**Viavi PCI Express**

分析仪方案

**Ag So**

add a

ad

**Dy**

**Xgig1000**系列分析仪及模块



**16G FC/10G/40G**以太网一体式分析仪



**PCIe 3.0**一体式分析仪



**PCIe 4.0**一体式分析仪



**32G FC/25G**以太网一体式分析仪





**24G SAS** 一体式分析仪

**12G SAS**一体式分析仪



**Xgig 4000**系列**PCIe Gen4**分析仪

**Gen4x16**主机

#### 内存128G

* 支持速率 – 2.5 to 16 GT/s
* 支持带宽 – x1, x2, x4, x8 and x16

**Gen4x4**主机

#### 内存32G

* 支持速率 – 2.5 to 16 GT/s
* 支持带宽 – x1, x2, x4,





**Interposers**

* Add-in Card Interposer
* Server U.2 interposer
* CEM U.2 Interposer
* M.2 Interposer
* Fly lead
* OcuLink interposer
* 8674 interposer
* EDSFF interposer

##### M.2



**X16 AIC**

**Fly Lead**

**OcuLink**



**X8 AIC**

**U2-C**

**U2-S**



M.2 Card

Power

Custom cable and PCB

to M.2 host

LEDs

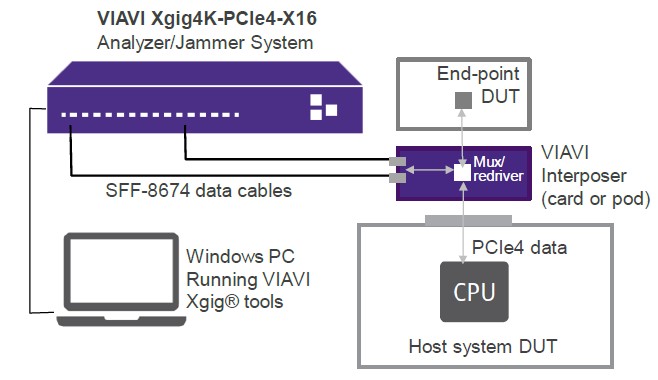
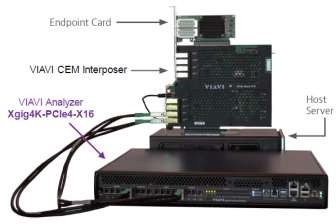
system

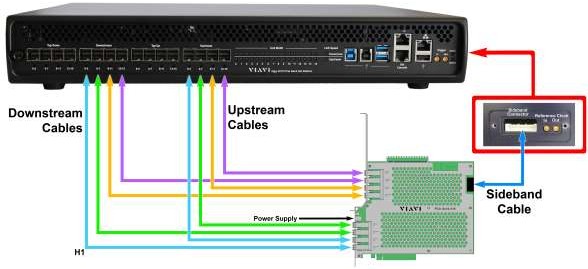
Sideband cable to analyzer

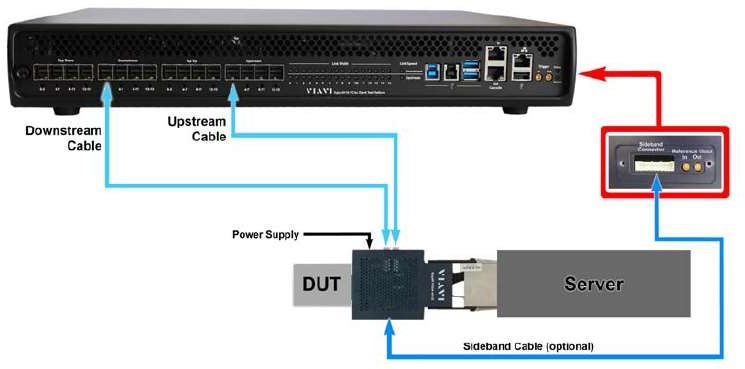
Analyzer data cable connectors

连接方法与操作步骤

需要在主板与DUT之间串接interposer Card,然后连接至分析仪。





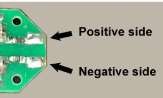
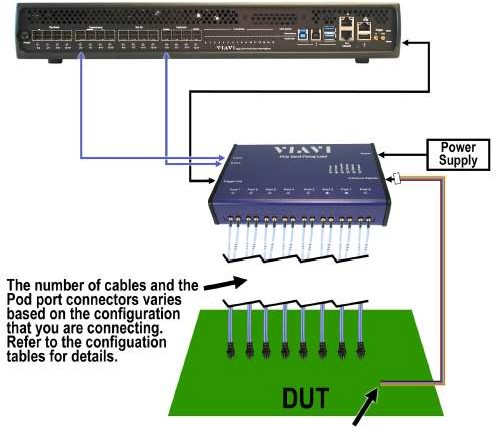


8639 U.2

Interposer连接方法

AIC

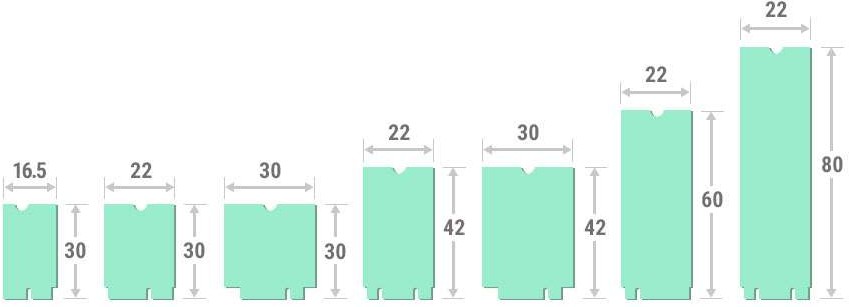
Interposer连接方法



10

支持的**M.2**接口类型

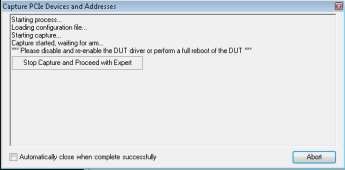
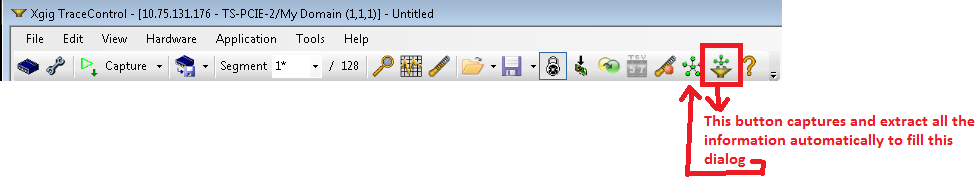
* 支持所有的M.2尺寸(including 22110 (22mm x 110mm), not shown)
* Simple break-away PCBA for insures good host system fit



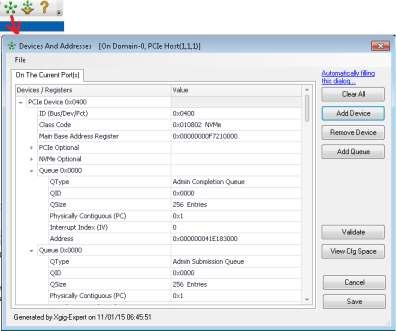
# Interposer - Notebook PC Application

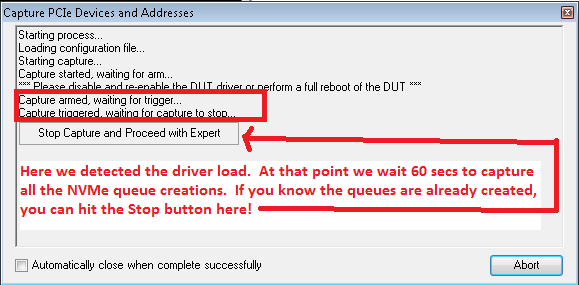


* + 1. 连接分析仪并锁定端口后，点击 Capture PCIe Device and Address

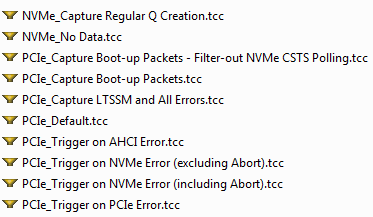


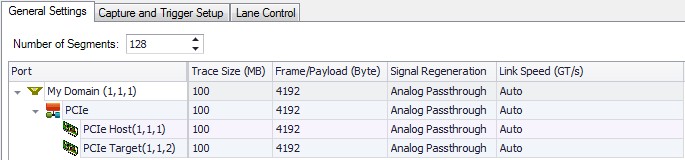
地址空间列表



* + 1. 重启或在资源管理器中Disable、Enable DUT



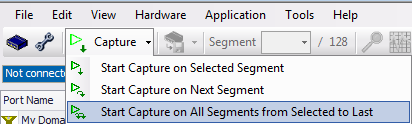
Trace Control内置了常用的捕获模板，可以直接使用。

什么是Segment？

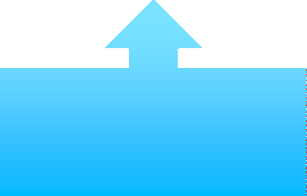
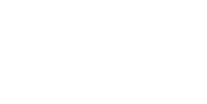
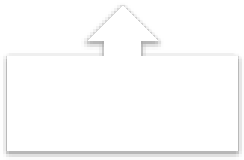
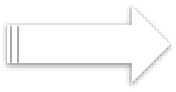
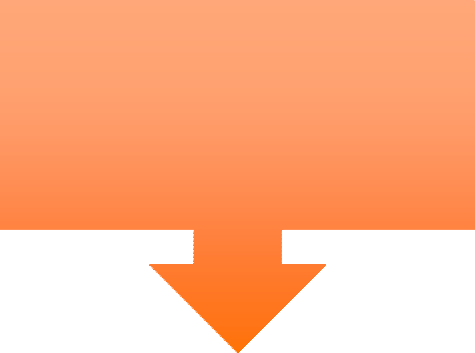
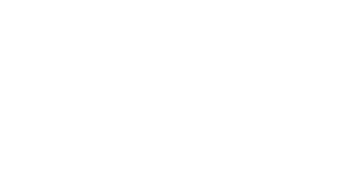
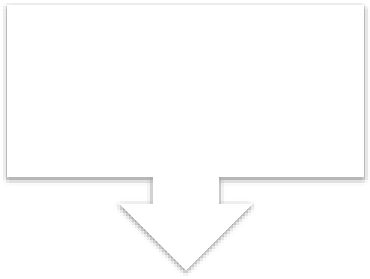
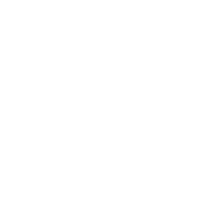
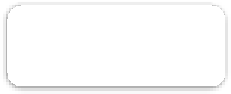
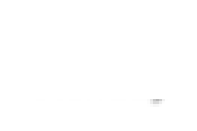
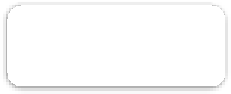
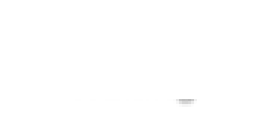
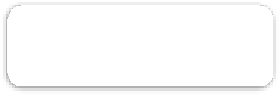
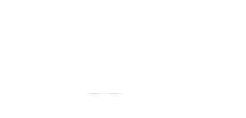
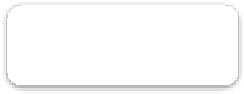
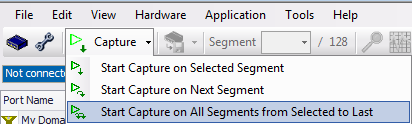
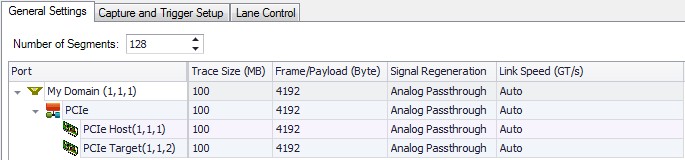
连续多

Segment触发

发



## 内存分段的多次触发支持



Capture move to next Segment

**Seg 1(500M)**

**Triggered**

##### Multiply Triggers

**Condition 1**

**Condition 2**

**… Condition 30**

##### Seg 2(500M)

**Waiting**

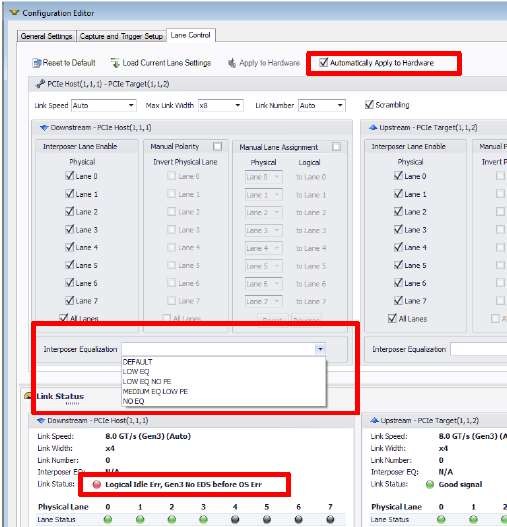
**64G Buffer**

…

**Seg 128 Standby**

**Condition 1**

**data**

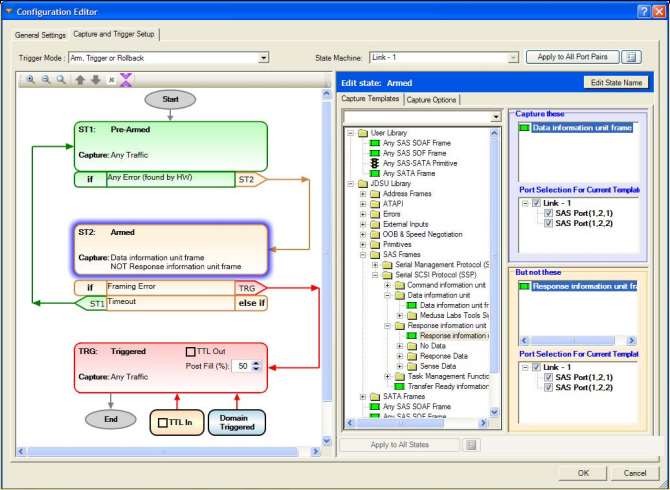


调整EQ

捕获模式

* Stop When Buffer is Full

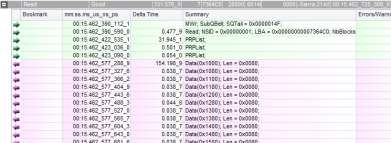
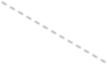
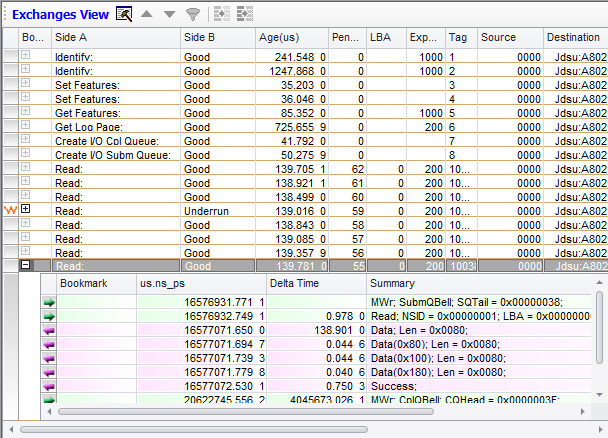
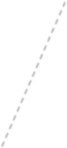
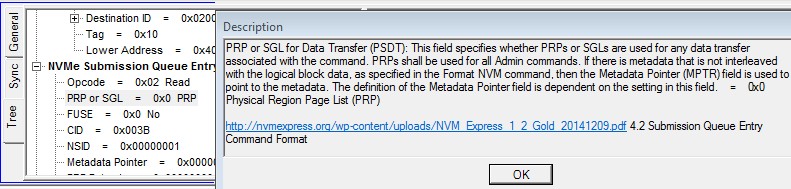
(preset trigger condition)



* Stop When Stop Button is Clicked (no trigger condition)
* Trigger (two-state triggering)
* Arm and Trigger (three- state triggering)
* Arm, Trigger or Rollback

(three-state triggering)

* Advanced (multi-state triggering)



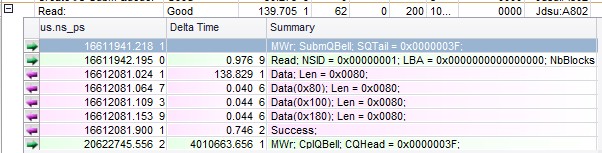
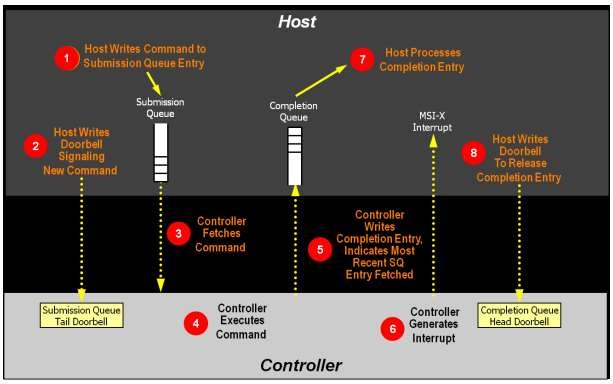
支持将所有的交互过程进行组合

分端口显示所有捕获数据， 并用颜色区分

提供帧的多种显示方

法，并支持所有字段

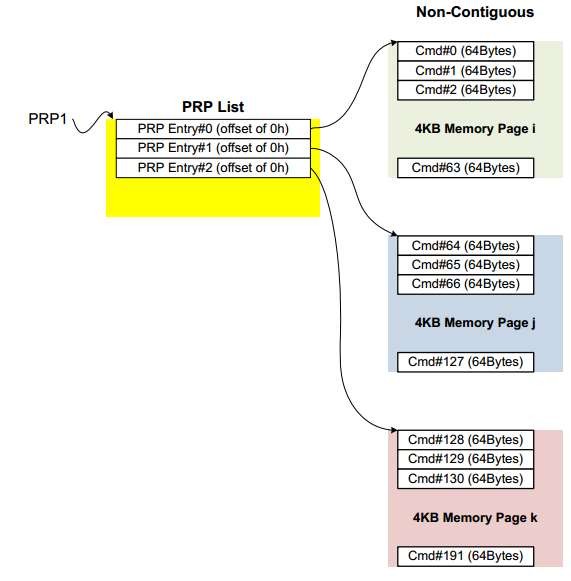
的详细解释

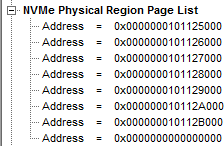


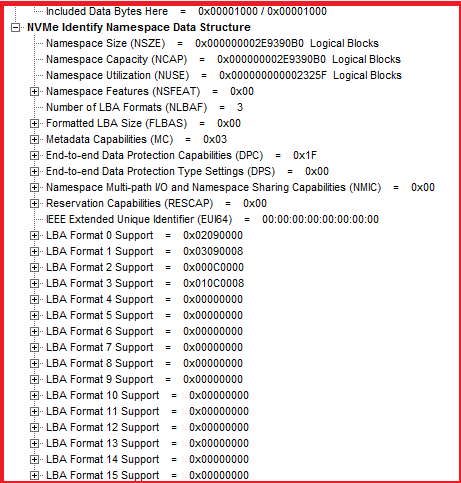
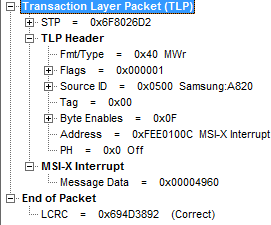
**Doorbell to**

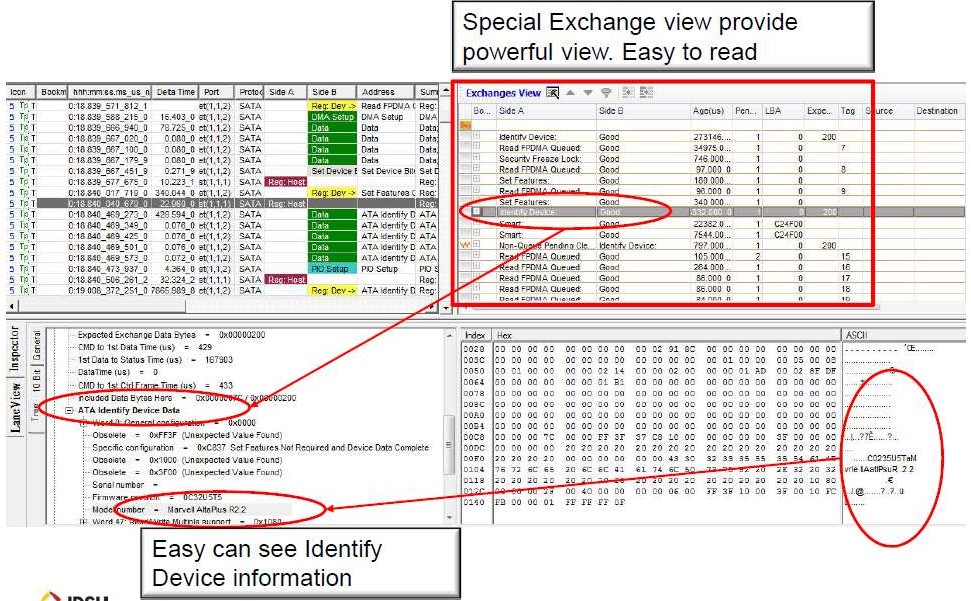
**Doorbell group**

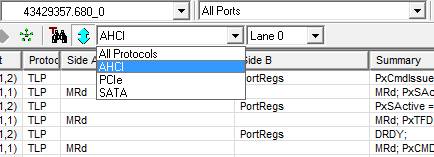
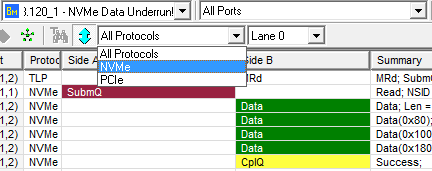
数据重组功能



**PRP List decode**

**MSI-X decode** 数据重组功能



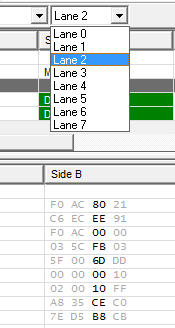
通过协议选择栏，选择查看的协议层

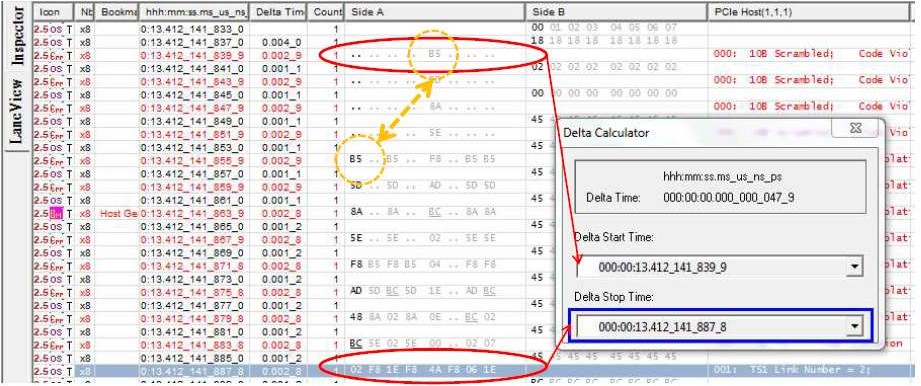
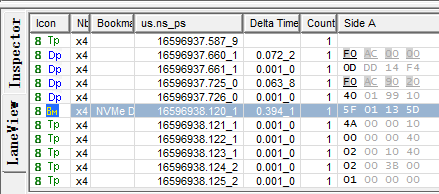
通过左侧选项卡，选择查看Lane View

或详细解码

通过选择

Lane号查看Lane数据



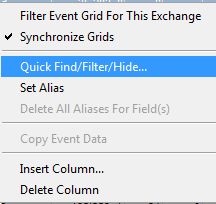
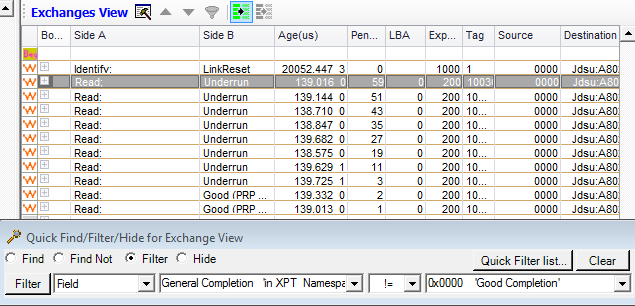


Line View便于用户观察各个Lane的物理层数据传送情况，如上例子中：

* + 从RC到第一个TS1的时间间隔为47.9ns
  + 第一个Link是Lane 4，而不是Lane 0

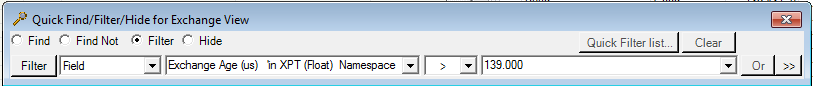
如何在**Exchange View**中快速查找错误或异常

在Exchange View中Side B位置右键进行过滤和查找，可以快速查看出错。



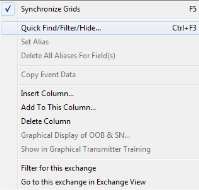
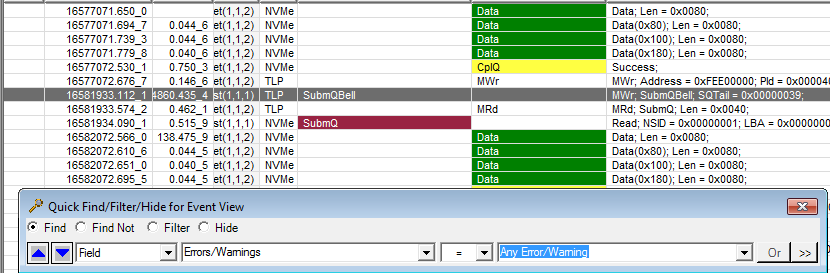
1

2

在Exchange View中同样可以查看用时过长的Exchange。

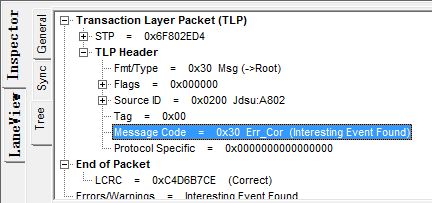
## 如何在解码窗口中快速查找错误或异常

在解码窗口中查找Error和Warning，在详细解码窗口查看具体出错。



1

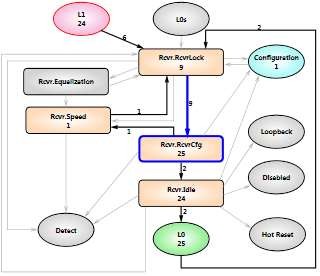
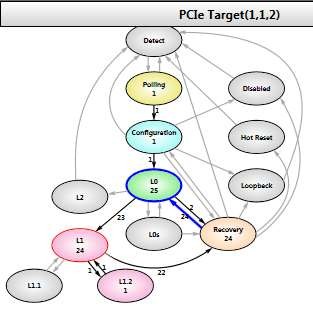
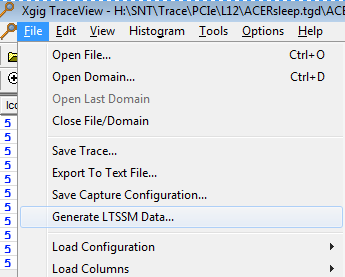
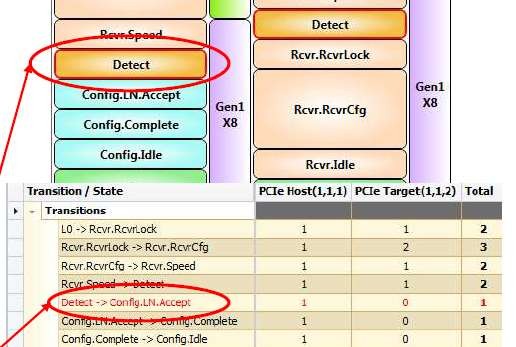
2



3

在菜单中选择Generate LTSSM Data来生成LTSSM。

**Recovery**状态机



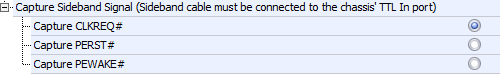
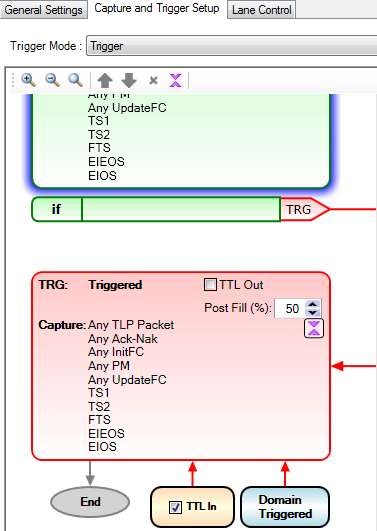
当状态机切换有问题时，用红色标出

支持**L1.x**分析

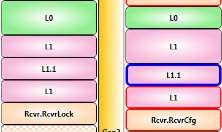
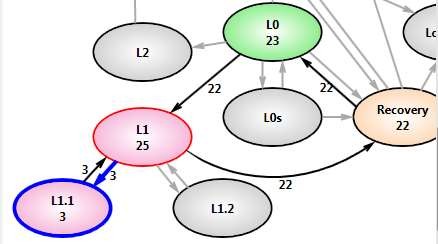
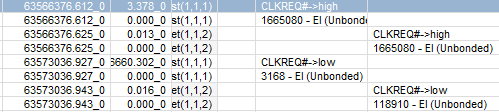
27

使用Cable连接Interposer和机箱的Trigger In接口，并在Trace Control中使用Trigger

模式，勾选TTL IN，并选择捕获CLKREQ、PERST或PEWAKE。

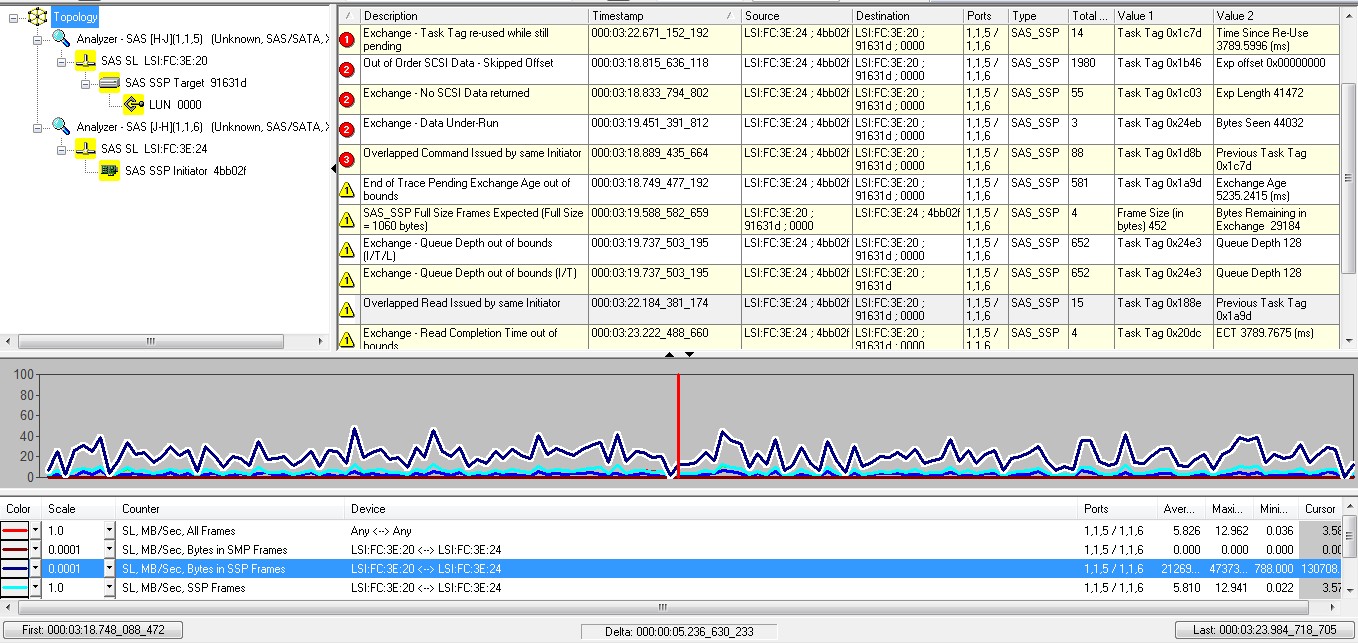


28



Expert专家分析工具自动对捕获的数据进行分析，图形化网络拓扑结构，

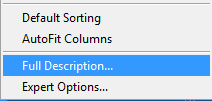
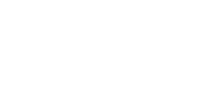
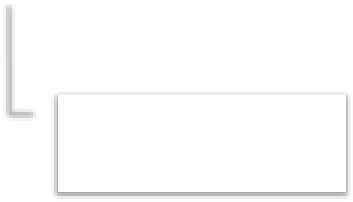
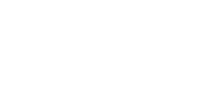
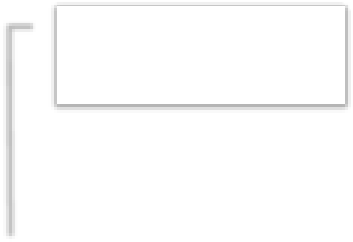
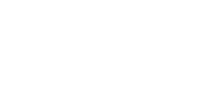
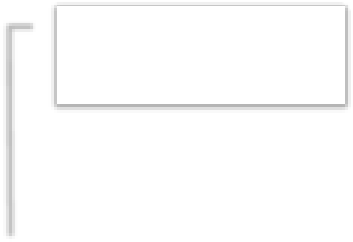
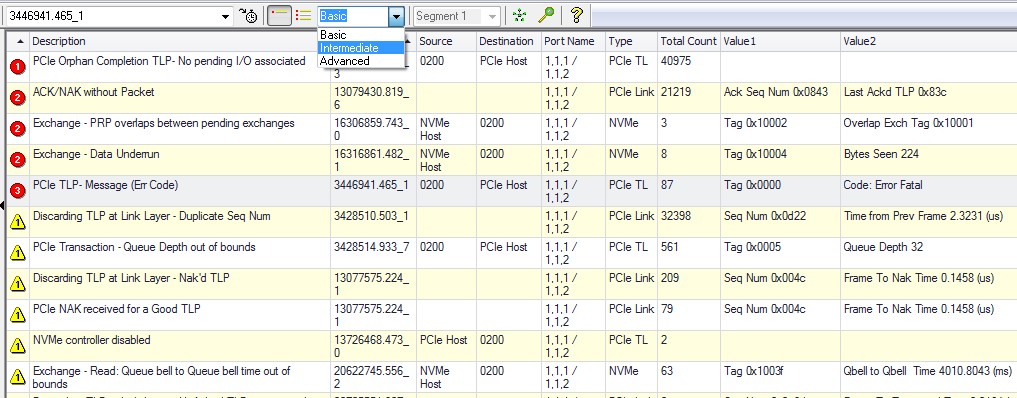
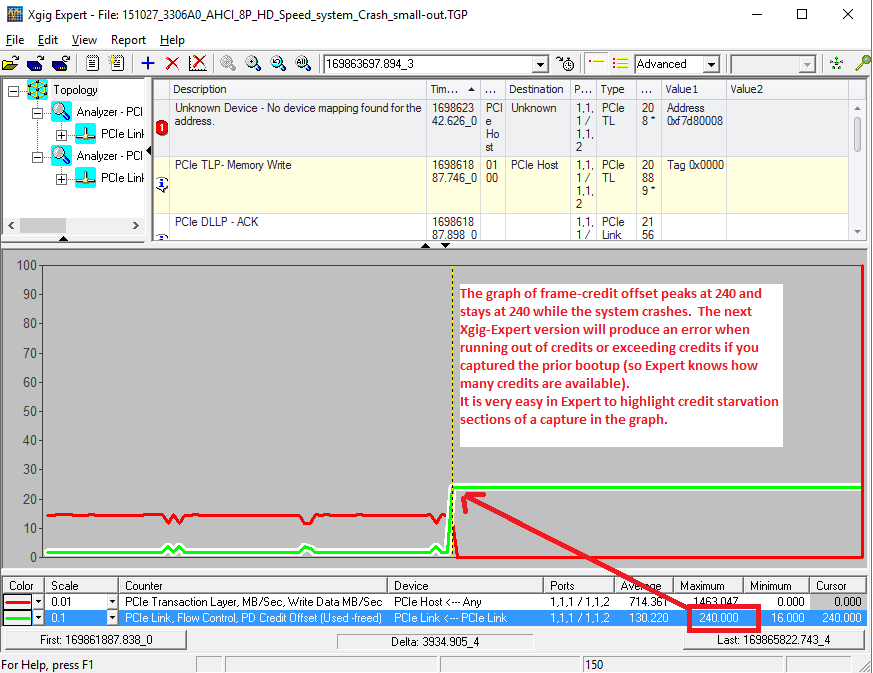
显示网络告警及流量，帮助用户快速定位网络问题。



自动学习网络拓扑 检测网络错误及告警，进行分级显示

#### 流程Counter

帮助用户分析复杂问题，如Credit等。



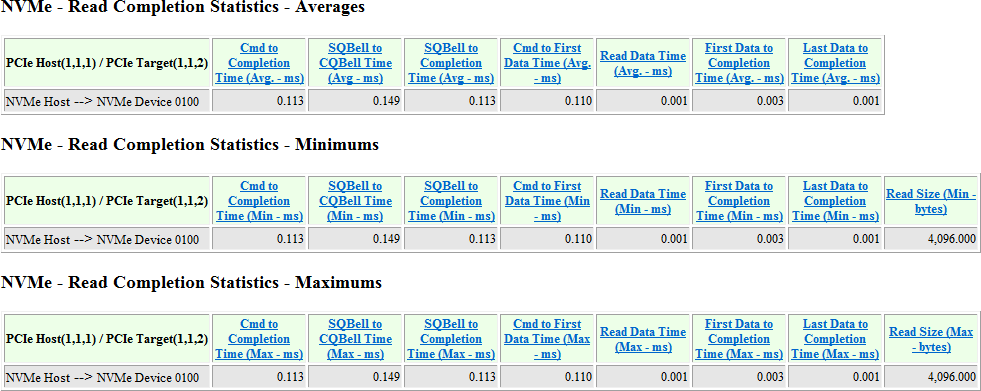
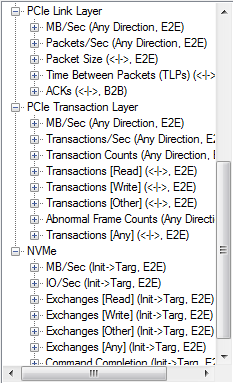
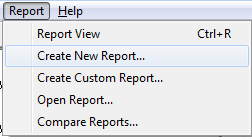
告警级别

发生层级

错误原因

发生次数

用户可自定义数据报表，进行数据的

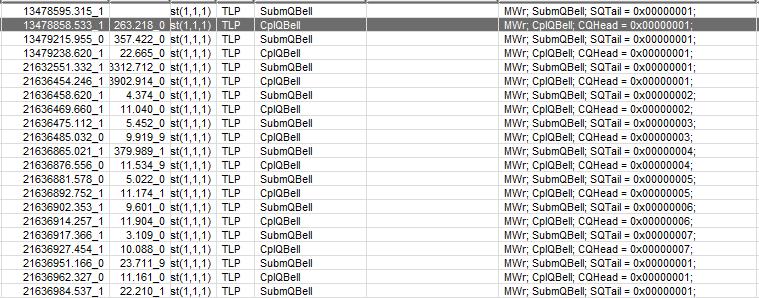
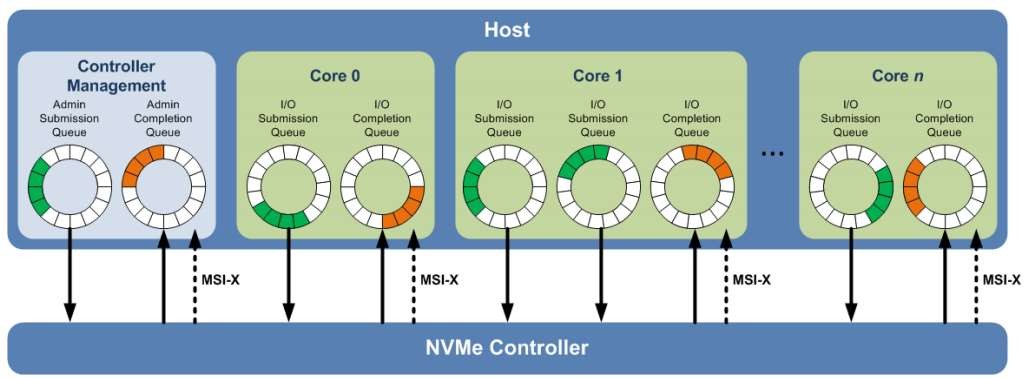


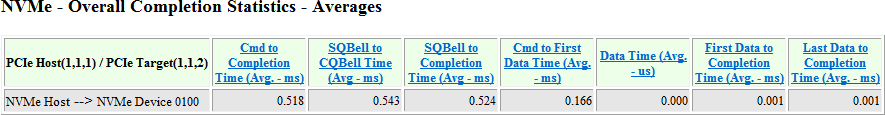
深入分析。

NVMe Read支持性能统计：

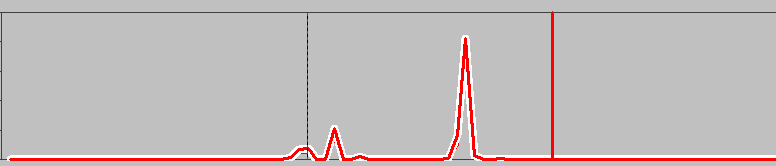
* + - 命令到结束用时
    - SQ Bell到 CQBell用时
    - SQ Bell到结束用时
    - 命令到第一个数据帧返回用时
    - 数据传送用时
    - 第一个数据帧到结束用时
    - 最后一个数据帧到结束用时

分析队列使用情况

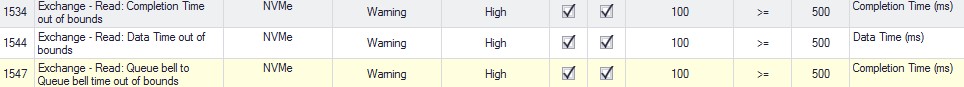


Report功能可以分步统计出IO的性能指标

所有统计项可以按时间轴进行图形化显示，方便性能观察



设置合适的阀值，专家系统会自动检测出延时较大的IO



支持多种技术的混合分析 **- SAS**和**PCIe**

XgigTraref‹etv-C\traces]tPC]etQAtl]Cr lnquJ Cnrhand- overPCb3gp

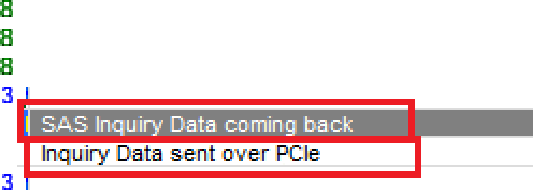


File Edit View Hi stogr am Tools Options Hel p





I7BZ.121\_054\_837\_D 1.443\_1 st(1,1,1} TLP CpD Len = 0xO040; BytesLeft = 0x0040; 84



8 Inquiry Data sent over PCIe

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | BDDkrrark | ss. rrls us\_ns\_ps | Delta Tirfle Port | Proto | Side A | Side B | Summary | Bytes |
|  |  | I7BZ.121\_053\_393\_9 | st(1,1,1} | TLP | MWr |  | MWr; Ad+Press = 0xFA4000C4; PI0=Ex0O09000O; | 24 |

I7BZ.121\_054\_912\_3 0.075\_2 st(1,1,1} TLP CpD Len = 0x0040; BI

I7BZ.121\_06B\_SB0\_O 13.667\_ 'rt(3,2,2} SOAF Open Address, SSP; 3 Gbps; 40

@@@

I7BZ.121\_102\_799\_9 33.404\_9 et(1,1,2} TLP HWr MWr; Address = 0x777BSBC20; Len = 0xO060; 120

I7BZ.121\_110\_610\_O 7.810\_1 'rt(3,2,2} SOAF Open Address; SSP; 3 Gbps; 40

I762.121\_111\_420\_6 0.810\_0 'rt(3,2,2} SSP SSPResp; Good Status; 60

I7BZ.121\_1S2\_797\_7 41.377\_7 et(1,1,2} TLP HWr MWr; Ad+Press = 0x7CBF1340; PKI=0x0000O0EFO01E 28

BD... Side A SdeB Age[... Sum... LBA



Good 510....

GD0d HWr: O. 00...

“



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| * Inda | | | Ha |  |  |  |  |  |  |  |  |  |  |  | ASCII |
| 0000 | | | BC GB B4 | 67 | OF 01 BB cA | 00 BE 3E DD | 00 | 00 | OO 00 | 00 | OO 00 | 00 | OO BE | 3C CO | As.a ..z\*.e^Z. i¥A |
| 001B | | | 00 OO 00 | 00 | OO 00 03 1c | BB 00 TO OZS | E3 | 4E | 41 47 | 41 | E4 4E | c0 | E3 E4 | 33 33 | ......«...SBAGATB ST33 |
| 0030 | | | 3G S7 3E | 34 | E3 53 20 20 | c0 20 c0 TO | 30 | 30 | TO 3c | 33 | 4B II | 31 | 41 TO | E2 3B | 7E4EE 00023B 1A9BB |
| a | .-- H ash ed Src! =" 0xEA3FDD | 0048 | 00 00 00 00 | | 00 00 00 00 | 00 00 00 00 | 0C 00 | | 00 00 | 00 00 00 | | 00 | 00 00 00 00 | | ............ .... .... |
|  |  | 0060 | 00 00 00 00 | | 00 00 00 00 | 00 00 00 00 | 00 00 | | 00 00 | 00 00 00 | | 00 | 00 00 00 00 | |  |
|  |  | **0078** | **00 00 00 00** | | **33 7D** 4 Al | BC lB FO 9B |  | |  |  | |  |  | |  |



.-- Inquiry Date; (Interestin g Event Found}



. - Peripheral Qualifier = 0x0 CDnnected

- Peripheral Device Type = 0x00 Direct-access

SAS Inquiry Data coming back from the drive.



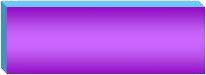
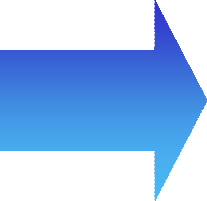
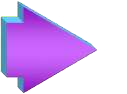
|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |
| E]- Tran sacton Layer Packet (TLP) | Inda | Ha |  |  |  |  |  | I ASCII |
| . - TLP Len gth[3: 0] = 0xE | 000 | Bl BD 69 | 60 00 00 lB | OS 00 B1 FF | 00 00 00 07 | 77 B9 8C 0 | 00 00 03 1 | Md |  |
| .- SOP = 0xF STP | **0018** | **8B 00 10 OA** | **S3 4S 41 47** | **41 S4 4S 20** | **S3 S4 33 33** | **36 37 3S 34** | **S3 S3 20 20** | .. |  |
| . - FP = 0x1 (Correct) | **003** | 0 0 0 0 | 30 30 30 3 | 33 4B S1 31 | 41 SO S 38 | 00 00 00 00 | 00 00 00 00 |  | **00023KQ1APB8.......** |
| . - TLP Len gth[10:4} = 0x01 | 00• | 00 00 00 00 | OC 00 00 00 | 00 00 00 00 | 00 00 00 00 | 00 00 00 00 | 00 00 00 00 |  |  |
| . - TLP Len gth = 30 DW0 RDs 0060  .- FCRC = 0xB (CDrrect)  .- Seg\_N um = 0xEO9 El- TLP Eeader  Frnt/Type = 0x6O MWr  E]- Flags = 0x600O18  E]- Sourced = Ox0500  .-- Tag = 0x81  @- Byte EnabW = 0xFF  .-- Address = 0x77TB98C20  - PH = 0x6 Off  - PI0 = 12030600 0A10608B 47414553 20455441 33335453 34353736 20205353 2(  LCRC = 0x1D7451 F3 {Correct) | | 00 00 00 00 | 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 lD 74 S1 F3 tQd  Inquiry Data being written from the Device to the Hast an the PCIe bus, in the following packet,  33.404\_8 us aher! | | | | | | |

**Jammer**功能 **--** 链路错误注入

## 什么是错误注入？

将链路上指定条件的帧或Order Set替换，或修改成其内容。

## 为什么需要错误注入？



Packet Generator/Exerciser

需要使用脚本语言来定义数据

支持功能有限

无法测试实际链路

#### Trigger

Compa**M**r**ATC**

**H!**

使用复杂

Jammer

简单易用

在实际链路上测试，更加真实

速度更快

#### Link

fic

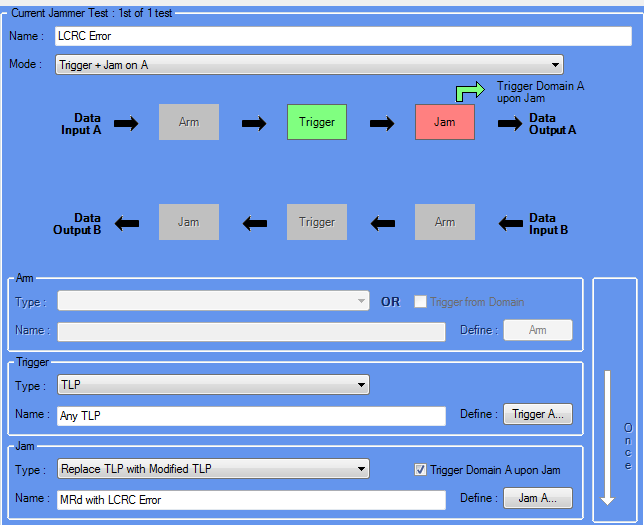
Pipeline

Jam

Data

Jammed Link fic

* Example : Crate LCRC Error



3

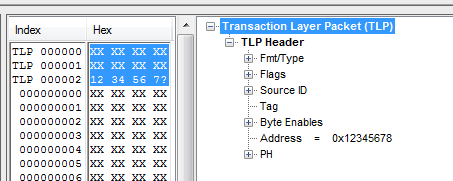
1

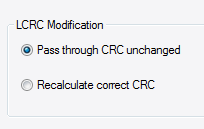
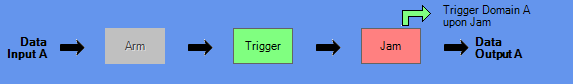
2

* + - 1. Define Trigger

Condition

* + - 1. Set Jam Condition
      2. Check Status

We plan to do LCRC error in MRd

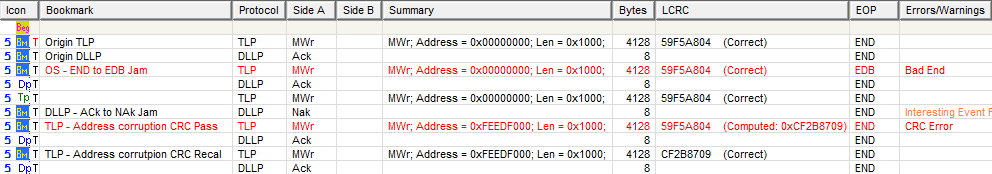
1. Change TLP=MRd address to 0x12345678
2. Select “Pass through CRC unchanged – address already changed so LCRC became error
3. Jam will change output A (out from

RC, into EP)

Case 2 – DLLP Jam – ACK to NAK

Case1

OS Jam END to EDB



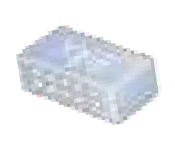
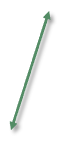
Case 4 – Address corruption and CRC Recalculation

Case 3 – Address corruption and CRC passthrough



**Medusa Lab Test Tool** 存储性能测试软件

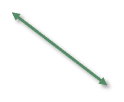
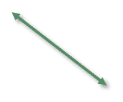
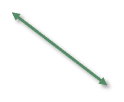
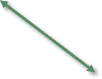
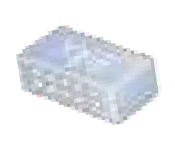
MLTT运行在主机侧的软件，不需要特别的硬件支持，但它可



以与Xgig配合，进行联合测试。

MLTT

**MLTT**可以支持如下方面的测试：



### 数据中心设备的验证及选型测试



Analyzer

* 研发、测试阶段的数据发包、打压及负载测试
* 存储网络的性能测试
* 数据中心的验收测试
* 主机虚拟化后的虚拟机与存储IO能力测试
* 虚拟机之间的TCP接口测试

Load Tester



Storage

I I