Retraction

Retracted: Cloud Network and Mathematical Model Calculation Scheme for Dynamic Big Data

Yiren Chen; Zhiyong Qiu

IEEE Access

10.1109/ACCESS.2020.3009675

<p>Notice of Retraction</p> <p>Y. Chen and Z. Qiu, “Cloud network and mathematical model calculation scheme for dynamic big data,” IEEE Access, vol. 8, pp. 137322–137329, 2020, doi: 10.1109/ACCESS.2020.3009675.</p> <p>After careful and considered review by a duly constituted expert committee, this article was retracted owing to irregularities in the peer review process, including acceptance for publication without the minimum number of independent reviews required by IEEE.</p> <p>The authors were contacted about the retraction and did not dispute it.</p>

IEEE Access
Multidisciplinary : Rapid Review : Open Access Journal
SPECIAL SECTION ON GIGAPIXEL PANORAMIC VIDEO WITH VIRTUAL REALITY

Received June 17, 2020, accepted July 2, 2020, date of publication July 16, 2020, date of current version August 5, 2020.
Digital Object Identifier 10.1109/ACCESS.2020.3009675

Cloud Network and Mathematical Model Calculation Scheme for Dynamic Big Data

YIREN CHEN[1] AND ZHIYONG QIU[2]
[1]College of Mathematics and Statistics, Shenzhen University, Shenzhen 518060, China
[2]Tencent Inc., Shenzhen 518057, China

Corresponding author: Yiren Chen (yrchen@szu.edu.cn)

This work was supported in part by the NSF of Shenzhen University under Grant 2019082, and in part by the Outstanding Innovative Young Talents of Guangdong Province under Grant 2019KQNCX122.

ABSTRACT Cloud network oriented to dynamics big data is a popular way of big data operation at present. It is a big data that can be applied to human behavior under dynamics. Time-based features include communication, network access and migration activities combined with unique physiological characteristics to complete big data. This paper aims to study a new cloud hybrid network architecture based on edge computing. This article uses this architecture to tectonic fog calculation layer between cloud servers and devices using edge devices such as communications and networks. After analysis, the obtained results are actively cached on the fog computing device and compared with the data of the telecommunication network detection terminal on the fog device. To consider the final result. The experimental data show that the distributed computing scheme can achieve the goal of minimizing the task processing delay. The experimental results show that the cloud network of the dynamic big data can meet the requirements of the contemporary big data completely, and the utilization ratio of the big data can reach 90%, and the calculation scheme of the mathematical model can run completely.

INDEX TERMS Tunnel mechanical engineering, mining law, risk management, construction safety risk, risk assessment matrix.

I. INTRODUCTION

Dynamics big data is a kind of big data cloud computing system which is divided into four parts: cloud platform, cloud storage, terminal and security. Cloud platform is the basic platform to help us do cloud computing, the hardware resources we need are managed by him, mainly composed of memory, CPU, switch and so on, the platform virtually creates each data center through technology, and integrates to protect the difference between different underlying devices. Transparently provide various services to users, for users, the platform is three modes: public cloud, private cloud, mixed cloud. Shared Cloud is a third-party supplier to Guangzhou the public cloud platform for large users, and the user group can be accessed through the network. The private cloud is built only for a private user, so the cloud network of dynamical big data is built.

Dynamics big data in this era of vigorous development of science and technology has become the mainstream, because we have more and more demand for technology, so the construction of dynamics big data cloud network is particularly important, as the key to continuous development and improvement of new technology, data processing and analysis has become the most important scientific development. Now there are more and more data processing schemes at home and abroad, but how to choose suitable solutions for different purposes is a huge challenge to cloud computing model, a kind of computing model, we can easily share applications, storage schemes and various tools on the Internet, Work anytime, anywhere. The proposal of fog computing makes up for the deficiency of cloud computing and attracts the wide attention of experts and scholars. Cisco introduced fog, introducing the characteristics of fog computing, as well as the application network of fog computing in the Internet of things (including vehicles), smart grid, etc., and analyzed the interaction between fog and cloud [1], [2]. The fog meter is also studied to study the definition and application scenarios of the calculation. The study of fog computing in augmented reality (ar). Development and caching networks, mobile big data analysis and other applications.

The associate editor coordinating the review of this manuscript and approving it for publication was Zhihan Lv.

Singh SP has found that cloud computing plays a crucial role in processing large amounts of data. However, with the advent of the Internet of things, these devices produce huge data. Therefore, the cloud features need to be closer to the request generator to process these enormous data at a closer one-hop distance to the end user. This has led to the emergence of fog computing with the aim of providing storage and computing at the edge of the network, thereby reducing network traffic and overcoming many cloud computing flaws. Singh SP found that fog computing helped overcome the challenge of big data processing. Singh SP discusses FOG meter classification of computations, differences from cloud computing and edge computing technologies, their applications, emerging key technologies (i.e., communication and storage technologies), and the various challenges facing fog technologies [3]. The barik rk discovery spatial data infrastructure (sdi) is an important framework for sharing geospatial big data using networks. BarikRK believes that the integration of SDI with cloud computing has led to the emergence of Cloud SDI as a geospatial data transfer, processing and analysis tool. Fog computing is an example of using embedded computers to improve network throughput and reduce network edge latency. Bar ikrk developed and evaluated a fog-based sdi framework called geofog4health mining analysis from earth health big data [4].

Based on the definition of fog computing given by scholars, in order to distinguish fog computing from some related technologies, this paper defines fog computing as:" fog computing is an example of computing that is deployed between cloud computing and terminals. An edge computing layer constructed from heterogeneous, heterogeneous edge network devices that can provide computing, storage, and network services [5]–[7]. Edge computing is an open platform. We integrate the functions of network, computing, storage, and program applications into the data source of this open platform, while we provide marginalized intelligent network services to meet the industry's digitization, agility, practicality, and intelligence. And ensures securityall and privacy these key elements [8]–[10]. The difference between fog computation and edge computation is that the computation has a higher hierarchy and a flat architecture. In short, fog computing is a network of grass roots, while edge computing is a separate network node. There are a large number of equal docking among the nodes of fog computing, which is more advantageous than the edge computing which can only run in isolation in the isolated environment [11], [12]. This article uses this architecture to tectonic fog calculation layer between cloud servers and devices using edge devices such as communications and networks. After analysis, the result will be actively cached in the fog computing setup prepared and compared with the data of the telecommunication network detection terminal on the fog equipment to consider the final result. The distributed computing scheme can achieve the purpose of delay.

II. PROPOSED METHOD

A. NEW CLOUD/FOG HYBRID NETWORK ARCHITECTURE BASED ON EDGE COMPUTING

1) BRIEF ANALYSIS OF CLOUD COMPUTING TECHNOLOGY

Under the current cloud computing technology system, the Internet provides users with the services they need directly to users, thus replacing the single way of transferring data and information only to clients in the past. Data center is one of the most important resources for Internet enterprises to construct the infrastructure of cloud computing technology. With cloud computing technology now providing more and more services, reading materials tend to be complex and refined, which requires that the data center network architecture must be redesigned and optimized to adopt new ideas and the operational value of cloud computing, especially the most basic part of information transmission. The network layer Data forwarding as well as management mechanisms, these two contents must be redesigned to meet the transport requirements of now increasingly diverse cloud computing services [13].

2) PRINCIPLES OF NETWORK ARCHITECTURE DESIGN FOR DATA CENTRES IN CLOUD COMPUTING

Data center network architecture design is cloud computing data center has been built Important links in the process must be strictly in accordance with the relevant regulations and The design structure should conform to the corresponding technical index and performance index. Point in the network architecture design needs to adhere to the principles.

1) Extensibility. Data center network architecture design to ensure the scalable performance of the structure. That is, network systems and data are extensible. In terms of data, extensibility is reflected in the ability to maintain existing data or add new data to the use of data centers, that is, to add and delete and modify data types at any time when cloud computing data centers provide services to clients. On the system side, the extensibility is that the system can maintain the application according to the requirements of the application. Extensibility table on the system in the case of rapid increase in client access Now it can be quickly counted According to and application shunt, make system server even load.
2) Stability. Today's clients are in great demand for data on cloud computing services, and cloud computing's data centers need to work continuously for a long time, even under overloaded conditions. This requires that in the process of designing the network architecture of the data center, we should pay attention to the design of the stable performance, ensure that the data center can work stably for 24 hours after it is put into use, and provide the corresponding service to the client. Stability is an important index to measure the service quality of data center, and reasonable data center structure design

will greatly improve the stability performance of data center.

3) Safety performance. As the most important index of information system, the security performance of the system cannot be ignored. In the design process of the data center network of cloud computing, we should pay attention to the design of security performance, and the security performance directly affects the stability of the system. Good network architecture components have far-reaching significance for improving the security performance of the whole data center.

3) NETWORK TOPOLOGY OF CLOUD COMPUTING DATA CENTRES

In general, when building a data center network, it is more important to minimize the cost under the premise of ensuring high performance, which is the purpose of data center network construction. Here's a cloud computing data center network system that uses low-cost, single-model programmable switches and commercial-level servers to build a data center network topology. In order to reduce the cost of the enterprise and improve the cost-effective network, the low-cost switch and commercial and server are used to construct the data center. At present, most servers and PCs have more than two service ports to get bigger These service ports must be fully exploited for network throughput and improved connectivity of each node in the network topology. As shown in Fig 1 below: in Fig 1 above, the data center network topology diagram consists primarily of the same type of programmable switch. To ensure that any network port of each server allows broadband communication with a network hardware interface and is no longer constrained by the network communication broadband, the server in the middle splits the network into variants of two stacked tree structures. Based on the above mentioned cloud computing data center network topology the following several advantages: first, on the basis of making full use of the two network ports of the server, it increases the throughput of the network and improves the connectivity of the network. Second, the use of more switches reduces the cost of the company's build compared to the traditional tree structure. Again, traditional tree structures are often prone to single-point failures, and now this construction solves the problem while enhancing fault tolerance. Finally, in the above network structure, a path of equal length can be chosen between any server or two.

Cloud computing has powerful computing and storage capabilities to compare and compute patient medical test data with big data analysis and mining results transmitted to the cloud [14]. In order to solve the problems existing in the medical big data computing framework in the present traditional application, we propose a new framework to solve such problems. Based on the edge of the calculation, a new hybrid computing framework is applied, as shown in Fig 1.

The network architecture is mainly divided into three layers: cloud computing layer, fog computing layer and infrastructure layer [15]. Among them, the cloud computing layer is

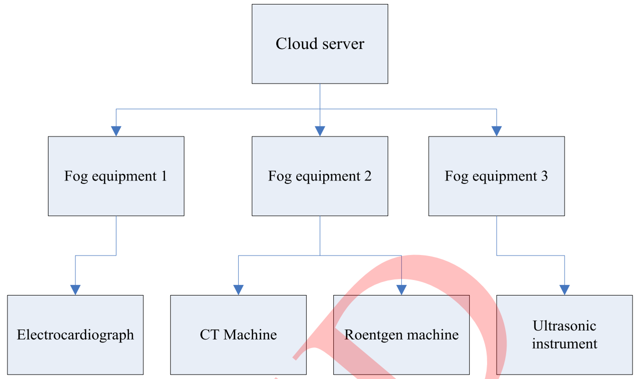

FIGURE 1. New cloud/fog hybrid network architecture based on edge computing.

composed of high performance server clusters with powerful computing and storage functions, so that the collected medical big data can be stored in the server, and then the desired results can be obtained and analyzed by using computing and mining [16]. At the same time, the device downloads the required drug directory to the storage server, then uses the active cache to obtain the data according to the needs of the surrounding department, and then analyzes the results. The resulting results are transmitted and stored. Mist equipment can receive and store terminal equipment detection during medical process to the data, and based on these data to get the analysis results, so as to compare, analyze, and at the same time, these comparison data, the results are uploaded to the server to achieve information sharing. hesiting that these medical devices have a large amount of detection information, the edge computing devices can perform distributed computing to balance the load, facilitate the short time to get the diagnosis results, and provide the medical staff for reference, and solve the problem of long waiting time and more consultation times in the medical process [17].

B. THE THEORETICAL MODEL OF CLOUD/FOG NETWORK DISTRIBUTED COMPUTING

Because multiple k fog computing devices $(z_1, z_2, \ldots, z_k)$ are considered, these devices form many edge computing clouds/fogs, which make up the hybrid network. The fog network nodes in the above network are abstracted as weighted undirected graphs G = (V, E) [16]. where zi is the device for vertex fog computation, $v = \{z_1, z_2, .., z_i.., z_k\}$ is the set of many vertices, which we call the vertex set. We usually use k to indicate the number of equipment in fog calculation. The edge set is then $E = \{e_{z1,z2,}.. e_{zi,zj}.., e_{zk-1,zk}\}$, which is our definition, communication link we use edge $e_{zi,zj}$ and fog compute the connection between node z_i and z_j as representation [17]. The communication delay is then represented by the relation between the weights $\tau_{zi,zj}$ and fog computation nodes $\{z_i, z_j\}$ on the edge. We assume that the computational power of z_i is v_{zi}. We represent each fog computing node in this way [18]. Each time the user performs the task, this computing task d is given to zi, the fog computing device that is submitted to the connection. Meanwhile, Z_i will divide the task D so as to be able to satisfy several sub-tasks $di = \delta$, and also assign it to the computing node including itself for the calculation [19]. Therefore, the total time t of the whole computing task D can be expressed as the edge computing fog network.

$$t\left(\delta_i\right) = \max\{\frac{\delta_i D}{v_{z_i}} + \tau_{z_i}, z_i m_{z_i}, z_i\} \tag{1}$$

so in the formula: z_i denotes the processing subtask, while d_i denotes time, so δid/vzi denotes that it can only be a computational device; so the τzi, zjmzi in the formula, and the communication overhead denotes the relational variables between (zi, zj), where the existence of the subtask is between m_{zi}, z_j denotes (zi, zj). If there is a sub-task distribution relation, then it is represented by the distribution relation of $m_{zi}, z_j = 1$, so $m_{zi}, z_j = 0$ means there is no sub-task allocation relation. since the processing time of the total distributed computing task is equal to the maximum computational delay of all sub-tasks, in order to achieve the goal of minimum processing delay, we must find the best δi set to minimize the objective function t. In summary, the whole process can be modeled as follows

$$\min\left\{\max\left[\frac{\delta_i D}{v_{z_i}} + \tau_{z_i}, z_i m_{z_i}, z_i\right]\right\}, i, j = 1, 2, \ldots, k \quad \text{s.t.} \tag{2}$$

$$m_{z_i} = \begin{cases} 1, & \delta_i \neq 0 \\ 0, & \delta_i = 0 \end{cases}, \sum_{i=1}^{k} \delta_i = 1 \tag{3}$$

the subcalculation task $di = \delta$id is required to be processed on each fog computation node, so the k-dimensional vector $d = [d,d,d,..,d]$, can be represented and formed in computational subtasks processed on k fog computing nodes. So when considering the specific case, D can come from any node and as its computing task, since node z1 comes to assume it. According to Equation (1), in total time t, tasks D to be processed in the edge computing fog network can be expressed as:

$$t(d) = \max\{\frac{d_1}{v_{z_1}} + \tau_{z_1}, z_1 m_{z_1}, \ldots, \frac{d_k}{v_{z_k}} + \tau_{z_1}, z_k m_{z_1}, z_k\} \tag{4}$$

Therefore, the solution of task d_i can be attributed to the following optimization problems for each computing node in a fog network, that is, for task vector d

$$d = \arg\min_{d \in I}\{t(d)\} \tag{5}$$

C. CPSO-LB ALGORITHM

The fast convergence rate is one of the main characteristics of particle swarm optimization (pso). Because of the advantages of strong overall search ability and easy programming, the particle swarm optimization algorithm is selected in this big data scenario. To solve the above optimization problems [19]. Optimal position $i = 1$ setting x, when using the pso algorithm to solve the optimization problem in equation (4), the particle group *{xl (i)}* moves in the search space i to find, l \8712;{0,.., Lmax} is the number of iterations and Lmax is the maximum number of iterations. Where s is the size of the particle set. The bit of the first particle Set and speed can be expressed as:

$$sX_i^l = \left[x_{i1}^l, x_{i2}^l, \ldots, x_{ik}^l\right] \tag{6}$$

$$v_i^l = \left[v_{i1}^l, v_{i2}^l, \ldots, v_{ik}^l\right] \tag{7}$$

Since the optimization problem in formula (4) is a constrained optimization problem, this paper uses the CPSO-LB algorithm to solve the problem. The fitness function f (X) is defined as follows:

$$f(x) = \begin{cases} t(x), & x \in F \\ t(x) + r\sum_{j=1}^{k+1} t(X) + \varphi(X, l), & x \in I - F \end{cases} \tag{8}$$

In the formula: f denotes the feasible domain in the search space, r is the penalty factor, tj (x) is the constraint violation measure of the non-feasible particle for the j-th constraint, The expressions t (X) and (X, l) are:

$$t_j(X) = \begin{cases} \max(0, -X(j)), & 1 \\ \left|\sum_{i=1}^{k} X(i) - D\right|, & j = k+1 \end{cases} \tag{9}$$

$$\varphi(X, l) = C(l) - \min\{t(X) + r\sum_{j=1}^{k+1} t(X)\} \tag{10}$$

D. SYSTEM MODELING AND PROBLEM MODELING

We consider a network of fog node carrier centers consisting of N UEs, a WiFi AP type and a remote node [20]. Make the UE set N. Each UE is connected to the fog node through a wireless link, and the fog node and the cloud center are connected by a high-speed fiber. Each UE has an indivisible application processing. In this architecture, you can process the user ' s application locally or uninstall it to a remote application by the following procedure [21]. First, each UE sends an uninstall request (e.g., information about the UE and the application running on it. For example, UE's local processing power, the power of the UE, the maximum tolerable delay of the application, etc. The decision center collects all users' uninstall requests and instantaneous wireless channel gain information, and then based on this information, determine whether to process the user's application locally on the UE, or to uninstall it to the fog node for execution, or to uninstall it to the cloud, and then send the uninstall decision to the corresponding UE. Since the uninstall request is usually small, we do not consider the queue delay of the uninstall request [22]–[24]. Meanwhile, we do not consider the decision delay of decision center [25].

III. EXPERIMENT

A. FOG COMPUTING AND CLOUD COMPUTING SIMULATION EXPERIMENT

Use this architecture to build a fog computing layer between cloud servers and devices that use edge devices such as communications and networks.After analysis, the obtained results are actively cached on the fog computing device and compared with the data of the telecommunication network detection terminal on the fog device to consider the final result. We want to verify whether the algorithm is reasonable and effective, whether it can really reduce the most reasonable use of resources, high quality and efficient completion of our task. So the experiment is set. First we choose the corresponding terminal data as the measurement index. The average response of the node is often calculated when the terminal requests data. Then we use two A variety of different algorithms to compare the good or bad of this index, so as to measure the algorithm to some extent [26]–[28]. The specific corresponding data are shown in table 1.

TABLE 1. Response data of model 1 (in seconds).

	Response time in traditional mode	Response time to the first algorithm in this experiment	Response time to the second algorithm in this experiment
service terminal A	35	12	15
service terminal B	34	13	13
service terminal C	36	13	15
service terminal D	33	14	13

B. CONCRETE STEPS FOR SIMULATION OF FOG COMPUTING AND CLOUD COMPUTING

(1) First define two sets, A and B. Where set A is the set B of the edge data stored in the fog computing algorithm represents the set of the computing data stored in the cloud computing algorithm.
(2) Using the MTALAB platform to simulate 20 to 50 end users sending instructions for requesting data to the server.
(3) Distribute the requested data to the set A, and the data to the edge storage of the fog computation to test its response time.
(4) Distribute the requested data into set B, data to the cloud computing node, and then test its response time.
(5) Compare the response time of the two algorithms and measure the cheapness of the two algorithms by comparing them. Its specific simulation process is shown in Fig 2.

IV. DISCUSSION

A. RESULTS AND ANALYSIS

This section combines the cf-cpso-lb with the processing characters of medical big data, using the performance delay of cloud computing networks and individual fog nodes to

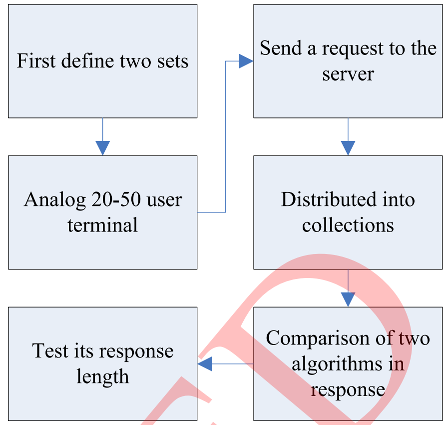

FIGURE 2. Simulation step implementation.

analyze the execution order and ratio α in execution task d. Meanwhile, weighting algorithms err and pick-kx validation are performed between different services and algorithms of the cf-cpso-lb processing network [29], [30]. The load balancing algorithm is compared with other common algorithms. Use this system for calculations set to 10 GHz. The computing power and one-way communication of each fog computing node, where i = 1 … 10, and the communication delay only considers devices and connections. The task of receiving the task. Assign communication delays between devices, and task initialization uses random assignments. The basic parameters of the cpso-lb algorithm are: population size s = 50, maximum number of iterations lmax = 1000, acceleration factor c1 = c2 = 1, inertial weight w = 1.2, penalty factor r = 10, control parameter c (0) = 106.

TABLE 2. Comparison of task processing delays between CF-CPSO-LB.

Volume of tasks	Individual fog nodes	CF-CPSO-LB
1.8	2	2
1.9	4	3
2	6	3.5
2.2	8	3.7
2.5	10	4.2

B. ANALYSIS OF DELAY PERFORMANCE OF CF-CPSO-LB

To verify the effectiveness of the proposed cf-cpso-lb network, the efficiency of this paper compares the business processing latency of this network with traditional cloud computing networks and individual fog nodes as shown in table 2. This experiment simulates the real network environment and simulates the network model. The selected single fog node is the receiving node z1 and α is 0. The comparison results are shown in Fig 3.

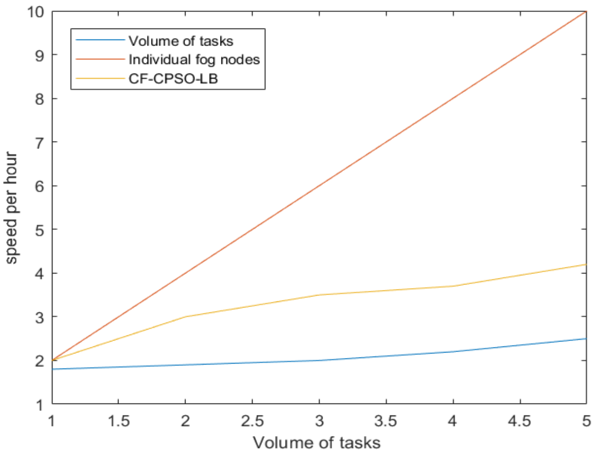

FIGURE 3. **Comparison of task processing delays between CF-CPSO-LB.**

When the task quantity D is close to 0, there is still a certain task processing delay due to the existence of communication link overhead. As shown in the result of figure 3, when the task quantity is less than 1 gb, the single task processing node of this system will not delay to cause the node overhead increase delay. At the same time, although the performance of cloud computing network is better than that of fog equipment, because the cloud server is far away from the terminal and the communication cost is higher, the processing delay of business is higher than that of CF-CPSO-. Pounds. Because of the limited computing power of a single fog node, it shows poor delay performance as the number of tasks continues to increase. At the same time, there is a threshold value, so that the delay of distributed computing in the fog network is no longer better than the cloud computing network. That is, when d >12.78 gb, the cloud computing network will rely on its strong computational performance to effectively reduce task processing time and make its delay performance better than cf-cpso-lb. Therefore, CF-CPSO-LB processing for appropriate tasks can be more effective in reducing service processing latency than using only traditional cloud computing networks.

C. EFFECT OF SERIAL TASK PERCENTAGE A ON TASK PROCESSING DELAY

Since not all parts of task D can be assigned, it is necessary to study the ratio of tasks that must be performed sequentially to the total tasks in task D. α to CF-CPSO-LB delay is shown in Table 3.

As shown in Fig 4, the smaller the α, the smaller the ratio that must be performed continuously in the total task D, the smaller the delay of the CF-CPSO-LB processing task. At the same time, the simulation results in Fig 4 also prove the efficiency of distributed computing in reducing the delay of business processing. In addition, this paper compares the latency performance of cloud computing networks with a parameter,Fig 4 shows that when the number of tasks is in a certain range, the delay performance of the fog network is completely better than that of the cloud computing network. The ratio of continuous tasks to tasks performed by fog networks has certain limits. As shown in Fig 5, when the workload is less than 1.8 gb, the delay of fog network is completely smaller than that of cloud computing only when α is less than 0.1. network, which means that when the serial ratio in task D is less than 0.1, the use of fog network can effectively reduce the delay.

TABLE 3. **Shadow of CF-CPSO-LB task processing delay ring.**

a=0.0	a=0.1	a=0.5	a=0.9	a=1.0
0	0	0	0	0
4	8	20	15	30
5	10	30	30	50
7	15	45	50	70
10	20	60	80	100

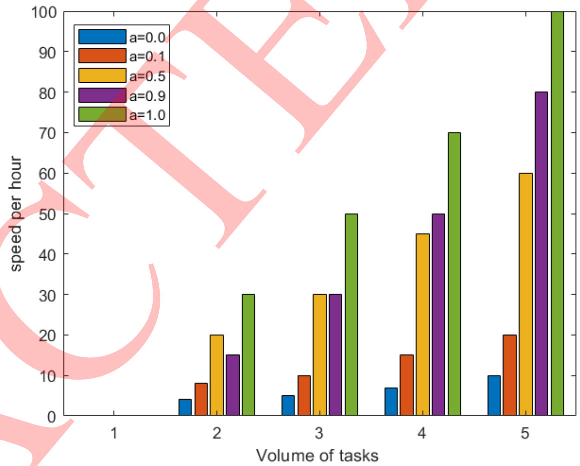

FIGURE 4. **Shadow of CF-CPSO-LB task processing delay ring.**

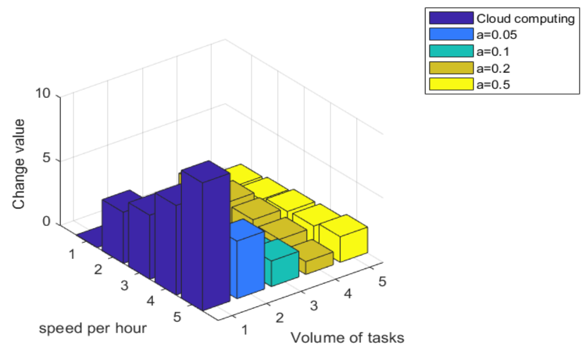

FIGURE 5. **Comparison of ductility between cloud computing networks.**

TABLE 4. Comparison of ductility between cloud computing networks.

Cloud computing	a=0.05	a=0.1	a=0.2	a=0.5
0	0	0	2	1
4	2	0.5	1.9	1.2
5	2.5	1	1.8	1.5
7	3.5	1.5	1.5	1.6
10	4.5	2	1	2

TABLE 5. Comparison of delay performance between CPSO-LB.

WRR	Pick-KX	Greedy-LB	CPSO-LB
0	0	0	0
5	4	2	1
9	6	3.5	2.2
10	8	4.5	3.3
12	10	6	4

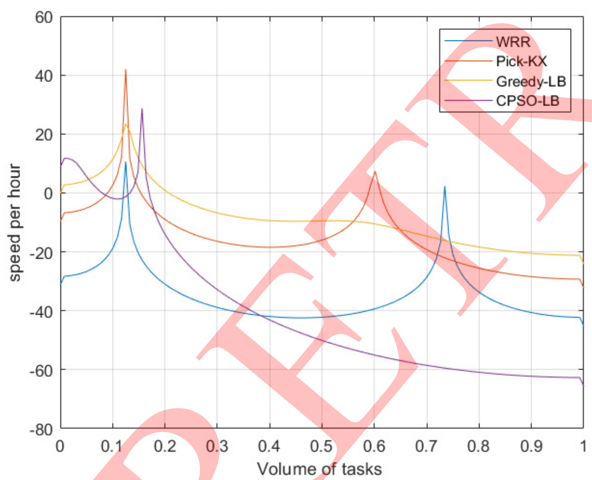

FIGURE 6. Comparison of delay performance between CPSO-LB.

D. COMPARISON OF DELAY PERFORMANCE BETWEEN CPSO-LB AND SOME CLASSICAL LOAD BALANCING ALGORITHMS

To test the performance of the cpso-lb algorithm in reducing the delay in business processing, this paper compares the pick-kx algorithm with the greeddy-lb load balancing algorithm (greedy-lb) using the weighted wheel-cycle algorithm. Three load balancing algorithms are compared, α is 0, and the simulation results are shown in Table 4.

As shown in Fig 6, when the amount of tasks to be processed is small, the delay difference between the four algorithms is not obvious. As the amount of tasks increases, the advantages of the CPSO-LB algorithm are gradually realized, and when the amount of tasks is 6Gb.Compared with the other three algorithms, the delay performance of CPSO-LB is improved compared with the other three algorithms 5 per cent,56 per cent and 37 per cent. It fully proves that applying the CPSO-LB algorithm to the new cloud/fog hybrid network can reduce the business processing delay and enhance the user experience more effectively than several other algorithms.

V. CONCLUSION

In the traditional technology, when the cloud computing data center uses in the medical aspect, the processing medical big data application, has the question which cannot satisfy the instant. In this paper, we propose a cloud network and mathematical model calculation scheme of the base plane dynamics big data, that is, constructing a marginalized fog computing layer between the medical service terminal and the computing center to detect our clinical medical equipment and put the measured medical data into this computing layer. So as to solve the problem of high delay, reduce the time of data processing, improve the efficiency of clinical medical treatment, and improve the user experience. At the same time, we propose a fog layer network mode through which we can distributed computing task processing, based on the CPSO-LB load balancing strategy to balance the load of the fog network, this can better reduce the clinical time consumed and reduce unnecessary expenses.

The generation of fog computing is a fill-in to cloud computing, which extends to more marginal and nuanced areas, filling the gap in cloud computing. On the basis of the original equipment technology framework, more customers can better provide computing, storage services, reduce the cost of time to meet different needs. It is necessary to develop fog computing technology.

Nowadays we are demanding more and more computation speed. Because the cloud computing technology has the extremely high delay problem in the application, has caused the very big trouble to our data transmission, the storage, the application, cannot be widely applied to the service cloud cloud network architecture system which has the extremely high demand for the instant, we apply the SDN controller to the system centralized control processing, the resources as well as the load balance, has greatly reduced the time and the expense. Using the cloud data center as a whole computing node, we combine it with the fog computing network for distributed joint computing, thus realizing the low-delay processing process and improving the network the convenience of network computing. This system uses this experimental architecture to build different aspects of fog computing between a cloud server and a device that uses edge devices (such as communications and networks).after analysis, the obtained results are actively cached on the fog computing device and compared with the data of the telecommunication network detection terminal on the fog device to consider the final result. The experimental data show that the distributed computing scheme can achieve the goal of minimizing the task processing delay using the constrained particle swarm optimization load balancing (cpso-lb) algorithm. The experimental results show that the cloud network of dynamic big data can meet the requirements of modern big data, and the utilization rate of big data can be improved up to 90%.

REFERENCES

[1] X. L. He, Z. Y. Ren, C. H. Shi, and C. Li, "Cloud and fog network for medical big data and its distributed computing scheme," *J. Xi'an Jiaotong Univ.*, vol. 1, no. 10, pp. 106–188. 2016.

[2] D. M. Cheng and Z. Li, "Hospital information service system based on fog computing," *Comput. Sci.*, vol. 5, no. 07, pp. 188–195. 2015.

[3] S. P. Singh, A. Nayyar, R. Kumar, and A. Sharma, "Fog computing: From architecture to edge computing and big data processing," *J. Supercomput.*, vol. 75, no. 4, pp. 2070–2105, Apr. 2019.

[4] R. K. Barik, H. Dubey, K. Mankodiya, S. A. Sasane, and C. Misra, "GeoFog4Health: A fog-based SDI framework for geospatial health big data analysis," *J. Ambient Intell. Hum. Comput.*, vol. 10, no. 2, pp. 551–567, Feb. 2019.

[5] H. Gamal El Din Hassan Ali, I. A. Saroit, and A. M. Kotb, "Grouped tasks scheduling algorithm based on QoS in cloud computing network," *Egyptian Informat. J.*, vol. 18, no. 1, pp. 11–19, Mar. 2017.

[6] R. Gupta, "Resource provisioning and scheduling techniques of IoT based applications in fog computing," *Int. J. Fog Comput.*, vol. 2, no. 2, pp. 57–70, Jul. 2019.

[7] K. Gai, M. Qiu, L. Tao, and Y. Zhu, "Intrusion detection techniques for mobile cloud computing in heterogeneous 5G," *Secur. Commun. Netw.*, vol. 9, no. 16, pp. 3049–3058, Nov. 2016.

[8] B. I. E. M. Ismail Goortani and M. B. Ab Karim, "Evaluation of docker as edge computing platform," in *Proc. IEEE Conf. Open Syst. (ICOS)*, Jan. 2015, vol. 5, no. 1, pp. 130–135.

[9] J. Oueis, E. C. Strinati, and S. Barbarossa, "The fog balancing: Load distribution for small cell cloud computing," *IEEE Trans. Vehicular Technol.*, vol. 25, no. 7, pp. 385–399, Oct. 2015.

[10] Yingjuan. Zhejiang, "Analysis and application of software architecture of fog computing platform," *Normal Univ.*, vol. 30, no. 5, pp. 1025–1333. 2016.

[11] Q. Guo, "Task scheduling based on ant colony optimization in cloud environment," *AIP Conf. Proc.*, vol. 1834, no. 1, 2017, Art. no. 040039.

[12] H. W. Li, "Research on short-term electricity price prediction based on cloud computing and BP neural network," *North China Electr. Power Univ.*, vol. 36, no. 15, pp. 985–1211. 2015.

[13] L. Nie, D. Jiang, and Z. Lv, "Modeling network traffic for traffic matrix estimation and anomaly detection based on Bayesian network in cloud computing networks," *Ann. Telecommun.*, vol. 72, nos. 5–6, pp. 297–305, Jun. 2017.

[14] R. Deng, R. Lu, C. Lai, T. H. Luan, and H. Liang, "Optimal workload allocation in fog-cloud computing toward balanced delay and power consumption," *IEEE Internet Things J.*, vol. 3, no. 6, pp. 1171–1181, Dec. 2016.

[15] S. Singh, "Load balancing algorithms in cloud computing environment," *Int. J. Adv. Res. Comput. Sci.*, vol. 9, no. 2, p. 397. 2018.

[16] X. He, Z. Ren, C. Shi, and J. Fang, "A novel load balancing strategy of software-defined cloud/fog networking in the Internet of vehicles," *China Commun.*, vol. 13, no. 2, pp. 140–149, 2016.

[17] K. Intharawijitr, K. Iida, and H. Koga, "Simulation study of low latency network architecture using mobile edge computing," *IEICE Trans. Inf. Syst.*, vol. E100.D, no. 5, pp. 963–972, 2017.

[18] K. H., F. M., M. R., and H. Fajraoui, "Cloud computing security challenges in higher educational Institutions–A survey," *Int. J. Comput. Appl.*, vol. 161, no. 6, pp. 22–29, Mar. 2017.

[19] S. Khan, S. Parkinson, and Y. Qin, "Fog computing security: A review of current applications and security solutions," *J. Cloud Comput.*, vol. 6, no. 1, p. 19, Dec. 2017.

[20] M. Sarkar, S. Banerjee, Y. Badr, and A. K. Sangaiah, "Configuring a trusted cloud service model for smart city exploration using hybrid intelligence," *Int. J. Ambient Comput. Intell.*, vol. 8, no. 3, pp. 1–21, Jul. 2017.

[21] P. Hu, H. Ning, T. Qiu, Y. Zhang, and X. Luo, "Fog computing based face identification and resolution scheme in Internet of Things," *IEEE Trans. Ind. Informat.*, vol. 13, no. 4, pp. 1910–1920, Aug. 2017.

[22] V. G. Menon and P. J. Prathap, "Moving from vehicular cloud computing to vehicular fog computing: Issues and challenges," *Int. J. Comput. Sci. Eng.*, vol. 9, no. 2, pp. 14–18. 2017.

[23] R. Moreno-Vozmediano, R. S. Montero, E. Huedo, and I. M. Llorente, "Cross-site virtual network in cloud and fog computing," *IEEE Cloud Comput.*, vol. 4, no. 2, pp. 46–53, Mar. 2017.

[24] Nielsen, Rasmus Østergaard, "Shedding light on the etiology of sports injuries: A look behind the scenes of time-to-event analyses," *IEEE Sensors J.*, vol. 46, no. 4, pp. 1–34, Feb. 2016.

[25] K. Koren, P. Ø. Jensen, and M. Kühl, "Development of a rechargeable optical hydrogen peroxide sensor – sensor design and biological application," *Analyst*, vol. 141, no. 14, pp. 4332–4339, 2016.

[26] H. Liu, H. Kou, C. Yan, and L. Qi, "Link prediction in paper citation network to construct paper correlation graph," *EURASIP J. Wireless Commun. Netw.*, vol. 2019, no. 1, pp. 1–12, Dec. 2019.

[27] W. Gong, L. Qi, and Y. Xu, "Privacy-aware multidimensional mobile service quality prediction and recommendation in distributed fog environment," *Wireless Commun. Mobile Comput.*, vol. 2018, Apr. 2018, Art. no. 3075849.

[28] M. A. Rahman, M. M. Hasan, and A. T. Asyhari, "A 3D-collaborative wireless network: Towards resilient communication for rescuing flood victims," in *IEEE 15th Intl Conf Dependable, Autonomic Secure Comput.*, Oct. 2017, pp. 385–390.

[29] F. Piccialli, S. Cuomo, V. S. D. Cola, and G. Casolla, "A machine learning approach for IoT cultural data," *J. Ambient Intell. Hum. Comput.*, pp. 1–12, Sep. 2019.

[30] H. Song, *Smart Cities: Foundations, Principles, and Applications*. Hoboken, NJ, USA: Wiley, 2017.

YIREN CHEN received the bachelor's and Ph.D. degrees from the South China University of Technology, Guangzhou, China, in 2013 and 2017, respectively, totally eight years combined for the bachelor's and Ph.D. degrees. He is currently an Assistant Professor with Shenzhen University, China. His current research interests are in the areas of mathematical models, big data, and dynamics research for applications.

ZHIYONG QIU received the bachelor's and master's degrees from the South China University of Technology, Guangzhou, China, in 2013 and 2015, respectively, totally six years combined for the bachelor's and master's degrees. He is currently an Algorithm Engineer of Tencent Inc., China. His current research interests are in the areas of mathematical models and data mining.