

Cloud Computing with Azure PaaS for Educational Institutions

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Abstract

Many Universities provide the provision for online admissions, filling exam form online, declaring results online. Filling exam form online requires uploading the previous semester mark sheets and verifying subject for the current semester. Lacs of students are hitting the university server at certain duration to fill online exam form, which results in server crash. These occasional spikes require enough machines to handle the peak. Cloud computing is an excellent alternative for educational institutions which are especially under budget shortage in order to operate their information systems effectively without spending any more capital for the computers and network devices. When any University reduces the need for on premises resources they reduce the maintenance and operational overhead. In this project I have proposed the Azure PaaS for Educational institutions or universities. Azure Storage and Compute Services are giving high performance computing considering the University scenario. In this project data from affiliated colleges under one university is stored in single Azure Table using the concept of partition key. Later performance analysis is done.

Keywords: Educational institutions, Windows Azure PaaS, Azure Table. Partition key.

1. Introduction

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction[1]

As technology is changing the educational institutions have to fundamentally change the way it delivers services. Now in every institution the storage and servers are consuming huge funds and servers and hardware needed to upgrade or to replace to boost the performance. The trained staff is required for the maintenance and to deal with other technical issues. In this project Azure PaaS compute services and storage services are used for educational institution. This paper mainly focuses on the university under which many colleges are affiliated. The Students information their hall tickets and their result are kept on Azure storage. Azure provides developers with on demand compute and storage to host, scale and manages web applications on the internet through Microsoft data centers. Azure is designed to support the applications that scale out, running multiple copies of the same code across many commodity servers.[2].Considering the university scenario where data grows rapidly by every semester this feature is very important. Windows Azure is an open platform that supports both Microsoft and non-Microsoft languages and environments. Windows Azure welcomes third party tools and languages such as Eclipse, Ruby, PHP, and Python [3].

Apart from scalability and cost, there is a great advantage for university IT staff to take them away the responsibility of the maintenance burden in the university. Cloud provides instant global platforms, elimination of H/S capacities and licenses, reduced cost, simplified scalability [4].Azure PaaS consist of three major components, Storage, Compute and base fabric controller to hold everything together.AS shown in Fig. 1

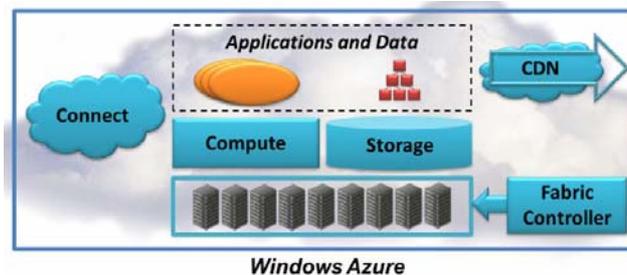


Fig. 1: Azure Architecture.

2. Why Azure for Educational Institutions

2.1 Handling the peak at the time of examinations and results

University needs to handle large number of simultaneous users. Building it on a platform explicitly designed to support this makes sense. The intrinsic support for scale out applications and scale out data that Azure provides can handle much larger loads than more conventional web technologies [2] As we know that university load will vary significantly at the time of admission, examination and at the time of results. Many times university sites crashes when the results are out. So running the application with occasional spikes always requires enough machines to handle the peaks. Here almost for three months when semester is running those system goes unused most the time. If the application is running in Azure, the university can expand

the number of instances running and shrink back to smaller number. As Azure is charging is usage based, so this solution is cheaper than maintaining a lots of mostly unused machines. To create this kind of application developer can use Web roles. To handle peak university load multiple Web role and worker role instance can be configured using the configuration file As shown in Fig. 2

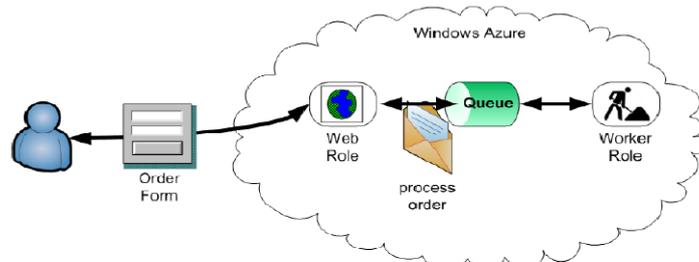


Fig. 2: Windows azure Compute (Source Microsoft)

In this application web roles are responsible for the following

- College wise Report generation.
- Uploading/downloading students data
- Uploading/downloading exam data and hall ticket
- Uploading the gazettes

2.2 Parallel processing for colleges

University will occasionally needs lots of computing power for parallel processing application. For example in this project several college are doing result analysis for their colleges or many students are taking their report. It is possible to make large cluster of machines to meet this occasional need, but this solution is expensive. Azure can instead provide these resources as needed. In this project parallel work is done by number of worker role instances running simultaneously. This worker load can take data from Azure table or Blob storages.

2.3 Worker Load with background processing

Web roles are provided interface and worker role can be used for background processing. University can have some number of web role instances to handle each college. The student's data from each college is stored in a single table. For background processing it will rely on worker role instance.

3. Azure Storage Services for Educational Institutions

Storage in the cloud is scalable, durable and available anywhere at any time. Azure provides Tables, blobs and queues for storage. These storage can be access through HTTP or HTTPS by the applications running on premises or on the cloud. Blobs are used for storing binary and text data. Queues service for storing messages access by the client. Tables are used for storing non relational data. The importance of Azure

platform has been recognized by industry as well as academia as is evident from the rare partnership of National Science Foundation (NSF) and Microsoft in funding scientific research on Azure cloud[9].

Azure tables are not relational they hold data in the form of entities and properties. These feature is helpful considering that several colleges are affiliated to single university .Each college will be having different branches. Name and number of branches will vary from college to college. So azure Table is the best choice to use in this application. Each entity in Azure table consists of Partition key and Row key.

A Student table is a collection of all the student entities and staff Table is collection of all the staff entities. Tables don't enforce a schema on entities, which means a single table can contain entities that have different sets of properties. The number of tables that a storage account can contain is limited only by the storage account capacity limit[5] .

The concept of Partition Key is introduced for load balancing. When the table is spread across multiple servers then all the rows with the same partition Key are kept together. Each entity on table contains Partition Key, Row Key and timestamp. Fig. 3 shows the Student table with Properties. In this project Student table contain Partition Key as “College Code” and Students ID as Row Key. All the rows with same college code will be kept together this feature is helpful in group entity transaction.

PartitionKey	RowKey	Timestamp	CollegeCode	EnrollCode
01-10	01-10	11/27/2013 10:2...	01	01-10
01-100	01-100	11/27/2013 10:2...	01	01-100
01-1000	01-1000	11/27/2013 10:2...	01	01-1000
01-1001	01-1001	11/27/2013 10:2...	01	01-1001
01-1002	01-1002	11/27/2013 10:2...	01	01-1002
01-1003	01-1003	11/27/2013 10:2...	01	01-1003

Fig. 3: Student Table.

If a programmer can anticipate more activity on given partition than more granular partition should be created. A partition is a consecutive range of entities possessing the same Partition Key. Programmer must include the Partition Key property in every insert, update and delete operation. The Row Key is a unique identifier from an entity within a given Partition. Together Partition Key and Row Key uniquely identify every entity within a table. Timestamp property is a Date Time value i.e. manipulated on the server side to record the time on entity was last modified.

In this project Blobs are used to store the Students and Faculties photographs. As the data in tables, Blobs and Queues are stored in Microsoft data center, some latency is always involve when colleges are inserting, updating and deleting the entities from the table. Here Average E2E Latency is 54.15 ms for 21191 requests for table. Since

those request and responses can travel through any number of routers before they return to the client. One can monitor the key performance metrics for cloud services in the windows Azure management portal. As shown in Fig. 4. Monitoring displays in the management portal are highly configurable. One can choose the metrics to monitor the in the metrics list on the Monitor and one can choose which metrics to plot in metrics chart on the monitor page and dashboard.



Fig. 4: Azure table performance on monitor page.

4. Conclusions

Many cloud providers offers a pre configured virtualized application server environment to which Educational Institutions can deploy applications. The Azure PaaS manages the hardware without having to worry about the setup, maintenance and occasional spikes. Azure provides three type of storage services, Blobs, Tables, and Queues. In order to get the best performance out of the Table service, the Table entity should be accessed by using Partition Key and Row Key.

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