Developing and Deploying Applications for Highly Available Storage of Cloud Service through Secured Channels

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Abstract—**Cloud Computing is storing of data and application on remote servers and accessing them via internet rather than installing and saving them on your personal computers. Growing volume of scientific data sets which are publicly available has made it impractical to move data to desktop for analysis. To solve these issues we require a new computing paradigm. In recent years,cloud computing has grown from its mere futuristic concept into reality and helped to remove these barriers. Microsoft has a huge contribution in the development of data centers for public cloud infrastructure known as Microsoft Windows Azure which serves the need for scientific community. A variety of cloud service is provided by Microsoft Azure which enables you to select right combination that meet your needs from setting up a community website to document. The paper deals with a brief introduction about Microsoft Azure, its services,features and developing and deploying applications securely on the cloud. Azure Management Process will help enterprise project team to study in detail how existing methodology should be altered for the project that is targeted to be developed on Azure. It also describes the benefits offered by Azure Cloud Platform by comparing it with other cloud service platforms, to identify the gaps and see what benefits IT and business may gain by adapting to Azure.**

Keywords—Cloud computing, Azure Active Directory, Microsoft Windows Azure.

I. INTRODUCTION

In the past few decade, cloud computing has become a ubiquitous concept in the IT field. Although, it is not a new concept and many advancement has been done in this field. Yet, Cloud Computing is not easily defined. Cloud Computing provides various capabilities to user enterprise to store and process their data in third party data centers. Its main focus is to maximize shared resources. Cloud

Computing helps companies to focus on project that differentiate their businesses instead of infrastructure which also helps to avoid upfront infrastructure cost. Some people consider cloud as a solution for every issue IT field faces.

But this is not the case always. Many businesses can benefit from adopting Cloud Computing approach but it also faces several crucial issues that IT companies have to deal with. Many companies have their own cloud service providers.

Microsoft Windows Azure is a cloud computing platform released on 1stFebruary 2010 and created by Microsoft. It helps to build, deploy and manage application and services through a global network of Microsoft-managed data centers. It provides both PaaS and IaaS services. Paper provides detail introduction of Microsoft Azure and highlights all the services and features offered by Azure. It also describes the steps involved in developing and deploying applications securely on Azurecloud. The aim of Microsoft Azure is to build a web application that runs and stores its data in Microsoft datacenters. It store data while the applications that consume this data run on premise. The aim of this concept is to minimize the need for managing these resources by providing automated services for easily provisioning scalable, cheaper sources in a timely manner. Main focus of Windows Azure is on development not the infrastructure and it develops massively scalable applications with many users.

II. LITERATURE SURVEY

By Studying different research papers, related to this topic provided lot of useful information. This information consist of various cloud computing services, features and current issues related to such systems, possibility to proceed further with different solutions to the existing problems. Hence it helps a lot to enhance and overcome issues of existing methodology in future. To help enterprise rely sensitive data on cloud infrastructure, security enhancement are needed [5]. Overall Efficiency of existing ERP system was improved due to the advancement of cloud based ERP system architecture. But the cloud architecture faced few difficulties [1]. To support interaction between different Cloud Service Provider and to support negotiation of Quality of Service based on Service Level Agreement, few protocols and Cloud Computing needs to be extended [2]. Cloud based ECM that provided secured platform management of all structured and unstructured content across, unfortunately contained a list of potential risks [4]. Despite of significant benefits offered by cloud computing, still current technologies are not up to its full potential. Many keychallenges like power and security management needs to pay attention [8]. Although Cloud Computing is a flexible paradigm for delivering computational power. Yet, performance, security, bandwidth cost are some of the key challenges faced by cloud computing [7]. Windows Azure provided a windows based computing

for running applications and storing data in cloud which proved right in many situations [6]. A new and interesting competitor known as Microsoft Azure has come into existence with a long and mostly distinguished pedigree[3].
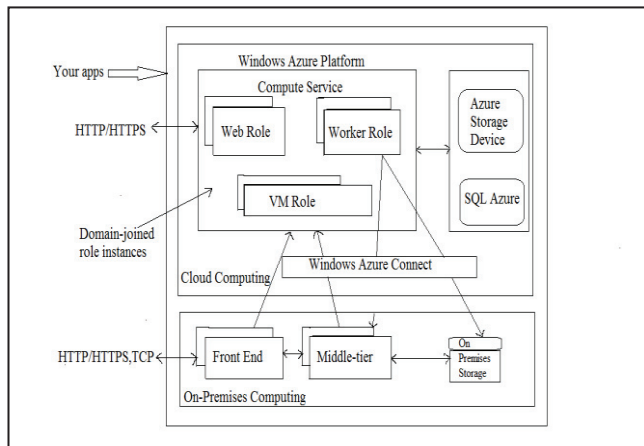
III. PROPOSED SYSTEM

Fig. 1. *System Architecture*

Windows Azure platform consist of following:
A. Windows Azure.
B. Microsoft SQL Azure
C. Windows Azure Platform AppFabric

A. Windows Azure Compute

Windows Azure presently supports three roles; Web role instance, Worker role and Virtual Machine Role.

- #### Web Role

It is the front end of the application hosted in the cloud environment.. Web role acts as a connection point between user and worker role. It is intended for running Web-based applications. Each Web role instance has Internet Information Services(IIS) 7 pre-configured to run inside it, so creating applications using ASP.NET, or other Web technologies is straight forward.

- #### Worker Role

It represents that part of the cloud service that runs in background. It does not have User Interface, it performs background actions such as data processing. A web role takes a request from application and forwards it to worker role for further processing.

- #### Virtual Machine Role

Virtual Machines provide powerful processing resources for developing new applications. On-premises Windows Server application are moved to Windows Azure with the help of Virtual Machine Role. Whenever, Windows Azure receives an application which is to be run, it submits

configuration information along with it which tells the platform the number of instances of each role to run. The Windows Azure Fabric Controller then creates a Virtual Machine for each instances, running the code for appropriate role in each Virtual Machine.

- #### Windows Azure Storage

Windows Azure Storage consists of:
1. Blob
It is the Binary Large Object which is simplest way to store data. A storage account consists of one or more containers which contain son or more blobs. They store large amount of unstructured data. Blobs size is as large as 1 TB and large blobs are further divided into blocks.

2. Tables
Applications can work with data in a more fine grained way with the help of tables. The data they contain is actually stored in set of entities with properties. Different tables can contain entities with different set of properties. Tables do not have size limits, but entity can have maximum size of 1MB. A single table may contain billions of entities holding terabytes of data, and Windows Azure storage can partition it a cross many servers if necessary to improve performance.
.
3. Queues
Performance and response time of a worker role is increased as queues helps to store large number of messages. Web role instance communicate with worker role instance. Queue can be used to store the request when large number of requests are received from web role and does not forward it until and unless the worker role instance is free. A queue can contain count less message but message can be as large as 64 KB.

B.Microsoft SQL Azure
SQL Azure consists of SQL Azure Database and SQL Azure Data Sync. SQL Azure Database provides a cloud-based database management system (DBMS). This technology allows on-premises and cloud applications store relational data on Microsoft servers in Microsoft data centers. SQL Azure is built on Microsoft SQL server. Using a cloud database also allows converting what would be capital expenses, such as investments in disks and DBMS software, into operating expenses

C. Windows Azure AppFabric

Main goal of Azure App Fabric is to provide cloud based infrastructure. This layer provides the services that differentiate Microsoft Windows Azure platform from other cloud platform. It serves as a communication bridge between application running on different systems. It

consists of two components. Service bus and Access Control. Service Bus allows an application to expose end points in the cloud that are accessed by other applications, whether on-premises or in the cloud. A URL is assigned to each exposed endpoint, which helps clients to locate and access the service. Access Control provides authentication and authorization services.

During the period of literature survey, what I noticed was, lack of security. Security which is the main concern of cloud computing has been the future work in many of the papers. So I thought of giving special attention towards this(security) concept. In public cloud, it is necessary to manage identity as it is on-premises. To overcome this problem and help us out, azure supports many different cloud identity technologies.
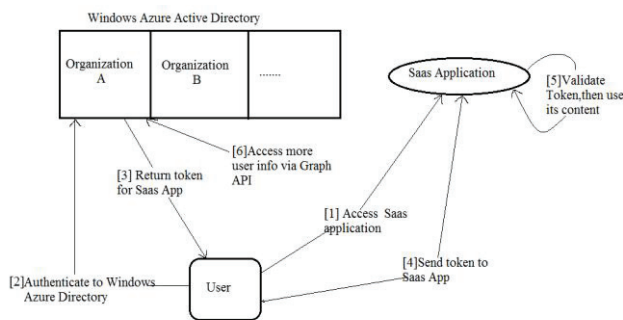

Fig.2.*AzureActiveDirectory*

Organizations using only SAAS application can rely on Azure Active Directory as their sole directory service. Organizations that run windows server Active Directory can connect the iron-premises directory to Azure Active Directory to give users single sign on to SAAS application. In given fig.2, user at organization wants to access SAAS application.

1) To access SAAS application, user has to first present a token which is issued by Azure Active.

By providing username and password, the user authenticates himself to Azure Active Directory and gets the token. The information contained in the token is digitally signed by Azure Active Directory that identifies the user.

2) Azure Active Directory then returns the token to the user.

3) The user then forwards the token to SAAS application.

4) Before using the contents, the application first validates the token signature. Using the information contained in the token the application decides which information the user is allowed to access.

5) If the application needs more in formation of the user that is not present in the token then it can request directly from Azure Active Directory using Azure Active Directory graph API. Graph API uses an ordinary REST ful protocol, which

makes it straight forward to use from most clients.

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- **Azure Development Life cycle**

A. *Development Phase*
1. *Construct*

Construction of application code is done locally on a developers workstation. Visual Studio serves as best development platform for developers to build Windows Azure Application. Hence, Windows Azure Application are developed in Visual Studio IDE.

2. *Testing*

Once the application is developed, using Visual Studio suite of testing tools such as unit test, integration test etc unit testing of code is done by the developer locally. Azure development tools contains emulators for both compute and storage known as Development Fabric and Development storage respectively. Various test such as Smoke test, Integration test, User Acceptance test are being carried out.

B. *Deployment Phase*

Organization have to first provision Azure account to deploy package on Azure. This can be done by Registering into Azure Portal using a Live ID and a valid debit card. This completes the registration process. After this, the user then uploads the compiled cloud packages and configuration file through Azure Management Portal. Deployment is carried in two stages: Staging and Production. The application is first uploaded into Staging which provides testing environment where it is tested using various tests. Once the applications runs without any error in this stage then it is promoted to production which is made accessible to public using a user friendly URL.

IV. MATHEMATICAL EQUATION AND ALGORITHM

This section describes the equation used and different algorithm used.

A) Mathematical Equation

Assume proposed system S
Functions performed by system S:

S = {I, O, F, Øs, SUCCESS, FAILURE}
    where,

I = set of instructions given by user
O = requested output information by user

Øs = set of constraints where,
Øs = {Ø$_1$, Ø$_2$, Ø$_3$, …. Ø$_6$}

SUCCESS = desired outcome generated if set of constraints are followed
FAILURE = desired outcome not generated due to invalidation of set of   constraints or system failure
Fs = {F$_1$, F$_2$, F$_3$, …. F$_6$}
where F$_1$, F$_2$, F$_3$, …. F$_6$ are the functions performed by proposed system.

Step1: Developing Application to be deployed
Functions to design website (F$_D$)
Function to initialize : initialization()
 F$_1$ = {X$_1$, Y$_1$, Ø$_1$}
where,
          X$_1$ = {project_type,template_type}
          Y$_1$ = {login_foldr, image_foldr, controller_foldr, app_code_foldr}
          Ø$_1$ = {valid login, image, controller and application code folders are created}
Function to design Master Page : designMasterPage()
F$_2$ = {X$_2$, Y$_2$, Ø$_2$}
 where,
          X$_2$ = {item, item_type, page_url}
          Y$_2$ = {masterpage, banner}
          Ø$_2$ = {check_master_page_url is set correctly}
Function to add controller : addController()
F$_3$ = {X$_3$, Y$_3$, Ø$_3$}
   where,
          X$_3$ = {controller_foldr, class_name}
          Y$_3$ = {controller}
          Ø$_3$ = {valid controller}
Function to createWebsite : createWeb()
F$_4$ = {X$_4$, Y$_4$, Ø$_4$}
   where,
          X$_4$ = {url_content, web_config_file}
          Y$_4$ = {url_setting, database_connection}
          Ø$_4$ = {valid url n database connection}
F$_D$ = {F$_1$, F$_2$, F$_3$, F$_4$ }

Step2: Application deployment on Cloud
Function for database deployment : deployDB()
F$_{DB}$ = {X$_{DB}$, Y$_{DB}$, Ø$_{DB}$}
   where,
          X$_{DB}$ = {account_name, password, serverkey}
          Y$_{DB}$ = {Micrososft SQL server and Windows_Azure connection }
          Ø$_{DB}$ = {validate database connection}
Function for Website Deployment :deployWeb()
F$_{WB}$ = {X$_{WB}$, Y$_{WB}$, Ø$_{WB}$}
   where,
          X$_{WB}$ = {website_url, website_profile}
          Y$_{WB}$ = {publish_web_url, publish_web_profile}
          Ø$_{WB}$ = {check web_url and web_profile}

   B) Algorithm used
In the proposed system there are two algorithm used
a) Hosting application on Cloud
b) Ranking various cloud service provider

a)   Algorithm for hosting application on cloud

Step I . Application development
Provision (Live ID & Credit card)
Develop application (Visual studio)
Unit Testing Locally(VS test tools)

Step II . Application Deployment
Build (Build Verification test)
Publish
Deployment (Staging & Production)
Staging- System Testing (Smoke test, Integration &UAT)
Production Release (Hosted on cloud Made available to public)

b)   Algorithm for ranking various cloud service provider Broker algorithm
Start
 1. Broker gets all service information fromregistered cloud providers along with its cost.
 2. Calculate response time of individual CSP's.
Average response time=ΣTi/r Where Ti is the time taken between the user i request and when service is available and r is the number of user requests. Maximum response time= response time, cloud provider promised to customer.
Response time failure=number of times response time > maximum response time. Response time failure =(a/r)*1000, a = number of times response time > maximum response time and r = number of requests.
 3. Interoperability for individual CSP=number of platforms offered by cloud service provider/numberof platforms needed by the customer.
4.Suitability parameter for individual CSP=number of features offered by provider/number of features needed by the provider.
 5. Get requirements from client .
 6. Rank CSP's based on performance, suitability, interoperability and cost.
 7. Display the list to client
 8. Pull the provider's services, performance, suitability, interoperability and cost of services information from all registered CSP's regularly.
9. Based on the collected information update the database.
10.Repeat steps 2to 9.
   End.

V. RESULTS AND DISCUSSION

A) PERFORMANCE ANALYSIS

This section highlights the advantages of cloud hosting over traditional web hosting with relevant parameters.
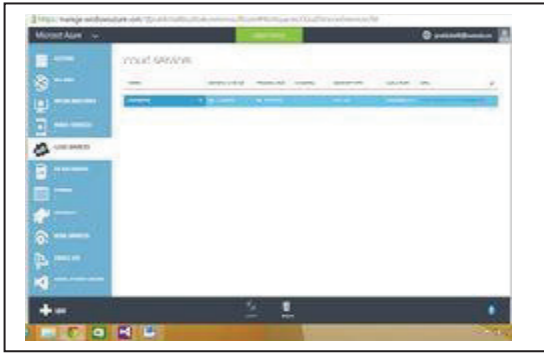
a) Deployment Time

Fig.3. *Successfully deployed Application on Azure Cloud*

With Azure based Cloud, the server can be deployed within minutes. On the other hand, to deploy a normal server, lots of hardware, software, memory and networking equipment need to be installed which consume slot of time and money and depending on the level of complexityit can take days or even weeks.
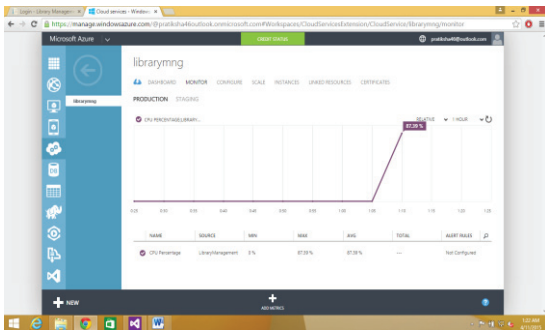
b) CPU Utilization

Fig. 4. *CPU Utilization Interface*

Windows Azure based Cloud provides a facility to see CPU utilization at different intervals. Hour wise or week wise details are available which is cumbersome approach in normal webhosting.
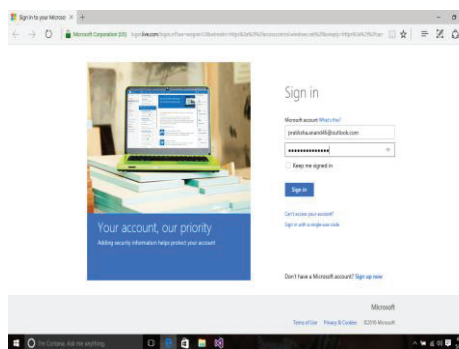
c) Secured Platform

Fig. 5. *Secured Platform*

In public cloud, it is necessary to manage identity as it is on-premises. To overcome this problem and help us out, Windows Azure Active Directory gives a comprehensive identity and access management cloud solution. It provides a secured platform. Manage user accounts, get single sign on across Windows Azure, Microsoft online services and non-Microsoft cloud applications. Provides developers an identity management platform to deliver access control to their applications.

TABLE I. COMPARISON OF EXISTING CLOUD SERVICE PROVIDER WITH AZURE CLOUD PROVIDER

Feature	Amazon EC2	Google App Engine	Microsoft Engine
Cloud Service Area	IaaS	Paas	IaaS and PaaS
Development Tools	To create images of server platform, provides only virtual machine.	Provides editing, simulation and deployment tools.	Visual Studio provides best development platform for developers to build Azure applications.
Platform Services	Not available	Google Services	Windows Azure App Fabric Services-Service Bus Access Control.
Programming Language Support	Supports oracle ,.NET	Python and Django	.NET, JAVA, Apache, Ruby, PHP, C, C++,

VI. CONCLUSION AND FUTURE WORK

After the comparative study of Amazon, Google and Microsoft Azure we come with the conclusion that no public cloud can compare to the offerings of AWS. You can definitely go with azure if you are in need of PaaS, you want seamless hybrid cloud and if you are using lot of Microsoft Azure services. Microsoft Azure provides the necessary cloud platform that reduces not only the time to discovery, but also the cost of discovery. It minimized the need for managing these resources and provided automated services for easily provisioning scalable, cheap resources in a timely manner. Future work will be oriented towards comparing performance of various cloud service provider in terms of providing effective support to the deployed web application.

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