BIG DATA ANALYTICS FOR SMART CLOUD-FOG BASED APPLICATIONS

Dr. Robert Bestak
Department of Tele Communication Enginnering
Czech Technical University in Prague
Technicka 2, Dejvice
Prague, Czech Republic, EU, CZ-166 27
Email: robert.bestak@fel.cvut.cz

Dr. S. Smys
Professor, Department of Computer Science Engineering
RVS technical Campus
Coimbatore, India
Email: smys375@gmail.com

Abstract: The internet connectivity extended by the internet of things to all the tangible things lying around and used by us in our day today life has convert the devices into smart objects and led to huge set of data generation that holds both the valuable and invaluable information. In order to perfectly handle the information's generated and mine the valuables from them, the analytics are engaged by the cloud. To have a timely access, most probably the fog services are preferred than the cloud as they bring down the service of the cloud to the user edge and reduces the time complexity in accessing of the information. So the paper proposes the big data analytics for the fog assisted health care application to effectively handle the health information's diagnosed for the aged persons. The proposed model is simulated using the IFogSim toolkit to examine the performance fog-assisted smart healthcare application.

Keywords: Cloud Computing, Internet of Things, Fog Computing, Fog Nodes, Big-Data-Analytics, health care based smart applications.

1. INTRODUCTION

The emergence of internet of things has enabled the entire device embedded with the internet connection to connect and communicate seamlessly. It has enabled to evince the smart functioning of the much wider range of tangible commodities such as the vehicles, electric meters, household devices, medical appliances, traffic signals and street lights. This results in the continuous generation of information's at a huge rate making necessary for application of

the analytics to extract the useful information. The cloud paradigm employs the perfect analytical schemes to mine the valuables form the information gathered, to improve the decision making in the futuristic actions. Recent the FOG computing or the micro cloud services are opted in most of the application's as it enables a timely and more cost effective access of the service compared to the cloud.

The FOG computing is usually anticipated   as the   as the complementary service or the remedy for the cloud computing to elude the issue associated with the cloud computing in terms of the connectivity, time complexity, and bandwidth . The notion for the emergence of the fog is to, fundamentally to bring down the cloud service to the user edge allowing the things to directly communicate and reduce the cost of the services. They are usually placed over the intermediary devices such as the sensors, switches and the smart machines separating the devices from the cloud paradigm. The fig.1 below shows how the Fog network brings down the cloud services to the user edge.
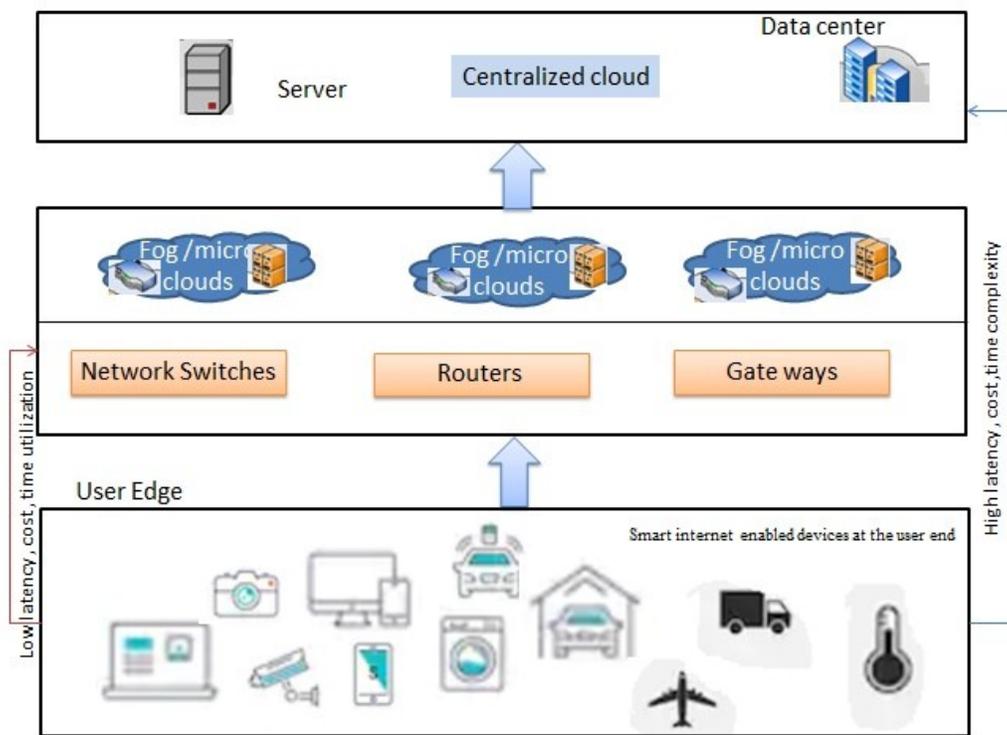

Fig.1 FOG Network

The utilization of the analytics is in the fog paradigm to bring out the more useful information is still in the early stage. So the paper puts forth the big data analytics in the fog assisted heath care management of the elderly persons.

The paper is organized with the related work in section 2. Big data analytics for fog assisted health care application in section.3 the performance evaluation of the proposed frame work using IFogSim in section.4 and Conclusion in section 5.

2. RELATED WORKS

As the analytics for the fog computing is in the beginning stage, and requires more research's to gain more valuable information that provides deep knowledge, the related work includes the utilization of the predictive analytics in the cloud paradigm to learn how the analytics are applied to extract useful information's Khan, et al [1] and Zaheer, et al [2] details "utilization of the cloud based big data analytics in the smart future cities" Simmhan et al [3] present the "Cloud-based software platform for big data analytics in smart grids".

Talia, et al [4] in his paper explores the "Clouds for scalable big data analytics." , Hashem et al [5] elaborates the"The role of big data in smart city." Dey et al [6] presents the "Internet of things and big data analytics toward next-generation intelligence" Bessis et al [7] details the " big data as the roadmap for smart environments"

Strohbach et al [8] in his paper puts forth the "big data analytics framework for IoT and smart city applications." The author Song et al [9] explains the "foundations, principles, and applications of the Smart cities" as survey. Tu et al [10] present the review of the "Big data issues in smart grid"

Munshi et al [11] in his paper provides the "visual analytics for smart grids big data using he cloud" Rajeswari, S et al [12] details the " integration of the IoT, mobile and cloud-based big data analytics for developing smart IOT" Zhang et al [13] puts forth the ". "Health-CPS: Healthcare cyber-physical system assisted by cloud and big data." Channe et al [14] puts forward the " usage of the internet-of-things (IoT), sensors, cloud-computing, mobile-computing & big-data analysis in the Multidisciplinary model for smart agriculture"

Plageras et al [15] "the utilization of the IoT-based sensor BIG Data collection in the processing and the analysis of the smart building" Dastjerdi, et al [16] presents the "principles and the architectures and the applications of the FOG computing" Babu, et al [17] provides the "study on the cloud based internet of things"

Mohamed, et al [18]   details the survey on the "IoT Cloud Computing, Storage, and Data Analytics." Al Yami, et al [19] details the utilization of the " fog as the complementary to the cloud" Qi, et al [20] present the "smart manufacturing system that is based on the edge, fog and cloud computing"

Smys, S. et al [12] is his paper elaborates the essentiality of the "Big Data Business Analytics As A Strategic Asset For Health Care Industry." Duraipandian, et al [22] details the " involvement of the Cloud In Internet Of Things For Smart Connected Objects" Suma,et al [23] provides the " utilization of the big data and the internet to improve the sustainability in the industrialization" MahmoudZadeh et al [24] puts forth the "prioritization and the scheduling of the tasks in the AUV mission using the swarm intelligence" Pandian, et al [25] presents the "Enhanced Edge Model For Big Data In The Internet Of Things Based Applications." Durai Pandian et al [26] In His Paper Presents The "Performance Evaluation Of Routing Algorithm For Manet Based On The Machine Learning Techniques"

3. PROPOSED WORK

The big data analytics is the engaged in the proposed model for the Fog –assisted heath care management of the elderly persons. The analytics and the processing of the information's are done in the user edge utilizing the fog nodes. This is done to elude the unnecessary time and the cost wastage in conveyance of the health care details gathered and the remedies provided.

The Fog located in a closer proximity to the clients/patients enables a timely processing and conveying of the information to the patient as well as the physician. The block diagram below in fig. 2 shows the application of the big data analytics in the fog assisted healthcare information gathering for the elderly.
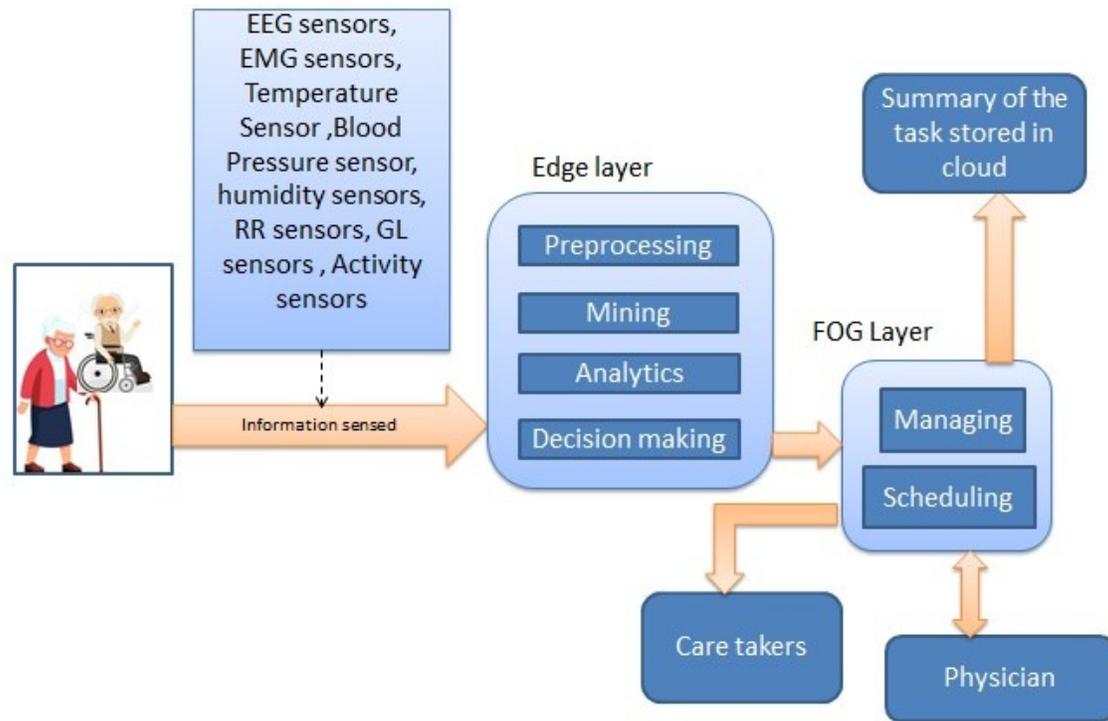
Fig .2 Block Diagram of the Proposed Model

The proposed frame work of Fog assisted health care services for the elderly, monitors the health care of the elderly by engaging the body area sensor networks such as the EEG , EMG , body oxygen, temperature, humidity, activity, respiration rate (RR), glucose level (GL), and the blood pressure sensor , to sense the changes in the body of the elderly. The sudden changes monitored in the body are conveyed to the edge layer, where the huge set of data monitored are preprocessed, filtered and mined applying the MAHOUT.

The mined information enables the automatic identification of the health status of the persons as the information sensed are properly clustered and classified in the MAHOUT. Based on the decision of the health status conveyed to the Fog layer, the fog layer decides to the convey the information to the appropriate physician and the care taker without the need for the intervention of the cloud. The proper information conveyance in the fog is perfectly managed by proper prioritization and scheduling based on the urgency using the swarm intelligence [24]. This

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allows having a timely service provision reducing the severities in the patient's condition as well as the cost of the service provisioning. Once the information's are processed and conveyed to the appropriate persons. The immediate measure to be taken are conveyed back by the physician to the care take of the elderly and if necessary to the hospitals and the emergency vehicles.

The complete process that has taken place in the Fog layer is summed up to the cloud along with the complete record of the patients as well as the treatment details provided by the physician for further access.

This reduces the time, cost and the energy consumption in the conveyance compared to the direct communication with the cloud. The next section with the results analysis of the proposed frame work using the IFogSim shows the variation in the energy, time and the cost consumption in the fog assisted application and the cloud based applications.

4. RESULTS

The proposed method is evaluated using the iFog Simulator for different number of elderly person monitored over a year. It was found that the processing using the fog assistance reduces the average usage time of the network when compared to the cloud, and heightens the performance of the service provided in terms of the reduced latency, energy consumption and time complexity.

Type of Device	CPU GHz	Power (W)	RAM (GB)
Cloud-Virtual Machine	4.0	87.89	6

Table.1 Configurations of Devices in Fog

The Table.1 above provides the configuration details of the different devices in the fog layer. The fig.3 provides the percentage of the energy and the latency observed when executed in the Fog and the Cloud.
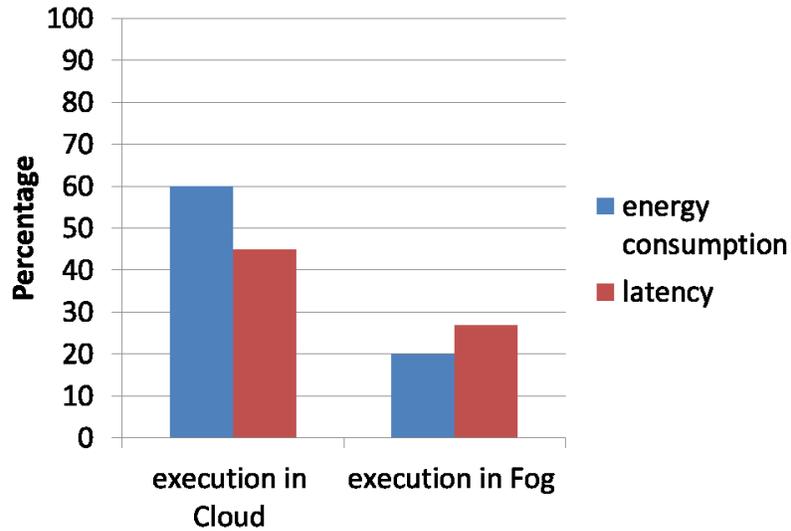

Fig.3 Energy and Latency Observed

The Table.2 below presents the comparison of the performance parameters such as the, average energy consumption, average latency and average time consumption, when executed in Fog and Cloud.

	Processing layer	Conveyance Time (s)	Energy Consumption (joules)	Latency (ms)
Cloud	Devices to Cloud	75.566	98.45	200.45
Fog	Device to Fog	20.783	45.67	80.34

Table.2 Comparison of Performance Parameters

5. CONCLUSION

The paper proposes the big data analytics for the Fog assisted elderly people monitoring. The monitoring is done employing the bodily area sensors that monitors the sudden changes in the body. The changes monitored are sent to the Edge layer for processing and decision making applying the MAHOUT. Based on the status of the health the information from the Fog layer is sent to the physician and the caretaker. The prioritization and the scheduling of the task are initiated by the swarm intelligence based on the conditions of the patients. The execution in fog avoids the time, energy and the latency consumption compared to the cloud. The validation of the proposed model using the IFogSim evinces the performance up gradation in terms of the energy, time and latency consumption when compared to the execution in cloud.

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