

SDN Readings

1 Useful Articles (Current and “Classics”)

Lots of useful readings... Let me know what you find too!

1. One of the first papers folks should read is the original OpenFlow editorial piece [1].
2. “The Road to SDN: An Intellectual History of Programmable Networks” [2]

Very nice overview includes history and concepts. Students can skim over the section on “active networks”. Very good sections on OpenFlow and Network Virtualization and how these relate to SDNs in general. Highly recommended.
3. “FlowVisor: A network virtualization layer” [3]

Early well throughout/explained approach to SDN based virtualization. Good analysis of problem space. Clearly written.
 - (a) Follow on virtualization work at ON.lab <http://www.slideshare.net/nvirters/virt-july2013meetup>
 - (b) OpenVirteX (<http://ovx.onlab.us/>) Some good info here. Relatively new work.
4. “ONOS Towards an Open, Distributed SDN OS” [4]

“We present our experiences to date building ONOS (Open Network Operating System), an experimental distributed SDN control platform motivated by the performance, scalability, and availability requirements of large operator networks.” Aimed at traffic engineering and scheduling. Gives design/development history and lessons learned.
5. A recent overview with good definitions, application areas, and concepts is [5].
6. The November 2014 issue of IEEE Computer has a special section mostly drawn from ONF contributors [6].
7. The paper [7] provides an overview of the ONF standards process, conceptual overview, and use-cases. It also includes details on the two track approach to OpenFlow standardization (hardware vs. software switch implementations).
8. The paper [8] provides fairly up to date information of SDNs and open source efforts including combining traditional routing with SDN concepts.
9. SDN Blog from some of the OpenVSwitch folks: <http://networkheresy.com/2015/01/13/ovn-bringing-native-virtual-networking-to-ovs/>
10. The OpenVSwitch database structure and protocol is actually JSON-RPC. This is much better documented in <https://tools.ietf.org/html/rfc7047> (RFC7047 an informational RFC from

2013).

(a) JSON-RPC: <http://json-rpc.org/> , Wikipedia: <https://en.wikipedia.org/wiki/JSON-RPC> ,

11. [10 SDN Startups On The Cutting Edge](#): Mentions some of the big acquisitions, BigSwitch, Plexxi, Midokura (has open sourced some of its network virtualization software), Pica 8 (supplies OS for white box switches), Cumulus Networks (mentions win with Dell TOR switches), PLUMgrid (network virtualization for open stack...), Embrane (little info), Pluribus Networks (little info), Anuta Networks (orchestration platform), Viptela (WAN space, including encryption, other WAN players: CloudGenix, Glue Networks).

12. 2014-02-21 [The Evolution Of The Ethernet Switch](#)

More of his articles on Ethernet can be found at: <http://ethancbanks.com/?s=ethernet+switching+landscape>

13. 2013-02-26 [Will SDN Kill TRILL?](#)

Not bad perspective piece. Also applies to Ethernet SPB (shortest path bridging)

2 WebSites and Such

2.1 Controllers and Such...

A quick review of whats out there and how it looks:

1. Mininet “An Instant Virtual Network on your Laptop (or other PC)” <http://mininet.org/>

The most used emulator for SDN ever! Get hands on now! Get the VM, go through the tutorials. Don't delay.

2. Ryu (<https://osrg.github.io/ryu/>)

(a) “Ryu is a component-based software defined networking framework. Ryu provides software components with well defined API that make it easy for developers to create new network management and control applications. Ryu supports various protocols for managing network devices, such as OpenFlow, Netconf, OF-config, etc. About OpenFlow, Ryu supports fully 1.0, 1.2, 1.3, 1.4 and Nicira Extensions. All of the code is freely available under the Apache 2.0 license.

(b) Have a fairly good introductory document: <http://osrg.github.io/ryu-book/en/Ryubook.pdf>. *This also goes through a number of interesting **basic SDN use-cases**.* Includes an architecture section. Has a bunch of examples of REST interfaces. Need to try these on Mininet.

3. POX (<https://openflow.stanford.edu/display/ONL/POX+Wiki> and <http://www.noxrepo.org/>)

(a) Currently still limited to OpenFlow 1.0 switches. Hmm, looks like no activity in 2014 on github: <https://github.com/noxrepo/pox>

4. OpenDaylight (<http://www.opendaylight.org/>)
 - (a) This is a Linux foundation project, Uses the Eclipse Public License (EPL-1.0).
 - (b) Technical overview: <http://www.opendaylight.org/project/technical-overview>
5. FlowVisor (<https://github.com/OPENNETWORKINGLAB/flowvisor/wiki>)

“FlowVisor is a special purpose OpenFlow controller that acts as a transparent proxy between OpenFlow switches and multiple OpenFlow controllers”
6. OpenVirteX <http://ovx.onlab.us/> “Successor” to FlowVisor. Open source SDN based network virtualization. Active development. Tutorial VMs to get you started.
7. ONOS Web site: <http://onosproject.org/> Related to to ONF, part of ON.lab(?)
 - (a) Use-cases page: <https://wiki.onosproject.org/display/ONOS/ONOS+Use+Cases>
 - (b) Aimed at service providers. Has an Optical/SDN example. Easy to use tutorial VMs for download.
8. OpenStack (open source cloud computing) <http://www.openstack.org/>
 - (a) Neutron project wiki: <https://wiki.openstack.org/wiki/Neutron>
 - (b) Architecture/Design Guide: <http://docs.openstack.org/arch-design/content/>
 - (c) Networking design discussions: <http://docs.openstack.org/arch-design/content/technical-considerations-general-purpose.html>.

2.2 Standards and Such

Always be efficient when reviewing any standards related documents. They can contain an excessive amount of formality, or detail, or both.

1. Open Networking Foundation <https://www.opennetworking.org/>
 - (a) The folks that bring you the OpenFlow specifications <https://www.opennetworking.org/sdn-resources/technical-library>
2. IETF <http://www.ietf.org/>
 - (a) Look over the current working groups at: <http://datatracker.ietf.org/wg/>. We're particularly interested in Routing Area Groups such as: CCAMP, MPLS, PCE, and TEAS; and Transport Area Groups such as ALTO.
 - (b) Closely related is the IRTF (Internet Research Task Force) <https://irtf.org/>. They have research groups on SDN and NFV.
3. ETSI (European Telecommunications Standards Institute) is involved in SDN and Network Function Virtualization (NFV): <http://www.etsi.org/index.php/technologies->

[clusters/technologies/nfv](#) . White Paper:

https://portal.etsi.org/Portals/0/TBpages/NFV/Docs/NFV_White_Paper3.pdf

3 References

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