Hyperiondev

TASK

Introduction to Cloud and DigitalOcean

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Introduction

WELCOME TO THE INTRODUCTION TO CLOUD AND DIGITALOCEAN TASK!

In this task, you'll be introduced to cloud computing and DigitalOcean, a cloud hosting provider.

Cloud computing allows you to access remote computing resources, such as servers, storage, and databases, over the Internet. In this task, you'll gain a better understanding of cloud computing and DigitalOcean, and become better equipped to make informed decisions about using cloud services for your own projects.

WHAT IS CLOUD COMPUTING?

Cloud in the context of **DigitalOcean** refers to a network of remote servers hosted on the Internet to store, process, and manage data and applications. These servers are maintained and managed by the cloud provider, and users can access them over the internet through a web interface or API.

The term Cloud is used to describe this model of computing because it abstracts away the underlying infrastructure and makes it appear as though the resources and services are being delivered from an undefined “cloud” instead of a specific set of hardware. With **Cloud computing**, users can easily scale their resources and services as needed, only paying for what they use, and reducing the need for them to invest in and manage their own infrastructure.

Some popular Cloud solutions in no particular order include:

- Amazon Web Services (AWS)
- Microsoft Azure
- Google Cloud Platform (GCP)
- DigitalOcean
- Hetzner
- IBM Cloud
- Oracle Cloud
- VMware vCloud
- Heroku

- Salesforce Cloud
- Nvidia GeForce Now
- Nvidia Cloud & Data Center

These **Cloud Solutions** offer a range of services, including **infrastructure as a service (IaaS)**, **platform as a service (PaaS)**, and **software as a service (SaaS)**. Some of these Cloud Providers like AWS, DigitalOcean, Hetzner and so on, offer infrastructure as a service that allows users to upload and host their own websites on a **Cloud Server** by using a **Virtual Machine**.

Each Cloud Solution has its own strengths, features, and pricing, making it important to evaluate them based on the specific needs and requirements of an organisation or project.

Other Cloud Solutions like Nvidia GeForce Now and Salesforce Cloud don't offer solutions for Web Development, but were included for the purpose of demonstrating how broad the term "**Cloud**" is and "Cloud Computing" really is.

For example, Nvidia's GeForce Now is purely aimed at gamers who don't have the processing power in their local computers to play modern games, or who don't want to carry their computers with them while they travel. It instead renders the games and streams the video output to the user via one of Nvidia's Cloud Computers.

Nvidia, however, also offers alternative Cloud Computing Solutions for topics such as AI Model Training. This offers the benefit of having multiple powerful Cloud Computers training your AI model for just a fraction of the time it would take you to do the same on your local computer.

Alternatively, the cost of training an AI model on your local computer could mean waiting days, weeks or even months depending on the AI model. Because of this, you would also end up spending a lot of money on the electricity required to run your hardware.

It could also mean that you might need to spend around 66000 GBP/80000 USD to build an AI workstation with suitably powerful GPUs to train your model in a short enough time span.

Similarly, Web Developers can also greatly benefit from uploading their websites to a Cloud Server instead of trying to permanently host it on a local computer. While you could host your website on a local computer, there are a few key factors that could negatively impact the user experience when they visit your website.

These factors include:

- **Uptime** - You'll need to ensure your computer is powered on and has an Internet connection at all times.
- **Geolocation** - Users who are located further away from your location will experience longer load times due to higher latency.
- **Static IP Address** - In order to correctly configure the DNS for your website's domain name, you would need a static IP address. If you don't have one it will result in your website becoming unavailable every time your router is assigned a new IP by your ISP.
- **Performance** - While you don't need a cutting edge computer to run a website, your computer may begin to slow down if you try to perform other tasks while you're hosting a website with it. This could negatively impact the user's experience when they visit your website.
- **Bandwidth** - Not everyone has access to stable or fast Internet connections. If your upload and download speeds cannot meet the demands of your website's traffic for any reason, then your users will experience longer loading times, which will again lead to a poor experience for them.

These challenges are part of the reason why infrastructure as a service (IaaS) is being offered by multiple entities such as AWS, Microsoft Azure, DigitalOcean and many more.

Not only will the hardware be managed and maintained for you, but you will also be able to choose the geolocation of your server, assign it a static IP, scale your performance, and much more, with just a few simple clicks.

HOW TO CHOOSE THE RIGHT CLOUD SERVICE

Since we're primarily focused on Web Development, we will be looking into Cloud Providers that offer infrastructure as a service (IaaS), primarily those that allow us to host our own Web Server via a Virtual Machine on a Cloud Server. For this we will primarily be using DigitalOcean as an example, however, most of these principles will be applicable to nearly any Cloud Provider and their Virtual Machine Services, including AWS.

Rest assured, there is no "*right*" or "*wrong*" Cloud Service. However, there are a few important factors that you should consider.

One such important consideration is to ensure the service offers Cloud Servers with Virtual Machines that run a version of Linux you're comfortable working with.

If you're not familiar with Linux, don't worry; we'll soon be introducing Linux and looking into Ubuntu as well as how to use it in some more detail.

As such, if you do ever decide to use an alternative cloud service to DigitalOcean, like AWS, then it would be *recommended* to also create an **EC2** instance that's running **Ubuntu** since most of what we'll be covering will be equally applicable to your **EC2 instance**.

Don't let the terminology confuse you too much at this point. Just be aware that each cloud service has their own unique "*naming convention*" for their Cloud Services. In the case of DigitalOcean, everything has a more nautical theme, so their virtual machines are referred to as "**Droplets**". The **AWS** equivalent of a Droplet is an **EC2 instance**. (**EC2** is short for "**Elastic Compute Cloud**")

In both instances, your Web Server will still be a Virtual Machine that's been created with the respective Cloud Service that's running a version of Linux of your choosing. Keep in mind that while some Cloud Providers do also offer Virtual Machines that run Microsoft or Apple operating systems, those options are usually much more expensive because of their higher system requirements and are generally overkill if you're only trying to host a website of your own.

When choosing a **Cloud Provider** some of the following should be considered:

- Available Services
- Versatility of Services
- Cost of Services
- Cost of Support
- Potential free trials and limitations
- Compliance Frameworks and Certification
- Technologies, Data Security and Governance Policies
- Reliability and Performance of Cloud Services

Seeing "*Cost of Support*" as an item that should be considered might surprise some of you. However, some Cloud Services like AWS will charge you a subscription fee if you'd like to make use of their customer support. However, other Cloud Services like DigitalOcean offer customer support for no additional charge. On the other hand, AWS has more services available when compared to DigitalOcean such as SNS and SES for sending SMS notifications and Emails to your website users, so there are pros and cons to each different option.

There are also alternative Cloud-Based Services like **Mailgun** that will offer email delivery APIs along with various other tools needed to also send your users emails

or even create a subscription email list. It isn't a deal breaker when a Cloud Service like DiIgitalOcean or AWS doesn't offer a specific service – it all boils down to your use case, and what you need to do with the service. It's best to do thorough research into the costs involved and how robust the available services are. In the case of Mailgun some of the AWS users may also opt to use Mailgun over AWS' SES solution due to its greater versatility and offerings.

COST OPTIMISATION

Cost optimisation is an important consideration when using Cloud Services, especially for Web Development. As a Web Developer you want to run your websites as cheaply and efficiently as possible while presenting the best user experience possible.

Here are some basic concepts to keep in mind when trying to find the right balance between performance and cost:

Choosing the right instance type

Different Cloud Providers offer a range of instance types with varying specifications and prices.

As mentioned earlier a Virtual Machine running a Windows OS will almost always cost more than a Virtual Machine that's running a variant of Linux like Ubuntu because of the higher system requirements.

It's important to choose the instance type that best fits the workload you are running. For example, a Web Application with low traffic may not require a *high-powered instance*, while an application with heavy traffic may benefit from a larger instance. Choosing the right instance type can help you save on costs. Try to start small with the cheapest option and then scale up as needed.

Resource allocation

Cloud Providers allow users to allocate various resources to their instances. For example, you'll get to choose from a variety of CPU, memory, and storage options for your instance. Over-allocating resources can lead to unnecessary costs. It's important to monitor resource usage and adjust allocations as needed to avoid wasting resources and overspending. Again, it's better to start small, see how your website performs, and then scale up as needed.

Usage monitoring

Monitoring usage is an important part of cost optimisation. Cloud Providers offer a range of monitoring tools to help track of instance usage and identify areas where costs can be reduced. For example, you can monitor instance usage and automatically shut down idle instances, or use usage reports to identify underutilised resources. If you also notice that your Virtual Machine is being underutilised, you could also opt to scale down to help save costs.

Cloud cost management tools

Some Cloud Providers offer a range of cost management tools to help users optimise costs. For example, you can set budgets, use cost alerts, and view cost reports to identify cost savings opportunities.

WEB HOSTING WITH DIGITALOCEAN

After you've reviewed the cost and selected the best available option to meet your current needs, it's time to start hosting your website! With DigitalOcean this will mean setting up a new "Droplet".

Here are some key concepts and things to keep in mind as a new user:

Droplet Sizes

As mentioned earlier, this is important for limiting our budget.

- DigitalOcean offers a range of Droplet sizes with different specifications, such as CPU, memory, and storage.
- It's important to choose the right Droplet size based on your needs and budget.

For this learning Task, we will opt for the most affordable option, as we won't need anything more for now.

Operating Systems

DigitalOcean offers a variety of operating systems to choose from, including Linux distributions and FreeBSD. It's important to choose an operating system that is compatible with your application and that you are comfortable working with. For our examples moving forward, we will be mostly focused on Ubuntu, as this is the operating system that's currently most widely used for Web Hosting.

SSH

Secure Shell (SSH) is a secure way to remotely access your Droplet or other Virtual Machines you are hosting with Cloud Providers. It's usually important to generate an **SSH Key Pair** and securely store your private key. DigitalOcean offers a web-based console for accessing your Droplet if you don't have an SSH client installed on your computer. In this task you won't need to set up a key pair, instead we'll be using the web-based console instead.

DigitalOcean is not the only Cloud Provider with web-based consoles, which are most commonly needed if SSH is disabled on the Virtual Machine for any reason. This will also help keep our Web Server more secure as nobody will be able to access it unless our DigitalOcean account itself is compromised.

Networking

DigitalOcean offers various networking features, such as floating IPs, private networking, and load balancers. It's important to configure your networking settings to ensure that your application is accessible and secure. For now, we won't need to make use of any of these services, but you may need to consider using load balancers and a static ip address for any professional sites that you plan on making publically available. Keep in mind that these may come at an additional cost.

Backups and snapshots

It's important to regularly back up your Droplet to prevent data loss. DigitalOcean offers automated backups and the ability to create snapshots, which are like images of your Droplet at a specific point in time. Keep in mind these will also come at an additional cost and should not be used for any of the tasks during this bootcamp.

Security

Security is a critical consideration when using a Virtual Server. DigitalOcean offers various security features, such as firewalls, two-factor authentication, and SSH Key Management. Make sure to never share your login details or any other information that might grant someone access to your DigitalOcean account!

Community

DigitalOcean has a large community of developers who share knowledge and resources. It's important to leverage the community to learn best practices and troubleshoot issues. You can also contact their support channel if you run into any issues with your project along the way. Currently, DigitalOcean offers customer support services at no additional cost.

These are just a few key concepts to keep in mind when using DigitalOcean droplets. DigitalOcean, similar to providers like AWS, offers a range of resources, including tutorials and documentation, to help new users get started.

We recommend that you always review the appropriate tutorials and documentation when making use of any of these services to ensure you not only utilise them properly, but also so you can ensure you know how to mitigate any unnecessary costs that might come with such services.

Compulsory Task

Follow these steps:

- Create a new text file called "**answers.txt**" and note down your answers to the following items inside it.
- Find at least 2 **Cloud Providers** (excluding **AWS** and **DigitalOcean**) and list their Virtual Machine Services and what they call their services (for example, as explained earlier, virtual machines with DigitalOcean are called "Droplets").
- List any three additional services provided by any **Cloud Provider** that may be useful for **Web Development**, along with reasons why each would be useful.
- List at least 3 challenges you might face as a web developer if you were to host your own web server at home, along with reasons why they would be a challenge.
- List at least 3 benefits of using Cloud Providers to host a website.
- Explain how you can ensure you don't go beyond your budget when using a Cloud Service.

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