Research on the Architecture of Data Center Network

Pan Yun

Information engineering college，Xinyang college of agriculture and forestry，Xinyang 464000,China

Abstract: With big data and cloud computing technology, the hierarchical structure of traditional data center networks can not satisfy the need of the development of new technologies, mainly in size, bandwidth, scalability and cost etc.. To solve this problem, this paper introduces the architecture of data center network, VL2, PortLand, Monsoon of SecondNet and Jellyfish of the model. The paper also puts forward the future development direction of the future data center network, which is mainly manifested in the research and use of the new network structure;The data center network protocol must be explored and improved, the measurement and modeling of flow and failure law and the mechanism of energy saving;The data center traffic engineering etc..

Key words： Data center; Architecture; Network

INTRODUCTION

The rapid and diversified development of information service has promoted the emerging of some large-scale data centers; these data centers host a large quantity of servers (as many as 100, 000 sets). As the coming of big data era, some large-scale search engine data centers on network host more and more applications. The position of data center serving as basic facility for information service is more and more important; and many challenges are put forward for traditional data center by the new applications and computing mode. How to make the new data center network satisfy the needs of applications that are developing continuously? It has been become the current and future research direction [1]. At present, the research about this involves two aspects: center is network and center is server. The scheme that center is network is mainly analyzed in this paper, and the existing defects are given; and prospect for future research direction is also put forward.

1 Structure and needs of traditional data center

DCN (data center network): a large number of servers are connected with switch via high speed link in the data center. The architecture of such network is realized by hierarchy [2]; and the application mode hosted by it is client/server mode. See the following figure for the architecture.

We can see from the above figure that traditional network center structure is unable to meet the increasingly developing demands of network; and it mainly involves the following aspects:

I. Now the network scale is developing very rapidly, and more and more servers are demanded. For existing network scale, hundreds of thousands of servers are needed at least.

II. The flow needed by existing network is larger and larger; application of MapReduce and virtual machine migration is very wide, and these technologies are bandwidth-intensive application, so very high internal flow is demanded for data center [3]. These flow accounts for about 80% of the total flow.

III. Traditional network structure only can be used to assist the design of high-efficiency routing algorithm, and there is very big difference between many new type data center structures traditional structure.

IV. The technology applied most widely for existing data center is virtualization technology, so that the data center network must be able to realize the free migration and deployment of virtual machine, and meanwhile, there shall be no impact on application layer.

V. There are many servers and switches in existing data center; under this circumstance, data center network must realize the function of plug and play.

VI. For the global network resource, the energy consumption of existing data center network is the highest, and over 80% link load of data center is very small. The energy consumption of traditional data center network structure is higher.
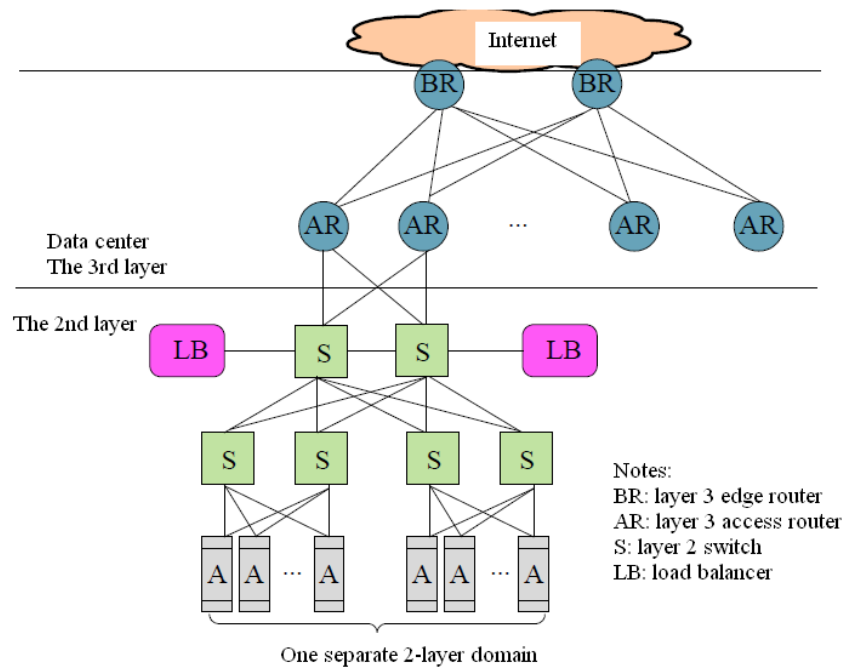
Corresponding Author: Pan Yun, Information engineering college, Xinyang college of agriculture and forestry, Xinyang 464000,China

Figure 1 Hierarchical architecture of traditional data center network

THE SCHEME THAT NETWORK IS CENTER

In this scheme, there is one important characteristic: network traffic routing and forwarding function is mainly realized via switch and router. To realize this important characteristic, the interconnection method and routing mechanism of existing network need to be changed, and the scheme selected in the paper mainly involves 5.

The first is Monsoon[4], and see figure 2 for the architecture. In this architecture, all servers share one 2-layer network. Meanwhile, there is no oversubscribed link in the this system, which indicates that in this system, all servers are able to perform quick communication with the network interface of any server. This system realizes the communication between data center and Internet via the 3rd layer part.
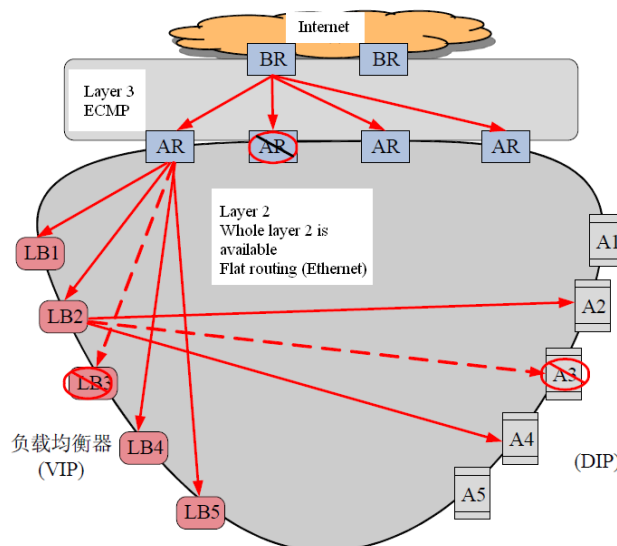

Figure 2 Monsoon architecture

The second is VL2, and see figure 3 for the architecture. The structure of this system is similar to traditional topology, and in this system, rack (ToR) switch is connected to two aggregation switches [5].

Corresponding Author: Pan Yun, Information engineering college, Xinyang college of agriculture and forestry, Xinyang 464000,China

However, there is one important problem: the two aggregation switches must be connected with relay

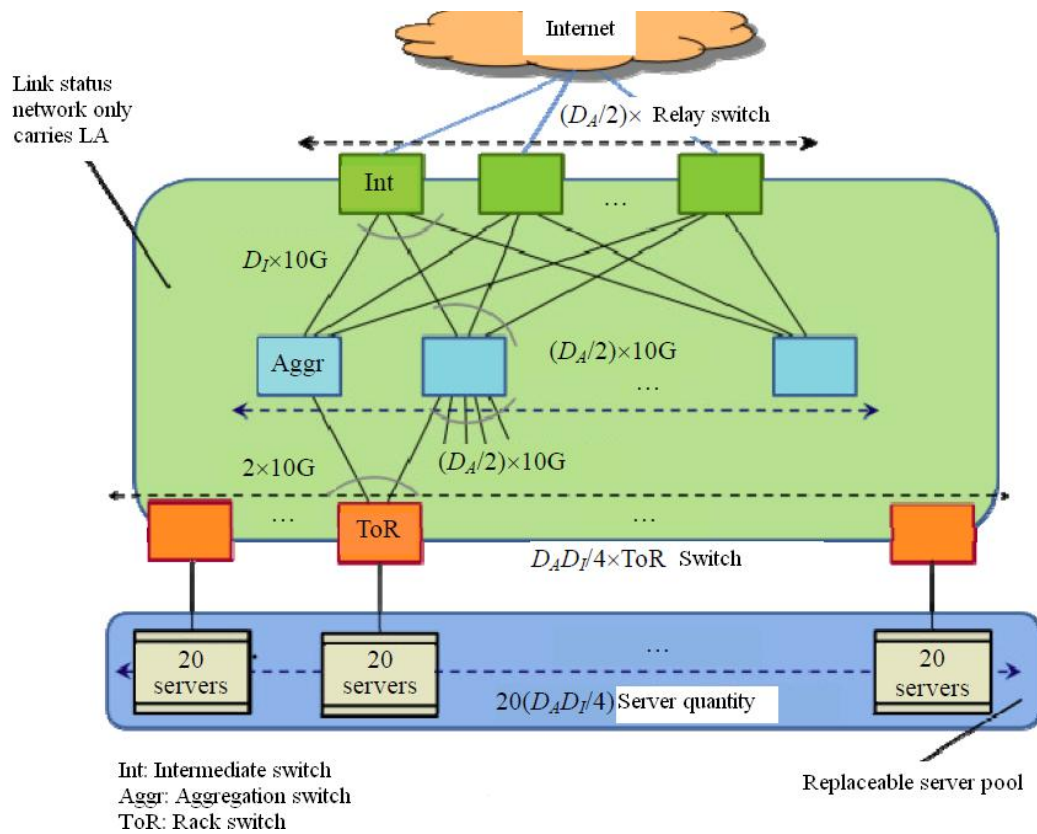switch, so there will be many possible routes.

Figure 2 VL2 network structure

The third is PortLand; see figure 4 for the architecture. The architecture is evolved from FatTree network structure. The biggest difference of the two is that an important parameter is used by

PortLand structure [6]; this parameter is fabric manager; meanwhile, it is responsible for grouping and forwarding via hierarchical dummy MAC address.
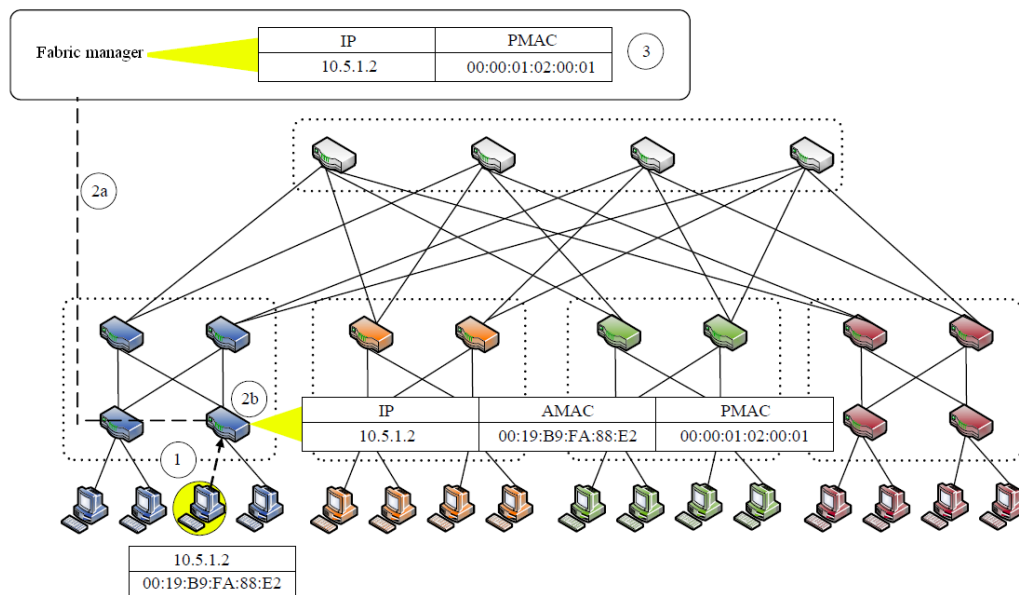

Figure 4 Mapping of AMAC and PMAC

145

The fourth is SecondNet, and see figure 5 for the architecture. This system has an important characteristic: an important parameters is introduced (VDC manager). The main task of this parameter is to complete line VDC building, adjustment and deletion.

At the same time, system calculation can be realized via this parameter and switch. The dotted line in the figure means the tree management system of VDC manager, and the heavy line in the figure means one PSSR route [7].
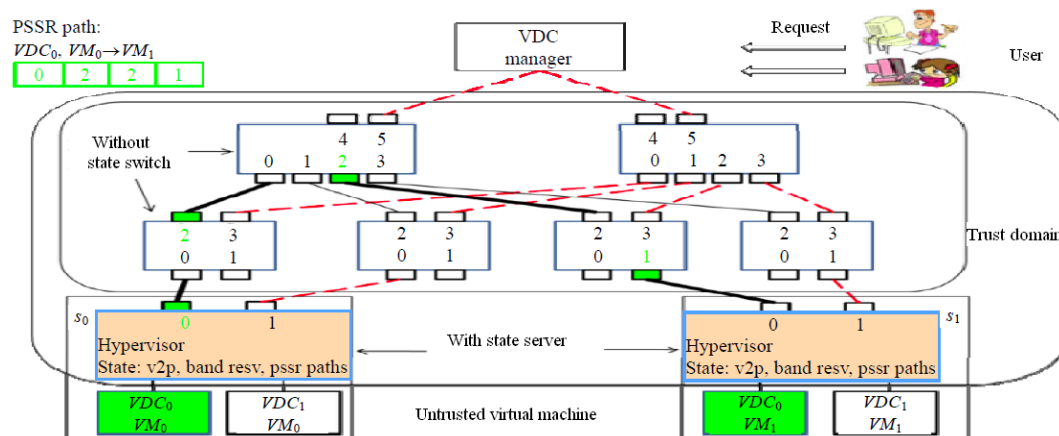

Figure 5 SecondNet architecture

The fifth is Jellyfish, and see figure 6 for the architecture. The traditional network structure limits the network expansion to a large degree. To get shorter average route length and reduce network cost,

scholars put forward this architecture. One important characteristic of this system is that a random graph can be built on ToR switch layer.
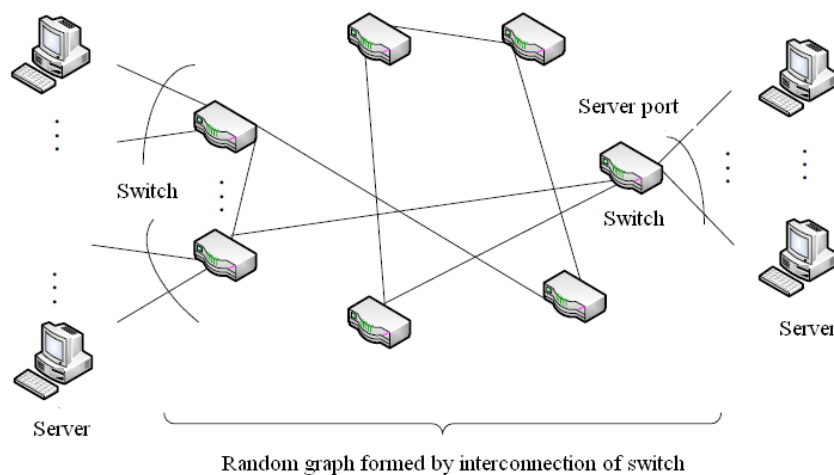

Figure 6 Jellyfish topology

FUTURE DEVELOPMENT DIRECTION OF DATA CENTER NETWORK

The architecture of several used data center networks is described above, so we can know that now many domestic and foreign experts and scholars are performing research for data center network. Now the new data center network structure is unable to completely meet the requirements for development of new network technology, and the main reason is that the new computing and application mode has very

high requirements for data center network structure [8].

The future research direction mainly involves the following aspects:

I. Research and use of new network structure. Now distributed system is mainly researched; and many scholars in the field have put forward many network structures. However, for the existing new data center network, many verifications and researches must be performed for practical application of network structure. In particular, during

application of server, the research on emerging network structure is valuable.

II. The data center network protocol shall be explored and improved. All data center network protocols shall be improved, including all protocols from MAC layer to transport layer. There is very big difference in structure and protocol of traditional network architecture and data center network; and compared with Internet structure, data center network structure is more complex. Therefore, the corresponding protocol also shall be improved, so as to guarantee the operation efficiency of data center network.

III. Measurement and modeling of flow and failure law. In new data center network, there are many flow modes of different types, and so flow with different characteristics appears. Therefore, processing must be performed via the data center network of multiple architectures. Thus, deep research must be performed for the flow and failure features of data center, and realize measurement and modeling analysis. Scientific data center network model can be built via data analysis.

IV. Energy saving mechanism. Now China has higher and higher requirements for environmental protection, so unnecessary energy consumption shall be reduced as possible for the data center structure and routing (device energy conservation, routing energy conservation, energy conservation of virtual machine, etc.). At present, many scholars in the filed are performing the research on these aspects.

V. Data center traffic engineering. The routing mechanism shall meet the requirements for time delay, reliability and throughput capacity, etc. That is to say, deep research shall be performed for the flow in data center and between data centers. At present, during the practical application, the main used schemes include ECMP and VLB [9]. However, these schemes have certain deficiencies, such as changeable position of virtual machine, known topology, etc. To realize reliable and energy saving traffic engineering with balanced load, deep research must be performed.

CONCLUSION

Traditional data center network structure is described in the paper, and the existing problems of traditional data center network structure are put forward. Such architectures as Monsoon, VL2, PortLand, SecondNet and Jellyfish are mainly demonstrated, and the future development direction of data center network is put forward in the paper.

REFERENCES

[1] Zhao Chunlei, George · Nahan. Computer Information Processing Technology of "Big Data" Era [J]. World Science. 2012, (2):30-31.

[2] Yi Xiancheng, Zhu Hong. Research on Method for Big Data Set Processing by Multilayer Application System Developed by Delphi5 [J]. Application Research of Computers, 2001(12):126-128.

[3] Li Hongjian, Liu Heng, Huang Guangwen, Bu Li. Research on Cloud Computing Platform for Mass Telecommunication Data Based on Hadoop [J]. Telecommunications, 2012, (8): 80-83.

[4] Guo Zhimao, Zhou Aoying. Research Overview for Data Quality and Data Cleaning. Journal of Software, 2002, 13 (11): 2076-2082.

[5] Liu Wei, Meng Xiaofeng, Ling Yanyan. A kind of web Database Sampling Method Based on Graph Model. Journal of Software, 2008, 16 (2): 179-193.

[6] Gao Ming, Jin Cheqing, Wang Xiaoling, Tian Xiuxia, Zhou Aoying. Research Overview for Data Provenance Management Technique. Chinese Journal of Computers, 2010, 33(3): 373-389.

[7] Gong Xueqing, Jin Cheqing, Wang Xiaoling, Zhang Rong, Zhou Aoying. Data-intensive Science and Engineering: Demands and Channelges. Chinese Journal of Computers, 2012, 35 (8): 1563-1578.

[8] Cheng Xueqi, Guo Jiafeng, Jin Xiaolong. Review for Network Information Search and Mining. Journal of Chinese Information Processing, 2011, 26(6): 111-117.

[9] Shen Huawei, Jin Xiaolong, Ren Fuxin, Cheng Xueqi. Social Media-oriented Public Opinion Analysis. Communications of the CCF, 2012, 8(4): 32-36.