

## **CSC547 Homework Assignment #1**

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*(Questions Answered - 1.1, 1.3, 1.4, 1.8, 1.13, 1.14)*

**Problem 1.1.** Cloud definitions. Consider the NIST, Amazon and Microsoft definitions of cloud computing mentioned in Section 1.1, page 1.

1. The Amazon and Microsoft definitions mention the Internet as the delivery medium. Is this necessary?
2. The NIST definition mentions a shared pool of resources. Provide examples of entities who can share. Do you see any tradeoffs in sharing?
3. The NIST definition mentions minimal management effort. Which entity sees its effort reduced? Since "there is no free lunch in engineering", is there another entity whose management effort increases?

### **Solution 1.1**

1. The first question deals with answering the question of whether or not the Internet as a medium is necessary. In my opinion, I believe that connectivity to the internet is required as a medium of distribution for Cloud services. According to the National Institute of Standards and Technology, "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) ...." This implies that cloud computing only requires "on-demand network access," and that the cloud user can connect to the cloud provider via several channels other than the public internet. Assume that if a cloud consumer is not connected to any network and want to access computing resources, these resources must be physically present in his location. If this is the case, these resources can only be used by that one cloud customer, which breaches the rule on shared pooling resources. Furthermore, if not in-house, the management team will only be able to work on controlling these resources at the consumer end, which violates the minimal manageability principle. This means that a user cannot access cloud computing services if he or she is not connected to the internet.
2. According to the NIST definition, resource pooling is the pooling of resources among multiple cloud customers. These can be various business instances. UNCC and NCSU can share compute resources dynamically, with different physical and virtual resources dynamically assigned and reassigned based on customer demand. The tradeoffs may include an increase in the risk of cloud security vulnerabilities such as data theft and denial of service attacks caused by inadequately configured security tools or the use of unsecured third-party applications. Another such trade off involves the potential for conflicting resource requirements between multiple users. While resource pooling and dynamic allocation provide scalability and cost benefits, the problem is managing possible conflicts that develop when users with various and often conflicting needs share the same resource pool. In the design and maintenance of multi-user cloud environments, striking the correct balance between resource fairness and performance efficiency is critical.
3. Clients of cloud services observe a reduction in their efforts - they are the entities who have "minimal management efforts." The cloud service provider's management effort increases since they must handle fluctuating computation power based on consumption, handling security, producing a backup in case of failure, privacy, physical resource allocation, and so on. However, in the larger scheme of things, using a single cloud service provider to manage the effort for multiple cloud users reduces the work for all

parties, including ourselves. When clients choose a single cloud service provider, they benefit from the provider's specialty, economies of scale, shared resources, knowledge, and consolidated management. This reduction in duplication of effort and more efficient resource use results in less overall effort for all parties involved - clients and cloud service providers.

**Problem 1.3:** Consider Example 1.2, page 4. Is this an example of cloud computing? If yes, according to which definition?

**Solution 1.3:**

We feel that computing Pi's 1,000,000,000,000,060th digit is not an example of cloud computing. This, we feel, conforms to the definition of grid computing as stated in the reference textbook section 1.1.7, "Grid computing." *"Grid computing. A form of distributed and parallel computing, whereby a 'super and virtual computer' is composed of a cluster of networked, loosely coupled computers acting in concert to perform very large tasks".*

- There are no exclusive "service providers" in this scenario, as needed by the NIST definition of cloud computing, because "personal" machines are employed for this calculation. There is no second entity involved in resource management.
- We do not have on-demand scalability because we have a fixed amount of systems that may or may not be available at all times.
- Grid computing links together devices to pursue a common purpose, such as performing one task that's related to the goal of calculating the digits of pi.

**Problem 1.4.** Actors in the ecosystem. Give an example (different from the one we presented in the notes or discussed in class) of:

1. A cloud consumer.
2. A cloud provider.
3. A cloud carrier - google the term "Sprint cloud services", for example.

**Solution 1.4**

1. Dell Technologies (Uses PaaS solutions to build and deploy in-house business tools)
2. Nutanix (Provides a hybrid multicloud for the ease of consumption by users)
3. Megaport (Carrier that helps connect to Microsoft Azure)

**Problem 1.8.** Cloud architect skills. Read reference [9]. It describes "Top 10 MustHave Skills for Successful Cloud Computing Career in 2021" as well as eight additional technical plus "soft" skills.

1. Identify the skills that are pertinent for the architect role.
2. In your opinion, which skill is the most important? Why?
3. In your opinion, which skill is the least important? Why?

**Solution 1.8**

1. Based on the skills listed in reference [9]: "Top 10 MustHave Skills for Successful Cloud Computing Career in 2021", we believe that the skills pertinent towards playing a crucial role of cloud architect can be categorized as "technical" and "soft" skills. Based on these, we can categorize the skills mentioned in the article as follows:

- A. Soft skills: These skills, when honed, can play a critical role in translating requirements and designing robust, accurate, and well-structured solutions. The following are some such skills mentioned in the article:

- a. Collaboration : Effectively communicate with multiple stakeholders to build robust solutions
  - b. Business management skills : Ability to communicate, lead, strategise, solve problems, negotiate, and much more
  - c. Project management skills : Ability to manage design, development and implementation of said architectures along with a team of technical contributors
  - d. Skills to handle ad-hoc requests and agile projects : Ability to integrate new trends and changing requirements seamlessly
- B. Technical skills: These skills play an important role in augmenting the design decisions to build architectures and choose the most appropriate elements within infrastructures, network, and services. The following are some skills mentioned in the article:
- a. Multi Cloud Environments management : Ability to understand multiple cloud services to design an effective cloud architecture
  - b. Analytics : Ability to gather, analyze, and convert data generated from multiple sources into meaningful insights and action items
  - c. Linux : Having knowledge of operating systems to best suit any design
  - d. Programming and Coding : Ability to write code in one or more programming languages for cloud native development
  - e. DevOps : Knowledge of operations for software development lifecycles
  - f. Problem-solving skills : Being able to analyze and logically propose solutions to old and new problems

2. We believe that collaboration is the most important skill needed. A cloud architect plays a pivotal role in laying down designs for solutions meant to meet important business goals. In the process, the architect has to ensure they communicate effectively with the business stakeholders, the application developers, and the DevOps engineers. Being able to collaborate with each of these distinct groups of individuals is necessary as it would ensure accuracy of the final product. Failing to collaborate with any of these groups could lead to a faulty design which subsequently leads to systems behaving unexpectedly, unhappy customers, and more.

3. We think the least important skill would be programming and writing code. An architect can champion translating business requirements into logical technical requirements. These technical requirements can subsequently be picked by software engineers and other technical members of the team to be implemented as software code. Having some background knowledge of these programming languages can help architects tailor their designs better for each requirement, however the implementation and coding can be delegated.

**Problem 1.13:** Cloud Computing Certifications, Architect role. Read reference [9]. It mentions several industry certifications that are available in the cloud computing space (the analogs of Cisco Certifications in the networking space). In this problem, we'll narrow the list to the "big three" cloud providers. (More on these providers in Section 3.4.1, page 58.) Consider the Cloud architect role. 1. Find information on the AWS certification exams. Supply a summary. 2. Repeat for Google Cloud. 3. Repeat for Microsoft Azure.

**Solution 1.13:**

- AWS Certified Solutions Architect:
  - Candidates for the AWS Certified Solutions Architect certification must have at least one year of hands-on expertise with various AWS technologies such as networking, databases, computing, deployment, and management. The

certification requires skill in deploying, managing, and operating AWS workloads, as well as applying security measures and maintaining AWS compliance. Candidates should be comfortable with the AWS CLI and management console, as well as have a thorough understanding of AWS's worldwide architecture and services.

- The certification stresses the ability to match AWS services to specific technical requirements, successfully mapping them to meet a variety of objectives. Passing the test provides candidates with in-depth knowledge of numerous AWS services and their interaction to create comprehensive solutions.
- Individuals who become certified gain the ability to create secure, efficient, and cost-effective cloud solutions for clients, as well as analyze and suggest changes to current infrastructure. The exam itself consists of 65 multiple-choice and multiple-response questions to be completed in 130 minutes. The exam, which is available in various languages, can be taken in testing centers or through online proctoring for a charge of \$150.
- Google Professional Cloud Architect:
  - To obtain the Google Professional Cloud Architect certification, you must have 3+ years of industry experience and at least 1 year of hands-on experience with Google Cloud Platform (GCP).
  - Once the exam is passed, certification demonstrates an individual's competence to enable their organization to fully utilize the Google Cloud Platform. This necessitates a thorough understanding of cloud solution design, strategic thinking, and adherence to architectural best practices. Certified professionals learn how to design long-term, secure, robust, scalable, and highly available cloud systems.
  - The exam, which lasts 120 minutes, costs \$200 and requires renewal over time to remain valid.
  - It has multiple-choice and multiple-select question types and is available in both English and Japanese. Individuals can take the exam remotely or in person at an authorized test location.
- Microsoft Azure Solutions Architect Expert:
  - The Microsoft Azure Solutions Architect Expert certification requires knowledge of cloud solution architecture in the Microsoft Azure environment. This includes a broad range of IT operations such as virtualization, networking, security, identity and access management, data governance, and business continuity.
  - Individuals who pass the test get the ability to translate business objectives into technological designs that are specifically designed for Microsoft Azure products.
  - Furthermore, the certification stresses the ability to effectively cooperate with persons with varied technological backgrounds, resulting in the production of meaningful cloud solutions. The exam, which is available in many languages, costs \$165.

**Problem 1.14.** Job advertisements. Search for job advertisements. Create a list of technical as well as non-technical skills you find in these advertisements. You can use your own source in addition to the following two.

1. Cloud providers; an example is Google Cloud Platform: <https://careers.google.com/cloud/>
2. All actors in the ecosystem: <https://www.indeed.com/jobs>

**Solution 1.14:**

For various hats that a potential employee could wear, the following are some skills that we found as a part of multiple job advertisements:

**Technical:**

- Designing, building, and implementing highly distributed cloud systems
- Knowledge of Operating Systems : (Linux, Windows)
- Knowledge of Programming and Scripting Languages : (Java, Python, PowerShell, and more)
- Knowledge of Networks, and how to monitor, administer, secure and integrate a large cloud platform
- Knowledge of various publicly available cloud platforms : (GCP, AWS, and more)
- Familiarity with automation tools : (Ansible)
- Knowledge of databases, data warehousing, relations and non-relational data processing
- Knowledge of compliance practices important for data privacy and security
- Knowledge of version control tools : (Git)
- Knowledge of cloud migration for keeping up with new trends in infrastructure and applications
- Knowledge of tools for running analytics

**Non-technical:**

- Excellent communication skills
- Ability to work cross functionally
- Having foresight while designing solutions to accommodate new trends
- Program management
- Managing multiple projects
- Engage and influence audience
- Good strategies for customer success
- Supporting the product launch lifecycle
- Ability to delegate tasks to team members