Hybrid Local Area Networks

Ronald van der Pol, SARA, Kruislaan 415, 1098 SJ Amsterdam, The Netherlands[1]
email: rvdp@sara.nl

keywords

Hybrid Networks, Lightpaths, Lambda Grids, LAN

Abstract

Many National Research and Education networks have started to deploy hybrid networks. Hybrid networks consist of a traditional packet switched routed part and an optical circuit switched part. The optical part is used for high bandwidth data streams. These optical layer circuits are called lightpaths. One possible use for these dynamic lightpaths is to interconnect grid resources. Most of the work done in the area of hybrid networks concentrates on how to provide end-user provisioned lightpaths through an NREN. SARA is investigating the issues related to supporting lightpaths in the Local Area Networks of providers of grid resources.

Problem Statement

In hybrid networks, end-users will be able to allocate several grid resources (e.g. supercomputers, data storage, visualization) and interconnect them via lightpaths. This means that providers of grid resources must be able to accept dynamically provisioned lightpaths towards their grid resources. This poses questions like: how to advertise which grid resources are available (possibly through web services), how to do resource scheduling and AAA and how to let end-users dynamically provision lightpaths through the LAN and what addresses to use on both sides of the lightpath.

Supporting Lightpaths through a LAN

SARA has several grid resources (supercomputers, data storage, visualization equipment, etc) that can be used by end-users. Currently, these resources are available over the packet switched routed network. Our work focuses on the question of how these grid resources can be made accessible by using lightpaths. SARA is connected to the hybrid SURFnet6 network[1]. SURFnet provides two possible lightpath interfaces to the customers: 1GE or 10GE. We are investigating how we can transport the traffic from these interfaces to the grid host(s) in our internal network.

One of the possibilities is to terminate the lightpath at a border router and route the traffic to the grid resources. This is probably a relatively expensive solution when we need to support several 10GE concurrent data streams.

It is also possible to terminate the lightpath on an Ethernet switch. The traffic can be carried through the internal network via an Ethernet VLAN. These VLANs can be setup dynamically or

1 This work is done in cooperation with the Advanced Internet Research Group of the University of Amsterdam.

we can pre-configure a VLAN for each grid resource. When we do the latter, we only need to map the incoming lightpath to the proper VLAN.

Finally, we can use MEMs devices to pass the lightpath at layer 1 through the internal network. Each grid resource host can either have its own connection to the MEMs device, or several grid hosts can be connected via an Ethernet switch to the MEMs device.

Control Plane Issues

The previous section described the questions of how to physically transport large data streams through the LAN. However, this will all be done in an dymanic environment. The end-user will setup and tear down lightpaths through SURFnet6. The end-user will also pick several grid resources to connect to the lightpaths. This means that the mapping from lightpath to Ethernet VLAN or MEMs device port will also change according to the allocations of the end-user. SURFnet uses DRAC[2] for dynamically provisioning lightpaths. SARA needs similar middleware. The interaction beween the two and/or the end-user application needs to be investigated.

Virtualisation, Resources Scheduling and AAA

The end-user will use an application to find and allocate grid resources and network connections. Web services[3] and RDF (Resource Description Format)[4] can be used to advertise grid resources and network elements and connections. Scheduling software is used to allocate grid resources and network connections for the end-user. Finally, AAA is needed to determine what information the end-user is allowed to see about the grid resources and network characteristics. AAA is also used to determine what grid resources and network connections the end-user is allowed to allocate.

Addressing Issues

Addressing is not trivial task too[5]. In most cases the grid resources at one site are connected at layer 2 to grid resources at other site. Both sites are in different administrative domains and have their own IP addressing, policy and routing plans. Therefore, it will not be easy to use IP addresses from one site at the other side. This is especially true when the traffic is routed through the internal network or when several grid resource hosts are connected to the lightpath by using an Ethernet switch.

Building a Test Setup

We are investigating the issues described in the previous sections by building a test environment. We are interconnecting several grid resources with lightpaths. We use RDF to describe the grid resources and web services to announce them. Initially, we use some simple provisioning tools for the internal network and DRAC for the lightpaths through SURFnet6.

Acknowlegements

I would like to thank Cees de Laat of the Advanced Internet Research Group of the University of Amsterdam[6] for driving me in this direction and for the many useful discussions we had on this subject.

References

[1] http://www.gigaport.nl/info/en/publications/artikel_content.jsp?objectnumber=23395
[2] http://www.nortel.com/drac
[3] http://vangogh0.uva.netherlight.nl/AIRWebServices/doc/NetherLightWS.htm
[4] http://staff.science.uva.nl/~vdham/research/ndl/index.html
[5] http://staff.science.uva.nl/~fdijkstr/publications/Link_Local_Addressing.pdf
[6] http://www.science.uva.nl/research/air

Vitea

Ronald van der Pol is project leader in the network R&D group of SARA. He is working on on hybrid networks and network management tools. His group is working on projects like OptIPuter, SURFnet's Research on Networks, LHC and LOFAR. Ronald has been working in the Research and Educational network world for more than ten years. His former employers include SURFnet and NLnet Labs.