Automated GOLE Dashboard: a monitoring system for Bandwidth on Demand networks

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Abstract

The Global Lambda Integrated Facility (GLIF) Automated GOLE (AutoGOLE) is a collaboration of GLIF Open Lightpath Exchanges (GOLEs) and networks to deliver dynamic circuits end-to-end. To date this is achieved by using virtual LANs (VLANs) and Quality of Service (QoS) on switching infrastructures, although the underlying standard, the Network Service Interface (NSI) by OGF is technology agnostic.

Each participating GOLE runs a Network Service Agent (NSA) that establishes control plane peering relationships with NSAs of other domains and has control of the local switching infrastructure; this is used to establish data plane paths on demand to neighboring infrastructures. NSAs can have two different roles: *Provider* and *Requester*. A Provider NSA offers connectivity resources, while a Requester NSA requests resources from a provider. Besides these, there are also *aggregator NSAs, that do not necessarily have data plane connected to it*, which are aware of how GOLEs are configured and connected to each other; they are capable of performing path calculation and can contact the domains where a requested path will go through.

Such multi-domain collaboration poses, however, many operational and maintenance issues. The root causes of these issues are often hard to find and are usually only discovered when path reservations start to fail. This often leads to service downtimes that are longer than needed, which proves to be very inconvenient for AutoGOLE users. This situation has driven the need of a **monitoring system** that:

1. Periodically checks the configuration of all domains, looking for configuration issues that might lead to path reservation issues,
2. Performs test path reservations (to test the control plane) and connectivity tests (to test the data plane), to assess a complete view of the health status of the multi-domain collaboration.

The **AutoGOLE Dashboard** is the first prototype implementation of the monitoring system described. The AutoGOLE Dashboard retrieves the configuration of the NSAs in all participating domains from an NSI aggregator, which provides this configuration by means of a Document Discovery Service (DDS), a service used by aggregators to share configuration information; it performs multiple configuration checks and it finds issues with the NSAs' configuration.

Figure 1 shows the architecture of the system we developed. It contains a number of core components that perform useful checks of the system, a database where the results are stored and a Web GUI users can interact with.

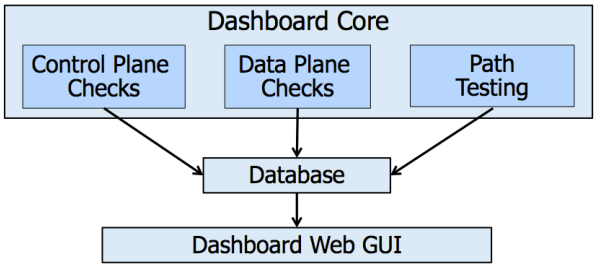

Figure 1 - AutoGOLE Dashboard architecture

The checks performed in the core are of three types: Control Plane checks, Data Plane checks and Path tests. The Control Plane checks test the high level configuration of the NSAs, such as control plane peering, required so the NSAs can share topologies and talk with each other in order to establish reservations. The Data Plane checks relate to the configuration of physical topologies, to determine how switching is performed within a topology and if ports interconnecting domains are correctly configured. In addition, the AutoGOLE Dashboard performs connectivity tests (path testing) in order to verify if the NSA hosts are online, and performs connectivity tests when test reservations are made, in order to verify the layer 2 path reserved and provisioned by AutoGOLE. For the moment, these tests are performed from a testing machine hosted at the University of Amsterdam to testing machines provided by each domain. All checks and tests store their result in a MariaDB database.

The Dashboard has the form of Web GUI[1], where AutoGOLE operators and users in general can see both configuration and connectivity issues for all domains. The actual tests and checks are performed by the core components' application, which runs as a daemon and stores all results on the database. The Web GUI retrieves the results from the database and uses those to generate the content. The Web GUI can be partially seen on Figure 2.

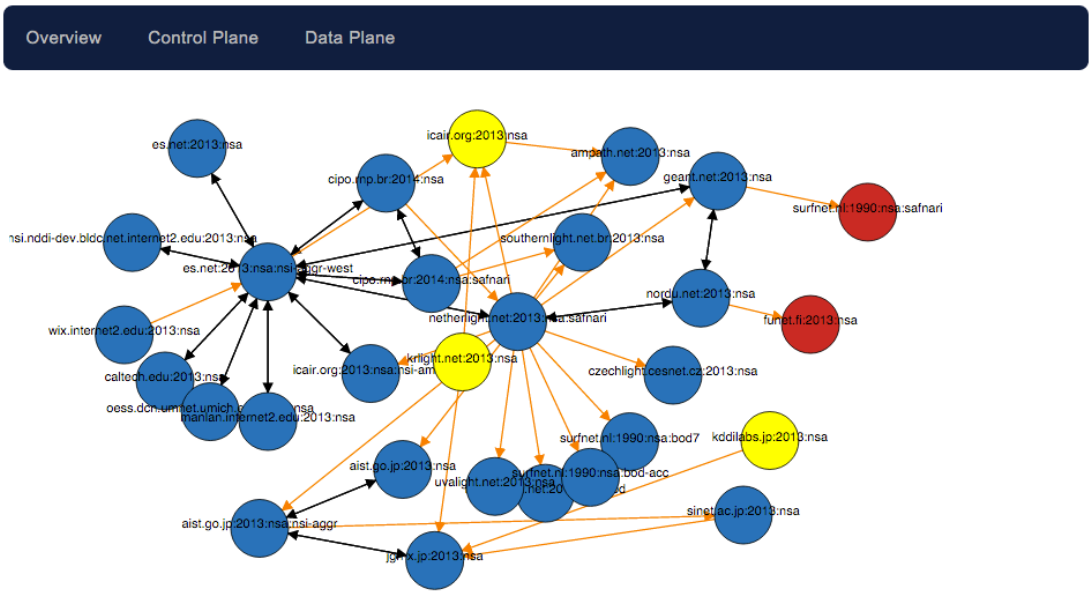

Figure 2 – Web GUI: Control Plane peering graph

[1] http://dashboard.lab.uvalight.net

The current version of the AutoGOLE Dashboard prototype was shown to the AutoGOLE operators during a GOLE operators meeting at the SC15 conference, which took place in Austin, Texas, from 15th to 20th of November 2015. By this time, the AutoGOLE Dashboard was already helping operators to find issues with their NSAs, being very well received by the community. At the end of the conference, the AutoGOLE Dashboard was reporting control plane misconfigurations on 12 of 28 NSAs and data plane misconfigurations on 20 of 28 topologies. Previously, a less feature complete version had been shown at the GLIF meeting, which took place in Prague, Czech Republic, from 28th to 30th of September. During this meeting, very relevant feedback was received, mainly from AutoGOLE operators, which had great importance in the development of the version available today.

While the AutoGOLE Dashboard already provides very useful information and significantly reducing the troubleshooting time, there are still missing features that are desired. Among these features are: SSL certificate validity checking of the control plane peering relationships, fine grain data plane path testing (path testing between any two domains), and detailed testing on a path, for example available bandwidth assessment.

At TNC16, we will present the latest version of the AutoGOLE Dashboard, giving an insight of the overall collaboration, explaining the issues tackled and how they were solved.

Acknowledgements

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References

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Vitae

Daniel Romão received his Master degree in System and Network Engineering in 2015 from the University of Amsterdam and his Bachelor in Electronics, Telecommunications and Computer Engineering in 2012 from ISEL, Lisbon. Currently, he is a Scientific System Engineer for the System and Network Engineering research group and an ICT developer for the Science Faculty Research IT Support group at the University of Amsterdam. In his current position, he is responsible for network and system administration as well as deploying and developing extensions for cloud computing systems, and participates in research projects. His research interests are: SDN/NFV, Cloud Computing, Bandwidth on Demand networks, and security of networks.

Prof. de Laat chairs the System and Network Engineering (SNE) laboratory in the Informatics Institute of the Faculty of Science at University of Amsterdam. The SNE lab conducts research on leading-edge computer systems of all scales, ranging from global-

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Paola Grosso is assistant professor in the SNE group. She is the lead researcher of the group activities in the field of optical networking, distributed infrastructure information modeling and GreenIT. She leads the UVA activities in the Research on Network project with SURFnet as well as in the EU-funded GN4 project to exploit network programmability for the delivery of richer network services Her research interests are provisioning and design of programmable network; development of information models for hybrid multi-domain multi-layer networks; sustainable and secure network architectures.
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Hans Trompert is a senior network architect at SURFnet, the national research and education network in the Netherlands. In his role as technical product manager he is responsible for all the technical aspects and innovation of the Bandwidth on Demand service. He is also one of the leads for the research into software defined networking, network function virtualization and chaining, and orchestration of single and multi domain end-to-end services. He is an active member of the GLIF automated GOLE task force, who deploy an international multi domain BoD infrastructure, and an active member of the OGF Network Service Interface working group.