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# Analytical Perspectives on Event -Driven Cloud Models in Cloud Computing

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**Abstract**

This paper discusses the notion of the serverless cloud computing paradigm, its uses in the information technology industry, and its benefits. The traditional approach comprised three models founded on the service required the developer to oversee and own servers as well as distribute Assets include IaaS, SaaS, and PaaS. The cloud is used for content storage and network access in Infrastructure as a Service (IaaS). A model in Paas (Platform as a Service), in which the developer gets access to Some services help one implement the organizing process in accordance with it. The cloud service provider takes care of ownership, management, and upkeep of servers in serverless cloud computing; therefore, the developer need not. Employing this method also saves money and greatly reduces the time a system must go to market. Google Cloud, Azure, and AWS Lambda are three varieties of serverless architecture. Other problems involve its inability to be used in cases when a process takes longer to run, as we will discuss farther on in this paper.

**Keywords:** Serverless cloud computing, Traditional model, AWS Lambda, Azure, Google cloud

## 1. Introduction

The term Serverless computing is used everywhere in IT industry recently and the termserverless has been the most searched term in google [1]. Nowadays, all sorts of business involvecloud services, without thinking about the issues in the infrastructure which lead to serverless architecture. The term serverless does not mean it works without any servers, the running of applications is done on servers but managing, owning or maintaining the server is not carried out [2]. Cloud service provider takes care of all those processes including allocating the

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resources, hence the developer need not worry about it. The billing is carried out on the basis of usage of theresources. When serverless model is proposed, it provides various benefits such as the time required to meet the market is low, cost effective, provides higher efficiency but it can also produce certain risks - the control over the infrastructure is lost, as the cloud service provider takes care ofit, we cannot produce any change in infrastructure according to the suitable process [3]. Serverlesscomputing does not provide any solution to problems in IT industry, but it will be the future of most cloud computing solutions [4].

Infrastructure virtualization in software and hardware led to the emerging of cloud computing. Cloud computing is divided into three categories namely SaaS, PaaS and IaaS. SaaS (Software as a Service) as shown in the Figure 1, here various kinds of software is provided by cloud provider as a service to the users [5]. Fig. 1 represents the tasks that are handled by customers and also tasks that are handled by vendors.

For example, Google provides various services to users like Gmail and Google play. The management and development services are not carried out by the users [6]. In PaaS (Platform as a Service) the services such as accessing network, storage of data is provided by the cloud provider so that the developer can access to the services, organize them, run it accordingly and manage them. Finally, IaaS (Infrastructure as a Service), the services such as accessing the networks, storage of contentare carried over by the cloud providers [7].

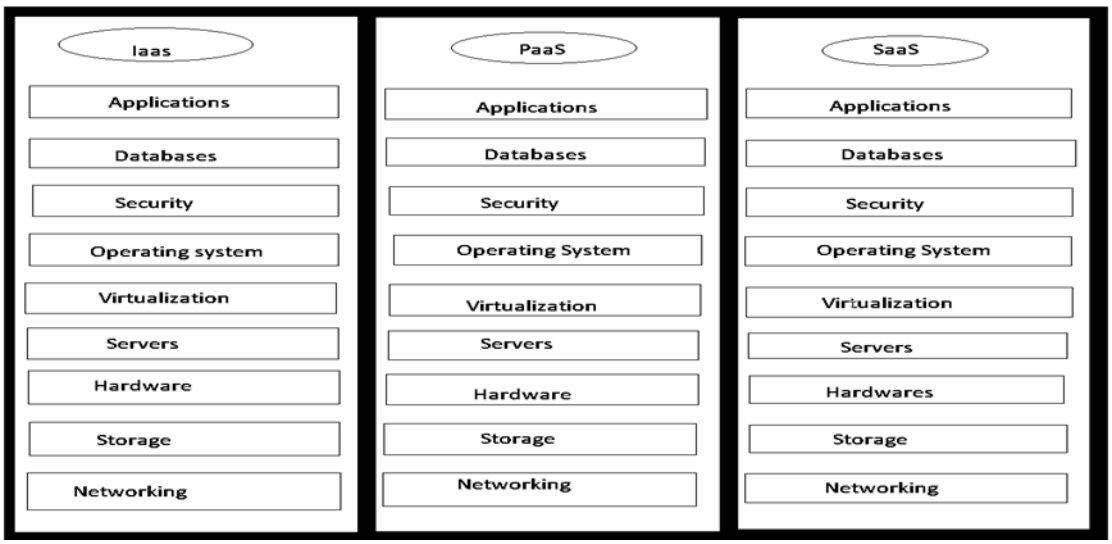


**Fig 1.** Cloud Computing Models

In serverless computing when the particular application is not in use, resources will not be allocated by cloud service provider, hence it is cost efficient as billing is carried out on the basis of usage of resources [8]. Serverless makes the developers to focus completely on the tasks, as managing, owning and maintaining the servers is not carried out by them, instead the cloud

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serviceprovider takes care of it. Zimki in the year 2006, introduced the serverless method “pay as you go”and this idea was brought into market as a serverless service in the year 2006, the evolution of serverless computing is shown in the Figure 2, here physical machines, virtual machines, containerization are server models and final process is the serverless model [9].

Later in 2014 Amazon proclaimed this technology as AWS Lambda, the exploration of this technology was laterdone by Microsoft, Google and IBM. After this serverless cloud computing infrastructure was launched by Microsoft. While considering Facebook, this application is used everywhere in the world. The main function of Facebook is to allow the users to upload their pictures or videos and share it to their friends and it is a huge platform with two billion plus users [10].

Hence, scaling such a big platform is difficult process, but this capability can be seamlessly implemented using serverless computing. This capability can be implemented using Amazon Lambda, Google function or Azurefunction by which an HTTP end point is exposed so that we can upload the data through that endpoint [11]. When serverless technology has not existed, the functionalities will take fewer monthsto get implemented.

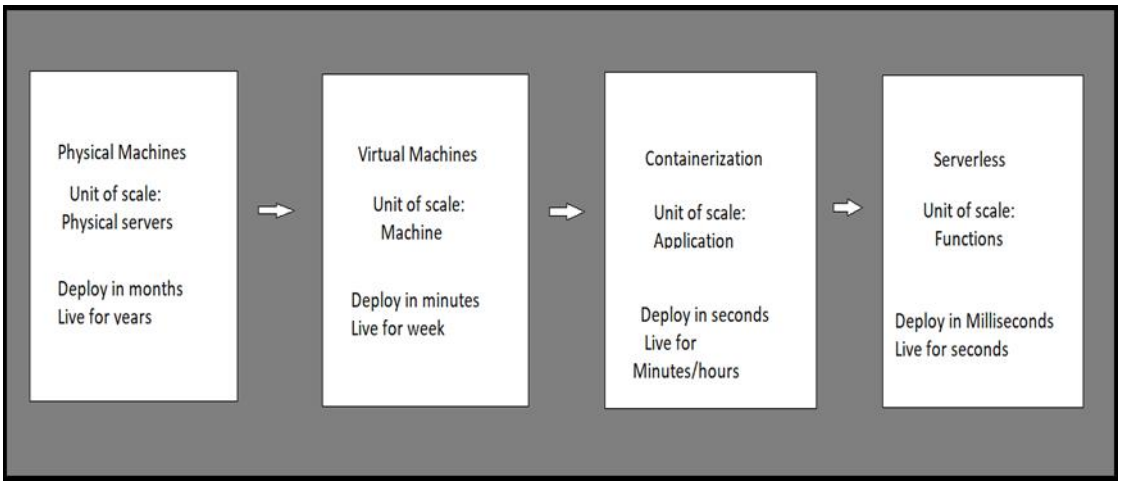


**Fig 2.** Evolution of Serverless Computing

## 2. Background Knowledge

Managing the cloud services has not been an easy task. Various challenges have been addressed [12] in the management of cloud services such as balancing the load, scaling, security, etc. These problems are directed to the introduction of another method of cloud computing known asserverless cloud computing [13]. This provides two services, such as Backend as a Service and Function as a Service as shown in the Figure 3.

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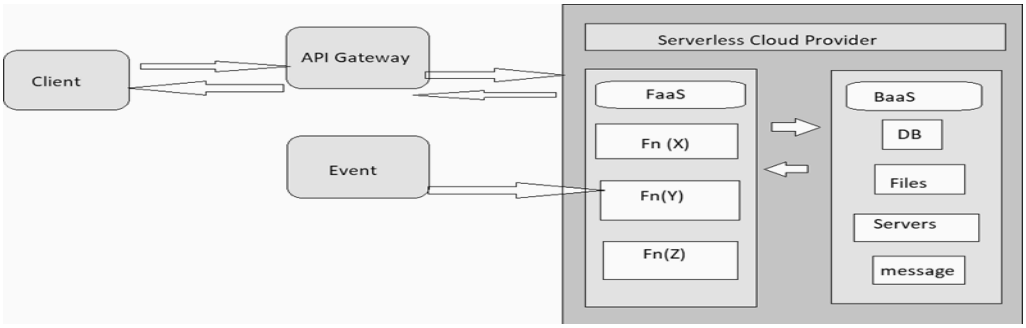


**Figure 3.** Demonstration of FaaS and BaaS

Backend as a Service provides certain services such as content storage, management of users etc. while Function as a Service provides organization of code and executing it. Amazon Lambda introduced the concept of serverless computing in 2014, later the companies Microsoft and Google implemented this method in 2016 [14]. The serverless architecture enhances another layer to the cloud computing model while the management of servers are abstracted from the developers [15]. This model lets the developer to work more on the logic than the other functions such as resource allocation, owning, and management of servers as they are handled by cloud service providers [16, 17]. Authors in [18] examined how the serverless computing is being practiced in IT industry and concluded that to operate the tools that are essential for serverless architecture, the developerfaces a barrier to implement the right mindset to best operate the tools. In IT industry the serverlessarchitecture is increasing the capabilities, hence it can be used not only for infrastructure enhancement but can also be used in different kinds of purposes such as big data [19], training ofneural networks [20], messaging and processing of videos [21]. The scheduling of tasks was explained by the authors in [22], for the purpose of reducing the time of execution and cost, variousscheduling techniques have been described by them. They developed a hybrid model by using IaaSand FaaS, FaaS (Function as a Service) executed smaller tasks that diminishes the cost of executionand longer tasks was based on IaaS (Infrastructure as a Service).

Considering the properties throughput and latency, an efficient model should have higher throughput and lower latency, [23] explains that the serverless computing is mostly used where there must be higher throughput than the lower latency and also used in cases of completing the individual requests in a shorter time. Thus, innovative features take minimal time to reach the market. They also used a case study of Yubl and Mindmup which used serverless platforms to show how their cost reduced up to 66 percentage, and also the disadvantages addressed while adopting it. In deep learning approach, the models were trained using serverless computing [24], here slight modifications were carried out by the researchers due to the challenges faced because of the tightly coupled characteristics of deep learning models. Some limitations were proposed for the serverless model in [25], it describes that serverlessplatform cannot be used for

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all applications. If certain products contain no event-based functions,but the running period of that product is high, then the cost required will be higher, hence it is not cost effective in this scenario.

For serverless computing platform, a resource managing methods was proposed [26] for enhancing the resources, focusing on containers allocation of memory, herea design called Open Lambda is added to the top layer of the serverless platform. A demonstrationfor the serverless platform is carried out by using AWS Lambda in [27], and it is shown in the Fig 4 below. SNS (Simple Notification Service) is used in the process of delivering bulk messages, IAM (Identity and Access Management) – AWS resources can be assessed securely byusing IAM.

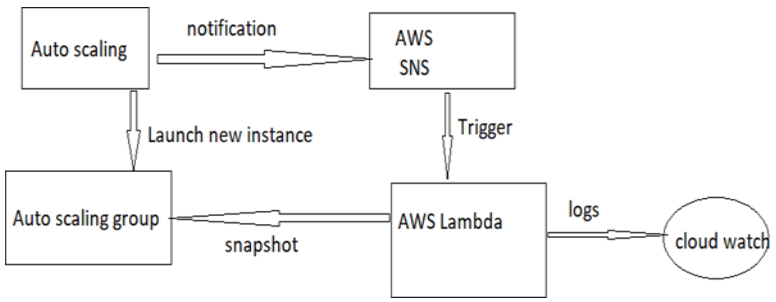


**Fig 4.** Demonstration scenario

Cloud watch is used for receiving and monitoring log files, setting of alarms and respond automatically for the changes produced in resources of AWS, Autoscaling is used for the management of scaling.

## 3. Serverless Architecture

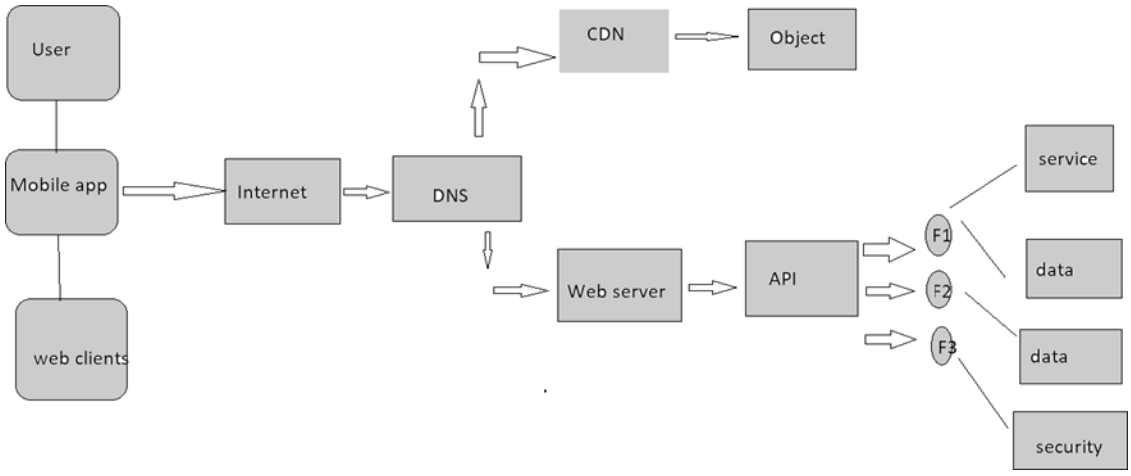


**Fig 5.** Architecture of Serverless Application

The serverless architecture includes basic components such as serverless API gateway, FaaS (Function as a service) and BaaS (Backend as a service). Communication process between first

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end and FaaS is provided by serverless API gateway. Business related logics are executed in FaaS, BaaS eliminates the burdens of the admin in database. The access to the services is providedby accessing the internet in traditional architecture, for example a machine hosting the websites and delivering it to the browser and its size is bigger. When reducing the size of the machine, thecost of it is very much higher, also the life time of the machine is low. To overcome these issues,serverless model have been introduced.

In serverless architecture, AWS Lambda, Azure and Google cloud services are available. Fig 5 represents the serverless application architecture. The user gets access to the serverless model through a mobile phone, the HTTP request is passed through the Domain Name Server routing, the request outcome is provided through Content Delivery Network, which communicates to the object store [28]. Runtime data isprovided to web server by passing the requests via API gateway which forwards the requests to many kinds of functions. The first function is used for the purpose of providing service while second one is used for read and write operations and third one is used for state saving.

Thus, from the process involved from the flow chart, we can easily understand that serverless model is an effective and time efficient process which many IT industries follow. Sincethere is not much burden to the developer such as allocating resources, maintaining servers, and owning servers, the developer can concentrate more on the logic process.

## 4. Comparing different models of Serverless Computing (Azure, AWS and Google cloud)

- **Supporting language**: When comparing three models, AWS Lambda model is better because the programming language here is relatively diverse, also more kinds of supporting languages are provided in AWS Lambda.

- **Stateful functions**: The stateful function is not supportedin AWS Lambda model, but the services that are stored can be accessed. This kind of supportis not present in Google cloud model also. Only Azure function provides stateful function support.

- **Storage**: S3 and DynamoDB are used in AWS Lambda model for storage purposes, Azureuses blob and Google cloud uses Cloud SQL, Cloud datastore and Cloud storage.

- **Number of functions**: There is no limited functionality in AWS Lambda and Azure modelwhereas the Google Cloud have 1000 as a limit for per project.

The growth of different models of serverless computing is shown in the Fig 6.

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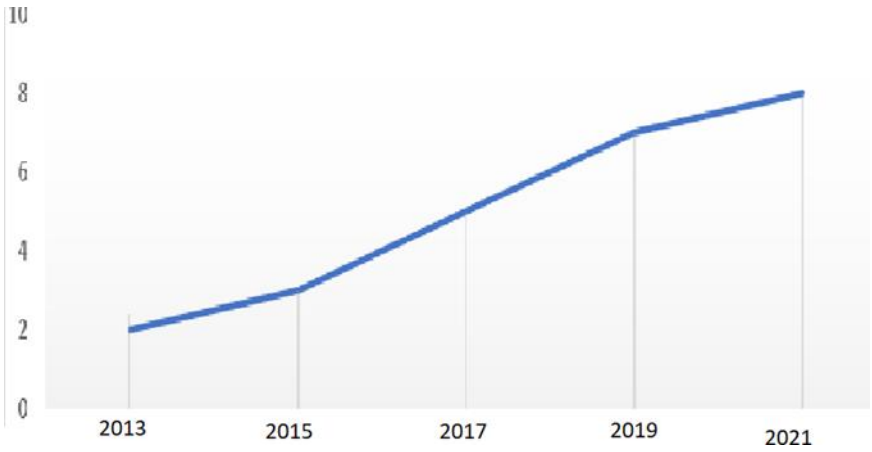


**Fig 6.** Graph that shows the growth of serverless computing

## 5. Execution Cost Trends in Serverless Computing

The comparative analysis of serverless platforms provides valuable insights into their overall efficiency and applicability in cloud-based environments. The results demonstrate that while all three providers AWS Lambda, Azure Functions, and Google Cloud Functions offers reliable uptime and scalable performance, notable differences exist in latency, energy efficiency, and cost. AWS Lambda generally outperforms its counterparts in terms of availability, energy consumption, and cost-effectiveness, making it a balanced choice for large-scale workloads. Azure Functions, despite their slightly higher latency and cost, is advantageous in scenarios requiring stateful function support. Google Cloud Functions falls between the two, offering competitive pricing and moderate latency performance. These findings highlight that platform selection should not be based solely on one parameter but rather on a holistic evaluation of workload requirements, budget, and efficiency goals. The cost modeling results in Table 1 illustrates how serverless platforms scale economically with the number of invocations. At lower workloads, such as 1,000 executions, the cost difference between providers is minimal, with AWS Lambda at $0.20, Google Cloud Functions at $0.22, and Azure Functions slightly higher at $0.25. However, as the number of invocations increases, the variation in pricing becomes more noticeable. At 100,000 invocations, AWS Lambda maintains the lowest cost at $12.00, followed closely by Google Cloud at $12.50, while Azure incurs the highest cost at $13.00. This trend demonstrates that although all three providers follow a near-linear cost growth model, AWS proves to be more cost-efficient at scale, making it a favorable option for high-frequency workloads. The results

also suggest that while the differences are marginal at small workloads, the cumulative savings become significant for enterprises handling millions of requests, positioning cost modeling as a critical factor in serverless platform selection.

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**Table 1. Cost Modeling of Serverless Platforms**

| Invocations | AWS Lambda | AZURE Functions | Google Cloud Functions |
|---|---|---|---|
| 1,000 | 0.2 | 0.25 | 0.22 |
| 10,000 | 1.5 | 1.6 | 1.55 |
| 50,000 | 6.8 | 7. 20 | 7 |
| 1,00,000 | 12 | 13 | 12.5 |

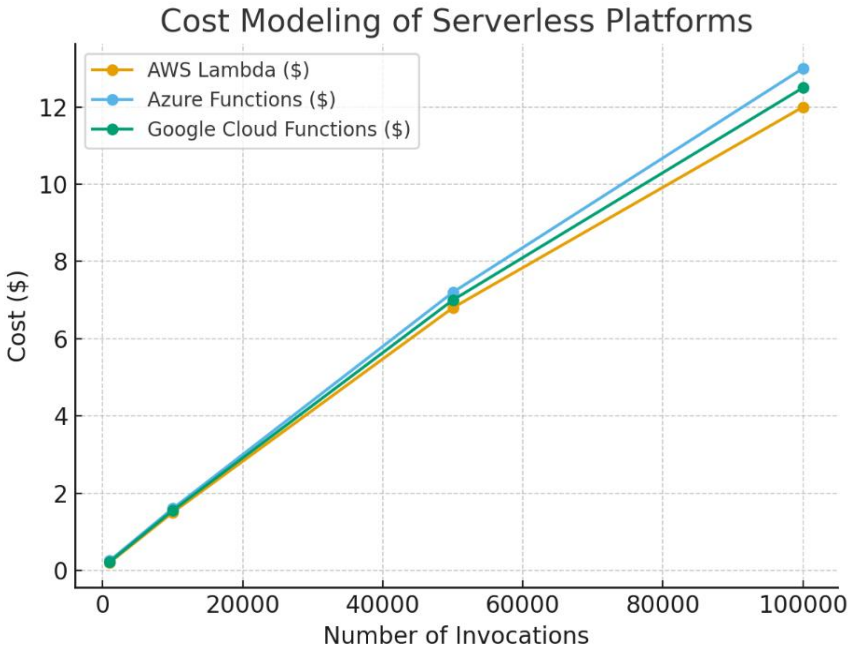


**Fig 7. Economic Analysis of Serverless Architectures**

Fig. 7 shows how the cost of serverless platforms increases with the number of invocations. All three platforms AWS Lambda, Azure Functions, and Google Cloud Functions which follow a linear growth pattern. At smaller workloads, the cost difference is very small, but as the number of requests increases, AWS remains the cheapest option, followed closely by Google Cloud. Azure is slightly more expensive at higher workloads. This means that while all platforms are cost-efficient for small tasks, AWS provides better savings for large-scale applications.

## 6. Conclusion

In IT industry the parameters such as cost, security, efforts, time to reach the markets etc. plays a major role. When we host a scheme by using cloud computing, the time required for hostingthe project is low, but the security and cost of maintenance cannot be considered. But by using serverless cloud computing the execution time, and cost of maintenance is very low, also it offers high security. Several computing includes various benefits such as maintenance, owning

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of server, resource allocation is not handled by the developer as the cloud service provider takes care of it. The maintenance cost is low as the pricing is based on how muchtime the application or resource is used. The serverless cloud computing also includes certain challenges such as for a process which takes longer time period to run, serverless architectures cannot be used, as the pricing is based on how much time the code runs. It also includes certain security concerns as the whole backend is run by vendors.

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