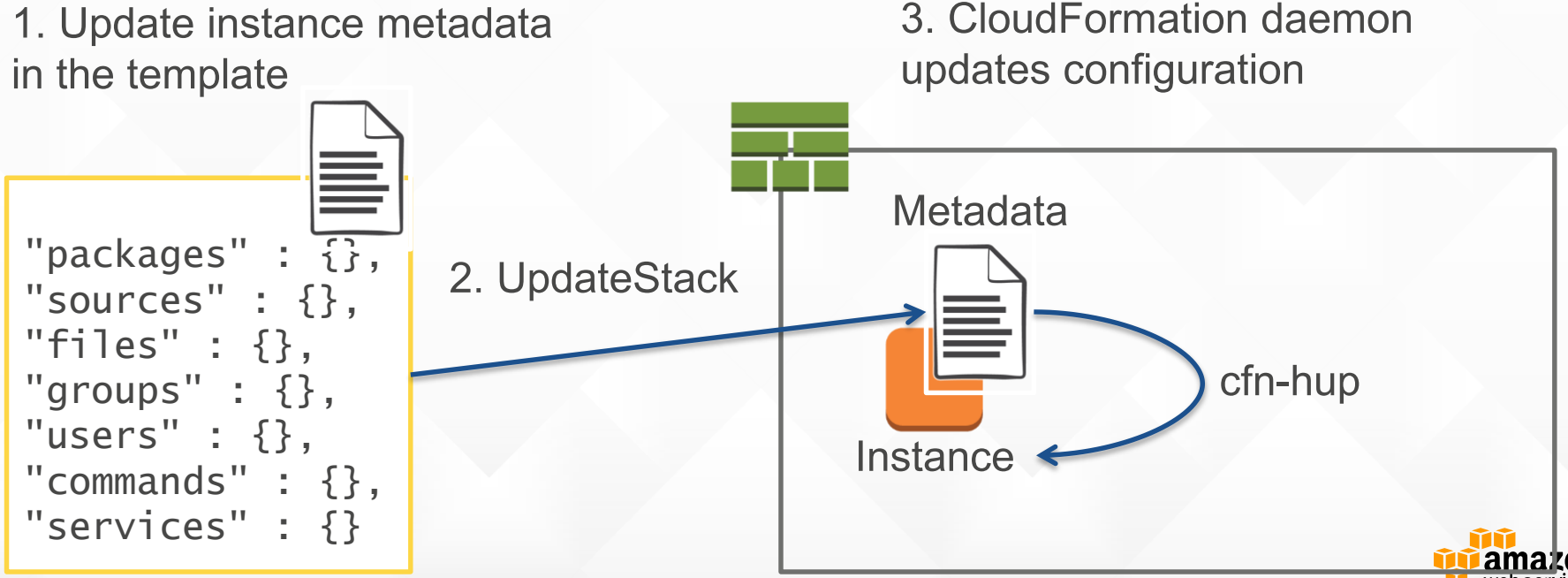
AWS::CloudFormation::Init

Debug-able



AWS::CloudFormation::Init

Supports updates



AWS::CloudFormation::Init

Flexibility to bring in other tools such as AWS CodeDeploy and Chef

```
"install_chef" : {},

"install_wordpress" : {
    "commands" : {
        "01_get_cookbook" : {}, ...,
        "05_configure_node_run_list" : {
            "command" : "knife node run_list add -z `knife
node list -z` recipe[wordpress]",
            "cwd" : "/var/chef/chef-repo",
            "env" : { "HOME" : "/var/chef" }
```

ow.ly/DiNkz

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AWS::CloudFormation::Init

Supports role-based auth

```
"YourInstance": {
    "Metadata": {
        "AWS::CloudFormation::Authentication": {
            "S3AccessCreds": {
                "type": "S3",
                "roleName": { "Ref" : "InstanceRole"},
                "buckets" : ["your-bucket"]
            }
        },
        "AWS::CloudFormation::Init": {}
```

Choose auth type. IAM Role is recommended

Securely download

ow.ly/DqkrB

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Use AWS::CloudFormation::Init

```
"UserData": {

"# Get the latest CloudFormation helper scripts package\n",
"yum update -y aws-cfn-bootstrap\n",

"# Trigger CloudFormation::Init configuration \n",
"/opt/aws/bin/cfn-init --stack ", {"Ref": "AWS::StackId"},
          " --resource WebServerInstance ",
          " --region ", {"Ref": "AWS::Region"}, "\n",

"# Signal completion\n",
"/opt/aws/bin/cfn-signal -e $? --stack ", {"Ref": "AWS::StackId"},
          " --resource WebServerInstance ",
          " --region ", {"Ref": "AWS::Region"}, "\n"
```

Use CloudWatch Logs for debugging

```
"install_logs": {
    "packages" : { ... "awslogs" ... },
    "services" : { ... "awslogs" ... }
    "files": {
      "/tmp/cwlogs/cfn-logs.conf": {}
```

```
file = /var/log/cfn-init.log
log_stream_name = {instance_id}/cfn-init.log

file = /var/log/cfn-hup.log
log_stream_name = {instance_id}/cfn-hup.log
```

ow.ly/E0zO3

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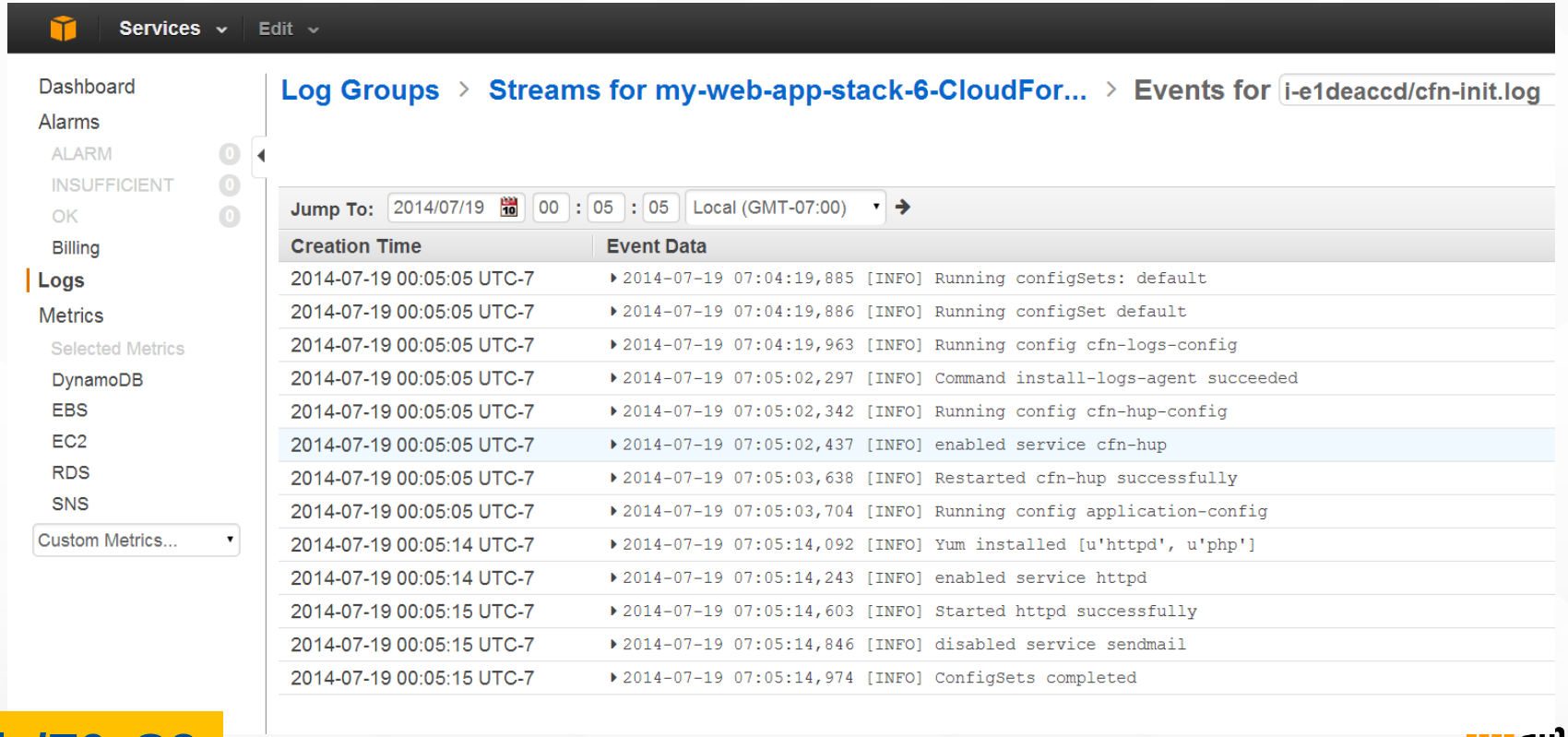
Use CloudWatch Logs for debugging



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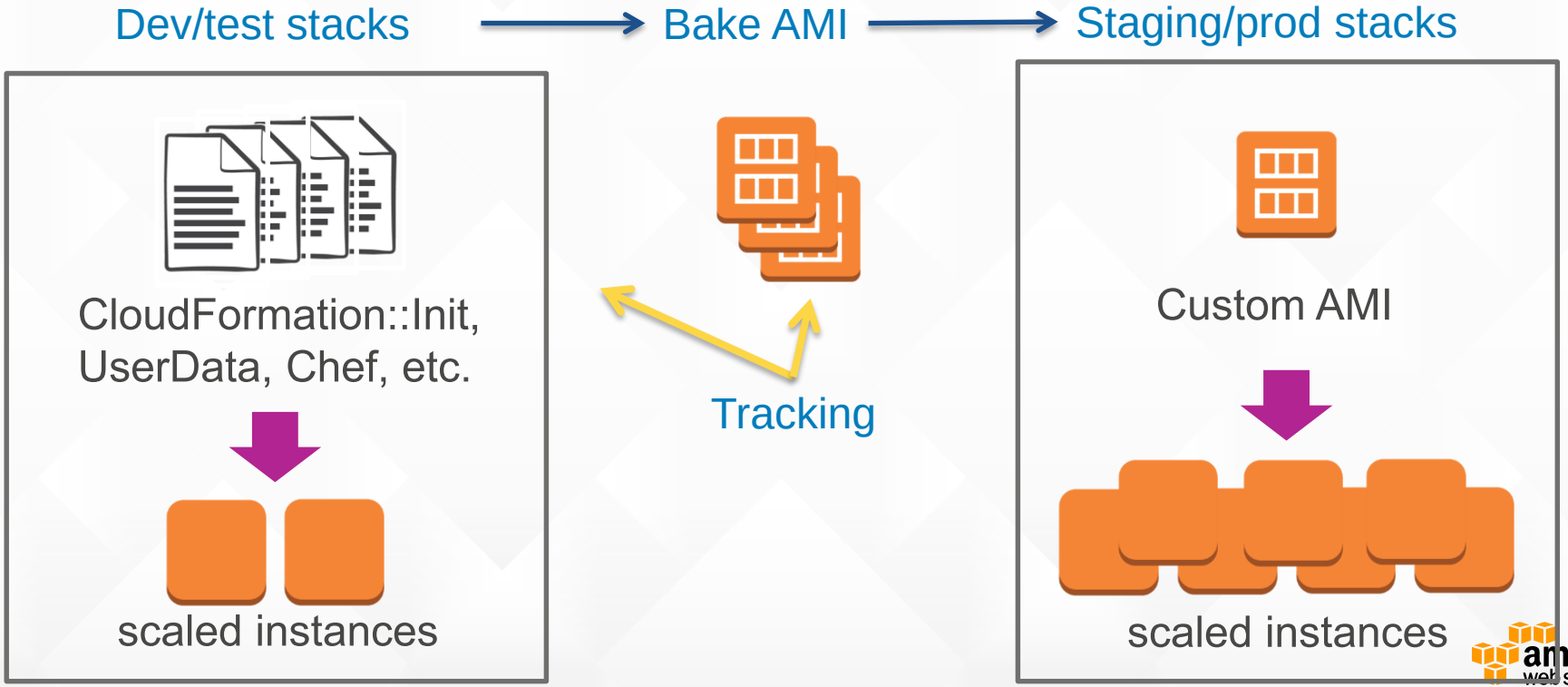
Bake AMIs for faster booting
Bake AMIs for maintaining golden images



Using CloudFormation and OpsWorks together

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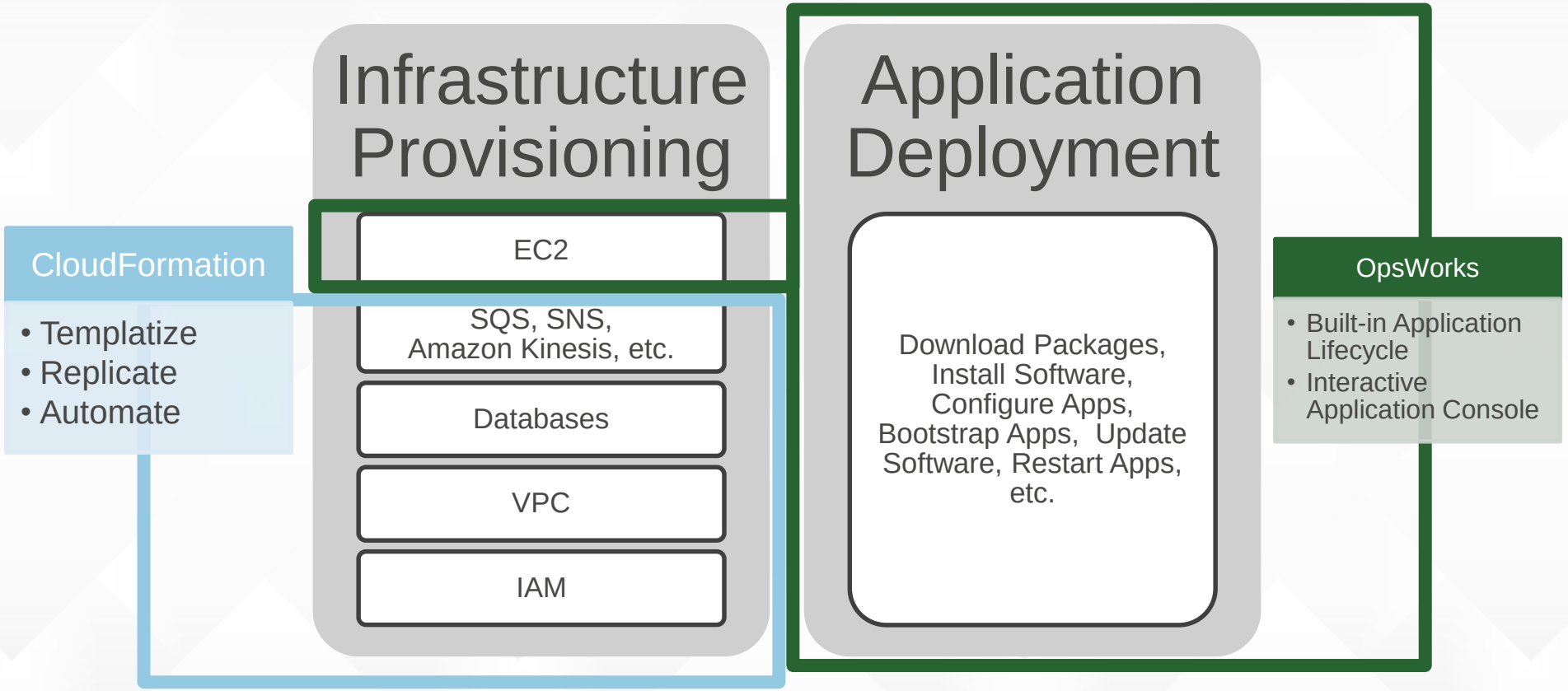
OpsWorks & CloudFormation “side-by-side”



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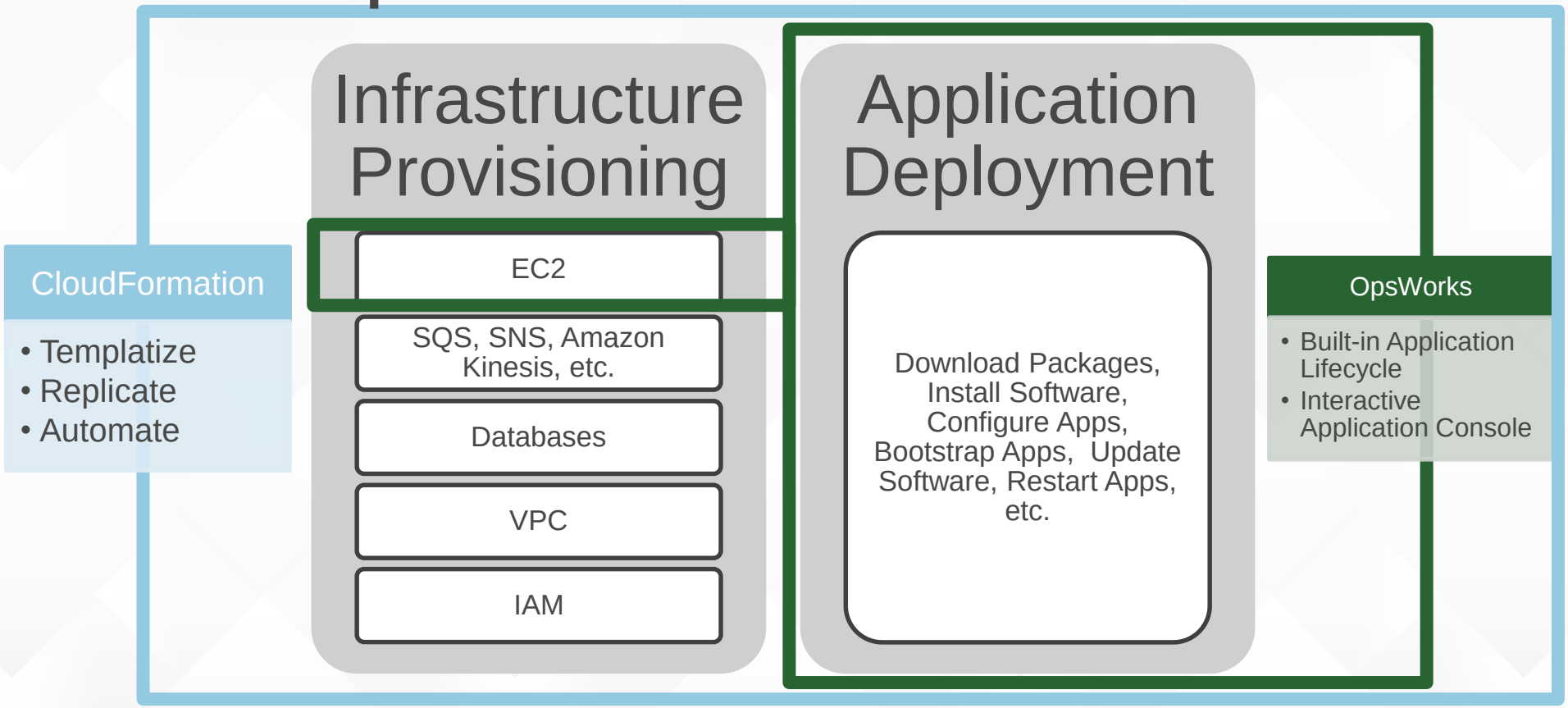
OpsWorks “inside” CloudFormation



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Infrastructure-as-code in a CI/CD pipeline

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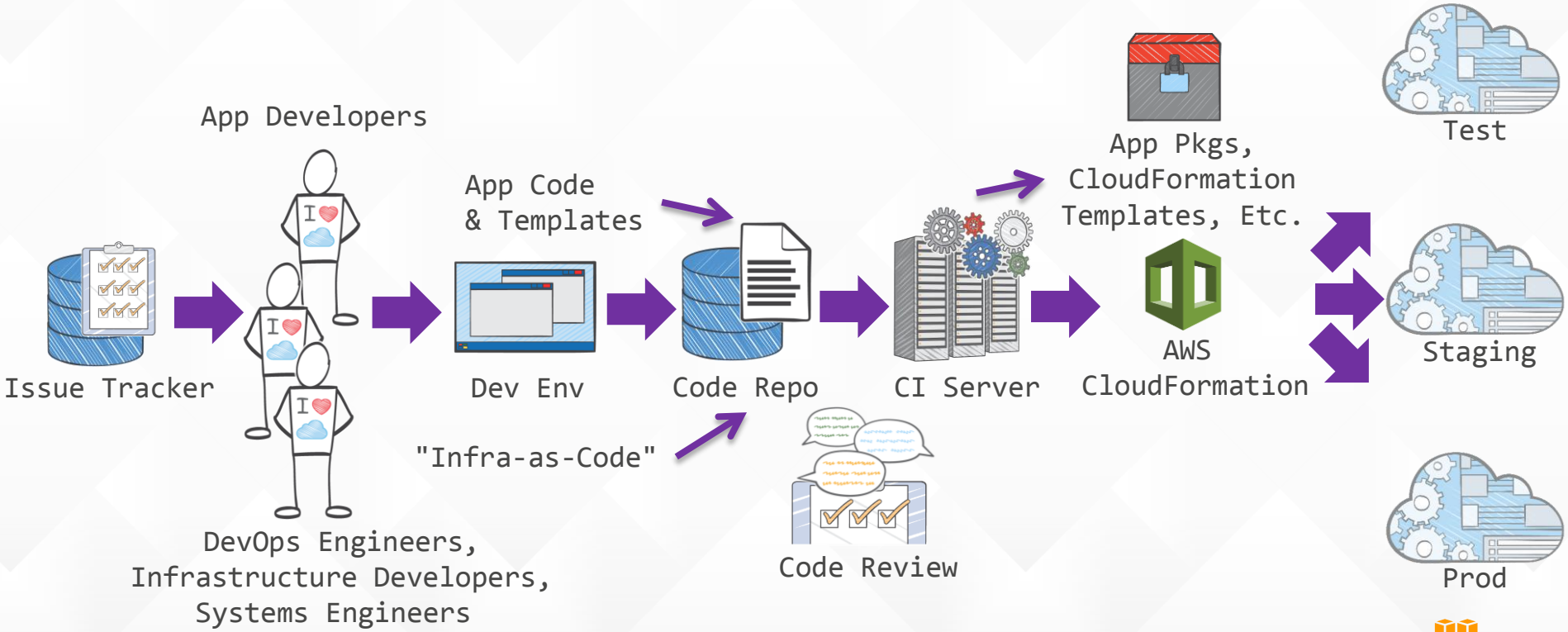
CloudFormation in a CI/CD pipeline



Templatize existing resources

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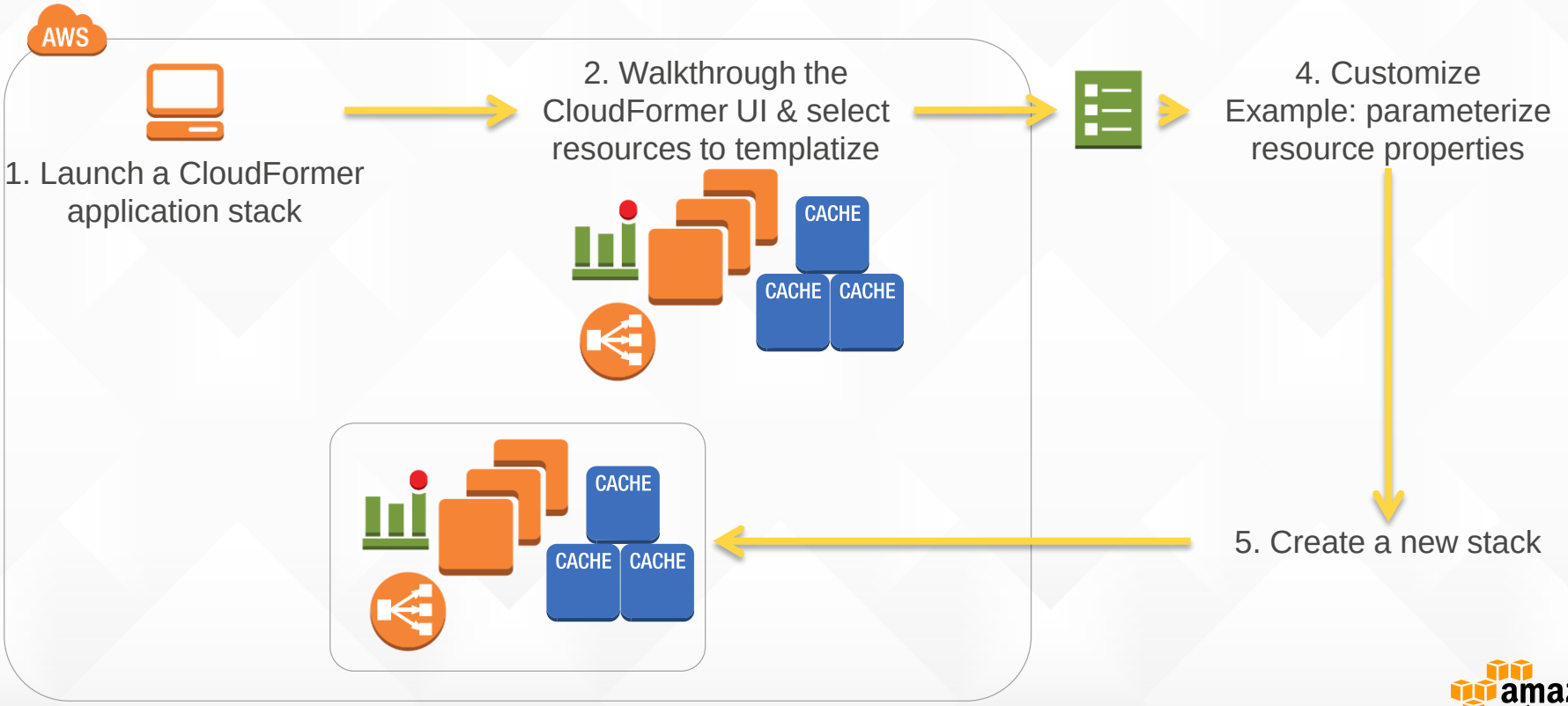
CloudFormer: Templatize existing resources



Practitioners of infrastructure-as-code

- **Developers/DevOps** teams value CloudFormation for its ability to treat infrastructure as code, allowing them to apply software engineering principles, such as SOA, revision control, code reviews, integration testing to infrastructure.
- **IT Admins and MSPs** value CloudFormation as a platform to enable standardization, managed consumption, and role-specialization.
- **ISVs** value CloudFormation for its ability to support scaling out of multi-tenant SaaS products by quickly replicating or updating stacks. ISVs also value CloudFormation as a way to package and deploy their software in their customer accounts on AWS.

Thank You

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AWS Summit

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