Software Forge

Compliance Test Suite

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Introduction

The Compliance Test Suite (CTS) is an application and framework which provides for the development and execution of compliance tests. The current version of the test suite provides InfiniBand testing based on the Compliance and Interoperability Working Group (CIWG) InfiniBand Test Specification.

While InfiniBand is the first test suite available, the CTS framework is designed to allow development and execution of tests from any technology.

System Requirements

CentOS 6.5 or newer, Mellanox OFED 3.2-2.0.0 or newer.

Installation

Before you install a new version of CTS, please make sure you uninstall older versions.

- 1. Issue the command rpm -qa cts to check if you have any packages of CTS installed.
- 2. Once you have the results to step (1) above, remove older versions with the command (assume the above command returned cts-0.0.55-1.x86_64.rpm)
 - a. rpm -e cts-0.0.55-1.x86_64

After downloading the RPM, install it with the following command:

rpm -ivh cts-[version].x86_64.rpm

where "[version]" is the build version of the CTS RPM package you just downloaded. This command will install the binaries in /opt/compliance-test-suite.

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Setup

CTS *must* be installed on a server with a Mellanox HCA – this device will be known as the Tester. Please connect the Device Under Test (DUT) directly to this Tester. The DUT can be an HCA or a switch.

To execute CTS, type the following command in a terminal:

```
/opt/compliance-test-suite/cts
```

Whenever you run CTS, it will automatically load the IBTA Test Library. This library first discovers the local Test Server HCA which it will use to initiate and respond to messages sent to and received from the DUT. CTS utilizes two different methods to retrieve DUT information depending on the DUT type.

Licensing

CTS uses node-locked, expiring licenses. The application will not function without a license. When loading the application for the first time or any subsequent time without loading a license, you will be presented with the error dialog shown in Figure 1



FIGURE 1- LICENSING ERROR DIALOG

Clicking the "Continue" button will load CTS but features will be disabled until a valid license is loaded. You may select the "Start trial" option to start a 15 day trial during which time all of the CTS features will be available but they will be disabled again after the trial period has expired. You cannot start another trial on the same machine. Click on the "Load license" option to load the license inside the textbox shown in Figure 2 below.



File	Help			
Drag fi	le or paste l	icense text		

FIGURE 2 – LOADING THE LICENSE

Copy and paste the license file's text contents into the text area or drag and drop the license file from the system file explorer into the text area. Click apply to load the license. If the license is loaded successfully, a message will flash across the screen and full application functionality will be enabled. If the loading failed, an error dialog will be displayed. This window can also be opened via the Help→Load License menu (Figure 3).

Compliance Test Suite@sm-node-14		
File Results Help	/home/llk/software-forge/compliance-test-suite/LLK-Config.xml	
Settings Load License Display Help About	Compliance Test Suite	Software Forge

FIGURE 3—LOAD LICENSE FROM HELP MENU

HCA Discovery

If the DUT is an HCA, then CTS will attempt to retrieve device information as shown in Figure 4 via an SSH connection with the DUT server.



FIGURE 4 – DUT INFORMATION



For this reason, it is very important that the information you supply in the settings under DUT Server (Figure 7) is accurate.

Switch Discovery

If you are testing a switch, then the DUT Server information is not necessary. CTS will get the available DUT information through IB commands. In order for CTS to retrieve all DUT information from a switch you must fill out the Root Login on Tester field accurately. If you do not have this password you must enter the additional information manually before tests can be run.

If you switch devices, or, if for some reason, CTS has not automatically discovered the DUT, you can click on the **Query Device** button at the bottom left of the Device tab (see Figure 4).

When you start CTS and there is no link between the server where you are running CTS and the DUT, you will see something similar to the display in Figure 5.

		Compliance Test Suite (on SM-Node-10)	×
File Results Help		/home/llk/Projects/CTS/trunk/testsuite/LLK-config.	ml
Settings		Compliance Test Suit	e Software Forge
Device Selection Summary	Vendor & Tester	Current Test Results	
Tester	Vendor		Tester
Device: mlx4_0 👻	Company Name:	Mellanox Technologies Ltd	Name: Lloisten Kaonga
Port: 🗸 🗸	Address:	Hakidma 26	Email: Ilk@soft-forge.com
	Address 2:	Ofer Industrial Park	
DUT	City, State, Zip:	Yokneam, Israel,	
Type: null	Phone:	+972-74-723-7200	
Technology:	Contact:	Yoav Pais	
Device Information	Title:	Firmware Engineer	
Vendor:	Email:	yoavp@mellanox.com	
Board ID:			
GUID:			
Rate (Gb/s):			
Width:			
HW Version:			
FW Version:			
O/S Version:			
SW Version:			
Description:			
Course Device			
Query Device			

FIGURE 5 – NO LINK TO DUT

If you see this image, please double check that there is a link between the tester and the DUT and click the Query Device button. You may need to close CTS and restart it after you have established a link between the tester and the DUT.



Settings

Open up the settings by clicking on the blue settings gear icon or select **File**→**Settings** from the menu (Figure 6).



FIGURE 6 - OPEN SETTINGS BUTTON

You should then see the following dialog box (Figure 7) which shows the default logging selections.

Kan Settings@sm-node-14		
Logging C Enable Automat Log Folder: /home Failures: V Indiv Successes: I Indiv Warnings: V Indiv	ic Logging /Ilk/software-forge/compliance-test-: /idual Files Common File /idual Files Common File /idual Files Common File	Browse
Packet Capture Pass Fail Warning	Cancelled Critical Error	
DUT Server IP Address: User: Password:	10.20.0.226 root	
Root Login on Te	ings OK	Cancel

FIGURE 7 – SETTINGS WINDOW

- 1. Under the Logging section, highlighted in red
 - a. **Enable Automatic Logging** CTS will automatically log the test results if this option is selected. Both raw text and HTML log files will be generated.
 - b. **Log Folder** Specify the location of the base folder where the logs will be written. The logs will be saved to device-specific locations based on the **Device Information** under the **Device** tab.
 - c. Failures, Successes, and Warnings Select which log files should be created on test failure, success, or warning. Check Individual Files to log tests with this result in their own separate file. Select Common File to include the test results in a single common file. Please Note: if you execute many tests all at once, they will all appear in this common file. If you selected both Individual Files and Common File, then CTS will save individual test logs and a single log file containing all the tests you selected to execute. In the example shown in Figure 7, test passes, failures and warnings will be logged to individual files and there will be no common file. NAs and canceled tests will always automatically be logged to individual files, and to a common file if it



exists. Note that common files are only applicable to plain text logs and not HTML logs. By default, failures, successes and warning results are logged to individual files.

- 2. CTS has functionality to capture pcap files which you can open with Wireshark. You can set this under the **Packet Capture** section, highlighted in **blue** in Figure 7. You can choose for which test results you should capture traces. In the above example, CTS will capture traces for tests which fail, return a warning or a critical error.
- 3. Under the **DUT Server** section, highlighted in **green**, you must specify the IP Address, User name and Password of the remote DUT server. This is valid only when the DUT is an HCA. The information is used to perform an SSH connection to the server to obtain information about the DUT during device query.
- 4. Specify the root password under the **Root Login on Tester** section, highlighted in yellow. This is required when the DUT is a switch. It allows CTS to retrieve all of the DUT information.



Test Execution

Once the DUT has been discovered click the **Selection** tab to choose which tests you wish to run. Only the tests applicable to the device type (HCA or Switch) will be available. Information on the current selected test is visible on the "Current Test" tab.

		Compliance Test Suite (on SM-Node-10)	_ 0 X
File Results Help		/home/llk/Projects/CTS/trunk/testsuite/LLK-config.xml	
Settings		Compliance Test Suite	Software Forge
Device Selection Summary	Vendor & Te	Current Test Results	
Filters:	Test Name:	No M Key Checking	
✓ Automated	Number:	C14 015	
Interactive	ategories	Subat Management	
 All Tests 	The state goines.		
Management Model	Assertions:	VIC14-015#01, VIC14-015#02, VIC14-015#03, VIC14-028#01, VIC14-025#01, VIC14-028#02	
Subnet Management	Node:	AUTOMATED	
M Key Checking - SubpGet	Device Type:	CA, SWITCH	
M Key Checking - Subneet		Check that M_Key checking is not performed when PortInfo:M_Key is zero at a receiving port.	
M Key Lease Period Timer - I	Description:		
M_Key Lease Period Timer - I			
M_Key Lease Period Timer - I			
M_Key Lease Period Timer - I			
M_Key Lease Period Timer - I		Click this button to run the selected test	
M_Key Violation Counter		("No M_Key Checking" in this case)	
GUIDInfo			
PortInfo xCA - Part 1			
Portinfo xCA - Part 2			
Portinfo xCA - Part 3			
Portinfo xCA - Part 5			
Portinto LocalPortNum			
P_Key - Part 1			
SLIOVL Mapping - Part 1			
VI Arbitration - CA			

FIGURE 8 - RUN BUTTON

Click the green run button or select *Results* \rightarrow *Run Tests* from the menu to begin test execution. The **Results** tab will be displayed and show the current status and log of the running test. If there are any failures, you can navigate to those failures in the log by using the *Next* and *Previous* buttons at the top of the **Results** tab (see HTML Log Navigation). You can select and run any number of tests from the **Selection** tab.

Note: The **Device Information** section under the **Device** tab must be complete *before* you can run the tests. Without this information, CTS will not allow you to proceed and run the tests. You will see the following dialog box shown in Figure 9 instead.



FIGURE 9 – MISSING DUT INFORMATION WARNING

While tests are running, the **Summary** tab will display the test status as *Running*. During test execution, the test status may change to *Sleeping* to indicate that the test is waiting for a period of time as indicated by the most recent log message in the result tab. Once the test completes, the status will change to **Pass/Fail/NA/Warning** depending on the final test result. The **Results** tab will display the HTML test log (Figure 10). Notice that the **Results** tab displays device, vendor and tester information at the top of the page above the log information.

HTML Log Navigation

The HTML log for an executed test will be displayed in the **Results** tab and will also be saved to disk if individual logs have been enabled in the settings window. The HTML logs have three components: the blue header bar at the top of the page, the test/device/vendor/tester information tables, and the log table.



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The log table is paginated and so only a certain number of log messages will be displayed per page. You can navigate between log pages using the controls at the bottom of the HTML page as shown at the bottom of Figure 12. You can also configure the number of log messages displayed per page using the drop down menu above the log table shown on the left in Figure 10.

			Compliance 1	ſest Suite (on SM−N	ode-10)		
File Results Help			/home/IIk/Projects/C	TS/trunk/testsuite/Ll	LK-config.xml		
Settings	Vendo	or & Tastar Gur		nce Test	Suite		Software Forge
Name State	venuo	a rester curre	ent lest results				
SLToVL Mapping PASS	SLTo	SLToVL Mapping - Part 1					
							Bottom
			Test Information		Device Information	Vend	lor Information
		Name	SLToVL Mapping - Part 1	Туре	CA	Company Name	Mellanox Technologies Ltd
		Number	C14_024_08_01	Technology	InfiniBand	Address 1	Hakidma 26
		Categories	Subnet Management	Vendor	Mellanox Technologies	Address 2	Ofer Industrial Park
			v1c13-024#01 (cont), v1c14-	Board ID	MCX353A-FCBT	City/State/Zip	Yokneam, Israel,
		Assertions	024.1.1#08.01, v1c14-024.1.1#08.03, v1c14-024.1.1#08.04, v1c14-031#01	GUID	0002:c903:0042:6ec3	Phone	+972-74-723-7200
		Mode	AUTOMATED	Rate (Gb/s)	10	Contact	Yoav Pais
		Device Type	CA	Width	4X	Title	Firmware Engineer
			This test performs checks of	HW Version	0x1	Email	yoavp@mellanox.com
		Description	SLtoVLMappingTable attribute and	FW Version	2.36.5000		
		Description	are tests for both Read-Only (RO) and	OS Version	CentOS Linux release 7.2.1511 (Core)	Test	er Information
			Read-Write (RW) attribute components.	SW Version	OFED-internal-3.2-2.0.0	Name	llk@soft-forge.com
				Description	CW-HeadNode HCA-1	Email	LloIsten Kaonga
	Show	100 🔹 entrie	s				Filter:
		Description Result					
	Execu	ting test 'SLToVL M	Mapping - Part 1				
			Initialization				
	Creati	ing SubnGet Direct	cate is initialized, Armed or Active for both N Routed mad attr: Portinfo	and rester and D	JI.		
	>>>>	SubnGet(PortInfo) trid: 0x51D41FB3				
	<<<<	< SubnGetRespons	e(PortInfo) trid: 0x51D41FB3				

FIGURE 10 – HTML LOG CONTROLS

You can filter for keywords in the log table by typing into the filter text box above the log table as shown in the bottom right of Figure 10. For example, you can type *ASSERT* into the text box to only show the log messages for assertions.

The *Top/Bottom* buttons on the right side of the blue header bar and shown in the top right corner of Figure 10 can be used to navigate to the top or bottom of the HTML page.

If a test fails, the failure navigation controls will be displayed in the center of the blue header bar as shown in Figure 11. The controls will display the total number of failures in the test. The *Previous/Next* buttons can be used to navigate to failures within the log table. In Figure 11, there is one failure in test C14_017_01. Using the *Previous/Next* buttons shows that the assertion which checks the MKey Violations count is incorrect. The test expected **0x01** but the DUT returned **0x21**.

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		Compliance Test Suite (o	n SM-Node-10)			- • ×
File Results H	lelp	/home/llk/Projects/CTS/trunk/tes	tsuite/LLK-config.xml			
Settings	Results	Compliance To	est Suite		Softw	≫ vare Forge
Device Selection	Summary	Vendor & Tester Current Test Results				
Name	Status	M Key Lease Period Timer - Fa	ilure Navigation - 1 / 1 fails			Тор
M_Key Lease Perio	FAIL	Part 1	Previous Next			Bottom
		Show 50 - entries			Filter	Dottom
		Show but Penches	7		Filter:	
		De	escription			Result
		Step 4: SMP DATA = ReceiveMad(SubnGetResp(PortInfo))	\			
		<<<< SubnGetResponse(PortInfo) trid: 0x51D421BE				
		ASSERT IB_MAD_TRID_F Expected: '0x51D421BE' Actual: '0x51D421BE'				PASS
		Step 5: Verify SMP_DATA format:				
		ASSERT IB_PORT_MKEY_PROT_BITS_F Expected: '0x00' Actual: '0x02'		Use these buttons to navigate to the		FAIL
		ASSERT IB_PORT_MKEY_VIOL_F Expected: '0x01' Actual: '0x01'		failures in the log		PASS
		Resetting MKey = 0; ProtectBits = 0 and MKeyViolations = 0				
		Creating SubnGet Direct Routed mad attr: PortInfo				
		Setting IB_MAD_MKEY_F Old Value: 0x00000000 New Value: 0x1234567812345678				
		>>>> SubnGet(PortInfo) trid: 0x51D421BF				
		<<<< SubnGetResponse(PortInfo) trid: 0x51D421BF				
		ASSERT IB_MAD_TRID_F Expected: '0x51D421BF' Actual: '0x51D421BF'				PASS
		Creating SubnSet Direct Routed mad attr: PortInfo				
		Setting IB_PORT_PHYS_STATE_F Old Value: 0x00000005 New Value: 0x00000000				
		Setting IB_PORT_STATE_F Old Value: 0x00000003 New Value: 0x00000000				
		Setting IB_MAD_MKEY_F Old Value: 0x00000000 New Value: 0x1234567812345678				
		Setting IB_PORT_MKEY_F Old Value: 0x1234567812345678 New Value: 0x00000000				
		Setting IB_PORT_MKEY_PROT_BITS_F Old Value: 0x00000002 New Value: 0x00000000				
		Setting IB_PORT_MKEY_VIOL_F Old Value: 0x00000001 New Value: 0x00000000				
		>>>> SubnSet(PortInfo) trid: 0x51D421C0				
		<<<< SubnGetResponse(PortInfo) trid: 0x51D421C0				
		ASSERT IB_MAD_TRID_F Expected: '0x51D421C0' Actual: '0x51D421C0'				PASS
		ASSERT IB_MAD_STATUS_F Expected: '0x00' Actual: '0x00'				PASS
		Test Result:				FAIL
		Showing 51 to 74 of 74 entries		First Previous	1 2	Next Last

FIGURE 11 – HTML LOG FAILURE NAVIGATION

		Compliance Test Suite (on SM-Node-10)		-	n x
File Results	Help	/home/lik/Projects/CTS/krunk/testsuite/LLK-config.xml			
Settings	Results	Compliance Test Suite	Soft	» ware l	Forge
Device Selection	Summary	Vendor & Tester Current Test Results			
Name	Status				Тор 🤷
M_Key Lease Perio	FAIL	GUIDInfo		Be	ttom
	PASS Run Open Log Save Log	ASSERT IB_G1_GUID6_F Expected: '0xFFFFFFFFFFF Actual: '0xFFFFFFFFFFFFF ASSERT IB_G1_GUID6_T Expected: '0xFFFFFFFFFFFFF Actual: '0xFFFFFFFFFFFFF Step 21: SendMad (SubnGtGUIDInfo the: SoUDO0000 New Value: 0x00000002 >>>> SubnGtGUIDInfo thi: 0x51042098 Step 22: SMP_DATA = ReceiveMad (SubnGtRespIGUIDInfo) // v1c14-030#01 <<< <subngtgresponse(guidinfo 0x51042098<br="" thi:="">ASSERT IB_MAD_TRID_F Expected: '0x51042098 ASSERT IB_MAD_TRID_F Expected: '0x51042098' ASSERT IB_MAD_TRID_F Expected: '0x51042098' ASSERT IB_MAD_TRID_F Expected: '0x51042098' ASSERT IB_MAD_TRID_F Expected: '0x62' Actual: '0x6104209B' ASSERT IB_MAD_TRID_F Expected: '0x62' Actual: '0x00' ASSERT IB_MAD_TRID_F Expected: '0x67FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF</subngtgresponse(guidinfo>		PASS PASS PASS PASS PASS PASS PASS PASS	ittom
		Showing 101 to 200 of 1,518 entries First Previous 1 2 3 4 5	16	Next	Last

FIGURE 12 – HTML LOG PAGE NAVIGATION

After test execution has completed for all tests, you can click on a test in the summary page to display the HTML log for that test in the **Results** tab. You can save the log file of an executed test to a custom location by right clicking the test in the summary page and selecting *Save Log*. This functionality can be especially useful if you did not enable saving individual log files for a test result but would like to save the log file for a test which finished with that result after execution. In that same right click context menu, you can select the *Run* item to run the selected test and only that test. You can also open the selected test's log in an external browser by clicking the *Open Log* item.

As shown in Figure 13, you can either reload a results page or save it to a new html file by right clicking in the highlighted region and selecting the appropriate menu item.



	Compliance Test Suite (on SM-Node-10)	_ 0 ×
File Results Help	/home/lik/Projects/CTS/trunk/testsuite/LLK-config.xml	
Settings	Compliance Test Suite Software Current Test Results	>> vare Forge
Filters:	M_Key Checking - SubnSet	Top Bottom
All Tests Management Model	Show 100 • entries Filter:	Result
Subnet Management Mo M_Key Checking M, Key Checking - SubnGet M_Key Checking - SubnGet M_Key Lesse Period Timer - 1 M_Key Lesse Period Timer - 1	Executing test: M_Key Checking - SubnSet	PASS
GUIDInfo Portinfo xCA - Part 1 Portinfo xCA - Part 2 Portinfo xCA - Part 3 Portinfo xCA - Part 3 Portinfo xCA - Part 5 Portinfo LocalPortNum P_Key - Part 1 SLTöVL Mapping - Part 1 SLTöVL Mapping - Part 2	<<<< SubnGetResponse(Portinfo) trid: 0x510421A0'	PASS PASS PASS PASS
VI Arbitration - CA	Creating SubnGet Direct Routed mad attr: PortInfo >>>> SubnGet(PortInfn) trid: 0x51D421A4	

FIGURE 13 – RELOADING/SAVING HTML LOGS

Known Issues

- 1. CTS may function while connected to multiple DUTs. It is reccomended that when performing compliance testing you connect to only one DUT at a time and that the DUT is not connected to any other device. If you experience unexpected behavior during device query then you should restart the openibd drivers and simplify your IB fabric.
- 2. Device information for HCAs is gathered from two sources: directly from the connected DUT and from the DUT's host server via an SSH connection. To avoid displaying incorrect information, please make sure that the Tester HCA is connected directly to the DUT and that the SSH settings are set correctly for the DUT host server.
- 3. Device information automatically queried from switches is currently limited to device type, board ID, GUID, rate, width, and node description. Missing data can be added by manually typing into the associated text fields in the device information section of the device tab.
- 4. Device query returns the PSID of a DUT and posts that data to the Board ID field. If this PSID is listed in the device_lookup.xml file then the Board ID field will be updated with the model information of that DUT instead of the PSID.
- 5. You may see unusual DUT behavior such as the DUT not linking or CTS DUT discovery failing to display complete DUT information, etc. Rebooting the DUT may help cure this.