HiSLIP for Fast Remote Control of LXI Instruments

Ethernet is an inexpensive and readily available technology for quickly transferring large amounts of data via the LAN. LAN eXtensions for Instrumentation (LXI) is the standard for Ethernet control of instrumentation. LXI is an open, accessible standard based upon Ethernet that identifies specifications and solutions related to the functional test, measurement and data acquisition industries.

LXI instruments connect via the LAN to a common network that uses the TCP/IP network protocol (refer to figure 1). VISA is the standard I/O interface for communicating with LAN-connected instruments from application software running on a controller such as a PC.

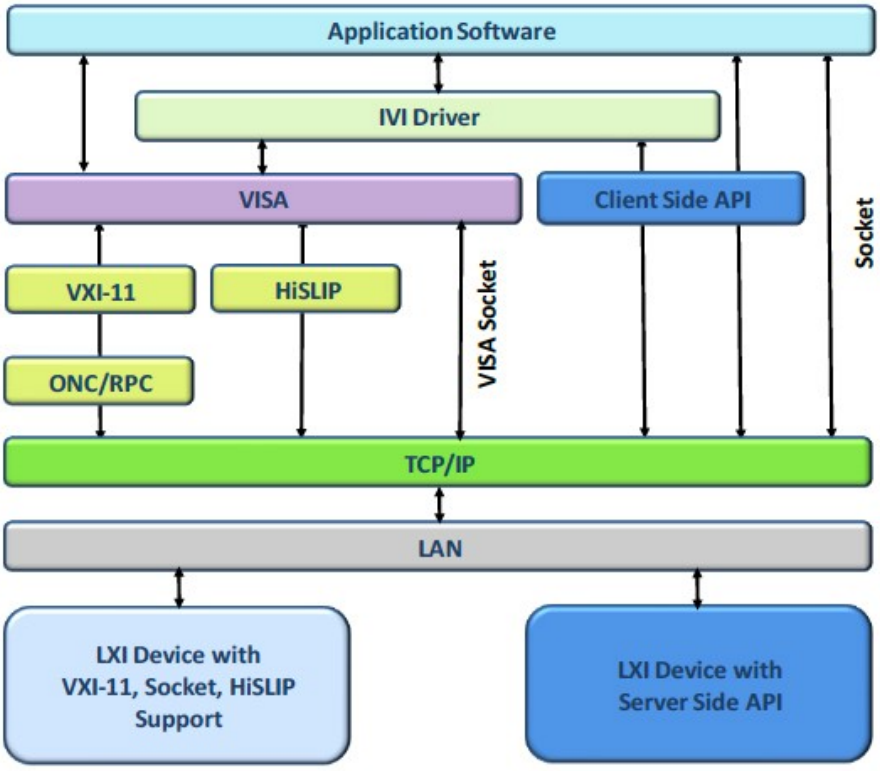

Figure 1. Communication Interfaces to LXI Devices

Computers using VISA to communicate with LXI instruments use one of several protocols: VISA Sockets, VXI-11, or HiSLIP. HiSLIP is a non-proprietary standard developed in 2011 by the IVI Foundation. Sockets and HiSLIP provide a 2-5 times faster interface to LXI instruments than VXI-11. The following table summarizes the bandwidth available and protocol support for various interfaces:

Bandwidth comparison of interfaces and protocols for remote control			
Interface	**Maximum interface**	**Protocol**	**Typical throughput**
10 GB/s LAN	1.25 GB/s	HiSLIP, Raw Sockets	
1 GB/s LAN	125 MB/s	HiSLIP, Raw Sockets	up to 60 MB/s
100 MB/s LAN	12.5 MB/s	HiSLIP, Raw Sockets	11 MB/s
1 GB/s LAN	125 MB/s	VXI-11	34 MB/s
100 MB/s LAN	12.5 MB/s	VXI-11	11 MB/s
USB 2.0	60 MB/s	USBTMC	18 MB/s
GPIB-PCI	1.8 MB/s	IEEE 488.2	1 MB/s

HiSLIP and Sockets make more efficient use of whatever speed LAN connection compared to VXI-11. However, a Socket only provides a simple serial interface for communication. Therefore, HiSLIP is ideally used for optimal performance.

HiSLIP emulates GPIB using Sockets. It includes the conventional features used to control instruments as well as advanced functions. HiSLIP implements core VXI-11 capabilities and adds additional features, plus it includes GPIB communications features that were missing in the VXI-11 protocol.

VXI-11 is built upon the Open Network Computing Remote Procedure Call (ONC RPC) protocol ONC/RPC protocol. Since HiSLIP communicates directly between the VISA and TCP/IP layers, it eliminates the need for the overhead and handshaking of ONC RPC messages. In addition, HiSLIP data is sent with an immediate return, as opposed to VXI-11 where each VISA read or write read operation is blocked until a VXI-11 device handshake is returned. Therefore, messaging communications using HiSLIP is simplified and provides improved performance.

HiSLIP has also been developed to work in conventional IPv4 Ethernet networks as well as IPv6 Ethernet networks. This makes it possible to use HiSLIP regardless of the underlying Internet Protocol layer, which is responsible for the virtual addressing of the network components. Since the number of unallocated IPv4 addresses has been depleted, the support for IPv6 is critical to continue to enable future devices to be connected to the Internet.

Table 2 compares the features available with HiSLIP, VXI-11 and Sockets.

Feature Comparison of LAN Communication Protocols			
Feature	**Sockets**	**VXI-11**	**HiSLIP**
GPIB emulation	-	✓	✓
SRQ asynchronous program support	-	✓	✓
Device Clear independent of data channel.	-	✓	✓
In-instrument Instrument locking	-	✓	✓
Extended in-instrument locking (lazy lock errors; shared locks)	-	-	✓
Support of message exchange protocol (detect interrupted)	-	✓	✓
IPv6 support	✓	-	✓
High performance	✓	-	✓

The LXI Consortium has adopted HiSLIP as the recommended LAN instrument control protocol for LXI devices. HiSLIP is one of the Consortium's optional Extended Functions that has conformance requirements in addition to the core set of features required by the LXI specification. The HiSLIP Extended Function leverages the HiSLIP standard created by the IVI Foundation to create a fast control interface, extend the features of VXI-11 and emulate the capabilities of GPIB. However, not all LXI devices support HiSLIP yet. A list of LXI devices that support HiSLIP, as well as other Extended Functions, can be found on the Product List page of the LXI Consortium website.