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Dynamic multimedia transmission control virtual machine using weighted Round-Robin

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Abstract This paper addresses the problem caused by the large amount of traffic generated and dynamically changing traffic patterns and Round-Robin scheduling algorithm applied Weighted to provide the best service to the user requests. Currently the network has a lot of parts, but many problems need to be addressed and changed rapidly. We virtualize the existing network equipment using Openstack to propose a scheme for improving the quality of multimedia transmission services via a scheduling algorithm and contents delivery network techniques. The results of this study demonstrates that a large amount of multimedia that can be used as a future of excellence in real time.

Keywords Network function virtualization · CDN · Weighted Round-Robin scheduling · OpenStack · Multimedia transmission

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1 Introduction

Today, as large amounts of multimedia and real-time service traffic are generated according to the number of servers rapidly, prediction of the network size is inevitable due to the changing traffic patterns in real-time. To address these issues, NFV technology that integrate Network Device by virtualizing high capacity of the servers, switches, storage, network node with standard IT virtualization technology has recently been raised. NFV is the latest technology that reduces the dependency of equipment by applying virtualization technology in existing network equipment and enables users to easily use a variety of network functions implemented as common hardware platform software. For NFV environment, although there are a variety of open-source platforms, the cloud platform which currently represents the most prominent are CloudStack, EUCALYPTUS, OpenNebula, OpenStack. Although OpenNebula and CloudStack have the advantage of scalability and flexibility, it is difficult to establish the NFV environment because these platforms are vendor dependent and the community of developers is not activated. From the statistics of OpenStack community Korea, Fig 1. Shows the monthly number of participants according to the type of platform. Nowadays, mainly used for OpenStack which not depend on the vender and has a number of community developers activated. In the case of overseas, about 180 of the companies such as Rackspace, Redhat, and HP are involved in the development of NFV with open stack and provide the actual service.

Finally, Conclusion and future work is discussed in Sect. 5. However, it is difficult to fill the needs of the user only with virtualization of servers. For example, the bottleneck occurs when multiple users receive a real-time streaming or download a large movie and music files at the same time, through a limited server. In this case, the server could be

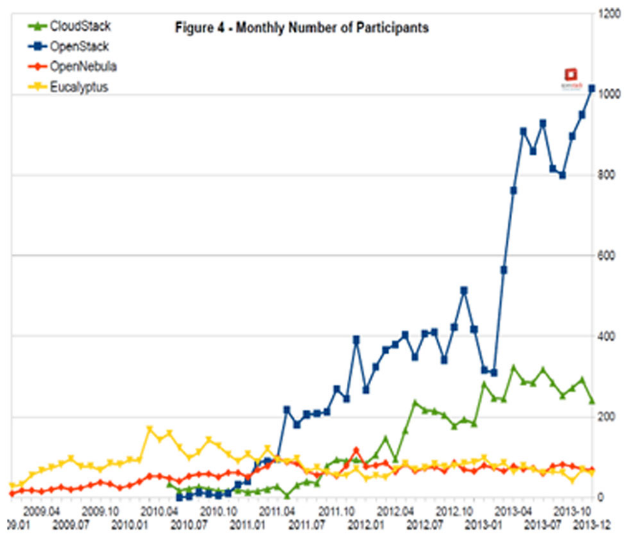


Fig. 1 The monthly number of participants

down and it is difficult to provide the best quality. CDN technology provides the best quality because it searches the optimal path to the server that has a content the user wants. Additionally it uses Scheduling in order to use many of the Virtual Machine's resource efficiently Designed Scheduling ensures and improve quality of large amounts of multimedia and typical Scheduling methods include FIFO, SRT and RR. FIFO method allocates resources according to the order requested and SRT method is the minimum residence time priority scheduling and Round Robin allocates by the hour without priority.

This paper proposes a scheme that a large number of virtual machine controls the dynamic multi-media transmission in NFV environment by using the CDN technology. This paper is organized as the following Sect. 2 of this paper will identify the topic and related research. Section 3 is the design of the propose structure, and Sect. 4 shows the performance analysis. Finally, Conclusion and future work is discussed in Sect. 5.

2 Related research

2.1 Cloud data center and scheduling researches

There are researches of new techniques to optimize the efficiency of the resources in order to reduce the consumption of the energy generated in the data center, [1]. Using hybrid queuing model that determines the number of virtual machines in the data center, the virtual machine based on the proposed new dynamic provisioning and [2] a user requests for QoS(Quality of Service) live a minimum and power consumption while providing the utilize the migration [3]. Also de-scribing the SLA (Service Level Agreements) new techniques for dynamic integration of the virtual machine based on the threshold value [4] guarantees to be able to optimize the use of cloud resources, and utilizing the network resource to reduce the occurrence of loss of bandwidth pro-poses a flow dynamic scheduling system [5]. Live VM migration to relieve the micro-architecture, resource contention can be used to show [6]. DENS [7] Method of adjusting the energy consumption of the task being performed and the scheduling of traffic demand and the energy efficiency of a cloud data center, Genetic algorithm [8] is a scheduling strategy for load balancing the resources of the VM. EVMSA [9] (Virtual Machines Efficient Scheduling Algorithm) approaches in the management of VM management effective and efficient resource allocation, MDWRR (Modified Dynamic Weighted Round Robin) scheduling algorithm [10] is to ensure the quality of the content, QoS (Quality of Service), Custom Queuing (CQ) and Priority Queuing (PQ) [11], ensure the average end-to-end latency decreases with average throughput in order to improve the revised MWRR Scheduler [12]. In addition, it is a flexible way, which allows the maximum use of the physical resources assigned to a virtual machine (VM) [13]. The comparative study between some of the IaaS (Infrastructure as a Service), further analyzes identify OpenStack structure and function [14]. Resource management through the OpenStack cloud platform for private and public cloud systems design and implementation [15]. According to CloudSim, we propose NFV framework and a number of applications based on the scheduling algorithms of the NFV cloud, NFV scenario based on the multi-dimensional extension of implementing a toolkit that can simulate Clousim NFV describes energy consumption model [16].

2.2 CDN (contents delivery network) researches

Recent CDN trend and analysis of the network status [17] describes the VM creation and CDN network configuration to describe a scheme using OpenStack [18] CDN-P2P hybrid architecture, the comparison between the CDN and peer-to-peer [19]. VM environment in the CDN are treated with different priorities according to the user's content request through the request response speed compared with the existing set thresholds [20]. Tree-Round-Robin-Replica [21] is use in order to solve the problem in an efficient and large file content push large-scale distributed content delivery network.

3 Problem formulation and description

Dynamic resource provisioning in cloud based environments involves the development of dynamic scheduling algorithms, which can be used to provide service differentiation guaran-

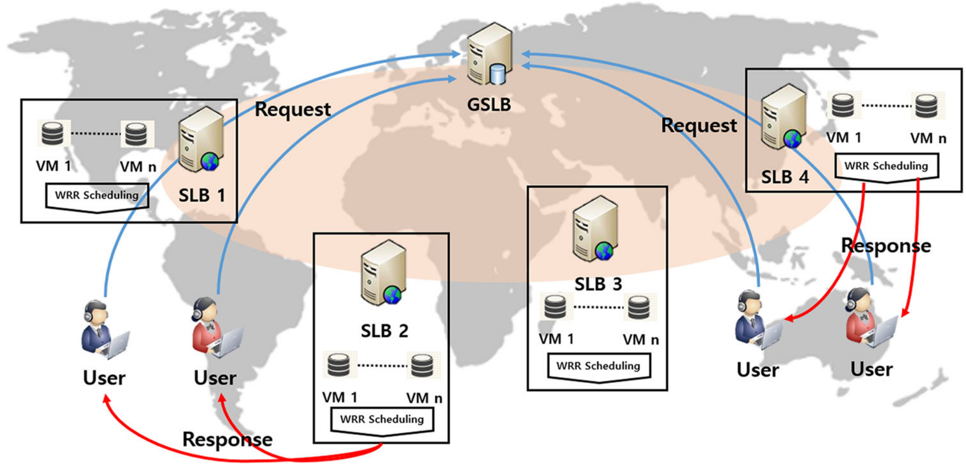


Fig. 2 System architecture

tees. In addition, the dynamic resource provisioning problem involves the modeling of applications, where multiple virtual operators utilize shared physical infrastructures, with the objective to maximize the service provider profit.

In complex systems, it is hard for the infrastructure provider to guarantee clients the service quality when the systems are under load stress. In practice it is quite challenging to offer guaranteed end-to-end delay performance to each client class and delay is not the only metric to be considered. An SLA with alternative metrics of performance must be clearly chosen.

CPU utilization is a metric that is easily observable, even in virtualized environments and CPU power is the dominant resource that determines the server/system performance. The main idea is that under load stress, the system cannot effectively guarantee the same level of performance as the normal load metrics describe.

The main motivation is that in many applications scenarios, (like in VM scheduling), it is not easy to correlate actual processing time with the type of request or with the request/packet size. In addition, statistics about the interarrival and service time for a customer's requests are, in general, unknown in practice and may not be easily estimated or correlated to metrics that are easily observable in a service processing environment. For example, VM scheduling in the hypervisor, where we want to guarantee a specific percentage of CPU power to each VM in the long run, without having a priori knowledge of the workload density, related to VM activity.

Dynamic Weighted Round Robin policies, that can be used to provision not approximate but exact CPU cycle percentages among competing users in a system operating both under "normal load" (work-conserving) and overload conditions (non work-conserving), while they fulfill a number of design criteria.

Under stochastic workloads and surge load, the analysis of the repercussions in performance of the service redistribution mechanisms is unknown, depending on multiple factors like I/O dependencies. Percentages are not actually guaranteed and usually there is a minimum performance threshold satisfaction that is verified only by simulations. The analysis they present can exert a measure of control in it and also other concepts where dynamic prioritization is required.

4 Proposed dynamic multimedia transmission control

Figure 2 shows the overall proposed system architecture including the NFV, CDN, and Scheduling in this paper. The entire network is composed of networks CDN service type; each of the SLB PM servers has a number of the VM environment of NFV. In addition, efficient transmission of multimedia data over a number of the VM and to provide the best quality to the user reliably, we use the Weighted Round Robin Scheduling. When the first User requests a desired content to the GSLB server that manages the entire SLB server of the CDN network, GSLB server identifies the SLB server with the content based on the information requested by the user and transmit the content via an optimum route to the user. The selected VM internal SLB provides the content that the user wants through the WRR Scheduling (Fig. 3).

4.1 Architecture of OpenStack

Figure 3 shows about simple architecture of OpenStack and how it deals with the creation of NFV. OpenStack is a cloud OS that provides IaaS services with the Apache license, is largely divided into seven projects, and each project is complementary with each other. The Nova (Compute) is a cloud computing fabric controller. It creates and shuts down VMs by the hypervisor API and manages large-scale virtual compute instances. Horizon (Dashboard) is the GUI on the Horizon through which administrator or user use to provide

Provisioning Automation and cloud-based resources for easy access. It can also be used to design a GUI according to the individual taste. The Keystone (Identity) performs a function that is responsible for the authentication of all services in the integrated OpenStack. Next, Glance (Image) provides a catalog and storage for the virtual disk image, and serves to transfer the stored image registration, management. However, is the capacity is large, Swift is use. Neutron (Network) is a Load Balancer, it has features such as Firewall, DHCP, etc. So it is something like a physical network with features and functionality, and all involved with the network, and to accommodate the needs of a wide variety of vendors, plug-ins are organized into agent. Swift (Object Storage) is the mass distributed storage to store objects and provides storage space needed for services such as Haoop Big Data. Finally Cinder (Block Storage) provides a volume for the VM and stores the user's service data continuously.

Figure 4 shows the current status information of an instance through monitoring and Compute via the Dashboard. The user using the OpenStack in this way can be easily controlled and managed through the GUI provided by the OpenStack.

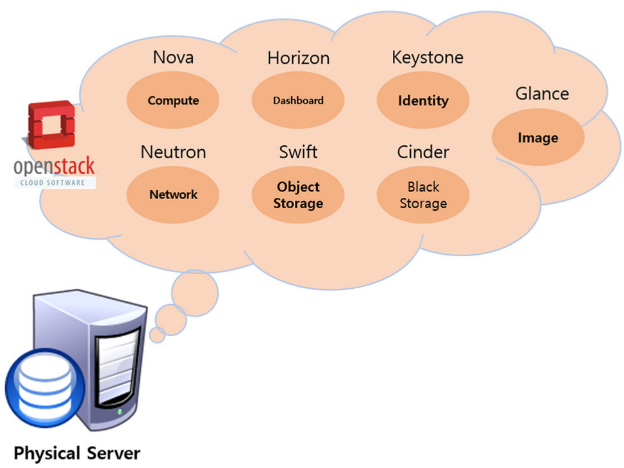


Fig. 3 OpenStack architecture

4.2 Dynamic multimedia transmission network using CDN

The main core of the CDN may be divided into two parts: the synchronization GSLB. GSLB provides faster speed performance and provides the best route to the user to prevent bottlenecks in the local environment; it also stores the content that users often request at a dedicated server provided on the network in advance, by doing this is possible to reduce the effective traffic. Figure 5 shows a flow of the CDN service that is used in this paper. GSLB Server delivers VM server information in the PM of the best route to you when you request a DNS Query of content you want the user to GSLB Server VM identified in advance and then linking content information to the PM server. The request content is in the VM of PM 4 through content information provided to the user.

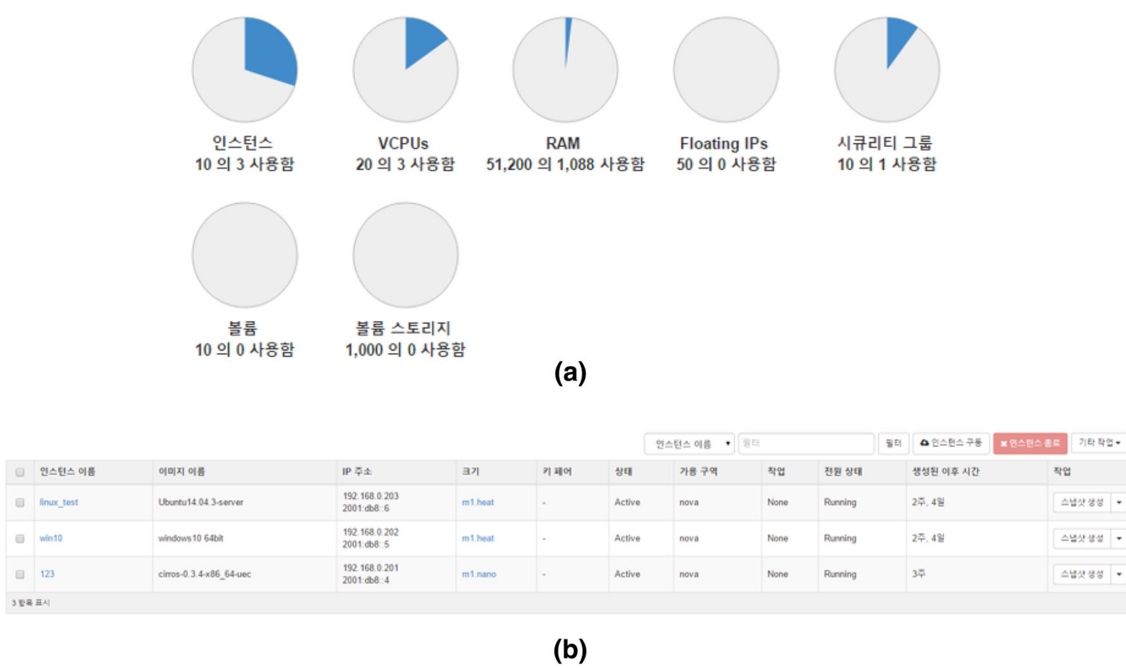


Fig. 4 Korea version Dashboard of the current status of instance information through monitoring

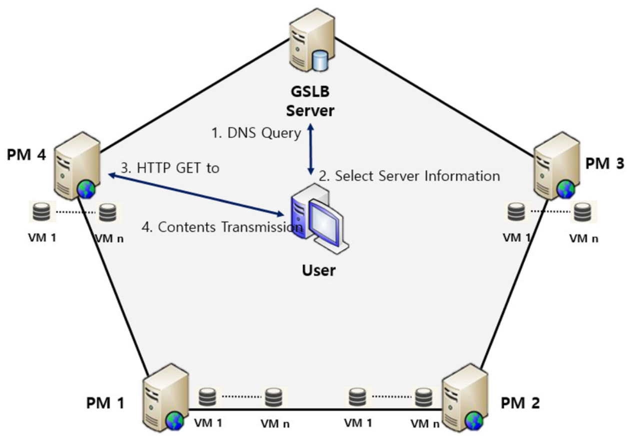


Fig. 5 CDN service environment

4.3 Weighted Round Robin scheduling for efficient multimedia transmission

We saw and handled the existing VM in the study of dynamic multimedia more efficient transport and guarantee the quality of the content and you want to improve your Round-Robin, all the servers are evenly handled the same way each server scheduling time share is giving weight to change the ratio of the Weighted variance Round-Robin scheduling. WRR scheduling weights frequently choose the biggest server capable of handling more processing power due to the higher weight. Figure 6 shows how the process contents are processed by the WRR Scheduling. The Round-Robin scheduling in conventional transmits data to the user, divides the data coming from each of the VM to a time division. However, we set the Weight values for the three different VM in order to apply the Weighted Round-Robin Scheduling method. VM1 is Weight = 3, VM2 is Weight = 2, VM3 has a Weight = 1. Data after passing through the WRR Scheduling is a high weight ratio, as a major order.

Figure 7 VM is obtained by the Total Weight to specify the scale of the weight arranged to insert a set according to the weight value set in the Number VM. After obtaining a ratio of each VM, the following formula is multiplied by a fixed length of time division. Depending on the weight given to their own VM, WRR Scheduling this process the amount of data transferred is different.

$$\left(\frac{\text{Total\_Weight}}{\text{VM\_Number\_Weight}}\right) \times \text{fixed time slice length} \qquad (1)$$

In the next Section, we evaluate and show results of our proposed method experiments. CDN network flow analysis on the basis of the performance of the data flow sent to the user via the WRR scheduling in each VM.

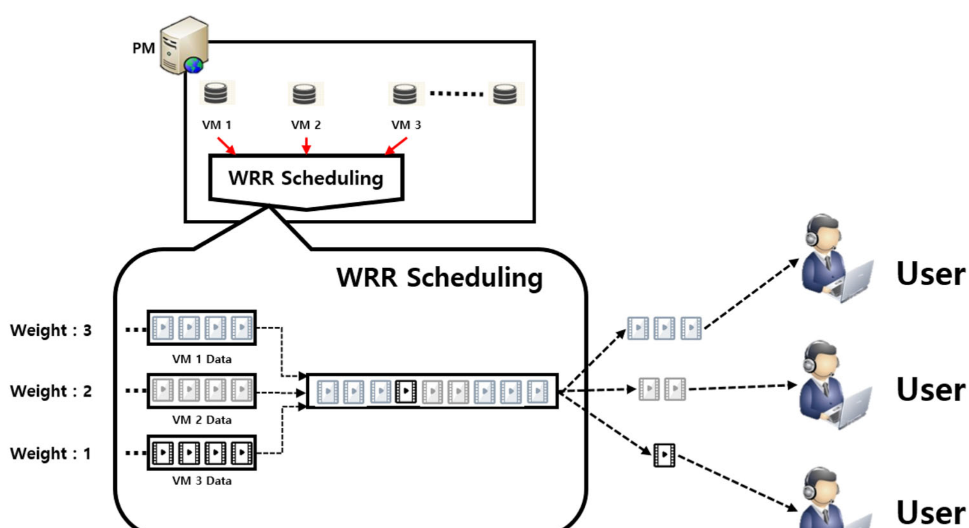
5 Performance analysis

In this section we demonstrate the performance of the proposed scheduling method to compare it with the way we offer existing RR scheduling.

We set to produce the traffic of each node in the three average of 1.024 bps, the scheduler only processed and handles the packet 3,072 bps but more speed was set at 64kbps to ease that generated traffic is properly delivered to the destination. Figure 8a looks RR only relatively data enter a constant for the time-division length through scheduling Fig. 8b are a Blue-line and Red high setting the weights more than the other node through the WRR scheduling, Green graph traffic is delivered to the user.

Figure 9 is a graph comparing the Queuing Delay analysis of the RR and WRR scheduling. Figure 9a is the RR schedul-

Fig. 6 WRR scheduling process



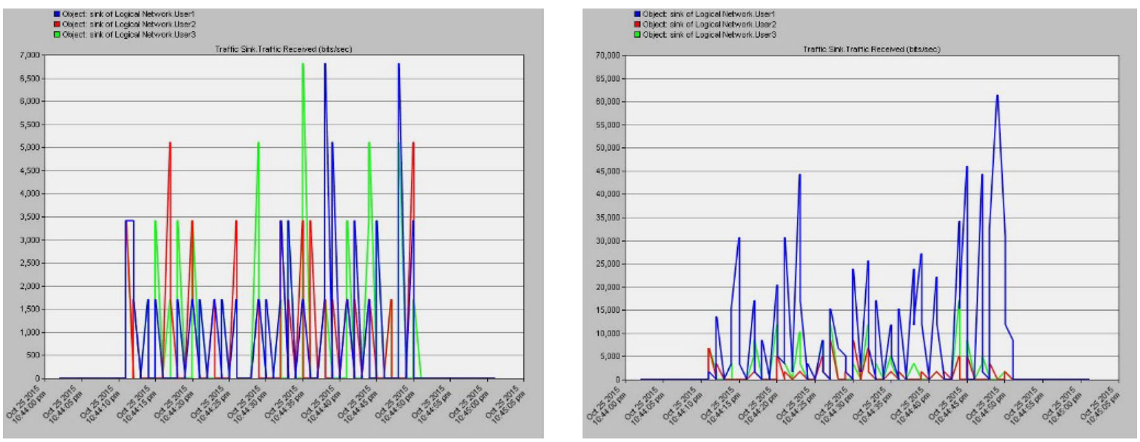
```
INPUT: VM_Number, VM_NUmber_Weight
OUTPUT: Weight Sort, Total_Weight
FOR i TO VM_Number DO
Weight[i] = VM_Number_Weight
END FOR

FOR i TO i< VM_Number DO
temp = Weight[i]
j = i-1
WHILE(j > 0 && weight[j] > temp)
Weight[j+1] = Weight[j]
j=j-1
ENDWHILE
Weight[j+1] = temp
END FOR

FOR i TO VM_Number Do
Total_Weight += Weight[i]
END FOR
```

Fig. 7 Insert sort algorithm and Total Weight

ing, but is relatively evenly process the generated traffic at each node, Figure 9b is WRR scheduling, Blue-line setting higher weight can be sure that the Queuing Delay is higher than other nodes. WRR scheduling is set at a higher weight than the RR scheduling node, it was confirmed that the higher the traffic can be sent to a particular user.

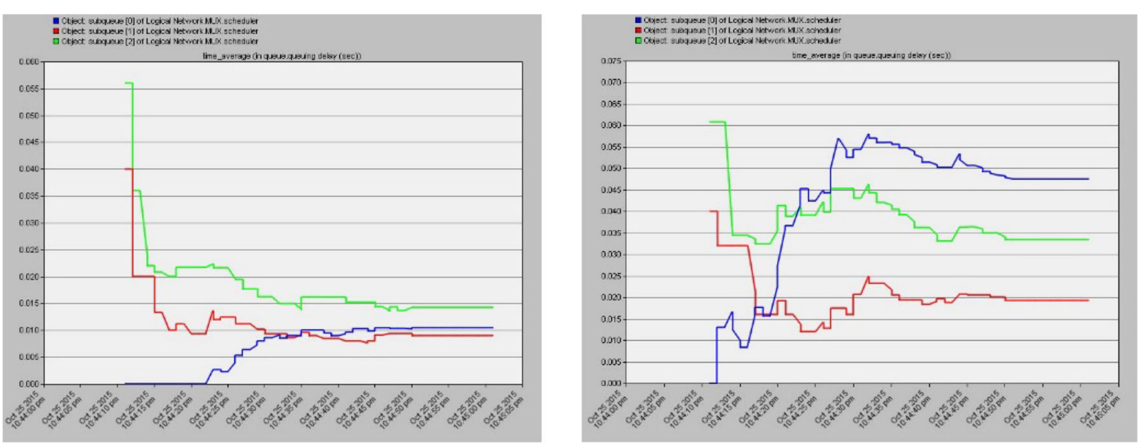
6 Conclusions

This paper presented a number of virtual machines utilizing a CDN technology NFV environment offered a plan for dynamic multimedia transmission control. Our experiments in Sect. 5 are designed based on the information in Sect. 4, and analyzed the performance of the scheme we proposed. The result showed that the conventional RR scheduling process-



(a) RR Scheduling **(b)** WRR Scheduling

Fig. 8 Traffic received (bits/s)



(a) RR Scheduling **(b)** WRR Scheduling

Fig. 9 Queuing delay (s)

ing power are the same VM with the same conditions, WRR scheduling has confirmed that the amount of traffic may vary depending on the performance of the VM. We showed and provide the best content to users via the implementation of the results required by a number of VM and CDN network, and can also prevent a waste of system in which the VM is produced indiscriminately.

In the future, we are going to solve and show all the VM can suffer from the same problems apply Queuing Delay, the results of this study and a number of the VM with the VM if the weight is set to be highly weighted setup altogether different to the actual VM environment.

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