CSCI 5902 Advanced Cloud Architecting (Fall 2023)
Assignment 4 – Networking

Scenario:

Cupid, a global dating application similar to Tinder, has over 50 million active users across the world. It operates on a hybrid model, employing both on-premises servers and AWS Cloud.

One of the critical components of Cupid's architecture is its recommendation system. The system, based on a machine learning model developed over the years, still runs on the on-premise infrastructure in Atlanta, Georgia, USA. It uses sophisticated algorithms to find potential matches based on users' interests, geographical location, and online activity patterns.

Cupid's architecture comprises several key services: User Profile Service (UPS) that manages profiles and sensitive user information; a Matching Engine that uses machine learning to match users; the Messaging Platform for in-app communications; and an Image Processing Service (IPS) to manage high-resolution images uploaded by the users.

Cupid faces several challenges:

1. Network complexity: As the application's popularity continues to grow globally, the network infrastructure becomes increasingly intricate and challenging to manage.
2. Security: Cupid has to comply with data privacy laws like GDPR in Europe, CCPA in California, and PDPA in Singapore. They need to ensure sensitive user data is encrypted both in-transit and at-rest. They also need to enhance the security of the application at every single layer.
3. Scalability: The architecture needs to handle significant usage spikes on occasions like Valentine's Day and New Year's Eve.
4. Hybrid Communication: There needs to be a secure and efficient communication setup between the on-premises system and AWS Cloud across different regions.

Tasks (Total marks: 10):

My friend Shay, an AWS certified cloud practitioner who's just started learning about cloud architecting, has made some decisions on how to address these challenges. Your task is to evaluate these decisions. If you think Shay's decision is correct, explain why you believe it's the right choice. If you think it's incorrect, point out the issue, and suggest a better approach.

Shay’s Architectural decisions:

1. To handle outbound internet connectivity from the private subnets, I propose deploying a NAT Gateway in every subnet in all VPCs globally. (2 marks)

2. Given that we have multiple AWS regions in use, I suggest creating a fully meshed VPC peering setup for all VPCs in each region. (2 marks)

3. To ensure the security of our sensitive user data, I propose encrypting all traffic in-transit within our VPCs using IPsec tunnels. (1 mark)

4. I propose using the same NACLs for all our subnets to maintain a consistent security posture. (1 mark)

5. To enable secure access to user profile from the VPCs, I propose using public APIs which is very convenient. (2 marks)

6. I wanted to use transit gateway to centrally route the traffic. However, since transit gateway cannot be connected to the on-premise network, I will have a mix of VPC peering and Direct Connect or VPN connection to the on-premise network. (2 marks)

How to do this assignment?
To complete this assignment, start by thoroughly reading and understanding the scenarios and challenges presented in each iteration. Write a detailed response for each challenge, explaining how your proposed architectural decisions cater to the challenge's needs and your rationale behind those decisions. Once you have completed all the questions, compile your responses into a single PDF file. Submit this PDF on Brightspace by the due date.

Academic Standards:
The assignment must adhere to academic standards, including proper citation and referencing of sources, adherence to academic writing standards, and originality of work. Plagiarism or any form of academic misconduct is not tolerated and may result in an academic integrity offense. The report must demonstrate a thorough understanding of the concepts and storage services used and must be original work. It should be well-organized, clear, concise, and free of errors in grammar and spelling.

FAQ:
Q: How many pages should the report be?
A: There is no specific page requirement, but the report should be long enough to address all the assignment questions thoroughly and clearly.

Q: Can I use external sources to support my report?
A: Yes, you may use external sources such as research papers, articles, or official documentation from cloud providers to support your report. However, you should ensure that all sources are properly cited and referenced in the report to avoid plagiarism.

Q: What citation and reference format should I use for the assignment?
A: You should use either the APA or IEEE citation and reference format.

Q: Is there any specific format for the assignment report?
A: No, there is no specific format, but make sure that your report is well-organized, properly formatted, and easy to read and understand, as this will help the marker to evaluate your work more effectively.

For any other questions or concerns, reach out to the course TA.

Good luck :)