JDSU

White Paper

Xgig®: Powerful Hardware-Based Ethernet/iSCSI Analyzer for SAN and NAS

Selecting the right protocol analyzer for debugging a SAN or NAS is a critical decision for developers. Traditionally, software-based application-level tools were considered sufficient for most network analysis needs. However, today's sophisticated iSCSI and FCIP technology enables the transport of tremendous amounts of data over fast network connections that, through tuning and optimization, utilize most of the available network bandwidth.

Enabling deep analysis of equipment utilizing high-bandwidth protocols such as SMB, NFS, iSCSI, FCIP, and iFCP requires complete and accurate data capture which is beyond the capability of software-based analyzers. In addition, software-based analyzers that operate over TCP cannot perform proper analysis if captured packets contain truncated bytes, as is possible with TCP which will embed headers at any possible offset within the packet for efficiency. As a consequence, the resulting exponential increase in network traffic and speed over recent years has created an unbridgeable gap between the data-capture capabilities of traditional software-based analyzers and the needs of network developers and managers for comprehensive access to data for troubleshooting and development.

Finisar now enables network developers and managers to cross that gap. Finisar's hardware-based Xgig® analyzers provide the bandwidth and advanced analysis capabilities network operators require to capture complete packets as is necessary for accurate network analysis, even on highly sophisticated networks. Complete data capture means complete network analysis.

Complete Data Capture

Typically, software-based analysis tools do not have access to dedicated capture RAM but rather must utilize limited resources on the host system to store captured data. Given the limited availability of system memory for use as a trace buffer, as well the impact using such memory has on network performance, not only can software-based data capture negatively affect the very network being monitored, the analyzer must be very selective in the data it captures to avoid exceeding available memory. For these reasons, data is captured only from traffic that is either in-bound or out-going – not both – from the monitored adapter, thus not providing valuable visibility into other communications occurring on the wire. Furthermore, timestamps for captured data generated or simulated by the capture engine often only have 10-20 microsecond resolution, and in many cases resolution is in milliseconds. For out-bound capture, timestamps are generated when the frame is generated, not when the actual transmission occurs on the wire. These discrepancies in timestamps can make it extremely difficult for network developers to correlate and trace specific transactions.

Finisar's Xgig Analyzer provides hardware-based data capture capabilities that not only enable developers to collect more complete information but offer more accurate timestamping. Equipped with dedicated RAM per channel, Finisar analyzers offer lossless data capture with exceptional nanosecond resolution. Since data is captured at the Gigabit Ethernet physical layer, developers have access to the entire spectrum of physical layer characteristics (i.e., pre-amble, idles, carrier extend, etc.) as well as the complete packets from any devices visible on the monitored physical link. Additionally, capture at the physical layer gives developers visibility into all traffic segments, including CRC errors, Checksum errors, and otherwise corrupted packets and/or primitives.

Real World Test Results

The best way to illustrate the extensive benefits complete and accurate capture provides is through a real-world capture and analysis example. In this case, the Finisar Xgig analyzer was placed "in-line" to the network, specifically between the iSCSI Initiator and the GigE switch. As applications that run on TCP cannot be properly captured and analyzed if packets have truncated bytes, the analyzer was configured to capture all packets, without truncation.

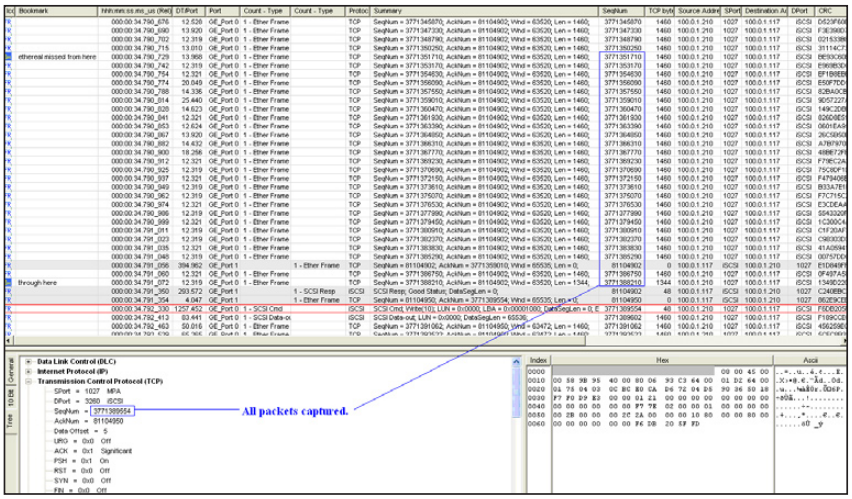

Figure 1: Finisar captured all the data

For this example, 40MB of iSCSI Writes and 40MB of iSCSI Reads were sent across two iSCSI drives, with all activity ceasing upon completion. These short, controlled bursts of iSCSI traffic were captured using the Xgig analyzer and, given the Xgig's deep buffers, every bit of transmitted data was captured.

In Figure 1, Xgig TraceView shows that the analyzer captured 128,522 iSCSI packets between the source and the destination. Additionally, TCP Port 1027 transmitted 37,844 bytes starting at Sequence Number 3771351710 and ending with Sequence Number 3771389554 (an iSCSI Write Command). Note that the traces have been filtered to show traffic only from TCP Port 1027.

While Xgig TraceView cannot natively identify embedded application PDU headers (i.e. iSCSI, FCIP, SMB) unless they are located at the beginning of the TCP data, Xgig Expert is able to correct data by producing a re-aligned PDU output that is completely decoded for every segment. Xgig Expert also extends TraceViews debugging capabilities with powerful analysis features such as the ability to filter all exchanges for a single LUN or viewing Exchange Completion Timing measurements from within TraceView.

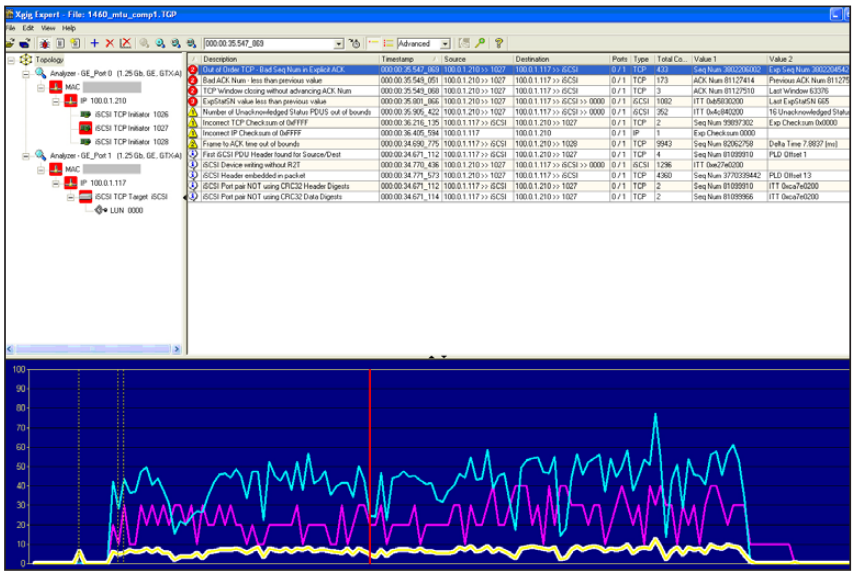

Figure 2: Some of the errors and warnings automatically diagnosed by Xgig Expert

Figure 2 shows that Xgig Expert has now thoroughly parsed the Gigabit Ethernet (MAC), IP, TCP and iSCSI layers. Xgig Expert also inserts errors and warnings relative to each layer to highlight fields of interest to make debugging a much simpler task. For example, clicking on "Go To TraceView" within Expert will open up the related event in TraceView. The errors shown in the figure mark long TCP acknowledgement times and incorrect usage of ExpStatSN values by the iSCSI Initiator, among others.

Figure 3 illustrates how Xgig TraceView displays the actual packet transmitted over the wire with the correct Checksum value.

The Xgig platform also offers Xgig Expert PDU View, a feature unique to Finisar analyzers. Once Xgig Expert has processed a trace, it creates a new trace to augment the original, as shown in Figure 4. This new trace extracts and fully decodes iSCSI PDU headers (and FCIP/iFCP when applicable). The new trace is

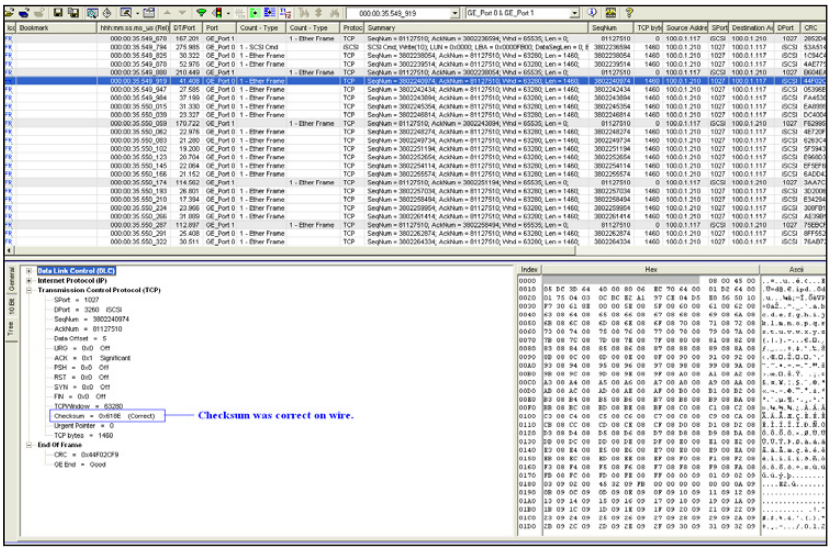

Figure 3: Finisar shows that the actual packet on the wire contained the correct checksum value

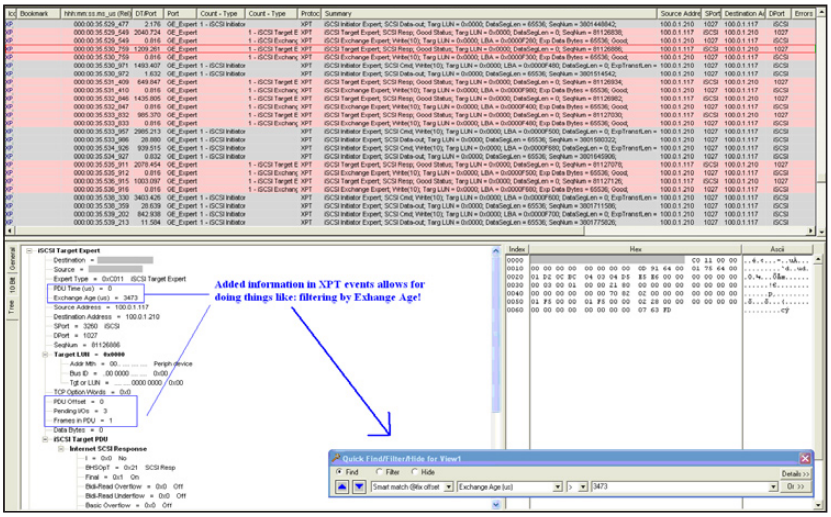

Figure 4: Expert PDU View

also augmented with key debugging information, including exchange ages and timings of iSCSI transactions, number of pending I/Os, and PDU transmission time on the wire. The unique accessibility of this information provides a 100% accurate iSCSI view of the network after the data has been acknowledged by TCP. When combined with the original trace, developers can easily switch between the TCP view and the iSCSI view, accelerating debugging.

Developers also have iSCSI Exchange Expert at their disposal. The iSCSI Exchange Expert indicates the completion of a single SCSI transaction (or Initiator Task Tag) and provides all of the information for a single transaction available as a single event, including Command to Status time, Command to First Data time, Completion Status, CDB, 48 bytes of pay-load data (user modifiable), and much more.

Finisar's Xgig hardware-based protocol analyzer provides the high performance capabilities developers need for complete data capture and deep packet analysis of today's sophisticated SAN and NAS networks. Combined with powerful and advanced analysis tools such as TraceView, Expert PDU View, and iSCSI Exchange Expert, the Xgig analyzer gives developers thorough, complete, and accurate information, accelerating troubleshooting of even the most challenging network problems.

Key Features

1. Dedicated hardware capture buffers with capture depth up to 2GB per channel without any dropped packets, no matter what operating conditions.
2. Capable of simultaneous captures with highly synchronized time-stamps from multiple different physical topologies (i.e. Fibre Channel and Gigabit Ethernet) and/or multiple links within these topologies, simplifying correlation of transactions between topologies and links.
3. Hardware-generated timestamps are extremely accurate, down to nanosecond resolution.
4. Omniscient network visibility – developers can observe all physical layer activity and errors occurring on the network as well as capture data from all participating devices visible on the network.
5. Highly configurable trace viewing software allows developers to work with captured data at the desired protocol level (i.e. iSCSI views of pertinent PDU information). This facilitates quick searches and filtering of data within large traces in a timely and efficient manner.
6. Extremely powerful analysis capabilities with Xgig Expert for analyzing and identifying incorrect usage/protocol behavior for GigE, IP, TCP, iSCSI, SCSI, FCIP/iFCP and other protocols (FC, SAS, SATA). Over 1200 Experts are available to identify flaws and performance behaviors across these protocols, as well as to graph captured data according to over 1800 metrics and analyze most of the "shall" statements documented in the FCIP/iFCP and iSCSI specifications.
7. Xgig Expert's re-aligned PDU output guarantees complete decodes for every segment of data, extending powerful debugging capabilities to TraceView.
8. Sophisticated algorithms correctly identify iSCSI packet headers, resulting in substantially reduced incorrect decodes for iSCSI headers based on matches of SCSI data.

Test & Measurement Regional Sales

NORTH AMERICA
TEL: 1 888 746 6484
sales-snt@jdsu.com

ASIA PACIFIC
apacsales-snt@jdsu.com

EMEA
emeasales-snt@jdsu.com

WEBSITE: www.jdsu.com/snt