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Intelligent Knowledge Based Algorithm for Internet Quality of Services Enhancement

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Abstract
The accumulated knowledge in the internet servers can be utilized for its performance enhancement. In this paper an intelligent knowledge-based algorithm (IKB) proposed for internet quality of services enhancement. The enhancement achieved by optimizing the bandwidth distribution in the network and adaptation of on demand bandwidth distribution concept. The internet customer behavior can be used to extract the set of indicators of the services and bandwidth demand. A MATLAB simulation program is written based on the physical and mathematical modelling taking in consideration the flow in and out of the user traffic. The results include the utilization concept and the QoS improvement percentages.

Keyword: Intelligent algorithm, Knowledge based Algorithm, QoS enhancement, Internet performance, Bandwidth distribution.

1. Introduction
Data can be collected from various sources. Those sources might be stand alone or a node in a certain network. Those data buildup a group on information. The knowledge can be extracted from an inter related group of information. Thus, A knowledge base is online library of information about an application, product, service, department, or software. Many knowledge bases are structured around artificial intelligence that can interact and respond to user input. Others are simply indexed encyclopedias. There are also machine-readable knowledge bases that store content in system-readable forms. Solutions are based on automated deductive reasoning. When a user enters a query, software helps narrow down the solution.

A knowledge base is considered as a foundation for the knowledge management practice. Knowledge management enables user to create, curate, share, utilize and manage knowledge across their whole company and across industries for performance enhancement. There is a demand of deep knowledge base from the network users. Strong knowledge base and knowledge management practice, empower the organization with ability to deliver faster service, improve self-service, give greater access to more articles, and offer regular updates through that knowledge management system.

Knowledge extraction model is based on a predictive analytics technique. Predictive analytics is the practice of extracting information from existing data sets in order to determine patterns and predict future outcomes and trends. Predictive analytics does forecasts what might happen in the future with an acceptable level of reliability, and includes what-if scenarios and risk assessment. Predictive analytics is a category of data analytics aimed at making predictions about future outcomes based on historical data and analytics techniques such as statistical modeling and machine learning. The science of predictive analytics can generate future insights with a significant degree of precision. Predictive analytics uses historical data to predict future events. Typically, historical data is used to build a mathematical model that captures important trends. That predictive model is then used on current data to predict what will happen next, or to suggest actions to take for optimal outcomes [1].

2. Related Research work

In 2018, Aida A. Nasr, Nirmeen A. El-Bahnasawy, Gamal Attiya, Ayman El-Sayed, Proposed a (New online scheduling approach for enhancing QoS in cloud), their paper represents a new task scheduling approach called (Online Potential Finish Time (OPFT)),to decorate the cloud data-center broker, that's chargeable for the scheduling manner, consequently decorate QoS in cloud, due to the fact scheduling plays crucial role in optimizing QoS. The experimental outcomes mean that the proposed OPFT is extra gifted than the FCFS, RR, Min-Min, and MCT algorithms in terms of schedule length, cost, balance degree and resource utilization [2].

In 2015 AFuzan Chen, Minqiang Li, Runliang Dou, Harris Wu, Shanshan Hao, proposed a technique (A flexible QoS-aware web service composition method by multi-objective optimization in cloud manufacturing). The core of the cloud manufacturing is choosing suitable service for each component of a service composition from a group of functionally identical service to gratify the users' end-to-end QoS constraints. So that the QoS-aware Web service composition (QWSC) proposed to help users to make a supple decision, the problem of QWSC is formulated to a multi-objective enhancing model where either QoS performance or QoS risk (difference comparing to the user`s QoS requirement) is the individual optimization objective. And then, an efficient ε-dominance multi-objective evolutionary algorithm (EDMOEA) is developed to solve the presented model, the results show the helpfulness and efficiency of the proposed method [3].

In 2019, Xing Chen, Haijiang Wanga,b, Yun Mac, Xianghan Zheng, Longkun Guo, developed a method called (A Self-Adaptive Resource Allocation For Cloud-Based Software Services Based On Iterative QoS Prediction Model),the self-adaptive resource allocation is concentrate on machine learning and control theory. But machine learning techniques need multitude training data, which is insufficient and results in decrease accuracy of QoS prediction model and the inefficiency of resource allocation, while resource allocation based on control theory needs a large number of iterations, resulting in ahigh overhead like frequent virtual machine switches. This method improves the predicted QoS value, and the percentages of optimization in QoS prediction accuracy is 15% and in resource allocation 5%–6% [4].

In 2015, Sangeeta R. Alagi, Srinu Dharavath, Proposed a (Efficient Algorithm For Predicting QoS In Cloud Services), the high-quality cloud applications has extensive demand. QoS rankings provide optimal cloud service selection. To obtain QoS values, avoid the time-consuming and expensive real-world service invocation, they proposed Cloud Rank Framework for QoS ranking prediction framework for cloud services and described Amazon.com recommendation. The results show a personalized ranking prediction framework Cloud Rank, used to predict the QoS ranking of a set of cloud services without requiring additional real-world service invocations from the intended users. For making personalized ranking prediction it uses past experience of other use. It generally uses utilizing content information Technique [5].

In 2016, J. Amudhavel1, R. Vigneshwaran1, A. Janakiram1, S. Jarina1, K. Prem kumar, B. Anantharaj and D. Sathian, Madean analysis (An Empirical Analysis on Quality of Services (Qo) In Cloud Computing) using of Quality of Services based on the three approaches is comparison, evaluation and trustworthiness of the services. Findings: Cloud services have some problems in the data stored which are not secure and network dependency. The QoS parameters are speed of the performance, processing, storage, memory allocation, security, functions, service response time and total throughput. The Quality of Services can be predicted by the workflow model and the ranking prediction approaches. Applications/Improvements: The result observed from this work will serve as the motivation to improve service response time and total throughput therefore improve quality of service in cloud environment [6].

In 2013, Sonal Dubey, Sanjay Agrawal, discussed a (QoS Driven Task Scheduling in Cloud Computing) Real-time applications play a significant role in cloud environment. The particular scheduling algorithms have been tested for real-time tasks and priority-based strategies. Their paper discussed the fixed priority preemptive task scheduling algorithms in cloud computing for improving the QoS parameters [7].

In 2012, Tiejiang Liu, Tun Lua, Wei Wanga, Qi Wanga, Zhenyu Liu, Ning Gua, Xianghua Ding, presented a system (SDMS-O: A Service Deployment Management System for Optimization In Clouds While Guaranteeing User's QoS Requirements), cloud vendors must manage effectively and the cost of service deployment, the SDMS-O designed with a novel optimization approach to improve deployment effectiveness and decrease deployment cost while guaranteeing the users' QoS requirements. Also, the safety and usability in are evaluated. A simulated test of SDMS-O demonstrates method's effectiveness and efficiency [8].

In 2015, Manar ABOUREZQ and Abdellah IDRISSI, developed a system (Integration of QoS Aspects in the Cloud Computing Research and Selection System), the need to search through Cloud services and select the ones that meet certain requirements. To adaptive this need, the Cloud Service Research and Selection System (CSRSS) allow Cloud users to search through Cloud services in the database and find the ones that match their requirements, the system used method called ELECTREIS Skyline to determine which Cloud services meet better the users' requirements. The method designed and evaluated for a total of 10 dimensions and for 50 000 cloud services. The results show the effectiveness [9].

In 2015, Snehal A.Narale, P.K.Butey, made a study (Cloud Computing Techniques Helps to Meet QoS), The resource provision provides the QoS(quality of service) in cloud computing, Users must use different techniques such as dynamic resource provisioning, scheduling, admission control and traffic control. Resource provisioning used for ensuring guaranteed. Admission control methods are used to determine whether or not to admit a set of services to the cloud and scheduling is used to increase the resource utilization. In the paper the scheduling techniques and its types, admission control and resource provisioning techniques have been studied to optimize the QoS in cloud computing [10].

In 2017, K. J. Modi1, D.P. Chowdhury, proposed a framework (A Framework for Management and Monitoring of QoS -Based Cloud Services), the major challenge in the cloud environment is maintaining the Quality-of-Service (QoS), where cloud provider has to manage the resources to provide promised QoS metrics such as, performance, availability, reliability and cost. To measure what quality of the services, we require monitoring the cloud computing services. Monitoring is important for both customer and service provider. They proposed the general framework and addressed the different aspects related to management and monitoring of QoS-based cloud computing services, and discuss the key issues and challenges related [11].

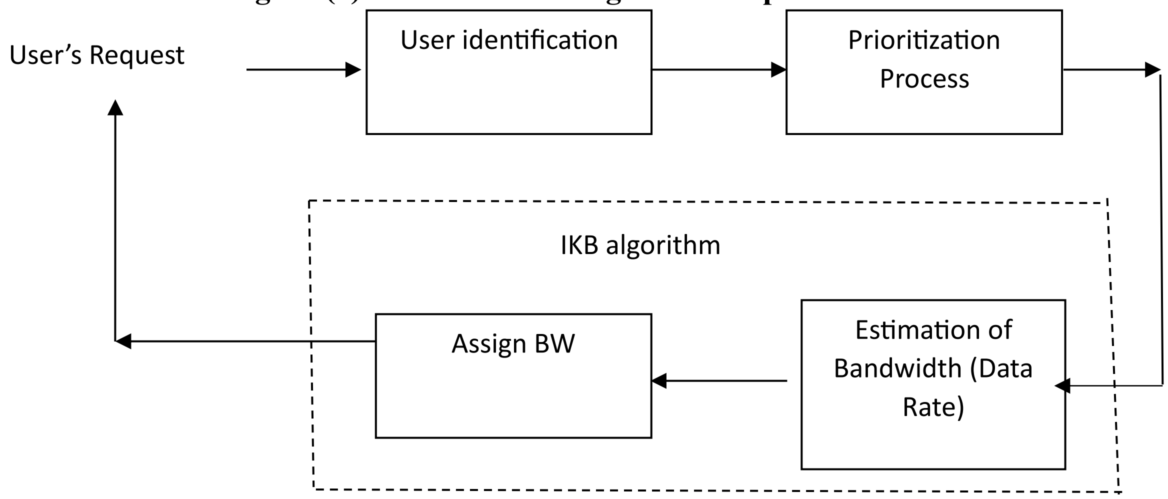
In 2017, Yilei Zhang • Michael R. Lyu, proposed a QoS prediction approaches (QoS Prediction in Cloud and Service Computing approaches and Applications), they classify the QoS prediction problem and propose three QoS prediction methods, which utilize the users' past usage experiences. The first prediction method employs the information of neighborhoods for making QoS value prediction and engages matrix factorization techniques to enhance the prediction accuracy. The second method provides time-aware personalized QoS value prediction service. The third method employs time information for efficient online performance prediction. The predicted QoS values can be employed to a variety of applications in cloud and service computing [12].

In 2014, Amid Khatibi Bardsiri and Seyyed Mohsen Hashemi, provide a QoS matrices (QoS Metrics for Cloud Computing Services Evaluation), there's no methodical explanation relating to metrics for estimating Cloud products and services. QoS (Quality of Service) metrics playing an important role in selecting Cloud providers and also optimizing resource utilization efficiency. To guarantee a specialized product is published, describing metrics for assessing the QoS might is necessity. So, this text suggests various QoS metrics for service vendors. The article provides the metrics list to help the future study and also assessment in Cloud service's evaluation [13].

3. Intelligent Knowledge-Based (IKB) algorithm description

Figure (1) illustrates those IKB algorithm processes. The first process is user identification according to his location. This process important to access the user services profile, which includes the history of his services requests, duration and demands. In the second process the user request prioritized according to the services history and the quality of services tolerances. Thus, the user without tolerance has the highest priority. In the third process the user load computed according to the services request and the resources availability. The fourth process deals with the bandwidth or data rate estimation. The fifth process involves the algorithm execution phase by assigning the bandwidth for each user's requests. Figures (2) and (3) presents the flowchart of the algorithm.

Figure (1) The Process of Algorithm Implementation



Pseudocode of the algorithm:

```
BW_requir = prioraty*BW_min
If BW_switch > BW_requir then
Status = 1
BW_switch=BW_switch-BW_requir
Elseif BW_another_switch> BW_requir then
Status = 1
BW_another_switch=BW_another_switch-BW_requir
Else
Status =2
connection failure indicator = +1
```

4. Modelling and Simulation

The performance of IKB algorithm is tested by simulation program. The simulation program is written using MATLAB coding editor based on two models; physical and mathematical model. In the physical model three switches considered within a square area of 50 Km. This area called simulation windows and the three provides their services as shown in figure (2).

In the mathematical models a uniform random distribution is used for the user location distribution within the simulation window. The traffic generation model consists of the poison random distribution of the connection duration and the inter connection time, which is the time between two consecutive requests. The connection request is the commutative sum of the inter connection time. The services generated randomly into five classes class. Class five (C5) has the highest demand of the bandwidth and class one (C1) has the minimum demand of the bandwidth. The nodes are stationary nodes. Table (1) provides the values of the input parameters.

Figure (2) simulation windows and switches distribution

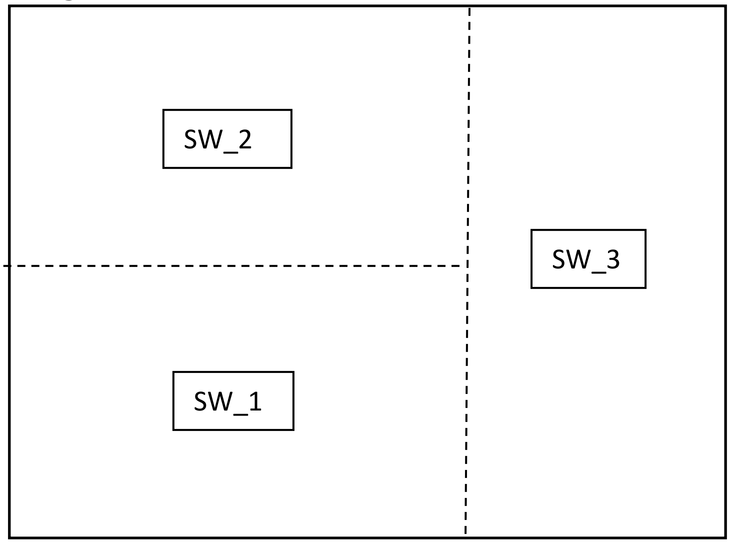


Table (1) Input parameters

Input parameters	Value
Simulation window length [Km]	15
Simulation window width [Km]	15
Simulation Time [seconds]	3600
Switch Bandwidth [Mbs]	50 Mbps
Total users	5000
Average connection duration [second]	900
Average request arrival time [second]	60

Figure (3) and (4) shows the simulation flowchart. The simulation is time driven with internal clock with an incrementation step of 1 second. Figure (3) includes the initialization part of the simulation and figure (4) includes the BW allocation and release part.

5. Result and Discussion

Figure (5) shows the random distribution of the network users within the simulation area. The horizontal and vertical axis indicates the distance in meters. Figure (6) shows the histogram of the distribution of the users to the network switches. The horizontal axis includes the switch Identification number and the vertical axis includes the number of attached users to each switch. Figure (7) shows the connection request arrival time to the network switch. The horizontal axis shows the user nodes identification number (UNID) and the vertical axis shows the arrival time of the connection in seconds. Figure (8) shows the connection duration for each user. The horizontal axis shows UNID and the vertical axis shows the connection duration in seconds. Figure (9) shows histogram of the user services prioritization; the horizontal axis is the priority of user services and the vertical is the number of users.

Figures (3) The flowchart of the algorithm

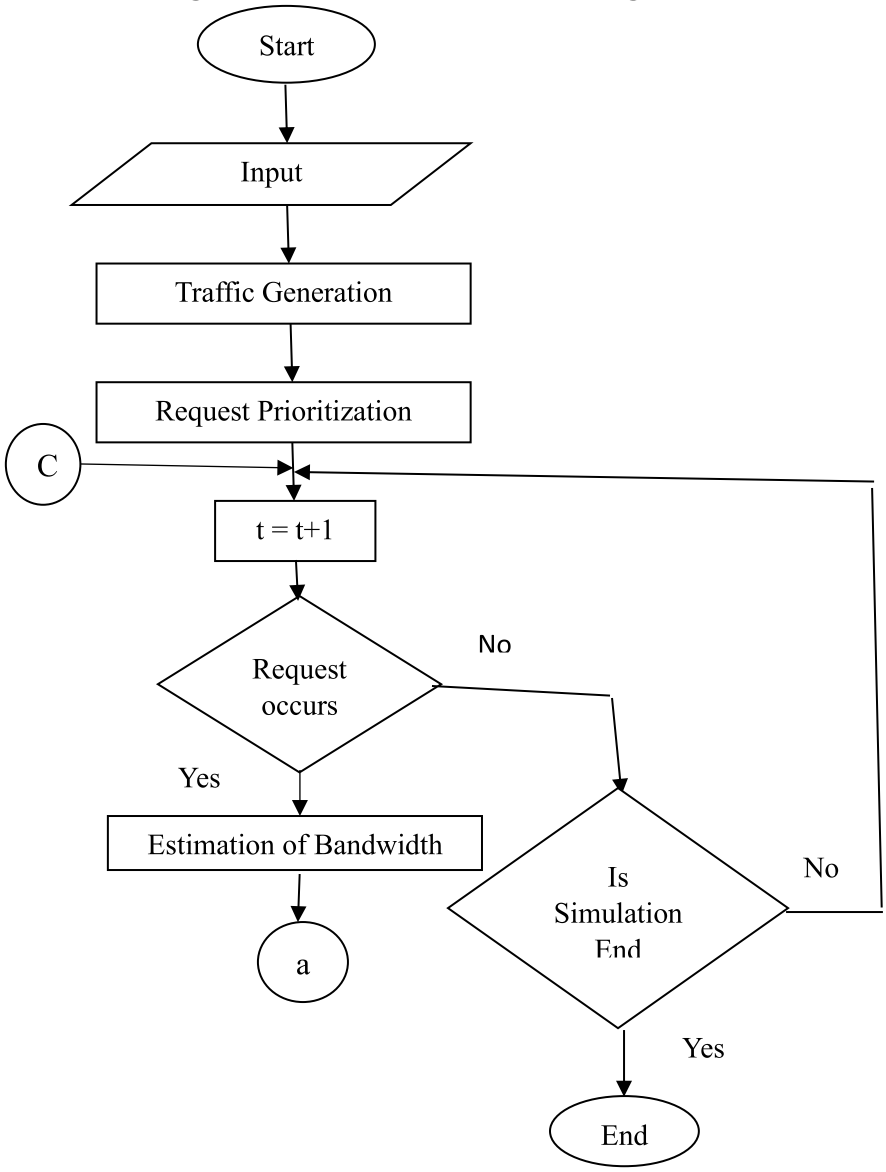
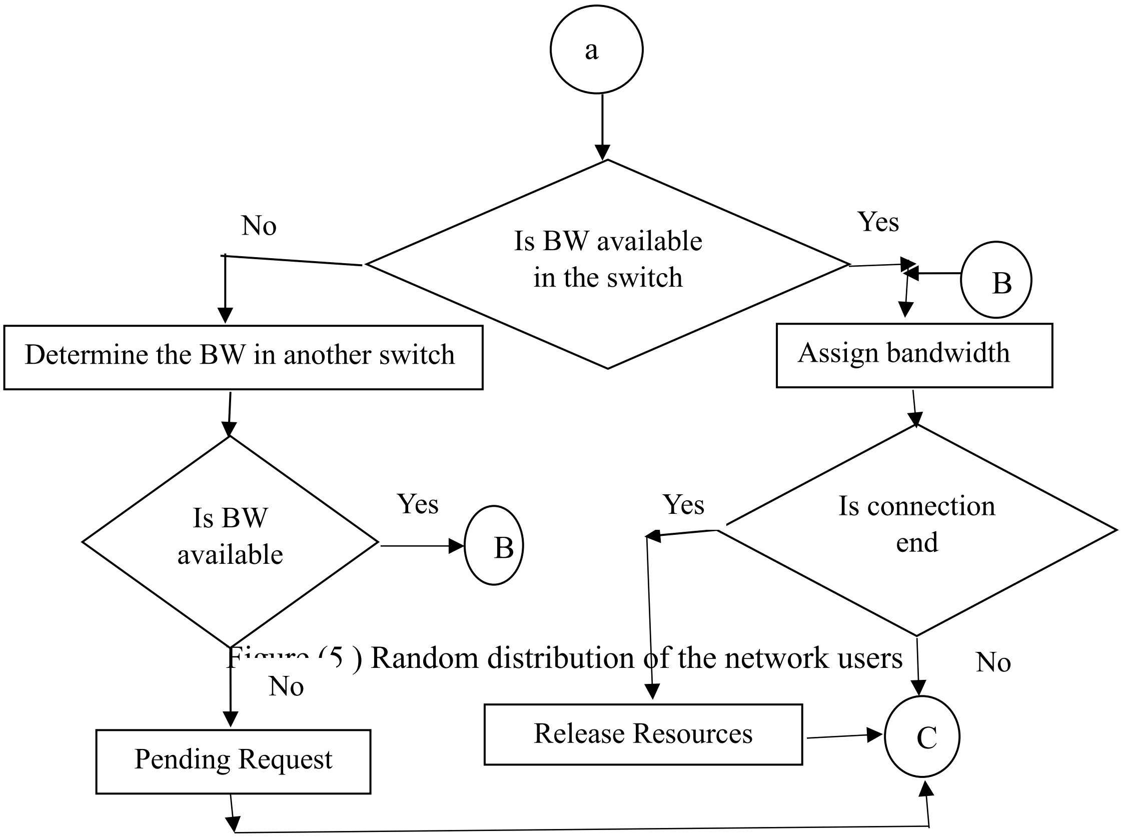


Figure (10) shows the numbers of nodes which has QoS degradation due to the traditional fixed distribution of the Bandwidth compare to the ones from IKB algorithm. Figure (11) shows the same percentages of those nodes from the total operating nodes. Figure (12) shows the percentage for two hours simulation. Figure (13) shows the Percentage of connection normal flow for 1 hour simulation. This the percentage of active nodes served by their local switch if it is less than 100% this means the total bandwidth from the switch cannot satisfy the needs and demand of the customer. Figure (14) shows the percentage of connection normal flow for hour simulation. For 100 Mbps and more the switch can satisfy the customers need without borrowing extra resources.

Figures (4) Cont. The flowchart of the algorithm



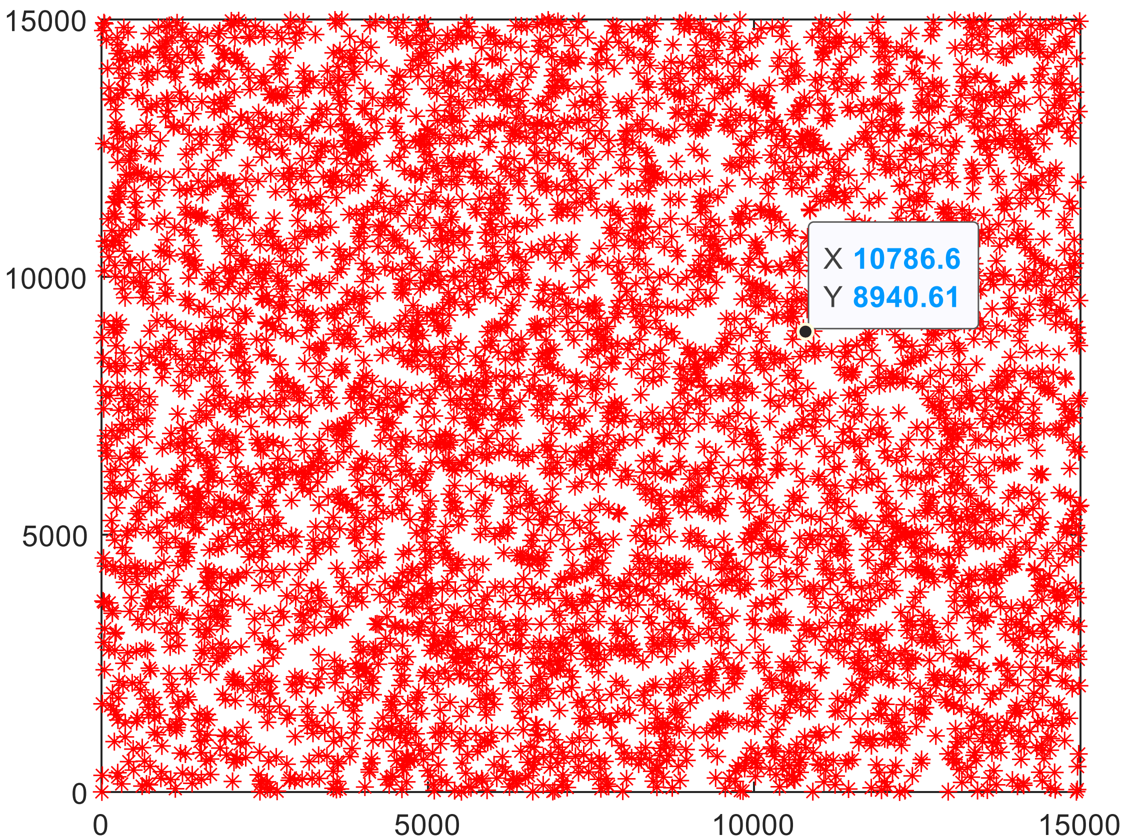


Figure (5) Random distribution of the network users

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Figure (6) The distribution of the users to the network switches

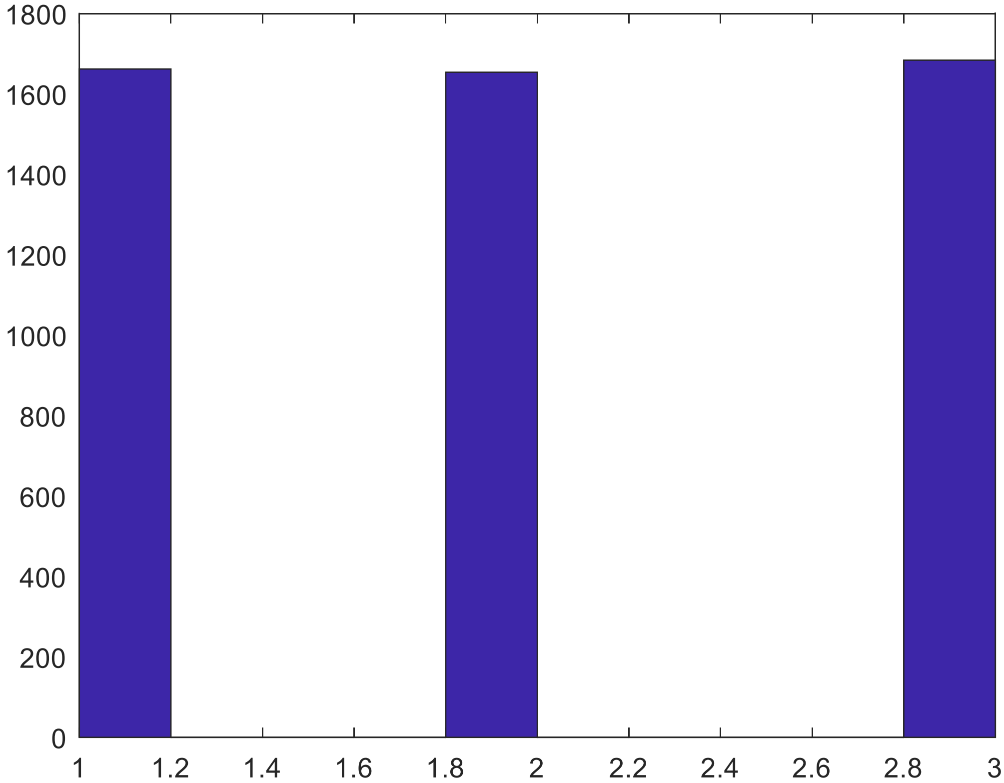

Figure (7) The connection request arrival time to the network switch

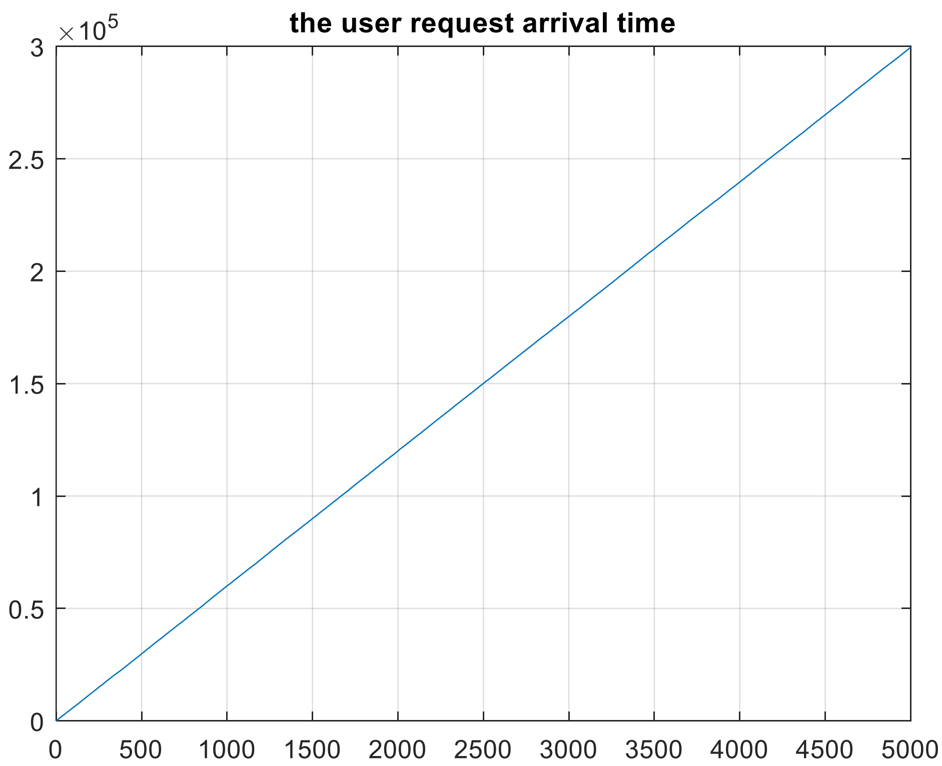

Figure (8) The connection duration time for all users

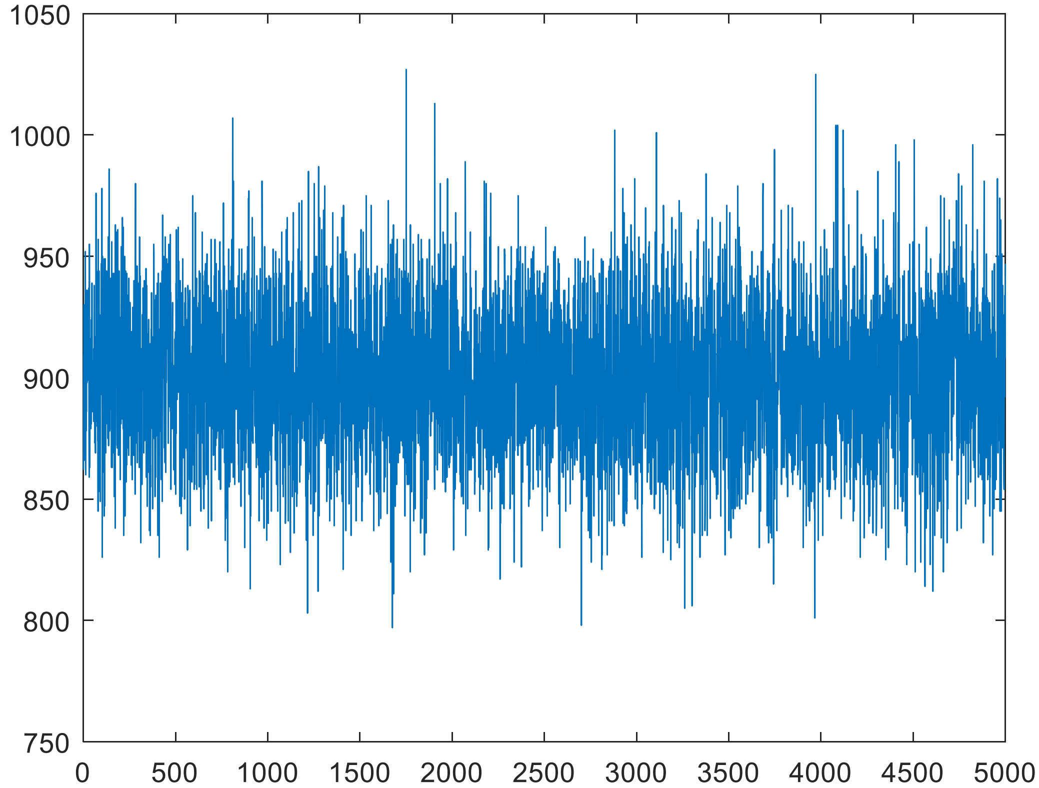

Figure (9) Histogram of the user services prioritization

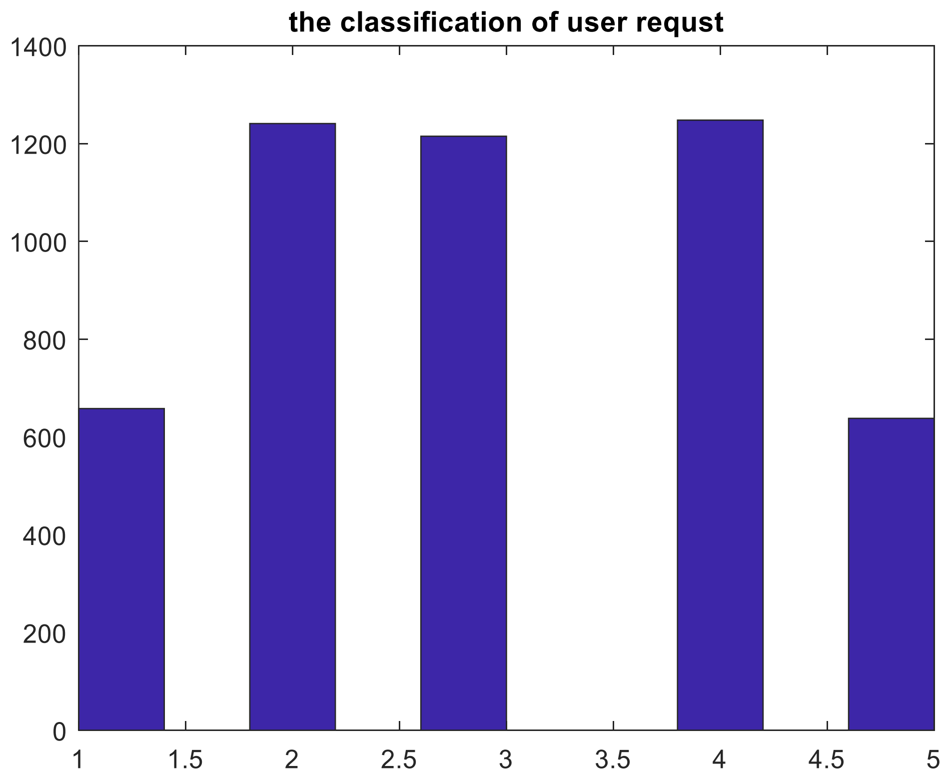

Figure (10) numbers of nodes with QoS degradation

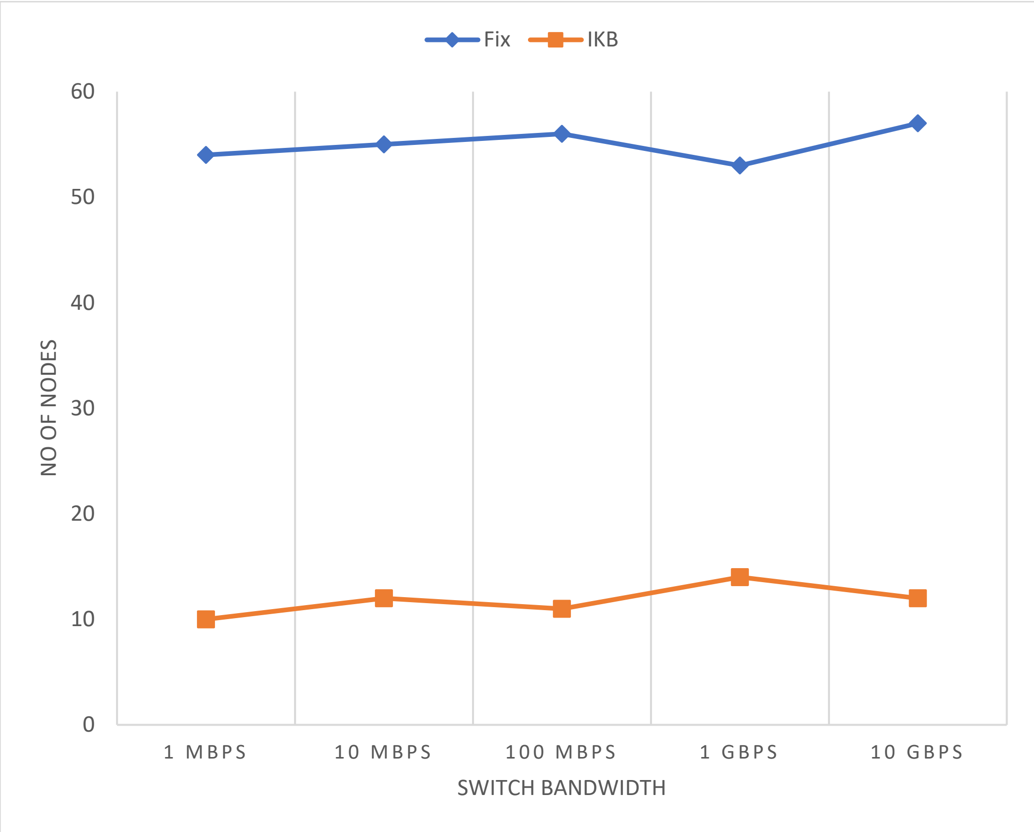

Figure (11) Percentage of nodes with QoS degradation for 1 hour simulation

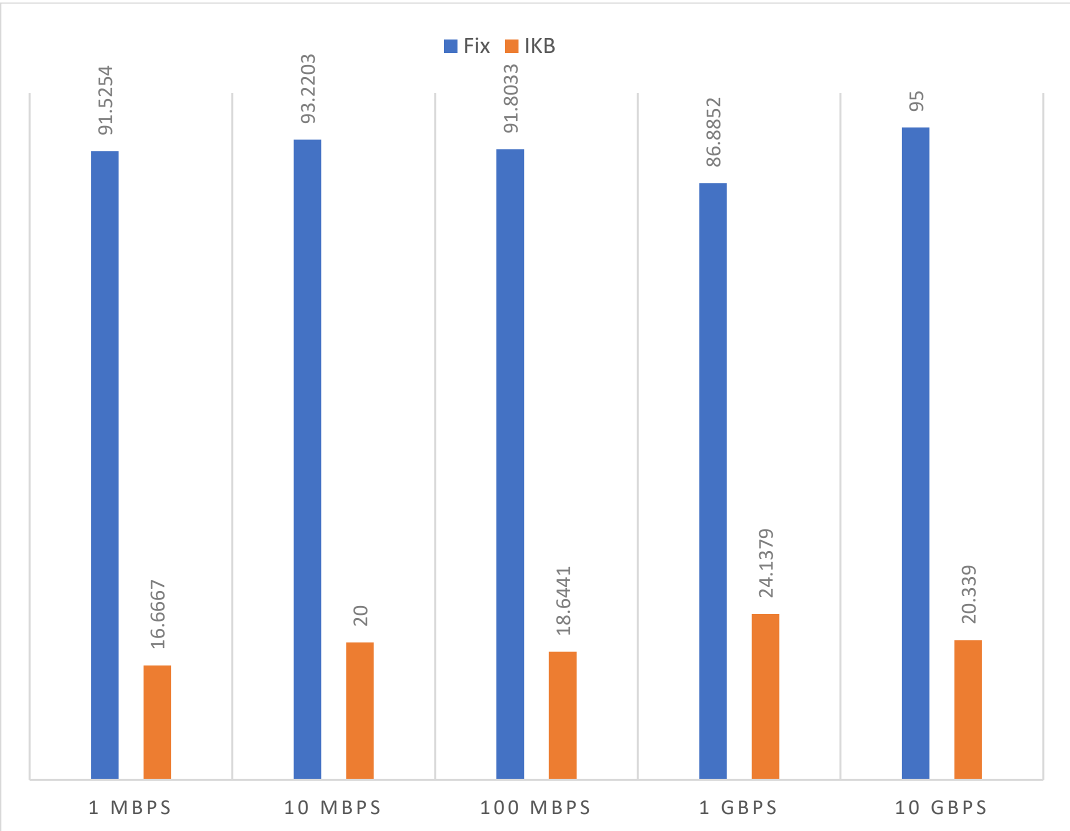

Figure (12) Percentage of nodes with QoS degradation for 2 hours simulation

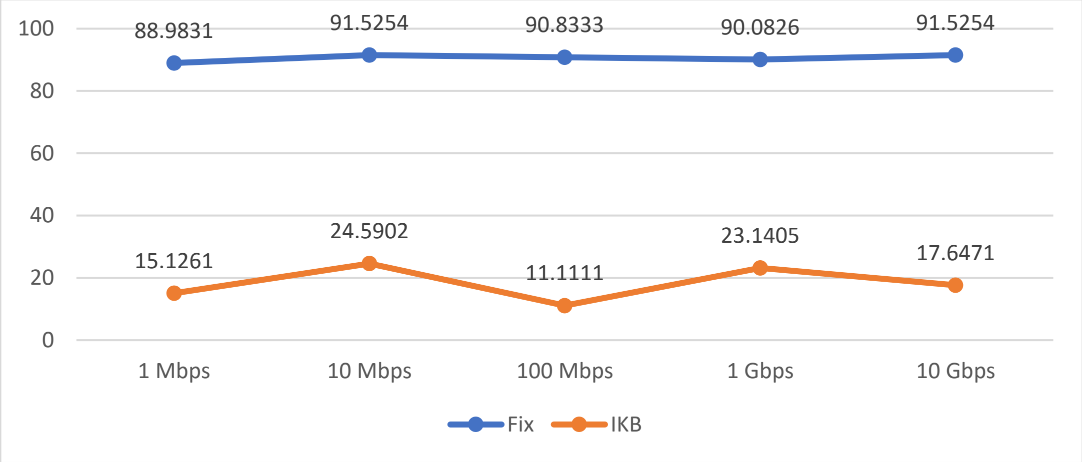

Figure (13) Percentage of connection normal flow for 1 hour simulation

Figure (14) Percentage of connection normal flow for 2 hours simulation

6. Conclusion

The proposed Algorithm based on customer behavior analysis and his services requirement prediction and allocation. It improves the QoS and provides the user with grantee QoS. However, the fixed traditional approach in the bandwidth distribution has a better performance in term of switch resource utilization and reduction of the resource borrowing. An adaptive approach can be used to balance the QoS requirement with the switch utilization.

7. Authors' Biography

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