Virtualization and Networks: Openflow and Xen

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***Abstract*—The idea of developing an Internet of the Future [1] came up after noticing that today's Internet has serious structural problems and cannot support today's demands, such as management, security, quality of service, and mobility. But then, the research community realized that it is not enough just developing a new project for the Internet. It is necessary to test the new Internet model in a test environment, as realistic as possible. Using the existing network as a test environment is not acceptable for network administrators, because it could interfere with the running production network. Trying to solve these problems, two virtualization platforms have shown to be promising and became object of this study: Openflow and Xen. Our first step is to investigate the network performance of both.**

I. Openflow

Through the Openflow platform [2], alongside with controllers (in this study, Nox [3] and FlowVisor [4]), it is possible to use production networks, such as an University's, as a test environment without interfering with the production traffic.

One great advantage of Openflow is the easy installation on switches, which allows users to become familiar with the working system and to adapt the current network more easily, without having major expenses.

We have implemented an Openflow testbed composed by two notebooks, both working with the NOX 0.6 controller, one PC with the FlowVisor 0.3, and three switches running Openflow-0.8.9rev2. The preliminary tests were promising, with the switches registering in the controller, and the flows being managed normally, all through the FlowVisor's 'transparent proxy'.

Other tests are in progress to test the interesting properties of this new platform, such as bandwidth isolation, easy management, and security.

II. Xen

Xen [5] provides a Virtual Machine Monitor which allows more than one operating system to run in a physical machine at the same time, through the use of virtual machines. In Xen, there is a privileged virtual machine, called Domain 0, and common virtual machines are called User Domains.

When a virtual machine is started in Xen, a network is created between the physic machine and the virtual one. The default mode used is called bridge (to be forwarded, a packet uses a bridge between the virtual interface and the IP layer, it does not happen when router mode is set up).

The image below show tests made using three computers, two of them using one network interface each and running native linux, and the other running native linux first and than Xen dom 0 and a Xen dom U.

All the tests had the objective to evaluate the performance of the network. The tests show us that the best performances

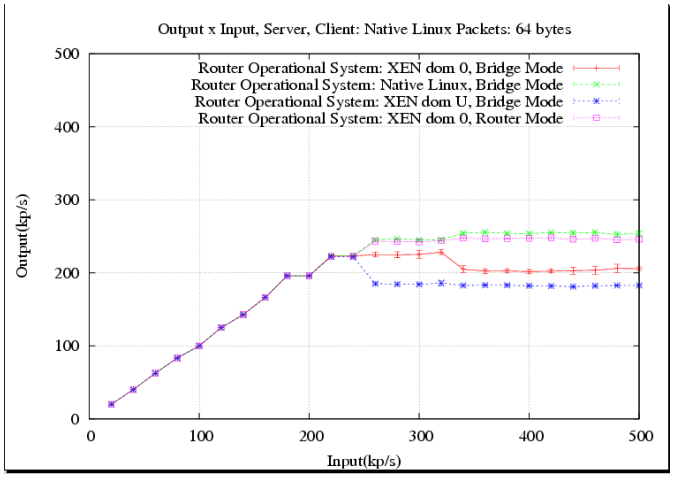

Figure 1. Routed packets rate, 64kb

were: the performance using native linux, maybe since the computer did not consume processing running Xen and because Xen's virtual machines are paravirtualized; followed by the test using the router mode, maybe because the bridged mode is not so well implemented, then the bridged router mode using Domain 0 and the worst is using a common virtual machine, the complexity involved in forwarding packets is bigger when packets pass through a VM, besides, there are hypervisor calls.

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References

[1] M. D. D. Moreira, N. C. Fernandes, L. H. M. K. Costa, and O. C. M. B. Duarte, "Internet do futuro: Um novo horizonte (in Portuguese)."

[2] N. McKeown, T. Anderson, H. Balakrishnan, G. Parulkar, L. Peterson, J. Rexfor, S. Shenker, and J. Turner, "Openflow: Enabling innovation in campus networks," 2008.

[3] N. Gude, T. Koponen, J. Pettit, B. Pfaff, M. Casado, N. McKeown, and S. Shenker, "NOX: Towards an operating system for networks," 2008.

[4] R. Sherwood, G. Gibby, K.-K. Yapy, G. Appenzellery, M. Casado, N. McKeowny, and G. Parulkary, "Flowvisor: A network virtualization layer," 2009.

[5] N. Egi, A. Greenhalgh, M. Handley, M. l Hoerdt, L. Mathy, and T. Schooley, "Evaluating Xen for router virtualization."