Researchers Guide to NLR Services

1 Introduction

1.1 Overview

National LambdaRail's nationwide advanced optical network infrastructure is capable of meeting the needs of the most demanding network and scientific research. Because NLR owns the underlying fiber optic cable and optical equipment, as well as other networking equipment, it can cost-effectively implement multiple, diverse experimental and production networks on its nationwide optical fiber footprint with unprecedented flexibility and responsiveness. A core set of basic services are currently available from NLR. Variations of these basic services, as well as additional services are available upon request.

NLR, its members, and individual institutions associated with its members, work together to provide end-to-end network services. Because of the close and ongoing coordination among these organizations, NLR is able to provide for researchers a unique level of assistance and facilitiation in provisioning and maintaining these services. Furthermore, NLR has a dedicated national Experiment Support Services team to support the networking needs of scientific research.

This guide is a quick reference document providing the reader with key and essential information about the capabilities and services available via NLR as well as the mechanisms available for obtaining additional information about the services. Links are provided within the document to more in-depth or to additional information. The primary audience for this document is members of the research community interested in including NLR infrastructure in a proposal, but the information is applicable to anyone interested in obtaining services from NLR.

1.2 NLR Community

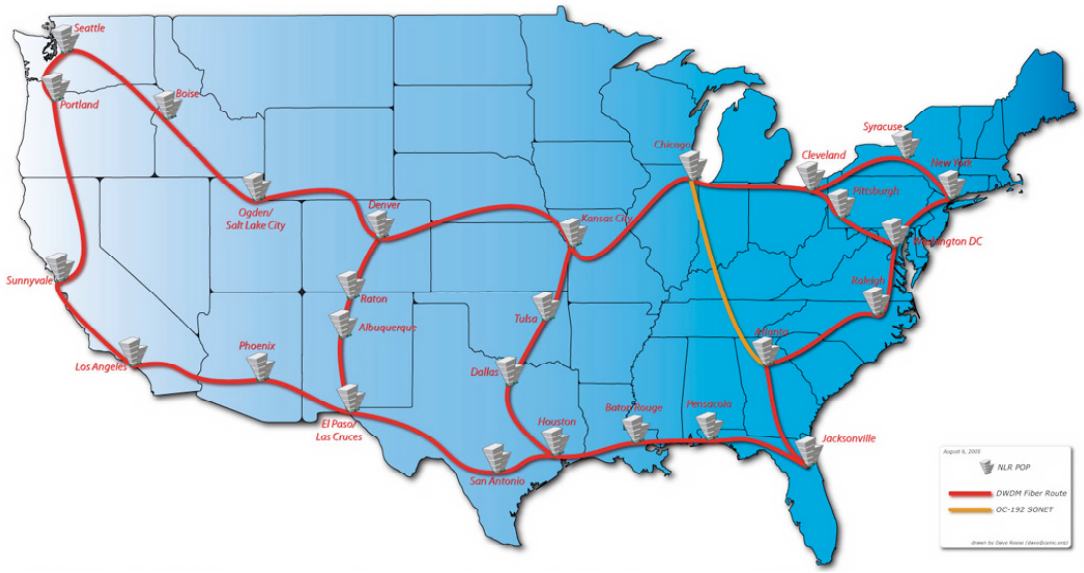
1.2.1 Composition

NLR is a membership-based organization with 15 Members and several Associates that include over 150 universities, research institutions and other organizations. As illustrated in Figure 1, the NLR infrastructure has nodes located in 28 cities. NLR's core set of basic services are offered from these nodes and then distributed regionally by its Members and Associates. A list of the current NLR Members and Associates and their participants is provided in Appendix A.

This list is updated on a regular basis to reflect the NLR's membership. In some instances a specific site or region of interest to a researcher may not be listed in the appendix. If this is the case, the NLR support staff reachable at noc@nlr.net or by following the Direct

Contact procedures outlined in Section 3.2.2 below, can often provide additional information.

Figure 1. NLR Infrastructure



1.2.2 End-to-End Model

For almost all of the NLR services described below, NLR provides the national backbone, or wide-area network component, of an end-to-end service with an NLR Member or Associate organization providing or coordinating the regional component and an individual institution the local component. Appendix A provides a list of the services currently supported by the NLR Members and Associates as well as their members. This list is updated on a regular basis in order to reflect the expansion of services members, and associated organizations and institutions.

While NLR does not provide the regional components of its service, it is able to facilitate the entire connection either through providing contacts for each end site or through providing the coordination necessary to implement the entire path. Appendix, Administrative and Technical Contacts, provides contact information for each of the NLR Members. These contacts can provide additional technical and cost information for the regional components of the services. The NLR Service Desk and Experiment Support Service group can provide support for a researcher who would like NLR's help in coordinating the end-to-end path. Both groups are easily reachable by sending email to noc@nlr.net.

2 NLR Services

This section provides a basic description NLR's core set of basic services and the mechanisms for obtaining the costs for these services.

2.1 Core Service Description

NLR is a unique and rich set of facilities, capabilities and services that support a set of multiple, distinct, experimental and production networks. On NLR, different networks exist side-by-side in the same fiber-optic cable pair, but are physically and operationally independent of each other as each network is supported by its own lightwave or lambda. This infrastructure provides the basis for the core set of basic service offered by NLR and described below. A more detailed description of the services can be found at: http://www.nlr.net/services/. Description of current project using NLR and the services they use can be found at: http://www.nlr.net/supported.html

2.1.1 WaveNet

NLR WaveNet offers point-to-point, high-capacity 10-gigabit Ethernet LAN-PHY or OC-192 lambdas between any two nodes on the NLR infrastructure. The NLR WaveNet service is a full-production, unprotected point-to-point wavelength. Pricing for the WaveNet service is distance sensitive, specifically based on a cost per segment.

2.1.2 FrameNet

NLR FrameNet offers Ethernet-based transport services over the nationwide NLR optical infrastructure. These services facilitate point-to-point or multipoint Ethernet transport at subgigabit, gigabit and multigigabit data rates. All Ethernet-based services are available from any of the FrameNet-enabled nodes of the NLR infrastructure. Three standard types of NLR FrameNet service are available:

- National Exchange Fabric – a multipoint Ethernet which carries not bandwidth guarantees.
- Point-to-Point Ethernet – an Ethernet between two specific sites with a specific guaranteed bandwidth.
- Multipoint Ethernet – an Ethernet between multiple sites with no guaranteed bandwidth

2.1.3 PacketNet

NLR PacketNet provides nationwide AUP-free IP-based services utilizing Cisco CRS-1 routers. Two services are available:

- Routed IP Service - A stable, production-quality, non-interruptible, AUP-free routed IP network on a 10-gigabit Ethernet backbone that provides a range of IP-based services and connects to both NLR Member and Peer Networks. Both 10 GE and GE connections are available to the network.
- Breakable IP Service - A breakable, interruptible, AUP-free routed IP network that allows researchers to test new technologies and services, including ones that may be disruptive to the routed network.

2.1.4 Other

NLR is able to offer researcher a range of other services that are primiarly in support of, but can be separate from, the core network services. These services include:

- Co-Location Services – ability to co-locate equipment at any of the NLR nodes along the NLR footprint.
- Cross-Connections – ability to order cross-connections within an existing NLR Node location.
- Remote Hands – arrange for remote hands support for equipment located within NLR Nodes.
- Dark Fiber – IRU's for diverse locations, specifically those associated with the NLR footprint.

2.2 Service Types – Shared and Dedicated

The core set of basic services includes both shared and dedicated services. Two services, the NLR PacketNet Routed IP Service and the NLR FrameNet National Exchange Fabric are shared services whose cost is included as part of the basic NLR Membership. Thus, there are no additional NLR costs for these services. Dedicated services, such as the point-to-point WaveNet or FrameNet, do have additional costs associated with them. Section 2.3 below outlines the mechanisms available for getting NLR costs as well as any regional costs associated with a service.

2.3 Costs

Cost for the backbone portion of the services can be obtained directly from NLR. In many cases, NLR Members are still developing the cost schedules for the regional portion of the service. Until a complete a comprehensive cost schedules can be developed for end-to-end connectivity NLR staff will assist researchers in developing preliminary costs for their proposals. Researchers can send costing requests to noc@nlr.net or use the direct contact methods described below.

2.4 Technical Support

2.4.1 NLR Support Services

Support for NLR is provided by a distributed support organization that includes the NLR Service Desk, the WaveNet, FrameNet and PacketNet Network Operations Centers and the Experiment Support Services group. The NLR Service Desk (noc@nlr.net) is the primary contact point for researchers using NLR services and provides the coordination and communication between NLR's support organization. Inquires sent to the Service Desk will be evaluated and assigned to the appropriate NLR staff.

NLR's Experimental Support Services group (ess@nlr.net) provides technical support for the NLR research community. They are available to assist researchers identify, define and document NLR services of interest for their research projects as well as provide planning and engineering support for end-to-end connections between sites.

2.4.2 Direct Contact

While NLR and its NOC and Service Desk understand and respect the confidential nature of the proposal process, we also realize there are some instances where a researcher may be hesitant to send email to a mailing list regarding their research project. Therefore, for researchers who feel a more direct path is necessary, the following NLR staff and partners can be contacted directly.

- Wendy Huntoon, NLR Director of Operations, huntoon@nlr.net
- Javad Boroumand, Cisco Academic Research and Technology Initiatives (ARTI), jborouma@cisco.com
- Tom West, NLR CEO, twest@nlr.net

Appendix A: NLR Members, Participants and Services

as of 6 January 2006
(Note: services offered by members and participants to be added please contact noc@nlr.net for more information)

Duke/NCLR
Duke
NCSU
UNC-CH
MCNC
RENCI

PSC/UPitt
PSC
PENN STATE
UofPitt

CENIC
NAVAL POST GRADUATE SCHOOL
NASA-AMES RESEARCH CENTER
Hewlett-Packard
CAL TECH
JET PROPULSION LAB
CSU EAST BAY
CSU SYSTEM
CAL POLY SLO
Charles Drew Medical
21 CSU Campuses (SEGP)
109 CA. Comm. Colleges (SEGP)
All K-12 Schools (SEGP)
UC PRESIDENTS OFFICE
UC BERKELEY
UC DAVIS
UC IRVINE
UC LOSA
UC RIVERSIDE
UC SAN DIEGO
UC SAN FRANCISCO
UC SANTA BARBARA
UC SANTA CRUZ
STANFORD UNIVERSITY
UNIVERSITY OF SO. CAL.
UNIV. OF NEVADA-RENO
UNIV. OF NEV.-LAS VEGAS
UCCSN-DESERT INSTITUTE
UNIV OF ARIZONA
ARIZONA STATE UNIV.
CLAREMONT COLLEGES

PNWGP
U OF WASHINGTON
WASHINGTON STATE U.
U OF ALASKA
U OF IDAHO
MICROSOFT RESEARCH
U OF MONTANA
MONTANA STATE U
OREGON HEALTH & SC. U.
DOE-PACIFIC NORTHWEST NL
UNIVERSITY OF HAWAII

LLC/FRGP
BRIGHAM YOUNG U
NOAA-Boulder
COLORADO STATE U
IDAHO STATE U.
UCAR/NCAR
U OF COLORADO-BOULDER
U OF COLORADO-DENVER and Health Sciences Center (UCDHSC)
U OF UTAH
UTAH STATE U.
U. OF WYOMING
Colorado School of Mines (SEGP)

CIC
CHICAGO
ILLINOIS
ILLINOIS AT CHICAGO
INDIANA
IOWA
MICHIGAN
MICHIGAN STATE
MINNESOTA
NORTHWESTERN
OHIO STATE
PENN STATE
PURDUE
WISCONSIN

Cornell/NeLR-NY
NYSERNet
Columbia University
New York University
Rensselear Poly Tech.
Rochester Institute of Tech.
SUNY at Albany
SUNY at Buffalo
University of Rochester
Tufts University
CORNELL UNIVERSITY

MATP
COLLEGE OF WILLIAM AND MARY
GEORGE MASON UNIVERSITY
NASA-LANGLEY
NASA-GODDARD
OLD DOMINION UNIVERSITY
SURA JEFFERSON LAB (DOE)
UNIVERSITY OF VIRGINIA
VIRGINIA COMMONWEALTH UNIVERSITY
VIRGINIA TECH
OAK RIDGE ASSOCIATED UNIVERSITIES (ASSOCIATE MEMBER)

SLR (Georgia Tech)
NASA-MARSHALL FIELD-HUNTS
OAK RIDGE NATIONAL LAB
GEORGIA TECH
GEORGIA STATE U
MEDICAL COLLEGE OF GA
U OF GEORGIA

FLR
NASA-KENNEDY SPACE CENTER
FLORIDA ATLANTIC U.
FLORIDA A&M U.
FLORIDA INST. TECH
FLORIDA INTERNATIONAL U.
FLORIDA STATE U.
U. OF CENTRAL FLORIDA
U. OF FLORIDA
U OF MIAMI
U OF WEST FLORIDA
NOVA SOUTHEASTERN U.
U OF NORTH FLORIDA

LONI
NASA-STENNIS/MICHAUD
LSU SYSTEM
SOUTHERN U. SYSTEM
LSU H.S.C NEW ORLEANS
LSU H.S.C SHREVEPORT
TULANE U
LOUISIANA TECH
U OF LOUISIANA LAFAYETTE
U OF NEW ORLEANS

LEARN
LEARN
BAYLOR COLLEGE OF MED.
BAYLOR U
LAMAR U
RICE U
SAM HOUS STATE U
SOUTHERN METHODIST U
THE TEXAS A&M SYSTEM
TEXAS A&M SYSTEM H.S.C.
TEXAS A& M CORPUS CHRISTI
TEXAS CHRISTIAN U.
TEXAS S. U. SYS.-SAN MARCOS
U OF HOUS SYSTEM
U OF NORTH TEXAS H.C.
U OF NORTH TEXAS SYS.
U OF TEXAS AT ARLINGTON
U OF TEXAS AT AUSTIN
U OF TEXAS AT Dallas
U OF TEXAS AT EL PASO
U OF TEXAS H.S.C.-HOUSTON
U OF TEXAS H.S.C.-SAN ANT.
U OF TEXAS MD AND. CTR.
U OF TEXAS H.C. AT TYLER
U OF TEXAS M.B. AT GALV.
U OF TEXAS AT SAN ANTONIO
U OF TEXAS SW MC AT Dallas
U OF TEXAS SYSTEM

OKLAHOMA
OKLAHOMA STATE U.
OKLAHOMA STATE BOARD
U OF OKLAHOMA

NEW MEXICO
LOS ALAMOS
NEW MEXICO STATE U
NEW MEXICO TECH
U OF NEW MEXICO

Appendix B: NLR Member Contacts

as of 16 January 2006

	Administrative Contacts			Technical Contacts		
Member	**Name**	**Telephone**	**Email**	**Name**	**Telephone**	**Email**
CENIC	Jim Dolgonas	714-220-3434	jdolgonas@cenic.org	Dave Reese	714-220-3444	dave@cenic.org
CIC	Karen Partlow	217-265-0395	kpartlow@uiuc.edu	Ron Rusnak	773-702-7607	r-rusnak@uchicago.edu
Cornell NeLR	Gina Banfield	607-255-7253	Reb36@cornell.edu	Dan Eckstrom	607-255-5902	De10@cornell.edu
CWRU	Linda Lazzaro	216-368-2983	Linda.lazzaro@case.edu	Roger Bielefeld	216-368-3971	Roger.bielefeld@case.edu
FLR	Veronica Sarjeant	850-645-1283	VSarjeant@admin.fsu.edu	Dave Pokorney	352-392-2061	dp@ufl.edu
UCAR/FRGP	Marla Meehl	303-497-1301	marla@ucar.edu	Scot Colburn	303-497-1299	colburn@ucar.edu
Internet2	Steve Corbató	801-585-1623	corbato@internet2.edu	Rick Summerhill	734-352-4952	rrsum@internet2.edu
LEARN	Jim Williams	512-475-8754	jwilliams@tx-learn.net	Wayne Wedemeyer		w.wedemeyer@its.utexas.edu
LONI	Mike Abbiatti	225-342-4253 x 623	abbiatti@regents.state.la.us	Charlie McMahon	225-578-4956	cmcmaho@lsu.edu
MATP	Jeff Crowder	540-231-3900	crowder@vt.edu	John Lawson After hours contact:	540-231-3917	lawsonj@vt.edu
NCLR	Mark Johnson	919-248-1807	mj@ncren.net	Mark Johnson	919-248-1807	mj@ncren.net
ORNL	William R. Wing	865-574-8839	wrw@ornl.gov	William R. Wing	865-574-8839	wrw@ornl.gov
NM	Terry Yates	505-277-3838	tyates@unm.edu	Gary Bauerschmidt	505-277-8035	gbauers@unm.edu
OKSBR	Kurt Snodgrass	405-225-9185	kurt@onenet.net	Bill Johnson	405-225-9437	bjohnson@onenet.net
PNWGP	Jan Evelyth	206-221-2300	Eveleth@cac.washington.edu	David Richardson	206-543-2876	drr@washington.edu
PSC/PGH	Wendy Huntoon	412-268-4960	huntoon@psc.edu	Jim Miller	412-268-4960	millerjw@psc.edu
SLR	Brian Savory	404-385-5171	brian.savory@oit.gatech.edu	Cas D'Angelo	404-894-1356	Cas.dangelo@oit.gatech.edu
SURA	Peter Bjonerud	202-408-7872	bjonerud@sura.org	Gary Crane	315-597-1459	gcrane@sura.org