



ONUG Virtual Networks/Overlays Working Group Status Report

A white paper from the
ONUG Virtual Networks/Overlays
Working Group

May, 2016

**VIRTUAL NETWORKS/
OVERLAYS WORKING GROUP**
2016

**OPEN INTEROPERABLE
CONTROL PLANE (OICP)**



Open Networking
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Definition of Open Networking

Open networking is a suite of interoperable software and/or hardware that delivers choice and design options to IT business leaders, service and cloud providers. At its core, open networking is the separation or decoupling of specialized network hardware and software - all in an effort to give IT architects options in the way in which they choose to design, provision, and manage their networks. These technologies must be based on industry standards. The standards can be de-facto as adopted by a large consortium of the vendor community, open in the sense that they are community based, or defined as standards by the prevailing standards bodies. Open networking hopes to deliver on two promises:

- 1) Decoupling of network hardware and software which mitigates vendor lock-in and shifts network architecture structure options to users
- 2) Significant reduction of the total cost of ownership model, especially operational expense

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Open Networking User Group (ONUG)

ONUG is one of the largest industry user groups in the IT infrastructure market. Its board is comprised exclusively of IT business leaders, with representation from Fidelity Investments, FedEx, Bank of America, UBS, Cigna, Pfizer, GE, JPMorgan Chase, Morgan Stanley, Citigroup, Credit Suisse, Gap and Yahoo. The ONUG mission is to enable greater choice and options for IT business leaders by advocating open, interoperable hardware and software-defined infrastructure solutions that span the entire IT stack, all in an effort to create business value.

The ONUG community is led by IT business leaders and aims to drive industry dialogue to set the technology direction and agenda with vendors, standards and open source organizations. To that end, ONUG hosts two major conferences per year where use cases are developed and members vote to establish a prioritized list of early adopter, open interoperable hardware and software-defined infrastructure projects that communicate propensity to buy and budget development. The vendor community stages proof of concepts based upon ONUG Use Cases, while standards and open source organizations prioritize their initiatives and investments based upon them. ONUG organizes working groups to fully develop use cases and set industry initiatives. ONUG also hosts user summits and smaller, regional user-focused Fireside Chat Meet-Ups through the year.

Project Overview and Mission

The Virtual Networks/Overlays Working Group stemmed out of the ONUG Spring 2014 meeting, where users prioritized this use case as one of the top three. As ONUG's main interest is to enable users, business leaders and the IT community with greater choice and options, the format of the working group was to initially only allow users to define the plan, requirements and general framework, and later engaged vendors to provide solutions, testing and validation of their platforms.

Initial Focus:

- Open Software-defined Networking (SDN) Controllers, Open vSwitch Database (OVSDB), multiple tunneling protocol options, e.g., Virtual Extensible Local Area Networking (VXLAN), Generic Network Virtualization Encapsulation (GENEVE), open provisioning Application Program Interfaces (APIs), neutron, etc.
- Create an open approach to virtual networking/overlays
- Terminate end points on hypervisors + Top of Rack (ToR)
- Integrated tunneled traffic management

Gap: Lack of standards and/or a standard. Virtual LAN (VLAN) stretching not a solution

Benefits: Extend Layer 2 domains and decouple net configuration policies independent of underlay

- Business unit self-service delivery
- Lower OpEx cost

Deliverables and Achievements

As the working group was successful gathering users and contributors, defining requirements and creating a plan to define validation as well as engaging multiple vendors to POC and demonstrate their respective solutions, it also contributed guidelines, a framework for validating the options, and now offers some recommendations going forward.

- Created [white paper with detailed top-10 requirements](#),
- Designed and consolidated [Overlay Test Plan](#)
- Completed [feature verification testing](#), and
- Performed and facilitated [proof of concept demonstrations](#) based on the requirements.

Project Status and ONUG Responsibility

The ONUG Board and user community representatives met to decide the future of the group, evaluating two possible options under an environment of proprietorship and, even when open standard may be available, a clear lack of interoperability.

1st option: As the conditions in the industry showed general availability of products and sizeable competition but not a common framework for multiple solutions to interoperate, put the activities of the group on standby until the state of the industry and conditions improve.

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2nd option: To continue the group’s activities by requesting vendors to address and possibly define roadmaps for a number of action items including interoperability and other required design principles.

As ONUG’s mission has and always will be to work on behalf of the interest of users, the Virtual Networks/Overlays working group decided to go with the second option to continue addressing and working towards the interests of users by creating a complete list of action items that it believes are required for any overlay or underlay solution to meet and continue working with vendors on getting solutions for these gaps.

Action Items and Required Response from Vendors

The following list shows the gap analysis of specific conditions or issues the working group sees in the industry or among users providing solutions for the Virtual Networks/Overlays working group.

Design Principle / Challenge	GAP or Problem	What is Needed (Requirements)
Control Plane Interoperability	<ul style="list-style-type: none"> VXLAN still not yet a standard VXLAN control plane has no standard, some vendors using proprietor pool nodes or others using MP-BGP EVPN but there is not a standard yet Multiple vendors offer overlay capabilities but the control plane is not interoperable between vendors Any user is bound to use the same overlay solution even when some solutions may make more sense than others for specific environments 	<ul style="list-style-type: none"> Interoperable control plane standard that can be used and understood by all vendors so if there is a segment with vendor A, can integrate with another segment with vendor B and so on There needs to be a push for standards settings and capability for users to select an open framework that can work for all environments Standard that can be actionable and distributed by both overlay and underlay
Audit Capability of VMs and End Points	<ul style="list-style-type: none"> Difficult to keep audit across different/diverse environments and same procedures across different vendors Proliferation of new VM and container 	<ul style="list-style-type: none"> Network Access Control and troubleshooting and VM / container audit capability for a number of diverse virtualized and containerized solutions
Integration between Underlay or Overlay	<ul style="list-style-type: none"> Overlays solutions typically only integrate with switches that re do VTEP for them but the underlay requires a separate automation and orchestration solution, which in some cases the underlay solutions may not be compatible with the overlay or can overlap 	<ul style="list-style-type: none"> A common standard that can allow overlay routing or information to be distributed into the underlay and consumed by the underlay to achieve full integration
Underlay / Overlay Statistical Correlation and Analytics	<ul style="list-style-type: none"> The overlay vendor or solution may show analytics and statistics of flows passing the overlays but the underlay does not have the same capabilities or we do not have the same analytic capabilities for non-overlay flows 	<ul style="list-style-type: none"> Better visibility on underlay analytics not only for overlay flows but for entire data center and hybrid cloud flows



Design Principle / Challenge	GAP or Problem	What is Needed (Requirements)
Policy	<ul style="list-style-type: none"> There is no way to define a policy for isolation, security or any segmentation in overlay environments that can be interoperable with multiple vendors or that multiple vendors can consume from No way to have a compatible policy that translates between private or public clouds for isolation/security 	<ul style="list-style-type: none"> Have a policy that can be reusable between diverse virtual and containerized solutions Have a compatible policy that translates between private or public clouds for isolation/security
Multicast Support	<ul style="list-style-type: none"> For the most part, vendors still do not support applications requiring multicast 	<ul style="list-style-type: none"> Virtual network and overlay solutions should support multicast applications as possible multimedia and market data apps use multicast as distribution mechanism
Blast Radius	<ul style="list-style-type: none"> Hardware blast radius for data centers is changing as new density has been growing and changing with better compute capacity and density achieved with new compute solutions Blast radius compute PODs / rows of spine and leaf boundaries have increased 4 times based on better compute and can grow up to 10 times higher density with containers 	<ul style="list-style-type: none"> Need a way to dynamically redefine blast radius whether users can define virtual mobility zones within the same compute PODs/ rows in their data center or across compute PODs / rows creating diversity for compute and applications
Isolation / Multi-Tenancy Policy Definition	<ul style="list-style-type: none"> Isolation and segmentation capabilities and configuration is not standard among vendors Not standard or interoperable between overlay vendors and public cloud providers 	<ul style="list-style-type: none"> Use of an open policy standard that can transcend from overlay vendors to underlay Open policy standard could be used by public cloud solutions to extend isolation, security and policies
Automation and Orchestration	<ul style="list-style-type: none"> Overlay is orchestrated and automated but the underlay is left for other devops or possible integrations between overlay and underlay vendors 	<ul style="list-style-type: none"> With an interoperable control plane mechanism, underlay vendors could use multiple ways to automatically update the control plane and offer MAC learning and routing updates for all areas of the data center, firewall and any areas where the solution can be extended
Security and Policy Enforcement Points	<ul style="list-style-type: none"> Most vendors do a good job at creating VTNs like isolation of environments or even allowing service chain security, including a secure channel between gateways offered, but the public cloud still remains open on the other side unless you use the public cloud native mechanisms 	<ul style="list-style-type: none"> Identify ways to partner or integrate with cloud brokers or partner with public clouds to be able to apply same policies, isolation, security and other services in both the public and private spaces Work on implementing open policy solutions
Hybrid Cloud and Cross Connect	<ul style="list-style-type: none"> Most solutions on the overlay space cannot extend or integrate with native public cloud providers 	<ul style="list-style-type: none"> Identify ways to partner or integrate with cloud brokers or partner with public clouds to be able to apply same policies, isolation, security and other services in both the public and private spaces

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Conclusion and Recommendations

- The working group has achieved all goals that were initially defined and produced a number of guidelines and guidance documentation, which, hopefully, will help business leaders to make decisions.
- Maturity of the standards, especially on the VXLAN control plane front, needs to improve in order to get a greater rate of adoption.
- Currently, the working group does not see interoperability between vendors which will be recommended to truly get an open environment and avoid vendor lock-in.
- As part of a Software-Defined Data Center, overlay technologies are only part of the puzzle as the capability to control the underlay is not part of the solution in most cases. Partnerships or extension of the solutions may be required for getting a data-center-wide solution
- Different valid solutions are offered in the market, remaining proprietor or semi proprietor so it will require users to select and find the best alternative assuming the vendor lock-in risk.
- True open overlay solutions as implemented by OpenStack are one option to remain agnostic. However, scale is an issue after the control plane reaches a given number of hosts; therefore, SDN solutions are a way to bring scale.
- All of the solutions that were tested show a valid integration and feasible approach to operate SDN networks (overlay or not); however, vendor interoperability still remains missing.
- Extending data centers to public clouds, which is one of the hottest and most required use cases, is now a difficult proposition as the solutions used on data centers for overlays can only be used to possibly connect to the public cloud provider, but then on the other side (public cloud), these systems are not usable or cannot use the same isolation and security that is used on the data center.
- The working group decided that instead of just go-on-standby mode until solutions to these problems are provided to continue working and pushing vendors for open solutions to these common problems that are preventing or will be preventing users to adopt solutions.

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ONUG Virtual Networks / Overlays Working Group Participants

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