Joint scheduling of audio teaching resources in NFV service chain deployment

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Abstract. With the increasing network demand of users, the original middleware equipment shows the defects of single function and large geographical limitation, so the network function virtualization technology (NFV technology) should be introduced. Based on this, an audio teaching resource joint scheduling method for NFV service chain deployment is proposed. The audio resources are first virtualized and combined on demand. Then, the algorithm is deployed according to the NFV service chain to realize the joint scheduling of audio resource data. By comparing with the traditional method, it is proved that the method designed in this paper can accurately distinguish audio resources to a certain extent, ensure a higher scheduling utilization rate of resources, and have better stability and effectiveness.

Keywords: NFV service chain;Audio teaching resources;Joint dispatching;

1 Introduction

With the increasing network demands of users, the original middleware devices show the defects of single function and large geographical limitation. Network Function Virtualization (NFV) technology aims to use the general equipment in the data center to realize network functions, to replace the traditional proprietary equipment, so as to realize the flexible deployment and removal of network functions, and improve the intelligence of network management. Therefore, network function virtualization technology (NFV technology) should be introduced [1].A single network request is arranged in a reasonable order so that it has several virtual network functions.And under the support of standard x86 equipment, greatly improved the system performance.NFV technology migrates the traditional physical network into the virtual network to realize the large-scale scheduling and management of virtual equipment, which reflects the characteristics of good flexibility, security and reliability.NFV system services consist of a series of virtual network functions that can be flexibly deployed, authenticated, and enabled on demand through decoupling of network functions from

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proprietary hardware devices to manage hardware resources extremely efficiently.The NFV service function chain mainly consists of the following workflow: first, the VNF chain composition (VNFs) phase. In an NFV environment, different types and quantities of NF are virtualized and deployed in the virtual network infrastructure to allocate computing resources and link bandwidth resources according to the needs of different users.Related to the number of virtual network functions, the order of association, the distribution of service chains in the physical network and other factors, to provide users with high-performance network services.The second SFC mapping phase.This is the mapping of virtual resources to candidate physical resources, including the mapping of virtual nodes and virtual links, reflecting the typical virtual network embedding problem or virtual data center embedding problem.When each VNF is mapped to a physical node, it is necessary to ensure the fit of the attributes, so as to better realize point-to-point chain network services such as load balancing, data encryption and decryption [2].At the same time, in the mapping process involving choreographer, service, virtual layer and NFVI, the corresponding network service can be provided for users when the virtual resource is fully mapped to the physical network.Taking an SFC mapping stage as an example, the choreographer reasonably determines the mapping strategy through the operation of the SFC mapping algorithm, and carries different VNFS to the physical nodes in the virtual node mapping stage.In the virtual link mapping phase, the virtual links of VNFs are mapped to the physical network through the mapping algorithm.NFVI is used to calculate, store, and link support throughout the mapping process [3].Third VNFs scheduling phase.That is, virtual network function scheduling.In this stage, the focus is on efficient scheduling of different SFCS. On the premise of maintaining system service performance, SFC can be deployed and scheduled reasonably based on different user requests to save resource consumption and reduce system running time.In at the same time, in an age of artificial intelligence technology constantly infiltration, build a set of nonlinear signal processing system, can using the correlation algorithm and neural network in the system, realize the optimization of NFV service chain deployment and scheduling and better solve NFV service chain nodes and bandwidth resources waste problem in deployment, enhance the user's web experience.

2 Joint scheduling of audio teaching resources in NFV service chain deployment

2.1 Virtualization of audio resources

The virtualization of audio resources based on overlay network is based on the detection results of audio resources [4]. Access nodes distributed in different geographical areas send detection information to each other and obtain performance data of each rasterized access node through interactive detection results.VNF based on each node to obtain access to the network connection state (related to audio resources distribution and coverage), network interface queue occupancy (with audio resources distribution of processing power and business related), link transmission rate (associated with the transmission technology and the transmission bandwidth of audio resources), packet loss rate (related to the interference environment of audio resources) and other periodic detection data to build the network performance database.Abstract the service transmission and processing service capability of different link transmission services or network units to realize the service abstraction of network transmission capability. VNF upload abstraction of the underlying network transmission ability to VCD, VCD performance in relation to any location from the VNF normalized processing, sample values under different based on the Internet in Beijing to support the big data technology and application of hybrid teaching research business types of different transmission requirements and comprehensive performance measurement mechanism, as shown in figure 1.

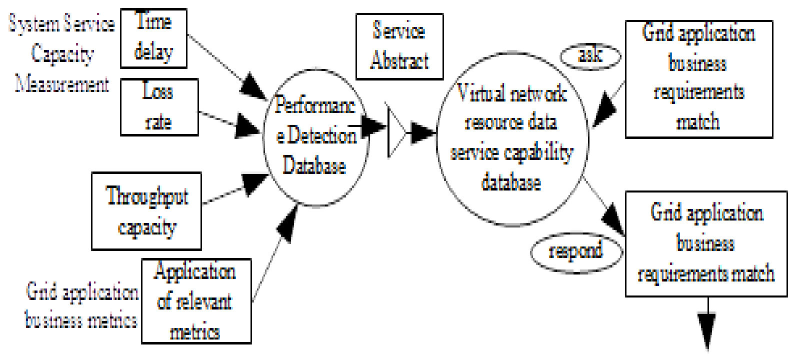

Fig. 1. Audio resource virtualization process based on performance database

2.2 Audio resources are combined on demand

First, according to the detection results of service transmission requirements and virtual link performance, select the appropriate cross-network cooperative forwarding entity, construct packet forwarding and track and monitor the forwarding capability of cooperative entity.Second, when the service capability of the collaboration entity changes, the collaboration entity is reselected to complete the flexible reorganization of the business transfer resources and smooth switching of the business transmission path [5].After receiving the intra-domain routing query business, DMC obtains the source node identity, destination node identity and business type, and then queries the corresponding routing table according to this condition.If a corresponding routing record exists in the local routing table, the channel reservation instruction is generated and sent to the VNF.If no routing record exists, send the inter-domain collaboration request and wait for the collaboration reply to be received before looking for the inter-domain routing table.When DMC performs intra-domain/inter-domain routing calculation, it calculates the link cost corresponding to the current source node and destination node identity based on the latest link state information between nodes maintained by VCD.Query the connection table maintained by DMC. If there is already a routing record for this source node and destination node, the link cost is the same as the current calculated result, there is no need to recalculate the route.Otherwise, update the link cost for this side, then use Dijkstra algorithm to calculate the route and regenerate the route table.According to the current QOS requirements for service transmission, DMC can choose multiple cooperative forwarding paths to provide parallel transmission services.After receiving the channel instruction returned by DMC, the VNF directly providing access to the source node reserves the resource and replies for confirmation.The combination of on-demand resources across domains is different from within domains in that the DMC distributes the business QOS reply to each VNF participating in the collaborative transport on the selected path based on the generated inter-domain routing.If the corresponding route record (unavailable resource) cannot be found, the VNF route establishment is notified of failure.

2.3 Design of NFV service chain deployment algorithm

The complexity of mathematical models in large-scale networks is relatively high and it is difficult to be fully applied [6].Therefore, this section will design an efficient algorithm to solve the NFV service chain deployment problem.By expanding the concept of the longest common subsequence and its dynamic programming method, an efficient algorithm based on the longest common subsequence was designed to deploy the NFV service chain.Given two sequences, sequence X and sequence Y.If sequence X is a subsequence of both X and Y, then sequence X is said to be a common subsequence of sequence X and sequence Y.Of all common subsequences of sequences X and Y, the sequence X with the maximum length is called the longest common subsequence of sequences X and Y.

The longest common subsequence is solved by dynamic programming.Given two sequences, the $X_m =< x_1, x_2, ..., x_m >$ sequence and the sequence $Y_n =< y_1, y_2, ..., y_n >$, assume that the $Z_k =< z_1, z_2, ..., z_m >$ sequence is any of the longest common subsequences of sequence X and sequence Y .So if $x_m = y_n$, then $z_k = x_m = y_n$, then the sequence Z_{k-1} is the longest common subsequence of the sequence X_{m-1} and the sequence Y_{n-1} .

If $x_m \neq y_n$, and $z_k \neq x_m$, then the sequence Z_k is the longest common subsequences of the sequence X_{m-1} and the sequence Y .If $x_m \neq y_n$, and $z_k \neq y_n$, then the sequence Z_k is the longest common subsequence of the sequence X_m and the sequence Y_{n-1} .

Through the above analysis, if we use $lcs[i, j]$ to represent the length of the longest common subsequence of sequence $< x_1, x_2, ..., x_i >$ and sequence $< y_1, y_2, ..., y_i >$, we can obtain the recursive expression to solve the length of the longest common subsequence of sequence $< x_1, x_2, ..., x_i >$ and sequence $< y_1, y_2, ..., y_i >$ as formula (1).

$$lcs[i, j] = \begin{cases} o, i = 0 or j = 0 \\ lcs[i-1, j-1]+1, i, j > 0 and x_i = y_j \\ \max\{lcs[i, j-1]\}, lcs[i-1, j], i, j > 0 and x_i \neq y_j \end{cases} \quad (1)$$

Therefore, the longest common subsequence length of sequence $X_m =< x_1, x_2, ..., x_m >$ and sequence $Y_n =< y_1, y_2, ..., y_n >$ only needs to be $lcs[m, n]$ [7].According to the recursive expression formula (1), the longest common subsequence length of the two sequences can be obtained.In the process of solving the longest common subsequence length of the two sequences, a table of constructing the longest common subsequence is maintained to construct the longest common subsequence of the two sequences.For the dynamic programming method to solve the longest common subsequence length, the time complexity is $\theta(m, n)$, and the time complexity of constructing the longest common subsequence is

$O(m+n)$.

For the VNF sequence φ in a VNF service chain, the expression of φ is $\varphi = <VNF(a_1),...,VNF(a_m)>$.If there is another VNF series in which $\varphi = <VNF(c_1),...,VNF(c_k)>$ is the VNF sub-sequence of φ, if and only if there is a strictly increasing sequence $<i_1,...,i_k>$ such that $VNF(a_{i_j}) = VNF(c_j)$.The $VNF(a_{i_j}) = VNF(c_j)$ here indicates that their VNF types are the same [8].For the VNF sequences φ and $\varphi^{'}$ of any two NFV service chains.If there exists a VNF series $\hat{\varphi}$ is a VNF common subsequence of the two sequences φ and $\varphi^{'}$, if and only if the VNF sequence $\hat{\varphi}$ is a VNF subsequence of both sequence φ and sequence $\varphi^{'}$.

In the calculation of the longest common subsequence length of VNF, for the VNF sequence φ and $\varphi^{'}$ of any two VNF service chains. In their VNF common subsequence, the VNF common subsequence with the maximum length is called the longest common subsequence of VNF(VNF鍶Longest鍶Common鍶Subsequence，鍶LCS).We write down the longest common subsequence of VNF of the VNF sequence φ and $\varphi^{'}$ as a structure LCS, which contains the longest common subsequence of VNF itself $LCS(\varphi,\varphi^{'}).sep$ and the length $LCS(\varphi,\varphi^{'}).len$ of the longest common subsequence of VNF.

As mentioned above, the longest common subsequence can be solved in polynomial time using dynamic programming algorithm [9].If we assume that φ is the VNF sequence of NFV service chain request $R_i(s_i,d_i,T_i,B_i)$, and $\varphi^{'}$ is the VNF sequence already deployed on the path $s_i \rightarrow d_i$, then $LCS(\varphi,\varphi^{'}).len$ is the VNF matching degree of sequence φ and $\varphi^{'}$

.For example, if you have the VNF sequences $\varphi =< VNF1, VNF6, VNF8 >$ and $\varphi^{'} =< VNF1, VNF5, VNF8, VNF9 >$, then their $< i_1, ..., i_k >=< VNF1, VNF8 >$, and $LCS(\varphi, \varphi^{'}).len = 2$.That is, the VNF match between sequence φ and $\varphi^{'}$ is 2[10].We will apply this VNF matching degree in the later algorithm design. 。For the deployment of NFV service chain in Inter-DC鎴EON network, an algorithm based on longest common subsequence design (LCS-Based鎴Algorithm， LBA) is proposed.Above, the details of the LBA algorithm are given, which considers the VNF sequence deployment of NFV service chain and the spectrum resource allocation in the deployment process.

2.4 Implementation of audio resource data joint scheduling

On the basis of the above resource scheduling arrangement and related algorithm design, the audio sharing resources are reasonably scheduled to ensure the audio data sharing of opencourseware teaching resources.In order to overcome the disadvantages of the traditional method, this paper adopts the conjugate hierarchical scheduling method. Firstly, the input resource information data is FFT at N points, which is expressed by equations (2) and (3).

$$x_1(k) = FFT\left[x_1(k), x_1(k+1), ..., x_1(k+N-1)\right]^T \quad (2)$$

$$x_2(k) = FFT\left[x_2(k), x_2(k+1), ..., x_2(k+N-1)\right]^T \quad (3)$$

The above input resource information data are used to carry out a balanced design for the audio resource scheduling process, and formula (4) is used to obtain the scheduling data set of the finite conjugate hierarchy.

$$X = \left\{x_1, x_2, ..., x_n\right\} \subset R^{'} \quad (4)$$

Using the finite conjugate hierarchical scheduling data set to schedule n audio resources. Schedule and use equations (5) to (7) for layered design of audio resources:

$$X = \left\{X\left[1\right], X\left[2\right], ..., X\left[N\right]\right\} \quad (5)$$

$$X\left[1\right] = (id_1, n_1) \quad (6)$$

$$X\left[N\right]=(id_m, n_m) \quad (7)$$

The characteristic decision rule base is formed by mining and processing the audio resource data at different levels.Formula (8) is used to calculate the power spectrum characteristics of audio resources in the cluster.

$$M=\varpi_1\sum_{i=1}^{\mathrm{m\times n}}(H_i-S_i)+M_h\varpi_2\sum_{i=1}^{\mathrm{m\times n}}(S_i-V_i)$$
$$\varpi_3\sum_{i=1}^{\mathrm{m\times n}}(V_i-H_i) \quad (8)$$

Enter the initial value $r=1$, $k_j^{'}=k_j$, $b_j^r=b_j$, $(j-1,2,...,m)$, $X=\varnothing$, 鍶 $Y=\varnothing$, $K^r=\bigcup_j\left\{k_j^{'}\right\}$, $B^r=\bigcup_j\left\{b_j^{'}\right\}$.Once new data features enter the system, the feature library is constantly enriched.So if $A_r=\sum_{i=1}^{n}a_i\varsigma_{ir}>0$ is equal to $x_k^r=\left[\frac{A_r}{b_i^r}\right]$. Carry out the classification attribute decomposition of R class items of audio resources in L time slices, when $j\neq t$, take the following formula.

$$A_r=A_r-x_k^r*b_t^r, k_j^r=\begin{cases}0, ifj\leq t\\ k_j^r, ift<j\leq m\end{cases}, t=t+1 \quad (9)$$

When $y_{i_qj}=0$ is equal to, let's take $Y_{i_t}=Y\cup\left|y_{i_qt}\right|$.

Through the above mentioned conjugation layer scheduling, the audio Shared resource data can complete the joint scheduling.

3 Experimental results and analysis

In this paper, a method of joint scheduling of audio teaching resources in NFV service chain deployment is designed. In order to verify the performance of this method, a comparative experiment is designed with the common method of joint scheduling of audio teaching resources.Through comparison, the experimental hypothesis is verified.

3.1 The experiment content,

In this section, the experiment will judge the advantages and disadvantages of the two methods by comparing the resource utilization of the two audio teaching resources.The experimental method is a comparative experiment, in which the experimental verification process is completed by controlling other variables, except the experimental variation, to remain unchanged.

The audio resources for data integration and resource partitioning, each resource scheduling of sampling time is 12 ms, audio resources are divided into several regions, each region with GridSim storage capacity expansion, the number of each audio resource scheduling task file access to 2500 gb, task delay for 10223 ms, according to the simulation environment and parameters for audio Shared resource scheduling simulation data set.

3.2 Analysis of experimental results

First, the time-frequency feature partition of audio resources is constructed. The resource Scheduling and load balancing fusion algorithm with deep learning based on cloud computing algorithm is used as the traditional comparison method[11]. The results of the two methods are compared. The more unified the scheduling resources, the better the scheduling effect. The specific experimental results are shown in Figure 2.

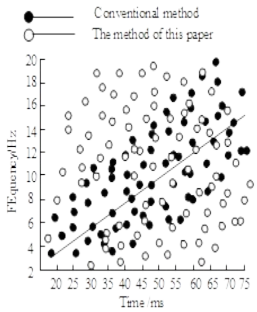

Fig. 2. Time-frequency characteristic partition of audio resources.

It can be seen from the analysis figure 2 that the algorithm in this paper is used for audio resource scheduling, which has a good grid partitioning ability.

In order to verify the performance of this method, the utilization of resource management mobile nodes is taken as the test index. The comparison results of data utilization ratio of audio sharing resources by different methods are obtained, as shown in Figure 3.

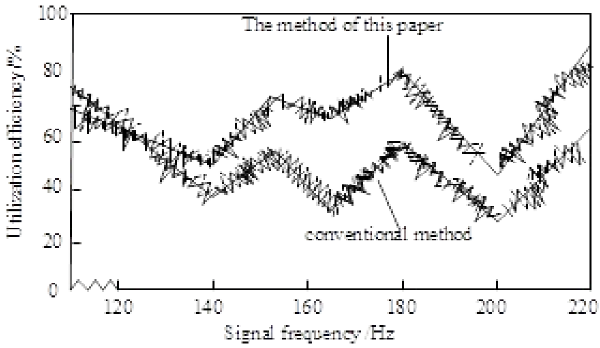

Fig. 3. Different methods for the utilization of audio Shared resource data.

It can be seen from figure 3 that the algorithm proposed in this paper is used for audio source scheduling, with high utilization rate and coverage of data management nodes, high space occupancy and superior performance to traditional methods.

4 Conclusion

This paper designed the NFV service chain deployment under the combined audio teaching resource scheduling method, combined with traditional audio teaching resource scheduling method of contrast experiment, proves that this design method can to a certain extent, accurately distinguish between audio resources, ensures high utilization rate of scheduling resources, has better stability and effectiveness.

5 Fund projects

Research on the artistic characteristics and cultural protection of gongs in Yichun （Project approval No.: yg2017121）

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