ASSIGNMENT 1 FRONT SHEET

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Student declaration			
I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice.			
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I. INTRODUCTION

With the development of the Internet and computer software technology, the development of a new model is expected to continue to grow strongly that is Cloud Computing. It is one of the key words in the information technology industry. The cloud is a metaphor for the Internet or infrastructure for communication between architectural components. In this Assignment 1 I present the definitions and issues related to cloud computing and its deployment and service models, including why ATN needs to use the cloud computers today and it is beneficial to use them.

II. ANALYSE THE EVOLUTION AND FUNDUMENTAL CONCEPTS OF CLOUD COMPUTING

1. Cloud computing evolution analysis

Cloud Computing is the provision of computing services entirely over the Internet. Or rather, the provision of resources tailored to the needs of users entirely through the Internet. Services here may include servers, storage, software ... Cloud Computing is considered to revolutionize the Internet world today. With the benefits that it brings, Cloud Computing is increasingly used by many organizations and businesses.

Evolution:

- Cloud computing has its origins in the 1950s when the mainframe was born. The cost of these mainframe equipment is so great that organizations cannot afford to buy them economically. This was the time when the idea of providing shared access to a single computer came up for companies to save money.

- In the 1970s, an operating system called VM appeared. This operating system can run on any virtual machine, has its own memory and other infrastructures, allowing data resource sharing. This makes the concept of virtualization in computers popular.

- In the 1990s, researchers and telecommunications operators began to provide virtual private network equipment with good service quality at low cost. This is a paving the way for telcos to provide multiple users sharing access to a single infrastructure.

- There is another factor that also influences the formation of cloud computing: grid computing. Grid computing allows major problems to be solved through parallel computing. Utility computing facilitates computing resources to be provided as a metering service and a SaaS service that allows subscribers to be posted on the network and applications. Since then, the cloud computing was officially born. The advent of cloud computing is the combination of all of the above factors.

2. Characteristics of Cloud Computing

Five essential features:

- On-demand self-service: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
- Broad network access: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms
- Elastic resource pooling: The provider's computing resources are pooled to serve multiple consumers using a multitenant model
- Rapid elasticity: Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in
- Measured service: Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service

3. Benefits and limitations

Benefits of Cloud Computing

- Cost: much cheaper than regular services (hardware investment, software, infrastructure, etc.) only pay for cloud rental.
- Scale: ability to scale easily (bandwidth, storage capacity, access speed, geographical location needed...).
- Reliability: data stored in the cloud makes backup and recovery easy (usually 24/7, 365 days a year, ...)
- Flexibility: easily access data anywhere with fast and stable speed.
- Productivity: save time (no need to set multiple layers of security and firewalls, …)

Limitation of Cloud Computing

- For large companies, important information stored at a third company can lead to risks despite high reputation and security services.
- With important data, large companies often have their own IT departments to store and protect.
- Ability to control restrictions on functions and ways of operation.

4. Applications on the Cloud

- A stand-alone application: standalone applications running on the system, not using the network => perform the functions of the application.
- Web application: run, perform functions completely based on network connections.

5. Cloud Architectures
- Layer 1: User/Client Layer
  This is the lowest layer in the architecture, all of users of clients belong to this one. Clients can be any devices such as thin client, thick clients or mobile and any handheld device which would support basic functionalities to access a web application.
- Layer 2: Network Layer
  This layer doesn't come under the purview of SLAs. This layer allows users to establish the connection to the cloud. It's the internet in the case of a public cloud. If the case is private cloud, the connection may be provided by a local area network (LAN).
- Layer 3: Cloud Management Layer
  This layer comes under the purview of SLAs. It consists of software which are used in managing the cloud. Software can be a cloud OS or a management software that allows managing resources.
- Layer 4: Hardware Resource Layer
  This layer comes under the purview of SLAs. In this layer, it consists of provisions for actual hardware resources. In both cases of public and private cloud, data center is used in the back-end. No matter when a user accesses the cloud, it should be available to the users as soon as possible and should be within the time that is defined by the SLAs.

Through what I have analyzed above, it can be seen that Cloud Computing is the right model for the company's context and should be applied to the ATN project. The application of Cloud Computing will help the board of directors as well as the company's executives to grasp many advantages that Cloud Computing brings.

III. DESIGN AN APPROPRIATE ARCHITECTURAL CLOUD COMPUTING FRAMEWORK FOR A GIVEN SCENARIO
1. Scenario
   ATN is a Vietnamese company which is selling toys to teenagers in many provinces all over Vietnam. The company has the revenue over 500.000 dollars/year. Currently each shop has its own database to store transactions for that shop only. Each shop has to send the sale data to the board director monthly and the board director need lots of time to summarize the data collected from all the shops. Besides the board can't see the stock information update in real time.
   Solution: In this case, in order to minimize the time spent in the store and the director's work, we designed an alternative system in which the entire database will now move to the cloud and only the director only have full control.

Each store must have access to an application designed to provide daily transactions to the cloud database with a unique ID. At the end of the day, the director directly accesses the cloud system to get all the data from the stores under each individual index to aggregate. In addition, the director can also monitor and update information storage anytime, anywhere.

2. Design from the solution

I will build the ATN project by applying Cloud Computing and the project will operate under 4 layers of Cloud:

- User/Client server:
  This layer is the lowest layer in cloud architecture. All users as well as customers can manipulate this layer. The client can be any device such as a thin client, a thick client or a mobile device, or any handheld device that supports basic functions to access web applications.

- Network layer
  This layer allows users to connect to the cloud. This is primarily the Internet in the case of public clouds. In the case of a private cloud, the connection can be provided by a local area network (LAN). This layer is not covered by service level agreements (SLAs).

- Cloud Management Layer
  This layer contains software used for cloud management
  Software can be cloud operating system (OS), software that acts as an interface between the data center (actual resource) and the user, or management software that enables resource management.
  This class is under the consideration of the SLA

- Hardware resource layer
  Layer 4 includes the permissions for the actual hardware resources.
  In the case of a public / private cloud, a data center is used in the background. This layer is under the SLA's vision. Whenever a user accesses the cloud, it will be available to the user as quickly as possible and should be within the time period defined by the SLA.

IV. DEFINE AN APPROPRIATE DEPLOYMENT MODEL FOR A GIVEN SCENARIO

Before diving into the most popular cloud deployment models and making model choices for the ATN project, it's important to first understand exactly what a cloud deployment model is. The cloud deployment model is a specific configuration of environment parameters such as the accessibility and ownership of the deployment infrastructure and storage size. This means that the types of deployments differ depending on who controls the infrastructure and where the infrastructure is located. Basically, there are four types of deployment models in the cloud:

1. Public Cloud

Public Cloud is a type of cloud hosting that allows the accessibility of systems & its services to its clients/users easily. Some of the examples of those companies which provide public cloud facilities are IBM, Google, Amazon, Microsoft, etc. This cloud service is open for use. This type of cloud computing is a true specimen of cloud hosting where the service providers render services to various clients.

Advantage	Disadvantage
• Hassle-free infrastructure management: Having a third party running your cloud infrastructure is convenient: you do not need to develop and maintain your software because the service provider does it for you. In addition, the infrastructure setup and use are uncomplicated. • High scalability. You can easily extend the cloud's capacity as your company requirements increase. • Reduced costs: You pay only for the service you use, so there's no need to invest in hardware or software. • 24/7 uptime: The extensive network of your provider's servers ensures your infrastructure is constantly available and has improved operation time.	• Compromised reliability: That same server network is also meant to ensure against failure But often enough, public clouds experience outages and malfunction, as in the case of the 2016 Salesforce CRM disruption that caused a storage collapse. • Data security and privacy issues give rise to concern: Although access to data is easy, a public deployment model deprives users of knowing where their information is kept and who has access to it. • The lack of a bespoke service: Service providers have only standardized service options, which is why they often fail to satisfy more complex requirements.

Table 1

2. Private Cloud

This is the Cloud infrastructure used by an organization. A Private Cloud system can be located in a customer's datacenter or service provider datacenter. This system is managed by customers / suppliers or by a third party.

Advantage	Disadvantage
• Customization: when hosted on-premise, private clouds can be configured to stakeholder's specific requirements to create the exact environment needed to run proprietary applications. If hosted by a third-party, there is no on-site setup of physical hardware, but it does require stakeholders to work with the third-party to set up and manage an environment for their exclusive use.	• Utilization: Companies are fully responsible for maximizing capacity utilization. Underutilization of purchased hardware or upfront cost associated with third-party hosted hardware can have a significant impact on a company's operational costs. • Scalability: Primarily applicable to companies that are not leveraging hybrid integration and that do not have consistent computing demand. A private cloud may not be able to scale effectively when demand is in flux,

• Visibility & Control: More direct control of the data. Companies that wish to keep a tighter grasp on physical security controls may adopt this model. • Hybrid integration: Integration between public and private clouds allows companies to extend private cloud resources onto the public cloud, benefiting applications that might need additional computing resources to maintain uptime.	costing more long-term, as additional computing resources will take extra time and money to procure than scaling a virtual machine or requesting additional resources from a public cloud provider. • Cost: Hardware required to run a private cloud on-premise can be very expensive, therefore requiring companies to make a substantial capital investment before seeing any value. Additionally, they require on-site cloud architects to set up, maintain, and manage. Hosted private clouds can help mitigate these costs substantially.

Table 2

3. Hybrid Cloud

   Hybrid Cloud is a cloud computing environment that intersects and combines Private Cloud and Public Cloud platforms. It is specifically built for an organization brought in by a third party and Public Cloud services (such as Amazon or Google). Hybrid Cloud allows users to switch workloads between Public Cloud and Private Cloud when there are changes in cost or computation needs. In addition, Hybrid Cloud provides businesses with more flexibility and more data deployment options.

Advantage	Disadvantage
• Control: Companies have increased control over their data, allowing stakeholders to choose from environments that best suit each individual use case. • Scalability: Most companies do not have a constant general computational use or demand. Computational demand could be seasonal or ad-hoc. Extending workloads to a public cloud allows for the ability to scale resources on-demand. • Cost: A hybrid cloud deployment model can benefit companies that can't afford to invest in a private data center, as well as those that need to scale in a cost effective manner. Also, this model requires much less space on-premises compared to a strictly private model	• Operational complexity: There is a lack of tools that can manage both on-premise and public cloud resources, making operational tasks more complex and involved

Table 3

4. Community Cloud

A community deployment model largely resembles the private one; the only difference is the set of users. Whereas only one company owns the private cloud server, several organizations with similar backgrounds share the infrastructure and related resources of a community cloud.

Advantages	Disadvantages
• Cost reduction • Improved security, privacy and reliability • Ease of data sharing and collaboration	• High cost if compared to a public deployment model • Sharing of fixed storage and bandwidth capacity • It is not widespread so far

Table 4

Conclusions and recommendations:

Through analyzing the models in Cloud Computing, I propose to use the Public Cloud model for the ATN project because the public cloud deployment model provides companies with the ability to use capable services. Highly scalable and hosted on shared infrastructure. These services are on-demand, maintenance-free and low-cost. This allows companies to grow in size, while avoiding upfront capital investments and high operating costs.

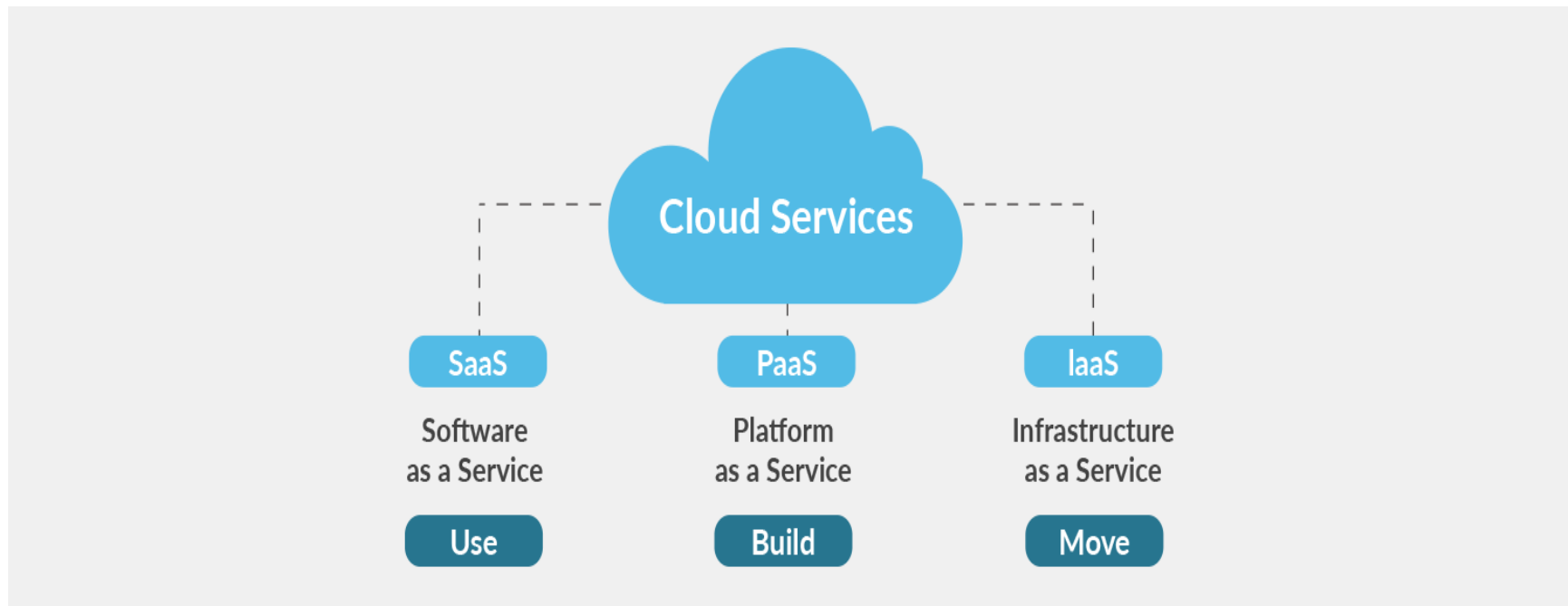V.   COMPARE THE SEVICE MODELS FOR CHOOSING AN ADEQUATE MODEL FOR A GIVEN SCENARIO

Figure 1

There are three main service models of cloud computing – Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). There are clear differences between the three and what they can offer a business in terms of storage and resource pooling, but they can also interact with each other to form one comprehensive model of cloud computing.

1. IaaS

   This is the most popular service model of cloud computing because it provides the basic infrastructure of virtual servers, networks, operating systems, and data storage drives. It enables the flexibility, reliability, and scalability that many businesses seek with the cloud and eliminates the need for hardware in the office. This makes it ideal for small to medium organizations looking for a cost-effective IT solution to support business growth. IaaS is a paid-for-use service that is completely outsourced and available as public, private, or combined infrastructure.

   Typical features:

   - Provide resources as services: including servers, network devices, memory, CPU, hard disk space, data center equipment.
   - Flexible scalability

- Costs vary according to reality
- Multiple tenants can share the same resource
- Enterprise level: Beneficial for the company by an aggregated compute resource

2. PaaS

Providing API for application development on an abstract platform

Provides a computational foundation and a set of multi-layered solutions. It supports application deployment regardless of the cost or complexity of equipping and managing the underlying hardware and software layers, providing all the features needed to support the cycle does the job of building and delivering an Internet-ready web application and service without the need for any download or installation of software for developers, IT managers, or end users. It is also known by another name, cloudware.

Platform Service Delivery (PaaS) including the conditions for the application design, development, testing, deployment, and hosting processes that are valuable as application services such as team collaboration, production Web service aggregation and integration, database integration, security, scalability, state management, application versioning, benefits for the application research and development community. These services are prepared as an integrated web-based solution.

Typical features:

- Serves for application development, testing, deployment and operation as an integrated development environment
- Tools with a web-based interface.
- Unified architecture
- Web services and database integration
- Support development team collaboration

Advantage:

- Platform Services (PaaS) is in its infancy and is favored for features that favor software services, in addition to integrating platform elements.
- Advantage in projects that comprise teamwork with geographic dispersion.
- Ability to integrate multiple sources of web services
- Reduce external costs when integrating security services, scalability, error control ...
- Reduce costs when abstracting high-level programming work to create services, user interfaces, and other application elements.
- Expect the knowledgeable user to continue to refine and facilitate interaction with many people to help determine the hardship of the problem we face.

- Drive the use of technology to make it easier for multi-user application development for people who are not only on a programming team but can combine multiple teams together.

Disadvantages:

- Constraint by the provider: due to the limitations of the provider's dependencies and services
- Development Limits: Its complexity makes it unsuitable for agile development because of its complex features implemented on a web platform.

3. SaaS

Software Services (SaaS) is an application deployment model in which a provider allows users to use services on demand. SaaS providers can host the application on their servers or download the application to a client device, disabling it after the deadline. On-demand functions can be controlled internally to share a license of a third-party application provider.

Typical features:

- Available software requires network access and management.
- Manage operations from a centralized location rather than a customer location, allowing customers to access it remotely via the web. The application provision is typically close to one or more mapping models, including architectural, pricing, and management features.
- Features focused on upgrading, helping users to get rid of downloading patches and updates.
- Regularly integrate communication software on a wide area network.

Summarizing the service model analysis process, I recommend using the PAAS service model because it provides a framework for developers that they can build and use to create custom applications. PAAS stores hardware and software on its own infrastructure. PAAS provides a platform for creating software distributed through the Website. Thus, PAAS frees ATN from having to install on premise hardware and software to develop or run a new application. PAAS allows ATN to design and create PAAS built-in applications with special software components also known as middleware, which are scalable and available as they have the most cloud features concentration.

4. Solution for ATN:

a) Deployment Model

Through analyzing the models in Cloud Computing, I propose to use the Public Cloud model for the ATN project because the public cloud deployment model provides companies with the ability to use capable services. Highly scalable and hosted on shared infrastructure. These services are on-demand, maintenance-free and low-cost. This allows companies to grow in size, while avoiding upfront capital investments and high operating costs.

b) Service Model

I recommend using the PAAS service model because it provides a framework for developers that they can build and use to create custom applications. PAAS stores hardware and software on its own infrastructure. PAAS provides a platform for creating software distributed through the Website. Thus, PAAS frees ATN from having to install on premise hardware and software to develop or run a new application. PAAS allows ATN to design and create PAAS built-in applications with special software components also known as middleware, which are scalable and available as they have the most cloud features concentration.

c) Programming Languages

In the scenario we chose the PHP language as the dominant programming language because PHP is an open source scripting language used to develop server writing applications. PHP files contain text, HTML, CSS, Javascript and PHP scripts. PHP is increasingly used widely and popularly.

d) Web server

I will use xampp as a webserver because XAMPP is a fairly popular application and is commonly used by developers to build and develop PHP-based website projects. In particular, Xampp has a quite convenient management interface, allowing users to actively enable or disable the service server at any time. The software is well established and developed on open source code.

e) Database Server

In the scenario we use PostgreSQL as the database for the system. PostgreSQL is a general-purpose object-relational database management system, the most advanced open source database system available today. PostgreSQL is a free and open source software. The source code for the software is available under PostgreSQL license, a free and open source license. Accordingly, you will be free to use, modify and distribute PostgreSQL in any form.

f) Github

I recommend using Gibhub as a library for deploying code and for easy linking with Heroku

g) Cloud Service Providers

For the ATN scenario, I suggest using Heroku, which is a Platform solution as a Service. It is generally considered to be easy to use and currently supports a variety of different programming languages including Java, Node.js, Scala, Python, PHP, etc. This means that ATN can turn to Heroku to inexpensively extend their application regardless of their preferred development language. Heroku, on the other hand, manages and runs applications so there's no need to manage the operating system or other internal system configurations. ATN can use Heroku for free not only for the service itself, but also for a host of add-ons that come with it, or they can pay monthly.

VI.   DEMONTRATE THESE DEPLOYMENT MODELS WITH REAL WORLD EXAMPLES

VII. CONCLUSION

Through this Assignment 1 I have covered the issues related to Cloud Computing as well as its deployment and service models. I also gave the reasons for applying Cloud Computing to ATN project and selected deployment models, programming languages, service models to develop for ATN project.

VIII. REFERENCE