

Cloud Standardisation Efforts

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April 6, 2020

What will be discussed

- ▶ Here we will discuss the current attempts and available documentation about how cloud standardisation efforts.
- ▶ If you look back at everything thus far we can see that different cloud vendors use different models.
- ▶ And thus vendor lock in is nearly unavoidable. The only real way around this was to use a multicloud solution but that was a lot of work.

What will be discussed

- ▶ There are now efforts to standardise parts of the cloud to reduce the amount of vendor lock in.
- ▶ Will cover as much as possible here but will leave the open virtual machine format and reference architectures to later weeks.

Why is standardisation needed

- ▶ At the moment due to the lack of standards cloud vendors must design and implement all aspects of a cloud.
 - ▶ Including the physical structure.
 - ▶ And all of the provided services.
- ▶ However because there is no specific standard for cloud services each vendor makes its own interpretation of what cloud services should be and how they should work.
- ▶ As you saw in previous lectures this leads to a problem of vendor lockin whereby it is extremely difficult and time consuming to move from one vendor to the next, should a change be desired.

Why is standardisation needed

- ▶ This issue is not just restricted to public clouds it also shows up in the private, community, and hybrid models as well.
- ▶ For example if we were to have a hybrid of a private and public cloud where OpenStack was used in the private part and AWS in the public part there would be no guarantee as to what services are provided in both.
- ▶ Or that they function in a similar way.
- ▶ And have similar APIs and programming languages.

Why is standardisation needed

- ▶ Thus if you want to change the private or the public part a lot of research has to be put in before making a decision.
- ▶ And then a lot of time in converting all existing services to run on the new platform.
- ▶ The aim of standardisation is to remove the need for doing this work and to establish the base set of capabilities and functionality that all clouds must provide.
- ▶ Making it easier to transfer from one cloud provider to the next and remove vendor lockin.

The aim of standardisation

- ▶ The main aim of standardisation is to produce interoperable clouds.
- ▶ Meaning that all elements of a cloud computing solution should be able to move seamlessly from one cloud provider to another cloud provider or deployment model and function without modification.
- ▶ This will encompass everything from storage, network, CPU to services provided, virtualisation methods, APIs etc.
- ▶ This also includes the important issue of security policies that need to be moved across from one provider to the next.

The Main Standardisation Bodies that are involved in this

- ▶ There have been many standardisation efforts over the years but currently there appears to be five organisations that are still working on the problem.
 - ▶ Storage Networking Industry Association (SNIA).
 - ▶ IEEE.
 - ▶ Distributed Management Task Force (DMTF).
 - ▶ Open Grid Forum (OGF).
 - ▶ Advancing Open Standards for Information Society (OASIS).
- ▶ We will discuss what each is aiming to do and also what they have produced thus far.

The Main Standardisation Bodies that are involved in this

- ▶ Distributed Management Task Force:
 - ▶ Trying to establish a transport mechanism for moving virtual machines from one hosted platform to another.
 - ▶ This has produced the OVF format that has been adopted by many virtualisation companies already
- ▶ IEEE:
 - ▶ CPIP: Metastandard with profiles for existing and in progress cloud computing standards in areas such as applications, portability, and management.
 - ▶ SIIIF: Establishes the characteristics necessary to create cloud interoperability and federation.

The Main Standardisation Bodies that are involved in this

- ▶ Open Grid Forum:
 - ▶ Development of APIs for cloud management tasks. APIs should enable interfacing between IaaS cloud implementations.
 - ▶ This is the Open Cloud Computing Interface (OCCI).
- ▶ Organisation for the Advancement of Structured Information Standards (OASIS):
 - ▶ ID Cloud is focused on security issues such as identity management and vulnerability mitigation.
 - ▶ Symptoms Automation Framework is to establish communications so that cloud providers understand consumer requirements.

The Main Standardisation Bodies that are involved in this

- ▶ Storage Networking Industry Association:
 - ▶ Provides standardisation for client interactions with cloud-based storage, cloud data management, and cloud to cloud storage interactions.
- ▶ Overall the bodies are looking to standardise: virtualisation, cloud models, interoperability, management tasks, security and consumer requirements.
- ▶ While this may not cover all aspects of the cloud right now. Any standardisation will reduce vendor lock in and the workload required to move from one cloud to the next.

The requirements for standards as defined by NIST

- ▶ NIST the body from which our definition of cloud computing comes from have also defined a number of things that need to be standardised.
- ▶ In their cloud computing reference architecture document they identify some issues that will need to be standardised and solved to improve interoperability.
- ▶ We will list some of the issues they have identified.
- ▶ CRUD functionality of data objects.

The requirements for standards as defined by NIST

- ▶ Moving VMs, Virtual appliances, and services between clouds.
- ▶ Portable tools for monitoring and managing cloud systems.
- ▶ Moving data between clouds.
- ▶ Single Sign-On (SSO) access across clouds.
- ▶ Orchestration of Processes across clouds.

The requirements for standards as defined by NIST

- ▶ The above list is by no means exhaustive but it does feature some of the most important issues that need to be resolved and standardised if interoperability is desired.
- ▶ We will explore what the benefits of standardisation in each area will bring and if possible what standards are being considered for it.

The requirements for standards as defined by NIST

- ▶ Note that standardisation takes a long time as standardisation bodies, vendors, and consumers all take part in the process.
- ▶ NIST and the other bodies is aiming to produce and ratify standards as soon as possible.

CRUD functionality of data objects

- ▶ The aim of standardisation here is to standardise interfaces to metadata and data objects.
- ▶ The benefit being that there is one and only one way to interface with data across all cloud providers.
- ▶ Making it much easier to build cross cloud applications as only one data mechanism needs to be written instead of one per provider.
- ▶ Authentication and authorization also needs to be considered with this.
- ▶ CDMI as mentioned earlier is being considered as a standard for this.

Moving VMs, Virtual Appliances, and Services between clouds

- ▶ The aim of standardisation here is to agree on formats for VMs and for VMMs along with service and application description formats.
- ▶ The potential benefits here are: Migration of VMs between clouds, Hybrid cloud setups, Disaster recovery, and Cloudbursting.
 - ▶ Cloudbursting is when an application runs in a private cloud and only uses the public cloud to deal when a demand spike exceeds private cloud capacity.

Moving VMs, Virtual Appliances, and Services between clouds

- ▶ Again makes it easier for cross cloud applications as VMs and services will not need to be duplicated or converted from one service to the next.
- ▶ OVF has been decided for VM formats and OASIS's TOSCA, OpenID, and OAuth being considered as well.

Portable tools for monitoring and managing cloud systems

- ▶ The aim of standardisation here is to agree on common tools for consumers to manage, maintain, and monitor their cloud applications across different vendors.
- ▶ The main benefit is that operations will be vastly simplified as a single set of tools can be used to manage the application in multiple clouds.

Portable tools for monitoring and managing cloud systems

- ▶ Instead of having to rely on and correlate each set of tools, as there will be a set of such tools for each individual cloud vendor.
- ▶ There are a number of competing standards for this including OCCI as mentioned above.

Moving data between clouds

- ▶ The aim of standardisation here is to make it easy to migrate data from one cloud to the next.
- ▶ Currently this is the biggest cause of vendor lockin in clouds as each vendor has different ways of storing data.
- ▶ The main cause here is the lack of standardised metadata/data formats for data.
- ▶ Thus when a consumer wishes to move from one cloud to the next they must spend a significant amount of time and energy converting their data from one format to the next.

Moving data between clouds

- ▶ Standardised query languages will also be required along with secure data transfer.
- ▶ The benefits of having standardised metadata/data formats it that migration between clouds will become a much easier and quicker process.
- ▶ Will also make cross-cloud/multicloud integration significantly easier as well as data conversion will not be necessary.
- ▶ Possible standards for this that are being considered are CDMI as mentioned earlier but also NoSQL amongst others.

Single Sign On (SSO) access across clouds

- ▶ The aim of standardisation here is to enable consumers to use the same credentials across multiple cloud platforms, instead of having to maintain and coordinate multiple sets of credentials.
- ▶ Something like this would need to use a federated identity and authorisation mechanism.
 - ▶ "A federated identity in information technology is the means of linking a person's electronic identity and attributes, stored across multiple distinct identity management systems."
 - ▶ Definition from wiki.

Single Sign On (SSO) access across clouds

- ▶ In this way there would only be a single set of credentials required across multiple clouds making cross-cloud and multi-cloud operations and transfers to occur much more easily.
- ▶ Standards being considered for this include OpenID and OAuth.

Orchestration of Processes across cloud systems

- ▶ The aim of standardisation here is to enable processes across multiple clouds to coordinate their activities as a fully distributed system.
- ▶ A lot of standardisation has been identified by NIST here in order for this to function.
- ▶ A lot of what you see here will be very similar to requirements for a distributed system.
- ▶ The benefit of standardisation here is that it makes it easier to synchronise and coordinate process amongst different clouds.

Orchestration of Processes across cloud systems

- ▶ The capabilities that need to be standardised here according to NIST are:
 - ▶ Infrastructure services.
 - ▶ Execution Management services.
 - ▶ Data services.
 - ▶ Resource management services.
 - ▶ Security services.
 - ▶ Self-management services.
 - ▶ Information services.

Orchestration of Processes across cloud systems

- ▶ There are many competing standards for this as there are a large number of things that need to be standardised here.
- ▶ Thus it may take a while before this is fully agreed on.

Other areas that require standardisation in the cloud

- ▶ The list that you saw in the previous slides deal with technical issues that have arisen in the cloud computing space that deal with processing.
- ▶ However, there are other still technical issues that deal with the more administrative elements of running a cloud, such issues are the following:
 - ▶ Discovering Cloud Resources.
 - ▶ Evaluating SLAs and penalties.
 - ▶ Auditing Cloud Systems.

Discovering Cloud Resources

- ▶ The aim of standardisation here is to support inter-cloud resource discovery, and also to enable discovery of resources and associated APIs.
- ▶ The idea here would be that if resources and their descriptions have a standard format and discovery mechanism it will make it much easier for a consumer to discover cloud vendors that provide the services they require.

Discovering Cloud Resources

- ▶ RDF is one such technology that is under strong consideration for this as it is a machine readable format for description of resources.
- ▶ Some metadata resource competing standards are using this as a way of making it easy to discover the necessary resources.

Evaluating SLA and penalties

- ▶ The aim of standardisation here is to have a common description language for SLAs and also the penalties described within.
- ▶ Different vendors will have different terminology in their SLAs and the meaning of similar terms may differ from one vendor to the next.
- ▶ Thus if a common language and penalties were to be used it would make it much easier for a consumer to see and understand an SLA.
- ▶ The current standards that are being considered for this are WS-Agreement and WS-AgreementNegotiation.

Auditing Cloud Systems

- ▶ An absolute must particularly if the application or task in question requires regulatory compliance (banking, insurance, etc).
- ▶ Auditing will generally be done between a single client and provider.
- ▶ A standard for this needs to observe standards for authentication, authorisation, integrity, and non-repudiation.
- ▶ At the moment the current possible standard for this is the CSA Cloud Audit.

Where we are and where we are headed

- ▶ At the moment very few if any of these standards have been ratified or implemented (aside from OVF).
- ▶ It may be a significant amount of time before the first standards appear and cloud vendors adopt them.
- ▶ Thus currently we are still stuck with the situation where a consumer can be locked in to a vendor from the moment they choose what service to use.
- ▶ Not an ideal situation.

Where we are and where we are headed

- ▶ When standards do eventually come along and are adopted the following things will happen.
 - ▶ Based on experience with standards appearing in other areas of computing.
- ▶ Vendor lock in should be vastly reduced if not removed altogether.
- ▶ Implementation of multi-cloud and hybrid cloud models will become much easier.
- ▶ Vendors will then have to compete on the quality and performance of services they provide instead of trying to lock in consumers.