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Retraction

Retracted: Wireless Network Virtualization Resource Sharing Based on Dynamic Resource Allocation Algorithm

Wireless Communications and Mobile Computing

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Ren and X. Li, “Wireless Network Virtualization Resource Sharing Based on Dynamic Resource Allocation Algorithm,” *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 5654188, 11 pages, 2022.

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Research Article

Wireless Network Virtualization Resource Sharing Based on Dynamic Resource Allocation Algorithm

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In recent years, with the continuous development of IT industry, network virtualization technology has gradually developed into a hotspot of research and application in the field of communication because IT allows the construction of customized virtual network (VN) on shared physical infrastructure. In particular, the proposal of wireless network virtualization for the development of the enhanced Internet. Because these technologies require effective algorithms named virtual network mapping (VNE) to instantiate virtual networks on the SN, on the basis of satisfying the isolation between wireless network slices, a resource allocation mechanism based on bilateral auction is proposed. At present, many researchers have proposed that network virtualization technology is a feasible way to solve the rigid Internet architecture. In the field of existing research focuses on the cable network virtualization, mainly related to the data center network and backbone, then, the side of the wireless access network virtualization the key technology research is still in its infancy, in order to accelerate the process of wireless skill for innovation and meet the demand of the difference of the emerging business, wireless network virtualization becomes the research hotspot and focus of academia and industry. However, no one has applied the dynamic resource allocation algorithm to wireless network virtualization resource sharing field. Here, this paper analyzes and summarizes the existing virtual network resource allocation schemes at home and abroad. The wireless virtual network resource allocation model and cross-domain virtual network resource allocation model are established, and the network centrality theory in social network and complex network is introduced to analyze the topology properties of virtual network and physical network, and two efficient virtual network resource allocation methods are proposed.

1. Introduction

Since cloud computing and data centers, the network service requests of end users are very important for quality of service (QoS) [1]. The increasing demand has accelerated the evolution of network architectures towards utilization. Internet service providers (ISPs) must meet the individual needs of their customers and therefore push for the usage [2–4]. Visualization technology is one of the research emphases and hotspots.

Virtualization technology provides a new opportunity to improve resource utilization by creating virtual (rather than real) versions of corresponding resources (such as network infrastructure servers) to utilize key resources [5]. In particular, the concept of network virtualization, which allows the establishment of customized virtual networks (VNS) on shared physical infrastructure, is considered one of the key technologies for the development of the future Internet, aimed at solving the obstacles of the current transformation of the Internet architecture [6, 7]. Virtualization is an abstraction that hides the complexity of the underlying network details to enable ISPs to meet the needs of their customers. In network virtualization, the task of equipment provider (InP) is to manage physical infrastructure resources and divide them into blocks (called VNS). The main task of SP is to dynamically lease infrastructure from InP. During virtualization, resource blocks are isolated from each other, and different service networks are independent from each other and share the same things [8–11]. In addition to visualization technology, wireless sensor technology can also effectively improve the level of network visualization.

With the progress of modern network technology, wireless communication technology showed superior potential, intelligent devices such as the use of broader, also inspired the user preference for equipment and superfast adaptability. Although now wireless communications networks have good development soon, but there still exist the problems and challenges [12], such as how to correctly choose us optimal access networks and users and improve the work efficiency of different wireless network technology; the wireless network virtualization is put forward to improve the network utilization and access between the user problem and found a new and effective ideas such as face isolation between different structure networks; wireless network virtualization has high flexibility and effectiveness and can do it in different networks for effective compatibility, in order to achieve the interconnection between the network, and to further meet the diverse needs of users [13]. 5G communication systems can provide ubiquitous connectivity to the IoT (Internet of Things) based on applications. Thanks to the successful use of SDN (software-defined network) and NFV (network function virtualization) in cloud computing, virtual network slices have been introduced into mobile networks to enable flexible connectivity and collaboration between multiple INPs and multiple MVNOS through shared physical substates [4, 14, 15].

The rapid progress of modern communication has led to the development of more and more emerging technologies [16]. The disadvantages of the current internet lie in the mismatch between emerging technologies and the current system structure. These disadvantages have a great impact on the future development of the network. With the gradual development of wireless network virtualization technology, the controversial problem of future network architecture has been resolved, and wireless network virtualization technology has provided a great help to the development of future network, and the fossilization of network has also achieved further effective results. From decades of development, even though wireless network virtualization is a good technical support in network development, we also need to understand that virtualization technology in the real application of wireless network still face a variety of problems and challenges, such as isolation between virtual networks, how to efficiently allocate resources, and how to properly manage the network and how to ensure the system security. In wireless network virtualization, if the network resources can be reasonable allocation, then multiple virtual networks can together exist in a physical network [17]. In wireless network virtualization environments, there are a large number of physical resources, such as spectrum and power infrastructure resources. In addition, the channel transmission between networks will be unstable, and there are also impacts between chains. In this case, it is difficult to allocate the physical resources mentioned above in wireless network virtualization. Therefore, one of the main contents of wireless network virtualization research is to efficiently allocate resources for the network in an unstable state [17, 18].

As a result of the wireless network to the rapid growth of the business in the wireless network, it is necessary to implement virtualization since virtualization can gain some advantages. For example, it can improve the overall utilization of network resources and capital expenditure, and operation cost can significantly be reduced. In addition, small low entry barriers of the service providers can improve service to provide customer. However, despite its potential, wireless virtualization still faces some key challenges, one of which is resource allocation [19]. To sum up, the study of the wireless network virtualization resource allocation in the fifth-generation (5 G) mobile communication technology and wireless communication network has good prospects for development, also has the very high research value, and is one of the key technologies to promote the development of the current 5G; wireless communication is one of the key technologies of IoT; its application is very wide, in the city of wisdom, intelligent transportation, intelligent medical treatment, and other aspects of social development exist, and more and more countries and researchers have also invested in its research. Secondly, deep learning technology is a key technology. How to make efficient use of the spectrum in wireless communication system, maximize its efficiency, allocate resources reasonably, and maximize the energy efficiency of the system to better meet the actual research and application situation is a relatively important research direction in the future [20–23].

In conclusion, the contributions of this paper are listed as follows:

(1) Analyzes and summarizes the existing virtual network resource allocation schemes at home and abroad

(2) The wireless virtual network resource allocation model and cross-domain virtual network resource allocation model are established, and the network centrality theory in social network and complex network is introduced to analyze the topology properties of virtual network and physical network

(3) Two efficient virtual network resource allocation methods are proposed

2. Related Works

The origin of network virtualization is proposed by Zhang [24] through a large number of studies. The emergence of network virtualization enables multiple different virtual networks to exist on the unified network infrastructure at the bottom the technology separates network infrastructure and other resources from network services and then provides different services by the diversity of users, realizing resource distribution in the network. Network virtualization technology has some research results in a wired network. Although a wired network is similar to wireless network in the environment, which can realize the sharing of infrastructure resources and network resources, wireless network environment often has problems such as network interference node mobility and network security. Ho et al. [25] called the collection of virtual links and virtual node virtual network. However, virtual network is not invariable. The virtual network provided by service providers will make corresponding adjustments according to the different needs of different users to provide more appropriate services, so that the virtual network will be more flexible and changeable. Lieto et al. [3] proposed the resource allocation problem of adaptive virtual wireless network based on mobile edge computing. Firstly, VNS were created for mobile virtual network operators (MVNO) according to users' needs, and then, a multivariable network cooperative resource sharing algorithm was proposed to improve resource utilization, which is divided into two stages: On this basis, the intrachip and a new algorithm, heuristic algorithm, is proposed to solve NP hard problem. However, the network virtualization technology is not enough for solving the resource allocation problem. For resource allocation problem, it can use different learning algorithms to solve the convex optimization problem, use the auction theory and fully distributed to the allocation of resources, and find the slice thickness using the algorithm to optimize the effectiveness of the whole system. In the use of contract theory to multiple InP and MVNOS trading process modeling, Ren et al. [26] proposed a new contract theory incentive mechanism to provide services for multiple users in network virtualization. Wireless virtualization technology uses its wireless characteristics to decouple complex network control functions from hardware devices and unify them to the upper layer for management and coordination, to enhance the efficiency of network management. Research on virtualization for heterogeneous wireless networks is also advancing. Wu and Chen [27] can realize virtualization in integrated cellular networks, including heterogeneous access technology, by using the concept of OpenFlow. This mechanism adapts wireless resource allocation after initial allocation and dynamically reallocates resources to meet the minimum capacity of heterogeneous virtual base station requests. There are also some network virtualization methods without specifying wireless access technology, such as the popular online embedding algorithm [28]. To handle online request of wireless virtualization and dynamically embedded virtual network, to study and put forward existing Karnaugh map method and game theory, a resource allocation mechanism was used; otherwise, a combination of space-time resource allocation algorithm was used, by minimizing the predetermined time slot to realize reasonable allocation of resources and to ensure the isolation of the wireless network experiment and improvement of resource utilization. Other studies have proposed novel architectures that divide networks into multiple adaptive, personalized, and accessible virtual network requirements, which can be achieved by the users themselves [28, 29]. The above works are mainly about the virtual networks; then, the virtualization technology is tended to be introduced as below.

Network virtualization technology can also save a lot of energy through resource integration. The existing energy-saving VNE algorithm uses different methods to minimize energy consumption and eliminates the deviation between the numbers of dormant physical network links by using the number of dormant physical network links. In addition, researchers also adopt some novel algorithm allocation ideas to solve the VNE problem [29]. Based on the classical reserved income model (including fixed income and variable income), a new admission control strategy is designed to selectively accept virtual network requests (VNRequests) with high revenue-cost ratio to maximize the profits of InP. Different virtual network mapping strategies are selected under different bandwidth rental prices by a noncooperative game to maximize InP revenue. Based on the stability of the queue since the return virtual wireless network, virtual resource allocation is put forward based on the frequency division duplex wireless network virtualization integration framework since the return mechanism and the return small unit grid virtual resource allocation righteousness into an optimization problem, that is, the network stability and MBS since SBS virtual is towed back into virtual resources [30].

The rest of this article is laid out as follows: Section 3 gives the wireless network virtualization resource sharing by the dynamic resource allocation algorithm, including the structure and dynamic resource allocation model. Then, the experimental results and analysis are shown in Section 4. Finally, the conclusion is drawn in Section 5.

3. Wireless Network Virtualization Resource Sharing by Dynamic Resource Allocation Algorithm

3.1. The Structure of Wireless Network Virtualization Resource. The wireless network virtualization in ensuring communication transmission and high isolation, at the same time, the efficiency of wireless physical devices and wireless network resources are able to abstract into virtual resources; this is because each other can guarantee isolation used in the real life scenario, and mobile users can rely on virtualization network resources service requests to complete the user's business, In wireless network virtualization, auction becomes an appropriate solution to the problem of how to efficiently allocate limited MVNO resources to SP. In this case, it can ensure that resources are allocated to the demanders who value the resource most. In traditional auction, buyers compete for resource unit prices by submitting their resource units, that is, bids, and given the bids received, MVNO will determine the winner and the price paid. For the system model, we consider a set of SP and an MVNO with power and channel resources. Virtual resources owned by MVNO are distributed across the network to provide resource services for mobile users. The wireless network virtualization system model is shown in Figure 1.

In principle, deep learning uses neural networks to encode any mapping from input to output. In particular, deep learning can find global optimal solutions by using stochastic gradient descent. Therefore, deep learning methods are suitable for designing optimal auction problems, especially in the auction of computing resources, where the input of the neural network is the bid of the buyer, and the output codes the final winner determination and payment.

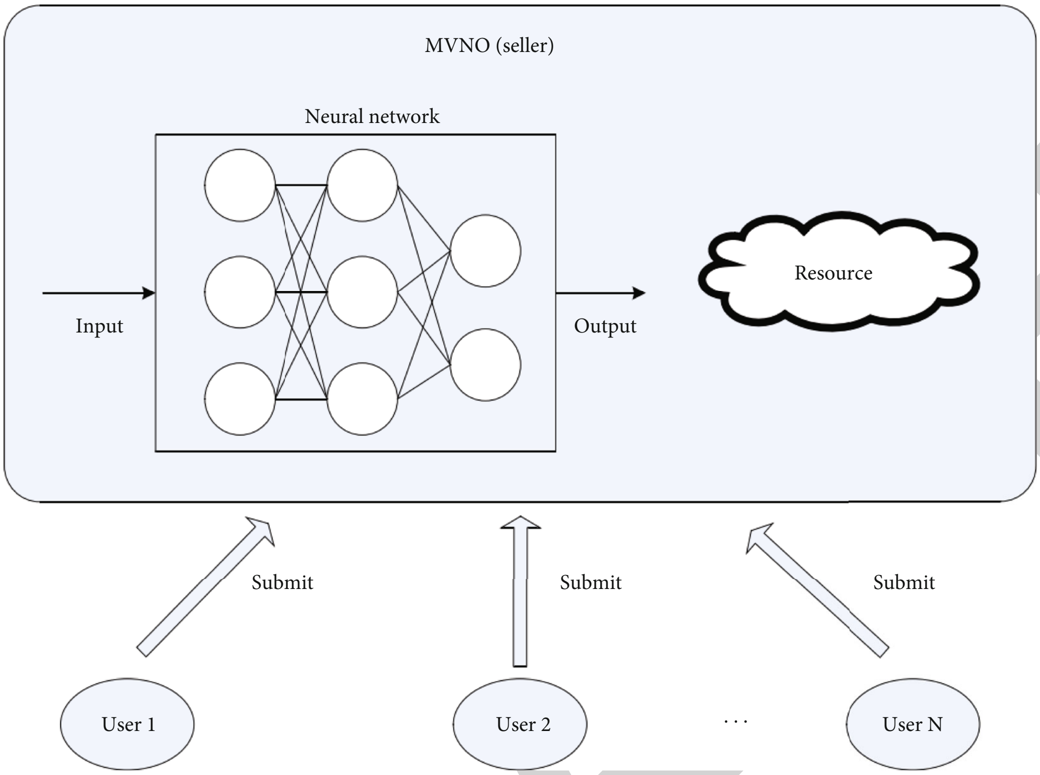


Figure 1: Wireless network virtualization model.

Therefore, deep learning can help find the optimal revenue of MVNO. Therefore, deep learning is used to design the best auction for MVNO resource allocation. In order to provide an accurate fit for the best auction, the neural network architecture is constructed. Finally, the neural network is trained to adjust the parameters of the neural network to optimize the loss function, which expected negative returns.

3.2. Dynamic Resource Allocation Model. After the SLA module processes the bandwidth to meet the requirements of the current virtual network to improve the VN access rate and link utilization, the bandwidth is obtained in the following way. The state of each user is simulated as the open state of discrete time Markov open-close process representing the active state. At this time, the user requires bandwidth a, and it is assumed that the size of A is constant and does not change with the change of users. Closed state indicates inactive state. In this state, the user does not send any packet information.

$$\Pr\{Q = a\} = 1\text{-}\Pr\{Q = 0\} = \alpha. \tag{1}$$

To ensure complete availability, the probability of the user obtaining the available bandwidth must be greater, that is,

$$\Pr\left\{\sum_n Q^n \le bw^{\text{full}}\right\} \ge 1 - \delta. \tag{2}$$

Since the bandwidth capacity required, thus, formula (2) above can be transformed into

$$\sum_{n=0}^{N_{exl}^{fxll}} \frac{N!}{n!(N-n)!}\alpha^n (1-\alpha)^{N-n} \ge 1 - \delta, \tag{3}$$

where N represents the total number of users on the virtual network request. By using the same derivation, the probability of users getting available bandwidth under the condition of limited availability is obtained:

$$\Pr\left\{\sum_n Q^n \le bw^{\lim}\right\} \ge 1 - \varepsilon. \tag{4}$$

According to the binomial distribution law of user activity, the above formula can be further transformed into

$$\sum_{n=0}^{N_{ex}^{lnm}} \frac{N!}{n!(N-n)!}\alpha^n (1-\alpha)^{N-n} \ge 1 - \varepsilon. \tag{5}$$

Therefore, a larger bandwidth must be allocated. Therefore, the actual bandwidth requirements corresponding to the virtual network request are finally expressed as follows:

$$\begin{gathered} bw\left(l^V\right) = \max\left\{bw^{\text{full}}, bw^{\lim}\right\}, \\ a_{u,v}^{(l)} = f\left(z_{u,v}^{(l)}\right). \end{gathered} \tag{6}$$

The CPU computing capability of a physical node has been described in Section 3.2, which reflects the resource

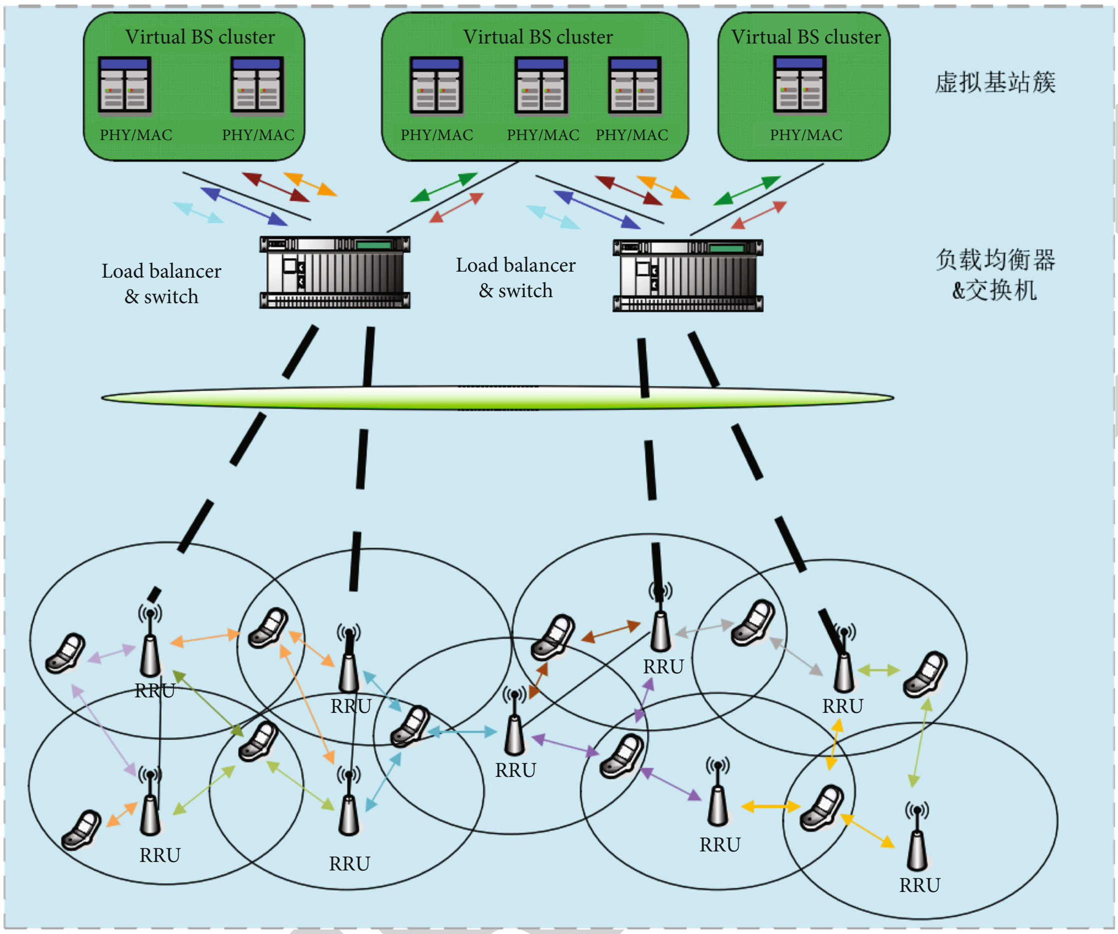


FIGURE 2: The schematic diagram of dynamic resource allocation algorithm.

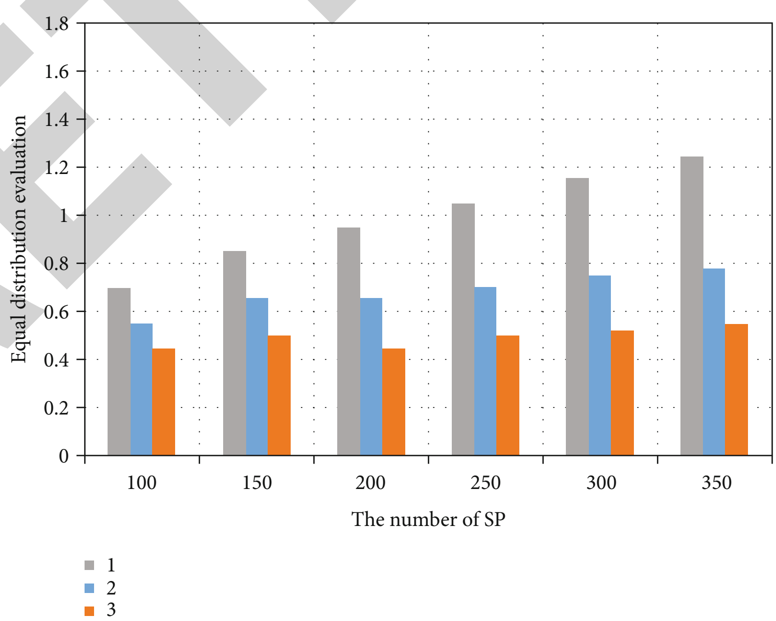


FIGURE 3: Sport data analysis chart.

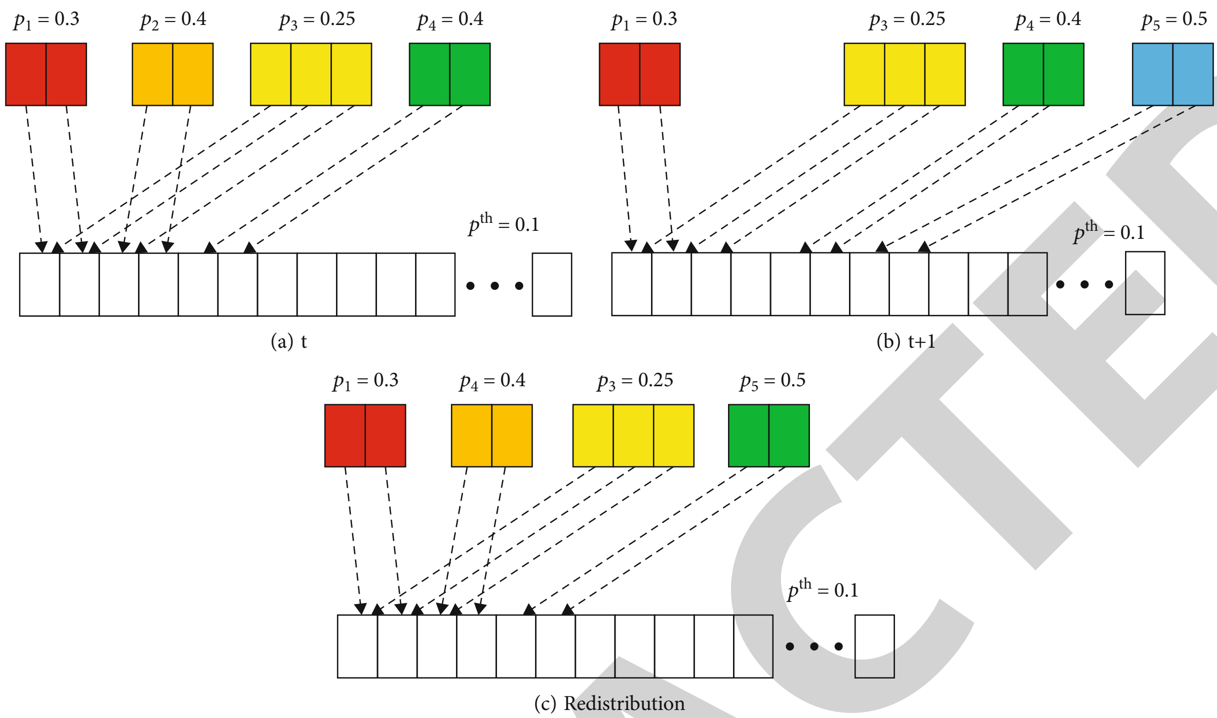


Figure 4: Schematic diagram of redistribution necessity.

capability of the node. It is one of the most important capabilities of a node and is expressed in formula:

$$\mathrm{rcpu}\left(n^S\right) = \mathrm{cpu}\left(n^S\right) - \sum_{\forall n^V \in N^V \longrightarrow n^S} \mathrm{cpu}\left(n^V\right). \quad (7)$$

The communication capability of physical node bandwidths of physical links connected to nodes, which to some extent reflects the resource capacity of nodes and the available bandwidths of physical links

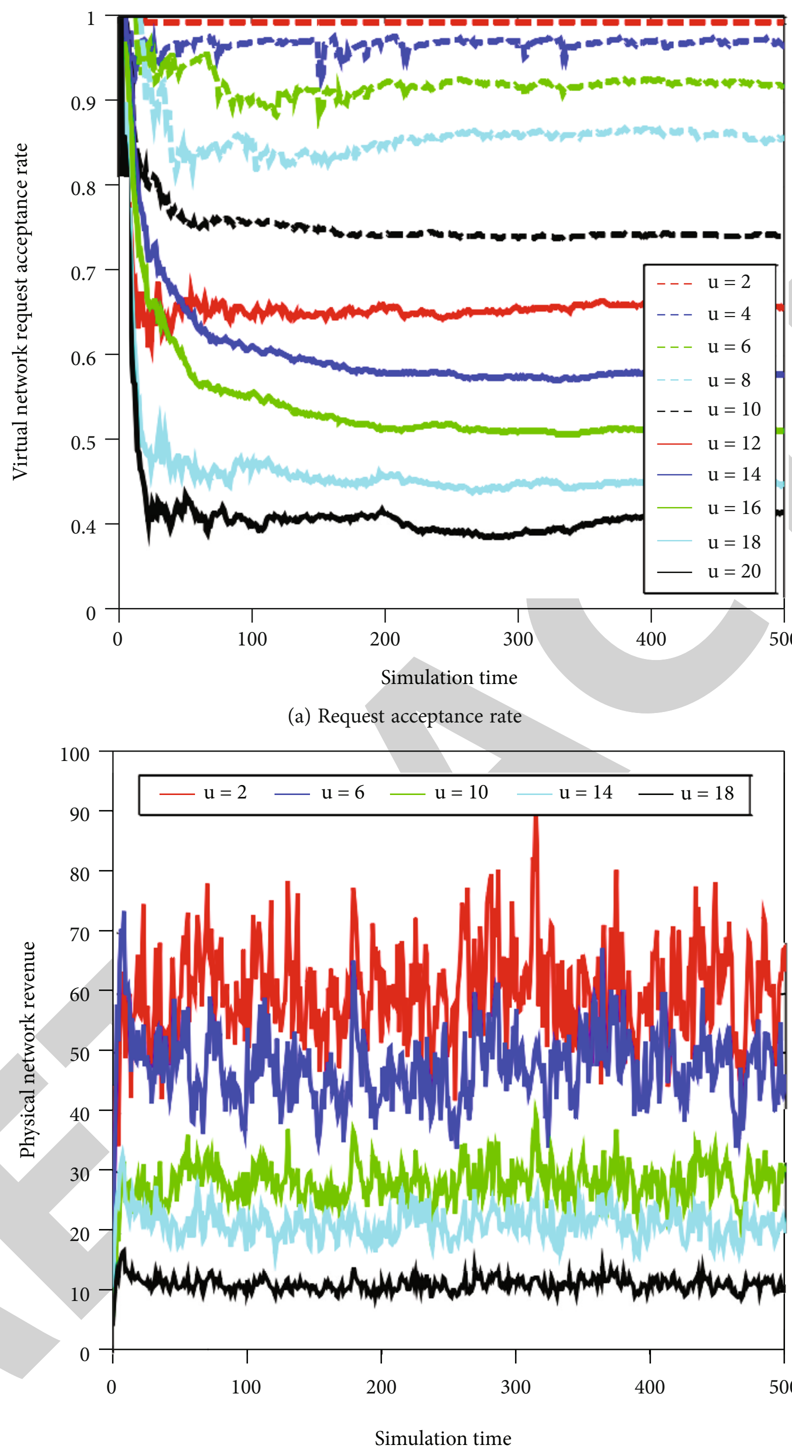
$$\begin{aligned} rbw\left(l^S\right) &= bw\left(l^S\right) - \sum_{\forall l^V \in L^V \longrightarrow l^S \in L_n^S} bw\left(l^V\right), \\ \mathrm{AR}\left(n^S\right) &= \mathrm{rcpu}\left(n^S\right) \sum_{l^S \in L_n^S} rbw\left(l^S\right). \end{aligned} \quad (8)$$

Similarly, for virtual request network, its node resources are expressed as

$$\begin{aligned} \mathrm{AR}\left(n^{\mathrm{v}}\right) &= \mathrm{cpu}\left(n^V\right) \sum_{l^v \in L_n V} bw\left(l^V\right), \\ bw\left(p^S\right) &= \max_{l^S \in p^S} rbw\left(l^S\right) - \min_{l^S \in p^S} rbw\left(l^S\right). \end{aligned} \quad (9)$$

From the above analysis, network function virtualization (NFV) was first proposed by operators. Network functions are installed on data center network nodes and end users as software. The purpose is to limit dependence on hardware and reduce network functionalization of data plane in wired or wireless mobile network infrastructure. As an open network platform, NFV realizes the function of automatic allocation of network resources according to different needs and abstracts into a virtual resource pool without boundaries. Providing virtual network services for VNS, this kind of distributed innovation has high value, making it become a revolutionary development trend. For the next-generation network, it is important to manage flows across different functional chains programmatically and dynamically. Per-flow control is an approach that allows network services, resulting in higher returns.

C-ran is a new dynamic resource allocation algorithm proposed by the China Mobile Communication Group to solve the problems of closure and rigidity in the current mobile network. The schematic diagram of network access architecture C-RAN is shown in Figure 2, which mainly consists of three parts: Distributed network composed of remote radiofrequency unit (RRU) and antenna connects RRU and BASEband unit (BBU) with high broadband, low-latency optical transmission network, and centralized baseband processing pool composed of high-performance processor and real-time virtualization technology. The deployment of high-density remote RF module reduces the distance from the user, thus reducing the transmission power without affecting the network coverage, but also prolongs the service life of the terminal user's battery and reduces the power consumption of the access network. The real-time cloud infrastructure and base station virtualization technology can effectively realize wireless resource sharing, and the processing resources in the resource pool can be dynamically scheduled to process the baseband signals of different RRUs, which is more consistent with the tidal effect of mobile communication in reality and ensures the better utilization of infrastructure resources.



(a) Request acceptance rate

(b) Request acceptance rate physical network revenue

Figure 5: Change in virtual network request acceptance rate and physical network revenue over time.

4. Experimental Results and Analysis

4.1. Introduction to Experimental Environment. This section uses MATLAB to simulate the proposed TARA algorithm to effectively analyze the mapping result of dynamic algorithm is obtained by changing the standard of dynamic resource allocation algorithm in the shortest path selection stage. In addition, this section adopts the basic virtual network mapping algorithm (G-SP) based on the greedy principle to conduct comparison simulation experiments, which is mainly verified and analyzed according to the performance indicators proposed in Section 3.2.

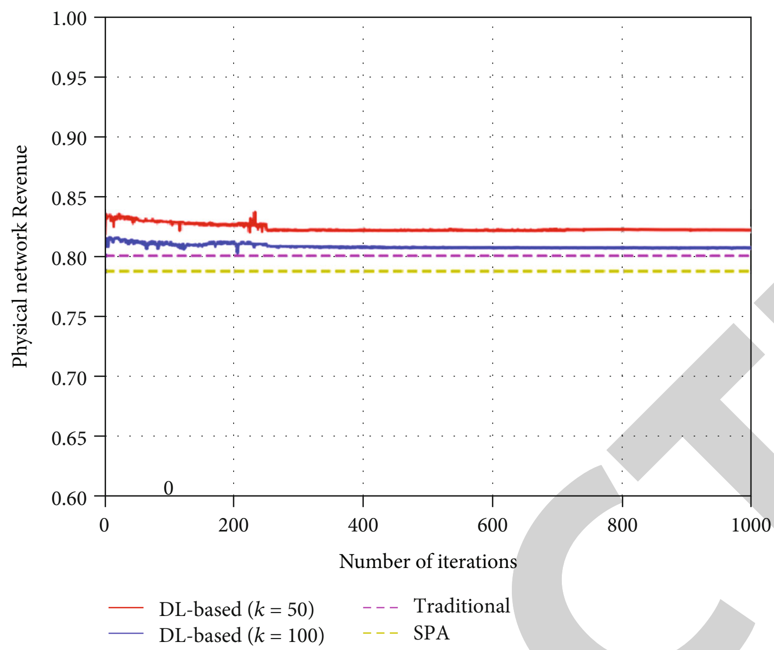


Figure 6: Uniform distribution B.

4.2. Experimental Result Analysis. Firstly, the experiment will be analyzed from two aspects of social welfare and user satisfaction: (1) average social welfare: set the auction process as 20, calculate the total social welfare, and take the average nad (2) resource utilization: the percentage of buyers who win the auction to the total participation. The heuristic algorithm and pricing scheme proposed in this chapter is bilateral auction allocation mechanism; after that, the second option is fixed price allocation mechanism, which can guarantee that each SP get the predetermined amount of resources at a fixed price; these are preminimum resource demand contracts, and the last option is based on the random allocation mechanism.

As can be seen from the Figure 3, this chapter proposed a bilateral auction allocation mechanism of total utility than the other two mechanisms has obvious preference trend, and then with the increase of the number of the buyer, win the auction side increases, the number of the slow increase of total social welfare But because of the fierce competition for resources, the total utility growth slow down. When the number of SP exceeds 250, because the design of fixed price mechanism does not take into account the different priorities of demand allocation among SP and the competition when resources are insufficient, the total utility of allocation is related low, and the fluctuation range of growth rate is not very large. However, in the same case, the random allocation algorithm cannot guarantee the stability of the system allocation, and the final price appears to float randomly within a range. It is obvious that the random allocation of social welfare performs poorly when compared with the method proposed in this paper.

Considering the dynamic nature of arrival and departure of VN requests, the frequency spectrum resources will be fragmented, which makes the resources not fully utilized. Due to the existence of a time slot in the life cycle where both new VNS arrive and VNS leave, the situation shown in Figure 4 occurs. T-slot channel sharing is shown in Figure 4(a). When $t+1$ time slot, VN request leaves and new VN request arrives. Since the occurrence probability of new VRR request is 0.5, the collision probability of each shared subchannel is checked. Currently, there is no shared subchannel that can meet the requirement, so the allocation result is shown in Figure 4(b). However, through observation and analysis, it can be found that since the life cycle of the second virtual request is over and the dynamic allocation algorithm based on spectrum resource sharing is 49 times removed; the fourth virtual request can be reallocated into Figure 4(c), which will occupy less channel quantity than Figure 4(b). Therefore, a redistribution mechanism is proposed.

According to different U values, the virtual network request acceptance rate and physical network revenue are shown in Figure 5. Figure 5(a) shows the relationships between the request acceptance rate and virtual network request acceptance rate, and Figure 5(b) gives the relationships between request acceptance rate physical network revenue and physical network revenue. It can be seen that the virtual network request acceptance rate decreases with the increase of U value. The reason is as follows: As time changes, the number of virtual network requests on the physical network increases. The longer the life cycle of virtual network requests is, the longer it takes to occupy physical resources, the more resources are required, and the less idle resources are available to receive new ones. The probability of reaching a virtual network request is low.

Therefore, the longer the virtual network request life cycle, the lower its acceptance rate. The physical network benefits are inversely proportional to the life cycle size (in order to facilitate the imitation effect, the simulation graph only selects the results of several parameters). When the virtual network request life cycle obeys the exponential

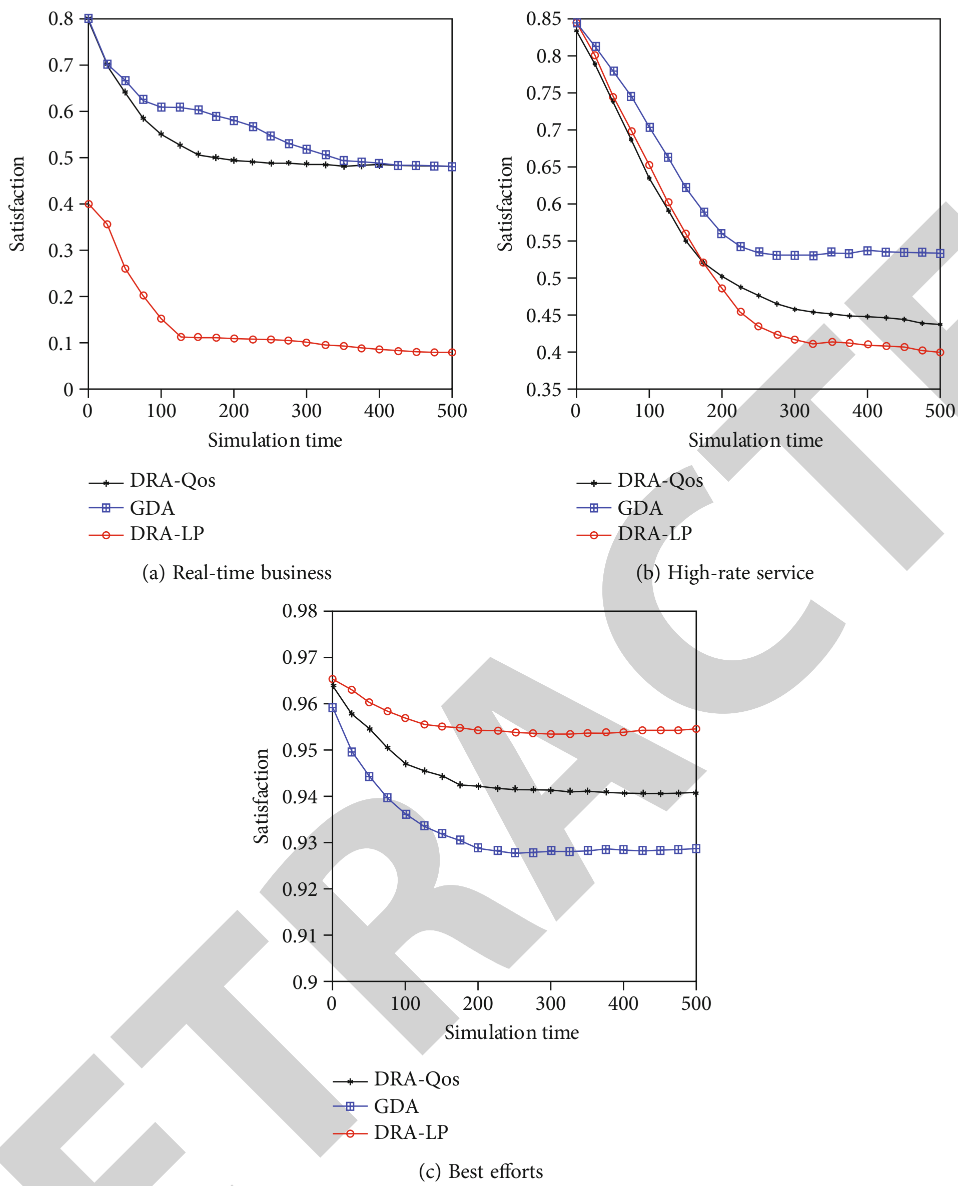


Figure 7: Delay constraint satisfaction comparison of different services.

distribution of parameter 2, the physical network benefits are the largest. Because life cycle is an important parameter in utility function, the smaller its value is, the more physical network benefits can be obtained, and the shorter the life cycle of virtual network request is, the shorter the occupation time of physical resources will be. Therefore, the virtual network requests occupied by the physical network are relatively small, so the physical network benefits will be stable in a relatively large range.

As shown in Figure 6, the distribution of all buyer SP is also 0,1, 0,1 I, I, p, U, c, U, so for $k = 50$, MVNO's income increases with the number of SP's and this improvement can also be observed at $k = 100$. In fact, if more SP's participate in this auction, it can motivate all of them to pay higher prices for the competition, so MVNO's income will increase.

Because the service delay constraint satisfaction is related to average delay, the simulation results of average delay and delay reduction satisfaction need to be combined to analyze and explain. As shown in Figure 7, considering the delay requirement, although the waiting delay of best-effort service is increased, because the service is not sensitive to delay, different algorithms have little impact on SoC of best-effort service, with only a difference of about 0.01, as shown in Figure 7(c). In dra-LP algorithm, the SoC of real-time service and high-rate service is 0.1 and 0.4, respectively. In DRA-QoS and GDA algorithm, the SoC of real-time service is stable at 0.48. As shown in Figure 7(a), the SoC of high-rate service is 0.45 and 0.54, respectively, as shown in Figure 7(b).

The resource allocation of Cayley wireless data center is carried out on the basis of link interference. Using the same phase mapping method, node allocation and link allocation are performed simultaneously, when links are established for virtual nodes according to the final results of the matrix.

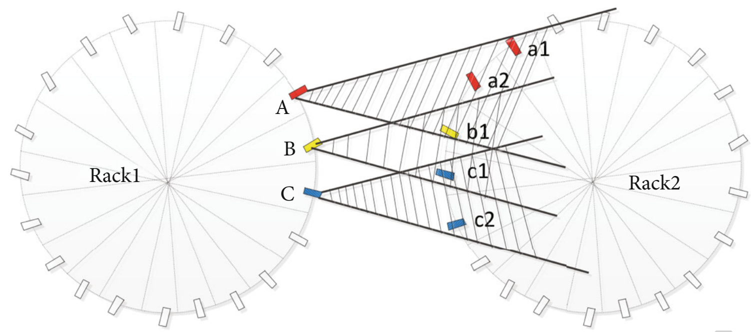


Figure 8: Top view of Cayley WDC link interference.

Given in Figure 8, nodes *A*, *B*, and *C* in Rack1 can send data to nodes *A*1, *B*1, and *C*1 in Rack2, respectively. Directional antennas are used for nodes *A*, *B*, and *C* to make data signals sent by nodes conical, so that signals will cause interference to other nodes in the process of data transmission. As can be seen from Figure 8, nodes *B*1 and *C*1 in Rack2 are located in the receiving region of node *B* of Rack1. Nodes *C*1 and *C*2 in Rack2 are located in the receiving region of node *C* in Rack1. For example, when node *B* sends a signal to *B*1, it will interfere with C1. When node *C* sends a signal to *C*1, *C*1 may not receive correctly due to the presence of interference.

5. Conclusions

In the current high-speed development of the Internet environment, through the limited system resources to optimize the allocation of the problem is discussed, to further improve the utilization rate of modern wireless communication resources, the development of a new generation of wireless communication network is a hotspot of today's communication network. Based on dynamic allocation, MVNO resources can be efficiently allocated. The research on resource allocation in a wireless network virtualization network structure is not only of great significance in theoretical research but also of great potential value in practical application. This paper considers the resource allocation and energy efficiency optimization of SP and MVNO in wireless network virtualization, studies the resource allocation based on bilateral auction mechanism and deep learning in wireless network virtualization, and studies that MVNO achieves its own revenue maximization in reasonable resource allocation.

Despite the current research of network virtualization technology has obtained some progress, but for the wireless network virtualization, particularly wireless virtual network mapping algorithm is still facing some problems to be solved. In order to design more reasonable and efficient distribution of resource optimization algorithm, the InP earnings are increased; the future direction of the research is from the following several aspects: (1) generality and expansibility of network mapping model at present, the research on wireless network virtualization mapping model and optimization algorithm is basically aimed at a specific scene, and it is necessary to make adjustments when the network optimization goal changes, to design universal models and algorithms with adaptive ability, or to improve the universality and expansibility of existing models and algorithms, and to deal with the emergence of different emergent scenarios when common scenarios are processed with high efficiency. (2) Coordination of high performance and low complexity. Most existing optimization algorithms either have high performance and high complexity at the same time. Or, contrary to the proposed wireless virtual network mapping method based on multiservice QoS guarantee vNEA-MS and wireless data center VNEA-LI, although the two algorithms to a certain extent improve the quality of the network communication and resource utilization, but the algorithm process have been tracking the allocation of resources, adopted include the selection of a node or link capacity under controlled conditions Therefore, in how to meet user demand for high network performance and low algorithm complexity of compromise, is the need to further study the problem of (3) fault-tolerant virtual network mapping.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

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