

# AMAZON WEB SERVICES CLOUDFORMATION GUIDE



Damian Ndunda

Version 0.0.3

MUGUMOINI - NAIROBI

## AMAZON WEB SERVICES CLOUDFORMATION GUIDE

Copyright © 2019 BICT Solutions.

Visit <https://businessict.weebly.com/cloud-computing.html>

Trademarks used belong Amazon.com, Inc. Icons used are reproduced from Amazon.com Trademark information about all of the companies and products mentioned herein are provided accordingly but cannot guarantee the accuracy of all information as information changes with time.

## CONTENTS AT A GLANCE

<b>AMAZON WEB SERVICES CLOUDFORMATION GUIDE .....</b>	<b>1</b>
<b>CONTENTS AT A GLANCE.....</b>	<b>3</b>
<b>TABLE OF CONTENTS.....</b>	<b>4</b>
<b>FOREWORD .....</b>	<b>10</b>
<b>AWS INTRODUCTION .....</b>	<b>11</b>
<b>AWS DATA CENTER LOCATIONS.....</b>	<b>12</b>
<b>WHAT IS “CLOUD COMPUTING”?.....</b>	<b>12</b>
<b>AWS CLOUDFORMATION .....</b>	<b>14</b>
<b>GETTING STARTED WITH AWS CLOUDFORMATION .....</b>	<b>49</b>
<b>AUTOMATING DEPLOYMENT: CLOUDFORMATION, ELASTIC BEANSTALK, AND OPSWORKS .....</b>	<b>85</b>
<b>REFERENCES.....</b>	<b>128</b>

## TABLE OF CONTENTS

<b>AMAZON WEB SERVICES CLOUDFORMATION GUIDE .....</b>	<b>1</b>
<b>CONTENTS AT A GLANCE.....</b>	<b>3</b>
<b>TABLE OF CONTENTS.....</b>	<b>4</b>
<b>FOREWORD .....</b>	<b>10</b>
<b>AWS INTRODUCTION .....</b>	<b>11</b>
AWS CLOUDFORMATION INTRODUCTION .....	11
<b>AWS DATA CENTER LOCATIONS.....</b>	<b>12</b>
<b>WHAT IS “CLOUD COMPUTING”?.....</b>	<b>12</b>
AMAZON AND CLOUD COMPUTING .....	13
<b>AWS CLOUDFORMATION.....</b>	<b>14</b>
USING A BLUEPRINT TO START A VIRTUAL SERVER .....	14
The benefits of CloudFormation are as follows:.....	15
■It’s a consistent way to describe infrastructure on AWS.....	15
■It can handle dependencies.....	15
■It’s replicable.....	15
■It’s customizable.....	15
■It’s testable.....	15
■It’s updatable.....	15
■It minimizes human failure.....	16
■It’s the documentation for your infrastructure.....	16
■It’s free.....	16

1 Anatomy of a CloudFormation template .....	16
A basic CloudFormation template is structured into five parts:.....	16
1 Format version—.....	16
2 Description—.....	16
3 Parameters— .....	16
4 Resources—.....	16
5 Outputs— .....	17
Listing 6 CloudFormation template structure .....	17
FORMAT VERSION AND DESCRIPTION.....	17
PARAMETERS.....	17
Listing 7 CloudFormation parameter structure .....	18
Table 1 CloudFormation parameter types.....	19
Table 2 CloudFormation parameter properties .....	20
RESOURCES.....	21
Listing 8 CloudFormation resources structure .....	22
Listing 9 CloudFormation EC2 server resource.....	23
OUTPUTS .....	23
Listing 10 CloudFormation outputs structure .....	23
Listing 11 CloudFormation outputs example.....	24
2 Creating your first template.....	24
Listing 12 Template to create an EC2 instance with CloudFormation.....	25
Where is the template located? .....	27
Figure 16 Overview of CloudFormation stacks.....	29
Figure 17 Creating a CloudFormation stack: selecting a template (step 1 of 4).....	30
Figure 18 Creating a CloudFormation stack: defining parameters (step 2 of 4).....	31
Figure 19 Creating a CloudFormation stack: summary (step 4 of 4) .....	32
Figure 20 The CloudFormation stack has been created. ....	33
Figure 21 Updating the CloudFormation stack: summary (step 1 of 4) .....	34
Alternatives to CloudFormation .....	35
Cleaning up .....	36
AWS CLOUDFORMATION CONCEPTS .....	36
TEMPLATES .....	36
Example JSON .....	36

Example YAML .....	37
Example JSON .....	38
Example YAML .....	40
STACKS .....	41
CHANGE SETS .....	41
HOW DOES AWS CLOUDFORMATION WORK? .....	41
UPDATING A STACK WITH CHANGE SETS.....	42
DELETING A STACK .....	44
Creating the VPC EndPoint for AWS CloudFormation .....	44
BEFORE YOU BEGIN.....	44
AWS CLOUDFORMATION LIMITS .....	46
AWS CLOUDFORMATION LIMITS TABLE .....	46
 <b>GETTING STARTED WITH AWS CLOUDFORMATION .....</b>	 49
GET STARTED .....	49
Step 1: Pick a template .....	49
Step 2: Make sure you have prepared any required items for the stack .....	53
Step 3: Create the stack .....	53
Step 4: Monitor the progress of stack creation .....	54
Step 5: Use your stack resources .....	55
Step 6: Clean Up.....	55
LEARN TEMPLATE BASICS.....	55
What is an AWS CloudFormation Template?.....	56
Resources: Hello Bucket! .....	56
Resource Properties and Using Resources Together .....	57
Receiving User Input Using Input Parameters .....	68
Specifying Conditional Values Using Mappings .....	71
Constructed Values and Output Values .....	75
Next Steps .....	81
WALKTHROUGH: UPDATING A STACK.....	82
A Simple Application .....	82
 <b>AUTOMATING DEPLOYMENT: CLOUDFORMATION, ELASTIC BEANSTALK, AND OPSWORKS .....</b>	 85

1 DEPLOYING APPLICATIONS IN A FLEXIBLE CLOUD ENVIRONMENT .....	85
Figure 1 Deployment must be automated in a flexible and scalable cloud environment.....	86
2 RUNNING A SCRIPT ON SERVER STARTUP USING CLOUDFORMATION .....	86
2.1 Using user data to run a script on server startup .....	86
2.2 Deploying OpenSwan as a VPN server to a virtual server.....	87
Figure 2 Using OpenSwan on a virtual server to tunnel traffic from a personal computer .....	87
Listing 1 Deploying a VPN server to a virtual server: CloudFormation and a shell script.....	87
SHORTCUT FOR OS X AND LINUX .....	88
USING CLOUDFORMATION TO START A VIRTUAL SERVER WITH USER DATA .....	90
FN::JOIN AND FN::BASE64 .....	90
Listing 2 Parts of a CloudFormation template to start a virtual server with user data .....	90
INSTALLING AND CONFIGURING A VPN SERVER WITH A SCRIPT .....	93
Cleaning up .....	95
2.3 Starting from scratch instead of updating .....	95
3 DEPLOYING A SIMPLE WEB APPLICATION WITH ELASTIC BEANSTALK .....	95
Elastic Beanstalk lets you handle the following recurring problems:.....	95
3.1 Components of Elastic Beanstalk.....	96
■ An application .....	96
■ A version .....	96
■ A configuration template.....	96
■ An environment .....	96
Figure 3 An Elastic Beanstalk application consists of versions, configurations, and environments.....	97
3.2 Using Elastic Beanstalk to deploy Etherpad, a Node.js application .....	97
CREATING AN APPLICATION FOR AWS ELASTIC BEANSTALK.....	98
CREATING A VERSION FOR AWS ELASTIC BEANSTALK.....	98
CREATING AN ENVIRONMENT TO EXECUTE ETHERPAD WITH ELASTIC BEANSTALK .....	98
HAVING FUN WITH ETHERPAD .....	99
Listing 4 Describing the status of the Elastic Beanstalk environment .....	100
Figure 4 Online text editor Etherpad in action .....	101
EXPLORING ELASTIC BEANSTALK WITH THE MANAGEMENT CONSOLE .....	101
Figure 5 Overview of AWS Elastic Beanstalk environment running Etherpad .....	103
Cleaning up .....	103
Figure 6 Downloading logs from a Node.js application via AWS Elastic Beanstalk .....	105

4 DEPLOYING A MULTILAYER APPLICATION WITH OPSWORKS .....	105
The service offers some standard layers with the following runtimes: .....	105
About Chef .....	106
4.1 Components of OpsWorks .....	107
A stack .....	107
■ A layer .....	107
■ An instance .....	107
■ An app .....	107
Figure 7 Stacks, layers, instances, and apps are the main components of OpsWorks. ....	108
4.2 Using OpsWorks to deploy an IRC chat application .....	108
Figure 8 Building your own IRC infrastructure consisting of a web application and an IRC server .....	109
CREATING A NEW OPSWORKS STACK .....	109
Figure 9 Creating a new stack with OpsWorks .....	112
CREATING A NODE.JS LAYER FOR AN OPSWORKS STACK.....	112
Figure 10 Creating a layer with Node.js for kiwiIRC .....	113
CREATING A CUSTOM LAYER FOR AN OPSWORKS STACK.....	113
Figure 11 Creating a custom layer to deploy an IRC server .....	114
Shortcut for OS X and Linux.....	114
Listing 5 Creating a custom firewall with the help of CloudFormation .....	115
Figure 12 Adding a custom firewall configuration to the IRC server layer .....	116
Figure 13 Adding an IRC package to a custom layer.....	117
ADDING AN APP TO THE NODE.JS LAYER .....	117
Figure 14 Adding kiwiIRC, a Node.js app, to OpsWorks .....	118
ADDING INSTANCES TO RUN THE IRC CLIENT AND SERVER .....	119
Figure 15 Adding a new instance to the Node.js layer .....	120
Figure 16 Starting the instances for the IRC web client and server.....	121
HAVING FUN WITH KIWIIRC .....	121
Figure 17 Waiting for deployment to open kiwiIRC in the browser .....	122
Figure 18 Using kiwiIRC to log in to your IRC server on channel #awsinaction .....	124
Cleaning up .....	125
5 COMPARING DEPLOYMENT TOOLS .....	125
1 Classifying the deployment tools .....	125
Figure 19 Comparingdifferent ways to deployapplications on AWS .....	126

2 Comparing the deployment services .....	127
<b>REFERENCES.....</b>	<b>128</b>