College of Computer Training (CCT)

Assignment Cover Page

Module Title:	Cloud Computing
Assignment Title:	Data Centre
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Assignment Due Date:	31/10/2021

Academic Year: **Year 1** ☐ **Year 2** ■ **Year 3** ☐

DECLARATION

I, the above-named student, confirm that by submitting, or causing the attached assignment to be submitted, to CCT, I have not plagiarised any other person's work in this assignment and except where appropriately acknowledged, this assignment is my own work, has been expressed in my own words, and has not previously been submitted for assessment.

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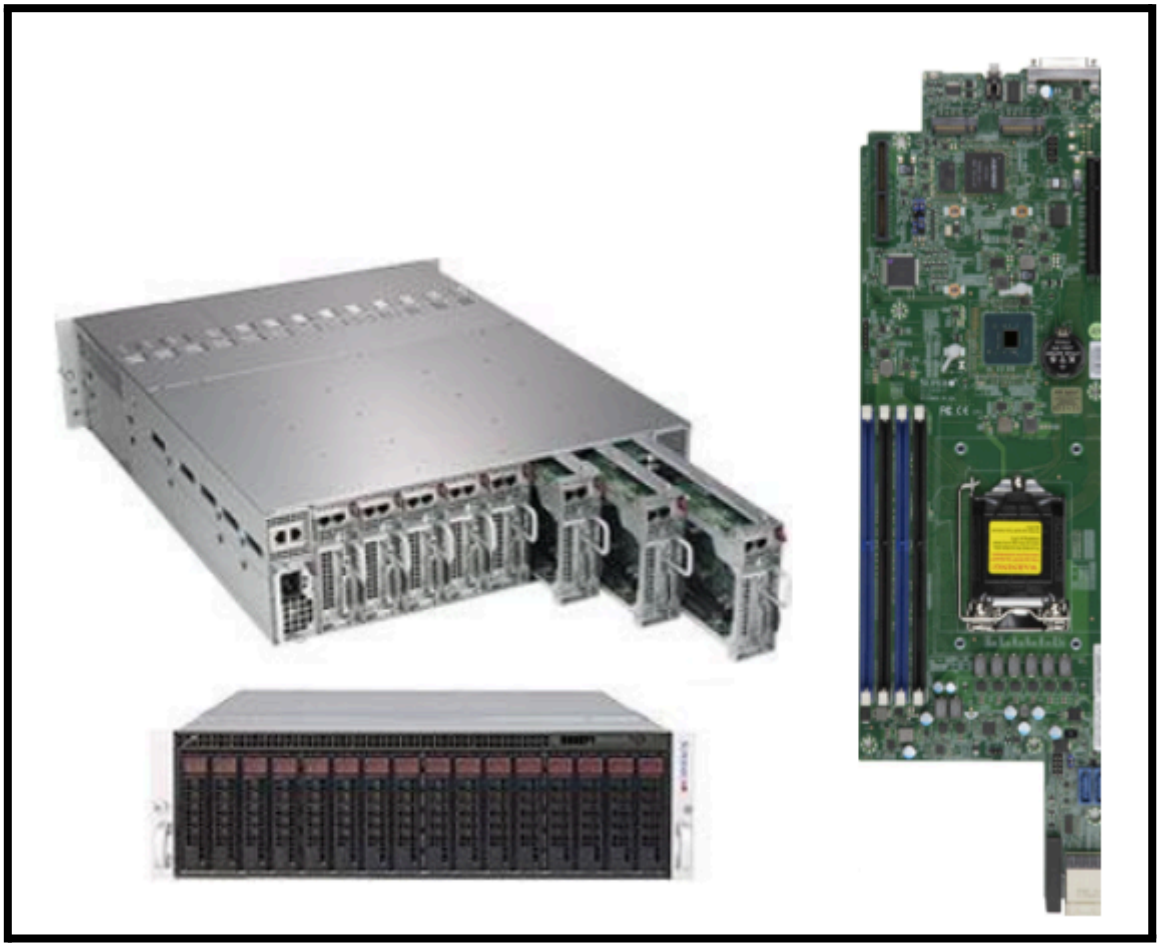
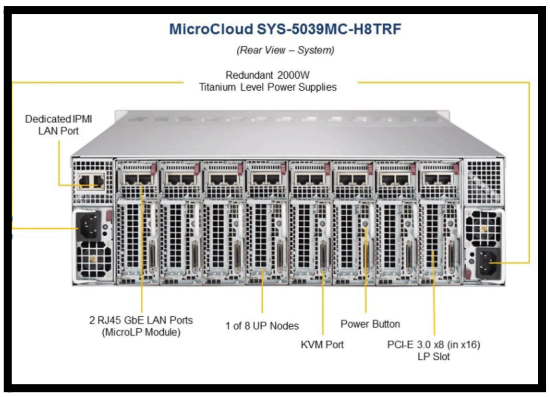
Digitech

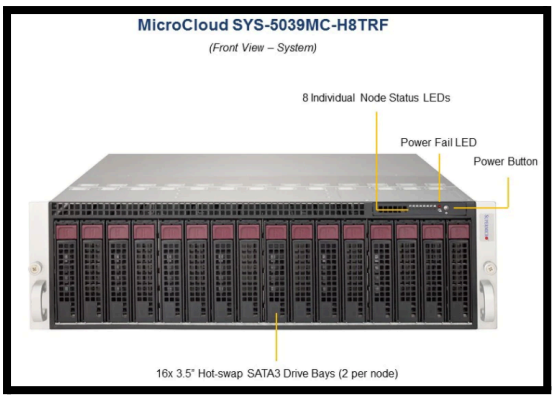
Digitech has requested a quotation of equipment prices for the data centre that will be installed in the future in our company. And based on the company's needs, always looking for the best cost-effective products and thinking about the company's improvement and growth, then we list the products and how they would be installed.



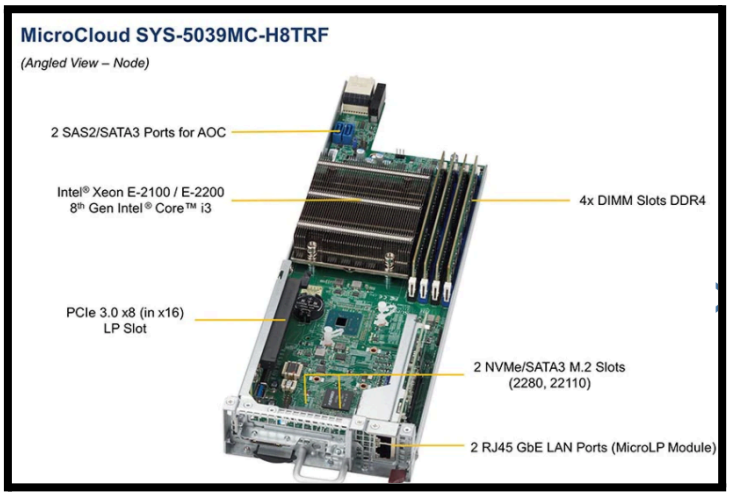
Supermicro SYS-5039MC-H8TRF.

Based on the website super micro which give us a good number of options and specifications to work with. It came with integrated Board – Super X11SCD-F. Price: €11741.83 and requesting five it will get a total of €58,709.15. Click Here to reach the website.





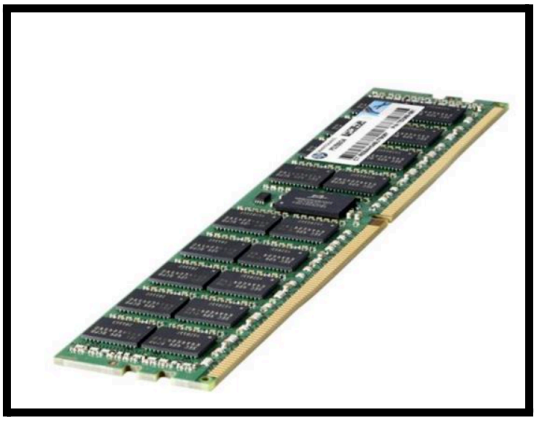
Supermicro SYS-5039MC-H8TRF has a Single socket H4 (LGA 1151) supports, CPU TDP support up to 95W, Intel® Xeon® processor E-2100/E-2200, 8th Gen. Intel® Core™ i3 Processors, Intel® Celeron®, Intel® Pentium®, Intel® C246 chipset, 8 cores max., up to 128GB unbuffered ECC, up to DDR4-2666MHz; 4 DIMM slots, 1 PCI-E 3.0 x8 LP slot, 1 Micro-LP slot (MicroLP upgradable), 2x 3.5" SATA3 drives or 2x 2.5" SATA3 with optional kits, M.2 Interface: 2 PCI-E 3.0 x4, M.2 Form Factor: 2280, 22110, M.2 Key: M-Key, 2 GbE LAN ports via Intel i350, Aspeed AST2500 graphics, 4x 8cm Heavy duty fans with optimal cooling zone and 2000W Redundant power supplies Titanium Level Certified (per system).



Mother board Super X11SCD-F has a single socket H4 (LGA 1151) supports Intel® Xeon® processor E-2100, E-2200, Intel® 8th Gen. Core™ i3 series, Intel® Celeron® and Intel® Pentium®, Intel® C246 chipset, Up to 128GB Unbuffered ECC UDIMM DDR4 2666 MHz; 4 DIMM slot, 2 SATA (6Gbps), 1 M.2 M-key SATA/PCI-E 3.0 x4 2242/2280, 1 M.2 M-key SATA/PCI-E 3.0 x4 2242/2280/22110 and 1 VGA, 2 USB 2.0, 1 COM via KVM dongle.

Rack Cabinet 19 "600x400 27 Units Black.

Reversible front door with tempered glass, removable blind side and rear panels with ¼ turn system, roof prepared with holes for ventilation system and equipped with cable entry, bottom prepared for cable entry and equipped with door, blades placed in a vertical, numbered 19 "front uprights, complete with blind plinth (h. 100 mm) with removable panels, static load capacity 500 kg, 220 kg on wheels, degree of protection IP20. Price: €615.99. Click Here to reach the website.

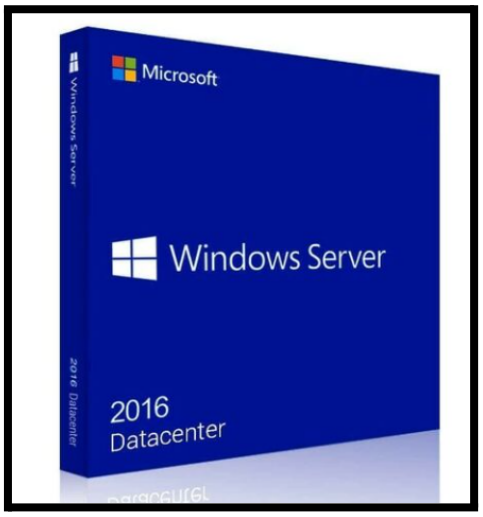


Hewlett Packard Enterprise 854596-B21 32 GB DDR4 2400 MHz memory.

Hewlett Packard Enterprise 854596-B21. Component for: PC / Server, Installed RAM: 32 GB, Memory layout (modules x size): 1 x 32 GB, RAM type: DDR4, Memory speed: 2400 MHz, Memory form factor: 288-pin DIMM, Latency CAS: 17. Price: €261.00. Click Here to reach the website.

OWC ThunderBay 4 8TB 4-Bay Thunderbolt 2 RAID Array (4 x 2TB, RAID 5 Edition)

Add 8TB of Thunderbolt 2 storage to your Mac with the ThunderBay 4 8TB 4-Bay Thunderbolt 2 RAID Array (4 x 2TB, RAID 5 Edition) from OWC / Other World Computing. These drives are pre-configured for RAID 5 via software. 8TB provides you with plenty of space to store files such as music, photos, movies, and documents, but this array also allows you to operate a production workflow with 2K video, 4K video, and audio. Price: € 662,88. Click Here to reach the website.



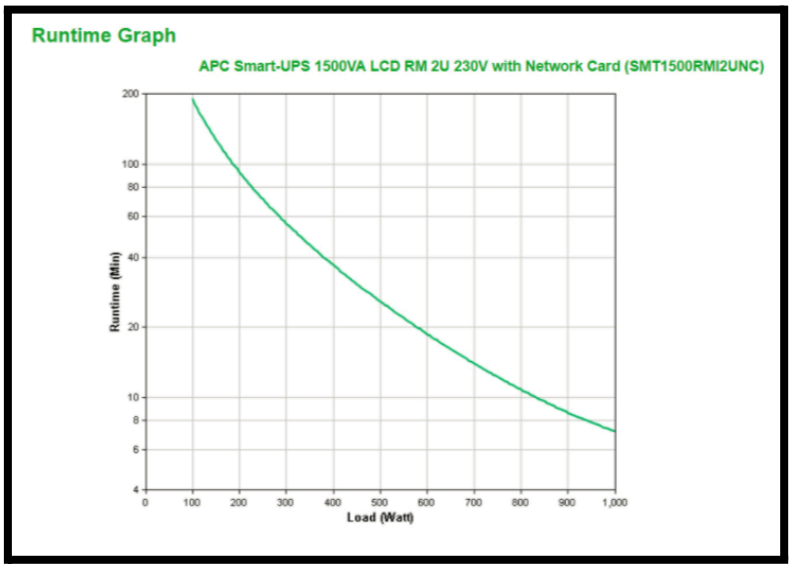
Windows Server 2016 Datacenter.

Windows Server 2016 Datacentre is designed for large companies that require an elevated level of virtualization and want to optimize their efficiency and operational performance. Windows Server 2016 Datacentre is an easy-to-install, cost-effective, application-centric, and user-centric version. Windows Server 2016 Datacentre comes with several features such as: Protected Virtual Machines, Storage Spaces Direct, Storage Replica and Software Defined Networking as well as Server Virtualization.

This edition acts as a stand-alone virtualization server for virtual machines, including all the new features around virtualization in Windows Server 2016. The host OS has no licensing cost, meaning it is free for installation, but the virtual machines must be licensed separately. This edition supports up to 64 sockets and up to 4 TB of RAM and can even be added to domains with a member server. Price: €1,999.00. Click Here to reach the website.

APC Smart-UPS 1500VA A 1000W interactive line 4 AC socket (s).

230 V, 1 KW / 1.5 kVA, 50/60 Hz, RJ-45, SmartSlot, USB, 480 x 683 x 86 mm, 44.19 kg. Cold start capability provides temporary battery power in the absence of other sources. Interactive line, 2U, Battery technology: Lead acid (VRLA) and battery capacity 432 Ah (higher than 7 hours). Price: €1,408.43. [Click Here to reach the website.]



Having 5 servers and considering that each of them will release 95W then, 475W in total, therefore, it will hold the whole data for about 30 minutes.

8 Lan Firewall Intel Core I5 6500 para Pfsense com gabinete de montagem em rack 1u 4 Sfp

Acting as reverse proxy and distributing network or application traffic across several servers, load balancers increase capacity and reliability of applications. Improving thorough performance of applications by decreasing the burden on servers, network sessions, as well as by performing application-specific tasks.

This product combines the advantages of stable and reliable industrial-grade performance and network security management and can be widely used in virtual network Private Network, Flow Control, Network Firewall, or Other Network Application Specification Type: Wired Concurrent Sessions: 800000, VPN SUPPORT: Yes, Model Number: F8 Certification: CE / RCC / ROHS Throughput: 1 Gbps Size: 430mm * 360mm * 44.5mm OS: Linux / Win XP / Win7 / Win8 / Win10 / pfSense. 8 Lan Firewall Intel Core I5 6500 for Pfsense with 1u Rackmount Case 4 Sfp. Features Supports 6th / 7th Intel® Celeron / Pentium Core ™ I3 / i5 / i7 LGA1151 architecture processors using Intel® H170 Express Chipset 2 * SODDR4 memory SLOT, support 2400MHz, maximum support 32G integrated Intel® HD Graphics Core Graphics, support 1 * HDMI Display Output 8 * Intel WGI211AT Gigabit Network Card, support Wake on LAN, PXE Function H17SL. Price: € 1,299.00. Click here to reach the website.

Company budget to be approved.

Product	Quantity	Price/unity €	Total €	Where to buy it?
Blade Server	5	11,741.83	58,709.15	Click Here to shop.
Rack cabinet	1	615.99	615.99	Click Here to shop.
RAM	1	261.00	261.00	Click Here to shop.
RAID 5	1	662.88	662.88	Click Here to shop.
OS	1	1,999.00	1,999.00	Click Here to shop.
UPS – 1500A	1	1,408.43	1,408.43	Click Here to shop.
Load Balancer	1	1,299.00	1,299.00	Click here to shop.
			64,965.45	

Parallels items - Optic cable 100M. Price: 103.87

Initially our data centre could have two or three rooms, which the first can be smaller and rectangular where we can have meetings or solve subjects that is not needed to be inside the data centre room, there will have the main door and a table with few chairs. And the other room beside to have the access into it the employees will have to use two-factor authentication, as well as to entering in the building, also biometric systems such as iris scanners, facial recognition, and fingerprint readers. On that room we will be filled with the rack to hold the servers and the UPS. Finally, the last and smaller room equipped with same physical security, we could keep computers, extra cables. As well as all rooms, the building will have security guards that will check for suspicious activity through monitoring cameras such as CCTV and DCIM (Data center infrastructure Management).

Finally, to build it up will be required a good physical infrastructure, capable of preserving equipment and its information and support for the project. Cables that carry or supports information services must be protected from interception or damages. And not forgetting that a data centre requires a solid telecommunications framework so that it can be circularly wiped. Temperature and humidity must be controlled, considering that processors raise the temperature of the environment.

Inside a Modern Data Centre

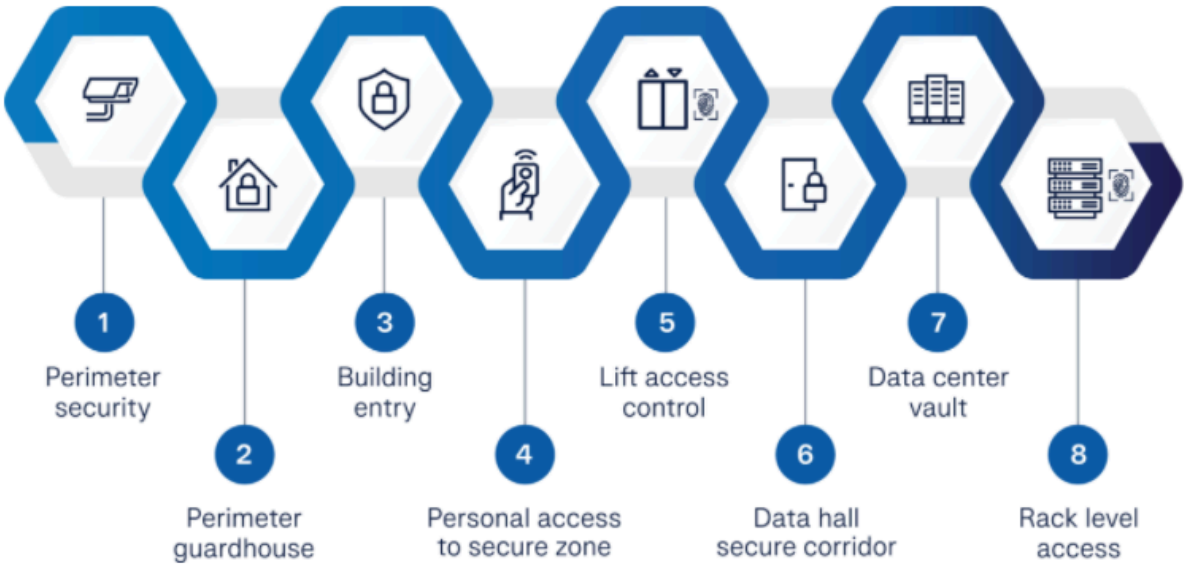
Just before we get in detail about a data centre, it will briefly be explained what it is, and how it works.

Data centres differ not simply in size, however it can also be found in some types, as well as those that are built and used by the organization itself; those who place the service using the place and equipment; those that only use data centre storage; edge data centre which built their smaller centre as closer as possible to the end user, improving the customer service, and finally the data centre clouds where companies sell space on their servers in the form of infrastructure or as a service platform, which I will explain in more detail later on.

Getting in a data centre you are going to see a big, structured building and well external security. The main pillars of the data centre that we are going to see following are: IT so then we can find Racks, fiber and copper cables, servers, another but secondary components that will be seen are the transformers, gensets, fuelling system, UPS and its battery, power panels, then another system is the cooling, where we can find chillers plants, pump system, DX air conditioning, humidification, and dehumidification system.

Inside the main room where we find the servers, we see a raised floor which some of the cables can be under it, also suspended ceilings which you can also find some cables passing through, not only cable related directly to the servers, but for the lights, energy, we can again find grounding and bounding and all the supporting for the power, cooling and id. Fire rated doors must be found once we want all equipment to secure and protected by everything. Pointing out the security, all of equipment need to be not only physically but more than that supervised.

Data is a precious product for their owners, clients, for the company, for the reason that is stored personal information and so on, consequently security is essential, a graphic with layers of security that data centre must have, is shown below to exemplify:



In a nutshell:

1- Perimeter security is the multifaceted wall, they are like pawns on the chess board, being there to resist all kinds of attacks and possible natural disasters.
2- Perimeter guardhouse which defines with prior notice who can enter and what is the limit of people in the establishment.
3- Building entry - it checks how or if it is reliable are the items that are getting inside the building.
4- Personal access to secure zone – this interesting one not only delimits the areas visitors can enter, moreover visitors are weighed in the arrival and departure location to be sure when they are leaving, but they also are not carrying anything with them surplus their weight.
5- Lift access control in the bigger data centre the visitors can go through the lift access control but only can be used designed lifts. To prevent the integrity and security of the data centre the visitors' movements are limited.
6- Data hall secure corridor - by using smart sensors and CCTV along the corridor are installed to prohibit unauthorized use. Following a policy of entry to the Network Operations centre (NOC) every person is monitored.
7- Data centres vault the most-watched place in the data centre by CCTV and where the racks are – if there are more than the authorized people there, an alarm must go off.
8- Rack level access to get the access there must be a really specific person with bunch of authorizations such as biometric access.

Safety is another big and considerable part of a data center design, so there are an amount of safety requirements starting from a fire alarm, Very Early Smoke Detection Apparatus (VESDA) which attend to a range more specific chemicals that are recognized even before the smoke of a fire, preventing it to get in a stage where it no longer has a solution. As well as the Oxyreduct that can capture the reduction of oxygen in the environment then realize that there is fire or something wrong in the environment, causing the alarm to go off. Fire stopping are installed in all the doors and cables that are connected through different rooms must be built with the fire stopping to prevent it to spread. Counting with all this safety it is hardly difficult to happen something wrong in the data centre, right? Although what if a natural disaster, such as tornadoes, earthquakes or even fire happens.

What if we could split in another location our big data centre so that we could ensure that if one of the data centres went down then we would have all our information stored and working from the other data centre without any interference to customers – this is the proposal that geo-redundancy presents to us, which in theory would work very well, but the cons are not few - especially for small businesses. Double the number of employees, machines, and everything mentioned above, which for large companies would not be a problem, but a way to prevent future expenses and losses. So, as in all situations, we must choose the ones that fit us best, meet our demands and needs.

Lastly another topic of vigilance in data centre is the DCIM – Data centre Infrastructure Management which is an automation tool which can be managed remotely by the data centre; can control the humidity in between a plenty of environments; can monitor how much energy is spent; can continuously control access to the Data Centre through closed circuit TV; it can remotely monitor the indications of the sensors for opening doors, flooding, smoke and other environmental controls adopted.

So, we have seen how is built a data centre, how is protected, how is the security and the structure, now we are going to see how it can work. Data centre are getting bigger and bigger since the number of web applications are increasing on the Internet. Those applications are getting

complex and demanding it of the data centre. The number of resources required for a given resource type is termed as workload. The workload classification and characterization are used for resource and application performance management, capacity sizing and to estimate the future source demand.

As soon as cloud computing becomes all over the place, the hypervisor has come up as an inestimable tool for running virtual machines and driving innovation in a cloud environment. Then the hypervisors are a key element of the technology once it enables one host computer to simultaneously support multiple VMs, making cloud computing possible.

The hypervisor has the client-side and server side, and some conditions differ them, scalability, reliability, cost, and responsiveness.

Client-side hypervisor	*Server-side hypervisor*
New users add with no impact.	Limited and requires overbuilding for a peak of capacity.
A failure may bring down one user.	An incident can bring down an entire company
Provides a secure container on the device, protecting user and company data.	Secures the data in a data centre. Vulnerable when accessed from an unmanaged machine.
Low cost – simple and use CPU storage.	High cost – complex, has network upgrades and SAN storage.
Users can access applications in cloud, in a quick way.	Takes time by transmit keystroke and mouse click between the data centre and user.

Cloud is an important subject from the small to big business, as soon as we want to migrate to the cloud, we must understand what they are and how they work.

Saas: Software as service, this is the most common used by the busyness, once it works in an easy way – in the majority of the applications, SaaS run straight forward in the web browser, which means that it is not required to download or install anything on client side.	PaaS: Plataform as Service, customized applications can get the structure from PaaS once they deliver framework for developers. The developers can keep management of the applications while all server's storage, and networking can be managed by the enterprise or a third-party provider.	IaaS Infrastructure as Service, in a smart way, IaaS allows companies purchase resources on-demand and as-needed and they are made of highly scalable and automated compute resources. It is known as well as a self-service to have an easy access and monitoring of computers, networking, storage, and other services.

Migration Strategy

The process of moving an organization data that already exists from a data centre to another operating environment is what we know as a migration. For many reasons the migration is an option for companies which wants to increase agility, reduce costs, improve time to market or to eliminate server sprawl.

There are two options to transfer their website and virtual machines to the cloud – in a Big Bang Approach – all-at-once, and Phased Approach which goes in segments.

The first one is the one I would really recommend to you because it has some benefits and getting things done at once, is an easy way of being organized and compromised. The total migration cost is reduced, once it is only one work, and the ability to work on it with a single deadline. It can take time, but once is done everything gets back to normal.

In the phased one the data is shifted in segments, and the phases depend on the time, size, or volume of data. It can take a short time it phases but they are more steps, on the other hand, it is easy to find and work out on bugs, and also the time that is taking can be used to train about the new system.

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