Spatial Query Performance For GIS cloud

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Abstract

Geographic Information System (GIS) is very important in our live and spatial data is required for several fields. Cloud computing is one of the most technology used in the modern data interchange. Spatial data query response time over cloud depends on the cloud data resource. This paper presents a query response time measurement for cloud GIS query. Spatial Query Performance (SQP) is a software designed and represented in Java programming language for measuring query response time. SQP's main functionality is to compare the response time for two spatial data resource servers by asking one query for both servers in the same time and calculate the response time for each server. Google and Bing map servers are used as spatial data resources for measuring the query response time for each server. Google and Bing map servers are used as spatial data resources for measuring the query response time for each. SQP determines that Google is faster than Bing over different test times.

Keywords: Cloud Computing, GIS, GIS Cloud, Bing map, Google map.

Montilva *et al.* (2010)

1. Introduction

As of late, Infrastructure as a Service (IaaS) distributed computing has developed as a suitable distinct option for the obtaining and administration of physical assets. With IaaS, clients can rent storage and processing time from extensive datacenters. Renting of calculation time is proficient by permitting clients to convey virtual machines (VMs) on the datacenter's assets. Since the client has complete control over the design of the VMs utilizing on-interest arrangements, IaaS renting is equivalent to obtaining committed equipment yet without the long haul responsibility and expense. The on-interest nature of IaaS is discriminating to making such rents appealing, since it empowers clients to extend or shrink their assets as per their computational needs, by utilizing outside assets to supplement their nearby asset base. B. Claudel *et al.*(2009). This rising model prompts new difficulties identifying with the outline and improvement of IaaS frameworks. One of the normally happening examples in the operation of IaaS is the need to convey an extensive number of VMs on numerous hubs of a data centre at the same time, beginning from an arrangement of VM in ages already put away in an industrious manner. For example, this pattern happens when the client needs to convey a virtual cluster that executes a circulated application or an arrangement of situations to bolster a work process. We allude to this example as multi deployment. Such an expansive sending of numerous VMs without a moment's delay can take a long time. This issue is especially intense for VM pictures utilized as a part of experimental figuring where picture sizes are huge (from a couple of gigabytes up to more than 10 GB). A run of the mill sending comprises of hundreds or even a great many such pictures. Customary organization procedures telecast the pictures to the nodes before beginning the VM occasions, a procedure that can take several minutes to hours, not including the time to boot the working framework itself. This can set aside a few minutes of the IaaS establishment any longer than worthy and delete the on-interest advantages of cloud computing. Once the VM examples are running, a comparable test applies to snapshotting the organization: numerous VM pictures that were by regional standards altered should be simultaneously exchanged to stable storage with the reason for catching the VM state for later utilize (e.g., for verify guiding or off-line movement toward another group or cloud). We allude to this example as multi snapshotting. Ordinary snapshotting approaches depend on custom VM picture file formats to store just incremental contrasts in another document that relies on upon the first VM picture as the sponsorship record, figure1.
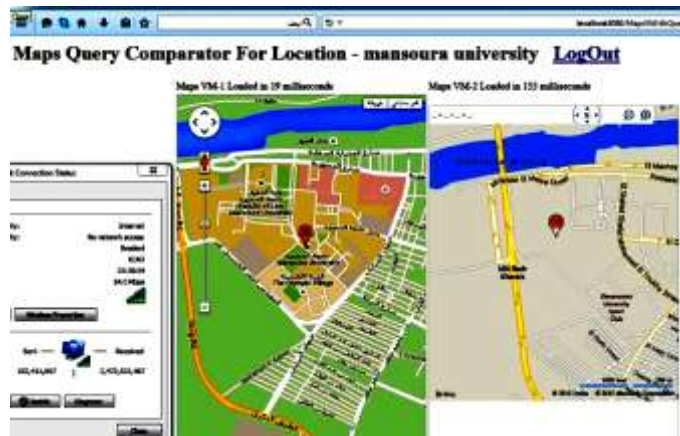
Figure1. Using DVM to get the result.

1.1 CLOUD COMPUTING

Cloud Infrastructure as a Service (IaaS) helps offices acknowledge cost funds and efficiencies while modernizing and growing their IT capacities without spending capital assets on base. Cloud-based framework is quickly adaptable, secure, and open over the Internet. Although there are several variations on the definition of cloud computing, some basic tenets characterize this emerging environment. Cloud computing outfits technological capacities normally kept up off premises that are conveyed on interest as an service by means of standard Internet protocols. For open cloud services, since an outsider gives access to the applications and framework, shoppers of open cloud services do not claim the benefits in this cloud show yet rather pay for them on a for each utilization premise. In essence, they are renting the physical infrastructure and applications within a shared architecture. Cloud offerings can run from data storage to end-client web applications to other centred processing services. One discriminating contrast in the middle of conventional and cloud computing is the versatile and flexible nature cloud computing gives. Rather than a static framework structural planning, cloud computing backings the capacity to rapidly scale up and rapidly scale down, offering cloud purchasers high reliability, quick response times, and the flexibility to handle unpredictable traffic fluctuations and sporadic demand. Cloud computing likewise bolsters multitenancy, giving frameworks arranged in a manner that they can be pooled and shared by numerous associations or people. Virtualization innovation permits cloud sellers to change over one server sinto numerous virtual machines, in this way wiping out client-server processing with single-reason systems Rajkumar Buyya *et al*.(2008) This augments equipment limit and permits clients to influence economies of scale as figure 2.

Figure2. Cloud Computing

1.2 GIS

GIS software represents features on the earth, such as buildings, cities, roads, rivers, and states, on a computer. People use GIS to visualize, question, analyze, and understand spatial data about the world and human activity. Often, spatial data is seen on a guide, which gives leverage over utilizing spreadsheets or databases. Why? Since maps and spatial examination can uncover examples, call attention to issues, and show associations that may not be obvious in tables or content. This is called The Geographic Advantage. Cities, streets, and waterways are not by any means the only physical areas that can be mapped. GIS can be utilized to guide dynamic occasions, for example, the way of a typhoon or the spread of an illness flare-up. Organizations can delineate data to take in more about their clients. By utilizing GIS to uncover these shrouded examples, associations acquire knowledge that can enhance their execution and save their cash through more prominent effectiveness, better choice making, enhanced correspondence, and more exact geographic record keeping. /www.co.rice.mn.us. GIS isn't new, although many people haven't heard about it. On any given day, millions of individuals around the globe use GIS in various ways, figure(3).
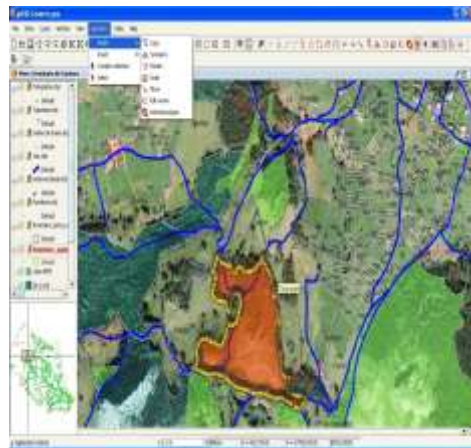
Figure(3). Geographic information system (GIS)

1.3 GIS CLOUD

Geographic information system (GIS) GIS CLOUD GIS is an Integrated System of Computer Hardware, Software and Spatial Data (topographic, demographic, plain, realistic picture, digitally condensed), performs manipulative and investigative operations on this data to deliver reports, illustrations and measurements and controls geographic data processing workflows. According to the Buyya et al. [2], Cloud computing is: "a parallel and conveyed sort of framework comprising of a gathering of interconnected and virtualized PCs that are alterably provisioned and introduced as one or more bound together figuring assets in light of administration level assentions". This definition reflects the fact that both compute and data exhaustive applications, such as GIS applications, can with good grace be moved to Clouds.

GIS Cloud has been a suggestive way to deal with redesign the ordinary GIS applications keeping in mind the end goal to give expansive range services to the clients over the globe. The broad utilization of GIS throughout the decades has been put to a question mark whether to move it to more prevalent option i.e. Cloud computing Paradigm. Geographic Information Systems (GIS) applications have been moving into the cloud with expanded commute, Global associations like ESRI, GIS Cloud Ltd and so forth have officially taken the quantum jump and taken a innovative movement to Cloud Computing Paradigm and are resolved to give on-interest services to their broad shades of clients. World's largest GIS Cloud infrastructure providers are Amazon (Amazon EC2 & S3), Microsoft (Microsoft Windows Azure, Windows Server Hyper-V), and IBM (IBM Cloud) which provide reliable and secure cloud IT infrastructure to the customers on-demand. www.esri.com.

1.4 BING MAPS

BING Maps is an overall gathering of current data sorts that bolster numerous web conveyance formats. Bing Maps is delivered as a web service and can be provided to Spatial on Demand customers as native Bing Map cached services, as (OGC) The Open Geospatial Consortium (OGC), an international voluntary consensus standards organization, originated in 1994. In the OGC, more than 500 business, administrative, not-for-profit and examination associations overall work together in an accord procedure empowering improvement and execution of open gauges for geospatial substance and services, GIS data preparing and data sharing. compliant Web Mapping Service and delivered with the Bing Maps (SDK) A software

development kit (SDK or"devkit") is typically a set of software development tools that permits the production of applications for a certain software package , software framework, hardware platform, computer system, video game console, operating system, or similar development platform. www.spatialenergy.com.(2011). To create applications you have to download this software development kit. For example if you want to create an Android app you require a SDK with java programming, for iOS apps you require an iOS SDK with swift language, and to develop MS Windows apps you require the .net language. for use by singular clients of GIS and other mapping applications, notwithstanding supporting inward web applications as figure 4.

Figure4. Bing Map

1.5 GOOGLE MAPS

Google Maps is a desktop and mobile web mapping service application and technology provided by Google, offering satellite symbolism, road maps, and Street View viewpoints, and additionally capacities, for example, a route planner for going by foot, auto, bike (beta test), or with open transportation. Likewise upheld are maps inserted on outsider sites by means of the Google Maps API, and a locator for urban organizations and different associations in various nations around the globe. Google Maps satellite pictures are not redesigned continuously; be that as it may, Google adds data to their Primary Database all the time. Google Earth support vast majority of the pictures are close to 3 years old.

The (opt-in) Express permission by a customer, or a recipient of a mail, email, or other direct message to allow a marketer to send a merchandise, information, or more messages. This is the method generally used by most direct marketing firms, subscription or non-subscription periodicals, information suppliers, etc. After the pick in, the advertiser will continue sending the material or messages until the beneficiary decides to quit. overhauled version of the desktop application has been accessible since 2013, close by the "classic" (pre-2013) variant. The overhauled version was met by client feedback with respect to lateness, some concealing normal functions, uprooting a scale bar, and absence of different components that incorporate My Places and sharable customized connections to parameterize split Street View and Map sees. It is conceivable to change back to the old rendition.   Google Maps utilizes a nearby variation of the Mercator projection, and in this manner can't precisely indicate ranges around the poles. A related item is Google Earth, a stand-alone program which offers more globe-review elements, including indicating polar regions. Google Maps for mobile is the world's most popular app for smart phones, with over 54% of global smart phone owners using it at least once during the month of August 2013 as figure 5.

Figure5. Google Map

2. Query Performance Measurement

This paper presents a comparison methods to measuring the best performance for spatial data query over cloud and determine which is the best map server. Spatial Query Performance (SQP) software is designed for the measurement between two servers Google map, and Bing map. SQP measures the query response time for each map servers, The main site of SQP

consist of Dual Virtual Machine (DVM) which designed and implemented using Java. The response time was declared for each virtual machine, this time is used to determine which map server is preferred.

2.1 SQP Tools

Java is the main programming language used for implementing the SQP it is integrated with   MySQL 5.5 as a data base management system.

2.2   SQP Hardware

The system was run and tested over two machine: DELL cor i3 and Hp cor i5. on DELL the speed of the Internet was 1MG and router type TP-Link were our results to differ when we installed the software on a HP cori5 and speed of the net 1MG and Router type TP-Link well and the results were the best on the computer HP them on the Dell and we note the differences in the results in the response both Google map and Bing map and equipped in various online queries are TE Data company for internet service in Egypt.

2.3 SQP Description

SQP is a web based software, therefore the main page   contains Login and Sign Up page (Main page), from this page any user can be Sign up if he use the software for the first time by his E-mail and password   or begin by login if he Sign up in earlier time. Sign up bottom   in this page when click on it, will move you to another web page designed for register (Register Page) by E-mail and password when you successfully this operate   clicking on Home bottom to return you to the login page to complete login and then take you to search page (Search page), from this page we can start search process about any street, city or state name in the allotted then click on the Search icon field (Submit), after clicked on the search icon (Submit) the search process will begin in both of DVM, the DVM page (Result Page) shows SQP performance between two map servers by the difference in time that taken to response that SQP query over two servers.
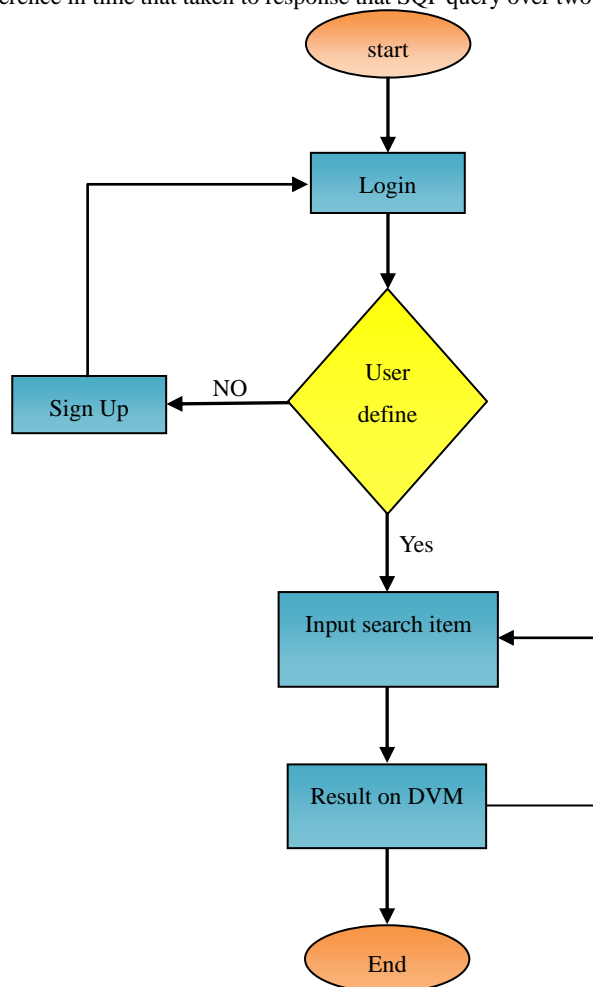

Figure (6) SQP Sequence

A Systematic research on the application of a practical program which consists of several Web pages.   Figure (7) shows the

SQP sequence, a main page is the SQP start page it is used for registered users and also registering the new users Email and password are mandatory, when the program starting it will shows the start page that consists of a program title at the top and also the email and the password section   where these items are not to enter the search page without using e-mail and password to be register. Then we can go to the search page and searching for any street, city or state as the home page on a private register. If we used the software for the first time we must lunch register page by clicked on bottom (Sign up for free) this will move to registration page in the   registration process which   then enable to access the search page.

The Registration Page is recording users who want to enter and conduct the search process where the user register; by clicking on Date icon Department (Sign Up For Free)   it will move from the home page to the registration page, which consists of a number of special fields. The e-mail and password should be written where we using the first field enter then repeat the e-mail again in the second field to make sure that it is the same as,   in the third field where   the password and repeat the password in the fourth field to be sure to enter the same password in both fields where you will insert characters to the word Traffic in the field make sure that   the number does not exceed six letters or numbers. After the completion of the input, press on the icon (register) to complete registration process and show a message insure the   completion   process , then return to the main page after pressing the Start icon process.

After completing the registration processing and accessing of e-mail and password successfully, we turn to the login page where they will be the introduction of the e-mail in the allotted field and also enter the password; click on the icon entry field (Login), we are not   moving to the search page that through we find any street name city or state.

Figure (7) Main page

Dual Virtual Machine Page it was created and tested for comparison between the two remedies map (GIS query) replies, DVM have the same properties. After the completion of the search process using the street name, city or states and press the search icon will jump to the DVM page that consists of two virtual machine, each virtual machine has a particular server where the VM consists first Google server virtual machine and the second from the server where the Bing search results appear in order to compare the time difference between the two servers, both for the first registration process and then we process access to the search page. What the results will show how to measure the time difference between the two servers used in both the first and second virtual machine for different results and that gives us a good server that takes less time to show results with the installation of the speed of the Internet in both; virtual machine definition will show the use of the system. We can also refer to the search page to search for the name of a street or another city or state by clicking on the icon go back and repeat the process until the completion of the work then we can also refer to the start page for registration of a new user and repeat the same steps as-mentioned.

Upon completion of the work we can close the program and get out of it.

The software was installed on a machine connected to internet of 1 Mega byte through TP – Link Router, figure (8).
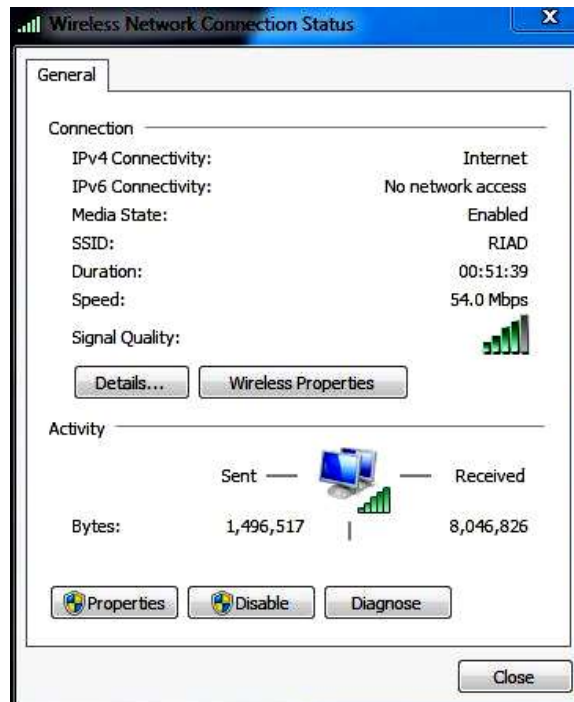

Figure (8) Router properties

2.4 SQP Measurement

The system was checked and tested in Mansoura University in different intervals of time during a day, it was observed that internet services speed depends on chick time, which affect spatial query response time. We tested the SQP to determine Mansoura University location through DVMs once for search on Google map server and the other search on Bing map server. At different times as shows on figure(9- a,b,c,d).

Figure (9-a) shows the search result on DVM about Mansoura University at (01:25 am – 4/5/2015).

Figure (9-a)

Figure (9-b) shows the search result on DVM about Mansoura University at (06:06 am – 4/5/2015).

Figure (9-b)

Figure (9-c) shows the search result on DVM about Mansoura University at (12:38 pm – 4/5/2015).

Figure (9-c)

Figure (9-d) shows the search result on DVM about Mansoura University at (12:01 am – 5/5/2015).

Figure (9-d)

The internet speed in all SQP is 1 MG. Below tables determine difference in SQP on two servers   Google map and Bing map. this tables show the differ response of   SQP in different time. Each row contains the order on the day and time that is a spatial query shows the response time in milliseconds for the same street name, city or state.

3. Results

Table (1) shows the response time of spatial query for the same location (Cairo) on times (12:41   am - 06:18   am – 12:34 pm – 11:41 pm), response time average in all day of SQP for Google server was (35.5)mille seconds, and for Bing map server was (140.75)mille seconds, Through our for spatial query for Cairo on more than timing various conclude that time better query is at(06:18   am).

At this time was the time of spatial query is preferable because the speed of the Internet, and the same case for table.

Table (1) SQP for Cairo

Location / Different SQP	Cairo	
	Google	Bing
4-5-2015/ 12:41 am	40 ms	151 ms
4-5-2015/ 06:18 am	19 ms	76 ms
4-5-2015/ 12:34 pm	42 ms	159 ms
4-5-2015/ 11:41 pm	41 ms	177 ms
Response time average	35.5 ms	140.75ms

Table (2) shows the response time of spatial query for the same location (Mansoura University) on times (01:25   am - 06:06 am – 12:38 pm – 12:01 am), response time average in all day SQP for Google map server was (30.75)mille seconds, and for Bing map server was (134.25)mille seconds, Through our for spatial query for Cairo on more than timing various conclude that time better query is at(06:18   am).

Table (2) SQP for Mansoura university

Location / Different SQP	Mansoura uni	
	Google	Bing
4-5-2015/ 01:25 am	35 ms	162 ms
4-5-2015/ 06:06 am	25 ms	82 ms
4-5-2015/ 12:38 pm	34 ms	157 ms
5-5-2015/ 12:01 pm	29 ms	136 ms
Response time average	30.75ms	134.25 ms

From tables (1,2) we deduce conclude that the SQP was better on Google map server than Bing map server in faster response. In table(3) below we review a different SQP for different location in the same time and the speed of the Internet was 1M , machine type Dell core i3. The result appear was for El mansoura, the SQP response time in Google map server was (31 ms), in same time we do SQP on Bing map server the time response was (140 ms) , then do SQP for locations Cairo and Tanta and result of SQP respectively was (38 ms) on Google map server   and (177 ms) on Bing map server, (50 ms) on Google map server and (220 ms) on Bing map sever.

Table (3) Different SQP location

SQP Result on machine cor i3 CPU 2.20 GH RAM 8 GB Operating System 64 – Bit			
NO	Location	Response Time in Google	Response Time in Bing
1.	EL mansoura 02:42 am 1/4/2015	31 milliseconds	140 milliseconds
2.	Cairo 03:07 am 1/4/2015	38 milliseconds	177 milliseconds
3.	Tanta 03:15 am 1/4/2015	50 milliseconds	220 milliseconds

4. CONCLUSION

This paper provided a 12Spatial Query Performance (SQP) software. It is a comparison method between different spatial data query's response time. SQP was executed on both Google and Bing map servers by using Dual Virtual Machines (DVM). A spatial query was requested in different times during the day. SQP proved that Google map server is better in   spatial query response performance than Bing map server. That because the average response time for Google map server was 30.75 millisecond, and for Bing map server was 134.25 millisecond, in Mansoura university locations. The system was tested also on Cairo city, and the average response time for Google map server was 35.5 millisecond, and for Bing map server was 140.75 millisecond.

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