Rebuttal letter

**Authors**: We would like to thank the reviewers for the fruitful feedback as well as their time to carry out the review.

**Review 1 (Reviewer A)**

The motivation of the paper and its connection with SDN is not clear. It seems forced, and it lacks of a discussion of SDN as mechanism for configuration management rather than dataplane management.

**Authors**: The main problem faced in this paper is related to the service model’s abstraction provided by an SDN network controller. The service abstraction provided by the controller can be used to manage the complexity related to the daily service provision tasks in a service provider network. The authors have complemented the problem statement definition with the following sentences under the introductory section:

“In this paper, we present the intent-based configuration of the MPLS L3 VPN services in a carrier grade ecosystem. A commercial SDN domain controller using RESTCONF NBI (Northbound Interface) is tested. The controller implements a YANG network model named L3NM (A Layer 3 VPN Network YANG Model) used to abstract the complexity of the network configuration.”

The paper lacks of strong literature support and therefore it is not presenting a relevant related work section.

**Authors**: New references as well as similar work as been included in the problem definition with the following sentences:

“Lately, similar works has been done using more modern tools such as NETCONF/RESTCONF [8-9] interfaces and YANG [10] abstract models. Some of the works available are focus, on solution the Layer-2 services (L2VPNs) provision in datacenter or pure network environments [11-12] and/or Layer-3 Services (L3VPNs) [14].”

* P. L. Ventre, S. Salsano, M. Gerola, E. Salvadori, M. Usman,S. Buscaglione, L. Prete, J. Hart, and W. Snow, “Sdn-based ip andlayer 2 services with an open networking operating system in the geantservice provider network,”IEEE Communications Magazine, vol. 55,no. 4, pp. 71–79, 2017.
* K. A. Noghani, C. H. Benet, A. Kassler, A. Marotta, P. Jestin, andV. V. Srivastava, “Automating ethernet vpn deployment in sdn-based datacenters,” in 2017 Fourth International Conference on Software DefinedSystems (SDS), pp. 61–66, IEEE, 2017.
* Q. Wu, M. Boucadair, C. Jacquenet, L. M. C. Murillo, D. R. Lopez,C. Xie, W. Cheng, and Y. Lee, “A framework for automating serviceand network management with yang,”
* R. Rokui, H. Yu, L. Deng, D. Allabaugh, M. Hemmati, and C. Janz, “Astandards-based, model-driven solution for 5g transport slice automationand assurance,” in 2020 6th IEEE Conference on Network Softwarization(NetSoft), pp. 106–113, IEEE, 2020

Finally, the paper has many wording and grammar issues, which makes difficult its reading and understanding.

**Authors**: Typos were corrected, and a proofreading were added to improve the English.

The architectural proposal presented by authors is not actually an architecture. It is just a shallow discussion of phases to execute the specified task. Authors are not presenting a detailed definition of the role of the SDN controller in this scenario.

**Authors**: The architecture proposed is based on the iFusion Telefonica architecture. Due to the length of the paper not all the architectural details were added. However, we have added this section with the following addition to the architectural section:

“Figure 1 shows the role of IP SDN Controller (IPSDNc) under the iFusion network architecture defined in [15]. ”

* L. Contreras, O. Gonzalez, V. Lopez, J. Fernandez-Palacios, and J. Folgueira, “ifusion: Standards-based sdn architecture for carrier trans-port network,” in 2019 IEEE Conference on Standards for Communica-tions and Networking (CSCN), pp. 1–7, IEEE, 2019.

The experiments are very ad-hoc and they do not seem to follow a clear methodology. Therefore, the conclusions achieved can not be adequately assessed.

**Authors**: The experimentation was conducted based on the YANG model structure. The number of calls used to create a service using the L3NM is highly dependent of the model structure. The goal was to measure the impact (time consumed) of a granular deployment of the model vs a more compact CALL creation. Initially, we have depicted in the results the total time. However, we have, split those results between intent creation time (t0) and network deployment time (t1) to expand the discussion of the obtained results.



The collection of those measures is a first attempt evaluate the complexity of a YANG model against other.

This reviewer suggests the authors to review the following references in order to provide a better support for the ideas included in the paper:

* Kreutz, D., Ramos, F. M., Verissimo, P. E., Rothenberg, C. E., Azodolmolky, S., & Uhlig, S. (2014). Software-defined networking: A comprehensive survey. Proceedings of the IEEE, 103(1), 14-76.
* Bahnasse, A., Talea, M., Badri, A., Louhab, F. E., & Laafar, S. (2020). Smart hybrid SDN approach for MPLS VPN management on digital environment. Telecommunication Systems, 73(2), 155-169. van der
* Pol, R., Gijsen, B., Zuraniewski, P., Romão, D. F. C., & Kaat, M. (2016). Assessment of SDN technology for an easy-to-use VPN service. Future Generation Computer Systems, 56, 295-302. Noghani, K. A.,
* Benet, C. H., Kassler, A., Marotta, A., Jestin, P., & Srivastava, V. V. (2017, May). Automating ethernet VPN deployment in SDN-based data centers. In 2017 Fourth International Conference on Software Defined Systems (SDS) (pp. 61-66). IEEE.
* Mirkhanzadeh, B., Taheri, N., & Khorsandi, S. (2016, April). SDxVPN: A software-defined solution for VPN service providers. In NOMS 2016-2016 IEEE/IFIP Network Operations and Management Symposium (pp. 180-188). IEEE.

**Authors**: The authors thank the references provided. Some of them has been included as part of the motivation and related work with the following sentences:

**Review 2 (Reviewer D)**

The paper is intended to be a short paper, which is fair; although some non-obvious abbreviations should be extracted to ease the reading.

**Authors**: The following abbreviations were expanded to improve the readability:

Introduction:

Virtual Leased Lines (VLL), Layer-2 services (L2VPNs) and Layer-3 Services (L3VPNs)

NBI: Northbound Interface)

L3NM: A Layer 3 VPN Network YANG Model

Similarly, the text n the Figures should be readable, meaning the font size is similar to the normal text of the paper. Figure 5 is bearly visible.

**Authors**: The figure 5 compare the mean time consumed during the execution of the CREATE and DELETE calls on the SDN controller. The figure has been updated and a complementary table added to improve readability.

A screenshot of a cell phone

Description automatically generated



Figures should be referenced as Figure 1 or Fig. 1 rather than just the number 1 - throughout the paper.

**Authors**: The figure labeling were corrected to increase the paper readability.

There are some erroneous sentences that should be corrected, such as "Secondly, the work implements for the first the very first time the L3NM." (moreover, this sentence may not factually true: the paper may be the first publicly available report on the implementation....

**Authors**: We have reviewed and corrected the typos errors, we have added a proofreading to improve the English and increase the readability.

**Review 3 (Reviewer E)**

The paper aims to conduct experimentation with standard interfaces to manage heterogeneous devices to provision L3VPNs, which is a notable effort, but the experimentation is quite short. As an experimentation paper, I expected more results from the evaluation scenario than those that were presented.

**Authors**: We agree that the experimentation part could be extended, but we decided to focus on the implementation of the L3NM in the NBI of the network controller. We think that if we include more information it would complicate the understanding of the work. We have included in the conclusions sections that we will expand the experimental work in future papers. Some of the planned work includes the implementation of the L2NM and the support of several SBI interfaces.

The main shortcoming of the paper is the experimentation conducted. As an experimentation paper, the evaluation should provide more results leveraging the real components deployed. I respectfully make a few comments that may be used to improve the paper. Perhaps, the title could be about a broader aspect of your work. For instance, it could point to the bigger problem:

* The management of heterogeneous devices that use heterogeneous management interfaces. In such a case, L3VPNs could be just a case study, and the paper could include other case studies. Section III could be shortened to open space for further evaluation results.

The discussion in Section III is rich in detail. However, a significant part of the discussion is about well-known issues that could be presented briefly.

**Authors**: We agree, we are able to reduce this part and expand the discussion and the set of results we have obtained.

The main addition is the possibility to split the Total Creation Time into the sum of:

* The time consumed by the network controller to process the request
* The time consumed by the network element to implement the requested configuration using NETCONF and proprietary YANG data models:
  + The time consumed by the device to configure the service was in average 8.152 secs.

As a future work other data models (i.e OpenConfig) and protocols can be included as a reference to compare the performance of the tasks executed.

With the emergence of 5G, a lot has been discussed about Network Orchestrators, such as ONAP, OSM, and OpenBaton. Their main focus is in NFV, but their frameworks also tackle the management of physical devices. How these efforts relate to your work? Is it possible to have Hybrid SDNs managed by such orchestrators? Indeed, the OSS/BSS interfaces problem pointed in your work are also addressed by such frameworks.

About the evaluation, the total time to create/delete an L3VPN in the management system is a simple measure that could be improved. How much time is related to the sending of a command? How much time is spent by the controller in the processing? It is not clear what was implemented to experiment. Only the registration of the L3NM YANG module within the controller made it ready to receive RESTCONF operations regarding the model?

The authors had to develop additional parts? The experimentation could explore multiple SB interfaces to investigate how the controller interfaces with each one. Do they perform the same? Even without the real devices, the authors could explore CLIs/management interfaces simpler to deploy (SSH, SNMP). These are just examples of possible improvements to the evaluation.

**Authors**: We agree this is an interested topic, authors in [10] did a comparison of different management interfaces to assess its performance. We’ve included the reference. Complementary model evaluations are also being planned, expanding the scope to different flavors of L2VPNs.

* R. Vilalta, R. Muñoz, G. Landi, L. Rodriguez, M. Capitani, R. Casellas, and R. Martinez, “Experimental demonstration of the bluespace’s nfv mano framework for the control of sdm/wdm-enabled fronthaul and packet-based transport networks by extending the tapi,” in 2018 Eu-ropean Conference on Optical Communication (ECOC), pp. 1–3, IEEE, 2018.

Typos:

Introduction, Paragraph 4: higest → highest

Figure 1: “Service Orchestation” → “Service Orchestration”

Subsection III-A (title): Desing → Design

**Authors**: We have reviewed and corrected the typos errors, we have added a prof reading to improve the English and increase the readability.

**Review 4 (Reviewer F)**

**Majors**: The results are not well presented. The testing is very minimum and the only result figure is unreadable.

**Authors**: The figure 5 compare the mean time consumed during the execution of the CREATE and DELETE calls on the SDN controller. The figure has been updated and a complementary table added to improve readability.

A screenshot of a cell phone

Description automatically generated



The authors claim that the L3NM implementation is introduced for the first time, in fact, there is implementation already available on Github. The literature review is incomplete. In particular, only one recent reference was used.

**Authors**: To the best of our knowledge, the only github project pointing L3NM is <https://github.com/IETF-OPSAWG-WG/l3nm>. This repository is maintained by the authors of the current paper. The repository includes the L3VPN network data model and the IETF draft document referenced on the proposal on [12]. The draft includes an implementors notes section, with the notes from Nokia, Huawei, Infinera and Cisco. Cisco is co-authoring this paper.

We claim this work as the first implementation of the L3NM mainly because the draft is on track for standardization in the IETF and is process of adoption on the commercial SDN controllers. There are other set of implementations reported using the L3 Service Model (L3SM).

**Minor**: Many typos in the paper, the manuscript needs a careful proofreading

**Authors**: We have reviewed and corrected the typos errors, we have added a prof reading to improve the English and increase the readability.