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# Current Trends and Issues Legacy Application of the Serverless Architecture

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**Abstract:** Serverless computing has emerged as a new compelling paradigm for the deployment of applications and services. It represents an evolution of cloud programming models, abstractions, and platforms, and is a testament to the maturity and wide adoption of cloud technologies. In this research, we discuss the new concept in cloud computing that allows the services computation that triggers the code execution as a response for certain events. Cloud computing as provisioning more servers on demand are one of the primary issues and traffic of servers or load is not consistent. The Services are moved to the cloud and a great change is observed in all fields. People are more comfortable having their services on the Internet. As E-commerce services have reached exponential growth. The problem associated with this research is that the organization often spends huge chunks of dollars only for server provisioning, and another chunk for its security and management. As compared to serverless, the vendor serves all security and management aspects. Mostly the Online service providers are often stuck with unexpected traffic. Having more provisioned servers creates a hike in prices. There are needed to be a solution where vendors can only have to pay for the services on demand and describes serverless infrastructure, which assists to do all without taking care of these as a simple model and a simple structure. In this research, the serverless architecture service is providing the use of functions, which are on clusters and compels users "Pay as you go", is more refined in serverless, and now is known by "Pay what is used". It represents an evolution of cloud programming models has gained increasing attention by researchers. It concludes the impact, legacy application migration and using this new approach as standard to build the application. Serverless architecture is far greater than having a legacy approach. Its word to mouth to say serverless will prevail all others but still having the approach might take time. This is not only a cost-effective factor; rather a huge portion of service is somehow is outsource to a vendor. An extension of the restricted time limit by cloud vendors will allow running the complete workflow using the serverless architecture with avoiding the scheduling problem.

**Keywords**: Serverless Architecture, Technology, E-commerce, Server Infrastructure, Cloud Computing.

## 1. INTRODUCTION

Serverless computing (or simply without servers) is a ne w and attractive model for the deployment of cloud applicati ons, largely due to the recent shift from corporate applicatio n architectures to containers and micro - services.[22]. According to Google Trends, the search term "serverless" has become popular in in in the last five years. This is an indication of the growing interest in trade fairs, meetings, and blogs and industry development created by server - free computing. On the contrary, there was limited interest in the academic community.

This shift in the model represents both opportunity and risk from the point of view of the Infrastructure - as - a - Service (IaaS). On the one hand, developers offer a simplified programming model to create the most extracting applications in the cloud, Operational concerns, if not all; reduce the cost of implementing code in the cloud by imposing execution time instead of allocating resources; In the event-responsive cloud, for example, the original code is fast to format SOA structures that can work on the customer or in a custom medium. On the other hand, the implementation of these applications on a platform without a server is challenging and requires the delivery of platform design decisions, which include quality of service (QoS), tolerance properties and error scale characteristics.

From the perspective of the cloud provider, serverless computing offers further opportunities to control the entire development range, Reduce operating costs by improving cloud efficiency and resource management and providing a user-friendly platform. Additional ecosystem services reduce the effort to create and manage cloud-based applications.

Serverless computing is an industry term used to describe a programming and architecture model in which small pieces of code are run in the cloud without any control over the resources used to execute the code. This does not mean that there are no servers; the developer simply has to leave most of the operational concerns, such as the provision of resources, monitoring, maintenance, and scalability and cloud provider fault tolerance.

The astute reader can ask how the PaaS model differs, which also removes summaries of server management. A server - free form provides a "simplified" programming model based on stateless functions. In contrast to PaaS, developers can write random code and use the packaged application not only. The server version that explicitly uses

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the functionality is also called the Function as a Service (FaaS) publishing unit.

Serverless platforms rely on new capabilities to create scalable, scalable microprocessor services that are easier and more profitable, making it a next step in the development of cloud computing architectures. Most leading cloud computing companies have recently launched fewer computing capabilities than servers, including Amazon [1], IBM [16], Microsoft [23] and Google [14]. Many open source efforts are also underway, including the OpenLambda project [24].

In its infancy, the research community has published only a few publications without server computing. OpenLambda [24] offers a reference structure for server-free platforms and describes challenges in this area that the researcher previously published two of our use cases [6, 29]. Many books also target developers interested in creating applications using serverless platforms for professionals.

Serverless architecture is one of the most refined technologies for lighter and more responsive working systems. As the need for computing increases exponentially, a wider area of today's approach is more automation. To run an application, dedicated servers were deployed to the previous decade. It takes more than a month to complete the time from the organization decision to stack the server. And more often than not, having everything takes more than six months. This was not the only pain of dedicated servers, recovery from disasters, data loss, hardware failure, and many more are the main aspects of dedicated servers. Since servers are in one place and any failure can cause the server to fall. This also moves the security team to make contact patches, where all essential updates must be regularly performed. Since it was time to grow resources and technologies, companies also bear downtime for their maintenance work application on order. But as things go fast, the industry's main obstacle is a tangible delay or a delay that can be noticed. However, a new nature is evolving where everything is needed without delay or you have lost it. This is what our organization is trying to do without delay.

The evolution moves to VM, where it is possible to deploy many different applications to a virtual machine. A virtual machine is a physical machine that shares the kernel but is completely isolated. In this era of fast computing, many new features and applications have evolved. This helped people to achieve their goals. People often buy machines and share them at a cost with different people. Cloud computing is using this now. They stack and take care of the machines at the datacenter. They allocate virtual hardware to the organization at a cost by means of applications.

New technologies have spread further things. A term micro service has been launched that accelerates development dramatically. It was a new tool for DevOps (an operator and development manager). Like VM, where OS runs on the same machine but is virtually segregated, it is not based on the OS. Microservice uses the same operating system and its dependencies are separated. A standard VM needs a separate operating system and its resources. The only flaw in its operation is that we must deploy a whole new OS for a minor change in the application, which costs a lot in all procedures. Microservice has now handled this problem only by separating its dependencies from the OS. This is a new form of technology for the new era.

The cost and scaling is the problem with conventional application architecture. Estimating traffic is a problem. E - commerce has seen unusual spikes in its campaigns. It cost a lot more to deploy a hit load server. Many cloud providers provide scaling policies, but customers still face the main problem of downtime.

## 2. PROBLEM STATEMENT

Serverless is one of the cheapest (cost and management) technologies. The organization often only spends huge amounts of dollars on server provisioning and another piece on security and management. The vendor serves all security and management aspects in comparison to serverless. This research discusses all trends in this architecture and deals with problems faced by the organization that moves a legacy application into a serverless architecture.

## 3. RELATED WORK

There was an approach to the use of shared resources before this century. According to the old tech model, dedicated servers are one of the options, but one of the most difficult tasks is to make it work. The time it took to make the server available, the costs it handles, the overall environment, and the expertise to control it, was a nightmare for organizations. This was an evolving stage in IT, which had many barriers to having all resources under a hood. That was the time; the organization often goes for shared recourses, where one person manages all that an organization uses only the resources according to the shared model of responsibility. That was one of the trailing considerations of a startup to work. People go to tangible business more often. Virtual machines have made one of the most influential changes. One of the awakened technologies was available on the market to handle multiple co-operations under one physical machine. The change was here to begin. The main thing was cost; above all, as expected, it was low. In this era, many startups began.

Starting of the 21$^{st}$ century was the game changer, things were changed. Now it was simple and easy to deploy and manage the server. As this was the era of new innovation, this has changed the market exponentially.

All was settled when new thinking in the market was bought. The era of cloud computing. From 2005 onwards giants had started to work on clouds. A cloud model simple describe the model of having the whole infrastructure in the cloud (the vendor) rather than having it on premises. Cloud computing had bought a massive change in the field of IT. All sizes companies were able to have a technology platform.

*a. Objectives*

The main objective of this research is to prove this architecture complexity, and feasibility is our legacy applications.

As legacy applications can be moved to serverless, to overcome scaling and be on a cost-effective solution.

The objective of the study are as follows:

- ✓ To find out an effective way to deploy the legacy application to serverless architecture.
- ✓ To find out issues faced by developers to build an application in a serverless architecture rather on conventional methodology
- ✓ To find out limitations of using serverless compared to legacy approach and limitation implemented using this.

*b. Significance*

The main reason for doing this research to find out a solution of using serverless technology, the issues faced by developers will help new developers to maintain it with advanced ways. As it is a cost-effective way of having an application. Other than that, this research will mitigate the need of an operational person as vendor itself is handling the servers with the best optimization.

*c. Hypotheses*

Hypotheses are as follow

H1: There is a significant impact of using serverless architecture and adopting it

H2: is a significant impact of moving legacy applications into serverless before of lack of expertise

H3: There is a significant impact of adopting serverless for a new application and using as a predefined rule

## 4. LITERATURE REVIEW

As moving to new technologies, serverless architecture is a way with a new coding model approach, a simplified coding approach. In this model, the user (the client) does not have to take care of management resources. The vendor providing this service manages all. Serverless architecture has stateless functions to run. In this architecture, the developer is only responsible for code nothing more. All the management is controlled by the vendor itself [1]. Moving some earlier, there was an era of making applications isolated. The term, which was called three-tier application. This work requires an application of services. Which was reputed by SOA, service-oriented architecture. This is one of the key aspects of all approaches now. Applications are using this for decoupled architecture. As comparing the conventional application to SOA structured application, performance and maintenance are much easier [2]. The requirement of serverless infrastructure also copes with business needs. As part of a huge application, modifying a single work may impact the whole area. This is the main benefit of using functions as compared to a procedural way where all code is segmented into small nodes [3].

Term serverless uses functions to execute the code. These small functions make the structure Function as a Service or FaaS. As relying on these small functions makes entire architecture lightweight and easily manageable. Not cost is one the factors, this architecture also include elasticity in it [4]. As for scientific research, it needs a complex computing power. Many background tasks are needed to work. Scientific research consists of a number of dependent tasks represent a complex scientific application. Functions are executed in code specific events with having server management such as new file upload trigger. In this, the vendors do all resource management. FaaS or function as a service is the best way to handle this approach. Benchmarks are created which depict the way of it [5]. As moving further, many technologies in the web are socket based. They can also be called serverless, like a torrent, chat application. An application like IRC-chat and another peer-to-peer application needs socket level understanding. This also goes with this concept of serverless [6].

Many applications like video on demand servers that renders the videos shared by people was also a huge problem. People usually share videos, in which compress version of that video is saved in the server and then rendered by others. This process burns a lot of CPU and storage capacity. In which peer-to-peer method was discovered in which client computer itself become a server from which video is played [7]. Many conventional applications, decades ago use client machines for data. A cached data is saved on servers where the actual and whole dataset is fetched by the client machine. The term was also known by serverless approach [8].As concerning develops a person responsible for both operation and development has a massive responsibility for running an application in the machine. Serverless architecture is used for auto-scaling feature and cost reduction. One another part of serverless makes DevOps work easier. It reduces the time consuming of server management, code deployment issues. On for CI/CD continues integration and continues delivery methodology, serverless is one of the optimum methods [9]. Scheduling task in the cloud using FaaS is optimal for systems. Using FaaS, it can run a small task easily and remotely. This method decreases loads on an actual server; rather small work units are made to run on serverless. This has an effective approach. The new methodology, high demand, and low cost are a key benefit. Public cloud, private cloud, and hybrid cloud these can also have the same performance. Using Faas has a simplified approach to the scheduling problem. FaaS user has to only pay off using the resource rather paying all infrastructure amounts. By using serverless architecture, we can minimize execution time, cost and both [10].

As on shared responsibility model, security is one of the main aspects. Furthermore using new technologies like containers and services, they needed to be more secure. Using serverless architecture cope security issues with its

own dealing. Security in shared responsibility model indulges tenant make some part of it by him. Cloud providers are more responsible for VM and hypervisor level attacks, as compared to Tenants, which are on servers, have to go for security automation in process. Serverless architecture solves all these security issues as on VMs and services. For in serverless architecture there are many design patterns solving security issues [11]. New improvements in current currency model, known by "Blockchain" is widely spread technology. Where all data is decentralized and stored distributed systems rather than centralized control. As on top trend, this is a new era look for the advancement of transparency and ownership. The main defect, which is dragging this term down is high CPU usage. As updating the tenant's script in each and every node requires a high CPU usage. Serverless can also be used to hinder this. Using functions and running them on their needs are aspects of serverless architecture [12]. Use of new technology like function as a service, software-defined networking or network function virtualization, edge computing is trending edges for now. These technologies have increase capabilities of the underlying computational substrate. The changes have brought new requirement of orchestration. Changing the nature of service, a huge code model into small pieces run as functions with low overhead [13].

OpenLambda is an open source platform used for serverless architecture. This uses AWS lambda and Google engine cloud functions for its work. The one the main advantage of using serverless architecture is the cost. An ideal scenario of users that have to pay what they have used. And further go on is the scale feature, which is one more main benefit [14]. Cloud computing new model (FaaS) works on events. Deep learning and artificial intelligence is key epitome now a day. This architecture has many new paradigms and easiness of use. Benefits of serverless approach are countless. The simplified programming model is a key benefit [15]. Servers are not immune to attacks, which is one of the crucial parts of an organization. A data is something, which is the key importance to any industry. The moment customer stops losing trust from an organization it starts to fall. From this perspective serverless has an important role in the industry. In which many are secured by vendor best practices [16]. Moving from traditional methods to the cloud has shaped new model in IT infrastructure. Cloud structures such as PaaS, IaaS, SaaS etc. have bought new changes in technology. All are set up to the level of intimate design. A rapid execution has made a new goal set for the entire industry [17].

## 5. RESEARCH METHODOLOGY

*a. Methods of Data Collection*

Research is based on primary data to get feasibility and issues moving the legacy application to serverless. The tool used for data collection is the questionnaire. Twenty questions based questionnaire was designed to collect data. Google questionnaire has been used to design and collect data. The questionnaire consists of detailed questions, multiple selections and only given chance to agree or disagree.

*b. Sampling Technique*

Non-probability convenient based sampling technique is used for data collection. This helped to get an effective response from the respondent. All field related people were the targets to get data, from which a valid and more useful data is gathered.

*c. Sample Size*

The sample size of 25 to 50 people was decided. People from all over the world were targeted. The reason why people are targeted huge was only that the technology is not common and not many concern people are found in a specific area. The link was shared to targeted people regarding serverless architecture.

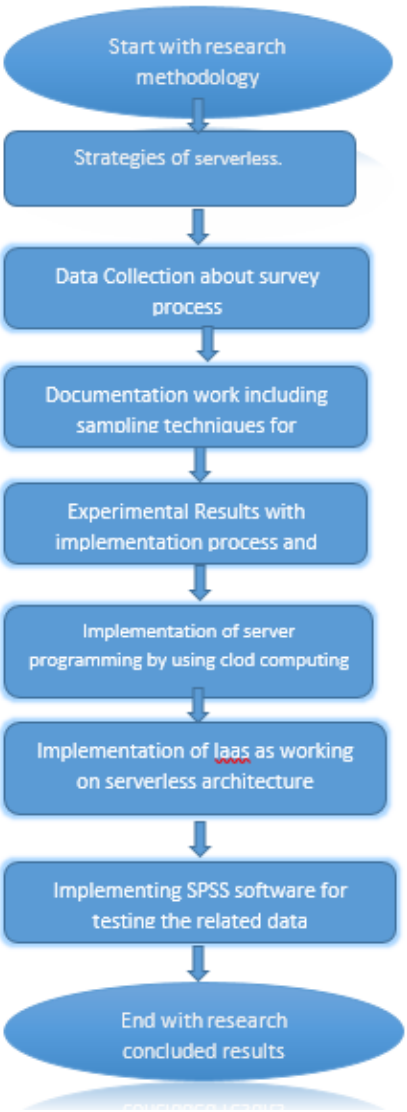



Fig.1: Flow chart of schedule implementation of serverless computing

*d. Instrument of Data Collection*

The instrument used for data collection was close-ended questions. Primary data was used using questionnaires based survey. Questionnaires cover all dependent variables in the survey. The purpose was to understand the need and the issues of the topic.

*e. Validity and Reliability Test*

On analyzing the data, was done for validity and reliability, the results show the value of Cronbach is 0.6, depicted in the table. This result indicates that data is highly reliable that is 60%. As part of this research, which thus identifies the need for reliability in this dataset. So, therefore, it summarized the tool results are with accurate results.

TABLE 1: RELIABILITY STATISTICS FOR SECURITY

| Case Processing Summary | | | |
|---|---|---|---|
| | | N= Total No. of item | % |
| Cases | Valid | 10 | 71.4 |
| | Excluded | 4 | 28.6 |
| | Total | 14 | 100.0 |
| a. Deletion based on all variables in the procedure. | | | |

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| .405 | -.086 | 4 |
| a. The value is negative due to a negative average covariance among item. This violates reliability model assumptions. You may want to check item | | |

TABLE 2 : RELIABILITY STATISTICS FOR FEASIBILITY

| Case Processing Summary | | | |
|---|---|---|---|
| | | N | % |
| Cases | Valid | 10 | 71.4 |
| | Excluded | 4 | 28.6 |
| | Total | 14 | 100.0 |
| a. Deletion based on all variables in the procedure. | | | |

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| -.304 | -.589 | 9 |
| a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item coding. | | |

TABLE 3: RELIABILITY STATISTICS FOR CONVENIENCE

| Case Processing Summary | | | |
|---|---|---|---|
| | | N= Total No. Item | % |
| Cases | Valid | 10 | 71.4 |
| | Excluded | 4 | 28.6 |
| | Total | 14 | 100.0 |
| a. List wise deletion based on all variables in the procedure. | | | |

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| -.309 | -.156 | 4 |
| a. The value is negative due to a negative average covariance among item. This violates reliability model assumptions. You may want to checkitem | | |

*e. Cronbach's Alpha Analysis*

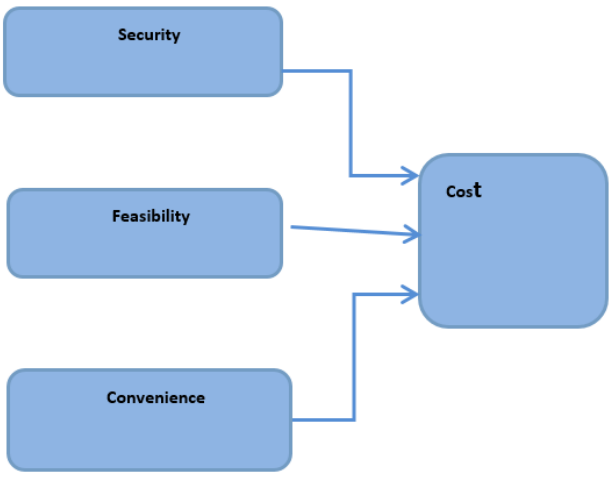
TABLE 4: RELIABILITY OF ALL VARIABLES

| Variables | Reliability |
|---|---|
| Security | 0.405 |
| Feasibility | 0.304 |
| Convenience | 0.309 |
| Overall | 0.641 |

This table mentions the Cronbach alpha values of variables security 0.405, feasibility 0.304 and convenience 0.309. As per result, the overall resultis greater than indicates its reliability as per data and the Cronbach results.

*f. Research Model (Framework)*

*Conceptual Framework*




**Independent variables** **Dependent Variable**

Fig.2: Dependent and Independent variables

On study the impact of serverless architecture concern with security, feasibility and convenience on cost. The regression model can be represented as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \mu$$

This study is developed to determine the effects of different factors on, these factors have used in Regression model:

C is Cost

SF is Security factor

CF is a Convenience factor

FF is Feasibility factor

$\beta_0$ is the constant

$\beta_1$is the coefficient of Security

$\beta_2$ is the coefficient of Convenience

$\beta_3$ is the coefficient of Feasibility

μ is the Standard Error

Regression equation will now become:

C= $\beta_1$o+$\beta_1$ SF+$\beta_2$CF+β3FF+ μs

To calculate linear regression on the data, we have one dependent variable and three independent variables. The data implies cost relation with security, feasibility and convenience.

These all dictates, increasing any factor do increase cost. All show a positive result.

C= 0 +0.2(SF) + 0.2(CF) +0.2(FF) + μs

Inception point ($\beta_1$o) is zero due to increase in linearity. Data plotted in graph shows direct relation of parameters with cost.

Equation Explanation,

$\beta_0$ is intercept

B1SF shows whenever we increase 1 unit of cost on security factor will increase by 0.2units other factors remain constant.

B2CF shows whenever we increase 1 unit of cost on convenience factor will increase by0.2 units other factors remain constant.

B3FF shows whenever we increase 1 unit of cost on feasibility factor will increase by 0.3units other factors remain constant.

*a. Statistical Techniques*

All responses were collected through a survey. The survey was conducted through a questionnaire. The result is calculated in software SPSS for validity and reliability for all variables (dependent and independent). Then after survey, all calculation for reliability on cost regression was performed.

***b.** Data Analyze*

As data showed on regression, all aspects of research apply the methodology. As we seen on results, the cost is one of the main factors. This research has made a limited scope of having one depend on a variable, but using new technology impact in many. Moving forward to serverless, all independent variables are controllable by the vendor itself. Which itself defines its cost, which tends to become lower and perform the same results. Thus using one of the main uses of serverless architecture impacts great insecurity, feasibility, and convenience.

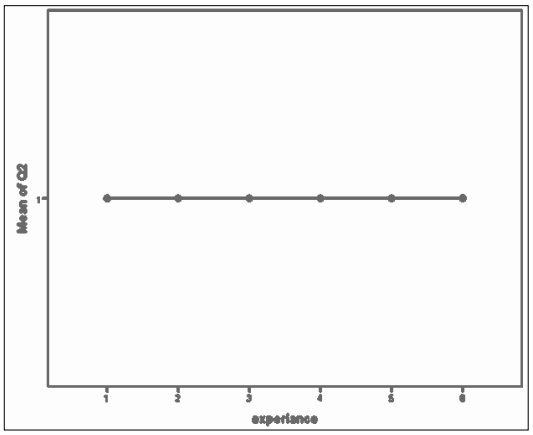



Fig.3: Survey audience experience with respect to serverless technology

Above graph shows survey audience experience with respect to serverless technology. Q3 variable defines the survey question that was asked about their experience. Straight line depicts mean of Q2 and x-axis defines the experience.

Regression analysis for Cost with security:

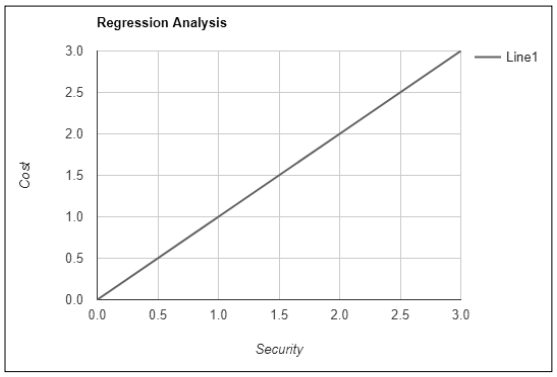



Fig.4: Regression Analysis for security

As increasing security with the overall system, also needs additional cost. This graph has a clear output on it.

Regression analysis for or cost with convenience:

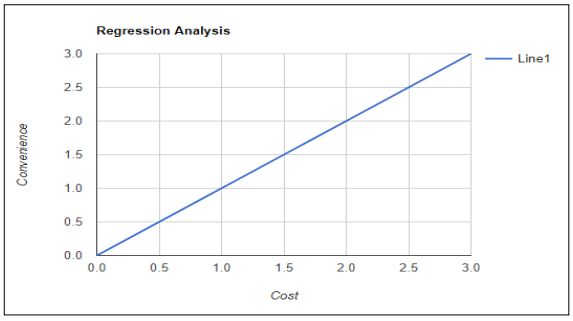



Fig.5: Regression Analysis for coat

As increasing convenience with the overall system, also needs additional cost. This graph has a clear output on it. Regression analysis for or cost with feasibility:

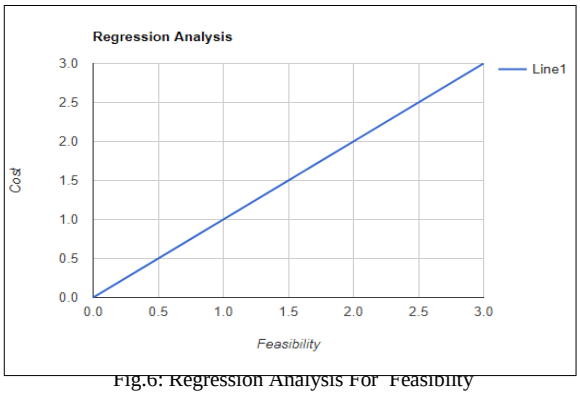



Fig.6: Regression Analysis For Feasibility

As increasing feasibility with the overall system, also needs additional cost. This graph has a clear output on it.

## 6. RESULTS AND DISCUSSION

### *a. Interpretation of results & finding*

This research was floated among hundreds of people. From which data is submitted by 10 people on different geographic locations. All variables are used to collect data by software, and there is only one independent variable used in this research for simplicity.

### *b. Regression Analysis*

In table 5, means is calculated by using one-way ANOVA, which is computing means by using standard equation. Data is used, as the cost is dependent variable and on other experience is used as an independent. All results are shown in table 5

TABLE .5: TESTING OF ANOVA

| ANOVA | | | | | |
|---|---|---|---|---|---|
| Q2 | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig |
| Between Groups | .000 | 5 | .000 | | |
| Within Groups | .000 | 4 | .000 | | |
| Total | .000 | 9 | | | |

### *c. Flow Chart*

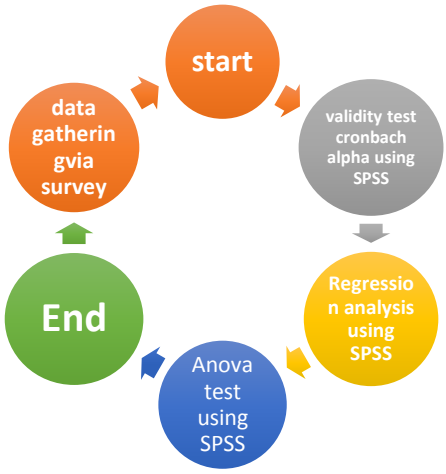



Fig.7: Cycle of testing procedure

In this flow chart show the procedure of testing and analyzation of the concept of architecture.

### *d. Hypotheses Assessment*

Table 4.2 show hypotheses, where all acceptance and rejection is shown based on the calculation above.

TABLE.6 : Hypotheses Assessment Summary

| S. # | Hypothesis | Sig value | T-Value | Conclusion |
|---|---|---|---|---|
| H1 | There is a significant impact of using serverless architecture and adopting it | .000 | 13.317 | Accepted |
| H2 | There is a significant impact of moving a legacy application into serverless before of lack of expertise | .000 | 2.617 | Accepted |
| H3 | There is a significant impact of adopting serverless for a new application and using as a predefined rule | .000 | 2.296 | Accepted |

## 7. DISCUSSIONS, CONCLUSION, POLICY IMPLICATIONS AND FUTURE RESEARCH

*a. Discussions*

Considering serverless architecture has been analyzed that migrating an existing application to serverless has a huge impact on cost. The cost was the only dependent variable for this research, other than that many other reforms impact by using a new way of deploying apps. We have seen the impact of cost versus other parameters. As being a part of this research, this is what is needed to be implemented in our new forms. Company and IT organization should use this moderate approach to have a satisfactory level implementation. This research strongly encourages using a new method on application rather than an existing one. The migrating legacy app might be an issue, but we have seen the impact in terms of cost, which has a greater value than having an existing one.

*b. Conclusions*

This research concludes the overall impact, legacy application migration and using this new approach as standard to build the application. Every new technology was an obstacle at the initial stage, but as the fast-moving world had made it apart. So as serverless, this does still not know many organizations, but the real impact is far greater than having a legacy approach. Its word to mouth to say serverless will prevail all others but still having the approach might take time. This is not only a cost-effective factor; rather a huge portion of service is somehow is outsource to a vendor. The reliable thing is, not any human intervention is controlling the flow, rather machines which are more, secure than the others.

*c. Policy Implications*

According to the results, it is proved using serverless architecture have a positive impact on cost and other parameters. So organization show moves to new policy and strategy rather using conventional approach for great output. This policy and strategy help in building maximum outputs.

*d. Future Research*

As doing this research, many other areas where determined in which more finding can be done. As an organization, more cost can be reduced using the optimized methodology for coding. Moreover, as per technical limitation, there should be proper workshop and training to be done in an organization to overcome this issue.

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