Generic Cloud Computing Framework Understanding and Implementation

Emmanuel Kayode Akinshola Ogunshile
Department of Computer Science, University of the West of England, Bristol, U.K.

Keywords: VLAN – Virtual Local Area Network, IaaS – Infrastructure as a Service, SaaS – Software as a Service, PaaS – Platform as a Service, CAD – Computer Aided Design, CRM – Customer Relationship Management, vCPU – Virtual Central Processing Unit, COTS – Components of the Shelf.

Abstract: The rate of adoption of cloud services is increasing year on year as organisations realise the many benefits that moving operations onto a cloud based platform provides. However, there is an argument to be made that with the multitude services that offer cloud solutions in various forms, that choosing the right technology for a business is not straight forward and cloud services may not always provide all the benefits suggested by the service providers. Using the case study of *OneDrum Ltd* as a comparison of compatibility, an analysis of current cloud providers as well as hardware that is used to provide cloud solutions is considered. With these examples, potential solutions for the *OneDrum Ltd* scenarios have been devised with the aim to create transferable solutions for other small manufacturing businesses.

1 INTRODUCTION

The numbers of cloud service types and providers has increased rapidly as the technology has become more widely understood and easier to deploy. This increase in cloud solution providers and types of service provides a new set of issues and potential confusions for any small or medium sized business which is trying to understand the potential benefits and risks of moving any of their operations to a cloud solution. Some of the key advantages as marketed by cloud providers are ideas such as increased flexibility, reduced running costs, reduced capital expenditure and automated software updates *(Rackspace, 2014).* These however, may not be applicable for all business cases depending on a particular businesses requirements therefore further consideration is required to assess a business's suitability to cloud based infrastructures and which solution is most beneficial to the individual business.

This paper therefore intends to outline the *OneDrum Ltd* business case study and summarise some of the current solutions that are available for the business as well as the solutions suitability to that businesses requirements. This will also include an overview of the available hardware which underpins these services. From this analysis, multiple cloud solution will be designed and justified using the requirements to try and create a solution that would help facilitate the goals the business has for moving operations to cloud based infrastructure.

2 BUSINESS SCENARIO

OneDrum Ltd is a small business based in Reading that produce drum kits and accessories. The business has three distinct departments: Administration, Design and Manufacturing (See Figure 1). The business currently has a 10Gbps Ethernet network connection to which it has dedicated VLANs for each department. Further to this, the company has two HP ProLiant ML110s, one of which is used as a webserver and the other which is used as a storage, database and domain controller server. The company mainly shares data through shared drives on the storage server and backups are done via tape drives within the servers. In terms of daily operations, all employees have their own desktop computer which has all of their required software, such as Microsoft Office, installed locally.

OneDrum Ltd is looking to expand its online ecommerce presence due to a recent increase in demand for their products and their intended focus to expand internationally. They have recently had issues with their webserver crashing due to increased user

Ogunshile, E.
Generic Cloud Computing Framework Understanding and Implementation.
In *Proceedings of the 6th International Conference on Cloud Computing and Services Science (CLOSER 2016) - Volume 1*, pages 206-215
ISBN: 978-989-758-182-3

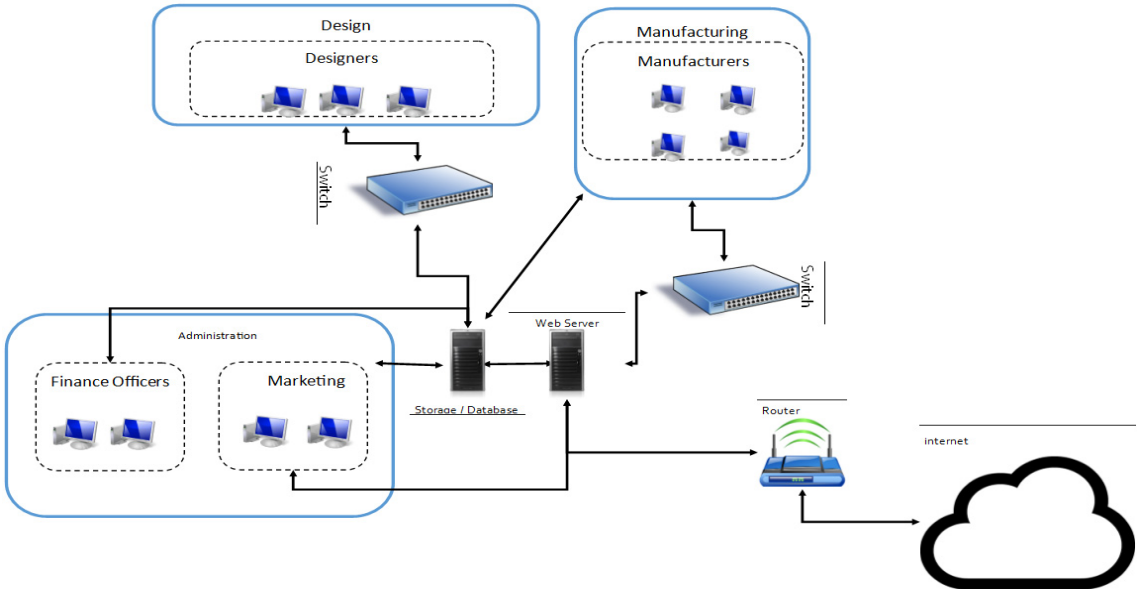

Figure 1: Distinct Departments of OneDrum Ltd.

traffic on their website which the HP ProLiant ML110 was not equipped to handle. Further to this also had an incident with loss of customer data due to a hard drive failure and the tape backups only being run once a day and the day's sales and communication was lost. The CEO of *OneDrum Ltd* is also increasingly concerned with the free use of shard drives on the network to send files as these are not properly secured with the appropriate credentials and this has resulted in some employees seeing data that they are not supposed to have access to.

OneDrum Ltd need a solution that will cater to their backup and security needs as well as help them to expand easily when it comes to online orders and international sales in terms of storage, compute and network requirements.

3 CLOUD SERVICE TYPES

One of the main issues with comparing different cloud providers is that they do not often use the same metrics to describe what they offer even when offering similar services. This can be due to reasons such as not disclosing the hardware resources that are being used by each provider, therefore two providers may offer the same service but performance may vary greatly. It is therefore hard to analyse the pros and cons of one service over another. There have been some attempts to create standards in this respect but none have become universal as of writing.

Therefore, in order to successfully discuss and design a cloud solution for *OneDrum Ltd*, discussion of the various different types of Cloud Solutions and how they could be used within *OneDrum Ltd* will be undertaken to decide which would be best suited to the businesses requirements. These cloud solutions are often split into 3 main groups: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) *(IBM, 2015)*.

3.1 IaaS

IaaS gives the service consumer the most control as this type of solution most closely resembles that of a traditional on-premises datacentre. The cloud provider provides the consumer with ability to provision compute power, storage and networks while managing the underlying cloud infrastructure itself. The consumer has control in terms of operating systems, storage, applications and to a limited degree networking components *(Michael J. Kavis, 2014)*.

The advantage to the service consumer is that it removes the level of hardware management that is required, simplifying the process of procuring more compute performance, storage or network bandwidth. This management is replaced with web based management consoles and can also give the ability to automate certain standard deployment procedures *(Michael J. Kavis, 2014)*. This also means that the speed at which the infrastructure is deployed is much quicker allowing for a much greater degree of flexibility for a business.

3.2 IaaS within OneDrum Ltd

OneDrum Ltd could use this type of cloud service to migrate its physical servers to an IaaS provider, allowing *OneDrum Ltd* to adapt quickly to any potential new requirements in terms of compute performance, storage or network throughput that expanding their online e-commerce business and expanding internationally could result in. This would however mean that management of the servers would still be the responsibility of *OneDrum Ltd It Administrators*. *OneDrum Ltd* are also having issues with keeping data backed up regularly, which would be solved using an IaaS solution as it would then be the responsibility of the service provider to ensure the data is safe should hardware fail. However depending on service, the IaaS solution may mean that *OneDrum Ltd* is susceptible to any outages on the part of the service provider or network infrastructure issues may result in the inability to connect and manage *OneDrum Ltd's* servers.

3.3 PaaS

PaaS involves the delivery of a computing platform such that it often involves the delivery of web applications without the need to configure the underlying hardware and software that would normally be required *(Michael J. Kavis, 2014)*. There are two forms of PaaS, which are public and private variations. Public PaaS involves a consumer uses applications that are hosted on a public cloud via a provider where the consumer has access to software deployment and some configuration settings *(David Linthicum, 2013)*. Private PaaS involves the use of private datacentres that are managed by consumer IT departments *(David Linthicum, 2013)*. The public PaaS takes away some of the requirement to configure underlying infrastructure for applications to run, this includes networks, servers, storage or operating systems but allows the consumer to have control over the application and possibly settings for the application environment. One main issue with this is that the developers deploying software services provided by a PaaS vendor are sometimes limited to the tools and programming languages they can use as well as not having much control over memory allocation or other hardware functionality *(Michael J. Kavis, 2014)*.

3.4 PaaS with OneDrum Ltd

PaaS is not suited for use with *OneDrum Ltd* as none of the requirements outlined in the scenario require the development of customised web based applications.

3.5 SaaS

SaaS involves delivering the entire application as a service to the consumer and the entirety of the infrastructure behind that is handled by the service provider and only the users and any specific application configuration is handled by the user *(Michael J. Kavis, 2014)*.

SaaS can be advantageous to smaller companies as they do not have to configure any of the application infrastructure or provide support and maintenance therefore no staff are required for this role. These solutions are usually paid for via a subscription fee and the software has the advantage of being updated regularly with the ability to add new features and have them deployed quickly *(Naresh Kumar, 2012)*. One of the disadvantages is that the user may be locked into the use of that software without any easy option to migrate should the companies situation change as the company does not actually own the software they are using *(Naresh Kumar, 2012)*. Further to this like all cloud solutions SaaS requires a connection to the internet for full functionality therefore, should the company have network issues, it could overall be costly over an offline equivalent piece of software.

3.6 SaaS with OneDrum Ltd

OneDrum Ltd Administration department can use SaaS software such as CRM management tools to track stock and sales on their website as well as the potential use of SaaS office suites which would potentially reduce the cost of new hires and providing them with software licenses. Further to the Design department of *OneDrum Ltd* could potentially use SaaS based CAD software to facilitate the designing of new products and potentially reducing the cost of expensive Workstation hardware, these SaaS CAD solutions often allow a more collaborative design approach which could potentially allow the designers to work more closely together and further allowing for remote work Rene *(Millman, 2012)*. As to using the SaaS, this does rely on the particular service being reliable in terms of access with minimal downtime. Further the network infrastructure of *OneDrum Ltd* requires a stable internet connection as latency could be an issue especially with CAD software. Further to this if *OneDrum Ltd* decide to change vendor, the process of migration may not be straightforward. A further consideration is the security issue when handling customer data offsite and storing the businesses potentially sensitive data somewhere that

is not fully under your control.

4 CLOUD SERVICE COMPARISON

This section is an overview and a comparison of popular cloud service providers given the *OneDrum Ltd* case study and assuming that both current hardware servers would be directly replaced by IaaS solutions. They will be compared in terms of the services most prominent features as well as the pricing model they adopt. Using the *OneDrum Ltd* case study an analysis will then be made in terms of which IaaS service would be cheapest and whether this would be the deciding factor as to whether *OneDrum Ltd* would adopt this service.

4.1 Amazon AWS

The Amazon AWS offers both IaaS and PaaS services and overall has some of the lowest prices in the market. It is also in the forefront in terms of innovation when it comes to cloud infrastructure providers *(Dan Sullivan 2014)*.

Table 1 is a summary of the key capabilities and costs of Amazon AWS solution *(Script Rock, 2015)*.

Table 1: Capabilities and costs of Amazon AWS solution.

Low-end	1core/1gb
High-end	16core/117gb
Pricing	$0.013 - $4.6/hr
Bandwidth	15GB incl.
Network Out	Unavailable

4.2 Google Compute Engine

Google has a vast infrastructure backing this service up and has integration between many of its services including Google Cloud SQL which could potentially be adopted by *OneDrum Ltd* as a replacement for their current physical database server *(Dan Sullivan 2014)*.

Table 2 is a summary of the key capabilities and costs of Google Compute Engine solution *(Script Rock, 2015)*.

Table 2: Capabilities and costs of Google Compute Engine solution.

Low-end	1 core/.6gb
High-end	16core/104gb
Pricing	$.012 -$1.184/hr
Bandwidth	$0.01/GB
Network Out	Unavailable

4.3 Rackspace Open Cloud

Rackspace offers both IaaS and SaaS services, both of which could potentially be adopted by *OneDrum Ltd*. All of Rackspace's servers run using Solid-State Drives meaning that performance is a key factor to this solution. It is also known for its support and customer service which could be key to a small business moving their infrastructure and vital business systems to a cloud service *(Dan Sullivan 2014)*.

Table 3 is a summary of the key capabilities and costs of Rackspace's solution *(Script Rock, 2015)*.

Table 3: Capabilities and costs of Rackspace solution.

Low-end	1core/1gb
High-end	32core/120gb
Pricing	$.052 - $6.24/hr*
Bandwidth	$0.10/GB
Network Out	200MB-10GB

4.4 Summary Table and Comparison

The above tables' give examples where some cloud providers do not reveal all of their performance values as in the above case both Google and Amazon do not indicate clear values for Network Output. When comparing the above pricing models it shows that Google's Compute Engine is cheaper for its lowest level of service however Amazon gives a large Bandwidth allowance away free, which overall makes it the cheaper service of the three cloud providers for IaaS.

Table 4 is a summary of the costs of each platform assuming the following conditions for *OneDrum Ltd: Two servers running using the least compute power available and the most compute power available from each service.*

Table 4: Summary of the costs of each platform.

	Google	Rackspace	Amazon
Two Server with minimum compute power available	$0.44 per day with 15GB throughput	$2.75 per day with 15GB throughput	$0.31 per day with 15GB throughput
Two Server with maximum compute power available	$28.57 per day with 15GB throughput	$151.26 per day with 15GB throughput	$110.40 per day with 15GB throughput

Using Table 4 it is clear that the Amazon service

is the cheapest per day assuming a lower level of computation is required. However when it comes to requiring a higher compute performance Google's service would be a lot cheaper per day for *OneDrum Ltd*. It would therefore be wise to consider whether *OneDrum Ltd* is likely to require such a high level of compute performance and if so Google service might be more advantageous.

5 HARDWARE EXAMPLES AND COST COMPARISON FOR CLOUD INFRASTRUCTURE

In this section there will be an overview and comparison of the hardware that underpins cloud solutions. Typically cloud datacentres fundamentally include the following hardware: Storage arrays, Rack and Blade servers, networking appliances. This makes up the necessary equipment to provide IaaS, PaaS and SaaS.

5.1 Storage Arrays

These are typically arrays of hard drives that are either traditional spinning hard drives or SSDs depending on the requirements for performance *(Vangie Beal 2015)*. SSD are used where quick response time is required such as in processes that require a lot of data to be read from or written to the disk quickly whereas spinning drives read and write data slower and are suited to less demanding processes. These storage arrays can be in the form of Storage Area Networks (SANs) which are essentially arrays of disks that usually have a central hardware controller managing where data is written and read from. Some datacentres use Software-defined storage which means that the management of data is controlled by software rather than hardware and therefore, enterprises can use different vendors and types of storage hardware without the normal issues of poor interoperability *(Mary Branscombe, 2015)*.

Table 5 is a summary of initial investment should a storage array be required for *OneDrum Ltd*.

Table 5: OneDrum initial investment with strorage array.

	Dell MD3620F	HP P2000	FUJITSU ETERNUS ETDX602
Cost of Storage solution	£7,495	£7772	£6214

5.2 Rack and Blade Servers

Rack servers that are mounted in rack configurations within datacentres and are typically hosts for virtual machines (VMs) within the context of cloud datacentres. These appliances can often be used to host multiple VMs and services. Blade servers are more modular and typically are dedicated to only providing a single dedicated application such as a webserver. They typically take up less room that a rack server and use less power.

Table 6 is a summary of initial investment should a rack server be required for *OneDrum Ltd*.

Table 6: OneDrum initial investment with rack server.

		Dell PowerEdge - R220	HP ProLiant DL160	Lenovo ThinkServer RD440
Cost of rack server		£893	£981	£936

5.3 Networking Hardware

Networking hardware is vital in terms of interconnecting all the resources within a cloud datacentre. There are high requirements in terms of networking scalability as well as bandwidth in order to provide the service that the cloud service consumer expects. These are also vital in terms of managing security of the cloud network, ensuring that only the traffic with the correct permission has access to the correct resources. These appliances are often connected via Fibre-Channel networking cards which provide higher bandwidth than traditional copper wire due to the higher throughput of data that can be achieved using fibre optics *(Manek Dubash, 2011)*.

6 SYSTEM REQUIREMENTS DEFINITION

6.1 Project Purpose

Analyse and suggest potential use cases for the adoption of cloud solutions to identify whether viable for *OneDrum Ltd* to use for international and e-commerce based expansion requirements in terms of cost and security and ease of adaptability.

6.2 Stakeholders

These are the people that would be directly affected

should an implementation of a cloud solution be undertaken. Their roles and needs, need to be analysed and understood in order to design a solution that meets *OneDrum Ltd's* requirements.

6.2.1 Finance Officers

The two finance officers are responsible for accounting for all sales and financial planning including record keeping for all transactions. This role involves communication with manufacturing department in order to fulfil orders as well as the database server to manage customer orders. *OneDrum Ltd*'s financial officer currently uses a CRM tool to administer this task. This software is dependent on a backend server which is installed on the Database server.

6.2.2 IT Administrators

The two IT administrators who currently administer the company's two servers, including patches, backups, maintenance and upgrades. They also maintain company internal network, webserver and security including access control and individual employee PCs.

6.2.3 Marketing Managers

Marketing mangers regularly update the company's website to include latest products and promotions and they also create documentation in and around the products and therefore require good communication with the design team in order to fully understand the products they sell. They use locally installed versions of website design and creation tools and company email.

6.2.4 Human Relations Officer

The Human Relations officer has access to the payroll system and regularly is required to facilitate communications between departments. Her current tools include locally installed payroll software and email hosted on the company's webserver.

6.2.5 CEO and Vince CEO

Manage direction of the company so require close communication with all areas of the company but especially design and manufacturing. They mainly use locally installed Office productivity tools as well as company email.

6.2.6 Manufacturing Team

Manufacturing Team have workstations dedicated to computer aided manufacturing machines as well and computers to aid communication with design team. They use custom software tools for the machinery as well as company email for communication to process orders.

6.2.7 Design Team

The design team use workstations dedicated to CAD software that facilitate designing new products. They require direct communication with manufacturing team as well as with the CEO and Vice CEO.

6.3 Project Assumptions

These are the assumption being made prior to the analysis of the company and any suggested solutions consider these.

1. Budget is agreed is to be a maximum of $16,000 in the first year.
2. Cost analysis is dependent on current cloud service costs as of writing this document.
3. Transfer to new system may require staff retraining.

May take unknown amount of time to migrate old infrastructure to new cloud based infrastructure.

6.4 Constraints

These are the non-functional requirements of the project that any solution put forward must adhere to.

1. Budget is $16,000 per year.
2. Customer and financial data security must be ensured to legal requirement.
3. Cloud service must be accessible 99.5% of the time with minimal downtime and disruption.
4. Data recovery must be ensured should there be a datacentre failure.

Cloud solution must be scalable to adapt to increased traffic on website and orders.

6.5 Functional Requirements

Functional requirements define how the solution should behave.

1. Company departments should only be accessible to those with the correct privileges.
2. Transactions should be traceable to analyse resource usage.

3. New cloud infrastructure must allow for communication with existing infrastructure if required.

Solution must be compatible with current desktop environment.

7 ARCHITECTURE DEFINITION

The following section intends to outline three potential solutions for *OneDrum Ltd* to adopt cloud infrastructures and services. These solutions intend to look at both the use of both currently available cloud solutions as well as development of a custom cloud solution.

7.1 Solution 1 – IaaS and SaaS

This solution involves using both IaaS and SaaS in order to fulfil the business functionality. IaaS would be used to fulfil the functionality of the webserver and database that is currently setup on the two HP Proliant ML100s. The webserver would be managed by the current IT staff and be accessible in terms of content uploading and updating by the marketing department this would connect to an IaaS database for storing both orders and website assets and business documents. A CRM SaaS would be linked to the webserver in order to control and track any orders for the finance team and also the manufacturing team for production information, this can then be updated once orders have been fulfilled by manufacturing.

Further to this payroll would be migrated to a cloud based SaaS solution as well as CAD for the design time and all business office tools.

The purpose of this solution would be to negate any local data loses and also allow easier expansion should *OneDrum Ltd* take on new employees. Moving the majority of business functions over to the cloud would provide *OneDrum Ltd* with a greater degree of flexibility, should any changes to the business require quick expansion.

One of the major downsides to this solution is the added initial cost of both the migration of the server to IaaS as well as the use of SaaS immediately. There would also be an element of retraining for the staff to use the new implementation which could initially cause some slowdown in business processes.

7.2 Solution 2 – IaaS Only

Similar to Solution 1, this solution uses IaaS for both the webserver, database and file storage. The webserver would be managed by the current IT staff and be accessible in terms of content uploading and updating by the marketing department. The webserver would connect to an IaaS database for storing both orders and website assets. The main differences is that OneDrum would keep all their current locally installed CRM, Payroll, CAD and Office applications. The main purpose of this solution would be to reduce the initial costs of retraining and potential downtime that would be caused by transferring all services over to the cloud. This would however mean an onsite server would need to be maintained or replaced for local storage backups.

7.3 Solution 3 – Private Cloud Solution

A private cloud solution would involve providing the storage, servers and networking equipment required to create a private cloud service that would operate as both IaaS and PaaS similar to how the Solution 1 is outlined. Using the storage servers as outline in section ‘V’ of this paper as an idea of the potential solutions the HP SAN was selected due to its better specification for a similar cost such as the inclusion of fibre channel networking. Further to this the HP Rack server was chosen in order to ensure better compatibility between two bits of hardware. Finally in terms of networking a fibre channel network was chosen due to the performance due to fibre channel connections as well as expandability should further bandwidth be required.

Providing this custom cloud solution allows a higher level of security and control over the resources compared to other public cloud solutions. This solution also means that hardware can be selected to the consumer’s specification as compared to other cloud solutions which often do not disclose the hardware specifications of their cloud services.

8 SYSTEM ANALYSIS

8.1 Cost Comparison

The cost of solution 3 is by far the most costly as it involves investment in hardware infrastructure in order to create private cloud. This solution is within the budget of *OneDrum Ltd* however may not be necessary to such a scale, it would depend on the CEO’s priorities regarding security when comparing it to using shared resources on other cloud providers solutions.

When comparing the cost of Solution 1 and Solution 2, Solution 1 may cost more overall as it

requires more downtime in terms of training and server and application migration. However the benefits of this long term are a reduction in maintenance costs due to lack of individual staff members pc configurations and updates which may cause unexpected downtime.

This overall result in Solution 2 having the lowest cost over the course of the first year of deployment however this is at the potential cost of increased maintenance of the local machines at *OneDrum Ltd*.

8.2 Latency Modelling

Table 7 compares the estimates of latency when using each solution from input to result of updating the webserver database with new content to be used on the *OneDrum Ltd* website.

Table 7: Estimates of latency from proposed solutions.

	Outbound	Inbound	Total
Solution 1	25ms	10ms	35ms
Solution 2	25ms	10ms	35ms
Solution 3	5ms	5ms	10ms

As demonstrated by Table 7, latency is least when running a private cloud solution as the location of the data centre can be much nearer to business operations even though the same data transfer is done when compared to Solution 1. When comparing Solution 1 and 2 however there is little to no difference as essentially the latency is determined by the connection from *OneDrum Ltd* to the datacentre which is the same in both instances.

8.3 Requirement Analysis

It is reasonable with certain large solutions architecture projects that use COTS that requirements may need to be adapted as cannot be otherwise met fully. When considering the three solutions the following previously outlined constraints must be considered:

1. All three solutions met the budgetary consideration with the cheapest solution being Solution 2.
2. Service Level Agreements (SLAs) cover both solution 1 and 2 regarding security of data between other user of the cloud providers services however as both solutions use IaaS, there may still be susceptible in terms of *OneDrum Ltd*'s IT Administrators not patching the servers regularly. Solution 3 would have an added level of security in that the cloud solution is solely used by *OneDrum Ltd and therefore there is no risk of sharing resources with other customers*.
3. One of the considerations was availability of the service being above 99.5% to which services such as Amazon AWS has a service level agreement which states availability will be up to 99.95% which therefore would meet the requirement for both solution 1 and solution 2. In terms of solution 3, it is harder to quantify a private cloud solution that is created specifically for *OneDrum Ltd*, however this is why it is important to build in a high level of redundancy in the hardware choice.
4. In terms of data recovery Solution 1 and 2 differ. Solution 1 has both IaaS in terms of web and database servers as well as SaaS which means that it is covered in terms of hardware failure of the cloud provider. However Solution 2 does not have the SaaS element to the design therefore, software such as CRM, payroll, CAD and Office are still dependant on local backups, this therefore is dependent on the It Administrators. Solution 3 using the private cloud would mean that redundancy is dependent on the hardware purchased which in this case has been chosen to give a level of redundancy.
5. In terms of scalability, Solution 1 and 2 have the resources of a large cloud provider therefore scalability is vast. Both Solution 1 and 2 can adapt to compute, storage and bandwidth scaling but only Solution 1 can scale application usage in terms of CRM, Payroll, CAD and Office should new employees require access to these.

Further to this the following Functional requirements must be considered:

1. In terms of access restrictions, all solutions outlined can have user restrictions applied meaning that each department and user is only able to access content they have the correct privileges for. In the case of cloud solutions there is an added level of protection in terms of less people having physical access to the hardware to penitential gain access to the solution maliciously. However this may not be the case with Solution 3 as the private cloud depends on where it is situated and how it is secured.
2. Cloud services such as Amazon AWS allows a level of traceability in terms of amount of resources used *(Jeff Barr, 2014)* and

purchased however with IaaS it is down the the IT Administrator to further log any activity on the servers. With SaaS however there is a larger degree of traceability as often service that track application usage but this is often dependant on the software. Therefore this is true to varying degrees for Solution 1 and 2 and due to the high customisability of Solution 3, it is likely that more traceability would be available using a custom private cloud solution.

3. All three solutions allow communication to existing *OneDrum Ltd* infrastructure via the internet.

The solutions are all compatible with the current environment as all solutions purely require an internet connection on the host computer.

9 FINAL SOLUTION FOR ONEDRUM LTD

Out of the three solutions, the benefits of using Solution 1 seem to be greater than the negatives in terms of meeting the requirements as outlined in the case Study with a much reduced initial start-up cost than Solution 3 in creating a custom private cloud.

10 DESIGN DEFINITION

The design definition section will outline in more detail the components of Solution 1, the chosen solution to allow for potential future implementation.

10.1 Webserver

The webserver that will host the *OneDrum Ltd* website will be migrated over to the Amazon AWS IaaS it will stay on the same Windows OS as previously do reduce the time to migrate the website. This server will be administered by the *OneDrum Ltd* IT Administrators and will be setup for limited access to the Marketing department to upload any website changes. Further to this it will require a connection to the Database Server also migrated to the Amazon AWS IaaS.

10.2 Database Server

This database server will be configured to store the assets and customer information for the *OneDrum Ltd* website. It will be a Linux OS running a MySQL server. This will be connected to the webserver using Amazon's internal networking infrastructure. The IT Administrators will have administrator access, the marketing team will have limited access to the database to change website content and access customer data.

10.3 Cad Software

The design team will have access to CAD SaaS applications. This will mean that most of the processing and rendering can be done using the cloud providers hardware thus the designer does not need a high end workstation or any upgrades as all processing is handle by the cloud vendor.

10.4 CRM Software

The CRM software will also be deployed as a SaaS. This will be used by the Finance Officers to connect to the database server in order to retrieve transaction information for accounting purposes.

10.5 Payroll Software

The Payroll software will also be deployed as a SaaS. This will be used by the Human Resource employees to manage finances and payment of employees.

10.6 Network Connections

Current site internet connection will be upgraded to ensure that increased traffic requirements are met this includes the addition of a secondary router on a different line in order to increase the unlikelihood that an issue with the network at *OneDrum Ltd's* site would cause the inability to use the cloud services.

11 CONCLUSIONS

This paper set out to give an overview and comparison between different types of cloud solutions as well as the variations in service offered by different cloud solution providers. In order to do this effectively a scenario of a drum kit and accessory manufacturer called *OneDrum Ltd* was used. Using a realistic scenario allowed for the analysis to have a greater grounding in a likely scenario in which the use case could be potentially adapted and used on other projects. From this assessment of the scenario, three main solutions were produced and discussed that

would meet the requirements of *OneDrum Ltd*. These were: a combined IaaS and SaaS solution that involved moving two hardware server onto a cloud platform as well as several key applications, secondly a solution that used the company's existing software assets in combination with IaaS by moving just the servers onto a cloud platform and finally by creating a customised Private Cloud Solution and using it for both IaaS and SaaS.

This has potential to be a model for similar manufacturing based small or medium businesses. Solution 1 solution involves a complete committal to cloud based services with issues such as cloud provider lock in and added network security concerns. However it has the advantage of allowing for a high degree of flexibility in terms of computation, storage and network bandwidth as well as application deployment for new employees. Solution 2 involved less commitment to cloud services only using the IaaS in order to run a database and webserver. This allows flexibility in terms of *OneDrum Ltd*'s international expansion and e-commerce but the company would not commit to cloud solutions in terms of managing their finances and customers which is potentially the company's concern. Finally the third solution involve the creation of a custom private cloud which has massive initial cost implications but would provide *OneDrum Ltd* with maximum control of their data should security by the highest priority.

It is considered that these three solutions could be adapted to suit many different small manufacturing businesses that want to take advantage of cloud solutions but have differing priorities regarding their data.

REFERENCES

Louis Columbus. (2013). Gartner Predicts Infrastructure Services Will Accelerate Cloud Computing Growth. Available: http://www.forbes.com/sites/louiscolumbus/2013/02/19/gartner-predicts-infrastructure-services-will-accelerate-cloud-computing-growth/. [Last accessed 23rd Mar 2015]

Rackspace. (2014). *Moving your Infrastructure to the Cloud: How to Maximize Benefits and Avoid Pitfalls.* Available: http://www.rackspace.com/knowledge_center/whitepaper/moving-your-infrastructure-to-the-cloud-how-to-maximize-benefits-and-avoid-pitfalls. Last accessed 23rd Mar 2015.

IBM.. (2015). *What is cloud?*. Available: http://www.ibm.com/cloud-computing/in/en/what-is-cloud-computing.html. Last accessed 22rd Mar 2015.

Michael J. Kavis (2014). *Architecting the Cloud*. New Jersey: John Wiley & Sons, Inc.. 13-18.

David Linthicum. (2013). *Wrestling with the concept of private PaaS.* Available: http://searchcloudcomputing.techtarget.com/feature/Wrestling-with-the-concept-of-private-PaaS. Last accessed 22rd Mar 2015.

Naresh Kumar . (2012). *Advantages and Disadvantages of SaaS (Software as a Service) Business Model in Cloud Computing* . Available: http://theprofessionalspoint.blogspot.co.uk/2012/12/advantages-and-disadvantages-of-saas.html. Last accessed 21st Mar 2015.

Rene Millman. (2012). *Autodesk reveals cloud-based 3D CAD platform.* Available: http://www.cloudpro.co.uk/saas/5070/autodesk-reveals-cloud-based-3d-cad-platform. Last accessed 21st Mar 2015.

Dan Sullivan. (2014). *IaaS Providers List: Comparison And Guide.* Available: http://www.tomsitpro.com/articles/iaas-providers,1-1560.html. Last accessed 22rd Mar 2015.

Script Rock. (2015). *Roundup: Best of the Best.* Available: http://www.scriptrock.com/articles/cloud-service-provider-roundup-the-best-of-the-best. Last accessed 24st Mar 2015.

Vangie Beal. (2015). *disk array.* Available: http://www.webopedia.com/TERM/D/disk_array.html. Last accessed 21st Mar 2015.

Mary Branscombe. (2015). *Why you don't need a SAN any more.* Available: http://www.zdnet.com/article/why-you-dont-need-a-san-any-more/. Last accessed 25th Mar 2015.

Manek Dubash. (2011). *search Hardware / Data Centre And here's how a datacentre network works....* Available: http://www.theregister.co.uk/2011/01/12/dc_network/. Last accessed 23rd Mar 2015.

Jeff Barr. (2014). *Track AWS Resource Configurations With AWS Config.* Available: https://aws.amazon.com/blogs/aws/track-aws-with-config/. Last accessed 25th Mar 2015.