Optimizing cloud health Care Data Transmissions using Fog

Nagarjuna Valeti ¹, V Ceronmani Sharmila ²

¹Faculty, Sri Harshini Degree & PG College, AP, India.
²Associate Professor, Department of CSE, Sir C R Reddy College of Engineering, Eluru, India.

Abstract: Cloud computing has been dominating enterprise data management solutions for a while now but still requires human-computer interface agents to govern and facilitate services and healthcare domain is no exception. Fog Computing the latest buzz word often considered an extension to Cloud computing enables smart pervasive devices to directly interact with the cloud while simultaneously upholding Quality of Service (QoS) metrics such as performance and security. For smooth transition of communication services in health care computing domain, prior approaches suggested a data collection protocol to support autonomic fogging between medical devices and cloud storages. Although efficient and automated this approach is facing a bottleneck scenario leading to data retransmissions when health data spikes exponentially. To address this problem we propose a dynamic buffering algorithm that ensures the optimized queue and power management scheme within the medical user’s device to hold the data in the queue for updating, to prevent queue over flows and thus reducing important health data losses when involved entities are offline. To improve the performance of the proposed system a new sensor technology is adapted to the system. This approach is a first of its kind approach in health care driven fog computing that can offer smooth automated data transitions.

Index Terms: Dynamic algorithm, optimized queue, IOT

1. Introduction
The advanced version of cloud computing is fog computing. Fog computing applications need low latency and real time analysis [1]. It is having basic infrastructure like cloud computing and extended with some advanced features. The hosting in the fog computing for the services host at the final devices like access points or set-top boxes. The infrastructure of the cloud used by the fog such as computing same building blocks, storage, resources and many other technologies. The fog applications are run by advanced distributed computing which allows run in the same cloud. The main aim of the fog computing is to enhance the proficiency and lessen the measure of information that is transported to the cloud for information examination, stockpiling and handling. Recently many home appliances electronic devices are using smart technology by utilizing the fog computing. The cloud and fog is divided the application services are executed at network edge in a smart device and remote data center in the cloud.

Cloud computing is the service oriented infrastructure which provide the services for many applications. Fog computing uses the cloud infrastructure for the fog applications. For the web of Things (IOT) requires mobility bolster and geo-circulation notwithstanding area mindfulness and low inertness. To overcome the problems in cloud computing such as latency and other smart problems such as server issues [1]. Cloud computing and fog computing uses the cross platform for deploying services and
applications. There is a wide range of relation between the cloud and fog especially on storage and management analysis.

Health care plays the major role in all the technologies. Patient reports on various tests need much result of the reports. In hospitals there is a lack of problems in generating the patient test reports and send to the patient directly is not possible in now a days. There are many tools available for the hospitals (e.g. capable hospital data frameworks, associated research facility comes about) [2] these instruments are not more adequate and new advances should bolster another method for visualizing the future hospital. In this paper, a new power management dynamic patient reporting technique in fog computing. For smooth transition of communication services in health care computing domain prior approaches suggested a data collection protocol to support autonomic fogging between medical devices and cloud storage's. Although efficient and automated this approach is facing a bottleneck scenario leading to data re-transmissions when health data spikes exponentially. To address this problem we propose a dynamic buffering algorithm that ensures the optimized queue and power management scheme within the medical user’s device to hold the data in the queue for updating, to prevent queue over flows and thus reducing important health data losses when involved entities are offline. To overcome the problems in the proposed system the new sensing technology is adopted to predict the faults within the proposed system. This approach is a first of its kind approach in health care driven fog computing that can offer smooth automated data transitions.

The remaining chapters explain the chapter-2 related work, 3-existing system, 4-proposed algorithm, 5-Simulation and Analysis and 6.conclusion.

2. Related work
Mobile fog proposed by [3] is the huge level of developing model and very lite internet applications. Mobile Cloud comprises of an arrangement of occasion assistants and capacities that an application can desidel. Mobile Fog is not displayed as bland type, yet rather is worked for specific approach, although forgetting capacities that arrangement with specialized difficulties of included picture handling natives.

Cloud computing approach decreases inertness and system activity.

The migration for cloud and fog is presented by [4]. This project explains last to last inertness limitations and decreases the system usage by arranging the movement of time. They likewise indicate how the application learning of the mind boggling occasion handling framework can be utilized to diminish the required data transfer capacity of virtual machines amid their relocation. System administrators are determined to circulated Fog gadgets although computing concentrated administrators are in the Cloud. Transfer costs are pay-off by choosing movement focuses on that guarantee a low expected system use for an adequately lengthy time span. This work fails to upgrade workload versatility since Fog gadgets are additionally ready to convey computationally concentrated errands. It additionally does not improve the measure of control data or portability overhead, and does not depict arrange control approaches to identifying ideal ways towards various applications.

There are numerous current strategies connected for web advancement in a novel way [5]. Inside Cloud preparing setting, these techniques can be combined with unique data that is only open at the Cloud contraptions. All the more intense change in accordance with the customer's conditions can similarly be capable with arrange edge specific data.

This is totally based on the requirements of Smart Grid, Cloud, and sensors and actuators the main surveys [7].This work joins the reliable fog computing. The aim of this system is to build the mist figuring ventures is trying and does not offer any original thought for the steadfast nature of the arrangement of adroit contraptions in the Cloud preparing perspective

From [9] the research is done how vitality utilization might be improved by thinking about the communication between the two gatherings. The vitality value show is a component of aggregate vitality utilization. The target work enhances the variations between the regard and cost of essentialness. The adopted system between the power association and its users is exhibited through a two-arrange fused preoccupation, in light of which the work [11] proposed the Game Theoretic Energy Schedule (GTES)
system. The objective of the GTES system is to diminish the best to typical power extent by redesigning the customers' imperativeness designs.

**Health Care using Manual Processing:**

i. The hospital service person collects the patient data and note them into the paper.

ii. Again the data entered into the system by data entry operator.

iii. The hospital software is used to take all the inputs of the patient and maintain the data into the database for the future purpose.

iv. Here the total process is based on hospital service persons to update the data, communicate each other for better updates of patient information.

v. There may be chances of getting errors when the data is entering into the software and it is time taking, more expensive.

![Manual Process](image1)

**Figure: 1. Manual Process**

**Health Care using Cloud Computing:**

The sensor nodes are arranged at the patient bedside which is loaded with software to collects, encode and transmit data through wireless communication channels to be stored. The software acts as a medium between sensors and users for the better support for the hospitals. In this scenario, the no of patients sends their reports (these are text format) at a time like flooding then the error occurs in the cloud. To overcome these types of errors Round Robin Load Balancing algorithm used to maintain the constant loading in the cloud data sends the reports to the cloud storage without any data loss.

![Architecture Diagram in Sensors and Cloud Computing](image2)

**Figure: 2. Architecture Diagram in Sensors and Cloud Computing**

**Pseudo Code for Round Robin Algorithm:**

```plaintext
RoundRobinLoadBalancing ()
{
    Initialize all the VMs;
    While (new patient record received by the cloud data controller)
    Do
    {
        Cloud data controller queue the requests; Cloud data controller removes a request from the beginning of the queue;
    }
}
```
If (load list contain any entry of a VM corresponding to the present requesting patient base \&\& VM allocation status == AVAILABLE) 
{
    The VM is reallocated to the patient base request;
} 
Else 
{
    Allocate a VM to the patient base request using Round Robin Algorithm;
    Update the entry of the user base and the VM in the list and the VM state list;
} 

Dis-Advantages of this System

- Due to the improper behaviour of sensors the data may lost.
- If the data flow is very high the cloud server may not be work properly.

3. HEALTHCARE SYSTEM USING WIRELESS SENSOR NETWORK DATA DECISION SYSTEM

In this system, there are two phases: Health State Monitor (HSM) and Input Handler. HSM is the most important phase for predicting the health analysis in the early stages. In this system, we allow that arrangement of the senior's exercises is a limited set and we have sufficiently given sensor nodes that can respond to every one of these exercises. Subsequent to revamping and abstracting new information gathered by sensor hubs, the present position and movement of the elderly, (for example, dozing in bed or cooking in the kitchen) can be resolved. From the database, HSM can retrieve the health states and action of the elderly finished an earlier timeframe. We call it Past State. The present health conditions of the elderly are chosen by HSM through a coordinated thought of the present position, movement, and the past state. Figure 5 demonstrates the choice procedure of HSM. In this situation, for the better execution of sensor nodes, the vitality utilization is stretched out with a Bin-Packing approach. In this calculation, the arrangement of servers pressed into VMs as per the power utilization. The goal of the calculation is keeping up the vitality utilization at the sensor hubs for sending the information to the cloud storage.

Pseudo code for multiple waiting queues algorithm

Info: Multiple holding up lines
Mapping occupations in lightweight of line models/Constructing examining holding up lines
1: For k=1 to N do
2: produce set energy by examining Q/N/N is that the amount of holding up lines/Determine indistinguishability lines in lightweight of line models
3: Let one two X Q qn square measure the equivalence holding up queues.
4: Set ∅ =E X ( ) ; ∅ =E X ( ) /Computing lower and higher sitting tight time for every holding up work
5: Set ∅ =L X ( ) ; ∅ =U X ( ) ;
6: For j = one to n begin
7: if q X j ⊆ then L X L X q ( ) ( ) j ⊆ ;
8: Else if q X j then j ∪
9: End if
10: End for
12: ( ) ( ) =MJ E X E X
Figure: 3. Healthcare System in WSN

Drawbacks of BPA (Bin-Packing Approach):
1.) The energy capacity should not be exceeded from maximum energy.
2.) The cloud server should not be violated SLA rules that VM should be allocated to only one server.

Local Queue Algorithm
This gives supports for inter process migration. The static allocation of all new process with process migration initiated by the host when its load falls under the predefined minimum number of ready processes (threshold limit). Initially, new processes created on the main host are allocated on all under loaded hosts. From then on, all the processes created on the main host and all other hosts are allocated locally.

Dis-Advantages:
- Less number of processes.
- Hard to find the faults.

Cloud Health Care System:
1. The word fog computing was initially instituted by the organizations as an illustration for the principle integrative thought behind it: mist is somewhere about to the cloud (server farms) and also the ground, the devices of the users are found.
2. A term frequently utilized synonymously is edge process, explaining tasks that are placed at the edge of the system instead of the cloud. Note that the term edge will suggest to numerous levels of the look.

Wireless Implantable Medical Devices

Figure: 4. various medical devices used as manual process
3. In a very trendy setting, edge oftentimes alludes to hubs in a very generation plant and dwells on premises with the shopper, for instance as a feature of a machine controller or a system portal.

4. The sensor network contains scattered detector hubs with restricted procedure skills and battery management. All the data collected by the sensor nodes are forwarded to a storage device like cloud while fog devices such as network equipment or local data centers.

5. Healthcare applications are considered as promising fields for wireless sensor networks, where patients can be monitored in hospitals and even at home using wireless medical sensor networks (WMSNs).

6. Some examples of Medical Sensor devices besides standard CT-Scanner, MRI are as follows

7. Three compatible applications were found w.r.t to fog in health care scenario:
   - Various no of computing process are need to take benefit from fog computing principles;
   - To process the tasks high network tiers is needed due to the issues in wireless devices and the need to aggregate data; and
   - Privacy concerns and dependability prevent computation tasks to be completely moved to the cloud.

8. So a better system is required to handle above mentioned issues of health care in fog computing.

**Dynamic Buffering Algorithm**

The buffer queue management architecture in medical devices are as follows:

Step-1 Very important issues that should be routed to build the concentrated protection safeguarding cloud-based information storage system is cradle and line administration in medicinal devices amid correspondences.

Step-2 For example, information is being produced at the medicinal user (MU) gadgets and should be transferred to the focal system through a wireless Access Point (AP) called Fog.

![Figure: 5. Buffer Model at each MU](image)

Step-3 This problem in particular becomes significant size of medical data under consideration is huge leading bottle neck problems.

Step-4 This explosion of medical data will need a more sophisticated database management strategy as well as cloud and virtual environments to enhance data discovery as well as ensure data security and privacy.

Step-5 These following dynamic buffering algorithm ensures the optimized power management scheme within the MU to hold the data in the queue for updating, to prevent queue over flows and thus reducing important health data losses.

Step-6 These results showed the efficiency of our queue buffer management proposal in reducing data losses within the medical fog data platform.

**4. DISTRIBUTED STOCHASTIC DECISION MAKING (DSDM) FOR ADAPTIVE DATA TRANSFER**

**Pseudo Code for data transfer**

Initializing values:

- ‘V’- channel adjustment.
- ‘G_i’ and ‘G_j’ transmit and receive antenna gain
- ‘W’ the BW of WS.

DSDM t=0.
‘T’—time for distinct operations.

While \( t < T \) do

Observes \( Q_i, h_{ij}, x, L(d) \).

Allocation of power distribution \( P_i(t) \) with:

\[
P_i(t) = \frac{V Q_i(t) W}{\ln 2 - x^2/ h_{ij}}
\]

Adjust the \( P_i(t) \) with:

\[
P_i(t) = \min \{ \max \{ P_i(t), P_{\text{min}} \}, P_{\text{max}} \}:
\]

Transmit bits with \( P_i(t) \):

End

In this paper, the DSDM Making algorithm with a new sensing technology is adopted to improve the performance of the proposed algorithm. This technology predicts the faults within the server and communication system between the nodes and alerts the system to overcome the predicted faults. Thus the proposed system performs more than the any existing system.

5. Simulation and Analysis
The above approaches are implemented using java as a programming language and net beans as a IDE, my sql as backend. Using Netbeans 8.0.2 in java it is very easy to implement the proposed dynamic buffering algorithm that ensures the optimized queue and power management scheme within the medical user’s device to hold the data in the queue for updating, to prevent queue over flows and thus reducing important health data losses. Results show the performance of proposed system. Table-1 shows the use case classes with their properties.

| Use Case | Computing | Real Time | Critical | Feedback |
|----------|-----------|-----------|----------|----------|
| BBCC     | No        | No        | No       | No       |
| BBCA     | No        | Yes       | No       | No       |
| BBDL     | Yes       | Yes       | No       | Yes      |
| BBM      | Yes       | Yes       | Yes      | Yes      |

Table-1 use case classes after using the proposed system.

| Algorithm                        | Energy Saved | Factors Considered     | Data Format from Sensors to Cloud |
|----------------------------------|--------------|------------------------|----------------------------------|
| Manual                           | --           | Time, Energy and Cost  | No                               |
| Round Robin Algorithm            | 70%          | Time, Energy and Cost  | Text Data                        |
| Dynamic Buffering Algorithm      | 90%          | Time, Energy and Cost  | Text data, image data and any other formatted data. |

Table-2, performance of the proposed system with Energy saved, factors, data format
Figure: 6. Performance of the algorithms.

Power faults and other faults such as performance, time computation and cost are shown the figure-6. According to the fog computing it is very important to find the faults occurring in the data transfer and maintaining the queue for the data transfer. The above graph shows the comparison and performance of the proposed algorithm with existing algorithms and it is shown that proposed algorithm performs better than the existing algorithms.

6. CONCLUSION

The proposed dynamic buffering algorithm that ensures the optimized queue and power management scheme within the medical user’s device to hold the data in the queue for updating, to prevent queue overflows and thus reducing important health data losses when involved entities are offline. The adopted sensor technology to identify the faults in the power management and other system faults shows the better performance to overcome the issues. This approach is a first of its kind approach in health care driven fog computing that can offer smooth automated data transitions.

References

[1] Redowan Mahmud, Fernando Luiz Koch, Rajkumar Buyya. 2018. Cloud-Fog Interoperability in IoT-enabled Healthcare Solutions. In ICDCN ’18: 19th International Conference on Distributed Computing and Networking, January 4–7, 2018, Varanasi, India. ACM, New York, NY, USA, 10 pages. https://doi.org/10.1145/3154273.3154347.

[2] P. K. Sharma, P. S. Kaushik, P. Agarwal, P. Jain, S. Agarwal and K. Dixit, "Issues and challenges of data security in a cloud computing environment," 2017 IEEE 8th Annual Ubiquitous Computing, Electronics and Mobile Communication Conference (UEMCON), New York City, NY, 2017, pp. 560-566, doi: 10.1109/UEMCON.2017.8249113.

[3] K. Hong, D. Lillethun, U. Ramachandran, B. Ottenwälder, and B. Koldehofe, “Mobile fog: A programming model for large-scale applications on the internet of things,” in Proceedings of the Second ACM SIGCOMM Workshop on Mobile Cloud Computing, ser. MCC’13. ACM, 2013, pp. 15–20.

[4] B. Ottenwalder, B. Koldehofe, K. Rothermel, and U. Ramachandran, “Migcep: Operator migration for mobility driven distributed complex event processing,” in Proceedings of the 7th ACM International Conference on Distributed Event-based Systems, ser. DEBS’13. ACM, 2013, pp. 183–194.
[5] J. Zhu, D. Chan, M. Prabhu, P. Natarajan, H. Hu, and F. Bonomi, “Improving web sites performance using edge servers in fog computing architecture,” in Service Oriented System Engineering (SOSE), 2013 IEEE 7th International Symposium on, March 2013, pp. 320–323.

[6] T. Nishio, R. Shinkuma, T. Takahashi, and N. B. Mandayam, “Service-oriented heterogeneous resource sharing for optimizing service latency in mobile cloud,” in Proceedings of the First International Workshop on Mobile Cloud Computing and Networking, ser. MobileCloud’13. ACM, 2013, pp. 19–26.

[7] H. Madsen, G. Albeanu, B. Burtschy, and F. Popentiu-Vladicescu, “Reliability in the utility computing era: Towards reliable fog computing” in Systems, Signals and Image Processing (IWSSIP), 2013 20th International Conference on, July 2013, pp. 43–46.

[8] BETaaS, “Building the environment for the things as a service,” BETaaS, Tech. Rep., Nov. 2012.

[9] S. Maharjan, Q. Zhu, Y. Zhang, S. Gjessing, and T. Basar, “Dependable demand response management in the smart grid: A stackelberg game approach,” Smart Grid, IEEE Transactions on, vol. 4, no. 1, pp. 120–132, March 2013.

[10] D. Korzyk, V. Conitzer, and R. Parr, “Solving stackelberg games with uncertain observability,” in The 10th International Conference on Autonomous Agents and Multiagent Systems - Volume 3, ser. AAMAS ’11, 2011, pp. 1013–1020.

[11] Z. Fadlullah, D. Quan, N. Kato, and I. Stojmenovic, “Gtes: An optimized game-theoretic demand-side management scheme for smart grid,” Systems Journal, IEEE, vol. 8, no. 2, pp. 588–597, June 2014.