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Educational Recommendation System Using Cloud Computing System Architecture

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***Abstract*----Educational Recommendation System committed to empowering students. This is a web application which uses the Green Cloud Computing architecture. Cloud Computing is a highly scalable and cost-effective infrastructure for running enterprise and Web applications. However, the growing demand of Cloud infrastructure has drastically increased the energy consumption of data centers, which has become a critical issue. High energy consumption not only translates to high operational cost, which reduces the profit margin of Cloud providers, but also leads to high carbon emissions which is not environmentally friendly. Hence, energy-efficient solutions are required to minimize the impact of Cloud computing on the environment. In order to design such solutions, deep analysis of Cloud is required with respect to their power efficiency. So here we have given a solution for using less energy efficient system with our proposed system of Educational recommendation engine. The students with similar profile's will be able interact in this system to share their ideas / recommendations too. This system is not only to empower the students and also the Educators are benefited. They can create invites for theircourse's with their requirements. Then the system sendsthe invites for the students who meets their criteria. The student can accept or deny invites. The statistical reports of the invites are generated.**

Keywords -cloud education recommender; university recommender ; recommendation engine ; know the university matches you ; university resources ; affective recommendation

I. Introduction

With our proposed system unlike like other recommendation systems, this will aim for something different. We use 9 academic parameters in our algorithm such as Country Interested, Level Of Education, Area Of Interest, Specialization, CGPA, Percentage, Standardized Proficiency (GRE / GMAT) , English Proficiency (ILETS / TOEFL), Year Of Completion. The data's are huge so the performance should not get's affected or decreased, due to this the algorithm should take much less time to execute for that the optimizations are done through the structuring of data and through the logical computations processing. There will be lacks of records, the algorithm should terminate that record from listing if it doesn't matches the basic requirements itself, otherwise the statistical algorithm executes and computes the percentage of matching.

With the growth of high speed networks over the last decades, there is an alarming rise in its usage comprised of thousands of concurrent e-commerce transactions and millions of Web queries a day. This ever-increasing demand is handled through large-scale datacenters, which consolidate hundreds and thousands of servers with other infrastructure such as cooling, storage and network systems. Many internet companies such as Google, Amazon, eBay, and Yahoo are operating such huge datacenters around the world.

The commercialization of these developments is defined currently as Cloud computing [2], where computing is delivered as utility on a pay-as-you-go basis. Traditionally, business organizations used to invest huge amount of capital and time in acquisition and maintenance of computational resources. That is, small or medium enterprises/organizations do not have to worry about purchasing, configuring, administering, and maintaining their own computing infrastructure. They can focus on sharpening their core competencies by exploiting a number of Cloud computing benefits such as on-demand computing resources, faster and cheaper software development capabilities at low cost.

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Moreover, Cloud computing also offers enormous amount of compute power to organizations which require processing of tremendous amount of data generated almost every day.

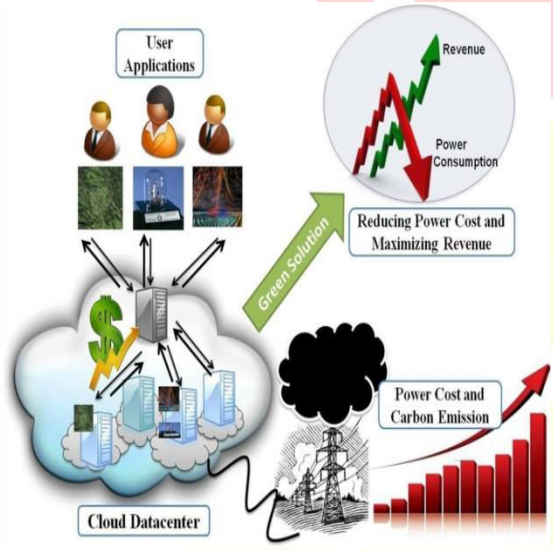

Figure 1, Cloud and Environmental Sustainability

Clouds are essentially virtualized datacenters and applications offered as services on a subscription basis as shown in Figure 1. They require high energy usage for its operation [4]. Today, a typical datacenter with 1000 racks need 10 Megawatt of power to operate [5], which results in higher operational cost. Thus, for a datacenter, the energy cost is a significant component of its operating and up-front costs. In addition, in April 2007, Gartner estimated that the Information and Communication Technologies (ICT) industry generates about 2% of the total global CO_2 emissions, which is equal to the aviation industry [5]. According to a report published by the European Union, a decrease in emission volume of 15%–30% is required before year 2020 to keep the global temperature increase below 2 ^{0}C. Thus, energy consumption and carbon emission by Cloud infrastructures has become a key environmental concern.

II. WHAT IS THE NEED OF CLOUD COMPUTING

Cloud computing is an evolving paradigm which is enabling outsourcing of all IT needs such as storage, computation and software such as office and ERP, through large Internet. The shift toward such service-oriented computing is driven primarily by ease of management and administration process involving software upgrades and bug fixes.

The literary meaning of "Cloud computing" can be "computing achieved using collection of networked resources, which are offered on subscription". In terms of qualities of real "Clouds," which do not have any definite shape or position, Cloud computing is also called "Cloud" since a Cloud server can have any configuration and can be located anywhere in the world. Internet is a fundamental medium through which these Cloud services are made accessible and delivered to end user.

The characteristics of Clouds include on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. The available service models are classified as SaaS (Software-as-a-Service), PaaS (Platform-as-a-Service), and IaaS (Infrastructure-as-a-Service). The deployment models is categorized into public, private, community, and hybrid Clouds.

A. Cloud Computing Characteristics

- **Virtualized:** Resources (i.e. compute, storage, and network capacity) in Clouds arevirtualized and it is achieved at various levels including VM (Virtual Machine) and Platform levels. The most basic one is at Virtual Machine (VM) level where different applications can be executed within their containers or operating systems running on the same physical machine. Platform level enables seamless mapping of

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applications to one or more resources offered by different Cloud infrastructure providers.

- **Service-Oriented**: Cloud is implemented using Service-Oriented Architecture modelwhere all the capabilities/components are available over the network as a service. Whether it is software, platform or infrastructure everything is offered as a service.

- **Elastic:** Resources (i.e. compute, storage, and network capacity) required for Cloudapplications can be dynamically provisioned and varied i.e., increase or decrease at runtime depending on user QoS requirements. Major Cloud providers such as Amazon even provide services for automatic scale-out and scale-in based on hosted application requirements.
- **Dynamic and Distributed:**Although Cloud resources are virtualized, they are oftendistributed to enable the delivery of high-performance and/or reliable Cloud services.

  These resources are flexible and can be adapted according to customer's requirements such as software, network configuration, etc.
- **Shared (Economy of Scale)**: Clouds are shared infrastructure where resources servemultiple customers with dynamic allocation according to their application's demand. This sharing model is also termed as "multi-tenant" model. In general, the customers neither have any direct control over physical resources nor they are aware of the resource location and with whom they are being shared.
- **Market-Oriented (Pay as you go):**In Cloud computing, customers pay for services on apay-per-use (or pay-as-you-go) basis. The pricing model can vary depending on the QoS expectation of application. Cloud IaaS providers such as Amazon price resources using market models such as commodity or on-spot pricing models. A pricing model proposed by Allenofor&Thulasiram [4] for grid resources could be used as a base for cloud resources.
- **Autonomic:**To provide highly reliable services, Clouds exhibit autonomic behavior bymanaging themselves in case of failures or the performance degradation.

III. Educational Recommendation System

Educational Recommendation System is the online recommendation engine used to recommendthe students with the universities that matches their profile. It is an interactive tool to getOnlinerecommendations. It is easy foraddingan University to their favorites, accept invites and chat with the students of similar profiles. Now we can access to ourEducational Recommendation System from anywhere and anytime through the Network. In this network you can share your recommendation with your friends. This system can be accessed by the students and also by the university administrator. Universities can create invites for the courses that they have with their requirements in simple English. The simple English conditions are converted to logical conditions and sends invites for the student profiles which meets their criteria. The universities can track the invites by the total number of invites sends, total number of invites accepted, etc. The statistics are send with a mail for the universities and also the statistics will be available on their account too.

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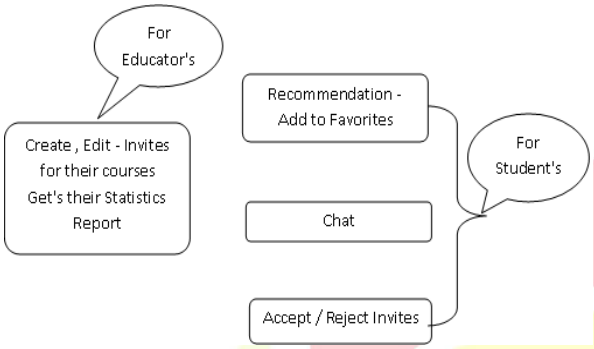

Figure 2, Overview OfEducational Recommendation System

IV. Features of Clouds enabling Green computing

Even though there is a great concern in the community that Cloud computing can result in higher energy usage by the datacenters, the Cloud computing has a green lining. There are several technologies and concepts employed by Cloud providers to achieve better utilization and efficiency than traditional computing. Therefore, comparatively lower carbon emission is expected in Cloud computing due to highly energy efficient infrastructure and reduction in the IT infrastructure itself by multi-tenancy. The key driver technology for energy efficient Clouds is "Virtualization," which allows significant improvement in energy efficiency of Cloud providers by leveraging the economies of scale associated with large number of organizations sharing the same infrastructure. By consolidation of underutilized servers in the form of multiple virtual machines sharing same physical server at higher utilization, companies can gain high savings in the form of space, management, and energy.

Server Utilization: In general, on-premise infrastructure run with very low utilization,sometimes it goes down up to 5 to 10 percent of average utilization. Using virtualization technologies, multiple applications can be hosted and executed on the same server in isolation, thus lead to utilization levels up to 70%. Even though high utilization of servers results in more power consumption, server running at higher utilization can process more workload with similar power usage.

Datacenter Efficiency: As already discussed, the power efficiency of datacenters has majorimpact on the total energy usage of Cloud computing. By using the most energy efficient technologies, Cloud providers can significantly improve the PUE of their datacenters. Today's state-of-the-art datacenter designs for large Cloud service providers can achieve PUE levels as low as 1.1 to 1.2, which is about 40% more power efficiency than the traditional datacenters. The server design in the form of modular containers, water or air based cooling, or advanced power management through power supply optimization, are all approaches that have significantly improved PUE in datacenters. In addition, Cloud computing allows services to be moved between multiple datacenter which are running with better PUE values. This is achieved by using high speed network, virtualized services and measurement, and monitoring and accounting of datacenter.

V. Characteristics Of Educational Recommendation System

Educational Recommendation System, typically entails:

- **High scalability**

  Cloud environments enable servicing of business requirements for larger audiences, through high scalability

- **Agility**

  The cloud works in the 'distributed mode' environment. It shares resources among users and tasks, while improving efficiency and agility (responsiveness)

- **High availability and reliability**

  Availability of servers is high and more reliable as the chances of infrastructure failure are minimal

- **Multi-sharing**

  With the cloud working in a distributed and shared

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mode, multiple users and applications can work more efficiently with cost reductions by sharing common infrastructure

- **Services in pay-per-use mode**

  SLAs between the provider and the user must be defined when offering services in pay per use mode. This may be based on the complexity of services offered

  Application Programming Interfaces (APIs) may be offered to the users so they can access services on the cloud by using these APIs.

- **Reliability**

  Reliability is improved if multiple redundant sites are used, which makes well-designed cloud computing suitable for business continuity and disaster recovery.

- **Performance**

  Performance is monitored and consistent and loosely coupled architectures are constructed using web services as the system interface.

- **Security**

  Security could improve due to centralization of data, increased security-focused resources, etc., but concerns can persist about loss of control over certain sensitive data, and the lack of security for stored kernels. Security is often as good as or better than other traditional systems, in part because providers are able to devote resources to solving security issues that many customers cannot afford.However, the complexity of security is greatly increased when data is distributed over a wider area or greater number of devices and in multi-tenant systems that are being shared by unrelated users. In addition, user access to security audit logs may be difficult or impossible. Private cloud installations are in part motivated by users' desire to retain control over the infrastructure and avoid losing control of information security.

- **Maintenance**

  Maintenanceof cloud computing applications is easier, because they do not need to be installed on each user's computer and can be accessed from different places.

- **Cost**

  Cost is claimed to be reduced and in a public cloud delivery model capital expenditure is converted to operational expenditure. This is purported to lower barriers to entry, as infrastructure is typically provided by a third-party and does not need to be purchased for one-time or infrequent intensive computing tasks. Pricing on a utility computing basis is fine-grained with usage-based options and fewer IT skills are required for implementation (in-house). The e-FISCAL project's state of the art repository contains several articles looking into cost aspects in more detail, most of them concluding that costs savings depend on the type of activities supported and the type of infrastructure available in-house.

- **Virtualization**

  Virtualization technology allows servers and storage devices to be shared and utilization be increased. Applications can be easily migrated from one physical server to another. So using this technology we can consume the power also no multi server is required we can use it from the single server.

- **Device and Location Independence**

  Enable users to access systems using a web browser regardless of their location or what device they are using (e.g., PC, mobile phone). As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect from anywhere.

VI. Structure of Educational Recommendation System

VII. It is not mandatory for the student to enter the relative parameters. The relative parameters helps to compute the statistical algorithm to know the possibility

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of getting an admission in the Universities with percentage value. The most of the records are filtered out based on the hard cut off parameters itself. The remaining records which satisfy the precondition only enters the Statistical Algorithm , so the performance of the algorithm is increased. The data's are structured using the Heap Data Structures and the Space Complexity is O(n). Figure3 shows the execution structure of this system.

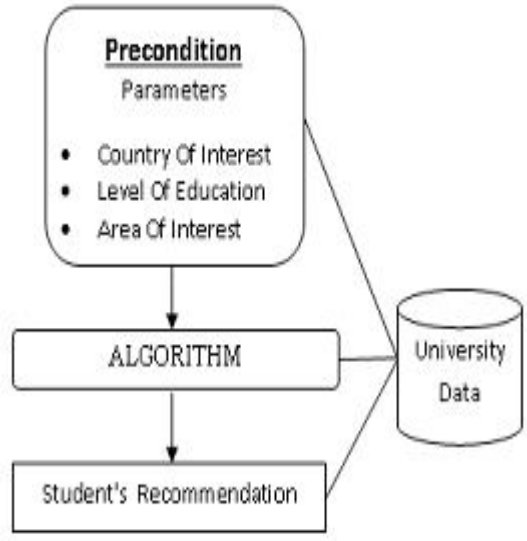

Figure 3, Structure OfEducational Recommendation Process

The Algorithm takes up the minimum requirement of the Universities and also the Student's Profile and it matches both the conditions and it generates the recommendation and report for each university with 11 Parameters they are,

- Overall Recommendation
- Academics
- Standardized Proficiency
- English Proficiency
- Scholarship
- Part Time Job
- Job Prospect
- Average Salary
- Extra-Curricular
- LOR

VIII. Our Proposed Educational Recommendation System

This application is not only based on the machine and its data but also it allows human interaction with the system. So the users can easily identify the Universities that they are looking for. The data's will be keep on changing for each academic year so the maintainability of data is very difficult. So with the help of human interactions we can reduce the data efforts. The data's are only updated only after verification. The student's with similar profiles are matched through the algorithm and it allows them to interact with our real-time chat notification systems.

IX. Features of Educational Recommendation System

- **Student's Recommendation**

  This feature enables you to get recommended universities based on the country, level of education, and area of interest as hard cutoff. The student will be able to identify why he is getting / missing this university.

- **Student - Add to Favorites**

  Here in this system you provide you with a feature of adding the universities to your favorites.

- **Student - Chat**

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The students with the similar profiles can be able to Chat. Which enables you to share the ideas with your friends.

- **Student - Advanced Search Filter Option**

  The application provides you with the filter options whatever you want in the whole application.

- **Data Security**

  This system has a secured access to the database. This system provides authorized access to all your private data.

- **Universities - Create Invites**

  The Universities can create invites for their available courses with their conditions in simple English. The invites are sent for the student's profile which matches their conditions.

- **Universities - Invite'sReport**

  The universities get their statistical reports for their invites. The total number of invites sent , total reach , total accepted, students lists, etc.

X. Implementation

Educational Recommendation Engine is a Web Application in PHP focuses on creating interactive user friendly Online University Recommender for students with a large Database to store Data. The Front End or Presentation tire uses HTML and CSS design. PHP as Server Side Scripting and JavaScript as Client Side Scripting are used as Logical tire or Middle tire. MySQL Database is used as Back End or Third Tire in this Application. This can be implemented vey easily and can be done from using some common technologies.

The registration Process for the students are very much interactive and they won't get bored on filling form, since the design is made in such a way. If the students terminates in between in registration process means for the next time the student can resume his progress from he stopped the registration process.

XI. Applications Of Cloud Computing

- Gmail
- Google Calendar
- Google Docs
- Google Groups
- Drop Box
- Basecamp
- Highrise
- Backpack

XII. Conclusion

In Old recommendation systemperformance, data managing is too tedious and there is no socialisms to share your thoughts.This application allows you to share your thoughts withthose of similar student profiles. After so many years, Cloud Computing today is the beginning of "network based computing" over Internet in force. It is the technology of the decade and is the enabling element of two totally new computing models, the Client-Cloud computing and the Terminal-Cloud computing. These new models would create whole generations of applications and business. Our prediction is that it is the beginning to the end of the dominance of desktop computing such as that with the Windows. It is also the beginning of a new Internet based service economy: the Internet centric, Web based, on demand, Cloud applications and computing economy.Saving Paper, Saves Trees and hence our proposed system concentrates on green computing since computing system consumes lots of

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energy we have concentrated more on virtualization technique. This technology helps you to do shortlist the universities you like and get a hope that you will get admission for the University or not

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