

A Self-organized, Service-Oriented GMPLS Optical Network Testbed

Apostolis Siokis and Kyriakos Vlachos*

Computer Engineering and Informatics Dept. & Computer Technology Institute and Press,
University of Patras, GR26500, Rio Patras, Greece
{kvlachos, siokis}@ceid.upatras.gr

Abstract. In this paper, we detail the implementation of a self-organized GMPLS network using the DRAGON software suite to introduce service awareness in a GMPLS network. DRAGON daemon has been extended to support anycast routing to allow forwarding user (service) requests to the most suitable servers based on their advertised service attributes. Furthermore, OSPF daemon has been also extended to allow for these advertisements to propagate through the network and modify shortest paths based on these service attributes that can be network (i.e. bandwidth, delay etc) and non-network (storage capacity, CPU units, availability etc) resources.

Keywords: GMPLS, DRAGON, routing, path selection, anycast, service awareness.

1 Testbed Development and Testing

DRAGON (*Dynamic Resource Allocation in GMPLS Optical Networks*) project [1, 2] deploys the IP network infrastructure and creates a GMPLS optical core network to allow dynamic provisioning of dedicated LSPs (*Label Switched Paths*). *Virtual Label Switch Router* (VLSR) is a basic element of the control plane architecture of DRAGON. VLSR translates GMPLS protocols into device specific commands, to allow dynamic reconfiguration of non-GMPLS aware devices. The *Client System Agent* (CSA) is a software that runs on (or on behalf of) any system, which terminates the data plane link of the provisioned service.

There are four software daemons running at every VLSR node. OSPF and Zebra daemons are used for routing. RSVP daemon is used for signaling and DRAGON daemon provides all the necessary commands in order to request, delete and set the attributes of LSPs. We extended DRAGON daemon in order to support anycast routing to allow forwarding user (service) requests to the most suitable servers based on their advertised service attributes, [3]. OSPF daemon has been also extended to allow for these advertisements to propagate through the network (via LSAs - *Link State Advertisements*) and modify shortest paths based on these service attributes that can be network and non-network resources.

* Corresponding author.

A simple network testbed has been employed to test the extensions of OSPF and DRAGON daemon, see Fig. 1. It consists of three hosts/CSAs and one VLSR. In VLSR, DRAGON software is installed in Linux software switch mode. VLSR will use Linux commands in order to create or delete LSPs /VLANs (in the current setup). All CSAs run DRAGON in peer mode (CSAs have both RSVP and OSPF). Connectivity in the control plane is provided via a switch. GRE tunnels are setup for control plane messages. Two hosts are setup as service hosts that support two services, namely SERVICE 1 and SERVICE 2. A unique cost is associated for each service for each host. RSVP will ask local OSPF daemon for routing paths, in order to route the signaling messages.

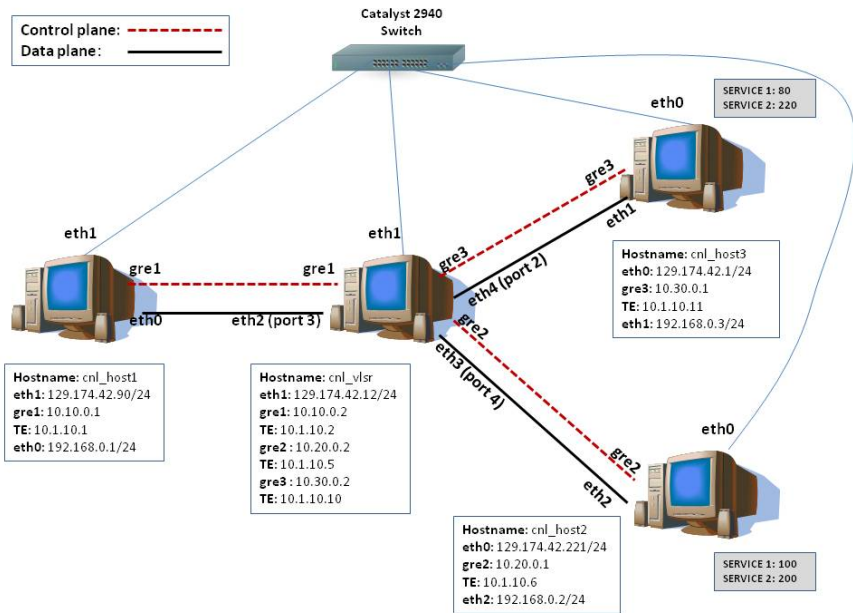


Fig. 1. Testbed design and development

2 Service Requests

For requesting a service, CLI (*Command Line Interface*) was used. Provision for SERVICE 1 is requested with the commands shown in Fig. 2, using “S1”. The chosen service host is 129.174.42.221 (cnl_host2). “show lsp” allows the inspection of the LSPs. An LSP between cnl_host1 and cnl_host2 is created, as shown in Fig. 3a. The output of the added commands “show servers” (DRAGON daemon) and “show ip ospf servers” (OSPF daemon) can be seen in Fig. 4a. AGE column denotes the AGE of the respective LSA.

```

cml_host1-dragon> edit lsp test
cml_host1-dragon(edit-lsp-test)# set source ip-address 129.174.42.90 lsp-id 1000 destination ip-address 1.1.1.1
tunnel-id 2000 S1
Chosen server id for service S1: 129.174.42.221 metric 100
cml_host1-dragon(edit-lsp-test)# set bandwidth eth150M swcap 123c encoding ethernet gp id ethernet
cml_host1-dragon(edit-lsp-test)# set vtag any
cml_host1-dragon(edit-lsp-test)# exit
cml_host1-dragon> commit lsp test
cml_host1-dragon> show lsp

**LSP status summary**

Name      Status      Dir      Source (IP/LSP ID)  Destination (IP/Tunnel ID)
-----
test      In Service  <=>    129.174.42.90      129.174.42.221
          1000          2000
    
```

Fig. 2. Commands for the provision of SERVICE 1

3 Service Host Failure

After having stopped cml_host2, we requested provision for SERVICE 1 again. In such a case, host cml_host3 was chosen as a destination (see Fig. 3b for LSP creation

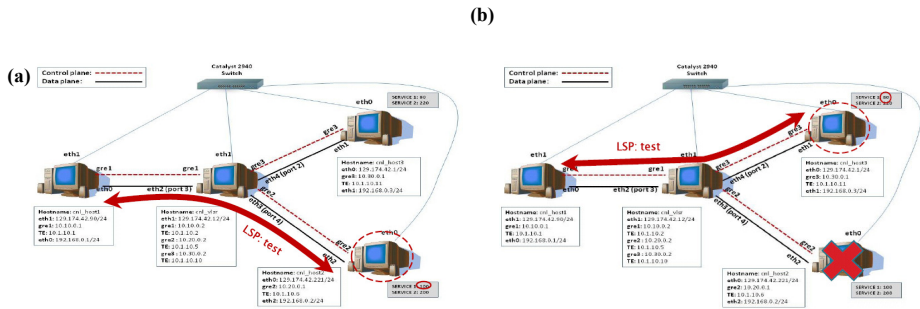


Fig. 3. a) LSP created for SERVICE 1. b) LSP created for SERVICE 1 after failure of cml_host2.

(a)			
cml_host1-dragon> show servers			
SERVER_ID	SERVICE_1	SERVICE_2	
129.174.42.1	80	220	
129.174.42.221	100	200	

cml_host1-ospf> show ip ospf servers			
SERVER_ID	SERVICE_1	SERVICE_2	AGE
129.174.42.1	80	220	34
129.174.42.221	100	200	8

(b)			
cml_host1-dragon> show servers			
SERVER_ID	SERVICE_1	SERVICE_2	
129.174.42.1	80	220	

cml_host1-ospf> show ip ospf servers			
SERVER_ID	SERVICE_1	SERVICE_2	AGE
129.174.42.1	80	220	38

Fig. 4. Output of commands “show servers” (left) and “show ip ospf servers” (right) before (a) and after (b) a service failure in cml_host2

and Fig. 4b for “show servers” output command). In such a case, the network has been self-organised to now point to cnl_host3 for service 1. We also emulated a failure in cnl_host3 and re-requested provision of SERVICE 1. In this case “set” command returns “No servers available for service S1. LSP attributes not set”.

Acknowledgements. This work was partially supported by the Greek NSRF, via project "MEDOYSA" Grant No. 09SYN-24-769.

References

1. Yang, X., et al.: Policy-Based Resource Management and Service Provisioning in GMPLS Networks. In: Proceed. of IEEE INFOCOM 2006, pp. 1–12 (2006)
2. http://dragon.maxgigapop.net/twiki/pub/DRAGON/VLSR/DRAGON_VLSR_Implement_v02.pdf
3. Vlachos, K., Siokis, A.: A Service-Transparent and Self-Organized Optical Network Architecture. In: Proceed. of IEEE ICC, pp. 1–6 (June 2009)