Higher Nationals in Computing

UNIT 16

CLOUD COMPUTING

ASSIGNMENT

No.1

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Class: GCS0704B

Learner's ID: GCS18793

Subject's ID: 1644

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ASSIGNMENT 1 FRONT SHEET

Qualification	BTEC Level 5 HND Diploma in Computing		
Unit number and title	Unit 16: Cloud computing		
Submission date		Date Received 1st submission	
Re-submission Date		Date Received 2nd submission	
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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.

Student's signature	

Grading grid

P1	P2	P3	P4	M1	M2	D1

Grade:	**Assessor Signature:**	**Date:**
Signature & Date:		

ASSIGNMENT 1 BRIEF

Qualification	BTEC Level 5 HND Diploma in Computing		
Unit number	Unit 16: Cloud computing		
Assignment title	Cloud Computing Solutions		
Academic Year	2018 – 2019		
Unit Tutor	Hồ Nguyễn Phú Bảo		
Issue date	10/09/2020	Submission date	
IV name and date	Hoàng Khánh Sơn		

Submission Format:
Format: The submission is in the form of 1 document You must use font *Calibri size 12, set number of the pages and use multiple line spacing at 1.3. Margins must be: left: 1.25 cm; right: 1 cm; top: 1 cm and bottom: 1 cm.* The reference follows Harvard referencing system. *Submission* Students are compulsory to submit the assignment in due date and in a way requested by the Tutors. The form of submission will be a soft copy posted on http://cms.greenwich.edu.vn/ *Note:* The Assignment *must* be your own work, and not copied by or from another student or from books etc. If you use ideas, quotes or data (such as diagrams) from books, journals or other sources, you must reference your sources, using the Harvard style. Make sure that you know how to reference properly, and that understand the guidelines on plagiarism. *If you do not, you definitely get failed*

Unit Learning Outcomes:
LO1 Demonstrate an understanding of the fundamentals of Cloud Computing and its architectures. **LO2** Evaluate the deployment models, service models and technological drivers of Cloud Computing and validate their use.

Assignment Brief and Guidance:

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.

The table of contents in your technical report should be as follows:

1. Explain to the board director the fundamentals of cloud computing and how it is popular nowadays(500 words)
2. Persuade the board director to use Cloud Computing in ATN(300 words)
3. Proposed solution (higher level solution description – around 200 words).
4. Explain the appropriateness of the solution for the scenario (350 words with images and diagrams).
5. Architectural design (architectural diagram and description).
6. Detailed design:
   a. Deployment model (discussion on why that model was chosen).
   b. Service model (discussion on why that model was chosen).
   c. Programming language/ webserver/database server chosen.
7. Summary.

Learning Outcomes and Assessment Criteria		
Pass	**Merit**	**Distinction**
LO1 Demonstrate an understanding of the fundamentals of Cloud Computing and its architectures		**LO1 & 2** **D1** Justify the tools chosen to realise a Cloud Computing solution.
P1 Analyse the evolution and fundamental concepts of Cloud Computing. **P2** Design an appropriate architectural Cloud Computing framework for a given scenario.	**M1** Discuss why an organisation should migrate to a Cloud Computing solution.	
LO2 Evaluate the deployment models, service models and technological drivers of Cloud Computing and validate their use		
P3 Define an appropriate deployment model for a given scenario. **P4** Compare the service models for choosing an adequate model for a given scenario.	**M2** Demonstrate these deployment models with real world examples.	

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1. Introduction to Cloud Computing

1.1. Definition of Cloud Computing

Definitions.

Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software.

Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it.

Cloud computing is a popular option for people and businesses for a number of reasons including cost savings, increased productivity, speed and efficiency, performance, and security.

Cloud computing is the use of various services, such as software development platforms, servers, storage and software, over the internet, often referred to as the "cloud." [1].

In the simplest terms, cloud computing means storing and accessing data and programs over the Internet from a remote location or computer instead of our computer's hard drive.

The cloud is just a metaphor for the Internet

With an online connection, cloud computing can be done anywhere, anytime, and by any device [2].

Advantages of Cloud Computing:

Universal Access: Cloud computing services are platform independent; they are accessible across all devices with internet connection. This increases mobility and ensures that you can access all your information from any place. By this, cloud computing also increase productivity as it allows staff to collaborate on projects.

More Storage Capacity: Cloud computing offers an unlimited storage as long as you can afford it. You don't have to worry about running out of storage and having to buy SSD hard disks for backups.

Easy and Quick Set-Up: Unlike On-Premise infrastructure, when using cloud, you don't need to install anything or worry about the underlying hardware. All you need is to connect to a network/Internet, register with a cloud provider and adjust some simple configurations and that's it. Other providers may require you install a client software on your device; this is suitable if you don't like using browsers to access their services.

Automatic Updates: Cloud providers are responsible for their underlying infrastructure. You will not worry about acquiring an update, a new software, their licenses or upgrading some hardware. With cloud computing, all this solely done by the provider. Maybe you only need to download a client software update.

Cost Effective: As an on demand service, cloud computing is cheap. You only pay for what you use, and you don't incur the initial capital of acquiring the infrastructure. You don't also incur other costs such as maintenance, security, and storage costs. Some providers may offer cloud computing for free to their clients [14].

Disadvantages of Cloud Computing:

UnivesSecurity Risks: As with all other technologies, cloud computing is susceptible to security vulnerabilities. Cloud providers's servers can be attacked given the fact that millions of people are accessing them hourly. Since cloud uses the Internet, Internet related risks such as malware, man in the middle attacks and eavesdropping can be experienced.

Privacy Issues: The CIA triad - confidentiality, integrity, and availability of information can be breached when using cloud computing. Your data can be accessed by unauthorized entities or even modified. The privacy and security issues can also be perpetrated by you, to avoid this, ensure you use a strong password and never give it out to someone else.

Loss of Control: Using some services of cloud computing means that you lose control over some entities. The entities dictate on how they'll be used since cloud uses the on-demand service model. And at times if the servers are down, you will have no option but to wait.

Internet Reliance: If you don't have access to the Internet, well, you also lose access to the cloud. And yes there are places where Long Term Evolution and even the 3rd generation networks are not available.

Cloud Provider Reliability: Since you don't have control over the cloud computing entities, you have to rely fully on the cloud provider. If anything happens to your cloud provider, you will also be affected. Although other providers offer lightweight offline solutions, you will still depend on them for syncing services. This dependency can affect productivity and also efficiency [14].

The Evolution of Cloud Computing [13]

Over recent years the success of cloud technology has snowballed and as each day passes, more and more businesses and individuals start to embrace remote apps and move their data into the cloud. However, while **Cloud computing** may seem like a relatively new phenomenon, the cloud has actually been in the making since the 50s. Here's your one-stop timeline for the evolution of Cloud Computing and the major milestones it's managed to reach:

1950s

- Let's start in the 1950s with mainframe computing. It allowed multiple users to access a central computer through access points or terminals. However, due to the costs of purchasing and maintaining a mainframe computer (let alone multiple computers), it was not cost-effective for an organisation to buy a terminal for every employee. Plus, most users at the time didn't even need the processing power or storage capacity of a mainframe.

The 1960s

- During the late '60s, the Advanced Research Project Agency developed ARPANET, the predecessor to the Internet. In 1969, it became a reality by interconnecting four University computers, each in different geographic locations across the United States of America. ARPANET was initially designed as a communication and compute resource sharing tool, between the science departments of four institutions, but it grew into the internet as we know it today.

The 1970s and 1980s

- The 70s gave birth to the Virtual Machine (VM) which allowed users to run multiple operating systems simultaneously in one physical computer. Think of this as the precursor to Virtual Desktop Infrastructures (VDIs.) However, instead of accessing multiple desktops from a server, you were accessing them from within the same machine.
- Due to the complexity of software development and the lack of developers, it was difficult for companies to create software for multiple operating systems (and even instruction sets). Before the introduction and uptake of UNIX based operating systems, Virtualisation on a local level was a necessity during the 20th century.

- The term "client-server" also came into use, defining the compute model of "clients accessing data and applications from a central server, over a local area network."

The 1990s

- As early as 1995, clouds started to appear within network diagrams and represented anything too complicated for non-technical users to understand. This may be the reason why there is confusion, even today, surrounding the definition of 'the cloud.'
- Historically, telecommunications were only able to offer a single, dedicated data connection – think of it as a point-to-point connection. Now, however, they could offer Virtualised Private Networks (VPNs.) By allowing more users to share access to the same physical infrastructure, they could offer the same quality of service as a dedicated data connection, at a lower price point.
- In 1999, Salesforce.com launched – becoming the first company ever to make enterprise applications available from a website.
- Another few companies launched in 1999. Companies that would go on to make the cloud the powerful resource it is today. Firstly, Google.com, that started off in life as a simple search service. Secondly, Netflix.com. Before they brought binge-watching into every Internet-connected home, they were posting DVDs to people in little red envelopes.

Cloud Evolution in the 2000s

- With ISPs rolling out significant bandwidth to the masses at the start of the 21st century, cloud computing began to really take off.
- In 2003, Web 2.0 was born. Along with it came rich multimedia, user-generated content and dynamic interfaces.
- Facebook, possibly the biggest cloud-photo sharing platform in the world, launched way back in 2004. It was originally intended as an easy way for Harvard students to connect and share information about themselves in a public domain. Who knew back then that it would go on to be the global platform it is now, boasting over a billion users.
- Amazon Web Services (AWS) officially launched in 2006, making cloud storage and computation resources available to smaller businesses for the first time.
- Eric Schmidt (who was CEO of Google at the time,) uttered the word "cloud" at an industry event – making it possibly the first high-profile use of the word in public. Although, sources claim that

executives within Compaq used the term "cloud" for over a decade behind closed doors, before Mr Schmidt.

- 2007 saw the rebirth of Netflix as they launched their video-streaming service, evolving into the industry leader we know it as today.

- 2008 sees the launch of the Dropbox, a major player in public cloud storage even today.

- The concept of the private cloud emerges in 2008 and is seen by enterprises as a more secure version of the "public cloud."

- Browser-based cloud enterprise applications such as Google Apps are ushered into the market during 2009, releasing users from the burden of desktop software.

Cloud evolution in the 2010s

- Thanks to the likes of OpenStack, the concept of an open-source cloud becomes a reality during 2009 and 2010.

- 2011 sees the public and private clouds merge, forming the "Hybrid cloud." Essentially what the cloud should have been from the start, it combines the security of the private cloud with the ease-of-use and accessibility of the public cloud.

- Microsoft rolled out a campaign during the same year titled "to the cloud," in the hopes of explaining the cloud to the everyday user.

- During late 2011, Apple launched iCloud – allowing people to automatically and wirelessly back up their photos, music and videos. iCloud became a common reference point as a way to explain cloud storage, due to the ubiquitous nature of Apple products.

- Google launch Google Drive in 2012 and with their initial free tier, helped push cloud-storage and general online applications.

- IBM acquires SoftLayer in 2013, offering the speed, savings and security of a hybrid-cloud setup to a market still in the early adoption phase.

- Synextra opens its doors in late 2014, hoping to bring "Big IT to the SME."

- And, one year on, Synextra is helping more and more companies connect to the cloud. However, adoption has yet to reach peak levels – despite the fact it's been in the making as long as the Internet.

We hope this Evolution of Cloud Computing timeline has given you an insight into the cloud, cloud computing and cloud hosting. You know where it's been and how it's got there. The question is: where will it go next?

Related Post – see our post about the future of Cloud Computing

Synextra offers a range of cloud IT and virtual telecommunications services to help your business compete, collaborate and grow. If you're curious about the cloud, get in touch with our Support team for more information.

1.2. Cloud Computing essential characteristics

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 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 (e.g., mobile phones, tablets, laptops and workstations).

Elastic Resource pooling: The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state or datacenter). Examples of resources include storage, processing, memory and network bandwidth.

Rapid elasticity: Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

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 (e.g., storage, processing, bandwidth and active user accounts). Resource usage can be monitored, controlled and reported, providing transparency for the provider and consumer. [2]

1.3. Cloud Computing deployment models

Public Cloud

The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider [3]

Public Cloud's advantages [5]

- There is no need of establishing infrastructure for setting up a cloud.

- There is no need for maintaining the cloud.

- They are comparatively less costly than other cloud models.

- Strict SLAs are followed.

- There is no limit for the number of users.

- The public cloud is highly scalable

Public Cloud's disadvantages

- Security is an issue.

- Privacy and organizational autonomy are not possible.

Public Cloud Examples:

1. Amazon Web Services AWS (https://aws.amazon.com/vi/)

AWS (Amazon Web Services) is a comprehensive, evolving cloud computing platform provided by Amazon that includes a mixture of infrastructure as a service (IaaS), platform as a service (PaaS) and packaged software as a service(SaaS) offerings. AWS services can offer an organization tools such as compute power, database storage and content delivery services.

Pros

- Easy to Use
- No Capacity Limit
- Provides Speed and Agility
- Secure and Reliable

Cons

- Limitations OF Amazon EC2
- Security Limitations
- Technical Support Fee
- General cloud Computing Issues
2. Google Compute Engine (https://cloud.google.com/)

Google Compute Engine (GCE) is the Infrastructure as a Service (IaaS) component of Google Cloud Platform which is built on the global infrastructure that runs Google's search engine, Gmail, YouTube and other services. Google Compute Engine enables users to launch virtual machines (VMs) on demand. VMs can be launched from the standard images or custom images created by users. GCE users must authenticate based on OAuth 2.0 before launching the VMs. Google Compute Engine can be accessed via the Developer Console, RESTful API or command-line interface (CLI).

Pros

- Good documentation.
- Different storage classes for each necessity.
- High durability.
- Many regions available to store our data.
- Easy to integrate with other Google Cloud Services.

Cons

- Support fee is quite hefty.
- Downloading data from Google Cloud Storage is expensive.
- SDK APIs seem less than the Amazon S3 ones.
- Google Cloud Platform web interface a bit confusing.
- It has a complex pricing schema.

3. Microsoft Azure (https://azure.microsoft.com/en-us/)

4. IBM Cloud (https://www.ibm.com/cloud)

Private Cloud [5]

The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises

Private cloud's advantages

- The cloud is small in size and is easy to maintain.

- It provides a high level of security and privacy to the user.

- It is controlled by the organization.

Private cloud's disadvantages

- For the private cloud, budget is a constraint.

- The private clouds have loose SLAs.

1. Sync
2. Nextcloud
3. OwnCloud
4. Pydio
5. SeaFile
6. AeroFS
7. Resilio Sync
8. Syncthing

The private cloud is defined as computing services offered either over the Internet or a private internal network and only to select users instead of the general public. Also called an internal or corporate cloud, private cloud computing gives businesses many of the benefits of a public cloud - including self-service, scalability, and elasticity - with the additional control and customization available from dedicated resources over a computing infrastructure hosted on-premises. In addition, private clouds deliver a higher level of security and privacy through both company firewalls and internal hosting to ensure operations and sensitive data are not accessible to third-party providers. One drawback is that the company's IT department is held responsible for the cost and accountability of managing the private cloud. So private clouds require the same staffing, management, and maintenance expenses as traditional datacenter ownership.

Two models for cloud services can be delivered in a private cloud. The first is infrastructure as a service (IaaS) that allows a company to use infrastructure resources such as compute, network, and storage as a service. The second is platform as a service (PaaS) that lets a company deliver everything from simple cloud-based applications to sophisticated-enabled enterprise applications. Private clouds can also be combined with public clouds to create a hybrid cloud, allowing the business to take advantage of cloud bursting to free up more space and scale computing services to the public cloud when computing demand increases.

- Heroku is a cloud platform as a service (PaaS) supporting several programming languages. One of the first cloud platforms, Heroku has been in development since June 2007, when it supported only the Ruby programming language, but now supports Java, Node.js, Scala, Clojure, Python, PHP, and Go. For this reason, Heroku is said to be a polyglot platform as it has features for a developer to build, run and scale applications in a similar manner across most languages. Heroku was acquired by Salesforce.com in 2010 for $212 million.

- OpenStack is the proven Open Cloud Platform being adopted by Service Providers and Enterprise Private Clouds enabling large scale production-ready clouds that accelerate innovation and drive down the Total Cost of Ownership (TCO) for cloud solutions. Supermicro has partnered with the leading OpenStack software firms to jointly-engineer total solutions for OpenStack. These solutions are built on best-in-class Supermicro Server and Storage systems that deliver broad platform choice, fast to market innovation and optimized for value, performance and efficiency.

Community Cloud [6]

The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns. It may be managed by the organizations or a third party and may exist on premise or off premise

Community cloud's advantages

- It allows establishing a low-cost private cloud.
- It allows collaborative work on the cloud.
- It allows sharing of responsibilities among the organization.
- It has better security than the public cloud.

Community cloud's disadvantages

- Autonomy of an organization is lost.
- Security features are not as good as the private cloud.
- It is not suitable if there is no collaboration.

Hybrid Cloud [6]

The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability

Hybrid Cloud's advantages

- It gives the power of both the private and public clouds.
- It is highly scalable.
- It provides better security than the public cloud.

Hybrid Cloud's disadvantages

- The security features are not as good as the public cloud.
- Managing a hybrid cloud is complex.
- It has stringent SLAs.

1.4. Cloud Computing service models

IaaS

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources on a pay-per-use basis where he or she is able to deploy and run arbitrary software, which can include operating systems and applications.

The consumer does not manage or control the underlying cloud infrastructure but has control over the operating systems, storage, and deployed applications and possibly limited control of select networking components

Cloud computing basic service models [8]

Characteristic of IAAS

- **Web access to the resources:** Through any web browsers or management console, the users can access the required infrastructure

- **Centralized management:** Even though the physical resources are distributed, the management will be from a single place.

- **Elasticity and dynamic scaling:** The usage of resources can be increased or decreased according to the requirements

- **Shared infrastructure:** Allows multiple IT users to share the same physical infrastructure. IaaS ensures high resource utilization.

- **Preconfigured VMs:** The IT users can select any kind of VMs of their choice. The users can directly start using the VMs as soon as they subscribed to the services

- **Metered services:** The services consumed by the IT user will be measured, and the users will be charged by the IaaS providers based on the amount of usage.

Suitable of IaaS

- **Eliminates capital expense and reduces ongoing cost.** IaaS sidesteps the upfront expense of setting up and managing an onsite datacenter, making it an economical option for start-ups and businesses testing new ideas.
- **Improves business continuity and disaster recovery.** Achieving high availability, business continuity, and disaster recovery is expensive, since it requires a significant amount of technology and staff. But with the right service level agreement (SLA) in place, IaaS can reduce this cost and access applications and data as usual during a disaster or outage.
- **Innovate rapidly.** As soon as you've decided to launch a new product or initiative, the necessary computing infrastructure can be ready in minutes or hours, rather than the days or weeks—and sometimes months—it could take to set up internally.

Drawbacks

- *Vendor lock-in*: Because proprietary technologies used by PaaS providers so that the applications to be migrated from one PaaS provider to the other.
- *Security issues:* Since data are stored in off-premise third-party servers, developers are afraid to go for PaaS
- *Less flexibility*: PaaS providers do not give much freedom for the developers to define their own application stack
- *Depends on Internet connection*: With slow Internet connection, the usability and efficiency of the PaaS platform do not satisfy the developer requirements

Pros:

- The Cloud provides the infrastructure.
- Enhanced scalability – dynamic workloads are supported.
- IaaS is flexible.

Cons:

- Security issues.
- Network and service delays.
- List all infomations related to IaaS

	Amazon Web Services	**Microsoft Azure**	**Google Cloud**
Vitural Server	Amazon EC2	Azure Vitural Machine	Compute Engine
Object Storage	Amazon Simple Storage Service (Amazon S3)	Block Blob	Google Cloud Storage
Computing	Amazon EC2	Azure Funtions	Google Cloud Funtions
Relational Database	Amazon RDS	Azure SQL Database	Google Cloud SQL

PRODUCT	aws	Microsoft Azure	Google Cloud Platform
Virtual Servers	Instances	VMs	VM Instances
Platform-as-a-Service	Elastic Beanstalk	Cloud Services	App Engine
Serverless Computing	Lambda	Azure Functions	Cloud Functions
Docker Management	ECS	Container Service	Container Engine
Kubernetes Management	EKS	Kubernetes Service	Kubernetes Engine
Object Storage	S3	Block Blob	Cloud Storage
Archive Storage	Glacier	Archive Storage	Coldline
File Storage	EFS	Azure Files	ZFS / Avere
Global Content Delivery	CloudFront	Delivery Network	Cloud CDN
Managed Data Warehouse	Redshift	SQL Warehouse	Big Query

PaaS

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider
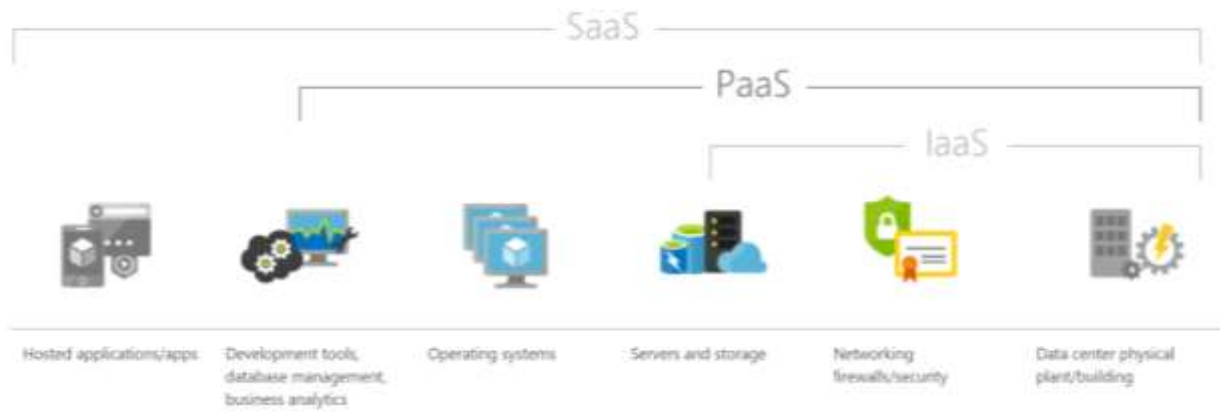
Cloud computing basic service models [9]

CHARACTERISTICS OF PAAS

All in one: Most of the PaaS providers offer services to develop, test, deploy, host, and maintain applications in the same IDE

Using web UI, any developer can get access to the development platform. The web-based UI helps the developers create, modify, test, and deploy different applications on the same platform.

Offline access: Some of the PaaS providers allow the developer to synchronize their local IDE with the PaaS services

Built-in scalability: This ensures that the application is capable of handling varying loads efficiently

Collaborative platform: Developers can collaboratively work together on the same project from different workplaces.

Diverse client tools: To make the development easier, PaaS providers provide a wide variety of client tools to help the developer

SUITABILITY OF PAAS

- **Collaborative development:** A common place where the development team and other stakeholders of the application can collaborate with each other

- **Automated testing and deployment:** The development team needs to concentrate more on development rather than testing and deployment.

- **Time to market:** The PaaS services follow the iterative and incremental development methodologies. The PaaS services are the best option for application development that uses agile development methodologies

DRAWBACKS OF PAAS

- Vendor lock-in: Because proprietary technologies used by PaaS providers so that the applications to be migrated from one PaaS provider to the other.

- Security issues: Since data are stored in off-premise third-party servers, developers are afraid to go for PaaS

- Less flexibility: PaaS providers do not give much freedom for the developers to define their own application stack

- Depends on Internet connection: With slow Internet connection, the usability and efficiency of the PaaS platform do not satisfy the developer requirements

PaaS products: AWS Lambda, Heroku Platform, AWS Elastic Beanstalk, Salesforce Lightning Platform (formerly Salesforce App Cloud), SAP Cloud Platform, Google App Engine.

SaaS

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure, including network, servers, operating systems, storage, and even individual application capabilities, with the possible exception of limited user-specific application configuration settings

Typical applications offered as a service include customer relationship management (CRM), business intelligence analytics, and online accounting software.

Cloud computing basic service models [10]

CHARACTERISTICS OF SAAS

- One to many: application can be shared by multiple tenants or customers
- Web access: It allows the end user to access the application from any location with internet connection
- Centralized management: the SaaS providers will perform the automatic updates that ensure that each tenant is accessing the most recent version of the application without any user-side updates
- Multi-device support: can be accessed from any end user devices such as desktops, laptops, tablets, smartphones
- Better scalability: The dynamic scaling of underlying cloud resources makes SaaS applications work efficiently even with varying loads.
- High availability: ensure the 99.99% availability of user data as proper backup and recovery mechanisms are implemented at the back end
- API integration: the capability of integrating with other software or service through standard APIs

SUITABILITY OF SAAS

- On-demand software: The licensing-based software model increases the spending on buying software.
- Software for start-up companies: Can reduce the initial expenditure on buying high-end hardware
- Software compatible with multiple devices: The SaaS applications are adaptable with almost all the devices.
- Software with varying loads: Applications can handle varying loads efficiently without disrupting the normal behavior.

DRAWBACKS

- *Real-time applications*: Since SaaS applications depend on Internet connectivity, it may not work better with low Internet speed
- *Applications with confidential data:* Since data are stored with third-party service providers, there is no surety that our data will be safe.
- *Better on-premise application*: In such situations, migrating to the SaaS model may not be the best option.

1.5. Cloud Architecture

Cloud Architecture refers to the various components in terms of databases, software capabilities, applications, etc. engineered to leverage the power of cloud resources to solve business problems. Cloud architecture defines the components as well as the relationships between them [11].

The various components of Cloud Architecture are:

- On premise resources
- Cloud resources
- Software components and services
- Middleware

The entire cloud architecture is aimed at providing the users with high bandwidth, allowing users to have uninterrupted access to data and applications, on-demand agile network with possibility to move quickly and efficiently between servers or even between clouds and most importantly network security

The various cloud based services have their own distinct and unique cloud architectures:

Software as a Service (SaaS) involves software hosted and maintained on internet. With SaaS, users do not have to install the software locally.

Platform as a Service (PaaS) provides users with application platforms and databases, equivalent to middleware services.

Infrastructure as a Service (IaaS) provides for infrastructure and hardware such as servers, networks, storage devices, etc. running in the cloud, available to users against a pay per usage basis.

Layer Cloud [3]

LAYER 1 (USER/CLIENT LAYER)

- This layer is the lowest layer in the cloud architecture.All the users or client belong to this layer.
- The client can be any device such as a thin client, thick client, or mobile or any handheld device that would support basic functionalities to access a web application

LAYER 2 (NETWORK LAYER)

- This layer allows the users to connect to the cloud
- This is primarily the Internet in the case of a public cloud
- In the case of a private cloud, the connectivity may be provided by alocal area network (LAN).
- This layer does not come under the purview of service-levelagreements (SLAs)

LAYER 3 (CLOUD MANAGEMENT LAYER)

- This layer consists of softwares that are used in managing the cloud
- The softwares can be a cloud operating system (OS), a software that acts as an interface between the data center (actual resources) and the user, or a management software that allows managing resources.
- This layer comes under the purview of SLAs

LAYER 4 (HARDWARE RESOURCE LAYER)

- Layer 4 consists of provisions for actual hardware resources.
- In the case of a public/private cloud, a data center is used in the back end
- This layer comes under the purview of SLAs.
- Whenever a user accesses the cloud, it should be available to the users as quickly as possible and should be within the time that is defined by the SLAs

2. Benefit and drawback of Cloud Computing

2.1. Benefits of Cloud Computing

- Cost savings

With cloud computing, businesses can reduce or completely cut down on the initial investment because there is no need for on-site data centers (no server installation, hardware, software, equipment depreciation, etc...). In addition, the power used in server operation and cooling has decreased, contributing to increased environmental friendliness.

- Instant access anytime anywhere

Data can easily be stored, downloaded, restored, or processed with just a few clicks. Users can access their accounts on the go, 24/7, via any device, anywhere in the world as long as you're still connected to the internet.

- The ability to transform endlessly

The application of cloud computing is extremely rich, often classified by features and belongs to one of the following three types of services:

- Software as a service (SaaS)
- Infrastructure as a service (IaaS)
- Platform as a service (PaaS)

Users can also optionally create a private, public or hybrid cloud model, or optionally to determine the location of your virtual data center. Cloud computing offers countless applications, endless changes depending on the budget of the business.

- Sustainable cooperation, not disturbance

With cloud computing, files are centrally and consistently stored, accessed anywhere, creating a virtual space where people directly discuss, share a file and get feedback instant. This makes productivity significantly improved, minimizes trouble, increases customer satisfaction, and more.

2.2. Drawbacks of Cloud Computing

- **Network Connection Dependency**

In order to reap the benefits of cloud computing, your business must always have an internet connection. You need a network to be able to use your virtual machines even if you opt for an IaaS, Infrastructure-as-a-Service. If you lose your network connection because of a storm or an outage, you may experience some downtime.

- **Limited Features**

SaaS offerings may usually begin with a free package, but you will be charged for premium offerings and extra space. Limited functionality is partnering with hosted Service Providers that can meet your cloud storage, virtualization and backup needs both now and in the future as your business grows. Ideally, you would want to work with a provider that will provide you with the highest value for Hosted Service package for the features and space your business needs.

- **Security**

Cloud hacking cases as recent as the past few months have shown that not all cloud providers are as secure as they claim to be. As a business, you can't afford to have sensitive information about your company or your clients fall victim to hackers. One of cloud computing's greatest disadvantages is that you don't always know which providers you can trust.

This cloud computing disadvantage is more prevalent in SaaS providers than with Hosted providers. Because of the popularity of SaaS providers, they get targeted more frequently, and more easily, than a Hosted provider.

- **Loss of Control**

You are essentially, trusting another party to take care of your data. You are trusting that they will maintain their data centers and servers with the same care as you would, if not more. You have to trust that your provider's data centers are compliant and secured both physically and online. Some find the lack of in-house control of the server unnerving.

If this is one of your concerns, work with a partner with local contacts. Speak one-on-one with a representative who can address your access concerns, and learn about the measures that the Hosted Services company takes to ensure the integrity and safety of their cloud servers.

3. Propose solution for ATN system

3.1. ATN existing system

Script

ATN is a Vietnamese company that sells toys to teenagers in many provinces across Vietnam. The company has a turnover of over 500,000 USD / year.

ATN sells toys and children's activities related to the sale of products or services directly to end consumers for personal use.

Currently each store has its own database to store transactions for that store only. Each store must send sales data to the board director monthly and it takes a long time for the board manager to summarize the data collected from all stores. Besides, the board of directors can view real-time updated securities information

3.2. Advantages and Disadvantage for existing ATN

Current system of ATN company has some advantage and disadvantage as below

Advantages of ATN system:

Unlimited scope of business: Simply because the explosion of stores and products is always "stand close to each other" mentality to easily compete with both buyers and prices. Therefore, if your product is nothing special, advantageous, or not in business, it will be successful. Moreover, the business scope is not only in a fixed position with a modest number of customers, your business network can be globally covered if your brand is strong enough to compete with companies. other. rivals of the same product.

Customer care by phone, email, direct: The type of direct interaction helps you better identify the feelings of customers. Conversation history is kept by both parties for future reference. Convenient for customers because they do not need to go to the service provider. Can better understand customers. Can reinforce brand quality through consultants.

Wide distribution network across the province thanks to the talented establishments and leaders.

Disadvantages of ATN system:

Increasing competition ATN Company must take measures to reduce product costs.

Customer information security issues.

Do not use management software such as MySQL, so it is difficult to manage the warehouse, supplies and production.

3.3. Solution

Analyze sales data of each store, manage import and export of each store of the company system with the management subsystem.

Receive online and respond to complaints on social networking sites, by phone or email.

Optimize security: software allows managing program access by user login and password. Allows decentralization according to user groups, according to the processing function (add, edit, delete, approve, print ...) and details to each information field of the voucher. Allows recording the entire operation log of the user, especially the program records both the old value and the new value when manipulating data.

Manage product information by creating an aggregated database of all branches and assigning an excellent staff to manage and check weekly.

When customers come to buy products or order via the website and phone, the consulting department will listen directly to customers' information and products.

The consulting department will then notify the product database management team if it is available. If the product is still in stock and the customer wants to buy it, the consulting department will quote the price and details of the product to the customer and make an order.

Next, the order will be delivered to the customer service manager.

The last step is extremely important in the sales process of a company (or business) forcing no salesperson to forget it is after-sales customer care. Therefore, we should review comments, receive them online and respond to customer complaints continuously and quickly.

4. Explain the appropriateness of solution for the scenario

There are 4 deployment models as mentioned in section 1.3. From that, I will choose the suitable cloud deployment model for the ATN system.

	Suitable for system	ATN system
Public cloud	• **The low-cost** public cloud storage platform is cost-effective, as it only pays for the services you actually use and saves on the cost of upgrading an existing IT system. • **Scalable on-demand** as the extensive network of servers facilitates easy handling of increasing or decreasing business needs • **Maximum uptime** with the public cloud you no need to worry about downtime, because a server's failure is handled by other servers in the network, automatically. • **Accessible from anywhere** this feature of the public cloud provides remote access to IT infrastructure or online group / document collaboration from various locations.	Easy to deploy Continuous operating time No need maintenance Suitable for businesses, websites, small and medium-sized e-commerce sites, which need high flexibility in deploying, installing, and expanding flexibility.
Private cloud	• **Complete security** Private Cloud is a private cloud option more secure than the public cloud option because it allows you to integrate the cloud in your data center.	The level of privacy and data security of Private Cloud is higher than that of Public Cloud. ATN requires strict security, latency, regulation and data privacy.

	• **Other privacy** with Private Cloud, resources are not shared to any other business on the private cloud. • **More control** this option allows you to install virtualization software according to your needs and options. • **Greater reliability** than Private Cloud helps to increase resilience and load balancing. In addition, you can easily access additional resources	ATN needs high-performance access to a file system, for example media companies, data storage and business critical applications.
Community cloud		ATN or the businesses participating in the model have the right to use the services provided from other businesses and use the best applications from the cooperative businesses.
Hybrid cloud	• **On-demand scale** because it allows you the flexibility to move highly scalable activities to the public cloud and activities requiring smaller scale on your private cloud. • **Flexible management online** with hybrid cloud storage, you can secure your sensitive data on private cloud and save money. • **Security and disaster recovery** by combining both private clouds and	ATN provides customer interaction, which can be stored in the public cloud while corporate data can be stored in the Private Cloud. For important data can be stored on the private cloud.

| | | public cloud options businesses can solve compliance and security issues.
• **High reliability and performance** this cloud option allows you to change the workload between public cloud and private cloud according to business needs. | |

Summary 1

Finally, I suggest that ATN should use **a private cloud** model because the reliability, confidentiality of customer information and product information should be as confidential as possible. Moreover, the private cloud model has continuous uptime, full control and less risk of data loss or hacking.

As mentioned in section 1.4, there are 3 service models and I will choose one suitable for cloud service model for ATN system.

	Suitable for the system	ATN system
IaaS	• IaaS is responsible for managing aspects such as application, runtime, operating system, middleware and data. • IaaS manages servers, hard drives, networking, virtualization, and storage. Some vendors provide even more services outside of the virtualization layer, such as databases. • Easily enable storage deployment, networking, server, and automated processing power	• Resources available as an ATN sales service • Cost varies depending on consumption • Highly scalable services for ATN • There are usually multiple users on a specific hardware • Provides complete control of infrastructure for ATN

	• Additional hardware may be purchased based on usage • Give customers complete control of the infrastructure	
PaaS	• Make developing and deploying applications simpler and more cost effective. • Easy scalability. • High availability. • Gives developers the ability to create custom applications without the need for headaches in maintaining software. • Significant reduction in the number of lines of code. • Automated business policies. • Allows easy integration with hybrid models.	Building on virtualization technology, meaning resources can easily scale up or down as your business changes. Provides many services to develop, test, and deploy applications. Integrated web services and databases.
SaaS	• Because SaaS's distribution model is web-based, SaaS eliminates the need for IT staff to download and install applications on each individual computer. With SaaS, vendors will manage all potential technical issues, such as data, middleware, servers and storage, allowing businesses to manage. • This gives technical staff more time to focus on the company's urgent issues.	• Service management from a central location. • Put on the remote server. • Accessibility via internet. • Users are not responsible for hardware and software updates. • Deploy e-commerce service quickly without time and staff for server and software issues.

Summary 2

Finally, I choose IaaS service model. IaaS is also beneficial for ATN if it wants full control of its applications and infrastructure.

IaaS may be a good choice because ATN does not need to upgrade or replace hardware or software to meet development needs. It also helps if ATN is uncertain about the requirements that a new application will require because of its flexibility in scalability or reduction as needed.

Programming language

The company supplies ATN toys using PHP, PostgreSQL , Heroku, Github and web writing language is Javascript.

5. Design system

Design new database for system

➢ Customer (customerID, Name, Phone, Email, Username,Password).

➢ Order (orderID, customerID, OrderDate, AgencyID).

➢ Agency (agencyID, AgencyName,AgencyLocation).

➢ OrderDetail (OrderdetailID, OrderID, date, product).

➢ Product(productID, productname, categoryID, supplierID, price).

➢ Supplier(supplierID, Productname, date of manufacture, Contact).

➢ Category(categoryID, gentle).

Entity relationship diagram
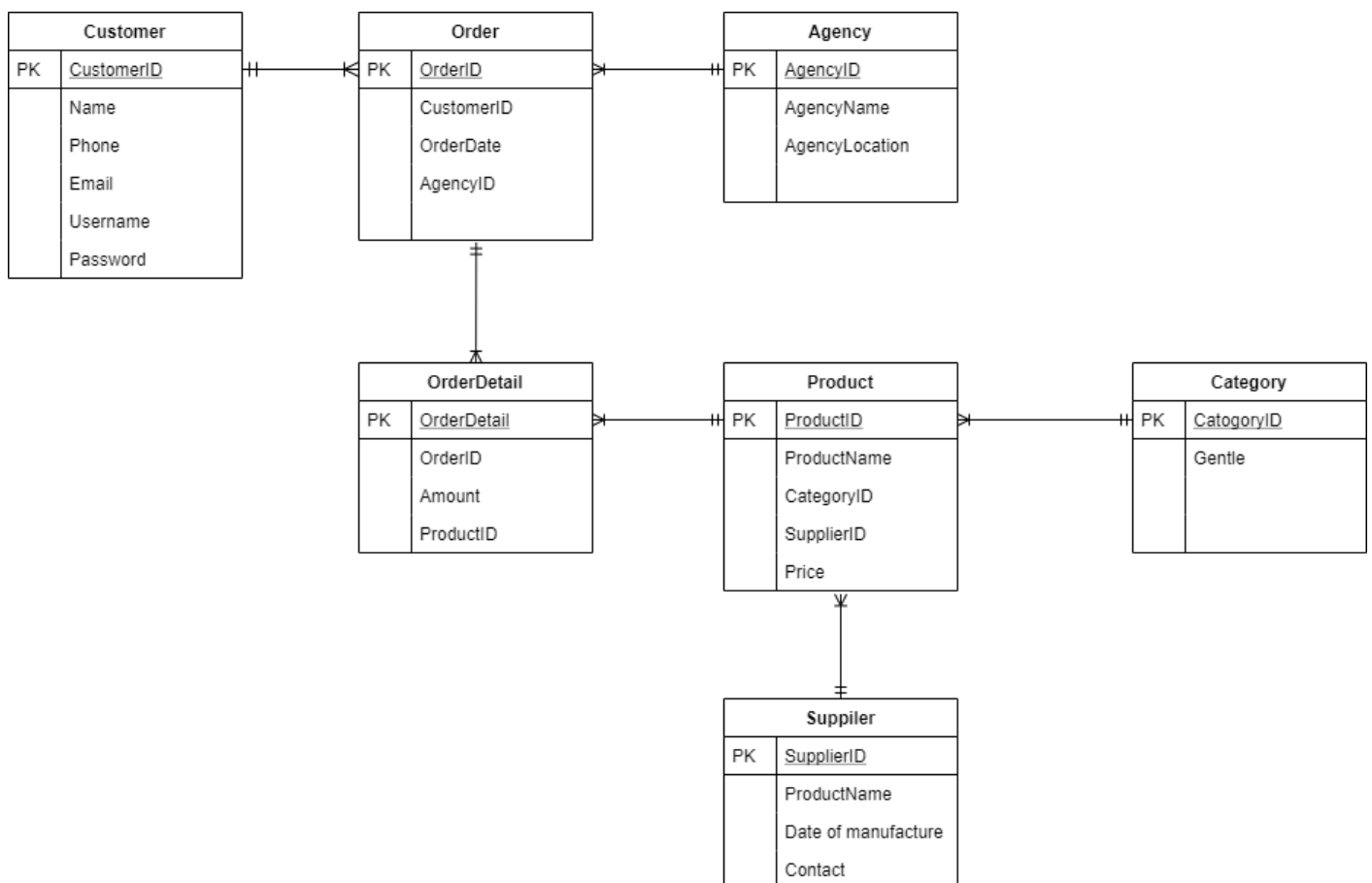
Design new website Ui (wire frames for ATN system

- Login Page

- Registration page

- List all product
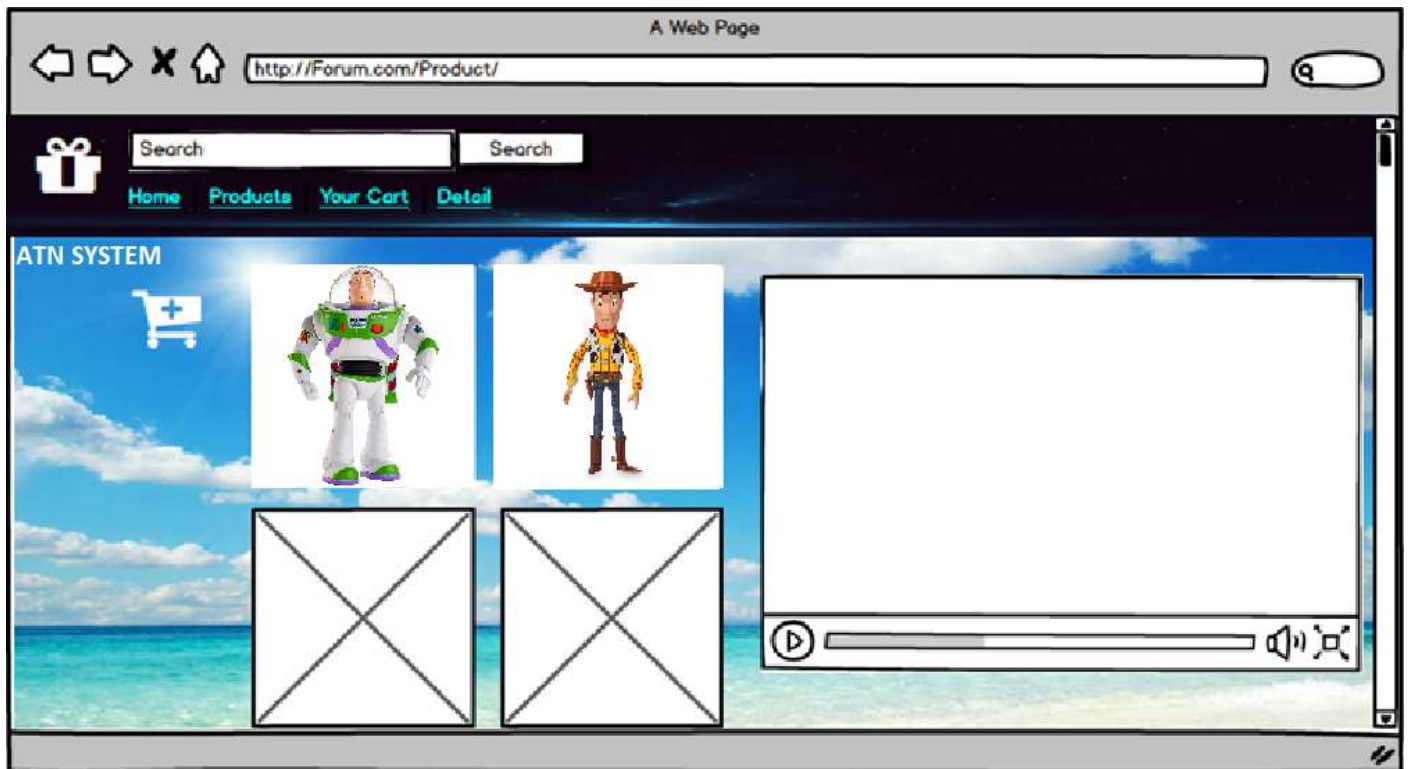
- Create a new order for customer
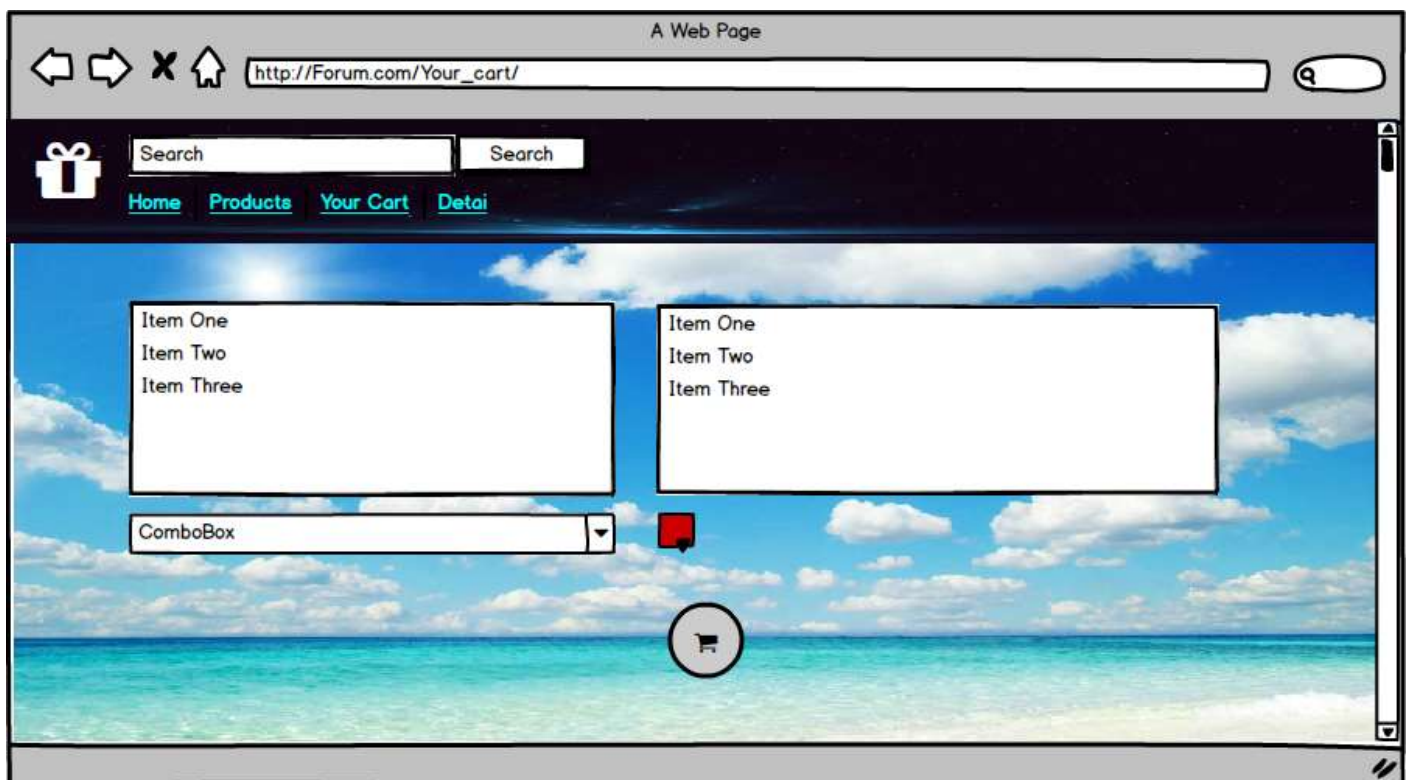
- Report Page

Success
Do you wanna buy another things?

Yes	No

6. Architecture design

Migration the application to cloud environment [6]

Evaluation (current status of an application, structure of system/application

- Evaluation is carried out for all the components like current infrastructure and application architecture, environment in terms of compute, storage, monitoring, and management, SLAs, operational processes, financial considerations, risk, security, compliance, and licensing needs are identified to build a business case for moving to the cloud .Migration strategy pros cons in specific situation

Based on the evaluation, a migration strategy is drawn

- A hotplug strategy is used where the applications and their data and interface dependencies are isolated and these applications can be operationalized all at once.
- A fusion strategy is used where the applications can be partially migrated; but for a portion of it, there are dependencies based on existing licenses, specialized server requirements like mainframes, or extensive interconnections with other applications.

Prototyping

- Migration activity is preceded by a prototyping activity to validate and ensure that a small portion of the applications are tested on the cloud environment with test data setup

Provisioning

- Necessary platform software
- Configuration (database , webserver)
- Test in new environment(cloud environment

Pre migration optimizations identified are implemented. Cloud servers are provisioned for all the identified environments, necessary platform softwares and applications are deployed, configurations are tuned to match the new environment sizing, and databases and files are replicated. All internal and external integration points are properly configured. Web services, batch jobs, and operation and management software are set up in the new environments.

Testing

Post migration tests are conducted to ensure that migration has been successful. Performance and load testing, failure and recovery testing, and scale-out testing are conducted against the expected traffic load and resource utilization levels

- Test Performing and loading
- Test failure and recovery
- Test Scale-out (load balancing resource utilization)

7. Summary

According to the given scenario, ATN company is having problems with data storage, we have some

Proposal for the company: Cloud storage. It has our advantages and disadvantages, we also have some imperfections.

If the company has chosen Cloud Storage, then we have given the advantages and disadvantages as well as objective opinions about the choice.

An enterprise needs more bandwidth than usual, so cloud-based services can meet that need immediately thanks to the large capacity of remote server services. In fact, flexibility is a deciding factor.

This can have serious financial risks. But when everything is stored in the cloud, data can still be accessed no matter what happens to the computer.

With cloud computing, businesses can reduce or completely cut their initial investment because there is no need for on-site data centers (no need to install servers, hardware, software, equipment depreciation, etc.).

The application of cloud computing is very diverse, often classified by features and belonging to one of the following three types of services:

• Software as a service (SaaS)

• Infrastructure as a service (IaaS)

• Platform is a service (PaaS)

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