Retraction

Retracted: Design Analysis of Intelligent Enterprise Costing Platform Based on a Virtual Network Mapping Algorithm

Discrete Dynamics in Nature and Society

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets 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 own 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] X. Meng, D. Zhao, and S. Tian, "Design Analysis of Intelligent Enterprise Costing Platform Based on a Virtual Network Mapping Algorithm," *Discrete Dynamics in Nature and Society*, vol. 2022, Article ID 9181962, 12 pages, 2022.

Research Article

Design Analysis of Intelligent Enterprise Costing Platform Based on a Virtual Network Mapping Algorithm

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Cost management is an important part of enterprise management and is fundamental to the survival and development of enterprises. Cost management is of great significance to promote production and cost-saving, strengthen cost accounting, improve management, and enhance the overall management level of enterprises. In this paper, different factors affecting mapping are combined with a group intelligence algorithm to study virtual network mapping, which dissects enterprise cost management in a new perspective and analyzes the relationship between enterprises in each supply chain and the association between the processes of each link in the supply chain. The algorithm uses node CPU, node degree, and neighboring bandwidth resources as advisors' strategies, respectively, and customers consult multiple advisors in the process of constructing mapping solutions, and the advisors give suggestions to customers according to their strategies. CGS-VNE uses an advisor-guided search mechanism to ensure the diversity of mapping solutions, which can fully explore the solution space and derive high-quality enterprise costing solutions through iteration. Whether in evaluating enterprise cost control or enhancing enterprise cost control capability, the value chain theory can be practically applied to clarify the current situation of enterprise cost control under the premise of combining theory and practice and truly achieve the fundamental purpose of helping enterprises to fully implement cost control.

1. Introduction

Cost management is an important part of enterprise management and is fundamental to the survival and development of enterprises. Cost management is of great significance in promoting production and cost-saving, strengthening cost accounting, improving operation and management, and raising the overall management level of enterprises. The impact of technological innovation on enterprises is significant and far-reaching, and technological progress will inevitably lead to changes in productivity within the enterprise, which will put forward new requirements for production relations within the enterprise [1]. From this point of view, technological progress is bound to affect or lead to cost management innovation through some or several paths. The world economy is currently moving in the direction of globalization, which has led to very significant changes in the business environment within

various industries and companies, with increasing space and volume of company logistics activities. Therefore, companies can only continuously increase their capital investments to gain a foothold in this very competitive market environment. Therefore, more and more companies are treating corporate cost control as the top priority of company management, trying to take a longer-term view and turning the original rough cost management system into a fine-tuned management system, and this change is the main manifestation of company growth and maturity [2]. In this paper, the cost accounting method based on the virtual network mapping algorithm of an optimal subnetwork is proposed to emphasize the cost control of the manufacturing company, which is deeply analyzed, and the theory of value chain and the cost control of the company are deeply combined, and the company is comprehensively controlled from the perspective of cost accordingly. By introducing network virtualization based on optimal

subnetworks, the physical resources of the underlying physical network can be virtualized and flattened.

The physical resources after virtualization are easy to operate, manage, allocate, maintain, and update. The main significance of optimal subnet-based network virtualization: it becomes possible for Internet service providers to deploy and build novel network protocols and network applications without affecting the existing Internet. At the same time, network virtualization based on optimal subnets provides conditions and a basis for the birth of new personalized network services and applications [3]. Therefore, whether in evaluating enterprise cost control or enhancing enterprise cost control capability, value chain theory can be practically applied to clarify the current situation of enterprise cost control under the premise of combining theory and practice and truly achieve the fundamental purpose of helping enterprises to fully implement cost control. The case study steps followed in this paper are as follows: first, based on innovation theory, scientific management theory, and organization theory, the theoretical view of the impact mechanism of technological innovation on cost management innovation is initially constructed; second, based on the theoretical view, the case study plan is designed and the case study framework is formed; third, through the continuous cycle of theoretical construction and case evidence analysis, the theoretical view and research of this paper are finally formed in conclusion. In the analysis of cost control, the application of value chain theory can help enterprises improve their business concepts and thus increase their profitability. This approach can help companies not only to consider costs as a whole, but also to reduce them significantly. By conducting an in-depth study of this, potential costs can be controlled more effectively [4]. The value chain can play a positive role in the sustainable operation of the enterprise, the market share of the enterprise, and the comprehensive strength of the enterprise. In other words, under the modern management concept, the construction of the value chain is the foundation of enterprise operation and development, and it is also an important theoretical content that enterprises should adopt to integrate into the market and enhance market competitiveness. Under the guidance of value chain analysis cost control, enterprises can analyze the cost of competitors more effectively and make the differences the focus of analysis to discover the competitive strategies which are beneficial to their development, to take more advantages in the market competition and thus gain more profits.

2. Related Work

While each company will have different jobs and different products and business models, the underlying purpose is to create the company's value through this set of actions. These actions include, but are not limited to, purchasing, production, sales, and a range of human and financial costs. Together, these actions can be combined to achieve value-add for the company. Therefore, the application of virtual network mapping theory through optimal subnetworks can make the development goals of the company in the process

of business management clearer and can likewise help the company to achieve open source savings under the preconditions of corporate value combining, which can help the sustainable development of the company.

Chu et al. [5] introduced the curve cost function equation to facilitate the implementation of cost control, and in the process of practical testing, the two scholars divided the equipment cost of chemical enterprises into two parts, i.e., running and investment costs. And the two states, nonnormal (overdue) and normal, together constitute the equipment operation state. The curve cost function can calculate how to make both running and investment costs reach the minimum solution and then enhance the overall effect of cost control by scientific accounting. Othman and Nayan [6] believed that all departments of the company can use the value chain for analysis; specifically, the enterprise can analyze the motivation by using the operating cost method and can also improve the efficiency of the company's employees, so that, under the application of the operating cost method, the enterprise managers can clarify the actual situation of the development of various types of business operations and the corresponding costs paid and provide help for the formulation of enterprise business strategies. Literature [7] uses the idea of hierarchical mapping to solve the virtual network mapping problem of cross-domain data centers. The virtual network is mapped to the physical network layer by layer. The physical network can be specifically divided into layers of the underlying facility, containers of multiple servers within the facility, and physical servers, where the virtual network is mapped at a similar cost in each layer. Also to minimize the mapping cost, the data nodes are placed in the same data center. Thus the algorithm focuses on the impact of mapping cost on the virtual network mapping algorithm. Literature [8] proposes a distribution-based cross-domain virtual network mapping framework PolyViNE. In this framework each InP is responsible for mapping a part of a virtual network request or rejecting the request. In addition, the study introduces a hierarchical addressing scheme with location-aware protocols to implement a geolocation-based forwarding mechanism. Silva et al. [9] propose a cross-domain virtual network mapping solution based on a bidding auction mechanism. In this solution, each InP makes an offer for a virtual network request and the virtual network mapping policy is decided based on the offer level. This mapping scheme is based on InPs sharing private information in their respective domains, and hence this application is not realistic. Literature [10] proposes a novel chromosome-based genetic algorithm model, which is utilized to solve the cross-domain virtual network mapping problem. In this algorithm, genes are used to represent the physical structural domains, and alleles are used to represent the underlying nodes. The chromosome represents a scheme for mapping virtual nodes in the underlying network. A hierarchical cross-domain virtual network mapping architecture with distributed control and centralized management has been proposed in [11]. The cross-domain virtual network mapping algorithm designed under this architecture aims at minimizing the virtual network mapping overhead. The algorithm slices the

incoming virtual network requests and then solves for the best solution based on an optimized artificial bee colony algorithm. It can be seen that the algorithm focuses on the impact of mapping cost on the virtual network mapping algorithm. A two-stage cross-domain mapping strategy DPSOK is proposed in [12]. This strategy considers the impact of node resources and interdomain link bandwidth resources on the mapping cost based on resource bidding. The mapping of cross-domain virtual networks is then performed using an optimized particle swarm algorithm. In the intradomain mapping phase, the strategy utilizes the Kruskal minimum spanning tree algorithm to solve the intradomain mapping since the mapping overhead is relatively small. The objective is to shorten the slice instantiation time and reduce the business go-live time. So the strategy focuses on the impact of mapping overhead on the cross-domain virtual network mapping algorithm. Barakabitze et al. [13] propose a resource allocation algorithm for the problem of how to provide resilience against network failures for virtual network services. The algorithm utilizes a heuristic virtual network mapping scheme and a recovery path selection scheme based on intelligent bandwidth sharing to efficiently utilize network resources and protect virtual network services from network failures. This shows that the algorithm focuses on the impact of algorithm stability on the virtual network mapping algorithm. Asensio et al. [14] transform the cross-domain virtual network mapping problem into an integer linear programming problem. The algorithm separates the different virtual network requests by deflating integer variables. The virtual network provider first receives a virtual network request containing geographically qualified and physical network information with hidden intradomain links, combining the two in the form of an augmented network. Afterward, the multicommodity flow problem in this augmented network is solved and the constraints are deflated to finally obtain the mapping scheme that minimizes the mapping cost of the cross-domain virtual network. So this study focuses on the effect of mapping cost on the performance of the algorithm.

3. Application of Optimal Subnetwork-Based Virtual Network Mapping Algorithm in Enterprise Costing

3.1. Virtual Network Mapping Algorithm Based on an Optimal Subnetwork. Optimal subnetting-based network virtualization is a new network technology that enables the deployment of different network architectures and protocols on shared physical infrastructure. Optimal subnetwork-based network virtualization provides a direction for future networks, which supports the coexistence of multiple network architectures, overcomes the current "rigidity" of the Internet, and facilitates the development and deployment of new network technologies, services, and applications. Unlike traditional network architectures, a virtual network environment is a collection of network architectures built by different service providers. As shown in Figure 1, each SP leases equipment from one or more infrastructure providers

for virtual network construction. The optimal subnet-based network virtualization model differs from the traditional network architecture in that there are two different roles, InPs and SPs, where InPs are responsible for the deployment and operation of physical network resources and use software programming techniques to secure the resource requirements of different SPs; SPs selectively create and deploy VNs by selectively leasing multiple InPs resources and partitioning network resources to provide customized services to various end-users; in addition, SPs can also act as virtual infrastructure providers to create subvirtual networks by partitioning resources and lease these subnetworks to other service providers to provide network services to other SPs. In an optimal subnet-based network virtualization environment, the basic entity for allocating resources is the virtual network, which contains two main elements, namely, virtual nodes and virtual links. When performing the mapping of each virtual network service, the virtual network service provider reduces unnecessary physical resource consumption while ensuring the successful mapping of that virtual network. This helps to reduce virtual network mapping expenses and allows more physical resources to be set aside for the mapping and deployment of additional virtual network services. In addition, the virtual network service provider should fully utilize the physical network elements that are already being used for mapping and reduce the use of new physical network elements that are in a shutdown state. Virtual nodes are interconnected by virtual links, forming a virtual network topology, which is, in essence, a subset of the physical network topology, where each virtual node corresponds to a physical node, each virtual link corresponds to one or more physical links, and each virtual network is managed and operated by a service provider [15]. In Figure 1, there are two virtual networks, VN1 and VN2, which are operated by service providers SP1 and SP2, respectively. SP1 leases the physical resources managed by infrastructure providers InP1 and InP2 to form VN1 on top of the physical resources to provide end-to-end services to user 2 and user 3, respectively; SP2 uses the resources of infrastructure provider InP1 and service provider SP1's subvirtual network to deploy VN2, where End User 1 and End User 3 establish connectivity through VN2.

Optimal subnetting-based network virtualization technologies provide customized services by building isolated virtual networks on the physical network, with the advantage that the underlying provider reuses the physical infrastructure and establishes connectivity to edge users to support diverse network services for SPs. As a result, multiple tenants can deploy their services without significant investment. How to efficiently allocate physical resources to virtual networks is the challenge for optimal subnetting-based network virtualization technology. The main problem of optimal subnet-based network virtualization is virtual network resource allocation, i.e., virtual network mapping, the core idea of which is to map virtual resources to physical devices through a predesigned algorithm, thus maximizing the use of limited physical devices. Service providers offering customized end-to-end assurance services to end-users need to optimize dynamic resource allocation, thus enabling self-
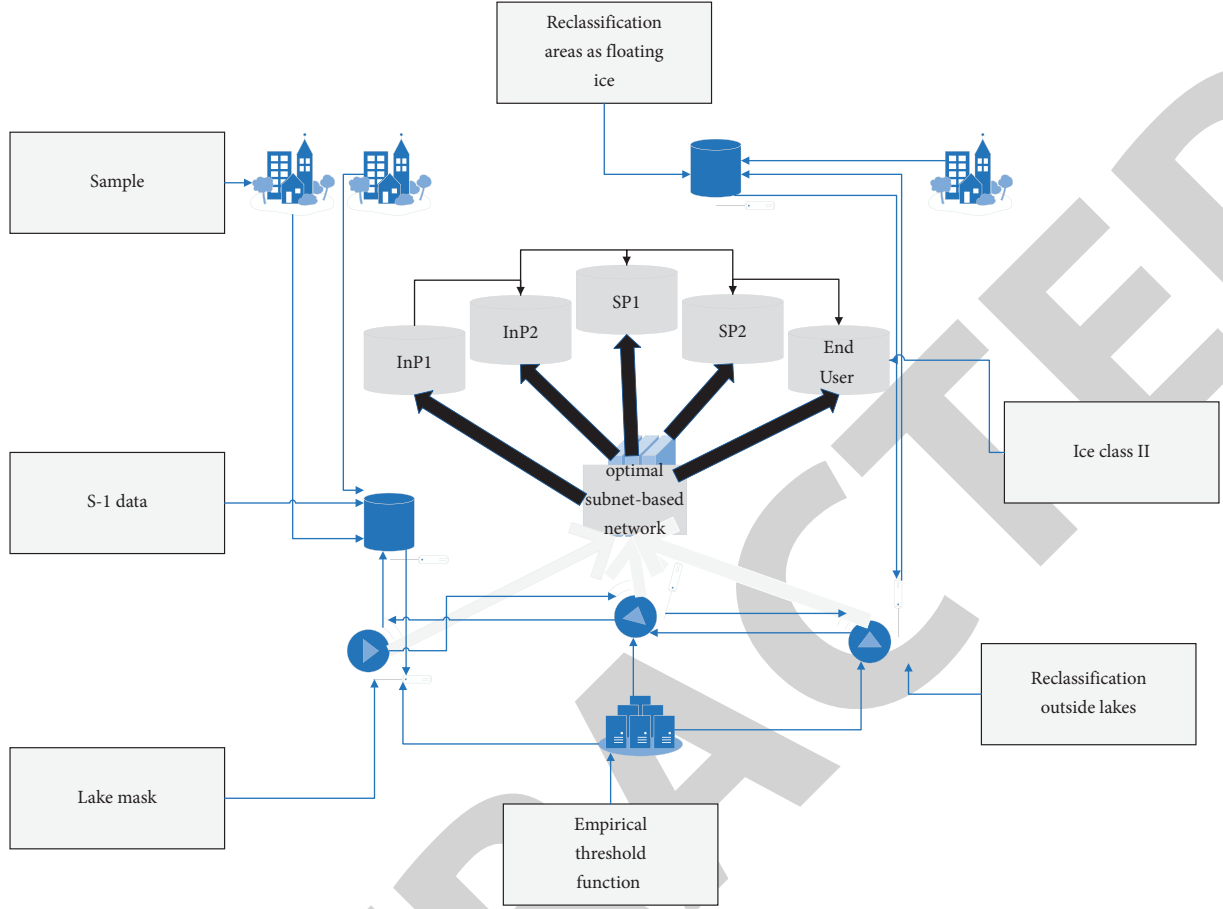
FIGURE 1: Optimal subnet-based network virtualization environment.

configuration and organization of future networks. Cost control in a broad sense consists of five main aspects, which are cost forecasting, cost planning, cost accounting, cost decision making, and cost assessment. These five aspects cover all business actions of the company. Figure 2 illustrates how network virtualization uses mapping algorithms to optimally allocate virtual resources across the physical infrastructure. Virtual network operators use mapping algorithms to decide to request certain virtual resources from the VNP, which are then instantiated by the underlying InPs [16]. Virtual network mapping allocates virtual resources to nodes and links and can be divided into two subproblems: virtual node mapping, i.e., mapping all virtual nodes to the corresponding physical nodes, and virtual link mapping, i.e., mapping the virtual links connecting virtual nodes to the physical links connecting physical nodes accordingly.

Virtual network mapping aims to make full use of physical network resources to serve more virtual network requests, which in turn improves the revenue of network operators, with the following relevant evaluation metrics. Virtual network requests acceptance rate.

$$I(i,j) = \frac{\overline{\delta}(i,j) + \overline{\delta}\max}{\overline{\delta}\max - \overline{\delta}\min}. \tag{1}$$

The total long-term benefit is the economic profit that the acceptance of the virtual network can generate for the InPs. The benefits to the infrastructure provider of successfully mapping a virtual network at time t are calculated according to the following equation:

$$A_t(\alpha, \beta) = F[A(t, t-1), M(i, t)]. \tag{2}$$

The physical network long-term benefit-cost ratio refers to the fact that, at time t, it takes a certain amount of physical network resources to accept a virtual network, which is defined as the mapping cost, as shown in the following equation:

$$\beta_t = \alpha_t - \frac{(\alpha_2 + \alpha_1)(E_n^1 + \lambda_1)}{(\lambda_2 + \lambda_1)}. \tag{3}$$

Average node resource utilization:

$$Q_k = \frac{\sum g_i y_{ik}^2}{Cx} + C_k. \tag{4}$$

When performing the mapping of each virtual network service, the virtual network service provider reduces the unnecessary consumption of physical resources while ensuring that the virtual network is successfully mapped. This helps to reduce virtual network mapping expenditures and allows more physical resources to be set aside for the mapping and deployment of additional virtual network services. In addition, the VNS provider should fully utilize
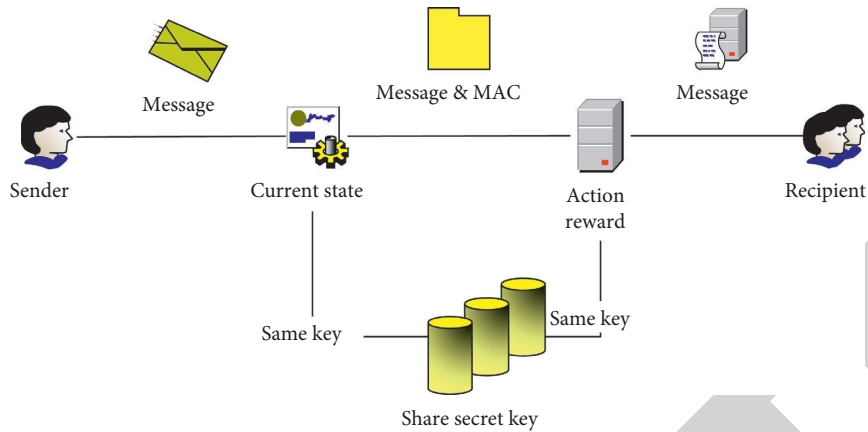
Figure 2: Network virtualization environment resource allocation.

the physical network elements that are already being used for mapping and reduce the use of new physical network elements that are in a shutdown state. This will help reduce the energy expenses of the VNE. Once the new network devices are used and activated, the VNS provider needs to pay for the additional energy consumption of the network devices.

In a network virtualization environment, each virtual network (VN) is a virtual network topology consisting of a series of virtual nodes (e.g., virtual routers and virtual hosts) and logical links that connect these virtual nodes. The shared underlying physical network (PN) is composed of many specific underlying physical nodes (e.g., routers, switches, servers, and data centers) and physical links (e.g., coaxial cables, fiber, and twisted-pair cables). Network virtualization technology separates traditional Internet service providers (ISPs) into underlying equipment providers (InPs) and service providers (SPs) [17]. The InP is responsible for building, managing, and operating the underlying network and resources. To meet the different virtual network requirements of network end-users, service providers (SPs) need to rent physical networks and resources from InPs to build and deploy different virtual networks. The process of mapping virtual networks to shared physical networks based on users' resource and functional requirements is called virtual network mapping (VNE). Since each virtual network has different goals and needs, the best mapping scheme for each virtual network is different. The mapping of cross-domain virtual networks is subject to certain constraints, which require that the virtual network cannot be mapped to the underlying network indefinitely due to the number of underlying network resources and other conditions. When a virtual network is successfully mapped wait, it will occupy the corresponding underlying resources and the virtual network request will leave after some time, at which time the physical resources it occupies are released.

3.2. Application of Optimal Subnetwork-Based Virtual Network Mapping Algorithm in Enterprise Costing.
Cost control in a narrow sense is formed in the process of calculating the company's costs, when the company needs to set a target cost, in the actual production of products in the process of

strictly calculating the difference between the planned cost and the actual cost of production, to reduce the difference between the planned cost and the actual cost for cost control. Relatively speaking, if the actual cost is lower than the target cost, it means that the cost control implemented by the enterprise has achieved certain results. In addition, from a narrow perspective, the key point of cost control is to control the management of implementation costs and related manufacturing costs, to achieve the purpose of reducing costs in the production process, the implementation of effective cost control. At this point, the enterprise can analyze whether the cost control target is feasible, clarify the way to achieve cost planning, and analyze how to further deepen the concept of cost management in the development, such as by measuring whether the existing production methods meet the needs of the development concept of the relevant departments and the needs of the future development plan of the enterprise, to find the "ideal and reality gap." While finding the gap between the ideal and the reality, we are committed to cutting costs reasonably and bringing more profit space for the enterprise through effective cost management. When performing the mapping of each virtual network service, the virtual network service provider reduces unnecessary physical resource consumption while ensuring the successful mapping of that virtual network. This helps to reduce virtual network mapping expenses and allows more physical resources to be set aside for the mapping and deployment of additional virtual network services. In addition, the virtual network service provider should fully utilize the physical network elements that are already being used for mapping and reduce the use of new physical network elements that are in a shutdown state. Cost control in a broad sense consists of five main aspects, namely, cost forecasting, cost planning, cost accounting, cost decision making, and cost assessment. These five aspects cover all business actions of the company. In addition, under the broad cost control, the cost control process of a company can be divided into three aspects, such as ex-ante control, ex-post control, and ex-post control. Relatively speaking, cost control management in the broad sense is based on achieving smooth profitability of the company and controlling costs from different directions. It includes not only

the cost control of the research and development, material purchase, and other links before the production operation but also the cost control during the production process and the cost control afterward such as marketing and market development [18]. At the same time, the broad cost control requires that the business decision-makers of the enterprise need to make the business decisions related to the future development strategy of the enterprise at each stage by clarifying the fundamental objectives of cost control, to ensure the coordination between cost control and the direction of the business, and thus sublimate the fundamental value of cost control of the enterprise.

The virtual network mapping algorithm based on optimal subnetworks is mainly reflected in the form of "value chains" in enterprise costing. The "value chain" is a dynamic process that links activities that appear to be different on the surface but are related internally, and through the linkage and interaction of related activities, a value-driven chain can be formed and dedicated to the sublimation of enterprise value through effective resource allocation. "Any company is an aggregate, and this aggregate will carry out related work in the behavioral activities of research and development, production, sales, warehousing, and supporting various products." All of these efforts can be called value chains. In other words, the construction of a value chain is not only a process of sorting out the company's business but also a process of adding value to the company through the collaboration of the "connection points." At the same time, by coupling the virtual network mapping algorithm with it, there are

$$\frac{\partial}{\partial W_{ij}^l} J(w,b) = \frac{1}{b} \sum_{i=1}^{m} J\left(w,b;x^i,y^i\right) + \lambda W_{ij}^l. \tag{5}$$

To measure the quality of different solutions for virtual network mapping, an adaptation function needs to be defined in the virtual network mapping environment.

$$Z(i) = \sum_{i=1}^{n} \kappa X_i + \sum_{i=1}^{n} \left(X_i - \overline{X}\right)^2 + \mu_X. \tag{6}$$

In general, the internal value chain of a company can be composed of two parts, namely, the basic work, mainly in logistics, marketing services, production, and other work, and the auxiliary work, mainly in human resources, technology research and development, procurement, and other work. The value chain not only is internal but also exists between upstream and downstream enterprises in the same industry and the market environment where the company achieves market competition, etc. The value chain belonging to the internal business is called the internal value chain, while the value chains belonging to business partners outside the company and the market environment, which can have an impact on the actual operation of the company, are referred to as external value chains. In addition, the value chains formed within the company's business industry are vertical value chains, which can be extended into two types of value chains: downstream customers and upstream suppliers. In the process of building an internal value chain, we should first explore the value-added and non-value-

added parts of each part independently and then build an internal value chain based on the relevance of the enterprise's business by effectively measuring the impact of each part on the daily operation of the enterprise. The corresponding horizontal value chain is another name for the value chain of competitors, and both the vertical and horizontal value chains are within the scope of the external value chain of the company [19]. Overall, each part of the entire company value chain including internal and external ones has values that are associated with business units, and all activities in the value chain will affect the final value of the company. The details can be organized as shown in Figure 3.

The value chain is one of the chains that organize the various business conditions of the enterprise, and in the process of construction, it is necessary to dismantle the company and the business operations related to the company's periphery in the form of dismantling, to seek the correlation between each other on top of the independent basis and then build a value system that is exclusively for the business development of the enterprise. Partially mutual in the existing research field, the analysis of the enterprise value chain is often achieved through the following two methods.

3.2.1. Analysis Method of the Internal Value Chain.
While R&D technologies and manufacturing levels vary within a company, the fundamental purpose of technological R&D is to increase corporate value through internal technological improvements and other related activities. Therefore, in the process of analyzing the internal value chain, we should first analyze the cost drivers of various activities and then analyze the costs in a multilevel and all-around way to effectively reduce costs. In addition, since the composition of the internal value chain of the company is derived from the relevant auxiliary activities and basic activities, the auxiliary activities are composed of human resource management and the basic functional activities of the company; the basic activities mainly cover the sales, production, and other operations. The main issue of optimal subnet-based network virtualization is virtual network resource allocation, i.e., virtual network mapping, the core idea of which is to maximize the use of limited physical devices by mapping virtual resources to physical devices through predesigned algorithms. Service providers providing customized end-to-end assurance services to end-users need to optimize dynamic resource allocation, thus enabling self-configuration and organization of future networks. Therefore, in the process of building the internal value chain, the value-added and non-value-added parts of each part should be explored independently first, and based on the practical measurement of the degree of influence of each independent part on the daily operation of the company, the internal value chain should be built together according to the relevance of the business of the company. In this way, based on the division criteria of value-added and non-value-added, not only can the integrity of the internal value chain be ensured, but also the key links in the chain can be clarified to provide the general direction for managers to make business decisions.
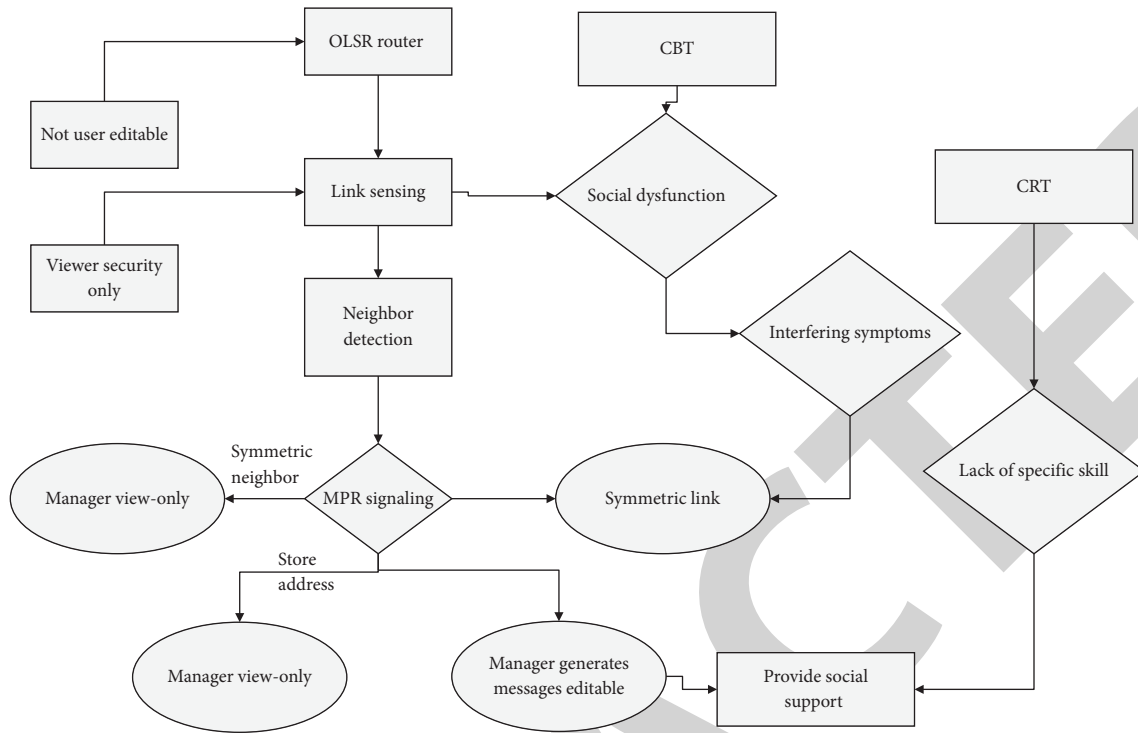
FIGURE 3: Value chain combined with a virtual network mapping algorithm.

3.2.2. Analysis Method of the External Value Chain. Since the external value chain of an enterprise consists of both vertical and horizontal value chains together, among them, the vertical value chain consists of customer and supplier value chains, while the horizontal value chain refers to the value chain of competitors related to the business activities of the enterprise. The key point of defining horizontal value chain is how to measure the market environment and the comprehensive strength of competitors to understand the market position of enterprises and the main direction of future development and then, through the construction of horizontal value chain, truly take the essence and remove the dross to promote the steady growth of enterprises themselves. In addition, the vertical value chain often takes the enterprise itself as a unified whole in the process of construction, mostly including the purchase of raw materials, product production, and product sales, etc. It is worth noting that the formulation of the vertical value chain should not focus too much on the actual value of the enterprise but should incorporate some non-value-added behaviors into the enterprise value chain to meet the integrity of the vertical value chain.

4. Experimental Verification and Conclusions

4.1. Direct and Indirect Cost Distribution of Virtual Network Mapping Collection. In this paper, GT-ITM is used to generate graphs of the physical and virtual networks. The physical network consists of 5 domains, randomly distributed on a 100×100 grid. The number of physical nodes in each domain is uniformly distributed between 50 and 90. The CPU capacity of the physical nodes is distributed

between 50 and 100. There is a 50% probability of connectivity between nodes; i.e., there is a 50% probability that any two nodes in the domain are connected. The bandwidth of the intradomain links varies between 50 and 100; the bandwidth of the cross-domain links is 10 times the intradomain bandwidth. Experiments were conducted using 3 different VN sizes: small, medium, and large. Similar to each domain of the physical network, the virtual nodes of the virtual network are randomly distributed on a 100×100 grid. The number of virtual nodes per requested VN corresponds to 3 different VN sizes: 2–5, 2–10, and 2–15. There is a 50% probability of connectivity between the virtual nodes and the CPU and bandwidth are also distributed between 0 and 50. In this paper, we assume that the arrival of requests is a Poisson process with an average arrival rate of 3 requests in every 60-time unit; the duration of requests satisfies an exponential distribution with a mean of 500-time units. After the physical network receives the mapping request from the global controller, the physical domain is mapped. The physical network mapping process includes intradomain mapping and interdomain mapping. The global controller forms a pseudo-topology after the local controller uploads the information. The simulation experiments run from time point 0 to 40,000 and contain approximately 2,000 requests. The experiment counts the sum of the costs consumed due to construction as the cost of the building construction project, including the cost of direct and auxiliary materials consumed during the construction of the project, the cost of labor and the rental, maintenance, and depreciation of machinery and equipment, and also the overhead costs incurred by the management in managing and coordinating the project to make it run smoothly. Thus,

all expenses other than profits and taxes are part of the cost of construction. Costs in an engineering construction project can be classified as direct and indirect costs based on their economic attributes.

As shown in Figure 4, according to the virtual network mapping algorithm of the optimal subnetwork, the direct costs include the costs that can constitute the engineering entity or the costs directly incurred to complete the construction project, the former being the direct engineering costs and the latter being the direct measure costs. The direct project costs are generated by the construction project and directly invested in the specific project, which includes the material costs of construction, including the cost of raw materials and parts required for that construction project; the wages, allowances, labor insurance, and welfare costs of construction workers; and the use of machinery and equipment, such as purchase, rental, handling, and repair costs and depreciation costs.

In the production process, some costs occur directly but do not belong to the project costs; they do not directly but indirectly on the project; this type of cost is known as direct measure costs, for example, environmental sanitation costs arising from the need to have workers at the construction site and to clean it regularly; temporary facilities costs arising from temporary buildings erected or leased at the construction site, such as offices, staff canteens, and dormitories; costs arising from the need for lighting and heating during extreme weather or night-time construction; and auxiliary construction costs and costs arising temporarily at the construction site.

Indirect costs mainly consist of fees and enterprise management costs, which refer to the costs consumed by the enterprise in the process of managing and organizing production activities, the former including the cost of sewage in the construction process, social security, and pension insurance costs, the cost of unemployment and medical insurance for employees, the cost of accident insurance and maternity work injury insurance, and the cost of employee housing fund, the latter mainly including the salaries, bonuses, labor insurance, and welfare of management personnel.

The latter mainly includes the salaries, bonuses, labor insurance, and welfare costs of the management staff, the costs of engineering warranty and material consumption, etc. Through the cost composition of the project, it is easy to see that the proportion of indirect costs in the construction industry is smaller than the proportion of direct costs. The costs that cannot be directly included in the cost of each product and are borne by the production cost of the product are collected in the overhead account, which probably includes all types of expenses incurred by each departmental unit for managing production or organizing activities, including insurance and transportation costs, travel costs, costs of machinery and materials, office costs, and repair costs, as well as costs of utilities, low-value consumables, and other aspects. The costs are shown in Figure 5.

4.2. Application Performance Comparison. Figure 6 shows the comparison of the request acceptance rate of the three algorithms in the environment of low virtual network

resource demand; as the virtual network continues to arrive over time, the request acceptance rate of all algorithms changes from high to low and gradually stabilizes. The EAJTA-VNE algorithm uses the weighted relative entropy method and combines the node CPU and related topology information to rank the virtual nodes, and the request acceptance rate is kept around 80.6%. The CGS-VNE algorithm proposed in this paper utilizes an advisor-guided mechanism to intelligently guide the virtual network mapping by using factors such as node CPU, node adjacency bandwidth, and node degree as advisors' policies, thus improving the mapping success rate, which stays around 90.1%.

In terms of the integrated mapping cost, as shown in Figure 7, the BWA-VNE algorithm is optimal because it takes into account the selection of the maximum bandwidth link by using an algorithm that selects candidate nodes based on the predicted mapping cost, where each physical domain calculates the predicted mapping cost of all nodes based on the formula for calculating the predicted mapping cost and selects the node with the smallest predicted mapping cost as a candidate node, so it can reduce the overall mapping cost.

The VNE-PSO algorithm performs less well than the BWA-VNE algorithm; although the algorithm considers the overhead prediction of node and link mapping, this algorithm does not achieve a very good decision because the algorithm selects the boundary node from the nearest node to the boundary node, i.e., only the metric of the number of hops from the boundary node is considered when selecting the candidate node. The LID-VNE algorithm is designed based on distributed virtual network mapping architecture; due to the distributed architecture, each data domain has less knowledge about the global information, and the algorithm selects the mapping target domain first for each node based on the offer of each physical domain and decomposes the bandwidth demand matrix for each physical domain, and each physical domain maps the nodes and links based on the received bandwidth demand matrix. This leads to errors in deciding which physical domain the virtual node should be mapped to during the virtual network mapping process, and this error leads to an increase in the mapping cost.

The MC-VNM algorithm integrated mapping cost is the highest, this is because the algorithm does not adopt the commonly used heuristic algorithm in solving the NP-hard problem, it uses the traditional Kruskal minimum spanning tree-based optimization algorithm to select the link with the lowest link unit cost to map first, and it is the link mapping scheme that determines the node mapping scheme, resulting in a relatively high integrated mapping cost.

Figure 8 shows the virtual network request loss rate; the BWA-VNE algorithm has a higher virtual network request acceptance rate than the other three algorithms, thanks to the fact that this algorithm takes into account the idea of load balancing while optimizing the bandwidth metric to have the best possible acceptance rate without losing the bandwidth metric.

The link with the lowest link priority mapping and the link mapping scheme determines the node mapping
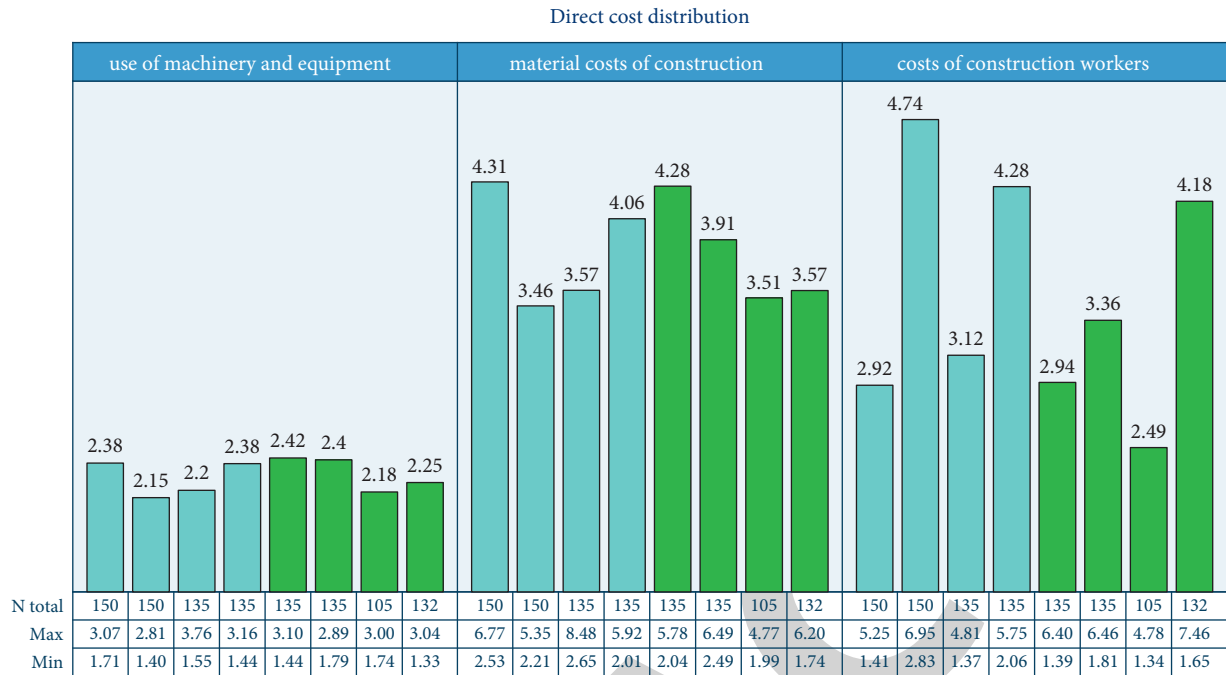
Direct cost distribution

	use of machinery and equipment								material costs of construction								costs of construction workers							
N total	150	150	135	135	135	135	105	132	150	150	135	135	135	135	105	132	150	150	135	135	135	135	105	132
Max	3.07	2.81	3.76	3.16	3.10	2.89	3.00	3.04	6.77	5.35	8.48	5.92	5.78	6.49	4.77	6.20	5.25	6.95	4.81	5.75	6.40	6.46	4.78	7.46
Min	1.71	1.40	1.55	1.44	1.44	1.79	1.74	1.33	2.53	2.21	2.65	2.01	2.04	2.49	1.99	1.74	1.41	2.83	1.37	2.06	1.39	1.81	1.34	1.65

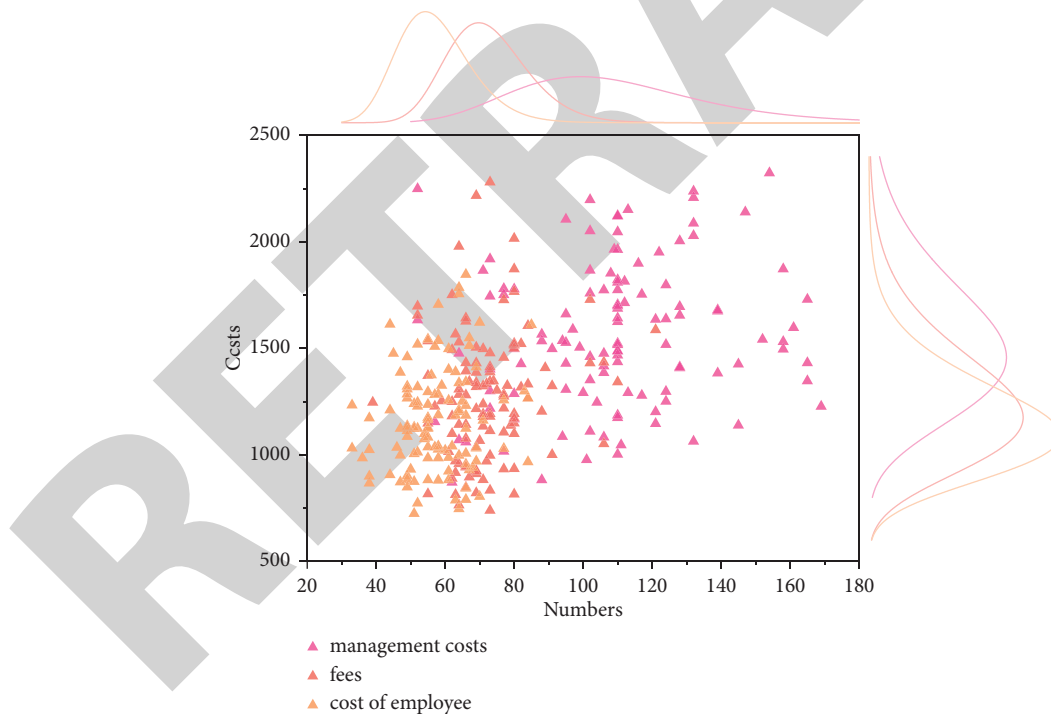FIGURE 4: Direct cost distribution of virtual network mapping collection based on the optimal subnetwork.

FIGURE 5: Indirect cost distribution of virtual network mapping collection based on the optimal subnetwork.

scheme; this strategy also has a high virtual network request acceptance rate. In contrast, the poor performance of the two algorithms VNE-PSO and LID-VNE is due to the overly rigid and rigid algorithm of selecting mapping nodes, which makes the node resources be often insufficient or link resources be insufficient during the virtual network request reception. Specifically, the VNE-PSO algorithm is prone to the situation of excessive load pressure on the boundary nodes because it always prefers the boundary nodes as candidate nodes. In contrast, the LID-VNE algorithm is prone to mapping virtual nodes to physical domains with low average offers because only the average offer is known for each physical domain, thus causing a situation of excessive load pressure on
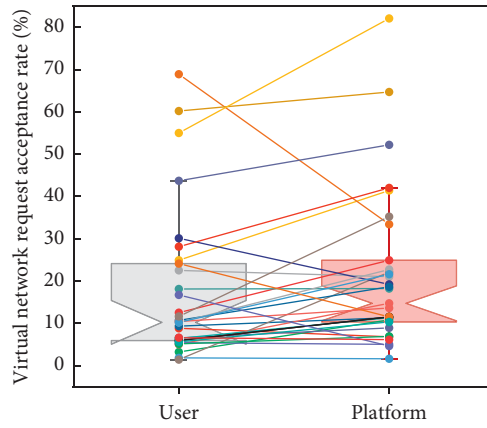
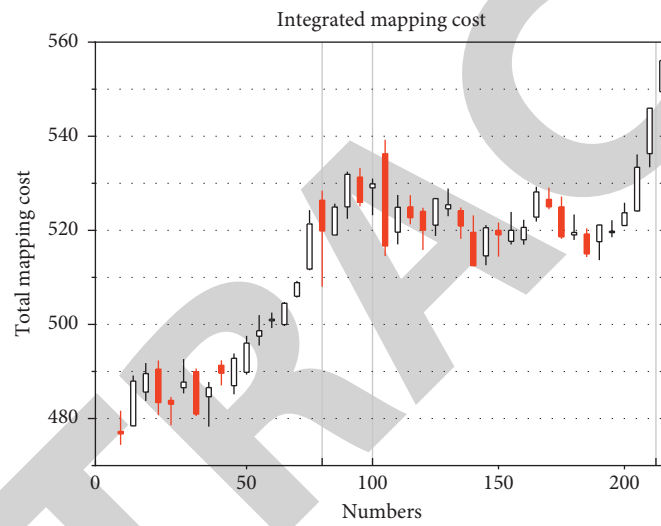Figure 6: Virtual network request acceptance rate.
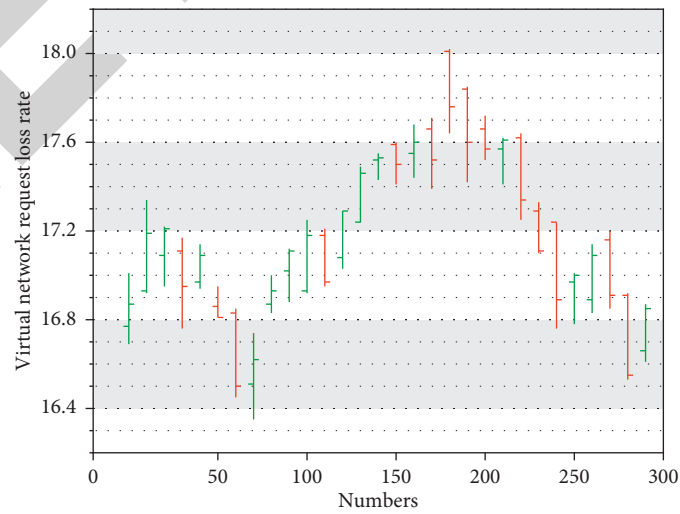

Figure 7: Integrated mapping cost.

Figure 8: Virtual network request loss rate.

individual physical domains and leading to a decrease in the reception rate of virtual network nodes.

5. Conclusions

Profit is the ultimate purpose of the company; only by paying attention to the company's cost control issues, and being able to expand the company's cost control channels based on the internal and external value chain in the control of the company's cost issues, can the company's costs be effectively managed. Modern society is developing rapidly, the competition faced by the company is also increasing, and only in the competition, fully understand their strengths and weaknesses, to develop a perfect cost control strategy. Only for the company's cost control problems to analyze, to put forward the solution, to make the company in the fierce market competition to occupy the initiative position, in this paper, a cost-aware cross-domain virtual network mapping algorithm is proposed for the company's demand for low cost and high revenue. The algorithm takes minimizing the mapping cost as its goal, with local controllers selecting candidate physical nodes for virtual nodes, global controllers abstracting the network topology based on the candidate and boundary node information, slicing virtual network requests using a particle swarm algorithm, and finally each local controller collaborating to complete the full virtual network mapping. As the number of virtual network requests grows, the algorithm in this paper outperforms existing algorithms in terms of overall delay, node delay, and link delay of virtual network requests. The simulation experimental results show that the algorithm significantly reduces the embedding cost and has good stability and scalability. The virtual network mapping algorithm is based on optimal subnetwork costing for enterprises, slicing cross-domain virtual network requests into several subgraphs, using nodes first and then links to complete the mapping of the entire virtual network, improving upstream supplier cost control capability, enhancing downstream customer cost control connectivity, and identifying internal value chain advantages to enhance the division's external competitiveness and other countermeasure suggestions.

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 interest or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

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