

Hybrid Network Console for Cloud Testbeds

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The exponential growth in clouds in recent years, especially the growth in the size of cloud data centers, in the diverse geographic locations of these data centers, and in the demand for faster communication among data centers as well as among data centers and users has created new communication challenges because of the limitations of the legacy network technology being used to support these facilities. Furthermore, these legacy network technology cannot support emerging and anticipated changes in cloud environments. Today, limited options are available using legacy network solutions to address these challenges and almost none are available to address future challenges. However, new network technologies such as SDN/OpenFlow have been developed and implemented. The fast adaption of SDN, commercial activities such as the VMware/Nicira acquisition and other related acquisitions of SDN startups in the last 1-2 years demonstrated the demand for such technology. SDN/OpenFlow has been adopted to support some advanced cloud network requirements. Yet, a wide gap remains between the challenges of next generation cloud requirements and potential approaches to resolving those challenges using SDN/OpenFlow technologies. This white paper discusses several current research challenges in developing SDN/OpenFlow networking for clouds and propose solution potential approach for NSF Cloud project to consider to address these challenges in a testbed environment, specifically, a Hybrid Network Console for Cloud Testbeds. We also suggest possible technologies that should be part of this Hybrid Network Console.

The SDN community has made tremendous progress in building an ecosystem for this technology. For example, the NSF funded GENI project has successfully implemented a number of services using SDN networking for an experimental research environment. . To build on top of experience from GENI and other testbed projects from around the world (i.e., the Open Grid Form's Network Service Interface (NSI) environment, Europe's Future Internet Research Environment (FIRE), vNode, ToMaTo, and many others), as well as to adopt advancements from the SDN industry, an integration platform is needed so that cloud builders and cloud experimenters can easily implement new types of technologies in their experiments. We name this integration platform the Hybrid Network Console for Cloud Testbeds.

This approach arises from several observations. Despite the success of SDN, non-SDN networking continue to proliferate. Traditional legacy network solution providers have developed alternative technology, for example, they are deploying a wide range of virtualization technologies such as VXLAN, NVGRE and other technologies as solutions for the cloud network challenges. The emerging model of the future Internet integrating the Cloud + Internet of Things is based on non SDN network, a situation that will remain in the near term.

The explosion of Cloud and mobility services is based on traditional networks – it is not based on SDN networking. This is also true of rapidly growing cloud based digital media services. Consequently, two worlds, which are almost mutually exclusive, are emerging in parallel, one based on the expansion of the legacy networking technology and the other based on SDN/OpenFlow and also alternative SDN networks that do not use OpenFlow. Cloud researchers must be able to investigate issues related to these types of environments, in which hybrid SDN, non-SDN, SDN/OpenFlow, and SDN without OpenFlow all co-exist and in which these approaches may be integrated. We believe that providing a hybrid SDN and non SDN cloud testbed network environment for cloud testbeds will be necessary. We are developing the architecture for such a tool. The Hybrid Network Console for Cloud Testbeds can be a focal point for deliver many different types of network available for different users and different research scenarios.

We strongly recommend that options for hybrid networking consisting of many networking options including SDN and non SDN network should be the basis for Cloud testbeds, which will provide research-oriented cloud designers and experimenters a realistic environment for experiments. Further, we propose the concept of the Hybrid Network Console for Cloud Testbeds as a focal point and platform for this type of experimental integration, as well as inter networking between SDN and non SDN networks. We are looking forward to further presenting and discussing these concepts with Cloud testbed community.