CONL715: Assignment 2: Comparing and contrasting traditional networks to Software Defined Networks (SDN)

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# Introduction

Computer networks are sets of connected devices, controlling network traffic including resource sharing across its users [1]. However, this report aims to provide a comparison of two network approaches, Software Defined Networks (SDN) and Traditional Networks; uncovering commonalities and distinctions where found.

# Divergencies found between Traditional Networks and SDN’s

One difference found between SDN and Traditional Networks, is how the control plane implements. Within a Traditional Network, the control plane couples with the data plane and independently distributed over each device operated within the network, individually configured for that device [4]. This approach adds complexity due to each device having to be configured with its respected protocols to apply, therefore any change needed to be conducted across the network becomes administratively expensive. Conversely with SDN’s where the data plane remains on any device utilised within the network, the control plane however is separately placed onto one node known as the SDN Controller, which overlooks all devices in the network, which allows changes to the configuration in the control plane to be more streamline to implement [2-3]. An area worth consideration is that as the SDN has the control plane centralised at the top level of the network - interfacing with the Northbound API and the applications there, as well as the devices below using the southbound API, care still needs to be taken with configuration, because if incorrectly configured, can drastically affect the whole network at once as a single point of failure.

Another observation captured amongst literature, is that SDNs are obstensively software-based, whereas a Traditional Network is predominately hardware-based. Due to this setup, SDN can manage the entire network with deployment and propagation from a centralised user interface, allowing for increased flexibility and is also programmable, which can be catered based on the needs going forward [2,3,5]. However, with Traditional Networks, as these are hardware based at the device, which could become very complex and cumbersome to maintain [6].

An additional distinction that has been distinguished between the types of computer network, is the form of interface in play. SDN’s for instance incorporates an open interface, with such protocols as OpenFlow, a software - defined network standard that allows communication between the SDN controller and a device on the network via the southbound API and the applications above the controller known as the northbound API [7-8]. This setup allows for any device to connect to any other device, application, or network, if the protocol is adopted. This allows a SDN to be more innovate and customisable for a business need. On the contrary however, a Traditional Network using the opposite in terms of a closed interface – where all components of the network are proprietary and not able to connect with other technologies [9], which can limit innovation and relies heavily on vendor dependence.

One position to consider when looking at both networking frameworks, is regarding security. An example of where a traditional network may be more favoured than a SDN, is that as the control plane is now a SDN centralised controller in an SDN, it could be more liable to Denial of Service (DoS) attacks or flow table flooding [10-11].

A further topic in which to compare, comes with the adoption of cloud computing; where SDN’s can integrate well within cloud computing requirements with some evidence of being provide Quality of Service (QoS) [12]. Additionally, SDN can adopt a method of cloud computing well, as the network type is agnostic of the hardware used to function so long as there is a protocol in which the controller and devices can communicate with another, as well as connecting to any applications that would be hosted onto the cloud. In contrast, Traditional Networks may not be adopted in a cloud computing space, as it introduces complexity and increased cost managing proprietary hardware to interface with the cloud network, particularly where licenses may be required between the hardware and the software of the cloud platform – if feasible as the concept of cloud computing goes against how a traditional network could be run; especially when trying to interface with Internet of Things (IoT) devices.

# References

[1] J. S. Quarterman and J. C. Hoskins, “Notable computer networks,” Communications of the ACM, vol. 29, no. 10, p. 932, Oct. 1986, doi: 10.1145/6617.6618.

[2] W. Stallings, Data and computer communications. Boston: Pearson, 2014, p. 703.

[3] S. H. Haji et al., “Comparison of Software Defined Networking with Traditional Networking,” Asian Journal of Research in Computer Science, vol. 9, no. 2, pp. 1–18, May 2021, doi: 10.9734/ajrcos/2021/v9i230216.

[4] geeksforgeeks, “Difference between Software Defined Network and Traditional Network,” GeeksforGeeks, Aug. 18, 2020. https://www.geeksforgeeks.org/difference-between-software-defined-network-and-traditional-network/ (accessed Nov. 15, 2022).

[5] Vmware, “What is Software-Defined Networking (SDN)? | VMware Glossary,” VMware, Sep. 28, 2022. https://www.vmware.com/topics/glossary/content/software-defined-networking.html#:~:text=Because%20the%20control%20plane%20is (accessed Nov. 15, 2022).

[6] W. Stallings, Foundations of modern networking : SDN, NFV, QoE, IoT, and Cloud. Indianapolis, In: Pearson, 2016, pp. 135–137.

[7] L. Peterson, “OpenFlow: Catalyst that Kickstarted the SDN Transformation,” Open Networking Foundation, Mar. 03, 2021. https://opennetworking.org/news-and-events/blog/openflow-catalyst-that-kickstarted-the-sdn-transformation/ (accessed Nov. 15, 2022).

[8] W. Braun and M. Menth, “Software-Defined Networking Using OpenFlow: Protocols, Applications and Architectural Design Choices,” Future Internet, vol. 6, no. 2, pp. 302–336, May 2014, doi: 10.3390/fi6020302.

[9] A. Hakiri, A. Gokhale, P. Berthou, D. C. Schmidt, and T. Gayraud, “Software-Defined Networking: Challenges and research opportunities for Future Internet,” Computer Networks, vol. 75, no. A, pp. 453–471, Dec. 2014, doi: 10.1016/j.comnet.2014.10.015.

[10] T. A. Assegie and P. S. Nair, “A review on software defined network security risks and challenges,” TELKOMNIKA (Telecommunication Computing Electronics and Control), vol. 17, no. 6, p. 3168, Dec. 2019, doi: 10.12928/telkomnika.v17i6.13119.

[11] N. Faujdar, A. Sinha, H. Sharma, and E. Verma, “Network Security in Software defined Networks (SDN),” 2020 International Conference on Smart Technologies in Computing, Electrical and Electronics (ICSTCEE), Oct. 2020, doi: 10.1109/icstcee49637.2020.9277300.

[12] T.-C. Yen and C.-S. Su, “An SDN-based cloud computing architecture and its mathematical model,” 2014 International Conference on Information Science, Electronics and Electrical Engineering, Apr. 2014, doi: 10.1109/infoseee.2014.6946218.