Butterfly Effect of Mobile Computing in the Context of Cloud Architecture

Mr. Vishnukumar R. Teraiya
Department of Computer Science, Sardar Patel University
Vallabh Vidyanagar, Gujarat, India.

Abstract **- The title of this paper itself contains three different theories to be explained. Butterfly effect, mobile computing and cloud architecture. Before we discuss the actual concept of the paper it is required to have some knowledge about all of these.**

Keyword **- Mobile computing, cloud architecture, butterfly effect**

I. INTRODUCTION

The aim is this paper that it represent Butterfly effect of mobile computing in context of cloud architecture.

II. METHODOLOGY

Butterfly effect

About fifty years ago Sir Edward Lorenz professor at MIT was trying to simulate weather pattern in USA. One day he entered some numbers allowing the computer program to start calculating and left his office. The computer model was based on 12 variables like speed of wind and temperature, which could be depicted on line graph over a period of time. On that day he was repeating the simulation that he had performed earlier but he rounder of one variable from 0.506127 to 0.506 and surprisingly that small alteration drastically changed the pattern that program used to produce.

On a winter day 50 years ago, Edward Lorenz, SM ‘43, ScD ‘48, a mild-mannered meteorology professor at MIT, entered some numbers into a computer program simulating weather patterns and then left his office to get a cup of coffee while the machine ran. When he returned, he noticed a result that would change the course of science.

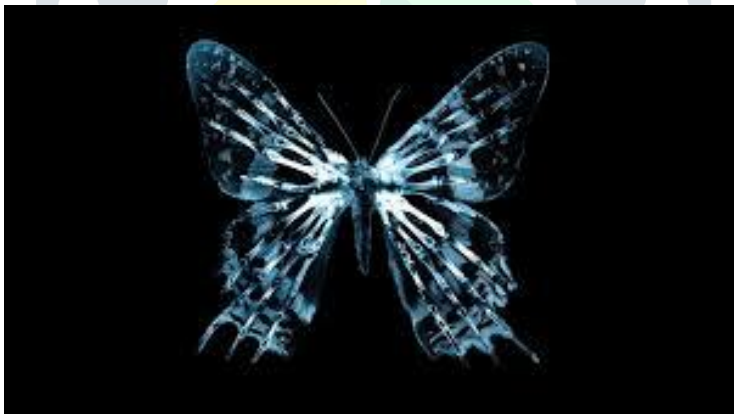

Fig 1

The computer model was based on 12 variables, representing things like temperature and wind speed, whose values could be depicted on graphs as lines rising and falling over time. On this day, Lorenz was repeating a simulation he’d run earlier—but he had rounded off one variable from .506127 to .506. To his surprise, that tiny alteration drastically transformed the whole pattern his program produced, over two months of simulated weather.

The unexpected result led Lorenz to a powerful insight about the way nature works: small changes can have large consequences. The idea came to be known as the “butterfly effect” after Lorenz suggested that the flap of a butterfly’s wings might ultimately cause a tornado. And the butterfly effect, also known as “sensitive dependence on initial conditions,” has a profound corollary: forecasting the future can be nearly impossible.

To understand butterfly effect in a different sense let us take an example of a story. This story is merely fiction. It is given as an example of what is meant by the Butterfly Effect. A mosquito is flying, looking for some flesh to draw some nourishing blood from. He spots a man, high on a pole. He lands on the man’s arm, inserts his syringe, after he is sated he roughly withdraws and flies away. The electrician, anxious to finish work, decides not to wait for the “cherry picker”, instead uses the ladder that he had with him. Whilst at the top of the electric pylon he was pierced by a mosquito and quickly moved to squat it, missing.

The sudden movement, by the electrician, caused him to lose balance on the ladder. He dropped to the ground and the ladder fell against the wires causing a short, creating a black out across the whole district. The town became a "Ghost Town" because one mosquito, two thousand miles away, was hungry.

Enterprise Mobility

Mobile technologies today have allowed businesses to move from their fixed location, unlocked immense value, and unleashed innovative solutions to further help businesses. However, companies encounter challenges in their journey to unlock the opportunities offered by mobile devices.

Challenges and opportunities

- Create new mobile-driven business processes: These new business processes are cantered on the concept of mobility, which involve technologies such as cloud and analytics, and use context-driven and location-aware data to influence the way companies function.

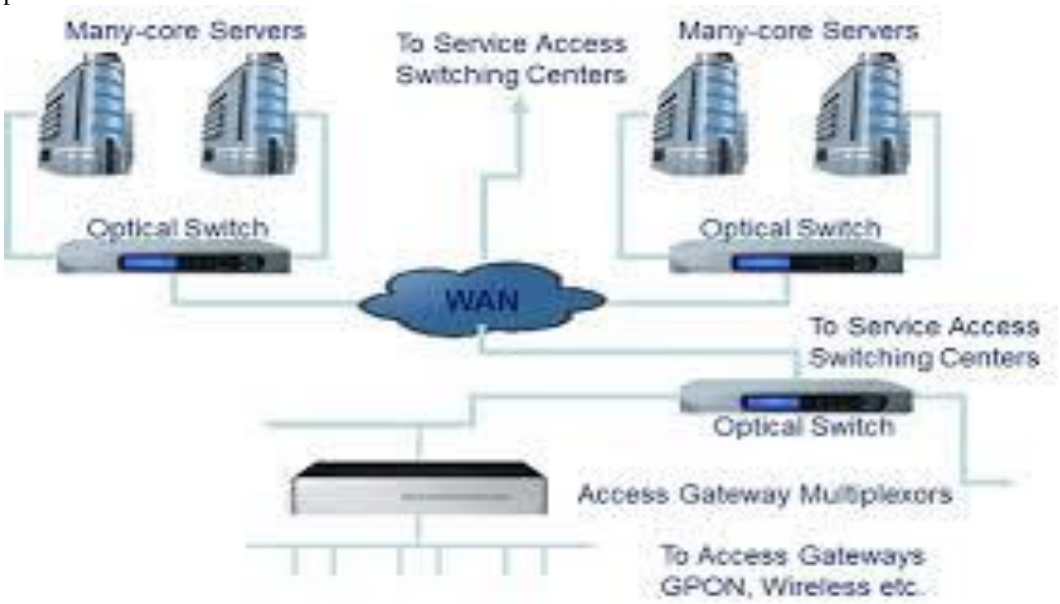

Fig 2

- Define new business models for mobile implementation: The speed of innovation of mobile technologies, combined with multiplicity of platforms and releases, has stretched the resources of companies. Mobility today offers newer business streams, but managing mobile implementation has become a much more complex affair.
- IT policies vs. Smartphone app explosion: The availability of sleeker, better-equipped phones in the market is throwing the traditional IT policies in the backseat. Companies are facing tremendous pressures from their employees for better devices, or worse still, to adopt a 'bring your own device' policy. The implications of such policies for security are tremendous. These pressures add complexity to management of apps and devices for companies.

Cloud computing

Cloud computing is a technology that uses the internet and central remote servers to maintain data and applications. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. This technology allows for much more efficient computing by centralizing storage, memory, processing and bandwidth.

There are various definitions of Cloud computing floating on the web. I found the following to the point and simple: Common, Location-independent, and Online Utility that is available on Demand.

There's a good chance you've already used some form of cloud computing. If you have an e-mail account with a Web-based e-mail service like Hotmail, Yahoo! Mail or Gmail, then you've had some experience with cloud computing. Instead of running an e-mail program on your computer, you log in to a Web e-mail account remotely. The software and storage for your account doesn't exist on your computer -- it's on the service's computer cloud. There's one model or style of computing which satisfies the three requirements mentioned above, and is becoming the technology trend of future. It's known as Cloud Computing.

A simple example of cloud computing is Yahoo email, Gmail, or Hotmail etc. You don't need software or a server to use them. All a consumer would need is just an internet connection and you can start sending emails. The server and email management software is all on the cloud (internet) and is totally managed by the cloud service provider Yahoo, Google etc. The consumer gets to use the software alone and enjoy the benefits. The analogy is, 'If you need milk, would you buy a cow?' All the users or consumers need is to get the benefits of using the software or hardware of the computer like sending emails etc. Just to get this benefit (milk) why should a consumer buy a (cow) software /hardware?

Interrelation between all these

As we discussed earlier "butterfly effect" is a concept that shows how small changes in the system can cause large changes in the whole system. We also discussed that enterprise mobility is something that we all would like to use. (Let it be for "Facebook" or "whatsapp"). We also discussed that cloud architecture is of prime importance to provide enterprise mobility. (By mobility of an enterprise we mean allowing data or resources of an organization to move around outside the boundary of an enterprise)

Now point of discussion comes is that do we really deserve the facility of mobility or using the cloud architecture? Or rather we should say do we really make optimum use of the structure that we use for our enterprises to have mobility? Do we really pay equally for the resources and facilities that we are using? Whom to pay? Well, are service providers the ultimate source of our facility? I don't think so. If take any business that is having mobility is definitely using cloud architecture. But we should once again think the consequences of cloud computing.

From here onwards we will discuss in the context of "google.com" as an enterprise having mobility and provider and user of cloud facility. Google recently introduced a feature called "Google Instant" for search optimization that may have the same type of effect on the Internet. If you go to Google's search page and begin to type in the search box, Google will take every letter that you type and return a full search result page as you type. For example, if you enter "t" in as the first letter, Google returns a page with the first entry as Target, and other associated Target web sites. Add a "w" as the second letter, and the search page result changes to Twitter, with a number of associated Twitter sites. Add another "il" and suddenly you are transported to the world of Twilight, Stephanie Meyer's successful vampire love story. Interestingly enough, The Twilight search page has picture and video thumbnails and graphic returned, even though I have not even completed my search. Any letters that I add continue to suggest pages dynamically. Previously, Google would only suggest search terms (but not make an actual search) base on your browser or search history.

This innovation by Google results in faster response to searches by users.

III. BUT AT WHAT COST?

A quick look at some of the traffic results from some of our deployed systems shows that since the launch of Google Instant, traffic to Google Search has grown 125% to 200% (i.e. doubled) since the launch of Instant and the number of connections used has increased dramatically. Based on testing, the difference is driven by searches that generate images as part of the search rather than just simple text, which generate more connections and use more bandwidth. Granted, the total volume of bandwidth is still small compared with other applications, but with the frequency of searches on the Internet, this feature will likely attract more people over time, which will drive more traffic to Google. This will in turn make sponsoring these Instant search results more popular and lucrative, and sponsors will put more effort into making the search results more attractive (read more graphics). This will result in more bandwidth being used for each letter typed in the search.

As a user, I don't think that Google Instant is a bad thing, I am actually very impressed by the speed that it adds to searches, and when I know exactly what I am looking for, I don't even register the intermediate pages as I type in my search. The challenge will be for network infrastructures that are already strained on bandwidth and connection scalability (firewall systems for example) to cope with the increase in the number of sessions and bandwidth utilization resulting from this new feature. Below are some facts about power consumption of "google.com" for providing such a high level of facility.

Google uses enough energy to continuously power 200,000 homes: Google's many data centres around the world burn through 260 million watts—one quarter of the output of a nuclear power plant—the New York *Times* reports. The company had been careful about revealing energy usage stats in the past, probably because it didn't want to reveal to competitors how quickly its data centres were growing. It's no longer a secret that Google needs a crazy amount of data centres to keep things running smoothly.

Google accounts for roughly 0.013 percent of the world's energy use: Data centres in general are responsible for 1.3 percent of the world's electricity consumption, according to one estimate, and Google says it accounts for a mere one-hundredth of that statistic. Do the math. The company claims that its data centres are twice as energy-efficient as most others. That sounds like a lot of power, but the company argues that the efficiency of searching for something on the internet is actually an energy saver. And the company notes the data centres themselves are more energy-efficient than most. Unlike many data-driven companies, Google designs and builds most of its data centres from scratch, including its servers that use energy-saving chips and software.

One Google search is equal to turning on a 60W light bulb for 17 seconds: Google says it spends about 0.0003 kWh of energy on an average search query, translating to roughly 0.2g of carbon dioxide. Related fact: searching the web 100 times is equivalent to drinking 1.5 tablespoons of orange juice, Google says. That's hard work!

YouTube can stream for three days on the energy it takes to make a DVD: That stat includes manufacturing, packaging and delivery of the DVD, Google says. One minute of streaming YouTube video consumes 0.0002 kWh of energy, which is about the same amount of energy your body uses in eight seconds.

Google's carbon footprint is zero (after offsets): No, Google doesn't get all of its energy from wind farms and solar panels. But to make up for the 1.46 million metric tons of carbon dioxide that Google emits every year—mostly from purchased energy to power its data centres—the company buys and generates its own renewable energy or purchases carbon offsets (essentially, funding green efforts elsewhere). The company invests in enough renewable energy to power more than 350,000 homes.

According to some estimates, for every 100 watts spent on running the servers, roughly another 50 watts is needed to cool them. Iceland, which has a cold climate all year as well as cheap and carbon-neutral geothermal electricity supply, is building its first site. Fibre optic cables are being laid from Iceland to North America and Europe to enable companies there to locate their servers in Iceland

Most data centers, by design, consume vast amounts of energy in an incongruously wasteful manner. Online companies typically run their facilities at maximum capacity around the clock, whatever the demand. As a result, data centres waste 90 percent or more of the electricity they pull off the grid, The Times found.

To guard against a power failure, they further rely on number of generators that release diesel exhaust. The pollution from data centres has increasingly been mentioned by the authorities for violating clean air regulations. In Silicon Valley, many data centres appear on the state government's Toxic Air Contaminant Inventory.

Worldwide, the digital warehouses use about 30 billion watts of electricity, roughly equivalent to the output of 30 nuclear power plants, according to estimates of industry experts of The Times. Data centres in the United States account for one-quarter to one-third of that load, the estimates show.

Energy efficiency varies widely from company to company. But at the request of The Times, the consulting firm McKinsey & Company analysed energy use by data centres and found that, on average, they were using only 6 percent to 12 percent of the electricity powering their servers to perform computations. The rest was essentially used to keep servers idling and ready in case of a surge in activity that could slow or crash their operations.

The inefficient use of power is largely driven by a symbiotic relationship between users who demand an instantaneous response to the click of a mouse and companies that put their business at risk if they fail to meet that expectation.

Even running electricity at full throttle has not been enough to satisfy the industry. In addition to generators, most large data centres contain banks of huge, spinning flywheels or thousands of lead-acid batteries — many of them similar to automobile batteries — to power the computers in case of a grid failure as brief as a few hundredths of a second, an interruption that could crash the servers.

At least a dozen major data centres have been cited for violations of air quality regulations in Virginia and Illinois alone, according to state records. Amazon was cited with more than 24 violations over a three-year period in Northern Virginia, including running some of its generators without a basic environmental permit.

A few companies say they are using extensively re-engineered software and cooling systems to decrease wasted power. Among them are Facebook and Google, which also have redesigned their hardware. Still, according to recent disclosures,

For security reasons, companies typically do not even reveal the locations of their data centres, which are housed in anonymous buildings and vigilantly protected. Companies also guard their technology for competitive reasons, said Michael Manos, a long-time industry executive. "All of those things play into each other to foster this closed, members-only kind of group," he said. The survey did discover that the number of federal data centres grew from 432 in 1998 to 2,094 in 2010.

This is the mundane face of digital information — player statistics flowing into servers that calculate fantasy points and league rankings, snapshots from nearly forgotten vacations kept forever in storage devices. Each year, chips in servers get faster, and storage media get denser and cheaper, but the furious rate of data production goes a notch higher.

Jeremy Burton, an expert in data storage, said that when he worked at a computer technology company 10 years ago, the most data-intensive customer he dealt with had about 50,000 gigabytes in its entire database. Today, roughly a million gigabytes are processed and stored in a data centre during the creation of a single 3-D animated movie, said Mr Burton, now at EMC, a company focused on the management and storage of data.

Just one of the company's clients, the New York Stock Exchange, produces up to 2,000 gigabytes of data per day that must be stored for years, he added.

IV. CONCLUSION

We can have number of different facilities with enterprise mobility but we should also be aware whether we really deserve to have such one. To implement such a high performance structure with is powered with cloud computing, it seems that power required is far more than importance it information itself. Ultimately our mother Earth is bearing this entire burden and giving us this place to live in. It becomes our moral duty to use natural resources as minimum as possible. We could never ever get an idea while seating in AC labs about what are the adverse effect all this computers and high- tech infrastructure. Enterprise mobility is absolutely a race between our ability to create data and our ability to store and manage data. The consequences of dependence of the Internet Cloud and enterprise mobility are geographically, socially and temporally displaced from users.

REFERENCES

[1] http://eapsweb.mit.edu/research/Lorenz/Deterministic_63.pdf
[2] http://www.technologyreview.com/magazine/mitnews/2011/03/
[3] http://www.infosys.com/mobility/pages/index.aspx
[4] http://www.techno-pulse.com/
[5] http://www.idc.com/
[6] http://techland.time.com/2011/05/09/google-hires-fancy-green-friendly-architects-to-build-fancy-green-friendly-office/
[7] http://computingclouds.wordpress.com/tag/distributed-computing-clouds/
[8] http:// www.wallpaperswa.com

About Author

Mr.Vishnukumar Ramnikbhai Teraiya is a Master degree in computer science application student of Sardar Patel University. He achieved six National level, eight state level and three university level programing competition award winner. His interest's area java programing, network security, object oriented programing language and open source.