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OPTIMIZE OPTICAL DATA NETWORKS USING SDN TECHNOLOGIES

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Оптимізація оптичних мереж передачі даних з використанням технології SDN

Контролер T-SDN (транспортні програми, визначені програмним забезпеченням) дає змогу автоматизувати значну частину мережевих операцій і, як результат, дозволяє оператору значно заощадити час - сотні годин, які інженери витрачають на налаштування мережі та надання послуги. За допомогою спрощення операцій по роботі з транспортною мережею та оптимальним використанням пропускної спроможності каналу виконується автоматична конфігурація мережі та спрощує роботу мережевим інженерам та зменшує витрати для кінцевого користсувача. У рамках транспортного рівня кластеризація системи може бути відокремлена від способів прискорення прокладки шляху, а також оптимізації напруги на контрольному рівні низького рівня.

You will not surprise anyone with start-ups and developments in the field of software-defined networks (SDN) - the topic is widely studied by both large world corporations and open source communities.

T-SDN (transport software-defined networks) controller produced by NetCracker company has been deployed on the network of one of the European operators. The controller automated a significant part of network operations and, as a result, allowed the operator to significantly save time - hundreds of hours that engineers spent on setting up the network and providing the service [1].

The main idea of T-SDN, as well as in SDN for data centers, is the separation of the data plane and the control plane, which is implemented through the creation of a single control controller that interacts with network devices of a certain domain of the transport network. Above the controller is the application layer (SDN application layer), which communicates with the controller via a specific interface. Due to the fact that the controller knows everything about the structure of its domain, there are additional opportunities for improving the network. For some of them, solutions already exist in various protocols, but T-SDN can significantly improve existing approaches [2, 3].

So what does T-SDN (Figure 1.)offer:

• Simplification of operations with the transport network.

It is assumed that requesting a service from a provider will be as simple as placing an order in an online store. Once the order is placed, the controller will automatically reconfigure all devices and allocate the necessary resources. Thus, the client will receive the necessary service in minutes.

• Optimal bandwidth utilization.

Optimizing the use of channel capacity (or, as they say, the optimal

utilization of the channel) is not a new task. However, a complete solution for the dynamic distribution of client channels in the transport network still does not exist, and it is assumed that in the future the transport controller will take care of this task.

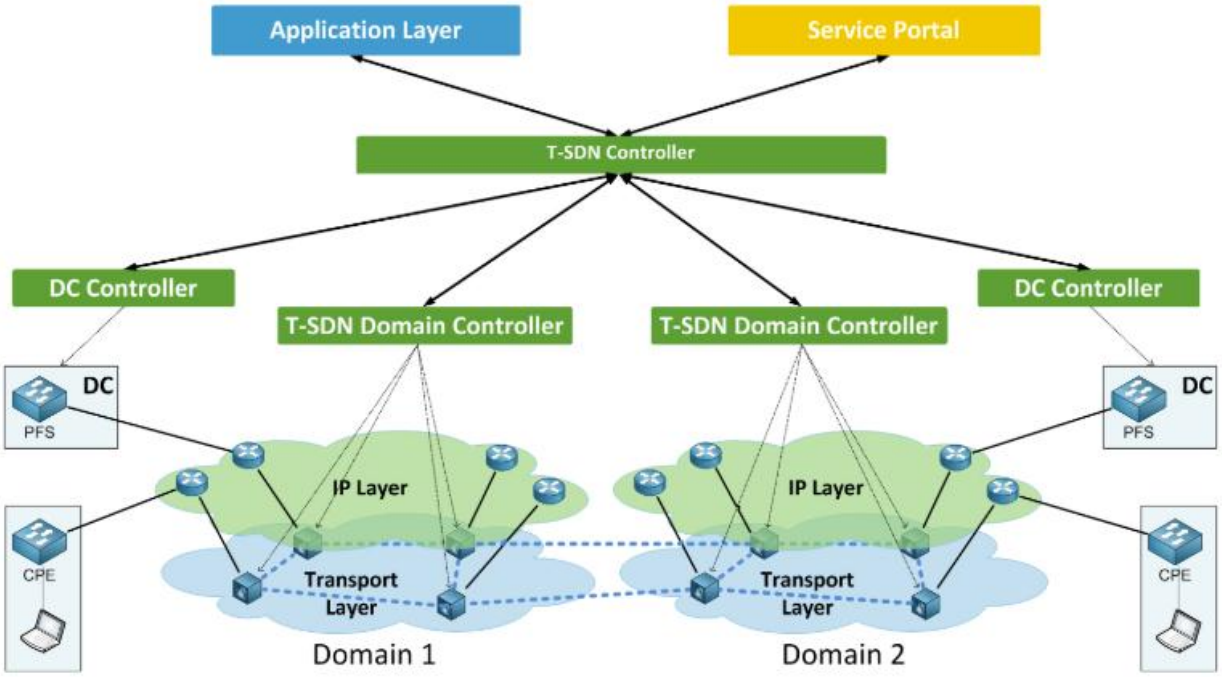

Figure 1. Multi-domain transport network architecture

The successful launch of the pilot version enables the T-SDN controller developers to contribute to the development of Open Source projects such as ONOS and ODENOS, to participate in the standardization of new SDN technology in the Open Networking Foundation and in other organizations. The project is being developed in close cooperation with NEC, a manufacturer of modern network equipment. Thus, the controller's functionality is tested in the NetCracker network laboratory on the latest devices from NEC, and the development departments of NetCracker and NEC have the opportunity to closely collaborate and directly discuss technical issues. This interaction allows you to better understand the capabilities of vendors and work more efficiently with network devices. Significant development will have (and already are [4]) absolutely all the components - from low-level network interfaces Mediator (the Mediation) to the imaging and control applications. Controller Team T-SDN company NetCracker, which has many years of experience working with leading providers within OSS- and BSS- making sure initiated the development of this difficult but highly interesting region [1].

Requests for services "bandwidth on demand" are carried out by the Service Orchestrator, which is architecturally related to the application level for the Controller.

Based on the data received from the underlying infrastructure, the controller

can create multi-level virtual topologies that include all levels of existing transport networks: 1) L0 (WDM ROADM), 2) L1 (OTN), 3) L2 / L3 + (IP / MPLS).

All controller operation should be as close to real-time as possible. There is the concept of Active Real-Time.

First of all, the path calculation time is determined by the size of the topology formed on the basis of the network. However, technological specificity (for example, for DWDM) has significant weight. Based on the experience gained by the NetCracker team as a result of the implementation, we can say that calculating the path on one segment of the provider's network (controlled by the lower-level controller) takes less than 50 ms. The time taken by the top-level controller to calculate the path can vary significantly. This is due to the fact that it aggregates various network domains within itself. So, for example, the calculation of the path during load testing on a topology consisting of 10,000 elements took about 2 seconds [3].

Within the transport level of the system, clustering can be one of the ways to speed up the laying of the path, as well as optimizing the load on the lower level controllers.

It is also important to note that the time taken by the controller to calculate the path is negligible compared to the time that may be required to lay or re-route this path at the level of optical equipment.

Initially, the top-level controller is responsible for ensuring the optimal laying of the service according to the criteria obtained from the Service Orchestrator. Traffic optimization is performed both on the upper and lower level controllers. This process affects not only the main routes (Main), but also backup (Protection).

Controllers can monitor network parameters (such as bandwidth, traffic balancing and load of deployed VNFs) both independently and through third-party systems.

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