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An Evolution of Cooperating Architecture for Layered SDN (CLAS) ~~Architecture including~~ for Compute and Data Awareness

draft-contreras-nmrg-clas-evolution-00

Abstract

This document proposes ~~the~~ an extension ~~of~~ to the Cooperating Layered Architecture for Software-Defined Networking (SDN) ~~framework~~ by including Compute and Data Awareness.

Commenté [BMI1]: Difficult at this stage to see what is meant here. I would elaborate further.

Status of This Memo

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1. Introduction

~~Current t~~Telecommunication networks are evolving towards a tight integration of interconnected compute environments, offering capabilities for the instantiation of virtualized network functions interworking with physical variant~~s~~ of other network functions, altogether used to ~~constituting~~ build and deliver services~~ end-to-end~~.

Moreover, network operations are complementing the capabilities of Automation (e.g., [RFC8969]) and programmability (e.g., [RFC7149][RFC7426]) with the introduction of Artificial Intelligence (AI) and Machine Learning (ML) techniques to facilitate informed decisions as well as predictive behaviors enabling consistent closed loop automation.

It is then necessary to provide a network management framework that ~~could~~ incorporates these ~~trends in a smooth manner~~technical components, structuring the different concerns and the interaction among components operating the network.

Commenté [BMI2]: You may discuss why we can't leverage architectures such as RFC8969

Commenté [BMI3]: Of whom?

This document describes ~~the~~ an evolution of ~~one of those frameworks, named~~the Cooperating Layered Architecture for Software-Defined Networking (CLAS) [RFC8597] to include the aforementioned aspects into the architecture.

2. Cooperating Layered Architecture for Software-Defined Networking (CLAS)

[RFC8597] describes an SDN architecture structured in two different strata, namely Service Stratum and Transport Stratum. On one hand, the Service Stratum contains the functions related to the provision of services and the capabilities offered to external applications. On the other hand, the Transport Stratum comprises the functions focused on the transfer of data between the communication endpoints (e.g., between end-user devices, between two service gateways~~, etc.~~).

Each of the strata is structured in different planes, as follows:

- The Control plane, which centralizes the control functions of each stratum and directly controls the corresponding resources.

- The Management plane, logically centralizing the management functions for each stratum, including the management of the control and resource planes.

- The Resource plane, that comprises the resources for either the transport or the service functions.

Figure 1 illustrates the original CLAS architecture.

```
                                         Applications
                                               /\
                                               ||
                                               ||
         +-------------------------------------||-------------+
         | Service Stratum                     ||             |
         |                                     \/             |
         |                       ...........................  |
         |                       . SDN Intelligence        .  |
         |                       .                         .  |
         |  +--------------+     .        +--------------+ .  |
         |  | Resource Pl. |     .        |   Mgmt. Pl.  | .  |
         |  |              |<===>.  +--------------+     | .  |
         |  |              |     .  |  Control Pl. |     | .  |
         |  +--------------+     .  |              |-----+ .  |
         |                       .  |              |       .  |
         |                       .  +--------------+       .  |
         |                       ...........................  |
         |                                     /\             |
         |                                     ||             |
         +-------------------------------------||-------------+
                                               ||    Standard
                                            -- || --    API
                                               ||
         +-------------------------------------||-------------+
         | Transport Stratum                   ||             |
         |                                     \/             |
         |                       ...........................  |
         |                       . SDN Intelligence        .  |
         |                       .                         .  |
         |  +--------------+     .        +--------------+ .  |
         |  | Resource Pl. |     .        |   Mgmt. Pl.  | .  |
         |  |              |<===>.  +--------------+     | .  |
         |  |              |     .  |  Control Pl. |     | .  |
         |  +--------------+     .  |              |-----+ .  |
         |                       .  |              |       .  |
         |                       .  +--------------+       .  |
         |                       ...........................  |
         |                                                    |
         |                                                    |
         +----------------------------------------------------+
```

Figure 1: Cooperating Layered Architecture for SDN

3. Augmentation of CLAS with Compute and Data Awareness

The CLAS architecture was initially conceived from the perspective of exploiting the advantages of network programmability in operational networks.

The evolution of current telecommunication services and networks are, However, introducing new aspects ~~to consider.~~:

o ConsiderationsConsideration of distributed computing capabilities attached to different points in the network, intended for hosting a variety of services and applications usually in a virtualized manner (e.g., [I-D.contreras-alto-service-edge]).

o Introduction of Artificial Intelligence (AI) and Machine Learning (ML) techniques in order to improve operations by means of closed loop automation (e.g., [I-D.pedro-nmrg-ai-framework]).

With that in mind, this memo proposes augmentations to the original CLAS ~~proposition~~ by adding the aforementioned aspects.

3.1. Compute Stratum

~~For the first aspect, t~~The CLAS architecture is extended by adding a new stratum, named Compute Stratum. ~~The objective is to contain in this~~ This stratum contains the control, management, and resource planes related to the computing ~~part~~aspects. ~~As in the other two strata, the mission is to make t~~This additional stratum cooperates with the other two in order to facilitate the overall service provision in the network.

With this addition, and in order to be more explicit in the strata scope, the previously named Transport Stratum is renamed as Network Stratum, representing the fact that this stratum responsibility is focused on the overall connectivity supporting the other two strata in the architecture.

3.2. Learning Plane

A further extension to the original CLAS architecture is related to the need of collecting, processing, and sharing relevant data from each of the considered strata. With that purpose a Learning Plane is proposed to complement the already existing planes per stratum.

The learning plane will be in charge of handling the data specificities of each ~~particular~~ stratum. Thus, the learning plane in the Service Stratum is focused on data relevant to the service as defined by the application or service owner, usually in terms of service key performance indicators (KPI) [TMV]. Then, the learning

Commenté [BMI4]: Isn't this implementation-specific and internal to each SDN intelligence?

Commenté [BMI5]: From the perspective of RFC8597, this is no more than an example of a service stratum.

If reclusiveness (3.1.3 of 8597) is kept in mind, I wonder if you can reason more an applicability of CLAS rather than an extension of CLAS.

Commenté [BMI6]: Connectivity Stratum would be more appropriate, then.

plane in the compute stratum concentrates on data related to the computing capabilities in use (e.g., CPU load, RAM usage, storage utilization, etc.) [OpenStack]. Finally, the learning plane in the network stratum is in charge of handling the monitoring and telemetry information obtained from the network (e.g., [I-D.ietf-opsawg-service-assurance-yang]).

3.3. Extended CLAS architecture

Figure 2 presents the augmentation proposed showing the relationship among strata.

```
                                   Applications
                                        /\
                                        ||
      +-------------------------------------||-------------+
      | Service Stratum                     ||             |
      |                                     \/             |
      |  +--------------+     ...........................  |
      |  | Learning Pl. |     . SDN Intelligence        .  |
      |  |              |<===>.                         .  |
      |  +-----/\-------+     .        +--------------+ .  |
      |        ||             .        |   Mgmt. Pl.  | .  |
      |        ||             .  +--------------+     | .  |
      |  +-----\/-------+     .  |  Control Pl. |-----+ .  |
      |  | Resource Pl. |     .  |              |       .  |
      |  |              |<===>.  +--------------+       .  |
      |  +--------------+     ...........................  |
      |                                /\             /\   |
      |                                ||             ||   |
      +--------------------------------||-------------||---+
                       Standard API -- || --          ||
      +--------------------------------||-----+       ||
      | Compute Stratum                ||     |       ||
      |                                \/     |       ||
      |  +----------+    ..................   |       ||
      |  | Learning |    . SDN             .  |  Std. ||
      |  | Plane    |<==>. Intelligence    .  |  API  ||
      |  +-----/\---+    .    +----------+ .  |    -- || --
      |        ||        .    | Mgmt. Pl.| .  |       ||
      |        ||        .  +----------+ | .  |       ||
      |  +-----\/---+    .  | Control  |-+ .  |       ||
      |  | Resource |    .  | Plane    |   .  |       ||
      |  | Plane    |<==>.  +----------+   .  |       ||
      |  +----------+    ..................   |       ||
      +---------------------------------/\---+       ||
                         Standard API -- || --        ||
```

```
+-------------------||-----------||-----+
| Network Stratum   ||           ||     |
|                   \/           \/     |
|  +----------+    ..................   |
|  | Learning |    . SDN            .   |
|  | Plane    |<==>. Intelligence   .   |
|  +-----/\---+    .    +----------+ .  |
|        ||        .    | Mgmt. Pl.| .  |
|        ||        .  +----------+ | .  |
|  +-----\/---+    .  | Control  |-+ .  |
|  | Resource |    .  | Plane    |   .  |
|  | Plane    |<==>.  +----------+   .  |
|  +----------+    ..................   |
+---------------------------------------+
```

Figure 2: Extended CLAS architecture

4. TODO for next versions of this document

This version is a work-in-progress. Next versions of the document will address somo further aspects such as:

- o Communication between strata (and planes).
- o Deployment scenarios (including legacy ones).
- o Potential use cases (specially in alignment with on-going activities in NMRG).

5. Security Considerations

Same security considerations as reflected in [RFC8597] with regards to the strata architecture apply also here.

Apart from that, the introduction of the Learning plane on the data management imposes additional security concerns. (TODO: elaborate on data-related security issues).

6. IANA Considerations

This draft does not include any IANA considerations

7. References

[I-D.contreras-alto-service-edge]
Contreras, L. M., Lachos, D. A., Rothenberg, C. E., and S. Randriamasy, "Use of ALTO for Determining Service Edge", draft-contreras-alto-service-edge-03 (work in progress), July 2021.

[I-D.ietf-opsawg-service-assurance-yang]
Claise, B., Quilbeuf, J., Lucente, P., Fasano, P., and T. Arumugam, "YANG Modules for Service Assurance", draft-ietf-opsawg-service-assurance-yang-01 (work in progress), July 2021.

[I-D.pedro-nmrg-ai-framework]
Martinez-Julia, P., Homma, S., and D. R. Lopez, "Artificial Intelligence Framework for Network Management", draft-pedro-nmrg-ai-framework-00 (work in progress), October 2021.

[OpenStack]
"OpenStack performance documentation", https://docs.openstack.org/developer/performance-docs/index.html .

[RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011, <https://www.rfc-editor.org/info/rfc6241>.

[RFC8597] Contreras, LM., Bernardos, CJ., Lopez, D., Boucadair, M., and P. Iovanna, "Cooperating Layered Architecture for Software-Defined Networking (CLAS)", RFC 8597, DOI 10.17487/RFC8597, May 2019, <https://www.rfc-editor.org/info/rfc8597>.

[TMV] "Service performance measurement methods over 5G experimental networks", 5G-PPP TMV white paper , May 2021.

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