## LESSON: Cloud Fundamentals and Core Cloud Services​

## Primer This is the beginning of the Cloud Course (1 of 2), and instructors should ensure they practice the EC2 instance Creation Lab. If the instructor uses a MacBook, please download the RDP client application before the class and be prepared to help other students use a MacBook.

## For this lesson and upcoming lessons, instructors are required to ensure the following activities are completed for each lesson

* Check-in with the students to see if they have any questions or need further clarification from any subject from the last class and self-study module.
* Review the “Lesson Opener” and “Real World Scenario” with the learners prior to starting the module.
* Throughout the module, you will find “Consider the Real World Scenario” slides. Review the questions found on these slides, tie the concepts back to the scenario discussed at the start of the lesson as well as content you are presenting, and encourage the learners to share their thoughts.
* For each lesson, you will find a “Pulse Check” slide which is the opportunity for instructors to open a poll to gather feedback from the learners. Leave the poll open for about 1 minute and after you close the poll, share the results with the learners. Encourage the learners to share their thoughts. This information will help the instructors as well as the learners better understand where they are with regards to the lesson.
* Labs are to be demonstrated live for each module. The demonstration and student engagements of the labs are the top priority for the lead instructor. While demonstrating each lab, encourage students to participate and explore.
* At the end of each lesson, it is important to take a few minutes to review the key concepts for the lesson, provide guidance on what the learners can do to prepare for the next lesson, and wrap up with Q&A.
* Instructors should manage breaks based on need, considering both timing and duration. You may take a break if you feel the students need it or if a particularly challenging topic has just been covered.

### Summary

In this lesson, learners will explore the fundamental concepts of cloud computing, a technology that offers accessible and scalable computing resources over the internet. They will understand the advantages of adopting cloud computing, including scalability, cost-effectiveness, flexibility, accessibility, backup and recovery, and enhanced security. Learners will discover how clouds can be categorized based on deployment models, such as private and public Clouds, and they will delve into the different service models: IaaS, PaaS, and SaaS, each providing varying levels of control and management. Additionally, learners will gain insights into the dynamics of security responsibilities in cloud migrations, understanding how these responsibilities shift between the company and the cloud provider. They will explore the shared responsibility model, which outlines the security, compliance, and management responsibilities between cloud service providers and users. Furthermore, this lesson covers the practical aspects of AWS (Amazon Web Services), introducing learners to the AWS Free Tier accounts and guiding them through the registration process, including identity verification and payment information. Learners will also learn about Amazon Machine Images (AMIs) and their role in launching EC2 instances. Finally, learners will discover the extensive personalization options offered by Amazon, allowing them to specify hardware attributes, enhance performance measures, and establish stringent security protocols. They will also explore the two primary methods for remote access to an EC2 instance: SSH, suitable for inconsistent internet conditions, and RDP, ideal for Windows systems with a stable connection.

### Objectives

* Define cloud computing.
* Recognize the importance of Amazon Web Services (AWS) within cloud infrastructure services.
* Explain the development and progress of cloud services throughout the years.
* Analyze the benefits and drawbacks of cloud computing.
* Compare and contrast between different types of clouds based on their deployment and service models.
* Define and illustrate the shared responsibility model used in cloud security.
* Identify the various types of regulations and standards for cloud users and providers.
* Set up an AWS account.
* Define Amazon Elastic Compute Cloud (EC2).
* Identify and illustrate the different Amazon EC2 settings and options.
* Practice launching an EC2 instance.

### Lesson Activities and Teaching Strategies

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| Estimated Time | Lesson Portion | Directions |
| 2 min | **Lesson Opener:**  Cloud Fundamentals and Core Cloud Services​ | * Introduce learners to the importance of cloud fundamentals and core cloud services​ in cybersecurity. |
| 5 min | **Real World Scenario:**  Cloud Fundamentals and Core Cloud Services​ | * Review the real world scenario challenge and inform learners that you will be constantly coming back to this scenario throughout the lesson to discover how to solve and apply concepts to this real situation. |
| 2 min | **Lesson Companion Review:**  Cloud Fundamentals and Core Cloud Services | * Review the lesson companion, and inform learners that you will be constantly coming back to this scenario throughout the lesson to discover how to solve and apply concepts to this real situation. |
| 20 min | **Cyber Uncovered:**  Cloud Fundamentals | * Begin by explaining the concept of cloud computing as a means to access computing resources over the internet. * Mention the historical origins of the term "cloud" in network diagrams. * Describe the specific focus of cloud computing in providing services over remote servers. Share the widely accepted NIST definition of cloud computing for clarity. * Teach the evolution of cloud computing from the 1960s concept of global interconnection to the modern era with virtualization technologies. * Highlight Amazon's pivotal role in the development of cloud computing. * Discuss the challenges Amazon faced as it expanded its product lines and the need for a shared infrastructure layer. * Explain how AWS became one of the pioneering cloud service providers (CSPs). * Outline key milestones in the development of cloud services, including Amazon's SQS, EC2, and S3, as well as the emergence of other providers like Google and Microsoft. * Emphasize the continuous expansion of services and tools offered by major cloud providers. * Explore the advantages of cloud computing, such as scalability, cost-effectiveness, flexibility, accessibility, backup/recovery, and security. Provide a relatable real world analogy to illustrate the concept. * Discuss potential drawbacks, such as hidden costs, limited control, internet dependency, exposure to attacks, information security, and platform vulnerabilities. * Explain the two main aspects used to differentiate between cloud services: Deployment models and service models. Introduce deployment models, including private cloud and public cloud, and briefly mention community and hybrid clouds. * Describe CSPs in relation to organizations offering cloud computing resources and mention the most common providers: AWS, Microsoft Azure, and Google Cloud Platform. * Provide a brief overview of each CSP. * Explain the service models: IaaS, PaaS, SaaS, and FaaS, and how they determine the responsibilities of clients and cloud providers. * List common IaaS options (compute, storage, networking) and PaaS options (application hosting, databases, analytics and big data). * Highlight the services offered by major cloud providers in these categories. * Describe SaaS as a model for delivering software applications over the internet. * Mention examples of popular SaaS applications, such as Google Workspace and Microsoft Office 365. * Be prepared to discuss the implication of the real world scenario presented at the beginning of class on Fundamentals. |
| 5 | **Real World Scenario:**  Cloud Fundamentals | * Review the real world scenario challenge and inform learners that you will be constantly coming back to this scenario throughout the lesson to discover how to solve and apply concepts to this real situation. |
| **5 min Break** | | |
| 20 min | **Cyber Uncovered:**  Cloud Security and Account Setup | * Begin by introducing the concept of security in cloud computing and explain how security responsibilities shift when a company migrates to the cloud. Emphasize that cloud providers offer security solutions for defending services. * Introduce the shared responsibility model as a framework in cloud computing and provide examples on how to vary based on the service model such as IaaS, PaaS, SaaS, etc. * Explain its purpose in delineating responsibilities between cloud service providers (CSPs) and cloud users, specifically in terms of security, compliance, and management. * Provide an example of a security responsibility that cloud providers handle, such as DDoS protection. * Explain what DDoS attacks are and why they are a concern for web applications and cloud-hosted services. * Discuss an example of user responsibility, like identity and access management (IAM). Describe what IAM is, its role in controlling user identity and access, and why it's important for limiting low-level user actions. * Transition to cloud regulations and standards, explaining that they are not unique to the cloud and vary across fields. * Introduce the concept of setting requirements for organizations. * Detail regulations and standards for cloud users, including GDPR, PCI-DSS, and HIPAA. * Explain the purpose and significance of each regulation. * Describe regulations and standards for cloud providers, such as the EU Cloud Code of Conduct (CoC), ISO 27017, and ISO 27018. * Explain how these standards focus on cloud providers and set requirements for a secure cloud environment. * Discuss the practical aspects of AWS accounts and registration. * Mention that the lesson will explain the account creation process without requiring students to create dedicated accounts. * Explain the AWS Free Tier and its purpose for familiarizing users with AWS services. * Mention the types of offers available and their durations. * Address the importance of the personal account warning, emphasizing that setting up a personal account is not mandatory for course completion and that any associated payments are not the institution's responsibility. * Walk through the AWS registration process step by step, starting from accessing the registration page via the "Create an AWS Account" button. * Explain the process of user creation within AWS, including email verification and the importance of a strong root user password. * Cover the account setup step, specifically the "Personal" option for providing contact information. * Discuss the payment information step and the $1 charge for card verification. * Explain the identity verification step, highlighting the use of SMS or an audio call for verification. * Conclude by discussing the selection of a support plan, with a focus on "Basic support – Free," and completing the registration process. * Mention that once registration is complete, students can sign in to their new AWS account and access the AWS Management Console. * Be prepared to discuss the implication of the real world scenario presented at the beginning of class on Account Security and Set Up. |
| 5 | **Pulse Check** | * Before you launch the pulse check, explain each section clearly, and encourage the learners to participate in the survey. * After administering the survey, share the poll results with learners and ask learners to provide feedback * Encourage learners to attend office hours with the associate instructor. |
| **5 min Break** | | |
| 20 min | **Cyber Uncovered:**  Managing EC2 Instances | * Begin by introducing Amazon Elastic Compute Cloud (EC2) as Amazon's computing service that allows users to rent hardware to run virtual machines (VMs). * Emphasize that EC2 instances are a fundamental component of cloud computing. * Explain the concept of Amazon Machine Images (AMI) and how they are used to configure virtual machines within EC2. Mention that AMIs include pre-configured OS images and applications. * Discuss the process of accessing EC2 through the AWS Management Console. * Highlight the significance of the "Launch a virtual machine" button. * Describe the importance of AMI selection and how it influences the configuration of EC2 instances. * Mention that AWS provides a wide range of AMIs for different operating systems and applications. * Introduce EC2's advanced options with an emphasis on the customization capabilities, such as memory, storage, and performance features like EBS-optimized placement groups. * Explain that security and access management tools can also be set up during instance creation. * Explain the process of launching EC2 instances. Emphasize that if advanced options are not configured manually, they will be set by default. * Walk through the steps involved and mention that further advanced options will be explored in subsequent slides. * Introduce EC2 instance types as the defining factor for virtualized hardware assignment. * Explain that some instance types are available for free as part of the Free Tier, while others require payment based on usage. * Mention that both basic and advanced options can be utilized. * Discuss remote access options for EC2 instances, including Secure Shell (SSH) and Remote Desktop Protocol (RDP). * Highlight SSH as the preferable option and explain the key pair authentication process for SSH access. * Explain RDP as an alternative remote access protocol, particularly suitable for Windows instances. * Describe the steps involved in setting up RDP access and mention its dependency on a stable network connection. * Conclude by discussing the RDP remote access process, emphasizing that not all AMIs support RDP. Mention that students should be aware of the availability and suitability of these options when working with EC2 instances. * Be prepared to discuss the implication of the real world scenario presented at the beginning of class on Managing EC2 Instances. |
| 20 min | **Lab:**  EC2 Instances | * Remind learners to use this lab to practice and apply the concepts they have learned throughout the day. * Learners will receive direct feedback on their lab to properly assess their knowledge and determine where they might need additional assistance. * Before prepared to share your entire desktop as you will be downloading the key to obtain the Windows RDP password * For learners that have a MacBook, ensure that they download “Microsoft Remote Desktop” app from the AppStore to establish RDP from the MacBook to AWS Windows EC2 instance via RDP |
| 15 min | **Lesson Closure** | * Encourage learners to read ahead of time * Provide learners additional resources to read / practice and assign homework (e.g., future labs) before you demonstrate the labs during the next class * Spend some time to highlight what are the key takeaways from today’s lesson * Important topics covered during the class includes   + Definition of Cloud Computing   + An overview of AWS Cloud Services   + Advantages and disadvantages of Cloud Services   + Key takeaway regarding Deployment and Service Models   + Highlight the big 3 Cloud Service Providers (AWS, Microsoft and GCP)   + Provide the key takeaway with respect to security in the Cloud   + Highlight the main goal of Share Responsibilities Models   + Provide the key takeaway for the main Cloud regulations   + Mention that the AWS has Free Tier Account and provide a high-level overview discussed in the class   + Provide the key takeaway for EC2 instance deployment, and recap on the Windows deployment in the lab and access via RDP |
|  | **Add Additional Time Filler** | * Review using Kahoot or other similar platforms * Conduct interview preparation conversations * Continue discussions on real-world scenarios * Demonstrate how to create users in Linux and grant them permissions * Discuss different career paths in cybersecurity and highlight the roles that require Linux skills |

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