

SDN Path Control Experiment Based on Social Information by Network Virtualization Node on JGN-X

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Abstract—This paper shows the effectiveness of the system that controls the network route based on social information. An automatic route control is performed with the network virtualization node FLARE that uses VLAN coupling between each base of the wide area network test bed called JGN-X as a platform.

Index Terms—SDN, OpenFlow, FLARE, JGN-X, VLAN

I. INTRODUCTION

In the current Internet, a wide variety of applications traffic coexists. Therefore, when a disaster such as a great earthquake occurs, there is a problem that people cannot access to emergency information immediately because all of the traffic is handled equally. Therefore, we consider that it is necessary to determine the type of traffic and control for each application. We also need a mechanism that detects rapid changes of circumstances in the real world by using social information and that automatically and stably provides the application information required by users.

In this research, we use the network virtualization node FLARE [1] that uses VLAN coupling between each site of JGN-X as a platform to achieve the automatic control. We demonstrate the effectiveness of SDN path control system based on social information by doing the automatic route control experiments with SDN based on social information, such as Twitter.

II. PATH CONTROL SYSTEM OVERVIEW BASED ON THE SOCIAL INFORMATION

An overview of the automatic path switching system based on social data in the event of a disaster is as follows.

A. Failure detection based on Twitter [2]

The tweets are monitored in real time to detect where failure has occurred by counting the number of Tweets related to communication failure and getting the name of the place where communication failure has occurred.

B. Update of the cost value between the switches

Cost value is updated every 60 seconds. The default of the cost value between the switches is 1. This is incremented if the number of tweets including the name of the place that corresponds to the failure in the tweets is more than 20.

C. Optimal path Search

The optimal path search is performed such that the cost value becomes minimum by using Dijkstra method, and the path of traffic is determined.

D. Resetting of the route

The route is switched automatically from the controller by using the REST-API of OpenFlow.

III. EXPERIMENT ENVIRONMENT

In this research, we use JGN-X which is the research network NICT is operating. We execute path switching experiment by using the FLARE nodes placed in the base of JGN-X and the Universities. FLARE can achieve Deeply Programmable Network(DPN) where not only control plane but also data plane is programmable. In addition, FLARE can program multiple network functions and operate them according to virtualization of the network.

IV. EXPERIMENTAL NETWORK

Fig.1 shows nine FLAREs disposed on nationwide eight locations on JGN-X. Each of the nodes is connected by VLAN.

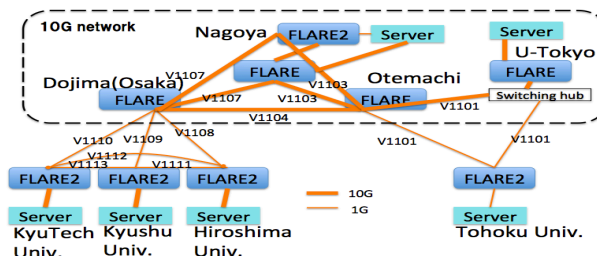


Fig. 1. FLAREs on JGN-X

To perform the experiment, we constitute the FLARE switches to the VLAN in each node. The function of the VLAN can be handled from outside of the switches because FLARE supports the OpenFlow feature and OpenFlow of FLARE is implemented in the Click module router. Fig.2 shows the FLARE switch corresponding to VLAN on Nagoya. By implementing in this way, it is possible to perform the same routing as it is not connected with VLAN.

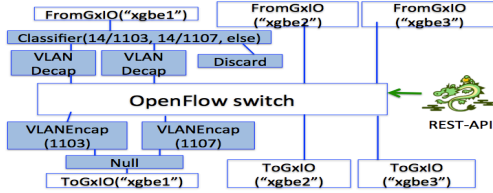


Fig. 2. FLARE switch corresponding to VLAN (Nagoya)

The controller can switch between slices by implementing OpenFlow feature on Slicer slice. Fig.3 shows FLARE node on KyuTech Univ.. We consider that GRE tunnel is useful to distinguish the slices. Therefore, it becomes possible to switch between slices and control the path per application.

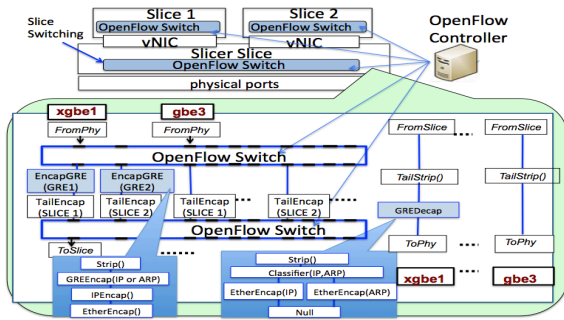


Fig. 3. FLARE node on KyuTech Univ.

V. EXPERIMENT

A. Experiment overview

After we implement on a virtual environment Mininet and check the operation, we execute an experiment on JGN-X. Based on Tweets on 2011/03/11 14:00-15:00 when the Great East Japan Earthquake occurred, we assume that we communicate from Tohoku Univ. to U-Tokyo. A path is switched when the network fault between Tohoku Univ. and U-Tokyo occurs. Due to convenience of this experiment network, this experiment is carried out in the path switching scenario, which changes the server to access from the server on U-Tokyo to the server on Nagoya that replicates data from the server on U-Tokyo.

B. Experiment result

Fig.4 shows the experiment result. This shows that the controller switched on 2700 sec. We measure the response delay time of Ping to check if the route is switched.

At first, Ping communicated between Tohoku Univ. and U-Tokyo. After this system detected a failure between Tohoku Univ. and U-Tokyo, the result shows that they change their communication through Tohoku Univ. and Otemachi and

Nagoya. It takes 3 seconds after the system detect a failure to switch the route. Because of this result, it is successful to experiment to switch the network route automatically.

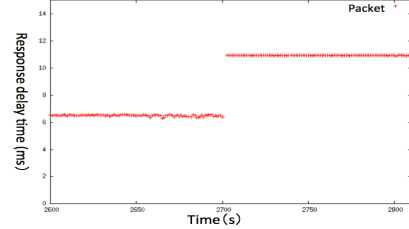
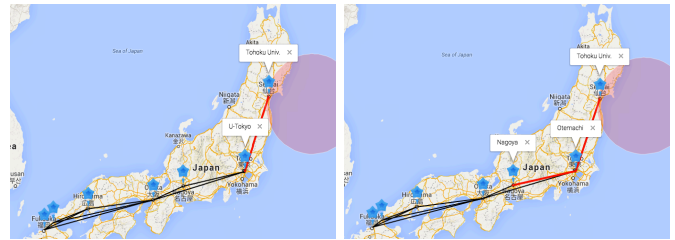


Fig. 4. Experiment result (response delay time)

VI. VISUALIZATION OF THE EXPERIMENTAL RESULTS

We visualize the network route to confirm that the route is switched automatically and correctly. The network before a failure is detected and the one after a failure is detected are shown in Fig.5.

Fig.5 shows that FLAREs of JGN-X on Google Map. The blue pin are FLARE switches, and the red circle is the center of the shock, and the red line is the network route. In the convenience of the experiments, the access traffic to a server is not re-routed but the destination of the access is changed to a replicated server in Fig.5(B). From this visualization result, we confirm that the network route is switched.



(A) Before switching

(B) After switching

Fig. 5. Visualization

VII. CONCLUSION

We trimmed the experimental environment by configuring the FLARE switches on JGN-X in the form of supporting VLAN, and implement the control function of each application. We show the effectiveness of this system by confirming experimentally the mechanism for automatic switching at SDN control to the route to avoid a network failure based on the social information in Mininet and JGN-X.

Future works include the network control demonstration experiment of each application.

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