

Fall 2016 ONUG Meeting Highlights

Open networking enters production, prepares for digital transformation

Executive Summary

Every six months, the Open Networking User Group (ONUG) gathers to discuss developments in open networking and focus on the work of their respective project teams. Each meeting brings ONUG closer to the goal of driving open networking requirements back to the market through a concerted effort to map user input and feedback into specific use cases that vendors can utilize in developing products and/or standards and open source communities. This meeting saw not only an increase in attendance but also an increase in production deployments, signaling increased maturity.

This paper is a summary of the primary sessions where the working groups report progress, businesses share their strategies and successes, and vendors have an opportunity to share their plans for addressing the open networking market.

The ONUG Journey – Nick Lippis

As always, the event kicked off with the executive view of ONUG, but instead of focusing on how far they've come, there was much more of a focus on where they are headed.

The organizational opportunity for traditional IT has run its course and companies need to change. One of the largest market opportunities was termed "analytics 2.0," which will be essential for companies facing the digital transformation. Digital transformation is enabled by cloud technology transformation, but it is really the talent transformation that needs to happen if companies are going to make this pivot.

In terms of initiatives, Software Defined WAN (SD-WAN) has the most traction. The use case was identified early in ONUG and has received heavy attention. "We have liftoff" was the proclamation, as 50% are in production now, and almost half of those deployments qualified as "large scale production." This is a serious ONUG success. 97% of the pilots move into production in less than a year, leading to the claim that 2017 will be the year that SD-WAN goes mainstream. The fact that several carriers are now selling SD-WAN solutions is important because businesses view these offerings as being solid business choices; carriers won't deploy risky strategies.

IT's role as vendor management has changed to become integration and solution engineering as businesses seek to build infrastructure via a best-of-breed group of highly integrated solutions. Horizontal functions will drive far more value but individuals need to collaborate, they can no longer sit in silos. Changing this dynamic is culturally difficult; discussions throughout the session that began to focus more on how to attract and train the right people, another acknowledgement of progressing plans.

80% of an admin's time is spent managing configurations and change management with the typical admin managing around 200 devices. But if the goal is to be like hyperscale companies with an admin managing thousands of devices, significant automation will be required, allowing the admin to only focus on the exceptions. With an average of 42 days to configure the dependency map and get all of the signoffs – whether cloud or hosted – today's businesses cannot scale. Workloads need to deploy in seconds or minutes, not days or months - something has to change.

To handle the influx of monitoring and analytics, businesses should be planning for an additional 25% bandwidth increase from all of the machine to machine communication that will be happening.

When Nick asked how many people were spending more than \$100M per year in monitoring, there were 9 people that stood up. At the "more than \$10M/year" level most of the audience was on its feet, signaling more than a billion dollars of spend in the audience alone.

To address the need for a different style of training, starting next year NYU will be offering a full stack engineering program, along with a graduate level program. In 2.5 years ONUG has delivered 12 use cases with more on the way as each of these meetings identifies new projects that will be spun up based on user needs.

The Journey to Cloud-based Open IT Frameworks - Gene Sun, FedEx

"We are at the last era of the 70's, 80's, and 90's job descriptions," stated Gene Sun of FedEx. In the past, businesses relied on logs to determine what happened, but new cloud-based environments make it harder to figure out what is happening because there is rarely a "known" state. FedEx is making large bets on open infrastructure and sees ONUG as a safety net to ensure that they are doing the right thing and following standards.

With a company that fields 50M package requests daily, FedEx believes the metadata (the information about the package) is just as valuable as the package itself. The FedEx DNA always leaned on technology; they were one of the first companies to make the Internet "do something," as opposed to just being a means for information sharing, and they were mobile before anyone else, even buying their own 900MHz spectrum.

Around 2007, FedEx ran out of data center space, and with the cost of a data center build out at ~\$200M, they sought a better way to expand. FedEx became an early believer in virtualization (with over 200,000 VMs deployed) and rapidly adopted cloud technology. When the IT spend relative to revenue was reduced by 1%, the leadership began to have both the confidence and proof that they were on the right track. Previously, high availability (HA) was assumed at the hardware level, but this new, cloud-based environment forced them to "re-platform," building HA into the software layer instead of relying on robust hardware to drive uptime.

Today, FedEx is convinced they can run cloud more efficiently, primarily running applications on their own private clouds, bursting out to AWS and Azure when extra capacity is needed. They believe that private cloud becomes more efficient than public cloud as the VM counts move north of 5,000.

Bridging Legacy to Cloud at GE – Chris Drumgoole

General Electric is running an extremely complex environment as it tries to convert itself from an industrial company to a software company. Tough love was the message of the day as they needed to move themselves from a static legacy IT to a cloud future. They did this by creating a greenfield environment and building out the tools that they needed instead of just trying to force fit all of their old legacy tools into the new environment.

While this sounds simple, they found that just because they built it developers, were not going to necessarily jump right on it; it took the right message and management direction to make this happen. They had 11,000 legacy applications and only 5 or 6 in the new environment when they went back to management to get their buy in and support. GE IT placed the big bet and swung for the fences by going to the executive board; soon they were no longer funding any projects that were not developed for the new cloud.

Their success was built on the following principles:

- **Take away the legacy tools and processes.** You cannot go completely greenfield, but go greenfield on your tools at a minimum.
- **Build & buy what you actually need** (not what vendors want to sell you). GE's vendor spend in new cloud development dropped, but the fewer vendors that remained are better off, making more money and delivering more value.
- **Jettison your baggage.** It was culturally hard to change people and processes, because there was so much invested in the old process, but it was imperative to get over that hump.
- **Make the hard choices early.** Make decisions fast, people will respond, and know they want to stay. "Nobody ever looks back and wishes they waited, it is always the opposite."
- **Invest in training.** But not the kind you are used to, it's not in the certifications (letters) that matter. Send infrastructure people to the retraining classes, they will hate you initially, but they will change eventually when they see the big picture.
- **Educate the teams around you.** If you do this in a vacuum they will ignore you. GE missed on this one. You have to spend as much time educating peers around you as you spend educating your own teams. Vendor ads for cloud are targeted at the C-suite, so get in front of that message or you will be on the tail end of it.

IT for the Next Business Cycle: The IT Executive View – Panel

This panel focused on the need for IT executives to own the agenda for change. There is a lot of money and pressure coming from cloud vendors and venture-backed startups,

but enterprises need to drive the change, lest they let others control their destiny. What is the role of product infrastructure if we put everything into AWS? IT needs to find its place in this complex new world and be the advisor/consultant to the business as more of IT is handled outside of the company premises.

Businesses need to evolve as the pace of change is picking up. End users want things to happen fast, so IT cannot get in the way; they have to not just enable change but also proactively look for enablement opportunities. This requires a shift from today's organizational view where vertical silos run IT into a horizontal view with generalist skill sets. Broker and advisor are new roles for IT but there will still need to be some deep vertical knowledge pools; however, those will be the exceptions not the rules. Moving to the cloud and software defined infrastructures will not make things easier, they actually bring new complexity to IT, the benefits will be seen mainly on the business side. Understanding how to rationalize the different cloud choices and how to securely execute business across multiple domains will be a critical and important skill, as IT becomes more advisory and less "hands on."

Being able to talk to the business is a new skill that IT will need to master in order to transition into this new world. The automation that IT teams are building in this new environment should be designed around freeing them up from manual tasks so that they can spend more time dealing with the business. At the end of the day, IT will have to answer "why did something happen the way it did?" This will need to be addressed from behavior analytics and post mortem analytics, making data collection, analytics, and reporting critical components. For the longest time the network was the source of truth, but the complexity and disaggregation breaks that. Hopefully big data will bring that together, joining the data and correlation through machine learning and AI to help automate many of the network tasks. This will help IT stay ahead of the problems instead of responding to them. Today's IT conversations are about the 5 outages that the company experienced but should be about the 50,000 outages that they prevented.

Open Hybrid Cloud Framework – Panel

How [hybrid cloud is defined varies](#), so the first thing this panel did was define how their companies see hybrid cloud. Some saw hybrid cloud as application services being hosted internally (private) and externally (public), while others saw it as the ability to access multiple public cloud providers, consuming IaaS, PaaS, and SaaS. This may include multi-tenant public, private but hosted single-tenant clouds, or multiple internal private clouds. Most businesses are not bursting from internal to external now, but that is a use case for the future. While each vendor has their own management path, they share a desire to have a singular approach to orchestration across multiple clouds, hopefully leading to leveraging one common denominator to reach them all with the same tooling.

In terms of business outcomes, these companies want to use external cloud providers for best-in-breed services and deliver better efficiency for cost savings. The companies would like to see more competitive advantage from utilizing cloud services.

In terms of where the companies stood on their journey, many non-production capabilities have been migrated to external cloud services with several pilots in process for production services. One of the companies had migrated more than 1,250 applications from internal public clouds across three different global regions while also deploying edge meet-me colocations where their enterprise network meets cloud & SaaS service providers. This allows common inspection as well as common services (e.g. identity, DNS) that can be made available to all cloud applications.

But all is not rosy, there are challenges as well. Understanding the critical path items in service delivery and limitations of cloud providers are clearly things that can be glossed over in the process. Network automation/orchestration lags behind compute/storage in robustness as well. Security was a common theme, as well as defining a cloud management model that is consistent with IT processes back in the headquarters.

The group saw an important role for ONUG in helping define the common challenges and informing vendors about the needs of members. The commonality across platforms will be a key issue, with most agreeing that ~80% of a vendor's cloud offering should be standardized, but still allow for some innovation and differentiation.

Open SD-WAN Exchange Update - Panel

There are multiple SD-WAN vendors but they are all island solutions, not doing an adequate job of plugging into the broader frameworks. The key reasons that businesses are utilizing multiple SD-WANs and not standardizing on a single vendor include:

- Mergers and acquisitions that merge multiple technology platforms
- Connectivity with multiple business partners
- Connectivity to multiple service providers on different platforms
- Technology transitions between different SD-WAN platforms
- As a hedge against vendor lock-in

An Open SD-WAN Exchange would help to define the service specifications and architectural frameworks. Most importantly, it would give common naming for all of the reference points in the architecture. It will be significantly easier for businesses to deploy with some level of standardization and naming consistency.

At this point, the working team is not focused on the idea of heterogeneous end points as the typical business use case does not demand that and pushing this to vendors would be very difficult, stifling their innovation.

North-south service policies should be developed, then reachability and authentication service policies for east-west traffic can be implemented afterwards. Today MP-BGP or

MPLS could be implemented as they are well established, but unfortunately they are also complex. New protocol proposals for API-based options like REST or possibly using XML would be more compatible at the server level, but would require a lot of new capability to be developed by vendors.

The path management has three key components: traffic classifier, link/path policy and link/path performance SLAs. These would allow SD-WAN solutions to identify traffic and know how to handle it. Challenges include how to standardize metrics across multiple vendors and create a defined level of trust in order to handle security.

The ONUG Great Debate – Two Roads to Open Networking

The great debate always pits two speakers against each other in a discussion of topics critical to the community. Dr. Jennifer Rexford of Princeton argued that network platform disaggregation reduces vendor lock in and open interfaces democratize innovation. We are hitting a perfect storm with chipsets, OpenFlow, and large data centers. But the real change will be when carriers and large enterprises start to deploy in quantity.

Open source will drive the next wave, perfect for non-differentiated features. Lots of parties are creating open source, and there is more open source than closed source, but both are required and have a specific purpose. Networking is bought by savvy users who have the ability to innovate. Good open source does not just happen – one must define the right problem and the right proof of concept (PoC) if they expect developers and industry to drive that forward. Promising signs are CORD, ONOS, OpenDaylight, ONF, and ON.Lab, as well as the P4 consortium. But open source is only going to work if you are involved.

Dr. David Cheriton of Stanford argued that we are heading towards either incremental innovation or rapid annihilation. If we have self-driving cars, why can't we have self-driving networks? And what happens when things go wrong? Standards are great, but they take too long to achieve. David created multicast and it took a scant 16 years to become an approved standard – at this rate how can we truly innovate? To put this delay in perspective, 16 years ago Mark Zuckerberg was in high school. Old technology leads to slow death; new technology leads to certain death.

But what is the big hurry on innovation? Amazon and Google. Both are moving quickly, highly scalable, highly flexible, and can run anything. They are a significant threat. It is automation or annihilation; there is no other choice. The insanity of open source is that one develops something and then gives it away; there is no gold standard because nobody ends up with any gold. Open source is actually closed to anyone that does not have the resources to hire their own developers to modify the code for them. Communities claim lots of local support, but nobody has direct accountability.

Modern Enterprise IT Infrastructure Management: New Paradigms for Infrastructure Monitoring

Originally, the world thought SNMP was going to solve the monitoring and management issues. Traditional infrastructure was long lived, so a monitoring solution could do the same; now we have very transitive IT with containers, VMs, and flexible networking. In a distributed architecture, you need to be able to look across the service and time. Modern applications are delivered as a service, and the service quality/level needs to be tracked via trends.

To effectively manage, we need to move from a model-based approach to an intelligence-based approach that employs machine learning and big data to look at process, timing, and other data that may come from one-time incidents. Increasingly we are seeing that the provisioning tools are the best place to look for the most complete information about services being deployed.

If you can give people a response in less than a second, you have time to ask another question and figure out the next steps. A minute to get an answer back stunts that process. Businesses need to be able to interact within the process, not just ask and wait.

Change management is now focusing on how to limit the size of changes, having a smaller impact that can be rolled out quickly instead of larger changes that are costlier and more difficult to roll back in the event of a problem.

Networking continues to be opaque; it is difficult if not impossible to pull state data out of devices and when you can, its format is typically proprietary. Being able to pull this data in a standard metadata format and add it to a data lake can significantly help to bring better insights and provide more logical context that is not normally found with just IP traffic and flow data. This is also very important when containers can be spun up and down in minutes as it enables forensics on a millisecond time scale.

There are both pros and cons on open source that the panelists addressed. There are roughly 28,000 active monitoring projects out on GitHub. The good news is that these can all have absolute transparency, but the bad news is that open source can lead to too much complexity in the market.

Organizations do not want to be in the business of building out big analytics practices in their organization, having this provided as SaaS is a better option for many, but it does not have to be all or nothing. Having SaaS and internal tools split by function works for some, but most are still doing things internally because the vast amount of data lives in their data centers.

How to Develop DevOps Staff for Modern Data Center Architecture and Operations – Bryan Larish, Verizon, Lane Patterson, Yahoo

Verizon's goal was to create an elastic, scalable, network-wide platform and environment, based on Big Switch, OpenStack, and Ceph. The biggest lesson learned is the importance of knowing *why* you are doing what you are doing upfront; it is far more complex to answer this than they thought. Verizon joined the OpenCompute Project early on, but while there were plenty of reasons to join, the approach and engagement could vary based on the true reasons.

Verizon found that people are first, but processes are a close second, especially the operational processes. As they went through their journey, the processes needed to be addressed early. It is important to have the conversations, understand the needs, and then work through the issues proactively so you are prepared when things break. For example, Verizon needed to change their well-known process for buying servers, instead focusing on racks, but this was more complex than they thought. On the technology side, the key requirements were establishing a migration path, planning for architecture to evolve, and finally to move reliability from hardware into software.

Yahoo is utilizing full stack integration at web scale. SDN means something different to everyone, but what it really means to them is a mindset around automating services on top of hardware. Leaf/spine networks are built to accommodate around 20,000 server deployments; they could have scaled to 100,000 but the failure domain would be too large. Yahoo's evolution will evolve into a hybrid model with public and private availability zones.

DevOps operates vertically, while product development operated horizontally. Product Engineering (DevOps) is the "glue" to hold all of the services together. Yahoo decided to replicate the talent themselves instead of trying to find them on the market because it simply did not exist; domain expertise can be taught later, but the abstraction of the problems is the real challenge. Rapid collaboration is important, but you need to standardize on one collaboration platform (like Slack or HipChat). Look for mentors with teaching skills and give them more authority, especially for coaching on how to get things done. DevOps does not tap into books; instead, they use online communities for the most up-to-date information. Code reviews are critical but simple peer reviews do not bring quality; instead they make the developer present and rationalize their code to the group.

Open Interoperable Control Plane (OICP) Update

The technology adoption has been slow because of the complexity. Unless one gets prescriptive about management and policy, the global adaptability will be more difficult. The team is trying to balance maintaining an unbiased approach with keeping the project on track. The initial reference architecture will be published and then the team can critique/work to develop a common ground. The definition needs to be flexible, handling the work no matter where businesses are defining their layer 3 boundary.

The key use case definitions include a standard interoperability between the overlay and underlay as well as interoperability between the overlay and underlay vendors. Beyond these key requirements, the interoperability needs to extend into hybrid environments, between both public cloud and private cloud overlays. The standard interoperability would mean that an OICP solution should tie to the Open SD-WAN Exchange as well as OTMF and ONSF. As expected any solution will need to tie in with the analytics tools and provide visibility between the layers.

Recommendations include facilitating the standardization of management and policy planes to achieve a single set of APIs. BGP could be utilized as the transport connectivity model for L3-based underlays. MP-BGP EVPN could be utilized as the control plane for VXLAN-based network overlays. The SDN controller does need to be capable of importing and exporting the underlay BGPv4 routes both in and out of the multi-tenant VRFs. Existing technologies like YANG and NETCONF are so widely utilized in networking today that these will also need to be comprehended as well.

ONUG Software-Defined Security Services

The Software Defined Security Services Framework whitepaper has been released and the team is now deep working on open source and container use cases while beginning to collaborate with other ONUG Working Groups. In initial polling, 92% of the respondents said that they would either benefit or highly benefit from the work that the team is doing.

In looking at the use cases, it is no surprise that common policy enforcement across physical and virtual infrastructure, a “write once, work anywhere” deployment, and measurability/reporting are the top themes that ONUG members are demanding. More people want focus on private cloud vs. hybrid cloud with the expectation that the security must be consistent across both domains.

It is more difficult to review the security in ephemeral workloads; a framework could help reduce the amount of effort required as it can present a “solid base” standard. This is why containers are treated exactly the same as VMs and other compute elements across the security framework, enabling consistency.

Open source projects like Open vSwitch can help move security closer to the workload, and integration of security into orchestration layers (like Kubernetes) enables the security to tie closer to workloads and data. Automating the security requires monitoring to ensure that intents are being carried out as companies cannot wait until an attack to see whether their security is working as planned.

IT Infrastructure for the Next Business Cycle – Financial Panel

Given the enterprise and carrier market trajectories, most believe that networking hardware is relatively flat while applications like SD-WAN are exploding (off of a small base). All of the growth is in the private cloud/public cloud buckets; companies involved in the cloud market are doing much better than others. Overall there is still growth in the

market, but because much of the build out is with the hyperscale players, the growth is “chunky” versus sustained because it is coming from a smaller set of buyers.

The big 7 internet players are on the path to re-create the old AT&T and France Telecom models, providing delivery of services as well as the access tools and devices. Services and support are the most important parts of the vendor offering, which is why Cisco is still holding share despite the competitive market. There will be disruption because in networking **you’re paying 80% of the box cost for the OS, compared to servers where it is only about 20%.**

Most see the public cloud as another mode of lock-in, making it very difficult for the analysts to understand which workloads will move to the cloud. Before the spending can shift to the public cloud, the kind of security that enterprises have today needs to move to those platforms. There won’t be any real savings, however, the money people save will simply shift to security and services.

Town Hall Meeting – Big Network Data Analytics: How Ready Are Networks to be Analytics Friendly?

Networking is not just an end to itself, it is the means to an end and too many forget this fact. An example was given about management wanting to be able to keep a record of all of the data passing over a switch. But with 3.2Tb/s of data, this would create a massive storage problem; perhaps it is better to take a step back and think about retaining all of the metadata instead of the actual data.

As new applications and equipment come out, we will need to ensure that the analytics will be captured and be useable; the best way to accomplish this is to work on standardizing the data models. However, with hundreds of thousands of APIs, there is a veritable free-for-all in the market. This includes both open and standard APIs, but open APIs are not necessarily better; in this case “open” simply means that the API has been published. This situation is primed for open source to assist as it enables the end users to gravitate around technologies that can become the de facto standard instead of relying on vendors to fight it out to see who wins.

There needs to be a change in how we engage analytics, the tools themselves are going to have to be incredibly robust and be able to handle rapid change because what businesses are asking for today will be very different from their needs in a year. The analytics now need to comprehend network, compute and storage across multi domains that can be targeted at services, not silos. We may get closer but will never fully achieve zero touch automation. Just as everyone marvels at self-driving cars, the reality is that people would not be comfortable with a car rebooting while it careens towards the cliff.

The changes that we face today in open networking are the first serious changes to the networking model since we collapsed everything onto IP. At the same time, the threat vectors are going up daily. We have never seen a significant event on Amazon, but what happens when we have a 3-day outage with the Fortune 500 all shut down? Will

that cause a migration back to the private cloud? Building data centers with the “free money” caused by today’s low interest rates is less expensive; what about taking IT back in-house amidst a backdrop of higher interest rates and “expensive money”?

An Analyst’s Viewpoint

Twice a year we attend these events, not only to participate, but also as an opportunity to get a pulse of the market and engage with some of the most forward-thinking companies in IT. These are not the bulk of the market, they are the early adopters, the people who are making decisions now because they must stay competitive and relevant – truly not the risk-averse profile.

Each event sees businesses becoming more bullish about open networking. A few years ago you heard references to “bets” that were being made on open networking and today you hear about investments, not gambles, as IT directors talk about what they are doing. Some key observations from this meeting include:

SD-WAN is mainstream. This was always the “lowest hanging fruit” and the most visible example of the work that ONUG has held up to the world to show their value. With deployments now tipping over the 50% mark and most of them larger scale, this means SD-WAN is here to stay. As we have said before, the market will probably start to see some SD-WAN vendor consolidation as the market moves from the 30 or so players vying for space into fewer, better established options. Seeing carriers starting to ink deals and place bets is the first step.

Second-level problems are pointing to maturity and deployments. First we needed SD-WAN, but then, once that started to get deployed, we realized that multiple SD-WANs would probably be reality. No vendor initially ever thought that they would have to share an end customer with another vendor, but once companies started deploying, they quickly realized that one SD-WAN to rule them all was never going to happen. You learn these things from real deployments. The fact that this is happening is a sign that people are doing SDN, not just talking about it.

Analytics is becoming more of an issue. As everything becomes instrumented and we have the ability to store and analyze in real time, the requirement to provide clear analytics is quickly becoming an issue for businesses. As we ask businesses to virtualize more of their environment and increase the complexity, the need arises for tools that will help them understand exactly what is happening. The age of the blinking lights has ended, the age of machine learning driving proactive actions is just starting.

Complexity is a given. The promise of SDN and open networking is shifting. Initially positioned as a way to make networking easier, as more people deploy it they realize that this is a pipe dream. SDN makes networking more complex. Still, it is far more powerful, far more agile, and delivers far more value back to the business; but ultimately, it *is* more complex. The dream of simplifying your networking is giving way to the reality simplifying your business – but that is a far more powerful message.

People are going to make the difference. In almost every session there was a discussion about people. Whether it was how to handle them organizationally or individually, it was clear that people are going to make the difference if SDN and open networking are going to be viable in the long term. We can't continue business as usual because the skills that we will need for the future just don't exist today. Investments need to be made in the future and made immediately.

Hybrid cloud is going to be critical. This is not just hype. Whether it is private and public cloud combinations or using multiple public clouds, the reality is that businesses are not going to put all of their eggs in a single basket. Just as multiple platforms, technologies, or data centers are an essential part of any IT strategy, multiple cloud environments are going to be the norm. Businesses will need help from organizations like ONUG to help standardize more of the stack because the complexity is coming at breakneck speed and there is no simple one-size-fits-all solution. Things are forever changing and businesses want to be ahead of the complexity, because once you fall behind it is difficult, if not impossible to catch back up.

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