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*MEMORANDUM*

DATE: August 24, 2005

TO: Stan Whitcomb, Fred Raab, LSC Executive Committee, Albert Lazzarini, Larry Wallace  
 FROM: Christine Barker  
 SUBJECT: LHO Network Upgrade Options  
 Refer to: LIGO-T050126-00-W

Currently LHO's WAN consists of a fiber pair from the LHO site to PNNL in Richland which is leased from Lockheed Martin (LMSI) as a special circuit associated with our phone services. From PNNL the fiber is connected to an OC-3 circuit on an OC-12 pipe leased by PNNL and Ligo through Amerion which provides transport from Richland to Seattle over the NoaNet infrastructure. Once at the Weston building in Seattle, the LHO circuit is connected to the ESnet infrastructure which then transmits the LHO traffic to the rest of the world. ESnet provides LHO with two Class C (/24) subnets of IP addresses.

Table 1. Current monthly Costs

LMSI Special Circuit – Charged on phone bill	Amerion - OC-3 to Seattle	ESnet - connection in Seattle and IP addresses
\$100.00	\$7384.88	\$1000.00
	Total current monthly cost:	\$8484.88

As of September 2004, PNNL has partnered with Charter Communications to acquire fiber between Richland and Seattle. They are installing DWDM equipment to establish multiple "lightwaves" to Seattle. These "lightwaves" will be provisioned as multiple GigE circuits. PNNL's motivation to install this optical network is to connect to the DOE's planned UltraSciences network. PNNL has offered LHO a GigE circuit over their DWDM infrastructure and a connection to the ESnet infrastructure in Seattle. With the PNNL DWDM infrastructure being an un-protected and non-redundant circuit, PNNL is requiring LHO maintain backup network services as PNNL thinks that outages of 24 to 48 hours are conceivable on their DWDM infrastructure. The amounts in the following table are provisional because although we have had email notification from PNNL, to date we still do not have any contractual paper work from PNNL. I'm told they are working on it.

Table 2. Provisional PNNL DWDM to ESnet monthly costs

LMSI Special Circuit – Charged on phone bill	GigE Circuit on PNNL DWDM to Seattle	ESnet – connection in Seattle and IP addresses
\$100.00	\$3000.00	\$1000.00
	Total monthly cost:	\$4100.00

A search for GigE services from other local network providers did not turn up any services that could match PNNL’s service or price.

A search for backup network services, as required by PNNL, has provided two options:

1. Contract with a local ISP to provide Layer2 services between Richland and ESnet in Seattle. This would just be an “empty pipe” between Richland and Seattle ending in a second LHO connection on the ESnet router that ESnet would only use if the PNNL primary connection went down. The ESnet router requires a minimum connection of 10 Mbs. This option allows LHO to continue using the ESnet IP addresses. This is by far the easiest option to implement. Amerion is the lowest bidder for this option and has presented a formal quote.
2. Contract with a local ISP to provide Layer3 services. This would require giving up the ESnet IP addresses, as the ISP can not re-announce ESnet addresses to the greater Internet. LHO would either have to obtain IP addresses from the ISP which could be re-announced by ESnet to the Internet or LHO could purchase our own IP addresses from ARIN. This option also requires a new level of complexity on the LHO border router as it will now be multihomed and must run Border Gateway Protocol (BGP) to enable the router to route traffic to either the PNNL/ESnet primary path or to the ISP backup path. This option is available through Amerion or Lockheed Martin who has a contract with PocketiNet. I don’t have any formal quotes for this option, however Lockheed Martin has given me a verbal quote of \$736.00/mo and Amerion’s verbal quote is \$765.00/mo.

Table 3. Cost to buy IP addresses from ARIN

Initial allocation fee	\$1250.00
Annual membership fee	\$500.00
Annual renewal fee	\$100.00

Table 4. Comparison of Option 1 and Option 2

Option 1: 10 Mbs pipe between Richland/Seattle		Option 2: T1 Internet Services	
Pros	Cons	Pros	Cons
Easy to implement	\$1683.28/mo	\$736.00/mo	Extremely difficult to implement
Continue using ESnet IP addresses		IP addresses will change, but computer names remain the same	Requires ESnet to re-announce ISP IP addresses
Network security not degraded		Richard is upgrading phone system, new equipment will have a digital T1 port	Requires re-addressing all computers on site
Enough bandwidth for normal GC traffic and to transfer some LDAS data			Requires changing all LHO listings in the Caltech DNS tables
ESnet does not have to re-announce ISP IP addresses			Requires implementation of BGP and multihoming configurations
			Less secure, commercial ISPs are always targets of hackers

Table 5. Provisional total monthly costs of primary and backup networks

Primary + Option 1	Primary + Option 2 w/ Amerion	Primary + Option 2 w/ LMSI and PocketiNet
LMSI \$100.00	LMSI \$100.00	LMSI \$100.00
ESnet 1000.00	ESnet 1000.00	ESnet 1000.00
PNNL 3000.00	PNNL 3000.00	PNNL 3000.00
Amerion 1683.28	Amerion \$765.00	LMSI 736.00
Total \$5783.28	Total \$4865.00	Total \$4836.00
Total NRC \$8730.89	Total NRC \$50.00	Total NRC ?

Albert is of the opinion that a T1 link as a stopgap measure in the case of PNNL down time would be fine. I agree with Albert, however I really prefer Option 1 because of the simplicity of implementation for myself and for ESnet. At Albert's request, I am requesting a decision from the addressees as to the option that should be pursued for the LHO backup network.

Thank you,  
Christine Barker