Appendix [ ]

The Global Lambda Integrated Facility: GLIF

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What is Lambda Networking and a Lambda Grid?

Lambda-based networking is ultimately about using different “colors” or wavelengths of (laser) light in fibers for separate connections. Each wavelength is called a “Lambda”. Current coding schemes allow for typically 10 Gbit/s to be encoded by a laser on a high-speed network interface. In Lambda Networking the goal is to achieve ultimate Quality of Service by giving applications and user communities their own sets of Lambda’s on a shared (dark) fiber infrastructure and thus isolating the different communities from each other. The implementation requires dense wavelength division multiplexing (DWDM\(^2\)) to accommodate many wavelengths on a fiber, optical switches (e.g. based on MEMS\(^3\)), and other optical networking equipment. A “Lambda Grid” involves interconnecting individual optical links each carrying a Lambda dynamically, to form an end-to-end LightPath on demand, in order to meet the needs of very demanding Grid-based applications\(^4\).

What is GLIF:

GLIF is a World Scale Lambda based Laboratory for Application and Middleware development on the emerging “LambdaGrid”, where Grid applications ride on dynamically configured networks based on optical wavelengths. GLIF\(^5\) was established at the third Lambda Workshop organized by Kees Neggers (SURFnet\(^6\)) and Cees de Laat (Univ. Amsterdam), hosted by NORDUnet at their annual conference in Reykjavik. The GLIF community shares the vision to build a new Network paradigm, which uses the Lambda network to support data transport for the most demanding e-Science applications, concurrent with the normal aggregated best effort Internet for the commodity traffic [1][2].

\(^1\) Founding institutions: Argonne National Laboratory, Cal-(IT)2, Caltech, CANAIRE, CERN, CESNET/ CzechLight, DataTAG, IEEAF, Indiana University, Internet2, JISC (UK), MIT, NSF (USA), National LambdaRail, NetherLight, NORDUnet/ NorthernLight, Northwestern University, Pacific Northwest GigaPoP, Pacific Wave, StarLight, SURFnet, TeraGrid, TERENA, TransLight, UKERNA/JANET and UKLight, University of Amsterdam, University College London, University of Illinois at Chicago, University of Maryland, University of Washington, USAwaves, WIDE Project


\(^3\) Microelectromechanical systems; see for example [http://www.memsindustrygroup.org/faq.asp](http://www.memsindustrygroup.org/faq.asp)

\(^4\) Currently in many cases the term Lambda or LightPath is also used for more conventional SONET circuits, which are in fact are time division multiplexed (TDM) solutions, but are conceptually similar to optical Lambdas.

\(^5\) See for example [http://international.internet2.edu/resources/events/2003/Fall03ITF2-GLIF.ppt](http://international.internet2.edu/resources/events/2003/Fall03ITF2-GLIF.ppt)

\(^6\) See [http://www.surfnet.nl](http://www.surfnet.nl)
History:
In 2001, SURFnet and TERENA organized and hosted the first Lambda Grid meeting (invitation only), followed by an open Lambda Grid Workshop; the first for-research-only lambda between NetherLight and StarLight was on order. At that first meeting concepts of the Lambda Networking were established and the first experiments were defined. In 2002, iGrid 2002 (www.igrid2002.org) [3] was an open event, followed by the second, invitation-only Lambda Grid meeting, this time hosted by the Science Park Amsterdam and SURFnet. In that meeting the lessons learned from the first year and the iGrid event were discussed and the expansion of the testbed was discussed.

Photo: The Third Lambda Workshop\(^7\) at NORDUnet 2003 in Reykjavik

In 2003 the third invitation only meeting of the academic community with truly global attendance was organized by SURFnet and the UVA and hosted by NORDUnet at their

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\(^7\) Founding members, shown left to right, are: Maxine Brown (UIC/StarLight/Euro-Link/TransLight); Steve Wallace (Indiana University); Osamu Nakamura (WIDE); Sæþór Jónsson (NORDUnet/NorthernLight); Don Riley (University of Maryland/IEEEAF/USAwaves); Kees Neggers (SURFnet/NetherLight/TransLight); Akira Kato (WIDE); David Foster (CERN/DataTAG); Olivier Martin (CERN/DataTAG/TransLight); Markus Sadenniemi (NORDUnet/NorthernLight); Joe Mambretti (StarLight/Northwestern University); Peter Villemoes (NORDUnet/NorthernLight); Tom Greene (NSF/MIT); Bill St. Arnaud (CANARIE/TransLight); Cees de Laat (University of Amsterdam/SURFnet/NetherLight); Larry Smarr (Cal-(IT)2); Jan Gruntorad (CESnet/CzechLight); Heather Boyles (Internet2); Peter Clarke (University College London/UKLight); Harvey Newman (Caltech/UltraLight/TransLight); Malcolm Read (JISC/UKLight); Dennis Paus (SURFnet/NetherLight); Linda Winkler (ANL/TeraGrid/StarLight); Karel Vietsch (TERENA); David Richardson (Pacific Northwest GigaPonNLR/Pacific Wave/University of Washington); Alicia Wise (JISC/UKLight); René Hatem (CANARIE); Steve Corbatò (Internet2/NLR); Erik-Jan Bos (SURFnet/NetherLight); Tom DeFanti (UIC/StarLight/Euro-Link/TransLight). See [http://www.startap.net/starlight/ABOUT/meetGlobalLambda03.html](http://www.startap.net/starlight/ABOUT/meetGlobalLambda03.html) for workshop notes and presentations.
The 2003 meeting was organized around 3 topics, treated by 3 subgroups in parallel sessions. The topics were:
1) (RAP) research and applications, chaired by Cees de Laat
2) (TEC) technical issues, chaired by Erik-Jan Bos
3) (GOV) governance and growth issues, chaired by Kees Neggers
4) The RAP group worked to identify applications, which can benefit from Lambda networks. The TEC session concentrated on the build out of the International Lambda infrastructure whereas the GOV group dealt with governance issues and came up with the name GLIF. The main conclusion of the workshop was the need to move from one-time demonstrations to the support of persistent demonstrators. Since the Lambda grid is growing and reaching more and more research groups, which are already collaborating on the application level, this should become easier.

The fourth Lambda Workshop, now named GLIF meeting, will be held in early September 2004, hosted by UKLight in Nottingham (UK). It will be held in conjunction with the UK-all hands e-Science meeting.