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BEEF : Introducing flexibility in Experimental Network Environment

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The Internet has continued to developing as an important social infrastructure of people. This development is due to contribute the research and development of network technology, it is important. In the process of research and development of network technology, behavior and performance verification experiments are performed. If the verification experiments performed on the Internet, affected by the characteristics of the Internet and other network services. There is a possibility that the Internet is not the ideal environment for perform verification experiments because difficult to determine the cause when a problem occurs by multiple factors. Testbed are divided environment from the Internet. It are not affected by the environment of the Internet.

Some Testbed facilities are shared by more than one experimenter in order to improve the use efficiency of the equipment. There is a possibility that influence among some verification experiments because experimental verification is performed over a experimental network in shared space. So, Experimental network must be independent to avoid the influence of the traffic generated by other verification experiments. Data link virtualization to achieve independent verification experiments. Data link virtualization technology multiplexes data link media. The virtual data link can be used

to build a independent experimental networks. And the data link virtualization technology is used to build a experimental network topology. The experimental networks are connected by a virtual data link between nodes.

There is requirement to perform parallel verification experiments because of growing demand on Testbed. However, a conventional virtual data link identification method has problems. First, there is a limit to the number of data link that Testbed can build because the number of identifiers to use for identification of the virtual data link is determined by specifications. The scale of the experimental network is in a relation of the trade off with the parallel degree of the verification experiments, and it is difficult to perform a large-scale verification experiments in parallel. Second it is restricted that experimenter use a same data link virtualization technology in verification experiments to prevent from interfering identification of virtual data link building an experimental network. These restrictions may make it difficult to response to a request for experimental network.

To provide flexible construction of the experimental networks to the experimenter, it is necessary to remove the restrictions that are described in previous paragraph and limitation of the data communication format of Ethernet and to enable experimenters to perform large scale experiments in parallel.

In this paper, I propose a support system and Beef's Ethernet Equivalent Forwarding (BEEF). The Testbed using the proposed system consists of set of nodes that are connected to an OpenFlow Switch. BEEF is a data link virtualization technology that does not use data link network instance identifier using the OpenFlow. BEEF Domain(BOMAIN) is identified by OpenFlow Switch's port number that received the frame. Data communication between nodes that belong to same BEEF is switching processing same as conventional. Because it does not use a network instance identifier to identify the virtual link data, there is no limit to the number of data such as a VLAN's virtual link. Furthermore, it becomes possible to build a format free network about the data communication of Ethernet in the verification experiments.

In addition, the number of physical network interface that nodes have may be small. The virtual interface can compensate for the shortage. I propose the BEEF-V as a data link virtualization technology that corresponds

to the virtual network interface. By using BEEF-V, the construction of large-scale experimental network using virtual interface can be realized.

I have shown the usefulness of the experimental network created by BEEF. About a performance of BEEF, I considered two cases. One is implementation of the OpenFlow Switch. The other is placement of the nodes. I showed it about effective usage of BEEF.

The suggestion system realizes network construction with high flexibility. The experimenter can build experimental networks flexibly. This promotes research and development of network technologies, and the development of more and more of the Internet can be expected.