



NANODEGREE PROGRAM SYLLABUS

# Cloud DevOps Engineer



# Overview

Companies are looking for talented DevOps engineers to remain competitive in this agile world. Enroll now to operationalize infrastructure at scale and deliver applications and services at high velocity, an essential skill for advancing your career. Learn to design and deploy infrastructure as code, build and monitor CI/CD pipelines for different deployment strategies, and deploy scalable microservices using Kubernetes.

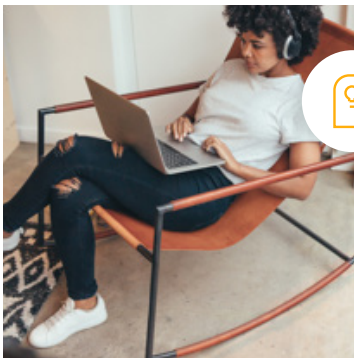
**Prerequisite Knowledge:** You should be familiar with the basics of programming in an object-oriented language. You should also be comfortable with the Linux Command Line.



**Estimated Time:**  
4 Months at  
10hrs/week



**Prerequisites:**  
Basic  
Programming and  
Linux Command  
Line



**Flexible Learning:**  
Self-paced, so  
you can learn on  
the schedule that  
works best for you.



**Need Help?**  
[udacity.com/advisor](https://udacity.com/advisor)  
Discuss this program  
with an enrollment  
advisor.

# Course 1: Cloud Fundamentals

The cloud has become a key enabler for innovation with beneficial features like high availability, unlimited capacity, and on-demand scalability and elasticity. Learn the fundamentals of cloud computing while being introduced to compute power, security, storage, networking, messaging, and management services in the cloud. While learning the fundamentals, you will explore tools and services offered by Amazon Web Services (AWS) through interactive hands-on exercises. By the end of the course, you will have deployed your first website to AWS, and you will be prepared to continue your learning journey in the Cloud Developer Nanodegree program.

## Course Project Deploy Static Website on AWS

The cloud is perfect for hosting static websites that only include HTML, CSS, and JavaScript files that require no server-side processing. In this project, you will deploy a static website to AWS. First, you will create a S3 bucket, configure the bucket for website hosting, and secure it using IAM policies. Next, you will upload the website files to your bucket and speed up content delivery using AWS's content distribution network service, CloudFront. Lastly, you will access your website in a browser using the unique S3 endpoint.

### LEARNING OUTCOMES

#### LESSON ONE

##### Cloud Overview

- Learn the basics of cloud computing including cloud deployment models, benefits, and popular options
- Explore services provided by Amazon Web Services(AWS)

#### LESSON TWO

##### Foundational and Compute Services

- Learn why we need servers, compute power, and security
- Explore AWS compute services like Elastic Cloud Compute (EC2), Virtual Private Cloud (VPC), Lambda for serverless framework, and Elastic Beanstalk in action
- Launch a secure EC2 instance, create and execute a Lambda, and deploy an application to Elastic Beanstalk

#### LESSON THREE

##### Storage and Content Delivery

- Learn why we need storage and content delivery in the cloud
- Learn storage services like S3, DynamoDB, Relational Database Service (RDS), and CloudFront
- Create a DynamoDB table, launch a MySQL database instance, and create a CloudFront distribution

## LESSON FOUR

### Security

- Learn the importance of security in the cloud
- See Identity & Access Management (IAM) in action
- Secure applications using IAM users, groups, and policies

## LESSON FIVE

### Networking & Elasticity

- Learn the basics of networking and elasticity in the cloud
- Examine services like Route 53, EC2 Auto Scaling, and Elastic Load Balancing
- Add an auto scaling policy to your EC2 instance

## LESSON SIX

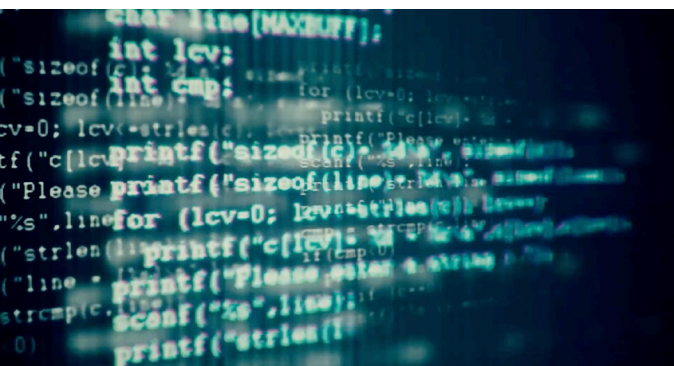
### Messaging & Containers

- Learn the basics of messaging and containers in the cloud
- Explore services like Simple Notification Service (SNS), Simple Queue Service (SQS), and Elastic Container Service (ECS)
- Create cloud notifications using SNS

## LESSON SEVEN

### AWS Management

- Learn why we need logging, auditing, and resource management in the cloud
- Understand services like CloudWatch, CloudTrail, CloudFormation, and the AWS Command Line Interface (CLI)
- Explore the CLI



## Course 2: Deploy Infrastructure as Code (IAC)

With the advent of cloud computing, along came several tools that enabled us to deploy the underlying infrastructure components that provide security and services to our servers by writing scripts. In this course, you'll learn how to deploy this infrastructure using CloudFormation, AWS' tool for Infrastructure as Code.

You will use CloudFormation to deploy Infrastructure patterns that are used broadly in the industry and can be readily used to deploy any cloud application. Like in the real world, you will begin with initial business requirements that you will turn into Cloud Architecture Diagrams. Then, you will deploy this architecture using CloudFormation.

### Course Project

Deploy a High-Availability Web App Using CloudFormation

In this project, you'll deploy web servers for a highly available web app using CloudFormation. You will write the code that creates and deploys the infrastructure and application for Instagram-like app from the ground up. You will begin with deploying the networking components followed by servers, security roles, and software. The procedure you follow here will become part of your portfolio of cloud projects. You'll do it exactly as it's done on the job: following best practices and scripting as much as possible.

### LEARNING OUTCOMES

#### LESSON ONE

##### Getting Started with CloudFormation

- Set up the necessary tools to get started with CloudFormation and deploy your first server using CloudFormation

#### LESSON TWO

##### Infrastructure Diagrams

- Convert business requirements into infrastructure diagrams and understand the principles behind design choices

#### LESSON THREE

##### Networking Infrastructure

- Implement a virtual private network and subnets and learn how to provide inbound and outbound internet access to your public and private subnets inside your VPC
- Use routing table to route the traffic within your virtual private cloud



## LESSON FOUR

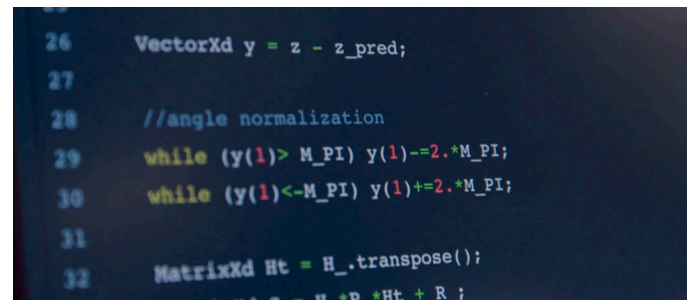
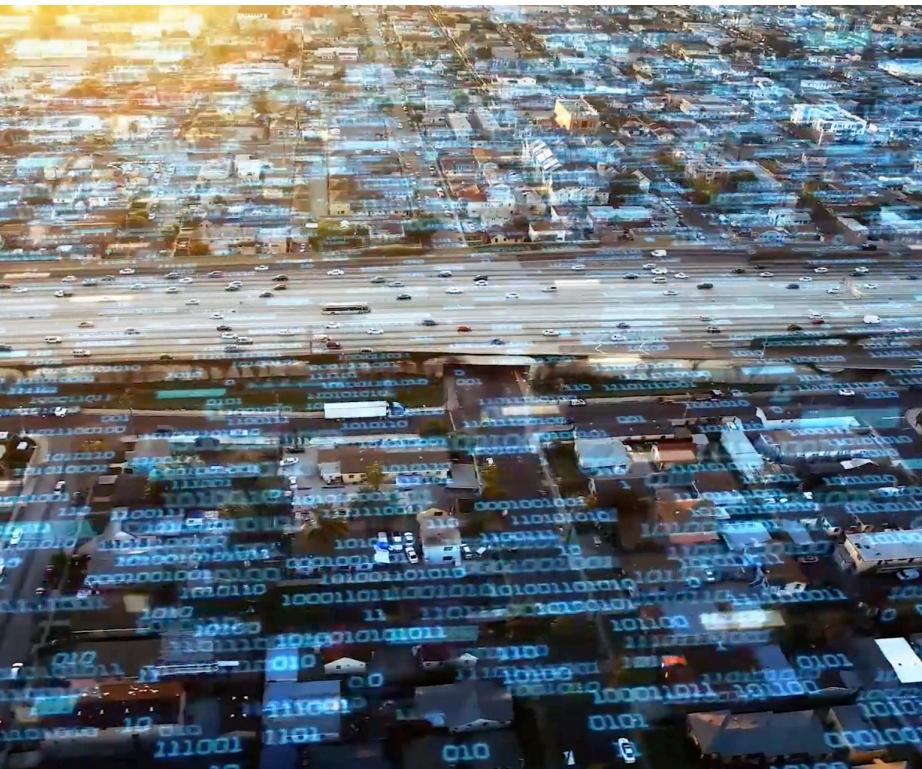
### Servers and Security Groups

- Deploy a web server into an autoscaling group
- Implement load-balancer to increase capacity of your app
- Implement security groups and understand the concept of least-privilege as it applies to network traffic

## LESSON FIVE

### Storage and Databases

- Deploy S3 storage for images, config files, and more.
- Deploy relational database and encryption service for your application



# Course 3: Build CI/CD Pipelines, Monitoring & Logging

In this course, you'll learn the process of taking software from source code to deployment and beyond. You'll learn about automated testing, choosing the right deployment strategy for your business needs and deploying an appropriate CI/CD pipeline. You'll also learn about monitoring and logging to ensure that your application is running at peak performance and stays that way.

You'll also learn to manage and make changes to your servers in an automated way, using Ansible, a leading Configuration Management tool.

## Course Project

Build CI/CD Pipeline for Blue/Green Deployment

In this project, you will build on the skills acquired during this course. You will first create a pipeline that spins up three servers and uses Ansible to deploy an application on the servers. Once those servers are running, you will create another pipeline to confirm that servers were configured as expected. You'll then use the "Blue/Green" deployment strategy to deploy additional features to those servers.

## LEARNING OUTCOMES

### LESSON ONE

#### Configuration Management with Ansible

- Install software automatically with a tested and repeatable process that can be executed across your entire server fleet
- Apply patches to your infrastructure without having to manage servers individually

### LESSON TWO

#### Build CI/CD Pipelines with Jenkins on AWS

- Select the appropriate deployment strategies to avoid downtime
- Create pipelines that include automated testing to ensure software packages are delivered with quality in mind
- Identify and create pipelines for development and production

### LESSON THREE

#### Logging

- Use CloudWatch to aggregate logs
- Setup log agents to collect data directly from the source and send it to a centralized location for analysis

### LESSON FOUR

#### Monitoring & Alarms

- Identify and monitor meaningful metrics
- Set up alarms that will alert you of potential server issues
- Create dashboards to visualize your server metrics

# Course 4: Microservices at Scale Using Kubernetes

In this course, you will learn to create and deploy a Kubernetes cluster, configure Kubernetes autoscale, and load test a Kubernetes application. You'll learn to operationalize both existing and new microservices, and apply containers best practices. You'll learn to deploy Machine Learning microservices that are elastic and fault tolerant. You'll learn to pick the appropriate abstraction for microservices: Serverless (AWS Lambda) or Container Orchestration (Kubernetes).

## Course Project

Operationalize a Machine Learning Microservice API

In this project, you will continue your work on operationalizing microservices by deploying an elastic and fault-tolerant Machine Learning inference API using Kubernetes. You'll configure this microservice to be highly available by using Kubernetes best practices. You will validate your design by load testing the service and verifying the application architecture performs as designed.

### LEARNING OUTCOMES

#### LESSON ONE

##### Deploy High-availability Microservice Event-Driven Application

- Understand Serverless (AWS Lambda) concepts
- Understand which container abstraction to use: AWS Lambda or Kubernetes
- Deploy producer/consumer AWS Lambda applications
- Configure CloudWatch events

#### LESSON TWO

##### Use Docker Format Containers

- Understand Docker image format
- Run and modify Docker containers locally
- Deploy customized containers to Amazon ECR

#### LESSON THREE

##### Containerization of Existing App

- Use the appropriate Docker base image
- Install packages into Docker image
- Copy application into Docker image
- Configure application setup and start in Docker image

#### LESSON FOUR

##### Operationalize & Orchestrate Kubernetes

- Understand Kubernetes concepts
- Configure monitoring, alerts, and incidence response
- Integrate CI/CD Pipeline
- Configure Autoscaling



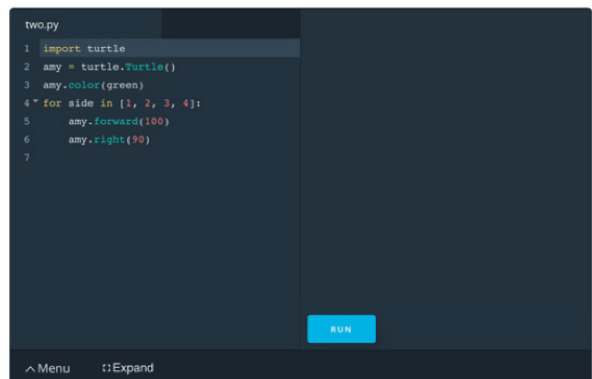
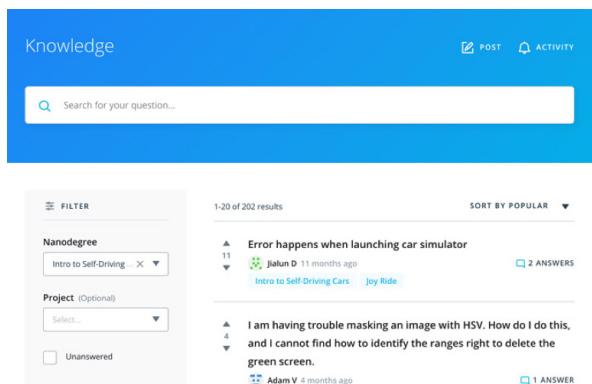
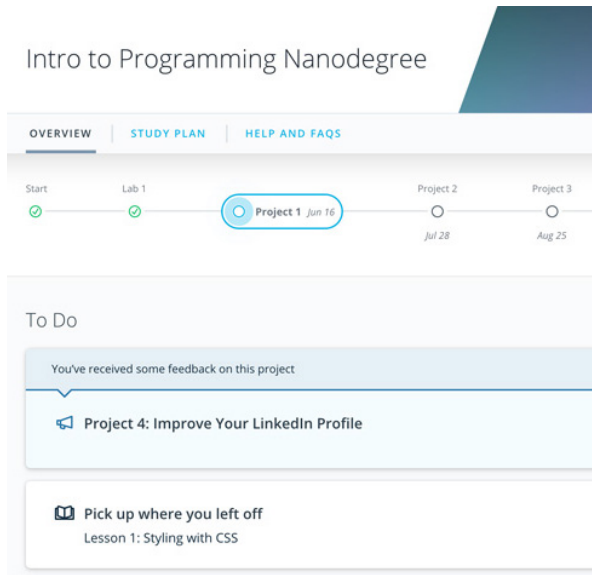
# Capstone Project

The purpose of the Cloud DevOps capstone project is to give you a chance to combine what you've learned throughout the program. This project will be an important part of your portfolio that will help you achieve your cloud development-related career goals.

In the capstone project, each project is unique to the student. You'll build a CI/CD pipeline for a microservices application for different deployment strategies. Students define the scope of the project and select the right deployment strategy based on different business requirements.



# Our Classroom Experience



## REAL-WORLD PROJECTS

Build your skills through industry-relevant projects. Get personalized feedback from our network of 900+ project reviewers. Our simple interface makes it easy to submit your projects as often as you need and receive unlimited feedback on your work.

## KNOWLEDGE

Find answers to your questions with Knowledge, our proprietary wiki. Search questions asked by other students and discover in real-time how to solve the challenges that you encounter.

## STUDENT HUB

Leverage the power of community through a simple, yet powerful chat interface built within the classroom. Use Student Hub to connect with your technical mentor and fellow students in your Nanodegree program.

## WORKSPACES

See your code in action. Check the output and quality of your code by running them on workspaces that are a part of our classroom.

## QUIZZES

Check your understanding of concepts learned in the program by answering simple and auto-graded quizzes. Easily go back to the lessons to brush up on concepts anytime you get an answer wrong.

## CUSTOM STUDY PLANS

Work with a mentor to create a custom study plan to suit your personal needs. Use this plan to keep track of your progress toward your goal.

## PROGRESS TRACKER

Stay on track to complete your Nanodegree program with useful milestone reminders.

## Learn with the Best



**Kesha Williams**

INSTRUCTOR

Kesha has over 20 years experience in software development and is a software engineering manager at Chick-fil-A, routinely leading innovation teams in proving out the use of cloud services to solve complex business problems. She was recently named an Alexa Champion by Amazon.



**Alfredo Deza**

INSTRUCTOR

Alfredo is a passionate software engineer, avid open source developer, Vim plugin author, photographer, and former Olympic athlete. He has rebuilt company infrastructure, designed shared storage, and replaced complex build systems, always in search of efficient and resilient environment.



**Carlos Rivas**

INSTRUCTOR

Carlos is a Senior Solutions Architect at Infinity Consulting where he helps institutions move traditional data centers to the cloud. He has worked for several large telecommunication providers managing and configuring network infrastructure, using Java, Groovy, Python, Perl, and PHP.



**Olin Wread**

INSTRUCTOR

Olin is a Senior DevOps Engineer at Figure Eight. He has over 13 years of experience in a variety of DevOps, Systems Engineer, and Systems Administration roles at companies such as Heartflow, Netgear, and Turnitin. Outside work, he enjoys photography and spending time with his daughter.



# All Our Nanodegree Programs Include:



## EXPERIENCED PROJECT REVIEWERS

### REVIEWER SERVICES

- Personalized feedback & line by line code reviews
- 1600+ Reviewers with a 4.85/5 average rating
- 3 hour average project review turnaround time
- Unlimited submissions and feedback loops
- Practical tips and industry best practices
- Additional suggested resources to improve



## TECHNICAL MENTOR SUPPORT

### MENTORSHIP SERVICES

- Questions answered quickly by our team of technical mentors
- 1000+ Mentors with a 4.7/5 average rating
- Support for all your technical questions



## PERSONAL CAREER SERVICES

### CAREER COACHING

- Personal assistance in your job search
- Monthly 1-on-1 calls
- Personalized feedback and career guidance
- Access to Udacity Talent Program used by our network of employers to source candidates
- Advice on negotiating job offers
- Interview preparation
- Resume services
- Github portfolio review
- LinkedIn profile optimization





# Frequently Asked Questions

## PROGRAM OVERVIEW

### WHY SHOULD I ENROLL?

The Cloud Computing field is expected to continue growing rapidly over the next several years, and there's huge demand for DevOps engineer across industries. In fact, DevOps Engineer topped LinkedIn's "Most recruited jobs" list in 2018.

Udacity has collaborated with industry leaders to offer a world-class learning experience so you can become a DevOps Engineer. You'll get hands-on experience building CI/CD pipelines using Jenkins, deploying infrastructure using code, implementing configuration management using Ansible, deploying microservices at scale, and more. You'll have personalized support as you master in-demand skills that qualify you for high-value jobs in the cloud computing field.

By the end of the program, you'll have an impressive portfolio of real-world projects, and valuable hands-on experience. You'll also receive career support via profile and portfolios reviews to help make sure you're ready to establish a successful devops career, and land a job you love.

### WHAT JOBS WILL THIS PROGRAM PREPARE ME FOR?

This program is designed to prepare people to become devops engineers. This includes job titles such as DevOps Engineer, Reliability Engineer, Release Manager, and more. Obtaining the skills required to be a DevOps will make you extremely valuable across many industries, and in many roles. As a graduate of this program, you'll be prepared to seek out roles that run the gamut from generalist to specialist, and all points in between.

### HOW DO I KNOW IF THIS PROGRAM IS RIGHT FOR ME?

If you're a developer, system admin or operations manager interested in automating IT infrastructure, building software delivery pipelines, and deploying and managing infrastructure, this program is for you. This program will enable you to gain the skills necessary to succeed in this rapidly-growing field.

## ENROLLMENT AND ADMISSION

### DO I NEED TO APPLY? WHAT ARE THE ADMISSION CRITERIA?

There is no application. This Nanodegree program accepts everyone, regardless of experience and specific background.



# FAQs Continued

## WHAT ARE THE PREREQUISITES FOR ENROLLMENT?

To optimize your success in this program, we've created a list of prerequisites and recommendations to help you prepare for the curriculum. To enroll, you should have experience in the following:

- Basic knowledge of Linux Command Lines
- Basic understanding of any programming language

## IF I DO NOT MEET THE REQUIREMENTS TO ENROLL, WHAT SHOULD I DO?

We have a number of Nanodegree programs and free courses that can help you prepare, including:

- [Intro to Computer Science](#)
- [Introduction to Python Programming](#)
- [Linux Command Line Basics](#)
- [Intro to Programming Nanodegree program](#)



## TUITION AND TERM OF PROGRAM

### HOW IS THIS NANODEGREE PROGRAM STRUCTURED?

The Cloud DevOps Engineer Nanodegree program is comprised of content and curriculum to support 5 (five) projects. We estimate that students can complete the program in four (4) months, working 10 hours per week.

Each project will be reviewed by the Udacity reviewer network. Feedback will be provided and if you do not pass the project, you will be asked to resubmit the project until it passes.

### HOW LONG IS THIS NANODEGREE PROGRAM?

Access to this Nanodegree program runs for the length of time specified in the payment card on the Nanodegree program overview page. If you do not graduate within that time period, you will continue learning with month to month payments. See the [Terms of Use](#) for other policies around the terms of access to our Nanodegree programs.

### CAN I SWITCH MY START DATE? CAN I GET A REFUND?

Please see the Udacity Nanodegree program [FAQs](#) for policies on enrollment in our programs.

## SOFTWARE AND HARDWARE - WHAT DO I NEED FOR THIS PROGRAM?

### WHAT SOFTWARE AND VERSIONS WILL I NEED IN THIS PROGRAM?

For this Nanodegree program you will need a desktop or laptop computer running recent versions of Windows, Mac OS X, or Linux and an unmetered broadband Internet connection.