IoT from Cloud to Fog Computing-Security Concerns

Sameena Shaik [1], Sangeetha Komandur [2]

[1] *Department of Computer Science, College of Computer Science and Information Technology, Jazan University, Jazan,Kingdom of Saudi Arabia.*

[2] *Department of Computer Science, College of Computer Science and Information Technology, Jazan University, Jazan, Kingdom of Saudi Arabia.*

[1]sabdualoheed@jazanu.edu.sa, [2]skomandur@jazanu.edu.sa

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Abstract *- The availability of computational resources, particularly external data storage that is not directly or actively managed by the user, is known as cloud computing. One type of computer architecture called fog computing uses edge devices to perform a significant amount of computation. The fastest-growing network of connected things, known as IoT, allows for the transmission of data in scenarios of the environment in real time. This was made possible with the assistance of integrated sensors. This study provide the overall undertandinng regarding the revolution of cloudcomouting to fog computing systems that has esssential significance in the recent times.*

Keywords *- Wildlife surveillance, Object detection, Classification, Machine learning, Deep learning, Mask RCNN.*

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1. Definition

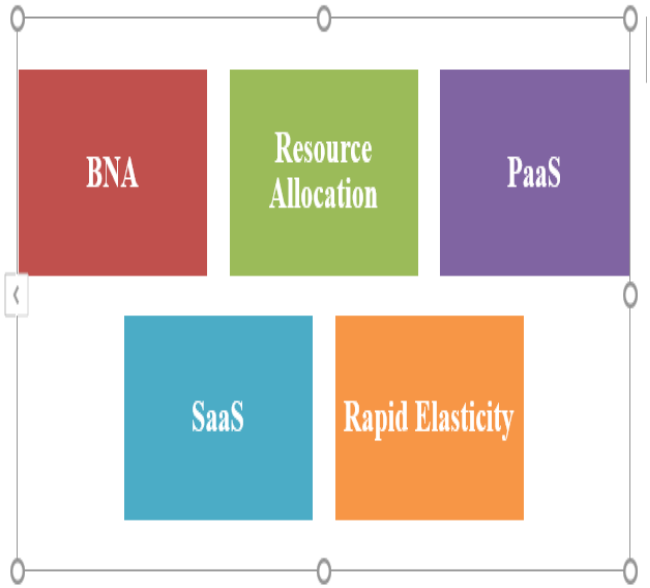

Fig. 1. Key Terms in IoT

(Source: Influenced by Abid *et al*. 2020)

- ***BNA:*** It stands for ***"Broad Access Network"***. It is one kind of network that hosts resources in a private cloud network which is made available to a broader access area of resources.
- ***Resource Allocation:*** It is the process of assigning available resources to cloud applications via the help of the internet. There is the presence of three available methods of resource allocation (Abid *et al*. 2020). They are the ***"Critical Path Method, Critical Chain Method, and Resource Leveling and Resource Smoothing"***.
- ***PaaS:*** It stands for ***"Platform as a Service"***. It is a cloud computing model that enables third-party vendors to provide hardware and software tools to customers or users over the Internet.
- ***SaaS:*** It stands for ***"Software as a service"***. It is one kind of software-based distribution model with the help of which the provider in the clod genre hosts applications to make it available for the end-users. "Adobe creative cloud" is an example of this (Fithri *et al*. 2020).
- ***Rapid Elasticity:*** It is the ability to scale a service dynamically that is mainly done based on direct response to the needs of customers for space and other services.it helps establish the flexibility of ***"cloud-based services"*** to the demands of customers.

2. Classification

There is the presence of many types that the cloud-based service does effectively and efficiently present. Rashid and Chaturvedi (2019) have stated that the types of cloud computing are discussed in a detailed manner below:

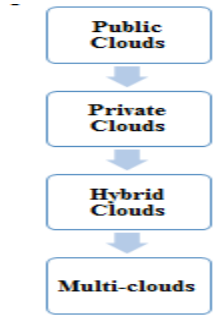

Fig. 2. Types of Cloud Computing

(Source: Inspired by Virupakshar *et al*. 2019)

- ***Public Clouds:*** They are the environments related to the cloud that are typically designed by the IT infrastructure and do not belong to the end user. The largest public service cloud providers are ***"IBM Cloud, Google Cloud, Amazon Web Services (AWS) and Microsoft Azure"***. As soon as the environmentalists are divided up and distributed among several renters, they all become public clouds.
- ***Private Clouds:*** They are certain types of cloud-related environmentalists when the above-stated environmentalists are entirely dedicated to a single end-user or group. The working of the above-mentioned environment does usually occur behind the group's firewall. When the current IT infrastructure is completely devoted to a single end-user, all clouds transform into private clouds.
- ***Hybrid Clouds:*** The creation of a single IT environment with the help of multiple cloud environments (Virupakshar *et al*. 2019). The above-stated environments are connected with the help of ***"Local Area Networks"*** **(LANs),** ***"Wide Area Networks"*** **(WANs),** and ***"Virtual Private Area Networks"*** **(VPNs)**. The requirements of a hybrid cloud mainly include the following things. These are ***"at least one public and private cloud, 2 or more public and private clouds, presence of a bare metal or virtual environment"***.
- ***Multi-clouds:*** They are made up of more than one cloud service from more than one cloud vendor. It should also be observed that ***"all hybrid clouds are multi-clouds, but not all multi-clouds are hybrid clouds"***.

3. Architecture diagram

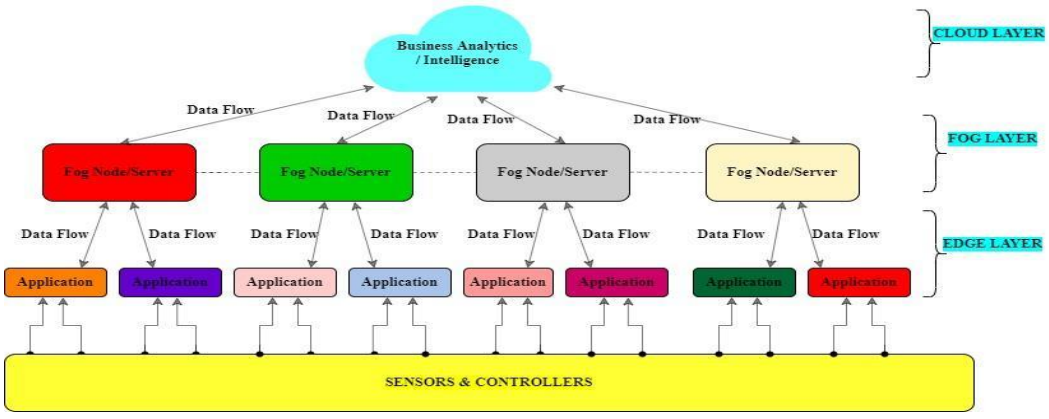

Fig. 3. Network Architecture

(Source: Created by Learner)

The above figure shows the network architecture diagram of cloud-to-edge computing. The data gets flowed from the ***business analytics*** cloud base to the different nodes of fog computing. From the ***Fog*** nodes, the data flows into the respective application blocks. These applications have sensing devices that are got connected to

the main block of the sensors and controllers that regulate the flow of data.

4. Parameters

There is the presence of a lot of parameters used for cloud and fog computing. The first parameter is the ***location of server nodes***. It is present within the Internet in the case of cloud computing and at the edge of the network for fog computing. Then there is the presence of other two parameters namely ***latency*** and ***delay jitter***. In the case of cloud computing both the above-mentioned parameters are high and for fog cloud computing, they are (Kumar *et al*. 2019). The list of other available parameters in both cloud and fog computing is ***"Client and Server Distance, Security, vulnerability, awareness about location, mobility, kind of last time connectivity and real-time interactions"***.

5. Standards/protocols used

There is the presence of numerous portals that are seemed to be suing in cloud computing. The names of the major protocols found in cloud and fog computing are discussed below:

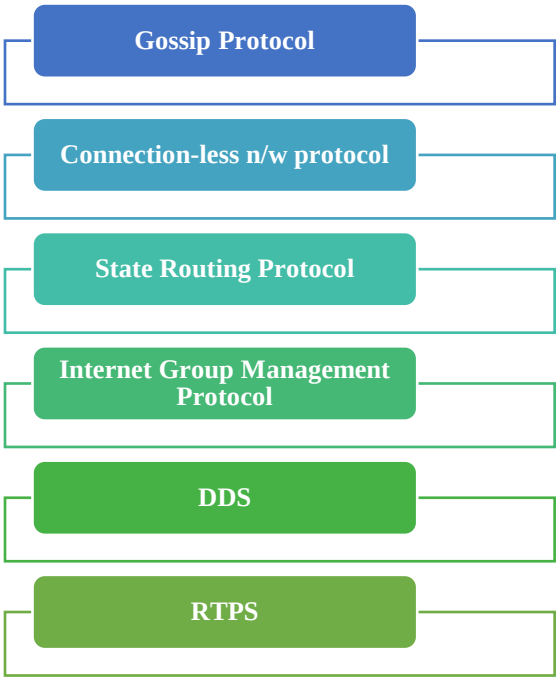

Figure 4: Protocols in Cloud and Fog Computing
(Source: Influenced by Yildirim Okay *et al*. 2020)

- ***Gossip Protocol:*** It is one special kind of communication protocol that helps in the spreading of information through a flooding mechanism.
- ***Connection-less n/w protocol:*** It works on the 3-layer platform of the OSI model mainly used for fragmentation of data (Yildirim Okay *et al*. 2020).
- ***State Routing Protocol:*** This type of protocol is mainly used to identify the exact path to route the information.
- ***Internet Group Management Protocol:*** It is one kind of communication protocol that helps in the multicasting of data to reach the does with the help of a router.
- ***DDS:*** It stands for ***" Data Distribution Service"***. It is extensively used in ***"very exigent real-time distributed systems in Aerospace and defence systems"***.
- ***RTPS:*** It stands for ***"Real-Time Publish-Subscribe Protocol"***. It is mainly used in the establishment of low latency mad low bandwidth in the field of fog computing to match the actual scenario of the IoT (Rupa *et al*. 2020).

6. Algorithms or techniques used in the papers u used for review/survey

The **parallel computation algorithm** has been used. This is so because it helps in the real-time tracking of data. They are also known to be optimised algorithms for time and resource consumption mechanisms availability. It has been used in the review for the effective consumption of time in order to complete the study effectively and efficiently on time. By the influence of Samann *et al*. (2021), it can effectively and efficiently be stated that the ***IoT sensing layer technique*** is applied in order to sense the major and minor challenges in the IoT proto; layer present in the architecture. The presence of ***several scheduling algorithms*** helps in the effective and correct mapping of distributed services present in the fog computing architecture. All the above-stated algorithms and techniques help in the formulation of survey questions. These questions help to have a detailed understanding of the topic by the responses collected from the organisation employees of a total strength of 40 who are working in this field or domain for quite some time.

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7. Survey should be summarised as a table

Table 1. Survey Questionnaire

Q1. Age a. 18-23 b. 24-30 c. 31-37 d. 38-44 e. Above 45
Q2. Gender a. Female b. Male c. Prefer not to say
Q3. Experience (in years) a. 0-1 b. 2-3 c. 4-5 d. 5-6 e. Above 6
Q4. Do you think that cloud computing was of no help to IoT? a. Strongly Concur b. Concur c. Neutral d. Disconcur e. Strongly Disconcur
Q5. What is your opinion about the mitigation of security concerns related cloud IoT before jumping to IoT fog computing? a. Strongly Concur b. Concur c. Neutral d. Disconcur e. Strongly Disconcur
Q6. Do you think that the security concerns pertaining to Fog Computing will get rectifiable? a. Yes b. No c. Not Sure
Q7. What is the future of IoT in regards to the SMEs sustainability present globally? a. Strongly Concur b. Concur c. Neutral d. Disconcur e. Strongly Disconcur
Q8. What is your take on the future of eradication of cyberattacks based the conversion of cloud to fog computing? a. Strongly Concur b. Concur c. Neutral d. Disconcur e. Strongly Disconcur
Q9. Do you that all kinds of business firms present globally will get benefitted from IoT and its conversion from cloud to fog? a. Strongly Concur b. Concur c. Neutral d. Disconcur e. Strongly Disconcur
Q10. Will the combined effect of IoT and ML be able to monitor health-related parameters by the help of real-time data tracking techniques? a. Yes b. No c. Not Sure

8. Conclusion

From the above section of the study, it can be concluded that cloud computing has a bast range of applications in the field of data processing and data protection in today's world. The given architectural diagram explains the fact that the resources and data are securely kept with different peripherals assigned to the architecture performing specific parts. Some parts are specific for the detailed identification of different kinds of cyber attacks in relation to the server network of the business firm. The future scope not only helps in a better understanding of the given research topic but also in

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widening the scope of career opportunities in future times.

9. Future work /scope

The future scope or work of this research study will help in the effective implication of fog computing with IoT. It will also help to strengthen the relationship between IoT and fog. This is so because there is the presence of open issues of Fog with IoT is causing a serious hindrance to the future success story of the above-two merger being widely used in global firms. The security concern is the main issue because of ***"diverse characteristics, outstandingly portability, heterogeneity, and large-scale distribution"***. The future work will help in the implementation of various useful parameters that will help in the fixation of the existing issues for better scalability and reliable widespread usage with IoT.

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