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The Survey on Self -Optimization Optical Network With Cloud -Edge Collaboration: Architecture and Application

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ABSTRACT :*In this paper are using the fifth generation (5G) mobile communication technology, The OTN (optical transport network)need to have very high-quality network performance. In this paper we describe the self -optimizing optical network (SOON).and also addition ,this paper are introduces the Applications of AI based network.*
Key words: *OTN, SOON, AI, SDN.*

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I. INTRODUCTION:

The 5G technology it is a very popularization and promotion .the OTN is provides not only end to end rigid transparent pipe connection and strong networking capabilities, but also long distance and high- capacity transmission.

In recent years, there are two technologies SDN and AI it almost inevitable to combine these two technology. The Software -defined Optical network (SOND) is used to trigger unified control. In this paper are AI technology are used in very time it is used in estimate crucial single parameters. And also AI is improving network reliability . that's why in this paper are using AI algorithms. The AI are including the application, testing and training. there are very challenges: like this 1) Unified control, 2) computing resources ,3) Hierarchical optimization .

The self optimizing optical network (SOON) was proposed in novel optical network architecture. The AI technology are improve network intelligent control and management capabilities. In this paper are SOON architecture are describe in very detail.

The II Section in this paper presents an overview of SOON. In section III overview of SOON with cloud -edge Collaboration .In section IV overview of cloud-edge collaboration strategy. In section V overview of Innovative AI-Based Application. In section VI is a Conclusion .Finally , we summarize this paper.

II. SELF OPTIMIZING OPTICAL NETWORK.

The Self optimizing optical network are need to be gradually intelligent . the rapid development of optical network technology has spawned with intelligent optical network architectures. The self optimizing optical network are using two network elements. Such as automatically switched optical network (ASON) and path computation elements(PCE). The ASON introduced the management capabilities of telecommunications management network (TMN) [5]. The control plane can be collect and diffuse the network topology information , and it also services connections is very quickly and effectively. It is also solve the problem in complex path calculation in large multi-domain and multi -layer optical networks.

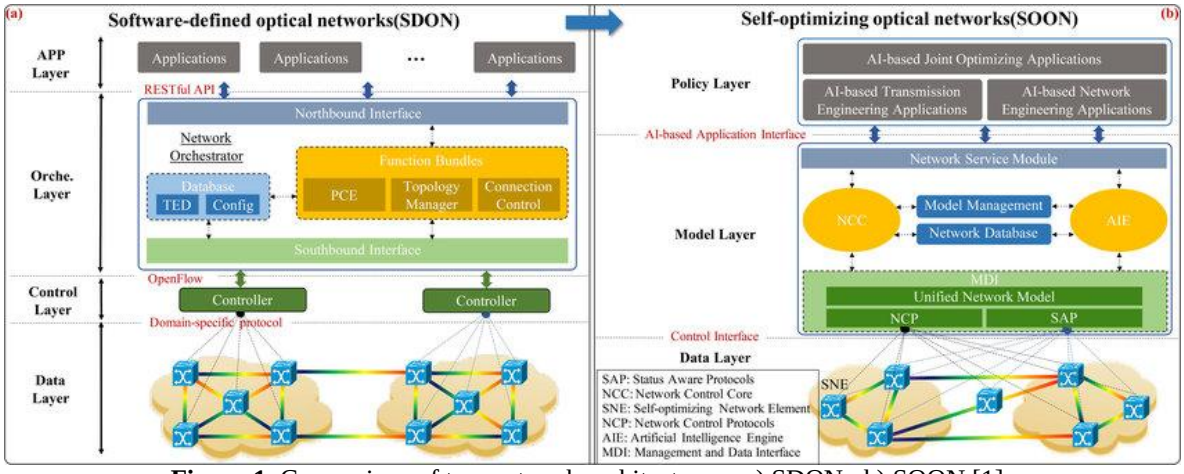

Figure 1. Comparison of two network architectures : a) SDON ; b) SOON [1].

The compared to SDON ,SOON it is a three layer network architectures . The Software defined optical network (SDON) there are four type of layer 1) App Layer , 2) Orche Layer , 3) Control Layer ,4) Data Layer.

And Self -Optimizing Optical network (SOON) . there are three type of layer 1) Policy Layer , 2) Model Layer , 3) Data Layer. The data layer there are six sub parts .SAP :Status Aware Protocols , NCC : Network Control Core , SNF : Self -optimizing Network Element , NCP : Network Control Protocols , AIE : Artificial Intelligence Engine , MDI : Management and Data Interface.

The Traditional network protocols are include the network control protocols such as a general multi-protocol label switching (GMPLS).and open flow protocol in SDON, etc. The unified network model collects all information for NCC and AIE.

In this way model layer cooperate with each other and to achieve the upper layer based on AI Optimization application there are including three applications, 1) Optical transmission -oriented , 2) Optical network -Oriented , and 3) joint Optimization applications.

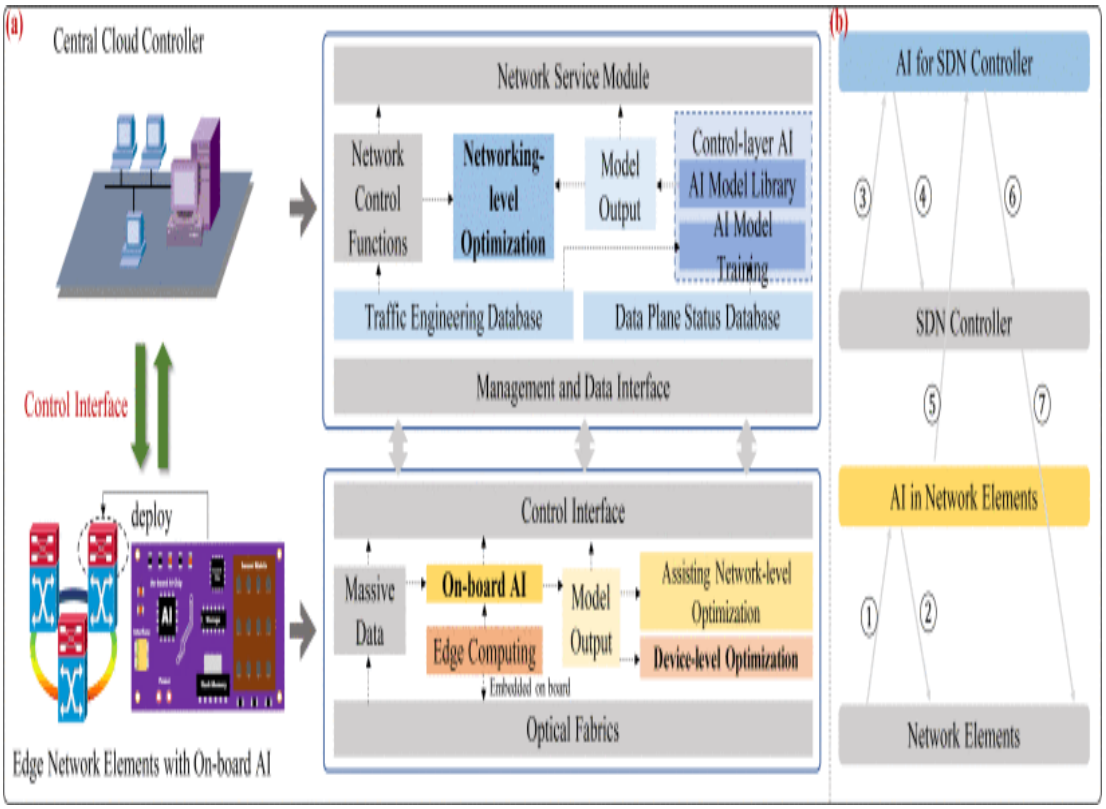

Figure 2. SOON with cloud -edge Collaboration : a) Function modules ; b) Collaborative Workflow.

TABLE 1. Comparison between Control-layer AI and On -board AI [1].

Evaluation	Control-layer AI	ON -board AI
Model training	Support	**Partial support**
Model testing	Support	Support
Computing resource	Huge	Small
Power consumption	High	**Low**
Delay for network -level Application	Low	High
Survivability	Weak	Strong
price	high	Low

III. SOON WITH CLOUD-EDGE COLLABORATION

The Data layer in the SOON architecture can be a physical optical network actually. And it is also provide historical records and real -time network . there are two layer are located on a deep integration 1) model layer , 2) Policy layer.

The AI engine deployed in the SDN controller, this AI engine can be achieve network -level Optimization . and AI board is deployed on network devices in the data layer . that's why the AI board can provide a faster response for device -side optimization .

Table(1) . compares the different performances of the control -layer AI and on -board AI. AI is a low cost and low power consumption . AI there are also limits its computing power and training function .

Fig 2(a). the collaboration between functional modules on-board AI in SOON are deploying .therefore ,AI model still needs to be completed at the control -layer AI.

Fig 2(b). in this fig they are show the collaborative workflow of the control layer . and also the control layer AI are the solve the problem in network layer optimization.

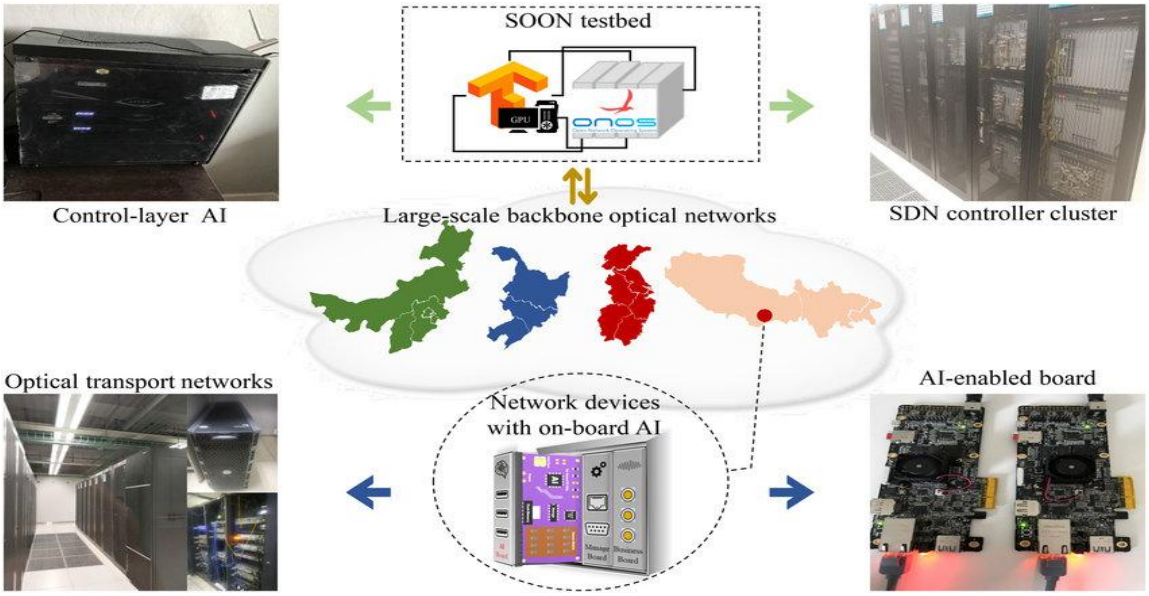

Figure 3. SOON testbed with cloud -edge collaboration [1].

IV. CLOUD-EDGE COLLABORATION STRATEGY

On-board AI there are faced with different performances , service, requirements, resource status in networking . In this paper there are different cloud-edge collaboration

strategy are used to train and apply AI models .in this paper we will start the SOON testbed based on cloud-edge collaboration.

There are several strategy are used in cloud-edge collaboration are following, A) SOON testbed with cloud-edge collaboration, B) Cross-layer optimization based on optimal model ,C) Distributed training of AI models based on data parallelism , D) DNN inference as a service.

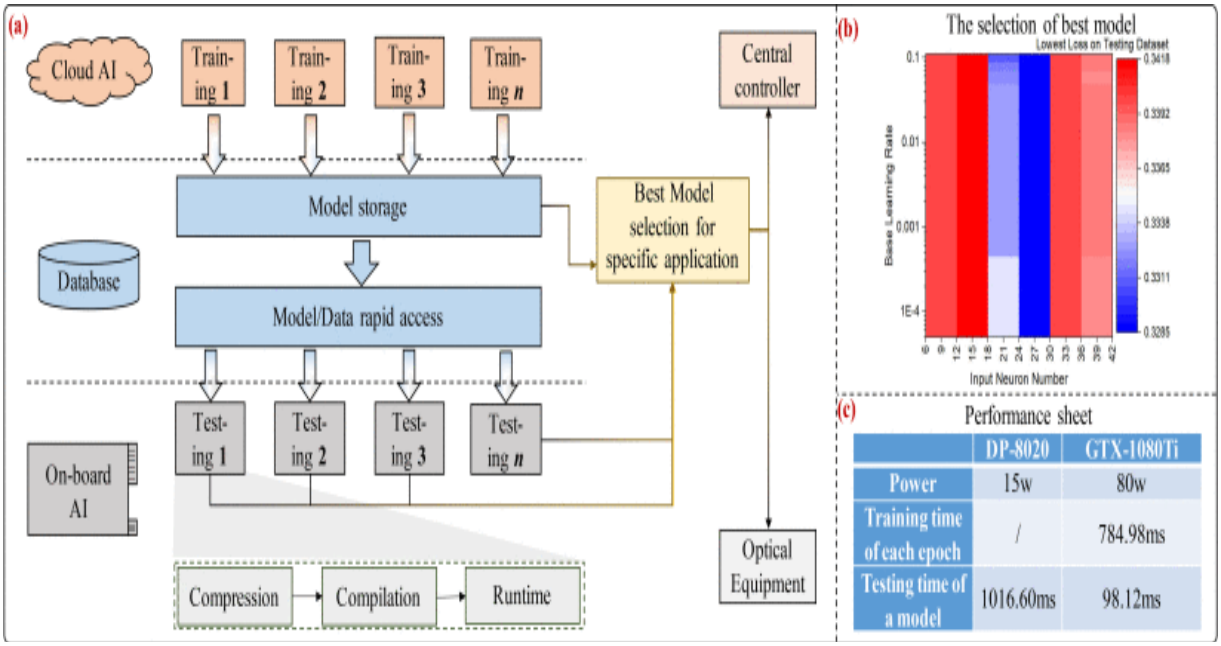

Figure 4 . Cross layer optimization : a) Collaboration training and testing and of models ; b) the selection of best model ; C) the performance sheet of control-layer AI and on-board AI [1].

A general cross-layer optimization strategy to solve the problems as show in fig 4. The cloud AI are responsible for training the model on training data set . after specific iteration the model need to saved in the data base .

The verification of the strategy ,twoDP-8020 board developed by Xilinx were used on-board AI.and the average time consumption of a training epoch in the controller is about 784.99ms. This strategy save the additional 98.13ms test time consumption in the AI model are using in control-layer AI .

The On-board AI are not a block of training of the control layer AI.

V. INNOVATIVE AI-BASED APPLICATION

The various innovative AI-based optimization applications are developed by SOON testbed .in this application are use in AI technology are provide the users with network optimization services . there are three application are used in the AI technology are following ,

A) Alarm prediction : A single fiber or node failure in optical network ,even for few second .alarms are the most direct manifestation of network failures.

B) Resource allocation : Allocation resources for network services in optical networks is always been the focus of research .

C) Fault Localization :A major difficulty in dealing with faults in optical network in the complex relationship between the alarm with the identification of root -cause alarm.

VI. CONCLUSION

The deployment of AI in the optical network is conducive to improving network control capabilities . IN this paper review the evolution of self -optimization optical network architecture that implement AI services in SDON. In addition ,on-board AI introduced to SOON to achieve the cloud -edge collaboration. The current AI model training limited by performance of on-board AI . In the future ,as the performance of AI embedded board improves ,more AI services can be provided better in optical networks.

REFERENCES

[1]. ZHUOTONG LI 1, YONGLI ZHAO 1 (Senior Member, IEEE), YAJIE LI 1, MINGZHE LIU1, ZEBIN ZENG1, XIANGJUN XIN 1, FENG WANG2, XINGHUA LI2, AND JIE ZHANG 1 'Self-Optimizing Optical Network With Cloud-Edge Collaboration: Architecture and Application'Received 10 September 2020; accepted 10 October 2020. Date of publication 14 October 2020; date of current version 9 November 2020. The review of this paper was arranged by Associate Editor Song Guo.

[2]. Y. Choi, J. H. Kim, and C. K. Kim, "Mobility management in the 5G network between various access networks," in Proc. 11th Int. Conf. Ubiquitous Future Netw., Zagreb, Croatia, 2019, pp. 751–755.

[3]. Whiter Paper on 5G Vision and Requirements, MT-2020(5G) PG, 2014.

[4]. Y. Ji, J. Zhang, Y. Xiao, and Z. Liu, "5G flexible optical transport networks with large-capacity, low-latency and high-efficiency," China Commun., vol. 16, no. 5, pp. 19–32, May 2019

[5]. Zhao, B. Yan, D. Liu, Y. He, D. Wang, and J. Zhang, "SOON: Self-optimizing optical networks with machine learning," Opt. Express, vol. 26, no. 22, pp. 28713–28727, 2018.