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**Math and Computer Science**

**MCS- 7013 – Collaborative Research Project**

**Cloud Security and Multi-Cloud Environments**

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**One-Page Proposal: Enhancing Security and Traffic Management in Multi-Cloud Environments**

**Objective:**

This project aims to design a secure, scalable, and optimized multi-cloud architecture leveraging AWS and Azure. The focus is on addressing security challenges, enabling secure cross-cloud connectivity, managing network traffic, and proactively monitoring and mitigating threats to ensure compliance with cloud security best practices.

**Approach:**

1. **Infrastructure Setup and Traffic Management:**
   * Create isolated environments using **AWS VPC** and **Azure VNet**, connected via secure VPN or Direct Connect.
   * Deploy **Aviatrix** to establish a secure and scalable network connection between AWS and Azure, simplifying cross-cloud communication.
   * Use **AWS Load Balancers** and **Azure Load Balancers** to manage and distribute traffic efficiently.
   * Simulate network traffic using tools like **Apache Benchmark (ab)**, **Iperf**, and **hping3** for HTTP/HTTPS requests and TCP/UDP throughput testing.
2. **Security Implementation:**
   * Implement **IAM (AWS)** and **RBAC (Azure)** for role-based access control.
   * Enable **AWS GuardDuty** and **Azure Security Center** for threat detection and security posture management.
   * Apply encryption for data in transit and at rest using **AWS KMS** and **Azure Key Vault**.
3. **Monitoring and Logging:**
   * Centralize log aggregation using **Splunk** for unified visibility across AWS and Azure.
   * Use **CloudWatch** (AWS) and **Azure Monitor** to track performance and detect anomalies.
   * Enable **VPC Flow Logs** (AWS) and **Network Watcher** (Azure) for network traffic analysis.
4. **Penetration Testing and Vulnerability Assessment:**
   * Perform penetration testing using **PACU** for AWS and general-purpose tools like **Metasploit**.
   * Conduct vulnerability scanning with **Nessus** to identify and remediate security gaps.
5. **Automation and Incident Response:**
   * Automate incident response using **AWS Lambda** and **Azure Automation**, such as isolating compromised resources or revoking access.
   * Configure compliance checks and real-time alerts for suspicious activities.

**Expected Outcomes:**

* **Enhanced Security:** Robust cross-cloud security through IAM, RBAC, and threat detection.
* **Optimized Performance:** Efficient traffic flow and load balancing across AWS and Azure.
* **Proactive Monitoring:** Real-time visibility into security threats and network performance.
* **Compliance Assurance:** Automated compliance checks for industry standards like GDPR and ISO 27001.
* **Scalable Networking:** Secure, scalable multi-cloud connectivity enabled by Aviatrix.

**Tools and Technologies:**

**AWS (VPC, CloudWatch, GuardDuty, Lambda, Security Hub)**, **Azure (VNet, Monitor, Security Center, Automation)**, **Aviatrix**, **Splunk**, **Apache Benchmark**, **Iperf**, **hping3**, **PACU**, **Nessus**, **Terraform**.

**References:**

1. Amazon Web Services. (n.d.). AWS Security Best Practices. Retrieved from <https://aws.amazon.com/security/>
2. Microsoft Azure Documentation. (n.d.). Azure Security Best Practices. Retrieved from <https://learn.microsoft.com/en-us/azure/security/>
3. Rhino Security Labs. (n.d.). PACU: AWS Exploitation Framework. Retrieved from <https://github.com/RhinoSecurityLabs/pacu>
4. Aviatrix Documentation. (n.d.). Secure Multi-Cloud Networking. Retrieved from <https://aviatrix.com/>
5. Nessus Vulnerability Scanner. (n.d.). Retrieved from <https://www.tenable.com/products/nessus>