**EC2 - Elastic Compute Cloud Learning Material**

**1. EC2 Service Introduction**  
Amazon Elastic Compute Cloud (EC2) provides scalable computing capacity in the AWS cloud. EC2 allows users to rent virtual servers (instances) to run their applications, websites, or databases. With EC2, you can choose the instance type, operating system, and storage that fits your needs.

**Key Benefits of EC2**:

* **Scalable**: Easily scale your computing capacity up or down based on demand.
* **Cost-Effective**: Pay only for the compute resources you use.
* **Flexible**: Multiple instance types, storage options, and networking configurations are available.

**2. Understanding Basic EC2 Service**  
The core of EC2 is the ability to launch and manage virtual servers. Key elements of EC2 include:

* **Instances**: Virtual servers running your applications.
* **Elastic IP**: Static IP address for reliable access to your instances.
* **Elastic Load Balancing (ELB)**: Distributes incoming traffic across multiple instances for high availability.
* **Security Groups**: Firewalls to control traffic to your instances.
* **Key Pairs**: Secure login credentials (private key for SSH access).

**3. Key Features of EC2 Instances**  
Here are some important features of EC2 instances:

* **Customizable**: Choose instance types based on CPU, memory, and storage needs.
* **Operating System Options**: Run Linux, Windows, and other operating systems.
* **Elastic IPs**: Attach static IPs to your instances for reliable access.
* **Auto Scaling**: Automatically adjust the number of instances based on load or traffic.
* **Amazon Machine Images (AMIs)**: Pre-configured software templates to quickly launch instances.

**4. Types of EC2 Instances**  
AWS provides a variety of instance types to meet different needs:

* **General Purpose**: Balanced CPU, memory, and networking.  
  Example: T3, M5, M6g
* **Compute Optimized**: High CPU power for compute-intensive tasks.  
  Example: C5, C6g
* **Memory Optimized**: High RAM capacity for memory-intensive workloads.  
  Example: R5, X1e
* **Storage Optimized**: High storage throughput for large data needs.  
  Example: I3, D2
* **Accelerated Computing**: Instances with GPUs for tasks like machine learning.  
  Example: P3, G4

**5. Instance Connection Methods**  
You can connect to EC2 instances in different ways based on the operating system:

* **Linux Instances**:  
  Use **SSH** (Secure Shell) to connect via the terminal. Example:
* ssh -i /path/to/your-key.pem ec2-user@<public-ip-address>
* **Windows Instances**:  
  Use **RDP** (Remote Desktop Protocol) to connect. Retrieve the administrator password and connect with an RDP client (like Windows Remote Desktop).

**6. EC2 Instance Creation (Linux Machine)**  
To create a Linux EC2 instance:

1. **Log in to AWS Management Console** and navigate to EC2.
2. **Click “Launch Instance”**.
3. **Choose AMI**: Select a Linux AMI (Amazon Linux 2, Ubuntu, etc.).
4. **Choose Instance Type**: Select an instance (e.g., t2.micro for free-tier).
5. **Configure Instance**: Set the network, security, and storage options.
6. **Create a Key Pair**: Select or create a key pair for SSH access.
7. **Launch**: Start the instance.

**7. EC2 Instance Creation (Windows Machine)**  
To create a Windows EC2 instance:

1. **Log in to AWS Management Console** and go to EC2.
2. **Click “Launch Instance”**.
3. **Choose AMI**: Select a Windows AMI (e.g., Windows Server 2019).
4. **Choose Instance Type**: Select instance type like t2.micro.
5. **Configure Instance**: Set network and security settings.
6. **Create a Key Pair**: Select or create a key pair for RDP login.
7. **Launch**: Start the instance and use RDP to connect.

**8. Pricing Options for EC2**  
EC2 offers various pricing models that allow you to optimize costs based on your usage:

* **On-Demand Instances**:  
  Pay for compute capacity by the second or hour with no long-term commitments.   
  *Example*: $0.0116 per hour for a t2.micro instance in the US East region.
* **Reserved Instances**:  
  Reserve instances for 1 or 3 years and get a significant discount (up to 75%). Best for steady-state workloads.  
  *Example*: A t3.micro instance reserved for 1 year can cost around $35 annually.
* **Spot Instances**:  
  Purchase unused EC2 capacity at a lower price (up to 90% off). However, spot instances can be terminated with little notice if the capacity is needed elsewhere.  
  *Example*: Spot prices can be as low as $0.0025 per hour.
* **Savings Plans**:  
  Commit to a certain amount of usage over 1 or 3 years in exchange for discounted prices. You can choose a flexible plan where you pay for the compute usage, but can switch instance types.
* **Free Tier**:  
  AWS offers a free tier with up to 750 hours per month of t2.micro or t3.micro instances for 12 months for new users.

**9. Hands-On: EC2 Instance Creation**  
For hands-on learning, students will:

1. **Launch a Linux EC2 instance** and SSH into it.
2. **Launch a Windows EC2 instance** and RDP into it.
3. **Create a custom Security Group**: Learn how to add firewall rules.
4. **Explore EC2 Dashboard**: View instance details, monitor performance, and configure auto scaling.
5. **Terminate Instances**: Learn to properly stop or terminate instances when done.

**10. Additional Features of EC2**

* **Elastic Load Balancing (ELB)**: Distribute incoming traffic across multiple EC2 instances to ensure high availability.
* **Auto Scaling**: Automatically adjust the number of EC2 instances to handle fluctuations in traffic or workload.
* **Elastic Block Store (EBS)**: Persistent storage for your EC2 instances that remains intact even after the instance is stopped or terminated.
* **CloudWatch**: Monitor EC2 instances and other AWS resources in real-time to track performance metrics.