IEEE ComSoc Distinguished Lecture Tour – South America, Sept. 6-20, 2015

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DLT Planning and Itinerary

This DLT (Distinguished Lecture Tour) was packed with three talks in South America and piggybacked to ONF (Open Networking Foundation) Member Workday in San Jose, California. This was the third time I was invited by the IEEE ComSoc chapters of Chile, Argentina, and Uruguay. The previous two did not get through because of my schedule conflict. The local hosts were quite persistent because they were very interested in the topic of software defined networking (SDN) and from the ComSoc Web page no other distinguished lecturers offered such a topic. My friend, Jeans Tseng (former Country Manager of Alcatel-Lucent Taiwan), joined this DLT and also lectured from the industrial viewpoint. We flew to San Francisco to attend the ONF meeting in Santa Clara, and detoured via Houston to Santiago, Chile, then flew to Buenos Aires, Argentina, and finally took a ferry to Montevideo, Uruguay. The way back was so long that it took 47 hours door-to-door. All three lectures were on SDN and hosted by Mr. Pedro Aguilera (ComSoc Director of Latin America Region, Manager of Switch Communications Ltd.) and Prof. Diego Dujovne in University of Diego Portales (UDP), Mr. Jorge Hedderwick (ComSoc Chair of Argentina Chapter, Manager of Cisco Argentina) and Prof. Richardo Veiga in University of Buenos Aires, and Mr. Gustavo Giannattasio (ComSoc Chair of Uruguay Chapter) and Prof. Claudio Ruibai in University of Montevideo, Montevideo, Uruguay. Pedro and Gustavo have been great hosts to show us around the country and tell us its history. One unique thing is that all main hosts were from the industry, whereas most hosts in my previous DLTs were in the academia. Many professors also work part-time in the industry, or full-time in the industry but part-time in the university. The exchange and interaction between academia and industry appear to be strong.

One Topic in Three Lectures

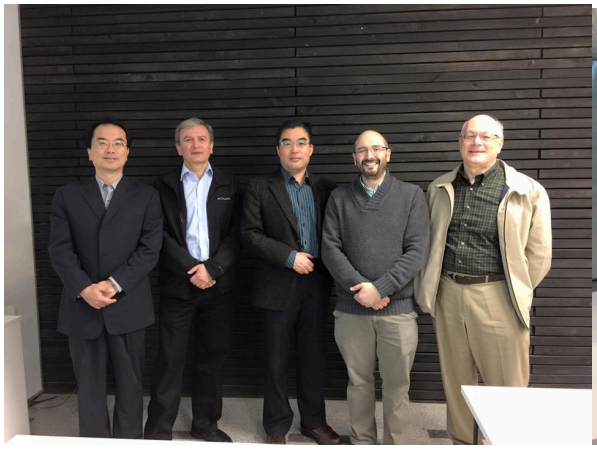
Each lecture consisted of my talk and Jeans' talk, from academic and industrial viewpoints, respectively. First I argued why, where, and when for SDN and NFV (Network Function Virtualization). Then I illustrated how SDN-NFV works in sections of research, standardization, development, and testing. Jeans gave SDN-NFV use case scenarios with real deployments world-wide. The number of attendees per lecture was about 30 in both Santiago and Montevideo, and 120 in Buenos Aires. The auditorium in College of Engineering in University of Buenos Aires was so classic that it felt like lecturing in a museum. About a half of attendees were from the industry, which was quite different from most of my previous DLTs. The audience liked the combined flavors of academia and industry and asked 4-7 questions per lecture. We received positive comments like "very vivid and logical arguments", "it clarifies my mist about SDN and

NFV", "now I know what I or my company can do on SDN and NFV", etc.

In-Depth Discussions During and After Lectures

There were many good questions from the audience. I list major questions and my answers below. For questions similar to the ones listed in my previous DLT reports, they are not repeated here.

1. How far is the controller from OpenFlow switches?
   It should not be as far as the traditional big data centers. The first tier should be in local exchanges which are within 5km.
2. If there are multiple controllers in a multi-tier architecture, how do we decide which controller to dispatch an OpenFlow message to?
   It should be computed and decided in the control plane by the controller but dispatched in the data plane by OpenFlow switches which run load balancing.
3. In using NSH (Network Service Header) in NFV, what is the difference with the idea of MPLS?
   The idea is the same to pave the path to switch packets quickly in a closed network environment.
4. Can Google compete with operators world-wide to offer SDN-NFV services?
   No, because Google does not have local exchanges that can reach users within 5km.
5. To what degree will be SDN-NFV services "locked-in" to vendors?
   The framework would remain open, but individual apps and services would have vendor lock-in.



Left: University of Diego Portales (UDP) - Jeans Tseng, Pedro Aguilera, me, Diego Dujovne
Right: University of Diego Portales (UDP) – lecture attendees


Left: University of Buenos Aires – lecture attendees
Right: University of Buenos Aires - Richardo Veiga, Jeans Tseng, me, Jorge Hedderwick

Left: University of Montevideo – Claudio Ruibai, Jeans Tseng, me, Gustavo Giannattasio, Diego Campistrous
Right: University of Montevideo - lecture attendees

Appendix:

Talk Title: **Software Defined Networking: Why, When, Where, and How**

Abstract:

The first wave of cloud computing was to centralize and virtualize servers into the clouds, with a phenomenal result. The emerging second wave, named Software Defined Networking (SDN), is to centralize and virtualize networking, especially its control, into the clouds. SDN deployment started from data centers and now expands to the model of “networking as a service” (NaaS) offered by the operators to enterprise and residential subscribers. By centralizing the control-plane software of routers and switches to the controller, and its applications, and controlling the data-plane of these devices remotely, SDN reduces the

capital expenditure (CAPEX) and operational expenditure (OPEX) because the devices become simpler and hence cheaper and number of administrators could be reduced. SDN also enables fast service orchestration because the data plane is highly programmable from the remote control plane at controllers and applications. However, as we detach control plane from where data plane resides, new protocols shall be introduced between control plane and data plane, as the southbound API between controllers and devices and the northbound API between controllers and applications. As we further extend the control plane from controllers to applications such as Service Chaining (SC) and data plane from devices to Network Function Virtualization (NFV), newer mechanisms and APIs need to be added to these APIs. We argue why, when, and where SDN would prevail, and then illustrate how to make it happen. We shall introduce the key technology components, including OpenFlow, SC, NFV, and Network Service Header (NSH) and then review the issues on standardization, development, deployment, and research. At the end, the development and deployment experiences of a campus SDN solution for Wi-Fi/switch control and management are shared.

Autobiography:

YING-DAR LIN is a Distinguished Professor of Computer Science at National Chiao Tung University (NCTU) in Taiwan. He received his Ph.D. in Computer Science from UCLA in 1993. He served as the CEO of Telecom Technology Center during 2010-2011 and a visiting scholar at Cisco Systems in San Jose during 2007–2008. Since 2002, he has been the founder and director of Network Benchmarking Lab (NBL, www.nbl.org.tw), which reviews network products with real traffic. NBL recently became an approved test lab of the Open Networking Foundation (ONF). He also cofounded L7 Networks Inc. in 2002, which was later acquired by D-Link Corp. His research interests include design, analysis, implementation, and benchmarking of network protocols and algorithms, quality of services, network security, deep packet inspection, wireless communications, embedded hardware/software co-design, and recently software defined networking. His work on "multi-hop cellular" was the first along this line, and has been cited over 650 times and standardized into IEEE 802.11s, IEEE 802.15.5, WiMAX IEEE 802.16j, and 3GPP LTE-Advanced. He is an IEEE Fellow (class of 2013), an IEEE Distinguished Lecturer (2014&2015), and a Research Associate of ONF. He is currently on the Editorial Boards of *IEEE Transactions on Computers, IEEE Computer, IEEE Network, IEEE Communications Magazine - Network Testing Series, IEEE Wireless Communications, IEEE Communications Surveys and Tutorials, IEEE Communications Letters, Computer Communications, Computer Networks, Journal of Network and Computer Applications, and IEICE Transactions on Information and Systems*. He has guest edited several Special Issues in IEEE journals and magazines, and co-chaired symposia at IEEE Globecom'13 and IEEE ICC'15. He published a textbook, *Computer Networks: An Open Source Approach* (www.mhhe.com/lin), with Ren-Hung Hwang and Fred

Baker (McGraw-Hill, 2011). It is the first text that interleaves open source implementation examples with protocol design descriptions to bridge the gap between design and implementation.