Creating a Virtual Private Cloud (VPC)

README

World Domination One Beat At A Time

Congratulations! You are the newest employee at **BitBeat.** We are a new start-up that is planning to take the record industry and the world by storm with our new product **BitBanger,** a web-based music mixer app.

The company is prepping for an official launch, we are operating on a shoe-string budget. We are going to the cloud – this means we need a cloud network that we can use to host our public website, our internal website, email, and give our employees access to resources like printers and private tools and information.

That's where you come in. **BitBeat** has hired you to setup their infrastructure, you've already gathered their requirements and are ready to get started.

BEFORE GETTING STARTED

Here's some important information to know before starting this hands-on activity.

Activity Time: 60 min

**Requirements:** You must have an AWS Educate account.

Getting Help: If you experience any issues as you complete this activity, please ask your instructor for assistance.

Creating a Virtual Private Cloud (VPC)

Virtual Private

TASK OVERVIEW

In this hands-on activity you will create an **Amazon Virtual Private Cloud** (**VPC**). When you create the VPC you will create a Public and a Private subnet to manage the flow of traffic between the subnet and the Internet gateway. Below is a diagram of the infrastructure you will build:
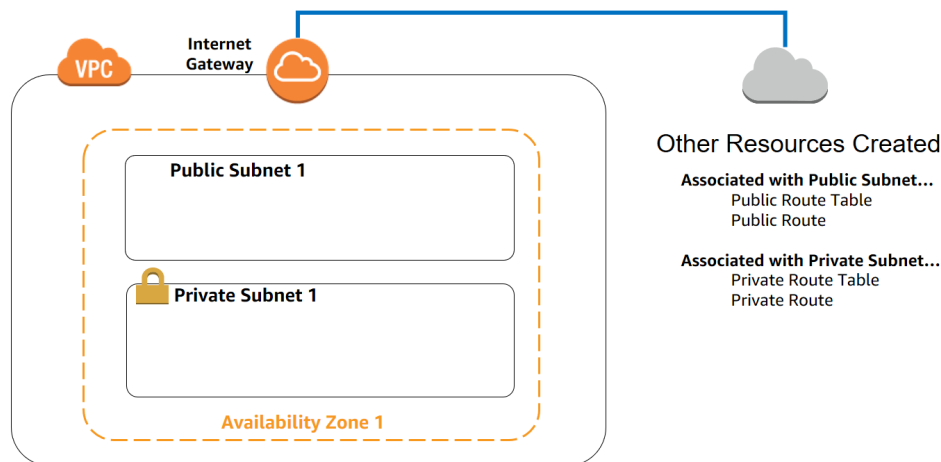
You will:
- Create and configure a VPC
- Create a private and a public subnet
- Create an Internet Gateway

LEARNING OUTCOMES
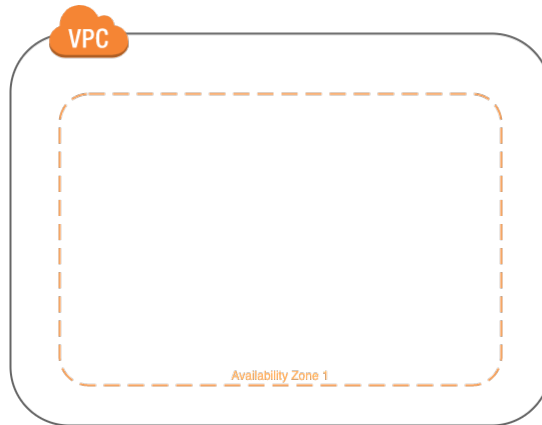
After completing this activity, you should be able to:
- Build a Virtual Private Cloud (VPC) in the AWS Console and discuss its purpose.
- Create Subnets and Route Tables and explain their role within a VPC.
- Create an Internet Gateway and summarize its role in within the VPC.

Let's Get Started!

Creating a Virtual Private Cloud (VPC)

Virtual Private Network

Create a VPC

When you register for an Amazon AWS account, a **default VPC** is associated with your account and ready for use, it's great for launching things like a personal blog or simple website. Since you want control over our infrastructure, you are going to create a *Non Default VPC* following these steps:

Create a NonDefault VPC
1. In the **AWS Management Console** find the **VPC Dashboard**.
2. Click on **Your VPCs**.
3. Click **Create VPC**.
4. Configure the following settings, leaving other fields at their default values:
   - **VPC name:** MyVPC
   - **Public subnet's IPv4 CIDR:** 10.0.0.0/16
   - **IPv6 CIDR Block:** No IPV6 CIDR Block
   - **Tenancy:** Default
5. Click **Create** to create your VPC.
6. Click **Close** to return to your VPC dashboard.

Your new VPC, called **MyVPC,** appears in your dashboard along with your default VPC.

DID YOU KNOW?

A **Default VPC** automatically configured with a /16 IPv4 CIDR block (172.31.0.0/16), a /20 subnet in each availability zone, an associated internet gateway, a default security group, network access control list (ACL) and DHCP.

A **Non Default VPC** has a private IP address but does NOT have a public IP address. It can only access resources using an EIP, VPN, or Gateway instance.

Creating a Virtual Private Cloud (VPC)

Create a public and a private subnet

You now want to run a public-facing web application, while maintaining back-end servers that aren't publicly accessible. This is a common example of a multi-tier website. The web servers are in a public subnet and the application and database servers are in a private subnet. You can set up security and routing so that the web servers can communicate with other resources in your VPC.

The instances in the public subnet can send outbound traffic directly to the Internet, whereas the instances in the private subnet cannot. Instead, the instances in the private subnet can access the Internet by using a Network Address Translation (NAT) that resides in the public subnet. In this activity, we are focusing on our infrastructure so we will not be creating a **NAT**.

Next, continue to build the **BitBeat** infrastructure by creating public and private subnets.

Create a Public Subnet
1. In the **VPC Dashboard** click **Subnets** in the left sidebar.
2. Click **Create Subnet**
3. Enter a **Name tag** : Public Subnet 1
4. Select the VPC you just created from the dropdown list
5. Save the **Availability Zone** as **No Preference**
6. **IPv4 CIDR Block:** 10.0.1.0/24
7. Click **Create.**

Create a private subnet
1. Repeat steps 2 – 7 using the following information:
   a. Enter a **Name tag** : Private Subnet 1
   b. **IPv4 CIDR Block:** 10.0.2.0/24
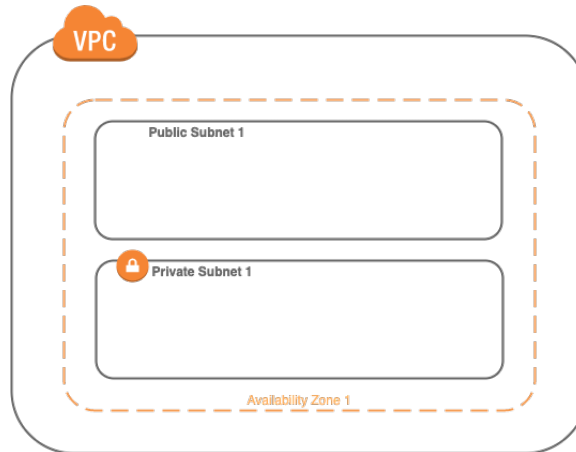
Virtual Private Network

DID YOU KNOW?

Each subnet you create must reside entirely within one Availability Zone and cannot span zones. The minimum size of a subnet is /28 (or 14 IP addresses) for IPv4. For IPv6, the subnet is fixed to be a /64. Only one IPv6 CIDR block can be allocated to a subnet. All VPCs and Subnets must have IPv4 CIDR blocks. The allowed block size is between /16 (~65,536 IP addresses) and /28 (16 IP addresses). The first four IP addresses and the last IP address in each subnet CIDR block are not available for you to use, and cannot be assigned to an instance.

Creating a Virtual Private Cloud (VPC)

DID YOU KNOW?

Traditionally, a NAT is a configured EC2 Instance located in a public subnet and serves as the means by which resources in private subnets can communicate out to the Internet for patches, service calls, etc. An AWS NAT Gateway is a managed version of a standard NAT resource. Find out more here: https://docs.aws.amazon.com/vpc/latest/userguide/vpc-nat-gateway.html

Create an Internet Gateway
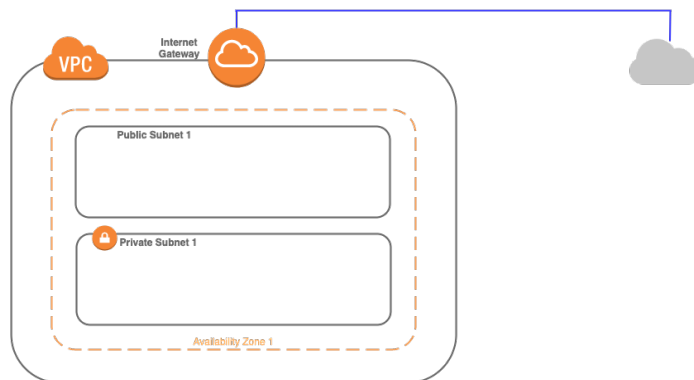
Our **BitBeat** website needs to be publicly accessible for our customers. To do this, we need to create an Internet Gateway and attach it to our VPC. An Internet Gateway is managed VPC component that allows communication between instances in your VPC and the internet

Create an Internet Gateway
1. In the **VPC Dashboard** click **Internet Gateways** in the left sidebar.
2. Click **Create internet Gateway**
3. Enter a **Name tag**: MyVPC_IG
4. Click **Create**

Attach your Internet Gateway to your VPC
1. In the **VPC Dashboard** click **Internet Gateways** in the left sidebar.
2. Find your Internet Gateway and notice the State: *detached*
3. Select your Internet Gateway and **Go to Actions -> Attach to VPC**
4. Select the *NonDefault VPC* names **MyVPC** from the list and click **Attach**
5. Click **Close**

Once you have attached the Internet Gateway to your VPC pause here. Take a minute to discuss what you just created.

Creating a Virtual Private Cloud (VPC)

Adjust the Subnet Route Tables

The resources in our Public Subnet need a route to allow communication out to the internet. Our **BitBeat** webservers need to be able to respond to our customer's requests. To accomplish this, we need to alter the VPC route tables to point all traffic destined for the public internet to the Internet Gateway we just created and attached to our VPC.

Create Route Table
1. In the **VPC Dashboard** click **Route Tables** in the left sidebar.
2. Click **Create route table**
3. Enter a **Name tag**: MyVPC Public Route Table
4. Select the VPC: MyVPC
5. Click **Create** and then click **Close**
6. Select the Route Table you just created and then go to the bottom of the screen and select the **Routes** tab
7. Click **Edit Routes**
   a. Note that a route already exists that coincides with your VPC CIDR range. This route keeps all local traffic in your VPC within your VPC
8. Click **Add Route**
9. Enter Destination: 0.0.0.0/0 representing all internet traffic
10. Enter Target
    a. Select **Internet Gateway**
    b. Select the Internet Gateway you created previously
11. Click **Save Routes** and then click **Close**

You have created a public route table that will allow resources to communicate with the internet through the internet gateway. The only remaining step is to associate this Route Table to our Public Subnet where our **BitBeat** Webservers will be deployed.

Associate Route Table
1. With the route table you just created selected, find the tab **Subnet Associations**
   a. Note that it is not associated with any subnet that you created
2. Click **Edit subnet associations**
3. Select the checkbox next to the Public Subnet you created earlier and click **Save**

⭐ **GREAT JOB!** ⭐

You have successfully created and configured **BitBeat**'s virtual infrastructure

Creating a Virtual Private Cloud (VPC)
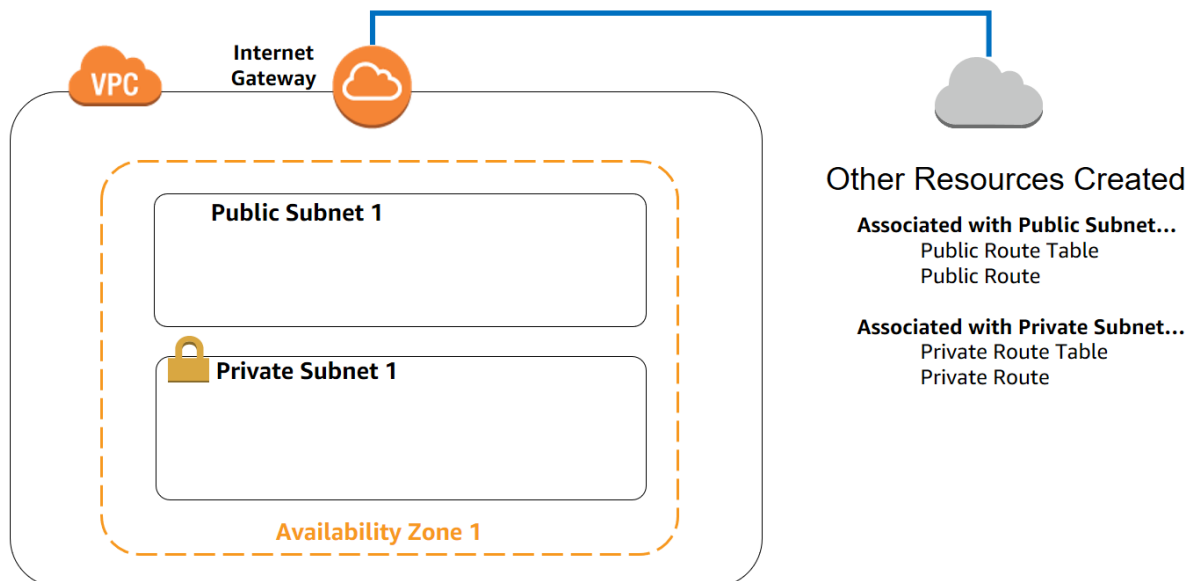
Virtual Private Network

Let's Review

You were able to create the first virtual private network for **BitBeat** which will be the eventual location of their new web-based music service **BitBanger**. You also created subnets within your VPC to allow for secure segmentation of the resources you will launch. This is one of the first steps of creating a cloud architecture using AWS without the cost and complexity of a physical network. You have access to more resources to help you focus on helping your company launch and grow.

In this activity you:
• Created a new Amazon VPC.
• Created both a public and a private subnet
• Created an Internet Gateway
• Configured the VPC so traffic can flow between the public subnet and the Internet gateway using Route Tables
• Explored the basic components of a VPC.

VPC

Internet Gateway

Public Subnet 1

Private Subnet 1

Availability Zone 1

Other Resources Created

Associated with Public Subnet...
Public Route Table
Public Route

Associated with Private Subnet...
Private Route Table
Private Route

Test Your Knowledge

- ☐ What does the acronym VPC stand for? _____

- ☐ What is a VPC? _____

- ☐ What are your Public & Private Subnet IDs?

  _____

- ☐ What is the purpose of your Public Subnet and of the Private Subnet?

  _____

- ☐ What are the two routes in the Public Subnet? (*Hint: look at your route tables*)

  _____

- ☐ What is the purpose of the Internet Gateway?

  _____

- ☐ Can resources launched in your Private Subnet communicate to the Internet Gateway directly?

  _____

- ☐ What is a NAT? What is a NAT Gateway? _____

- ☐ What is the allowed block size for a VPC? _____

- ☐ What is the minimum size for a VPC subnet? _____

Creating a Virtual Private Cloud (VPC)

Resources

Reference Tools

CIDR Notation: https://tools.ietf.org/html/rfc4632#section-3.1
Subnet Calculator: http://www.subnet-calculator.com/cidr.php
VPC and Subnet Documentation: https://docs.aws.amazon.com/vpc/latest/userguide/VPC_Subnets.html

CIDR Reference

The following is a list of CIDR Blocks, with available IP Range, Subnet Mask, and IP addresses you can use as reference:

CIDR Block	IP Range	Subnet Mask	IP Qty
10.0.0.0/32	10.0.0.0 – 10.0.0.0	255.255.255.255	1
10.0.0.0/31	10.0.0.0 – 10.0.0.1	255.255.255.254	2
10.0.0.0/30	10.0.0.0 – 10.0.0.3	255.255.255.252	4
10.0.0.0/29	10.0.0.0 – 10.0.0.7	255.255.255.248	8
10.0.0.0/28	10.0.0.0 – 10.0.0.15	255.255.255.240	16
10.0.0.0/27	10.0.0.0 – 10.0.0.31	255.255.255.224	32
10.0.0.0./26	10.0.0.0 – 10.0.0.63	255.255.255.192	64
10.0.0.0/25	10.0.0.0 – 10.0.0.127	255.255.255.128	128
10.0.0.0/24	10.0.0.0 – 10.0.0.255	255.255.255.0	256
10.0.0.0/16	10.0.0.0 – 10.0.255.255	255.255.0.0	65536