sFlow Monitoring for a Virtualization Testbed in KREONET

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1. INTRODUCTION

Nowadays, the Software Defined Networks (SDNs) are a new technological direction for the future internet architecture to innovatively resolve traditional network’s problems and has been being developed as the future infrastructure in the research as well as industry fields. The architecture is mainly composed of the OpenFlow switches [1] which separate the network Data Plane and Control Plane, permitting external software to monitor and control network resources and the FlowVisor [2] which is used as a virtualization slice isolation and delegate specific messages to the designated OpenFlow controller. In develop SDN systems, it use OpenFlow and sFlow enabled commodity switches with a sophisticated software-based centralized controller [3] which enables network engineers to monitor and engineer network traffic in new ways. The network of sFlow enabled switches exports sFlow measurement datagrams to one or more collectors. sFlow collectors enable an SDN application to gain visibility into the traffic across the network. sFlow and OpenFlow [4] together provide complementary functions for software defined network environments.

GENI [5] and Ofelia [6] are famous testbed to successfully apply the OpenFlow and OpenVisor concepts. As the physical networks are provided as an individual virtual network to each customer in switch a flow table in physical switch can be organized with flow spaces spaces sliced for customers, switches should be manipulated concurrently by individual customers’ multiple controllers. Therefore, operation systems for those testbeds must be complex and should provide full-featured capability to appropriately handle virtualized resources. As an approach going to those operation system, we have a plan to develop an mechanism to automate the deployment and operation of arbitrary virtualized SDN topologies with minimum intervention by the substrate operator. For our development, we have taken a policy based approach in order to automatically allocate resources a slice by customer’s requests.
In this paper, we have described our development for sFlow monitoring. Our system has been being developed to deploy the virtualized infrastructure in KREONET network infrastructure, validating our idea to the operation production networks. The rest of the paper is organized as follows. In section II KREONET – a Research and Education network in Korea is introduced and related work for the virtualized service network service on KREONET is described. In section III policy based management system is designed and how we have been developing it is described. In section IV, we provide details of sFlow system. Finally section IV concludes the paper.

2. INFRASTRUCTURE AND NETWORK MONITORING

A. KREONET

KREONET (Korea Research Environment Open NETwork) is a national R&D network supported managed and operated by KISTI (Korea Institute of Science and Technology Information) since 1988. KREONET has a high performance network infrastructure that provides R&D resources, including a wide range of information on science and technology, supercomputing, GRID, and e-science applications, to about 200 key R&D centers in the industrial academic, and corporate sectors. KREONET is comprised of 16 areas and 16 local network centers (GigaPop) and is providing a 10Gbps backbone, in the form of the SuperSiReN to boost their advanced applied R&D and tests with a high performance network, also provide thirty more 1Gbps high-bandwidth lines as a state-of-the-art applied R&D network for advanced applied R&D.

B. A Virtualized Network Service on KREONET

In this paper, a service to provide virtual networks to KREONET users is developed. Backbone switches in KREONET provide connections to OpenFlow switches such as Pronto switches and Open vSwitches (OVSes), providing a testbed as OpenFlow@KREONET. When a KREONET user requests a virtualized network to OF@KREONET management system, the management system assigns a slice to the user. The FlowVisor recognizes it and the user’s OpenFlow controller is able to control his/her own virtual networks by delivering the OpenFlow messages through FlowVisor(s). Interaction between the network manager and the management system users for virtual network service in OF@KREONET can be seen in figure 1, user can send their request for virtual network slices to OF@KREONET virtual network management system (VNMS) anytime [7]. If the user request is permitted to provide a slice is delivered to the user through the Web interface.

All of the process from user requests to service provisioning are administered by the network manager. The managers investigates user requests and decides network status. The manager in OF@KREONET VNMS set policies to appropriately assign network resources and monitors the resultant network status by the visualized web reports without individual intervention of the manager. After that the manager decided, OF@KREONET VNMS assigns an OpenFlow controller through the FlowVisor and provides a proper topology for a slice. Then, user can control their own virtual networks and send/receive their traffic within a slice. User should be able to monitor their own traffic and the management system should be able to collect network information in multi-levels such as the individual user’s network level and the administrative whole network level.

C. sFlow Monitoring

sFlow is a multi-vendor sampling technology embedded within switches and routers [8]. The ability to continuously monitor application level traffic flows at wire speed on all interfaces simultaneously is provided. It is used for monitoring traffic network and also continuously monitor traffic flows on all ports gives network-wide visibility into the use of the network. This visibility replaces guesswork, fundamentally changing the way that network services are managed. sFlow is a sampling technology that meets the key requirements for a network traffic monitoring solution [8], such as: provides a network-wide view of usage and active routes, scalable (enabling it to monitor links of speeds up to 10Gb/s, beyond without impacting the performance of core internet routers and switches and without adding significant network load), and a low cost solution.

3. POLICY-BASED MANAGEMENT SYSTEM

A. The Policy-based OF@KREONET VNMS

OF@KREONET VNMS is for automatically providing service to allocate slices user as exclusive virtual network according to requests. When the user sends a request, a manager firstly checks whether resources for it is available or not.

Figure 2 shown OF@KREONET VNMS interacting with policy based Engineering (PBE) module. In order to PBE
module to figure out network status, what user have requested as well as what resource for allocated slices is being serviced should be investigated, and current usage information about network traffic should be gotten in the multi-levels. In this paper, it is designed that all information about users, users’ request and allocated virtual network resources is stored in the database and the current network usage information is gotten from sFlow system [8] that has been customized to our virtualized network. Then it is possible for users as well as the administrator to be able to monitor the resource in their view points.

(Figure 2) The Policy based OF@KREONET VNMS

4. sFlow System

A. Flow Monitoring using sFlow

Switches are configured to use sFlow and OpenFlow protocols to communicate with the sFlow Analytics engine (e.g., sFlow-RT [3]) and OpenFlow controller (e.g., Floodlight [9]) respectively in the control plane. Control plane software such as sFlow and OpenFlow controller use Open Northbound APIs to provide summary statistics and control functionality to SDN applications such as Load Balancer, DDoS, etc.

The OpenFlow protocol enables SDN Controller running on a server to gather topology information of a network of switches and configure the forwarding behavior of these switches. SDN controller builds a graph based model of the network and runs a sophisticated routing algorithm to decide the path of flows through the network. Flow routes decided by the controller are added to the forwarding tables of the switches using the OpenFlow protocol. The sFlow standard is implemented in the switches using a separate ASIC (Application Specific IC) which allows for real time network wide visibility in the traffic flows. Together, sFlow and OpenFlow can be used to provide an integrated flow monitoring system where OpenFlow controller can be used to define flows to be monitored by sFlow. Furthermore, metrics from sFlow can be used as feedback by an SDN application to control the forwarding behavior in the switches.

B. sFlow Monitoring System in OF@KREONET Testbed

In OF@KREONET, sFlow agent is embedded in OpenFlow enable physical and virtual network device. sFlow is configured to capture packets according to a specified sampling rate. It sends samples in the form of measurement datagrams to sFlow-RT. sFlow-RT is real-time analytics engine. sFlow-RT processes the stream of measurement datagrams from sFlow in real time and, therefore, provides real-time summary statistics to application via northbound REST APIs. OF@KREONET employs FlowVisor proxy between physical switches and multiple OpenFlow controllers. Each OpenFlow controller controls flows within its own slice. FlowVisor slice the network resources such as link bandwidth, maximum number of forwarding rules, topology and fraction of switch/router CPU. OF@KREONET flow monitoring system supports monitoring of per slice FlowSpace. An Experimental can monitor his/her own FlowSpace while network administrator can monitor all spaces. Figure 3 shown Real-time visualization of flow (sFlow-RT). We use sFlow-RT as follow collector and analytics engine. It receives a continuous stream of sFlow datagrams from network devices and converts them actionable metrics that are accessible through REST APIs.

(Figure 3) Real-time visualization of flow (sFlow-RT)

Figure 4 shown the client request to sFlow monitoring system and then sFlow system sent data resources to the client. In this system, sFlow information like data, protocol, bandwidth, is going from switch to sFlow-RT. From sFlow-RT, this information is going through REST APIs until sFlow monitoring system. In slow monitoring system this information is arranged and continuously gathering in database. This information is sent to client when client request. And this system is developed using PHP.

(Figure 4) the client request to sFlow monitoring system and sFlow monitoring system sent data resources to the client
5. CONCLUSION

This paper proposed a service to provide virtual networks to KREONET users. In order to provide virtual networks, it uses Policy-based OF@KREONET VNMS. When a KREONET user requests a virtualized network to OF@KREONET management system, the management system assigns a slice for it, and makes the FlowVisor recognize it and the user’s OpenFlow controller be able to control his/her own virtual networks by delivering the OpenFlow messages through FlowVisor(s). The manager in OF@KREONET VNMS set policies to appropriately assign network resources and monitors the resultant network status by the visualized web reports without individual intervention of the manager. FlowVisor slice the network resources such as link bandwidth, maximum number of forwarding rules, topology and fraction of switch/router CPU. OF@KREONET flow monitoring system supports monitoring of per slice FlowSpace. An Experimental can monitor his/her own FlowSpace while network administrator can monitor all spaces.

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References
