Health Cloud Architecture

Proposed Cloud Analysis

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Introduction

This purpose of this document is to highlight how JACT Technology Solutions will use cloud computing architecture to minimize the time, effort and resources that is expended by utilizing physical records management techniques within Victoria Medicare and to maximize the efficiency and effectiveness of accessing and maintaining data respectively. This will be offered in the form of Software as a service (SaaS). This software will be running on windows R2 server 2012 platform which will be housed on the VMware infrastructure and respectively both being offered as a service. i.e. Paas and Iaas.

Overview of Customer's Problem

The creation of this Application was stimulated by the widespread problem that we have in private practice and small medical institutions in Jamaica, where patient records are being stored inefficiently using physical files in cabinets and drawers. As a result, JACT Technology Solutions has chosen to approach the Victoria Medicare. Due to the uneconomical file storage medium that is difficult to keep track of patient's records, which is commonly hard to find, or may even get lost in some instances. JACT Patient Management System should eliminate, these inefficiencies and loss of productivity, as the relevant information will be easily retrievable despite any mishaps to the computer system. As a result, tasks will be carried out more efficiently, there will be increase in productivity, and there will be an increase in physical space for better and more ergonomically friendly utilization.

Cloud Service Layers

How it Works

JACT Technology Solutions will use platform as a service (PaaS) in the form of VMware vSphere client to create a virtual machine. This is an environment that will allow us to host Windows Servers R2 2012. As best practices, we have made the decision to create two different servers. One will contain the JACT Patient Management System that clients will interact with and the other will contain a domain controller which will aid in configuring Windows Server R2 2012 also, to facilitate clients and to remotely connect to the JACT Patient Management System that will be offered. The PaaS layer will also contain a database that will facilitate the storing of data to complement the application.

The software as a service layer (SaaS) that will contain the JACT Patient Management System that will be offered as a service. Clients will be able to access this over the internet, hence no installation on their local PC would be required. Users will be required to sign up with the application to gain access where the relevant privileges will be tagged accordingly. Users will be able to connect using their personal computer and mobile devices to access the application, the initial phase of testing the functionality of the web based application will be first used by medical professionals of small patient oriented organizations and patients. Information sent and retrieved from interfacing with this application or software will be facilitated by a database, both will be seated on top of the platform as a service layer.

This service layer will take two forms, physical and virtual. Physical in the sense that we will need to have a computer with the necessary components (RAM memory, hard disk, CPU etc.) and specifications to run VMware exsi v6.5.0 on which all other layers will be seated on. Virtual in the sense of having a logical machine created in the VMware vSphere client. This virtual machine will also have the necessary components and specifications

allocated to it. This will be the basis on the PAAS (Windows Server R2 2012) and IAAS (JACT Patient Management System).

Software as a service

SaaS is at the top of the layer or stack is typically built on top of a Platform as a Service solution, whether that platform is publicly available or not, and provides software for end-users such as email, word processing, or a business CRM. Software as a Service is typically charged on a per-user and per-month basis, and companies have the flexibility to add or remove users at any time without additional costs beyond the monthly per-user fee.

Platform as a service

Provides a platform allowing customers to develop, run, and manage applications without the complexity of building and maintaining the infrastructure typically associated with developing and launching an app.

Infrastructure as a Service

IaaS deals with the physical computer hardware, such as servers, storage arrays, and networking. It also allows you to build virtual infrastructure that mimics these resources.

Type of Clouds

The services being provided to the patient oriented institution requires a high level of confidentiality. As such, the cloud service s will be made available both on premise and off premise. Resulting from the great need to easily and quickly retrieve Patients' records, many of the institutions have already invested in physical machines to accomplish this. So as not to put those aside and have them take up physical space on premise without making a valuable contribution to the institution, we propose that those machines continue to be used; with a

change in architecture. This changed architecture will allow the Institution to build on what currently exists, in that, it will gain additional storage space to house its records, but now, in the cloud also. This solution will allow all authorised users to login and gain access through a web interface, irrespective of their physical location and device type.

Along with the on premise solution, we also have an off-premise solution. This is to compensate for any unfortunate occurrences. Primarily, this service will provide data recovery and backup of the same records that are accessible on and off premise but not limited to the records kept on premise.

Data Backup and Recovery

The main purpose of storing information is to have access to it at one's convenience. Unfortunately, though, failure is inevitable when working with computers, be it virtually or physically. As a result of this, the need for backup and recovery has become essential. JACT Technology Solutions recognizes the importance of this and as such will provide backup and recovery for Victoria Medicare so the patients' records are always accessible to the institution. Unlike a physical storage medium where additional space would be taken up to make backups of records, with the possibility of misplacing those records, employing cloud services will allow the records to be accessible without use of a physical medium and use no additional physical space as the information is stored and made available in the cloud. Backups of this nature will be secured in an off-premise site to ensure data integrity should failure occur to the primary database in the cloud; providing 99.9% service availability. These backups will be seamless and scheduled so as not to interrupt the daily operations of the institution.

Use Case Diagrams

The use case diagram represents the cloud network infrastructure service for operations we will be deploying at Victoria Medicare. There, we will be deploying two (2) Virtual Machine clients, one will be used by the receptionist, at the front desk, and the other by the doctor in his office. Each of these clients will have access to the same database. Also, allowance will be given for the functions of the database to be assumed by a secondary database when the primary one is unavailable, hence, a failover database will be implemented. The firewall provided by VMware ESXi version 6.5.0 through NSX will assist in securing the platform on which the service will be deployed so users outside of the private cloud are given less opportunities to be make malicious requests as depicted in Fig 1.0.

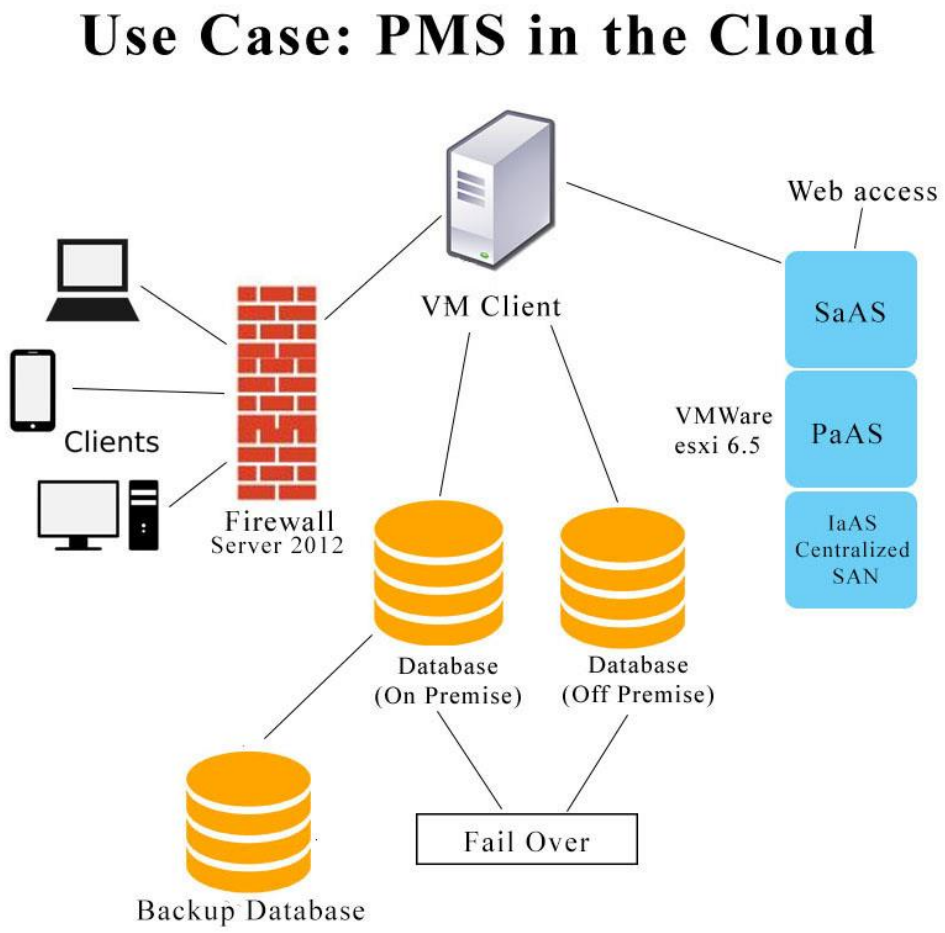

Fig 1.0 Showing use case of the cloud model to be used in implementation of PMS

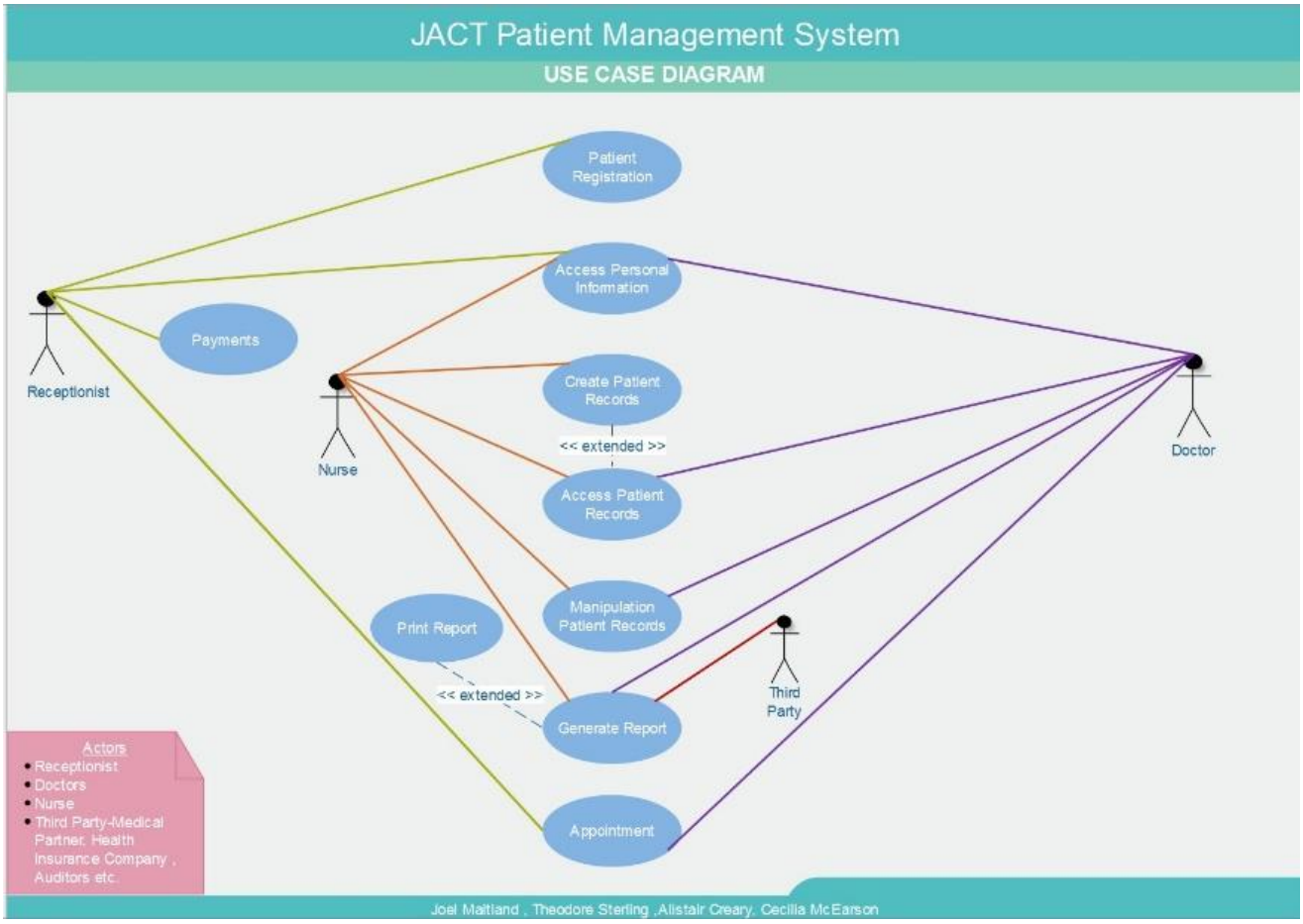

Fig 2.0 Showing use case of the Software to be used on the SaAS layer of the PMS implementation

Model of the Cloud Architecture

SaAS - The interface to interact with **-Offered Software** **-Security**
PaAS - the environment **-esxi 6.5** **-Security**
IaAS - both on and off Premise **-Backup** **-Storage** **-Recovery** **-Security**

Fig 3.0 showing the three layers being offered to the Institution for the PMS implementation

Service Level Agreement (SLA)
For *Customer*

By

JACT Technology Solutions

This Service Level Agreement between JACT Technology Solutions and the user (Customer) of JACT Technology Solutions' Cloud Service sets forth the service level terms and conditions. This SLA defines the terms of Customer's responsibility with respect to the services that JACT Technology Solutions provides and Customer Remedies in the event that JACT Technology Solutions fails to meet these Service Commitments. This SLA and the SLA Credits set forth herein represent JACT Clouds sole obligation and Customer's sole remedy for failure to meet such Service Commitments. This SLA does not apply to the availability of Third Party Services.

Definitions-The following are definitions of capitalized words used in this Agreement:

a. "Agreement" -The Customer's use of and access to Services is governed by the Terms of Services ("TOS"), Service Level Agreement, Privacy Agreement, Acceptable Use Policy, any other documents referenced herein (collectively, the "Agreement").

b."Business Hours" -means 9:00 a.m. to 6:00 p.m. (Central Standard Time - CST), Monday through Friday, and, notwithstanding the foregoing, does not include times during Service Maintenance

c."Service Maintenance"- means JACT Technology Solutions maintaining of the Service including software. Service Maintenance includes, without limitation, database index rebuilding, hardware upgrades, software upgrades, and network upgrades, as applicable.

d. "**Data Retention"-**JACT Technology Solutions shall make a full backup copy of each database and file system daily and retain each such daily backup copy for seven (7) days. JACT Technology Solutions retains copies of Agent and API log files for at least sixty (60) days.

e. **Service Availability** - General. JACT Technology Solutions' goal is to provide Service Availability twenty-four hours per day, seven (7) days per week (referred to as "24x7 Availability") EXCEPT during times of Service Maintenance as set forth in Section 3d herein. However, the parties recognize that 24x7 Availability is only a GOAL, and JACT Technology Solutions cannot represent or guarantee that such goal can be achieved. As per our CLOUD SUPPORT POLICY (show below), response time goals cover predominantly Production Clouds and the Cloud Dashboard.

f. **Response Time to Error.** JACT Technology Solutions has internal notification tools for Cloud service problems. Additionally, Customer may report problems to JACT Technology

Solutions Support. Once notified JACT Technology Solutions Support will respond as per the CLOUD SUPPORT POLICY.

CLOUD SUPPORT POLICY- JACT Technology Solutions shall attempt to schedule Service Maintenance during the times specified. However, the parties agree that it may be necessary for JACT Technology Solutions to perform Service Maintenance during times other than those specified, and JACT Technology Solutions reserves the right to perform Service Maintenance during times other than those times specified.

Service Maintenance Times (Day)	Service Maintenance Times (Hours)
Monday to Friday	8pm to 4am (CST)
Saturday	12pm to 12 am (CST)
Sunday	12pm to 12 am (CST)

Limitations-JACT Technology Solutions cannot assume responsibility and shall not be liable for any impacts on Service Availability due to (i) any requests for non-standard environment or Customer machine access; (ii) any downtime caused by Customer produced code; or (iii) any changes to the Service by parties other than JACT Technology Solutions. JACT Technology Solutions will make reasonable efforts to ensure that Service changes do not affect customers.

FINANCIAL PENALTIES FOR SLA VIOLATION

i. In the event that JACT Technology Solutions fails to meet the guarantee stated above (excluding Service Maintenance during the windows described and downtime for viable reasons JACT Technology Solutions will refund 5% of the Customer monthly service Fees for each thirty (30) minutes of network downtime experienced up to 100% of the monthly service Fee for those Services affected ("**SLA Credits**").

ii. All SLA claims should be communicated via the JACT Technology Solutions Dashboard or email to customer support within seven (7) days of the incident. The notice must include all relevant information, including Cloud name, IP address, full description of the incident, and any logs (if applicable). All SLA credits will be issued as credits against future invoices for services.

iii. In order to qualify for Service Credits, Customer must be current on all payment obligations, and not be in violation of the Terms of Service

iv. No Service Credits will be given for service interruptions: (i) caused by the action or failure to act by Customer , (ii) due to failure of any equipment or software provided by Customer, (iii) which are the result of scheduled maintenance, (iv) due to a force majeure event, (v) for which Customer is entitled to a SLA Credit for the same or contemporaneous Service Commitment failure or (vi) resulting from Customer's breach of the Terms of Service, Acceptable Use Policy or any other policies and procedures of this Agreement.

v. Total cumulative SLA Credits during any given month shall not exceed the Customer monthly fee for those Services affected.

JACT Technology Solutions reserves the right to change this SLA at any time, and without notice.

Costing

It is well-known that operating any business will come at a cost to the proprietor both financially, time-related, and in other ways for some business owners. With the focus being on financial side of things, there are a number of factors that have been considered.

There are two categories of expenses that relates to every business, thus it will be no different for JACT Technology Solutions. These are operating expenses (OPEX), and Capital Expenses (CAPEX). Capital expenses are those expenses that we spend to purchase assets, and promote business expansion. Operating expenses are those that are incurred on a regular basis and are expended for the daily operation of the business.

The capital expenses that will affect JACT Technology Solutions as was discovered by thorough research are:

Server, storage, network, and hardware facility (not seeking to rent a space but rather to purchase or use what is at the proprietor's possession).

The operating expenses are utilities, and Internet connectivity. Initially, the proprietors will be the only form of labour provided as can be afforded.

The proprietors have taken the initiative to make necessary investments to ensure that they can survive without seeking any personal financial returns from the business for the duration of year. This will allow for the sustainable growth of JACT Technology Solutions.

Total Cost Calculations of Company Expenditure:

EXPENSE	MONTHLY COST	TOTAL YEARLY COST PER EXPENSE
CAPITAL EXPENSES		
Server	N/A	$50,000 (Only for one year)
Router	Depending on depreciation method employed	$30, 000 (Only for one year)
Switch	Depending on depreciation method employed	$7, 000 (Only for one year)
Materials and Equipment		$300,000 (Only for one year)
Hardware	Depending on depreciation method employed	$150, 000 (Only for one year)
Total Capital Expenses	- - -	$537,000
Operating Expenses		
Hardware facility		

Lease	$10,000	$120,000
Utilities		
Lighting	$12, 000	$144,000
Water	$8,000	$96,000
Internet connectivity	$9, 000	$108,000
Cloud security outsourcing	$25,000	$300,000
Grand Total	**$55,000**	**$768, 000**

Costing to customer

Item	Unit Amount or time usage	Price per unit US	Monthly expense US
Storage – HDDs & SSDs	150 GB	$0.01/B/hr	$2
Computing - RAM Chips	2GB	$1.99/GB/mo	$4
CPUs	2.0 GHZ	$4.44/GB/mo	$8.88
Bandwidth	15 mbps	$ 23.34/Mbps/hr	$350

Public IP Addresses	2	$22	$44
Compute Support	Included in RAM and CPU offer	---	$5.98
Virtual PC Rental	4GB Ram, 2.0GHZ, 80 GB Hard drive	1	$110
Software Licence	Monthly licence	$40/per month	$40
Total			$564. 86 ($72, 434.44)

With a total monthly operating expense of $55,000 and an income earning of $72, 434.44 on a monthly basis, it is evident that the business will be able to make a profit of approximately $16,000($72, 434.44 - $55,000) it is also possible due to JACT Technology Solutions' trade technique of incurring expenses in JMD and charging clients in USD currency.

Future Projections

The fact that the proprietors do not intend to make any deductions from the business for personal gain for the duration of a year, as stated previously stated, this will enable the business to re-use its profits for the purpose of expansion. In the next five (5) to seven (7) years, it is projected that the business will have up to 20 virtual machines for the use of server operations. Also, the company aims to be able to host cloud services for fifteen (15) small businesses or seven (7) medium size businesses. A client based consisting of a combination of small and medium size enterprises (SMEs) is also highly anticipated. Expansion is planned as a continuous objective for the JACT Technology Solutions.