Cloud Deployment Models

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What will be discussed

- So far we have seen the basic models of cloud computing and the technical requirements necessary in order to make such a platform happen.
- In this topic we will cover how a cloud may be deployed.
- As using a public cloud like AWS, GAE or another is not the only option.
- The choice of an appropriate deployment model will depend on each individual situation as no one option will suit all cases.

What will be discussed

- There are four basic deployment models: public, community, private, and hybrid.
- Each model has its advantages and disadvantages which must be considered when a cloud application is being built or acquired.
- Thus as part of the design or acquisition process you will need to know how you intend the application to run as well as determining if SaaS, PaaS, or IaaS is the appropriate model.

Private Cloud definition

- A private cloud is one in which the cloud infrastructure is provisioned for exclusive use by a single organisation comprising multiple consumers.
- It may be owned, managed, and operated by the organisation, a third party, or some combination of them, and it may exist on or off premises.

Private Cloud Deployment Model

- For a private cloud to function the organisation in question must have physically available computation resources that are located on premises or offsite but connected to the organisation.
- This also requires that the organisation in question has the necessary capital and skillset available to construct and maintain said computation resources.

Private Cloud Deployment Model

- In doing so the organisation will have a cloud resource devoted entirely to itself that is available for use 24/7 and the organisation does not have to compete with other entities for access to computation resources.
- However the organisation will need to maintain and upgrade this cloud in line with demands on this cloud resource.

How a Private Cloud is put together

- Like the cloud examples you saw previously a private cloud needs to have computation power, bandwidth, and storage available.
- Then using a cloud OS like OpenStack they are linked together and made available to the organisation.
- The cloud OS will then provide services for running VMs, storage, networking, load balancing etc.
- E.g. similar in nature to the services provided by AWS, Google Cloud, etc.

How a Private Cloud is put together

- All applications will be written to these services and set running on this private cloud.
- And can be configured to scale with demand as necessary.
- As resources are virtualised they are free to move around and can be killed and cloned with ease compared to a traditional IT setup.
- Requires a lot of setup work but can lead to much better use of resources as a result.

Advantages of the Private Cloud Deployment Model

- The private cloud provides an always on 24/7 resource devoted entirely to the organisation. There is no competition for access to the resource.
- All data held by the organisation remains in the entire control of the organisation. There is no outside data access or storage. Confidentiality is assured.

Advantages of the Private Cloud Deployment Model

- More complete and efficient usage of all computation resources. Virtual machines can be used to make sure physical resources are running as close to 100% all the time.
- Complete control over the security of the system. Easier to define who has access to what parts of the system.

Disadvantages of the Private Cloud Deployment Model

- If a private cloud is required a significant amount of time and cost must be set aside for either creating this cloud from scratch or converting current disparate computation resources into a single cohesive cloud.
- There is an ongoing cost in maintaining the computation resources and they will need to be added to or upgraded depending on the computation demands of the organisation.

Disadvantages of the Private Cloud Deployment Model

- Taking the two previous points together there doesn't appear to be much initial benefit to having a cloud computing model over the previous model that existed of separate resources.
- The security of the private cloud is the entire responsibility of the organisation.

Community cloud definition

- A community cloud is one in which the cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organisations that have shared concerns.
- It may be owned, managed, and operated by one or more of the organisations in the community, a third party, or some combination of them, and it may exist on or off premises.

How a Community Cloud is put together

- A community cloud is put together in a similar way to a private cloud but there are additional steps and decisions that need to be taken.
- This is because more than one organisation is involved in the setup and management of the cloud.
- Decisions need to be made as to where computation power is stored, managed, and maintained.
- Also decisions need to be made as to who contributes to the cost, maintenance, and computation upgrade budgets.

How a Community Cloud is put together

- Once these decisions have been made the construction of the community cloud follows a similar process to that of a private cloud.
- Except multiple organisations collaborate to integrate all elements of the community cloud.
- Once running usage tracking of all resources is done to ensure that each organisation adequately pays for how much of the resources they use.
- Applications are then converted and run on this community cloud in a similar way to that of a private cloud.

Advantages of the Community Cloud Deployment Model

- As there are multiple organisations involved in the creation and upkeep of the cloud the capital cost is not a severe as the private cloud model as the cost of the cloud is shared.
- There is some physical and computation redundancy introduced if there are multiple physical sites for this cloud.
  - i.e. if a fire in one part destroys part of the cloud this may reduce the overall available computation power but that organisation still has internet facing resources by using the other's infrastructure.

Disadvantages of the Community Cloud Deployment Model

- As there are multiple organisations there is some element of competition for access to and use of resources.
- Segregation and access control to data has to be very carefully controlled. If not there is the possibility of one organisation seeing another organisation's data.

Public cloud definition

- A public cloud is one in which 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 organisation, or some combination of them.
- It exists on the premises of the cloud provider.
- This is the model used by AWS and GAE.
- Won't go into how one of these are constructed and used as we had an entire lecture on this already.

Advantages of the Public Cloud Deployment Model

- There is no capital outlay required for constructing a cloud as the cloud vendor is responsible for this.
- Consequently there is no capital required for upgrades as again this is the responsibility of the vendor.
- Applications run on cloud infrastructure that is almost guaranteed to be running 24/7 without fail as this is the infrastructure that runs Amazon, Google, Microsoft etc.
- Open to everyone, individuals as well as large organisations can make use of a public cloud.

Disadvantages of the Public Cloud Deployment Model

- As was seen previously in the Security lecture there are many security concerns with using a public cloud for running applications.
- Loss of data control. You have no idea where in the public cloud your data is stored, or even if data is deleted when it will be permanently removed.
- Application security is also a concern particular if services provided by the vendor are used. If security issues present in these services your application is vulnerable if services used.
- Potential for vendor lock-in is also present.

Hybrid cloud definition

- A hybrid cloud is one in which the cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but our bound together by standardised or proprietary technology that enables data and application portability.
- The main use for a hybrid cloud is to take advantage of the resources provided by a public cloud when a private cloud or community cloud has currently exhausted its own resources.

How a Hybrid Cloud is put together

- To put together a Hybrid cloud a private or community cloud must already be in place. (Process for both is already documented).
- A public cloud must be chosen and the applications that may use the public cloud need to be augmented with versions that will work on the public cloud.

How a Hybrid Cloud is put together

- These public versions must then be made to integrate and work with those already existing in the private or community cloud.
- A VPN (Virtual Private Network) is then used to connect the public and private parts together with a secure communication link to prevent man in the middle attacks.

Advantages of the Hybrid Cloud Deployment Model

- Provides additional external computation power as and when it is needed.
- Is useful for dealing with large irregular spikes in demand that don't occur often.
- Consequently the private/community section of the cloud can be designed for the typical rather than the worst case.
- Can minimise the cost of the private/community section as a result.

Disadvantages of the Hybrid Cloud Deployment Model

- Requires a lot of work to construct and ensure that it works as applications potentially have to be written twice, once for each model.
- Consequently maintaining two codebases for each application is a difficult software engineering challenge.
- Still requires the capital outlay for the private/community resources and their upkeep.

Multi cloud definition

- A multicloud is one in which the cloud infrastructure is a composition of multiple cloud computing services connected together into a single heterogeneous architecture to reduce dependence on a single vendor.
- Used to mitigate against disasters that may threaten a datacentre.
- Also used to increase flexibility through choice of different vendors in a single system.

How a Multicloud is put together

- A multicloud application is constructed in the same way as a public cloud application. Except this has to be done multiple times, one for each vendor.
- Any components that are common between vendors (use the same language, APIs etc) can be written once and shared amongst all vendors.

How a Multicloud is put together

- Any components that require APIs, languages that are not common between vendors have to be written once per vendor and each tested to ensure that they work correctly.
- Finally all components need to be connected and synchronised across the clouds.

Advantages of a Multicloud Deployment Model

- Avoids the issue of vendor lock in, enables resources to move between multiple cloud vendors depending on the required criteria (usually cost).
- As multiple datacentres are used an outage in one datacentre will not affect the other provider's datacentres.

Disadvantages of a Multicloud Deployment Model

- An absolute nightmare to design and build such a cloud.
- Very difficult to ensure that each version of the application functions in the same way considering the difference in APIs, languages, services, etc.
- As a result this is a very long and intensive task to get up and running.
- Different security issues will be present in different clouds making securing an application very difficult.

Factors that are involved in the decision for a deployment model

- There are various reasons why an organisation may chose from a different range of deployment models.
- The consideration of factors such as security concerns, data control, data confidentiality, capital cost will have a direct influence on what kind of deployment is used for the cloud application.
- Here we will explore some of these factors and how they will then influence the choice made on which deployment model will be used.

Factors that are involved in the decision for a deployment model

- If data control and data confidentiality are the main concerns this would strongly suggest a move towards a completely private deployment model.
- As this is the only model that will guarantee complete control over all data.

Factors that are involved in the decision for a deployment model

- A community model may work here but only if the organisation can ensure and trust that the other organisations will not access or attempt to access their data.
- Public clouds are not allowed in this situation as in a public cloud data is under the control of the provider.

Factors that are involved in the decision for a deployment model

- If cost is the main concern then the public cloud is the best option as there is no capital outlay for acquiring access to computing power, storage, and bandwidth.
- Also the ongoing cost of the application will be at a minimum due to economy of scale with a large public cloud.
- In cases where some data and processing needs to be confidential but other data and processing tasks can take advantage of the public cloud then a hybrid model may be best.

Factors that are involved in the decision for a deployment model

- Particularly in cases where there are very few demand spikes in a year that could be offloaded to the public cloud.
- If avoiding vendor lock in and geographical redundancy are the highest priorities then the multicloud is the way to go.
- However as stated previously this will require a huge amount of work.