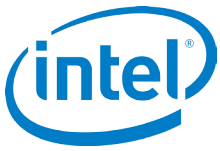
On the promise of SDN: A whitepaper

By

John Healy and Cliff Farrah

Spring 2013



www.intel.com

www.beacongroupconsulting.com

Whitepaper Thesis

In early 2012, Intel teamed with The Beacon Group to study the evolution of Software-Defined Networking (SDN) in the communications market. In conjunction, Intel was working with several early movers to develop and test SDN concepts in a carrier environment. This paper discusses the Beacon study findings and the lessons Intel learned through their partnerships, and offers a shared opinion on the implications for market participants.

Our analysis showed that network transformation is accelerating in the carrier space. The perfect storm of growing smartphone usage, increased data demand and continued margin pressure is creating a flawed and unsustainable business model. In the near term, capacity demand has begun to outpace carrier supply, and carriers are searching for solutions on both the revenue and cost sides of their network business model. Unless the carriers are willing to significantly increase the fees charged to users, profitability has to be achieved through a more efficient use of existing and future network investments.

Our research found that many carriers believe SDN is the most cost effective way to do this, and is actively being evaluated around the globe. In the SDN architecture, the control and data planes are decoupled, network intelligence and state are logically centralized, and the underlying network infrastructure is abstracted from the applications. As a result, enterprises and carriers gain unprecedented programmability, automation and network control, enabling them to build highly scalable, flexible networks that readily adapt to changing business needs.[1]

Carrier testing of SDN solutions is based on four key market perceptions:

1. SDN is the most cost effective way to execute a network transformation capable of supporting future growth in data traffic.
2. The current communications industry business model makes some version of SDN inevitable.
3. The definition of carrier grade is changing and may be achievable with existing datacenter OEM solutions.
4. Telecommunications equipment manufacturers (TEMs) will embrace (but control) SDN progress, or new competitors will enter the network.

A key variable in this discussion is the change in the end users' and customers' expectations. IP telephony and wireless communications have brought about a change in the definition of some long held industry terms. "Carrier grade" is one standard that has evolved over time. If carrier grade solutions are seen to be offered/proven by the OEMs, then the door is open to a whole new ball game. Shaping the "new" carrier grade will be the challenge confronting OEMs looking to enter the market.

Our study showed there is much at stake here for all parties. The promise of SDN in its fullest state would have carriers gain efficiency from existing networks and the opportunity to provide new services to customers. TEMs would find new revenue streams and adopt business models that have more to do with the value of software than closed hardware solutions. Datacenter OEMs will have a new value proposition in the carrier domain as they migrate their capabilities from datacenter SDN applications to carrier grade solutions, either as partners with existing TEMs or as new providers of core network solutions.

The work also highlighted the increasing importance and growing relevance of virtualization in the industry, as seen by an initiative called Network Functions Virtualization (NFV) launched by over a dozen leading telecom service providers. More and more aspects of network management and control are virtualized through new software offerings, which are being decoupled from traditional, hardware-centric solutions. Of note is VMware*'s acquisition of Nicira*. SDN architectures facilitate network virtualization, which enables hyper-scalability in the data center, automated VM migration, tighter integration with storage, better server utilization, lower energy usage and bandwidth optimization.[1]

While SDN offers great promise to carriers, there are still many hurdles to be cleared and decisions to be made by all players in the market. Below, we offer our opinion on some of the key issues that all SDN ecosystem participants need to consider:

1. Implementation challenges
    a. Legacy systems – who will provide the APIs for integration with existing infrastructure, and what functionality will current hardware be able to provide in a hybridized system.
        i. This is no different than the adoption of digital solutions with legacy analog systems, except that much value will

come from better managing and virtualizing existing network assets.

b. Despite clear demand from carriers, slow progress in standards development, a lack of implementation frameworks and no clear proof points are delaying the deployment of SDN solutions (despite the availability of most SDN components today).

c. Investment in R&D is being done now, with both TEMs and datacenter OEMs aggressively working to prove the capability of SDN in a carrier grade network.

d. Current SDN components have not been proven to be carrier grade and must either clear the hurdle of the current definition, or force a reevaluation of that standard in today's network environment.

e. Within five years, Beacon expects to see early adopters deploy SDN in an operational environment beyond the data center, directly in carrier networks.

f. SDN hardware will likely move from ASICs to COTS as control is provided through control plane (network controller, network orchestrator) software.

g. SDN adoption will drive growth in the telecom network software market over the next 10 years.

h. TEMs need to begin working now on SDN solutions that will use APIs to manage legacy infrastructure while introducing SDN controls and capabilities to the network.

2. The timing of adoption

a. The pace of adoption will largely be driven by the visible success of early adopters.

b. Carriers will shift focus to SDN deployment as LTE build out is completed.

i. Successful proof points will drive fast adoption by Tier 1 providers in the EU and US.

ii. Absent a large number of vendor solutions, we expect share and revenue to flow to innovator OEM and TEM suppliers.

iii. TEMs need to acknowledge the commoditization of hardware and the increasing importance of software in their value proposition.

3. How players will collaborate

a. Technical challenges and barriers to adoption that can be overcome include:

i. The ability to integrate with disparate, closed legacy systems.

ii. The lack of "carrier grade" proof points.

iii. An unproven migration process.

iv. The lack of standards and open APIs for legacy and future hardware/software solutions.

Despite the different possible reactions to these challenges and their potentially daunting nature, there is a significant amount of activity from carriers and TEMs alike as they work to drive the adoption of SDN in carrier grade deployments. While not meant to be exhaustive, the proof points offered below illustrate the level of interest and investment currently being made with SDN initiatives.

Proof points: recent market movement that demonstrates SDN/Technology adoption in communications

- **PRC -- China Mobile*** - Intel is working with China Mobile*, embracing the new Cloud-RAN network design concept to reshape wireless networks by using off-the-shelf silicon (Intel® Xeon® processors). Using supercomputing principles to handle baseband processing, operators would no longer have to build networks to meet peak demands at every tower and could drastically cut the processing power necessary to run the network as a whole – by some estimates, as much as 40 percent.

- **APAC -- KT* and Samsung*** - KT*, Intel and Samsung* jointly demonstrated an LTE approach to the deployment of Cloud-RAN, based on Cloud Communications Center (CCC) architecture and an open hardware platform. Samsung utilized its commercial-ready LTE end-to-end solution with servers powered by an Intel® architecture-based, general-purpose processor platform. LTE CCC harnesses virtualization technology to flexibly allocate central processing resources according to the peaks and troughs of demand, while reducing an operator's total costs for network deployment and operation. http://www.rethink-wireless.com/2011/12/08/korea-telecom-plans-worlds-commercial-cloud-ran.htm

- **ASMO -- Verizon*** - In collaboration with ADARA Networks*, HP* and Intel demonstrated key aspects of SDN. The demonstration bypasses traditional traffic-management rules – especially within data centers – giving carriers more flexibility to choose and quickly change network-traffic routing to allow for optimum energy use, security, efficiency and reliability in the network.

- **EMEA -- BT*** - UK-based BT* has joined WindRiver*, Intel and other companies in a joint initiative to accelerate innovation and encourage development of an open ecosystem of software vendors that can replace hardware-based network appliances with software running on industry standard servers. Termed 'Network Virtualisation,' BT's research shows that using industry standard servers has the potential to reduce the total cost of ownership by a third to a half and reduce power consumption by more than 50 percent. This new approach to future networks will take advantage of the scalability, flexibility and performance of Intel's computing technologies to reduce costs and increase efficiencies.

- **EMEA -- Telefonica*** - Telefónica I+D* and Intel are exploring how to evolve telecom network edge infrastructure with a software-defined approach. While the general trend in IT has been away from fixed hardware, telecom service providers still rely on expensive, purpose-built hardware to perform essential network processes. Using the Intel® Xeon® processor E5 family, Telefónica I+D and Intel have collaborated to convert processes in the network edge infrastructure into software-based solutions that can be virtualized and run on general Intel architecture-based hardware. By removing its reliance on dedicated, proprietary technologies, Telefónica I+D has seen increased opportunities for service innovation, faster development cycles, and reduced costs for network operation and evolution.

  http://www.intel.com/content/www/us/en/high-performance-computing/high-performance-computing-xeon-e5-telefonica-study.html.

- **ONS Summit -- Intel** - At the 2013 Open Networking Summit conference, Intel announced three strategic reference architectures that will enable the IT and telecom industries to accelerate hardware and software development for Software-Defined Networking (SDN) and Network Functions Virtualization (NFV). Developed to boost data center networking efficiency and performance, the hardware and software tools include the Intel® Open Network Platform Switch and Intel® Open Network Platform Server Reference Design, and the Intel® Data Plane Development Kit Accelerated Open vSwitch*. Several ISVs, OEMs and service providers, including Big Switch Network*, HP, NEC*, NTT Data*, Quanta*, Super Micro, VMware and Vyatta* (a Brocade company), are building innovative solutions based on the new Intel reference architectures. http://newsroom.intel.com/community/intel_newsroom/blog/2013/04/17/intel-accelerates-the-data-center-and-telecom-network-transformation-with-new-reference-architectures.

Conclusion

SDN is simply too big to ignore, whether approaching the market as a carrier seeking new solutions to a critical business issue, a TEM working to protect share and move its value proposition to a software driven model, or an OEM working to leverage the expertise driven through large scale datacenter deployments. As standards begin to emerge in conjunction with successful test deployments, it is important that leading companies work together to plan and support the adoption of SDN in all of its implementations across carrier networks. While OEMs can provide solutions, having them work exclusively from the TEMs would likely be a painful process for all parties as SDN continues to mature. The collaboration of key OEMs and TEMs, as shown in the examples above, is extremely important not only in the definition of carrier grade SDN, but also in learning how the business models and value propositions of all three entities (carrier, TEM and OEM) will interact in this promising new world: the world of carrier network SDN.

John Healy is the director of strategic marketing in the Communication and Storage Infrastructure Group at Intel. He is one of the leading strategists behind software-defined networking (SDN), a network architecture that increases scalability and decreases equipment cost. John's leadership in intelligent systems for the communications industry is informed by 21 years of experience in engineering, network deployment, transmission planning, switching and maintenance. Prior to his work in the communications group, John held positions in finance, information systems, network planning and sales management at Intel. He is an engineering graduate from the University of Limerick in Ireland.

Cliff Farrah is the President and Chairman of The Beacon Group (www.beacongroupconsulting.com). Mr. Farrah has over twenty years of management consulting experience in the areas of strategic planning, commercialization of new technologies, merger and acquisition, licensing, and market analysis. Mr. Farrah has focused on both the communications and computing marketplace throughout his career.

Mr. Farrah is responsible for the development of innovative growth strategies for his Fortune 100 clients, in the areas of both organic and inorganic growth for both domestic and international markets. As a seasoned thought leader, Mr. Farrah is responsible for the development of innovative growth strategies specifically for Fortune 100 clients in the areas of both organic and inorganic growth for both domestic and international markets. Mr. Farrah holds an undergraduate degree in Economics from the University of Massachusetts at Amherst, and an MBA from the University of Virginia's Darden School where he currently serves as visiting lecturer, and formerly as a member of the Alumni Board of Directors. Mr. Farrah also serves on the Advisory Board of Biovista, and as a judge on The Innovation Challenge.

[1] Source: "Software-Defined Networking: The New Norm for Networks," ONF White Paper April 13, 2012, pgs 2 & 8, https://www.opennetworking.org/images/stories/downloads/sdn-resources/white-papers/wp-sdn-newnorm.pdf.

Printed in USA MS/VC/0513 Order No. 328988-001US