

# Bus Analyzer Module User Guide

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# Introduction

BAM is a versatile tool used which can capture, display, and analyze trace data from I/O operations sent to storage peripherals. BAM can work with any type of storage interface such as SCSI, Fibre Channel, iSCSI, SAS, ATA, and SATA.

BAM is a software level bus analyzer, which in many cases can serve the same purpose as a hardware based bus or protocol analyzer. It provides a trace view of I/O captured within the operating system. As such it cannot be used to view detailed phase or timing information, but it can provide an accurate trace overview with incredibly detailed trace information.

BAM is perfect for viewing commands and data sent between your host computer and your storage devices. It can help you quickly determine if the commands you think are being sent are indeed, as well as confirming that your storage device is responding as expected.

It's highly accurate phase timing can be used to directly measure inter-command latency as well as data throughput and I/O's per second. And its real-time performance display gives you at-a-glance confirmation of command queue depth achieved.

Post capture analysis shows percentage of bus bandwidth being used, performance statistics, and detailed command mix information.

Programmers at SCSItoolbox use BAM daily to confirm that tests are actually sending the commands that we think we are sending, and for troubleshooting strange device behavior. We also use it for driver testing – to test performance as well as regression testing.

BAM utilizes a filter driver to intercept I/O information as it passes between the I/O Subsystem driver layer and the mini-port driver level – as illustrated here:



# **Starting BAM**

# From the desktop icon

When you install the SCSItoolbox Suite it will place an icon for BAM on your desktop. To start BAM simple double-click on this icon



# From within STB32

You can also launch BAM from within SCSItoolbox32 by clicking on the top menu Bus Analyzer choice as show here:

SCSI Toolbox32		
File Adapter Options Disk Tape Jukebox ATA Commands	SAF-TE / SEP Advanced Tests Bus Resets Bus Analy	zer Buffer Scripts and Sequences Help
Scan Bus Scan System   Target 0: Not Available Target 1: Not Available   Target 1: Not Available Target 2: Not Available   Target 3: Not Available Target 3: Not Available   Target 4: MAXTOR_ATLAS10K5_73SCA Version GVYV Capacity = 71833 MB   Target 5: Not Available Target 5: Not Available   Target 6: SUPER_GEM318 Version 0   Unknown Capacity Target 7: adpu160m   ROAPPT TARGET 7: ADPUTATION	LUN Print Reports Safe Error Logging : Click i File Star Type None Clear File View File Log Performance Data Send "A" to COM1: on Error	this top choice to t BAM
	Read Capacity	

# **The BAM User Interface**

The main screen of BAM is shown below - in this section we will discuss how to :

- Select a device to monitor
- Select which phases to capture
- Select which phases to display on the screen
- Switch between Capture and Performance mode
- Specify a trace buffer size
- Specify how much data per I/O to capture
- Start and stop a capture

Later sections of this manual will describe how to display and analyze the data that you captured.

# **The Main BAM Screen**

Once you launch BAM you will see the screen below. You will first need to select a device to capture trace data from.



# Selecting Device(s) to monitor

Use the Device icon to select what devices you wish to monitor. Note – in Performance Mode you are only allowed to select one device. Also, if you are planning to record the I/O session for later playback with the SCSItoolbox 32 CDB Sequencer you will also want to select only one device.



Otherwise you may select as many devices as you wish to monitor

#### The Device Selection menu

The Drive Selection Menu displays all adapters and devices on your system.

			к
HBA 0: Primary IDE Channel	~	Car	ncel
HBA 0: Bus 0: Target 0: Lup 0: TSSTcorp CD/DVDW TS-H652L			
HBA 1: Secondary IDE Channel			
HBA 2: Primary IDE Channel			
HBA 2: Bus 0: Target 0: Lup 0: WDC WD5000KS-00MNB0			
HBA 3: Secondary IDE Channel			
HBA 4: Primary IDE Channel			
HBA 5: Secondary IDE Channel			
HBA 6: Adaptec SCSI Card 29160 - Ultra160 SCSI			
HBA 6: Bus 0: Target 0: Lun 0: HITACHI DK32CJ-18MC			
HBA 6: Bus 0: Target 1: Lun 0: SEAGATE ST34572WC			
HBA 6: Bus 0: Target 2: Lun 0: FUJITSU MAN3184MC			
HBA 6: Bus 0: Target 3: Lun 0: SEAGATE ST34572WC			
THRA & Due Or Target & Lup Or MANTOD ATLACIONE 7200A	×		

BAM can monitor all types of storage devices on your system – ATA, SATA, SCSI, FC, iSCSI, and SAS, The examples below show various different types of interfaces and devices that BAM has discovered.





Important point – all storage device types SCSI, FC, ATA, SATA, iSCSI, SAS can be monitored with BAM!

To select the device(s) to monitor simple click the checkbox next to the device.

Devices	
Devices    HBA 1: Secondary IDE Channel   HBA 2: Primary IDE Channel   HBA 2: Bus 0: Target 0: Lun 0: WDC WD5000KS-00MNB0   HBA 3: Secondary IDE Channel   HBA 4: Primary IDE Channel   HBA 5: Secondary IDE Channel   HBA 5: Secondary IDE Channel   HBA 6: Adaptec SCSI Card 29160 - Ultra160 SCSI   HBA 6: Bus 0: Target 0: Lun 0: HITACHI DK32CI-18MC   HBA 6: Bus 0: Target 1: Lun 0: SEAGATE ST34572WC   HBA 6: Bus 0: Target 2: Lun 0: FUJITSU MAN3184MC   + 3: Lun 0: SEAGATE ST34572WC	OK Cancel
Click the checkbox next to a device to select that device	

#### **The Phase Selection Menu**

There are several types of phases that can be captured with BAM, from high-level phases such as CDB and DATA-IN DATA-OUT, down to low-level driver SRB phases. A complete command nexus will consist of at least a CDB phase, possibly a DATA IN or OUT phase, and possibly an OK phase if there is not data phase. We recommend you select these phases as a minimum.

We also suggest always leaving the Bus Reset phase choice selected – it can be very informative to see a bus reset occur when you are not expecting it.

Unless you are doing device driver level testing we do not recommend that you select the Spt, SRB, IRP or NT Status phases.



#### Typical Phase Setup for SCSI capture



#### Typical Phase Setup for ATA capture



#### Typical Phase Setup for Driver test capture



#### **Display column setup**

You can decide what columns you want to be displayed in the main screen, and what order they will be displayed.



#### Switch mode selection

There are two capture modes – Performance Mode does minimal screen I/O to insure that bus throughput is not compromised. In this mode only one devices I/O can be captured at a time.

Capture Mode displays all I/O in real-time as the capture progresses, and in this mode you can capture I/O data for many devices at a time.



#### Setting Capture Buffer Size and Data Size per I/O

You may specify the overall size of the BAM capture buffer, and also the maximum number of bytes of data.

Set the Data Size to be as large as the largest data transfer you will encounter. For working with normal captures a setting of 32 bytes should be sufficient. I you want to capture read and write data to disk you should set this to at least the block size of the disk – the default size is 512 bytes.

The size you set will directly influence the size of saved trace and CDB Sequencer files that you may create.



### Starting a trace capture

Now that you have set up all parameters to your liking it is time to actually capture trace data. To do this click the green arrow icon to start the capture. Use the red stop icon to stop the capture.



### Stopping a trace capture

BAM by SCSI Toolbox, LLC -												
File Edit View Filters Help												
Ctr Device Prase Type CDB Desc	Data	Data Length	Delta	Date	Driver	Cap Size (MB)						
0 6:0:0:0 CDB Inquire 12:00:00 0	0 00	6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32						
1 6:0:0:0 Click on the Red Stop icon to stop a trace capture	B 00 01 3E 48 49 54 41 43 48 49 20	128 Bytes	602 us	06/28/2007 09:54:08		Data Size 512 Sort by Nexus						

# Explanation of captured data columns

# **The Device Column**

The device address associated with this phase is displayed as ha:bus:target:lun

Í	el B	AM by S	SCSI Toolbox,	, LLC -			-				$\mathbf{X}$
Ca	File	Edit Vie	ew Filters He	lp							
	Ctr	Device	Phase Type	CDB Desc	Data	Data Length	Delta	Date	Driver	Cap Size (MB)	^
e	0	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00	6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32	
	1	6:0:0:0	Data In		00 00 03 02 8B 00 01 3E 48 49 54 41 43 48 49 20	128 Bytes	602 us	06/28/2007 09:54:08		Data Size	
¢	512										
	The Device Column displays the device										
¢			ha:bus	:target:lun						Sort by Nexus	
1											
ĥ											
											~
		Performar	ce Monitore I I-		famatian Ì Dau Data Ì Taran Bafamanan Arabai	Luo auru					-
		renotitiai		idividual I/O Ir		s   1/O Statisti	cs				

# The Phase Type Column

The type of this phase is shown here, such as CDB, SRB, OK, Data In, Data out, etc. Depend on which phases you set for capture.

	<b>()</b>	AM by S	SCSI Toolbox,	, LLC -							
la	File	Edit Vie	ew Filters He	lp							
	Ctr	Device	Phase Type	CDB Desc	Data	Data Length	Delta	Date	Driver	Cap Size (MB)	<b>^</b>
e	0	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00	6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32	
	1	6:0:0:0	Data In		00 00 03 02 8B 00 01 3E 48 49 54 41 43 48 49 20	128 Bytes	602 us	06/28/2007 09:54:08		Data Size	
¢										512	
			(								
c				captured in	e Type column describes what phase has been n this row. In this example the first row is a CI	DB					_
Ì				phase,	the second row is a Data in phase which is associated with the preceeding CDB					Nexus	
				_							
)r Pr											
											~
		Performar	nce Monitors   In	ndividual I/O Ir	nformation Raw Data Trace Performance Analysis	i   I/O Statisti	cs				

# The CDB Description column

The text name of the CDB is displayed here, based on the op code of the CDB data

1	🖼 B/	AM by S	CSI Toolbox	. LLC -					•		
la	File I	Edit Vie	ew Filters He	lp							
	Ctr	Device	Phase Type	CDB Desc	Data	Data Length	Delta	Date	Driver	Cap Size (MB)	^
e	0	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00	6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32	
	1	6:0:0:0	Data In		00 00 03 02 8B 00 01 3E 48 49 54 41 43 48 49 20	128 Bytes	602 us	06/28/2007 09:54:08		Data Size	
c C				The C CDB	DB Description column interprets the op code - in this case op code 0x12 is an INQUIRY com	e of the Immand	)			Sort by Nexus	
	F	Performar	nce Monitors   Ir	ndividual I/O li	nformation   Raw Data   Trace Performance Analysis	s   I/O Statisti	cs				-

### **The Data Column**

Data associated with the phase type will be displayed here. In the case of this example the first row data is the CDB data, the second row data is Data In phase data. This data will depend on the phase type – CDB, SRB, ATA, Data In, Data Out, etc.

Í	<b>S</b>	BAM by S	SCSI Toolbox,	, LLC -								
la	File	Edit Vie	ew Filters He	lp								
	Ct	Device	Phase Type	CDB Desc	Data	Data Length	Delta	Date	Driver	Cap Size (MB)	<b>^</b>	
e	0	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00	6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32		
	1	6:0:0:0	Data In		00 00 03 02 8B 00 01 3E 48 49 54 41 43 48 49 20	128 Bytes	602 us	06/28/2007 09:54:08		Data Size		
c C	The Data Column displays the data that was captured in each phase. In this case the first row data is the data that makes up the CDB. In the second row the data is the actual data in associated with the preceeding CDB											
											<b>•</b>	
		Performance Monitors   Individual I/O Information   Raw Data   Trace Performance Analysis   I/O Statistics										

Note that more detail is available by using the *Individual I/O Information* tab, which will be explained later.

# The Data Length column



The actual number of bytes transferred in the phase is displayed here

# The Delta Time column

The time delta between this phase and the previous phase is displayed here.

Í	۲	AM by S	SCSI Toolbox	, LLC -									
Ca	File	Edit Vie	ew Filters He	lp									
	Ctr	Device	Phase Type	CDB Desc		Data	Data Length	Delta	Date	Driver	Can	Size (MB)	^
e	0	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00		6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32		
	1	6:0:0:0	Data In		00 00 03 02 8B 00 01	3E 48 49 54 41 43 48 49	20 128 Bytes	602 us	06/28/2007 09:54:08		Data	Size	
c C	The Delta column displays the amount of time that has passed since the preceeding phase												
													<b>V</b>
		Performar	nce Monitors   Ir	ndividual I/O li	nformation Raw Data	Trace Performance Ana	lysis   I/O Statist	ics					<u> </u>

# **The Date Column**

A time/date stamp is displayed here

	S) B	AM by S	CSI Toolbox,	LLC -								
a	File	Edit Vie	w Filters He	p								
				S 🕻								
	Ctr	Device	Phase Type	CDB Desc		Data	Data Length	Delta	Date	Driver	Cap Size (MB)	<b>^</b>
e	0	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00		6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32	
	1	6:0:0:0	Data In		00 00 03 02 8B 00 01	3E 48 49 54 41 43 48 49 20	128 Bytes	602 us	06/28/2007 09:54:08		Data Size	
c Ç Dr							The Date sho	Column d	displays a time/date st n this phase occurred	amp	Sort by Nexus	
	[	Performar	ice Monitors   In	dividual I/O Ir	nformation   Raw Data	Trace Performance Analysis	I/O Statisti	cs				-

# **The Driver Column**

The name of the Windows driver that generated this I/O is displayed here. This can be very useful to see if the I/O came from a source that you expected it to come from, or is the I/O and "intrusion" by another driver such as plug and play, or a device status monitoring application.

1	s) (	BAM by S	SCSI Toolbox,	, LLC -							
Ca	File	Edit Vie	w Filters He	lp							
				<u>ې</u> ک							
	Ctr	Device	Phase Type	CDB Desc	Data	Data Length	Delta	Date	Driver	Cap Size (MB)	<u>^</u>
e	0	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00	6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32	
	1	6:0:0:0	Data In		00 00 03 02 8B 00 01 3E 48 49 54 41 43 48 4	19 20 128 Bytes	602 us	06/28/2007 09:54:08	7	Data Size	
c C							The I issue SC	Driver Column shows v ed this I/O. In this cas Sltoolbox STS driver is commar	what Wind e we can so issued this h nd	ows driver ee that the INQUIRY	
											~
		Performar	nce Monitors   In	ndividual I/O Ir	nformation   Raw Data   Trace Performance Ar	nalysis   I/O Statist	ics				-

### Sort by Time or Sort by Nexus

You can choose to sort the contents of the trace data window either by time (default) or by nexus. Sorting by nexus can be useful when tracing commands and data phases when command tag queuing has occurred.

S B	AM by S	CSI Toolbox	, LLC -						
File	Edit Vie	w Filters He	lp						
			<u>چ</u> ک						
Ctr	Device	Phase Type	CDB Desc	Data	Data Length	Delta	Date	Driver	Cap Size (MB)
0	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00	6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32
1	6:0:0:0	Data In		00 00 03 02 8B 00 01 3E 48 49 54 41 43 48 49 20	128 Bytes	602 us	06/28/2007 09:54:08		Data Size
				TI	he <i>Sort By</i> B Sorting my N C	utton lets by eithe exus is us ommands	you choose to sort the r time or nexus. eful in analyzing trace have been queued.	e display es where	Sort by Nexus

# **The Pause Display button**

Clicking this button will pause scrolling of the trace data display while a trace capture is in progress.

	B	AM by S	SCSI Toolbox	, LLC -							
Fi	le	Edit Vie	ew Filters He	lp							
			~	<u>ې چ</u>							
	Ctr	Device	Phase Type	CDB Desc	Data	Data Length	Delta	Date	Driver	Cap Size (MB)	^
	0	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00	6 Bytes	13.2 sec	06/28/2007 09:54:08	stsclass	32	
	1	6:0:0:0	Data In		00 00 03 02 8B 00 01 3E 48 49 54 41 43 48 49 20	128 Bytes	602 us	06/28/2007 09:54:08		Data Size	
						The Pause	button let data d	s you pause screen dis uring a capture	splay of	Sort by Nexus	

# **The Lower Screen**

The lower section of the main BAM screen is used for real-time performance monitoring during capture, and for detailed post capture analysis.

2 File Edit View Filters Help   Image: Second Seco	1B) -
Stor   Stor <th< td=""><td>1B) -</td></th<>	1B) -
R   R   R   R   Cap Size (N     7792   6:0:0:0   Data Out   FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0   65536 Bytes   1.7 ms   06/28/2   32     7793   6:0:0:0   Data In   FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0   65536 Bytes   17.0 ms   06/28/2   Data Size     7794   6:0:0:0   Data In   FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0   65536 Bytes   17.0 ms   06/28/2   Data Size     7795   6:0:0:0   Data In   FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0   65536 Bytes   7.1 ms   06/28/2   11     7795   6:0:0:0   Data In   FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0   65536 Bytes   7.1 ms   06/28/2   11	1B) -
7792   6:0:0:0   Data Out   FF FE D FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0   65536 Bytes   1.7 ms   06/28/2   32     7793   6:0:0:0   CDB   Read (10)   28 00 00 03 CE 80 00 00 80 00   10 Bytes   70 us   06/28/2   Data Size     7793   6:0:0:0   Data In   FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0   65536 Bytes   17.0 ms   06/28/2   Data Size     7795   6:0:0:0   Data In   FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0   65536 Bytes   7.1 ms   06/28/2   512     7795   6:0:0:0   Data In   FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0   65536 Bytes   7.1 ms   06/28/2   11	-
7793 6.0:0:0 CDB Read (10) 28 00 00 03 CE 80 00 08 000 10 Bytes 70 us 06/28/2 Data Size   7794 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 17.0 ms 06/28/2 512   7795 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 7.1 ms 06/28/2 11   7796 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 7.1 ms 06/28/2 11	
c 7794 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 17.0 ms 06/28/2 512   7795 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 7.1 ms 06/28/2 111   7796 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 7.1 ms 06/28/2 111	_
7795 6:0:0: D Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 7.1 ms 06/28/2	-
7700 0.0.0 Dista la CE EE ED EO ED EA EO EO E7 E0 E5 E4 E0 E0 E1 E0 CE5500 Dista 2,2 ma 00/20/2	
1/30 0.0.0 Datam Prestore Branston Porter Bran	≣
7797 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 4.5 ms 06/28/2 Sort by Nexus	
7798 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 3.1 ms 06/28/2	1
7799 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Bytes 2.1 ms 06/28/2	
7 7800 6:0:0:0 Data In FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Butes 1.8 ms 06/28/2 ▼	
Performance Monitors Individual I/O Information Raw Data Trace Performance Analysis I/O Statistics	
1/0 Per Grand Terrafic Peter (MP (con) Ourus Death 1/0 Laterary (con)	
c	
293 29 20 74 220 366 22 37 15 25 55 92	
73 513 7 51 5 35 18 7129	
0 300 U 59 U 40 U 148	
N Ready RAM Status	

### **The Performance Monitors**

These speedometers show real-time performance information during a trace capture. The smaller blue pointers will record the highest value encountered, while the longer white arrow displays an average value.

Some things to note in this example:

- During this capture there was a maximum of 32 outstanding queued commands
- The highest (burst) data transfer rate was around 46 MB/sec, the average was 37 MB/sec
- The I/O latency the time between I/O's was fairly constant



# **Trace Performance Analysis**

This tab displays a summary analysis of the trace capture session. Number and type of commands, bus bandwidth utilization, etc.



# **General Statistics**

Number and type of commands, how much data was transferred in each direction, number of I/O's per second, bus bandwidth percentage, etc



#### **Performance statistics**

Data transfer rates for both directions, with average and high transfer rates. Low, Average, and High I/O inter-command latency, maximum queue depth, and number of incomplete commands in this capture.



#### Graphs

Command type mixture, phase mixture, and read and write transfer rates are graphed



### The I/O Statistics tab

A detailed report is collected for each device, showing number of commands, each command that was captured and how many of them occurred, plus transfer rate statistics.

If the trace contains data from multiple drives each drive will have it's own summary – just scroll down to see more.



Statistics for each device are shown – if multiple device data was captured this screen will scroll to show the summary for each device

# Individual I/O Information Tab

This tab lets you select a command from the trace data display and see a detailed description of the command.

					1		
16	6:0:0:0	CDB	Read Capacity	25 00 00 00 00 00 00 00 00 00	10 Bytes	208 us	06/28/2
17	6:0:0:0	Data In	~	02 26 E2 3F 00 00 02 00	8 Bytes	375 us	06/28/2
18	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00	6 Bytes	4.8 ms	06/28/2
19	6:0:0:0	Data In		00 00 03 02 8B 00 01 3E 48 49 54 41 43 48 49 20	128 Bytes	572 us	06/28/2
20	6:0:0:0	CDB	Inquiry	12 01 80 00 FF 00	6 Bytes	38 us	06/28/2
21	6:0:0:0	Data In		00 80 00 08 31 4C 32 31 31 33 34 38	12 Bytes	440 us	06/28/2
22	6:0:0:0	CDB	Write (10)	2A 00 00 00 00 00 00 00 80 00	10 Bytes	46.4 ms	06/28/2
23	6:0:0:0	CDB	Write (10)	2A 00 00 00 00 80 00 00 80 00	10 Bytes	107 us	06/28/2
24	6:0:0:0	CDB	Write (10)	2A 00 00 00 01 00 00 00 80 00	10 Bytes	77 us	06/28/2
•							•

Performance Monitors	Individual I/O Information	Raw Data Trace Perfo	omance	Analysis I/O Statistics
Originator: stsclass Device: 6:0:0:0 Operation Code: 25	Read Capacity		CDE Byte	3: 25 00 00 00 00 00 00 00 00 00 es Transferred: 10
Error Information — SRB Status: 01 Target Status: 00 Sense Data:		Sense Key: - Sense ASC: - Sense ASCO: -		The <i>Individual I/O Information</i> tab displays detailed information about the phase that is pointed to in the top section of the trace. CDB, Driver, and error information is interpreted.

# An example of a CHECK CONDITION

BA/	A by SC	SI Toolbox,	LLC -								
e Ed	dit View	Filters Help	)								
		-	چ 🗳 😂								
12	6:0:0:0	Data In		02 26 E2 3F 00 00 02 00	_	8 Bytes	376 us	Cap Size (MB)			
13	6:0:0:0	CDB	Service Action In(16)	9E 10 00 00 00 00 00 00 00 00	0 00 00 00 00 00 00 00 00	16 Bytes	28.3 ms	06/28/2 Data Size			
4	6:0:0:0	Data In		- 00 00 00 00 00 00 00 00 00 00	0 00 00 00 00 00 00 00	32 Bytes	8 us	06/28/2 512			
5	6:0:0:0	Sense		70 00 05 00 00 00 00 18 00	0 00 00 00 20 00 00 00	32 Bytes	3 us	06/28/2			
16 6.0.0. CDB Read Capacity 25 00 00 00 00 00 00 00 00 00 00 00 00 00											
17   6:0:0:0   Data In   02 26 E2 3F 00 00 02 00   8 Bytes   375 us   06/28/2   Sort by News											
18   6:0:0:0   CDB   Inquiry   12:00:00:00:80:00   6 Bytes   4.8 ms   06/28/2											
9	6:0:0:0	Data In		00 00 03 02 8B 00 01 3E 4	8 49 54 41 43 48 49 20	128 Bytes	572 us	06/28/2			
0	6:0:0:0	CDB	Inauiry	12 01 80 00 FF 00		6 Butes	38 us	06/28/2			
Pe	rformance	Monitors Inc	dividual I/O Information R	aw Data   Trace Performance A	Analysis   I/O Statistics						
0	)riginator:	stsclass		CDB:	9E 10 00 00 00 00 00 00 00 00 00 00	00 00 00 00 00					
0	peration (	Code: 9E	Service Action In(16)	bytes	s transferred: 16						
Г	Error Info	mation									
	SRB Stat	us: C4	Ser	nse Key: 05	Here is an example of a co	mmand that c	aused a CH	IECK CONDITION. Note the SRB			
	Target St	atus: 02	Ser	ise ASC: 20 ise ASCO: 00	and Target status, the Sen	se Key, ASC, ai terpretation o	nd ASCO ra f the SENSE	w information, along with an DATA			
	Sense Da	ata: . REQUEST	001								
	INVALID	COMMAND C	PERATION CODE								

When a CHECK CONDITION occurs you will see the error data details in this tab.

Note that error conditions are easy to find because they are displayed in RED

# The Raw Data Tab

🗐 B/	M by SC	SI Toolbox, L	LC -						- 🗆 🗙
File	Edit View	Filters Help							
		~ <	۹ 😂 🖾 ۹						
							•	Cap Size (MB)	^
18	6:0:0:0	CDB	Inquiry	12 00 00 00 80 00	6 Bytes	4.8 ms	06/28/2	32	
19	6:0:0:0	Data In		00 00 03 02 88 00 01 3E 48 49 54 41 43 48 49 20	128 Bytes	572 us	06/28/2	Data Size	
20	6:0:0:0	CDB	Inquiry	12 01 80 00 FF 00 🥂	6 Bytes	38 us	06/28/2	512	
21	6:0:0:0	Data In		00 80 00 08 31 4C 32 31 31 33 34 38	12 Bytes	440 us	06/28/2		
22	6:0:0:0	CDB	Write (10)	24 00 00 00 00 00 00 00 80 00	10 Bytes	46.4 ms	06/28/2		
23	6:0:0:0	CDB	Write (10)	24 00 00 00 00 80 00 00 80 00	10 Bytes	107 us	06/28/2	Sort by Nexus	
24	6:0:0:0	CDB	Write (10)	24 00 00 00 01 00 00 00 80 00	10 Bytes	77 us	06/28/2		
25	6:0:0:0	CDB	Write (10)	24 00 00 00 01 80 00 00 80 00	10 Bytes	77 us	06/28/2		
26 ◀	6:0:0:0	CDB	Write (10)	24, 00, 00, 00, 02, 00, 00, 00, 80, 00	10 Bytes	78 us	06/28/2 -		_
F	erformance	e Monitors   Indi	vidual I/O Information Raw	/ Data Trace Performance Analysis I/O Statistics					Ē
	0000	00.00.0	3 02 8B 00 01 3F	48 40 54 41 43 48 40 20 × NHTTAC	нт			1	
	0010	44 4B 3	3 32 43 4A 2D 31	38 4D 43 20 20 20 20 20 DK32CJ-18MC					
	0020	4A 36 4	1 36 31 4C 32 31	31 33 34 38 00 00 00 00 J6A61L211348.					
	0030	00 00 0	0 00 00 08 00 00	00 00 00 00 00 00 00	•••				
	0040	00 00 0							
	0060	43 6F 7	0 79 72 69 67 68	74 20 28 43 29 20 31 39 Copyright (C)	19				
	0070	39 39 2	0 48 69 74 61 63	68 69 20 41 6C 6C 20 72 99 Hitachi Al:	lr				
									<b>_</b>
Ready								BAM Status	

Click on a phase in the trace data display and see the raw numerical data in this tab

Note that the trace data displays truncates the amount of data seen – the Raw Data tab allows you to view all phase data, in this case 128 bytes of INQUIRY data

# **Filters**

Capture data may be filtered by Driver Name or by CDB Op Code.

In this example we will specify that we want to ignore any I/O generated by any driver identified as "unknown". Driver filtering is useful to filter out I/O from backup services, plug and play, etc

### **Filtering by Driver Name**

ir F	NSPENT	BAM	My Story		
S BAN	۸ by SC	SI Toolbox, L	-LC -		
File Ed	dit View	Filters Help			
			ا 💭 🤟		
					^
2893	6:0:0:0	CDB	Read (10)	28 00 00 01 65 80 00 00 80 00 10 Bytes 97 us 06/28/2007 10:21:03 stsclass 32	
2894	6:0:0:0	Data Out		FF FE FD FC FB FA F9 F8 F7 F6 F5 F4 F3 F2 F1 F0 65536 Byte 3.4 ms 06/28/2007 10:21:03 Data Size	
2895	6:0:0:0	Data Out		FF F Filter CDBs and Drivers	
2896	6:0:0:0	CDB	Read (10)	28 C Drivers to not capture	
2897	6:0:0:0	CDB	Read (10)	28 C Cancel B stsclass	
2898	6:0:0:0	Data Out		FF F Sort by Nexus	
2899	6:0:0:0	CDB	Read (10)	28 C Add Driver b ist	
2900	6:0:0:0	Data Out		FF F	
2901	6:0:0:0	Data Out		FF F Remove Driver from List	
<u> </u>					
Pe	formance	Monitors   Indi	vidual I/O Inform	ation CDBs to not capture	
I	0000	00 00 0	3 02 8B 00	01	
	0010	44 4B 3	3 32 43 42	2D	
	0020	4A 36 4	1 36 31 40 0 00 00 08	32 Add UDB to List	
	0040	00 00 0	0 00 00 00		
	0050	00 00 0	0 00 00 00	00	
	0060	43 6F 7	0 79 72 69	67 C1 Remove CDB from List	
	0070	33 33 Z	0 10 05 /1		
1					

Just enter the driver name and click Add Driver to List as highlighted above

# Filtering By CDB op code

Filtering CDB's is as easy as specifying the CDB op code that you wish to ignore – in the example below we have chosen to filter out TEST UNIT READY (op code 0x00) and INQUIRY (op code 0x12)

Filter CDBs and Drivers		
Drivers to not capture unknown Remove Driver from List	Add Driver to List	OK Cancel
CDBs to not capture	Add CDB to List	

# **Searching Trace Data**

Click on the Magnifying Glass icon to search through trace data.



For example, to search for a SENSE data phase, enter sense in the search for: box, then click the Magnifying Glass icon to search.

The trace data display will be positioned at the first occurrence of the search word. Click the Magnifying Glass icon to search for the next occurrence.

	BAM by	SCSI Toolbox	, LLC -						
File	Edit Vi	ew Filters He	lp						
		~	S 🔅						
c	tr Device	Phase Type	CDB Desc		Data	Data Length	Delta	Date 🔺 (	Cap Size (MB)
	0 6:0:0:0	Sense		70.00	05 00 00 00 00 18 00 00 00 00 24 00 00 C0	32 Bytes	4 us	06/28/2007 10:	32
1	1 6:0:0:0	CDB	Log Sense	4D 00	42 00 00 00 00 28 00 00	10 Bytes	4.7 ms	06/28/2007 10:	Data Size
1	2 6:0:0:0	Data In		02 00	00 54 00 00 20 08 00 00 00 00 00 00 00 00 00	88 Bytes	15.4 ms	06/28/2007 10:	512
1	3 6:0:0:0	CDB	Log Sense	4D 00	43 00 00 00 00 28 00 00	10 Bytes	1.5 ms	06/28/2007 10:	
1	4 6:0:0:0	Data In		03 00	00 54 00 00 20 08 00 00 00 00 00 00 00 00 00	88 Bytes	2.7 ms	06/28/2007 10:	
1	5 6:0:0:0	CDB	Inquiry	12 00	00 00 80 00	6 Bytes	3.5 ms	06/28/2007 10:	Sort by Nexus
1	6 6:0:0:0	Data In		00 00	Search Trace Data	×	558 us	06/28/2007 10: -	
1	7 6:0:0:0	CDB	Inquiry	12 01	Enter search term, then click the Search button - click Re	eturn when done	43 us	06/28/2007 10:	
	8 6:0:0:0	Data In		00 80	Search for:		438 us	06/28/2007 10	
-					sense			•	
					Return				_
	Performa	nce Monitors   Ir	ndividual I/O Informatio	on Ra	v Data   Trace Performance Analysis   1/O Statistics				

You can search for any data – in the example below we search for the sequence of bytes "00 00 03 02"

🗐 BAM	by SCSI Toolbox	s, LLC -								
File Edit	t View Filters He	elp								
		S 🔅	2 🔍 🚩							
Ctr De	vice Phase Type	CDB Desc		Data	Data Length	Delta	Date 🔺	Cap Size (MB)	-	
16 6:0	):0:0 Data In		00 00 03 02 88 00 01	3E 48 49 54 41 43 48 49 20	128 Bytes	558 us	06/28/2007 10:	32		
17 6:0	0:0:0 CDB	Inquiry	12 01 80 00 20 00		6 Bytes	43 us	06/28/2007 10:	Data Size		
18 6:0	):0:0 Data In		00 80 00 08 31 4C 32	31 31 33 34 38	12 Bytes	438 us	06/28/2007 10:	512		
19 6:0	):0:0 CDB	Inquiry	12 01 C0 00 FF 00		6 Bytes	154 us	06/28/2007 10:			
20 6:0	):0:0 Data In		00 CO 00 14 02 00 04	4A 20 20 20 20 20 20 20 20 20	24 Bytes	460 us	06/28/2007 10:		=	
21 6:0	0:0:0 CDB	Inquiry	12 01 C1 00 FF 00		6 Bytes	133 us	06/28/2007 10:	Sort by Nexus		
22 6:0	):0:0 Data In		00 CO 00 14 02 00 04	4A 20 20 20 20 20 20 20 20 20	255 Bytes	4 us	06/28/2007 10:			
23 6:0	0:0:0 Sense		70 00 05 00 00 00 00	18 00 00 00 00 24 00 00 C0	32 Bytes	3 us	06/28/2007 10:			
24 6:0	0:00 CDB	Inquiry	12 01 C2 00 FF 00	Search Trace Data			28/2007 10	]		
				Enter search term, then click the Search	button - click Re	turn when do	one		<b>~</b>	
Deef	amanan Mantan I.			Search for:	[				-	
Pen	Performance Monitors   Individual I/O Information   Raw Data   Trace 00 00 03 02									
	I/O Per Secor	nd T	ransfer Rate (MB/sec)	Return						
	5		39	5		5				
	4	6	30 49	4 6	4		6			

# **The File Menu**

BAM by SCSI Toolbo	ox, LLC -								
File Edit View Filters	Help								
New Open Save	Ctrl+N Ctrl+O Ctrl+S								
Save to CDB Seq. File	Ctrl+C B Des	c Data	Data Length	Delta	Date 🔺	Cap Size (MB)			
Print	Ctrl+P efect (	10) 37 00 15 00 00 00 00 00 04 00	10 Bytes	5.6 sec	06/28/2007 10	32			
Print Preview Print Setup		00 15 1A E0	4 Bytes	151.5 ms	06/28/2007 10:	Data Size			
Recent File efect (10)		10) 37 00 0D 00 00 00 00 00 04 00	10 Bytes	174 us	06/28/2007 10:	512			
Exit		00 0D 00 00	4 Bytes	102.5 ms	06/28/2007 10:				
4 6:0:0:0 CDB	Inquiry	12 00 00 00 80 00	6 Bytes	5.9 ms	06/28/2007 10:				
5 6:0:0:0 Data In		00 00 03 02 8B 00 01 3E 48 49 54 41	43 48 49 20 128 Bytes	557 us	06/28/2007 10:	Sort by Nexus			
6 6:0:0:0 Data In		18 02 64 01 68 C1 6D 01 72 97 04 10	00 00 00 00 512 Bytes	68 us	06/28/2007 10:				
7 6:0:0:0 CDB	Inquiry	12 00 00 00 80 00	6 Bytes	61 us	06/28/2007 10:				
8 6:0:0:0 Data In ∢		00 00 03 02 8B 00 01 3E 48 49 54 41	43 48 49 20 128 Butes	532 us	06/28/2007 10: -				

Allows you to save a trace file, open a previously saved trace file, or save the capture session to be played back later using the SCSItoolbox32 CDB Sequencer.

Trace data will be saved with a default file extension of ".bam", and CDB Sequencer files will be saved with a default file extension of ".his"