Medusa Labs Training

Serial Attached SCSI (SAS) 2.0 Protocol

Serial Attached SCSI Protocol (formerly ML270) — Based on the latest SAS 2.0!

Come investigate the inner workings of the SAS protocol, the latest high speed Storage Area Networking (SAN) technology.

Get concrete, detailed answers to your questions: how does speed negotiation work? What is an Expander? How does a Host find an Expander? How does routing work in a SAS environment? How does SAS handle Serial ATA (SATA)? What's new and different in SAS 2.0? You'll learn all these things and more in Medusa Labs' comprehensive SAS Protocol training.

Based on the latest SAS 2.0 standards documents and the latest real world test findings from Medusa Labs Testing Services, our SAS Protocol training covers 6G SAS and legacy data rates. And, each Medusa Labs' protocol class includes lab time.

Our classes are designed for engineering-minded individuals such as test engineers, design engineers, technical product/field support, and SAN administrators who address low-level protocol issues.

Cource Outline - 3 Days

- Fundamental Elements of SAS
- SAS PHY Reset & Opening Connections
- Expanders & SAS Management Protocol
- SAS SCSI Protocol Transport Layer
- SAS SATA Tunneling Protocol Transport Layer

What to expect from a Medusa Labs' class

- Never pay extra to look at trace captures
- Includes insight into the standard based on our real world testing experience.
- Learn from experts with over 10 years of experience in storage and networking.

Medusa Labs

JDSU Medusa Labs is a leading provider of testing & training services. We focus on Server, Storage, and Networking interfaces and protocols. Our engineers & trainers are experts in SAS, SCSI, RAID, iSCSI, SATA, SAS, and FCoE.

Medusa Labs' engineers helped develop some of the industry's key technologies and continue to have a vigorous passion for improving products and sharing their knowledge. This experience and enthusiasm translate into the highest quality testing and training services possible.

We further set ourselves apart by bringing the lab to the classroom through the use of JDSU Xgig® analyzers in every class.

Fundamental Elements of SAS

This section identifies the basic features of and the premises upon which SAS technology has been designed. SAS-specific objects and terminology are defined. Upon completion students are able to:

- Identify the basic features of SAS.
- Identify the physical options for a SAS configuration.
- Identify the basic role of each SAS layer.
- Define key SAS concepts and components such as PHY, Port, End Device, Expander, etc.
- Describe the structure of a SAS Address.
- Identify the format of a SAS Primitive.
- Identify the three transport layer types available in SAS.

Lab time included in every Medusa Labs' class!

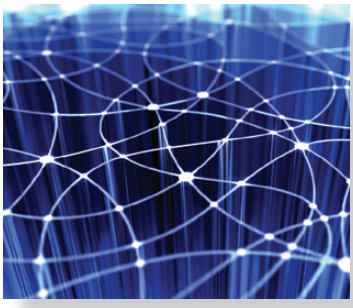
SAS PHY Layer – PHY Reset and Open

This section discusses the PHY Layer processes involved in initializing a SAS link. Trace analysis is used to investigate the out-of-band signals and frames used for identification of SAS devices and speed negotiation. Upon completion students are able to:

- Describe how SAS out-of-band signaling works
- Identify the process for speed negotiation including the SAS 2.0 updates to SNW-3.
- Describe the use of the Training phase of initialization.
- Describe the contents of the Identify frame.
- Explain what happens when an Identify frame is not received in a timely manner.
- Describe the use of the Open frame.

SAS Management Protocol (SMP) and Expanders

This section examines SMP and its relationship to SAS Expanders. Trace analysis is used to further examine how to determine topology and routing using SAS SMP tasks. Upon completion students are able to::



- Identify how to setup an SMP connection.
- Explain the unique flow control and acknowledgement characteristics of an SMP connection.
- Describe the discovery process facilitated in SAS.
- Identify how to determine the properties of Expanders.
- Determine the network topology from SMP query functions.
- Describe how to read the routing tables of an expander including the new SAS 2.0 option.
- Describe how to write (build) the routing tables of an expander including the options for which device performs the build.
- Describe how routing is carried out between SAS PHYs when an Expander is present.
- Define the different uses of the Arbitration In Progress (AIP) primitives.

Outlines are fully customizable for private classes!

SAS SCSI Protocol (SSP) Transport Layer

This section details SAS SCSI Protocol functionality which includes how SAS maps SCSI IO. Trace analysis is used to investigate the processing of SCSI commands through SAS. Upon completion students are able to:

- Identify the frame formats and primitives used for SSP communications.
- Describe the sequence of Information Units (IU) used to execute a SCSI command.
- Describe how connections are managed during SCSI command processing.
- Identify how an SSP connection is created.
- Identify how flow control is managed (R_RDY).
- Describe how guaranteed delivery is handled (ACK/NAK).
- Identify how to match an SSP frame to a specific SCSI IO.
- Describe how transport errors are handled for SSP.

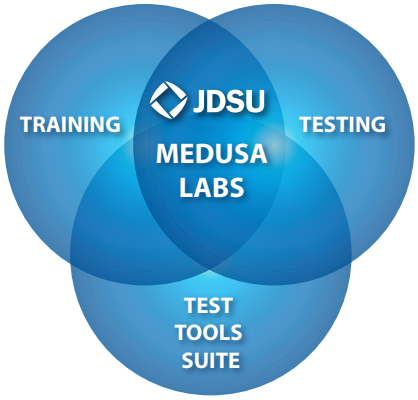
SATA Tunneling Protocol Transport Layer

This section discusses the SAS SATA tunneling protocol functionality. Trace analysis is used to investigate the proper handling of SATA through SAS. Upon completion students are able to:

- Describe how the SATA initialization works. Describe how it differs from SAS initialization.
- Characterize the role of the SAS Expander in an STP connection.
- Describe how to create and manage an STP connection.
- Identify the key difference between SAS primitives and SATA primitives.

JDSU Xgig® Analyzers

Medusa Labs was the first training company to recognize the importance of using test analysis equipment in the classroom. Today we insist that not only the instructor but also the students use analyzer software during class. We believe there is no better way to reinforce the concepts discussed in a lecture than by "seeing" them in a trace capture. Using the JDSU Xgig Analyzer, we'll show you how the protocol works. Whether onsite at your location, or at one of our own facilities, every Core Training course given by Medusa Labs includes lab time.



Medusa Labs testing

Medusa Labs Testing Services tests customers' products quickly and thoroughly in an enterprise environment to ensure that products will survive the rigorous demands of mission-critical applications. Customers come to us for our fast turnaround, superior analysis, excellent results, competitive prices, and, of course, 100% confidentiality. We work hand-in-hand with our customers' engineers to provide solutions, not just information. We provide not only the results of our tests, but also the debug, analysis, and regression test that is needed to ensure that the products we test perform as expected— not by our customers, but by your customers.

Medusa Labs Test Tool Suite

JDSU Medusa Labs brings its years of hands-on expertise and knowledge in the test and validation arena and puts it directly into the Medusa Labs Test Tool Suite. Medusa Labs Test Tool Suite was specifically designed to find elusive data corruptions, I/O timeouts, I/O loss, system lockup scenarios, and data integrity susceptibility. The tools are rich in debug and logging information to allow for rapid analysis of any found issues. They are designed to stress hardware and signal integrity and function on Linux, Solaris, and Windows so that familiarity on one platform leads to familiarity on all others. The suite was designed specifically for engineers that work with DVT, validation, bring-up, design validation, and Quality Assurance.

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