Construction of the SDN Control Level Based on ONOS

Oleksandr Romanov
Institute of Telecommunication System
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"
Kyiv, Ukraine
a_i_romanov@ukr.net

Nadiia Korniienko
Institute of Telecommunication Systems
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"
Kyiv, Ukraine
nkornienko2000@ukr.net

Ivan Obod
dept. of Microprocessor Technologies and System
Kharkiv National University of Radio Electronics
Kharkiv, Ukraine
ivan.obod@nure.ua

Iryna Svyd
dept. of Microprocessor Technologies and System
Kharkiv National University of Radio Electronics
Kharkiv, Ukraine
iryna.svyd@nure.ua

O. Romanov, N. Korniienko, I. Obod and I. Svyd, "Construction of the SDN Control Level Based on ONOS," *2021 IEEE International Conference on Information and Telecommunication Technologies and Radio Electronics (UkrMiCo)*, 2021, pp. 127-132, doi: 10.1109/UkrMiCo52950.2021.9716691.

DOI: 10.1109/UkrMiCo52950.2021.9716691

https://ieeexplore.ieee.org/document/9716691

***Abstract*—Possibilities of construction of logically centralized control plane in SDN networks on the basis of open network operating system ONOS are considered. The structure of the controller and its main functional blocks are considered, which provide the collection of information about the state of network elements, the solution of the main control tasks, the interaction of control systems built on different technological bases. The role and place of open network operating system in the controller structure are shown, the description of ONOS multilevel architecture in the form of a set of functional modules is given, the purpose and functions of ONOS subsystems are analyzed, protocols and interfaces that allow to present SDN network as a model are described. The peculiarity of the model is that the managed network can be represented as a set of virtual network functions. Therefore, the control process becomes independent of which vendor's equipment was used to build the network, as well as whether the network is built on real physical elements or virtual ones.**

Keywords—Open Network Operating System, ONOS, Controller, SDN, Control Plane SDN, Data Plane SDN.

REFERENCES

[1] Open Network Foundation. Accelerating the Adoption of SDN & NFV, 2021.

[2] "Open Network Operating System (ONOS) SDN Controller for SDN/NFV Solutions", *Open Networking Foundation*, 2021. [Online]. Available: https://opennetworking.org/onos.

[3] "What is SDN controller (software-defined networking controller)? - Definition from WhatIs.com", *SearchNetworking*, 2021. [Online]. Available: https://searchnetworking.techtarget.com/definition/SDN-controller-software-defined-networking-controller.

[4] "ONOS - Wikipedia", *En.wikipedia.org*, 2021. [Online]. Available: https://en.wikipedia.org/wiki/ONOS.

[5] "Apache License, Version 2.0 | Open Source Initiative", *Opensource.org*, 2021. [Online]. Available: https://opensource.org/licenses/Apache-2.0.

[6] ONF TR-525 SDN Interoperability Event Technical Issues Report AppFest 2015.

[7] K. Pentikousis, IETF RFC 7426. Request for Comments: 7426. ISSN: 2070-1721 EICT.

[8] O. I. Romanov, M. V. Oryschuk and Y. S. Hordashnyk, "Computing of influence of stimulated Raman scattering in DWDM telecommunication systems," *2016 International Conference Radio Electronics & Info Communications (UkrMiCo)*, 2016, pp. 1-4, doi: 10.1109/UkrMiCo.2016.7739622.

[9] K. Pentikousis, *ONOS. Security and Performance*. Analysis: Report No. 1. September 19, 2017.

[10] O. Romanov and V. Mankivskyi, "Optimal Traffic Distribution Based on the Sectoral Model of Loading Network Elements," *2019 IEEE International Scientific-Practical Conference Problems of Infocommunications, Science and Technology (PIC S&T)*, 2019, pp. 683-688, doi: 10.1109/PICST47496.2019.9061296.

978-1-6654-2651-0/21/$31.00 ©2021 IEEE

[11] O. Lemeshko and O. Yeremenko, "Linear optimization model of MPLS Traffic Engineering Fast ReRoute for link, node, and bandwidth protection," *2018 14th International Conference on Advanced Trends in Radioelecrtronics, Telecommunications and Computer Engineering (TCSET)*, 2018, pp. 1009-1013, doi: 10.1109/TCSET.2018.8336365.

[12] O. Romanov, M. Nesterenko, L. Veres, R. Kamarali and I. Saychenko, "Methods for Calculating the Performance Indicators of IP Multimedia Subsystem (IMS)", *Advances in Information and Communication Technology and Systems*, pp. 229-256, 2020. doi: 10.1007/978-3-030-58359-0_13.

[13] O. Lemeshko, J. Papan, O. Yeremenko, M. Yevdokymenko and P. Segec, "Research and Development of Delay-Sensitive Routing Tensor Model in IoT Core Networks", *Sensors*, vol. 21, no. 11, p. 3934, 2021. doi: 10.3390/s21113934.

[14] C. C. O'Connor, T. Vachuska, and B. Davie, "Software-Defined Networks: A Systems Approach", 2021, p. 152.

[15] K. Phemius, M. Bouet and J. Leguay, "DISCO: Distributed multi-domain SDN controllers," *2014 IEEE Network Operations and Management Symposium (NOMS)*, 2014, pp. 1-4, doi: 10.1109/NOMS.2014.6838330.

[16] J. Lam, S. Lee, H. Lee and Y. Oktian, "Securing SDN Southbound and Data Plane Communication with IBC", *Mobile Information Systems*, vol. 2016, pp. 1-12, 2016. doi: 10.1155/2016/1708970.

[17] O. I. Romanov, D. M. Fediushyna and T. T. Dong, "Model And Method Of Li-Fi Network Calculation With Multipath Light Signals," *2018 International Conference on Information and Telecommunication Technologies and Radio Electronics (UkrMiCo)*, 2018, pp. 1-4, doi: 10.1109/UkrMiCo43733.2018.9047550.

[18] I. Obod, I. Svyd, O. Maltsev, G. Zavolodko, D. Pavlova and G. Maistrenko, "Fusion the Coordinate Data of Airborne Objects in the Networks of Surveillance Radar Observation Systems", *Data-Centric Business and Applications*, pp. 731-746, 2020. doi: 10.1007/978-3-030-43070-2_31.

[19] O. Romanov, E. Siemens, M. Nesterenko and V. Mankivskyi, "Mathematical description of control problems in SDN networks", *International Conference on Applied Innovations in IT (ICAIIT)*, pp. 33-39, 2021. Available: 10.25673/36582.

[20] I. Svyd, I. Obod, O. Maltsev, T. Tkachova and G. Zavolodko, "Optimal Request Signals Detection in Cooperative Surveillance Systems," *2019 IEEE 2nd Ukraine Conference on Electrical and Computer Engineering (UKRCON)*, 2019, pp. 1-5, doi: 10.1109/UKRCON.2019.8879840.

[21] I. Obod, I. Svyd, O. Maltsev, G. Maistrenko, O. Zubkov and G. Zavolodko, "Bandwidth Assessment of Cooperative Surveillance Systems," *2019 3rd International Conference on Advanced Information and Communications Technologies (AICT)*, 2019, pp. 1-6, doi: 10.1109/AIACT.2019.8847742.

[22] D. Sanvito, D. Moro, M. Gullì, I. Filippini, A. Capone and A. Campanella, "ONOS Intent Monitor and Reroute service: enabling plug&play routing logic," *2018 4th IEEE Conference on Network Softwarization and Workshops (NetSoft)*, 2018, pp. 272-276, doi: 10.1109/NETSOFT.2018.8460064.

[23] D. Comer and A. Rastegarnia, "Externalization of Packet Processing in Software Defined Networking," in *IEEE Networking Letters*, vol. 1, no. 3, pp. 124-127, Sept. 2019, doi: 10.1109/LNET.2019.2918155.

[24] O. Romanov, M. Nesterenko and V. Mankivskyi, "The Method of Redistributing Traffic in Mobile Network", *Data-Centric Business and Applications*, pp. 159-182, 2021. doi: 10.1007/978-3-030-71892-3_7.

[25] "GitHub - OpenNetworkingFoundation/TAPI: ONF Transport API Repository (TAPI)", *GitHub*, 2021. [Online]. Available: https://github.com/OpenNetworkingFoundation/tapi.

[26] I. Svyd, I. Obod, O. Maltsev, T. Tkachova and G. Zavolodko, "Improving Noise Immunity in Identification Friend or Foe Systems," *2019 IEEE 2nd Ukraine Conference on Electrical and Computer Engineering (UKRCON)*, 2019, pp. 73-77, doi: 10.1109/UKRCON.2019.8879812.

[27] "TAPI Overview - Open Transport Configuration & Control - Confluence", *Wiki.opennetworking.org*, 2021. [Online]. Available: https://wiki.opennetworking.org/display/OTCC/TAPI+Overview.

[28] P. Littlewood, F. Masood, E. Follis. *Optical transport network*. Hannover: Ciena, 2014.

[29] "TAPI v2.1.3 Reference Implementation Agreement. TR-547. Version 1.0. July 2020", *Opennetworking.org*, 2018. [Online]. Available: https://opennetworking.org/wp-content/uploads/2020/08/TR-547-TAPI-v2.1.3-Reference-Implementation-Agreement-1.pdf.

[30] "Open Network Operating System (ONOS) SDN Controller for SDN/NFV Solutions", *Open Networking Foundation*, 2021. [Online]. Available: https://opennetworking.org/onos/.

[31] "Software-Defined Networks: A Systems Approach — Software-Defined Networks: A Systems Approach Version 2.1-dev documentation", *Sdn.systemsapproach.org*, 2021. [Online]. Available: https://sdn.systemsapproach.org/index.html.

[32] "Chapter 6: Network OS — Software-Defined Networks: A Systems Approach Version 2.1-dev documentation", *Sdn.systemsapproach.org*, 2021. [Online]. Available: https://sdn.systemsapproach.org/onos.html.